Appendix H

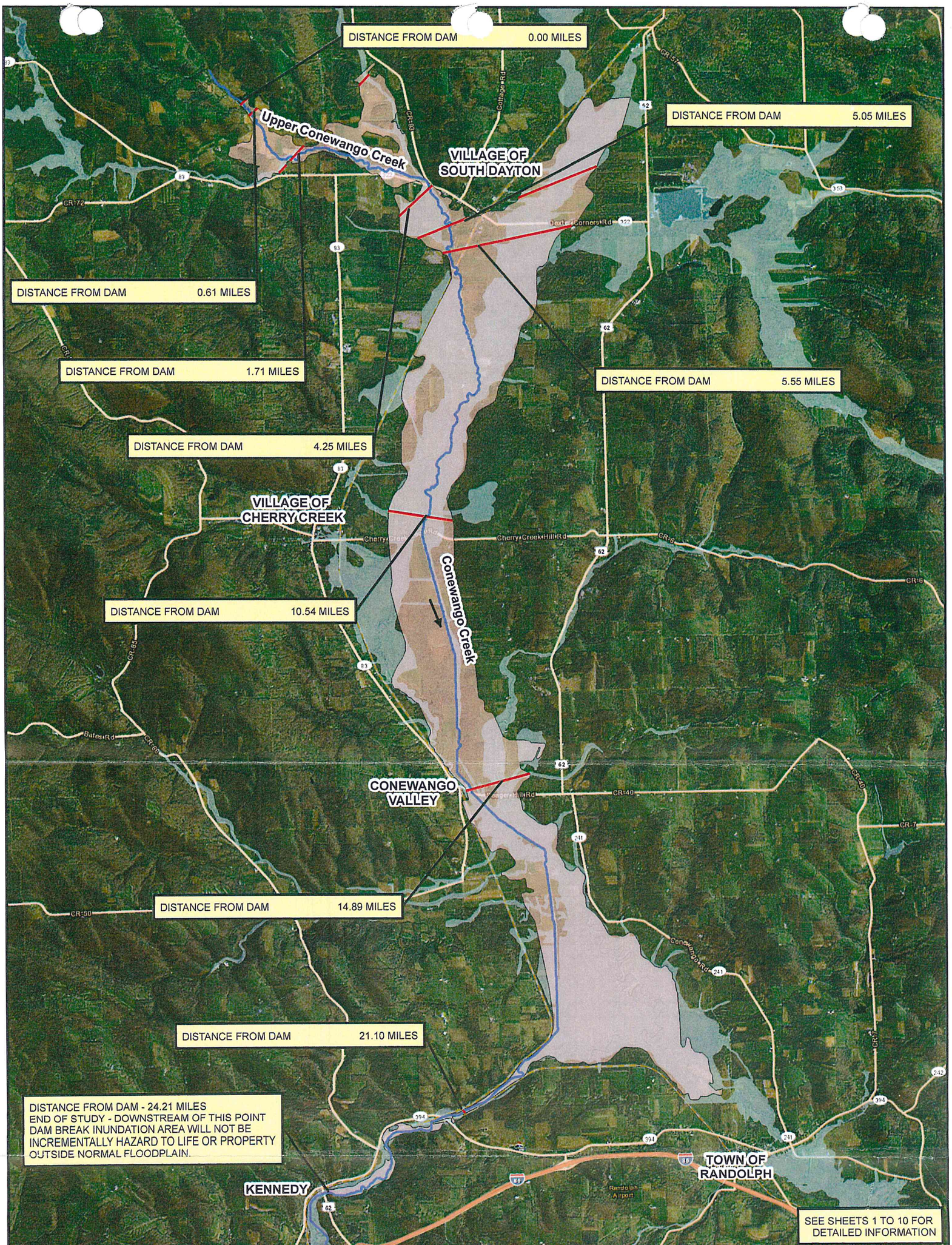
High Hazard Potential Dam Inundation Maps, Emergency Action Plans, and Engineering Assessments

Conewango Creek Watershed Dam No. 9A (page 2)

Conewango Creek Watershed Dam No. 33 (page 399)

Fredonia Reservoir Dam (page 759)

Conewango Creek Watershed Dam 9A



DAM BREAK FLOOD INUNDATION MAPPING

OVERALL LAYOUT

CONEWANGO CREEK DAM 9A

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255 East Avenue
Rochester, NY 14604
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Falconer, NY 14733
(716) 661-8400

FEBRUARY 2014

SUMMARY OF DAM FAILURE

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

NOTE: The flooding information and inundation areas shown on this map are approximate and should be used only as a guideline for establishing evacuation zones. Actual flooding conditions may differ from those depicted on the map.

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013 Copyright:© 2013 Esri, DeLorme, NAVTEQ, TomTom Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

*Source of FIS 100 Year Flood: The Q3 Flood Zone Data derived from the Flood Insurance Maps (FIRM) puiblished by the Federal Emergency Management Agency (FEMA); from the NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246

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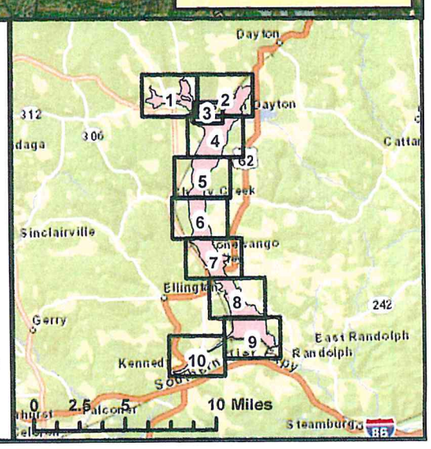

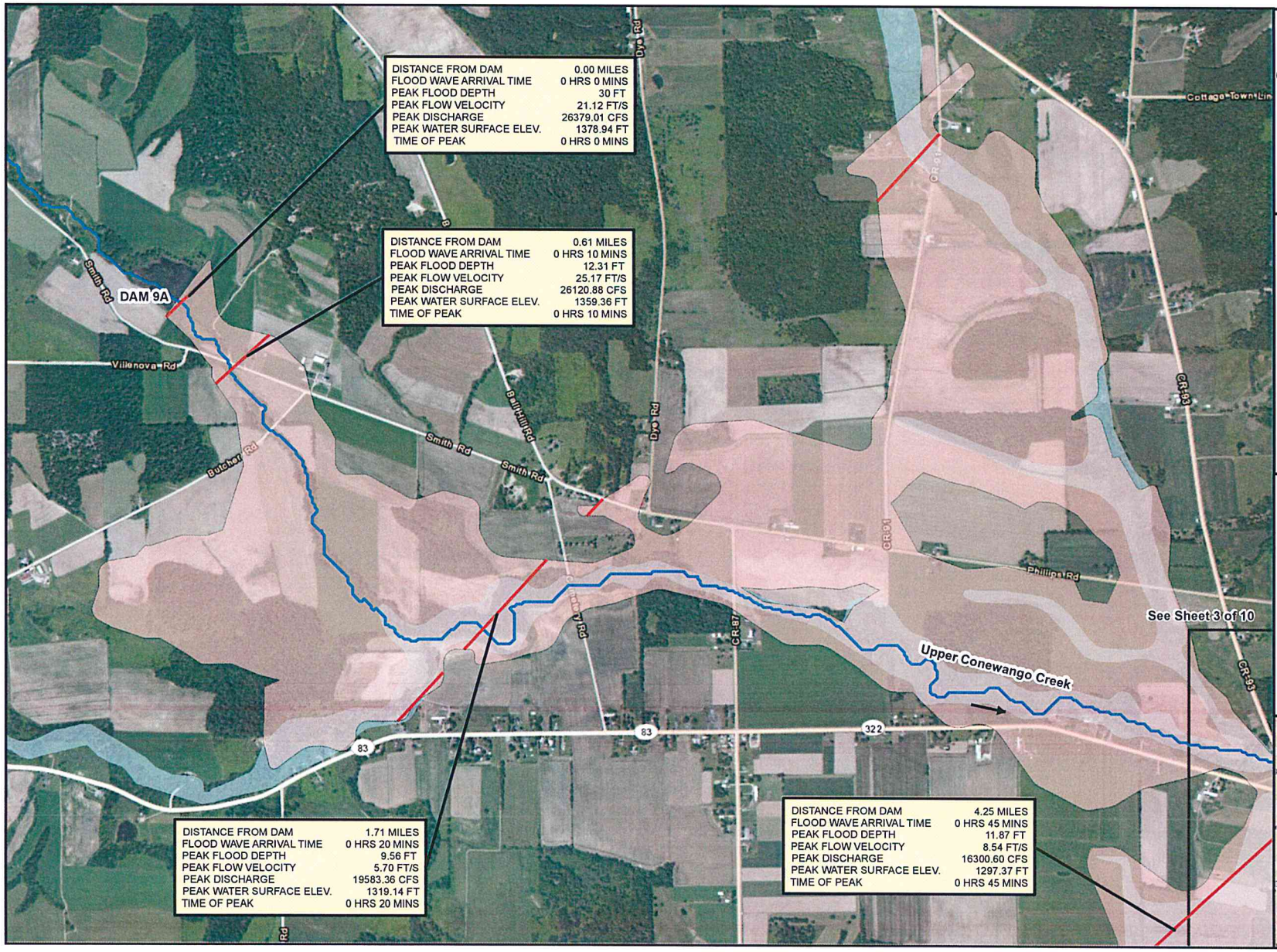

DAM BREAK FLOOD INUNDATION MAPPING

CONEWANGO CREEK DAM 9A

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OCTOBER 2013

SUMMARY OF DAM FAILURE (SHEET 1 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

NOTE: The flooding information and inundation areas shown on this map are approximate and should be used only as a guideline for establishing evacuation zones. Actual flooding conditions may differ from those depicted on the map.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

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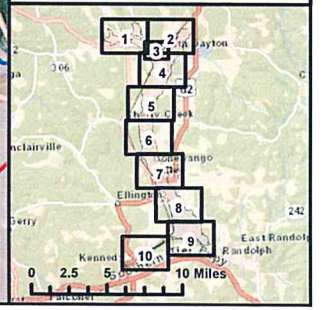

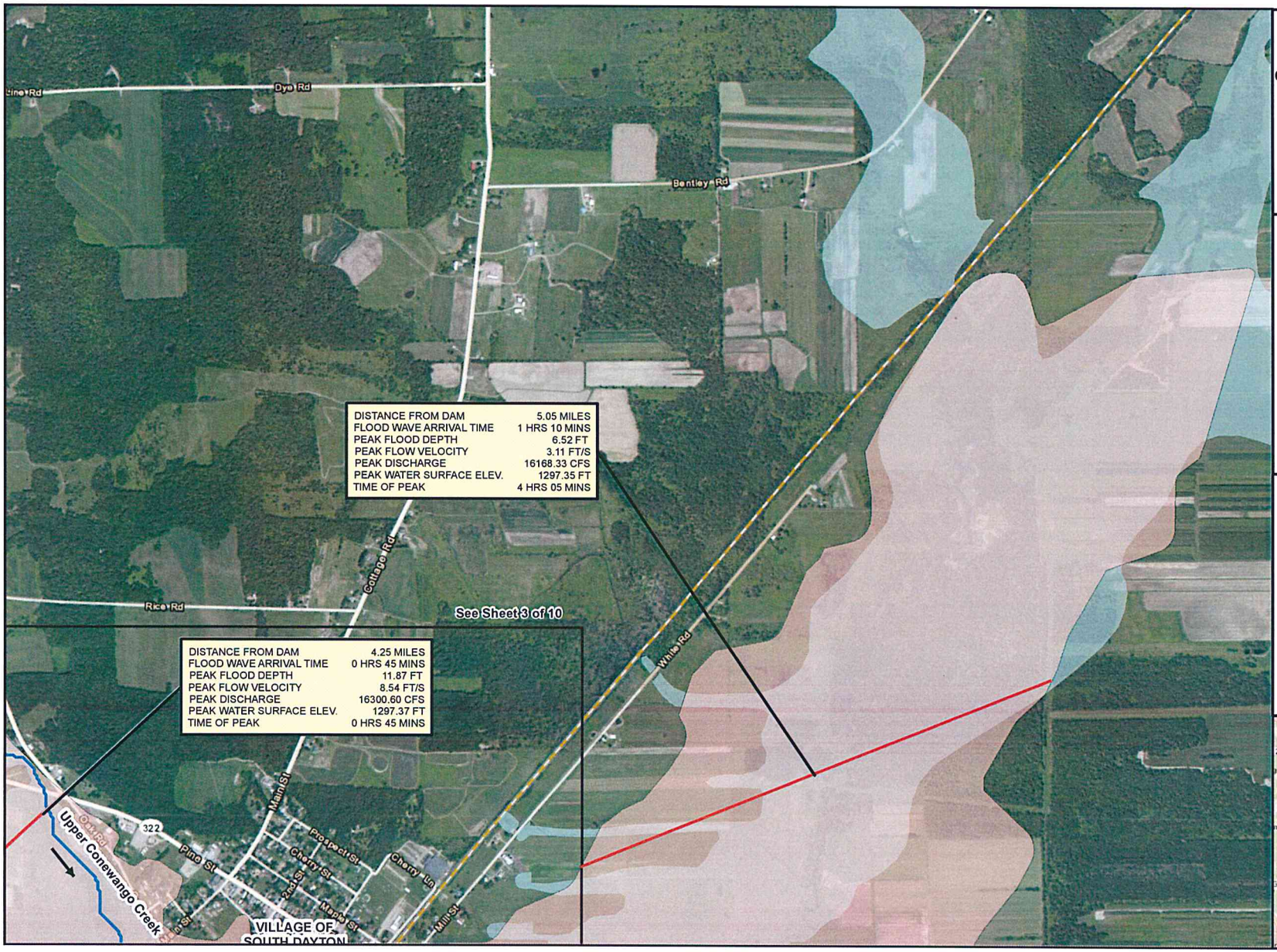

DAM BREAK FLOOD INUNDATION MAPPING

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SUMMARY OF DAM FAILURE (SHEET 2 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

*Source of FIS 100 Year Flood: The Q3 Flood Zone Data derived from the Flood Insurance Maps (FIRM) puibished by the Federal Emergency Management Agency (FEMA); from the NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246

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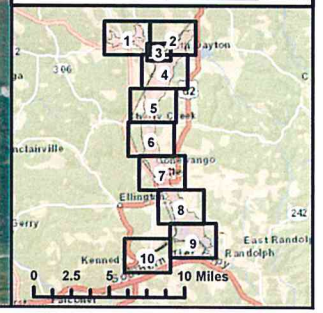

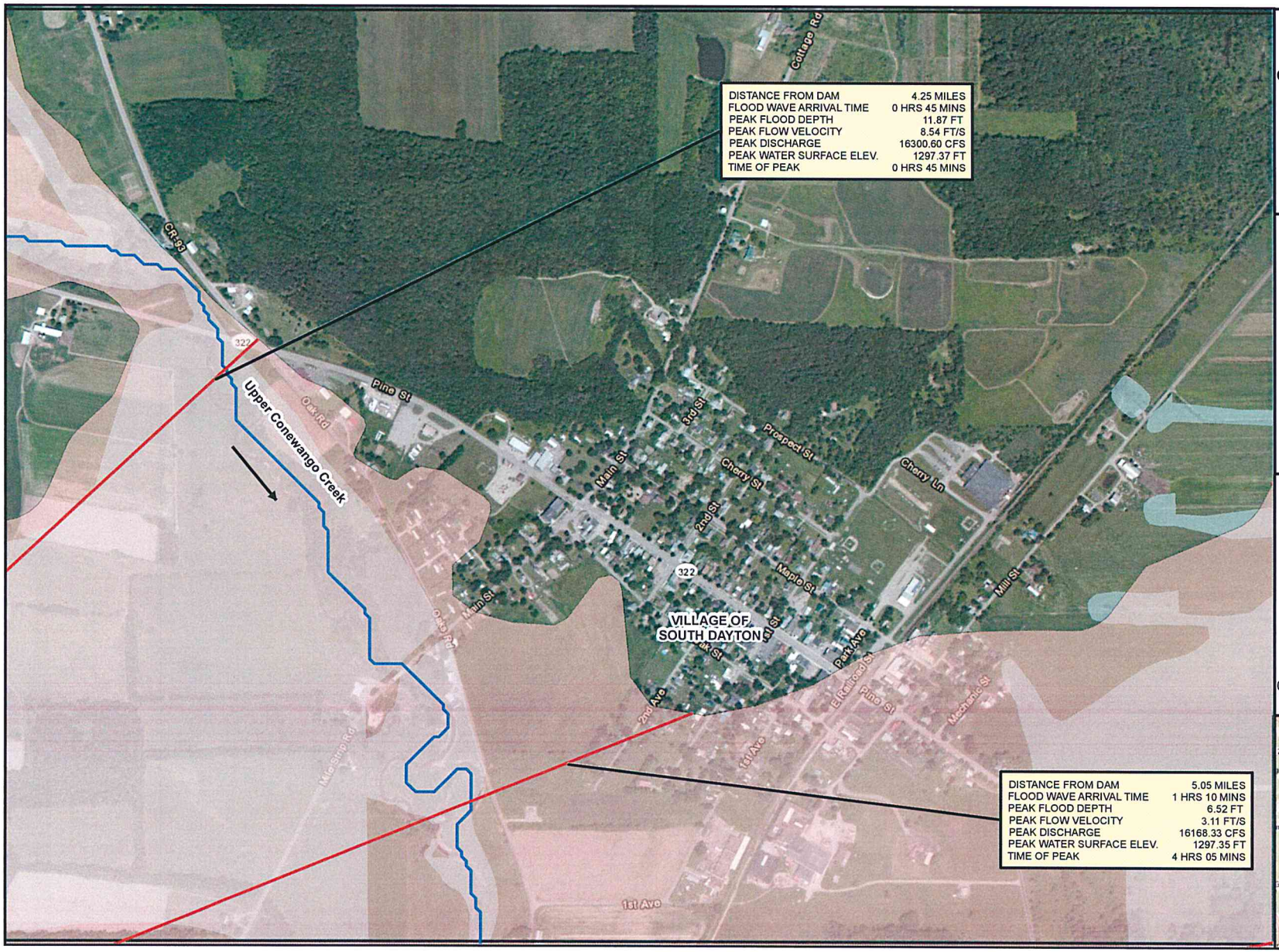

DAM BREAK FLOOD INUNDATION MAPPING

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SUMMARY OF DAM FAILURE (SHEET 3 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

NOTE: The flooding information and inundation areas shown on this map are approximate and should be used only as a guideline for establishing evacuation zones. Actual flooding conditions may differ from those depicted on the map.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

*Source of FIS 100 Year Flood: The Q3 Flood Zone Data derived from the Flood Insurance Maps (FIRM) published by the Federal Emergency Management Agency (FEMA); from the NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246

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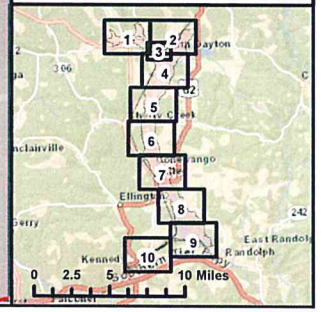

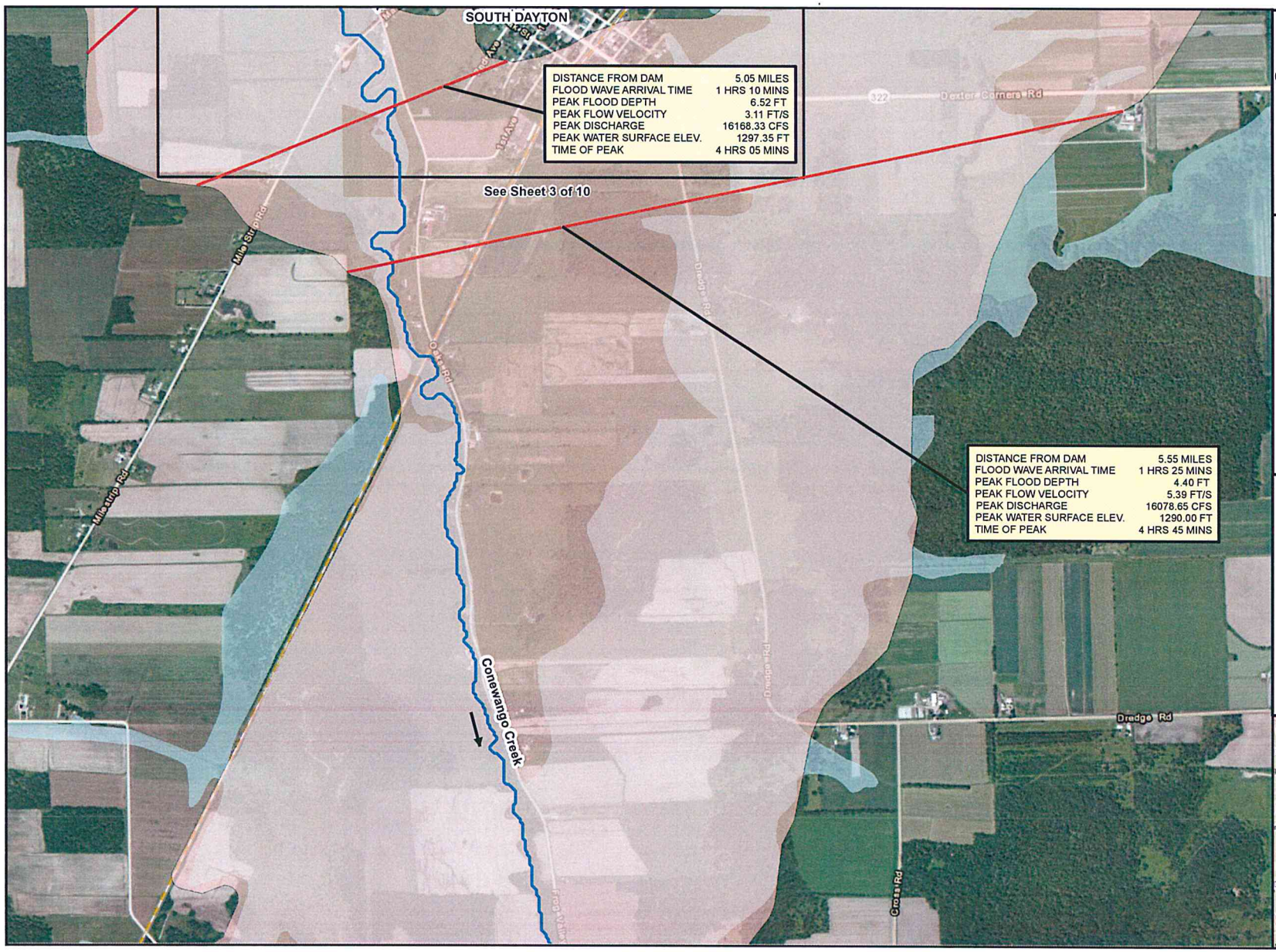

DAM BREAK FLOOD INUNDATION MAPPING

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SUMMARY OF DAM FAILURE (SHEET 4 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

NOTE: The flooding information and inundation areas shown on this map are approximate and should be used only as a guideline for establishing evacuation zones. Actual flooding conditions may differ from those depicted on the map.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

*Source of FIS 100 Year Flood: The Q3 Flood Zone Data derived from the Flood Insurance Maps (FIRM) published by the Federal Emergency Management Agency (FEMA); from the NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246

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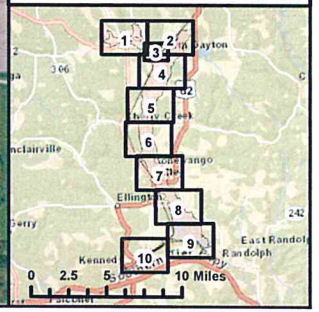

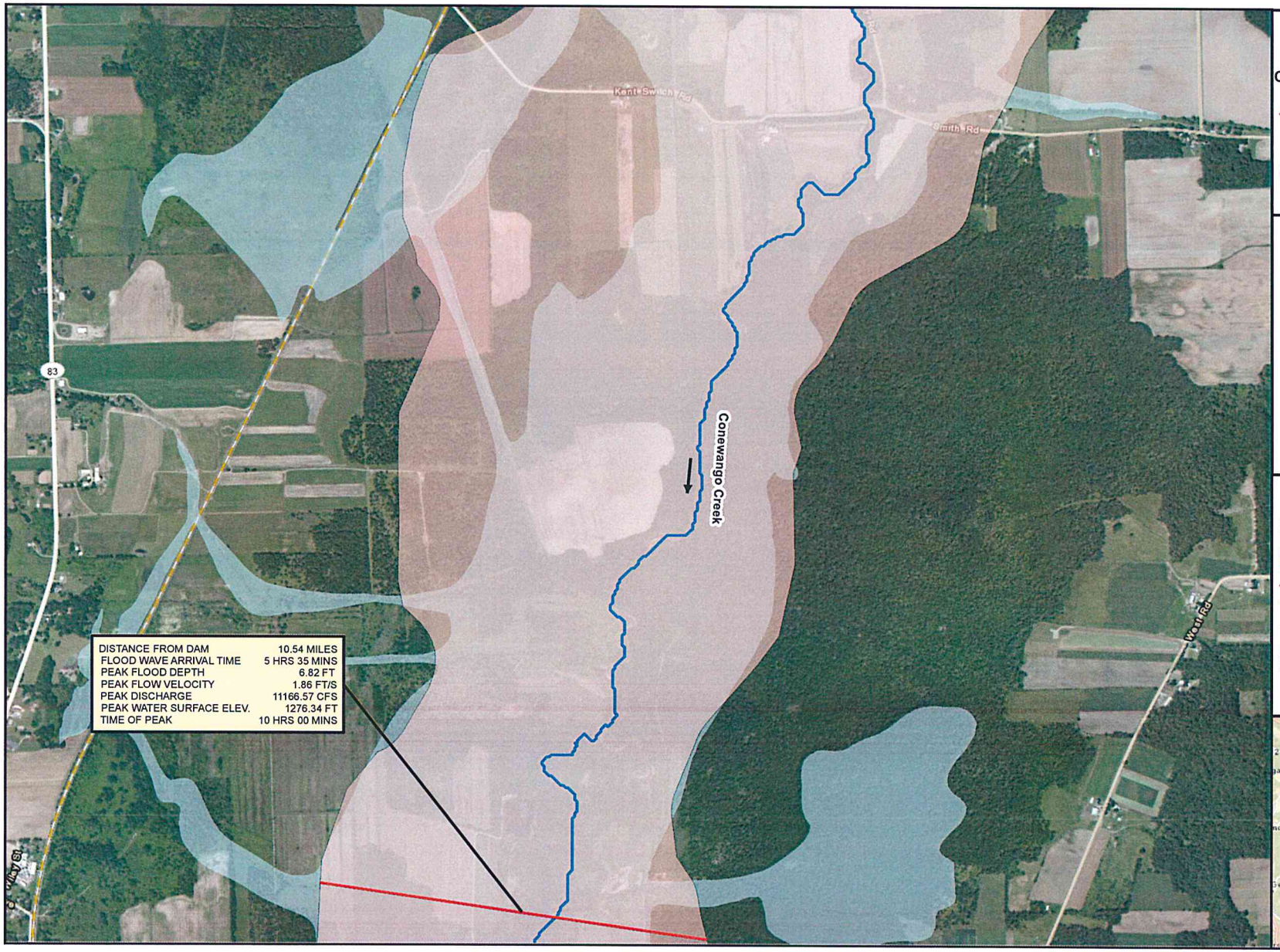

DAM BREAK FLOOD INUNDATION MAPPING

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OCTOBER 2013

SUMMARY OF DAM FAILURE (SHEET 5 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

NOTE: The flooding information and inundation areas shown on this map are approximate and should be used only as a guideline for establishing evacuation zones. Actual flooding conditions may differ from those depicted on the map.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

*Source of FIS 100 Year Flood: The Q3 Flood Zone Data derived from the Flood Insurance Maps (FIRM) published by the Federal Emergency Management Agency (FEMA); from the NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246

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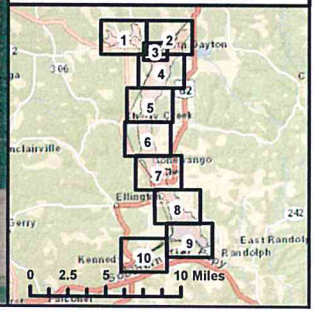

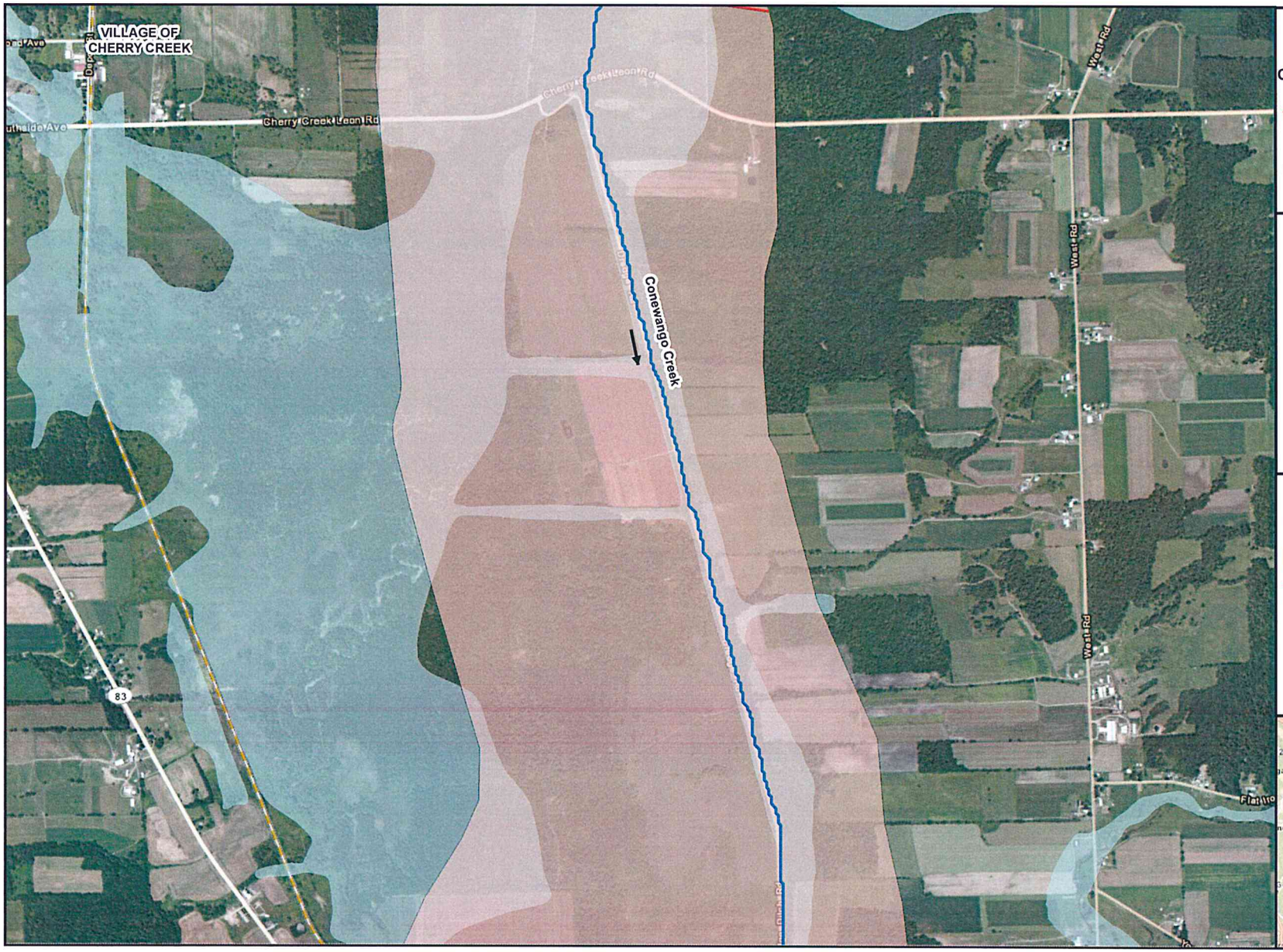

DAM BREAK FLOOD INUNDATION MAPPING

CONEWANGO CREEK DAM 9A

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OCTOBER 2013

SUMMARY OF DAM FAILURE (SHEET 6 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

NOTE: The flooding information and inundation areas shown on this map are approximate and should be used only as a guideline for establishing evacuation zones. Actual flooding conditions may differ from those depicted on the map.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

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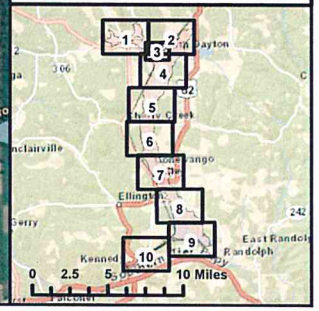

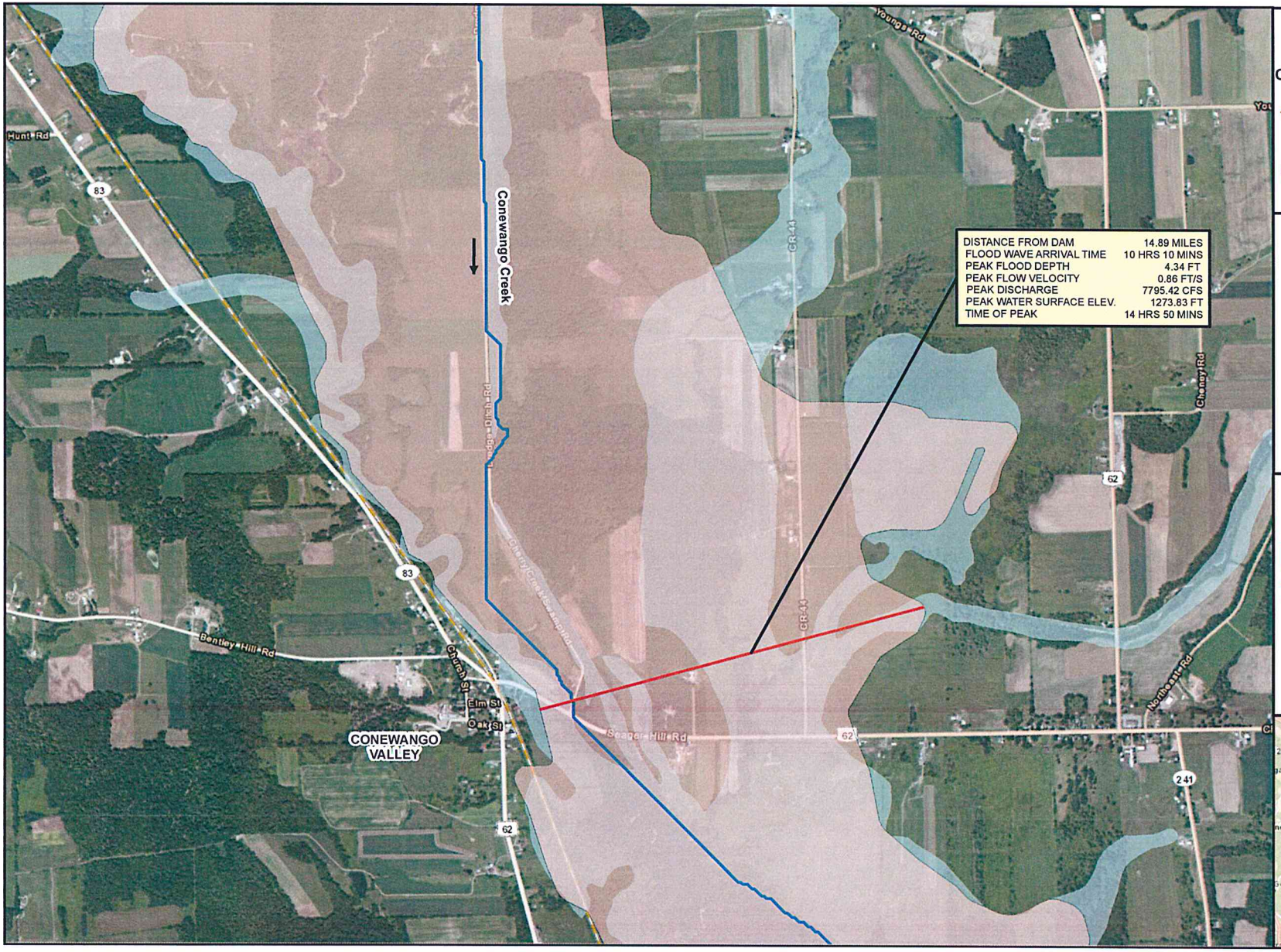

DAM BREAK FLOOD INUNDATION MAPPING

CONEWANGO CREEK DAM 9A

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OCTOBER 2013

SUMMARY OF DAM FAILURE (SHEET 7 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

NOTE: The flooding information and inundation areas shown on this map are approximate and should be used only as a guideline for establishing evacuation zones. Actual flooding conditions may differ from those depicted on the map.

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N

LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

*Source of FIS 100 Year Flood: The Q3 Flood Zone Data derived from the Flood Insurance Maps (FIRM) published by the Federal Emergency Management Agency (FEMA); from the NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246

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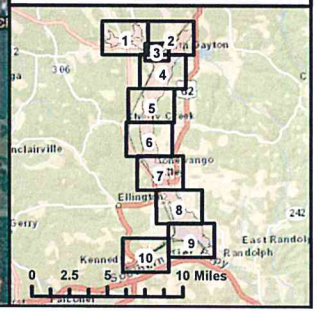

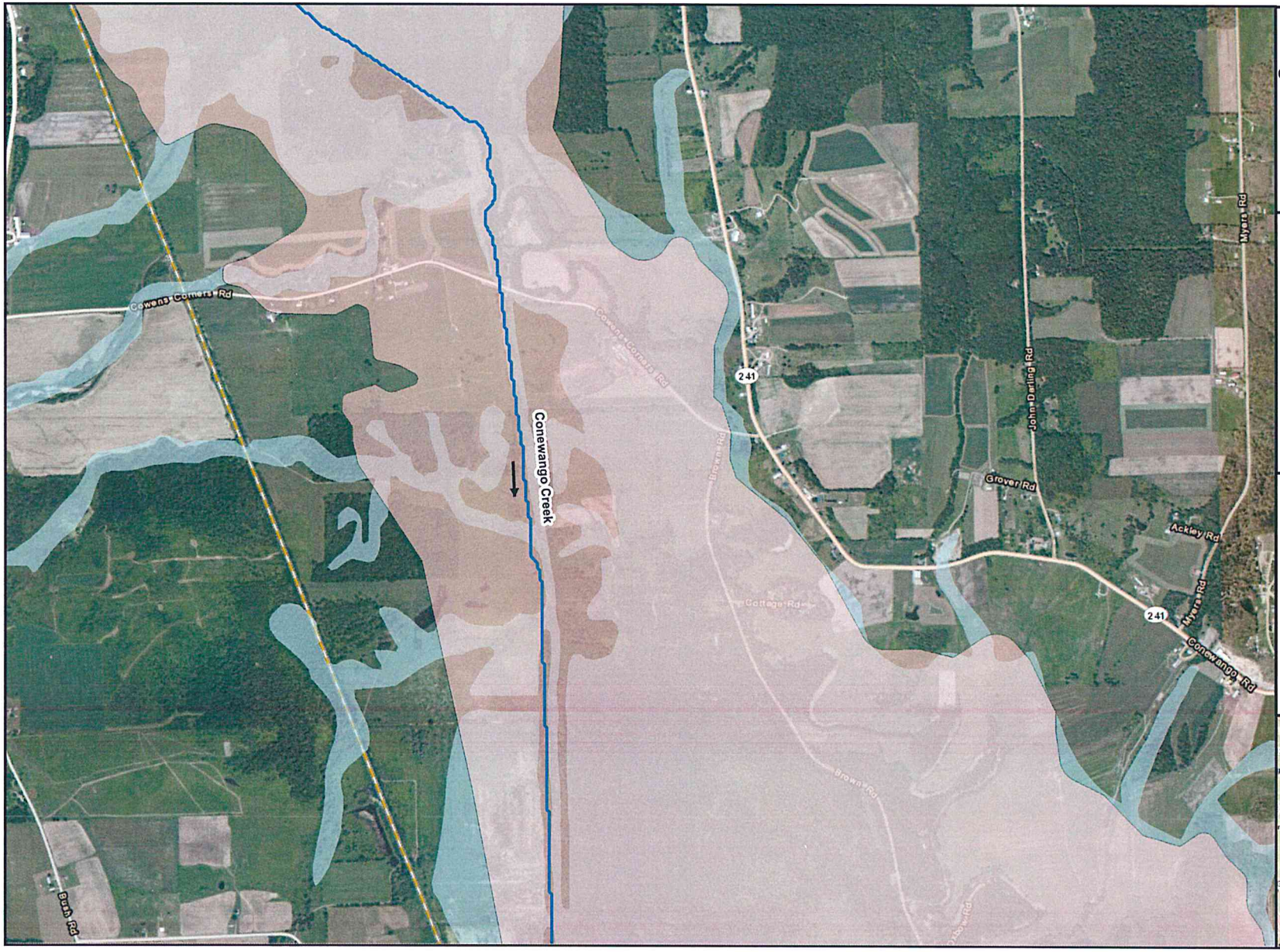

DAM BREAK FLOOD INUNDATION MAPPING

CONEWANGO CREEK DAM 9A

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OCTOBER 2013

SUMMARY OF DAM FAILURE (SHEET 8 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

*Source of FIS 100 Year Flood: The Q3 Flood Zone Data derived from the Flood Insurance Maps (FIRM) published by the Federal Emergency Management Agency (FEMA); from the NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246

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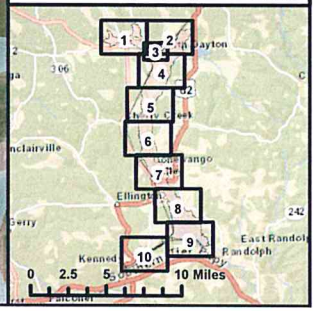

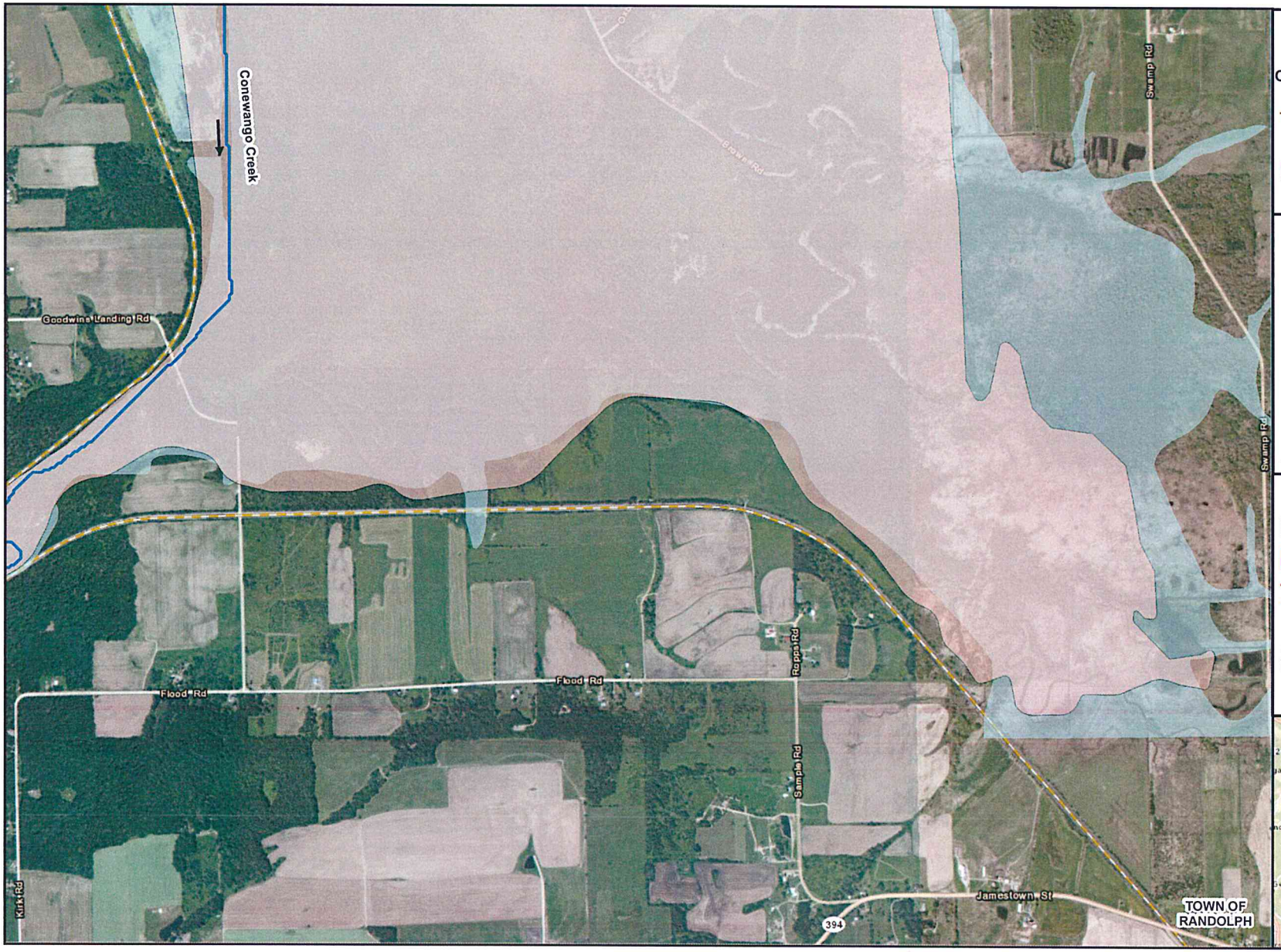

DAM BREAK FLOOD INUNDATION MAPPING

CONEWANGO CREEK DAM 9A

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SUMMARY OF DAM FAILURE (SHEET 9 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

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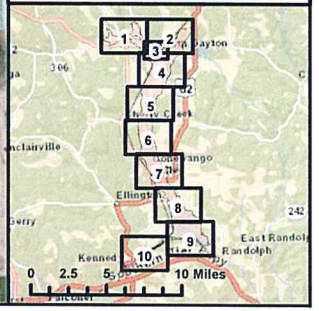

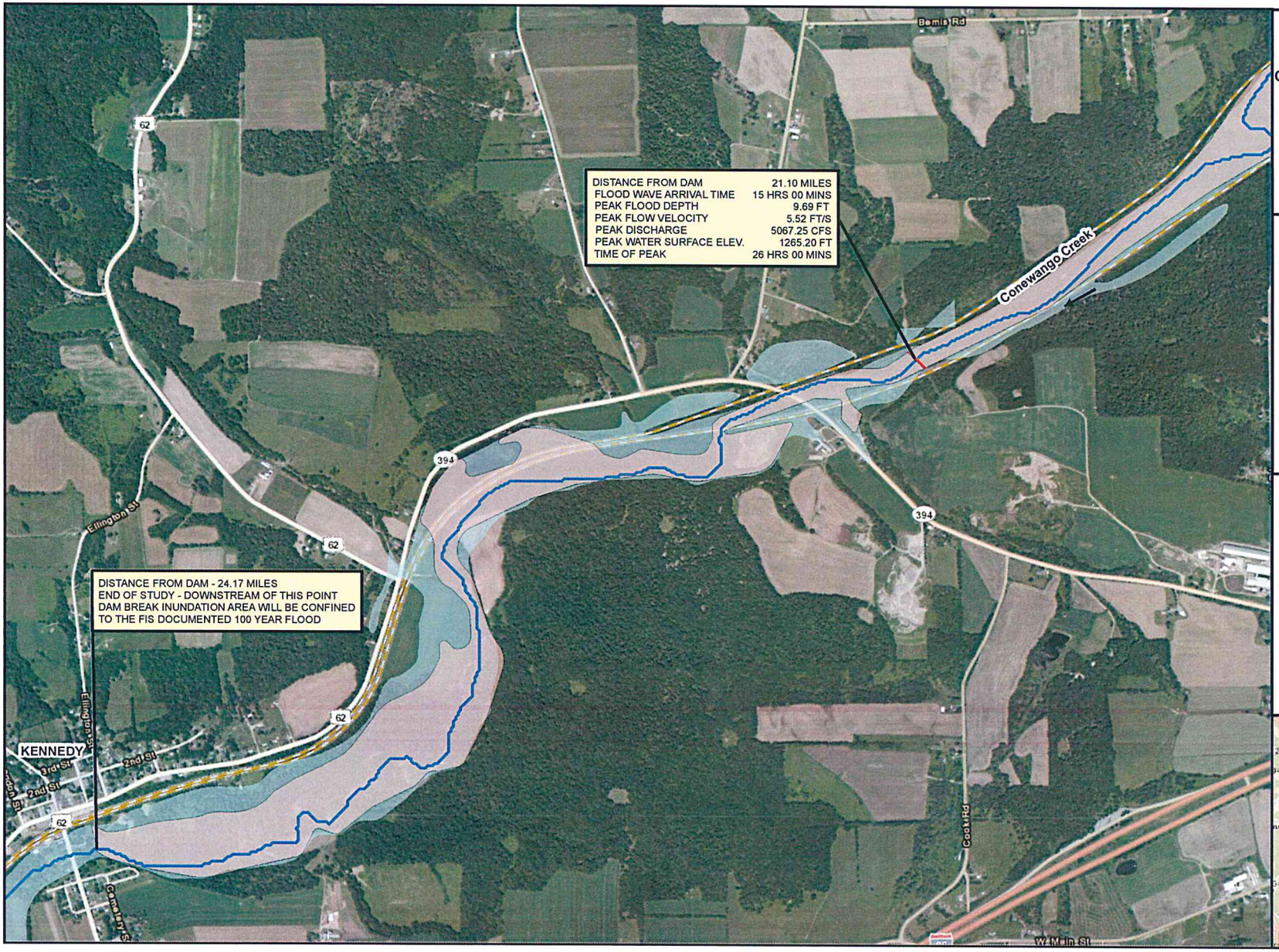

DAM BREAK FLOOD INUNDATION MAPPING

CONEWANGO CREEK DAM 9A

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OCTOBER 2013

SUMMARY OF DAM FAILURE (SHEET 10 of 10)

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

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LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

N

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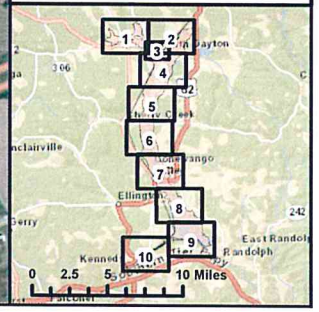

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Emergency Action Plan (EAP)

Conewango Creek Watershed, Dam No. 9A

National Inventory of Dams (NID) No. NY00596

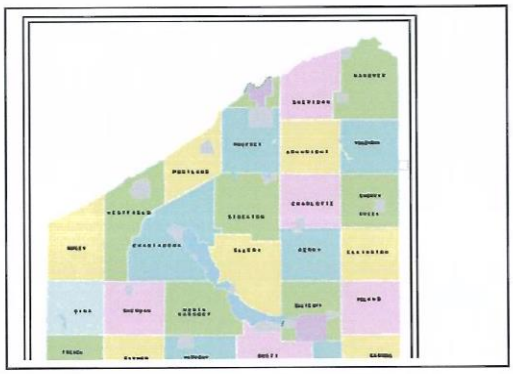
Chautauqua County, New York

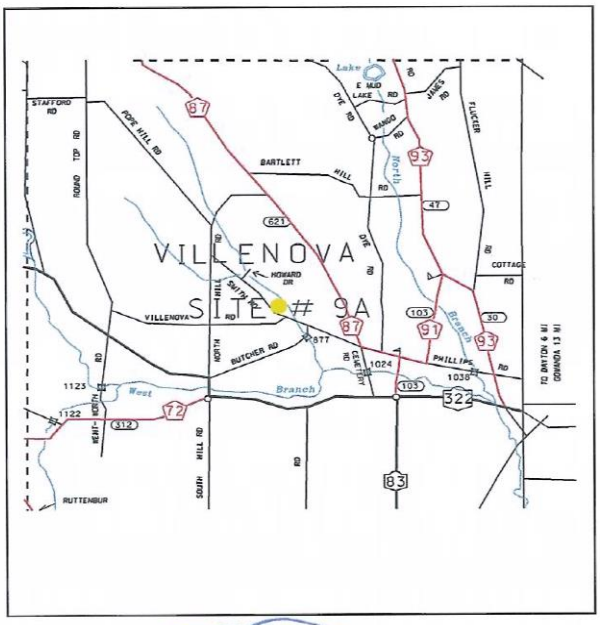
Chautauqua County Conservation District

With assistance from the

U.S. Department of Agriculture

Natural Resources Conservation Service





Reviewed and Updated:

Chair, Chautauqua County Conservation District

5/25/11

Date

Sheriff, Chautauqua County, NY

5/20/2011

Date

Copy ___ of ___

Conewango Creek Watershed, Dam No. 9A, Chautauqua County, NY– NID NY00596

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Basic EAP Data

Purpose

The purpose of this EAP is to reduce the risk of human life loss and injury and minimize property damage during an unusual or emergency event at Conewango Creek Watershed, Dam No. 9A.

Potential Impacted Area

See *Inundation/Evacuation Mapping* tab (Appendix B–4) and *People at Risk* tab (Appendix B–5) for the locations that may be flooded if the dam should fail and the estimated time for the flood wave to travel from the dam to these locations.

Dam Description

Height: 43 ft
Built: 1974
Legal Description: Sects. 14 and 23, T13N, R21W
Latitude: 42.3833 Longitude: 79.1161
National Inventory of Dams No.: NY 00596

Drainage Area: 6 sq. mi
Hazard Classification: High
Dam Operator: Chautauqua County
Maj. Prop. Owners: Evorett Wolfe / Kristopher Ivett
Dam Designer: NRCS

See detailed design data in *Appendix B* tab.

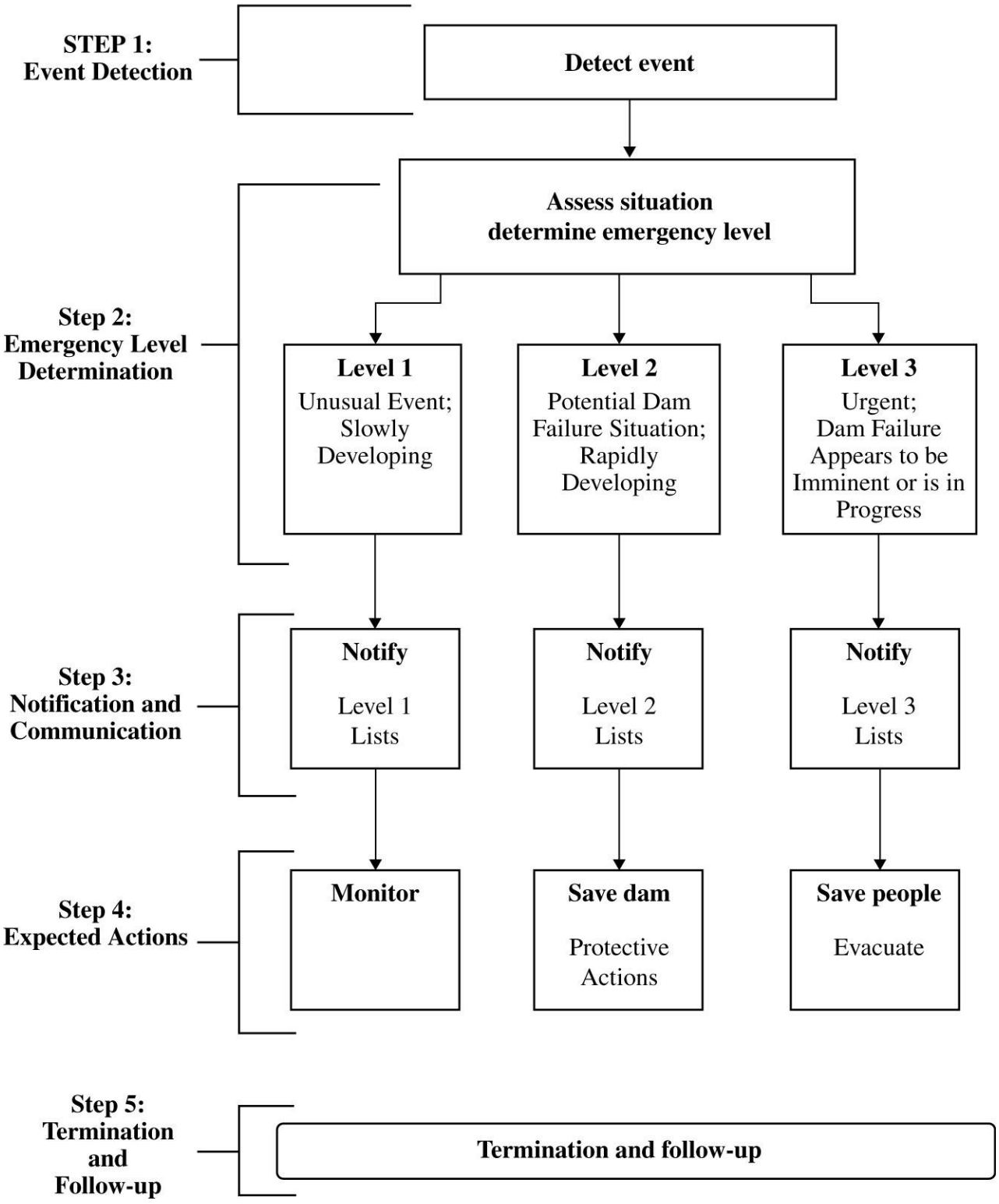
Directions to dam (See *Location and Vicinity Map*; Appendix B–2.)

From NYS Rt. 83N, @ Balcom Corners, go straight through intersection on County Rd. 87. At "T" intersection turn left. Continue on County Rd. 87 to Smith Rd. Turn left onto Smith Road. Go to Dam on right side of the road.

If the main route is flooded take from the northwest side of Hamlet on NYS Rt. 83 South, turn left on North Hill Rd. to Smith Road. Turn right on Smith Road to the Dam.

An alternate route to the dam is from Forestville, take County Rd. 87 South to North Hill Road. Turn right on North Hill Rd. Take North Hill Rd. south to Smith Road. Turn left on Smith Rd. to the dam.

EAP Overview



Roles and Responsibilities

Dam Operator's Representative (Chaut. County Soil & Water)

- As soon as an emergency event is observed or reported, immediately determine the emergency level (see *Emergency Levels* tab).
  - Level 1: unusual event, slowly developing
  - Level 2: potential dam failure situation, rapidly developing
  - Level 3: dam failure appears imminent or is in progress
- Immediately notify the personnel in the order shown on the notification chart for the appropriate level (see *Notification Charts* tab).
- Provide updates of the situation to the police/sheriff dispatcher to assist them in making timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the EAP is reviewed and updated annually and copies of the revised EAP are distributed to all who received copies of the original EAP.

Incident Commander (Chaut. Co. Sheriff)

- Serve as the primary contact person responsible for coordination of all emergency actions.
- When a Level 2 situation occurs: Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
- When a Level 3 situation occurs:
  - Initiate warnings and order evacuation of people at risk downstream of the dam.
  - Notify local emergency management services to carry out the evacuation of people and close roads within the evacuation area (see *Evacuation Map* tab).
- Decide when to terminate the emergency.
- Participate in an annual review and update of the EAP.

Emergency Management Services (Chaut. Co. EMS)

- Maintain communication with media.
- When a Level 2 situation occurs:
  - Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
  - Alert the public as appropriate.
- When a Level 3 situation occurs:
  - Alert the public.
  - Immediately close roads and evacuate people within the evacuation area (see *Evacuation Map* tab).
- Participate in an annual review and update of the EAP.

Dam Operator's Technical Representatives (NRCS)

- Advise the dam operator of the emergency level determination, if time permits.
- Advise the dam operator of remedial actions to take if Level 2 event occurs, if time permits.

State Dam Safety Agency (NYSDEC)

- Advise the dam operator of the emergency level determination, if time permits.
- Advise the dam operator of remedial actions to take if Level 2 event occurs, if time permits.

The Five-step EAP Process

Step 1 Event Detection

This step describes the detection of an unusual or emergency event and provides information to assist the dam operator in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations at or near the dam by government personnel (local, state, or Federal), landowners, visitors to the dam, or the public
- Evaluation of instrumentation data
- Earthquakes felt or reported in the vicinity of the dam
- Forewarning of conditions that may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

See *Guidance for Determining the Emergency Level* table for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

Step 2 Emergency Level Determination

After an unusual or emergency event is detected or reported, the Conservation District Manager or his alternate is responsible for classifying the event into one of the following three emergency levels:

Emergency Level 1—Nonemergency, unusual event, slowly developing:
This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. NRCS technical representatives or state dam safety officials should be contacted to investigate the situation and recommend actions to take. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Sheriff should be informed if it is determined that the conditions may possibly develop into a worse condition that may require emergency actions.

Emergency Level 2—Potential dam failure situation, rapidly developing:
This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The Sheriff should be notified of this emergency situation and placed on alert. The dam operator should closely monitor the condition of the dam and periodically report the status of the situation to the Sheriff. If the dam condition worsens and failure becomes imminent, the Sheriff must be notified immediately of the change in the emergency level to evacuate the people at risk downstream.

If time permits, NRCS and state dam safety officials should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The dam operator should initiate remedial repairs (note local resources that may be available—see Appendix B–1). Time available to employ remedial actions may be hours or days.

This emergency level is also applicable when flow through the earth spillway has or is expected to result in flooding of downstream areas and people near the channel could be endangered. Emergency services should be on alert to initiate evacuations or road closures if the flooding increases.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:
This is an extremely urgent situation when a dam failure is occurring or obviously is about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the earth spillway is causing downstream flooding of people and roads. The Sheriff should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed (see *Evacuation Map* tab).

See the following pages for guidance in determining the proper emergency level for various situations.

Guidance for Determining the Emergency Level

Event	Situation	Emergency level*
Earth spillway flow	Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion	1
	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	2
	Spillway flowing with an advancing headcut that is threatening the control section	3
	Spillway flow that is flooding people downstream	3
Embankment overtopping	Reservoir level is 1 foot below the top of the dam	2
	Water from the reservoir is flowing over the top of the dam	3
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2
	Seepage with discharge greater than 10 gallons per minute	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	2
	Rapidly enlarging sinkhole	3
Embankment cracking	New cracks in the embankment greater than ¼-inch wide without seepage	1
	Cracks in the embankment with seepage	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly proceeding slides of the embankment slopes	3
Instruments	Instrumentation readings beyond predetermined values	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Sabotage/ vandalism	Damage to dam or appurtenance with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	3

* Emergency Level 1: Nonemergency unusual event, slowly developing
* Emergency Level 2: Potential dam failure situation, rapidly developing
* Emergency Level 3: Urgent; dam failure appears imminent or is in progress

Examples of Emergency Situations

The following are examples of conditions that usually constitute an emergency situation that may occur at a dam. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original designed conditions can cause significant flow through the auxiliary spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency-level condition. The groupings are provided as guidance only. Not all emergency conditions may be listed, and the dam operator is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam.

Pre-existing conditions on this dam: There has been a small seepage area near the downstream toe on the north side of the release channel. This was first noticed in the 1990s, but has not changed since that time.

Earth Spillway Flows

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Significant erosion or headcutting of the spillway is occurring, but the rate does not appear to threaten an imminent breach of the spillway crest that would result in an uncontrolled release of the reservoir.
2. Flow through the earth auxiliary spillway is or is expected to cause flooding that could threaten people, homes, and/or roads downstream from the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Significant erosion or headcutting of the spillway is occurring at a rapid rate, and a breach of the control section appears imminent.
2. Flow through the earth auxiliary spillway is causing flooding that is threatening people, homes, and/or roads downstream from the dam.

Embankment Overtopping

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. The reservoir level is within 1 foot from the top of the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. The reservoir level has exceeded the top of the dam, and flow is occurring over the embankment.

Seepage and Sinkholes

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam or settlement of the dam is observed.
4. Reservoir level is falling without apparent cause.
5. The following known dam defects are or will soon be inundated by a rise in the reservoir:
   - Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
   - Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Embankment Movement and Cracking

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam that may eventually result in breaching of the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Sudden or rapidly proceeding slides, settlement, or cracking of the embankment crest, slopes, abutments, and/or foundation, and breaching of the dam appears imminent or is in progress.

Step 3 Notification and Communication

Notification

After the emergency level has been determined, the people on the following notification charts for the appropriate emergency level shall be notified immediately.

Communication

Emergency Level 1—Nonemergency, unusual event; slowly developing:
The Conservation District Manager and NRCS District Conservationist should contact the NRCS State Conservation Engineer and Conewango Watershed Commission. Describe the situation, and request technical assistance on next steps to take.

Emergency Level 2—Emergency event, potential dam failure situation; rapidly developing:
The following message may be used to help describe the emergency situation to the Sheriff or Chautuauqua County emergency management personnel:

"This is _____Identify yourself; name, position)_____.

We have an emergency condition at Conewango Creek Watershed, Dam No.33 , located 1 mile south of Cherry Creek.

We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 2.

We are implementing predetermined actions to respond to a rapidly developing situation that could result in dam failure.

Please prepare to evacuate the area along low-lying portions of Cherry Creek.

Reference the evacuation map in your copy of the Emergency Action Plan.

We will advise you when the situation is resolved or if the situation gets worse.

I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number _____."

Emergency Level 3—Urgent event; dam failure appears imminent or is in progress:
The Sheriff should be contacted immediately and the area evacuated (see *Evacuation Map* tab). The following actions should be taken:

1. Call the Sheriff's dispatch center. Be sure to say, "This is an emergency." They will call other authorities and the media and begin the evacuation. The following message may be used to help describe the emergency situation to the Sheriff or Chautauqua County emergency management personnel:

   "This is an emergency. This is _____Identify yourself; name, position)_____.

   Conewango Creek Watershed Site 9A-Villenova, located 4 miles Northeast of South Dayton, is failing. The downstream area must be evacuated immediately. Repeat, Conewango Creek Watershed, Dam No. Site 9A-Villenova, is failing; evacuate the area along low-lying portions of Villenova.

   We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 3. Reference the evacuation map in your copy of the Emergency Action Plan.

   I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number_____."

2. Do whatever is necessary to bring people in immediate danger (anyone on the dam, downstream from the dam, boating on the reservoir, or evacuees) to safety if directed by the Sheriff.
3. Keep in frequent contact with the Sheriff and emergency services to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.
4. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to re-establish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to re-establish contact with the Sheriff and emergency services.

The following prescripted message may be used as a guide for the Sheriff or Chautauqua County emergency services personnel to communicate the status of the emergency with the public:

Attention: This is an emergency message from the Sheriff. Listen carefully. Your life may depend on immediate action.

Conewango Creek Watershed, Dam No. 9A-Villenova, located 4 miles northeast of South Dayton, is failing. Repeat. Conewango Creek Watershed, Dam No. Site 9A, located 4 miles northeast of South Dayton, is failing.

If you are in or near this area, proceed immediately to high ground away from the valley. Do not travel on Smith Road or return to your home to recover your possessions. You cannot outrun or drive away from the flood wave. Proceed immediately to high ground away from the valley.

Repeat message.

Emergency Level 1 Notifications

Nonemergency
unusual event; slowly developing

Dam Operator's Rep.
Conewango Watershed / Conservation District Manager
Dave Spann (Chaut. Co. Soil & Water)
716-664-2351 x117 (Office)
716-969-5266 (Cell)

(1)

Dam Operator's Technical Reps.
Conewango Watershed
Ken Chase
716-296-5721 (Office)
716-499-5721 (Cell)

(2)

State Dam Safety Official.
DEC Division of Water
Alon Dominitz
518-402-8185 (Office)
518-852-0415 (Cell)

Dam Operator's Technical Reps.
NRCS Watershed Engineer
Batavia Office
585-343-9167 (Office)

Dam Operator's Technical Reps.
Chautauqua County
Dept. of Public Facilities
Drew Rodgers
716-661-8410 (Office)
716-450-4346 (Cell)

Dam Operator's Technical Reps.
NRCS State Engineer
Syracuse Office
315-477-6538 (Office)

Note:
1, 2, etc., denotes call sequence

Legend:
Calls by operator _____
Second level calls - - - - -

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Level 2 Notifications

Emergency event, potential dam failure situation; rapidly developing

Dam Operator's Rep.
Conewango Watershed / Conservation District Manager
Dave Spann (Chaut. Co. Soil & Water)
716-664-2351 x117 (Office)
716-969-5266 (Cell)

(1)

Dam Operator's Technical Reps.
Conewango Watershed
Ken Chase
716-296-5721 (Office)
716-499-5721 (Cell)

Dam Operator's Technical Reps.
Chautauqua County
Dept. of Public Facilities
Drew Rodgers
716-661-8410 (Office)
716-450-4346 (Cell)

Dam Operator's Technical Reps.
NRCS State Watershed Engineer
Batavia Office
585-343-9167

Dam Operator's Technical Reps.
NRCS State Engineer
Syracuse Office
315-477-6538

(2)

Incident Commander
Chautauqua County Sheriff
Jim Quattrone
716-753-4900 (Office)
911 (Emergency)
716-753-4232 (Non-Emergency)

Chautauqua County
Emergency Management
Dispatcher
716-753-4341 (Office)
911 (Emergency)

Chautauqua County
Sherriff's Dispatcher
911 (Emergency)
716-753-4232 (Non-Emergency)

New York State Police
Troop A Zone 3 Jamestown
716-665-3113

(3)

State Dam Safety Official
DEC Division of Water
Alon Dominitz
518-402-8185 (Office)
518-852-0415 (Cell)

Cattaraugus County
Emergency Management
Dispatcher
716-938-2240 (Office)

Ellington Volunteer
Fire Department
716-287-2168(Non-Emergency)
911 (Emergency)

National Weather Service
Judith Levan, Warning
Coordinating Meteorologist
716-565-0103

Note:
1, 2, etc., denotes call sequence

Legend:
Calls by operator _____
Second level calls - - - - - -

See *Communications* tab for prescripted messages.

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Level 3 Notifications

Urgent event, dam failure appears imminent or is in progress

Dam Operator's Rep.
Conewango Watershed / Conservation District Manager
Dave Spann (Chaut. Co. Soil & Water)
716-664-2351 x117 (Office)
716-969-5266 (Cell)

(1)

Incident Commander
Chautauqua County Sheriff
Jim Quattrone
716-453-4900 (Office)
911 (Emergency)
716-753-4232 (Non-Emergency)

Chautauqua County Emergency Management Dispatcher
716-753-4341 (Office)
911 (Emergency)

Chautauqua County Sheriff's Dispatcher
911 (Emergency)
716-753-4232 (Non-Emergency)

New York State Police
Troop A Zone 3 Jamestown
716-665-3113

(2)

State Dam Safety Official
DEC Division of Water
Alon Dominitz
518-402-8185 (Office)
518-852-0415 (Cell)

National Weather Service
Judith Levan, Warning Coordinating Meteorologist
716-565-0103
716-565-0013 (alt)

Cattaraugus County Emergency Management Dispatcher
716-938-2240 (Office)

Ellington Volunteer Fire Department
716-287-2168(Non-Emergency)
911 (Emergency)

(3)

Dam Operator's Technical Reps.
Conewango Watershed
Ken Chase
716-296-5721 (Office)
716-499-5721 (Cell)

Dam Operator's Technical Reps.
Chautauqua County Dept. of Public Facilities
Drew Rodgers
716-661-8410 (Office)
716-450-4346 (Cell)

Dam Operator's Technical Reps.
NRCS State Watershed Engineer
Batavia Office
585-343-9167

Dam Operator's Technical Reps.
NRCS State Engineer
Syracuse Office
315-477-6538

Note:
1, 2, etc., denotes call sequence

Legend
Calls by operator _____
Second level calls - - - - -

See *Communications* tab for prescripted messages.

Emergency Services Contacts

Agency / Organization	Principal contact	Address	Office telephone number	Alternate telephone numbers
Chautauqua County Office of the Executive	George Borrello County Executive	3 North Erie Street Mayville, NY 14757	716-453-4211	716-420-1010 (C)
Chautauqua County Depart. of Public Facilities	Brad Bentley, Director	454 North Work St. Falconer, NY 14733	716-661-8406	716-581-0103 (C)
Chautauqua County Depart. of Public Facilities	Drew Rodgers Engineer III	454 North Work St. Falconer, NY 14733	716-661-8410	716-450-4346 (C)
Chautauqua County Soil & Water Conservation District	Dave Spann District Field Manager	220 Fluvanna Ave Suite 600 Jamestown, NY 14701	716-664-2351 x117	716-969-5266 (C)
Natural Resources Conservation Service	State Engineer Syracuse Office	4415 S. Salina St, Ste. 354 Syracuse, NY13202	315-447-6538	
Natural Resources Conservation Service	State Watershed Engineer Batavia Office	USDA Service Center 26 Liberty St. Ste 1 Batavia, NY 14020	585-343-9167	
NY State Dame Safety Official – Division of Water	Alon Dominitz	625 Broadway, 4th Floor Albany, NY 12233	518-402-8185	518-852-0415 (C)
Conewango Watershed Commission	Ken Chase, Chairman	6267 South Rd. Cherry Creek, NY 14723	716-296-5721	716-499-5721 (C)
Chautauqua County Emergency Management Coordinator	John Griffith, Director	2 Academy St. Ste A Room 106 Mayville, NY 14757	716-753-4341	716-269-4656
Cattaraugus County Emergency Management Coordinator	Chris Baker Emergency Coordinator	303 Court Street Little Valley, NY 14755	716-938-2240	716-798-0697 (C)
Chautauqua County Sheriff	Jim Quattrone	13 E. Chautauqua St. Mayville, NY 14757	716-753-4900	716-753-4231 (D)
New York Department of Transportation	Resident Engineer Chautauqua County	109 East Chautauqua St. Mayville, NY 14779	716-753-2821	
New York State Police	Zone Sergeant	Rt. 60 Jamestown, NY 14733	716-665-3113	716-699-8783
South Dayton Volunteer Fire Department		34 Maple Street S. Dayton, NY 14138	716-988-5153	
Landowner of Dam No. 9A	Kristopher Ivett	8778 N. Hill Road South Dayton, NY 14138		
Landowner of Dam No. 9A	Everett Wolfe	7320 E. Shoreward Loop Tucson, AZ 85715		
National Weather Service	Judith Levan, Warning Coord. Meteorologist	587 Aero Drive Buffalo, NY 14225	716-565-0103	716-565-0013
Town of Villenova Highway Department	Charles Luce Sr.	1088 Butcher Road S. Dayton, NY 14138	716-988-3678	

WKSN-WHUG-WQFX	2 Orchard Park Road, Jamestown, NY 14701	716-664-2313	
WKSN 106.9 Radio	106 West Third Street, Jamestown, NY 14701	716-487-1106	
WKBW-TV Channel 7	7 Braodcast Plaza, Buffalo, NY 14202	716-845-6100	
WIVB Channel 4/23	2077 Elmwood Ave., Buffalo, NY 14207	716-874-4410	716-874-7333 716-794-3687
WGRZ Channel 2	259 Delaware Ave., Buffalo, NY 14202	176-849-2222	716-849-2220

Step 4 Expected Actions

If the police or Sheriff receives a 911 call regarding observations of an unusual or emergency event at the dam, they should immediately contact the Conservation District office. After the Conservation District Manager determines the emergency level, the following actions should be taken. If time permits, NRCS and the New York Water Resources Board should be contacted for technical consultation.

Emergency Level 1—Nonemergency, unusual event; slowly developing:

A. The Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS or the New York Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**

B. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

C. The Conservation District Manager should contact NRCS and request technical staff to investigate the situation and recommend corrective actions.

Emergency Level 2—Potential dam failure situation; rapidly developing:

A. The Conservation District Manager should contact the NRCS and the New York Water Resources Board to report the situation and, if time permits, request technical staff to investigate the situation and recommend corrective actions.

B. The Conservation District Manager should contact the sheriff to inform him/her that the EAP has been activated and if current conditions get worse, an emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.

C. Provide updates to the Sheriff and emergency services personnel to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.

D. If time permits, the Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS and the New York Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**

E. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

F. If time permits, the following emergency remedial actions should be taken as appropriate.

Emergency Level 2—Potential dam failure situation; rapidly developing—continued:

Emergency remedial actions

If time permits, the following emergency remedial actions should be considered for Emergency Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with NRCS and the New York Water Resources Board. See *Resources Available* (Appendix B–1) for sources of equipment and materials to assist with remedial actions.

Embankment overtopping

1. If the water level in the reservoir is no longer rising, place sandbags along the low areas of the top of the dam to control wave action, reduce the likelihood of flow concentration during minor overtopping, and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection.

Seepage and sinkholes

1. Open the principal spillway gate to lower the reservoir level as rapidly as possible to a level that stops or decreases the seepage to a nonerosive velocity. If the gate is damaged or blocked, pumping or siphoning may be required.

   Continue lowering the water level until the seepage stops.

2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials such as hay bales, bentonite, soil or rockfill, or plastic sheeting.
3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the gate is damaged or blocked, pumping or siphoning may be required.
2. Repair settlement of the crest by placing sandbags or earth and rockfill materials in the damaged area to restore freeboard.
3. Stabilize slides by placing a soil or rockfill buttress against the toe of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform a field survey to determine if there has been any settlement and movement of the dam embankment, spillway, and low-level outlet works.
3. Drain the reservoir, if required.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

A. The Conservation District Manager shall immediately contact the Sheriff and others shown on the notification chart.

B. The Sheriff shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam (see *Evacuation Map* tab).

C. Emergency management services personnel shall alert the public and immediately evacuate at-risk people and close roads as necessary.

D. The Conservation District Manager shall maintain continuous communication and provide the Sheriff with updates of the situation to assist him/her in making timely decisions concerning warnings and evacuations.

E. The Conservation District Manager should record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

F. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

Step 5 Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Sheriff is responsible for terminating EAP operations and relaying this decision to the Conservation District Manager. It is then the responsibility of each person to notify the same group of contacts that were notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Emergency Level 3 event that has not caused actual dam failure, the NRCS technical representative or the State Dam Safety Officer will inspect the dam or require the inspection of the dam to determine whether any damage has occurred that could potentially result in loss of life, injury, or property damage. If it is determined that conditions do not pose a threat to people or property, the Sheriff will be advised to terminate EAP operations as described above.

The Conservation District Manager shall assure that the *Dam Safety Emergency Situation Report* (Appendix A–3) is completed to document the emergency event and all actions that were taken. The Conservation District shall distribute copies of the completed report to the New York Water Resources Board and the NRCS State Conservation Engineer.

Maintenance—EAP Review and Revision

EAP annual review

The Department of Public Facilities will review and, if needed, update the EAP at least once each year. The EAP annual review will include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current. The EAP will be revised if any of the contacts have changed.
- Contacting the local law enforcement agency to verify the phone numbers and persons in the specified positions.
- Calling the locally available resources to verify that the phone numbers, addresses, and services are current.

Revisions

The Department of Public Facilities will be responsible for updating the EAP document. The EAP document held by the Department of Public Facilities will be the master document. When revisions occur, the Department of Public Facilities will provide the revised pages and a revised revision summary page to all the EAP document holders. The document holders are responsible for revising outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the revisions.

EAP periodic test

The Department of Facilities will host and facilitate a periodic test of the EAP at least once every 5 years.

The periodic test will consist of a meeting, including a tabletop exercise, conducted at the Chautauqua County Emergency Management office. Attendance should include the Department of Public Facilities, Emergency Management personnel, Conewango Watershed Committee Chairman, Conservation District Manager, key conservation district staff members, NRCS staff, at least one representative of the local law enforcement agency, and others with key responsibilities listed in the EAP. At the discretion of the Department of Public Facilities, other organizations that may be involved with an unusual or emergency event at the dam are encouraged to participate. Before the tabletop exercise begins, meeting participants will visit the dam during the periodic test to familiarize themselves with the dam site.

The tabletop exercise will begin with the facilitator presenting a scenario of an unusual or emergency event at the dam. The scenario will be developed prior to the exercise. Once the scenario has been presented, the participants will discuss the responses and actions that they would take to address and resolve the scenario. The narrator will control the discussion, ensuring realistic responses and developing the scenario throughout the exercise. The Conservation District Manager should complete an event log as they would during an actual event.

After the tabletop exercise, the five sections of the EAP will be reviewed and discussed. Mutual aid agreements and other emergency procedures can be discussed. The Department of Public Facilities will prepare a written summary of the periodic test and revise the EAP, as necessary.

Record of Holders of Control Copies of this EAP

Copy Number	Organization	Person receiving copy
1	Chautauqua County DPF 454 North Work Street Falconer, NY 14733	Drew Rodgers
2	Chautauqua County Soil & Water Conservation District 220 Fluvanna Avenue Suite 600 Jamestown, NY 14701	Dave Spann
3	Conewango Watershed Commission NRCS Field Office 6914 Main St. Cherry Creek, NY 14723	Ken Chase
4	Chautauqua County Sheriff's Department 15 E. Chautauqua Mayville, NY 14757	Jim Quattrone
5	Chautauqua County Emergency Management Services 2 Academy St., Ste. A Room 106 Mayville, NY 14757	John Griffith
6	N.Y.S. Police Rt. 60 Jamestown, NY 14701	Zone Sergeant
7	NRCS State Office 441 S. Salina St. Ste. 354 Syracuse, NY 13202	State Engineer
8	New York State Dam Safety 625 Broadway, 4th Floor Albany, NY 12233	Alon Dominitz
9	NYSOEM Headquarters Planning Section 1220 Washington Ave., Bldg. 22 Albany, NY 12226	Chris Pounds

Record of Revisions and Updates Made to EAP

Revision Number	Date	Revisions made	By whom
1	8/2017	**Basic EAP Data** – revised Potential Impacted Area Statement **Basic EAP Data** – revised Dam Description drainage area and major property owners **Roles and Responsibilities** – removed specific names and replaced with agency names **Emergency Level 1 Notifications** – updated names, agencies, and contact information **Emergency Level 2 Notifications** – updated names, agencies, and contact information **Emergency Level 3 Notifications** – updated names, agencies, and contact information **Maintenance – EAP Review and Revision** – modified plan to change EAP review, revision, and upkeep from Conservation District Manager to Department of Public Facilities **Record Holders of Control Copies of this EAP** – updated names, agencies, and contact information. Added NYSOEM **Appendix B-1** – updated Town of Villenova Highway Supt. contact information **Appendix B-2** – added location map from Engineering Assessment **Appendix B-3** – added watershed project map from Engineering Assessment **Appendix B-4** – added inundation mapping from Engineering Assessment **Appendix B-5** – updated Residents/Businesses/Highway at Risk and basis of evacuation area and flooding depths **Appendix B-6** – added plan view of dam from	D. Rodgers, CCDPF

		Engineering Assessment. **Appendix B-7** – added profile of principal spillway **Appendix B-8** – updated Reservoir Elevation-Area-Volume and Spillway Capacity Data from Engineering Assessment **Appendix B-9** – updated dam information from Engineering Assessment	
2	12/31/2018	**Emergency Level 2 & 3 Notifications; Emergency Services Contacts; Record of Holders** – updated names and/or contact information **Appendix B1** – updated names	Drew Rodgers

Concurrences

By my signature, I acknowledge that I, or my representative, have reviewed this plan and concur with the tasks and responsibilities assigned herein for me and my organization.

1._____

Signature *Organization* *Date*

Printed name and title:

2. _____

Signature *Organization* *Date*

Printed name and title:

3._____

Signature *Organization* *Date*

Printed name and title:

4._____

Signature *Organization* *Date*

Printed name and title:

5._____

Signature *Organization* *Date*

Printed name and title: _____

6._____

Signature *Organization* *Date*

Printed name and title:_____

7._____

Signature *Organization* *Date*

Printed name and title: _____

Appendices—Forms, Glossary, Maps, and Supporting Data

Appendix A

A–1 Contact Checklist

A–2 Unusual or Emergency Event Log Form

A–3 Dam Emergency Situation Report Form

A–4 Glossary of Terms

Appendix B

B–1 Resources Available

B–2 Location and Vicinity Maps

B–3 Watershed Project Map

B–4 Evacuation Map

B–5 Residents/Businesses/Highways at Risk

B–6 Plan View of Dam

B–7 Profile of Principal Spillway

B–8 Reservoir Elevation-Area-Volume and Spillway Capacity Data

B–9 National Inventory of Dams (NID) Data

Appendix A–1

Contact Checklist

Conewango Creek Watershed, Dam No. Site 9A

Chautauqua County, NY Date _____

The following contacts should be made immediately after the emergency level is determined (see pages 7–10 for guidance to determine the appropriate emergency level for a specific situation). The person making the contacts should initial and record the time of the call and who was notified for each contact made. See the *Notification Charts* tab for critical contact information and *Emer. Services Contacts* tab for contact information for other possible emergency services.

Emergency Level 1 (see page 12)	Person Contacted	Time Contacted	Contacted by
___ NRCS District Conservationist	_____	_____	_____
___ NRCS State Conservation Engineer	_____	_____	_____
___ New York Water Resources Board	_____	_____	_____

Emergency Level 2 (see page 13)	Person Contacted	Time Contacted	Contacted by
____ NRCS District Conservationist	_____	_____	_____
____ NRCS State Conservation Engineer	_____	_____	_____
____ New York Water Resources Board	_____	_____	_____
____ Sheriff	_____	_____	_____

Emergency Level 3 (see page 14)	Person Contacted	Time Contacted	Contacted by
____ Sheriff	_____	_____	_____
____ New York Water Resources Board	_____	_____	_____
____ NRCS District Conservationist	_____	_____	_____
____ NRCS State Conservation Engineer	_____	_____	_____

Appendix A–2

Unusual or Emergency Event Log

(to be completed during the emergency)

Dam name: Conewango Creek Watershed Dam #9A County: Chautauqua County

When and how was the event detected?

_____

_____

Weather conditions: _____

_____

General description of the emergency situation:

_____

_____

_____

Emergency level determination: _____ Made by: _____

Actions and Event Progression

Date	Time	Action/event progression	Taken by

Report prepared by: _____ Date: _____

Appendix A–3

Dam Emergency Situation Report

(to be completed following the termination of the emergency)

Dam name: Conewango Creek Watershed, Site 9A

National Inventory of Dams (NID) No.: NY 00596

Dam location: 4 Mile Northeast of South Dayton Chautauqua County Conewango Creek

(City) *(County)* *(Stream/River)*

Date: Time:

Weather conditions: _____

General description of emergency situation:

_____

_____

Area(s) of dam affected:

_____

_____

Extent of dam damage: _____

Possible cause(s): _____

Effect on dam's operation: _____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

_____

_____

Other data and comments:

_____

Observer's name and telephone number: _____

Report prepared by: _____ Date: _____

Appendix A–4
Glossary of Terms

Abutment That part of the valleyside against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.

Acre-foot A unit of volumetric measure that would cover 1 acre to a depth of 1 foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.

Berm A nearly horizontal step (bench) in the upstream or downstream sloping face of the dam.

Boil A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.

Breach An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.

Conduit A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.

Control section A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.

Cross section A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. Also, a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream.

Dam An artificial barrier generally constructed across a watercourse for the purpose of impounding or diverting water.

Dam failure The uncontrolled release of a dam's impounded water.

Dam Operator The person(s) or unit(s) of government with responsibility for the operation and maintenance of dam.

Drain, toe or foundation, or blanket A water collection system of sand and gravel and typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet.

Drainage area (watershed) The geographic area on which rainfall flows into the dam.

Drawdown The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.

Emergency A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.

Emergency Action Plan (EAP)	A formal document identifying potential emergency conditions that may occur at the dam and specifying preplanned actions to minimize potential failure of the dam or minimize failure consequences including loss of life, property damage, and environmental impacts.
Evacuation map	A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.
Filter	The layers of sand and gravel in a drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.
Freeboard	Vertical distance between a stated water level in the reservoir and the top of dam.
Gate, slide or sluice, or regulating	An operable, watertight valve to manage the discharge of water from the dam.
Groin	The area along the intersection of the face of a dam and the abutment.
Hazard classification	A system that categorizes dams (high, significant, or low) according to the degree of their potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or misoperation of a dam.
Height, dam	The vertical distance between the lowest point along the top of the dam and the lowest point at the downstream toe, which usually occurs in the bed of the outlet channel.
Hydrograph, inflow or outflow, or breach	A graphical representation of either the flow rate or flow depth at a specific point above or below the dam over time for a specific flood occurrence.
Incident Commander	The highest predetermined official available at the scene of an emergency situation.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation area or map	The geographic area downstream of the dam that would be flooded by a breach of the dam or other large discharge.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.
Outlet works (principal spillway)	An appurtenant structure that provides for controlled passage of normal water flows through the dam.
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.

Probable Maximum Precipitation (PMP) or Flood (PMF)	The theoretically greatest precipitation or resulting flood that is meteorologically feasible for a given duration over a specific drainage area at a particular geographical location.
Reservoir	The body of water impounded or potentially impounded by the dam.
Riprap	A layer of large rock, precast blocks, bags of cement, or other suitable material, generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.
Risk	A measure of the likelihood and severity of an adverse consequence.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway (auxiliary or emergency)	The appurtenant structure that provides the controlled conveyance of excess water through, over, or around the dam.
Spillway capacity	The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.
Spillway crest	The lowest level at which reservoir water can flow into the spillway.
Tailwater	The body of water immediately downstream of the embankment at a specific point in time.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.

Appendix B–1
Resources Available

Locally available equipment, labor, and materials:
The county has the following resources that can be utilized in the event of an emergency:

Contact: Brad Bentley, Director County Department of Public Facilities: 716-664-8400
Charles Luce Sr. HWY. Supervisor Town of Villenova: 716-988-3678

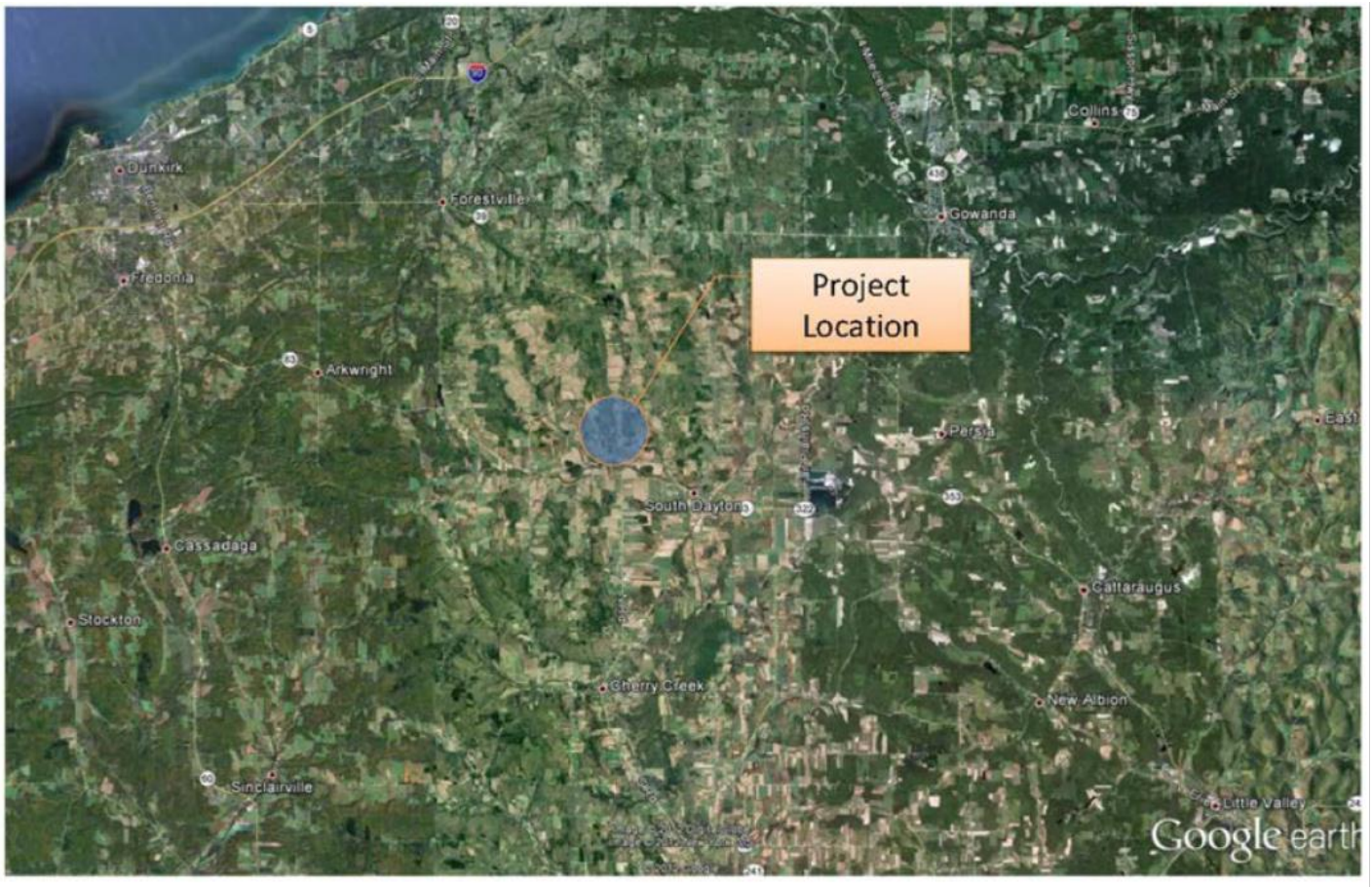
- Heavy Construction equipment, trucks and manpower.
- Loaders, Trucks, Dozer, Backhoe, etc.

Other locally available resources include:

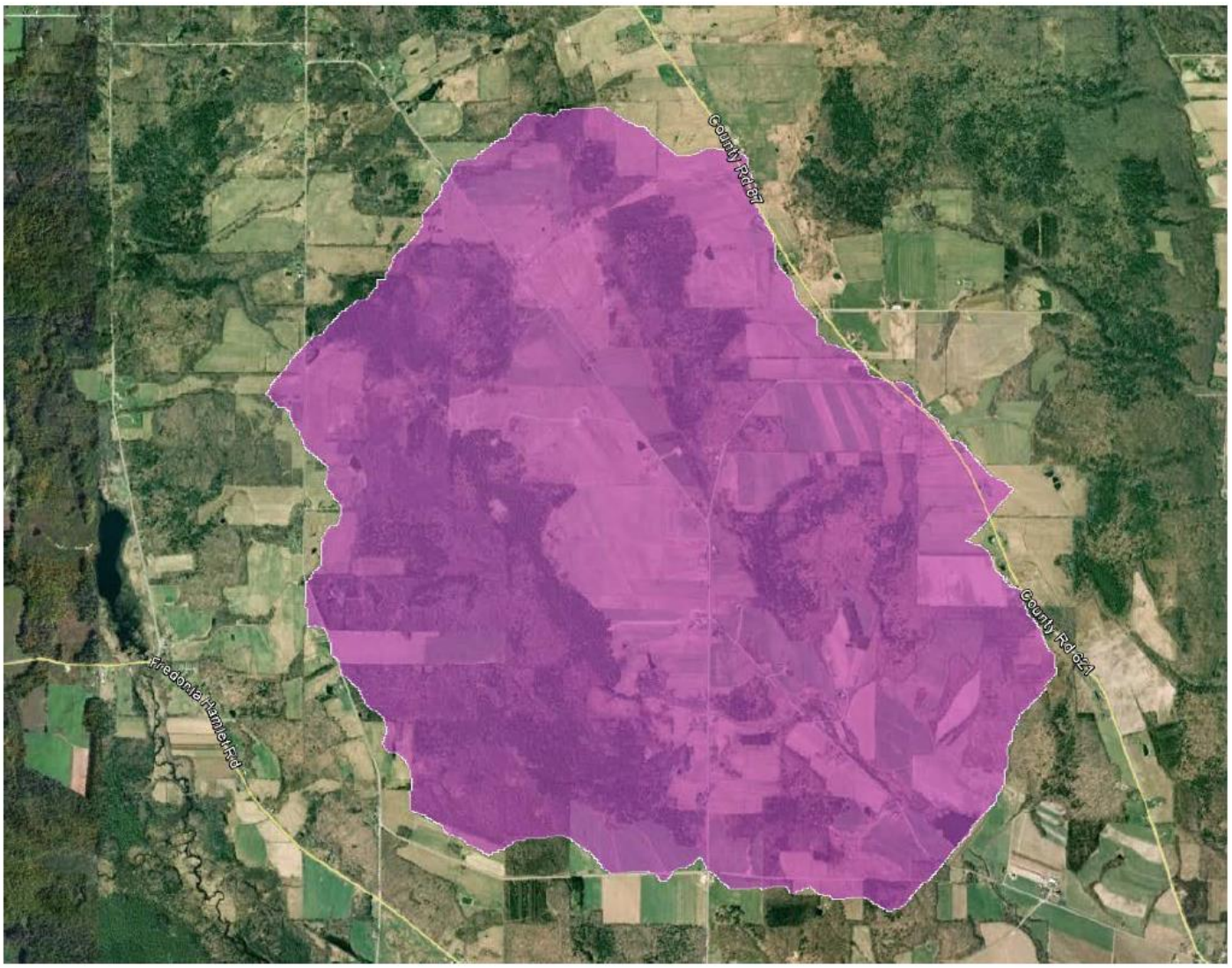
Heavy equipment service and rental	**Sand and gravel supply**	**Ready-mix concrete supply**
JSE Excavating 6032 Rt. 83 Cherry Creek, NY 14723 Jim Schimek 716-485-3800	Countryside Sand & Gravel Rt. 62 South Dayton, NY 14138 716-988-3271	LER Concrete, Inc. 1946 New York Ave. Falconer, NY 14733 716-665-4504
Doug Rice Excavating 28 Creek Road Ellington, NY 14732 716-287-3712	Cherry Creek Sand & Gravel PO Box 306 Cherry Creek, NY 14723 716-296-9910	Hanson Aggregates Allen St. Ext. Jamestown, NY 14701 716-665-4620
ADMAR Supply Co., Inc. 1394 Military Road Buffalo, NY 14207 1-800-353-2367	Frew Run Gravel Products 984 Frew Run Road Frewsburg, NY 14738 716-569-4712	JMI Concrete Products Jamestown, NY 14701 716-665-4504

Pumps	Diving contractor	Divers
ADMAR Supply Co. 1394 Military Rd. Buffalo, NY 14207 1-800-353-2367	Buffalo Industrial Diving, Inc 201 Ganson St. Buffalo, NY 14203 716-854-1041	Chautauqua County Emergency Services 2 Academy St. Mayville, NY 14757 716-753-14757
	Chautauqua County WET Mayville Dispatch	NYS Police Divers Falconer Barracks 716-665-3113

Appendix B–2
Location and Vicinity Maps



Appendix B–3
Watershed Project Map



Appendix B–4
Inundation/Evacuation Mapping

Appendix B–5
Residents/Businesses/Highways at Risk

A major flood caused by a sudden breach of the dam is estimated to inundate the areas shown in Appendix B-4. Specific residents that have higher potential of inundation are listed below.

House/ business no.*	Resident/business	Address	Phone no.	Distance downstream from dam (ft)	Travel time** (hr)	Max water depth above first floor (ft)
	Kristopher Ivett	752 Smith Road		0.6 miles	20 min	9 ft
	David Gregory	804 Smith Road		0.6 miles	20 min	9 ft
	Teresa Covert	NW Corner Dye Rd / Danker Road		1.7 miles	1hr	2 ft
	Marc Nobles	497 Danker Road		1.7 miles	1 hr	2 ft
	Lawrence & Evelyn J. Hooker Family Trust	422 Hooker Road		2.7 miles	2 hrs	3 ft
	Daniel Smallish	Hooker Road		2.7 miles	2 hrs	3 ft
	Dale Hooker	374 Hooker Road		2.7 miles	2 hrs	3 ft
	Allan Taber	8783 Buttermilk Road		1.7 miles	2 – 3 hrs	4 ft
	Charles West	8879 Buttermilk Road		1.7 miles	2 – 3 hrs	3 ft
	Stephen Foster	8911 Buttermilk Road		1.7 miles	2 – 3 hrs	1 ft
	Jacob Montgomery	Buttermilk Road		1.7 miles	2 – 3 hrs	1 ft
	William Klopf	Buttermilk Road		1.7 miles	2 – 3 hrs	1 ft
	Russel Duck	Buttermilk Road		1.7 miles	2 – 3 hrs	1 ft

	Brenda Spencer	194 Route 322		4 miles	3 hrs	2 ft
	Robert Taber	184 Route 322		4 miles	3 hrs	2 ft
	Alice Williams	Route 322		4 miles	3 hrs	2 ft
	David King	Villenova Road		4.5 miles	3 hrs	3 ft
	Village of S. Dayton from Pine St./Oak Road to Pine Street/Park Ave, approx. 0.1 mile south of Pine Street			4.5 miles– 5.1 miles	3 hrs – 4 hrs	1 ft
	Village of S. Dayton east and southeast of Pine Street/Park Ave			5.1 miles	4 hrs	1 ft

* See Appendix B–4.

** Estimated time for breach wave (peak) to travel from dam to downstream locations

Basis for computation of evacuation area and flooding depths

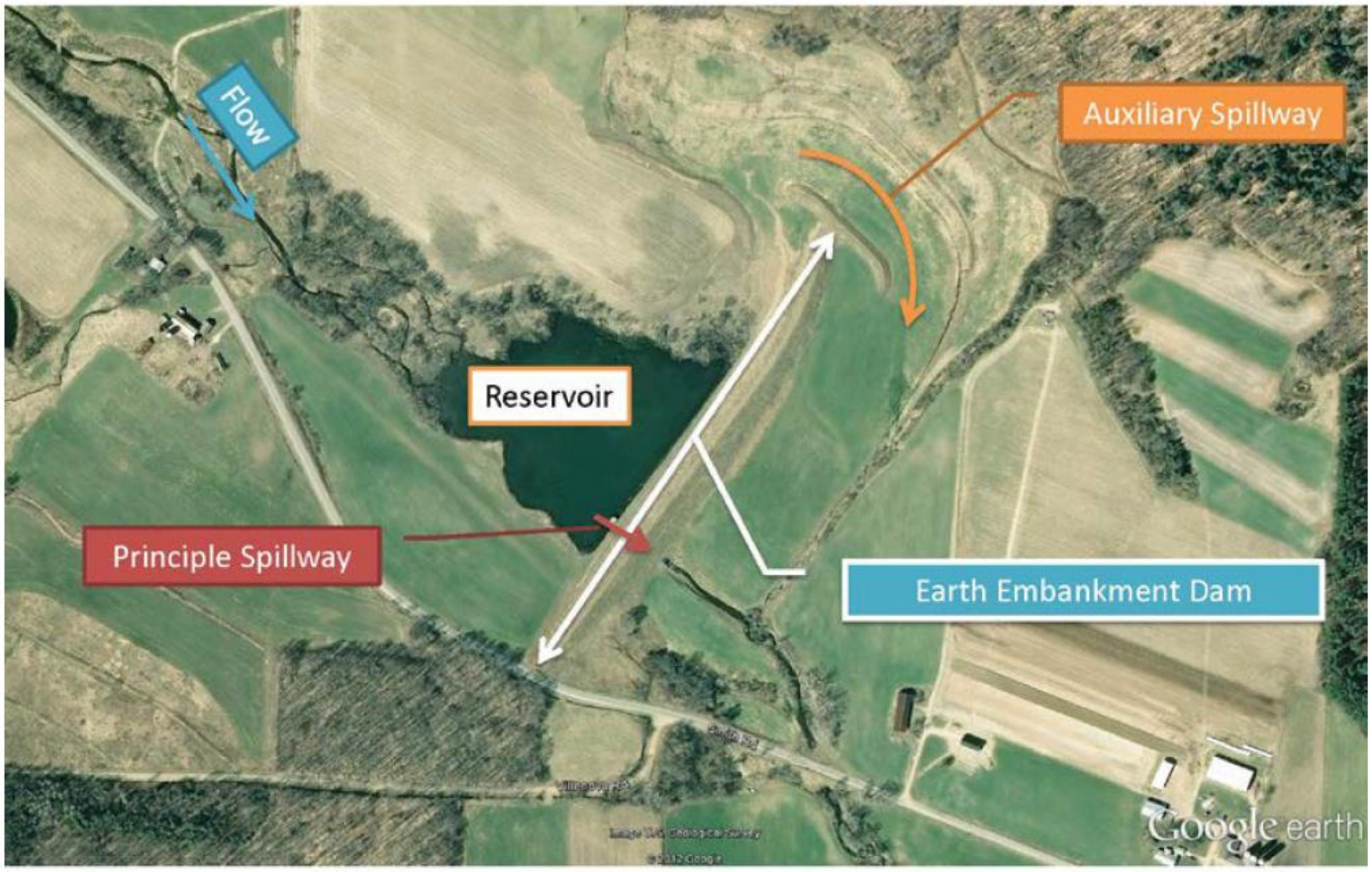
Breach inundation study completed by T.Y. Lin Internarial October 2013

Hydraulic model used: HEC-RAS (routing); HEC-HMS (peak discharge); HEC-HMS (hydrograph)

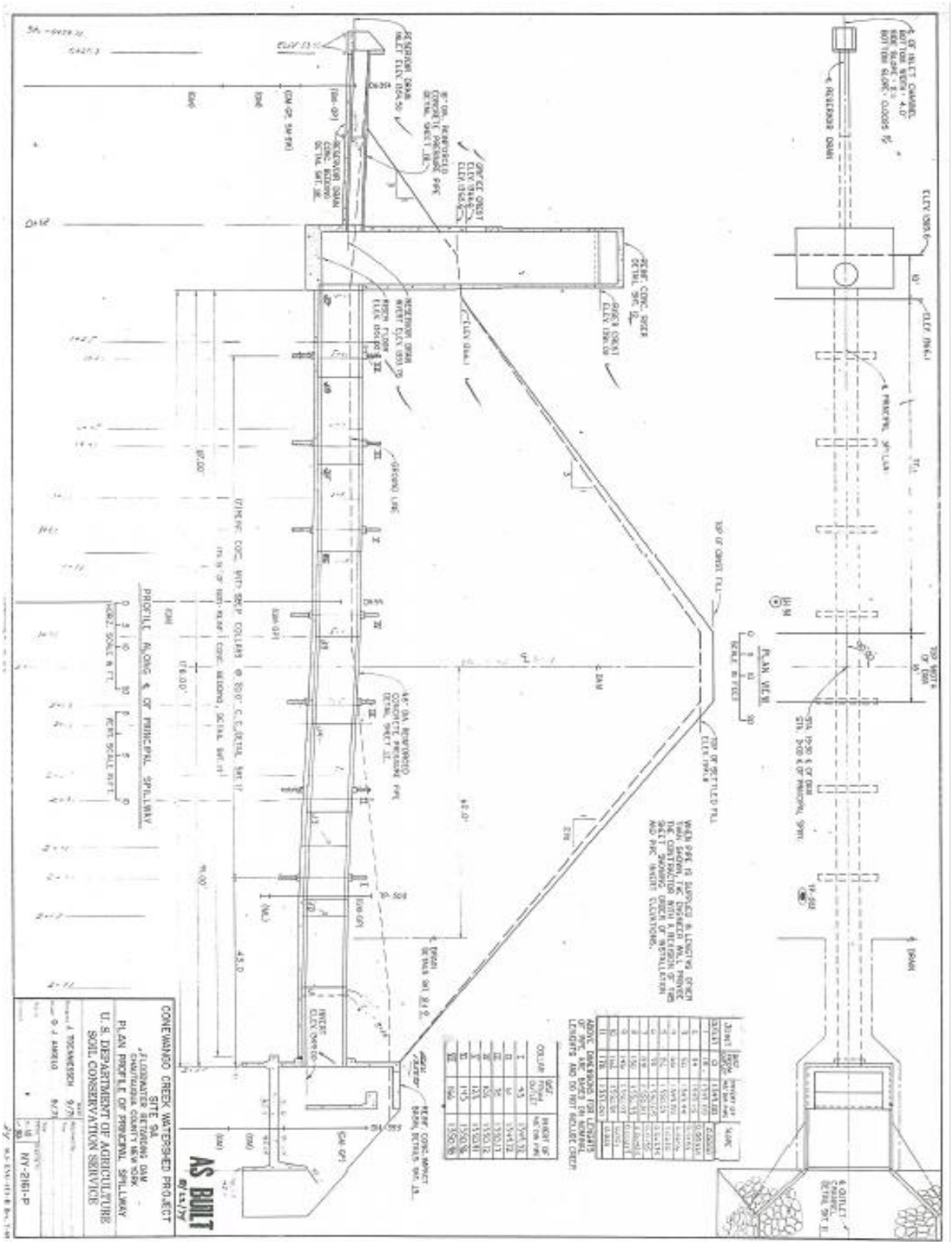
Model assumptions:

- X "Sunny Day" Breach (no inflow into the reservoir)
- X Water surface elevation in reservoir prior to breach = 1391.8 (top of dam)
- X Total volume of breach hydrograph = 1451.8 acre-ft
- X Height of water at time of breach = 1391.8 ft
- X Peak breach discharge = 26,379 ft^3/s
- ☐ Downstream area defined by field surveys consisting of __ cross sections and __ bridge openings

Appendix B–6
Plan View of Dam



Appendix B–7
Profile of Principal Spillway


CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
CHAUTAUQUA COUNTY NEW YORK
PLAN PROFILE OF PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AS BUILT
PLAN VIEW
PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY
DAM
TOP OF SETTLED FILL
TOP OF DAM
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EL. 1945.0
EL. 1941.0
EL. 1936.0
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Appendix B–8
Reservoir Elevation-area-volume and Spillway Capacity Data

CONEWANGO CREEK WATERSHED
DAM NO. 9A

Elevation	Reservoir Surface Area (Ac)	Reservoir Total Storage (ac-ft)	Combined Total Discharge (cfs)
Low Stage Inlet			
1366.6	9.39	0.00	0.0
1367	10.12	3.90	23.1
1368	11.96	14.94	43.3
1369	13.79	27.82	56.7
1370	15.62	42.52	67.4
1371	18.17	59.41	76.7
1372	20.72	78.86	85.0
1373	23.26	100.85	92.5
1374	25.81	125.38	99.5
1375	28.36	152.47	106.0
1376	30.95	182.12	112.1
1377	33.54	214.37	117.9
1378	36.13	249.20	123.5
1379	38.72	286.63	128.8
1380	41.31	326.64	133.9
Riser Inlet (1381.0)			
1381	44.02	369.31	138.8
1382	46.72	414.68	217.9
1383	49.43	462.75	358.5
1384	52.13	513.53	371.2
1385	54.84	567.02	382.0
Auxiliary Spillway (1386.0)			
1386	57.63	623.25	392.5
1387	60.41	628.27	562.3
1388	63.20	744.08	1454.4
1389	65.98	808.57	2769.4
Design High Water (1389.8)			
1389.8	68.21	862.35	4079.8
1390	68.77	876.04	4434.1
1391	71.69	946.28	6389.9
Top of Dam (1391.8)			
1391.8	74.03	1004.56	8148.7

Appendix B–9
National Inventory of Dams (NID) Data

Dam name: Conewango Creek Watershed, Dam 9A

State: **New York**

NID ID: **NY 00596**

Longitude: **79.1161**

Latitude: **42.3833**

Geodetic location: _____

County: **Chautauqua**

Stream: **Conewango Creek**

Nearest town: **South Dayton**

Distance to nearest town: **4 mi**

Operator: **Chautauqua County**

Year constructed: **1974**

Max. discharge: **8,149 ft^3/s**

Max. storage: **1005 acre-ft**

Normal storage: **41 acre-ft**

Surface area: **9.4 acres**

Drainage area: **6 mi^2**

Inspection frequency: **1 yr**

State regulated?: **Yes**

State reg. agency: **NYS-DEC**

Federal funding: **USDA NRCS**

Federal design: **USDA NRCS**

Federal constructed: **USDA NRCS**

Program authority: **PL-556 Flood Control**

Watershed No.: **05010002-010**

Watershed name: **Conewango Creek Watershed**

Service life: **100 yr**

O&M insp. Resp: **Chautauqua /Cattaraugus Co. Soil & Water (Conewango Watershed Committee)**

O&M insp. current?: **yes**

Population at risk: **601**

Dam height: **43 ft**

Dam length: **1590 ft**

Dam volume: **174,319 yd^3**

Design hazard potential: "C", **High**

Current hazard potential: **"C", High**

Hazard potential class. year: ____

Sediment storage: **96 acre-ft**

Flood storage: **612 acre-ft**

Surcharge storage: ____ **acre-ft**

Other storage: ____ **acre-ft**

Principal spillway type: **Concrete pipe**

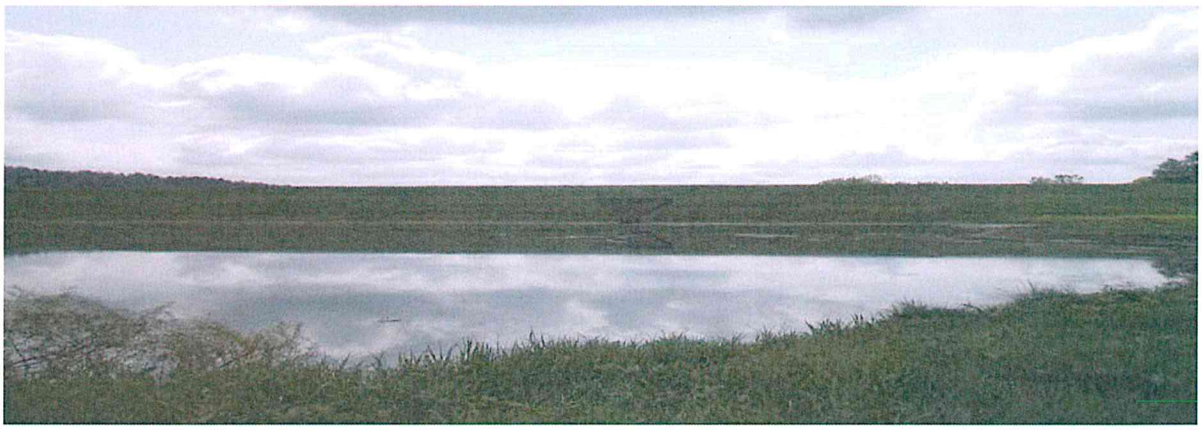
Principal spillway conduit diameter: **48 in**

Auxiliary spillway type: **Vegetated earth**

Auxiliary spillway width: **200 ft**

Dam Assessment Report

Conewango Creek Site 9A Dam



NYS Dam ID: 007-3979

Town of Villanova, County of Chautauqua, State of New York

April 2014

Prepared By:	Prepared For:
T·Y·LIN INTERNATIONAL	
STATE OF NEW YORK JAMES ROBERT GUISTINA 084113 LICENSED PROFESSIONAL ENGINEER	**Signature of Owner:** George Spanos
James R. Guistina, PE **NYS License: 084113**	**George Spanos, PE** **Facilities Director, Chautauqua County**

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I. Introduction

A. Location

Conewango Creek Site 9A Dam is located in central Chautauqua County approximately 3.5 miles northwest of the village of South Dayton within the Town of Villenova. The dam is on Smith Road near the intersection of Villenova Road. The dam is on a tributary of Conewango Creek, and flows into the West Branch of Conewango Creek approximately 1 mile downstream.

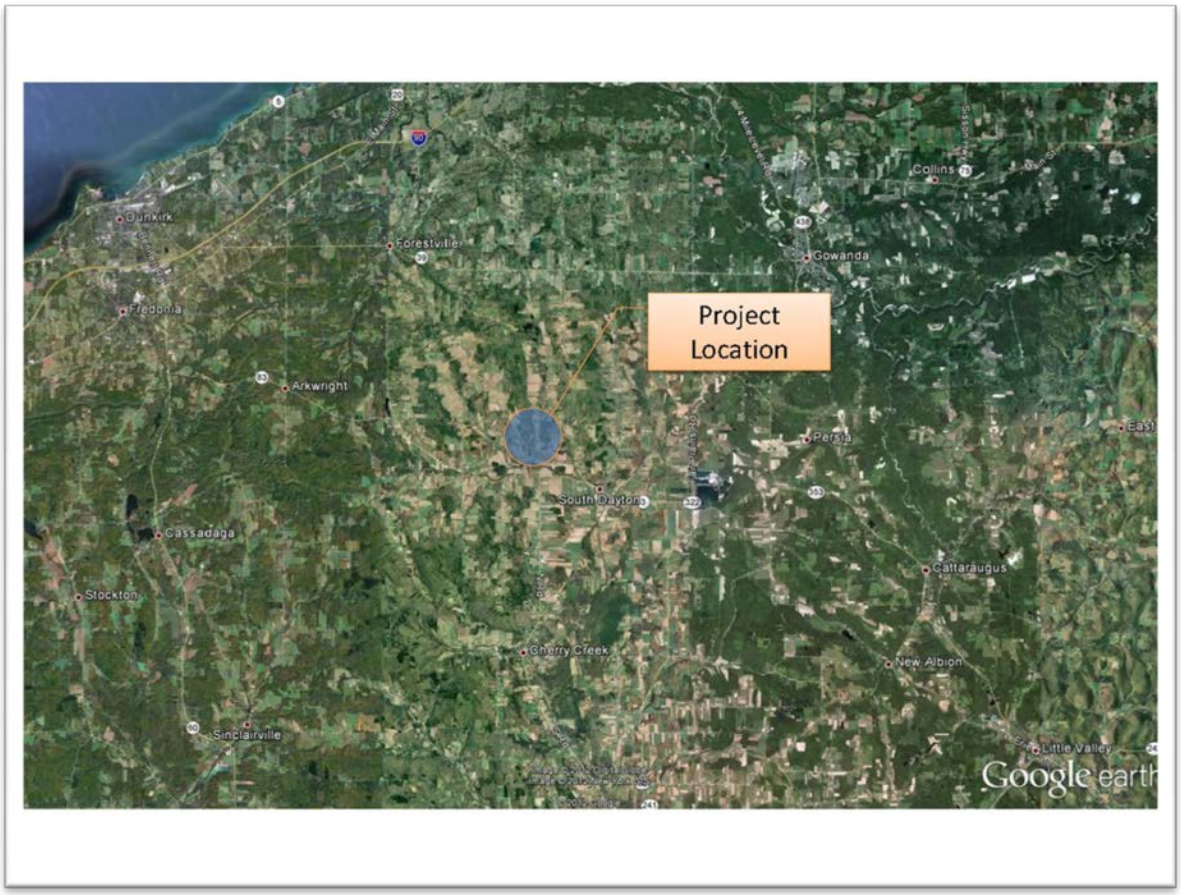

Figure I-I: Conewango 9A Dam Location

B. Description of Dam and Appurtenant Structures

1. General Description

The Conewango Creek Watershed Dam No. 9A is an earth embankment approximately 1590 ft. long, with a maximum height of about 43ft. and a crest width of 16 ft. The grassed downstream slope is 1 V: 2.5H. The upstream slope is 1 V: 3H and grassed from the bottom to the top. According to available contract drawings, the embankment consists of semi-pervious silty sand

and gravel core with coarse gravel shells. There is a berm on the upstream slope approximately 10 ft. wide. The berm extends the full length of the dam at elevation 1391.8 MSL (1391.38 NAVD 88). Beneath the embankment is an earth fill cutoff trench which is 12 ft. wide at the bottom. According to available record plans, it is constructed of the same silty sand and dense gravel material as the embankment. The principal spillway consists of a reinforced concrete drop inlet structure with a sluice gate controlled inlet pipe, two uncontrolled orifice inlets and a 48 in. outlet pipe supported on a concrete cradle.

The inside dimensions of the riser structure are 30 ft. high and 12 ft. wide normal to the axis of the dam. It is 4 ft. long parallel to the embankment and flares to 21.67 ft. long at the top. The walls of the structure are 18 in. thick for the bottom 4.5 ft., 15 in. thick for the next 10 ft., 12 in. thick for the next 5 ft., and 10 in. thick for the top section. The top slab is 8 in. thick. The structure is founded on a 9 ft. by 15 ft. spread footing. The "low stage inlet" is an uncontrolled opening approximately 15.6 ft. above the sluice gate invert. It is 3 ft wide and 2.2 ft. high and is located in the upstream face of the riser structure. The water flows through this orifice and drops into the riser structure. It is protected by a trash rack assembly approximately 11 ft. high and 5.5 ft. wide. This assembly is fabricated from galvanized steel angle sections. The "high stage inlet" consists of two openings approximately 30 ft. above the sluice gate invert. They are 12ft. wide and 2ft. high and are located in the left and right sides of the flared portion of the riser structure. They are protected by a galvanized steel grating 33.4 in. high placed in front of each high stage opening and 5 galvanized steel angles placed in the sloping section below each opening. A 3 ft. diameter manhole permits access into the riser structure. Record Plans are attached in Appendix F.

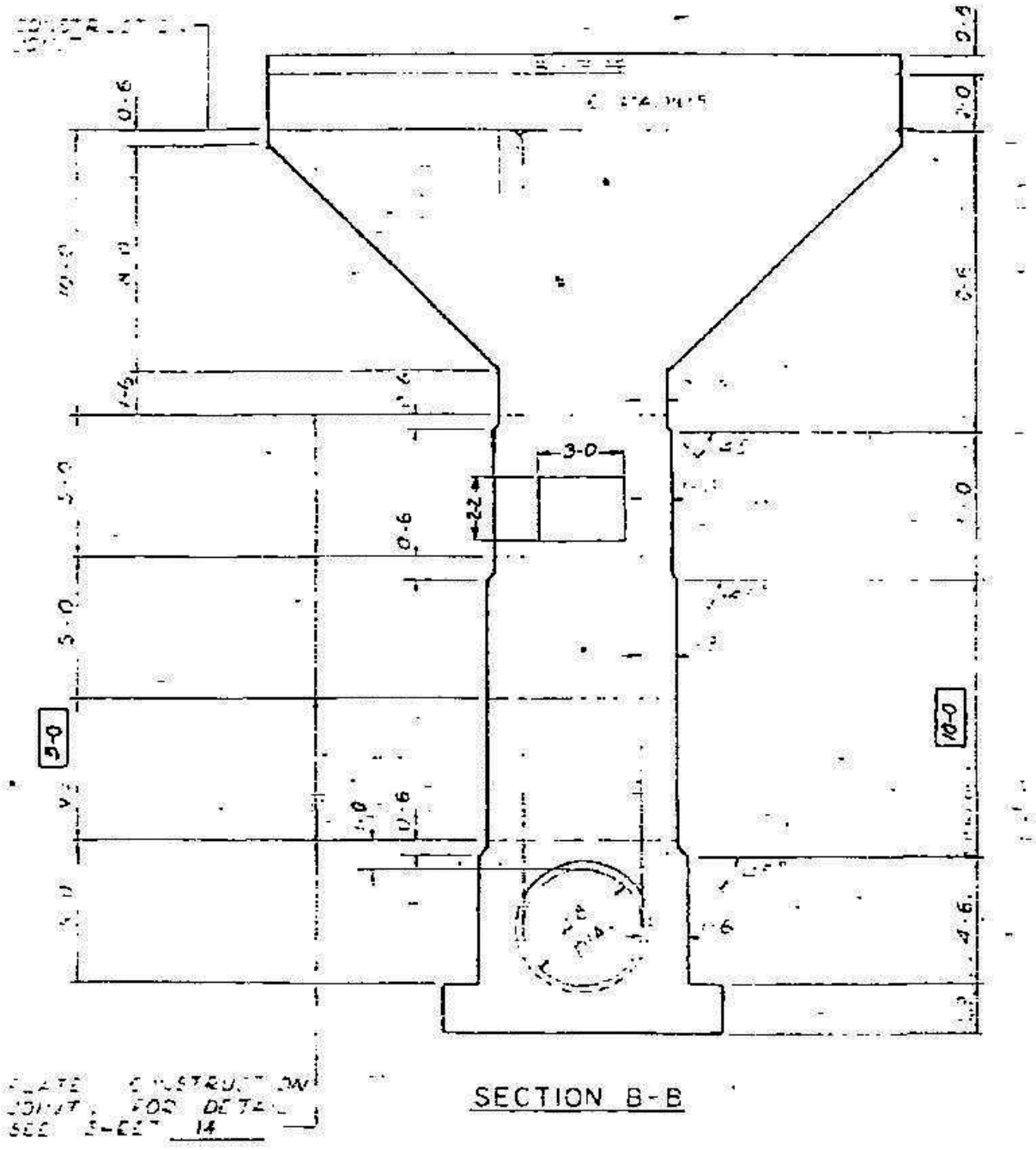

Figure I-II: Riser Elevation View

The riser structure is drained by a 48 in. diameter reinforced concrete pressure pipe. It is approximately 178ft. long and drops approximately 2 ft. over that length. The pipe penetrates the downstream side of the riser structure and is supported by a 6 in. thick concrete cradle within the embankment. Plans indicate seven (7) concrete anti-seep collars cast around the pipe within the embankment. The downstream end of the pipe penetrates the reinforced concrete impact basin.

The inside dimensions of the impact basin are 23.3 ft. wide normal to the axis of the dam and 17.5 ft. long parallel to the embankment. It is 12.3 ft. high at the upstream face and tapers to 7.3 ft. at the downstream end. At the downstream side there is a cutoff wall extending 3.0 ft. beneath the floor of the impact basin and there are two wingwalls extending 10.5 ft. beyond the sidewalls of the basin parallel to the embankment. There is a 1 ft. thick by 7.5 ft. high baffle spanning between the walls of the impact basin.

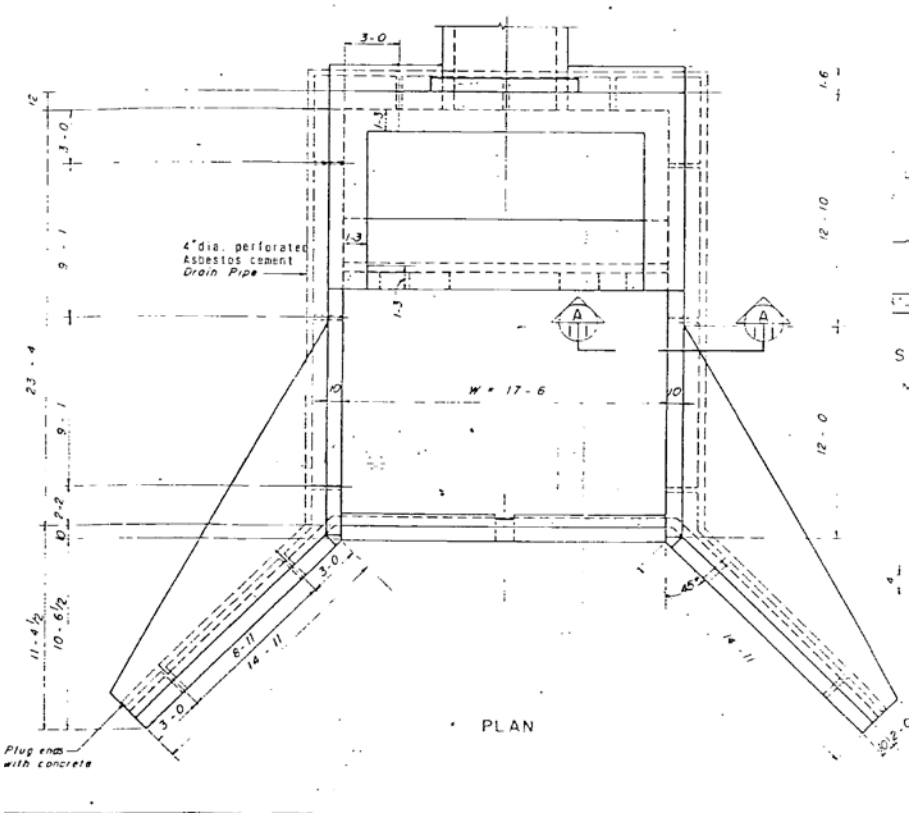

Figure I-III: Impact Basin Plan View

A 24 in. thick rip-rap apron extends 16ft. downstream from the end of the impact basin. An excavated emergency spillway channel is located at the north abutment. The channel is approximately 200 ft. wide at the base, 5.2 ft. high, and has 1 V:3H side slopes. The control section is 200 ft. wide and 50 ft. long and the downstream channel is roughly 400 ft. long. A 50 ft. wide excavated bench is located north of the emergency spillway at elevation 1396 MSL (1395.583 NAVD 88). The bench intersects existing ground at a 1 V:3H side slope.

A 48 ft. long reinforced concrete pressure pipe located on the upstream side of the principal spillway sewer acts as the reservoir drain. The pipe rests on a 6 in. thick unreinforced concrete cradle. The upstream invert is at elevation 1354.5 MSL (1354.08 NAVD 88), and the pipe enters the principal spillway at elevation 1353.8 MSL (1353.38 NAVD 88), 2.8 ft. above the riser floor. The drain is regulated inside the structure by an 18 in. diameter slide gate, a stem, and stem guides which rise to the top of the top slab where the handle housing is located.

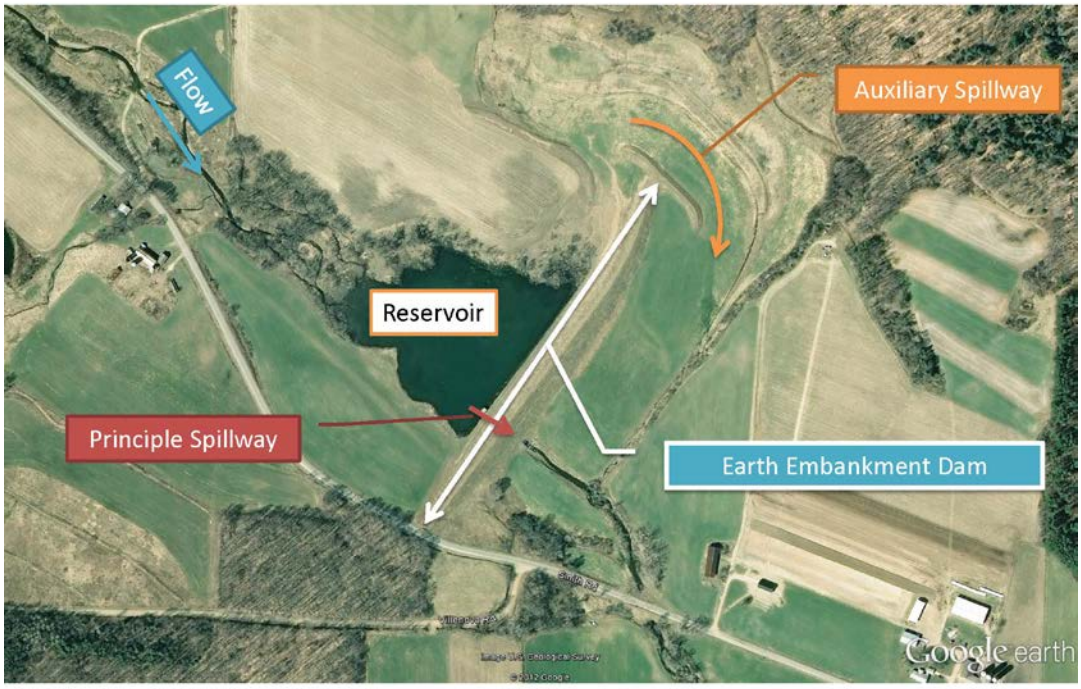

Figure I-IV: Anatomy of Conewango 9A Dam

Site 9A Dam Overview (Elevations in MSL)			
Drainage Area	6 square miles		
Discharge at Dam (cfs)			
Pool at Top of Dam	**Record Drawings**	**2014 Analysis**	**Delta**
A: Principle Spillway 1st Stage Discharge	114	133	19
B: Principle Spillway 2nd Stage	492	449	-43
C: Auxiliary Spillway Discharge	7708	7700	-8
D: Combined Spillway Discharge	8200	8149	-51
Elevations	**(Datum Change ^{ft}) = 0.417**		
	AS BUILT DATA		**SURVEY**
	NGVD 29 $^{(FT)}$	**NAVD 88 $^{(FT)}$**	**NAVD 88 $^{(FT)}$**
A: Top of Dam	1391.80	1391.38	1391.46
C: Auxiliary Spillway Crest	1386.60	1386.18	1386.37
D: Principal Spillway Crest	1366.60	1366.18	1365.84
E. Riser Crest Elevation	1381.00	1380.58	1380.34
Reservoir Surface Area			
A: Top of Dam	74.6 Acres		
B: Auxiliary Spillway Crest	8.8 Acres		
Storage Capacity			
A: Top of Dam	964 Acre-Feet		
B: Principle Spillway Crest	41 Acre-Feet		
Dam			
Embankment Type	Compacted Earthen Fill		
Embankment Length	1,590 ft		
Slopes (V:H)			
A: Upstream	1:3		
B: Downstream	1:2.5		
Crest Elevation	1391.8 ft NGVD, 1391.38 NAVD, 1391.46 SURVEY		
Crest Width	Varies between 15 and 20 ft		
Spillways			
A: Principle	Reinforced Concrete pipe, 48” O.D. Near the center of the reservoir in a concrete cradle. Rectangular Concrete drop inlet structure upstream with a reinforced concrete impact basin downstream.		
B: Auxiliary Spillway	Excavated channel, 200 ft in width. 5.2 ft in depth with 1:3 side		
Plunge Pool (Principle and Aux.	Natural stream channel lined with rip-rap		
Reservoir Drain	Reinforced Concrete Pipe, 18” O.D. with a vertical slide gate.		

Table I-1: Site 9A Overview

C. Dam Function

This Dam provides flood water storage for the Conewango Creek basin. It provided storage for 3,840 acres or runoff and releases it slowly through the two stage principle spillway system. Large storm events are routed through an auxiliary spillway to prevent overtopping.

D. Ownership and Design

The Dam is owned by Chautauqua County DPF and maintained by Cattaraugus County and Chautauqua County Soil & Water. The owner of contact is:

George Spanos, P.E.
Chautauqua County, Department of the Public Facilities
454 N. Work St.
Falconer, NY 14733
716-661-8400
SpanosG@co.chautauqua.ny.us

The dam was designed by the U.S. Department of Agriculture Soil Conservation Service. For this assessment, a set of "as-built" contract drawings was provided by the Soil Conservation Service in Syracuse, New York. "As-built" dam cross sections, geotechnical design and analysis data, and supervision of construction reports can be found at the U.S. Department of Agriculture- Soil Conservation Service, Design Section, Syracuse, New York. The dam was constructed in 1972. The contractor's name is unknown. [1]

E. Recent Updates to Structure

No major updates have been made to this structure since construction.

II. Hazard Classification Evaluation

A. Changes in Downstream Development

Original design documents classified Site 9A as a Class B, or intermediate hazard dam. This classification has since been updated by NYSDEC to a high hazard or Class C dam due to changes in the classification system unrelated to the changes that have occurred downstream which are minor for this site.

B. Classification Recommendation

The dam is classified as “high" hazard under the national inventory due to the presence of a town road, multiple homes, a state highway and the reservoir inundation area that passes through the Village of South Dayton.

Under New York State Department of Environmental Conservation (NYSDEC) guidelines this dam is classified as a Class C dam due to a potential loss of human life if the dam was to fail.

III. Visual Safety Inspection Report Summary

A. Findings

1. General Overview

On May 23, 2012 two representatives from TY-Lin International, Jim Guistina, P.E. and Sara Gilbert, P.E. (licensed engineers in the State of New York) evaluated the conditions, took photographs and recorded observations of the main dam and appurtenant structures. The completed inspection forms are included in Appendix B. The weather was sunny and clear, and the temperature was in the eighties. The water in the reservoir was generally calm. The water surface at the time of the inspection was several feet below the auxiliary spillway crest. A small amount of water was passing through the principle spillway. A subsequent annual inspection was performed on May 15th 2013, updates on maintenance work performed since 2012 are included in Appendix B and summarized at the end of this section.

2. Crest

The width of the crest is approximately 25 feet wide and is grassed lined on a well compacted subsurface. The crest is used as a walking path to access the dam and for vehicle access. The crest is generally flat and was observed to be in good condition with minor ruts and undulations from vehicles. The horizontal alignment of the dam is good and does not show signs of movement.

3. Embankment

The upstream embankment is approximately 43 feet high and 1,590 feet long. The embankment is compact earthen material with meadow grass as an erosion inhibitor. There are areas of slight settlement along the face at multiple locations but no active settlement was observed.

Photo III-1: Upstream Face Settlement (Photo 0010)

It did not appear that any of the deficiencies observed compromises the structural integrity of the dam.

Photo III-2: Upstream Face Looking North (Photo 0011)

On the northern end of the embankment between the dam and auxiliary spillway, the upstream face does have a few rodent holes ranging in size from 4" to 9" that should be filled. Significant erosion was not found in this area. The toe of slope has minor erosion from the reservoir and some debris.

Photo III-3: Rodent Hole on Upstream Face of Auxiliary Berm (Photo 0014)

The downstream face is also compact earthen embankment with meadow grass used as an armor. The slope is a uniform 3:1 slope with minor points of settling and two rodent holes near the auxiliary spillway.

Photo III-4: Rodent Hole on Downstream Face (Photo 0020)

There was no obvious area of dampness near the downstream side toe. And no settlement was noted across the embankment near the principal spillway tunnel.

4. Spillway

The principal spillway appeared to be in satisfactory condition. Some minor spalling of the concrete on the riser was noted and also on the low level outlet structure. The high stage trash rack on the riser was damaged by debris on the north side. The principal spillway structures appear to be operating normally.

Photo III-5: Low-Level Outlet Structure (Photo 0052)

Photo III-6: Riser (Photo 0065)

The emergency spillway appears to be in good condition. Grass, 10 in. high, covers the crest and downstream channel spillway. No debris was noted on the crest. As noted in the Phase I report an area of ponded runoff or natural

groundwater was noted downstream of the control section of the channel.. A small spring was noted on the north slope above the berm. The water is drained from the berm through a 4 in. cast iron pipe located approximately at station 8+00, 100 ft. left of the emergency spillway based on the attached record plans. There is a small tributary which joins the outlet channel approximately 250 ft downstream of the principal spillway outlet. The tributary flows normal to the direction of the outflow channel from the dam.

Photo III-7: Auxiliary Spillway (Photo 0013)

5. Downstream Channel, Plunge Pool

The downstream channel is a narrow channel passing over a relatively flat flood plain. Minor erosion of the right bank has taken place at a point 200 ft. downstream and large vegetation was noted on the north side of the channel which would reduce the capacity of the channel. Some rip-rap has also become dislodged just past the concrete apron of the spillway and should be replaced before erosion becomes an issue.

Photo III-8: Principal spillway (Photo 0028)

6. Reservoir

The shore of the reservoir is generally shallow sloping pasture and farmland. It appears to be stable and in good condition. There is no visible sign of sedimentation problems in the reservoir area.

Evaluation of Observations

The following deficiencies were noted during the inspection (and re-noted in the 2013 inspection):

- Rodent Holes on Upstream and Downstream Faces
- Vegetation on north side of outlet stream.
- Damaged upper stage trash rack on riser.
- Some Rip Rap has become dislodged in outlet channel.
- Debris accumulation on the upstream toe.
- Minor Vehicle wheel ruts on crest of dam.
- Dredging of Sediment within reservoir to maintain normal pool storage capacity and ensure the drain will work if necessary should be done within 5 years.

IV. Hydrologic/Hydraulic

A. Drainage Basin Characteristics

Conewango Creek Watershed Dam No. 9A is located on a tributary of Conewango Creek in the Allegheny River basin, and has a drainage area of 6.0 square miles. The dam is situated approximately 4- miles northwest of South Dayton, New York in the Town of Villenova. The topography of the watershed is hilly woodland, pastures, and farmlands.

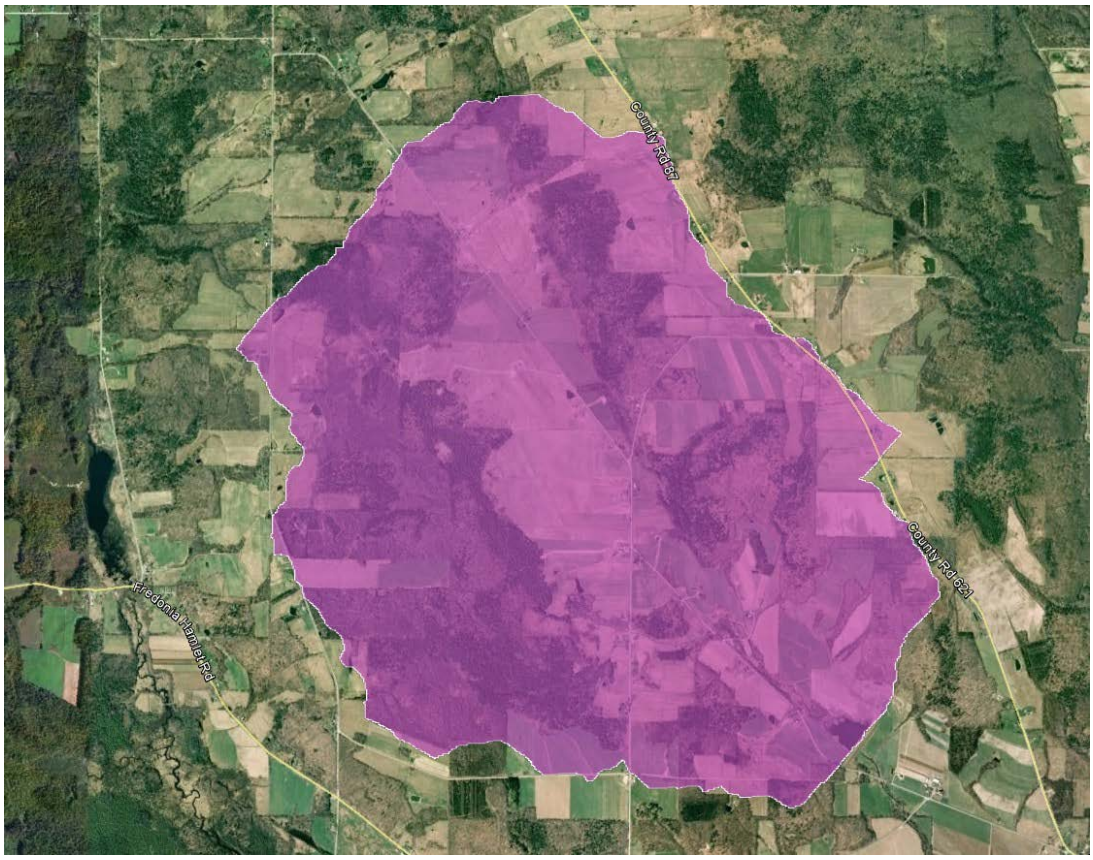

Figure IV-I: Dam 9A Watershed

B. Analysis Criteria

The analysis of the floodwater retarding capability completed in 2013 for this report was performed using the Corps of Engineers HEC-HMS v.3.5 computer program. This program developed an inflow hydrograph based upon the "Clark Unit Hydrograph" along with SCS Curve Number loss method for this dam. The spillway design flood selected for analysis was dependent on regulations to be placed in accordance with the recommended guidelines of NYSDEC and NRCS. See tables below for criteria. Appendix C contains the full calculations.

Class C Dams – **NYSDEC Existing Dams** (From Guidelines for Design of Dams – 1989, NYSDEC)

[Values for Chautauqua County] – HMR-51[1] and TP-40[2] and TP-29[3]

Mode		Design Flood (SDF)	Min Storm Duration (hr)*	Value (in)	Freeboard (ft)
Small Dams	Principal Spillway Design	25-year	6	3.0[2]	N/A
	Auxiliary Spillway Design	50% PMF		12.5[1] – 10 mi^2	0
Large Dams	Principal Spillway Design	100-year		3.72[3]	N/A
	Auxiliary Spillway Design	50% PMF		12.5[1] – 10 mi^2	0

Class C Dams (High Hazard) –**NRCS** (From TR-60 – Earth Dams and Reservoirs, USDA, NRCS – 2005)

[Values for Chautauqua County] – HMR-51[1] and TP-40[2] and TP-29[3] and TR-60[4]

Mode	Design Flood (SDF)	Min Storm Duration*	Freeboard (ft)	Value (in)	
Principal Spillway Design	100-year	10 day	N/A	8.0[4]	
Auxiliary Spillway Design	P100 + 0.26(PMP-P100)	24 hr & 6 hr MIN		24 Hour Storms** 11.6[1,2] – 10mi^2	6 Hour Storms** 9.12[1,2] – 10mi^2
Freeboard Requirement	PMP	24 hr & 6 hr MIN	1	24 Hour Storms 31[1,2] – 10mi^2	6 Hour Storms 24.5[1,2] – 10mi^2

**Based on 100-yr value of 3.7 for 6h duration and 5.0 for 24h duration.

C. Spillway Capacity

The outlet works at Site 9A consists of 2 spillways. One concrete, 48" diameter pipe (principal) and one 200' wide grass lined auxiliary spillway. The service spillway has a crest of 1366.6 feet (MSL) (1366.183 NAVD 88) and the auxiliary spillway has a crest of 1386.6 feet (MSL) (1386.18 NAVD 88) (Auxiliary storage of 20 feet). Survey taken in 2013 confirmed top of dam elevation to be higher than the record plan elevation of 1391.38 (NAVD 88). The record plan elevation was used to be conservative.

Spillway Capacities at Top of Dam – 1391.80 NGVD, 1391.38 NAVD		
	Record Plans	**2014 Analysis**
Service Spillway	442 cfs	449 cfs
Auxiliary Spillway	7,708 cfs	7,700 cfs
Combined Spillways	8,200 cfs	8,149 cfs

Table IV-1: Spillway Capacities

Using the ½ PMF the following analysis were determined:

Auxiliary Spillway Operation During PMF Event – RECORD PLANS			
	Peak Inflow	**Peak Outflow**	**Elevation (MSL)**
Combined Spillways	9,678 cfs	5,116 cfs	1390.32 feet

Table IV-2: Spillway during PMF Event – Record Plans

Auxiliary Spillway Operation During Storm Events – 2014 Analysis			
	Peak Inflow	**Peak Outflow**	**Elevation (NAVD 88)**
NYSDEC 50% PMF	6,107 cfs	5,202 cfs	1390.18
NRCS P100+0.26(PMP-P100)	5,241 cfs	4,523 cfs	1389.98
NRCS Freeboard (PMF)	16,236 cfs	10,132 cfs	1392.48 (-1.10 ft Freeboard)

Table IV-3: Auxiliary Spillway during Storm Events – 2014 Analysis

The spillway has the capacity to discharge the peak outflow from all NYSDEC required design storm events. However, the spillways do not have the required capacity to adequately discharge the NRCS principal spillway nor Freeboard event. The dam will overtop by 1.10 ft in the freeboard event. Refer to table IV-4.

NYSDEC Requirement Table (NAVD)					
PRINCIPAL SPILLWAY			AUXILIARY SPILLWAY		
Principal Spillway 100-year Storm Peak Inflow	Principal Spillway Capacity	Freeboard to Auxiliary Spillway	Auxiliary Spillway Flood 50% PMF Peak Inflow	Auxiliary Spillway Capacity	Freeboard to Top of Dam
1,031 cfs.	448.00 cfs.	6.80	6,107 cfs.	7,700 cfs.	1.2
Auxiliary Spillway Elevation	Water Surface Elevation	Freeboard To Auxiliary Spillway	Top of Dam Elevation	Water Surface Elevation	Freeboard To Top of Dam
1386.18	1379.38	6.80	1391.38	1390.18	1.2

NRCS Requirement Table (NAVD)								
PRINCIPAL SPILLWAY			AUXILIARY SPILLWAY			FREEBOARD REQUIREMENT		
Principal Spillway 100-year Storm Peak Inflow	Principal Spillway Capacity	Freeboard to Auxiliary Spillway	Auxiliary Spillway 24HR P100+0.26 (PMP-P100) Peak Inflow	Auxiliary Spillway Capacity	Freeboard to Top of Dam	Freeboard Requirement (PMF) Peak Inflow		Freeboard to Top of Dam
1,970.00 cfs.	448.00 cfs.	-0.80	5,241.50 cfs.	7,700 cfs.	1.40	16,236.20 cfs.		-1.10
Auxiliary Spillway Elevation	Water Surface Elevation	Freeboard To Auxiliary Spillway	Top of Dam Elevation	Water Surface Elevation	Freeboard To Top of Dam	Top of Dam Elevation	Water Surface Elevation	Freeboard To Top of Dam
1386.18	1386.98	-0.80	1391.38	1389.98	1.40	1391.38	1392.48	-1.10

Table IV-4: NYSDEC and NRCS Summary Table

Spillway Discharge Time	
Stage 1391.38	58 hours
Stage 1380.58	46 hours
Stage 1370.00	12 hours
Pond Drain from Normal Pool Stage 1366.18	15 hours

Table IV-5: Spillway Discharge Time

Spillway discharge times are within allowable parameters for both NYSDEC and NRCS regulations.

D. Reservoir Capacity

The normal water surface is set at or near 1366.6 ft (MSL) (1366.18 NAVD 88) the crest of the principal spillway. Storage for that elevation is 41 acre-feet. At the top of crest (1391.8 ft MSL)

(1391.38 NAVD 88), the total storage capacity of the dam is 964 acre feet. Table IV-3 shows the surface area and storage volumes of the Site 9A Dam at select stages. All areas and volumes were calculated based on current Chautauqua County Orthoimegry and survey where available.

Reservoir Volume and Area			
Stage (ft) MSL	**Stage (ft) NAVD 88**	**Surface Area (Acres)**	**Total Storage (Acre-ft)**
1366.6 (Princ Spill)	**1366.18**	9.4	36
1370	**1369.58**	15.6	42
1375	**1374.58**	38.4	152
1381 (Riser Elev)	**1380.58**	44.0	327
1385	**1384.58**	54.8	567
1386.6 (Aux Spill)	**1386.18**	57.6	624
1389.8	**1389.38**	68.2	744
1391.8 (Top of Dam)	**1391.38**	74.0	1,004

Table IV-6- Reservoir Volume and Area

E. Floods of Record

There are no floods of record that equal or surpass the design storm.

F. Overtopping Potential

The maximum capacity of the spillways is 8,149 cfs which is greater than the design storm peak outflow for NYSDEC regulations (1/2 PMF) of 6,107 cfs. The dam is also in compliance with NRCS regulations for the Auxiliary Spillway design storm of 5,241 cfs. The dam however, does not conform to the NRCS design storm for the principal spillway. The pool elevation will overtop the Auxiliary spillway crest at the 100 year storm by 0.8 ft. The dam is overtopped by the PMF storm by 1.1 ft, which is the NRCS design storm for freeboard. While it is unlikely this dam will overtop, if a PMF storm were to occur, the dam could be in jeopardy.

G. Overall Hydrologic/Hydraulic Evaluation

The auxiliary and principal spillways on this dam are assessed as adequate under current NYSDEC regulations, and would prevent overtopping from NYSDEC design storms. However, the dam does not satisfy the design regulations for the NRCS for freeboard nor principal spillway design storm.

V. Structural Stability

A. Visual Observations

Visual observations of the dam did not reveal any obvious signs of movement or distress. The western end of the dam was slightly irregular due to debris accumulation and wave/ice action.

Noted rodent holes and minor surface undulations on the embankment were found during inspection. We suspect that the longitudinal undulations on the embankment may be a function of mower action during a time of surface wetness. The grassy vegetation appeared lush and well suited to erosion control. We did observe debris (branches and silt) during the 2013 inspection on the uphill embankment and the inlet structure (trash rack) indicating that the water level had been about six to eight feet higher relatively recently. We did not see signs that this had been detrimental to the function of the dam.

B. Data Review and Stability Evaluation

The dam serves as a floodwater retarding structure. The embankment is 43 feet high and has a length at the crest of 1590 feet. The maximum storage capacity of the dam is 964 acre-feet. The upstream slope is (V:H) 1:3 and the down hill slope is (V:H) 1:2.5.

The dam embankment consists of borrow material generated from cut for the overflow spillway, and other borrow area adjacent to the dam. The dam embankment material is divided into two zones (I and II). Zone I is the core of the dam and cutoff trench. This zone is comprised primarily of a low plasticity silt (ML) and silty sand (SM). Zone II makes up the outer (21'+) surface of the dam. This zone consists of silty gravel (GM-GP) intermixed with silt and clay (CL-ML). Design values used for the stability analysis of the dam slope were based on parameters assumed during design and construction of the dam. The design values of the embankment fill include an internal friction angle, Ø, of 31.5º and a cohesion of 100 psf.

Geologic conditions beneath the dam generally consist of near surface fine grained lake deposits over alluvial granular soils. Boring and test pit logs from the predevelopment assessment classify the upper soils as silt. The deeper alluvial deposits consist of silty gravel and sand. Bedrock was not encountered in the exploration program.

A slope stability analysis of the downhill and uphill portions of the dam embankment was performed. Our analysis utilized the design parameters derived during the design phase of the project. Our analysis methods were Spencer-Wright and Bishop Simplified. The minimum factor of safety computed was 1.91. This occurred within the silty gravel embankment material, on the downhill slope, under saturated conditions. The recommended long term factor of safety (U.S. Army Corps of Engineers) for earth dams is 1.5.

As part of our seismic stability analysis we reviewed liquefaction, slope stability under seismic loading and geologic mapping of western New York faults.

- We applied a pseudo-static earthquake coefficient of 0.036 (1/2 of site PGA) to our slope analysis. The minimum factor of safety under this scenario was 1.72. The recommended minimum Factor of Safety under seismic load is greater than 1.0.

- No active fault zones have been documented in the area. The nearest active fault zone (Clarendon-Linden) is located in Wyoming and Allegany counties, over 40 miles to the northeast. The paleoliquefaction features of this fault indicate that earthquakes larger than Mw 6 have not occurred along this fault complex.

- A liquefaction analysis of the embankment material and underlying native soil has a factor of safety against liquefaction over 5.0.

We found no structural geotechnical issues with the dam. Service related issues include resolving the rodent holes and the mower action as well as cleaning the trash rack. The rodent holes did not show signs of having affected the immediately adjacent embankment. Therefore it is reasonable to fill them with a wet soil/grout mix. Top this backfill with six inches of topsoil to promote surface vegetation. The surface undulations we attribute to mower action did not appear deep enough at this time to be considered 'ruts' requiring filling. We do suggest trying to schedule the mowing around wet periods and varying the mower pattern somewhat. We expect that the mower runs parallel/along the embankment and the operator aligns the mower tires to efficiently cut a 'full deck width'. Consider a half-overlap of the second pass onto the first so that the tire tracks do not align.

Figure V-1 below shows the most recent survey taken in 2013 in which no settlement of the embankment nor spillways was evident. The dam is geometrically functioning as designed.

The full analysis is available in Appendix D.

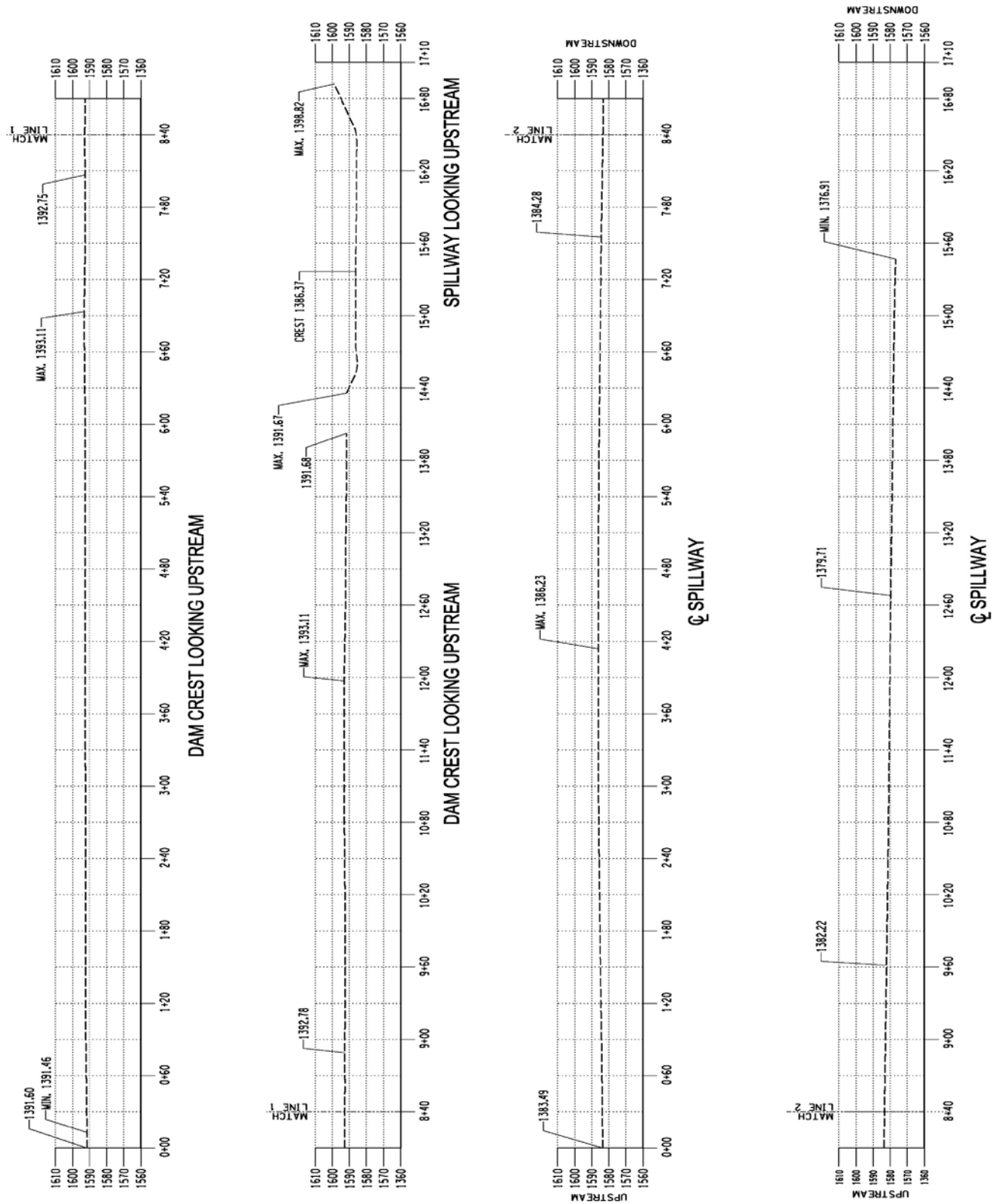

Figure V-I: Dam and Spillway Profiles

VI. Evaluation of Outlet Works and Operating Procedure

A. Procedure for Draining Reservoir

Water release from the lake is through the 48 in. reinforced concrete outlet pipe. There is also a 18" diameter reinforced concrete pipe with a vertical slide gate that can be used to drain the reservoir.

B. Maintenance of Dam

The dam is maintained by the County of Chautauqua. Grass on the embankment is mowed regularly. Other minor maintenance functions are performed as necessary although there is a written procedure for maintenance at this time.

C. Warning System in Effect

No apparent warning system is present.

D. Evaluation

Maintenance procedures and operating procedures appear to be satisfactory there is a written maintenance plan that is updated annually.

VII. Emergency Action Plan Evaluation

A. Review

An Emergency Action Plan has been completed for Site 9A Dam per NYSDEC regulations. The plan was last updated in 2013 and is currently up-to-date. An inundation map has been completed and there is a current emergency notification chart with clear responsibilities of those contacted, notification procedures, emergency identification/classification and preventative actions. A table top exercise with pertinent local officials was performed within 2 years of this report.

The county is responsible for updating and maintaining this "living" document as conditions and emergency contacts change and will be looked at on an annual basis.

Recommendations on the EAP include:

- Number and create a log of all EAP's in circulation. This is semi-classified information and should be treated as such for national security.
- The EAP should be clearly dated, labeled and tabbed for quick reference, a RED three-ring binder is recommended for protection and easy access/updating of the report.
- Be sure local officials have numbered, updated copies

VIII. Conclusion

A. Assessment

1. Safety

The Dam Assessment inspection of the Site 9A Dam did not reveal conditions which constitute a hazard to human life or property. No signs of instability were observed on the earth embankment. The stability analysis which was performed for the embankment on this dam indicates that conditions are acceptable. Both of the spillways capacities can discharge the current NYSDEC respective storm events. The spillways are not capable of passing the PMF event per NRCS freeboard design standards.

2. Adequacy of Information

The information available from State, Local and Federal sources for the generation of this report was adequate.

3. Need for Additional Investigation

- None at this time

4. Urgency for Repairs/Changes

- The large rodent holes on the downstream and upstream banks of the earthen dam should be filled within 3 months of this report.

B. Recommended Measures

- Vegetation within the outlet channel should be cleared.
- Rodent holes in earthen embankment should be filled.
- Replace dislodged rip-rap in the outlet channel.
- Clear debris on shore of reservoir. These may get lodged in the spillways under flood conditions and decrease their ability to pass flood waters.
- Dredging of Sediment within reservoir to maintain normal pool storage capacity and ensure the drain will work if necessary should be done within 5 years.
- Update the Emergency Action Plan (EAP) on an annual basis. Other EAP related recommendations include:
    - Number and create a log of all EAP's in circulation. This is semi-classified information and should be treated as such for national security.
    - The EAP should be clearly dated, labeled and tabbed for quick reference, a RED three-ring binder is recommended for protection and easy access/updating of the report.
    - Organize an orientation seminar for locals and local officials.
    - Be sure local officials have numbered, updated copies.

Appendix A

Photographs

CONEWANGO 9A – PHOTO LOG

Photo Log Index

TY·LIN INTERNATIONAL

Conewango 9A – Photo Log

0001: Dam Crest from South

0002: Southwest Groin

Conewango 9A – Photo Log

0003: Upstream Toe

0004: Low Spot on Upstream Face

Conewango 9A – Photo Log

0005: Upstream Face

0006: Upstream Face

Conewango 9A – Photo Log

0007: Upstream Face Looking South

0008: Upstream Face Looking North

Conewango 9A – Photo Log

0009: Upstream Face

0010: Low Spot on Upstream Face

Conewango 9A – Photo Log

0011: Upstream Face Looking toward Aux Spillway

0012: Northwest groin

Conewango 9A – Photo Log

0013: Aux Spillway From Berm (US Face)

0014: Rodent Hole, Aux Spillway Berm

Conewango 9A – Photo Log

0015: Rodent hole (2)

0016: Downstream Face Looking South

Conewango 9A – Photo Log

0017: Downstream Face Looking South

0018: Downstream Face Looking South

Conewango 9A – Photo Log

0019: Low Spot Downstream Face

0020: Rodent hole Downstream Face

Conewango 9A – Photo Log

0021: Downstream Face

0022: Downstream Face

Conewango 9A – Photo Log

0023: Downstream Face

0024: Downstream Face

Conewango 9A – Photo Log

0025: Downstream Face Looking South

0026: Spillway Outlet, Downstream View

Conewango 9A – Photo Log

0027: Principle Spillway

0028: Embankment at Principle Spillway Outlet

Conewango 9A – Photo Log

0029: Downstream Embankment Looking North

0030: Downstream Face @ Aux Spillway Station

Conewango 9A – Photo Log

0031: Downstream Face Looking South

0032: Downstream Face

Conewango 9A – Photo Log

0033: Downstream Face

0034: Downstream Face Looking North

Conewango 9A – Photo Log

0035: Dam Crest

0036: Dam Crest

Conewango 9A – Photo Log

0037: Dam Crest

0038: Upstream Face @ Spillway

Conewango 9A – Photo Log

0039: Downstream Emb @ Spillway

0040: Res. Line

Conewango 9A – Photo Log

0041: Top of Crest

0042: Top of Crest

Conewango 9A – Photo Log

0043: Low Spot Upstream Face

0044: Low Spot Upstream Face

Conewango 9A – Photo Log

0045: Rodent Hole Downstream Face @ NE groin

0046: Upstream Face of Dam

Conewango 9A – Photo Log

0047: US Toe

0048: Principle Spillway

Conewango 9A – Photo Log

0049: Principle Spillway

0050: Plunge Pool, Displaced RipRap

Conewango 9A – Photo Log

0051: Principle Spillway

0052: Principle Spillway

Conewango 9A – Photo Log

0053: Toe Drain

0054: Toe Drain

Conewango 9A – Photo Log

0055: Spillway Wingwall

0056: Embankment @ Spillway

Conewango 9A – Photo Log

0057: Outlet Channel

0058: Principle Spillway Intake Structure

Conewango 9A – Photo Log

0059: Trash Rack (South)

0060: Limited Warning Postings

Conewango 9A – Photo Log

0061: North Trash Rack Damage

0062: North Trash Rack

Conewango 9A – Photo Log

0063: Reservoir

0064: Intake Structure w/ Debris

Conewango 9A – Photo Log

0065: Intake Structure

0066: Intake Structure / Res

Conewango 9A – Photo Log

0067: Upstream View

Appendix B

Inspection Documents

Name of Dam Conewango Creek Site 9a Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	Item No.	CONDITION	OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
		EMBANKMENT 1 OF 2				
CREST	1	SURFACE CRACKING				
	2	CAVE IN, ANIMAL BURROW				
	3	LOW AREA (S)				
	4	HORIZONTAL ALIGNMENT				
	5	RUTS AND/OR PUDDLES				
	6	VEGITATION CONDITION				
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP	Minor sink holes in embankment			
	10	SLOPE PROTECTION				
	11	SINKHOLE, ANIMAL BURROW	Rodent hole NW Slope, Numerous holes at NW Abutment			
	12	EMB/ABUT CONTACT				
	13	EROSION				
	14	VEGITATION CONDITION	Knee high - Some veg. at SW groin			
	15		Some debris on slope, (Monitor) shoreline veg.			
	16					

Additional Comments (refer to Item No. if applicable)

~~Minor~~

Name of Dam: Conewango Creek Site 9a Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	Item No.	CONDITION	EMBANKMENT 2 OF 2 OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA (S) (NO FLOW)	At North East End no flow due to construction, Wet Spot At toe			
	18	SEEPAGE				
	19	SLIDE, SLOUGH, SCARP	None Noted			
	20	EMB/ABUT CONTACT				
	21	CAVEIN/ ANIMAL BURROW	Rodent hole At NE About; hole near North End More further down			
	22	EROSION	None noted			
	23	UNUSUAL MOVEMENT	None Noted			
	24	VEGITATION CONDITION	Knee high meadow grass, No Real concerns			
INSTRUMENTATION	25	PIZOMETERS/ OBSERVATION WELL				
	26	STAFF GAUGE AND RECORDER				
	27	WEIRS				
	28	SURVEY MONUMENTS				
	29	DRAINS				
	30	FREQUENCEY READINGS				
	31	LOCATION OF RECORDS				
	32					

Additional Comments (refer to Item No. if applicable)

Aux. Spillways Drain back towards the DAM, Reaches a high point then Channel continues along EDGE of DAM.

More Rodent holes towards center of DAM

Name of Dam Conewango Creek Site 9a Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	Item No.	DOWNSTREAM AREA AND MISC. CONDITION	OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	36	ABUTMENT LEAKAGE				
	37	FOUNDATION SEEPAGE				
	38	SLIDE, SLOUGH, SCARP				
	39	DRAINAGE SYSTEM				
	40					
	41					
	42					
	43					
MISC	44	RESERVOIR SLOPES				
	45	ACCESS ROADS	Road pull off access			
	46	SECURITY DEVICES				
	47					
	48					
	49					
	50					
	51					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 9a Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	Item No.	CONDITION	SPILLWAYS (_____ OF _____) OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
ERODABLE CHANNEL	51	SLIDE, SLOUGH, SCARP	NE Leveling Area drains back toward the DAM! (?)			
	52	EROSION	Knee high grass			
	53	VEGITATION CONDITION				
	54	DEBRIS				
	55					
	56					
NON-ERRODABLE CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
DROP INLET	64	INTAKE STRUCTURE	Good condition, @			
	65	TRASHRACK	Some debris			
	66	STILLING BASIN				
	67		Concrete in good shape			
	68		No Real problems			
	69					

Additional Comments (refer to Item No. if applicable)

Name of Dam Conewango Creek Site 9a Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	Item No.	CONDITION	OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
		OUTLET WORKS				
OUTLET WORKS	36	INTAKE STRUCTURE				
	37	TRASHRACK				
	38	STILLING BASIN				
	39	PRIMARY CLOSURE	Good Condition			
	40	SECONDARY CLOSURE				
	41	CONTROL MECHANISM				
	42	OUTLET PIPE				
	43	OUTLET TOWER				
	44	EROSION ALONG DAM TOE				
	45	SEEPAGE				
	46	UNUSUAL MOVEMENT				
	47	Vegetation	Some along channel			
	48	Rip Rap	Seems to be in place			
	49					
	50					
	51					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 9A Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	Item No.	CONDITION	OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
		EMBANKMENT 1 OF 2				
CREST	1	**SURFACE CRACKING**	None noted			
	2	**CAVE IN, ANIMAL BURROW**	Burrow wp 43, few holes in area			
	3	**LOW AREA (S)**	wp 36 depression from vehicle, w.p. crest 39			
	4	**HORIZONTAL ALIGNMENT**	None noted			
	5	**RUTS AND/OR PUDDLES**	Downstream fall rut w.p. 41 + wp42			X
	6	**VEGETATION CONDITION**	None noted			
	7		18' wide			
	8					
UPSTREAM SLOPE	9	**SLIDE, SLOUGH, SCARP**	SE side has dry crotch, w.p. 20 dry crotch			
	10	**SLOPE PROTECTION**	None noted			X
	11	**SINKHOLE, ANIMAL BURROW**	Depression (waypoint 12), w.p. 13, w.p. 22 - animal burrow (tip of spillway) - numerous			
	12	**EMB/ABUT CONTACT**	See above, minor slough on upstream side (± w.p. 39 on slope)			X
	13	**EROSION**	Minor at Bottom			X
	14	**VEGETATION CONDITION**	Heavy, overgrown, dense			X
	15	**Debris**	Scattered debris (mostly wooded material) - causeing bare or low vegetation spots			
	16					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 9A Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	Item No.	CONDITION	OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
		EMBANKMENT 2 OF 2				
DOWNSTREAM SLOPE	17	**WET AREA (S) (NO FLOW)**	No evidence found			
	18	**SEEPAGE**	No evidence found			
	19	**SLIDE, SLOUGH, SCARP**	SE abutment, slope approx. 1:1 (h:v) + narrow embankment (w.p. 23)			
	20	**EMB/ABUT CONTACT**	None noted			
	21	**CAVEIN/ ANIMAL BURROW**	w.p. 27 several animal burrows			X
	22	**EROSION**	Depressions around outlet and along bank			
	23	**UNUSUAL MOVEMENT**	No evidence found			
	24	**VEGETATION CONDITION**	long, overgrown, dense			
INSTRUMENTATION	25	**PIZOMETERS/ OBSERVATION WELL**	Not Applicable			
	26	**STAFF GAUGE AND RECORDER**	Not Applicable			
	27	**WEIRS**	Not Applicable			
	28	**SURVEY MONUMENTS**	Not Applicable			
	29	**DRAINS**	Not Applicable			
	30	**FREQUENCY READINGS**	Not Applicable			
	31	**LOCATION OF RECORDS**	Not Applicable			
	32					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 9A Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	DOWNSTREAM AREA AND MISC.			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATION	MONITOR	INVESTIGATI	REPAIR
DOWNSTREAM SLOPE	36	ABUTMENT LEAKAGE	None noted			
	37	FOUNDATION SEEPAGE	None noted			
	38	SLIDE, SLOUGH, SCARP	None noted			
	39	DRAINAGE SYSTEM	None noted			
	40					
	41					
	42					
	43					
MISC	44	RESERVOIR SLOPES	None noted			
	45	ACCESS ROADS	None noted			
	46	SECURITY DEVICES	Gate			
	47					
	48					
	49					
	50					
	51					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 9A Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	SPILLWAYS 1 OF 1			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATION	MONITOR	INVESTIGATI	REPAIR
ERODIBLE CHANNEL	51	SLIDE, SLOUGH, SCARP	None Noted			
	52	EROSION	None Noted			
	53	VEGETATION CONDITION	None Noted			
	54	DEBRIS	Not Applicable			
	55		Grading appear to direct towards dam embankment			
	56					
NON-ERODIBLE CHANNEL	57	SIDEWALLS	None Noted			
	58	CHANNEL FLOOR	None Noted			X
	59	UNUSUAL MOVEMENT	None Noted			
	60	APPROACH AREA	None Noted			
	61	WEIR OR CONTROL	None Noted			
	62	DISCHARGE AREA	None Noted			
	63					
DROP INLET	64	INTAKE STRUCTURE	None Noted			
	65	TRASHRACK	None Noted			
	66	STILLING BASIN	None Noted			
	67					
	68					
	69					

Additional Comments (refer to Item No. if applicable)

w.p. 44 - spillway

Name of Dam: Conewango Creek Site 9A Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	OUTLET WORKS			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATION	MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	36	INTAKE STRUCTURE	Concrete seems sound	X		
	37	TRASHRACK	Bent, looks like has been hit, debris in trashrack			
	38	STILLING BASIN	None noted			
	39	PRIMARY CLOSURE	None noted			
	40	SECONDARY CLOSURE	None noted			
	41	CONTROL MECHANISM	None noted			
	42	OUTLET PIPE	Good Shape			
	43	OUTLET TOWER	None noted			
	44	EROSION ALONG DAM TOE	None noted			
	45	SEEPAGE	None noted			
	46	UNUSUAL MOVEMENT	None noted			
	47		Rip Rap should be adjusted			
	48					
	49		Structure overall is sound, minor concrete spalling			
	50					
	51					

Additional Comments (refer to Item No. if applicable)

2013 Conewango Creek Watershed Maintenance Report

Robert M. Shenk
Cattaraugus County SWCD

2013 Conewango Creek Watershed
Maintenance Work on the
Watershed Structures

This is a brief report of the annual work that was done on the Conewango Creek Watershed structures over the spring, summer and fall of 2013. This watershed covers parts of both Cattaraugus and Chautauqua Counties. It will include the Inspection, mowing and maintenance work for the normal function of these structures.

This season the inspection was done on the 15th of May with interested parties from Cattaraugus County, Chautauqua County, NRCS (Natural Resources Conservation Service) staff, members of the Conewango Watershed Commission, staff from T Y Lin International and District staff from both Counties. T Y Lin International is the engineering firm that both Counties hired to do the 10 year inspection and help complete the Emergency Action Plans for all of the sites. This inspection is part of the requirements that were put out by DEC. The details of this year's work will be discussed on a per site basis.

The sites were mowed by Mow-Con, LLC of West Seneca. The mowing this year was done on a one-year contract and was done so that with a new contract for the Watershed Commission being worked on, next season's contract would go back to a two-year contract with help from the Cattaraugus County SWCD. There are 8 sites to be mowed in the watershed, approximately 50 acres in all. It was done on the 7th and 8th of August and they started at Site 16A on Walker Road in the Town of Conewango. The weather was not a concern mowing this season and there were no major problems doing the work. This winter, I will be putting together a new mowing package and getting it out to the contractors. It will go back to a two-year contract.

There are still concerns about the wetness on the south end of the structure at Site 3 in the Town of Ellington. I did make plans to get the Soil Scientists from NRCS back down to take another look at the site. The Ground Penetrating Radar was used to try to find the source of all the water and get an idea of how to deal with it and keep it off the dam. The best idea that could be determined from this test was that the surface water needed to be addressed before a determination could be made about the ground water. I will address this again in the report for that site.

NRCS is still trying to do the research that they need to upgrade Site 13 (New Albion Lake) from a Class "B" hazard dam to a Class "C" hazard structure. This has been going on for some time. We have done surveys of the upstream area, taken sediment surveys of the surrounding area and now they are looking at the buildings downstream to determine what is and is not in the floodway if the dam was ever to breach. This work was being done at NRCS's State level. This summer, we received a phone call from them requiring a letter of support for this project before any more work could be done. We told them that this was something that would have to come from the County Legislature because that is where the funding, if any were to be spent, was going to come from and that it should be their decision. It was referred to the County. We have not heard from them in some time.

As for the 10 year Engineering Assessment, T Y Lin was contacted by DEC with regards to needing proof that the structures have not settled since construction. They were talking about having to have borings done to prove this had not happened. Our Engineer thought that this could be proved

without the expense of having borings done. So I got hold of NRCS and we used their GPS survey equipment and surveyed all of the sites of concern from August 21st through the 23rd. We took shots along the top of the dams, at the inlet and outlet of the principal spillway and did a cross-section survey over the top of each of the dams. With my last conversation with the Engineer, that should answer DEC's concerns. This operation saved a large expense not having to hire a contractor to do borings. He is also working on the inundation maps for the sites. With these completed, we should be in good shape as to being in compliance with DEC's requirements.

This year, members of the Commission, both Counties and the District have been working on the new contract that the Commission has between Cattaraugus and Chautauqua Counties. There were some things that were needed to be reworded and reworked. We worked on it for most of the summer and fall. This will give the Commission a little more control of the operation and maintenance concerns and less work for the Counties and will let us (the District) work with the Commission to do the work.

The maintenance work this season was completed by Bill Bognar from Little Valley. This would be the second year of his 2-year contract for the work. In the past, we have had a time getting Mr. Bognar to do the work in a timely fashion. This season was a quite different story. He called and wanted to do the work in early September and I did everything I could to start as soon as possible. The work for the Conewango sites was done on the 17th through 19th of September. Most of the required work from the inspections was completed and the sites look very good this year. I will be working on a new contract for the next two years maintenance work over the winter to be out for bid in the spring.

In conclusion, all of the major work from this season's inspection was completed in a timely manner. Everything looks good going into the winter months. I have been checking all of the sites this fall and winter so far. There should be no problems through the winter. I will as usual, keep track of things throughout the winter months and take care of anything that arises. The Conewango sites will be due for the DEC to inspect them this coming year. I am looking forward to them seeing the work that has been done over the past two seasons, get their reactions and comments and see what will need to be done in the future to keep them functioning as needed.

We have been keeping an eye on the ditch through the fall. It was running water, but the south end of the dam is still wet. This is proving NRCS's theory of ground water being not what they thought. We will work at this situation until we figure out the problem and make the necessary repairs.

Site 6, Farrington Hollow Road, Town of Cherry Creek-

Inspection- The site was inspected on the 15th of May. This is also a Chautauqua dam and their County People were with us for the inspection. The work that was discussed at this site was:

1) Check the pH.
2) There was minor debris that needed to be removed.
3) Make repairs to the diversion ditch that is at the north end of the dam to divert runoff from the hillside.
4) Repair ruts on the dam at the north end.

Mowing- The site was mowed on the 8th of August. The weather was very good and he had no problem mowing the site. It was dry enough to mow right to the water and there was very little debris in the area to mow around.

Maintenance Work- The work was done here on the 17th of September. We repaired the ditch on the north end. Bill went up into the woods to catch the whole problem and worked his way down passed the top of the dam. This will hopefully catch the runoff from the woods and get it away from the top of the dam. We repaired the ruts at that end of the dam.
The landowners asked us if we could move the gate to the edge of the woods to see if we could cut down the vehicle traffic at the site. We have plans to do that as time and weather will allow. We will need to purchase a gate because the one there is not big enough for the mowing and maintenance machinery to get through.

Site 9A, Smith Road, Town of Villenova-

Inspection- This site was inspected on the 15th of May. This is another Chautauqua site, so their folks were with us for the inspection. The discussed items at this site were:

1) Check the pH of the site.
2) Address wood chuck holes as necessary.
3) Small willows along the water line.

Mowing- This site was the last site. It was done late on the 8th of August. There were no problems at this site. The weather had been dry and he was able to mow right to the water line, taking care of the willow. It looked very good when we were finished.

Maintenance Work- As with the other sites that had wood chuck holes, I am waiting until we can get a solution that will work to make repairs. I am going to get soil samples in the spring to have results before next spring's inspection.

Maintenance Work- As with the other sites that had wood chuck holes, I am waiting until we can get a solution that will work to make repairs. I am going to get soil samples in the spring to have results before next spring's inspection.

Site 13, New Albion Lake, Town of New Albion-

Inspection- This site is maintained by DEC as one of their "Multiple Use" areas. The inspection was done on the 15th of May. Members of DEC maintenance office were present for the inspection of the site. The discussed issues at the site were:

1) Check the pH.
2) Minor debris to be removed.
3) Remove small brush growing in the riprap at the water line.

Mowing- DEC takes care of the mowing at this site.

Maintenance Work- DEC takes care of the maintenance of the site as well.

Site 16, Co. Rd. #7, Town of Napoli-

Inspection- The site was inspected on the 15th of May with the rest. The discussed work to be done at this site was:

1) Vegetation was poor from over grazing.
2) Minor debris around the riser needed to be removed.
3) Remove brush from the inlet to the secondary spillway.
4) Remove brush from around the impact basin.

This is the only site that did not pass the inspection. It is used by the landowner for livestock grazing. There is an issue at the north end top of the dike because the animals are allowed to congregate there and there is getting a bad stop that the engineers are very concerned about. This landowner can be difficult to work with when it comes to the grazing issues of this site. We have told him of our concerns and he is willing to discuss it with us.

Mowing- This site doesn't get mowed because of the livestock grazing.

Maintenance Work- The landowner usually takes care of any minor maintenance work that the site needs. To take care of the situation at hand, we will need machine work and will address it with maintenance funds.

Outlet Channel on Site 9A

United States Department of Agriculture

Natural Resources Conservation Service

11 Campus Boulevard Suite 200 Newtown Square, PA 19073

Subject: ENG -- Ground-Penetrating Radar (GPR) Assistance

Date: 31 August 2005

To: Joseph Richard DelVecchio
State Conservationist
USDA-NRCS,
441 S Salina Street Room 520
Syracuse, NY 13202-2450

Purpose:
Ground-penetrating radar (GPR) was used to conduct lake sedimentation surveys on the reservoirs of seven floodwater retarding structures within the Conewango Creek Watershed in western Cattaraugus and eastern Chautauqua Counties, and on the reservoir of the Newtown-Hoffmann structure in Chemung County, New York.

Participants:
Stan Bishop, Cattaraugus County DPW, Ellicottville, NY
Chad Chase, Cherry Creek, NY
Ken Chase, Cheery Creek Highway Department, Cherry Creek, NY
Brian Davis, District Manager, Cattaraugus County Soil & Water Conservation District, Ellicottville, NY
Jim Doolittle, Research Soil Scientist, USDA-NRCS, Newtown Square, PA
Mark Ricker, Technician, Chemung County, SWCD,
Jim Schimmick, GSE Excavations, Cherry Creek, NY
Dave Sullivan, Geologist, USDA-NRCS, Syracuse, NY

Activities:
All field activities were completed during the period of 8 to 10 August 2005.

Survey Area:
Ground-penetrating radar surveys were completed on seven floodwater retarding structures within the Conewango Creek Watershed in western Cattaraugus and eastern Chautauqua counties, New York. These surveys were conducted as part of the National Dam Rehabilitation Program. These watersheds are underlain by Upper Devonian shales, sandstones, and siltstones of the Conewango, Conneaut, and Canadaway formations. Principal soils on the bottomlands include Canadice and Birdsall. Principal soils on the surrounding uplands include Lordstown, Volusia, and Mardin. The taxonomic classifications of these soils are listed in Table 1.

Table 1
Taxonomic Classification of the Principal Soils in the Study Areas

Birdsall	Coarse-silty, mixed, active, nonacid, mesic Typic Humaquepts
Canadice	Fine, illitic, mesic Typic Endoaqualfs
Lordstown	Coarse-loamy, mixed, active, mesic Typic Dystrudepts
Mardin	Coarse-loamy, mixed, active, mesic Typic Fragiudepts
Volusia	Fine-loamy, mixed, active, mesic Aeric Fragiaquepts

The reservoirs surveyed in Chautauqua County included those behind floodwater retarding structures numbers 3 (Bethany Camp Dam), 6 (Ferrington Hollow), and 9A (Villenova). Floodwater Retarding Structure #3 is located about 1.2 miles southwest of Thornton. Floodwater Retarding Structure #6 is located about 1.4 miles northwest of Cherry Creek. Floodwater Retarding Structure #9A is located about 1.4 miles northeast of Hamlet.

The reservoirs surveyed in Cattaraugus County included those behind floodwater retarding structures numbers 1 (Searles Dam), 13 (New Albion Dam), 16A (Walker Road Dam), and 19 (Battle Creek). Floodwater Retarding Structure #1 is located about 0.8 mile southeast of Waterboro. Multipurpose Structure #13 is located along Highway 5 just northwest of New Albion. Floodwater Retarding Structure #16A is located about 1.3 miles north of East Randolph. Floodwater Retarding Structure #19 is located about 1.7 miles southwest of Randolph.

Equipment:

The radar unit is the TerraSIRch Subsurface Interface Radar (SIR) System-3000, manufactured by Geophysical Survey Systems, Inc. (North Salem, New Hampshire).[1] Daniels (2004) discusses the use and operation of GPR. The SIR System-3000 weighs about 9 lbs and is backpack portable. With an antenna, this system requires two people to operate. A 70 MHz antenna was used in the surveys. All radar records were processed with the RADAN for Windows (version 5.0) software program (Geophysical Survey Systems, Inc).[1] Processing included setting the initial pulse to time zero, color transformation, marker editing, and range gain adjustments.

An Allegro field computer (Juniper Systems, North Logan, Utah) and a Garmin Global Positioning System Map 76 receiver (with a CSI Radio Beacon receiver, antenna, and accessories that are fitted into a backpack) (Garmin International, Inc., Olathe, Kansas).[1] The Garmin GPS receiver was operated in the manual mode. Geodetic datum was WGS-84 (World Geodetic System of 1984). The Geographic (longitude/latitude) Coordinate system was used with all units of measure expressed in decimal degrees.

To help summarize the results of the GPR survey, SURFER for Windows (version 8.0) software, developed by Golden Software, Inc.(Golden, Colorado), was used to construct the two-dimensional simulations shown in this report.[1] Grids of interpreted water depths and sediment thickness data were created using kriging methods with an octant search.

Background:

Presently, more than fifty percent of the dams constructed by the former USDA-Soil Conservation Service are older than 35 years and more than 1,800 will exceed their 50-year design life within the next 10 years (Caldwell, 2000). Many dams are in need of immediate rehabilitation. One of the primary issues in dam rehabilitation is reservoir sedimentation. Sedimentation is the major cause of reduced reservoir storage capacity. As part of a statewide assessment program, the USDA-NRCS is determining the volume of sediments deposited within selected reservoirs. The primary objectives of lake sedimentation surveys are to determine current reservoir capacity, learn of changes in storage volume, and estimate the volume of accumulated sediments.

Traditional methods used to conduct lake sedimentation surveys are slow and labor intensive. Acoustic equipment (fathometer) has been used to facilitate some reservoir surveys. However, this technology can not resolve gradational contacts nor penetrate layers of aquatic vegetation and organic materials. Recently, ground-penetrating radar (GPR) has been used to survey lakes (Haeni et al., 1987, Izbicki and Parker, 1991; Truman et al., 1991; Sellmann et al., 1992; Mellett, 1995; and Moorman and Michel, 1997) and stream channels (Spicer et al., 1997). The present surveys integrate GPS and GPR technologies to improve the efficiency of bathymetric assessments. The use of GPS is less labor intensive and time consuming than conventional positioning methods.

Survey Procedures:

The SIR System-3000 was mounted in a boat and the 70 MHz antenna was towed alongside in an inflatable raft. The boat and raft made multiple traverses across each reservoir. Locations of traverse lines were arbitrary and were continuously adjusted according to changing lake conditions and geometries. Measurement points for both GPS and GPR were simultaneously recorded at intervals of about 10 to 15 seconds. Intervals varied with the length of traverse and the speed of advance.

For each reservoir, coordinates outlining the shoreline of each reservoir were obtained by engineers in the New York State Office off of digitized maps. Locations of GPR measurement points were determined with GPS. For many point, GPS measurements were obtained in the differential mode. Differential correction requires data from four satellites. Often fewer than four satellites were visible (do to restricted mast angle and the negative influence of nearby slopes and vegetation), and, as a consequence, locations were recorded in the autonomous mode.

A warm and comparatively dry summer has resulted in a noticeable draw-down of water and the prolific growth of aquatic vegetation within the reservoirs. Areas of impenetrable aquatic vegetation fouled the outboard motor and arrested advance. Accordingly, these areas were avoided. As a consequence, large areas of most reservoirs could not be surveyed.

Calibration of GPR:

Ground-penetrating radar is a time scaled system. This system measures the time taken by electromagnetic energy to travel from an antenna to an interface (e.g., lake bottom, stratigraphic layer) and back. To convert the travel time into a depth scale, either the velocity of pulse propagation or the depth to a reflector must be known. The relationships among depth (D), two-way pulse travel time (T), and velocity of propagation (V) are described in the following equation (Daniels, 2004):

$$V = 2D/T \qquad [1]$$

[1] Manufacturer's names are provided for specific information; use does not constitute endorsement.

The velocity of propagation is principally affected by the relative dielectric permittivity (E_r) of the profiled material(s) according to the equation (Daniels, 2004):

$$E_r = (C/V)^2 \qquad [2]$$

Where C is the velocity of propagation in a vacuum (0.3 m/nanosecond). Velocity is expressed in meters per nanosecond (ns). The amount and physical state of water (temperature dependent) have the greatest effect on the relative dielectric permittivity of a material. The E_r of air and water are 1 and 80, respectively.

Water is assumed to have an E_r of 80 and a velocity of propagation of 0.033 m/ns. The electrical properties of lake bottom sediments are variable. Base on a referenced value for saturated silts (Daniels, 2004), the bottom sediments were assumed to have an E_r of 25 and a velocity of propagation of about 0.06 m/ns

Interpretations:
Radar records were of good interpretative quality. Figure 1 is a representative radar record from the reservoir at Multipurpose Structure # 13 (New Albion Dam) in the Conewango Creek Watershed. The vertical scale is a time scale expressed in nanoseconds. The horizontal scale is a distance scale expressed in scans. Although the radar provides a continuous bathymetric profile of the reservoir, measurements of water depths and sediment thicknesses were restricted to geo-referenced observation points (white vertical lines at the top of the radar profile). On this radar record, these lines are spaced at an interval of 200 scans.

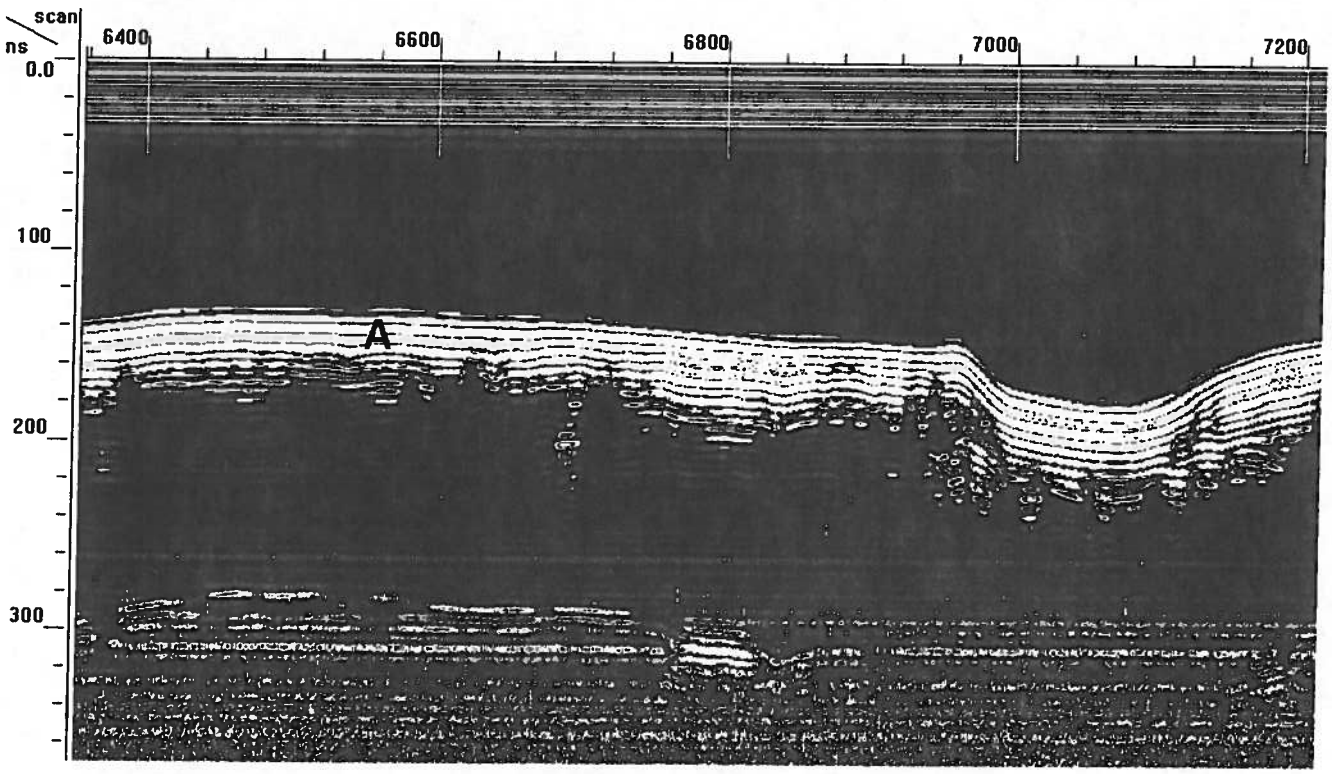

Figure 1. A representative radar record collected with 70 MHz antenna.

The horizontal reflector at the top of the radar record represents the reflection from the lake's surface and its multiples. The first series of high amplitude, subsurface bands (see "A"; bands are colored grey, white, grey) represents the lake bottom. On this radar record, this interface varies in depth from about 140 to 180 ns (about 2.5 to 3.0 m, respectively). The lowest group (see above "B") of high amplitude (also colored grey, white, grey), bands represents the base of the post-impoundment sediments and the contact with the original bottom materials. These reflectors are more segmented an uneven than the overlying reflectors from the more recently deposited, lacustrine sediments. A "double-return echo" from the lake bottom is evident at "C." This multiple reflection is a form of noise and should be ignored.

With the 70 MHz antenna the lake-bottom sediments were penetrated. These sediments represent recent deposits. As no borings were made through these sediments at the time of the surveys, the identity of these layers were not verified and the thickness of lake bottom sediments was estimated, but not measured. These recent deposits are assumed to consist principally of saturated silty sediments. This is an oversimplification, but is useful to approximate the relative thickness of the post-impoundment sediments.

A task of this investigation was to identify the lake bottom and the base of the post-impoundment sediments on each radar record. The interface separating water from saturated sediments was easily identified and trace laterally on all radar records. The interpreted base of the post-impoundment sediments was identified as the deepest continuous high amplitude reflection. Although an E_r of 25 and an average velocity of 0.060 m/ns were used to determine the general thickness of the underlying saturated post-impoundment silty sediments, saturated silts are known to have an E_r that ranges from 10 to 40 (Conyers and Goodman, 1997).

Results:

Conewango Creek Watersheds:

Seven reservoirs within the Conewango Creek Watershed were surveyed in a 2.5 day period. A total of 620 GPR observation points were recorded. For each reservoir, the number of observation points varied with the size of the reservoir and the area accessible to the boat. Basic statistics for the interpretations of water depths within each reservoir are listed in Table 2. At the recorded observation points, interpreted water depths ranged from 0.32 to 4.02 m. These reservoirs are relatively small and shallow. The greatest depth was recorded in the reservoir of flood retarding structure #13 (4.02 m). This reservoir also had the greatest averaged water depth (2.32 m). The shallowest averaged water depths were recorded at flood retarding structure #6 and #9A (about 1.1m).

Table 2
Basic Statistics for Water Depths in each of the Conewango Creek Watershed Reservoirs.
(With the exception of number of observations, all data are in m).

STRUCTURE	#1	#3	#6	#9A	#13	#16A	#19
Number	43	50	52	97	209	83	86
Mean	2.16	1.32	1.11	1.12	2.32	1.54	1.41
SD	0.55	0.63	0.29	0.56	0.70	0.43	0.76
Minimum	0.60	0.32	0.54	0.33	0.66	0.45	0.35
Maximum	3.25	2.37	1.65	2.29	4.02	2.21	3.37
25% Tile	1.93	0.86	0.97	0.69	1.96	1.22	0.77
75% Tile	2.42	1.86	1.33	1.51	2.74	1.90	2.02

Table 3
Basic Statistics for Sediment Thickness in each of the Conewango Creek Watershed Reservoirs.
(With the exception of number of observations, all data are in m).

STRUCTURE	#1	#3	#6	#9A	#13	#16A	#19
Number	43	50	52	97	209	83	86
Mean	0.77	0.94	0.89	0.89	0.79	0.92	0.67
SD	0.15	0.15	0.24	0.29	0.17	0.22	0.11
Minimum	0.52	0.56	0.44	0.16	0.34	0.47	0.45
Maximum	1.18	1.23	1.46	1.83	1.27	1.46	0.99
25% Tile	0.66	0.84	0.70	0.73	0.67	0.76	0.60
75% Tile	0.86	1.0323	1.04	1.03	0.90	1.08	0.73

Basic statistics for the interpretations of the post-impoundment sediment thickness within each reservoir are listed in Table 3. For the recorded observation points, based on radar interpretations, sediment thicknesses ranged from about 0.2 to 1.8 m. The greatest (1.83 m) thickness of post-impoundment sediments was obtained in the reservoir of flood retarding structure #9A. For all reservoirs, the averaged thicknesses of post-impoundment sediments were similar and ranged from about 0.7 to 0.9 m. The shallowest averaged thickness (0.67 m) of post-impoundment sediments was obtained in the reservoir of flood retarding structure #19.

Newtown-Hoffmann (Site 12E); Chemung County, New York:

Sullivan Dam is located along the east side of New York Highway 13 about 2.7 miles northeast of Horseheads. Based on radar interpretations made at 226 observation points, the averaged depth of water within this reservoir is 1.87 m with a range of about 0.3 to 4.6 m. At one-half of the observations points, the depth of water was between about 1.2 and 2.3 m. Also based on radar interpretations, recent sediments averaged 0.69 m thick with a range of about 0.4 to 1.1 m. At one-half of the observations points, the thickness of recent sediments was between about 0.6 and 0.7 m.

Two-Dimensional Plots:
Plots of the interpreted radar data can be found at the end of this report. In each plot, a gradational spectrum between two colors has been assigned to individual water depth or sediment thickness levels. In each plot, the color bar interval is 0.50 for water depths and 0.25 m for sediment thicknesses. For each structure, the approximate outline of the reservoir is shown. These outlines were achieved by digitizing data points off of base maps. As evident in each of the plots, large areas within each reservoir could not be navigated because of dense vegetation that fouled the motor and restricted the movement of the survey boat.

Discussion:

Major sources of measurement error are variations in the velocity of propagation through water and post-impoundment sediments. In addition, errors in identifying the base of the post-impoundment sediments may have occurred in areas with alluvial sediments that predated the impoundment of water. The dielectric contrast between water and the post-impoundment sediments is abrupt and contrasting. This characteristic provided a clear and easily identifiable interface on radar records. Though less contrasting the contrast between the saturated low-density, post-impoundment sediments and the higher-density pre-impoundment materials is substantial. As a consequence, this interface was identifiable at most observation points. However, misidentification of the base of the post-impoundment sediments could result in significant error in the estimation of sedimentation. Some reservoirs are situated on areas formerly occupied by alluvial soils. These soils have layers of sediment that may be confused with post-impoundment sediments. As the textural composition and moisture content of the post-impoundment sediments is unknown, the sediments were presumed to be saturated silts with an estimated dielectric permittivity of 25. Ancillary coring data would have greatly increased our knowledge of the composition, dielectric properties, and thickness of the post-impoundment sediments. In the absence of this data, estimations of the sediment thickness are constrained and subject to error.

It was my pleasure to work in New York. The surveys were well organized and the boat crews were very efficient. I deeply appreciated the assistance and counsel of David Sullivan.

With kind regards,

Jim Doolittle
Research Soil Scientist
National Soil Survey Center

cc:
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K. Chase, C/0 Cherry Creek, 6914 North Main Street, Cherry Creek, NY, 14723
M. Golden, Director, Soil Survey Division, USDA-NRCS, Room 4250 South Building, 14th & Independence Ave. SW, Washington, DC 20250
D. Hammer, National Leader, Soil Investigation Staff, USDA-NRCS, National Soil Survey Center, Federal Building, Room 152,100 Centennial Mall North, Lincoln, NE 68508-3866
D. Sullivan, Geologist, USDA-NRCS, 441 S Salina ST RM 520, Syracuse, NY 13202-2450
W. Tuttle, Soil Scientist (Geophysical), USDA-NRCS-NSSC, P.O. Box 974, Federal Building, Room 206, 207 West Main Street, Wilkesboro, NC 28697
P. Wright, Supervisory Engineer, USDA-NRCS, 441 S Salina ST RM 520, Syracuse, NY 13202-2450

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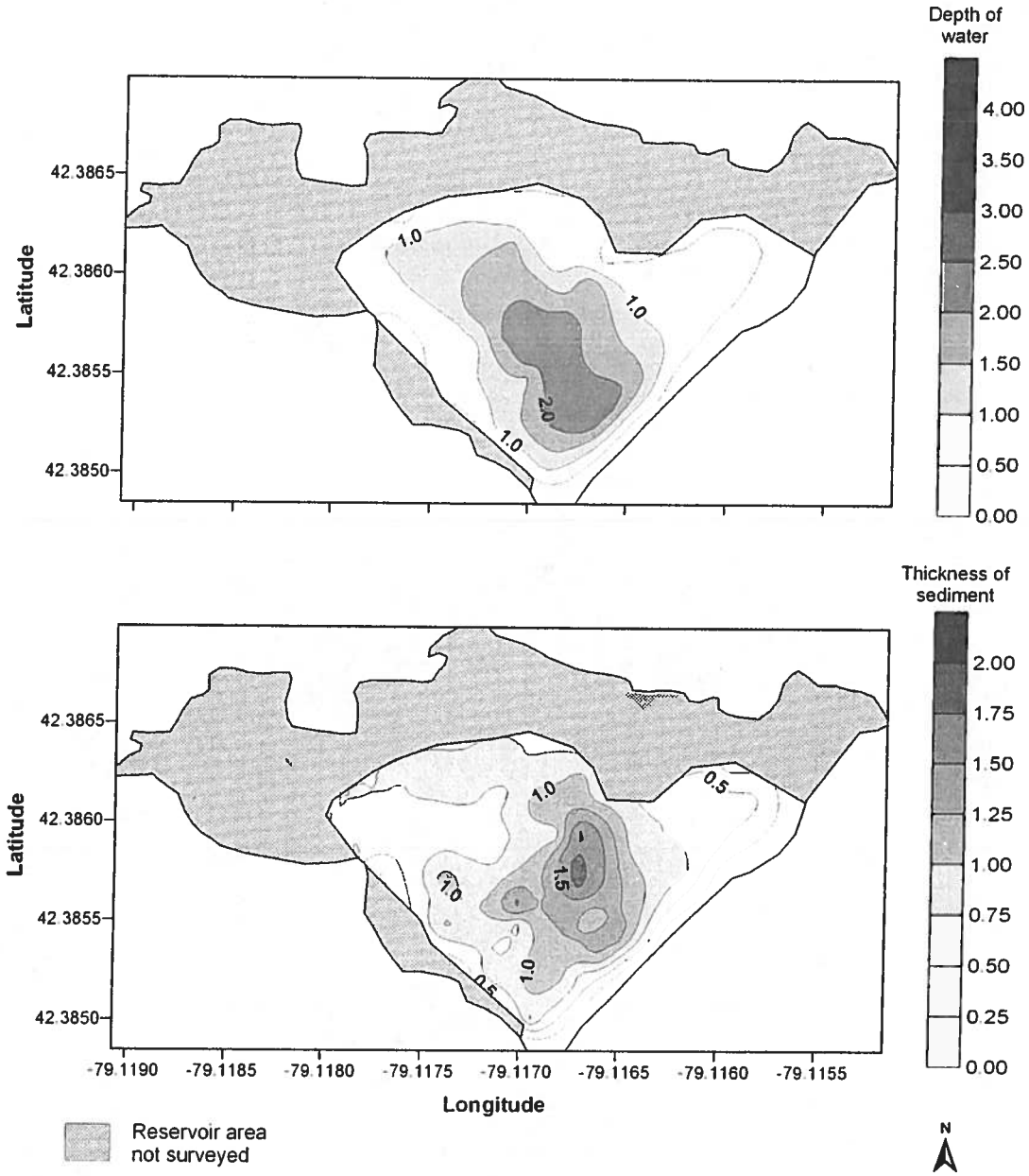

Figure 5. Conewango Structure #9A

OPERATION AND MAINTENANCE PLAN

AND

OPERATION AND MAINTENANCE AGREEMENT

FOR

CONEWANGO CREEK WATERSHED

FLOODWATER RETARDING STRUCTURE

SITE 9A

TOWN OF VILLENOVA

SPONSORED BY:

COUNTY OF CHAUTAUQUA
CHAUTAUQUA COUNTY SOIL & WATER DISTRICT
COUNTY OF CATTARAUGUS
CATTARAUGUS COUNTY SOIL & WATER DISTRICT

PREPARED WITH ASSISTANCE FROM
NATURAL RESOURCES CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FEBRUARY 2009

OPERATION AND MAINTENANCE PLAN

CONEWANGO CREEK SITE 9A

FLOOD WATER RETENTION STRUCTURE

General

The Sponsor and NRCS agree to carry out the terms of this agreement for the operation and maintenance of the practices in the State of New York. This structure is a part of the original Conewango Creek Watershed Plan that was approved March 1959 and the Supplemental Watershed Plan approved on April 1966 under the authority of Public Law 83-566.

This plan defines responsibilities for operating, inspecting, and maintaining the Conewango Creek floodwater retarding structure Site 9A. These responsibilities shall remain in effect for the program life of 100 years from the original date the structure is determined complete (1974) by the Natural Resources Conservation Service (NRCS) (Expiration Year 2074). After the expiration of this O&M Plan the Sponsors will not be eligible for any Federal technical or financial assistance administered by NRCS, unless Conewango Creek Site 9A is upgraded to the most recent NRCS dam safety criteria and the O&M Plan is recertified to current Federal dam safety criteria. After the expiration date of this O&M Plan, the Sponsors will remain liable for the health and safety of the general public and related infrastructure resulting from the failure of the Conewango Creek Site 9A flood control structure. This liability shall remain in force until the structure is removed.

Description of Practice

Floodwater retarding structure Conewango Creek Site 9A is located approximately 4 miles northwest of South Dayton on the South Branch of Conewango Creek in Chautauqua County, New York. This structure was designed as a high hazard dam. The dam is jointly owned by the County of Cattaraugus (County Legislature and the Soil and Water Conservation District) and County of Chautauqua (County Legislature and the Soil and Water Conservation District). The dam is a homogenous earth structure, 1600 feet long, with a height of 42 feet. The principal spillway inlet is a rectangular concrete drop box, 13.7 feet by 21.7 feet, 32.7 feet high. The spillway outlet is a 48 inch diameter AWWA C-301 pipe with a stilling basin. A 200 feet wide grassed auxiliary spillway is located on the left abutment.

Duration of O&M Requirements

Beginning with the date of acceptance of the works of improvement in whole or in part, the term of this agreement is for the evaluated life of the measure (100 years). The

expiration date is determined to be 2074, unless amended by mutual agreement between the sponsors and the NRCS.

Estimated Annual O&M Costs

The Cattaraugus and Chautauqua County Legislatures are responsible for financing the operation and maintenance activities for the Conewango Creek Site 9A floodwater retarding structure. Funds for these activities will be obtained from tax revenues collected by the Cattaraugus and Chautauqua County Legislatures and will be held in an operation and maintenance escrow account until needed. It is estimated that the average annual cost of maintenance will be $ 8,500 (2008 Dollars) for this structure. Estimated annual O&M costs are as follows (unused amounts will be added to escrow account each year)

Vegetation (mowing, liming, fertilizing)	$2,000
Debris Removal	$ 500
Concrete Repair/Replacement	$ 500
Metal works (trash racks, railings, grating, drainage)	$ 500
Engineering Evaluation and Record Keeping	$ 2,000
Unforeseen and Long term Maintenance (escrow account)	$ 3,000
	$ 8,500/Yr

Operation

For the floodwater retarding structure (FWRS) to serve its purpose of flood control, no human operation will be necessary. Flood control is provided by the size of the principal spillway pipe limiting the outflow and causing the storage of floodwater in the flood pool behind the dam. As the storm recedes, the limited outflow continues until the stored floodwater is discharged. The principal spillway discharge, when the flood pool is at its maximum elevation (1388.7 mean sea level), is 1709 cubic feet per second. The Conewango Creek Site 9A Dam is a high hazard structure (Hazard Class High)

The Conewango Watershed Commission will be responsible for all operation activities. The Conewango Watershed Commission will assist in the coordination of any required reservoir drawdown and other operation activities to be coordinated with other structures in the watershed.

Maintenance

It is the responsibility of the Conewango Watershed Commission to ensure that the following operation and maintenance items, as a minimum, are addressed annually. The Cattaraugus County Soil and Water Conservation District will conduct the inspections.

Required funds for maintenance will be obtained from tax revenues collected by the County of Cattaraugus and the County of Chautauqua in the state of New York

All materials used in the maintenance and repair of any component of the dam shall be equal or better quality than shown on the original plans and specifications. Maintenance activities that involve work in the stream channel, including the inlet channel, the concrete pipe and appurtenances, and the outlet channel, will be carried out between May 15 and October 1 to avoid adverse impact on the fishery.

Maintenance along the dam embankment and reservoir shoreline, portions of the inlet structure (riser), concrete pipe and outlet structures will be below the water surface. Maintenance of these structures may require dewatering involving the operation of the slide gate to lower the water level for short periods of time to complete the needed maintenance. Maintenance of these structures may also require the use of temporary barriers or coffer dams, pumps, temporary plugs in the concrete pipe, or similar items.

The principal spillway slide gate shall be opened and closed each year during the annual inspection, as a minimum, to ensure proper operation. The opening and closing of the principal spillway slide gate shall be documented on the annual and formal inspection report.

The following is a list of items needing specific inspection and maintenance. Each item will be discussed in detail in the next section.

1. Principal spillway (Inlet Riser and Outlet Structure)
2. Embankment and drainage system
3. Emergency Spillway
4. Access
5. Sediment Flood Pool

The following detailed operation and maintenance items will require annual attention unless otherwise noted.

1. Principal Spillway

    a. All metal work shall be visually inspected, repaired, or replaced if it is damaged or improperly removed. All painted surfaces shall be cleaned and painted when rust starts to appear or the paint system shows signs of peeling or heavy oxidation.

    b. Interior of conduit shall be visually inspected every five years. Any seepage through the pipe joints, cracking, and excessive pipe settlement and joint gaps shall be brought to the attention of NRCS.

    c. Trash racks shall be kept free from trees, logs, trash, debris, and other obstacles which will interfere with the proper functioning of the structure. Trash racks shall be checked after all high water conditions.

d. Riprap at inlet and outlet shall be replaced or rearranged as needed to provide the intended erosion control.

e. Outlet channel erosion or siltation will be corrected as needed to restore the outlet channel to the design grade and cross section.

f. Concrete will be visually inspected for cracks, spalls, misalignment, or structural breakage. Spalls deeper than 1-inch and cracks less than 0.25 inch shall be repaired with cement mortar and sealing compound respectively. Cracks greater than 0.25 inch, and misalignments of more than 0.5 inch, and any structural breakage shall be measured and repaired in accordance with NRCS recommendations. Exposed joints shall be visually inspected. Any joint where the sealing compound or joint filler is missing shall be repaired with materials similar to that used in the original construction. Any joints found to have opened more than 1-inch shall be measured and promptly repaired in accordance with NRCS recommendations

g. The principal spillway slide gate valve will be kept in working order. At a minimum, each gate slide valve shall be operated at each annual inspection. Excessive force shall not be used when operating gates. Repair or replace all non-functional hardware such as stem guides, anchors, and anchor bolts. Slide gate valves are not expected to retain operational capability for the design life of the dam and are anticipated to be replaced. Timing for replacement should be evaluated during annual O&M inspections.

h. Woody vegetation, trees, and large shrubs on the outlet channel area, and within 10 feet of all concrete structures shall be controlled by spraying or removal. This vegetation shall be killed or removed before it reaches 1 foot in height, or 1 inch in diameter (stalks of woody growth). All pesticide applications shall be done in accordance with applicable Federal, State, local, or tribal laws and regulations.

2. Embankment and Drainage System

a. Any soils removed from the embankment by erosion, slips, settlement, vandalism, rodents, vehicles or other causes shall be replaced on the original cross-section slopes and grades. All earthfill shall be approved material that is compacted and graded to prevent ponding or concentrated drainage. These areas shall be re-vegetated as soon as practical to ensure vigorous vegetated growth.

b. Fertilizer and lime shall be applied as needed to maintain vigorous growth of vegetation. Application rates will be based on soil tests

c. Holes created by animals shall be filled, compacted, graded, and re-vegetated.

d. Areas of sparse vegetation, including areas damaged by erosion, freezing, or drought shall be reseeded, fertilized, and limed as necessary to return area to vigorous growth and cover.

e. Riprap in gutters shall be replaced or rearranged as necessary to provide the intended erosion control.

f. Drain system piping outlets shall be: kept clear of blockage, clean and operational. Animal guards shall be visually inspected and replaced as needed. Visual inspection of drainage water (sediments or clear) will be made.

g. Woody vegetation, weeds, trees, and shrubs on the embankment shall be controlled by annual mowing, spraying or removal. This vegetation shall be killed or removed before it reaches 1 foot in height, or 1 inch in diameter (stalks of woody growth). All pesticide application shall be done in accordance with applicable Federal, State, local, or tribal laws and regulations.

h. The embankment shall be mowed at a frequency that prevents the establishment of woody vegetation. Mowing will be done after July 15 to protect ground nesting birds.

3. Auxiliary Spillway

a. Any material that restricts the full flow capacity or creates the potential for a discontinuity in the flow of the auxiliary spillway shall be removed as soon as possible.

b. All soils removed from the spillway by erosion, slips, settlement, vandalism, rodents, vehicles or other causes shall be replaced on the original slopes and grades. All earthfill shall be approved material that is compacted and graded to prevent ponding or concentrated drainage. Theses areas shall be re-vegetated as soon as practical to ensure vigorous vegetated growth.

c. Fertilizer and lime shall be applied as needed to maintain vigorous growth of vegetation. Application rates will be based on soil tests.

d. Holes created by animals shall be filled, compacted, graded, and re-vegetated.

e. Areas of sparse vegetation, including areas damaged by erosion, freezing, or drought shall be reseeded, fertilized, and limed as necessary to return the area to vigorous growth and cover.

f. Woody vegetation, weeds, trees, and shrubs on the spillway shall be controlled by annual mowing, spraying or removal. This vegetation shall be killed or removed before it reaches 1 foot in height, or 1 inch in diameter (stalks of woody growth). All pesticide application shall be done in accordance with applicable Federal, State, local, or tribal laws and regulations.

g. The spillway shall be mowed at a frequency that prevents the establishment of woody vegetation. Mowing will be done after July 15 to protect ground nesting birds. The mowed height of vegetation shall be no less than 3 inches and no greater than 6 inches.

h. Ruts or pathways created by foot or vehicle traffic will be revegetated to provide uniform vegetative cover in the spillway.

4. Access

    a. Access to the site shall be maintained.

5. Sediment Flood Pool

    a. Visually inspect the sediment flood pool for elevation of sediment and note on inspection report whether sediment is above or below the normal pool water line. If more than 1 ac-ft of sediment is above the normal pool water line, notify NRCS as soon as possible.

    b. The auxiliary spillway, principal spillway, and both slopes of the dam shall be kept clear of trees, logs, debris, trash, and other obstacles, which will interfere with the proper functioning of the structure.

Personnel

All personnel involved in conducting inspections and performing O&M activities shall be properly trained and equipped. NRCS may assist in training sponsor employees. NRCS may provide employees to accompany the sponsor during O&M inspections, if requested by the sponsors and if NRCS resources are available.

Inspections

Four types of inspections are required to ensure that the flood control structure functions and performs as designed in a safe manner.

1. **Monitoring** of the dam will be accomplished to identify and report abnormal conditions between scheduled inspections. This surveillance may be accomplished by any person, including landowners, O&M personnel, NRCS personnel, or others who visit or observe the site. Any unusual circumstances should be reported immediately to the sponsor or appropriate official for follow-up.

2. **Special** inspections will be conducted immediately following severe storms, earthquakes, initial filing of the reservoir, vandalism, any flow in the auxiliary spillway, or other significant events. Upon the occurrence of a special event, the sponsors shall notify the NYSDEC Dam Safety Section and NRCS Field and State Offices. A follow-up written report of the special inspection shall be forwarded to the NYSDEC Dam Safety Section and NRCS Field and State Offices.

3. **Annual** inspections will be accomplished in May (or prior to vegetative growth obscuring the ground surface) by properly trained personnel using an inspection checklist approved by NRCS. An NRCS engineer may participate in the annual inspection, if NRCS resources are available. A written report of the annual inspection shall be forwarded to the NYSDEC Dam Safety Section, the NRCS Watershed, Field and State Office.

4. **Formal** inspections shall be conducted at least once every 5 years. These inspections are to be accomplished under the leadership of a New York registered professional engineer with experience in dam engineering and may include soil and hydraulic specialists as needed. The State Dam Safety Section of NYDEC will be invited to participate in this inspection. The purpose of the inspection is to determine the safety and structural integrity of the dam, and to determine whether the dam meets the current NRCS and New York State Dam Safety criteria. The inspection criteria will include the following:

    a. Data Review and Analysis

        - Review all data related to the design and construction. Data that is unavailable, inadequate, or questionable shall be noted

        - Determine if the dam is in compliance with current NRCS, State Dam Safety, and other applicable criteria and policy. NRCS criteria are detailed in TR60 and may be determined by modeling with the NRCS SITES software.

        - Review the O&M Plan, previous inspection reports, and O&M history

        - Review the Emergency Action Workplan

b. Field Examination

- Complete a through visual inspection of all components (underwater inspections may be necessary)

- Inspect the principal spillway. A remotely controlled camera may be necessary to inspect the conduit

- Evaluate the downstream area to determine the current hazard classification

- Perform inspection in compliance with OSHA requirements

- Determine compliance with requirements of easements and landrights documents

- Determine if slopes, grades, and groundcover of the site has been modified from the original design. Where modification has occurred determine if modification has occurred with NRCS and NYDEC Dam Safety Section approval.

c. Contents of Inspection Report

- Summary of data reviewed and analyzed

- Visual inspection findings, including the inspection checklist

- Photographs, sketches, and maps

- Current hazard classification

- Adequacy of the Emergency Action Workplan

- Evaluation of data collected

- Determination if dam meets current NRCS and State Dam Safety criteria

- Required corrective action

- Evaluation of O&M Plan

d. Review and Distribution of Inspection Report

- Formal inspection reports shall be submitted to the NRCS State Conservation Engineer for review

- On approval of the report by the NRCS State Conservation Engineer, the report will be forwarded to the NYDEC Dam Safety Office

- Reports indicating serious deficiencies shall be forwarded to the NRCS State Conservationist for appropriate action

- A copy of each formal inspection report shall be filed with NRCS, the Sponsor(s) and NYDEC Dam Safety Section

Records

The Conewango Watershed Commission shall maintain the following records in a permanent file at the Chautauqua County DPW or other location where records can be maintained for the design life duration: a record of significant actions taken; the cost of performance and completion dates; as-built drawings; permits; inspection reports, and related material. Copies of all inspection reports shall be provided to the NRCS State Conservation Engineer and the NYDEC Dam Safety Office. The Conewango Watershed Commission shall also maintain a permanent file of the NRCS design books, as-built drawings, and other design related items.

Hazard Concerns

This structure is classified as a high hazard dam by NRCS and the NYDEC Dam Safety Section. The specific hazard concerns associated with Conewango Creek Site 9A are located in the downstream flood area.

The Emergency Action Plan for this structure outlines a sequential list of contingencies to be followed in the event this structure is subject to imminent failure or periods of high water flow. The Conewango Watershed Commission is responsible for ensuring that this plan is reviewed and updated annually. Copies of the original and sub-sequential updated plans shall be provided to the NRCS State Conservation Engineer and the NYDEC Dam Safety Section.

Violations

If NRCS determines that the Conewango Watershed Commission has failed to comply with the provisions of this O&M Plan, the County of Cattaraugus and the County of Chautauqua agrees to reimburse the Federal government for the financial assistance provided for the installation of Conewango Creek Site 9A. The Federal government also shall have the right to take any further action it deems necessary as per the O&M agreement.

OPERATION AND MAINTENANCE ANNUAL INSPECTION REPORT
FOR FLOODWATER RETAINING STRUCTURES

Watershed _____ Inspection Date _____

Dam Identification No. _____ Report Date _____

FWRS Sponsors _____

O&M Responsible Organization: Cattaraugus County Soil & Water District

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YES" responses need explanation added to "Remarks" section. (ie: What? Where? Extent?)
"NO" responses indicate problems not observed during inspection.
Non-applicable items should be lined out.

Inspection Item	Yes	No	Remarks
1. Previous Year Inspection			
a. Are prior year O&M action items completed			
2. General Conditions			
a. Alterations to dam			
b. Development in downstream floodplain			
c. Development around reservoir			
2. Embankment			
a. Is vegetative cover inadequate			
b Are trees growing on either slope			
c. Is brush/weed control needed			
d. Are trees growing at waterline			
e. Is drift debris present			
f. Are cracks, settlement, or bulges present			
g. Are animal burrows present			
h. Are trails present			
3. Front Slope Protection			
a. Any wave damage observed			
b. Is riprap inadequate			

c. Are rodent holes present			
Inspection Item	**Yes**	**No**	**Remarks**
4. Inlet Structure and Gate Valves			
a. Does concrete exhibit deterioration			
b. Is concrete reinforcement exposed			
c. Was leakage observed inside inlet			
d. Any corrosion of metal appurtenances			
e. Is debris guard obstructed			
f. Is debris guard corroded			
g. Is gate stem broken or bent			
h. Are components missing			
i. Was gate determined not operational			Date gate last operated:
j. Has inlet been modified to alter water surface			
5. Principal Spillway Conduit			
a. Is concrete conduit deteriorated			
b. Is metal conduit corroded			
c. Was leakage observed at pipe joints			
6. Auxiliary Spillway			
a. Is vegetative cover inadequate			
b. Any animal trails observed			
c. Any vehicular trails observed			
d. Is flow area obstructed			
e. Is control section disturbed			
7. Principal Spillway Release Channel			
a. Does scour hole appear unstable			
b. Any boils observed			
c. Is riprap inadequate			
d. Any seepage observed			
e. Is conduit outlet submerged			
f. Is conduit outlet not properly supported			
g. Is outlet channel obstructed			
h. Is outlet channel degrading			
i. Is foundation drain submerged			
j. Is foundation drain rodent barrier missing			
k. Is foundation drain not functional			
8. Perimeter Fence			
a. Is fence inadequate			
b. Are gates open			

9. Easements/landrights			
a. Are terms of landrights out of compliance			
Inspection Item	**Yes**	**No**	**Remarks**
b. Are landrights boundaries being encroached upon			

ACTION TAKEN: (Identify all work performed in the preceding 12 months by the sponsors and/or NRCS, Including approximate cost and date completed).

ACTIONS NEEDED: (Identify items by priority: Low –next 12 months; High – as soon as possible), (Indicate date assistance requested; technical or financial).

Sponsor Representative

NRCS Engineering Representative

OPERATION AND MAINTENANCE AGREEMENT

THIS AGREEMENT made on this _____ day of _____, 2009, is between the Natural Resources Conservation Service, United States Department of Agriculture, hereinafter referred to as NRCS, and the following organizations, hereinafter referred to as the Sponsor.

County of Cattaraugus, New York
Cattaraugus County Soil & Water Conservation District
County of Chautauqua, New York

THIS AGREEMENT replaces and supercedes the Operation and Maintenance Agreement signed by the Soil Conservation Service (SCS), United States Department of Agriculture (USDA) and the Conewango Watershed Commission dated 31 May 1968. This plan may be revised by mutual consent of all signatory parties.

The project measures covered by this agreement are identified as follows:

Conewango Creek Site 9A floodwater retarding structure located on the South Branch of Conewango Creek approximately 4 miles northwest of South Dayton, New York

The Sponsors' responsibility for O&M began when the structure was determined complete by NRCS (1974). This responsibility shall include the replacement of any component of the structure as needed. This O&M Agreement remains in effect for the program life of 100 years from the date the last structure covered by this Agreement is completed (2074), as determined by NRCS. After the expiration of this O&M Agreement, the Sponsors may still continue to be liable until the structure is removed or modified to eliminate potential hazards.

I. GENERAL

A. The Sponsor shall:

1. Complete all maintenance, repair, or replacement activities within a reasonable time after the identification of such need:

2. Obtain prior NRCS approval of all plans, designs, and specifications for any planned alterations to the structure or for deviating from the O&M plan.

3. Be responsible for the replacement of structure components that have a design life of less duration than the program life of the structure as specified in the O&M Plan.

4. Prohibit the installation of any structure or facility that will interfere with the operation and maintenance of the structure.

5. Notify NRCS of any proposed agreement with other parties for the operation or maintenance of all or any part of the structure, and provide NRCS with a copy of the executed agreement. Such agreement will not negate the Sponsors' responsibilities as stated in this agreement.

6. Comply with property management standards set forth in the NRCS Contracts, Grants, and Cooperative Agreements Manual, the National Watershed Manual, and all applicable Federal, State, local, and tribal laws and regulations.

7. Provide NRCS personnel or its agents the right of free access to the structure site at any reasonable time for the purpose of carrying out the terms of the agreement.

8. Comply with Federal, State, local, and tribal laws and regulation in the operation and maintenance of the structure; and

9. Consider air and water quality, sediment control, and other environmental concerns in the operation and maintenance of the structure.

10. Be responsible for inspecting, operating and performing, or having performed, all operation, maintenance, and replacement activities associated with floodwater retarding structure Conewango Creek Site 9A and their components, as described in the O&M Plan.

11. Assure that the Emergency Action Plan is prepared for Conewango Creek Site 9A floodwater retarding structure and that the EAP is reviewed and updated annually.

12. Establish an escrow account for operation, maintenance, and replacement of structure/components.

B. NRCS will:

1. Upon request from the Sponsor and to the extent that NRCS resources permit, provide consultative assistance in the operation, maintenance, and replacement of practices.

II. OPERATION AND MAINTENANCE PLAN (O&M PLAN)

1. An O&M Plan for each practice included in this agreement is attached to and becomes a part of this agreement.

2. The O&M Plan shall be reviewed every five (5) years and revised as required to include any revisions to NRCS regulations and Federal, State, and local laws.

III. INSPECTIONS AND REPORTS

1. The Sponsor will inspect the practices during the month of May as specified in the O&M Plan.

2. NRCS or Federal land administrating agency may inspect the practices at any reasonable time during the period covered by this agreement. At the discretion of the State Conservationist, NRCS personnel may assist the Sponsor in inspections.

3. A written report will be made within 30 days from the date the inspection was conducted of each inspection and provided to the following:

   NRCS State Office
   NRCS Watershed Office
   NRCS Field Office
   New York State DEC Dam Safety Office

4. The Sponsor responsible for O&M of specific structures shall retain a record of all inspections and O&M performed including costs and completion dates. Records shall be made available to NRCS upon request.

IV. TIME AND RESPONSIBILITY

1. The Sponsor's responsibility shall continue until the expiration of the evaluated life of all the installed project practices. This does not relieve the Sponsor's liability which continues throughout the life of the measure or until the measure is modified to remove potential loss of life or property.

V. RECORDS

1. The Sponsor shall maintain in a centralized location all project documents including plans and specifications, as-built plans and specifications, design books, and records of all inspections and significant actions taken, cost of

performance and completion date with respect to operation and maintenance. NRCS may inspect these records at any reasonable time during the term of the agreement or as required by New York State regulations.

CATTARAUGUS COUNTY

By: _____

Title: _____

Date: _____

CATTARAUGUS COUNTY SOIL & WATER CONSERVATION DISTRICT

By: _____

Title: _____

Date: _____

CHAUTAUQUA COUNTY

By: _____

Title: _____

Date: _____

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

By: _____

Title: _____

Date: _____

NRCS
Natural Resources
Conservation Service
United States Department of Agriculture

Conewango Site 9a
Inspection Summary

August 2005

Cutting Edge Group, LLC
14 Walkup Cutoff Road
Lake George, New York

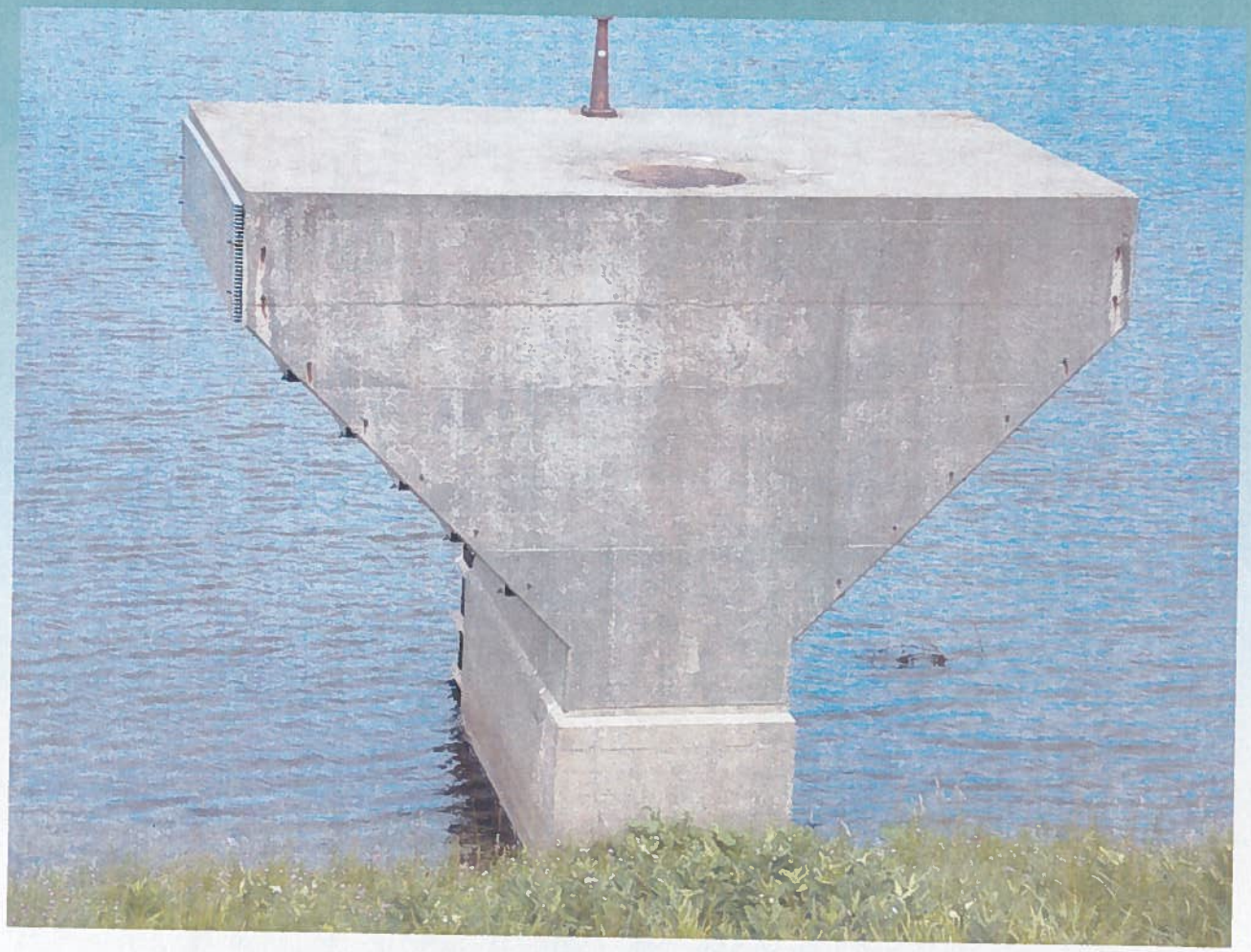
Introduction

- Cutting Edge Group, LLC was hired by the USDA NRCS to perform inspections of flood control structures in various watersheds in New York State. Each inspection included a general visual inspection of each site as well as a detailed CCTV inspection of each structure.

General Observations

- Conewango Site 9a appeared to be well maintained. The earthen dike was well vegetated with hay, clover and various wild flowers. There was minimal woody vegetation as the mowing appears to have limited its advancement.
- The exterior of the inlet structures was in very good shape with minimal cracking and spalling observed. The metal structures appear to be sound and properly anchored.

The Inlet Structure at Conewango Site 9a



General Observations Continued

- The exterior of the outlet structures were in good condition with no cracking and spalling observed.

The Outlet Structure

CCTV Summary

- The equipment used to perform the CCTV inspections was an ARIES Saturn III. This system properly equipped can be used for the inspection of pipes from 4 inches to 200 inches in diameter. The camera was mounted on an all terrain carrier.
- The video monitor and carrier control system was transported to the outlet structure with a 6 wheel drive cub cadet ATV

Equipment used

Equipment used

Conewango Site 9A

Municipal Services, Inc.
Fort Edward, NY 12828
Tel: 518/747-8079 Fax: 518/746-1795

Project Information

Project Name:	Contact :	Date:
Flood Control Structures	**Chris Henry**	**08/02/05**

Client:	**USDA-NRCS**
Contact:	**Chris Henry**
Position:	**Civil Engineer**
Road:	**441 S. Salina St. - Suite 354**
Town:	**Syracuse, NY**
County:	**Onondaga**
Telephone:	**315/477-6544**
Fax:	**315/477-6505**
Mobile:	
Email:	

Site:	
Contact:	
Position:	
Road:	
Town:	
County:	
Telephone:	
Fax:	
Mobile:	
Email:	

Contractor:	**Municipal Services, Inc.**
Contact:	**Mark A. Reynolds**
Position:	**President**
Road:	**268 Broadway**
Town:	**Fort Edward, NY 12828**
Telephone:	**518/747-8079**
Fax:	**518/746-1795**
Mobile:	**518/857-7420**
Email:	**mark@municipalsvcs.com**

Municipal Services, inc.
Fort Edward, NY 12828
Washington
Tel: 518/747-8079, Fax: 518/746-1795

Inspection report

Date:	P.O.#	Weather:	Surveyed By:	section number:	PSR:
08/02/2005		1 Dry	N. Higginson	6	
Total Pipe Length:	**Survey Customer:**	**System Owner:**	**Clean Date:**	**Pre-Cleaned:**	**Map Grid #:**
189ft	USDA-NRCS	USDA-NRCS		N No Pre-Cleaning	

Street: Flood Control Structure	Flow Control:	Start MH:	Outfall
City: Cherry Creek, NY	Year Renewed	End MH:	Inlet
Location Code: Conewango -Site 9A	Tape/Media #: 5	pipe length:	189 ft

Reason for inspection: F Routine Asseessment	Dia/Height: C Circular 48"
Use of Sewer: Dam Outlet	Material: RCP Reinforced Concrete Pipe Pipe Length: 16ft
Drain. Area:	Lining Method:
	Category:

Remark::

1:475	position	code	observation
Outfall	0.00	ADP	Discharge Point, Remark: Outfall
Inlet	189.00	AOC	Special Chamber, Remark: Inlet Chamber

QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0	0	0	0	0	0

CCTV observations

- No cracks were observed during the inspection of the reinforced concrete outlet pipes.
- The pipe length at Conewango site 9a was approximately 189 LF. The pipe was relatively free from debris.
- An inspection of the interior of the inlet structures revealed no problems.

Conclusions

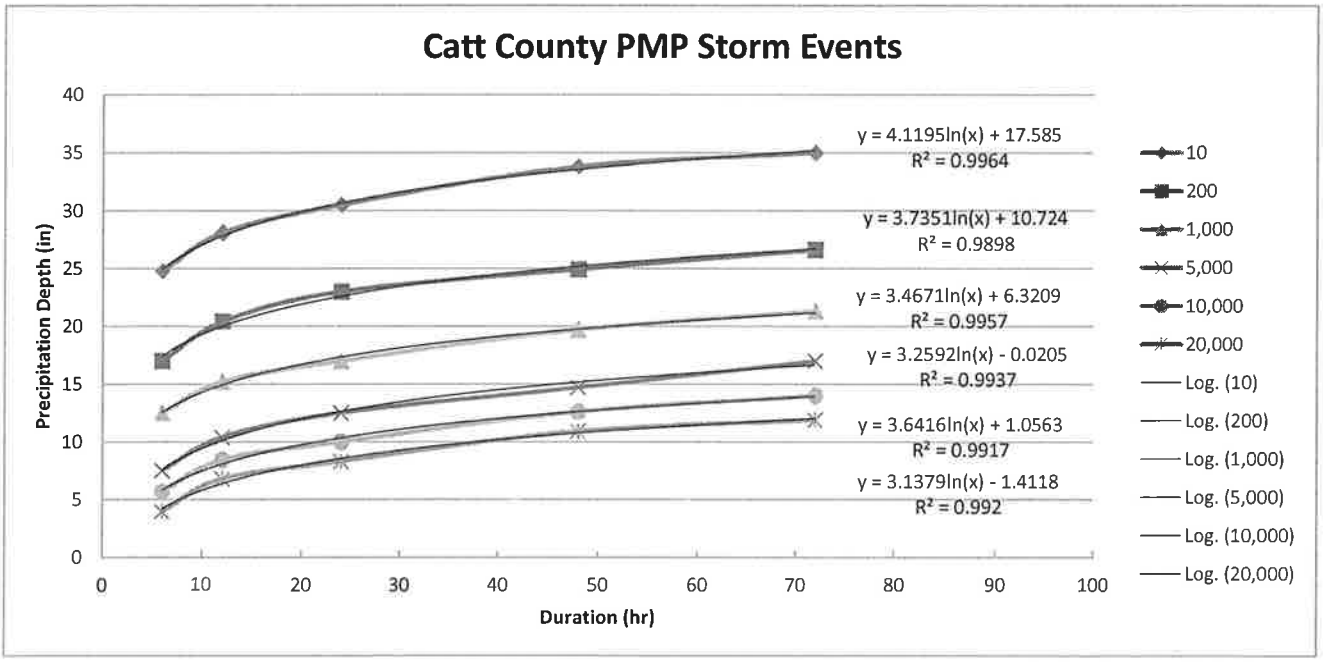
- The following conclusions are made regarding Conewango Site 9a.
  - All structures at site 9a are in good condition.

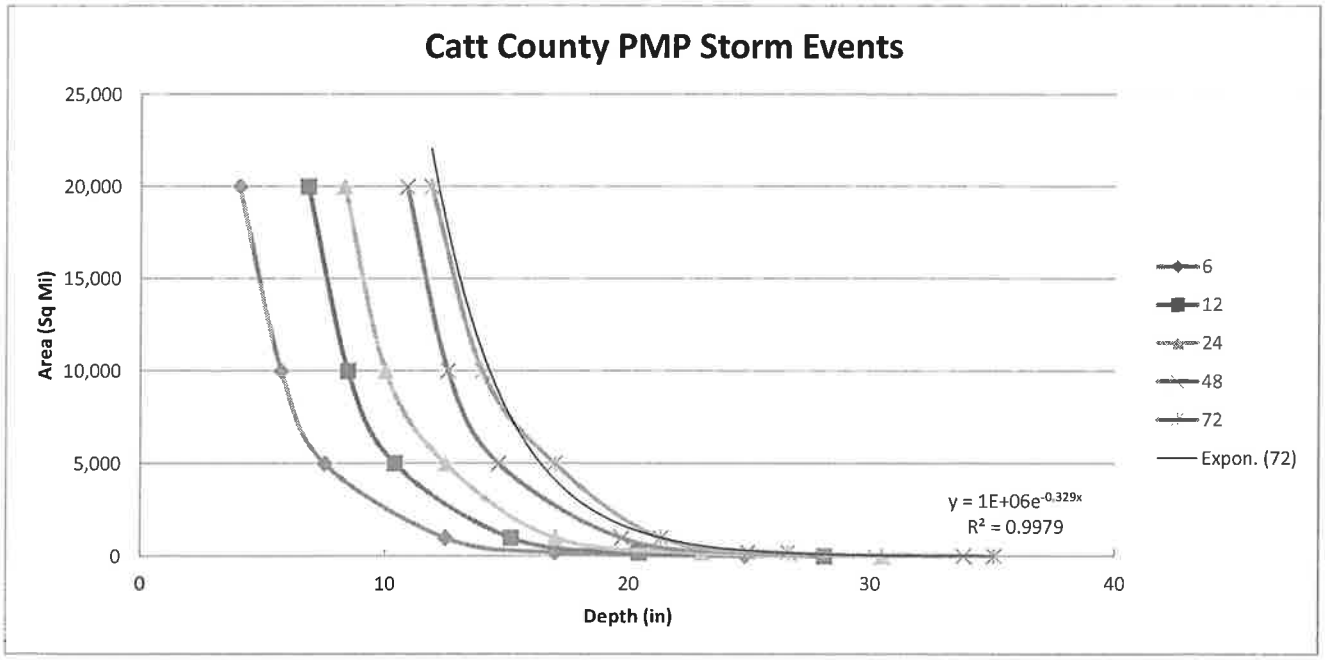
Appendix C

Hydraulic/Hydrologic Engineering Calcs

PMP in inches for Chautauqua County

Area (sq mi)	10	200	1,000	5,000	10,000	20,000
Duration (hr)						
6	24.8	17	12.5	7.5	5.7	4
12	28.1	20.4	15.2	10.4	8.45	6.8
24	30.5	23	17	12.5	10	8.3
48	33.8	24.9	19.7	14.7	12.6	10.9
72	35	26.6	21.3	17	14	11.9





Hydrologic and Hydraulic Methodology for Chautauqua County Dams

The following is an algorithm of the assumptions and methodologies used for analyzing the Class C dams for Chautauqua County. Each Dam will be analyses using current NRCS methodology and NYSDEC methodology for Spillway and Freeboard Design. Dam Break Analysis will assume a failure for both piping and flood event.

Hydrology

HEC-HMS will be used for determining the hydrology for each basin. This will be used in combination with GEO-HMS for topography and routing of each storm (geometry).

HEC-HMS Runs for different hydrology (Geometry remains the same):

- To Meet DEC Criteria:
  - Principal Spillway
  - Auxiliary Spillway
- To Meet NRCS Criteria:
  - Principal Spillway
  - Auxiliary Spillway
  - Freeboard

Design Criteria:

Class C Dams – **NYSDEC** (From Guidelines for Design of Dams – 1989, NYSDEC)

[Values for Chautauqua County] – HMR-51[1] and TP-40[2] and TP-29[3]

Mode		Design Flood (SDF)	Min Storm Duration (hr)*	Value (in)	Freeboard (ft)
Small Dams	Principal Spillway Design	25-year	6	3.0[2]	N/A
	Auxiliary Spillway Design	50% PMF		12.5[1] – 10 mi^2 8.25 – 200 mi^2 6.25 – 1000 mi^2	1
Large Dams	Principal Spillway Design	100-year		3.72[3]	N/A
	Auxiliary Spillway Design	50% PMF		12.5[1] – 10 mi^2 8.25 – 200 mi^2 6.25 – 1000 mi^2	2

*Note: If Tc is greater than Storm duration, storm shall be adjusted as necessary.

Class C Dams (High Hazard) –**NRCS** (From TR-60 – Earth Dams and Reservoirs, USDA, NRCS – 2005)

[Values for Chautauqua County] – HMR-51[1] and TP-40[2] and TP-29[3] and TR-60[4]

Mode	Design Flood (SDF)	Min Storm Duration*	Freeboard (ft)	Value (in)	
Principal Spillway Design	100-year	10 day	N/A	8.0[4]	
Auxiliary Spillway Design	P100 + 0.26(PMP-P100)	24 hr & 6 hr MIN		24 Hour Storms** 11.6[1,2] – 10mi^2 9.61 – 200 mi^2 8.05 – 1000 mi^2	6 Hour Storms** 9.12[1,2] – 10mi^2 7.12 – 200 mi^2 5.95 – 1000 mi^2
Freeboard Requirement	PMP	24 hr & 6 hr MIN	1	24 Hour Storms 31[1,2] – 10mi^2 23 – 200 mi^2 17 – 1000 mi^2	6 Hour Storms 24.5[1,2] – 10mi^2 16.8– 200 mi^2 12.3– 1000 mi^2

*Note: If Tc is greater than Storm duration, storm shall be adjusted as necessary.

**Based on 100-yr value of 3.7 for 6h duration and 5.0 for 24h duration.

Dam Break

A dam break is generally achieved in one of two ways, Sunny Day Failure (Piping) or a Flood Event. Both events will be looked at in this study.

Software and method:

Determination of software to be used will coincide with the Compaction Factor equation to determine if a Level Pool method (HEC-HMS) is acceptable for analysis or if Dynamic Hydraulic Routing (HEC-RAS) will be necessary. This relies heavily on reservoir size. The following equations will be used to determine the method:

$F_c * F_t \Rightarrow 0.41$ Then level pool routing is an appropriate method and HEC-HMS may be used for a breach analysis combined with an unsteady state HEC-RAS model to develop inundation mapping downstream.

$$F_c = H/L$$

$$F_t = \frac{c * t}{L}$$

H= Average Dam Height (ft)

L=Dam Length (ft)

$c = g * D^{0.5}$

D = H/2

$t = 0.015 h_w$ (hours)

h_w = Height of Water behind dam (or to bottom of break) **(m)**

Inundations areas will be marked for sunny day dam failure, spillway design flood and spillway design flood plus dam failure, unless the extent of inundation is not appreciably different.

Flood Routing:

Flood Routing will use the latest orthoimagry mapping available from COGIR , NYS or USGS. Mapping will be developed using ARC GIS with the GEO-RAS interface for inundation.

Distance of the flood routing will be until the sunny day failure and spillway design flood plus dam failure equal (within 1') the spillway design flood for effects on downstream areas. Also, the routing will be discontinued if the flood wave reaches a major river such as the Allegany.

Note	Contour (1927 Datum)	Max_Contou (1988)	AREA from Record Drawings (SF)	USGS (Datum 27)	Area_SF GIS (SF)	Pond Surface Area (SF)	Pond Surface Area (Acre)	Volume per Contour (Acre*FT)	Total Storage from Record Drawings (ACRE-FT)	Total Storage ARC GIS (Acre*FT)
	1352.417	1352.00								
	1353.417	1353.00								
	1354.417	1354.00								
Drain Inlet	**1354.500**	**1354.08**	0.00						0.000	
	1355.417	1355.00								
	1356.417	1356.00								
Low Point Reservoir (Original Construction)	1357.417	1357.00								
	1358.417	1358.00								
	1359.417	1359.00								
Low Point of Reservoir Current	1360.417	1360.00		0.00						
	1361.417	1361.00								
	1362.417	1362.00								
	1363.417	1363.00								
	1364.417	1364.00								
	1365.417	1365.00								
	1366.417	1366.00								
1st Stage Principal Spillway Crest/Normal Pool	**1366.600**	**1366.18**	383325.00						n/a	
	1367.417	1367.00								
	1368.417	1368.00								
	1369.417	1369.00								
	1370.417	1370.00		0.00						
	1371.417	1371.00								
	1372.417	1372.00			4063.00	4,063.00	0.09	0.093		0.093
	1373.417	1373.00			18459.00	22,522.00	0.52	0.517		0.610
	1374.417	1374.00			29194.05	51,716.05	1.19	1.187		1.798
	1375.417	1375.00			41715.16	93,431.21	2.14	2.145		3.942
	1376.417	1376.00			59202.23	152,633.44	3.50	3.504		7.446
	1377.417	1377.00			238067.00	390,700.44	8.97	8.969		16.416
	1378.417	1378.00			145115	535,815.72	12.30	12.301		28.716
	1379.417	1379.00			160697	696,513.14	15.99	15.990		44.706
	1380.417	1380.00		18.20	173692	870,204.79	19.98	19.977		64.683
2nd Stage Riser Intake	1381.000	**1380.58**	1916625.00		**134775**	1,004,980.21	23.07	13.450	41.000	78.134
	1382.417	1382.00			139488	1,144,468.18	26.27	37.229		115.363
	1383.417	1383.00			172800	1,317,268.45	30.24	30.240		145.603
	1384.417	1384.00			153822	1,471,090.63	33.77	33.772		179.375
	1385.417	1385.00			150213	1,621,303.73	37.22	37.220		216.595
	1386.417	1386.00			164551	1,785,854.50	41.00	40.998		257.593
Aux Spillway Crest	**1386.600**	**1386.18**	2591800.00			**1,785,854.50**			612.000	
	1387.417	1387.00			170563	1,956,417.04	44.91	44.913		302.506
	1388.417	1388.00			178831	2,135,247.94	49.02	49.019		351.524
	1389.417	1389.00			193857	2,329,104.67	53.47	53.469		404.993
	1390.417	1390.00		55.70	147830	2,476,934.89	56.86	56.863		461.856
	1391.417	1391.00			144919	2,621,853.89	60.19	60.189		522.045
Top of Dam	**1391.800**	**1391.38**	3245195.00			**2,621,853.89**			964.000	
	1392.417	1392.00			156390.00	2,778,243.89	63.78	63.780		585.825

Totals								585.825	1617.000	

Hydraulic Parameters for HEC-HMS Model

Assume SCS Clark Unit Hydrograph is used for estimating DA inflows.

Area is Agricultural and inputs below are taken for USGS NY Stream Stats for Dam 9A Watershed

Time of Concentration- Overall USGS numbers

$A := 5.69$ Area of Watershed (sq mi)

$S := 361$ Main Watercourse Slope (ft/mi)

$L := 4.89$ Main Channel Stream Length (mi)

$L_{ca} := 0.7$ Distance from concentration point along L to a point on L that is perpendicular to the watershed centroid. For Rectangular shaped WS it can assume to be 0.5L (mi)

$RTIMP := 2.5\%$ Impervious Area of Watershed

TYPE := Agricultural / Urban TYPE = 1

$$T_c := \begin{cases} 7.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.2} & \text{if TYPE} = 1 \\ \left(3.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.14} \cdot RTIMP\right) & \text{otherwise} \end{cases} = 3.589$$

Time of Concentration (hr)

Storage Coefficient

$R := 0.37 \cdot T_c^{1.11} \cdot L^{0.80} \cdot A^{-0.57} = 2.019$ Storage Coefficient (hr)

Time of Concentration- Subbasin W 40

$A := 1.8395$ Area of Watershed (sq mi)

$Elv\_Up := 519.26 \cdot 3.28 = 1703.173$ Upstream Elevation (feet)

$Elev\_Dwn := 426.45 \cdot 3.28 = 1398.756$ Downstream Elevation (feet)

$L := \frac{16066.82}{5280} = 3.043$ Main Channel Stream Length (mi)

$S := \frac{Elv\_Up - Elev\_Dwn}{L} = 100.04$ Main Watercourse Slope (ft/mi)

$L_{cen} := \frac{6190.39}{5280} = 1.172$ Length to the centroid along the main channel (mi)

$L_{ca} := \frac{L_{cen}}{L} = 0.385$ Distance from concentration point along L to a point on L that is perpendicular to the watershed centroid. For Rectangular shaped WS it can assume to be 0.5L (mi)

$RTIMP := 1.08\%$ Impervious Area of Watershed

$TYPE :=$

$TYPE = 1$

$$T_{c\_W40} := \begin{cases} 7.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.2} & \text{if } TYPE = 1 \\ \left(3.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.14} \cdot RTIMP\right) & \text{otherwise} \end{cases} = 3.17$$ Time of Concentration (hr)

Storage Coefficient

$R_{W40} := 0.37 \cdot T_{c\_W40}^{1.11} \cdot L^{0.80} \cdot A^{-0.57} = 2.291$ Storage Coefficient (hr)

Time of Concentration- Subbasin W 50

$A := 2.9920$ Area of Watershed (sq mi)

$Elv\_Up := 510.76 \cdot 3.28 = 1675.293$ Upstream Elevation (feet)

$Elev\_Dwn := 426.46 \cdot 3.28 = 1398.789$ Downstream Elevation (feet)

$L := \frac{23250.39}{5280} = 4.403$ Main Channel Stream Length (mi)

$S := \frac{Elv\_Up - Elev\_Dwn}{L} = 62.792$ Main Watercourse Slope (ft/mi)

$L_{cen} := \frac{9358.71}{5280} = 1.772$ Length to the centroid along the main channel (mi)

$L_{ca} := \frac{L_{cen}}{L} = 0.403$ Distance from concentration point along L to a point on L that is perpendicular to the watershed centroid. For Rectangular shaped WS it can assume to be 0.5L (mi)

$RTIMP := 1.08\%$ Impervious Area of Watershed

TYPE :=

TYPE = 1

$$T_{c\_W50} := \begin{cases} 7.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.2} & \text{if TYPE = 1} \\ \left(3.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.14} \cdot RTIMP\right) & \text{otherwise} \end{cases} = 4.05$$

Time of Concentration (hr)

Storage Coefficient

$R_{W50} := 0.37 \cdot T_{c\_W50}^{1.11} \cdot L^{0.80} \cdot A^{-0.57} = 3.064$ Storage Coefficient (hr)

Time of Concentration- Subbasin W 60

$A := 0.72689$ Area of Watershed (sq mi)

$Elv\_Up := 500.90 \cdot 3.28 = 1642.952$ Upstream Elevation (feet)

$Elev\_Dwn := 414.49 \cdot 3.28 = 1359.527$ Downstream Elevation (feet)

$L := \frac{8025.58}{5280} = 1.52$ Main Channel Stream Length (mi)

$S := \frac{Elv\_Up - Elev\_Dwn}{L} = 186.464$ Main Watercourse Slope (ft/mi)

$L_{cen} := \frac{1736.83}{5280} = 0.329$ Length to the centroid along the main channel (mi)

$L_{ca} := \frac{L_{cen}}{L} = 0.216$ Distance from concentration point along L to a point on L that is perpendicular to the watershed centroid. For Rectangular shaped WS it can assume to be 0.5L (mi)

$RTIMP := 1.08\%$ Impervious Area of Watershed

$TYPE :=$

$TYPE = 1$

$$T_{c\_W60} := \begin{cases} 7.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.2} & \text{if TYPE = 1} \\ \left(3.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.14} \cdot RTIMP\right) & \text{otherwise} \end{cases} = 1.856$$

Storage Coefficient

$R_{W60} := 0.37 \cdot T_{c\_W60}^{1.11} \cdot L^{0.80} \cdot A^{-0.57} = 1.233$ Storage Coefficient (hr)

Averages

$T_{c\_Ave} := \frac{T_{c\_W40} + T_{c\_W50} + T_{c\_W60}}{3} = 3.025$

$R_{ave} := \frac{R_{W40} + R_{W50} + R_{W60}}{3} = 2.196$

Time of Concentration DAM 9A

Assume River V= 5 ft/sec
Assume Overland V= 2 ft/sec

W 40

Longest flow path =	16066.81659	FT	
River Flow =	7082.235801	FT	
Overland Flow =	8984.580788	FT	
SLOPE	0.01894944745		1.89%
Tc River =	0.39	hr	
Tc Overland =	1.25	hr	
Tc Total =	1.64	hr	

W 50

Longest flow path =	23250.38865	FT	
River Flow =	12711.36741	FT	
Overland Flow =	10539.02124	FT	
SLOPE	0.01189502920		1.19%
Tc River =	0.71	hr	
Tc Overland =	1.46	hr	
Tc Total =	2.17	hr	

Reach 30

Longest flow path =	3667.838	FT	
River Flow =	3667.838	FT	
Overland Flow =	0	FT	
SLOPE	0.009451		0.95%
Tc River =	12.23	min	
Tc Overland =	0.00	min	
Tc Total =	12.23	min	

W 60

Longest flow path =	8025.584841	FT	
River Flow =	1463.25	FT	
Overland Flow =	6562.334841	FT	
SLOPE	0.03532537588		3.53%
Tc River =	0.08	hr	
Tc Overland =	0.91	hr	
Tc Total =	0.99	hr	

Chatagua County Dam 9A Hec HMS Results

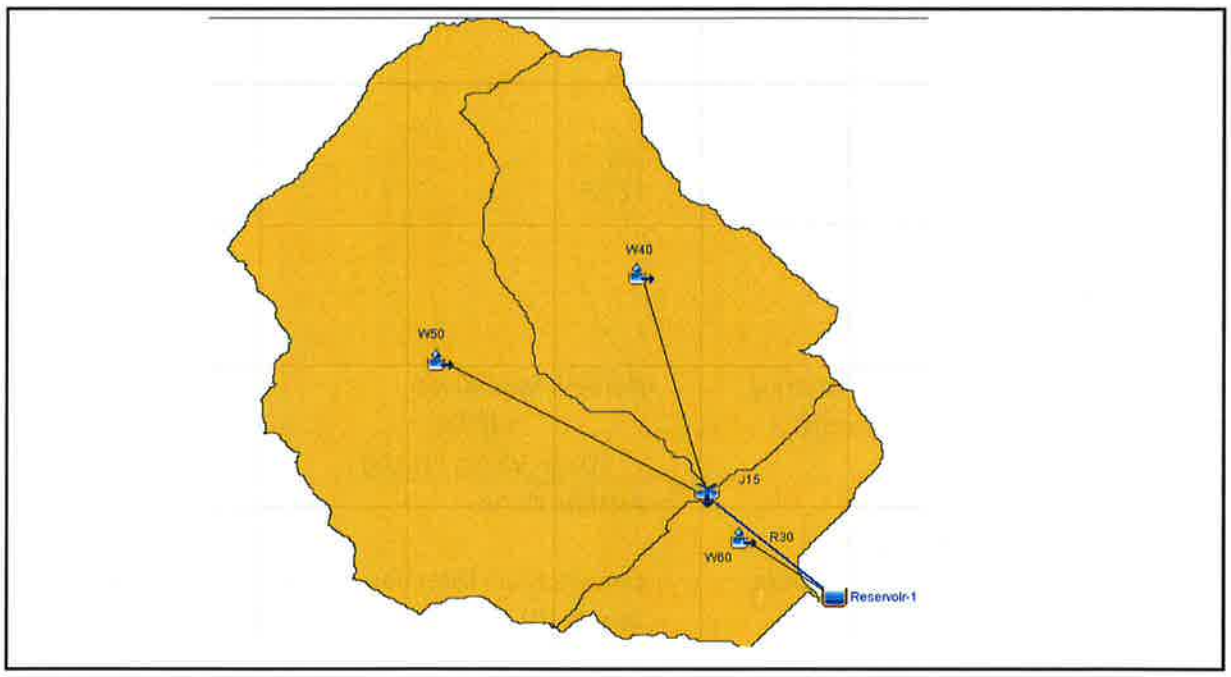
Hec HMS Version 3.5

I. Dam Elevations

Elevations	(Datum Change ^{ft}) = 0.417		
	AS BUILT DATA		SURVEY (FT) NAVD 88
	NGVD 29 (FT)	NAVD 88 (FT)	
A: Top of Dam	1391.80	1391.38	1391.46
C: Auxiliary Spillway	1386.60	1386.18	1386.37
D: Principal Spillway	1366.60	1366.18	1365.84
E. Riser Crest	1381.00	1380.58	1380.34

Note:
Model uses
NGVD 29 elevations

II. Basin Model Schematic



III. Sub-Basins Input

W50

- Area (mi2): 2.992
- Loss Method: SCS Curve Number
- Curve Number: 75
- % Impervious: 1.1
- Transform Method: Clark Unit Hydrograph
- Time Conc. (Hr): 4.05
- Storage Coef. (Hr): 1.994

W40

- Area (mi2):	1.8395
- Loss Method:	SCS Curve Number
- Curve Number:	75
- % Impervious:	1.1
- Transform Method:	Clark Unit Hydrograph
- Time Conc. (Hr):	3.17
- Storage Coef. (Hr):	1.994

W60

- Area (mi2):	0.7269
- Loss Method:	SCS Curve Number
- Curve Number:	75
- % Impervious:	1.1
- Transform Method:	Clark Unit Hydrograph
- Time Conc. (Hr):	1.856
- Storage Coef. (Hr):	1.994

IV. Reaches Input

R30

- Routing Method:	Lag
- Lag (min)	12.23

V. Reservoir Input

Reservoir

- Discharge Method:	Outflow Structures		
- Initial Elev. (ft):	1366.6 (Dam_9A No Prncpl))	&	1366.6 (Dam_9A)
- Tailwater:	Assume None		
- Spillways:			
- Outlet:	Culvert, Main Direction, Circular Concrete Pipe		
- Length (ft):	178		
- Diameter (ft):	4		
- Inlet Elev (ft):	1366.6		
- Ent Coef.:	0.1		
- Outlet Elev. (ft):	1364.6		Model uses 1% slope Actual elev. = 1349'
- Exit Coef.:	0.1		
- Manning No.:	0.014		
- Spillway:	Broad Crested, Auxillary Direction		
- Elev. (ft):	1386.6		
- Length (ft):	200		
- Coef.:	3.2		

- Dam Top: Level Overflow, Main Direction
  - Elev. (ft): 1391.8
  - Length (ft): 1590
  - Coef.: 3.2

- Storage:

Elev. (ft)	Area (Ac)
1366.6	8.8
1370	16.9
1375	30.41
1380	44.44
1385	51.23
1386.6	59.5
1390	72.21
1395	88.15

VI. Meterlogic Models

NRCS 24hr Formula

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 1 day
- Intensity Position: 50%
- Storm Area (mi2) 5.6
- Max Precp. (in): 11.75

NRCS 6hr Formula

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 6 hours
- Intensity Position: 25%
- Storm Area (mi2) 5.6
- Max Precp. (in): 9.23

NRCS 24hr PMF

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 1 day
- Intensity Position: 50%
- Storm Area (mi2) 5.6
- Max Precp. (in): 30.68

NRCS 6hr PMF

- Method: Frequency Storm
- Intensity Duration: 15 minutes
- Storm Duration: 6 hours
- Intensity Position: 25%
- Storm Area (mi2) 5.6
- Max Precp. (in): 24.97

NRCS Princp Spillway

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 10 days
- Intensity Position: 50%
- Storm Area (mi2) 5.6
- Max Precp. (in): 8

NYSDEC 100-yr

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 6 hours
- Intensity Position: 25%
- Storm Area (mi2) 5.6
- Max Precp. (in): 3.7

NYSDEC 50% PMF

- Method: Frequency Storm
- Intensity Duration: 15 minutes
- Storm Duration: 6 hours
- Intensity Position: 25%
- Storm Area (mi2) 5.6
- Max Precp. (in): 12.49

VII. Control

- 10 days, 1 hour time interval

VIII. Results

NYSDEC Principal Spillway

- Watershed Basin: Dam_9A
- Meterlogic Model: NYSDEC 100-yr

- Results Summary

Project: Conewango Creek Dam 9A Simulation Run: DEc Prinp Spill

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A
End of Run: 10Jan2000, 12:00 Meteorologic Model: NYSDEC 100yr
Compute Time: 24Sep2013, 13:24:11 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W50	2.99200	569.4	01Jan2000, 17:00	1.58
W40	1.83950	362.3	01Jan2000, 17:00	1.58
J15	4.83150	931.7	01Jan2000, 17:00	1.58
R30	4.83150	908.0	01Jan2000, 17:00	1.58
W60	0.72689	158.0	01Jan2000, 16:00	1.58
Reservoir-1	5.55839	204.4	01Jan2000, 22:00	1.57

- Reservoir Summary

Project: Conewango Creek Dam 9A
Simulation Run: DEc Prinp Spill Reservoir: Reservoir-1

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A
End of Run: 10Jan2000, 12:00 Meteorologic Model: NYSDEC 100yr
Compute Time: 24Sep2013, 13:24:11 Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	1031.0 (CFS)	Date/Time of Peak Inflow :	01Jan2000, 17:00
Peak Outflow :	204.4 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 22:00
Total Inflow :	468.1 (AC-FT)	Peak Storage :	337.6 (AC-FT)
Total Outflow :	466.2 (AC-FT)	Peak Elevation :	1379.8 (FT)

- Conclusion

For the 100-yr storm frequency event to discharge utilizing only the principle spillway, the resulting maximum ponding elevation in the reservoir is 1379.8 which is below the auxillary spillway. Therefore the principle spillway has adequate capacity.

NYSDEC Auxillary Spillway

- Watershed Basin: Dam_9A_No Principle
- Meterlogic Model: NYSDEC 50% PMF

- Results Summary

Project: Conewango Creek Dam 9A Simulation Run: DEC Aux Spill

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A
End of Run: 10Jan2000, 12:00 Meteorologic Model: NYSDEC 50% PMF
Compute Time: 04Feb2014, 16:45:00 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
W50	2.99200	3420.0	01Jan2000, 17:00	1451.5
W40	1.83950	2218.3	01Jan2000, 16:00	892.4
J15	4.83150	5517.3	01Jan2000, 17:00	2343.9
R30	4.83150	5439.1	01Jan2000, 17:00	2343.9
W60	0.72689	933.0	01Jan2000, 16:00	352.6
Reservoir-1	5.55839	291.3	01Jan2000, 18:00	955.9

- Reservoir Summary

Project: Conewango Creek Dam 9A
Simulation Run: DEC Aux Spill Reservoir: Reservoir-1

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A
End of Run: 10Jan2000, 12:00 Meteorologic Model: NYSDEC 50% PMF
Compute Time: 04Feb2014, 16:45:00 Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow : 6106.9 (CFS) Date/Time of Peak Inflow : 01Jan2000, 17:00
Peak Outflow : 291.3 (CFS) Date/Time of Peak Outflow : 01Jan2000, 18:00
Total Inflow : 2696.6 (AC-FT) Peak Storage : 1018.7 (AC-FT)
Total Outflow : 955.9 (AC-FT) Peak Elevation : 1390.6 (FT)

- Conclusion

For the 50% PMF storm event to discharge utilizing the auxillary spillway, the resulting maximum ponding elevation in the reservoir is 1390.6 which provides 1.2 ft of freeboard, the NYSDEC freeboard requirement is 2 ft. for new dams, however this dam does not overtop and meets section 5.3 of Guidelines of Dams

NRCS Principal Spillway

- Watershed Basin: Dam_9A
- Meterlogic Model: NRCS Princp Spillway

- Results Summary

Project: Conewango Creek Dam 9A Simulation Run: NRCS Prinp Spill

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A
End of Run: 10Jan2000, 12:00 Meteorologic Model: NRCS Prinp Spill
Compute Time: 19Sep2013, 15:57:45 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
W50	2.99200	1103.8	06Jan2000, 16:00	818.3
W40	1.83950	727.5	06Jan2000, 15:00	503.4
J15	4.83150	1767.3	06Jan2000, 16:00	1321.7
R30	4.83150	1760.0	06Jan2000, 16:00	1321.4
W60	0.72689	301.3	06Jan2000, 14:00	199.1
Reservoir-1	5.55839	268.4	06Jan2000, 20:00	1349.6

- Reservoir Summary

Project: Conewango Creek Dam 9A
Simulation Run: NRCS Prinp Spill Reservoir: Reservoir-1

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A
End of Run: 10Jan2000, 12:00 Meteorologic Model: NRCS Prinp Spill
Compute Time: 19Sep2013, 15:57:45 Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow : 1970.0 (CFS) Date/Time of Peak Inflow : 06Jan2000, 16:00
Peak Outflow : 268.4 (CFS) Date/Time of Peak Outflow : 06Jan2000, 20:00
Total Inflow : 1520.5 (AC-FT) Peak Storage : 726.9 (AC-FT)
Total Outflow : 1349.6 (AC-FT) Peak Elevation : 1387.4 (FT)

- Conclusion

For the 100-yr storm frequency event to discharge utilizing only the principle spillway, the resulting maximum ponding elevation in the reservoir is 1387.4 which is above the auxillary spillway. *Therefore the principle spillway has adequate capacity.*

NRCS Auxillary Spillway (24 hr Min. Storm Duration)

- Watershed Basin: Dam_9A No Principle
- Meterlogic Model: NRCS 24hr Formula

- Results Summary

Project: Conewango Creek Dam 9A Simulation Run: NRCS Aux Spill 24hr

Start of Run: 01Jan2000, 12:00
End of Run: 10Jan2000, 12:00
Compute Time: 19Sep2013, 15:57:32
Basin Model: Dam_9A_No Principle
Meteorologic Model: NRCS 24hr Formula
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
W50	2.99200	2947.2	02Jan2000, 04:00	1400.2
W40	1.83950	1952.1	02Jan2000, 03:00	860.9
J15	4.83150	4714.0	02Jan2000, 04:00	2261.1
R30	4.83150	4692.6	02Jan2000, 04:00	2261.1
W60	0.72689	813.0	02Jan2000, 02:00	340.2
Reservoir-1	5.55839	0.0	01Jan2000, 12:00	0.0

- Reservoir Summary

Project: Conewango Creek Dam 9A
Simulation Run: NRCS Aux Spill 24hr Reservoir: Reservoir-1

Start of Run: 01Jan2000, 12:00
End of Run: 10Jan2000, 12:00
Compute Time: 19Sep2013, 15:57:32
Basin Model: Dam_9A_No Principle
Meteorologic Model: NRCS 24hr Formula
Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	5241.5 (CFS)	Date/Time of Peak Inflow :	02Jan2000, 04:00
Peak Outflow :	0.0 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 12:00
Total Inflow :	2601.2 (AC-FT)	Peak Storage :	926.6 (AC-FT)
Total Outflow :	0.0 (AC-FT)	Peak Elevation :	1390.4 (FT)

- Conclusion

For the NRCS Aux. Spillway 24hr storm event to discharge utilizing only the auxillary spillway, the resulting maximum ponding elevation in the reservoir is 1390.4 which provides 1.4 ft of freeboard, therefore the auxillary design is adequate.

NRCS Auxillary Spillway (6 hr Min. Storm Duration)

- Watershed Basin: Dam_9A No Principle
- Meterlogic Model: NRCS 6hr Formula

- Results Summary

Project: Conewango Creek Dam 9A Simulation Run: NRCS Aux Spill 6hr

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A_No Principle
End of Run: 10Jan2000, 12:00 Meteorologic Model: NRCS 6hr Formula
Compute Time: 19Sep2013, 15:57:35 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
W50	2.99200	2378.0	01Jan2000, 17:00	1013.4
W40	1.83950	1532.7	01Jan2000, 16:00	623.1
J15	4.83150	3845.8	01Jan2000, 17:00	1636.5
R30	4.83150	3783.9	01Jan2000, 17:00	1636.5
W60	0.72689	651.3	01Jan2000, 16:00	246.2
Reservoir-1	5.55839	0.0	01Jan2000, 12:00	0.0

- Reservoir Summary

Project: Conewango Creek Dam 9A
Simulation Run: NRCS Aux Spill 6hr Reservoir: Reservoir-1

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A_No Principle
End of Run: 10Jan2000, 12:00 Meteorologic Model: NRCS 6hr Formula
Compute Time: 19Sep2013, 15:57:35 Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	4256.1 (CFS)	Date/Time of Peak Inflow :	01Jan2000, 17:00
Peak Outflow :	0.0 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 12:00
Total Inflow :	1882.7 (AC-FT)	Peak Storage :	876.7 (AC-FT)
Total Outflow :	0.0 (AC-FT)	Peak Elevation :	1389.7 (FT)

- Conclusion

For the NRCS Aux. Spillway 6hr storm event to discharge utilizing only the auxillary spillway, the resulting maximum ponding elevation in the reservoir is 1389.7 which provides 2.1 ft of freeboard, therefore the auxillary design is adequate.

NRCS Freeboard (24 hr Min. Storm Duration)

- Watershed Basin: Dam_9A No Principle
- Meterlogic Model: NRCS 24hr PMF

- Results Summary

Project: Conewango Creek Dam 9A Simulation Run: NRCS Freebrd 24hr

Start of Run: 01Jan2000, 12:00
End of Run: 10Jan2000, 12:00
Compute Time: 19Sep2013, 15:57:38

Basin Model: Dam_9A_No Principle
Meteorologic Model: NRCS 24hr PMF
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
W50	2.99200	9156.1	02Jan2000, 04:00	4342.8
W40	1.83950	6132.9	02Jan2000, 03:00	2670.0
J15	4.83150	14587.7	02Jan2000, 03:00	7012.8
R30	4.83150	14580.3	02Jan2000, 04:00	7012.8
W60	0.72689	2577.8	02Jan2000, 02:00	1055.1
Reservoir-1	5.55839	6044.2	02Jan2000, 04:00	1425.5

- Reservoir Summary

Project: Conewango Creek Dam 9A
Simulation Run: NRCS Freebrd 24hr Reservoir: Reservoir-1

Start of Run: 01Jan2000, 12:00
End of Run: 10Jan2000, 12:00
Compute Time: 19Sep2013, 15:57:38

Basin Model: Dam_9A_No Principle
Meteorologic Model: NRCS 24hr PMF
Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	16236.2 (CFS)	Date/Time of Peak Inflow :	02Jan2000, 04:00
Peak Outflow :	6044.2 (CFS)	Date/Time of Peak Outflow :	02Jan2000, 04:00
Total Inflow :	8067.9 (AC-FT)	Peak Storage :	1130.5 (AC-FT)
Total Outflow :	1425.5 (AC-FT)	Peak Elevation :	1392.9 (FT)

- Conclusion

For the NRCS Freeboard 24hr requirement the resulting maximum ponding elevation in the reservoir is 1392.9 which provides -1.1 ft of freeboard, therefore the freeboard requirement is not met.

NRCS Freeboard (6 hr Min. Storm Duration)

- Watershed Basin: Dam_9A No Principle
- Meterlogic Model: NRCS 6hr PMF

- Results Summary

Project: Conewango Creek Dam 9A Simulation Run: NRCS Freebrd 6hr

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A_No Principle
End of Run: 10Jan2000, 12:00 Meteorologic Model: NRCS 6hr PMF
Compute Time: 19Sep2013, 15:57:41 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
W50	2.99200	8123.5	01Jan2000, 17:00	3421.7
W40	1.83950	5322.7	01Jan2000, 16:00	2103.7
J15	4.83150	13052.6	01Jan2000, 17:00	5525.3
R30	4.83150	12916.6	01Jan2000, 17:00	5525.3
W60	0.72689	2205.7	01Jan2000, 15:00	831.3
Reservoir-1	5.55839	4409.2	01Jan2000, 17:00	961.0

- Reservoir Summary

Project: Conewango Creek Dam 9A
Simulation Run: NRCS Freebrd 6hr Reservoir: Reservoir-1

Start of Run: 01Jan2000, 12:00 Basin Model: Dam_9A_No Principle
End of Run: 10Jan2000, 12:00 Meteorologic Model: NRCS 6hr PMF
Compute Time: 19Sep2013, 15:57:41 Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	14463.7 (CFS)	Date/Time of Peak Inflow :	01Jan2000, 17:00
Peak Outflow :	4409.2 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 17:00
Total Inflow :	6356.6 (AC-FT)	Peak Storage :	1113.5 (AC-FT)
Total Outflow :	961.0 (AC-FT)	Peak Elevation :	1392.7 (FT)

- Conclusion

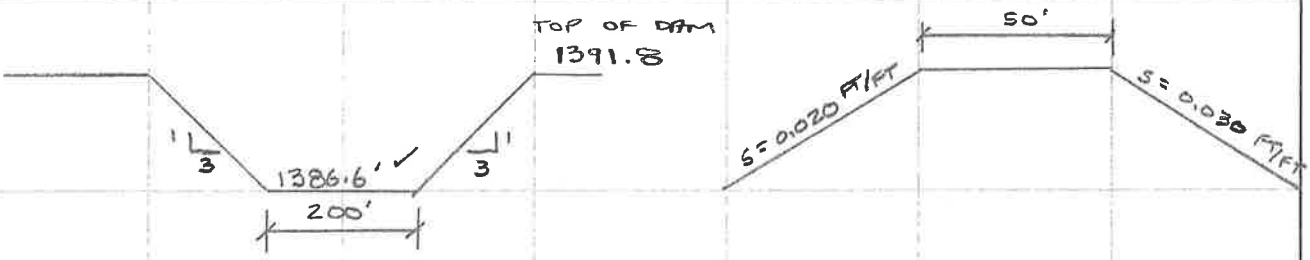
For the NRCS Freeboard 6hr requirement the resulting maximum ponding elevation in the reservoir is 1392.7 which provides -1.7 ft of freeboard, therefore the freeboard requirement is not met.

T·Y·LIN INTERNATIONAL

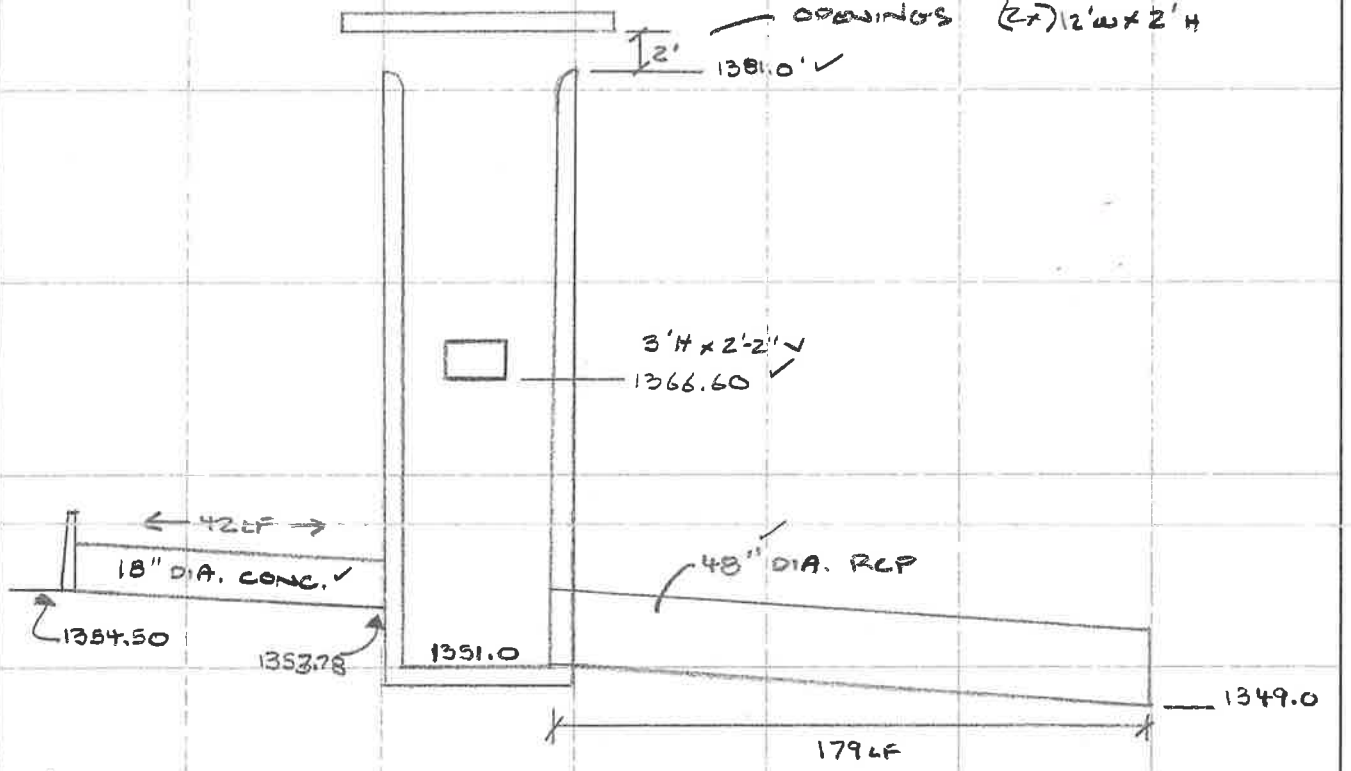
Project: DAM ASSESSMENT - SITE 9A	Job No.	Sheet: of
Item: SPILLWAY CAPACITY CHECK	Designer: RMA	Date: 12/9/13
	Checker: JRC	Date: 3/4/14
		Grid: 1/10"

SITE 9A OUTLET WORKS

AUX. SPILLWAY



PRINCIPLE SPILLWAY AND DRAIN

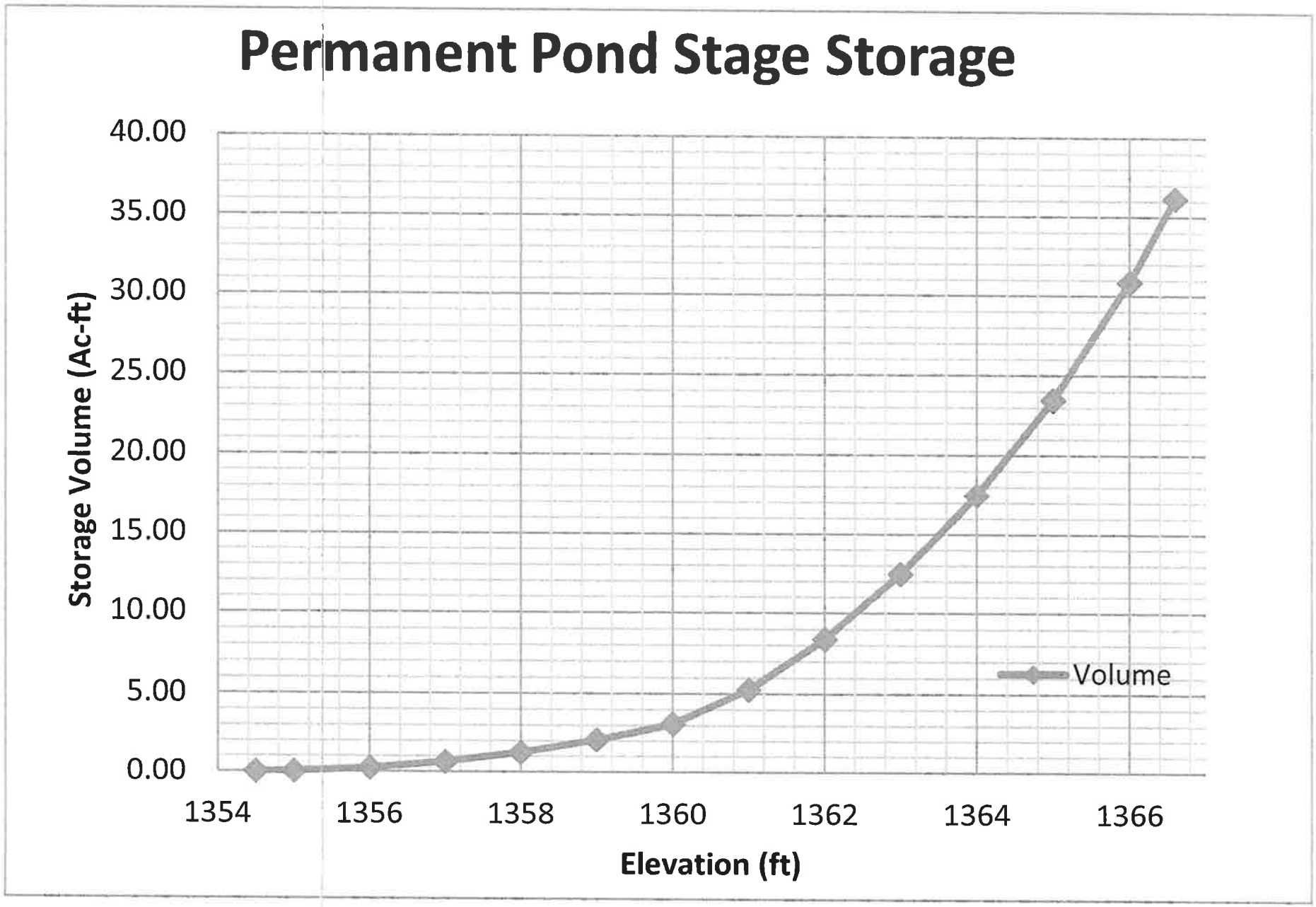


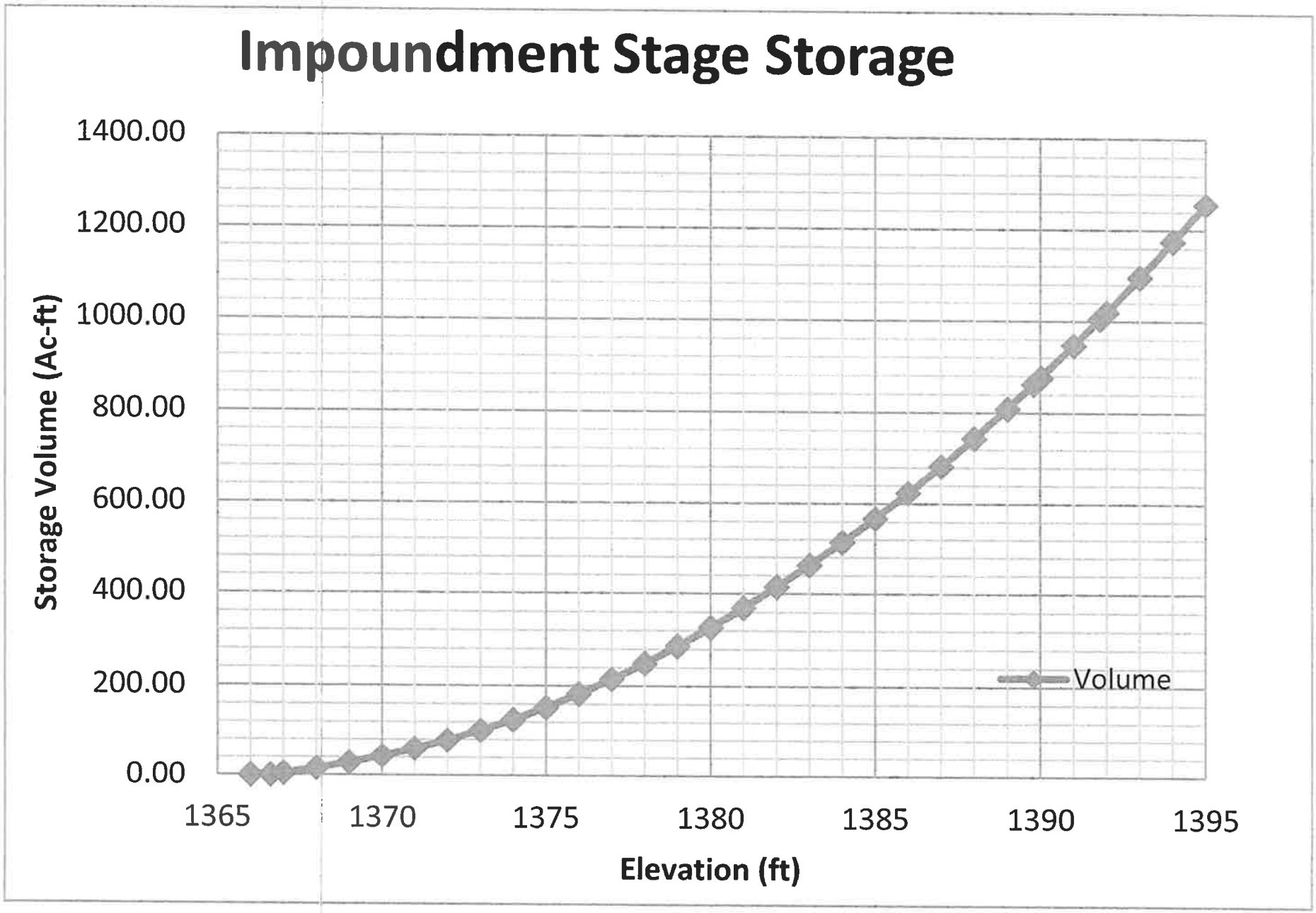
Headpond Elevation-Area Data From As-Built Survey Map

note	Elevation	Area (sq m)	Area(sf)	Area (Ac)
measured area from as-built record map	1360	7,171	73,800	1.69
measured area from as-built record map	1365	27,348	281,447	6.46
measured area from as-built record map	1370	66,130	680,560	15.62
measured area from as-built record map	1375	120,052	1,235,486	28.36
measured area from as-built record map	1380	174,862	1,799,553	41.31
measured area from as-built record map	1385	232,127	2,388,883	54.84
measured area from as-built record map	1390	291,072	2,995,498	68.77
measured area from as-built record map	1395	352,932	3,632,112	83.38

Elevation-Area Data Expanded

				Cum Vol (Ac-ft)		
note	Elevation	Area(Ac)	Inc Vol (Ac-ft)	Pond	Impound.	
assumed area=0	1354.5	0.00	0.00	0.00	-	drain invert
interpolated area	1355	0.15	0.03	0.03	-	
interpolated area	1356	0.46	0.20	0.23	-	
interpolated area	1357	0.77	0.41	0.64	-	
interpolated area	1358	1.08	0.61	1.25	-	
interpolated area	1359	1.38	0.82	2.07	-	
measured area-calculated end-area volume	1360	1.69	1.02	3.10	-	
interpolated area	1361	2.64	2.17	5.27	-	
interpolated area	1362	3.60	3.12	8.39	-	
interpolated area	1363	4.55	4.08	12.46	-	
interpolated area	1364	5.51	5.03	17.49	-	
measured area-calculated end-area volume	1365	6.46	5.98	23.47	-	
interpolated area	1366	8.29	7.38	30.85	-	
interpolated area	1366.6	9.39	5.30	36.15	0.00	pwsel
interpolated area	1367	10.12	3.90	-	3.90	
interpolated area	1368	11.96	11.04	-	14.94	
interpolated area	1369	13.79	12.87	-	27.82	
measured area-calculated end-area volume	1370	15.62	14.70	-	42.52	
interpolated area	1371	18.17	16.89	-	59.41	
interpolated area	1372	20.72	19.44	-	78.86	
interpolated area	1373	23.26	21.99	-	100.85	
interpolated area	1374	25.81	24.54	-	125.38	
measured area-calculated end-area volume	1375	28.36	27.09	-	152.47	
interpolated area	1376	30.95	29.66	-	182.12	
interpolated area	1377	33.54	32.25	-	214.37	
interpolated area	1378	36.13	34.84	-	249.20	
interpolated area	1379	38.72	37.43	-	286.63	
measured area-calculated end-area volume	1380	41.31	40.02	-	326.64	
interpolated area	1381	44.02	42.66	-	369.31	
interpolated area	1382	46.72	45.37	-	414.68	
interpolated area	1383	49.43	48.08	-	462.75	
interpolated area	1384	52.13	50.78	-	513.53	
measured area-calculated end-area volume	1385	54.84	53.49	-	567.02	
interpolated area	1386	57.63	56.23	-	623.25	
interpolated area	1387	60.41	59.02	-	682.27	
interpolated area	1388	63.20	61.81	-	744.08	
interpolated area	1389	65.98	64.59	-	808.67	
	1389.8	68.21	53.68		862.35	des. hw
measured area-calculated end-area volume	1390	68.77	13.70	-	876.04	
interpolated area	1391	71.69	70.23	-	946.28	
	1391.8	74.03	58.29		1,004.56	top of dam
interpolated area	1392	74.61	14.86	-	1,019.43	
interpolated area	1393	77.54	76.08	-	1,095.50	
interpolated area	1394	80.46	79.00	-	1,174.50	
measured area-calculated end-area volume	1395	83.38	81.92	-	1,256.42	


Permanent Pond Stage Storage
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Storage Volume (Ac-ft)
1354
1356
1358
1360
1362
1364
1366
Elevation (ft)
Volume


Impoundment Stage Storage
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
Storage Volume (Ac-ft)
1365
1370
1375
1380
1385
1390
1395
Elevation (ft)
Volume

Principle Spillway Stage Discharge Computation

Orifice Information

W	3	ft
H	2.17	ft
Cd	0.7	sq edge
Inv=	1366.6	ft

Riser Inlet Information

W	12	ft
HT	2	ft
Weir C	3.1	
Cd	0.7	
# Openings	2	
Inv=	1381	ft

Culvert Information

D	4	ft
L	179	ft
Inv up	1351	ft
Inv dn	1349	ft
n	0.012	
Ke	0.5	
R	1	
So	0.011173	

Note	Pond Elevation	Stage	Orifice Discharge	Riser Inlet Discharge	Total Q to Culvert	Outlet Pipe Capacity at satge HW			Stage Discharge	Control type
						H	V	Q		
Normal Pool	1366.6	0	**0**	0	0				0	orifice
	1367	0.4	**23.13**	0	23.13				23.13	orifice
	1368	1.4	**43.27**	0	43.27				43.27	orifice
	1369	2.4	**56.65**	0	56.65				56.65	orifice
	1370	3.4	**67.43**	0	67.43				67.43	orifice
	1371	4.4	**76.71**	0	76.71				76.71	orifice
	1372	5.4	**84.98**	0	84.98				84.98	orifice
	1373	6.4	**92.51**	0	92.51				92.51	orifice
	1374	7.4	**99.48**	0	99.48				99.48	orifice
	1375	8.4	**105.99**	0	105.99				105.99	orifice
	1376	9.4	**112.12**	0	112.12				112.12	orifice
	1377	10.4	**117.93**	0	117.93				117.93	orifice
	1378	11.4	**123.47**	0	123.47				123.47	orifice
	1379	12.4	**128.78**	0	128.78				128.78	orifice
	1380	13.4	**133.87**	0	133.87				133.87	orifice
riser inlet	1381	14.4	**138.77**	0	138.77				138.77	orifice
	1382	15.4	**143.51**	74.40	217.91	14.9	20.66	259.65	217.91	weir
	1383	16.4	**148.10**	210.43	358.53	15.9	28.65	360.01	358.53	weir
	1384	17.4	**152.54**	9,968.81	10121.35	16.9	29.54	371.16	371.16	pipe
	1385	18.4	**156.87**	9,972.47	10129.33	17.9	30.40	381.98	381.98	pipe
	1386	19.4	**161.07**	9,976.12	10137.20	18.9	31.24	392.51	392.51	pipe
	1387	20.4	**165.17**	9,979.78	10144.95	19.9	32.05	402.76	402.76	pipe
	1388	21.4	**169.17**	9,983.43	10152.60	20.9	32.85	412.75	412.75	pipe
	1389	22.4	**173.08**	9,987.08	10160.16	21.9	33.62	422.51	422.51	pipe
des. High water	1389.8	23.2	**176.14**	9,990.00	10166.15	22.7	34.23	430.16	430.16	pipe
	1390	23.4	**176.90**	9,990.73	10167.63	22.9	34.38	432.05	432.05	pipe
	1391	24.4	**180.64**	9,994.38	10175.02	23.9	35.13	441.39	441.39	pipe
top of dam	1391.8	25.2	**183.58**	9,997.30	10180.88	24.7	35.71	448.71	448.71	pipe

Auxiliary Spillway Stage Discharge Computation

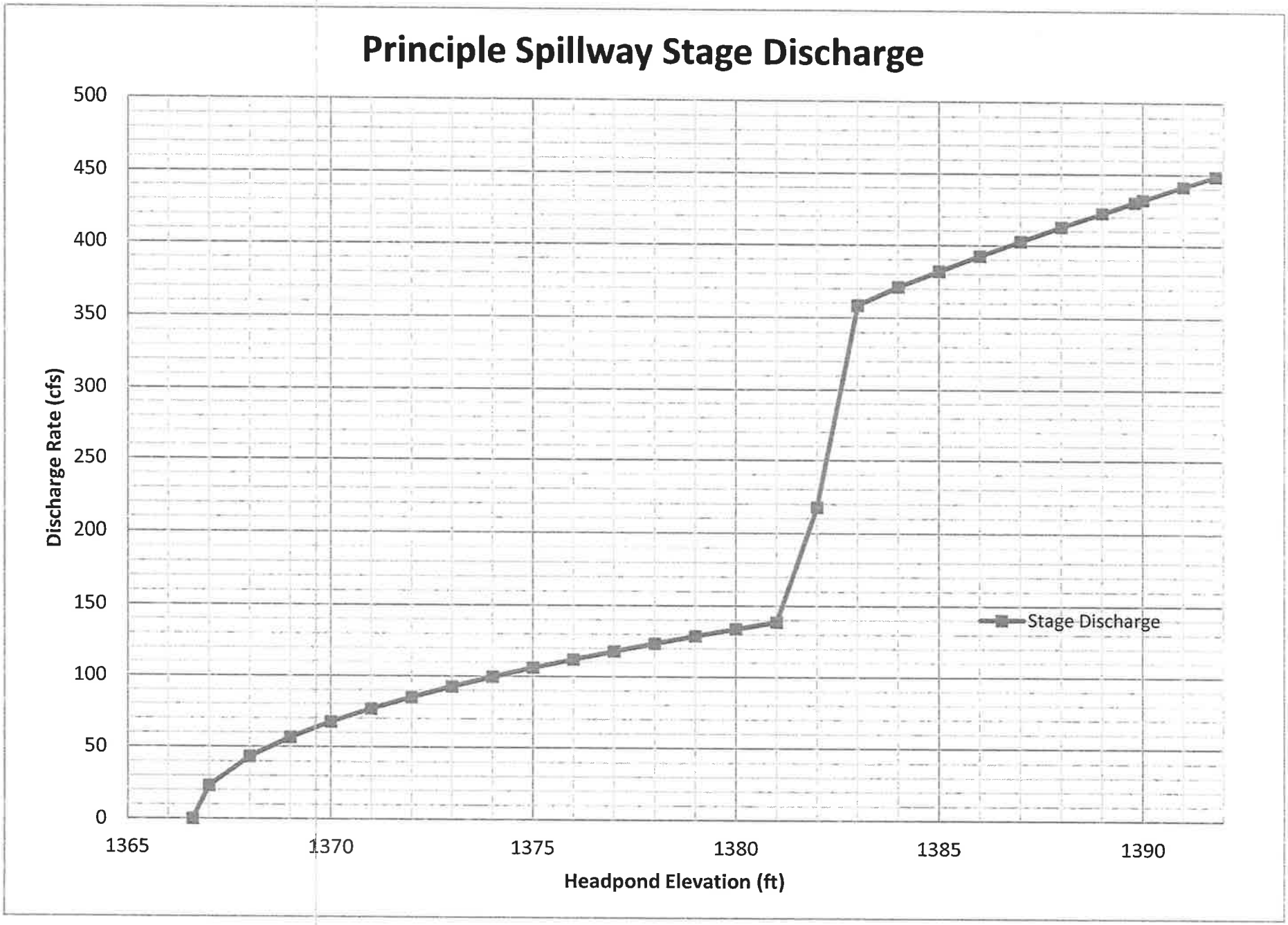
Spillway Information

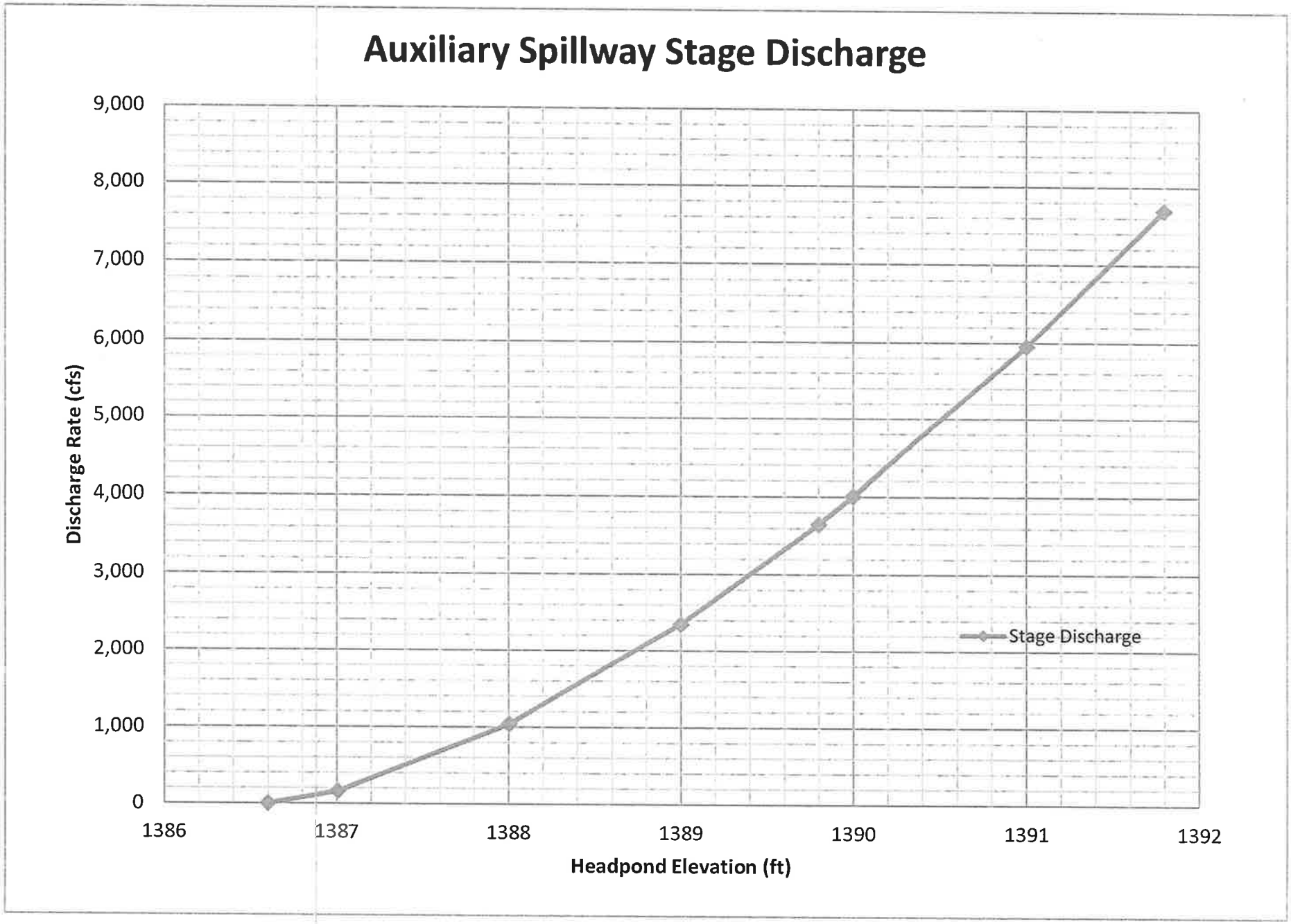
b	200	ft
z	3	
n	0.04	
s	0.030	ft/ft
Inv	1386.6	ft

Dc (ft)	Ac (sq ft)	T (ft)	Qc (cfs)	Rc (ft)	Sc (ft/ft)	check	Vc (ft/sec)	HW (ft)	Pond Elev.
0	0.00	0.00	**0**	0	0	0	0	0	1386.60
0.27	54.22	201.62	**159.5**	0.27	0.036	subcritical	2.94	0.40	1387.00
0.94	190.65	205.64	**1,041.7**	0.93	0.024	ok	5.46	1.40	1388.00
1.61	329.78	209.66	**2,346.9**	1.57	0.020	ok	7.12	2.40	1389.00
2.155	444.93	212.93	**3,649.6**	2.08	0.018	ok	8.20	3.20	1389.80
2.29	473.73	213.74	**4,002.1**	2.21	0.018	ok	8.45	3.40	1390.00
2.975	621.55	217.85	**5,957.5**	2.84	0.016	ok	9.58	4.40	1391.00
3.52	741.17	221.12	**7,700.0**	3.33	0.016	ok	10.39	5.20	1391.80

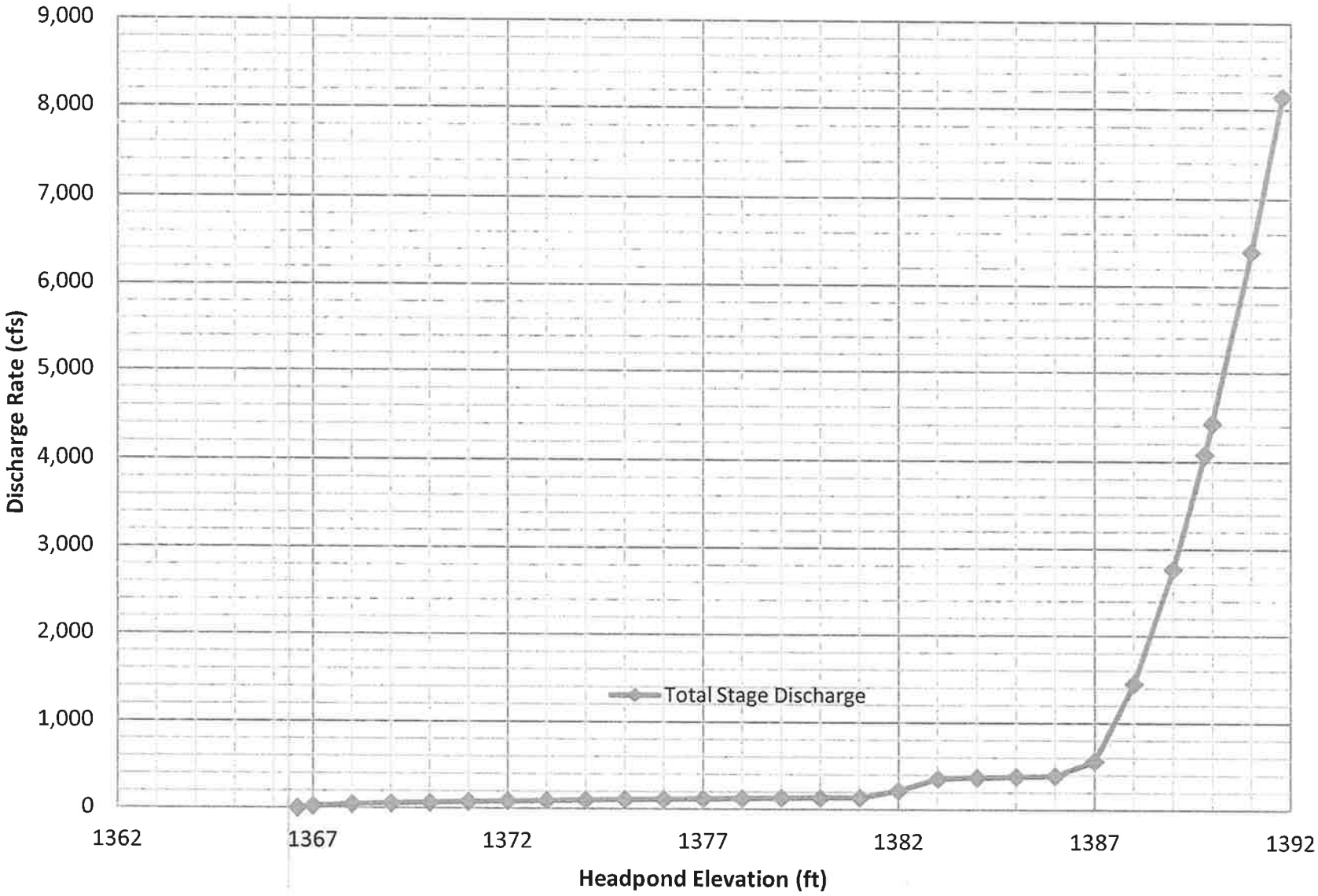
Total Stage Discharge

		Discharge (cfs)			Storage	Time to drain (hr)	
Note	Stage	Principle	Auxiliary	Total	(Ac-ft)	Stage	cum(hr)
normal pool	1366.6	0.0	0.0	**0.0**	0.00	0	57.39
	1367	23.1	0.0	**23.1**	3.90	2.04	55.34
	1368	43.3	0.0	**43.3**	11.04	3.09	52.26
	1369	56.7	0.0	**56.7**	12.87	2.75	49.51
	1370	67.4	0.0	**67.4**	14.70	2.64	46.87
	1371	76.7	0.0	**76.7**	16.89	2.66	44.20
	1372	85.0	0.0	**85.0**	19.44	2.77	41.44
	1373	92.5	0.0	**92.5**	21.99	2.88	38.56
	1374	99.5	0.0	**99.5**	24.54	2.98	35.58
	1375	106.0	0.0	**106.0**	27.09	3.09	32.48
	1376	112.1	0.0	**112.1**	29.66	3.20	29.28
	1377	117.9	0.0	**117.9**	32.25	3.31	25.97
	1378	123.5	0.0	**123.5**	34.84	3.41	22.56
	1379	128.8	0.0	**128.8**	37.43	3.52	19.04
	1380	133.9	0.0	**133.9**	40.02	3.62	15.43
riser inlet	1381	138.8	0.0	**138.8**	42.66	3.72	11.71
	1382	217.9	0.0	**217.9**	45.37	2.52	9.19
	1383	358.5	0.0	**358.5**	48.08	1.62	7.57
	1384	371.2	0.0	**371.2**	50.78	1.66	5.91
	1385	382.0	0.0	**382.0**	53.49	1.69	4.22
	1386	392.5	0.0	**392.5**	56.23	1.73	2.48
	1387	402.8	159.5	**562.3**	59.02	1.27	1.21
	1388	412.8	1,041.7	**1,454.4**	61.81	0.51	0.70
	1389	422.5	2,346.9	**2,769.4**	64.59	0.28	0.42
des. High water	1389.8	430.2	3,649.6	**4,079.8**	53.68	0.16	0.26
	1390	432.1	4,002.1	**4,434.1**	13.70	0.04	0.22
	1391	441.4	5,957.5	**6,398.9**	70.23	0.13	0.09
top of dam	1391.8	448.7	7,700.0	**8,148.7** ✓	58.29	0.09	0.00

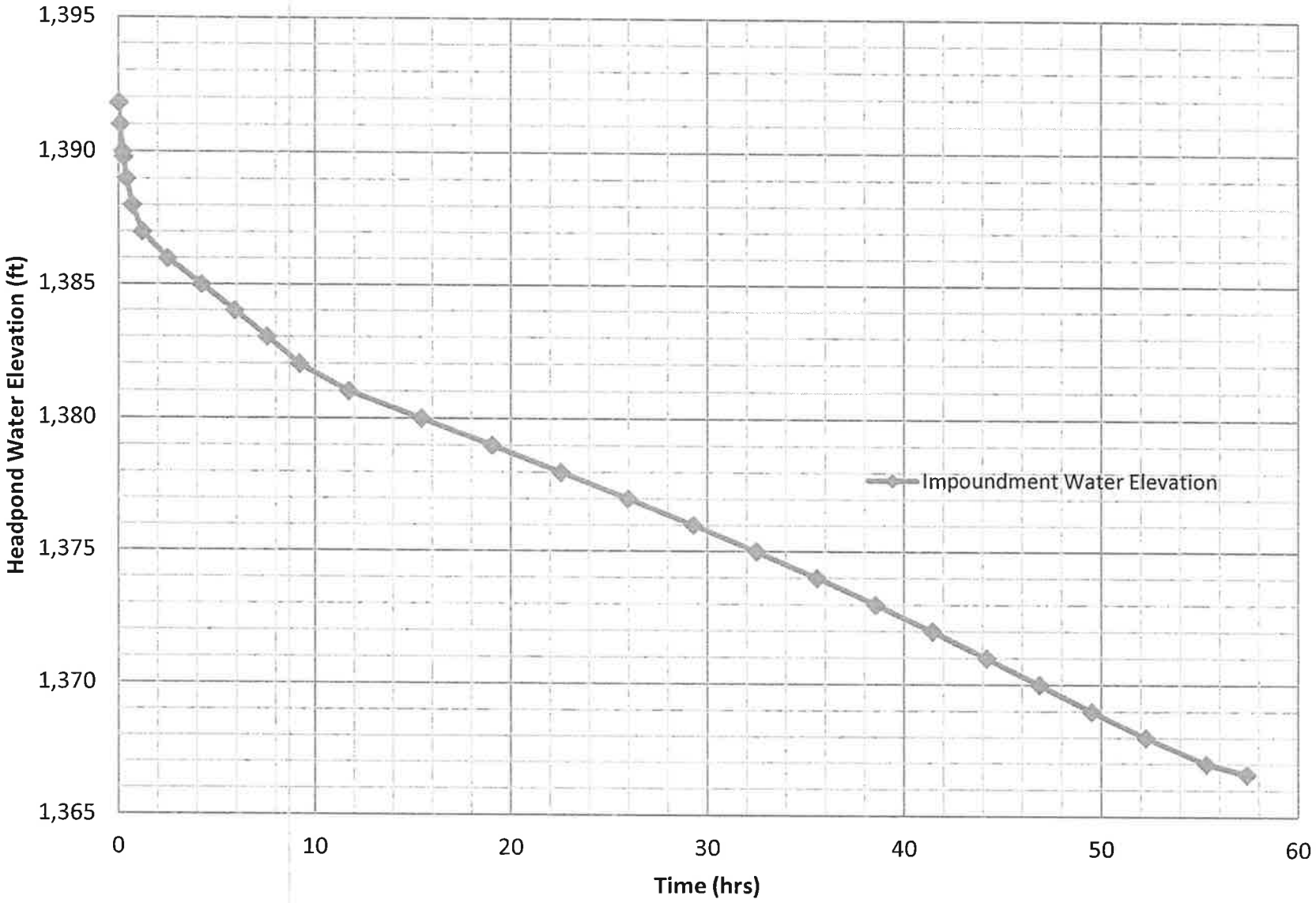

Principle Spillway Stage Discharge
500
450
400
350
300
250
200
150
100
50
0
Discharge Rate (cfs)
1365
1370
1375
1380
1385
1390
Headpond Elevation (ft)
Stage Discharge


Auxiliary Spillway Stage Discharge
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Discharge Rate (cfs)
1386
1387
1388
1389
1390
1391
1392
Headpond Elevation (ft)
Stage Discharge

Total Stage Discharge



Spillway Discharge Time



Pond Drain Stage Discharge Computation

Drain Information

D	1.5	ft
L	42	ft
n	0.013	
Inv US	1354.5	ft
Inv DS	1353.78	ft
Ke	0.5	headwall
Cd	0.7	headwall
TW	0	free discharge

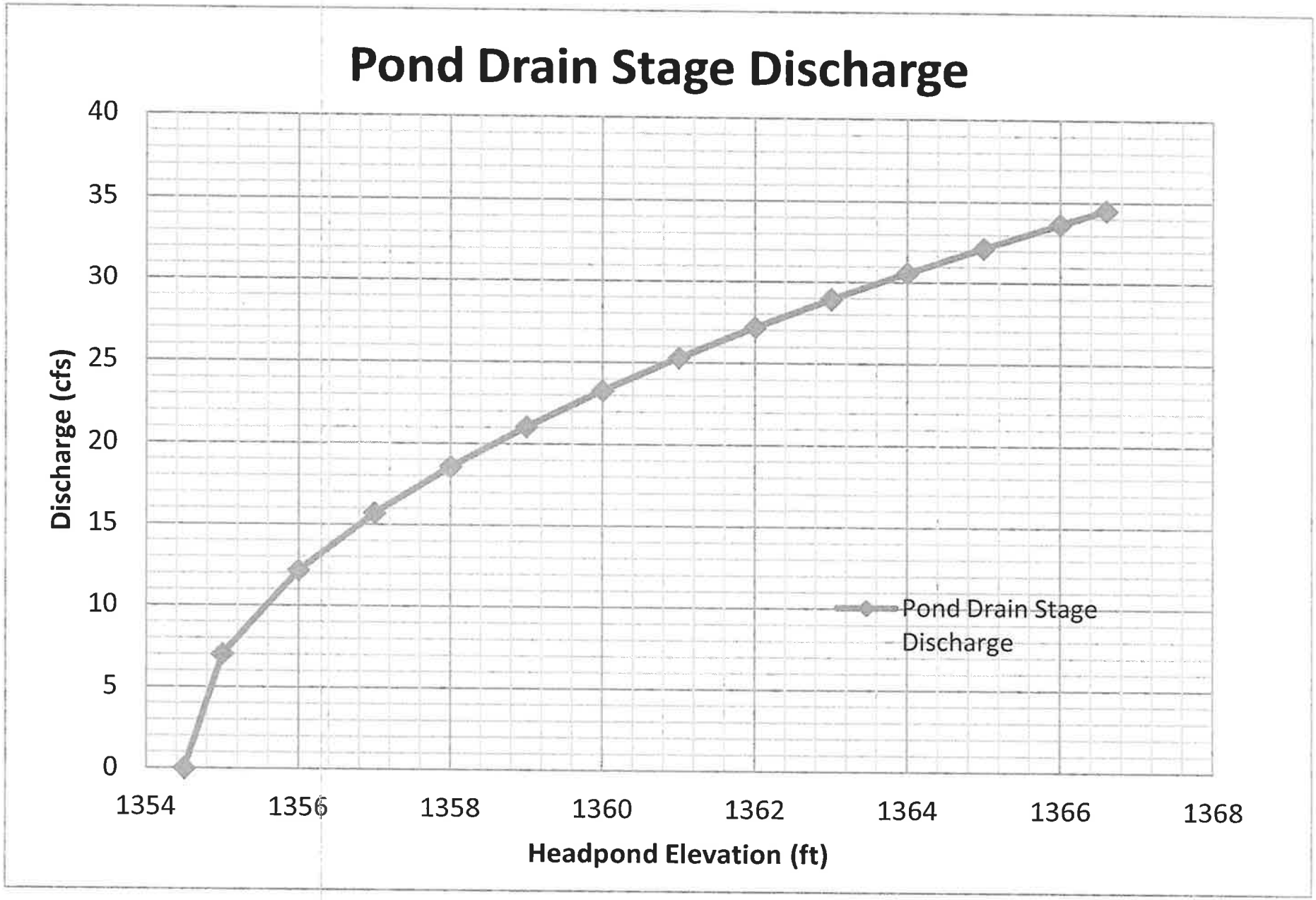
Compute

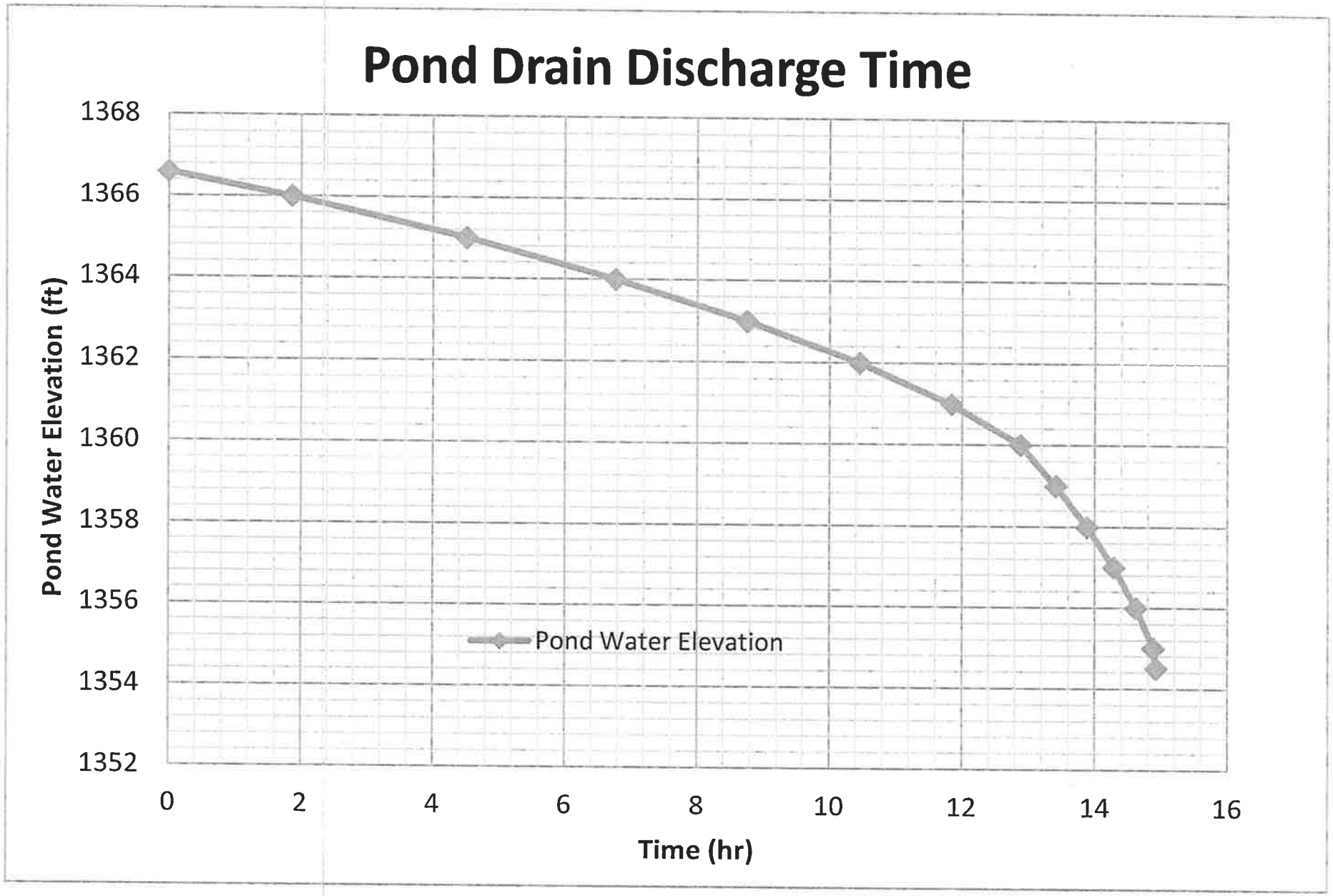
S	0.017143	ft/ft
A	1.767094	ft^2
R	2.094333	ft

Determine Pond Drain Stage-Discharge

			IC	OC			Storage	Time to Drain (hr)	
Note	Pond Elev	HW (ft)	Qic (cfs)	H (ft)	Qoc (cfs)	Q control	(Ac-ft)	Stage	Cum
drain inlet	1354.5	0	0	-	-	0	0.00	0	14.92
	1355	0.5	7.02	-	-	7.02	0.03	0.04	14.88
	1356	1.5	12.16	0.72	9.58	9.58	0.20	0.26	14.62
	1357	2.5	15.70	1.72	14.81	14.81	0.41	0.33	14.28
	1358	3.5	18.57	2.72	18.62	18.57	0.61	0.40	13.88
	1359	4.5	21.06	3.72	21.78	21.06	0.82	0.47	13.41
	1360	5.5	23.28	4.72	24.53	23.28	1.02	0.53	12.88
	1361	6.5	25.31	5.72	27.01	25.31	2.17	1.04	11.84
	1362	7.5	27.19	6.72	29.27	27.19	3.12	1.39	10.45
	1363	8.5	28.94	7.72	31.38	28.94	4.08	1.70	8.75
	1364	9.5	30.60	8.72	33.35	30.60	5.03	1.99	6.76
	1365	10.5	32.17	9.72	35.21	32.17	5.98	2.25	4.51
normal pool	1366	11.5	33.66	10.72	36.98	33.66	7.38	2.65	1.86
normal pool	1366.6	12.1	34.53	11.32	38.00	34.53	5.30	1.86	0.00

15 min


Pond Drain Stage Discharge
Discharge (cfs)
0
5
10
15
20
25
30
35
40
1354
1356
1358
1360
1362
1364
1366
1368
Headpond Elevation (ft)
Pond Drain Stage Discharge


Pond Drain Discharge Time
Pond Water Elevation (ft)
1368
1366
1364
1362
1360
1358
1356
1354
1352
0
2
4
6
8
10
12
14
16
Time (hr)
Pond Water Elevation

Dam Break for Dam 9A

The intent of this worksheet is to provide a "gut check" or alternative method to the HEC-HMS and HEC-RAS dam break models. At the end of this worksheet input values and methodology are determind for the HEC-HMS and HEC-RAS Dam Break Runs.

Assumptions:

- *Earthen Embankment Dam, Assumed to be primarily Sand and easily erodable material*
- *Assume trapezoidal failure*
- *Only Analyses under flood conditions since under normal conditions the pond is mostly dry*
- *Assume Average Attenuation of flood waters*

Reference:

- *DEC Guidelines for Dams*
- *Dam Safety Guidelines Technical Note 1 - Washington State Department of Ecology (Oct 2007) 92-55E*

State of Washington Method

$E_{crest} := 1391.8ft$ $E_{toe} := 1391.8ft - 43ft = 1348.8\,ft$ *Elevations of Dam Crest and Toe*

$H_b := 35ft$ *Breach Depth*

$Freeboard := 2ft$ *Height from Top of Dam to Water Surface Elevation under consideration.*

$H_w := H_b - Freeboard = 33 \cdot ft$ *Height of Water in the Dam*

$V_w := 960acre \cdot ft$ *Volume of Dam at water surface elevation under consideration.*

$Z_1 := 3$ *Side Slope on upstream face (Z1:1)*

$Z_2 := 2.5$ *Side Slope on downstream face*

$Z_3 := Z_1 + Z_2 = 5.5$

$C := 18ft$ *Crest Width of Dam*

$Z_b := 1$ *Failure Slope (Assumed) (1:1)*

Breach Characteristics

$BFF := V_w \cdot H_w = 31680 \cdot acre \cdot ft^2$ — *Eqn 1 : Wash State*

$V_m := 3.75 \cdot \left(\frac{BFF}{acre \cdot ft^2} \right)^{0.77} \cdot yd^3 = 10955.592 \cdot yd^3$ — *Volume of Dirt Moved by the break (Eqn 2)*

$W_b := \frac{V_m - H_b^2 \left(C \cdot Z_b + H_b \cdot Z_b \cdot \frac{Z_3}{3} \right)}{H_b \cdot \left(C + H_b \cdot \frac{Z_3}{2} \right)} = 48.802\,ft$ — *Width of Breach (Eqn 3)*

$\tau := 0.020 \cdot \left(\frac{V_m}{yd^3} \right)^{0.36} \cdot hr = 0.569 \cdot hr$ — *Time to Breach*

Dam Peak Discharge

$S_a := 74.6$ — *Surface area of Pond at Flood Stage (acre)*

$W := \frac{W_b + Z_b \cdot H_w}{ft} = 81.802$

$A := 23.4 \cdot \frac{S_a}{W} = 21.34$

$Q_p := 3.1 \cdot W \cdot \left(\frac{H_w}{ft} \right)^{1.5} \cdot \left(\frac{A}{A + \frac{\tau}{hr} \cdot \sqrt{\frac{H_w}{ft}}} \right)^3 \cdot \frac{ft^3}{sec} = 31342.966 \cdot \frac{ft^3}{sec}$ — *Peak Discharge from Pond (Eqn 7)*

Attenuation

Determine Flows at Point x (Qx) Downstream. Use Attenuation Charts 5a and 5b

Qp	31,343	cfs

Mile Point	Flow Ratio	Qx (cfs)
0	1	31,343
1	0.98	30,716
2	0.9675	30,324
3	0.955	29,933
4	0.9425	29,541
5	0.93	29,149
6	0.9175	28,757
7	0.905	28,365
8	0.8925	27,974
9	0.88	27,582
10	0.8675	27,190
11	0.855	26,798
12	0.85	26,642

Qp is the initial dam break flow, while Qx is the flow at location x (Mile Point) down stream.

Q_p

Wave Velocity from Dam

$$V := 2.4 \frac{ft}{sec}$$

From Table 7, assume a velocity of 2.4 ft/sec based on bed slope of 10 ft/mi and a Type 2 channel.

Inundation Area shall be based on A = Qx/V

Dam Break Parameters for HEC-HMS or HEC-RAS

Use Compaction method to determine whether HEC-RAS or HEC-HMS with Unsteady Routing downstream is an acceptable method for Flood Routing.

*If Fc * Ft is equal or greater to 0.41 then HEC-HMS (Level Pool Routing) is an acceptable method.*

*If Fc*Ft is between 0.41 and 0.24 engineering judgement can be applied, below 0.24 HEC-RAS must be used for the break.*

$H_{dam} := \frac{E_{crest} - E_{toe}}{ft} = 43$ *Height of Dam in Feet*

$L_{Dam} := 1590$ *Length of Dam in Feet*

$g := 32.2$ *gravitational constant*

$D := \frac{H_{dam}}{2} = 21.5$

$c := (g \cdot D)^{0.5} = 26.312$

$H_w = 33\,ft$ *Height of Water in Dam in Feet*

$h_w := \frac{H_w \cdot 0.3048}{ft} = 10.058$ *Height of water in Dam in Meters*

$t := 0.015 \cdot h_w \cdot 60 \cdot 60 = 543.154$ *Time of breach in seconds*

$F_c := \frac{H_{dam}}{L_{Dam}} = 0.027$

$F_t := \frac{c \cdot t}{L_{Dam}} = 8.988$ $F_c \cdot F_t = 0.243$

$Test := \begin{cases} \text{"HEC-HMS OK"} & \text{if } F_c \cdot F_t \geq 0.24 \\ \text{"USE HEC-RAS ONLY"} & \text{otherwise} \end{cases} = \text{"HEC-HMS OK"}$

Flood Attenuation for Dam Break

Dam Name: **Conewango Dam 9A**

Approximate Reservior Surface Area: 3000 acre-feet

Qp (Dam Break Flow at mile point 0): 28,000 cfs

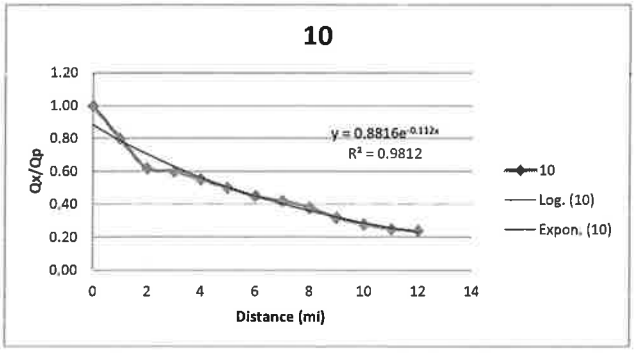
Mile Point (x)	Ratio	Flow (Qx) (cfs)
0	1.00	28,000
1	0.99	27,720
2	0.98	27,440
3	0.98	27,356
4	0.97	27,272
5	0.97	27,188
6	0.97	27,104
7	0.97	27,020
8	0.96	26,936
9	0.96	26,852
10	0.96	26,768
11	0.95	26,684
12	0.95	26,600
13	0.94	26,358
14	0.94	26,253
15	0.93	26,148
16	0.93	26,044
17	0.93	25,940
18	0.92	25,836
19	0.92	25,733
20	0.92	25,630
21	0.91	25,528
22	0.91	25,426
23	0.90	25,324
24	0.90	25,223
25	0.90	25,123
26	0.89	25,022
27	0.89	24,922
28	0.89	24,823
29	0.88	24,724
30	0.88	24,625
31	0.88	24,527
32	0.87	24,429
33	0.87	24,331
34	0.87	24,234
35	0.86	24,138
36	0.86	24,041
37	0.86	23,945
38	0.85	23,850
39	0.85	23,754
40	0.84	23,660
41	0.84	23,565
42	0.84	23,471
43	0.83	23,377
44	0.83	23,284
45	0.83	23,191
46	0.82	23,099
47	0.82	23,006
48	0.82	22,914
49	0.82	22,823
50	0.81	22,732

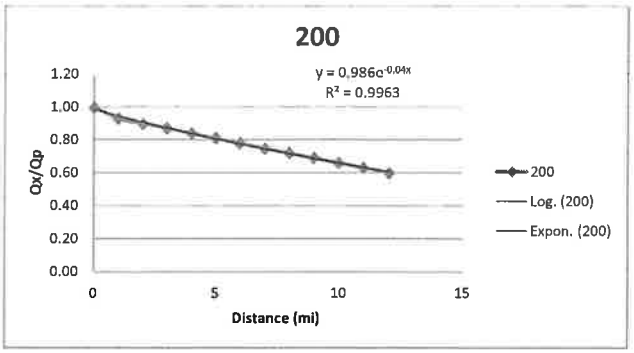
Qx / Qp Chart for Dam Break

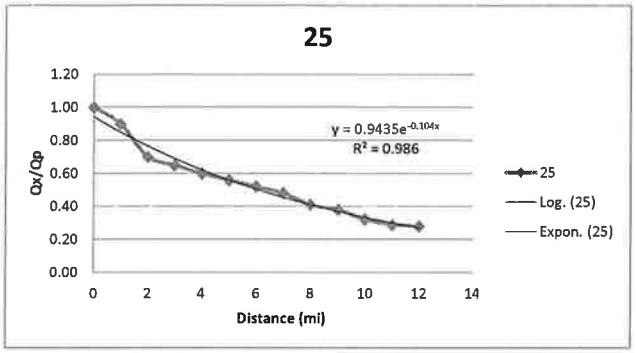
	Surface Area in Acre Feet of Reservoir								
x (mi)	10	25	50	100	200	500	1000	3000	
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	From Washington State Technical Paper Charts 5a and 5b
1	0.80	0.90	0.92	0.91	0.93	0.96	0.97	0.99	
2	0.62	0.70	0.85	0.88	0.90	0.95	0.96	0.98	
3	0.60	0.65	0.79	0.82	0.87	0.93	0.95	0.98	
4	0.55	0.60	0.70	0.75	0.84	0.90	0.95	0.97	
5	0.50	0.56	0.66	0.70	0.81	0.88	0.94	0.97	
6	0.45	0.52	0.60	0.68	0.78	0.86	0.93	0.97	
7	0.42	0.48	0.52	0.62	0.75	0.84	0.93	0.97	
8	0.38	0.41	0.46	0.58	0.72	0.81	0.92	0.96	
9	0.32	0.38	0.43	0.52	0.69	0.79	0.91	0.96	
10	0.28	0.32	0.38	0.49	0.66	0.77	0.90	0.96	
11	0.25	0.29	0.34	0.45	0.63	0.74	0.90	0.95	
12	0.24	0.28	0.33	0.41	0.60	0.72	0.89	0.95	
13	0.21	0.24	0.29	0.39	0.59	0.70	0.89	0.94	Inperpolated Values from Form Equations
14	0.18	0.22	0.26	0.36	0.56	0.69	0.88	0.94	
15	0.16	0.20	0.24	0.34	0.54	0.67	0.87	0.93	
16	0.15	0.18	0.22	0.31	0.52	0.65	0.86	0.93	
17	0.13	0.16	0.20	0.29	0.50	0.63	0.86	0.93	
18	0.12	0.15	0.18	0.27	0.48	0.62	0.85	0.92	
19	0.10	0.13	0.16	0.25	0.46	0.60	0.84	0.92	
20	0.09	0.12	0.15	0.23	0.44	0.58	0.84	0.92	
21	0.08	0.11	0.13	0.22	0.43	0.57	0.83	0.91	
22	0.08	0.10	0.12	0.20	0.41	0.55	0.82	0.91	
23	0.07	0.09	0.11	0.19	0.39	0.54	0.82	0.90	
24	0.06	0.08	0.10	0.18	0.38	0.52	0.81	0.90	
25	0.05	0.07	0.09	0.16	0.36	0.51	0.80	0.90	
26		0.06	0.08	0.15	0.35	0.50	0.80	0.89	
27		0.06	0.07	0.14	0.33	0.48	0.79	0.89	
28		0.05	0.07	0.13	0.32	0.47	0.79	0.89	
29			0.06	0.12	0.31	0.46	0.78	0.88	
30			0.05	0.11	0.30	0.45	0.77	0.88	
31			0.05	0.11	0.29	0.43	0.77	0.88	
32				0.10	0.27	0.42	0.76	0.87	
33				0.09	0.26	0.41	0.75	0.87	
34				0.08	0.25	0.40	0.75	0.87	
35				0.08	0.24	0.39	0.74	0.86	
36				0.07	0.23	0.38	0.74	0.86	
37				0.07	0.22	0.37	0.73	0.86	
38				0.06	0.22	0.36	0.72	0.85	
39				0.06	0.21	0.35	0.72	0.85	
40				0.05	0.20	0.34	0.71	0.84	
41					0.19	0.33	0.71	0.84	
42					0.18	0.32	0.70	0.84	
43					0.18	0.31	0.70	0.83	
44					0.17	0.31	0.69	0.83	
45					0.16	0.30	0.69	0.83	
46					0.16	0.29	0.68	0.82	
47					0.15	0.28	0.67	0.82	
48					0.14	0.27	0.67	0.82	
49					0.14	0.27	0.66	0.82	
50					0.13	0.26	0.66	0.81	

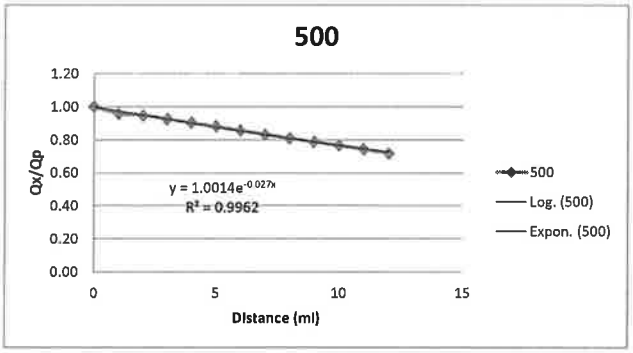
Form Equations

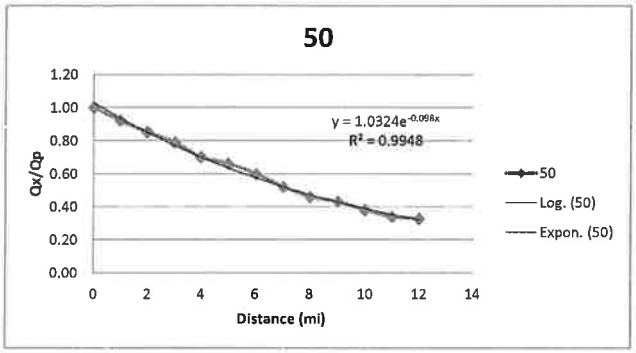
10	y=0.8816e^-0.112x
25	y=0.9435e^-0.104x
50	y=1.0324e^-0.098x
100	y = 1.0103e^-0.073x
200	y = 0.986e-0.04x
500	y = 1.0014e-0.027x
1000	y = 0.9824e-0.008x
3000	y = 0.9916e-0.004x

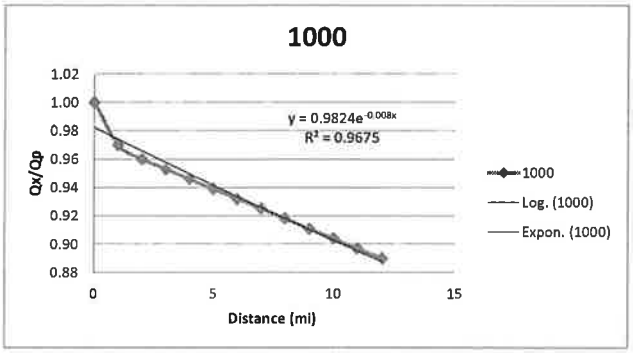

10
y = 0.8816e-0.112x
R² = 0.9812
Qx/Qp
Distance (mi)
10
Log. (10)
Expon. (10)

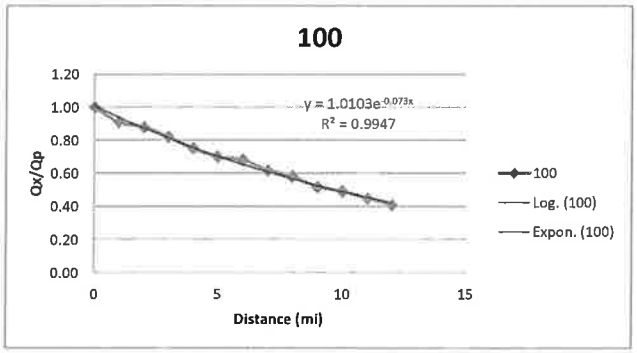

200
y = 0.986e-0.04x
R² = 0.9963
Qx/Qp
Distance (mi)
200
Log. (200)
Expon. (200)

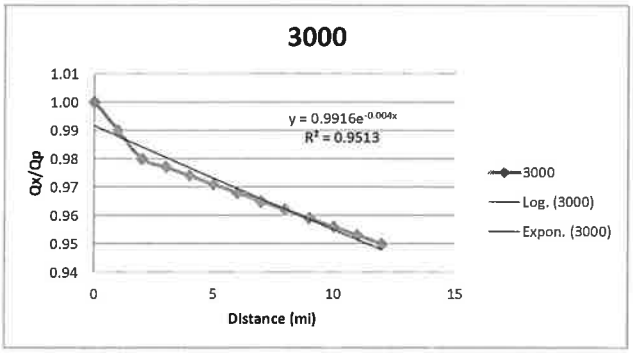

25
y = 0.9435e-0.104x
R² = 0.986
Qx/Qp
Distance (mi)
25
Log. (25)
Expon. (25)


500
y = 1.0014e-0.027x
R² = 0.9962
Qx/Qp
Distance (mi)
500
Log. (500)
Expon. (500)

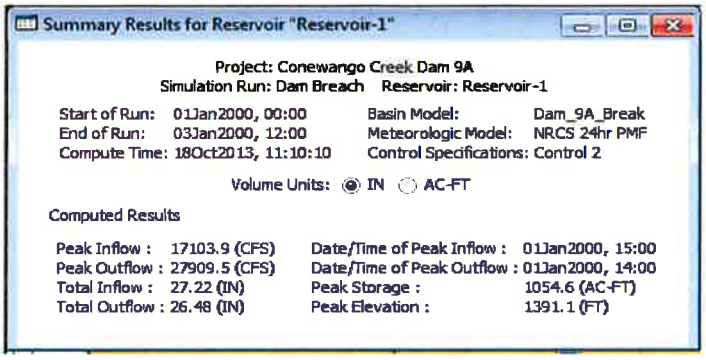

50
y = 1.0324e-0.098x
R² = 0.9948
Qx/Qp
Distance (mi)
50
Log. (50)
Expon. (50)


1000
y = 0.9824e-0.008x
R² = 0.9675
Qx/Qp
Distance (mi)
1000
Log. (1000)
Expon. (1000)


100
y = 1.0103e-0.073x
R² = 0.9947
Qx/Qp
Distance (mi)
100
Log. (100)
Expon. (100)


3000
y = 0.9916e-0.004x
R² = 0.9513
Qx/Qp
Distance (mi)
3000
Log. (3000)
Expon. (3000)

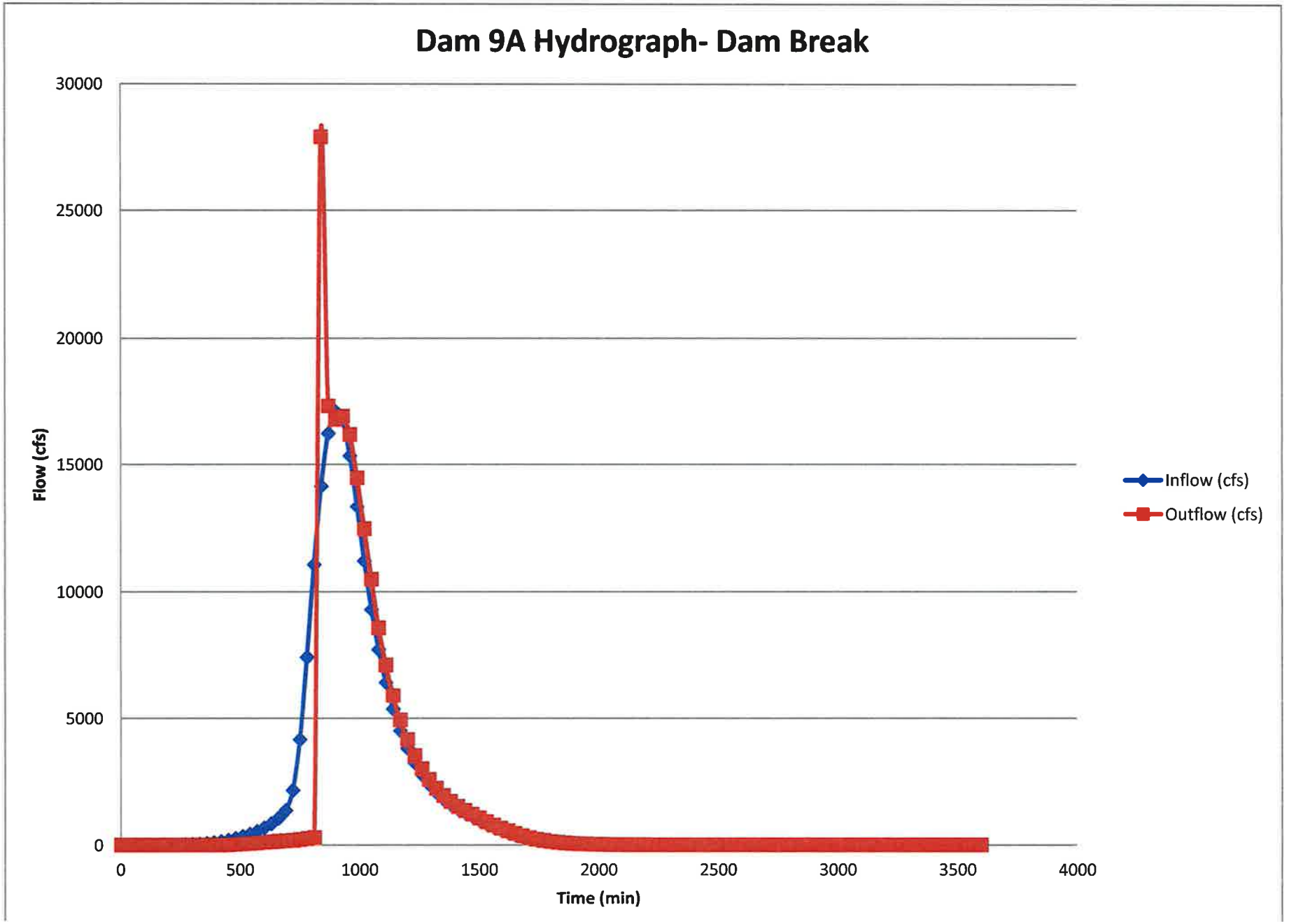
From Hec-HMS



Date	Time	Inflow (cfs)	Storage (Acre-ft)	Elevation	Outflow (cfs)	Total Time Lapse (min)
1-Jan-00	0:00	0	70.6	1366.6	0	0
1-Jan-00	0:30	0.1	70.6	1366.6	0	30
1-Jan-00	1:00	0.3	70.6	1366.6	0	60
1-Jan-00	1:30	0.7	70.7	1366.6	0	90
1-Jan-00	2:00	1.3	70.7	1366.6	0	120
1-Jan-00	2:30	2.1	70.8	1366.6	0	150
1-Jan-00	3:00	3.1	70.9	1366.6	0	180
1-Jan-00	3:30	4.4	71	1366.6	0	210
1-Jan-00	4:00	7.1	71.3	1366.7	0	240
1-Jan-00	4:30	13	71.7	1366.7	0	270
1-Jan-00	5:00	24	72.5	1366.7	0.1	300
1-Jan-00	5:30	41.5	73.8	1366.8	0.4	330
1-Jan-00	6:00	66.9	76	1367	1.2	360
1-Jan-00	6:30	101.2	79.4	1367.3	3.1	390
1-Jan-00	7:00	145.7	84.3	1367.7	7.2	420
1-Jan-00	7:30	201.2	91	1368.2	15.5	450
1-Jan-00	8:00	268.3	99.8	1368.9	30.3	480
1-Jan-00	8:30	347.4	110.8	1369.8	51.9	510
1-Jan-00	9:00	439.7	124.5	1370.5	69.3	540
1-Jan-00	9:30	548.5	141.7	1371.2	87.6	570
1-Jan-00	10:00	680.7	163	1372.1	106.6	600
1-Jan-00	10:30	845.4	189.7	1373.3	126.1	630
1-Jan-00	11:00	1058.7	223.4	1374.7	147.1	660
1-Jan-00	11:30	1360.2	267	1376	163.4	690
1-Jan-00	12:00	2151.4	332.3	1377.7	183.5	720
1-Jan-00	12:30	4158.8	454.4	1380.8	214	750
1-Jan-00	13:00	7425	684.1	1385.5	254	780
1-Jan-00	13:30	11059.8	1054.6	1391.1	294.3	810
1-Jan-00	14:00	14140.9	503.5	1381.8	27909.5	840
1-Jan-00	14:30	16219.7	256.9	1375.7	17319.8	870
1-Jan-00	15:00	17103.9	243.5	1375.4	16775.5	900

1-Jan-00	15:30	16741.8	246.8	1375.4	16910	930
1-Jan-00	16:00	15345	229.3	1375	16178.5	960
1-Jan-00	16:30	13333.8	201.7	1373.8	14467.7	990
1-Jan-00	17:00	11203.3	167.2	1372.3	12459.4	1020
1-Jan-00	17:30	9304.4	131	1370.7	10487.8	1050
1-Jan-00	18:00	7724.3	102.4	1369.1	8579.8	1080
1-Jan-00	18:30	6428.7	85.1	1367.7	7116.7	1110
1-Jan-00	19:00	5371	70.2	1366.5	5907.7	1140
1-Jan-00	19:30	4508.7	65.6	1365.4	4939.5	1170
1-Jan-00	20:00	3805.9	61.6	1364.5	4157.3	1200
1-Jan-00	20:30	3232.5	58.1	1363.6	3519.2	1230
1-Jan-00	21:00	2764	55	1362.9	2998.2	1260
1-Jan-00	21:30	2380.8	52.3	1362.3	2572.4	1290
1-Jan-00	22:00	2067	49.9	1361.7	2223.9	1320
1-Jan-00	22:30	1810	47.9	1361.3	1938.6	1350
1-Jan-00	23:00	1599	46.2	1360.8	1703.1	1380
1-Jan-00	23:30	1424.7	44.6	1360.5	1510.6	1410
2-Jan-00	0:00	1273.5	43.3	1360.2	1348	1440
2-Jan-00	0:30	1131.9	42	1359.9	1201.8	1470
2-Jan-00	1:00	981.9	40.7	1359.6	1056.1	1500
2-Jan-00	1:30	835.2	39.3	1359.2	908	1530
2-Jan-00	2:00	714	38	1358.9	774.4	1560
2-Jan-00	2:30	605.7	36.7	1358.6	660.1	1590
2-Jan-00	3:00	500.5	35.5	1358.4	553.8	1620
2-Jan-00	3:30	402.4	34.3	1358.1	452.9	1650
2-Jan-00	4:00	316.1	33.1	1357.8	361.5	1680
2-Jan-00	4:30	244.6	32	1357.5	284.3	1710
2-Jan-00	5:00	188.2	31	1357.3	220.8	1740
2-Jan-00	5:30	144.5	30.2	1357.1	170.9	1770
2-Jan-00	6:00	110.7	29.4	1356.9	132.1	1800
2-Jan-00	6:30	84.6	28.8	1356.8	102.1	1830
2-Jan-00	7:00	64.4	28.3	1356.7	78.7	1860
2-Jan-00	7:30	48.9	27.9	1356.5	60.7	1890
2-Jan-00	8:00	37	27.5	1356.5	46.7	1920
2-Jan-00	8:30	27.7	27.2	1356.4	35.8	1950
2-Jan-00	9:00	20.6	26.9	1356.3	27.3	1980
2-Jan-00	9:30	15.1	26.7	1356.3	20.8	2010
2-Jan-00	10:00	10.9	26.5	1356.2	15.7	2040
2-Jan-00	10:30	7.7	26.3	1356.2	11.7	2070
2-Jan-00	11:00	5.2	26.2	1356.2	8.6	2100
2-Jan-00	11:30	3.3	26	1356.1	6.2	2130
2-Jan-00	12:00	1.9	25.9	1356.1	4.4	2160
2-Jan-00	12:30	0.8	25.8	1356.1	3	2190
2-Jan-00	13:00	0.2	25.8	1356.1	1.9	2220
2-Jan-00	13:30	0	25.7	1356	1.2	2250

2-Jan-00	14:00	0	25.7	1356	0.8	2280
2-Jan-00	14:30	0	25.6	1356	0.6	2310
2-Jan-00	15:00	0	25.6	1356	0.4	2340
2-Jan-00	15:30	0	25.6	1356	0.3	2370
2-Jan-00	16:00	0	25.6	1356	0.2	2400
2-Jan-00	16:30	0	25.6	1356	0.2	2430
2-Jan-00	17:00	0	25.6	1356	0.1	2460
2-Jan-00	17:30	0	25.6	1356	0.1	2490
2-Jan-00	18:00	0	25.6	1356	0.1	2520
2-Jan-00	18:30	0	25.6	1356	0.1	2550
2-Jan-00	19:00	0	25.6	1356	0.1	2580
2-Jan-00	19:30	0	25.6	1356	0.1	2610
2-Jan-00	20:00	0	25.6	1356	0.1	2640
2-Jan-00	20:30	0	25.6	1356	0	2670
2-Jan-00	21:00	0	25.6	1356	0	2700
2-Jan-00	21:30	0	25.5	1356	0	2730
2-Jan-00	22:00	0	25.5	1356	0	2760
2-Jan-00	22:30	0	25.5	1356	0	2790
2-Jan-00	23:00	0	25.5	1356	0	2820
2-Jan-00	23:30	0	25.5	1356	0	2850
3-Jan-00	0:00	0	25.5	1356	0	2880
3-Jan-00	0:30	0	25.5	1356	0	2910
3-Jan-00	1:00	0	25.5	1356	0	2940
3-Jan-00	1:30	0	25.5	1356	0	2970
3-Jan-00	2:00	0	25.5	1356	0	3000
3-Jan-00	2:30	0	25.5	1356	0	3030
3-Jan-00	3:00	0	25.5	1356	0	3060
3-Jan-00	3:30	0	25.5	1356	0	3090
3-Jan-00	4:00	0	25.5	1356	0	3120
3-Jan-00	4:30	0	25.5	1356	0	3150
3-Jan-00	5:00	0	25.5	1356	0	3180
3-Jan-00	5:30	0	25.5	1356	0	3210
3-Jan-00	6:00	0	25.5	1356	0	3240
3-Jan-00	6:30	0	25.5	1356	0	3270
3-Jan-00	7:00	0	25.5	1356	0	3300
3-Jan-00	7:30	0	25.5	1356	0	3330
3-Jan-00	8:00	0	25.5	1356	0	3360
3-Jan-00	8:30	0	25.5	1356	0	3390
3-Jan-00	9:00	0	25.5	1356	0	3420
3-Jan-00	9:30	0	25.5	1356	0	3450
3-Jan-00	10:00	0	25.5	1356	0	3480
3-Jan-00	10:30	0	25.5	1356	0	3510
3-Jan-00	11:00	0	25.5	1356	0	3540
3-Jan-00	11:30	0	25.5	1356	0	3570
3-Jan-00	12:00	0	25.5	1356	0	3600


Dam 9A Hydrograph- Dam Break
30000
25000
20000
15000
10000
5000
0
Flow (cfs)
0
500
1000
1500
2000
2500
3000
3500
4000
Time (min)
Inflow (cfs)
Outflow (cfs)

Reach	River Sta		Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Length Chnl	Notes	Distance from Dam 9A		Distance from Warren, PA		Slope	Average Slope/mi		Flood Depth
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)		ft	mi	ft	mi	(ft/mi)	Per Section		ft
Tributary	91992.04		27556.52	1382.25	1392.97		1393.76	0.005582	15.32	5977.06	840.8	0.83	98.15	Reservior			298531	56.5	28.5			10.72
Tributary	91962.10		27523	1381.72	1392.43		1393.22	0.005614	15.34	5958.08	839.22	0.83	98.15		0	0.0	298432	56.5	28.5			10.71
Tributary	91932.20		27217.05	1381.19	1391.88		1392.66	0.005535	15.22	5939.89	838.1	0.82	98.15		98	0.0	298334	56.5	29.0			10.69
Tributary	91902.30		27202.97	1380.65	1391.34		1392.12	0.00557	15.26	5924.05	837.17	0.83	98.15		196	0.0	298236	56.5	28.5			10.69
Tributary	91872.30		27174.65	1380.12	1390.79		1391.58	0.0056	15.29	5909.07	836.59	0.83	98.15		294	0.1	298138	56.5	28.5			10.67
Tributary	91842.40		26952.04	1379.59	1390.25		1391.03	0.005558	15.21	5891.67	836.12	0.83	98.15		393	0.1	298040	56.4	29.0			10.66
Tributary	91812.50		26941.44	1379.05	1389.7		1390.48	0.0056	15.25	5877.48	836.32	0.83	98.15		491	0.1	297942	56.4	28.5			10.65
Tributary	91782.60		26920.02	1378.52	1389.15		1389.94	0.005643	15.29	5861.93	836.5	0.83	98.15		589	0.1	297844	56.4	28.5			10.63
Tributary	91752.70		26737	1377.99	1388.6		1389.38	0.005632	15.25	5843.98	837.41	0.83	98.15		687	0.1	297745	56.4	28.5			10.61
Tributary	91722.80		26731.07	1377.46	1388.04		1388.83	0.005714	15.33	5826.95	840.3	0.84	98.15		785	0.1	297647	56.4	29.0			10.58
Tributary	91692.80		26716.57	1376.92	1387.47		1388.27	0.005809	15.43	5807.42	844.05	0.84	98.15		883	0.2	297549	56.4	28.5			10.55
Tributary	91662.90		26693.78	1376.39	1386.89		1387.7	0.005926	15.53	5783.01	848.49	0.85	98.15		982	0.2	297451	56.3	28.5			10.5
Tributary	91633.00		26561.21	1375.86	1386.3		1387.12	0.006038	15.61	5755.46	856.07	0.86	98.15		1080	0.2	297353	56.3	28.5			10.44
Tributary	91603.10		26555.26	1375.33	1385.69		1386.53	0.006222	15.77	5723.58	863.51	0.87	98.15		1178	0.2	297255	56.3	29.0			10.36
Tributary	91573.20		26543.2	1374.79	1385.07		1385.92	0.006425	15.93	5687.02	870.97	0.88	98.15		1276	0.2	297156	56.3	28.5			10.28
Tributary	91543.30		26525.11	1374.26	1384.43		1385.29	0.006659	16.09	5642.8	877.98	0.9	98.15		1374	0.3	297058	56.3	28.5			10.17
Tributary	91513.40		26501.3	1373.73	1383.75		1384.64	0.006954	16.28	5584.87	884.63	0.91	98.15		1472	0.3	296960	56.2	29.0			10.02
Tributary	91483.40		26426.85	1373.19	1383.05		1383.95	0.007322	16.51	5509.42	892.28	0.93	98.15		1570	0.3	296862	56.2	28.5			9.86
Tributary	91453.50		26420.16	1372.66	1382.28	1380.13	1383.22	0.007895	16.86	5400.15	897.85	0.97	98.15		1669	0.3	296764	56.2	28.5			9.62
Tributary	91423.60		26409.83	1372.13	1381.44	1379.51	1382.44	0.008792	17.4	5230.88	899.23	1.01	98.15		1767	0.3	296666	56.2	28.5			9.31
Tributary	91393.70		26396.54	1371.6	1380.45	1378.84	1381.56	0.010414	18.29	4943.31	887.38	1.09	98.15		1865	0.4	296568	56.2	29.0			8.85
Tributary	91363.82		26379.01	1371.06	1378.94	1378.21	1380.45	0.016284	21.12	4226.65	844.91	1.34	93.26	Dam 9A	1963	0.4	296469	56.1	132.5			7.88
Tributary	91335.40		26342.3	1368.72	1377.11	1376.86	1379.2	0.017988	23.28	3902.31	781.21	1.43	93.26		2056	0.4	296376	56.1	133.0			8.39
Tributary	91306.90		26338.82	1366.37	1375.04	1375.24	1377.83	0.020215	25.3	3528.71	692.74	1.52	93.26		2150	0.4	296283	56.1	132.5			8.67
Tributary	91278.50		26331.27	1364.03	1372.76	1373.04	1376.22	0.022502	26.87	3170.62	592.8	1.61	93.26		2243	0.4	296190	56.1	133.0			8.73
Tributary	91250.10		26319.72	1361.68	1370.46	1370.9	1374.26	0.023033	27.3	2945.96	511.39	1.63	93.26		2336	0.4	296096	56.1	133.0			8.78
Tributary	91221.70		26266.8	1359.33	1368.7	1368.65	1372.09	0.018267	25.39	3070.5	482.49	1.47	93.26		2429	0.5	296003	56.1	132.5			9.37
Tributary	91193.27		26259.19	1356.99	1367.8	1366.49	1370.24	0.010769	21.43	3626.78	493.72	1.15	96.17		2523	0.5	295910	56.0	78.0			10.81
Tributary	91163.90		26247.06	1355.57	1366.69	1365.62	1369.33	0.010777	21.81	3637.92	513.98	1.16	96.17		2619	0.5	295814	56.0	78.0			11.12
Tributary	91134.60		26168.6	1354.15	1365.57	1364.63	1368.41	0.010736	22.12	3657.1	539.61	1.16	96.17		2715	0.5	295718	56.0	78.0			11.42
Tributary	91105.30		26165.55	1352.73	1364.44	1363.75	1367.52	0.010811	22.53	3682.67	573.39	1.17	96.17		2811	0.5	295621	56.0	78.0			11.71
Tributary	91076.00		26158.71	1351.31	1363.27	1362.65	1366.72	0.011203	23.2	3713.3	632.83	1.19	96.17		2907	0.6	295525	56.0	78.0			11.96
Tributary	91046.70		26148.73	1349.89	1362	1361.2	1365.96	0.011999	24.15	3726.55	715.01	1.24	96.17		3003	0.6	295429	56.0	78.0			12.11
Tributary	91017.40		26135.59	1348.47	1360.62	1362.48	1365.17	0.013094	25.2	3734.6	817.48	1.29	96.17		3100	0.6	295333	55.9	78.0			12.15
Tributary	90988.09		26120.88	1347.05	1359.36	1360.97	1364.01	0.012904	25.17	3960.93	991.94	1.28	90.14	Villinova Road/Smith Road Intersection	3196	0.6	295237	55.9	38.7			12.31
Tributary	90960.60		26079.15	1346.39	1358.39	1359.79	1362.61	0.012954	24.85	4117.13	1041.59	1.28	90.14		3286	0.6	295147	55.9	39.2			12
Tributary	90933.10		26071.16	1345.72	1357.31	1358.39	1361.22	0.013393	24.76	4180.4	1051.82	1.3	90.14		3376	0.6	295056	55.9	38.7			11.59
Tributary	90905.60		26057.05	1345.06	1356.29	1357.28	1359.75	0.013376	24.28	4296.98	1062.4	1.29	90.14		3466	0.7	294966	55.9	38.7			11.23
Tributary	90878.10		25999.36	1344.4	1355.27	1356.05	1358.26	0.01315	23.63	4429.52	1071.23	1.27	90.14		3556	0.7	294876	55.8	38.7			10.87
Tributary	90850.70		25994.93	1343.74	1354.26	1354.71	1356.78	0.012683	22.76	4585.65	1075.25	1.24	90.14		3646	0.7	294786	55.8	38.7			10.52
Tributary	90823.23		25986.31	1343.08	1353.4	1353.36	1355.33	0.011129	21.11	4917.33	1096.94	1.16	99.9		3737	0.7	294696	55.8	30.1			10.32
Tributary	90792.70		25972.46	1342.51	1352.44	1352.14	1354.06	0.010543	20.02	5155.76	1149.64	1.12	99.9		3836	0.7	294596	55.8	29.6			9.93
Tributary	90762.30		25919.85	1341.95	1351.47	1350.97	1352.88	0.010307	19.25	5324.31	1196.16	1.1	99.9		3936	0.7	294496	55.8	29.6			9.52
Tributary	90731.80		25917.25	1341.39	1350.51	1349.85	1351.77	0.01031	18.69	5445.4	1236.75	1.1	99.9		4036	0.8	294396	55.8	29.6			9.12
Tributary	90701.40		25911.51	1340.83	1349.47	1348.85	1350.67	0.01097	18.6	5430.18	1262.73	1.12	99.9		4136	0.8	294296	55.7	29.6			8.64
Tributary	90670.90		25905.58	1340.27	1348.18	1347.91	1349.52	0.014109	19.87	5124.21	1391.44	1.25	99.9		4236	0.8	294196	55.7	30.1			7.91
Tributary	90640.50		25862	1339.7	1346.53	1346.76	1347.98	0.020372	21.59	5200.39	1911.45	1.47	99.9		4336	0.8	294096	55.7	29.6			6.83
Tributary	90610.08		25851.8	1339.14	1345.76		1345.97	0.004756	10.2	9819.42	2616.65	0.7	99.93		4436	0.8	293997	55.7	55.5			6.62
Tributary	90579.60		25832.72	1338.09	1344.91	1344.11	1345.44	0.009618	14.84	7298.59	2196.4	1.01	99.93		4536	0.9	293897	55.7	55.5			6.82
Tributary	90549.10		25792.76	1337.04	1343.83	1343.17	1344.49	0.011255	16.03	6677.33	2018.83	1.09	99.93		4636	0.9	293797	55.6	55.5			6.79
Tributary	90518.70		25784.97	1335.99	1342.68	1342.11	1343.37	0.011909	16.34	6554.03	2058.26	1.12	99.93		4736	0.9	293697	55.6	55.5			6.69
Tributary	90488.20		25768.72	1334.94	1341.42	1340.92	1342.14	0.01301	16.75	6335.12	2137.29	1.16	99.93		4836	0.9	293597	55.6	55.5			6.48
Tributary	90457.70		25735.31	1333.89	1340.07	1339.5	1340.8	0.014184	16.96	6069.08	1988.23	1.21	99.93		4936	0.9	293497	55.6	55.5			6.18
Tributary	90427.30		25731.28	1332.84	1338.69	1338.15	1339.36	0.014653	16.62	6212.84	2007.49	1.21	99.93		5035	1.0	293397	55.6	55.5			5.85
Tributary	90396.80		25725.5	1331.79	1337.17	1336.67	1337.81	0.016446	16.66	6225.53	2179.74	1.27	99.93		5135	1.0	293297	55.5	55.5			5.38
Tributary	90366.40		25688.2	1330.74	1335.4	1335.14	1335.98	0.020289	16.82	6448.72	2754.98	1.38	99.93		5235	1.0	293197	55.5	55.5			4.66
Tributary	90335.94		25675.66	1329.69	1334.27		1334.44	0.006653	9.52	9571.04	3085.43	0.79	98.76		5335	1.0	293097	55.5	55.1			4.58
Tributary	90305.80		25614.21	1328.66	1333.61		1333.8	0.006747	10.09	9484.5	3074.51	0.8	98.76		5434	1.0	292998	55.5	55.6			4.95
Tributary	90275.70		25602.4	1327.62	1332.95		1333.16	0.006843	10.65	9397.52	3056.04	0.82	98.76		5533	1.0	292900	55.5	55.1			5.33
Tributary	90245.60		25539.29	1326.59	1332.27		1332.51	0.006955	11.2	9283.44	3034.9	0.83	98.76		5632	1.1	292801	55.5	55.1			5.68
Tributary	90215.50		25528.89	1325.56	1331.58		1331.85	0.007057	11.72	9179.68	3014.62	0.85	98.76		5730	1.1	292702	55.4	55.6			6.02
Tributary	90185.40		25462.98	1324.52	1330.89		1331.19	0.007116	12.2	9064.1	2987.81	0.86	98.76		5829	1.1	292603	55.4	55.1			6.37
Tributary	90155.30		25452.77	1323.49	1330.17		1330.52	0.007362	12.81	8920.62	2986.65	0.88	98.76		5928	1.1	292505	55.4	55.1			6.68
Tributary	90125.20		25383.32	1322.46	1329.42		1329.85	0.008181	13.87	8775.36	3155.55	0.93	98.76		6027	1.1	292406	55.4	55.6			6.96
Tributary	90095.10		25367.05	1321.42	1328.64	1327.34	1329.11	0.008375	14.34	8783	3256.86	0.95	98.76		6125	1.2	292307	55.4	55.1			7.22
Tributary	90065.00		25285.59	1320.39	1327.93		1328.33	0.006787	13.29	9235.46	3156.18	0.86	98.76		6224	1.2	292208	55.3	55.1			7.54
Tributary	90034.91		25189.15	1319.36	1327.43		1327.7	0.004433	11.23	10472.76	3129.26	0.7	90.59		6323	1.2	292110	55.3	5.8			8.07
Tributary	90007.30		25170.06	1319.26	1327.02		1327.29	0.004639	11.21	10325.2	3114.51	0.71	90.59		6413	1.2	292019	55.3	5.8			7.76
Tributary	89979.60		25079.8	1319.16	1326.6		1326.86	0.004884	11.18	10162.33	3113.28	0.73	90.59		6504	1.2	291928	55.3	5.8			7.44
Tributary	89952.00		24980.14	1319.06	1326.15		1326.4	0.005174	11.15	10009.46	3132.84	0.74	90.59		6595	1.2	291838	55.3	5.8			7.09
Tributary	89924.40		24969.38	1318.96	1325.67		1325.92	0.005609	11.19	9885.84	3208.27	0.77	90.59		6685	1.3	291747	55.3	5.8			6.71
Tributary	89896.80		24862.19	1318.86	1325.18		1325.41	0.005711	10.85	9912.55	3274	0.77	90.59		6776	1.3	291657	55.2	5.2			6.32
Tributary	89869.20		24737.49	1318.77	1324.71		1324.9	0.005242	9.99	10097.33	3232.8	0.73	90.59		6866	1.3	291566	55.2	5.8			5.94
Tributary	89841.60		24596.82	1318.67	1324.29		1324.44	0.004504	8.93	10508.57	3221.46	0.67	90.59		6957	1.3	291475	55.2	5.8			5.62
Tributary	89814.00		24445.74	1318.57	1323.95		1324.07	0.003596	7.76	11245.82	3281.82	0.59	90.59		7048	1.3	291385	55.2	5.8			5.38
Tributary	89786.41		24286.41	1318.47	1323.69		1323.78	0.002677	6.57	12566.39	3769.95	0.51	99.49		7138	1.4	291294	55.2	24.9			5.22
Tributary	89756.00		24120.52	1318	1323.45		1323.53	0.002337	6.32	13459.83	4119.41	0.48	99.49		7238	1.4	291195	55.2	24.4			5.45

Tributary	89725.70		23948.38	1317.54	1323.23		1323.3	0.002189	6.31	14203.92	4445.12	0.47	99.49		7337	1.4	291095	55.1	24.9			5.69
Tributary	89695.40		23775.06	1317.07	1323.03		1323.09	0.002114	6.39	14811.82	4766.87	0.46	99.49		7437	1.4	290996	55.1	24.9			5.96
Tributary	89665.10		23601.41	1316.6	1322.82		1322.89	0.002119	6.59	15219.9	5027.56	0.47	99.49		7536	1.4	290896	55.1	24.9			6.22
Tributary	89634.70		23425.67	1316.13	1322.6		1322.68	0.002214	6.92	15398.73	5318.83	0.48	99.49		7636	1.4	290797	55.1	24.9			6.47
Tributary	89604.40		23246.07	1315.66	1322.37		1322.46	0.002436	7.44	15289.27	5589.75	0.51	99.49		7735	1.5	290697	55.1	24.4			6.71
Tributary	89574.10		23070.47	1315.2	1322.12		1322.22	0.002723	8.03	14860.2	5837.3	0.54	99.49		7835	1.5	290598	55.0	24.9			6.92
Tributary	89543.80		22772.16	1314.73	1321.85		1321.97	0.002807	8.31	14319.66	5676.69	0.55	99.49		7934	1.5	290498	55.0	24.9			7.12
Tributary	89513.40		22626.78	1314.26	1321.56		1321.7	0.00314	8.94	13734.9	5711.62	0.58	99.49		8034	1.5	290399	55.0	24.9			7.3
Tributary	89483.10		22327.55	1313.79	1321.22		1321.4	0.003672	9.79	12867.3	5700.02	0.63	99.49		8133	1.5	290299	55.0	24.9			7.43
Tributary	89452.80		22000.8	1313.32	1320.87		1321.05	0.00342	9.54	11929.58	5600.69	0.61	99.49		8233	1.6	290200	55.0	24.4			7.55
Tributary	89422.40		21655.95	1312.86	1320.52		1320.71	0.003344	9.53	11117.72	5355.9	0.61	99.49		8332	1.6	290100	54.9	24.9			7.66
Tributary	89392.10		21137.29	1312.39	1320.2		1320.39	0.00313	9.34	10559.42	4984.85	0.59	99.49		8432	1.6	290001	54.9	24.9			7.81
Tributary	89361.80		20802.11	1311.92	1319.92		1320.1	0.002772	8.94	10399.26	4718.19	0.56	99.49		8531	1.6	289901	54.9	24.9			8
Tributary	89331.50		20479.68	1311.45	1319.69		1319.84	0.002292	8.29	10541.03	4248.96	0.51	99.49		8631	1.6	289802	54.9	24.9			8.24
Tributary	89301.10		20158.96	1310.98	1319.5		1319.62	0.001742	7.39	11032.15	3661.7	0.45	99.49		8730	1.7	289702	54.9	24.4			8.52
Tributary	89270.80		19860.16	1310.52	1319.35		1319.45	0.001388	6.76	11780.68	3604.68	0.4	99.49		8830	1.7	289603	54.8	24.9			8.83
Tributary	89240.50		19719.08	1310.05	1319.23		1319.32	0.001115	6.22	12682.44	3621.26	0.36	99.49		8929	1.7	289503	54.8	24.9			9.18
Tributary	89210.21		19583.36	1309.58	1319.14		1319.21	0.00089	5.7	13731.45	3708.39	0.33	99.26	Cemetery Road	9028	1.7	289404	54.8	13.8			9.56
Tributary	89179.90		19457.81	1309.32	1319.05		1319.12	0.00091	5.84	13518.33	3705.49	0.33	99.26		9128	1.7	289305	54.8	13.8			9.73
Tributary	89149.70		19229.73	1309.06	1318.96		1319.03	0.000922	5.94	13303.89	3735.04	0.33	99.26		9227	1.7	289205	54.8	13.8			9.9
Tributary	89119.40		19120.08	1308.8	1318.86		1318.95	0.000982	6.2	13151.73	4196.68	0.34	99.26		9326	1.8	289106	54.8	13.3			10.06
Tributary	89089.10		19014.23	1308.55	1318.77		1318.86	0.001001	6.32	13020.44	4211.27	0.35	99.26		9426	1.8	289007	54.7	13.8			10.22
Tributary	89058.90		18819.45	1308.29	1318.67		1318.76	0.00101	6.4	12899.81	4176.86	0.35	99.26		9525	1.8	288908	54.7	13.8			10.38
Tributary	89028.60		18637.81	1308.03	1318.56		1318.66	0.001019	6.5	12796.66	4193.04	0.35	99.26		9624	1.8	288808	54.7	13.8			10.53
Tributary	88998.40		18472.42	1307.77	1318.46		1318.57	0.001028	6.58	12723.2	4289.95	0.36	99.26		9723	1.8	288709	54.7	13.8			10.69
Tributary	88968.10		18320.69	1307.51	1318.36		1318.47	0.001037	6.67	12657.34	4375.17	0.36	99.26		9823	1.9	288610	54.7	13.8			10.85
Tributary	88937.90		18117.77	1307.25	1318.26		1318.37	0.001038	6.73	12630.03	4285.75	0.36	99.26		9922	1.9	288511	54.6	13.3			11.01
Tributary	88907.60		17995.59	1307	1318.16		1318.28	0.001045	6.81	12644.54	4371.06	0.36	99.26		10021	1.9	288411	54.6	13.8			11.16
Tributary	88877.40		17883.79	1306.74	1318.05		1318.18	0.001055	6.9	12655.2	4446.15	0.36	99.26		10120	1.9	288312	54.6	13.8			11.31
Tributary	88847.10		17737.6	1306.48	1317.95		1318.08	0.001068	7	12681.91	4587.52	0.37	99.26		10220	1.9	288213	54.6	13.8			11.47
Tributary	88816.80		17611.92	1306.22	1317.84		1317.98	0.001067	7.05	12725.08	4605.39	0.37	99.26		10319	2.0	288114	54.6	13.8			11.62
Tributary	88786.60		17501.04	1305.96	1317.73		1317.88	0.001067	7.1	12770.22	4623.6	0.37	99.26		10418	2.0	288014	54.5	13.8			11.77
Tributary	88756.30		17406	1305.7	1317.63		1317.78	0.001064	7.15	12824.5	4638.08	0.37	99.26		10517	2.0	287915	54.5	13.3			11.93
Tributary	88726.10		17349.46	1305.45	1317.52		1317.68	0.001066	7.21	12880.42	4651.38	0.37	99.26		10617	2.0	287816	54.5	13.8			12.07
Tributary	88695.80		17211.48	1305.19	1317.42		1317.58	0.001061	7.24	12934.92	4688.46	0.37	99.26		10716	2.0	287717	54.5	13.8			12.23
Tributary	88665.60		17156.8	1304.93	1317.31		1317.48	0.001065	7.31	12988.06	4722.89	0.37	99.26		10815	2.0	287617	54.5	13.8			12.38
Tributary	88635.30		17059.09	1304.67	1317.21		1317.38	0.001065	7.36	13042.5	4763.86	0.37	99.26		10914	2.1	287518	54.5	13.8			12.54
Tributary	88605.10		16946.51	1304.41	1317.1		1317.28	0.001063	7.4	13103.63	4811.38	0.37	99.26		11014	2.1	287419	54.4	13.8			12.69
Tributary	88574.80		16924.23	1304.15	1316.99		1317.17	0.001073	7.49	13154.7	4859.9	0.37	99.26		11113	2.1	287319	54.4	13.3			12.84
Tributary	88544.50		16907.5	1303.9	1316.88		1317.07	0.001084	7.57	13199.61	4911.76	0.37	99.26		11212	2.1	287220	54.4	13.8			12.98
Tributary	88514.30		16897	1303.64	1316.76		1316.97	0.001097	7.66	13235.36	4976.67	0.38	99.26		11311	2.1	287121	54.4	13.8			13.12
Tributary	88484.00		16896.25	1303.38	1316.64		1316.86	0.001111	7.76	13263.24	5036.38	0.38	99.26		11411	2.2	287022	54.4	13.8			13.26
Tributary	88453.80		16885.69	1303.12	1316.52		1316.79	0.001271	8.34	13272.8	5038.08	0.41	99.26		11510	2.2	286922	54.3	13.8			13.4
Tributary	88423.50		16874.33	1302.86	1316.39		1316.66	0.001261	8.35	13265.5	5024.92	0.41	99.26		11609	2.2	286823	54.3	13.8			13.53
Tributary	88393.30		16863.35	1302.6	1316.27		1316.54	0.001246	8.34	13276.89	5012.35	0.4	99.26		11709	2.2	286724	54.3	13.3			13.67
Tributary	88363.00		16852.7	1302.35	1316.15		1316.43	0.001231	8.34	13297.98	5007.78	0.4	99.26		11808	2.2	286625	54.3	13.8			13.8
Tributary	88332.80		16846.75	1302.09	1316.03		1316.31	0.001219	8.34	13324.81	5003.48	0.4	99.26		11907	2.3	286525	54.3	13.8			13.94
Tributary	88302.50		16841.27	1301.83	1315.91		1316.2	0.001203	8.33	13370.71	5122.57	0.4	99.26		12006	2.3	286426	54.2	13.8			14.08
Tributary	88272.30		16830.23	1301.57	1315.79		1316.09	0.001222	8.43	13432.12	5252.68	0.4	99.26		12106	2.3	286327	54.2	13.8			14.22
Tributary	88242.00		16819.34	1301.31	1315.68		1315.98	0.001205	8.42	13508.96	5312.24	0.4	99.26		12205	2.3	286228	54.2	13.8			14.37
Tributary	88211.70		16818.73	1301.05	1315.56		1315.86	0.001191	8.41	13578.05	5357.47	0.4	99.26		12304	2.3	286128	54.2	13.3			14.51
Tributary	88181.50		16813.55	1300.8	1315.44		1315.75	0.001174	8.39	13684.79	5437.81	0.4	99.26		12403	2.3	286029	54.2	13.8			14.64
Tributary	88151.20		16807.27	1300.54	1315.33		1315.64	0.001158	8.38	13812.75	5547.15	0.39	99.26		12503	2.4	285930	54.2	13.8			14.79
Tributary	88121.00		16802.01	1300.28	1315.22		1315.53	0.001138	8.35	13587.31	5677.8	0.39	99.26		12602	2.4	285831	54.1	13.8			14.94
Tributary	88090.70		16792.55	1300.02	1315.11		1315.42	0.001114	8.3	14226.22	5859.22	0.39	99.26		12701	2.4	285731	54.1	13.8			15.09
Tributary	88060.50		16791.47	1299.76	1315.01		1315.31	0.001068	8.18	14514.49	5956.51	0.38	99.26		12800	2.4	285632	54.1	13.8			15.25
Tributary	88030.20		16787.57	1299.5	1314.91		1315.2	0.001042	8.12	14856.77	6200.66	0.38	99.26		12900	2.4	285533	54.1	13.3			15.41
Tributary	88000.00		16786.01	1299.25	1314.81		1315.09	0.000967	7.86	15248.7	6197.79	0.36	99.42		12999	2.5	285434	54.1	6.9			15.56
Tributary	87969.70		16782.56	1299.12	1314.64		1315.18	0.001537	9.9	12133.8	3952.27	0.46	99.42		13098	2.5	285334	54.0	6.9			15.52
Tributary	87939.30		16775.68	1298.99	1314.38	1314.26	1315.33	0.00228	12	9214.47	3715.78	0.56	99.42		13198	2.5	285235	54.0	6.9			15.39
Tributary	87909.00		16769.85	1298.86	1314.11	1314.04	1315.21	0.002537	12.5	7847.37	4023.77	0.58	99.42		13297	2.5	285135	54.0	6.4			15.25
Tributary	87878.70		16772.54	1298.74	1313.86	1313.71	1314.95	0.002554	12.5	7670.66	3509.42	0.59	99.42		13397	2.5	285036	54.0	6.9			15.12
Tributary	87848.40		16766.59	1298.61	1313.62	1313.39	1314.69	0.002563	12.52	7596.01	3411.36	0.59	99.42		13496	2.6	284936	54.0	6.9			15.01
Tributary	87818.10		16760.89	1298.48	1313.35	1313.21	1314.42	0.002603	12.55	7479.77	3314.1	0.59	99.42		13595	2.6	284837	53.9	6.9			14.87
Tributary	87787.80		16760.21	1298.35	1313.09	1312.94	1314.16	0.002621	12.52	7413.17	3234.98	0.59	99.42		13695	2.6	284738	53.9	6.4			14.74
Tributary	87757.50		16757.22	1298.23	1312.84	1312.7	1313.88	0.00263	12.47	7357.96	3154.78	0.59	99.42		13794	2.6	284638	53.9	6.9			14.61
Tributary	87727.20		16750.91	1298.1	1312.58		1313.61	0.002632	12.41	7313.61	3070.75	0.59	99.42		13894	2.6	284539	53.9	6.9			14.48
Tributary	87696.90		16747.24	1297.97	1312.33		1313.33	0.002631	12.34	7299.96	3017.63	0.59	99.42		13993	2.7	284439	53.9	6.4			14.36
Tributary	87666.60		16743.58	1297.85	1312.08		1313.06	0.002629	12.27	7295.44	2973.68	0.59	99.42		14093	2.7	284340	53.9	6.9			14.23
Tributary	87636.30		16731.87	1297.72	1311.83		1312.79	0.002614	12.17	7307.36	2932.3	0.59	99.42		14192	2.7	284241	53.8	6.9			14.11
Tributary	87606.00		16727.35	1297.59	1311.58		1312.51	0.002596	12.06	7325.57	2897.43	0.58	99.42		14291	2.7	284141	53.8	6.9			13.99
Tributary	87575.70		16712.3	1297.46	1311.34		1312.23	0.00255	11.9	7364.19	2787.71	0.58	99.42		14391	2.7	284042	53.8	6.4			13.88
Tributary	87545.40		16707.15	1297.34	1311.1		1311.95	0.002517	11.76	7411.48	2765.21	0.57	99.42		14490	2.7	283942	53.8	6.9			13.76
Tributary	87515.10		16688.9	1297.21	1310.86		1311.68	0.002472	11.59	7470.79	2746.92	0.57	99.42		14590	2.8	283843	53.8	6.9			13.65
Tributary	87484.80		16682.05	1297.08	1310.62		1311.41	0.002431	11.44	7542.47	2740.12	0.56	99.42		14689	2.8	283743	53.7	6.9			13.54
Tributary	87454.50		16667.81	1296.95	1310.39		1311.14	0.002375	11.26	7636.76	2736.31	0.56	99.42		14788	2.8	283644	53.7	6.4			13.44
Tributary	87424.20		16652.75	1296.83	1310.18		1310.88	0.002298	11.03	7762.49	2735.39	0.55	99.42		14888	2.8	283545	53.7	6.9			13.35
Tributary	87393.90		16628.4	1296.7	1309.97		1310.62	0.002205	10.77	7914.08	2737.51	0.53	99.42		14987	2.8	283445	53.7	6.9			13.27
Tributary	87363.60		16610.88	1296.57	1309.77		1310.38	0.002102	10.48	8095.1	2741.84	0.52	99.42		15087	2.9	283346	53.7	6.4			13.2
Tributary	87333.30		16610.07	1296.45	1309.58		1310.14	0.001992	10.18	8303.87	2747.77	0.51	99.42		15186	2.9	283246	53.6	6.9			13.13
Tributary	87303.00		16591.13	1296.32	1309.41		1309.91	0.001865	9.83	8549.73	2756.09	0.49	99.42		15286	2.9	283147	53.6	6.9			13.09
Tributary	87272.70		16571.85	1296.19	1309.25		1309.7	0.001728	9.45	8835.63	2766.31	0.47	99.42		15385	2.9	283047	53.6	6.9			13.06
Tributary	87242.40		16551.56	1296.06	1309.1		1309.5	0.001591	9.06	9151.47	2779.09	0.45	99.42		15484	2.9	282948	53.6	6.4			13.04

Tributary	87212.10		16550.72	1295.94	1308.96		1309.31	0.001457	8.67	9504.77	2792.57	0.43	99.42		15584	3.0	282849	53.6	6.9			13.02
Tributary	87181.80		16530.33	1295.81	1308.84		1309.15	0.00132	8.26	9896.13	2807.94	0.41	99.42		15683	3.0	282749	53.6	6.9			13.03
Tributary	87151.50		16520.44	1295.68	1308.72		1308.99	0.001189	7.85	10322.92	2824.16	0.39	99.42		15783	3.0	282650	53.5	6.9			13.04
Tributary	87121.20		16519.54	1295.55	1308.62		1308.85	0.001067	7.46	10783.36	2841.37	0.37	99.42		15882	3.0	282550	53.5	6.4			13.07
Tributary	87090.90		16499.89	1295.43	1308.53		1308.73	0.000953	7.06	11274.37	2860.6	0.35	99.42		15981	3.0	282451	53.5	6.9			13.1
Tributary	87060.60		16499.32	1295.3	1308.45		1308.62	0.000849	6.69	11795.59	2880.44	0.33	99.42		16081	3.0	282352	53.5	6.9			13.15
Tributary	87030.30		16498.34	1295.17	1308.38		1308.53	0.000756	6.33	12346.75	2908.54	0.31	99.42		16180	3.1	282252	53.5	6.4			13.21
Tributary	87000.00		16490.26	1295.05	1308.31		1308.44	0.000678	6.02	12932.64	3000.75	0.3	99.42		16280	3.1	282153	53.4	-0.5			13.26
Tributary	86969.70		16489.38	1295.06	1308.22		1308.4	0.000855	6.73	10927.95	2667.55	0.33	99.42		16379	3.1	282053	53.4	-0.5			13.16
Tributary	86939.30		16481.24	1295.07	1308.13		1308.32	0.000901	6.88	10213.37	2005.21	0.34	99.42		16479	3.1	281954	53.4	-1.1			13.06
Tributary	86909.00		16480.85	1295.09	1308.04		1308.23	0.000917	6.9	10145.47	1986.62	0.34	99.42		16578	3.1	281854	53.4	-0.5			12.95
Tributary	86878.70		16472.94	1295.1	1307.95		1308.13	0.000931	6.92	10085.97	1967.73	0.35	99.42		16677	3.2	281755	53.4	-1.1			12.85
Tributary	86848.40		16465.47	1295.12	1307.85		1308.04	0.000943	6.93	10034.91	1947.94	0.35	99.42		16777	3.2	281656	53.3	-0.5			12.73
Tributary	86818.10		16465.11	1295.13	1307.76		1307.94	0.000956	6.94	9993.93	1933.1	0.35	99.42		16876	3.2	281556	53.3	-0.5			12.63
Tributary	86787.80		16464.62	1295.14	1307.66		1307.85	0.000971	6.96	9956.61	1925.21	0.35	99.42		16976	3.2	281457	53.3	-1.1			12.52
Tributary	86757.50		16457.7	1295.16	1307.56		1307.75	0.001013	7.07	9921.76	1955.23	0.36	99.42		17075	3.2	281357	53.3	-0.5			12.4
Tributary	86727.20		16457.06	1295.17	1307.46		1307.65	0.001056	7.18	9890.28	1990.6	0.37	99.42		17175	3.3	281258	53.3	-1.1			12.29
Tributary	86696.90		16450.46	1295.19	1307.35		1307.55	0.001096	7.27	9864.99	2027.25	0.37	99.42		17274	3.3	281158	53.2	-0.5			12.16
Tributary	86666.60		16444.2	1295.2	1307.24		1307.44	0.001134	7.35	9845.82	2064.34	0.38	99.42		17373	3.3	281059	53.2	-0.5			12.04
Tributary	86636.30		16443.61	1295.21	1307.13		1307.33	0.001174	7.43	9831.29	2109.59	0.39	99.42		17473	3.3	280960	53.2	-1.1			11.92
Tributary	86606.00		16442.81	1295.23	1307.01		1307.21	0.001202	7.47	9816.52	2133.51	0.39	99.42		17572	3.3	280860	53.2	-0.5			11.78
Tributary	86575.70		16437.15	1295.24	1306.89		1307.09	0.001228	7.49	9802.75	2155.37	0.39	99.42		17672	3.3	280761	53.2	-0.5			11.65
Tributary	86545.40		16424.94	1295.25	1306.77		1306.97	0.001255	7.52	9796.8	2186.32	0.4	99.42		17771	3.4	280661	53.2	-1.1			11.52
Tributary	86515.10		16430.39	1295.27	1306.65		1306.84	0.001291	7.57	9789.76	2227.56	0.4	99.42		17870	3.4	280562	53.1	-0.5			11.38
Tributary	86484.80		16419.4	1295.28	1306.52		1306.71	0.001321	7.6	9792.01	2271.91	0.4	99.42		17970	3.4	280463	53.1	-1.1			11.24
Tributary	86454.50		16419.04	1295.3	1306.39		1306.58	0.001346	7.61	9800.88	2306.73	0.41	99.42		18069	3.4	280363	53.1	-0.5			11.09
Tributary	86424.20		16413.41	1295.31	1306.26		1306.45	0.001362	7.59	9812.97	2324.22	0.41	99.42		18169	3.4	280264	53.1	-0.5			10.95
Tributary	86393.90		16407.89	1295.32	1306.13		1306.31	0.001374	7.56	9822.67	2332.97	0.41	99.42		18268	3.5	280164	53.1	-1.1			10.81
Tributary	86363.60		16407.49	1295.34	1305.99		1306.17	0.001387	7.52	9839.35	2345.98	0.41	99.42		18368	3.5	280065	53.0	-0.5			10.65
Tributary	86333.30		16402.46	1295.35	1305.86		1306.03	0.001402	7.5	9855.69	2365.65	0.41	99.42		18467	3.5	279965	53.0	-1.1			10.51
Tributary	86303.00		16401.97	1295.37	1305.72		1305.88	0.00142	7.47	9869.81	2386.47	0.41	99.42		18566	3.5	279866	53.0	-0.5			10.35
Tributary	86272.70		16397.63	1295.38	1305.58		1305.74	0.001431	7.43	9894.57	2403.8	0.41	99.42		18666	3.5	279767	53.0	-0.5			10.2
Tributary	86242.40		16397.08	1295.39	1305.44		1305.59	0.001442	7.39	9923.15	2422.44	0.42	99.42		18765	3.6	279667	53.0	-1.1			10.05
Tributary	86212.10		16392.39	1295.41	1305.3		1305.45	0.001451	7.34	9952.65	2437.71	0.42	99.42		18865	3.6	279568	52.9	-0.5			9.89
Tributary	86181.80		16387.51	1295.42	1305.16		1305.3	0.001458	7.28	9986.63	2454.38	0.42	99.42		18964	3.6	279468	52.9	-1.1			9.74
Tributary	86151.50		16391.28	1295.44	1305.02		1305.15	0.001468	7.23	10016.35	2468.07	0.42	99.42		19064	3.6	279369	52.9	-0.5			9.58
Tributary	86121.20		16387.15	1295.45	1304.87		1305	0.001472	7.16	10053.66	2481.33	0.42	99.42		19163	3.6	279270	52.9	-0.5			9.42
Tributary	86090.90		16383.2	1295.46	1304.73		1304.86	0.00148	7.11	10090.12	2498.25	0.42	99.42		19262	3.6	279170	52.9	-1.1			9.27
Tributary	86060.60		16379.46	1295.48	1304.59		1304.71	0.001487	7.04	10131.02	2514.37	0.42	99.42		19362	3.7	279071	52.9	-0.5			9.11
Tributary	86030.30		16382.02	1295.49	1304.44		1304.56	0.001493	6.97	10173.86	2530.88	0.42	99.42		19461	3.7	278971	52.8	-1.1			8.95
Tributary	86000.00		16379.11	1295.51	1304.3		1304.41	0.001499	6.9	10215.9	2546.93	0.41	99.89		19561	3.7	278872	52.8	18.5			8.79
Tributary	85969.50		16375.71	1295.16	1304.07		1304.28	0.002394	8.82	8498.78	2394.97	0.53	99.89		19660	3.7	278772	52.8	18.5			8.91
Tributary	85939.10		16373.29	1294.81	1303.81		1304.06	0.002668	9.37	7723.07	2118.63	0.56	99.89		19760	3.7	278672	52.8	18.0			9
Tributary	85908.60		16373.01	1294.47	1303.52		1303.82	0.002821	9.97	7324.67	2028.26	0.59	99.89		19860	3.8	278572	52.8	18.5			9.05
Tributary	85878.20		16370.41	1294.12	1303.24		1303.54	0.002767	9.93	7050.68	1903.66	0.58	99.89		19960	3.8	278472	52.7	18.0			9.12
Tributary	85847.70		16371.81	1293.78	1302.96		1303.27	0.002753	9.96	6892.3	1862.03	0.58	99.89		20060	3.8	278372	52.7	18.5			9.18
Tributary	85817.30		16367.61	1293.43	1302.68		1303.01	0.002808	10.11	6751.95	1836.7	0.59	99.89		20160	3.8	278272	52.7	18.0			9.25
Tributary	85786.80		16367.27	1293.09	1302.4		1302.73	0.002825	10.19	6619.6	1819.04	0.59	99.89		20260	3.8	278173	52.7	18.5			9.31
Tributary	85756.40		16364.73	1292.74	1302.11		1302.46	0.00283	10.25	6496.35	1802.33	0.59	99.89		20360	3.9	278073	52.7	18.0			9.37
Tributary	85725.90		16366.15	1292.4	1301.82		1302.2	0.002807	10.56	6367.7	1781.28	0.61	99.89		20460	3.9	277973	52.6	18.5			9.42
Tributary	85695.50		16362.23	1292.05	1301.53		1301.93	0.002865	10.71	6245.08	1762.96	0.62	99.89		20560	3.9	277873	52.6	18.0			9.48
Tributary	85665.10		16361.62	1291.71	1301.24		1301.64	0.002866	10.76	6131.33	1747.36	0.62	99.89		20659	3.9	277773	52.6	18.5			9.53
Tributary	85634.60		16359.16	1291.36	1300.96		1301.36	0.002858	10.79	6023.61	1731.56	0.62	99.89		20759	3.9	277673	52.6	18.0			9.6
Tributary	85604.20		16356.23	1291.02	1300.66		1301.09	0.002918	10.94	5911.76	1716.15	0.62	99.89		20859	4.0	277573	52.6	18.5			9.64
Tributary	85573.70		16353.18	1290.67	1300.37		1300.8	0.002913	10.97	5806.52	1703.05	0.62	99.89		20959	4.0	277473	52.6	18.0			9.7
Tributary	85543.30		16352.75	1290.33	1300.08		1300.54	0.00287	11.27	5688.51	1684.8	0.64	99.89		21059	4.0	277373	52.5	18.5			9.75
Tributary	85512.80		16349.51	1289.98	1299.8		1300.26	0.002805	11.19	5619.43	1666.89	0.63	99.89		21159	4.0	277274	52.5	18.0			9.82
Tributary	85482.40		16346.2	1289.64	1299.53		1299.99	0.002777	11.18	5553.79	1648.41	0.63	99.89		21259	4.0	277174	52.5	18.5			9.89
Tributary	85451.90		16342.68	1289.29	1299.27		1299.72	0.002659	11.01	5514.65	1634.73	0.62	99.89		21359	4.0	277074	52.5	18.0			9.98
Tributary	85421.50		16339	1288.95	1299.02		1299.46	0.002527	10.79	5501.43	1632.34	0.6	99.89		21459	4.1	276974	52.5	18.5			10.07
Tributary	85391.10		16335.25	1288.6	1298.78		1299.21	0.00245	10.7	5500.33	1633.97	0.59	99.89		21558	4.1	276874	52.4	18.0			10.18
Tributary	85360.60		16334.9	1288.26	1298.55		1298.99	0.002277	10.72	5509.39	1636.13	0.59	99.89		21658	4.1	276774	52.4	18.5			10.29
Tributary	85330.20		16330.78	1287.91	1298.34		1298.75	0.002112	10.41	5559.68	1653.08	0.57	99.89		21758	4.1	276674	52.4	18.0			10.43
Tributary	85299.70		16322.07	1287.57	1298.14		1298.53	0.001935	10.05	5640.31	1679.1	0.55	99.89		21858	4.1	276574	52.4	18.5			10.57
Tributary	85269.30		16317.1	1287.22	1297.96		1298.32	0.001814	9.82	5731.22	1706.86	0.53	99.89		21958	4.2	276474	52.4	18.0			10.74
Tributary	85238.80		16321.4	1286.88	1297.81		1298.14	0.001618	9.39	5896.99	1761.1	0.5	99.89		22058	4.2	276375	52.3	18.5			10.93
Tributary	85208.40		16316.66	1286.53	1297.67		1297.97	0.001422	8.91	6098.77	1823.72	0.47	99.89		22158	4.2	276275	52.3	18.0			11.14
Tributary	85177.90		16311.54	1286.19	1297.55		1297.84	0.001247	8.73	6331.01	1940.33	0.46	99.89		22258	4.2	276175	52.3	18.5			11.36
Tributary	85147.50		16310.88	1285.84	1297.45		1297.7	0.001086	8.26	6672.11	2489.11	0.43	99.89		22358	4.2	276075	52.3	18.0			11.61
Tributary	85117.09		16300.6	1285.5	1297.37		1297.64	0.001129	8.54	7180.24	2967.55	0.44	98.31	South Dayton Limits/Catt County Line	22457	4.3	275975	52.3	-0.5			11.87
Tributary	85087.10		16304.92	1285.51	1297.28		1297.54	0.001105	8.41	7184.35	2998.54	0.44	98.31		22556	4.3	275877	52.2	0.0			11.77
Tributary	85057.10		16295.3	1285.51	1297.18		1297.43	0.001101	8.35	7327.61	3019.84	0.43	98.31		22654	4.3	275778	52.2	-0.5			11.67
Tributary	85027.20		16290.64	1285.52	1297.07		1297.32	0.001098	8.29	7368.7	3038.36	0.43	98.31		22752	4.3	275680	52.2	-0.5			11.55
Tributary	84997.20		16294.57	1285.53	1296.97		1297.21	0.001094	8.22	7423.18	3061.28	0.43	98.31		22851	4.3	275582	52.2	-0.5			11.44
Tributary	84967.20		16293.86	1285.54	1296.87		1297.11	0.001085	8.14	7485.31	3084.35	0.43	98.31		22949	4.3	275483	52.2	0.0			11.33
Tributary	84937.30		16289.44	1285.54	1296.78		1297	0.001073	8.05	7560.46	3110.2	0.43	98.31		23047	4.4	275385	52.2	-0.5			11.24
Tributary	84907.30		16280.34	1285.55	1296.68		1296.9	0.001062	7.96	7634.6	3139.26	0.42	98.31		23146	4.4	275287	52.1	-0.5			11.13
Tributary	84877.30		16284.25	1285.56	1296.58		1296.8	0.00106	7.91	7685.5	3161.21	0.42	98.31		23244	4.4	275189	52.1	-0.5			11.02
Tributary	84847.40		16279.91	1285.57	1296.49		1296.69	0.001053	7.84	7747.35	3183.95	0.42	98.31		23342	4.4	275090	52.1	-0.5			10.92
Tributary	84817.40		16279.13	1285.58	1296.39		1296.59	0.001048	7.77	7805.68	3205.69	0.42	98.31		23441	4.4	274992	52.1	0.0			10.81
Tributary	84787.40		16271.17	1285.58	1296.29		1296.49	0.001044	7.71	7855.44	3225.7	0.42	98.31		23539	4.5	274894	52.1	-0.5			10.71

Tributary	84757.50		16270.83	1285.59	1296.19		1296.38	0.001042	7.65	7900.91	3240.34	0.42	98.31		23637	4.5	274795	52.0	-0.5			10.6
Tributary	84727.50		16270.33	1285.6	1296.09		1296.28	0.001045	7.61	7932.05	3254.39	0.42	98.31		23735	4.5	274697	52.0	-0.5			10.49
Tributary	84697.50		16262.53	1285.61	1295.99		1296.18	0.001044	7.56	7974.05	3270.6	0.42	98.31		23834	4.5	274599	52.0	0.0			10.38
Tributary	84667.60		16266.13	1285.61	1295.9		1296.07	0.001046	7.52	8014.01	3289.94	0.42	98.31		23932	4.5	274500	52.0	-0.5			10.29
Tributary	84637.60		16258.13	1285.62	1295.8		1295.97	0.001045	7.47	8057.11	3306.9	0.41	98.31		24030	4.6	274402	52.0	-0.5			10.18
Tributary	84607.60		16261.39	1285.63	1295.7		1295.87	0.001046	7.42	8097.27	3324.31	0.41	98.31		24129	4.6	274304	52.0	-0.5			10.07
Tributary	84577.70		16257.63	1285.64	1295.61		1295.77	0.001047	7.38	8134.92	3342.33	0.41	98.31		24227	4.6	274205	51.9	0.0			9.97
Tributary	84547.70		16254.19	1285.64	1295.51		1295.67	0.001046	7.33	8174.98	3354.66	0.41	98.31		24325	4.6	274107	51.9	-0.5			9.87
Tributary	84517.70		16253.47	1285.65	1295.41		1295.57	0.001048	7.28	8204.29	3363.15	0.41	98.31		24424	4.6	274009	51.9	-0.5			9.76
Tributary	84487.80		16252.74	1285.66	1295.31		1295.47	0.001053	7.24	8229.7	3374.05	0.41	98.31		24522	4.6	273911	51.9	-0.5			9.65
Tributary	84457.80		16250.04	1285.67	1295.21		1295.36	0.00106	7.21	8243.96	3383.43	0.41	98.31		24620	4.7	273812	51.9	0.0			9.54
Tributary	84427.80		16249.32	1285.67	1295.11		1295.26	0.001071	7.2	8247.78	3392.13	0.41	98.31		24719	4.7	273714	51.8	-0.5			9.44
Tributary	84397.90		16248.52	1285.68	1295.01		1295.15	0.00108	7.17	8256.36	3400.17	0.42	98.31		24817	4.7	273616	51.8	-0.5			9.33
Tributary	84367.90		16243.02	1285.69	1294.91		1295.05	0.001088	7.14	8266.99	3408.48	0.42	98.31		24915	4.7	273517	51.8	-0.5			9.22
Tributary	84337.90		16242.56	1285.7	1294.8		1294.95	0.001097	7.12	8271.17	3413.13	0.42	98.31		25013	4.7	273419	51.8	0.0			9.1
Tributary	84308.00		16242.1	1285.7	1294.7		1294.84	0.001107	7.09	8272.37	3415.21	0.42	98.31		25112	4.8	273321	51.8	-0.5			9
Tributary	84278.00		16241.42	1285.71	1294.6		1294.74	0.001119	7.07	8266.19	3417.09	0.42	98.31		25210	4.8	273222	51.7	-0.5			8.89
Tributary	84248.00		16236.49	1285.72	1294.49		1294.63	0.001133	7.06	8252.13	3417.76	0.42	98.31		25308	4.8	273124	51.7	-0.5			8.77
Tributary	84218.10		16238.45	1285.73	1294.38		1294.52	0.001157	7.07	8216.16	3416.25	0.42	98.31		25407	4.8	273026	51.7	-0.5			8.65
Tributary	84188.10		16237.42	1285.74	1294.27		1294.4	0.001186	7.09	8166.92	3414.25	0.43	98.31		25505	4.8	272927	51.7	0.0			8.53
Tributary	84158.20		16233.78	1285.74	1294.15		1294.29	0.00122	7.12	8106.15	3410.87	0.43	98.31		25603	4.8	272829	51.7	-0.5			8.41
Tributary	84128.20		16231.88	1285.75	1294.03		1294.17	0.001257	7.15	8038.95	3405.85	0.44	98.31		25702	4.9	272731	51.7	-0.5			8.28
Tributary	84098.20		16231.4	1285.76	1293.91		1294.05	0.001301	7.2	7962.99	3400.28	0.45	98.31		25800	4.9	272632	51.6	-0.5			8.15
Tributary	84068.30		16230.94	1285.77	1293.79		1293.93	0.001354	7.26	7870.31	3393.64	0.45	98.31		25898	4.9	272534	51.6	0.0			8.02
Tributary	84038.30		16229.38	1285.77	1293.66		1293.8	0.00142	7.36	7754.26	3384.12	0.46	98.31		25997	4.9	272436	51.6	-0.5			7.89
Tributary	84008.30		16226.59	1285.78	1293.51		1293.66	0.001511	7.49	7603.44	3371.87	0.48	98.31		26095	4.9	272338	51.6	-0.5			7.73
Tributary	83978.40		16228.63	1285.79	1293.36		1293.52	0.001645	7.7	7396.73	3354.56	0.5	98.31		26193	5.0	272239	51.6	-0.5			7.57
Tributary	83948.40		16224.07	1285.8	1293.18		1293.36	0.001836	8	7134.31	3333.97	0.52	98.31		26292	5.0	272141	51.5	0.0			7.38
Tributary	83918.40		16221.66	1285.8	1292.99		1293.18	0.002111	8.42	6810.8	3307.29	0.56	98.31		26390	5.0	272043	51.5	-0.5			7.19
Tributary	83888.50		16214.44	1285.81	1292.76		1292.99	0.002561	9.06	6371.64	3256.37	0.61	98.31		26488	5.0	271944	51.5	-0.5			6.95
Tributary	83858.50		16185.8	1285.82	1292.43		1292.74	0.003636	10.44	5607.1	3128.67	0.72	98.31		26586	5.0	271846	51.5	-0.5			6.61
Tributary	83828.57		16168.33	1285.83	1292.35		1292.36	0.000328	3.11	18733.16	9610.08	0.22	96.9	Center South Dayton	26685	5.1	271748	51.5	0.5			6.52
Tributary	83799.00		16176.68	1285.82	1292.32		1292.33	0.000343	3.17	18539.55	9679.74	0.22	96.9		26782	5.1	271651	51.4	0.5			6.5
Tributary	83769.50		16160.53	1285.81	1292.28		1292.3	0.000359	3.24	18333.52	9770.97	0.23	96.9		26879	5.1	271554	51.4	0.5			6.47
Tributary	83739.90		16158.57	1285.8	1292.25		1292.26	0.000378	3.31	18100.98	9842.29	0.23	96.9		26975	5.1	271457	51.4	0.5			6.45
Tributary	83710.40		16151.82	1285.79	1292.21		1292.23	0.000399	3.39	17861.93	9925.71	0.24	96.9		27072	5.1	271360	51.4	0.5			6.42
Tributary	83680.90		16137.65	1285.78	1292.17		1292.19	0.000422	3.48	17611.15	10017.96	0.24	96.9		27169	5.1	271263	51.4	0.0			6.39
Tributary	83651.30		16148.47	1285.78	1292.13		1292.15	0.000451	3.58	17342.55	10138.9	0.25	96.9		27266	5.2	271166	51.4	0.5			6.35
Tributary	83621.80		16136.15	1285.77	1292.09		1292.11	0.000483	3.7	17064.18	10279.77	0.26	96.9		27363	5.2	271069	51.3	0.5			6.32
Tributary	83592.30		16141.44	1285.76	1292.04		1292.06	0.000519	3.82	16772.6	10402.5	0.27	96.9		27460	5.2	270972	51.3	0.5			6.28
Tributary	83562.70		16130.46	1285.75	1291.99		1292.02	0.00056	3.95	16458.86	10531.05	0.28	96.9		27557	5.2	270876	51.3	0.5			6.24
Tributary	83533.20		16126.01	1285.74	1291.94		1291.96	0.000606	4.08	16105.36	10633.57	0.29	96.9		27654	5.2	270779	51.3	0.5			6.2
Tributary	83503.70		16124.51	1285.73	1291.88		1291.91	0.00066	4.24	15744.98	11205.29	0.3	96.9		27751	5.3	270682	51.3	0.5			6.15
Tributary	83474.10		16121.33	1285.72	1291.82		1291.85	0.000764	4.54	15439.39	11589.17	0.33	96.9		27848	5.3	270585	51.2	0.0			6.1
Tributary	83444.60		16119.78	1285.72	1291.76		1291.79	0.000838	4.72	15131.19	11930.77	0.34	96.9		27944	5.3	270488	51.2	0.5			6.04
Tributary	83415.00		16107.67	1285.71	1291.69		1291.72	0.000895	4.84	14863.4	12500.66	0.35	96.9		28041	5.3	270391	51.2	0.5			5.98
Tributary	83385.50		16110.97	1285.7	1291.61		1291.65	0.000973	5.01	14611.51	13782.51	0.37	96.9		28138	5.3	270294	51.2	0.5			5.91
Tributary	83356.00		16104.81	1285.69	1291.53		1291.57	0.001101	5.28	14351.79	13035.33	0.39	96.9		28235	5.3	270197	51.2	0.5			5.84
Tributary	83326.40		16105.7	1285.68	1291.44		1291.48	0.001129	5.29	14051.52	12948.07	0.39	96.9		28332	5.4	270100	51.2	0.5			5.76
Tributary	83296.90		16100.82	1285.67	1291.34		1291.38	0.001197	5.39	13650.7	12820.54	0.4	96.9		28429	5.4	270003	51.1	0.0			5.67
Tributary	83267.40		16094.97	1285.67	1291.22		1291.27	0.001352	5.64	13101.59	11438.69	0.43	96.9		28526	5.4	269907	51.1	0.5			5.55
Tributary	83237.80		16095.53	1285.66	1291.08		1291.14	0.001524	5.89	12478.78	11223.65	0.45	96.9		28623	5.4	269810	51.1	0.5			5.42
Tributary	83208.30		16093.86	1285.65	1290.94		1291	0.001765	6.22	11924.03	11046.16	0.48	96.9		28720	5.4	269713	51.1	0.5			5.29
Tributary	83178.80		16089.92	1285.64	1290.79		1290.86	0.001885	6.31	11457.93	11442.56	0.5	96.9		28817	5.5	269616	51.1	0.5			5.15
Tributary	83149.20		16090.23	1285.63	1290.64		1290.71	0.002016	6.4	11208.28	11381.08	0.51	96.9		28913	5.5	269519	51.0	0.5			5.01
Tributary	83119.70		16088.34	1285.62	1290.49		1290.55	0.002012	6.26	11050.35	11066.15	0.51	96.9		29010	5.5	269422	51.0	0.5			4.87
Tributary	83090.20		16083.99	1285.61	1290.33		1290.39	0.001955	6.02	10939.57	11694.63	0.5	96.9		29107	5.5	269325	51.0	0.0			4.72
Tributary	83060.60		16082.35	1285.61	1290.16		1290.22	0.001877	5.75	10793.89	11264.86	0.48	96.9		29204	5.5	269228	51.0	0.5			4.55
Tributary	83031.15		16078.65	1285.6	1290		1290.05	0.001736	5.39	10828.96	6892.92	0.46	99.06	South Dayton Limits	29301	5.5	269131	51.0	1.6			4.4
Tributary	83000.90		16076.02	1285.57	1289.84		1289.89	0.00184	5.44	10363.11	9440.49	0.47	99.06		29400	5.6	269032	51.0	1.1			4.27
Tributary	82970.70		16075.67	1285.55	1289.68		1289.73	0.001903	5.41	10039.58	8228.56	0.48	99.06		29499	5.6	268933	50.9	1.6			4.13
Tributary	82940.50		16074.86	1285.52	1289.52		1289.58	0.001925	5.32	9993.29	7785.54	0.48	99.06		29598	5.6	268834	50.9	1.1			4
Tributary	82910.30		16074.02	1285.5	1289.36		1289.41	0.001906	5.17	10011.19	7734.81	0.47	99.06		29697	5.6	268735	50.9	1.6			3.86
Tributary	82880.10		16071.65	1285.47	1289.19		1289.24	0.001893	5.02	9999.04	7642.61	0.47	99.06		29796	5.6	268636	50.9	1.1			3.72
Tributary	82849.90		16069.82	1285.45	1289.01		1289.06	0.001924	4.92	9913.9	7550.47	0.47	99.06		29895	5.7	268537	50.9	1.6			3.56
Tributary	82819.70		16068.92	1285.42	1288.82		1288.87	0.001993	4.85	9773.9	7460.19	0.47	99.06		29994	5.7	268438	50.8	1.1			3.4
Tributary	82789.60		16067.69	1285.4	1288.64		1288.69	0.002036	4.74	9677.58	7371.77	0.48	99.06		30094	5.7	268339	50.8	1.6			3.24
Tributary	82759.40		16064.06	1285.37	1288.46		1288.51	0.002033	4.59	9645.33	7277.14	0.47	99.06		30193	5.7	268240	50.8	1.1			3.09
Tributary	82729.20		16063.37	1285.35	1288.29		1288.34	0.002017	4.42	9633.5	7178.91	0.47	99.06		30292	5.7	268141	50.8	1.6			2.94
Tributary	82699.00		16061.73	1285.32	1288.11		1288.16	0.001988	4.24	9630.59	7058.65	0.46	99.06		30391	5.8	268042	50.8	1.1			2.79
Tributary	82668.80		16059.49	1285.3	1287.93		1287.98	0.002002	4.08	9555.57	6915.23	0.46	99.06		30490	5.8	267943	50.7	1.6			2.63
Tributary	82638.60		16058.67	1285.27	1287.74		1287.79	0.002055	3.95	9423.34	6721.92	0.46	99.06		30589	5.8	267844	50.7	1.1			2.47
Tributary	82608.40		16057.44	1285.25	1287.55		1287.59	0.002107	3.82	9296.18	6600.74	0.46	99.06		30688	5.8	267745	50.7	1.6			2.3
Tributary	82578.20		16055.59	1285.22	1287.37		1287.41	0.002091	3.62	9260.15	6490.65	0.45	99.06		30787	5.8	267645	50.7	1.1			2.15
Tributary	82548.00		16048.72	1285.2	1287.19		1287.24	0.002045	3.41	9261.14	6382.12	0.44	99.06		30886	5.8	267546	50.7	1.6			1.99
Tributary	82517.80		16047.99	1285.17	1287.03		1287.08	0.001962	3.18	9316.5	6275.08	0.42	99.06		30985	5.9	267447	50.7	1.1			1.88
Tributary	82487.60		16041.99	1285.15	1286.86		1286.91	0.001891	2.96	9353.21	6164.04	0.41	99.06		31084	5.9	267348	50.6	1.6			1.71
Tributary	82457.40		16034.35	1285.12	1286.69		1286.73	0.001874	2.76	9302.56	6043.25	0.4	99.06		31183	5.9	267249	50.6	1.1			1.57
Tributary	82427.20		16024.05	1285.1	1286.51		1286.56	0.001857	2.56	9246.88	5920.46	0.39	99.06		31282	5.9	267150	50.6	1.1			1.41
Tributary	82397.00		15997.22	1285.08	1286.35		1286.39	0.001777	2.33	9285.9	5805.02	0.38	99.06		31381	5.9	267051	50.6	1.6			1.27
Tributary	82366.80		15989.58	1285.05	1286.2		1286.25	0.001648	2.1	9421.53	5698.27	0.36	99.06		31480	6.0	266952	50.6	1.1			1.15
Tributary	82336.70		15941.58	1285.03	1286.08		1286.12	0.001485	1.86	9633.54	5600.15	0.33	99.06		31579	6.0	266853	50.5	1.6			1.05
Tributary	82306.50		15875.94	1285	1285.96		1286	0.001323	1.65	9875.89	5505.63	0.31	99.06		31678	6.0	266754	50.5	1.1			0.96

Tributary	82276.30		15726.22	1284.98	1285.85		1285.88	0.001165	1.45	10133.9	5430.73	0.29	99.06		31778	6.0	266655	50.5	1.6			0.87
Tributary	82246.10		15688.65	1284.95	1285.75		1285.79	0.001021	1.29	10486.22	5463.23	0.26	99.06		31877	6.0	266556	50.5	1.1			0.8
Tributary	82215.90		15590.12	1284.93	1285.67		1285.7	0.000888	1.14	10898.17	5959.97	0.24	99.06		31976	6.1	266457	50.5	1.6			0.74
Tributary	82185.70		15525.92	1284.9	1285.6		1285.63	0.000976	1.14	11441.71	6554.54	0.25	99.06		32075	6.1	266358	50.4	1.1			0.7
Tributary	82155.50		15434.98	1284.88	1285.52		1285.55	0.000798	0.99	12018.15	6443.86	0.23	99.06		32174	6.1	266259	50.4	1.6			0.64
Tributary	82125.30		15315.46	1284.85	1285.46		1285.48	0.00066	0.86	12586.51	6319.93	0.2	99.06		32273	6.1	266160	50.4	1.1			0.61
Tributary	82095.10		15265.29	1284.83	1285.4		1285.42	0.000545	0.76	13185.03	6186.14	0.18	99.06		32372	6.1	266061	50.4	1.6			0.57
Tributary	82064.90		15163.97	1284.8	1285.35		1285.37	0.000449	0.67	13788.9	6057	0.17	99.06		32471	6.1	265961	50.4	1.1			0.55
Tributary	82034.76		15059.95	1284.78	1285.32		1285.33	0.00037	0.61	14412.36	5933.55	0.15	98.59		32570	6.2	265862	50.4	15.5			0.54
Tributary	82004.70		15059.2	1284.49	1285.28		1285.3	0.000367	0.78	14426.54	5915.77	0.16	98.59		32669	6.2	265764	50.3	15.5			0.79
Tributary	81974.60		14981.92	1284.2	1285.25		1285.26	0.00036	0.93	14439.13	5897.7	0.17	98.59		32767	6.2	265665	50.3	15.5			1.05
Tributary	81944.60		14955.17	1283.91	1285.21		1285.23	0.000355	1.07	14466.86	5882.33	0.17	98.59		32866	6.2	265567	50.3	15.5			1.3
Tributary	81914.50		14848.4	1283.62	1285.18		1285.2	0.000345	1.19	14496.41	5867.1	0.17	98.59		32964	6.2	265468	50.3	15.0			1.56
Tributary	81884.50		14821.49	1283.34	1285.15		1285.16	0.00034	1.3	14527.33	5852.69	0.18	98.59		33063	6.3	265369	50.3	15.5			1.81
Tributary	81854.40		14739.84	1283.05	1285.12		1285.13	0.000331	1.4	14576.5	5845.2	0.18	98.59		33162	6.3	265271	50.2	15.5			2.07
Tributary	81824.40		14656.75	1282.76	1285.09		1285.1	0.000322	1.5	14623.03	5846.3	0.18	98.59		33260	6.3	265172	50.2	15.5			2.33
Tributary	81794.30		14630.07	1282.47	1285.06		1285.07	0.000316	1.59	14681.13	5846.2	0.18	98.59		33359	6.3	265074	50.2	15.5			2.59
Tributary	81764.30		14600.99	1282.18	1285.03		1285.04	0.000309	1.68	14744.24	5847.47	0.18	98.59		33457	6.3	264975	50.2	15.0			2.85
Tributary	81734.20		14545.06	1281.9	1285		1285.01	0.000301	1.75	14817.94	5846.24	0.18	98.59		33556	6.4	264877	50.2	15.5			3.1
Tributary	81704.20		14517.67	1281.61	1284.97		1284.98	0.000294	1.83	14893.9	5844.29	0.18	98.59		33655	6.4	264778	50.1	15.5			3.36
Tributary	81674.10		14432.92	1281.32	1284.94		1284.96	0.000284	1.89	14984.06	5843.62	0.18	98.59		33753	6.4	264679	50.1	15.5			3.62
Tributary	81644.10		14431.7	1281.03	1284.92		1284.93	0.000277	1.96	15076.94	5841.39	0.18	98.59		33852	6.4	264581	50.1	15.5			3.89
Tributary	81614.00		14376.26	1280.74	1284.89		1284.91	0.000268	2.01	15181.71	5838.67	0.18	98.59		33950	6.4	264482	50.1	15.5			4.15
Tributary	81584.00		14320.89	1280.45	1284.87		1284.88	0.000259	2.06	15292.33	5832.85	0.18	98.59		34049	6.4	264384	50.1	15.0			4.42
Tributary	81553.90		14293.02	1280.17	1284.84		1284.85	0.000251	2.11	15408.85	5825.69	0.18	98.59		34147	6.5	264285	50.1	15.5			4.67
Tributary	81523.90		14263.76	1279.88	1284.82		1284.83	0.000242	2.15	15537.14	5817.77	0.18	98.59		34246	6.5	264186	50.0	15.5			4.94
Tributary	81493.80		14155.06	1279.59	1284.8		1284.81	0.000231	2.18	15668.84	5809.68	0.17	98.59		34345	6.5	264088	50.0	15.5			5.21
Tributary	81463.80		14154.55	1279.3	1284.77		1284.79	0.000224	2.22	15803.32	5804.4	0.17	98.59		34443	6.5	263989	50.0	15.5			5.47
Tributary	81433.70		14153.42	1279.01	1284.75		1284.77	0.000217	2.25	15949.31	5797.69	0.17	98.59		34542	6.5	263891	50.0	15.5			5.74
Tributary	81403.70		14073.33	1278.72	1284.73		1284.75	0.000207	2.27	16101.64	5793.6	0.17	98.59		34640	6.6	263792	50.0	15.0			6.01
Tributary	81373.60		14072.63	1278.44	1284.71		1284.73	0.0002	2.29	16261.01	5787.84	0.17	98.59		34739	6.6	263693	49.9	15.5			6.27
Tributary	81343.60		14019.24	1278.15	1284.69		1284.71	0.000192	2.31	16425.06	5777.38	0.16	98.59		34838	6.6	263595	49.9	15.5			6.54
Tributary	81313.50		13968.1	1277.86	1284.68		1284.69	0.000183	2.32	16591.67	5767.81	0.16	98.59		34936	6.6	263496	49.9	15.5			6.82
Tributary	81283.50		13967.36	1277.57	1284.66		1284.67	0.000176	2.33	16773.88	5760.53	0.16	98.59		35035	6.6	263398	49.9	15.5			7.09
Tributary	81253.40		13943.72	1277.28	1284.64		1284.66	0.000169	2.35	16951.39	5754.39	0.16	98.59		35133	6.7	263299	49.9	15.0			7.36
Tributary	81223.40		13942.37	1277	1284.63		1284.64	0.000162	2.35	17145.15	5750.67	0.15	98.59		35232	6.7	263200	49.8	15.5			7.63
Tributary	81193.30		13871.89	1276.71	1284.61		1284.63	0.000154	2.35	17342.78	5742.59	0.15	98.59		35331	6.7	263102	49.8	15.5			7.9
Tributary	81163.30		13871.46	1276.42	1284.6		1284.61	0.000148	2.35	17538.39	5736.06	0.15	98.59		35429	6.7	263003	49.8	15.5			8.18
Tributary	81133.20		13850.05	1276.13	1284.58		1284.6	0.000141	2.35	17748.99	5728.71	0.15	98.59		35528	6.7	262905	49.8	15.5			8.45
Tributary	81103.20		13828.49	1275.84	1284.57		1284.58	0.000135	2.35	17956.01	5720.91	0.14	98.59		35626	6.7	262806	49.8	15.5			8.73
Tributary	81073.10		13827.82	1275.55	1284.56		1284.57	0.000129	2.35	18171.08	5714.34	0.14	98.59		35725	6.8	262708	49.8	15.0			9.01
Tributary	81043.10		13806.18	1275.27	1284.55		1284.56	0.000123	2.34	18402.09	5715.13	0.14	98.59		35823	6.8	262609	49.7	15.5			9.28
Tributary	81013.00		13785.34	1274.98	1284.53		1284.55	0.000118	2.33	18625.3	5715.51	0.14	98.59		35922	6.8	262510	49.7	15.5			9.55
Tributary	80983.00		13764.75	1274.69	1284.52		1284.54	0.000112	2.32	18857.58	5715.73	0.13	98.59		36021	6.8	262412	49.7	15.5			9.83
Tributary	80952.90		13763.99	1274.4	1284.51		1284.53	0.000107	2.31	19093.02	5714.09	0.13	98.59		36119	6.8	262313	49.7	15.5			10.11
Tributary	80922.90		13745.33	1274.11	1284.5		1284.52	0.000103	2.3	19339.43	5726.39	0.13	97.67		36218	6.9	262215	49.7	-0.5			10.39
Tributary	80893.10		13744.62	1274.12	1284.49		1284.51	0.000106	2.33	19118.22	5697.9	0.13	97.67		36316	6.9	262117	49.6	0.0			10.37
Tributary	80863.30		13726.5	1274.12	1284.48		1284.5	0.000108	2.36	18903.94	5654.59	0.13	97.67		36413	6.9	262019	49.6	-0.5			10.36
Tributary	80833.50		13725.66	1274.13	1284.47		1284.49	0.000111	2.39	18684.61	5610.73	0.13	97.67		36511	6.9	261922	49.6	0.0			10.34
Tributary	80803.80		13724.82	1274.13	1284.46		1284.47	0.000115	2.42	18467.77	5567.68	0.14	97.67		36609	6.9	261824	49.6	-0.5			10.33
Tributary	80774.00		13723.95	1274.14	1284.45		1284.46	0.000118	2.45	18254.79	5525.36	0.14	97.67		36706	7.0	261726	49.6	0.0			10.31
Tributary	80744.20		13690.74	1274.14	1284.44		1284.45	0.000121	2.47	18041.97	5482.14	0.14	97.67		36804	7.0	261629	49.6	0.0			10.3
Tributary	80714.50		13673.48	1274.14	1284.43		1284.44	0.000124	2.5	17826.35	5447.74	0.14	97.67		36902	7.0	261531	49.5	-0.5			10.29
Tributary	80684.70		13689.02	1274.15	1284.41		1284.43	0.000128	2.54	17612.66	5416.07	0.14	97.67		36999	7.0	261433	49.5	0.0			10.26
Tributary	80654.90		13656.97	1274.15	1284.4		1284.42	0.000132	2.57	17394.69	5386.12	0.15	97.67		37097	7.0	261336	49.5	-0.5			10.25
Tributary	80625.10		13656.2	1274.16	1284.39		1284.4	0.000136	2.6	17184.64	5354.46	0.15	97.67		37195	7.0	261238	49.5	0.0			10.23
Tributary	80595.40		13655.63	1274.16	1284.37		1284.39	0.000141	2.64	16977.05	5324.96	0.15	97.67		37292	7.1	261140	49.5	0.0			10.21
Tributary	80565.60		13626.22	1274.16	1284.36		1284.38	0.000145	2.67	16773.69	5297.62	0.15	97.67		37390	7.1	261043	49.4	-0.5			10.2
Tributary	80535.80		13625.63	1274.17	1284.35		1284.36	0.00015	2.71	16566.18	5270.94	0.16	97.67		37488	7.1	260945	49.4	0.0			10.18
Tributary	80506.10		13611.72	1274.17	1284.33		1284.35	0.000154	2.74	16364.83	5244.52	0.16	97.67		37585	7.1	260847	49.4	-0.5			10.16
Tributary	80476.30		13610.93	1274.18	1284.32		1284.33	0.000161	2.79	16159.2	5257.86	0.16	97.67		37683	7.1	260750	49.4	0.0			10.14
Tributary	80446.50		13610.06	1274.18	1284.3		1284.32	0.000167	2.84	15966.82	5277.36	0.16	97.67		37781	7.2	260652	49.4	-0.5			10.12
Tributary	80416.70		13597.2	1274.19	1284.28		1284.3	0.000173	2.88	15779.63	5264.36	0.17	97.67		37878	7.2	260554	49.3	0.0			10.09
Tributary	80387.00		13569.53	1274.19	1284.27		1284.29	0.000178	2.92	15598.06	5247.61	0.17	97.67		37976	7.2	260457	49.3	0.0			10.08
Tributary	80357.20		13583.01	1274.19	1284.25		1284.27	0.000184	2.96	15422.39	5235.77	0.17	97.67		38074	7.2	260359	49.3	-0.5			10.06
Tributary	80327.40		13544.61	1274.2	1284.23		1284.25	0.00019	3	15245.6	5222.27	0.17	97.67		38171	7.2	260261	49.3	0.0			10.03
Tributary	80297.70		13556.67	1274.2	1284.21		1284.24	0.000196	3.04	15076.01	5207.23	0.18	97.67		38269	7.2	260164	49.3	-0.5			10.01
Tributary	80267.90		13544.49	1274.21	1284.19		1284.22	0.000203	3.08	14910.72	5200.38	0.18	97.67		38367	7.3	260066	49.3	0.0			9.98
Tributary	80238.10		13532.91	1274.21	1284.17		1284.2	0.000209	3.12	14745.62	5196.36	0.18	97.67		38464	7.3	259968	49.2	-0.5			9.96
Tributary	80208.40		13542.99	1274.22	1284.15		1284.18	0.000217	3.17	14590.64	5193.01	0.19	97.67		38562	7.3	259871	49.2	0.0			9.93
Tributary	80178.60		13531.5	1274.22	1284.13		1284.16	0.000224	3.21	14436.34	5191.59	0.19	97.67		38660	7.3	259773	49.2	0.0			9.91
Tributary	80148.80		13508.19	1274.22	1284.11		1284.14	0.00023	3.25	14301.84	5191.69	0.19	97.67		38757	7.3	259675	49.2	-0.5			9.89
Tributary	80119.00		13496.72	1274.23	1284.09		1284.11	0.000237	3.29	14162.16	5197.5	0.19	97.67		38855	7.4	259577	49.2	0.0			9.86
Tributary	80089.30		13485.99	1274.23	1284.06		1284.09	0.000244	3.33	14031.41	5197.98	0.2	97.67		38953	7.4	259480	49.1	-0.5			9.83
Tributary	80059.50		13495.64	1274.24	1284.04		1284.07	0.000252	3.37	13908.47	5195.74	0.2	97.67		39050	7.4	259382	49.1	0.0			9.8
Tributary	80029.70		13474.71	1274.24	1284.02		1284.05	0.000258	3.4	13798.49	5196.74	0.2	97.67		39148	7.4	259284	49.1	-0.5			9.78
Tributary	80000.00		13484.29	1274.25	1283.99		1284.02	0.000266	3.43	13685.73	5193.83	0.2	99.42		39246	7.4	259187	49.1	0.0			9.74
Tributary	79969.70		13463.49	1274.25	1283.96		1284	0.000277	3.51	13510.62	5218	0.21	99.42		39345	7.5	259087	49.1	0.0			9.71
Tributary	79939.30		13453.01	1274.25	1283.94		1283.97	0.000289	3.58	13337.82	5244.11	0.21	99.42		39444	7.5	258988	49.1	-0.5			9.69
Tributary	79909.00		13442.72	1274.26	1283.91		1283.94	0.000302	3.66	13161.56	5276.47	0.22	99.42		39544	7.5	258889	49.0	0.0			9.65
Tributary	79878.70		13432.79	1274.26	1283.88		1283.91	0.000317	3.74	12984.09	5307.17	0.22	99.42		39643	7.5	258789	49.0	-0.5			9.62
Tributary	79848.40		13424.05	1274.27	1283.84		1283.88	0.000331	3.82	12813.66	5335.62	0.23	99.42		39743	7.5	258690	49.0	0.0			9.57
Tributary	79818.10		13413.81	1274.27	1283.81		1283.85	0.000346	3.9	12645.78	5363.75	0.23	99.42		39842	7.5	258590	49.0	-0.5			9.54

Tributary	79787.80		13413.05	1274.28	1283.77		1283.82	0.000362	3.98	12466.33	5184.84	0.24	99.42		39942	7.6	258491	49.0	0.0			9.49
Tributary	79757.50		13403.81	1274.28	1283.73		1283.78	0.000377	4.06	12300.72	5304.01	0.24	99.42		40041	7.6	258391	48.9	-0.5			9.45
Tributary	79727.20		13386.06	1274.29	1283.7		1283.75	0.000392	4.13	12139.86	5417.06	0.25	99.42		40140	7.6	258292	48.9	0.0			9.41
Tributary	79696.90		13376.64	1274.29	1283.66		1283.71	0.000407	4.2	11982.52	5424.05	0.25	99.42		40240	7.6	258193	48.9	-0.5			9.37
Tributary	79666.60		13367.91	1274.3	1283.62		1283.67	0.000423	4.27	11818.83	5429.23	0.26	99.42		40339	7.6	258093	48.9	0.0			9.32
Tributary	79636.30		13366.7	1274.3	1283.57		1283.63	0.000438	4.34	11662.83	5427.09	0.26	99.42		40439	7.7	257994	48.9	-0.5			9.27
Tributary	79606.00		13341.61	1274.31	1283.53		1283.59	0.000448	4.37	11514.65	5385.64	0.26	99.42		40538	7.7	257894	48.8	0.0			9.22
Tributary	79575.70		13341.07	1274.31	1283.49		1283.55	0.000456	4.4	11385.81	5322.41	0.27	99.42		40637	7.7	257795	48.8	-0.5			9.18
Tributary	79545.40		13323.86	1274.32	1283.44		1283.51	0.000461	4.41	11270.96	5250.63	0.27	99.42		40737	7.7	257696	48.8	0.0			9.12
Tributary	79515.10		13323.13	1274.32	1283.4		1283.46	0.000463	4.4	11185.63	5176.18	0.27	99.42		40836	7.7	257596	48.8	-0.5			9.08
Tributary	79484.80		13297.96	1274.33	1283.36		1283.42	0.000459	4.37	11116.98	5384.65	0.27	99.42		40936	7.8	257497	48.8	0.0			9.03
Tributary	79454.50		13281.3	1274.33	1283.31		1283.37	0.000453	4.33	11086.2	5301.16	0.26	99.42		41035	7.8	257397	48.7	-0.5			8.98
Tributary	79424.20		13289.52	1274.34	1283.27		1283.33	0.000445	4.28	11079.2	4308.65	0.26	99.42		41135	7.8	257298	48.7	0.0			8.93
Tributary	79393.90		13280.85	1274.34	1283.23		1283.29	0.000441	4.25	11085.86	4394.83	0.26	99.42		41234	7.8	257198	48.7	-0.5			8.89
Tributary	79363.60		13256.03	1274.35	1283.19		1283.24	0.00043	4.18	11113.81	4333.28	0.26	99.42		41333	7.8	257099	48.7	0.0			8.84
Tributary	79333.30		13263.75	1274.35	1283.15		1283.2	0.000425	4.14	11160.39	4837.44	0.26	99.42		41433	7.8	257000	48.7	-0.5			8.8
Tributary	79303.00		13255.65	1274.36	1283.1		1283.16	0.000419	4.1	11207.53	4345.99	0.25	99.42		41532	7.9	256900	48.7	0.0			8.74
Tributary	79272.70		13239.64	1274.36	1283.06		1283.12	0.000412	4.05	11260.69	4850.62	0.25	99.42		41632	7.9	256801	48.6	-0.5			8.7
Tributary	79242.40		13231.97	1274.37	1283.03		1283.08	0.000404	4	11327.23	4854.26	0.25	99.42		41731	7.9	256701	48.6	0.0			8.66
Tributary	79212.10		13231.11	1274.37	1282.99		1283.04	0.000397	3.95	11405.21	4868.7	0.25	99.42		41831	7.9	256602	48.6	-0.5			8.62
Tributary	79181.80		13229.78	1274.38	1282.95		1283	0.000391	3.91	11476.27	4891.25	0.24	99.42		41930	7.9	256502	48.6	0.0			8.57
Tributary	79151.50		13215.41	1274.38	1282.91		1282.96	0.000383	3.85	11565.67	4912.51	0.24	99.42		42029	8.0	256403	48.6	-0.5			8.53
Tributary	79121.20		13214.44	1274.39	1282.87		1282.92	0.000373	3.79	11662.79	4914.29	0.24	99.42		42129	8.0	256304	48.5	0.0			8.48
Tributary	79090.90		13192.29	1274.39	1282.84		1282.89	0.000355	3.68	11776.47	4866.37	0.23	99.42		42228	8.0	256204	48.5	-0.5			8.45
Tributary	79060.60		13198.98	1274.4	1282.81		1282.85	0.000341	3.6	11921.78	4816.1	0.23	99.42		42328	8.0	256105	48.5	0.0			8.41
Tributary	79030.30		13185.52	1274.4	1282.78		1282.82	0.000325	3.5	12087.78	4793.51	0.22	99.42		42427	8.0	256005	48.5	-0.5			8.38
Tributary	79000.00		13184.83	1274.41	1282.75		1282.78	0.000309	3.41	12270.62	4771.85	0.22	99.42		42526	8.1	255906	48.5	0.5			8.34
Tributary	78969.70		13178.26	1274.4	1282.72		1282.75	0.000314	3.42	12227.68	4781.89	0.22	99.42		42626	8.1	255807	48.4	0.0			8.32
Tributary	78939.30		13171.09	1274.4	1282.68		1282.72	0.000318	3.44	12178.28	4789.6	0.22	99.42		42725	8.1	255707	48.4	0.5			8.28
Tributary	78909.00		13170.63	1274.39	1282.65		1282.69	0.000323	3.45	12137.95	4795.7	0.22	99.42		42825	8.1	255608	48.4	0.5			8.26
Tributary	78878.70		13164.64	1274.38	1282.62		1282.66	0.000328	3.46	12086.82	4801.81	0.22	99.42		42924	8.1	255508	48.4	0.5			8.24
Tributary	78848.40		13163.85	1274.37	1282.59		1282.63	0.000333	3.48	12040.68	4808.61	0.22	99.42		43024	8.1	255409	48.4	0.0			8.22
Tributary	78818.10		13152.21	1274.37	1282.56		1282.6	0.000339	3.49	11987.52	4816.51	0.22	99.42		43123	8.2	255309	48.4	0.5			8.19
Tributary	78787.80		13151.64	1274.36	1282.53		1282.57	0.000345	3.51	11933.87	4827.87	0.23	99.42		43222	8.2	255210	48.3	0.5			8.17
Tributary	78757.50		13145.35	1274.35	1282.49		1282.53	0.000351	3.53	11881.55	4838.42	0.23	99.42		43322	8.2	255111	48.3	0.0			8.14
Tributary	78727.20		13150.38	1274.35	1282.46		1282.5	0.000358	3.55	11829.89	4850.55	0.23	99.42		43421	8.2	255011	48.3	0.5			8.11
Tributary	78696.90		13144.73	1274.34	1282.42		1282.46	0.000366	3.57	11763.23	4864.61	0.23	99.42		43521	8.2	254912	48.3	0.5			8.08
Tributary	78666.60		13133.51	1274.33	1282.39		1282.43	0.000373	3.59	11708.73	4880.7	0.23	99.42		43620	8.3	254812	48.3	0.0			8.06
Tributary	78636.30		13128.6	1274.33	1282.35		1282.39	0.000382	3.62	11648.32	4903.65	0.24	99.42		43720	8.3	254713	48.2	0.5			8.02
Tributary	78606.00		13123.05	1274.32	1282.32		1282.36	0.000391	3.65	11587.78	4929.91	0.24	99.42		43819	8.3	254613	48.2	0.5			8
Tributary	78575.70		13127.71	1274.31	1282.28		1282.32	0.000402	3.68	11521.83	4952.93	0.24	99.42		43918	8.3	254514	48.2	0.5			7.97
Tributary	78545.40		13126.84	1274.3	1282.24		1282.28	0.000411	3.7	11461.68	4966.78	0.24	99.42		44018	8.3	254415	48.2	0.0			7.94
Tributary	78515.10		13122.49	1274.3	1282.2		1282.24	0.00042	3.73	11395.93	4980.79	0.25	99.42		44117	8.4	254315	48.2	0.5			7.9
Tributary	78484.80		13112.63	1274.29	1282.16		1282.2	0.000431	3.75	11322.19	4996.62	0.25	99.42		44217	8.4	254216	48.1	0.5			7.87
Tributary	78454.50		13112.03	1274.28	1282.12		1282.16	0.000442	3.78	11247.55	5011.61	0.25	99.42		44316	8.4	254116	48.1	0.0			7.84
Tributary	78424.20		13111.05	1274.28	1282.08		1282.12	0.000454	3.81	11175.25	5027	0.26	99.42		44415	8.4	254017	48.1	0.5			7.8
Tributary	78393.90		13107.43	1274.27	1282.03		1282.08	0.000468	3.85	11086.42	5041.89	0.26	99.42		44515	8.4	253918	48.1	0.5			7.76
Tributary	78363.60		13102.42	1274.26	1281.99		1282.03	0.00048	3.88	11011.52	5057.62	0.26	99.42		44614	8.4	253818	48.1	0.0			7.73
Tributary	78333.30		13097.94	1274.26	1281.94		1281.98	0.000496	3.92	10915.9	5072.03	0.27	99.42		44714	8.5	253719	48.1	0.5			7.68
Tributary	78303.00		13097.04	1274.25	1281.89		1281.94	0.000514	3.96	10818.52	5093.11	0.27	99.42		44813	8.5	253619	48.0	0.5			7.64
Tributary	78272.70		13089.08	1274.24	1281.84		1281.89	0.000532	4.01	10715.07	5110.33	0.28	99.42		44913	8.5	253520	48.0	0.0			7.6
Tributary	78242.40		13088.5	1274.24	1281.78		1281.83	0.000552	4.05	10604.22	5113.43	0.28	99.42		45012	8.5	253420	48.0	0.5			7.54
Tributary	78212.10		13083.98	1274.23	1281.73		1281.78	0.000574	4.1	10478.62	5117.15	0.28	99.42		45111	8.5	253321	48.0	0.5			7.5
Tributary	78181.80		13083.22	1274.22	1281.67		1281.72	0.0006	4.16	10341.26	5117.89	0.29	99.42		45211	8.6	253222	48.0	0.5			7.45
Tributary	78151.50		13079.77	1274.21	1281.61		1281.66	0.000626	4.21	10205.33	5117.55	0.3	99.42		45310	8.6	253122	47.9	0.0			7.4
Tributary	78121.20		13071.59	1274.21	1281.55		1281.6	0.000656	4.28	10054.67	5118.12	0.3	99.42		45410	8.6	253023	47.9	0.5			7.34
Tributary	78090.90		13063.69	1274.2	1281.48		1281.54	0.000689	4.35	9897.37	5113.58	0.31	99.42		45509	8.6	252923	47.9	0.5			7.28
Tributary	78060.60		13059.37	1274.19	1281.41		1281.47	0.000731	4.44	9712.19	5109.49	0.32	99.42		45608	8.6	252824	47.9	0.0			7.22
Tributary	78030.30		13058.86	1274.19	1281.34		1281.4	0.000782	4.54	9519.56	5116.59	0.33	99.42		45708	8.7	252725	47.9	0.5			7.15
Tributary	78000.00		13046.2	1274.18	1281.26		1281.33	0.000842	4.66	9302.56	5124.43	0.34	99.42		45807	8.7	252625	47.8	-0.5			7.08
Tributary	77969.70		13041.39	1274.19	1281.18		1281.25	0.000838	4.62	9317.93	5109.45	0.34	99.42		45907	8.7	252526	47.8	-0.5			6.99
Tributary	77939.30		13036.45	1274.2	1281.11		1281.17	0.000835	4.58	9333.02	5097.37	0.34	99.42		46006	8.7	252426	47.8	-0.5			6.91
Tributary	77909.00		13022.17	1274.21	1281.03		1281.09	0.000829	4.54	9353.43	5086.48	0.34	99.42		46106	8.7	252327	47.8	-0.5			6.82
Tributary	77878.70		13010.92	1274.22	1280.95		1281.01	0.000829	4.51	9360.59	5085.18	0.33	99.42		46205	8.8	252227	47.8	-0.5			6.73
Tributary	77848.40		13005.59	1274.23	1280.87		1280.93	0.000828	4.47	9372.55	5083.84	0.33	99.42		46304	8.8	252128	47.8	-1.1			6.64
Tributary	77818.10		13009.92	1274.25	1280.79		1280.85	0.000829	4.44	9382.29	5079.38	0.33	99.42		46404	8.8	252029	47.7	-0.5			6.54
Tributary	77787.80		12993.68	1274.26	1280.71		1280.77	0.000831	4.41	9375.47	5075.64	0.33	99.42		46503	8.8	251929	47.7	-0.5			6.45
Tributary	77757.50		12975.77	1274.27	1280.63		1280.69	0.000825	4.37	9395.83	5071.66	0.33	99.42		46603	8.8	251830	47.7	-0.5			6.36
Tributary	77727.20		12956.79	1274.28	1280.55		1280.61	0.000819	4.32	9418.88	5070.26	0.33	99.42		46702	8.8	251730	47.7	-0.5			6.27
Tributary	77696.90		12962.75	1274.29	1280.48		1280.53	0.000811	4.27	9462.28	5069.72	0.33	99.42		46802	8.9	251631	47.7	-0.5			6.19
Tributary	77666.60		12936.04	1274.3	1280.41		1280.46	0.000796	4.21	9509.18	5066.74	0.32	99.42		46901	8.9	251531	47.6	-0.5			6.11
Tributary	77636.30		12929.37	1274.31	1280.34		1280.39	0.000782	4.15	9569.05	5067.61	0.32	99.42		47000	8.9	251432	47.6	-0.5			6.03
Tributary	77606.00		12913.82	1274.32	1280.27		1280.31	0.000768	4.08	9627.66	5068.78	0.32	99.42		47100	8.9	251333	47.6	-0.5			5.95
Tributary	77575.70		12898.92	1274.33	1280.2		1280.24	0.00075	4.01	9695.47	5066.52	0.31	99.42		47199	8.9	251233	47.6	-0.5			5.87
Tributary	77545.40		12891.25	1274.34	1280.13		1280.17	0.000734	3.95	9762.76	5064.81	0.31	99.42		47299	9.0	251134	47.6	-1.1			5.79
Tributary	77515.10		12867.07	1274.36	1280.06		1280.1	0.000715	3.87	9834.59	5056.79	0.31	99.42		47398	9.0	251034	47.5	-0.5			5.7
Tributary	77484.80		12858.19	1274.37	1279.99		1280.04	0.000694	3.79	9928.07	5054.54	0.3	99.42		47497	9.0	250935	47.5	-0.5			5.62
Tributary	77454.50		12825.47	1274.38	1279.93		1279.97	0.000673	3.72	10009.25	5052.38	0.3	99.42		47597	9.0	250836	47.5	-0.5			5.55
Tributary	77424.20		12833.35	1274.39	1279.86		1279.9	0.000655	3.65	10102.73	5046.96	0.29	99.42		47696	9.0	250736	47.5	-0.5			5.47
Tributary	77393.90		12799.16	1274.4	1279.8		1279.84	0.000629	3.56	10215.34	5046.62	0.28	99.42		47796	9.1	250637	47.5	-0.5			5.4
Tributary	77363.60		12798.63	1274.41	1279.75		1279.78	0.000604	3.47	10355.32	5048.78	0.28	99.42		47895	9.1	250537	47.5	-0.5			5.34
Tributary	77333.30		12781.11	1274.42	1279.69		1279.73	0.000577	3.38	10498.48	5050.81	0.27	99.42		47995	9.1	250438	47.4	-0.5			5.27
Tributary	77303.00		12772.29	1274.43	1279.64		1279.67	0.000548	3.28	10677.11	5056.91	0.26	99.42		48094	9.1	250338	47.4	-0.5			5.21

Tributary	77272.70		12754.28	1274.44	1279.59		1279.62	0.000519	3.19	10855.83	5062.33	0.26	99.42		48193	9.1	250239	47.4	-0.5			5.15
Tributary	77242.40		12746.07	1274.45	1279.55		1279.58	0.000489	3.09	11066.4	5073.03	0.25	99.42		48293	9.1	250140	47.4	-0.5			5.1
Tributary	77212.10		12736.56	1274.46	1279.51		1279.53	0.000461	2.99	11281.8	5084.51	0.24	99.42		48392	9.2	250040	47.4	-1.1			5.05
Tributary	77181.80		12726.91	1274.48	1279.47		1279.49	0.000433	2.9	11504.29	5094.63	0.24	99.42		48492	9.2	249941	47.3	-0.5			4.99
Tributary	77151.50		12710.2	1274.49	1279.43		1279.45	0.000404	2.79	11755.52	5102.69	0.23	99.42		48591	9.2	249841	47.3	-0.5			4.94
Tributary	77121.20		12709.32	1274.5	1279.4		1279.42	0.000378	2.7	12009.3	5109.34	0.22	99.42		48691	9.2	249742	47.3	-0.5			4.9
Tributary	77090.90		12701.61	1274.51	1279.36		1279.38	0.000351	2.6	12291.98	5114.61	0.21	99.42		48790	9.2	249642	47.3	-0.5			4.85
Tributary	77060.60		12692.66	1274.52	1279.33		1279.35	0.000327	2.51	12569.19	5120.6	0.2	99.42		48889	9.3	249543	47.3	-0.5			4.81
Tributary	77030.30		12684.19	1274.53	1279.3		1279.32	0.000303	2.42	12865.96	5126.31	0.2	99.42		48989	9.3	249444	47.2	-0.5			4.77
Tributary	77000.00		12675.54	1274.54	1279.28		1279.3	0.000281	2.33	13171.1	5135.11	0.19	99.73		49088	9.3	249344	47.2	0.0			4.74
Tributary	76969.60		12682.12	1274.54	1279.25		1279.27	0.00029	2.36	13010.88	5085.82	0.19	99.73		49188	9.3	249245	47.2	0.5			4.71
Tributary	76939.20		12674.94	1274.53	1279.22		1279.24	0.000298	2.39	12847.96	5039.28	0.19	99.73		49288	9.3	249145	47.2	0.0			4.69
Tributary	76908.80		12652.95	1274.53	1279.19		1279.21	0.000306	2.41	12683.68	4994.79	0.2	99.73		49387	9.4	249045	47.2	0.0			4.66
Tributary	76878.40		12665.38	1274.53	1279.16		1279.18	0.000317	2.44	12512	4948.04	0.2	99.73		49487	9.4	248945	47.1	0.5			4.63
Tributary	76848.00		12658.77	1274.52	1279.13		1279.15	0.000328	2.48	12342.68	4904.58	0.2	99.73		49587	9.4	248846	47.1	0.0			4.61
Tributary	76817.60		12651.39	1274.52	1279.1		1279.12	0.000339	2.51	12163.11	4856.81	0.21	99.73		49687	9.4	248746	47.1	0.5			4.58
Tributary	76787.20		12638.64	1274.51	1279.06		1279.08	0.000352	2.54	11982.2	4812.48	0.21	99.73		49786	9.4	248646	47.1	0.0			4.55
Tributary	76756.80		12644.46	1274.51	1279.03		1279.05	0.000366	2.58	11798.7	4766.6	0.21	99.73		49886	9.4	248546	47.1	0.0			4.52
Tributary	76726.40		12632.61	1274.51	1278.99		1279.01	0.000382	2.62	11598.59	4721.49	0.22	99.73		49986	9.5	248447	47.1	0.5			4.48
Tributary	76696.00		12632	1274.5	1278.95		1278.97	0.000397	2.66	11406.96	4669.64	0.22	99.73		50085	9.5	248347	47.0	0.0			4.45
Tributary	76665.60		12626.62	1274.5	1278.91		1278.93	0.000414	2.7	11206.84	4608.08	0.23	99.73		50185	9.5	248247	47.0	0.0			4.41
Tributary	76635.20		12615.1	1274.5	1278.87		1278.89	0.00043	2.73	11008.84	4539.78	0.23	99.73		50285	9.5	248147	47.0	0.5			4.37
Tributary	76604.80		12620.42	1274.49	1278.82		1278.85	0.000448	2.77	10794.96	4456.72	0.24	99.73		50385	9.5	248048	47.0	0.0			4.33
Tributary	76574.40		12614.9	1274.49	1278.78		1278.81	0.000463	2.8	10589.58	4360.6	0.24	99.73		50484	9.6	247948	47.0	0.5			4.29
Tributary	76544.00		12604.1	1274.48	1278.73		1278.76	0.000477	2.82	10380.66	4246.19	0.24	99.73		50584	9.6	247848	46.9	0.0			4.25
Tributary	76513.60		12603.5	1274.48	1278.68		1278.71	0.000463	2.76	10192.79	3980.56	0.24	99.73		50684	9.6	247749	46.9	0.0			4.2
Tributary	76483.20		12598.6	1274.48	1278.63		1278.66	0.000483	2.79	9996.63	3915.98	0.24	99.73		50784	9.6	247649	46.9	0.5			4.15
Tributary	76452.80		12587.87	1274.47	1278.58		1278.61	0.000502	2.82	9806.82	3853.03	0.25	99.73		50883	9.6	247549	46.9	0.0			4.11
Tributary	76422.40		12587.18	1274.47	1278.52		1278.56	0.000525	2.86	9609.72	3793.69	0.25	99.73		50983	9.7	247449	46.9	0.5			4.05
Tributary	76392.00		12576.37	1274.46	1278.47		1278.5	0.000551	2.9	9400.67	3735.36	0.26	99.73		51083	9.7	247350	46.8	0.0			4.01
Tributary	76361.60		12571.32	1274.46	1278.41		1278.44	0.000582	2.95	9205.04	3694.36	0.26	99.73		51183	9.7	247250	46.8	0.0			3.95
Tributary	76331.20		12565.27	1274.46	1278.35		1278.38	0.000616	3	9001.15	3651.07	0.27	99.73		51282	9.7	247150	46.8	0.5			3.89
Tributary	76300.80		12559.74	1274.45	1278.29		1278.32	0.000654	3.06	8794.71	3611.46	0.28	99.73		51382	9.7	247050	46.8	0.0			3.84
Tributary	76270.40		12541.45	1274.45	1278.22		1278.26	0.000699	3.12	8572.23	3568.17	0.29	99.73		51482	9.8	246951	46.8	0.0			3.77
Tributary	76240.00		12541.05	1274.45	1278.15		1278.19	0.000754	3.2	8334.11	3524.23	0.3	99.73		51581	9.8	246851	46.8	0.5			3.7
Tributary	76209.67		12515.02	1274.44	1278.07		1278.11	0.000818	3.28	8075.78	3477.92	0.31	99.62		51681	9.8	246751	46.7	6.4			3.63
Tributary	76179.30		12514.28	1274.32	1277.99		1278.03	0.000818	3.31	8089.97	3491.03	0.31	99.62		51781	9.8	246652	46.7	6.4			3.67
Tributary	76148.90		12486.12	1274.2	1277.91		1277.95	0.000814	3.33	8101.67	3500.6	0.31	99.62		51880	9.8	246552	46.7	6.9			3.71
Tributary	76118.50		12478.31	1274.07	1277.83		1277.88	0.000811	3.36	8117.8	3510.18	0.31	99.62		51980	9.8	246452	46.7	6.4			3.76
Tributary	76088.20		12445.38	1273.95	1277.76		1277.8	0.000793	3.35	8140.48	3493.7	0.31	99.62		52080	9.9	246353	46.7	6.4			3.81
Tributary	76057.80		12427.59	1273.83	1277.68		1277.72	0.00078	3.36	8173.96	3494.73	0.3	99.62		52179	9.9	246253	46.6	6.9			3.85
Tributary	76027.40		12399.53	1273.7	1277.61		1277.65	0.000766	3.36	8209.2	3497.9	0.3	99.62		52279	9.9	246154	46.6	6.4			3.91
Tributary	75997.10		12389.91	1273.58	1277.54		1277.58	0.000753	3.36	8248.44	3497.42	0.3	99.62		52379	9.9	246054	46.6	6.4			3.96
Tributary	75966.70		12338.88	1273.46	1277.47		1277.51	0.000731	3.34	8303.77	3501.34	0.3	99.62		52478	9.9	245954	46.6	6.9			4.01
Tributary	75936.40		12328.5	1273.33	1277.4		1277.44	0.000713	3.33	8361.73	3501.36	0.29	99.62		52578	10.0	245855	46.6	6.4			4.07
Tributary	75906.00		12294.62	1273.21	1277.33		1277.37	0.000693	3.32	8420.1	3503.36	0.29	99.62		52677	10.0	245755	46.5	6.4			4.12
Tributary	75875.60		12234.29	1273.09	1277.26		1277.3	0.000666	3.28	8496.16	3507.06	0.29	99.62		52777	10.0	245655	46.5	6.4			4.17
Tributary	75845.30		12209.54	1272.97	1277.2		1277.24	0.000642	3.26	8582.82	3510.27	0.28	99.62		52877	10.0	245556	46.5	6.9			4.23
Tributary	75814.90		12183.62	1272.84	1277.14		1277.18	0.000619	3.23	8667.29	3512.96	0.28	99.62		52976	10.0	245456	46.5	6.4			4.3
Tributary	75784.50		12130.34	1272.72	1277.08		1277.12	0.000592	3.19	8766.92	3521.91	0.27	99.62		53076	10.1	245357	46.5	6.4			4.36
Tributary	75754.20		12102.16	1272.6	1277.03		1277.06	0.000566	3.16	8886.24	3534.75	0.27	99.62		53175	10.1	245257	46.5	6.9			4.43
Tributary	75723.80		12045.1	1272.47	1276.97		1277.01	0.000541	3.12	8994.73	3547.05	0.26	99.62		53275	10.1	245157	46.4	6.4			4.5
Tributary	75693.50		11986.46	1272.35	1276.92		1276.95	0.000513	3.07	9127.17	3561.81	0.25	99.62		53375	10.1	245058	46.4	6.4			4.57
Tributary	75663.10		11940.6	1272.23	1276.87		1276.9	0.000486	3.02	9272.24	3581.49	0.25	99.62		53474	10.1	244958	46.4	6.9			4.64
Tributary	75632.70		11894.33	1272.1	1276.83		1276.86	0.000459	2.97	9427.99	3599.42	0.24	99.62		53574	10.1	244858	46.4	6.4			4.73
Tributary	75602.40		11814.72	1271.98	1276.78		1276.81	0.00043	2.91	9598.76	3619.76	0.23	99.62		53674	10.2	244759	46.4	6.4			4.8
Tributary	75572.00		11766.68	1271.86	1276.74		1276.77	0.000404	2.85	9779	3641.62	0.23	99.62		53773	10.2	244659	46.3	6.4			4.88
Tributary	75541.60		11734.08	1271.74	1276.71		1276.73	0.000379	2.79	9972.38	3664.91	0.22	99.62		53873	10.2	244560	46.3	6.9			4.97
Tributary	75511.30		11685.14	1271.61	1276.67		1276.7	0.000355	2.74	10174.11	3691.52	0.22	99.62		53972	10.2	244460	46.3	6.4			5.06
Tributary	75480.90		11636.11	1271.49	1276.64		1276.67	0.000331	2.68	10386.97	3716.29	0.21	99.62		54072	10.2	244360	46.3	6.4			5.15
Tributary	75450.60		11619.08	1271.37	1276.61		1276.63	0.00031	2.62	10613.64	3741.69	0.2	99.62		54172	10.3	244261	46.3	6.9			5.24
Tributary	75420.20		11537.31	1271.24	1276.58		1276.6	0.000288	2.55	10842.83	3768.8	0.2	99.62		54271	10.3	244161	46.2	6.4			5.34
Tributary	75389.80		11504.46	1271.12	1276.55		1276.58	0.000268	2.5	11086.83	3798.55	0.19	99.62		54371	10.3	244062	46.2	6.4			5.43
Tributary	75359.50		11470.83	1271	1276.53		1276.55	0.000251	2.44	11342.86	3839.42	0.18	99.62		54471	10.3	243962	46.2	6.9			5.53
Tributary	75329.10		11438.09	1270.87	1276.51		1276.53	0.000234	2.39	11600.78	3881.86	0.18	99.62		54570	10.3	243862	46.2	6.4			5.64
Tributary	75298.70		11405.08	1270.75	1276.49		1276.5	0.000219	2.34	11875.99	3924.6	0.17	99.62		54670	10.4	243763	46.2	6.4			5.74
Tributary	75268.40		11388.44	1270.63	1276.47		1276.48	0.000204	2.29	12165.4	3973.2	0.17	99.62		54769	10.4	243663	46.1	6.4			5.84
Tributary	75238.00		11340	1270.51	1276.45		1276.46	0.00019	2.23	12456.13	4020.69	0.16	99.62		54869	10.4	243563	46.1	6.9			5.94
Tributary	75207.70		11324.06	1270.38	1276.43		1276.45	0.000178	2.18	12757.92	4069.73	0.16	99.62		54969	10.4	243464	46.1	6.4			6.05
Tributary	75177.30		11276.28	1270.26	1276.41		1276.43	0.000165	2.13	13066.09	4123.73	0.15	99.62		55068	10.4	243364	46.1	6.4			6.15
Tributary	75146.90		11244.62	1270.14	1276.4		1276.41	0.000154	2.08	13389.72	4177.59	0.15	99.62		55168	10.4	243265	46.1	6.9			6.26
Tributary	75116.60		11244.24	1270.01	1276.38		1276.4	0.000144	2.04	13720.36	4233.46	0.14	99.62		55267	10.5	243165	46.1	6.4			6.37
Tributary	75086.20		11213.26	1269.89	1276.37		1276.38	0.000135	1.99	14053.59	4288.78	0.14	99.62		55367	10.5	243065	46.0	6.4			6.48
Tributary	75055.80		11182.47	1269.77	1276.36		1276.37	0.000125	1.94	14407.41	4345.95	0.13	99.62		55467	10.5	242966	46.0	6.9			6.59
Tributary	75025.50		11196.58	1269.64	1276.35		1276.36	0.000118	1.9	14768.44	4405.34	0.13	99.62		55566	10.5	242866	46.0	6.4			6.71
Tributary	74995.16		11166.57	1269.52	1276.34		1276.35	0.00011	1.86	15130.27	4463.61	0.13	98.94	Cherry Creek Road/ CR 5	55666	10.5	242766	46.0	0.0			6.82
Tributary	74965.00		11150.83	1269.52	1276.33		1276.34	0.000111	1.86	15081.52	4454.05	0.13	98.94		55765	10.6	242668	46.0	0.0			6.81
Tributary	74934.80		11150.32	1269.52	1276.32		1276.33	0.000111	1.87	15035.77	4446.08	0.13	98.94		55864	10.6	242569	45.9	0.0			6.8
Tributary	74904.60		11121.37	1269.52	1276.31		1276.32	0.000112	1.87	14982.57	4438.56	0.13	98.94		55963	10.6	242470	45.9	0.0			6.79
Tributary	74874.50		11091.77	1269.52	1276.29		1276.31	0.000112	1.87	14938.14	4429.63	0.13	98.94		56062	10.6	242371	45.9	0.0			6.77
Tributary	74844.30		11106.78	1269.52	1276.28		1276.3	0.000113	1.88	14897.16	4421.7	0.13	98.94		56161	10.6	242272	45.9	0.0			6.76
Tributary	74814.20		11050.14	1269.52	1276.27		1276.29	0.000114	1.88	14841.26	4414.18	0.13	98.94		56260	10.7	242173	45.9	0.0			6.75

Tributary	74784.00		11076.74	1269.52	1276.26		1276.27	0.000115	1.89	14789.85	4410.51	0.13	98.94		56359	10.7	242074	45.8	0.0			6.74
Tributary	74753.90		11035.32	1269.52	1276.25		1276.26	0.000116	1.89	14735.39	4405.55	0.13	98.94		56457	10.7	241975	45.8	0.0			6.73
Tributary	74723.70		11034.86	1269.52	1276.24		1276.25	0.000117	1.9	14691.39	4403.35	0.13	98.94		56556	10.7	241876	45.8	0.0			6.72
Tributary	74693.50		11021.7	1269.52	1276.23		1276.24	0.000118	1.91	14645.45	4404.34	0.13	98.94		56655	10.7	241777	45.8	0.0			6.71
Tributary	74663.40		11007.57	1269.52	1276.22		1276.23	0.000119	1.91	14594.97	4396.66	0.13	98.94		56754	10.7	241678	45.8	0.0			6.7
Tributary	74633.20		10979.99	1269.52	1276.21		1276.22	0.00012	1.91	14550.96	4394.97	0.13	98.94		56853	10.8	241579	45.8	0.0			6.69
Tributary	74603.10		10953.86	1269.52	1276.19		1276.21	0.00012	1.92	14497.74	4388.95	0.13	98.94		56952	10.8	241480	45.7	0.0			6.67
Tributary	74572.90		10966.38	1269.52	1276.18		1276.19	0.000122	1.93	14443.91	4385.78	0.13	98.94		57051	10.8	241381	45.7	0.0			6.66
Tributary	74542.80		10952.98	1269.52	1276.17		1276.18	0.000123	1.94	14400.09	4390.57	0.13	98.94		57150	10.8	241282	45.7	0.0			6.65
Tributary	74512.60		10927.3	1269.52	1276.16		1278.17	0.000124	1.94	14351.16	4393.48	0.13	98.94		57249	10.8	241183	45.7	0.0			6.64
Tributary	74482.50		10914.14	1269.52	1276.15		1276.16	0.000125	1.95	14306.85	4391.02	0.13	98.94		57348	10.9	241084	45.7	0.0			6.63
Tributary	74452.30		10901.58	1269.52	1276.13		1276.15	0.000126	1.95	14261.44	4381.18	0.13	98.94		57447	10.9	240986	45.6	0.0			6.61
Tributary	74422.10		10876.06	1269.52	1276.12		1276.13	0.000127	1.95	14211.47	4369.94	0.13	98.94		57546	10.9	240887	45.6	0.0			6.6
Tributary	74392.00		10875.53	1269.52	1276.11		1276.12	0.000127	1.96	14169.44	4359.99	0.13	98.94		57645	10.9	240788	45.6	0.0			6.59
Tributary	74361.80		10839.69	1269.52	1276.1		1276.11	0.000128	1.96	14117.73	4341.33	0.13	98.94		57744	10.9	240689	45.6	0.0			6.58
Tributary	74331.70		10827.77	1269.52	1276.08		1276.1	0.000128	1.96	14069.31	4324.22	0.14	98.94		57843	11.0	240590	45.6	0.0			6.56
Tributary	74301.50		10827.23	1269.52	1276.07		1276.08	0.000129	1.96	14020.92	4304.46	0.14	98.94		57942	11.0	240491	45.5	0.0			6.55
Tributary	74271.40		10815.66	1269.52	1276.06		1276.07	0.00013	1.97	13966.05	4285.94	0.14	98.94		58041	11.0	240392	45.5	0.0			6.54
Tributary	74241.20		10792.02	1269.52	1276.04		1276.06	0.00013	1.97	13918.27	4269.99	0.14	98.94		58139	11.0	240293	45.5	0.0			6.52
Tributary	74211.00		10780.4	1269.52	1276.03		1276.04	0.000131	1.97	13868.04	4270.46	0.14	98.94		58238	11.0	240194	45.5	0.0			6.51
Tributary	74180.90		10768.39	1269.52	1276.02		1276.03	0.000133	1.99	13812.88	4278.85	0.14	98.94		58337	11.0	240095	45.5	0.0			6.5
Tributary	74150.70		10746.47	1269.52	1276.01		1276.02	0.000135	2	13760.67	4292.1	0.14	98.94		58436	11.1	239996	45.5	0.0			6.49
Tributary	74120.60		10735.19	1269.52	1275.99		1276	0.000138	2.01	13711.88	4321.62	0.14	98.94		58535	11.1	239897	45.4	0.0			6.47
Tributary	74090.40		10734.77	1269.52	1275.98		1275.99	0.000142	2.04	13663.67	4391.03	0.14	98.94		58634	11.1	239798	45.4	0.0			6.46
Tributary	74060.30		10722.89	1269.52	1275.96		1275.98	0.000145	2.06	13616.81	4418.08	0.14	98.94		58733	11.1	239699	45.4	0.0			6.44
Tributary	74030.10		10701.42	1269.52	1275.95		1275.96	0.000146	2.07	13579.47	4432.39	0.14	98.94		58832	11.1	239600	45.4	0.0			6.43
Tributary	74000.00		10700.89	1269.52	1275.93		1275.95	0.000149	2.08	13530.01	4463.44	0.15	99.42		58931	11.2	239501	45.4	0.0			6.41
Tributary	73969.70		10679.2	1269.52	1275.92		1275.93	0.00015	2.09	13467.44	4500.28	0.15	99.42		59030	11.2	239402	45.3	0.0			6.4
Tributary	73939.30		10668.07	1269.52	1275.9		1275.92	0.000152	2.1	13408	4544.6	0.15	99.42		59130	11.2	239303	45.3	0.0			6.38
Tributary	73909.00		10635.42	1269.52	1275.89		1275.9	0.000159	2.14	13350.08	4574.34	0.15	99.42		59229	11.2	239203	45.3	0.0			6.37
Tributary	73878.70		10646.15	1269.52	1275.87		1275.89	0.000159	2.14	13298.02	4533.36	0.15	99.42		59329	11.2	239104	45.3	0.0			6.35
Tributary	73848.40		10625.25	1269.52	1275.86		1275.87	0.000159	2.14	13257.75	4514.04	0.15	99.42		59428	11.3	239004	45.3	0.0			6.34
Tributary	73818.10		10603.98	1269.52	1275.84		1275.86	0.000159	2.13	13225.42	4492.1	0.15	99.42		59528	11.3	238905	45.2	0.0			6.32
Tributary	73787.80		10593.17	1269.52	1275.83		1275.84	0.000159	2.13	13185.87	4471.65	0.15	99.42		59627	11.3	238805	45.2	0.0			6.31
Tributary	73757.50		10572.37	1269.52	1275.81		1275.83	0.000159	2.12	13149.77	4449.62	0.15	99.42		59726	11.3	238706	45.2	0.0			6.29
Tributary	73727.20		10571.87	1269.52	1275.8		1275.81	0.000159	2.12	13119.62	4436.11	0.15	99.42		59826	11.3	238607	45.2	0.0			6.28
Tributary	73696.90		10541.43	1269.52	1275.78		1275.8	0.000159	2.12	13093.6	4426.06	0.15	99.42		59925	11.3	238507	45.2	0.0			6.26
Tributary	73666.60		10520.84	1269.52	1275.77		1275.78	0.000159	2.11	13078.41	4425.57	0.15	99.42		60025	11.4	238408	45.2	0.0			6.25
Tributary	73636.30		10511.37	1269.52	1275.75		1275.77	0.000159	2.11	13056.6	4419.42	0.15	99.42		60124	11.4	238308	45.1	0.0			6.23
Tributary	73606.00		10500.97	1269.52	1275.74		1275.75	0.000159	2.11	13038.42	4415.67	0.15	99.42		60223	11.4	238209	45.1	0.0			6.22
Tributary	73575.70		10481.2	1269.52	1275.72		1275.74	0.000159	2.1	13028.03	4417.9	0.15	99.42		60323	11.4	238110	45.1	0.0			6.2
Tributary	73545.40		10460.31	1269.52	1275.71		1275.72	0.000159	2.1	13019.99	4417.95	0.15	99.42		60422	11.4	238010	45.1	0.0			6.19
Tributary	73515.10		10470.22	1269.52	1275.69		1275.71	0.000159	2.1	13017.43	4425.39	0.15	99.42		60522	11.5	237911	45.1	0.0			6.17
Tributary	73484.80		10450.75	1269.52	1275.68		1275.69	0.000159	2.09	13006.98	4426.06	0.15	99.42		60621	11.5	237811	45.0	0.0			6.16
Tributary	73454.50		10421.33	1269.52	1275.66		1275.67	0.000158	2.09	13011.21	4436.82	0.15	99.42		60721	11.5	237712	45.0	0.0			6.14
Tributary	73424.20		10401.68	1269.52	1275.65		1275.66	0.000158	2.08	13010.3	4441.32	0.15	99.42		60820	11.5	237612	45.0	0.0			6.13
Tributary	73393.90		10410.93	1269.52	1275.63		1275.64	0.000158	2.08	13018.98	4448.11	0.15	99.42		60919	11.5	237513	45.0	0.0			6.11
Tributary	73363.60		10401.63	1269.52	1275.62		1275.63	0.000158	2.07	13025.36	4462.05	0.15	99.42		61019	11.6	237414	45.0	0.0			6.1
Tributary	73333.30		10372.6	1269.52	1275.6		1275.61	0.000157	2.06	13034.94	4470.65	0.15	99.42		61118	11.6	237314	44.9	0.0			6.08
Tributary	73303.00		10381.53	1269.52	1275.58		1275.6	0.000157	2.06	13051.83	4485.18	0.15	99.42		61218	11.6	237215	44.9	0.0			6.06
Tributary	73272.70		10353.64	1269.52	1275.57		1275.58	0.000157	2.05	13063.72	4497.19	0.15	99.42		61317	11.6	237115	44.9	0.0			6.05
Tributary	73242.40		10353.38	1269.52	1275.55		1275.57	0.000156	2.05	13089.62	4517.09	0.15	99.42		61417	11.6	237016	44.9	0.0			6.03
Tributary	73212.10		10324.49	1269.52	1275.54		1275.55	0.000155	2.04	13115.85	4532.86	0.15	99.42		61516	11.7	236917	44.9	0.0			6.02
Tributary	73181.80		10324.12	1269.52	1275.53		1275.54	0.000155	2.03	13139.16	4548.95	0.15	99.42		61615	11.7	236817	44.9	0.0			6.01
Tributary	73151.50		10287.2	1269.52	1275.51		1275.52	0.000154	2.02	13165.68	4569.6	0.15	99.42		61715	11.7	236718	44.8	0.0			5.99
Tributary	73121.20		10295.8	1269.52	1275.5		1275.51	0.000153	2.02	13195.98	4587.48	0.15	99.42		61814	11.7	236618	44.8	0.0			5.98
Tributary	73090.90		10278.14	1269.52	1275.48		1275.49	0.000152	2.01	13235.98	4615.98	0.15	99.42		61914	11.7	236519	44.8	0.0			5.96
Tributary	73060.60		10268.82	1269.52	1275.47		1275.48	0.000152	2	13268.7	4638.04	0.14	99.42		62013	11.7	236419	44.8	0.0			5.95
Tributary	73030.30		10268.33	1269.52	1275.45		1275.47	0.000151	1.99	13308.38	4661.91	0.14	99.42		62112	11.8	236320	44.8	0.0			5.93
Tributary	73000.00		10240.89	1269.52	1275.44		1275.45	0.00015	1.98	13359.4	4691.69	0.14	99.42		62212	11.8	236221	44.7	0.0			5.92
Tributary	72969.70		10248.74	1269.52	1275.42		1275.44	0.00015	1.98	13361.5	4695.46	0.14	99.42		62311	11.8	236121	44.7	0.0			5.9
Tributary	72939.30		10222.54	1269.52	1275.41		1275.42	0.00015	1.97	13359.94	4702.12	0.14	99.42		62411	11.8	236022	44.7	0.0			5.89
Tributary	72909.00		10221.93	1269.52	1275.4		1275.41	0.00015	1.97	13360.03	4704.64	0.14	99.42		62510	11.8	235922	44.7	-0.5			5.88
Tributary	72878.70		10195.86	1269.53	1275.38		1275.39	0.00015	1.96	13356.37	4709.09	0.14	99.42		62610	11.9	235823	44.7	0.0			5.85
Tributary	72848.40		10195.5	1269.53	1275.37		1275.38	0.00015	1.96	13364.82	4712.98	0.14	99.42		62709	11.9	235723	44.6	0.0			5.84
Tributary	72818.10		10186.42	1269.53	1275.35		1275.36	0.00015	1.96	13354.84	4716.58	0.14	99.42		62808	11.9	235624	44.6	0.0			5.82
Tributary	72787.80		10152.07	1269.53	1275.34		1275.35	0.000149	1.95	13355.12	4720.4	0.14	99.42		62908	11.9	235525	44.6	0.0			5.81
Tributary	72757.50		10151.61	1269.53	1275.32		1275.34	0.000149	1.95	13368.33	4731.56	0.14	99.42		63007	11.9	235425	44.6	0.0			5.79
Tributary	72727.20		10151.04	1269.53	1275.31		1275.32	0.00015	1.94	13364.89	4736.25	0.14	99.42		63107	12.0	235326	44.6	0.0			5.78
Tributary	72696.90		10116.54	1269.53	1275.29		1275.31	0.000149	1.94	13365.82	4739.02	0.14	99.42		63206	12.0	235226	44.6	0.0			5.76
Tributary	72666.60		10124.16	1269.53	1275.28		1275.29	0.000149	1.93	13373.1	4744.83	0.14	99.42		63305	12.0	235127	44.5	0.0			5.75
Tributary	72636.30		10107.5	1269.53	1275.27		1275.28	0.000149	1.93	13376.15	4747.85	0.14	99.42		63405	12.0	235028	44.5	0.0			5.74
Tributary	72606.00		10090.41	1269.53	1275.25		1275.26	0.000149	1.92	13374.33	4752.6	0.14	99.42		63504	12.0	234928	44.5	-0.5			5.72
Tributary	72575.70		10098.79	1269.54	1275.24		1275.25	0.000149	1.92	13384.12	4757.7	0.14	99.42		63604	12.0	234829	44.5	0.0			5.7
Tributary	72545.40		10056.43	1269.54	1275.22		1275.23	0.000148	1.91	13378.55	4761.56	0.14	99.42		63703	12.1	234729	44.5	0.0			5.68
Tributary	72515.10		10048.29	1269.54	1275.21		1275.22	0.000148	1.91	13376.81	4764.42	0.14	99.42		63803	12.1	234630	44.4	0.0			5.67
Tributary	72484.80		10047.83	1269.54	1275.19		1275.21	0.000148	1.9	13382.08	4770.56	0.14	99.42		63902	12.1	234530	44.4	0.0			5.65
Tributary	72454.50		10039.59	1269.54	1275.18		1275.19	0.000148	1.9	13393.26	4780.32	0.14	99.42		64001	12.1	234431	44.4	0.0			5.64
Tributary	72424.20		10030.56	1269.54	1275.17		1275.18	0.000148	1.9	13392.03	4784.69	0.14	99.42		64101	12.1	234332	44.4	0.0			5.63
Tributary	72393.90		10014.08	1269.54	1275.15		1275.16	0.000148	1.89	13389.24	4789.52	0.14	99.42		64200	12.2	234232	44.4	0.0			5.61
Tributary	72363.60		9997.3	1269.54	1275.14		1275.15	0.000147	1.88	13394.18	4792.48	0.14	99.42		64300	12.2	234133	44.3	0.0			5.6
Tributary	72333.30		9996.5	1269.54	1275.12		1275.13	0.000147	1.88	13402.34	4797.99	0.14	99.42		64399	12.2	234033	44.3	0.0			5.58
Tributary	72303.00		9964.13	1269.54	1275.11		1275.12	0.000146	1.87	13406.4	4801.81	0.14	99.42		64499	12.2	233934	44.3	0.0			5.57

Tributary	72272.70		9947.29	1269.54	1275.09		1275.1	0.000146	1.86	13412.01	4808.28	0.14	99.42		64598	12.2	233834	44.3	-0.5			5.55
Tributary	72242.40		9931.02	1269.55	1275.08		1275.09	0.000146	1.86	13414.57	4812.47	0.14	99.42		64697	12.3	233735	44.3	0.0			5.53
Tributary	72212.10		9939.58	1269.55	1275.06		1275.08	0.000146	1.85	13426.03	4816.14	0.14	99.42		64797	12.3	233636	44.2	0.0			5.51
Tributary	72181.80		9922.85	1269.55	1275.05		1275.06	0.000146	1.85	13424.03	4822.88	0.14	99.42		64896	12.3	233536	44.2	0.0			5.5
Tributary	72151.50		9906.3	1269.55	1275.04		1275.05	0.000145	1.84	13425.94	4829.57	0.14	99.42		64996	12.3	233437	44.2	0.0			5.49
Tributary	72121.20		9890.01	1269.55	1275.02		1275.03	0.000145	1.84	13442.32	4836.85	0.14	99.42		65095	12.3	233337	44.2	0.0			5.47
Tributary	72090.90		9882.3	1269.55	1275.01		1275.02	0.000145	1.83	13449.09	4839.96	0.14	99.42		65194	12.3	233238	44.2	0.0			5.46
Tributary	72060.60		9865.61	1269.55	1274.99		1275	0.000144	1.83	13448.78	4844.77	0.14	99.42		65294	12.4	233139	44.2	0.0			5.44
Tributary	72030.30		9856.67	1269.55	1274.98		1274.99	0.000144	1.82	13453.65	4851.69	0.14	99.42		65393	12.4	233039	44.1	0.0			5.43
Tributary	72000.00		9832.68	1269.55	1274.96		1274.98	0.000143	1.81	13462.52	4855.33	0.14	99.42		65493	12.4	232940	44.1	-0.5			5.41
Tributary	71969.70		9808.58	1269.56	1274.95		1274.96	0.000145	1.82	13418.43	4876.77	0.14	99.42		65592	12.4	232840	44.1	0.0			5.39
Tributary	71939.30		9824.32	1269.56	1274.94		1274.95	0.000148	1.83	13384.28	4899.96	0.14	99.42		65692	12.4	232741	44.1	-0.5			5.38
Tributary	71909.00		9799.76	1269.57	1274.92		1274.93	0.000149	1.84	13344.87	4918.29	0.14	99.42		65791	12.5	232641	44.1	0.0			5.35
Tributary	71878.70		9773.98	1269.57	1274.91		1274.92	0.000151	1.84	13295.54	4943.48	0.14	99.42		65890	12.5	232542	44.0	-0.5			5.34
Tributary	71848.40		9766.75	1269.58	1274.89		1274.9	0.000153	1.85	13259.26	4969.74	0.14	99.42		65990	12.5	232443	44.0	0.0			5.31
Tributary	71818.10		9765.77	1269.58	1274.88		1274.89	0.000156	1.86	13225.77	4998.37	0.14	99.42		66089	12.5	232343	44.0	-0.5			5.3
Tributary	71787.80		9732.47	1269.59	1274.86		1274.87	0.000158	1.87	13168.83	5020.59	0.14	99.42		66189	12.5	232244	44.0	0.0			5.27
Tributary	71757.50		9698.12	1269.59	1274.85		1274.86	0.000159	1.88	13134.1	5053.36	0.15	99.42		66288	12.6	232144	44.0	-0.5			5.26
Tributary	71727.20		9697.82	1269.6	1274.83		1274.84	0.000163	1.89	13093.54	5096.35	0.15	99.42		66387	12.6	232045	43.9	0.0			5.23
Tributary	71696.90		9690.64	1269.6	1274.82		1274.83	0.000166	1.9	13054.92	5138.09	0.15	99.42		66487	12.6	231946	43.9	-0.5			5.22
Tributary	71666.60		9638.13	1269.61	1274.8		1274.81	0.000168	1.91	13013.19	5197.73	0.15	99.42		66586	12.6	231846	43.9	0.0			5.19
Tributary	71636.30		9646.82	1269.61	1274.78		1274.79	0.000172	1.93	12981.29	5261.69	0.15	99.42		66686	12.6	231747	43.9	-0.5			5.17
Tributary	71606.00		9595.14	1269.62	1274.77		1274.78	0.000175	1.94	12942.58	5334.98	0.15	99.42		66785	12.6	231647	43.9	0.0			5.15
Tributary	71575.70		9586.64	1269.62	1274.75		1274.76	0.000178	1.95	12904.4	5376.69	0.15	99.42		66885	12.7	231548	43.9	-0.5			5.13
Tributary	71545.40		9542.29	1269.63	1274.73		1274.75	0.000179	1.95	12879.11	5422.8	0.15	99.42		66984	12.7	231448	43.8	0.0			5.1
Tributary	71515.10		9532.86	1269.63	1274.72		1274.73	0.000182	1.96	12844.77	5466.6	0.15	99.42		67083	12.7	231349	43.8	-0.5			5.09
Tributary	71484.80		9506.59	1269.64	1274.7		1274.71	0.000185	1.97	12810.58	5516.58	0.16	99.42		67183	12.7	231250	43.8	0.0			5.06
Tributary	71454.50		9496.73	1269.64	1274.68		1274.7	0.000187	1.98	12787.21	5571.93	0.16	99.42		67282	12.7	231150	43.8	-0.5			5.04
Tributary	71424.20		9433.89	1269.65	1274.67		1274.68	0.000188	1.98	12751.87	5614.2	0.16	99.42		67382	12.8	231051	43.8	0.0			5.02
Tributary	71393.90		9425.05	1269.65	1274.65		1274.66	0.000191	1.99	12728.02	5646.94	0.16	99.42		67481	12.8	230951	43.7	-0.5			5
Tributary	71363.60		9387.24	1269.66	1274.63		1274.64	0.000191	1.98	12705.16	5677.01	0.16	99.42		67581	12.8	230852	43.7	0.0			4.97
Tributary	71333.30		9341.44	1269.66	1274.62		1274.63	0.000192	1.98	12682.7	5713.21	0.16	99.42		67680	12.8	230752	43.7	-0.5			4.96
Tributary	71303.00		9313.55	1269.67	1274.6		1274.61	0.000194	1.99	12651.7	5743.26	0.16	99.42		67779	12.8	230653	43.7	0.0			4.93
Tributary	71272.70		9285.13	1269.67	1274.58		1274.59	0.000195	1.99	12626.38	5767.31	0.16	99.42		67879	12.9	230554	43.7	-0.5			4.91
Tributary	71242.40		9228.5	1269.68	1274.56		1274.57	0.000195	1.98	12600.77	5795.25	0.16	99.42		67978	12.9	230454	43.6	0.0			4.88
Tributary	71212.10		9144.36	1269.68	1274.54		1274.55	0.000194	1.97	12582.93	5822.23	0.16	99.42		68078	12.9	230355	43.6	-0.5			4.86
Tributary	71181.80		9143.94	1269.69	1274.52		1274.54	0.000196	1.97	12558.47	5845.39	0.16	99.42		68177	12.9	230255	43.6	0.0			4.83
Tributary	71151.50		9115.1	1269.69	1274.51		1274.52	0.000197	1.97	12534.25	5871.28	0.16	99.42		68276	12.9	230156	43.6	-0.5			4.82
Tributary	71121.20		9049.43	1269.7	1274.49		1274.5	0.000197	1.96	12506.03	5893.65	0.16	99.42		68376	12.9	230057	43.6	0.0			4.79
Tributary	71090.90		9001.21	1269.7	1274.47		1274.48	0.000197	1.96	12483.21	5916.54	0.16	99.42		68475	13.0	229957	43.6	-0.5			4.77
Tributary	71060.60		8934.2	1269.71	1274.45		1274.46	0.000196	1.95	12463.45	5940.42	0.16	99.42		68575	13.0	229858	43.5	0.0			4.74
Tributary	71030.30		8914.52	1269.71	1274.43		1274.44	0.000197	1.95	12448.03	5964.1	0.16	99.42		68674	13.0	229758	43.5	-0.5			4.72
Tributary	71000.00		8877.79	1269.72	1274.41		1274.42	0.000198	1.94	12425.08	5986.03	0.16	99.42		68774	13.0	229659	43.5	0.0			4.69
Tributary	70969.70		8820.22	1269.72	1274.39		1274.41	0.000214	2.01	11792.3	5620.88	0.16	99.42		68873	13.0	229559	43.5	0.0			4.67
Tributary	70939.30		8726.49	1269.72	1274.37		1274.39	0.000189	1.89	11619.1	4912.74	0.16	99.42		68972	13.1	229460	43.5	0.0			4.65
Tributary	70909.00		8689.71	1269.72	1274.36		1274.37	0.000183	1.85	11604.52	4781.48	0.15	99.42		69072	13.1	229361	43.4	0.0			4.64
Tributary	70878.70		8670.34	1269.72	1274.34		1274.35	0.000169	1.78	11643.68	4539.85	0.15	99.42		69171	13.1	229261	43.4	0.0			4.62
Tributary	70848.40		8605.96	1269.72	1274.33		1274.34	0.000158	1.71	11720.21	4409.41	0.14	99.42		69271	13.1	229162	43.4	0.0			4.61
Tributary	70818.10		8605.67	1269.72	1274.31		1274.32	0.000154	1.69	11807.5	4404.69	0.14	99.42		69370	13.1	229062	43.4	0.0			4.59
Tributary	70787.80		8569.13	1269.72	1274.3		1274.3	0.000148	1.65	11896.29	4400.71	0.14	99.42		69470	13.2	228963	43.4	-0.5			4.58
Tributary	70757.50		8515.03	1269.73	1274.28		1274.29	0.000143	1.62	11998.61	4404.49	0.13	99.42		69569	13.2	228863	43.3	0.0			4.55
Tributary	70727.20		8469.68	1269.73	1274.27		1274.28	0.000138	1.59	12092.07	4408.2	0.13	99.42		69668	13.2	228764	43.3	0.0			4.54
Tributary	70696.90		8461.31	1269.73	1274.25		1274.26	0.000134	1.56	12196.67	4413.86	0.13	99.42		69768	13.2	228665	43.3	0.0			4.52
Tributary	70666.60		8417.08	1269.73	1274.24		1274.25	0.000129	1.53	12303.89	4423.79	0.13	99.42		69867	13.2	228565	43.3	0.0			4.51
Tributary	70636.30		8416.25	1269.73	1274.23		1274.24	0.000126	1.5	12409.86	4437.02	0.13	99.42		69967	13.3	228466	43.3	0.0			4.5
Tributary	70606.00		8381.82	1269.73	1274.22		1274.23	0.000121	1.47	12530.23	4451.17	0.12	99.42		70066	13.3	228366	43.3	0.0			4.49
Tributary	70575.70		8338.46	1269.73	1274.21		1274.21	0.000117	1.44	12646	4465.58	0.12	99.42		70165	13.3	228267	43.2	0.0			4.48
Tributary	70545.40		8321.26	1269.73	1274.19		1274.2	0.000113	1.42	12771.23	4481.6	0.12	99.42		70265	13.3	228168	43.2	0.0			4.46
Tributary	70515.10		8312.12	1269.73	1274.18		1274.19	0.000109	1.39	12896.5	4495.73	0.12	99.42		70364	13.3	228068	43.2	0.0			4.45
Tributary	70484.80		8254.08	1269.73	1274.17		1274.18	0.000105	1.36	13026.02	4512.67	0.11	99.42		70464	13.3	227969	43.2	-0.5			4.44
Tributary	70454.50		8245.28	1269.74	1274.16		1274.17	0.000101	1.34	13157.97	4528.06	0.11	99.42		70563	13.4	227869	43.2	0.0			4.42
Tributary	70424.20		8212.91	1269.74	1274.15		1274.16	0.000097	1.31	13297.73	4544.82	0.11	99.42		70663	13.4	227770	43.1	0.0			4.41
Tributary	70393.90		8228.29	1269.74	1274.14		1274.15	0.000095	1.29	13434.48	4563.2	0.11	99.42		70762	13.4	227670	43.1	0.0			4.4
Tributary	70363.60		8204.07	1269.74	1274.14		1274.14	0.000091	1.26	13585.66	4581.44	0.11	99.42		70861	13.4	227571	43.1	0.0			4.4
Tributary	70333.30		8179.81	1269.74	1274.13		1274.13	0.000088	1.24	13721.17	4600.93	0.1	99.42		70961	13.4	227472	43.1	0.0			4.39
Tributary	70303.00		8162.78	1269.74	1274.12		1274.13	0.000085	1.21	13884.57	4624.38	0.1	99.42		71060	13.5	227372	43.1	0.0			4.38
Tributary	70272.70		8131.49	1269.74	1274.11		1274.12	0.000082	1.19	14025.39	4644.78	0.1	99.42		71160	13.5	227273	43.0	0.0			4.37
Tributary	70242.40		8123.44	1269.74	1274.1		1274.11	0.000079	1.17	14187.12	4666.83	0.1	99.42		71259	13.5	227173	43.0	0.0			4.36
Tributary	70212.10		8131.22	1269.74	1274.1		1274.1	0.000076	1.15	14353.15	4690.09	0.1	99.42		71358	13.5	227074	43.0	0.0			4.36
Tributary	70181.80		8107.39	1269.74	1274.09		1274.09	0.000074	1.13	14507.9	4713.23	0.1	99.42		71458	13.5	226975	43.0	-0.5			4.35
Tributary	70151.50		8099.7	1269.75	1274.08		1274.09	0.000073	1.12	14693.83	4942.49	0.1	99.42		71557	13.6	226875	43.0	0.0			4.33
Tributary	70121.20		8069.35	1269.75	1274.07		1274.08	0.000071	1.1	14885.61	5065.68	0.09	99.42		71657	13.6	226776	42.9	0.0			4.32
Tributary	70090.90		8054.51	1269.75	1274.07		1274.07	0.000068	1.08	15103.38	5130.35	0.09	99.42		71756	13.6	226676	42.9	0.0			4.32
Tributary	70060.60		8047.3	1269.75	1274.06		1274.07	0.000066	1.06	15322.44	5199.01	0.09	99.42		71856	13.6	226577	42.9	0.0			4.31
Tributary	70030.30		8046.86	1269.75	1274.06		1274.06	0.000064	1.04	15550.66	5274.91	0.09	99.42		71955	13.6	226477	42.9	0.0			4.31
Tributary	70000.00		8031.72	1269.75	1274.05		1274.05	0.000061	1.02	15797.04	5365.5	0.09	99.68		72054	13.6	226378	42.9	0.5			4.3
Tributary	69969.60		8025.24	1269.74	1274.04		1274.05	0.000072	1.1	15031.79	5320.88	0.09	99.68		72154	13.7	226278	42.9	0.5			4.3
Tributary	69939.20		8010	1269.73	1274.04		1274.04	0.000079	1.16	14575	5288.34	0.1	99.68		72254	13.7	226179	42.8	0.0			4.31
Tributary	69908.80		8002.71	1269.73	1274.03		1274.03	0.000083	1.18	14351.43	5271.57	0.1	99.68		72353	13.7	226079	42.8	0.5			4.3
Tributary	69878.40		7988.49	1269.72	1274.02		1274.03	0.000083	1.19	14321.65	5269.37	0.1	99.68		72453	13.7	225979	42.8	0.5			4.3
Tributary	69848.00		7954.95	1269.71	1274.01		1274.02	0.000081	1.17	14395.03	5286.81	0.1	99.68		72553	13.7	225880	42.8	0.5			4.3
Tributary	69817.70		7967.27	1269.7	1274		1274.01	0.000078	1.15	14568.19	5293.67	0.1	99.68		72653	13.8	225780	42.8	0.0			4.3
Tributary	69787.30		7961.04	1269.7	1274		1274	0.000074	1.13	14805.91	5320.6	0.1	99.68		72752	13.8	225680	42.7	0.5			4.3

Tributary	69756.90		7919.07	1269.69	1273.99		1273.99	0.00007	1.09	15100.25	5363.33	0.09	99.68		72852	13.8	225581	42.7	0.5			4.3
Tributary	69726.50		7926.69	1269.68	1273.98		1273.99	0.000066	1.07	15417.04	5423.58	0.09	99.68		72952	13.8	225481	42.7	0.5			4.3
Tributary	69696.10		7926.3	1269.67	1273.98		1273.98	0.000063	1.04	15751.65	5555.24	0.09	99.68		73051	13.8	225381	42.7	0.5			4.31
Tributary	69665.70		7894.24	1269.66	1273.97		1273.98	0.000059	1.01	16117.46	5703.16	0.09	99.68		73151	13.9	225282	42.7	0.0			4.31
Tributary	69635.40		7899.95	1269.66	1273.97		1273.97	0.000056	0.98	16514.72	5849.49	0.08	99.68		73251	13.9	225182	42.6	0.5			4.31
Tributary	69605.00		7899.21	1269.65	1273.96		1273.96	0.000053	0.96	16931.73	6006.02	0.08	99.68		73350	13.9	225082	42.6	0.5			4.31
Tributary	69574.60		7905.8	1269.64	1273.96		1273.96	0.00005	0.93	17374.39	6140.05	0.08	99.68		73450	13.9	224982	42.6	0.5			4.32
Tributary	69544.20		7894.28	1269.63	1273.95		1273.95	0.000047	0.9	17836.08	6262.06	0.08	99.68		73550	13.9	224883	42.6	0.5			4.32
Tributary	69513.80		7893.28	1269.62	1273.95		1273.95	0.000044	0.87	18313.88	6382.84	0.07	99.68		73649	13.9	224783	42.6	0.0			4.33
Tributary	69483.40		7880.53	1269.62	1273.94		1273.95	0.000042	0.85	18810.75	6496.6	0.07	99.68		73749	14.0	224683	42.6	0.5			4.32
Tributary	69453.10		7879.94	1269.61	1273.94		1273.94	0.000039	0.82	19329.46	6607.66	0.07	99.68		73849	14.0	224584	42.5	0.5			4.33
Tributary	69422.70		7874.99	1269.6	1273.94		1273.94	0.000037	0.8	19854.17	6739.59	0.07	99.68		73948	14.0	224484	42.5	0.5			4.34
Tributary	69392.30		7861.81	1269.59	1273.93		1273.94	0.000034	0.77	20388.55	6837.75	0.07	99.68		74048	14.0	224384	42.5	0.5			4.34
Tributary	69361.90		7839.79	1269.58	1273.93		1273.93	0.000032	0.74	20954.36	6938.01	0.06	99.68		74148	14.0	224285	42.5	0.0			4.35
Tributary	69331.50		7861.21	1269.58	1273.93		1273.93	0.00003	0.72	21513.27	7043.26	0.06	99.68		74247	14.1	224185	42.5	0.5			4.35
Tributary	69301.10		7860.61	1269.57	1273.92		1273.93	0.000028	0.7	22099.18	7140.35	0.06	99.68		74347	14.1	224085	42.4	0.5			4.35
Tributary	69270.80		7856.75	1269.56	1273.92		1273.92	0.000026	0.68	22685.33	7224.71	0.06	99.68		74447	14.1	223986	42.4	0.5			4.36
Tributary	69240.40		7849.47	1269.55	1273.92		1273.92	0.000026	0.67	23288.23	7300.11	0.06	99.68		74546	14.1	223886	42.4	0.5			4.37
Tributary	69210.00		7844.36	1269.54	1273.92		1273.92	0.000024	0.65	23911.6	7367.28	0.05	99.68		74646	14.1	223786	42.4	0.0			4.38
Tributary	69179.60		7848.28	1269.54	1273.91		1273.92	0.000023	0.63	24521.3	7417.12	0.05	99.68		74746	14.2	223687	42.4	0.5			4.37
Tributary	69149.20		7847.5	1269.53	1273.91		1273.91	0.000021	0.61	25160.68	7559.93	0.05	99.68		74845	14.2	223587	42.3	0.5			4.38
Tributary	69118.80		7844.72	1269.52	1273.91		1273.91	0.00002	0.59	25810.99	7653.07	0.05	99.68		74945	14.2	223487	42.3	0.5			4.39
Tributary	69088.50		7822.88	1269.51	1273.91		1273.91	0.000018	0.57	26478.61	7776.66	0.05	99.68		75045	14.2	223388	42.3	0.5			4.4
Tributary	69058.10		7837.93	1269.5	1273.91		1273.91	0.000017	0.55	27154.96	7928.6	0.05	99.68		75145	14.2	223288	42.3	0.0			4.41
Tributary	69027.70		7818.22	1269.5	1273.91		1273.91	0.000016	0.53	27855.93	8015.27	0.04	99.68		75244	14.3	223188	42.3	0.5			4.41
Tributary	68997.35		7827.85	1269.49	1273.9		1273.9	0.000015	0.51	28553.26	8097.8	0.04	99.16		75344	14.3	223089	42.3	0.0			4.41
Tributary	68967.10		7841.22	1269.49	1273.9		1273.9	0.000016	0.53	27788.62	7967.42	0.04	99.16		75443	14.3	222989	42.2	0.0			4.41
Tributary	68936.90		7836.78	1269.49	1273.9		1273.9	0.000017	0.55	27054.44	7742.14	0.05	99.16		75542	14.3	222890	42.2	0.0			4.41
Tributary	68906.60		7817.23	1269.49	1273.9		1273.9	0.000018	0.57	26361.54	7493.35	0.05	99.16		75641	14.3	222791	42.2	0.0			4.41
Tributary	68876.40		7827.27	1269.49	1273.9		1273.9	0.00002	0.59	25713.13	7408.41	0.05	99.16		75741	14.3	222692	42.2	0.0			4.41
Tributary	68846.20		7835.73	1269.49	1273.89		1273.9	0.000021	0.61	25091.33	7292.2	0.05	99.16		75840	14.4	222593	42.2	0.0			4.4
Tributary	68816.00		7831.09	1269.49	1273.89		1273.89	0.000021	0.62	24541.11	7153.5	0.05	99.16		75939	14.4	222494	42.1	0.0			4.4
Tributary	68785.70		7822.8	1269.49	1273.89		1273.89	0.000022	0.63	24011.68	7035.67	0.05	99.16		76038	14.4	222394	42.1	0.0			4.4
Tributary	68755.50		7821.99	1269.49	1273.89		1273.89	0.000023	0.64	23539.96	6881.55	0.05	99.16		76137	14.4	222295	42.1	0.0			4.4
Tributary	68725.30		7821.11	1269.49	1273.89		1273.89	0.000023	0.64	23171.81	6602.94	0.05	99.16		76236	14.4	222196	42.1	0.0			4.4
Tributary	68695.10		7825.83	1269.49	1273.88		1273.89	0.000024	0.65	22875.06	6464.91	0.05	99.16		76335	14.5	222097	42.1	0.0			4.39
Tributary	68664.90		7813.62	1269.49	1273.88		1273.88	0.000024	0.65	22623.55	6326.83	0.05	99.16		76435	14.5	221998	42.0	0.0			4.39
Tributary	68634.60		7824.01	1269.49	1273.88		1273.88	0.000024	0.65	22401.68	6218.88	0.05	99.16		76534	14.5	221899	42.0	0.0			4.39
Tributary	68604.40		7809.37	1269.49	1273.88		1273.88	0.000024	0.65	22212.26	6109.88	0.05	99.16		76633	14.5	221799	42.0	0.0			4.39
Tributary	68574.20		7813.63	1269.49	1273.87		1273.88	0.000024	0.66	22038.47	6025.88	0.06	99.16		76732	14.5	221700	42.0	0.0			4.38
Tributary	68544.00		7816.99	1269.49	1273.87		1273.87	0.000025	0.66	21881.72	5948.86	0.06	99.16		76831	14.6	221601	42.0	0.0			4.38
Tributary	68513.70		7813.26	1269.49	1273.87		1273.87	0.000025	0.66	21741.38	5878.24	0.06	99.16		76930	14.6	221502	42.0	0.0			4.38
Tributary	68483.50		7812.63	1269.49	1273.87		1273.87	0.000025	0.66	21598.62	5811.97	0.06	99.16		77030	14.6	221403	41.9	0.0			4.38
Tributary	68453.30		7806.06	1269.49	1273.86		1273.87	0.000025	0.66	21474.81	5749.58	0.06	99.16		77129	14.6	221304	41.9	0.0			4.37
Tributary	68423.10		7818.92	1269.49	1273.86		1273.86	0.000025	0.67	21349.02	5691.35	0.06	99.16		77228	14.6	221205	41.9	0.0			4.37
Tributary	68392.90		7809.97	1269.49	1273.86		1273.86	0.000025	0.67	21236.99	5636.07	0.06	99.16		77327	14.6	221105	41.9	0.0			4.37
Tributary	68362.60		7815.49	1269.49	1273.86		1273.86	0.000026	0.67	21122.41	5581.88	0.06	99.16		77426	14.7	221006	41.9	0.0			4.37
Tributary	68332.40		7806.32	1269.49	1273.85		1273.86	0.000026	0.67	21016.99	5531.03	0.06	99.16		77525	14.7	220907	41.8	0.0			4.36
Tributary	68302.20		7805.82	1269.49	1273.85		1273.85	0.000026	0.67	20907.86	5482.62	0.06	99.16		77625	14.7	220808	41.8	0.0			4.36
Tributary	68272.00		7807.56	1269.49	1273.85		1273.85	0.000026	0.67	20807.13	5436.59	0.06	99.16		77724	14.7	220709	41.8	0.0			4.36
Tributary	68241.70		7810.66	1269.49	1273.85		1273.85	0.000026	0.67	20711.72	5391.51	0.06	99.16		77823	14.7	220610	41.8	0.0			4.36
Tributary	68211.50		7810.13	1269.49	1273.84		1273.85	0.000026	0.67	20615.04	5347.36	0.06	99.16		77922	14.8	220510	41.8	0.0			4.35
Tributary	68181.30		7808.54	1269.49	1273.84		1273.84	0.000026	0.68	20520.97	5303.63	0.06	99.16		78021	14.8	220411	41.7	0.0			4.35
Tributary	68151.10		7801.94	1269.49	1273.84		1273.84	0.000026	0.68	20421.75	5259.1	0.06	99.16		78120	14.8	220312	41.7	0.0			4.35
Tributary	68120.80		7800.31	1269.49	1273.84		1273.84	0.000026	0.68	20337.55	5216.61	0.06	99.16		78220	14.8	220213	41.7	0.0			4.35
Tributary	68090.60		7804.96	1269.49	1273.83		1273.84	0.000027	0.68	20248.76	5172.17	0.06	99.16		78319	14.8	220114	41.7	0.0			4.34
Tributary	68060.40		7804.2	1269.49	1273.83		1273.83	0.000027	0.68	20156.44	5131.02	0.06	99.16		78418	14.9	220015	41.7	0.0			4.34
Tributary	68030.20		7806.7	1269.49	1273.83		1273.83	0.000027	0.68	20072.59	5092.87	0.06	99.16		78517	14.9	219915	41.7	0.0			4.34
Tributary	68000.00		7795.42	1269.49	1273.83		1273.83	0.000027	0.68	19988.98	5052.68	0.06	97.91	US 62 - Conewango Valley	78616	14.9	219816	41.6	0.0			4.34
Tributary	67970.10		7803.73	1269.49	1273.82		1273.83	0.00003	0.72	19229.75	5021.32	0.06	97.91		78714	14.9	219718	41.6	0.0			4.33
Tributary	67940.30		7801.2	1269.49	1273.82		1273.82	0.000034	0.77	18480.96	3992.79	0.07	97.91		78812	14.9	219620	41.6	0.0			4.33
Tributary	67910.40		7799.01	1269.49	1273.82		1273.82	0.000039	0.82	17741.32	4971.72	0.07	97.91		78910	14.9	219523	41.6	0.0			4.33
Tributary	67880.60		7794.02	1269.49	1273.81		1273.81	0.000045	0.88	17010.46	4951.7	0.07	97.91		79008	15.0	219425	41.6	0.0			4.32
Tributary	67850.70		7798.23	1269.49	1273.81		1273.81	0.000051	0.94	16288.37	4934.08	0.08	97.91		79106	15.0	219327	41.5	0.0			4.32
Tributary	67820.90		7796.1	1269.49	1273.8		1273.8	0.000059	1.01	15568.59	4915.55	0.09	97.91		79204	15.0	219229	41.5	0.0			4.31
Tributary	67791.10		7788.82	1269.49	1273.79		1273.8	0.000068	1.08	14864.21	4897.28	0.09	97.91		79302	15.0	219131	41.5	0.0			4.3
Tributary	67761.20		7788.37	1269.49	1273.79		1273.79	0.000079	1.16	14158.59	4850.57	0.1	97.91		79399	15.0	219033	41.5	0.0			4.3
Tributary	67731.40		7793.6	1269.49	1273.78		1273.78	0.00009	1.24	13498.29	4733.85	0.11	97.91		79497	15.1	218935	41.5	0.0			4.29
Tributary	67701.50		7788.62	1269.49	1273.77		1273.77	0.0001	1.31	12882.9	4595.58	0.11	97.91		79595	15.1	218837	41.4	0.0			4.28
Tributary	67671.70		7793.05	1269.49	1273.76		1273.76	0.000107	1.35	12351.03	4342.48	0.12	97.91		79693	15.1	218739	41.4	0.0			4.27
Tributary	67641.80		7786.95	1269.49	1273.75		1273.75	0.00012	1.42	11862.7	4287.7	0.12	97.91		79791	15.1	218641	41.4	0.0			4.26
Tributary	67612.00		7787.67	1269.49	1273.73		1273.74	0.000135	1.5	11395.43	4234.62	0.13	97.91		79889	15.1	218543	41.4	0.0			4.24
Tributary	67582.20		7785.61	1269.49	1273.72		1273.73	0.000149	1.58	10948.88	4141.28	0.14	97.91		79987	15.1	218446	41.4	0.0			4.23
Tributary	67552.30		7783.01	1269.49	1273.7		1273.71	0.000162	1.64	10540.87	4021.13	0.14	97.91		80085	15.2	218348	41.4	0.0			4.21
Tributary	67522.50		7784.48	1269.49	1273.69		1273.7	0.000176	1.71	10162.23	3915.25	0.15	97.91		80183	15.2	218250	41.3	0.0			4.2
Tributary	67492.60		7783.28	1269.49	1273.67		1273.68	0.000177	1.71	9820.38	3803.08	0.15	97.91		80281	15.2	218152	41.3	0.0			4.18
Tributary	67462.80		7780.21	1269.49	1273.65		1273.66	0.000186	1.75	9532.21	3482.09	0.15	97.91		80379	15.2	218054	41.3	0.0			4.16
Tributary	67433.00		7778.31	1269.49	1273.63		1273.65	0.000195	1.78	9294.48	3389.19	0.15	97.91		80476	15.2	217956	41.3	0.0			4.14
Tributary	67403.10		7776.95	1269.49	1273.61		1273.63	0.000206	1.82	9069.3	3318.74	0.16	97.91		80574	15.3	217858	41.3	0.0			4.12
Tributary	67373.30		7772.49	1269.49	1273.59		1273.61	0.000215	1.86	8876.32	3261.43	0.16	97.91		80672	15.3	217760	41.2	0.0			4.1
Tributary	67343.40		7773.68	1269.49	1273.57		1273.59	0.000228	1.91	8682.41	3227.28	0.17	97.91		80770	15.3	217662	41.2	0.0			4.08
Tributary	67313.60		7769.53	1269.49	1273.55		1273.56	0.00024	1.95	8509.59	3193.45	0.17	97.91		80868	15.3	217564	41.2	0.0			4.06

Tributary	67283.70		7770.9	1269.49	1273.53		1273.54	0.000252	1.99	8350.97	3164.71	0.17	97.91		80966	15.3	217466	41.2	0.0			4.04
Tributary	67258.90		7763.9	1269.49	1273.5		1273.52	0.000265	2.03	8194.71	3136.84	0.18	97.91		81064	15.4	217369	41.2	0.0			4.01
Tributary	67224.10		7767.66	1269.49	1273.47		1273.49	0.000278	2.07	8058.9	3118.48	0.18	97.91		81162	15.4	217271	41.1	0.0			3.98
Tributary	67194.20		7763.65	1269.49	1273.45		1273.47	0.000288	2.1	7929.57	3080.35	0.19	97.91		81260	15.4	217173	41.1	0.0			3.96
Tributary	67164.40		7762.09	1269.49	1273.42		1273.44	0.000298	2.13	7819.05	3054.03	0.19	97.91		81358	15.4	217075	41.1	0.0			3.93
Tributary	67134.50		7751.46	1269.49	1273.39		1273.41	0.000308	2.15	7730.1	3049.15	0.19	97.91		81456	15.4	216977	41.1	0.0			3.9
Tributary	67104.70		7753.35	1269.49	1273.36		1273.38	0.000318	2.17	7649.39	3038.74	0.19	97.91		81553	15.4	216879	41.1	0.0			3.87
Tributary	67074.80		7755.89	1269.49	1273.33		1273.35	0.000327	2.19	7586.54	3041.47	0.2	97.91		81651	15.5	216781	41.1	0.0			3.84
Tributary	67045.00		7748.84	1269.49	1273.3		1273.32	0.00034	2.22	7539.33	3088.73	0.2	97.91		81749	15.5	216683	41.0	0.0			3.81
Tributary	67015.20		7747.25	1269.49	1273.26		1273.28	0.000347	2.23	7532.85	3134.99	0.2	97.91		81847	15.5	216585	41.0	0.0			3.77
Tributary	66985.30		7739.63	1269.49	1273.23		1273.25	0.000369	2.29	7611.87	3425.37	0.21	97.91		81945	15.5	216487	41.0	0.0			3.74
Tributary	66955.50		7741.01	1269.49	1273.2		1273.22	0.00035	2.22	7771.57	3422.99	0.2	97.91		82043	15.5	216389	41.0	0.0			3.71
Tributary	66925.60		7735.93	1269.49	1273.17		1273.18	0.000329	2.14	7952.61	3442.12	0.2	97.91		82141	15.6	216292	41.0	0.0			3.68
Tributary	66895.80		7737.71	1269.49	1273.14		1273.15	0.000303	2.04	8182.89	3449.76	0.19	97.91		82239	15.6	216194	40.9	0.0			3.65
Tributary	66865.90		7735.96	1269.49	1273.11		1273.13	0.000274	1.93	8456.06	3465.62	0.18	97.91		82337	15.6	216096	40.9	0.0			3.62
Tributary	66836.10		7728.52	1269.49	1273.09		1273.1	0.000243	1.81	8818.97	3522.98	0.17	97.91		82435	15.6	215998	40.9	0.0			3.6
Tributary	66806.30		7730.01	1269.49	1273.07		1273.08	0.000208	1.67	9688.06	3945.73	0.16	97.91		82533	15.6	215900	40.9	0.0			3.58
Tributary	66776.47		7726.49	1269.49	1273.05		1273.06	0.000141	1.37	10961.59	4050.1	0.13	98.19		82630	15.6	215802	40.9	9.1			3.56
Tributary	66746.50		7723.79	1269.32	1273.04		1273.05	0.00015	1.44	10860.09	4134.29	0.13	98.19		82729	15.7	215704	40.9	9.1			3.72
Tributary	66716.60		7722.13	1269.15	1273.02		1273.03	0.000159	1.52	10740.54	4213.57	0.14	98.19		82827	15.7	215606	40.8	9.1			3.87
Tributary	66686.60		7727.54	1268.98	1273.01		1273.02	0.000169	1.6	10611.55	4286.12	0.14	98.19		82925	15.7	215507	40.8	9.1			4.03
Tributary	66656.70		7721.72	1268.81	1272.99		1273	0.000179	1.68	10475.12	4350.7	0.15	98.19		83023	15.7	215409	40.8	8.6			4.18
Tributary	66626.80		7715.95	1268.65	1272.97		1272.99	0.00019	1.76	10331.78	4404.55	0.15	98.19		83121	15.7	215311	40.8	9.1			4.32
Tributary	66596.90		7714.74	1268.48	1272.96		1272.97	0.000198	1.83	10193.05	4420.64	0.16	98.19		83220	15.8	215213	40.8	9.1			4.48
Tributary	66566.90		7717.01	1268.31	1272.94		1272.95	0.000205	1.9	10082.66	4432.03	0.16	98.19		83318	15.8	215115	40.7	9.1			4.63
Tributary	66537.00		7716.55	1268.14	1272.92		1272.93	0.000211	1.95	9989.2	4434.12	0.16	98.19		83416	15.8	215016	40.7	9.1			4.78
Tributary	66507.10		7709.08	1267.97	1272.9		1272.91	0.000214	2	9922.96	4441.99	0.16	98.19		83514	15.8	214918	40.7	9.1			4.93
Tributary	66477.10		7708.77	1267.8	1272.88		1272.89	0.000214	2.03	9873.77	4407.92	0.17	98.19		83612	15.8	214820	40.7	9.1			5.08
Tributary	66447.20		7710.04	1267.63	1272.86		1272.87	0.000211	2.05	9853.47	4354.8	0.16	98.19		83711	15.9	214722	40.7	8.6			5.23
Tributary	66417.30		7710.86	1267.47	1272.84		1272.85	0.000205	2.05	9872.53	4296.73	0.16	98.19		83809	15.9	214624	40.6	9.1			5.37
Tributary	66387.30		7707.52	1267.3	1272.82		1272.83	0.000202	2.06	9915.3	4302.09	0.16	98.19		83907	15.9	214525	40.6	9.1			5.52
Tributary	66357.40		7709.48	1267.13	1272.8		1272.81	0.000189	2.02	9993.02	4186.13	0.16	98.19		84005	15.9	214427	40.6	9.1			5.67
Tributary	66327.50		7703.96	1266.96	1272.78		1272.79	0.00018	2	10102.51	4167.85	0.15	98.19		84103	15.9	214329	40.6	9.1			5.82
Tributary	66297.60		7703.58	1266.79	1272.76		1272.78	0.000173	1.99	10228.07	4180.74	0.15	98.19		84202	15.9	214231	40.6	9.1			5.97
Tributary	66267.60		7705.87	1266.62	1272.75		1272.76	0.000166	1.97	10364.47	4197.38	0.15	98.19		84300	16.0	214133	40.6	9.1			6.13
Tributary	66237.70		7697.31	1266.45	1272.73		1272.75	0.000159	1.95	10511.2	4218.95	0.15	98.19		84398	16.0	214035	40.5	8.6			6.28
Tributary	66207.80		7701.62	1266.29	1272.72		1272.73	0.000152	1.94	10660.47	4241.39	0.14	98.19		84496	16.0	213936	40.5	9.1			6.43
Tributary	66177.80		7700.92	1266.12	1272.7		1272.72	0.000145	1.92	10825.57	4268.15	0.14	98.19		84594	16.0	213838	40.5	9.1			6.58
Tributary	66147.90		7697.31	1265.95	1272.69		1272.7	0.000139	1.89	10995.39	4294.55	0.14	98.19		84692	16.0	213740	40.5	9.1			6.74
Tributary	66118.03		7697.74	1265.78	1272.68		1272.69	0.000132	1.87	11169.89	4323.32	0.14	99.14		84791	16.1	213642	40.5	0.5			6.9
Tributary	66087.80		7699.38	1265.77	1272.66		1272.68	0.000136	1.9	11063.04	4321.37	0.14	99.14		84890	16.1	213543	40.4	0.5			6.89
Tributary	66057.50		7697.88	1265.76	1272.65		1272.66	0.00014	1.93	10966	4320.92	0.14	99.14		84989	16.1	213444	40.4	0.5			6.89
Tributary	66027.30		7696.15	1265.75	1272.64		1272.65	0.000144	1.95	10866.6	4318.88	0.14	99.14		85088	16.1	213344	40.4	0.5			6.89
Tributary	65997.10		7696.4	1265.74	1272.62		1272.64	0.000148	1.98	10767.46	4317.65	0.14	99.14		85187	16.1	213245	40.4	0.5			6.88
Tributary	65966.90		7693.79	1265.73	1272.61		1272.62	0.000152	2	10677.14	4316.3	0.14	99.14		85286	16.2	213146	40.4	0.5			6.88
Tributary	65936.70		7695.05	1265.72	1272.59		1272.61	0.000157	2.03	10572.98	4314.78	0.15	99.14		85385	16.2	213047	40.3	0.5			6.87
Tributary	65906.50		7695.38	1265.71	1272.58		1272.59	0.000161	2.06	10472.93	4313.33	0.15	99.14		85485	16.2	212948	40.3	0.5			6.87
Tributary	65876.30		7695.12	1265.7	1272.56		1272.58	0.000166	2.09	10372.48	4310.6	0.15	99.14		85584	16.2	212849	40.3	0.5			6.86
Tributary	65846.00		7694.68	1265.69	1272.55		1272.56	0.000171	2.12	10270.51	4303.48	0.15	99.14		85683	16.2	212750	40.3	0.5			6.86
Tributary	65815.80		7693.76	1265.68	1272.53		1272.55	0.000176	2.15	10165.17	4296.31	0.16	99.14		85782	16.2	212650	40.3	0.5			6.85
Tributary	65785.60		7692.24	1265.67	1272.51		1272.53	0.000182	2.18	10056.21	4288.45	0.16	99.14		85881	16.3	212551	40.3	0.5			6.84
Tributary	65755.40		7692.9	1265.66	1272.49		1272.51	0.000187	2.21	9959.07	4283.44	0.16	99.14		85980	16.3	212452	40.2	0.5			6.83
Tributary	65725.20		7688.71	1265.65	1272.48		1272.49	0.000193	2.24	9845.49	4279.27	0.16	99.14		86079	16.3	212353	40.2	0.5			6.83
Tributary	65694.90		7691.56	1265.64	1272.46		1272.47	0.0002	2.28	9736.67	4273.26	0.17	99.14		86179	16.3	212254	40.2	0.5			6.82
Tributary	65664.70		7689.92	1265.63	1272.44		1272.46	0.000206	2.31	9631.1	4268.99	0.17	99.14		86278	16.3	212155	40.2	0.5			6.81
Tributary	65634.50		7689.35	1265.62	1272.42		1272.44	0.000214	2.35	9521.65	4263.22	0.17	99.14		86377	16.4	212056	40.2	0.0			6.8
Tributary	65604.30		7688.81	1265.62	1272.4		1272.42	0.000222	2.39	9405.99	4267.05	0.17	99.14		86476	16.4	211956	40.1	0.5			6.78
Tributary	65574.10		7688.06	1265.61	1272.37		1272.39	0.00023	2.43	9293.15	4267.77	0.18	99.14		86575	16.4	211857	40.1	0.5			6.76
Tributary	65543.90		7687.53	1265.6	1272.35		1272.37	0.00024	2.48	9172.65	4263.91	0.18	99.14		86674	16.4	211758	40.1	0.5			6.75
Tributary	65513.60		7687.32	1265.59	1272.33		1272.35	0.000249	2.52	9055.15	4259.91	0.18	99.14		86773	16.4	211659	40.1	0.5			6.74
Tributary	65483.40		7686.15	1265.58	1272.3		1272.33	0.000259	2.57	8939.18	4257.45	0.19	99.14		86873	16.5	211560	40.1	0.5			6.72
Tributary	65453.20		7686.04	1265.57	1272.28		1272.3	0.00027	2.62	8816.37	4253.5	0.19	99.14		86972	16.5	211461	40.0	0.5			6.71
Tributary	65423.00		7687.11	1265.56	1272.25		1272.27	0.000283	2.67	8688.16	4256.72	0.2	99.14		87071	16.5	211362	40.0	0.5			6.69
Tributary	65392.80		7686.63	1265.55	1272.22		1272.25	0.000297	2.73	8557.41	4257.16	0.2	99.14		87170	16.5	211262	40.0	0.5			6.67
Tributary	65362.60		7686.02	1265.54	1272.19		1272.22	0.000312	2.79	8418.51	4254.37	0.21	99.14		87269	16.5	211163	40.0	0.5			6.65
Tributary	65332.30		7685.69	1265.53	1272.16		1272.19	0.000328	2.86	8277.81	4253.84	0.21	99.14		87368	16.5	211064	40.0	0.5			6.63
Tributary	65302.10		7685.04	1265.52	1272.13		1272.16	0.000347	2.93	8134.13	4253.52	0.22	99.14		87467	16.6	210965	40.0	0.5			6.61
Tributary	65271.90		7685.24	1265.51	1272.09		1272.12	0.000367	3.01	7978.34	4250.49	0.22	99.14		87567	16.6	210866	39.9	0.5			6.58
Tributary	65241.70		7683.95	1265.5	1272.05		1272.09	0.00039	3.09	7823.38	4249.54	0.23	99.14		87666	16.6	210767	39.9	0.5			6.55
Tributary	65211.50		7683.75	1265.49	1272.01		1272.05	0.000417	3.18	7650.23	4240.84	0.24	99.14		87765	16.6	210668	39.9	0.5			6.52
Tributary	65181.30		7682.56	1265.48	1271.97		1272.01	0.000447	3.28	7465.19	4229.65	0.25	99.14		87864	16.6	210568	39.9	0.5			6.49
Tributary	65151.00		7684.34	1265.47	1271.92		1271.96	0.000482	3.39	7275.42	4219.28	0.25	99.14		87963	16.7	210469	39.9	0.5			6.45
Tributary	65120.80		7682.89	1265.46	1271.87		1271.92	0.000519	3.5	7069.03	4190.35	0.26	99.14		88062	16.7	210370	39.8	0.5			6.41
Tributary	65090.60		7683.3	1265.45	1271.82		1271.87	0.000558	3.61	6864.52	4105.54	0.27	99.14		88161	16.7	210271	39.8	0.5			6.37
Tributary	65060.40		7683.17	1265.44	1271.76		1271.81	0.000599	3.72	6652.63	3999.95	0.28	99.14		88261	16.7	210172	39.8	0.5			6.32
Tributary	65030.20		7682.31	1265.43	1271.7		1271.76	0.000653	3.85	6439.88	3941.34	0.29	99.14		88360	16.7	210073	39.8	0.5			6.27
Tributary	65000.00		7682.42	1265.42	1271.63		1271.69	0.0007	3.96	6216.16	3860.46	0.3	99.42		88459	16.8	209974	39.8	0.0			6.21
Tributary	64969.70		7682.57	1265.42	1271.57		1271.63	0.000741	4.06	6169.62	3905.12	0.31	99.42		88558	16.8	209874	39.7	-0.5			6.15
Tributary	64939.30		7682.38	1265.43	1271.5		1271.56	0.000763	4.09	6137.13	3935.53	0.32	99.42		88658	16.8	209775	39.7	0.0			6.07
Tributary	64909.00		7681.98	1265.43	1271.43		1271.49	0.000783	4.13	6108.31	3964.91	0.32	99.42		88757	16.8	209675	39.7	0.0			6
Tributary	64878.70		7681.74	1265.43	1271.36		1271.43	0.00082	4.2	6091.06	4097.98	0.33	99.42		88857	16.8	209576	39.7	0.0			5.93
Tributary	64848.40		7681.59	1265.43	1271.29		1271.35	0.000834	4.21	6075.16	4105.62	0.33	99.42		88956	16.8	209477	39.7	-0.5			5.86
Tributary	64818.10		7681.81	1265.44	1271.21		1271.28	0.000848	4.22	6050.3	4094.05	0.33	99.42		89055	16.9	209377	39.7	0.0			5.77

Tributary	64787.80		7681.05	1265.44	1271.13		1271.2	0.000866	4.24	6013.07	4078.92	0.34	99.42		89155	16.9	209278	39.6	0.0			5.69
Tributary	64757.50		7680.87	1265.44	1271.05		1271.12	0.000893	4.27	5957.29	4065.97	0.34	99.42		89254	16.9	209178	39.6	-0.5			5.61
Tributary	64727.20		7681.41	1265.45	1270.96		1271.03	0.000931	4.32	5880.56	4052.43	0.35	99.42		89354	16.9	209079	39.6	0.0			5.51
Tributary	64696.90		7680.08	1265.45	1270.87		1270.94	0.000967	4.37	5806.33	4035.83	0.35	99.42		89453	16.9	208979	39.6	0.0			5.42
Tributary	64666.60		7680.67	1265.45	1270.78		1270.85	0.001007	4.42	5731.17	4022.15	0.36	99.42		89552	17.0	208880	39.6	-0.5			5.33
Tributary	64636.30		7680.39	1265.46	1270.68		1270.75	0.001046	4.45	5662.52	4009.26	0.36	99.42		89652	17.0	208781	39.5	0.0			5.22
Tributary	64606.00		7680.48	1265.46	1270.59		1270.66	0.001085	4.49	5595.45	3998.15	0.37	99.42		89751	17.0	208681	39.5	0.0			5.13
Tributary	64575.70		7680.5	1265.46	1270.49		1270.57	0.001134	4.55	5516.6	3993.08	0.38	99.42		89851	17.0	208582	39.5	0.0			5.03
Tributary	64545.40		7680.42	1265.46	1270.39		1270.46	0.001193	4.61	5426.06	3985.51	0.39	99.42		89950	17.0	208482	39.5	-0.5			4.93
Tributary	64515.10		7679.88	1265.47	1270.28		1270.36	0.001273	4.7	5311.02	3980.21	0.4	99.42		90050	17.1	208383	39.5	0.0			4.81
Tributary	64484.80		7679.4	1265.47	1270.15		1270.24	0.001386	4.83	5165.34	3977.63	0.41	99.42		90149	17.1	208283	39.4	0.0			4.68
Tributary	64454.50		7679.58	1265.47	1270.01		1270.1	0.001582	5.06	4938.16	3965.42	0.44	99.42		90248	17.1	208184	39.4	-0.5			4.54
Tributary	64424.20		7679.39	1265.48	1269.85		1269.95	0.001848	5.35	4683.56	3959.2	0.47	99.42		90348	17.1	208085	39.4	0.0			4.37
Tributary	64393.90		7679.33	1265.48	1269.69		1269.81	0.002138	5.63	4444.06	3936.76	0.51	99.42		90447	17.1	207985	39.4	0.0			4.21
Tributary	64363.60		7679.12	1265.48	1269.53		1269.65	0.002281	5.68	4223.07	3923.19	0.52	99.42		90547	17.1	207886	39.4	-0.5			4.05
Tributary	64333.30		7678.09	1265.49	1269.36		1269.47	0.002202	5.42	4060.44	3958.01	0.51	99.42		90646	17.2	207786	39.4	0.0			3.87
Tributary	64303.00		7678.46	1265.49	1269.15		1269.26	0.002386	5.45	3878.4	3772.26	0.52	99.42		90745	17.2	207687	39.3	0.0			3.66
Tributary	64272.70		7677.64	1265.49	1268.91		1269.02	0.002604	5.45	3646.12	3508.92	0.54	99.42		90845	17.2	207588	39.3	0.0			3.42
Tributary	64242.40		7677.38	1265.49	1268.66		1268.77	0.002773	5.36	3467.6	3292.48	0.55	99.42		90944	17.2	207488	39.3	-0.5			3.17
Tributary	64212.10		7675.52	1265.5	1268.42		1268.53	0.002818	5.12	3343	3104.79	0.55	99.42		91044	17.2	207389	39.3	0.0			2.92
Tributary	64181.80		7669.98	1265.5	1268.16		1268.27	0.00272	4.74	3258.4	3926.07	0.53	99.42		91143	17.3	207289	39.3	0.0			2.66
Tributary	64151.50		5069.48	1265.5	1268		1268.04	0.001049	2.83	3370.51	1902.97	0.33	99.42		91243	17.3	207190	39.2	-0.5			2.5
Tributary	64121.20		5069.43	1265.51	1267.91		1267.95	0.000828	2.47	3647.99	1937.84	0.29	99.42		91342	17.3	207090	39.2	0.0			2.4
Tributary	64090.90		5069.16	1265.51	1267.84		1267.87	0.000647	2.15	3987.88	2005.67	0.25	99.42		91441	17.3	206991	39.2	0.0			2.33
Tributary	64060.60		5069.08	1265.51	1267.79		1267.82	0.000493	1.86	4424.87	2110.66	0.22	99.42		91541	17.3	206892	39.2	-0.5			2.28
Tributary	64030.30		5068.67	1265.52	1267.76		1267.77	0.000356	1.57	5022.89	2257.35	0.19	99.42		91640	17.4	206792	39.2	0.0			2.24
Tributary	64000.00		5068.55	1265.52	1267.73		1267.75	0.000229	1.26	5987.67	2502.24	0.15	99.22		91740	17.4	206693	39.1	15.4			2.21
Tributary	63969.70		5068.4	1265.23	1267.71		1267.72	0.000204	1.28	6301.46	2620.59	0.14	99.22		91839	17.4	206594	39.1	14.9			2.48
Tributary	63939.50		5068.96	1264.95	1267.7		1267.7	0.000179	1.28	6644.5	2727.12	0.14	99.22		91938	17.4	206494	39.1	15.4			2.75
Tributary	63909.20		5067.58	1264.66	1267.68		1267.69	0.000155	1.26	7004.57	2810.58	0.13	99.22		92037	17.4	206395	39.1	15.4			3.02
Tributary	63879.00		5068.15	1264.37	1267.67		1267.68	0.000134	1.24	7389.69	2898.92	0.12	99.22		92137	17.5	206296	39.1	14.9			3.3
Tributary	63848.70		5067.75	1264.09	1267.66		1267.66	0.000118	1.22	7799.45	5018.07	0.12	99.22		92236	17.5	206197	39.1	15.4			3.57
Tributary	63818.50		5068.35	1263.8	1267.65		1267.65	0.000103	1.2	8229.74	3136.14	0.11	99.22		92335	17.5	206097	39.0	15.4			3.85
Tributary	63788.30		5068.59	1263.51	1267.64		1267.64	0.00009	1.17	8687.25	3258.69	0.1	99.22		92434	17.5	205998	39.0	14.9			4.13
Tributary	63758.00		5068.92	1263.25	1267.63		1267.63	0.000079	1.14	9167.44	3381.53	0.1	99.22		92533	17.5	205899	39.0	15.4			4.4
Tributary	63727.80		5068.74	1262.94	1267.62		1267.63	0.000068	1.1	9672.71	3478.77	0.09	99.22		92633	17.5	205800	39.0	15.4			4.68
Tributary	63697.50		5068.35	1262.65	1267.62		1267.62	0.000059	1.06	10206.53	3580.02	0.09	99.22		92732	17.6	205701	39.0	14.9			4.97
Tributary	63667.30		5068.35	1262.37	1267.61		1267.62	0.000051	1.03	10762.4	3684.87	0.08	99.22		92831	17.6	205601	38.9	15.4			5.24
Tributary	63637.00		5067.32	1262.08	1267.61		1267.61	0.000045	0.99	11342.27	3779.09	0.08	99.22		92930	17.6	205502	38.9	14.9			5.53
Tributary	63606.80		5068.45	1261.8	1267.6		1267.61	0.000039	0.95	11945.67	3861.08	0.07	99.22		93030	17.6	205403	38.9	15.4			5.8
Tributary	63576.50		5068.81	1261.51	1267.6		1267.6	0.000034	0.92	12577.81	3953.56	0.07	99.22		93129	17.6	205304	38.9	15.4			6.09
Tributary	63546.30		5068.48	1261.22	1267.6		1267.6	0.00003	0.89	13240.37	4047.3	0.06	99.22		93228	17.7	205204	38.9	14.9			6.38
Tributary	63516.10		5067.64	1260.94	1267.59		1267.6	0.000026	0.85	13916.26	4148.71	0.06	99.22		93327	17.7	205105	38.8	15.4			6.65
Tributary	63485.80		5068.76	1260.65	1267.59		1267.59	0.000023	0.83	14645.32	4210.69	0.06	99.22		93426	17.7	205006	38.8	15.4			6.94
Tributary	63455.60		5068.53	1260.36	1267.59		1267.59	0.000021	0.8	15411.05	4249.17	0.05	99.22		93526	17.7	204907	38.8	14.9			7.23
Tributary	63425.30		5067.68	1260.08	1267.59		1267.59	0.000018	0.77	16210.21	4387.37	0.05	99.22		93625	17.7	204808	38.8	15.4			7.51
Tributary	63395.10		5068.62	1259.79	1267.59		1267.59	0.000016	0.74	17036.02	4514.26	0.05	99.22		93724	17.8	204708	38.8	14.9			7.8
Tributary	63364.80		5068.08	1259.51	1267.59		1267.59	0.000014	0.71	17874.18	4632.01	0.05	99.22		93823	17.8	204609	38.8	15.4			8.08
Tributary	63334.60		5068.82	1259.22	1267.58		1267.59	0.000012	0.68	18742.73	4744.13	0.04	99.22		93923	17.8	204510	38.7	15.4			8.36
Tributary	63304.40		5067.69	1258.93	1267.58		1267.58	0.000011	0.65	19628.38	4849.83	0.04	99.22		94022	17.8	204411	38.7	14.9			8.65
Tributary	63274.10		5068.07	1258.65	1267.58		1267.58	0.00001	0.63	20540.79	4954.6	0.04	99.22		94121	17.8	204311	38.7	15.4			8.93
Tributary	63243.90		5068.63	1258.36	1267.58		1267.58	0.000009	0.6	21468.37	5059.43	0.04	99.22		94220	17.8	204212	38.7	15.4			9.22
Tributary	63213.60		5068.23	1258.07	1267.58		1267.58	0.000008	0.58	22417.82	5172.73	0.03	99.22		94319	17.9	204113	38.7	14.9			9.51
Tributary	63183.40		5068.91	1257.79	1267.58		1267.58	0.000007	0.56	23393.41	5277.01	0.03	99.22		94419	17.9	204014	38.6	15.4			9.79
Tributary	63153.10		5068.79	1257.5	1267.58		1267.58	0.000006	0.54	24383.65	5381.39	0.03	99.22		94518	17.9	203915	38.6	14.9			10.08
Tributary	63122.90		5067.96	1257.22	1267.58		1267.58	0.000006	0.52	25400.84	5490.99	0.03	99.22		94617	17.9	203815	38.6	15.4			10.36
Tributary	63092.70		5068.45	1256.93	1267.58		1267.58	0.000005	0.5	26439.63	5608.55	0.03	99.22		94716	17.9	203716	38.6	15.4			10.65
Tributary	63062.40		5068.28	1256.64	1267.58		1267.58	0.000004	0.48	27515.23	5747.78	0.03	99.22		94816	18.0	203617	38.6	14.9			10.94
Tributary	63032.20		5067.16	1256.36	1267.58		1267.58	0.000004	0.47	28619.73	5923.46	0.03	99.22		94915	18.0	203518	38.5	15.4			11.22
Tributary	63001.97		5066.26	1256.07	1267.58		1267.58	0.000004	0.46	29801.78	6208.94	0.03	100		95014	18.0	203418	38.5	1.6			11.51
Tributary	62971.40		5067.74	1256.04	1267.58		1267.58	0.000004	0.47	29713.96	6408.76	0.03	100		95114	18.0	203318	38.5	1.6			11.54
Tributary	62941.00		5067.8	1256.01	1267.58		1267.58	0.000004	0.48	29676.41	6510.84	0.03	100		95214	18.0	203218	38.5	2.1			11.57
Tributary	62910.50		5067.28	1255.97	1267.58		1267.58	0.000004	0.48	29657.3	6570.98	0.03	100		95314	18.1	203118	38.5	1.6			11.61
Tributary	62880.00		5068.18	1255.94	1267.58		1267.58	0.000004	0.48	29662.25	6769.51	0.03	100		95414	18.1	203018	38.5	1.6			11.64
Tributary	62849.50		5067.41	1255.91	1267.58		1267.58	0.000004	0.49	29732.19	6864.79	0.03	100		95514	18.1	202918	38.4	1.6			11.67
Tributary	62819.00		5068.84	1255.88	1267.57		1267.58	0.000004	0.49	29806.59	6942.57	0.03	100		95614	18.1	202818	38.4	1.6			11.69
Tributary	62788.60		5069.41	1255.85	1267.57		1267.58	0.000004	0.49	29895.84	6995.56	0.03	100		95714	18.1	202718	38.4	1.6			11.72
Tributary	62758.10		5067.38	1255.82	1267.57		1267.58	0.000004	0.49	29992.97	7020.05	0.03	100		95814	18.1	202618	38.4	2.1			11.75
Tributary	62727.60		5067.22	1255.78	1267.57		1267.57	0.000004	0.49	30087.91	7038.71	0.03	100		95914	18.2	202518	38.4	1.6			11.79
Tributary	62697.10		5068.34	1255.75	1267.57		1267.57	0.000004	0.49	30190.04	7060.75	0.03	100		96014	18.2	202418	38.3	1.6			11.82
Tributary	62666.60		5068.37	1255.72	1267.57		1267.57	0.000004	0.49	30286.55	7115.72	0.03	100		96114	18.2	202318	38.3	1.6			11.85
Tributary	62636.20		5068.21	1255.69	1267.57		1267.57	0.000004	0.49	30411.4	7205.51	0.03	100		96214	18.2	202218	38.3	1.6			11.88
Tributary	62605.70		5067.47	1255.66	1267.57		1267.57	0.000004	0.49	30553.63	7276.68	0.03	100		96314	18.2	202118	38.3	2.1			11.91
Tributary	62575.20		5068.1	1255.62	1267.57		1267.57	0.000004	0.49	30714.42	7339.67	0.03	100		96414	18.3	202018	38.3	1.6			11.95
Tributary	62544.70		5067.83	1255.59	1267.57		1267.57	0.000004	0.49	30888.54	7385.2	0.03	100		96514	18.3	201918	38.2	1.6			11.98
Tributary	62514.20		5067.44	1255.56	1267.57		1267.57	0.000004	0.49	31063.3	7450.46	0.03	100		96614	18.3	201818	38.2	1.6			12.01
Tributary	62483.80		5066.88	1255.53	1267.57		1267.57	0.000004	0.48	31287.29	7676.37	0.03	100		96714	18.3	201718	38.2	1.6			12.04
Tributary	62453.30		5068.13	1255.5	1267.57		1267.57	0.000004	0.49	31552.41	7813.03	0.03	100		96814	18.3	201618	38.2	1.6			12.07
Tributary	62422.80		5066.92	1255.47	1267.57		1267.57	0.000004	0.48	31838	7835.01	0.03	100		96914	18.4	201518	38.2	2.1			12.1
Tributary	62392.30		5068.27	1255.43	1267.57		1267.57	0.000004	0.48	32129.63	7862.12	0.03	100		97014	18.4	201418	38.1	1.6			12.14
Tributary	62361.80		5066.3	1255.4	1267.57		1267.57	0.000004	0.47	32412.31	7885.93	0.03	100		97114	18.4	201318	38.1	1.6			12.17
Tributary	62331.40		5068.36	1255.37	1267.57		1267.57	0.000004	0.47	32702.86	7910.15	0.03	100		97214	18.4	201218	38.1	1.6			12.2
Tributary	62300.90		5068.43	1255.34	1267.57		1267.57	0.000004	0.46	33001.88	7936.19	0.02	100		97314	18.4	201118	38.1	1.6			12.23

Tributary	62270.40		5068.15	1255.31	1267.57		1267.57	0.000004	0.45	33298.87	7964.28	0.02	100		97414	18.4	201018	38.1	2.1			12.26
Tributary	62239.90		5068.78	1255.27	1267.57		1267.57	0.000004	0.45	33611.78	7997.5	0.02	100		97514	18.5	200918	38.1	1.6			12.3
Tributary	62209.40		5067.61	1255.24	1267.57		1267.57	0.000003	0.44	33936.03	8043.55	0.02	100		97614	18.5	200818	38.0	1.6			12.33
Tributary	62179.00		5068.53	1255.21	1267.57		1267.57	0.000003	0.44	34259.92	8109.02	0.02	100		97714	18.5	200718	38.0	1.6			12.36
Tributary	62148.50		5066.9	1255.18	1267.57		1267.57	0.000003	0.43	34612.07	8176.43	0.02	100		97814	18.5	200618	38.0	1.6			12.39
Tributary	62118.00		5067.38	1255.15	1267.57		1267.57	0.000003	0.43	34980.61	8223.05	0.02	100		97914	18.5	200518	38.0	1.6			12.42
Tributary	62087.50		5067.41	1255.12	1267.57		1267.57	0.000003	0.42	35364.34	8269.83	0.02	100		98014	18.6	200418	38.0	2.1			12.45
Tributary	62057.00		5067.53	1255.08	1267.57		1267.57	0.000003	0.42	35766.54	8323.36	0.02	100		98114	18.6	200318	37.9	1.6			12.49
Tributary	62026.60		5068.84	1255.05	1267.57		1267.57	0.000003	0.41	36198.9	8369.81	0.02	100		98214	18.6	200218	37.9	1.6			12.52
Tributary	61996.13		5068.18	1255.02	1267.56		1267.56	0.000003	0.4	36621.33	8395.55	0.02	99.96		98314	18.6	200118	37.9	-1.6			12.54
Tributary	61965.60		5068.74	1255.05	1267.56		1267.56	0.000003	0.41	36770.68	8579.83	0.02	99.96		98414	18.6	200019	37.9	-2.1			12.51
Tributary	61935.10		5067.31	1255.09	1267.56		1267.56	0.000003	0.41	36942.22	8728.99	0.02	99.96		98514	18.7	199919	37.9	-1.6			12.47
Tributary	61904.70		5068.37	1255.12	1267.56		1267.56	0.000003	0.41	37112.64	8836.29	0.02	99.96		98614	18.7	199819	37.8	-2.1			12.44
Tributary	61874.20		5066.81	1255.16	1267.56		1267.56	0.000003	0.41	37297.43	8936.17	0.02	99.96		98714	18.7	199719	37.8	-1.6			12.4
Tributary	61843.70		5068.02	1255.19	1267.56		1267.56	0.000003	0.41	37487.36	9086.94	0.02	99.96		98814	18.7	199619	37.8	-1.6			12.37
Tributary	61813.30		5069.14	1255.22	1267.56		1267.56	0.000003	0.42	37690.21	9246.02	0.02	99.96		98914	18.7	199519	37.8	-2.1			12.34
Tributary	61782.80		5069.05	1255.26	1267.56		1267.56	0.000003	0.42	37897.25	9414.29	0.02	99.96		99014	18.8	199419	37.8	-1.6			12.3
Tributary	61752.30		5067.22	1255.29	1267.56		1267.56	0.000003	0.42	38117.78	9578.02	0.02	99.96		99114	18.8	199319	37.7	-1.6			12.27
Tributary	61721.90		5066.21	1255.32	1267.56		1267.56	0.000003	0.42	38371.14	9838.11	0.02	99.96		99214	18.8	199219	37.7	-2.1			12.24
Tributary	61691.40		5069.17	1255.36	1267.56		1267.56	0.000003	0.4	38659.09	10017.6	0.02	99.96		99314	18.8	199119	37.7	-1.6			12.2
Tributary	61660.90		5067.04	1255.39	1267.56		1267.56	0.000002	0.38	39241.55	9459.58	0.02	99.96		99414	18.8	199019	37.7	-2.1			12.17
Tributary	61630.50		5068.11	1255.43	1267.56		1267.56	0.000002	0.36	40090.8	9090.68	0.02	99.96		99513	18.8	198919	37.7	-1.6			12.13
Tributary	61600.00		5066.5	1255.46	1267.56		1267.56	0.000002	0.35	41061.98	8978.77	0.02	99.96		99613	18.9	198819	37.7	-1.6			12.1
Tributary	61569.50		5067.11	1255.49	1267.56		1267.56	0.000002	0.33	42112.03	8934.78	0.02	99.96		99713	18.9	198719	37.6	-2.1			12.07
Tributary	61539.10		5066.37	1255.53	1267.56		1267.56	0.000002	0.32	43202.55	8916.61	0.02	99.96		99813	18.9	198619	37.6	-1.6			12.03
Tributary	61508.60		5068.26	1255.56	1267.56		1267.56	0.000002	0.31	44337.85	8933.5	0.02	99.96		99913	18.9	198519	37.6	-1.6			12
Tributary	61478.10		5067.91	1255.59	1267.56		1267.56	0.000002	0.3	45524.79	8955.18	0.02	99.96		100013	18.9	198419	37.6	-2.1			11.97
Tributary	61447.70		5068.62	1255.63	1267.56		1267.56	0.000001	0.29	46732.41	8986.42	0.02	99.96		100113	19.0	198319	37.6	-1.6			11.93
Tributary	61417.20		5066.73	1255.66	1267.56		1267.56	0.000001	0.28	47997.09	9033.66	0.01	99.96		100213	19.0	198219	37.5	-2.1			11.9
Tributary	61386.70		5066.44	1255.7	1267.56		1267.56	0.000001	0.27	49288.12	9063.98	0.01	99.96		100313	19.0	198119	37.5	-1.6			11.86
Tributary	61356.30		5067.09	1255.73	1267.56		1267.56	0.000001	0.26	50624.73	9058.44	0.01	99.96		100413	19.0	198019	37.5	-1.6			11.83
Tributary	61325.80		5068.35	1255.76	1267.56		1267.56	0.000001	0.25	52010.61	9093.1	0.01	99.96		100513	19.0	197919	37.5	-2.1			11.8
Tributary	61295.30		5067.39	1255.8	1267.56		1267.56	0.000001	0.24	53443.99	9152.61	0.01	99.96		100613	19.1	197819	37.5	-1.6			11.76
Tributary	61264.90		5066.28	1255.83	1267.56		1267.56	0.000001	0.23	54915.45	9229.65	0.01	99.96		100713	19.1	197719	37.4	-1.6			11.73
Tributary	61234.40		5066.59	1255.86	1267.56		1267.56	0.000001	0.22	56437.82	9308.6	0.01	99.96		100813	19.1	197619	37.4	-2.1			11.7
Tributary	61203.90		5065.94	1255.9	1267.56		1267.56	0.000001	0.21	57994.58	9372.68	0.01	99.96		100913	19.1	197520	37.4	-1.6			11.66
Tributary	61173.50		5067.71	1255.93	1267.56		1267.56	0.000001	0.2	59598.46	9454.83	0.01	99.96		101013	19.1	197420	37.4	-2.1			11.63
Tributary	61143.00		5066	1255.97	1267.56		1267.56	0.000001	0.19	61254.63	9523.92	0.01	99.96		101113	19.2	197320	37.4	-1.6			11.59
Tributary	61112.50		5067.47	1256	1267.56		1267.56	0.000001	0.19	62948.02	9574.74	0.01	99.96		101213	19.2	197220	37.4	-1.6			11.56
Tributary	61082.00		5068.05	1256.03	1267.56		1267.56	0.000001	0.18	64659.89	9626.39	0.01	99.96		101313	19.2	197120	37.3	-2.1			11.53
Tributary	61051.60		5068.12	1256.07	1267.56		1267.56	0	0.17	66392.35	9679.12	0.01	99.96		101413	19.2	197020	37.3	-1.6			11.49
Tributary	61021.10		5070.08	1256.1	1267.56		1267.56	0	0.16	68146.41	9730.03	0.01	99.96		101513	19.2	196920	37.3	-2.1			11.46
Tributary	60990.69		5068.86	1256.14	1267.56		1267.56	0	0.16	69919.59	9778.6	0.01	98.49		101613	19.2	196820	37.3	0.5			11.42
Tributary	60960.60		5069.8	1256.13	1267.56		1267.56	0.000001	0.2	58557.84	9258.39	0.01	98.49		101711	19.3	196721	37.3	0.5			11.43
Tributary	60930.60		5068.04	1256.12	1267.56		1267.56	0.000001	0.27	48208.45	8748.31	0.01	98.49		101810	19.3	196623	37.2	0.5			11.44
Tributary	60900.60		5069.21	1256.11	1267.56		1267.56	0.000002	0.37	38686.02	8328.36	0.02	98.49		101908	19.3	196524	37.2	0.5			11.45
Tributary	60870.60		5066.9	1256.1	1267.56		1267.56	0.000005	0.52	29928.86	7928.72	0.03	98.49		102007	19.3	196426	37.2	0.0			11.46
Tributary	60840.50		5067.72	1256.1	1267.56		1267.56	0.000009	0.73	22371.72	6656.39	0.04	98.49		102105	19.3	196327	37.2	0.5			11.46
Tributary	60810.50		5067.05	1256.09	1267.56		1267.56	0.000013	0.89	16976.49	4990.7	0.05	98.49		102204	19.4	196229	37.2	0.5			11.47
Tributary	60780.50		5066.85	1256.08	1267.55		1267.56	0.000015	0.95	14115.31	3410.25	0.05	98.49		102302	19.4	196130	37.1	0.5			11.47
Tributary	60750.50		5067.25	1256.07	1267.55		1267.56	0.000018	1.04	12559.8	2942.31	0.06	98.49		102401	19.4	196032	37.1	0.5			11.48
Tributary	60720.50		5067.56	1256.06	1267.55		1267.55	0.000021	1.11	11401.79	2537.59	0.06	98.49		102499	19.4	195933	37.1	0.0			11.49
Tributary	60690.40		5067.88	1256.06	1267.55		1267.55	0.000023	1.17	10683.07	2088.67	0.06	98.49		102598	19.4	195835	37.1	0.5			11.49
Tributary	60660.40		5067.28	1256.05	1267.54		1267.55	0.000025	1.23	10197.71	1948.01	0.07	98.49		102696	19.5	195736	37.1	0.5			11.49
Tributary	60630.40		5067.57	1256.04	1267.54		1267.55	0.000027	1.28	9757.11	1861.47	0.07	98.49		102795	19.5	195638	37.1	0.5			11.5
Tributary	60600.40		5067.61	1256.03	1267.54		1267.54	0.000026	1.25	9382.79	1626.47	0.07	98.49		102893	19.5	195539	37.0	0.5			11.51
Tributary	60570.40		5067.34	1256.02	1267.53		1267.54	0.000027	1.28	9105.81	1546.52	0.07	98.49		102991	19.5	195441	37.0	0.0			11.51
Tributary	60540.30		5067.02	1256.02	1267.53		1267.54	0.000029	1.31	8846.96	1501.39	0.07	98.49		103090	19.5	195342	37.0	0.5			11.51
Tributary	60510.30		5067.42	1256.01	1267.53		1267.54	0.00003	1.34	8598.16	1458.58	0.07	98.49		103188	19.5	195244	37.0	0.5			11.52
Tributary	60480.30		5067.54	1256	1267.52		1267.53	0.000032	1.38	8359.19	1417.4	0.07	98.49		103287	19.6	195145	37.0	0.5			11.52
Tributary	60450.30		5067.44	1255.99	1267.52		1267.53	0.000033	1.41	8126.02	1377.94	0.08	98.49		103385	19.6	195047	36.9	0.5			11.53
Tributary	60420.20		5067.2	1255.98	1267.52		1267.53	0.000035	1.45	7902.01	1339.79	0.08	98.49		103484	19.6	194948	36.9	0.0			11.54
Tributary	60390.20		5067.26	1255.98	1267.51		1267.53	0.000037	1.49	7680.68	1302.7	0.08	98.49		103582	19.6	194850	36.9	0.5			11.53
Tributary	60360.20		5067.46	1255.97	1267.51		1267.52	0.000039	1.53	7467.44	1267.44	0.08	98.49		103681	19.6	194752	36.9	0.5			11.54
Tributary	60330.20		5067.25	1255.96	1267.5		1267.52	0.000041	1.57	7260.19	1232.19	0.08	98.49		103779	19.7	194653	36.9	0.5			11.54
Tributary	60300.20		5067.63	1255.95	1267.5		1267.51	0.000043	1.61	7054.65	1196.38	0.09	98.49		103878	19.7	194555	36.8	0.5			11.55
Tributary	60270.10		5067.34	1255.94	1267.49		1267.51	0.000045	1.65	6852.25	1160.97	0.09	98.49		103976	19.7	194456	36.8	0.0			11.55
Tributary	60240.10		5067.37	1255.94	1267.49		1267.51	0.000047	1.69	6655.97	1125.55	0.09	98.49		104075	19.7	194358	36.8	0.5			11.55
Tributary	60210.10		5067.24	1255.93	1267.48		1267.5	0.000049	1.73	6466.64	1090.72	0.09	98.49		104173	19.7	194259	36.8	0.5			11.55
Tributary	60180.10		5067.34	1255.92	1267.48		1267.5	0.000052	1.78	6278.61	1056.73	0.09	98.49		104272	19.7	194161	36.8	0.5			11.56
Tributary	60150.10		5067.12	1255.91	1267.47		1267.49	0.000054	1.82	6096.16	1019.97	0.1	98.49		104370	19.8	194062	36.8	0.5			11.56
Tributary	60120.00		5067.22	1255.9	1267.47		1267.49	0.000056	1.86	5917.36	977.33	0.1	98.49		104469	19.8	193964	36.7	0.0			11.57
Tributary	60090.00		5067.48	1255.9	1267.46		1267.48	0.000058	1.89	5747.16	934.04	0.1	98.49		104567	19.8	193865	36.7	0.5			11.56
Tributary	60060.00		5067.18	1255.89	1267.45		1267.48	0.00006	1.92	5582.38	891.6	0.1	98.49		104666	19.8	193767	36.7	0.5			11.56
Tributary	60030.00		5067.28	1255.88	1267.45		1267.47	0.000062	1.95	5424.15	849.42	0.1	98.49		104764	19.8	193668	36.7	0.5			11.57
Tributary	60000.00		5067.31	1255.87	1267.44		1267.46	0.000063	1.98	5271.33	807.75	0.1	99.42		104863	19.9	193570	36.7	-0.5			11.57
Tributary	59969.70		5067.46	1255.88	1267.43		1267.46	0.000066	2.02	5151.06	792.95	0.11	99.42		104962	19.9	193470	36.6	0.0			11.55
Tributary	59939.30		5067.39	1255.88	1267.42		1267.45	0.00007	2.07	5035.37	782.2	0.11	99.42		105062	19.9	193371	36.6	-0.5			11.54
Tributary	59909.00		5067.22	1255.89	1267.42		1267.45	0.000074	2.13	4921.88	774.43	0.11	99.42		105161	19.9	193271	36.6	0.0			11.53
Tributary	59878.70		5067.32	1255.89	1267.41		1267.44	0.000078	2.19	4810.82	768.4	0.12	99.42		105260	19.9	193172	36.6	0.0			11.52
Tributary	59848.40		5067.34	1255.89	1267.4		1267.43	0.000082	2.25	4699.36	763.73	0.12	99.42		105360	20.0	193073	36.6	-1.6			11.51
Tributary	59818.10		5067.31	1255.92	1267.39		1267.42	0.000087	2.32	4587.96	759.97	0.12	99.42		105459	20.0	192973	36.5	1.1			11.47
Tributary	59787.80		5067.23	1255.9	1267.38		1267.42	0.000093	2.39	4477.68	756.86	0.13	99.42		105559	20.0	192874	36.5	0.0			11.48

Tributary	59757.50		5067.25	1255.9	1267.37		1267.41	0.000099	2.46	4366.27	754.15	0.13	99.42		105658	20.0	192774	36.5	-0.5			11.47
Tributary	59727.20		5067.24	1255.91	1267.35		1267.4	0.000105	2.54	4255.9	751.55	0.13	99.42		105758	20.0	192675	36.5	0.0			11.44
Tributary	59696.90		5067.3	1255.91	1267.34		1267.39	0.000112	2.62	4144.9	749.21	0.14	99.42		105857	20.0	192575	36.5	-0.5			11.43
Tributary	59666.60		5067.27	1255.92	1267.33		1267.38	0.00012	2.71	4032.82	747.11	0.14	99.42		105956	20.1	192476	36.5	0.0			11.41
Tributary	59636.30		5067.25	1255.92	1267.31		1267.37	0.000128	2.8	3921.63	743.4	0.15	99.42		106056	20.1	192377	36.4	0.0			11.39
Tributary	59606.00		5067.2	1255.92	1267.3		1267.36	0.000137	2.89	3810.46	739.66	0.15	99.42		106155	20.1	192277	36.4	-0.5			11.38
Tributary	59575.70		5067.25	1255.93	1267.28		1267.35	0.000146	2.99	3696.45	735.82	0.16	99.42		106255	20.1	192178	36.4	0.0			11.35
Tributary	59545.40		5067.22	1255.93	1267.26		1267.34	0.000156	3.09	3584.15	729.08	0.16	99.42		106354	20.1	192078	36.4	-0.5			11.33
Tributary	59515.10		5067.25	1255.94	1267.24		1267.32	0.000167	3.19	3471.03	721.19	0.17	99.42		106454	20.2	191979	36.4	0.0			11.3
Tributary	59484.80		5067.26	1255.94	1267.22		1267.31	0.000178	3.29	3359.36	709.37	0.17	99.42		106553	20.2	191879	36.3	0.0			11.28
Tributary	59454.50		5067.33	1255.94	1267.2		1267.29	0.000191	3.4	3246.56	701.99	0.18	99.42		106652	20.2	191780	36.3	-0.5			11.26
Tributary	59424.20		5067.25	1255.95	1267.17		1267.28	0.000205	3.52	3133.1	694.4	0.19	99.42		106752	20.2	191681	36.3	0.0			11.22
Tributary	59393.90		5067.31	1255.95	1267.15		1267.26	0.000219	3.64	3020.24	681.83	0.19	99.42		106851	20.2	191581	36.3	-0.5			11.2
Tributary	59363.60		5067.25	1255.96	1267.12		1267.24	0.000236	3.77	2909.66	676.34	0.2	99.42		106951	20.3	191482	36.3	0.0			11.16
Tributary	59333.30		5067.27	1255.96	1267.09		1267.22	0.000255	3.91	2796.97	669.34	0.21	99.42		107050	20.3	191382	36.2	0.0			11.13
Tributary	59303.00		5067.26	1255.96	1267.06		1267.2	0.000274	4.05	2684.77	660.06	0.22	99.42		107149	20.3	191283	36.2	-0.5			11.1
Tributary	59272.70		5067.29	1255.97	1267.03		1267.19	0.000294	4.18	2577.77	647.48	0.22	99.42		107249	20.3	191184	36.2	0.0			11.06
Tributary	59242.40		5067.27	1255.97	1267		1267.17	0.000314	4.31	2472.55	631.45	0.23	99.42		107348	20.3	191084	36.2	-0.5			11.03
Tributary	59212.10		5067.24	1255.98	1266.96		1267.11	0.00027	3.99	2410.98	427.33	0.21	99.42		107448	20.3	190985	36.2	0.0			10.98
Tributary	59181.80		5067.26	1255.98	1266.93		1267.08	0.000276	4.03	2376.14	417.8	0.22	99.42		107547	20.4	190885	36.2	0.0			10.95
Tributary	59151.50		5067.27	1255.98	1266.91		1267.06	0.000282	4.06	2345.36	410.16	0.22	99.42		107647	20.4	190786	36.1	-0.5			10.93
Tributary	59121.20		5067.19	1255.99	1266.88		1267.03	0.000288	4.1	2313.6	402.54	0.22	99.42		107746	20.4	190686	36.1	0.0			10.89
Tributary	59090.90		5067.25	1255.99	1266.85		1267	0.000294	4.13	2285.05	394.82	0.22	99.42		107845	20.4	190587	36.1	-0.5			10.86
Tributary	59060.60		5067.4	1256	1266.82		1266.98	0.0003	4.16	2257.79	388	0.22	99.42		107945	20.4	190488	36.1	0.0			10.82
Tributary	59030.30		5067.23	1256	1266.79		1266.95	0.000306	4.19	2232.89	382.03	0.23	99.42		108044	20.5	190388	36.1	0.0			10.79
Tributary	59000.00		5067.21	1256	1266.75		1266.92	0.000313	4.23	2207.23	376.56	0.23	99.42		108144	20.5	190289	36.0	0.5			10.75
Tributary	58969.70		5067.36	1255.99	1266.72		1266.89	0.000319	4.26	2183.17	372.94	0.23	99.42		108243	20.5	190189	36.0	1.1			10.73
Tributary	58939.30		5067.23	1255.97	1266.69		1266.86	0.000325	4.3	2160.57	369.21	0.23	99.42		108343	20.5	190090	36.0	0.5			10.72
Tributary	58909.00		5067.25	1255.96	1266.65		1266.82	0.000331	4.33	2136.95	365.53	0.24	99.42		108442	20.5	189991	36.0	1.1			10.69
Tributary	58878.70		5067.13	1255.94	1266.62		1266.79	0.000337	4.36	2114.69	361.94	0.24	99.42		108541	20.6	189891	36.0	0.5			10.68
Tributary	58848.40		5067.29	1255.93	1266.58		1266.76	0.000344	4.4	2091.7	358.36	0.24	99.42		108641	20.6	189792	35.9	1.1			10.65
Tributary	58818.10		5067.26	1255.91	1266.54		1266.73	0.00035	4.43	2070.11	354.89	0.24	99.42		108740	20.6	189692	35.9	0.5			10.63
Tributary	58787.80		5067.22	1255.9	1266.51		1266.69	0.000357	4.47	2048	351.31	0.24	99.42		108840	20.6	189593	35.9	1.1			10.61
Tributary	58757.50		5067.22	1255.88	1266.47		1266.66	0.000363	4.5	2027.35	347.94	0.25	99.42		108939	20.6	189493	35.9	0.5			10.59
Tributary	58727.20		5067.17	1255.87	1266.43		1266.62	0.00037	4.53	2005.73	344.46	0.25	99.42		109038	20.7	189394	35.9	1.1			10.56
Tributary	58696.90		5067.19	1255.85	1266.39		1266.59	0.000377	4.57	1984.91	341.11	0.25	99.42		109138	20.7	189295	35.9	0.5			10.54
Tributary	58666.60		5067.29	1255.84	1266.35		1266.55	0.000385	4.6	1964.59	337.86	0.25	99.42		109237	20.7	189195	35.8	0.5			10.51
Tributary	58636.30		5067.24	1255.83	1266.31		1266.51	0.000392	4.64	1943.88	334.45	0.25	99.42		109337	20.7	189096	35.8	1.1			10.48
Tributary	58606.00		5067.27	1255.81	1266.27		1266.47	0.0004	4.67	1924.06	331.29	0.26	99.42		109436	20.7	188996	35.8	0.5			10.46
Tributary	58575.70		5067.28	1255.8	1266.22		1266.44	0.000408	4.71	1903.79	328.08	0.26	99.42		109536	20.7	188897	35.8	1.1			10.42
Tributary	58545.40		5067.31	1255.78	1266.18		1266.4	0.000416	4.74	1884.38	325.16	0.26	99.42		109635	20.8	188797	35.8	0.5			10.4
Tributary	58515.10		5067.24	1255.77	1266.13		1266.36	0.000424	4.78	1864.45	321.88	0.26	99.42		109734	20.8	188698	35.7	1.1			10.36
Tributary	58484.80		5067.25	1255.75	1266.09		1266.31	0.000433	4.81	1845.47	319.23	0.27	99.42		109834	20.8	188599	35.7	0.5			10.34
Tributary	58454.50		5067.18	1255.74	1266.04		1266.27	0.000442	4.85	1825.58	316.33	0.27	99.42		109933	20.8	188499	35.7	1.1			10.3
Tributary	58424.20		5067.31	1255.72	1266		1266.23	0.000451	4.89	1807.81	313.74	0.27	99.42		110033	20.8	188400	35.7	0.5			10.28
Tributary	58393.90		5067.25	1255.71	1265.95		1266.19	0.000461	4.93	1787.67	310.88	0.27	99.42		110132	20.9	188300	35.7	1.1			10.24
Tributary	58363.60		5067.16	1255.69	1265.9		1266.14	0.000471	4.97	1769.33	308.2	0.28	99.42		110231	20.9	188201	35.6	0.5			10.21
Tributary	58333.30		5067.21	1255.68	1265.85		1266.1	0.000481	5.01	1750.54	305.53	0.28	99.42		110331	20.9	188102	35.6	1.1			10.17
Tributary	58303.00		5067.12	1255.66	1265.8		1266.05	0.000492	5.05	1731.54	302.87	0.28	99.42		110430	20.9	188002	35.6	0.5			10.14
Tributary	58272.70		5067.23	1255.65	1265.74		1266	0.000504	5.09	1712.09	300.21	0.29	99.42		110530	20.9	187903	35.6	1.1			10.09
Tributary	58242.40		5067.17	1255.63	1265.69		1265.95	0.000515	5.13	1693.43	297.55	0.29	99.42		110629	21.0	187803	35.6	0.5			10.06
Tributary	58212.10		5067.15	1255.62	1265.64		1265.9	0.000528	5.18	1674.3	294.92	0.29	99.42		110729	21.0	187704	35.5	1.1			10.02
Tributary	58181.80		5067.26	1255.6	1265.58		1265.85	0.000541	5.22	1654.87	292.25	0.3	99.42		110828	21.0	187604	35.5	0.5			9.98
Tributary	58151.50		5067.17	1255.59	1265.52		1265.8	0.000555	5.27	1635.29	289.7	0.3	99.42		110927	21.0	187505	35.5	1.1			9.93
Tributary	58121.20		5067.33	1255.57	1265.46		1265.75	0.000569	5.32	1616.29	286.97	0.3	99.42		111027	21.0	187406	35.5	0.5			9.89
Tributary	58090.90		5067.17	1255.56	1265.4		1265.69	0.000585	5.37	1596.47	284.27	0.31	99.42		111126	21.0	187306	35.5	1.1			9.84
Tributary	58060.60		5067.27	1255.54	1265.34		1265.63	0.000601	5.42	1576.95	281.6	0.31	99.42		111226	21.1	187207	35.5	0.5			9.8
Tributary	58030.30		5067.23	1255.53	1265.27		1265.57	0.000618	5.47	1557.32	278.93	0.31	99.42		111325	21.1	187107	35.4	1.1			9.74
Tributary	58000.00		5067.25	1255.51	1265.2		1265.51	0.000636	5.52	1537.37	276.21	0.32	99.42	SR 394	111425	21.1	187008	35.4	1.1			9.69
Tributary	57969.70		5067.19	1255.49	1265.14		1265.45	0.00063	5.48	1542.94	279.11	0.32	99.42		111524	21.1	186908	35.4	1.6			9.65
Tributary	57939.30		5067.28	1255.46	1265.08		1265.39	0.000624	5.44	1548.16	281.86	0.32	99.42		111623	21.1	186809	35.4	1.6			9.62
Tributary	57909.00		5067.28	1255.43	1265.02		1265.32	0.000618	5.4	1554.13	284.91	0.31	99.42		111723	21.2	186710	35.4	1.1			9.59
Tributary	57878.70		5067.18	1255.41	1264.96		1265.26	0.000613	5.36	1560.33	288.1	0.31	99.42		111822	21.2	186610	35.3	1.6			9.55
Tributary	57848.40		5067.18	1255.38	1264.9		1265.2	0.000607	5.32	1566.07	291.39	0.31	99.42		111922	21.2	186511	35.3	1.1			9.52
Tributary	57818.10		5067.16	1255.36	1264.84		1265.14	0.000601	5.28	1573.54	294.85	0.31	99.42		112021	21.2	186411	35.3	1.6			9.48
Tributary	57787.80		5067.18	1255.33	1264.79		1265.08	0.000595	5.24	1581.7	298.66	0.31	99.42		112120	21.2	186312	35.3	1.1			9.46
Tributary	57757.50		5067.19	1255.31	1264.73		1265.02	0.000589	5.2	1589.81	302.66	0.31	99.42		112220	21.3	186213	35.3	1.6			9.42
Tributary	57727.20		5067.19	1255.28	1264.67		1264.96	0.000583	5.16	1598.17	306.86	0.3	99.42		112319	21.3	186113	35.2	1.6			9.39
Tributary	57696.90		5067.27	1255.25	1264.62		1264.9	0.000576	5.11	1608.46	311.42	0.3	99.42		112419	21.3	186014	35.2	1.1			9.37
Tributary	57666.60		5067.17	1255.23	1264.56		1264.85	0.000569	5.07	1618.83	316.19	0.3	99.42		112518	21.3	185914	35.2	1.6			9.33
Tributary	57636.30		5067.14	1255.2	1264.51		1264.79	0.000563	5.03	1628.99	321.23	0.3	99.42		112618	21.3	185815	35.2	1.1			9.31
Tributary	57606.00		5067.17	1255.18	1264.46		1264.73	0.000556	4.99	1641.21	326.97	0.3	99.42		112717	21.3	185715	35.2	1.6			9.28
Tributary	57575.70		5067.18	1255.15	1264.4		1264.68	0.000551	4.95	1652.56	333.02	0.29	99.42		112816	21.4	185616	35.2	1.6			9.25
Tributary	57545.40		5067.19	1255.12	1264.35		1264.62	0.000544	4.91	1667.79	340.8	0.29	99.42		112916	21.4	185517	35.1	1.1			9.23
Tributary	57515.10		5067.27	1255.1	1264.3		1264.57	0.000537	4.87	1684.73	349.61	0.29	99.42		113015	21.4	185417	35.1	1.6			9.2
Tributary	57484.80		5067.15	1255.07	1264.25		1264.51	0.000529	4.83	1702.59	359.09	0.29	99.42		113115	21.4	185318	35.1	1.1			9.18
Tributary	57454.50		5067.15	1255.05	1264.2		1264.46	0.000519	4.78	1725.17	369.8	0.29	99.42		113214	21.4	185218	35.1	1.6			9.15
Tributary	57424.20		5067.14	1255.02	1264.15		1264.41	0.00051	4.73	1750.22	382.27	0.28	99.42		113314	21.5	185119	35.1	1.6			9.13
Tributary	57393.90		5067.2	1254.99	1264.11		1264.36	0.000502	4.68	1778.85	401.16	0.28	99.42		113413	21.5	185020	35.0	1.1			9.12
Tributary	57363.60		5067.27	1254.97	1264.07		1264.31	0.00049	4.62	1813.41	416.8	0.28	99.42		113512	21.5	184920	35.0	1.6			9.1
Tributary	57333.30		5067.15	1254.94	1264.02		1264.26	0.000472	4.53	1852.74	421.23	0.27	99.42		113612	21.5	184821	35.0	1.1			9.08
Tributary	57303.00		5067.15	1254.92	1263.99		1264.21	0.000454	4.44	1891.76	425.45	0.27	99.42		113711	21.5	184721	35.0	1.6			9.07
Tributary	57272.70		5067.28	1254.89	1263.95		1264.16	0.000435	4.34	1935.75	430.12	0.26	99.42		113811	21.6	184622	35.0	1.1			9.06

Tributary	57242.40		5067.14	1254.87	1263.91		1264.11	0.000417	4.25	1980.57	434.48	0.26	99.42		113910	21.6	184522	34.9	1.6			9.04
Tributary	57212.10		5067.08	1254.84	1263.88		1264.07	0.0004	4.16	2024.23	438.7	0.25	99.42		114009	21.6	184423	34.9	1.6			9.04
Tributary	57181.80		5067.25	1254.81	1263.85		1264.03	0.000381	4.06	2072.25	442.95	0.24	99.42		114109	21.6	184324	34.9	1.1			9.04
Tributary	57151.50		5067.11	1254.79	1263.82		1263.99	0.000365	3.97	2119.48	447.13	0.24	99.42		114208	21.6	184224	34.9	1.6			9.03
Tributary	57121.20		5067.31	1254.76	1263.79		1263.95	0.000348	3.88	2169.85	451.31	0.23	99.42		114308	21.6	184125	34.9	1.1			9.03
Tributary	57090.90		5067.33	1254.74	1263.76		1263.91	0.000331	3.78	2221.09	455.36	0.23	99.42		114407	21.7	184025	34.9	1.6			9.02
Tributary	57060.60		5067.18	1254.71	1263.73		1263.88	0.000315	3.69	2272.7	459.44	0.22	99.42		114507	21.7	183926	34.8	1.6			9.02
Tributary	57030.30		5067.3	1254.68	1263.71		1263.85	0.0003	3.6	2327.39	464.65	0.22	99.42		114606	21.7	183826	34.8	1.1			9.03
Tributary	57000.00		5067.19	1254.66	1263.69		1263.82	0.000285	3.51	2382.31	468.75	0.21	99.42		114705	21.7	183727	34.8	0.0			9.03
Tributary	56969.70		5067.24	1254.66	1263.66		1263.79	0.000293	3.55	2367.16	471.21	0.21	99.42		114805	21.7	183628	34.8	0.0			9
Tributary	56939.30		5067.15	1254.66	1263.62		1263.76	0.0003	3.58	2350.88	472.08	0.22	99.42		114904	21.8	183528	34.8	0.5			8.96
Tributary	56909.00		5067.02	1254.65	1263.59		1263.73	0.000308	3.61	2331.92	474.45	0.22	99.42		115004	21.8	183429	34.7	0.0			8.94
Tributary	56878.70		5067.3	1254.65	1263.56		1263.7	0.000316	3.65	2317.18	484.88	0.22	99.42		115103	21.8	183329	34.7	0.0			8.91
Tributary	56848.40		5067.2	1254.65	1263.52		1263.67	0.000325	3.68	2302.3	500.63	0.22	99.42		115202	21.8	183230	34.7	0.0			8.87
Tributary	56818.10		5067.07	1254.65	1263.49		1263.64	0.000345	3.78	2287.64	519.97	0.23	99.42		115302	21.8	183131	34.7	0.0			8.84
Tributary	56787.80		5067.2	1254.65	1263.45		1263.61	0.000354	3.82	2274.73	525.7	0.23	99.42		115401	21.9	183031	34.7	0.5			8.8
Tributary	56757.50		5067.11	1254.64	1263.42		1263.57	0.000364	3.85	2263.08	530.94	0.24	99.42		115501	21.9	182932	34.6	0.0			8.78
Tributary	56727.20		5067.23	1254.64	1263.38		1263.54	0.000374	3.88	2250.82	535.31	0.24	99.42		115600	21.9	182832	34.6	0.0			8.74
Tributary	56696.90		5067.08	1254.64	1263.34		1263.5	0.000384	3.92	2236.67	539.18	0.24	99.42		115700	21.9	182733	34.6	0.0			8.7
Tributary	56666.60		5067.17	1254.64	1263.3		1263.46	0.000395	3.96	2221.54	542.51	0.25	99.42		115799	21.9	182633	34.6	0.0			8.66
Tributary	56636.30		5067.32	1254.64	1263.26		1263.43	0.000407	4	2207.45	545.54	0.25	99.42		115898	22.0	182534	34.6	0.5			8.62
Tributary	56606.00		5067.26	1254.63	1263.21		1263.39	0.000419	4.04	2193.65	549.61	0.25	99.42		115998	22.0	182435	34.6	0.0			8.58
Tributary	56575.70		5067.17	1254.63	1263.17		1263.35	0.00043	4.08	2179.36	553.8	0.26	99.42		116097	22.0	182335	34.5	0.0			8.54
Tributary	56545.40		5067.19	1254.63	1263.12		1263.3	0.000446	4.12	2161.15	557.4	0.26	99.42		116197	22.0	182236	34.5	0.0			8.49
Tributary	56515.10		5067.11	1254.63	1263.08		1263.26	0.000461	4.17	2145.29	561	0.26	99.42		116296	22.0	182136	34.5	0.5			8.45
Tributary	56484.80		5067.16	1254.62	1263.03		1263.21	0.000477	4.21	2127.56	564.5	0.27	99.42		116396	22.0	182037	34.5	0.0			8.41
Tributary	56454.50		5067.09	1254.62	1262.98		1263.17	0.000492	4.26	2112.83	567.36	0.27	99.42		116495	22.1	181937	34.5	0.0			8.36
Tributary	56424.20		5067.19	1254.62	1262.93		1263.12	0.00051	4.31	2093.27	569.93	0.28	99.42		116594	22.1	181838	34.4	0.0			8.31
Tributary	56393.90		5067.1	1254.62	1262.87		1263.07	0.00053	4.36	2073.8	571.36	0.28	99.42		116694	22.1	181739	34.4	0.0			8.25
Tributary	56363.60		5067.14	1254.62	1262.82		1263.02	0.000552	4.42	2052.13	573.06	0.29	99.42		116793	22.1	181639	34.4	0.5			8.2
Tributary	56333.30		5067.15	1254.61	1262.76		1262.97	0.000574	4.47	2030.85	578.72	0.29	99.42		116893	22.1	181540	34.4	0.0			8.15
Tributary	56303.00		5067.2	1254.61	1262.7		1262.91	0.000598	4.53	2014.51	618.02	0.3	99.42		116992	22.2	181440	34.4	0.0			8.09
Tributary	56272.70		5067.24	1254.61	1262.64		1262.86	0.000623	4.59	2004.27	647.81	0.3	99.42		117091	22.2	181341	34.3	0.0			8.03
Tributary	56242.40		5067.24	1254.61	1262.58		1262.8	0.00065	4.65	1998.9	675.81	0.31	99.42		117191	22.2	181242	34.3	0.0			7.97
Tributary	56212.10		5067.08	1254.61	1262.51		1262.74	0.000679	4.71	1994.67	691.14	0.31	99.42		117290	22.2	181142	34.3	0.5			7.9
Tributary	56181.80		5067.23	1254.6	1262.44		1262.67	0.000706	4.77	1993.67	703.21	0.32	99.42		117390	22.2	181043	34.3	0.0			7.84
Tributary	56151.50		5067.21	1254.6	1262.37		1262.6	0.000738	4.83	1991.13	715.79	0.33	99.42		117489	22.3	180943	34.3	0.0			7.77
Tributary	56121.20		5067.3	1254.6	1262.29		1262.53	0.00077	4.89	1988.61	726.23	0.33	99.42		117589	22.3	180844	34.3	0.0			7.69
Tributary	56090.90		5067.26	1254.6	1262.21		1262.46	0.000807	4.95	1983.22	735.6	0.34	99.42		117688	22.3	180744	34.2	0.0			7.61
Tributary	56060.60		5067.29	1254.6	1262.13		1262.38	0.000845	5.01	1977.76	743.37	0.35	99.42		117787	22.3	180645	34.2	0.5			7.53
Tributary	56030.30		5067.05	1254.59	1262.04		1262.29	0.000884	5.07	1972.98	752.22	0.35	99.42		117887	22.3	180546	34.2	0.0			7.45
Tributary	56000.00		5067.25	1254.59	1261.95		1262.21	0.000927	5.13	1966.67	760.37	0.36	99.42		117986	22.3	180446	34.2	-0.5			7.36
Tributary	55969.70		5067.22	1254.6	1261.86		1262.12	0.000936	5.13	1977.23	768.23	0.36	99.42		118086	22.4	180347	34.2	0.0			7.26
Tributary	55939.30		5067.27	1254.6	1261.77		1262.02	0.000944	5.12	1989.8	776.97	0.36	99.42		118185	22.4	180247	34.1	-0.5			7.17
Tributary	55909.00		5067.14	1254.61	1261.69		1261.93	0.000952	5.11	2002.94	785.56	0.36	99.42		118285	22.4	180148	34.1	0.0			7.08
Tributary	55878.70		5067.07	1254.61	1261.6		1261.84	0.000958	5.11	2016.26	794.54	0.36	99.42		118384	22.4	180049	34.1	-0.5			6.99
Tributary	55848.40		5067.14	1254.62	1261.5		1261.74	0.000969	5.1	2027.15	803.82	0.37	99.42		118483	22.4	179949	34.1	0.0			6.88
Tributary	55818.10		5067.33	1254.62	1261.41		1261.65	0.000979	5.1	2038.6	813.25	0.37	99.42		118583	22.5	179850	34.1	-0.5			6.79
Tributary	55787.80		5066.97	1254.63	1261.32		1261.55	0.00099	5.09	2051.04	823.5	0.37	99.42		118682	22.5	179750	34.0	0.0			6.69
Tributary	55757.50		5067.26	1254.63	1261.22		1261.45	0.001	5.08	2062.99	833.95	0.37	99.42		118782	22.5	179651	34.0	-0.5			6.59
Tributary	55727.20		5067.18	1254.64	1261.12		1261.35	0.001013	5.08	2074.99	845.08	0.37	99.42		118881	22.5	179551	34.0	0.0			6.48
Tributary	55696.90		5067.26	1254.64	1261.03		1261.25	0.001023	5.06	2088.59	856.92	0.37	99.42		118980	22.5	179452	34.0	-0.5			6.39
Tributary	55666.60		5067.14	1254.65	1260.93		1261.14	0.001038	5.06	2099.1	880.66	0.37	99.42		119080	22.6	179353	34.0	0.0			6.28
Tributary	55636.30		5067.32	1254.65	1260.83		1261.04	0.001055	5.06	2115.75	911.3	0.38	99.42		119179	22.6	179253	33.9	-0.5			6.18
Tributary	55606.00		5067.09	1254.66	1260.73		1260.95	0.001099	5.12	2134.42	924.26	0.38	99.42		119279	22.6	179154	33.9	0.0			6.07
Tributary	55575.70		5067.22	1254.66	1260.64		1260.84	0.001097	5.07	2156.06	925.29	0.38	99.42		119378	22.6	179054	33.9	-0.5			5.98
Tributary	55545.40		5067.12	1254.67	1260.54		1260.74	0.001096	5.02	2176.55	926.17	0.38	99.42		119478	22.6	178955	33.9	0.0			5.87
Tributary	55515.10		5067.28	1254.67	1260.43		1260.63	0.0011	4.98	2191.55	927.02	0.38	99.42		119577	22.6	178855	33.9	-0.5			5.76
Tributary	55484.80		5067.1	1254.68	1260.33		1260.51	0.001105	4.94	2207.03	927.65	0.38	99.42		119676	22.7	178756	33.9	0.0			5.65
Tributary	55454.50		5067.31	1254.68	1260.22		1260.4	0.001114	4.9	2219.62	928.04	0.38	99.42		119776	22.7	178657	33.8	-0.5			5.54
Tributary	55424.20		5067.19	1254.69	1260.12		1260.29	0.001121	4.86	2233.48	928.5	0.38	99.42		119875	22.7	178557	33.8	0.0			5.43
Tributary	55393.90		5067.33	1254.69	1260.01		1260.18	0.001121	4.81	2250.66	928.97	0.38	99.42		119975	22.7	178458	33.8	-0.5			5.32
Tributary	55363.60		5067.13	1254.7	1259.91		1260.07	0.001126	4.76	2264.04	929.39	0.38	99.42		120074	22.7	178358	33.8	0.0			5.21
Tributary	55333.30		5067.1	1254.7	1259.81		1259.96	0.001127	4.7	2279.77	929.72	0.38	99.42		120173	22.8	178259	33.8	-0.5			5.11
Tributary	55303.00		5067.31	1254.71	1259.7		1259.85	0.00113	4.64	2294.07	929.86	0.38	99.42		120273	22.8	178160	33.7	0.0			4.99
Tributary	55272.70		5067.09	1254.71	1259.6		1259.73	0.001131	4.59	2308.37	930.21	0.38	99.42		120372	22.8	178060	33.7	-0.5			4.89
Tributary	55242.40		5067.15	1254.72	1259.49		1259.62	0.001132	4.52	2323.52	930.32	0.38	99.42		120472	22.8	177961	33.7	0.0			4.77
Tributary	55212.10		5067.02	1254.72	1259.38		1259.51	0.001134	4.46	2336.8	930.43	0.38	99.42		120571	22.8	177861	33.7	-0.5			4.66
Tributary	55181.80		5067.32	1254.73	1259.27		1259.39	0.00114	4.4	2347.24	930.53	0.38	99.42		120671	22.9	177762	33.7	0.0			4.54
Tributary	55151.50		5067.27	1254.73	1259.16		1259.28	0.001142	4.33	2359.53	930.28	0.37	99.42		120770	22.9	177662	33.6	-0.5			4.43
Tributary	55121.20		5067.18	1254.74	1259.06		1259.17	0.001143	4.26	2372.3	930.27	0.37	99.42		120869	22.9	177563	33.6	0.0			4.32
Tributary	55090.90		5067.14	1254.74	1258.95		1259.06	0.00114	4.17	2387.57	929.76	0.37	99.42		120969	22.9	177464	33.6	-0.5			4.21
Tributary	55060.60		5067.14	1254.75	1258.84		1258.95	0.001133	4.09	2403.48	928.85	0.37	99.42		121068	22.9	177364	33.6	0.0			4.09
Tributary	55030.30		5067.22	1254.75	1258.74		1258.84	0.001125	4	2419.49	927.35	0.36	99.42		121168	22.9	177265	33.6	-0.5			3.99
Tributary	55000.00		5067.2	1254.76	1258.64		1258.73	0.001112	3.9	2436.44	923.14	0.36	99.42		121267	23.0	177165	33.6	8.5			3.88
Tributary	54969.70		5067.17	1254.6	1258.53		1258.62	0.001129	3.97	2408.13	912.02	0.36	99.42		121367	23.0	177066	33.5	8.5			3.93
Tributary	54939.30		5067.11	1254.44	1258.41		1258.51	0.001141	4.04	2382.59	900.82	0.37	99.42		121466	23.0	176966	33.5	8.5			3.97
Tributary	54909.00		5067.03	1254.28	1258.3		1258.4	0.001158	4.12	2353.75	889.32	0.37	99.42		121565	23.0	176867	33.5	8.5			4.02
Tributary	54878.70		5067.21	1254.12	1258.19		1258.29	0.001167	4.17	2330.05	877.25	0.37	99.42		121665	23.0	176768	33.5	8.5			4.07
Tributary	54848.40		5067.2	1253.96	1258.07		1258.18	0.001179	4.24	2304.83	866.61	0.38	99.42		121764	23.1	176668	33.5	8.5			4.11
Tributary	54818.10		5067.29	1253.8	1257.96		1258.07	0.001189	4.3	2280.26	855.61	0.38	99.42		121864	23.1	176569	33.4	8.5			4.16
Tributary	54787.80		5067.07	1253.64	1257.84		1257.96	0.001192	4.34	2258.46	842.92	0.38	99.42		121963	23.1	176469	33.4	8.5			4.2
Tributary	54757.50		5067.03	1253.48	1257.72		1257.84	0.001195	4.39	2236.33	829.67	0.38	99.42		122062	23.1	176370	33.4	8.5			4.24

Tributary	54727.20		5067.06	1253.32	1257.6		1257.73	0.00119	4.41	2219.49	316.98	0.38	99.42		122162	23.1	176271	33.4	8.5			4.28
Tributary	54696.90		5067.3	1253.16	1257.49		1257.61	0.001184	4.44	2204.27	304.96	0.38	99.42		122261	23.2	176171	33.4	8.5			4.33
Tributary	54666.60		5067.19	1253	1257.37		1257.5	0.001173	4.45	2193.02	793.38	0.38	99.42		122361	23.2	176072	33.3	8.5			4.37
Tributary	54636.30		5067.11	1252.84	1257.26		1257.39	0.001123	4.4	2186.65	764.41	0.37	99.42		122460	23.2	175972	33.3	8.5			4.42
Tributary	54606.00		5067.13	1252.68	1257.15		1257.28	0.001079	4.35	2194.61	747.19	0.37	99.42		122560	23.2	175873	33.3	8.5			4.47
Tributary	54575.70		5067.05	1252.52	1257.04		1257.17	0.001036	4.31	2206.38	736.17	0.36	99.42		122659	23.2	175773	33.3	8.5			4.52
Tributary	54545.40		5067.07	1252.36	1256.95		1257.07	0.000991	4.25	2223.2	727.06	0.35	99.42		122758	23.2	175674	33.3	8.5			4.59
Tributary	54515.10		5067.06	1252.2	1256.85		1256.97	0.000941	4.19	2246.58	719.42	0.34	99.42		122858	23.3	175575	33.3	8.5			4.65
Tributary	54484.80		5067.26	1252.04	1256.76		1256.88	0.000891	4.12	2274.01	712.94	0.34	99.42		122957	23.3	175475	33.2	8.5			4.72
Tributary	54454.50		5067.12	1251.88	1256.68		1256.8	0.00084	4.05	2306.32	708.37	0.33	99.42		123057	23.3	175376	33.2	8.5			4.8
Tributary	54424.20		5067.19	1251.72	1256.61		1256.72	0.000789	3.98	2342.84	703.76	0.32	99.42		123156	23.3	175276	33.2	8.5			4.89
Tributary	54393.90		5067.22	1251.56	1256.53		1256.64	0.000739	3.9	2382.43	699.81	0.31	99.42		123256	23.3	175177	33.2	8.5			4.97
Tributary	54363.60		5067.2	1251.4	1256.47		1256.57	0.000688	3.81	2428.6	697	0.3	99.42		123355	23.4	175078	33.2	8.5			5.07
Tributary	54333.30		5067.25	1251.24	1256.41		1256.51	0.000641	3.73	2476.13	594.56	0.29	99.42		123454	23.4	174978	33.1	8.5			5.17
Tributary	54303.00		5067.25	1251.08	1256.35		1256.44	0.000594	3.64	2529.03	592.92	0.28	99.42		123554	23.4	174879	33.1	8.5			5.27
Tributary	54272.70		5067.12	1250.92	1256.3		1256.39	0.000551	3.55	2584.53	591.73	0.27	99.42		123653	23.4	174779	33.1	8.5			5.38
Tributary	54242.40		5067.28	1250.76	1256.25		1256.33	0.000509	3.47	2642.01	590.18	0.26	99.42		123753	23.4	174680	33.1	8.5			5.49
Tributary	54212.10		5067.25	1250.6	1256.2		1256.28	0.00047	3.38	2702.96	589.26	0.25	99.42		123852	23.5	174580	33.1	8.5			5.6
Tributary	54181.80		5067.05	1250.44	1256.16		1256.24	0.000434	3.29	2767.72	589.26	0.24	99.42		123951	23.5	174481	33.0	8.5			5.72
Tributary	54151.50		5067.18	1250.28	1256.12		1256.2	0.0004	3.21	2834.66	589.39	0.23	99.42		124051	23.5	174382	33.0	8.5			5.84
Tributary	54121.20		5066.95	1250.12	1256.09		1256.16	0.000369	3.13	2904.44	690.23	0.23	99.42		124150	23.5	174282	33.0	8.5			5.97
Tributary	54090.90		5067.19	1249.96	1256.05		1256.12	0.000341	3.05	2974.5	690.67	0.22	99.42		124250	23.5	174183	33.0	8.5			6.09
Tributary	54060.60		5067.32	1249.8	1256.02		1256.09	0.000314	2.97	3048.06	691.17	0.21	99.42		124349	23.6	174083	33.0	8.5			6.22
Tributary	54030.30		5067.03	1249.64	1256		1256.06	0.000291	2.89	3121.93	692.07	0.2	99.42		124449	23.6	173984	33.0	8.5			6.36
Tributary	54000.00		5067.09	1249.48	1255.97		1256.03	0.000268	2.82	3197.7	692.88	0.2	98.64		124548	23.6	173884	32.9	0.0			6.49
Tributary	53969.90		5067.04	1249.48	1255.94		1256	0.000274	2.84	3172.47	690.4	0.2	98.64		124647	23.6	173786	32.9	0.0			6.46
Tributary	53939.80		5067.09	1249.48	1255.91		1255.98	0.00028	2.86	3145.31	687.55	0.2	98.64		124745	23.6	173687	32.9	0.0			6.43
Tributary	53909.80		5067.15	1249.48	1255.89		1255.95	0.000287	2.89	3118.76	685.18	0.2	98.64		124844	23.6	173589	32.9	-0.5			6.41
Tributary	53879.70		5067.11	1249.49	1255.86		1255.92	0.000294	2.91	3089.87	682.42	0.2	98.64		124943	23.7	173490	32.9	0.0			6.37
Tributary	53849.60		5067.08	1249.49	1255.83		1255.89	0.000301	2.94	3063.22	680.09	0.21	98.64		125041	23.7	173391	32.8	0.0			6.34
Tributary	53819.60		5067.26	1249.49	1255.8		1255.86	0.000308	2.96	3035.43	677.65	0.21	98.64		125140	23.7	173293	32.8	-0.5			6.31
Tributary	53789.50		5067.22	1249.5	1255.76		1255.83	0.000317	2.99	3005.24	674.96	0.21	98.64		125238	23.7	173194	32.8	0.0			6.26
Tributary	53759.40		5067.21	1249.5	1255.73		1255.8	0.000325	3.02	2976.35	672.5	0.21	98.64		125337	23.7	173095	32.8	0.0			6.23
Tributary	53729.40		5067.21	1249.5	1255.7		1255.77	0.000333	3.05	2947.12	669.91	0.22	98.64		125436	23.8	172997	32.8	0.0			6.2
Tributary	53699.30		5067.32	1249.5	1255.66		1255.74	0.000343	3.08	2916.14	667.42	0.22	98.64		125534	23.8	172898	32.7	-0.5			6.16
Tributary	53669.20		5067.21	1249.51	1255.63		1255.7	0.000353	3.11	2885.92	665.01	0.22	98.64		125633	23.8	172799	32.7	0.0			6.12
Tributary	53639.20		5067.08	1249.51	1255.59		1255.67	0.000363	3.14	2853.64	662.13	0.22	98.64		125732	23.8	172701	32.7	0.0			6.08
Tributary	53609.10		5067.04	1249.51	1255.56		1255.63	0.000374	3.17	2822.64	659.57	0.23	98.64		125830	23.8	172602	32.7	-0.5			6.05
Tributary	53579.00		5067.2	1249.52	1255.52		1255.6	0.000386	3.21	2789.96	656.9	0.23	98.64		125929	23.9	172504	32.7	0.0			6
Tributary	53549.00		5067.13	1249.52	1255.48		1255.56	0.000399	3.24	2756.57	654.06	0.23	98.64		126028	23.9	172405	32.7	0.0			5.96
Tributary	53518.90		5067.1	1249.52	1255.44		1255.52	0.000412	3.28	2722.23	651.13	0.24	98.64		126126	23.9	172306	32.6	-0.5			5.92
Tributary	53488.80		5067.23	1249.53	1255.39		1255.48	0.000427	3.32	2688	648.17	0.24	98.64		126225	23.9	172208	32.6	0.0			5.86
Tributary	53458.70		5067.29	1249.53	1255.35		1255.44	0.000442	3.36	2651.97	645.09	0.25	98.64		126323	23.9	172109	32.6	0.0			5.82
Tributary	53428.70		5067.28	1249.53	1255.3		1255.39	0.000458	3.4	2616.71	642.07	0.25	98.64		126422	23.9	172010	32.6	0.0			5.77
Tributary	53398.60		5067.27	1249.53	1255.26		1255.35	0.000476	3.45	2579.08	637.99	0.25	98.64		126521	24.0	171912	32.6	-0.5			5.73
Tributary	53368.50		5067.16	1249.54	1255.21		1255.3	0.000495	3.49	2540.38	634.17	0.26	98.64		126619	24.0	171813	32.5	0.0			5.67
Tributary	53338.50		5067.16	1249.54	1255.16		1255.25	0.000516	3.54	2501.42	630.46	0.26	98.64		126718	24.0	171714	32.5	0.0			5.62
Tributary	53308.40		5067.06	1249.54	1255.1		1255.2	0.000538	3.59	2461.79	626.08	0.27	98.64		126817	24.0	171616	32.5	-0.5			5.56
Tributary	53278.30		5067.2	1249.55	1255.04		1255.15	0.000563	3.64	2419.89	621.76	0.27	98.64		126915	24.0	171517	32.5	0.0			5.49
Tributary	53248.30		5067.23	1249.55	1254.98		1255.09	0.00059	3.7	2378.24	617.53	0.28	98.64		127014	24.1	171418	32.5	0.0			5.43
Tributary	53218.20		5067.21	1249.55	1254.92		1255.04	0.00062	3.76	2334.36	613.39	0.29	98.64		127113	24.1	171320	32.4	-0.5			5.37
Tributary	53188.10		5067.02	1249.56	1254.86		1254.97	0.000654	3.83	2289.44	608.55	0.29	98.64		127211	24.1	171221	32.4	0.0			5.3
Tributary	53158.10		5067.01	1249.56	1254.79		1254.91	0.00069	3.9	2243.5	603.95	0.3	98.64		127310	24.1	171123	32.4	0.0			5.23
Tributary	53128.00		5067.32	1249.56	1254.72		1254.84	0.000732	3.97	2195.08	598.96	0.31	98.64		127409	24.1	171024	32.4	0.0			5.16
Tributary	53097.90		5067.22	1249.56	1254.64		1254.77	0.00078	4.06	2145.4	594.14	0.32	98.64		127507	24.1	170925	32.4	-0.5			5.08
Tributary	53067.90		5067.09	1249.57	1254.55		1254.69	0.000835	4.15	2092.55	588.77	0.33	98.64		127606	24.2	170827	32.4	0.0			4.98
Tributary	53037.80		5067.2	1249.57	1254.46		1254.61	0.000902	4.25	2035.74	583.01	0.34	98.64		127704	24.2	170728	32.3	0.0			4.89
Tributary	53007.79		5067.24	1249.57	1254.37		1254.52	0.000978	4.36	1977.05	577.34	0.35	99.81	Village of Fennecy	127803	24.2	170629	32.3	4.8			4.8
Tributary	52977.30		5067.28	1249.48	1254.27		1254.43	0.000979	4.36	1979.92	579.2	0.35	99.81		127903	24.2	170530	32.3	4.8			4.79
Tributary	52946.90		5067.1	1249.39	1254.18		1254.33	0.00098	4.36	1983.47	581.06	0.35	99.81		128003	24.2	170430	32.3	4.8			4.79
Tributary	52916.50		5067.13	1249.3	1254.08		1254.24	0.000982	4.36	1986.47	583.15	0.35	99.81		128103	24.3	170330	32.3	4.8			4.78
Tributary	52886.10		5067.19	1249.21	1253.98		1254.14	0.000983	4.36	1989.97	584.99	0.35	99.81		128202	24.3	170230	32.2	4.8			4.77
Tributary	52855.60		5067.2	1249.12	1253.89		1254.04	0.000984	4.36	1993.66	587	0.35	99.81		128302	24.3	170130	32.2	4.8			4.77
Tributary	52825.20		5066.95	1249.03	1253.79		1253.95	0.000987	4.36	1995.94	589.12	0.35	99.81		128402	24.3	170030	32.2	4.8			4.76
Tributary	52794.80		5067.24	1248.94	1253.7		1253.85	0.000988	4.36	1999.51	591.02	0.35	99.81		128502	24.3	169931	32.2	4.8			4.76
Tributary	52764.40		5067.21	1248.85	1253.6		1253.75	0.00099	4.36	2002.57	593.19	0.36	99.81		128602	24.4	169831	32.2	4.8			4.75
Tributary	52734.00		5067.08	1248.76	1253.5		1253.65	0.000991	4.35	2006.64	595.53	0.36	99.81		128701	24.4	169731	32.1	4.8			4.74
Tributary	52703.50		5067.13	1248.67	1253.4		1253.56	0.000992	4.35	2010.97	597.91	0.36	99.81		128801	24.4	169631	32.1	4.8			4.73
Tributary	52673.10		5067.3	1248.58	1253.31		1253.46	0.000994	4.35	2014.12	599.97	0.36	99.81		128901	24.4	169531	32.1	4.8			4.73
Tributary	52642.70		5067.03	1248.49	1253.21		1253.36	0.000993	4.34	2019.47	602.53	0.36	99.81		129001	24.4	169432	32.1	4.8			4.72
Tributary	52612.30		5067.24	1248.4	1253.11		1253.26	0.000996	4.35	2022.82	605.09	0.36	99.81		129101	24.5	169332	32.1	4.8			4.71
Tributary	52581.80		5067.23	1248.31	1253.02		1253.16	0.000999	4.34	2026.17	607.56	0.36	99.81		129200	24.5	169232	32.1	4.8			4.71
Tributary	52551.40		5067.17	1248.22	1252.92		1253.06	0.001	4.34	2030.52	610.07	0.36	99.81		129300	24.5	169132	32.0	4.8			4.7
Tributary	52521.00		5067.11	1248.13	1252.82		1252.97	0.000999	4.33	2036.01	612.73	0.36	99.81		129400	24.5	169032	32.0	4.8			4.69
Tributary	52490.60		5067.19	1248.04	1252.72		1252.87	0.001	4.33	2040.53	615.49	0.36	99.81		129500	24.5	168933	32.0	5.3			4.68
Tributary	52460.20		5067.2	1247.94	1252.62		1252.77	0.001001	4.33	2045.47	618.46	0.36	99.81		129600	24.5	168833	32.0	4.8			4.68
Tributary	52429.70		5067.17	1247.85	1252.53		1252.67	0.001002	4.33	2050.1	621.27	0.36	99.81		129699	24.6	168733	32.0	4.8			4.68
Tributary	52399.30		5067.03	1247.76	1252.43		1252.57	0.001002	4.32	2055.27	624.03	0.36	99.81		129799	24.6	168633	31.9	4.8			4.67
Tributary	52368.90		5067	1247.67	1252.33		1252.47	0.001002	4.31	2061.44	627.3	0.36	99.81		129899	24.6	168533	31.9	4.8			4.66
Tributary	52338.50		5067.03	1247.58	1252.23		1252.37	0.001	4.31	2068.54	630.51	0.36	99.81		129999	24.6	168434	31.9	4.8			4.65
Tributary	52308.10		5066.98	1247.49	1252.13		1252.27	0.001003	4.31	2072.35	633.75	0.36	99.81		130099	24.6	168334	31.9	4.8			4.64
Tributary	52277.60		5067.29	1247.4	1252.04		1252.17	0.001002	4.3	2078.84	636.85	0.36	99.81		130199	24.7	168234	31.9	4.8			4.64
Tributary	52247.20		5067.16	1247.31	1251.94		1252.08	0.001002	4.29	2085.41	640.54	0.36	99.81		130298	24.7	168134	31.8	4.8			4.63

Tributary	52216.80		5066.98	1247.22	1251.84		1251.98	0.001001	4.28	2092.2	644.03	0.36	99.81		130398	24.7	168034	31.8	4.8			4.62
Tributary	52186.40		5067.27	1247.13	1251.74		1251.88	0.001	4.28	2099.37	647.73	0.35	99.81		130498	24.7	167934	31.8	4.8			4.61
Tributary	52156.00		5067.27	1247.04	1251.64		1251.78	0.000999	4.27	2107.06	651.63	0.35	99.81		130598	24.7	167835	31.8	4.8			4.6
Tributary	52125.50		5067.25	1246.95	1251.55		1251.68	0.000995	4.26	2116.3	655.61	0.35	99.81		130698	24.8	167735	31.8	4.8			4.6
Tributary	52095.10		5067.1	1246.86	1251.45		1251.58	0.000994	4.25	2124.23	659.65	0.35	99.81		130797	24.8	167635	31.7	4.8			4.59
Tributary	52064.70		5067.35	1246.77	1251.35		1251.48	0.000991	4.24	2134.08	664.48	0.35	99.81		130897	24.8	167535	31.7	4.8			4.58
Tributary	52034.30		5067.17	1246.68	1251.25		1251.38	0.000987	4.22	2144.07	668.86	0.35	99.81		130997	24.8	167435	31.7	4.8			4.57
Tributary	52003.80		5067.17	1246.59	1251.16		1251.28	0.000982	4.21	2154.78	673.58	0.35	99.81		131097	24.8	167336	31.7	4.8			4.57
Tributary	51973.40		5067.06	1246.5	1251.06		1251.19	0.000978	4.19	2166.47	678.95	0.35	99.81		131197	24.8	167236	31.7	4.8			4.56
Tributary	51943.00		5067.04	1246.41	1250.96		1251.09	0.000973	4.18	2178.39	684.16	0.35	99.81		131296	24.9	167136	31.7	4.8			4.55
Tributary	51912.60		5066.97	1246.32	1250.87		1250.99	0.000967	4.16	2191.3	689.5	0.35	99.81		131396	24.9	167036	31.6	4.8			4.55
Tributary	51882.20		5067.32	1246.23	1250.78		1250.9	0.000959	4.14	2206.5	695.55	0.35	99.81		131496	24.9	166936	31.6	4.8			4.55
Tributary	51851.70		5067.03	1246.14	1250.68		1250.8	0.000951	4.12	2221.92	701.85	0.34	99.81		131596	24.9	166837	31.6	5.3			4.54
Tributary	51821.30		5067.11	1246.04	1250.59		1250.71	0.00094	4.1	2238.84	708.33	0.34	99.81		131696	24.9	166737	31.6	4.8			4.55
Tributary	51790.90		5067.16	1245.95	1250.5		1250.61	0.000928	4.07	2258.34	715.16	0.34	99.81		131795	25.0	166637	31.6	4.8			4.55
Tributary	51760.50		5067.28	1245.86	1250.41		1250.52	0.000915	4.04	2278.89	722.24	0.34	99.81		131895	25.0	166537	31.5	4.8			4.55
Tributary	51730.10		5067.17	1245.77	1250.32		1250.43	0.0009	4.01	2302.1	729.89	0.34	99.81		131995	25.0	166437	31.5	4.8			4.55
Tributary	51699.60		5067.22	1245.68	1250.23		1250.34	0.000886	3.98	2325.83	738.2	0.33	99.81		132095	25.0	166338	31.5	4.8			4.55
Tributary	51669.20		5067.06	1245.59	1250.15		1250.26	0.000866	3.94	2353.58	746.09	0.33	99.81		132195	25.0	166238	31.5	4.8			4.56
Tributary	51638.80		5067.2	1245.5	1250.07		1250.17	0.000848	3.9	2382.31	754.85	0.33	99.81		132295	25.1	166138	31.5	4.8			4.57
Tributary	51608.40		5067.18	1245.41	1249.99		1250.08	0.000826	3.85	2415.31	763.45	0.32	99.81		132394	25.1	166038	31.4	4.8			4.58
Tributary	51578.00		5067.1	1245.32	1249.91		1250	0.000798	3.79	2452.22	770.15	0.32	99.81		132494	25.1	165938	31.4	4.8			4.59
Tributary	51547.50		5067.21	1245.23	1249.83		1249.93	0.000772	3.74	2491.03	779.02	0.31	99.81		132594	25.1	165838	31.4	4.8			4.6
Tributary	51517.10		5067.08	1245.14	1249.76		1249.85	0.000744	3.68	2534.45	789.12	0.31	99.81		132694	25.1	165739	31.4	4.8			4.62
Tributary	51486.70		5067	1245.05	1249.69		1249.78	0.000715	3.62	2582.19	800.06	0.3	99.81		132794	25.2	165639	31.4	4.8			4.64
Tributary	51456.30		5067.21	1244.96	1249.63		1249.71	0.000685	3.55	2634.08	812.21	0.29	99.81		132893	25.2	165539	31.4	4.8			4.67
Tributary	51425.80		5067.14	1244.87	1249.56		1249.64	0.000652	3.48	2692.02	824.45	0.29	99.81		132993	25.2	165439	31.3	4.8			4.69
Tributary	51395.40		5067.12	1244.78	1249.5		1249.58	0.00062	3.41	2753.84	837.52	0.28	99.81		133093	25.2	165339	31.3	4.8			4.72
Tributary	51365.00		5067.09	1244.69	1249.45		1249.52	0.000586	3.33	2823.25	852.3	0.27	99.81		133193	25.2	165240	31.3	4.8			4.76
Tributary	51334.60		5067.29	1244.6	1249.39		1249.46	0.000553	3.25	2897.91	868.52	0.27	99.81		133293	25.2	165140	31.3	4.8			4.79
Tributary	51304.20		5067.15	1244.51	1249.34		1249.41	0.000518	3.16	2982.8	886.6	0.26	99.81		133392	25.3	165040	31.3	4.8			4.83
Tributary	51273.70		5067.19	1244.42	1249.3		1249.36	0.000483	3.07	3075.2	905.53	0.25	99.81		133492	25.3	164940	31.2	4.8			4.88
Tributary	51243.30		5067.05	1244.33	1249.26		1249.31	0.000449	2.98	3175.64	926.08	0.24	99.81		133592	25.3	164840	31.2	4.8			4.93
Tributary	51212.90		5067.11	1244.24	1249.22		1249.27	0.000414	2.89	3291.58	951.56	0.23	99.81		133692	25.3	164741	31.2	5.3			4.98
Tributary	51182.50		5067.24	1244.14	1249.18		1249.23	0.000381	2.79	3420.3	982.29	0.22	99.81		133792	25.3	164641	31.2	4.8			5.04
Tributary	51152.10		5067.06	1244.05	1249.15		1249.19	0.00035	2.69	3568.64	1025.53	0.21	99.81		133891	25.4	164541	31.2	4.8			5.1
Tributary	51121.60		5066.98	1243.96	1249.12		1249.16	0.00032	2.6	3751.82	1091.7	0.2	99.81		133991	25.4	164441	31.1	4.8			5.16
Tributary	51091.20		5066.96	1243.87	1249.09		1249.13	0.000285	2.47	3985.39	1163.46	0.19	99.81		134091	25.4	164341	31.1	4.8			5.22
Tributary	51060.80		5067	1243.78	1249.07		1249.1	0.000256	2.36	4293.05	1310.75	0.18	99.81		134191	25.4	164242	31.1	4.8			5.29
Tributary	51030.40		5067.04	1243.69	1249.05		1249.08	0.00021	2.16	4776.87	1461.9	0.17	99.81		134291	25.4	164142	31.1	4.8			5.36
Tributary	51000.00		5067.14	1243.6	1249.04		1249.06	0.000166	1.94	5447.73	1768.23	0.15	97.23	I-86	134391	25.5	164042	31.1	0.0			5.44
Tributary	50970.30		5067.24	1243.6	1249.02		1249.04	0.00017	1.96	5416.5	1781.2	0.15	97.23		134488	25.5	163945	31.1	0.5			5.42
Tributary	50940.70		5067.24	1243.59	1249		1249.02	0.000175	1.99	5379.89	1786.87	0.15	97.23		134585	25.5	163847	31.0	0.0			5.41
Tributary	50911.00		5067.16	1243.59	1248.99		1249.01	0.00018	2.01	5342.35	1795.95	0.15	97.23		134682	25.5	163750	31.0	0.0			5.4
Tributary	50881.40		5067.23	1243.59	1248.97		1248.99	0.000185	2.04	5301.88	1802.15	0.16	97.23		134779	25.5	163653	31.0	0.5			5.38
Tributary	50851.80		5067.06	1243.58	1248.95		1248.97	0.000191	2.07	5256.07	1806.24	0.16	97.23		134877	25.5	163556	31.0	0.0			5.37
Tributary	50822.10		5067.07	1243.58	1248.93		1248.95	0.000197	2.1	5207.7	1809.7	0.16	97.23		134974	25.6	163459	31.0	0.5			5.35
Tributary	50792.50		5067.14	1243.57	1248.91		1248.93	0.000204	2.14	5155.15	1808.7	0.16	97.23		135071	25.6	163361	30.9	0.0			5.34
Tributary	50762.90		5067.2	1243.57	1248.89		1248.92	0.000212	2.18	5099.46	1829.12	0.17	97.23		135168	25.6	163264	30.9	0.0			5.32
Tributary	50733.20		5067.11	1243.57	1248.87		1248.9	0.00022	2.21	5040.93	1849.71	0.17	97.23		135266	25.6	163167	30.9	0.5			5.3
Tributary	50703.60		5067.04	1243.56	1248.85		1248.87	0.00023	2.26	4973.46	1869.12	0.17	97.23		135363	25.6	163070	30.9	0.0			5.29
Tributary	50674.00		5067.02	1243.56	1248.82		1248.85	0.00024	2.3	4901.07	1889.44	0.18	97.23		135460	25.7	162972	30.9	0.5			5.26
Tributary	50644.30		5067.32	1243.55	1248.8		1248.83	0.000251	2.35	4828.8	1910.07	0.18	97.23		135557	25.7	162875	30.8	0.0			5.25
Tributary	50614.70		5067.2	1243.55	1248.78		1248.81	0.000264	2.4	4750.46	1929.55	0.19	97.23		135655	25.7	162778	30.8	0.0			5.23
Tributary	50585.00		5067.15	1243.55	1248.75		1248.78	0.000278	2.46	4665.72	1950.13	0.19	97.23		135752	25.7	162681	30.8	0.5			5.2
Tributary	50555.40		5067.09	1243.54	1248.72		1248.76	0.000293	2.52	4578.12	1970.65	0.2	97.23		135849	25.7	162583	30.8	0.0			5.18
Tributary	50525.80		5067.22	1243.54	1248.7		1248.73	0.000292	2.51	4486.87	1936.52	0.2	97.23		135946	25.7	162486	30.8	0.5			5.16
Tributary	50496.10		5067.03	1243.53	1248.67		1248.71	0.000307	2.57	4388.93	1904.06	0.2	97.23		136043	25.8	162389	30.8	0.0			5.14
Tributary	50466.50		5067.06	1243.53	1248.64		1248.68	0.000323	2.62	4292.04	1872.48	0.21	97.23		136141	25.8	162292	30.7	0.0			5.11
Tributary	50436.90		5067.1	1243.53	1248.61		1248.65	0.000338	2.68	4198.83	1838.24	0.21	97.23		136238	25.8	162195	30.7	0.5			5.08
Tributary	50407.20		5067.01	1243.52	1248.57		1248.62	0.000354	2.73	4095.66	1787.25	0.21	97.23		136335	25.8	162097	30.7	0.0			5.05
Tributary	50377.60		5067.3	1243.52	1248.54		1248.58	0.000317	2.57	4008.71	1525.86	0.2	97.23		136432	25.8	162000	30.7	0.5			5.02
Tributary	50348.00		5067.33	1243.51	1248.51		1248.55	0.000322	2.58	3943.8	1381.42	0.2	97.23		136530	25.9	161903	30.7	0.0			5
Tributary	50318.30		5066.87	1243.51	1248.47		1248.51	0.00033	2.6	3884.64	1336.11	0.21	97.23		136627	25.9	161806	30.6	0.0			4.96
Tributary	50288.70		5067.03	1243.51	1248.43		1248.48	0.000339	2.62	3829.02	1309.24	0.21	97.23		136724	25.9	161708	30.6	0.5			4.92
Tributary	50259.00		5067.23	1243.5	1248.4		1248.45	0.000351	2.65	3779.42	1300.47	0.21	97.23		136821	25.9	161611	30.6	0.0			4.9
Tributary	50229.40		5067.06	1243.5	1248.36		1248.41	0.000364	2.69	3724.32	1294.43	0.22	97.23		136919	25.9	161514	30.6	0.5			4.86
Tributary	50199.80		5067.05	1243.49	1248.33		1248.38	0.000378	2.73	3672.52	1287.06	0.22	97.23		137016	25.9	161417	30.6	0.0			4.84
Tributary	50170.10		5067.06	1243.49	1248.29		1248.34	0.000392	2.77	3618.23	1281.92	0.22	97.23		137113	26.0	161319	30.6	0.0			4.8
Tributary	50140.50		5067.25	1243.49	1248.25		1248.3	0.000408	2.81	3559.95	1279.01	0.23	97.23		137210	26.0	161222	30.5	0.5			4.76
Tributary	50110.90		5067.2	1243.48	1248.21		1248.27	0.000426	2.85	3501.15	1275.27	0.23	97.23		137307	26.0	161125	30.5	0.0			4.73
Tributary	50081.20		5067.12	1243.48	1248.16		1248.23	0.000444	2.89	3439.83	1267.98	0.24	97.23		137405	26.0	161028	30.5	0.5			4.68
Tributary	50051.60		5067.1	1243.47	1248.12		1248.19	0.000461	2.93	3383.22	1259.99	0.24	97.23		137502	26.0	160931	30.5	0.0			4.65
Tributary	50022.00		5067.08	1243.47	1248.08		1248.14	0.000438	2.84	3321.08	1247.19	0.24	99.19		137599	26.1	160833	30.5	4.8			4.61
Tributary	49991.70		5067.11	1243.38	1248.03		1248.1	0.000446	2.88	3266.66	1205.81	0.24	99.19		137698	26.1	160734	30.4	4.8			4.65
Tributary	49961.50		5067.04	1243.29	1247.99		1248.05	0.000454	2.93	3216.62	1164.32	0.24	99.19		137798	26.1	160635	30.4	5.3			4.7
Tributary	49931.30		5067.1	1243.19	1247.94		1248.01	0.00046	2.97	3169.94	1121.61	0.24	99.19		137897	26.1	160536	30.4	4.8			4.75
Tributary	49901.00		5067.18	1243.1	1247.9		1247.97	0.000467	3	3127.85	1079.2	0.24	99.19		137996	26.1	160437	30.4	4.8			4.8
Tributary	49870.80		5067.11	1243.01	1247.85		1247.92	0.000473	3.04	3087.8	1039.26	0.25	99.19		138095	26.2	160337	30.4	4.8			4.84
Tributary	49840.60		5067.07	1242.92	1247.8		1247.87	0.000479	3.08	3051.67	1023.89	0.25	99.19		138194	26.2	160238	30.3	4.8			4.88
Tributary	49810.30		5067.26	1242.83	1247.75		1247.83	0.000485	3.11	3015.69	1008.49	0.25	99.19		138293	26.2	160139	30.3	5.3			4.92
Tributary	49780.10		5067.01	1242.73	1247.7		1247.78	0.000491	3.15	2980.83	993.81	0.25	99.19		138393	26.2	160040	30.3	4.8			4.97
Tributary	49749.90		5067.13	1242.64	1247.65		1247.73	0.000497	3.18	2945.7	979.48	0.25	99.19		138492	26.2	159941	30.3	4.8			5.01

Tributary	49719.60		5067.03	1242.55	1247.6		1247.69	0.000502	3.22	2913.07	965.13	0.26	99.19		138591	26.2	159841	30.3	4.8			5.05
Tributary	49689.40		5067.15	1242.46	1247.55		1247.64	0.000508	3.25	2879.01	950.56	0.26	99.19		138690	26.3	159742	30.3	5.3			5.09
Tributary	49659.20		5067.19	1242.36	1247.5		1247.59	0.000514	3.29	2846.49	936.62	0.26	99.19		138789	26.3	159643	30.2	4.8			5.14
Tributary	49628.90		5067.09	1242.27	1247.45		1247.54	0.000519	3.32	2815.03	921.81	0.26	99.19		138889	26.3	159544	30.2	4.8			5.18
Tributary	49598.70		5066.95	1242.18	1247.4		1247.49	0.000526	3.35	2781.68	907.95	0.26	99.19		138988	26.3	159445	30.2	4.8			5.22
Tributary	49568.50		5067.23	1242.09	1247.35		1247.44	0.00053	3.38	2752.94	893.97	0.26	99.19		139087	26.3	159345	30.2	4.8			5.26
Tributary	49538.20		5067.28	1242	1247.29		1247.39	0.000536	3.42	2721.33	880.3	0.27	99.19		139186	26.4	159246	30.2	5.3			5.29
Tributary	49508.00		5067.15	1241.9	1247.24		1247.34	0.00054	3.44	2693.94	866.65	0.27	99.19		139285	26.4	159147	30.1	4.8			5.34
Tributary	49477.80		5067.05	1241.81	1247.18		1247.29	0.000545	3.48	2665.59	854.62	0.27	99.19		139385	26.4	159048	30.1	4.8			5.37
Tributary	49447.50		5067.04	1241.72	1247.13		1247.23	0.000552	3.51	2636.88	843.11	0.27	99.19		139484	26.4	158949	30.1	4.8			5.41
Tributary	49417.30		5067.01	1241.63	1247.07		1247.18	0.000559	3.55	2607.24	831.34	0.27	99.19		139583	26.4	158850	30.1	5.3			5.44
Tributary	49387.10		5067.05	1241.53	1247.01		1247.12	0.000565	3.58	2578.77	820.07	0.27	99.19		139682	26.5	158750	30.1	4.8			5.48
Tributary	49356.80		5066.96	1241.44	1246.96		1247.07	0.000574	3.62	2549.07	809.13	0.28	99.19		139781	26.5	158651	30.0	4.8			5.52
Tributary	49326.60		5067.05	1241.35	1246.9		1247.01	0.00058	3.66	2521.47	797.78	0.28	99.19		139881	26.5	158552	30.0	4.8			5.55
Tributary	49296.40		5067.05	1241.26	1246.84		1246.96	0.000588	3.69	2493.36	787.12	0.28	99.19		139980	26.5	158453	30.0	4.8			5.58
Tributary	49266.10		5067.03	1241.17	1246.78		1246.9	0.000595	3.73	2466.66	776.25	0.28	99.19		140079	26.5	158354	30.0	5.3			5.61
Tributary	49235.90		5067.01	1241.07	1246.72		1246.84	0.000602	3.76	2439.35	779.05	0.28	99.19		140178	26.5	158254	30.0	4.8			5.65
Tributary	49205.70		5066.98	1240.98	1246.66		1246.78	0.000611	3.8	2415.46	802.44	0.29	99.19		140277	26.6	158155	30.0	4.8			5.68
Tributary	49175.40		5067.02	1240.89	1246.6		1246.73	0.000618	3.83	2394.8	822.7	0.29	99.19		140376	26.6	158056	29.9	4.8			5.71
Tributary	49145.20		5066.97	1240.8	1246.54		1246.67	0.000623	3.87	2380.7	646.05	0.29	99.19		140476	26.6	157957	29.9	4.8			5.74
Tributary	49115.00		5067	1240.71	1246.47		1246.61	0.000632	3.9	2365.36	667.47	0.29	99.19		140575	26.6	157858	29.9	5.3			5.76
Tributary	49084.80		5067.08	1240.61	1246.41		1246.55	0.000638	3.94	2354.23	691.77	0.29	99.19		140674	26.6	157758	29.9	4.8			5.8
Tributary	49054.50		5067.02	1240.52	1246.35		1246.49	0.000645	3.97	2345.93	509.77	0.3	99.19		140773	26.7	157659	29.9	4.8			5.83
Tributary	49024.30		5067.15	1240.43	1246.28		1246.43	0.000651	4	2338.3	916.6	0.3	99.19		140872	26.7	157560	29.8	4.8			5.85
Tributary	48994.10		5067.06	1240.34	1246.22		1246.37	0.000657	4.03	2334.02	922.83	0.3	99.19		140972	26.7	157461	29.8	5.3			5.88
Tributary	48963.80		5067.03	1240.24	1246.16		1246.3	0.000662	4.05	2330.35	929.16	0.3	99.19		141071	26.7	157362	29.8	4.8			5.92
Tributary	48933.60		5067.12	1240.15	1246.09		1246.24	0.000667	4.08	2327.81	929.82	0.3	99.19		141170	26.7	157262	29.8	4.8			5.94
Tributary	48903.40		5067.16	1240.06	1246.03		1246.18	0.000672	4.1	2325.73	926.79	0.3	99.19		141269	26.8	157163	29.8	4.8			5.97
Tributary	48873.10		5066.93	1239.97	1245.96		1246.12	0.000676	4.13	2323.11	924.15	0.3	99.19		141368	26.8	157064	29.7	4.8			5.99
Tributary	48842.90		5067.02	1239.88	1245.9		1246.05	0.000679	4.15	2322.88	920.8	0.3	99.19		141468	26.8	156965	29.7	5.3			6.02
Tributary	48812.70		5067.13	1239.78	1245.83		1245.99	0.000683	4.17	2320.86	918.2	0.31	99.19		141567	26.8	156866	29.7	4.8			6.05
Tributary	48782.40		5067.09	1239.69	1245.76		1245.92	0.000684	4.19	2323.86	915.3	0.31	99.19		141666	26.8	156767	29.7	4.8			6.07
Tributary	48752.20		5067.03	1239.6	1245.7		1245.86	0.000688	4.21	2324.14	913.6	0.31	99.19		141765	26.8	156667	29.7	4.8			6.1
Tributary	48722.00		5067.17	1239.51	1245.63		1245.79	0.00069	4.22	2325.88	910.69	0.31	99.19		141864	26.9	156568	29.7	5.3			6.12
Tributary	48691.70		5067.15	1239.41	1245.56		1245.72	0.00069	4.24	2328.56	908.17	0.31	99.19		141963	26.9	156469	29.6	4.8			6.15
Tributary	48661.50		5067.12	1239.32	1245.5		1245.66	0.000692	4.25	2329.86	905.19	0.31	99.19		142063	26.9	156370	29.6	4.8			6.18
Tributary	48631.30		5066.97	1239.23	1245.43		1245.59	0.000692	4.26	2334.09	902.64	0.31	99.19		142162	26.9	156271	29.6	4.8			6.2
Tributary	48601.00		5067.07	1239.14	1245.36		1245.53	0.000693	4.27	2337.47	900.19	0.31	99.19		142261	26.9	156171	29.6	4.8			6.22
Tributary	48570.80		5066.93	1239.05	1245.3		1245.46	0.000693	4.28	2342.42	898.02	0.31	99.19		142360	27.0	156072	29.6	5.3			6.25
Tributary	48540.60		5067.16	1238.95	1245.23		1245.39	0.000691	4.29	2348.1	896.13	0.31	99.19		142459	27.0	155973	29.5	4.8			6.28
Tributary	48510.30		5067.15	1238.86	1245.16		1245.32	0.000692	4.3	2351.93	894.27	0.31	99.19		142559	27.0	155874	29.5	4.8			6.3
Tributary	48480.10		5067.05	1238.77	1245.1		1245.26	0.000689	4.3	2360.75	892.44	0.31	99.19		142658	27.0	155775	29.5	4.8			6.33
Tributary	48449.90		5067.04	1238.68	1245.03		1245.19	0.00069	4.31	2365.4	890.55	0.31	99.19		142757	27.0	155675	29.5	5.3			6.35
Tributary	48419.60		5067.08	1238.58	1244.96		1245.12	0.000685	4.31	2376.09	888.93	0.31	99.19		142856	27.1	155576	29.5	4.8			6.38
Tributary	48389.40		5067.07	1238.49	1244.89		1245.05	0.000682	4.31	2384.04	887.06	0.31	99.19		142955	27.1	155477	29.4	4.8			6.4
Tributary	48359.20		5067.01	1238.4	1244.83		1244.99	0.000679	4.31	2394.71	886.76	0.31	99.19		143055	27.1	155378	29.4	4.8			6.43
Tributary	48328.90		5067.1	1238.31	1244.76		1244.92	0.000674	4.3	2404.71	884.91	0.31	99.19		143154	27.1	155279	29.4	4.8			6.45
Tributary	48298.70		5067.06	1238.22	1244.7		1244.85	0.000669	4.3	2416.29	883.74	0.31	99.19		143253	27.1	155179	29.4	5.3			6.48
Tributary	48268.50		5067.12	1238.12	1244.63		1244.79	0.000664	4.29	2428.58	882.07	0.3	99.19		143352	27.2	155080	29.4	4.8			6.51
Tributary	48238.20		5066.97	1238.03	1244.57		1244.72	0.000656	4.28	2444.06	881.73	0.3	99.19		143451	27.2	154981	29.4	4.8			6.54
Tributary	48208.00		5067	1237.94	1244.51		1244.66	0.000649	4.27	2459.15	880.59	0.3	99.19		143551	27.2	154882	29.3	4.8			6.57
Tributary	48177.80		5067.04	1237.85	1244.44		1244.59	0.000641	4.25	2477.1	880.44	0.3	99.19		143650	27.2	154783	29.3	4.8			6.59
Tributary	48147.50		5067	1237.76	1244.38		1244.53	0.000631	4.23	2495.43	879.87	0.3	99.19		143749	27.2	154684	29.3	5.3			6.62
Tributary	48117.30		5067.05	1237.66	1244.32		1244.47	0.000622	4.21	2514.67	879.83	0.3	99.19		143848	27.2	154584	29.3	4.8			6.66
Tributary	48087.10		5066.97	1237.57	1244.27		1244.41	0.00061	4.19	2536.71	880.11	0.29	99.19		143947	27.3	154485	29.3	4.8			6.7
Tributary	48056.80		5066.88	1237.48	1244.21		1244.35	0.000598	4.16	2561.12	880.24	0.29	99.19		144046	27.3	154386	29.2	4.8			6.73
Tributary	48026.60		5066.86	1237.39	1244.15		1244.29	0.000586	4.13	2586.85	880.88	0.29	99.19		144146	27.3	154287	29.2	5.3			6.76
Tributary	47996.40		5067.13	1237.29	1244.1		1244.23	0.000573	4.1	2614.2	881.89	0.28	99.19		144245	27.3	154188	29.2	4.8			6.81
Tributary	47966.20		5067.02	1237.2	1244.05		1244.17	0.00056	4.07	2642.67	882.99	0.28	99.19		144344	27.3	154088	29.2	4.8			6.85
Tributary	47935.90		5066.88	1237.11	1243.99		1244.12	0.000546	4.03	2672.07	884.22	0.28	99.19		144443	27.4	153989	29.2	4.8			6.88
Tributary	47905.70		5066.96	1237.02	1243.94		1244.07	0.000532	4	2704.11	885.81	0.28	99.19		144542	27.4	153890	29.1	4.8			6.92
Tributary	47875.50		5066.97	1236.93	1243.9		1244.01	0.000518	3.96	2736.99	887.8	0.27	99.19		144642	27.4	153791	29.1	5.3			6.97
Tributary	47845.20		5066.97	1236.83	1243.85		1243.96	0.000503	3.92	2771.94	889.72	0.27	99.19		144741	27.4	153692	29.1	4.8			7.02
Tributary	47815.00		5066.81	1236.74	1243.8		1243.91	0.000488	3.88	2810.03	892.48	0.26	99.19		144840	27.4	153592	29.1	4.8			7.06
Tributary	47784.80		5066.79	1236.65	1243.76		1243.86	0.000473	3.83	2846.49	894.65	0.26	99.19		144939	27.5	153493	29.1	4.8			7.11
Tributary	47754.50		5066.77	1236.56	1243.71		1243.82	0.000458	3.79	2887.87	897.74	0.26	99.19		145038	27.5	153394	29.1	5.3			7.15
Tributary	47724.30		5066.86	1236.46	1243.67		1243.77	0.000443	3.75	2927.78	900.99	0.25	99.19		145138	27.5	153295	29.0	4.8			7.21
Tributary	47694.10		5066.72	1236.37	1243.63		1243.73	0.000429	3.7	2971.9	906.89	0.25	99.19		145237	27.5	153196	29.0	4.8			7.26
Tributary	47663.80		5066.81	1236.28	1243.59		1243.68	0.000417	3.67	3016.97	917.06	0.25	99.18		145336	27.5	153096	29.0	4.8			7.31
Tributary	47633.64		5066.64	1236.19	1243.55		1243.64	0.000407	3.64	3064.47	932.44	0.24	99.66		145435	27.5	152997	29.0	5.8			7.36
Tributary	47603.20		5066.71	1236.08	1243.5		1243.6	0.000428	3.75	2958.75	905.29	0.25	99.66		145535	27.6	152898	29.0	5.8			7.42
Tributary	47572.80		5066.69	1235.97	1243.45		1243.56	0.000453	3.87	2850.69	881.07	0.26	99.66		145634	27.6	152798	28.9	5.8			7.48
Tributary	47542.50		5066.59	1235.86	1243.4		1243.52	0.000479	3.99	2748.72	861.21	0.26	99.66		145734	27.6	152698	28.9	5.8			7.54
Tributary	47512.10		5066.81	1235.75	1243.35		1243.48	0.000508	4.12	2644.88	841.54	0.27	99.66		145834	27.6	152599	28.9	5.8			7.6
Tributary	47481.70		5066.74	1235.64	1243.29		1243.43	0.000539	4.26	2542.01	818.87	0.28	99.66		145933	27.6	152499	28.9	5.8			7.65
Tributary	47451.30		5066.6	1235.53	1243.22		1243.38	0.000569	4.38	2443.59	794.99	0.29	99.66		146033	27.7	152399	28.9	5.3			7.69
Tributary	47421.00		5066.79	1235.43	1243.16		1243.33	0.000599	4.51	2346.83	768.87	0.3	99.66		146133	27.7	152300	28.8	5.8			7.73
Tributary	47390.60		5066.5	1235.32	1243.09		1243.28	0.000625	4.61	2254.87	734.79	0.3	99.66		146232	27.7	152200	28.8	5.8			7.77
Tributary	47360.20		5066.67	1235.21	1243.02		1243.22	0.000655	4.72	2166.66	713.68	0.31	99.66		146332	27.7	152100	28.8	5.8			7.81
Tributary	47329.80		5066.65	1235.1	1242.94		1243.16	0.000687	4.84	2082.41	696.52	0.32	99.66		146432	27.7	152001	28.8	5.8			7.84
Tributary	47299.50		5066.45	1234.99	1242.86		1243.1	0.000721	4.96	1999.11	679.87	0.33	99.66		146531	27.8	151901	28.8	5.8			7.87
Tributary	47269.10		5066.61	1234.88	1242.78		1243.03	0.000755	5.08	1916.36	662.52	0.33	99.66		146631	27.8	151801	28.8	5.8			7.9
Tributary	47238.70		5066.42	1234.77	1242.69		1242.96	0.000788	5.18	1835.84	644.29	0.34	99.66		146731	27.8	151702	28.7	5.8			7.92

Tributary	47208.30		5066.56	1234.66	1242.6		1242.89	0.000822	5.29	1757.58	626.21	0.35	99.66		146830	27.8	151602	28.7	5.8			7.94
Tributary	47178.00		5066.47	1234.55	1242.51		1242.81	0.000856	5.39	1681.31	609.42	0.35	99.66		146930	27.8	151502	28.7	5.8			7.96
Tributary	47147.60		5066.43	1234.44	1242.41		1242.73	0.000891	5.49	1605.9	591.2	0.36	99.66		147030	27.8	151403	28.7	5.3			7.97
Tributary	47117.20		5066.42	1234.34	1242.31		1242.65	0.000921	5.57	1535.64	571.87	0.37	99.66		147129	27.9	151303	28.7	5.8			7.97
Tributary	47086.80		5066.43	1234.23	1242.21		1242.56	0.000947	5.64	1468.7	550.67	0.37	99.66		147229	27.9	151203	28.6	5.8			7.98
Tributary	47056.50		5066.37	1234.12	1242.11		1242.47	0.000967	5.69	1408.68	514.47	0.38	99.66		147329	27.9	151104	28.6	5.8			7.99
Tributary	47026.10		5066.38	1234.01	1242.01		1242.37	0.000975	5.7	1359.59	473.67	0.38	99.66		147428	27.9	151004	28.6	5.8			8
Tributary	46995.70		5066.35	1233.9	1241.91		1242.28	0.000973	5.69	1333.59	338.4	0.38	99.66		147528	27.9	150904	28.6	5.8			8.01
Tributary	46965.30		5066.33	1233.79	1241.81		1242.17	0.000966	5.66	1336.21	283.85	0.38	99.66		147628	28.0	150805	28.6	5.8			8.02
Tributary	46934.90		5066.34	1233.68	1241.71		1242.07	0.000963	5.64	1346.24	289.65	0.37	99.66		147727	28.0	150705	28.5	5.8			8.03
Tributary	46904.60		5066.26	1233.57	1241.62		1241.98	0.000969	5.65	1361.9	302.57	0.38	99.66		147827	28.0	150605	28.5	5.8			8.05
Tributary	46874.20		5066.24	1233.46	1241.52		1241.88	0.000963	5.62	1380.17	311.86	0.37	99.66		147927	28.0	150506	28.5	5.8			8.06
Tributary	46843.80		5066.26	1233.35	1241.44		1241.8	0.000996	5.72	1414.34	356.55	0.38	99.66		148026	28.0	150406	28.5	5.3			8.09
Tributary	46813.40		5066.19	1233.25	1241.36		1241.7	0.000945	5.57	1458.39	362.38	0.37	99.66		148126	28.1	150306	28.5	5.8			8.11
Tributary	46783.10		5066.2	1233.14	1241.28		1241.6	0.000891	5.41	1505.7	367.45	0.36	99.66		148226	28.1	150207	28.4	5.8			8.14
Tributary	46752.70		5066.18	1233.03	1241.21		1241.5	0.000836	5.24	1556.39	371.71	0.35	99.66		148325	28.1	150107	28.4	5.8			8.18
Tributary	46722.30		5066.13	1232.92	1241.15		1241.42	0.000778	5.07	1611.46	376.08	0.34	99.66		148425	28.1	150008	28.4	5.8			8.23
Tributary	46691.90		5066.09	1232.81	1241.09		1241.34	0.000723	4.89	1668.67	379.66	0.32	99.66		148525	28.1	149908	28.4	5.8			8.28
Tributary	46661.60		5066.11	1232.7	1241.03		1241.26	0.000666	4.71	1727.99	380.57	0.31	99.66		148624	28.1	149808	28.4	5.8			8.33
Tributary	46631.20		5066.07	1232.59	1240.99		1241.19	0.000612	4.52	1788.51	380.81	0.3	99.66		148724	28.2	149709	28.4	5.8			8.4
Tributary	46600.80		5066.02	1232.48	1240.94		1241.13	0.000563	4.35	1848.6	380.6	0.29	99.66		148824	28.2	149609	28.3	5.8			8.46
Tributary	46570.40		5065.99	1232.37	1240.9		1241.07	0.000517	4.18	1909.21	379.92	0.28	99.66		148923	28.2	149509	28.3	5.3			8.53
Tributary	46540.10		5065.93	1232.27	1240.86		1241.02	0.000475	4.02	1970.08	378.63	0.26	99.66		149023	28.2	149410	28.3	5.8			8.59
Tributary	46509.70		5065.93	1232.16	1240.82		1240.97	0.000437	3.87	2030.12	377.1	0.25	99.66		149123	28.2	149310	28.3	5.8			8.66
Tributary	46479.30		5065.8	1232.05	1240.79		1240.92	0.000402	3.73	2089.5	375.29	0.24	99.66		149222	28.3	149210	28.3	5.8			8.74
Tributary	46448.90		5065.85	1231.94	1240.76		1240.88	0.000371	3.6	2147.99	373.29	0.23	99.66		149322	28.3	149111	28.2	5.8			8.82
Tributary	46418.60		5065.81	1231.83	1240.73		1240.84	0.000342	3.47	2206.49	371.23	0.22	99.66		149422	28.3	149011	28.2	5.8			8.9
Tributary	46388.20		5065.77	1231.72	1240.7		1240.81	0.000316	3.36	2262.17	369.3	0.22	99.66		149521	28.3	148911	28.2	5.8			8.98
Tributary	46357.80		5065.69	1231.61	1240.68		1240.78	0.000293	3.25	2316.75	367.16	0.21	99.66		149621	28.3	148812	28.2	5.8			9.07
Tributary	46327.40		5065.62	1231.5	1240.65		1240.75	0.000272	3.14	2369.9	364.76	0.2	99.66		149721	28.4	148712	28.2	5.8			9.15
Tributary	46297.00		5065.56	1231.39	1240.63		1240.72	0.000254	3.05	2420.57	362.22	0.19	99.66		149820	28.4	148612	28.1	5.8			9.24
Tributary	46266.70		5065.53	1231.28	1240.61		1240.7	0.000237	2.96	2469.71	359.54	0.19	99.66		149920	28.4	148513	28.1	5.3			9.33
Tributary	46236.30		5065.47	1231.18	1240.59		1240.67	0.000221	2.88	2517.07	356.68	0.18	99.66		150019	28.4	148413	28.1	5.8			9.41
Tributary	46205.90		5065.42	1231.07	1240.57		1240.65	0.000208	2.8	2560.92	353.62	0.18	99.66		150119	28.4	148313	28.1	5.8			9.5
Tributary	46175.50		5065.43	1230.96	1240.56		1240.63	0.000197	2.74	2603.64	352.58	0.17	99.66		150219	28.5	148214	28.1	5.8			9.6
Tributary	46145.20		5065.35	1230.85	1240.54		1240.61	0.000188	2.69	2643.62	353.27	0.17	99.66		150318	28.5	148114	28.1	5.8			9.69
Tributary	46114.80		5065.28	1230.74	1240.52		1240.59	0.00018	2.64	2682.96	353.75	0.16	99.66		150418	28.5	148014	28.0	5.8			9.78
Tributary	46084.40		5065.3	1230.63	1240.51		1240.58	0.000172	2.6	2720.64	364.45	0.16	99.66		150518	28.5	147915	28.0	5.8			9.88
Tributary	46054.00		5065.15	1230.52	1240.5		1240.56	0.000162	2.54	2947.83	1201.77	0.16	99.66		150617	28.5	147815	28.0	5.8			9.98
Tributary	46023.71		5064.96	1230.41	1240.5		1240.55	0.000142	2.39	3729.16	1867.6	0.15	99.69		150717	28.5	147715	28.0	5.3			10.09
Tributary	45993.30		5064.82	1230.31	1240.48		1240.53	0.000149	2.47	3262.17	1297.51	0.15	99.69		150817	28.6	147616	28.0	5.3			10.17
Tributary	45962.90		5064.79	1230.21	1240.46		1240.52	0.00015	2.51	3104.24	1139.18	0.15	99.69		150916	28.6	147516	27.9	5.3			10.25
Tributary	45932.50		5064.66	1230.11	1240.44		1240.5	0.00015	2.53	2989.25	962.01	0.15	99.69		151016	28.6	147416	27.9	5.3			10.33
Tributary	45902.10		5064.52	1230.01	1240.42		1240.49	0.00015	2.55	2931.26	666.3	0.15	99.69		151116	28.6	147317	27.9	5.8			10.41
Tributary	45871.70		5064.39	1229.9	1240.41		1240.47	0.000149	2.57	2902.14	553.52	0.15	99.69		151216	28.6	147217	27.9	5.3			10.51
Tributary	45841.30		5064.36	1229.8	1240.39		1240.46	0.000148	2.59	2891.23	454.8	0.15	99.69		151315	28.7	147117	27.9	5.3			10.59
Tributary	45811.00		5064.28	1229.7	1240.38		1240.44	0.000147	2.6	2890.67	428.91	0.15	99.69		151415	28.7	147017	27.8	5.3			10.68
Tributary	45780.60		5064.13	1229.6	1240.36		1240.43	0.000147	2.62	2891.06	400.52	0.15	99.69		151515	28.7	146918	27.8	5.3			10.76
Tributary	45750.20		5064.11	1229.5	1240.35		1240.41	0.000146	2.63	2896.56	383.48	0.15	99.69		151614	28.7	146818	27.8	5.8			10.85
Tributary	45719.80		5063.99	1229.39	1240.33		1240.4	0.000146	2.65	2900.18	386.05	0.15	99.69		151714	28.7	146718	27.8	5.3			10.94
Tributary	45689.40		5064.05	1229.29	1240.32		1240.38	0.000145	2.67	2903.6	388.8	0.15	99.69		151814	28.8	146619	27.8	5.3			11.03
Tributary	45659.00		5063.95	1229.19	1240.3		1240.37	0.000146	2.69	2903.6	391.34	0.15	99.69		151913	28.8	146519	27.7	5.3			11.11
Tributary	45628.60		5063.94	1229.09	1240.29		1240.36	0.000146	2.71	2902.36	394.39	0.15	99.69		152013	28.8	146419	27.7	5.3			11.2
Tributary	45598.20		5063.92	1228.99	1240.27		1240.34	0.000147	2.74	2902.07	415.79	0.15	99.69		152113	28.8	146320	27.7	5.8			11.28
Tributary	45567.90		5063.8	1228.88	1240.25		1240.33	0.000148	2.76	2912.29	473.14	0.15	99.69		152212	28.8	146220	27.7	5.3			11.37
Tributary	45537.50		5063.82	1228.78	1240.24		1240.31	0.000149	2.79	2940.19	527.25	0.16	99.69		152312	28.8	146120	27.7	5.3			11.46
Tributary	45507.10		5063.75	1228.68	1240.22		1240.3	0.00015	2.81	2981.67	564.33	0.16	99.69		152412	28.9	146021	27.7	5.3			11.54
Tributary	45476.70		5063.58	1228.58	1240.21		1240.29	0.00015	2.83	3030.28	590.75	0.16	99.69		152512	28.9	145921	27.6	5.3			11.63
Tributary	45446.30		5063.57	1228.48	1240.2		1240.27	0.000149	2.84	3084.77	615.63	0.16	99.69		152611	28.9	145821	27.6	5.3			11.72
Tributary	45415.90		5063.46	1228.38	1240.18		1240.26	0.000149	2.85	3144.41	637.18	0.16	99.69		152711	28.9	145722	27.6	5.8			11.8
Tributary	45385.50		5063.39	1228.27	1240.17		1240.24	0.000147	2.85	3210.37	656.9	0.16	99.69		152811	28.9	145622	27.6	5.3			11.9
Tributary	45355.20		5063.26	1228.17	1240.15		1240.23	0.000146	2.84	3277.45	675.82	0.16	99.69		152910	29.0	145522	27.6	5.3			11.98
Tributary	45324.80		5063.17	1228.07	1240.14		1240.21	0.000144	2.84	3349.5	694.07	0.15	99.69		153010	29.0	145422	27.5	5.3			12.07
Tributary	45294.40		5063.02	1227.97	1240.13		1240.2	0.000142	2.82	3423.08	711.71	0.15	99.69		153110	29.0	145323	27.5	5.3			12.16
Tributary	45264.00		5063.01	1227.87	1240.11		1240.19	0.000139	2.81	3502.01	728.82	0.15	99.69		153209	29.0	145223	27.5	5.8			12.24
Tributary	45233.60		5062.86	1227.76	1240.1		1240.17	0.000136	2.78	3585.98	745.72	0.15	99.69		153309	29.0	145123	27.5	5.3			12.34
Tributary	45203.20		5062.67	1227.66	1240.09		1240.16	0.000132	2.76	3670.41	762.27	0.15	99.69		153409	29.1	145024	27.5	5.3			12.43
Tributary	45172.80		5062.91	1227.56	1240.08		1240.14	0.000128	2.72	3760.41	778.7	0.15	99.69		153508	29.1	144924	27.4	5.2			12.52
Tributary	45142.40		5062.71	1227.5	1240.07		1240.13	0.000124	2.69	3854.45	795.69	0.14	99.69		153608	29.1	144824	27.4	5.3			12.57
Tributary	45112.10		5062.59	1227.4	1240.06		1240.12	0.00012	2.64	3950.42	810.48	0.14	99.69		153708	29.1	144725	27.4	5.3			12.66
Tributary	45081.70		5062.52	1227.3	1240.05		1240.1	0.000115	2.6	4050.66	826.03	0.14	99.69		153808	29.1	144625	27.4	5.3			12.75
Tributary	45051.30		5062.37	1227.2	1240.04		1240.09	0.00011	2.55	4151.74	839.56	0.14	99.69		153907	29.1	144525	27.4	5.3			12.84
Tributary	45020.90		5062.05	1227.1	1240.03		1240.08	0.000105	2.5	4258.27	854.68	0.13	99.69		154007	29.2	144426	27.4	5.3			12.93
Tributary	44990.50		5062.02	1227	1240.02		1240.07	0.0001	2.44	4368.37	868.55	0.13	99.69		154107	29.2	144326	27.3	5.3			13.02
Tributary	44960.10		5061.79	1226.9	1240.01		1240.06	0.000095	2.38	4481.58	881.86	0.13	99.69		154206	29.2	144226	27.3	5.3			13.11
Tributary	44929.70		5061.71	1226.8	1240.01		1240.05	0.00009	2.32	4596.42	895.16	0.12	99.69		154306	29.2	144126	27.3	5.3			13.21
Tributary	44899.30		5061.59	1226.7	1240		1240.04	0.000085	2.26	4718.17	908.05	0.12	99.69		154406	29.2	144027	27.3	5.3			13.3
Tributary	44869.00		5061.43	1226.6	1239.99		1240.03	0.000081	2.2	4839.21	920.9	0.12	99.69		154505	29.3	143927	27.3	5.3			13.39
Tributary	44838.60		5061.46	1226.5	1239.99		1240.02	0.000076	2.13	4964.4	933.36	0.11	99.69		154605	29.3	143827	27.2	5.3			13.49
Tributary	44808.20		5061.24	1226.4	1239.98		1240.01	0.000071	2.07	5115.1	1219.52	0.11	99.69		154705	29.3	143728	27.2	5.3			13.58
Tributary	44777.80		5060.94	1226.3	1239.97		1240	0.000067	2	5336.9	1306.4	0.11	99.69		154804	29.3	143628	27.2	5.3			13.67
Tributary	44747.40		5060.77	1226.2	1239.97		1240	0.000062	1.93	5577.38	1375.32	0.1	99.69		154904	29.3	143528	27.2	5.3			13.77
Tributary	44717.00		5060.46	1226.1	1239.97		1239.99	0.000057	1.85	5836.55	1440.18	0.1	99.69		155004	29.4	143429	27.2	5.8			13.87

Tributary	44686.60		5060.51	1225.99	1239.96		1239.98	0.000053	1.77	6117.97	1502.71	0.09	99.69		155103	29.4	143329	27.1	5.3			13.97
Tributary	44656.30		5060	1225.89	1239.96		1239.98	0.000048	1.7	6413.73	1558.86	0.09	99.69		155203	29.4	143229	27.1	5.3			14.07
Tributary	44625.90		5059.79	1225.79	1239.95		1239.97	0.000044	1.62	6724.54	1611.64	0.09	99.69		155303	29.4	143130	27.1	5.3			14.16
Tributary	44595.50		5059.54	1225.69	1239.95		1239.97	0.00004	1.55	7057.62	1698.29	0.08	99.69		155403	29.4	143030	27.1	5.3			14.26
Tributary	44565.10		5059.24	1225.59	1239.95		1239.96	0.000037	1.47	7413.83	1754.28	0.08	99.69		155502	29.5	142930	27.1	5.3			14.36
Tributary	44534.70		5059.54	1225.49	1239.95		1239.96	0.000033	1.4	7792.95	1820.26	0.07	99.69		155602	29.5	142831	27.1	5.3			14.46
Tributary	44504.30		5058.92	1225.39	1239.94		1239.95	0.000031	1.34	8184.24	1895.49	0.07	99.69		155702	29.5	142731	27.0	5.3			14.55
Tributary	44473.90		5058.61	1225.29	1239.94		1239.95	0.000029	1.3	8595.3	2009.99	0.07	99.69		155801	29.5	142631	27.0	5.3			14.65
Tributary	44443.50		5058.18	1225.19	1239.94		1239.95	0.000026	1.23	9025.16	2046.77	0.07	99.69		155901	29.5	142531	27.0	5.3			14.75
Tributary	44413.20		5058.12	1225.09	1239.94		1239.95	0.000024	1.16	9470.3	2080.21	0.06	99.69		156001	29.5	142432	27.0	5.3			14.85
Tributary	44382.80		5057.74	1224.99	1239.94		1239.94	0.000021	1.1	9930.71	2112.18	0.06	99.69		156100	29.6	142332	27.0	5.3			14.95
Tributary	44352.40		5057.41	1224.89	1239.94		1239.94	0.000019	1.04	10410.88	2144.76	0.06	99.69		156200	29.6	142232	26.9	5.3			15.05
Tributary	44322.00		5056.82	1224.79	1239.93		1239.94	0.000017	0.98	10904.44	2168.69	0.05	99.69		156300	29.6	142133	26.9	5.3			15.14
Tributary	44291.60		5056.69	1224.69	1239.93		1239.94	0.000016	0.93	11419.52	2193.16	0.05	99.69		156399	29.6	142033	26.9	6.4			15.24
Tributary	44261.20		5056.5	1224.57	1239.93		1239.94	0.000014	0.88	11951.29	2234.38	0.05	99.69		156499	29.6	141933	26.9	5.8			15.36
Tributary	44230.80		5056.12	1224.46	1239.93		1239.93	0.000013	0.84	12503.87	2354.95	0.05	99.69		156599	29.7	141834	26.9	5.8			15.47
Tributary	44200.40		5055.4	1224.35	1239.93		1239.93	0.000012	0.79	13073.42	2373.2	0.04	99.69		156699	29.7	141734	26.8	3.2			15.58
Tributary	44170.10		5055.51	1224.29	1239.93		1239.93	0.000011	0.74	13654.46	2396.47	0.04	99.69		156798	29.7	141634	26.8	5.3			15.64
Tributary	44139.70		5054.58	1224.19	1239.93		1239.93	0.00001	0.7	14250.02	2419.87	0.04	99.69		156898	29.7	141535	26.8	5.3			15.74
Tributary	44109.30		5054.24	1224.09	1239.93		1239.93	0.000009	0.66	14859.12	2443.26	0.04	99.69		156998	29.7	141435	26.8	5.3			15.84
Tributary	44078.90		5053.87	1223.99	1239.93		1239.93	0.000008	0.62	15486.32	2449.62	0.04	99.69		157097	29.8	141335	26.8	5.3			15.94
Tributary	44048.50		5054.15	1223.89	1239.93		1239.93	0.000007	0.59	16239.93	2598.03	0.03	99.69		157197	29.8	141235	26.7	10.6			16.04
Tributary	44018.17		5053.84	1223.69	1239.93		1239.93	0.000006	0.55	17142.94	2656.27	0.03	98.22		157297	29.8	141136	26.7	1.1			16.24
Tributary	43988.20		5053.34	1223.67	1239.92		1239.93	0.000007	0.59	16140.12	2526.91	0.03	98.22		157395	29.8	141038	26.7	1.1			16.25
Tributary	43958.30		5052.92	1223.65	1239.92		1239.93	0.000008	0.62	15475.87	2401.3	0.04	98.22		157493	29.8	140939	26.7	1.1			16.27
Tributary	43928.30		5052.25	1223.63	1239.92		1239.92	0.000009	0.66	14847.28	2363.65	0.04	98.22		157591	29.8	140841	26.7	0.5			16.29
Tributary	43898.40		5052.56	1223.62	1239.92		1239.92	0.00001	0.7	14231.87	2325.35	0.04	98.22		157690	29.9	140743	26.7	1.1			16.3
Tributary	43868.40		5051.94	1223.6	1239.92		1239.92	0.000011	0.74	13626.76	2285.21	0.04	98.22		157788	29.9	140645	26.6	1.1			16.32
Tributary	43838.50		5051.48	1223.58	1239.92		1239.92	0.000013	0.79	13034.72	2244.72	0.04	98.22		157886	29.9	140546	26.6	1.1			16.34
Tributary	43808.60		5050.79	1223.56	1239.92		1239.92	0.000014	0.84	12455.4	2207.47	0.05	98.22		157984	29.9	140448	26.6	0.5			16.36
Tributary	43778.60		5050.32	1223.55	1239.92		1239.92	0.000016	0.9	11889.28	2184.94	0.05	98.22		158082	29.9	140350	26.6	1.1			16.37
Tributary	43748.70		5050.65	1223.53	1239.91		1239.92	0.000019	0.96	11333.17	2158.21	0.05	98.22		158181	30.0	140252	26.6	1.1			16.38
Tributary	43718.80		5050.16	1223.51	1239.91		1239.92	0.000021	1.03	10788.95	2107	0.06	98.22		158279	30.0	140154	26.5	1.1			16.4
Tributary	43688.80		5050.23	1223.49	1239.91		1239.91	0.000024	1.1	10257.27	2056.08	0.06	98.22		158377	30.0	140055	26.5	1.1			16.42
Tributary	43658.90		5049.6	1223.47	1239.9		1239.91	0.000028	1.18	9754.6	2057.4	0.07	98.22		158475	30.0	139957	26.5	0.5			16.43
Tributary	43628.90		5049.28	1223.46	1239.9		1239.91	0.000032	1.27	9295.07	2051.58	0.07	98.22		158574	30.0	139859	26.5	1.1			16.44
Tributary	43599.00		5048.75	1223.44	1239.9		1239.91	0.000036	1.35	8873.49	2029.82	0.08	98.22		158672	30.1	139761	26.5	1.1			16.46
Tributary	43569.10		5048.34	1223.42	1239.89		1239.9	0.000041	1.45	8474.54	2008.88	0.08	98.22		158770	30.1	139662	26.5	1.1			16.47
Tributary	43539.10		5048.16	1223.4	1239.89		1239.9	0.000047	1.54	8097.1	1979.76	0.09	98.22		158868	30.1	139564	26.4	1.1			16.49
Tributary	43509.20		5048.62	1223.38	1239.88		1239.9	0.000053	1.64	7734.55	1951.98	0.09	98.22		158966	30.1	139466	26.4	0.5			16.5
Tributary	43479.30		5048.18	1223.37	1239.87		1239.89	0.000059	1.74	7388.94	1921.74	0.1	98.22		159065	30.1	139368	26.4	1.1			16.5
Tributary	43449.30		5047.68	1223.35	1239.87		1239.89	0.000065	1.83	7071.95	1889.27	0.1	98.22		159163	30.1	139270	26.4	1.1			16.52
Tributary	43419.40		5047.23	1223.33	1239.86		1239.88	0.000071	1.92	6746.77	1851.89	0.11	98.22		159261	30.2	139171	26.4	1.1			16.53
Tributary	43389.40		5046.76	1223.31	1239.85		1239.88	0.000077	2	6450.62	1817.39	0.11	98.22		159359	30.2	139073	26.3	0.5			16.54
Tributary	43359.50		5046.71	1223.3	1239.84		1239.87	0.000082	2.07	6167.37	1776.79	0.12	98.22		159457	30.2	138975	26.3	1.1			16.54
Tributary	43329.60		5046.16	1223.28	1239.83		1239.86	0.000087	2.12	5901.05	1734.03	0.12	98.22		159556	30.2	138877	26.3	1.1			16.55
Tributary	43299.60		5045.75	1223.26	1239.82		1239.85	0.00009	2.16	5657.62	1689.21	0.12	98.22		159654	30.2	138779	26.3	1.1			16.56
Tributary	43269.70		5045.52	1223.24	1239.81		1239.85	0.000091	2.18	5437.34	1634.36	0.12	98.22		159752	30.3	138680	26.3	1.1			16.57
Tributary	43239.80		5045.64	1223.22	1239.8		1239.84	0.000091	2.18	5256.44	1550.8	0.12	98.22		159850	30.3	138582	26.2	0.5			16.58
Tributary	43209.80		5045.15	1223.21	1239.79		1239.83	0.000089	2.17	5131.97	1447.04	0.12	98.22		159949	30.3	138484	26.2	1.1			16.58
Tributary	43179.90		5045.08	1223.19	1239.78		1239.82	0.000087	2.14	5052.81	1393.88	0.12	98.22		160047	30.3	138386	26.2	1.1			16.59
Tributary	43149.90		5044.74	1223.17	1239.78		1239.81	0.000084	2.1	4993.75	1364.41	0.12	98.22		160145	30.3	138287	26.2	1.1			16.61
Tributary	43120.00		5044.47	1223.15	1239.77		1239.8	0.00008	2.06	4941.43	1320.84	0.11	98.22		160243	30.3	138189	26.2	0.5			16.62
Tributary	43090.10		5044.47	1223.14	1239.77		1239.79	0.000062	1.81	6049.02	1688.71	0.1	98.22		160341	30.4	138091	26.2	1.1			16.63
Tributary	43060.10		5044.01	1223.12	1239.77		1239.78	0.000031	1.29	7689.48	1571.51	0.07	98.22		160440	30.4	137993	26.1	1.1			16.65
Tributary	43030.20		5043.5	1223.1	1239.77		1239.78	0.000016	0.93	9466.93	1458.6	0.05	98.22		160538	30.4	137895	26.1	1.1			16.67
Tributary	43000.30		5043.17	1223.08	1239.77		1239.78	0.000009	0.68	11349.24	1367.65	0.04	98.22		160636	30.4	137796	26.1	1.1			16.69
Tributary	42970.37		5043.09	1223.06	1239.77		1239.78	0.000005	0.54	13369.12	1407.12	0.03	98		160734	30.4	137698	26.1	2.7			16.71
Tributary	42940.50		5042.82	1223.01	1239.77		1239.78	0.000007	0.63	12071.97	1437.84	0.03	98		160832	30.5	137600	26.1	3.2			16.76
Tributary	42910.60		5042.59	1222.95	1239.77		1239.77	0.00001	0.77	11059.81	1319.24	0.04	98		160930	30.5	137502	26.0	3.2			16.82
Tributary	42880.70		5042.31	1222.89	1239.77		1239.77	0.000012	0.85	10295.36	1181.95	0.04	98		161028	30.5	137404	26.0	2.7			16.88
Tributary	42850.80		5042.01	1222.84	1239.77		1239.77	0.000013	0.9	9921.3	1099.45	0.05	98		161126	30.5	137306	26.0	3.2			16.93
Tributary	42821.00		5041.73	1222.78	1239.77		1239.77	0.000013	0.95	9665.77	1101.56	0.05	98		161224	30.5	137208	26.0	3.2			16.99
Tributary	42791.10		5041.53	1222.72	1239.76		1239.77	0.000014	0.99	9409.65	1101.68	0.05	98		161322	30.6	137110	26.0	2.7			17.04
Tributary	42761.20		5041.74	1222.67	1239.76		1239.77	0.000015	1.04	9152.94	1101.4	0.05	98		161420	30.6	137012	25.9	3.2			17.09
Tributary	42731.40		5041.33	1222.61	1239.76		1239.77	0.000017	1.1	8896.17	1102.33	0.05	98		161518	30.6	136914	25.9	3.2			17.15
Tributary	42701.50		5041.09	1222.55	1239.76		1239.77	0.000018	1.15	8637.82	1103.31	0.06	98		161616	30.6	136816	25.9	2.7			17.21
Tributary	42671.60		5041.47	1222.5	1239.76		1239.77	0.00002	1.21	8376.64	1104.83	0.06	98		161714	30.6	136718	25.9	3.2			17.26
Tributary	42641.80		5040.7	1222.44	1239.75		1239.76	0.000021	1.27	8116.8	1106.99	0.06	98		161812	30.6	136620	25.9	3.2			17.31
Tributary	42611.90		5041.11	1222.38	1239.75		1239.76	0.000023	1.33	7851.5	1107.79	0.06	98		161910	30.7	136522	25.9	2.7			17.37
Tributary	42582.00		5040.84	1222.33	1239.75		1239.76	0.000025	1.4	7585.41	1108.42	0.07	98		162008	30.7	136424	25.8	3.2			17.42
Tributary	42552.20		5040.69	1222.27	1239.74		1239.76	0.000027	1.46	7320.87	1108.78	0.07	98		162106	30.7	136326	25.8	3.2			17.47
Tributary	42522.30		5040.22	1222.21	1239.74		1239.76	0.00003	1.53	7052.23	1108.85	0.07	98		162204	30.7	136228	25.8	2.7			17.53
Tributary	42492.40		5040.18	1222.16	1239.74		1239.76	0.000033	1.61	6785.05	1108.46	0.08	98		162302	30.7	136130	25.8	3.2			17.58
Tributary	42462.60		5039.97	1222.1	1239.73		1239.75	0.000036	1.68	6516.36	1106.22	0.08	98		162400	30.8	136032	25.8	3.2			17.63
Tributary	42432.70		5039.61	1222.04	1239.72		1239.75	0.00004	1.76	6246.58	1105.05	0.08	98		162498	30.8	135934	25.7	2.7			17.68
Tributary	42402.80		5039.72	1221.99	1239.72		1239.75	0.000043	1.83	5974.61	1095.98	0.09	98		162596	30.8	135836	25.7	3.2			17.73
Tributary	42372.90		5039.33	1221.93	1239.71		1239.74	0.000047	1.91	5703.39	1086.77	0.09	98		162692	30.8	135738	25.7	3.2			17.78
Tributary	42343.10		5039.2	1221.87	1239.71		1239.74	0.000051	1.97	5433.35	1070.99	0.1	98		162792	30.8	135640	25.7	2.7			17.84
Tributary	42313.20		5039.22	1221.82	1239.7		1239.74	0.000055	2.03	5161.95	1050.47	0.1	98		162890	30.9	135542	25.7	3.2			17.88
Tributary	42283.30		5039.04	1221.76	1239.69		1239.73	0.000059	2.08	4892.13	1034	0.1	98		162988	30.9	135444	25.7	3.2			17.93
Tributary	42253.50		5038.67	1221.7	1239.68		1239.72	0.000062	2.11	4628.4	1011.62	0.1	98		163086	30.9	135346	25.6	2.7			17.98
Tributary	42223.60		5038.5	1221.65	1239.67		1239.71	0.000064	2.13	4368.9	980.26	0.11	98		163184	30.9	135248	25.6	3.2			18.02

Tributary	42193.70		5038.58	1221.59	1239.67		1239.71	0.000066	2.12	4136.79	906.7	0.11	98		163282	30.9	135150	25.6	3.2			18.08
Tributary	42163.90		5038.41	1221.53	1239.66		1239.7	0.000066	2.09	4007.77	697.28	0.11	98		163380	30.9	135052	25.6	2.7			18.13
Tributary	42134.00		5038.28	1221.48	1239.66		1239.7	0.000065	2.04	3991.68	514.16	0.1	98		163478	31.0	134954	25.6	3.2			18.18
Tributary	42104.10		5038.25	1221.42	1239.65		1239.69	0.000064	1.99	4024.34	506.48	0.1	98		163576	31.0	134856	25.5	3.2			18.23
Tributary	42074.30		5038.13	1221.36	1239.65		1239.68	0.000063	1.93	4057.7	491.77	0.1	98		163674	31.0	134758	25.5	2.7			18.29
Tributary	42044.40		5038.09	1221.31	1239.64		1239.67	0.000062	1.87	4103.66	459.27	0.1	98		163772	31.0	134660	25.5	3.2			18.33
Tributary	42014.50		5038.01	1221.25	1239.64		1239.67	0.000061	1.8	4161.23	452.29	0.1	98		163870	31.0	134562	25.5	3.2			18.39
Tributary	41984.69		5037.91	1221.19	1239.63		1239.66	0.00006	1.73	4225.01	438.33	0.1	97.48		163958	31.1	134464	25.5	0.5			18.44
Tributary	41954.90		5037.93	1221.18	1239.63		1239.66	0.000061	1.78	4199.9	451.23	0.1	97.48		164066	31.1	134367	25.4	1.1			18.45
Tributary	41925.20		5037.79	1221.16	1239.62		1239.65	0.000065	1.89	4191.62	552.41	0.1	97.48		164163	31.1	134269	25.4	1.1			18.46
Tributary	41895.50		5037.69	1221.14	1239.61		1239.65	0.000066	1.93	4241.16	621.62	0.1	97.48		164261	31.1	134172	25.4	1.1			18.47
Tributary	41865.80		5037.53	1221.12	1239.61		1239.64	0.000065	1.96	4313.01	658.87	0.1	97.48		164358	31.1	134074	25.4	1.1			18.49
Tributary	41836.10		5037.5	1221.1	1239.6		1239.63	0.000064	1.97	4428.45	783.21	0.1	97.48		164456	31.1	133977	25.4	1.1			18.5
Tributary	41806.40		5037.31	1221.08	1239.59		1239.63	0.000061	1.96	4577.34	838.49	0.1	97.48		164553	31.2	133879	25.4	0.5			18.51
Tributary	41776.70		5037.14	1221.07	1239.59		1239.62	0.000058	1.94	4794.35	982.55	0.1	97.48		164651	31.2	133782	25.3	1.1			18.52
Tributary	41747.00		5036.99	1221.05	1239.59		1239.62	0.000055	1.91	5080.36	1097.23	0.1	97.48		164748	31.2	133684	25.3	1.1			18.54
Tributary	41717.20		5036.72	1221.03	1239.58		1239.61	0.000051	1.87	5404.53	1167.42	0.09	97.48		164846	31.2	133587	25.3	1.1			18.55
Tributary	41687.50		5036.54	1221.01	1239.58		1239.6	0.000047	1.82	5756.14	1222.38	0.09	97.48		164943	31.2	133489	25.3	1.1			18.57
Tributary	41657.80		5036.25	1220.99	1239.58		1239.6	0.000042	1.76	6133.75	1322.38	0.09	97.48		165041	31.3	133392	25.3	1.1			18.59
Tributary	41628.10		5035.92	1220.97	1239.57		1239.6	0.000038	1.69	6572.89	1390.57	0.08	97.48		165138	31.3	133294	25.2	0.5			18.6
Tributary	41598.40		5035.5	1220.96	1239.57		1239.59	0.000034	1.62	7038.05	1449.28	0.08	97.48		165236	31.3	133197	25.2	1.1			18.61
Tributary	41568.70		5035.25	1220.94	1239.57		1239.59	0.00003	1.54	7525.73	1498.53	0.07	97.48		165333	31.3	133099	25.2	1.1			18.63
Tributary	41539.00		5035.14	1220.92	1239.57		1239.58	0.000027	1.46	8029.96	1538.2	0.07	97.48		165431	31.3	133002	25.2	1.1			18.65
Tributary	41509.30		5034.9	1220.9	1239.57		1239.58	0.000024	1.39	8545.46	1575.58	0.07	97.48		165528	31.4	132904	25.2	1.1			18.67
Tributary	41479.60		5034.97	1220.88	1239.56		1239.58	0.000021	1.32	9072.5	1620.5	0.06	97.48		165626	31.4	132807	25.2	1.1			18.68
Tributary	41449.80		5034.63	1220.86	1239.56		1239.57	0.000019	1.25	9612.15	1661.86	0.06	97.48		165723	31.4	132709	25.1	0.5			18.7
Tributary	41420.10		5034.07	1220.85	1239.56		1239.57	0.000016	1.19	10174.27	1699.7	0.05	97.48		165820	31.4	132612	25.1	1.1			18.71
Tributary	41390.40		5033.39	1220.83	1239.56		1239.57	0.000014	1.12	10741.82	1736.19	0.05	97.48		165918	31.4	132514	25.1	1.1			18.73
Tributary	41360.70		5033.03	1220.81	1239.56		1239.57	0.000013	1.06	11319.47	1768.84	0.05	97.48		166015	31.4	132417	25.1	1.1			18.75
Tributary	41331.00		5032.82	1220.79	1239.56		1239.57	0.000011	1.01	11905.13	1798.2	0.05	97.48		166113	31.5	132320	25.1	1.1			18.77
Tributary	41301.30		5032.92	1220.77	1239.56		1239.56	0.00001	0.96	12493.07	1823.87	0.04	97.48		166210	31.5	132222	25.0	1.1			18.79
Tributary	41271.60		5032.42	1220.75	1239.56		1239.56	0.000009	0.91	13087.25	1847.28	0.04	97.48		166308	31.5	132125	25.0	0.5			18.81
Tributary	41241.90		5032.34	1220.74	1239.56		1239.56	0.000008	0.86	13688.14	1868.62	0.04	97.48		166405	31.5	132027	25.0	1.1			18.82
Tributary	41212.20		5031.97	1220.72	1239.56		1239.56	0.000007	0.82	14291.41	1970.38	0.04	97.48		166503	31.5	131930	25.0	1.1			18.84
Tributary	41182.40		5031.81	1220.7	1239.56		1239.56	0.000006	0.78	14922.26	2050.39	0.03	97.48		166600	31.6	131832	25.0	1.1			18.86
Tributary	41152.70		5031.06	1220.68	1239.56		1239.56	0.000006	0.74	15563.83	2121.23	0.03	97.48		166698	31.6	131735	24.9	1.1			18.88
Tributary	41123.00		5030.28	1220.66	1239.56		1239.56	0.000005	0.7	16214.44	2190.28	0.03	97.48		166795	31.6	131637	24.9	1.1			18.9
Tributary	41093.30		5029.6	1220.64	1239.56		1239.56	0.000005	0.67	16873.31	2256.18	0.03	97.48		166893	31.6	131540	24.9	0.5			18.92
Tributary	41063.60		5029.23	1220.63	1239.56		1239.56	0.000004	0.64	17551.07	2551.69	0.03	97.48		166990	31.6	131442	24.9	1.1			18.93
Tributary	41033.90		5029.19	1220.61	1239.56		1239.56	0.000004	0.61	18325.12	3249.6	0.03	97.48		167088	31.6	131345	24.9	1.1			18.95
Tributary	41004.20		5028.67	1220.59	1239.56		1239.56	0.000003	0.58	19160.41	3401.53	0.03	97.48		167185	31.7	131247	24.9	1.1			18.97
Tributary	40974.51		5028.04	1220.57	1239.56		1239.56	0.000003	0.56	20033.78	3668.97	0.02	99.11		167283	31.7	131150	24.8	-0.5			18.99
Tributary	40944.30		5027.26	1220.58	1239.56		1239.56	0.000003	0.57	19440.27	3429.14	0.02	99.11		167382	31.7	131051	24.8	0.0			18.98
Tributary	40914.00		5026.43	1220.58	1239.55		1239.56	0.000003	0.59	18882.36	3298.5	0.03	99.11		167481	31.7	130952	24.8	-0.5			18.97
Tributary	40883.80		5026.6	1220.59	1239.55		1239.56	0.000004	0.6	18334.28	3200.65	0.03	99.11		167580	31.7	130852	24.8	-0.5			18.96
Tributary	40853.60		5025.72	1220.6	1239.55		1239.56	0.000004	0.62	17808.88	3113.14	0.03	99.11		167679	31.8	130753	24.8	0.0			18.95
Tributary	40823.40		5024.89	1220.6	1239.55		1239.56	0.000004	0.64	17301.99	3013.97	0.03	99.11		167778	31.8	130654	24.7	-0.5			18.95
Tributary	40793.20		5024.3	1220.61	1239.55		1239.55	0.000004	0.66	16821.43	2887.22	0.03	99.11		167877	31.8	130555	24.7	-0.5			18.94
Tributary	40763.00		5023.94	1220.62	1239.55		1239.55	0.000005	0.68	16354.6	2769.41	0.03	99.11		167976	31.8	130456	24.7	0.0			18.93
Tributary	40732.80		5024.17	1220.62	1239.55		1239.55	0.000005	0.7	15910.63	2645.94	0.03	99.11		168076	31.8	130357	24.7	-0.5			18.93
Tributary	40702.60		5023.75	1220.63	1239.55		1239.55	0.000005	0.72	15487.22	2510.08	0.03	99.11		168175	31.9	130258	24.7	-0.5			18.92
Tributary	40672.40		5023.12	1220.64	1239.55		1239.55	0.000006	0.74	15073.42	2450.27	0.03	99.11		168274	31.9	130159	24.7	0.0			18.91
Tributary	40642.20		5022.6	1220.64	1239.55		1239.55	0.000006	0.77	14659.81	2431.89	0.03	99.11		168373	31.9	130060	24.6	-0.5			18.91
Tributary	40612.00		5022.34	1220.65	1239.55		1239.55	0.000006	0.79	14251.95	2368.15	0.03	99.11		168472	31.9	129960	24.6	-0.5			18.9
Tributary	40581.80		5021.28	1220.66	1239.55		1239.55	0.000007	0.82	13857.5	2291.45	0.04	99.11		168571	31.9	129861	24.6	0.0			18.89
Tributary	40551.50		5021.56	1220.66	1239.55		1239.55	0.000007	0.84	13467.77	2233.46	0.04	99.11		168670	31.9	129762	24.6	-0.5			18.89
Tributary	40521.30		5020.48	1220.67	1239.55		1239.55	0.000008	0.87	13086.77	2179.45	0.04	99.11		168769	32.0	129663	24.6	-0.5			18.88
Tributary	40491.10		5020.74	1220.68	1239.55		1239.55	0.000008	0.9	12707.93	2114.63	0.04	99.11		168868	32.0	129564	24.5	0.0			18.87
Tributary	40460.90		5020.74	1220.68	1239.54		1239.55	0.000009	0.93	12336.18	2023.44	0.04	99.11		168968	32.0	129465	24.5	-0.5			18.86
Tributary	40430.70		5020.11	1220.69	1239.54		1239.55	0.000009	0.96	11972.81	1973.45	0.04	99.11		169067	32.0	129366	24.5	-0.5			18.85
Tributary	40400.50		5019.33	1220.7	1239.54		1239.55	0.00001	1	11615.14	1922.54	0.04	99.11		169166	32.0	129267	24.5	0.0			18.84
Tributary	40370.30		5019.42	1220.7	1239.54		1239.55	0.000011	1.03	11262.32	1875.94	0.05	99.11		169265	32.1	129168	24.5	-0.5			18.84
Tributary	40340.10		5018.31	1220.71	1239.54		1239.55	0.000012	1.07	10912.86	1840.25	0.05	99.11		169364	32.1	129068	24.4	-0.5			18.83
Tributary	40309.90		5017.76	1220.72	1239.54		1239.55	0.000012	1.1	10570.36	1808.6	0.05	99.11		169463	32.1	128969	24.4	0.0			18.82
Tributary	40279.70		5018.76	1220.72	1239.54		1239.54	0.000013	1.14	10233.3	1777	0.05	99.11		169562	32.1	128870	24.4	-0.5			18.82
Tributary	40249.50		5018.1	1220.73	1239.53		1239.54	0.000014	1.18	9898.62	1748.29	0.05	99.11		169661	32.1	128771	24.4	-0.5			18.8
Tributary	40219.20		5017.48	1220.74	1239.53		1239.54	0.000015	1.22	9572.61	1718.3	0.05	99.11		169760	32.2	128672	24.4	0.0			18.79
Tributary	40189.00		5016.74	1220.74	1239.53		1239.54	0.000017	1.27	9252.11	1691.72	0.06	99.11		169860	32.2	128573	24.4	-0.5			18.79
Tributary	40158.80		5016.64	1220.75	1239.53		1239.54	0.000018	1.31	8931.58	1663.17	0.06	99.11		169959	32.2	128474	24.3	-0.5			18.78
Tributary	40128.60		5016.19	1220.76	1239.53		1239.54	0.000019	1.36	8619.93	1634.77	0.06	99.11		170058	32.2	128375	24.3	0.0			18.77
Tributary	40098.40		5015.87	1220.76	1239.52		1239.54	0.000021	1.41	8315.56	1626.57	0.06	99.11		170157	32.2	128276	24.3	-0.5			18.76
Tributary	40068.20		5015.82	1220.77	1239.52		1239.54	0.000022	1.46	8012.15	1597.34	0.06	99.11		170256	32.2	128176	24.3	-0.5			18.75
Tributary	40038.00		5015.33	1220.78	1239.52		1239.53	0.000024	1.51	7713.02	1571.86	0.07	99.11		170355	32.3	128077	24.3	0.0			18.74
Tributary	40007.80		5015.08	1220.78	1239.51		1239.53	0.000026	1.56	7422.09	1546.3	0.07	99.11		170454	32.3	127978	24.2	-0.5			18.73
Tributary	39977.60		5015.25	1220.79	1239.51		1239.53	0.000027	1.62	7140.46	1517.37	0.07	99.11		170553	32.3	127879	24.2	-0.5			18.72
Tributary	39947.40		5014.47	1220.8	1239.51		1239.53	0.000029	1.67	6857.74	1486.59	0.07	99.11		170652	32.3	127780	24.2	0.0			18.71
Tributary	39917.20		5014.74	1220.8	1239.5		1239.53	0.000031	1.73	6587.9	1458.75	0.08	99.11		170752	32.3	127681	24.2	-0.5			18.7
Tributary	39887.00		5014.44	1220.81	1239.5		1239.53	0.000034	1.79	6320.26	1425.72	0.08	99.11		170851	32.4	127582	24.2	-0.5			18.69
Tributary	39856.70		5014.07	1220.82	1239.49		1239.52	0.000036	1.85	6059.56	1395.81	0.08	99.11		170950	32.4	127483	24.1	0.0			18.67
Tributary	39826.50		5013.53	1220.82	1239.49		1239.52	0.000039	1.91	5809.69	1367.74	0.08	99.11		171049	32.4	127384	24.1	-0.5			18.67
Tributary	39796.30		5013.2	1220.83	1239.48		1239.52	0.000041	1.97	5560.71	1335.44	0.09	99.11		171148	32.4	127284	24.1	-0.5			18.65
Tributary	39766.10		5012.95	1220.84	1239.47		1239.52	0.000044	2.03	5322.69	1305.8	0.09	99.11		171247	32.4	127185	24.1	0.0			18.63
Tributary	39735.90		5012.4	1220.84	1239.47		1239.51	0.000047	2.09	5092.74	1273.07	0.09	99.11		171346	32.5	127086	24.1	-0.5			18.63

Tributary	39705.70		5012.42	1220.85	1239.46		1239.51	0.000049	2.15	4868.87	1238.67	0.1	99.11		171445	32.5	126987	24.1	-0.5			18.61
Tributary	39675.50		5011.9	1220.86	1239.45		1239.51	0.000052	2.21	4651.87	1206.21	0.1	99.11		171544	32.5	126888	24.0	0.0			18.59
Tributary	39645.30		5011.66	1220.86	1239.45		1239.5	0.000055	2.27	4440.1	1160.61	0.1	99.11		171644	32.5	126789	24.0	-0.5			18.59
Tributary	39615.10		5011.53	1220.87	1239.44		1239.5	0.000059	2.33	4238.64	1121.56	0.1	99.11		171743	32.5	126690	24.0	-0.5			18.57
Tributary	39584.90		5011.05	1220.88	1239.43		1239.49	0.000062	2.39	4043.17	1077.81	0.11	99.11		171842	32.5	126591	24.0	0.0			18.55
Tributary	39554.70		5011.15	1220.88	1239.42		1239.49	0.000065	2.44	3860.47	1037.37	0.11	99.11		171941	32.6	126492	24.0	-0.5			18.54
Tributary	39524.40		5010.65	1220.89	1239.41		1239.48	0.000068	2.49	3692.91	961.85	0.11	99.11		172040	32.6	126392	23.9	-0.5			18.52
Tributary	39494.20		5010.2	1220.9	1239.4		1239.48	0.000071	2.54	3532.44	923.86	0.11	99.11		172139	32.6	126293	23.9	0.0			18.5
Tributary	39464.00		5009.94	1220.9	1239.39		1239.47	0.000073	2.59	3379.63	881.14	0.12	99.11		172238	32.6	126194	23.9	-0.5			18.49
Tributary	39433.80		5010.12	1220.91	1239.38		1239.47	0.000076	2.63	3236.33	830.15	0.12	99.11		172337	32.6	126095	23.9	-0.5			18.47
Tributary	39403.60		5009.97	1220.92	1239.37		1239.46	0.000079	2.67	3101.23	763.17	0.12	99.11		172436	32.7	125996	23.9	0.0			18.45
Tributary	39373.40		5009.8	1220.92	1239.36		1239.45	0.000081	2.71	2979.67	684.34	0.12	99.11		172536	32.7	125897	23.8	-0.5			18.44
Tributary	39343.20		5009.81	1220.93	1239.35		1239.45	0.000084	2.74	2868.89	635.33	0.12	99.11		172635	32.7	125798	23.8	-0.5			18.42
Tributary	39313.00		5009.67	1220.94	1239.34		1239.44	0.000085	2.77	2768.12	588.65	0.13	99.11		172734	32.7	125699	23.8	0.0			18.4
Tributary	39282.80		5009.6	1220.94	1239.33		1239.43	0.000087	2.79	2672.05	560.46	0.13	99.11		172833	32.7	125600	23.8	-0.5			18.39
Tributary	39252.60		5009.54	1220.95	1239.32		1239.42	0.000089	2.81	2587.79	516.79	0.13	99.11		172932	32.8	125500	23.8	-0.5			18.37
Tributary	39222.40		5009.46	1220.96	1239.31		1239.41	0.00009	2.83	2518.4	456.97	0.13	99.11		173031	32.8	125401	23.8	0.0			18.35
Tributary	39192.20		5009.37	1220.96	1239.3		1239.4	0.000091	2.84	2471.45	393.3	0.13	99.11		173130	32.8	125302	23.7	-0.5			18.34
Tributary	39161.90		5009.36	1220.97	1239.29		1239.4	0.000092	2.85	2437.35	364.5	0.13	99.11		173229	32.8	125203	23.7	-0.5			18.32
Tributary	39131.70		5009.29	1220.98	1239.28		1239.39	0.000093	2.86	2406.38	352.05	0.13	99.11		173328	32.8	125104	23.7	0.0			18.3
Tributary	39101.50		5009.15	1220.98	1239.27		1239.38	0.000094	2.86	2381.17	331.59	0.13	99.11		173427	32.8	125005	23.7	-0.5			18.29
Tributary	39071.30		5009.17	1220.99	1239.26		1239.37	0.000095	2.87	2360.51	316.35	0.13	99.11		173527	32.9	124906	23.7	-0.5			18.27
Tributary	39041.10		5009.11	1221	1239.25		1239.36	0.000095	2.87	2344.04	292.01	0.13	99.11		173626	32.9	124807	23.6	0.0			18.25
Tributary	39010.90		5009.11	1221	1239.24		1239.35	0.000096	2.88	2339.56	260.08	0.13	99.11		173725	32.9	124708	23.6	-0.5			18.24
Tributary	38980.70		5009.02	1221.01	1239.23		1239.34	0.000096	2.88	2335.55	259.92	0.13	99.11		173824	32.9	124609	23.6	-0.5			18.22
Tributary	38950.50		5008.95	1221.02	1239.22		1239.33	0.000097	2.88	2335.12	285.82	0.13	99.11		173923	32.9	124509	23.6	0.0			18.2
Tributary	38920.30		5008.92	1221.02	1239.21		1239.32	0.000097	2.88	2339.1	333.05	0.13	99.11		174022	33.0	124410	23.6	-0.5			18.19
Tributary	38890.10		5008.87	1221.03	1239.2		1239.31	0.000098	2.89	2347.91	346.99	0.13	99.11		174121	33.0	124311	23.5	0.0			18.17
Tributary	38859.90		5008.81	1221.03	1239.19		1239.3	0.000098	2.89	2357.95	358.6	0.13	99.11		174220	33.0	124212	23.5	-0.5			18.16
Tributary	38829.70		5008.75	1221.04	1239.18		1239.29	0.000099	2.89	2371.1	373.13	0.13	99.11		174319	33.0	124113	23.5	-0.5			18.14
Tributary	38799.40		5008.66	1221.05	1239.17		1239.28	0.000099	2.89	2383.18	388.3	0.13	99.11		174419	33.0	124014	23.5	0.0			18.12
Tributary	38769.20		5008.59	1221.05	1239.16		1239.27	0.0001	2.89	2401.14	405.19	0.13	99.11		174518	33.1	123915	23.5	-0.5			18.11
Tributary	38739.00		5008.48	1221.06	1239.15		1239.26	0.0001	2.89	2420.78	421.23	0.14	99.11		174617	33.1	123816	23.4	-0.5			18.09
Tributary	38708.80		5008.61	1221.07	1239.15		1239.25	0.0001	2.89	2443.61	436.79	0.14	99.11		174716	33.1	123717	23.4	0.0			18.08
Tributary	38678.60		5008.49	1221.07	1239.14		1239.24	0.000101	2.89	2468.03	451.7	0.14	99.11		174815	33.1	123617	23.4	-0.5			18.07
Tributary	38648.40		5008.19	1221.08	1239.13		1239.23	0.000101	2.88	2493.65	467.34	0.14	99.11		174914	33.1	123518	23.4	-0.5			18.05
Tributary	38618.20		5008.34	1221.09	1239.12		1239.22	0.000101	2.88	2525.2	485.34	0.14	99.11		175013	33.1	123419	23.4	0.0			18.03
Tributary	38588.00		5008.21	1221.09	1239.11		1239.21	0.000101	2.87	2559.36	500.05	0.14	99.11		175112	33.2	123320	23.4	-0.5			18.02
Tributary	38557.80		5008.07	1221.1	1239.1		1239.2	0.000101	2.87	2595.34	529.4	0.14	99.11		175211	33.2	123221	23.3	-0.5			18
Tributary	38527.60		5008.02	1221.11	1239.09		1239.19	0.000101	2.86	2638.51	549.98	0.14	99.11		175311	33.2	123122	23.3	0.0			17.98
Tributary	38497.40		5007.88	1221.11	1239.08		1239.18	0.0001	2.85	2683.12	557.08	0.13	99.11		175410	33.2	123023	23.3	-0.5			17.97
Tributary	38467.10		5007.76	1221.12	1239.07		1239.17	0.0001	2.83	2729.52	564.26	0.13	99.11		175509	33.2	122924	23.3	-0.5			17.95
Tributary	38436.90		5007.62	1221.13	1239.07		1239.16	0.000099	2.82	2779.54	571.93	0.13	99.11		175608	33.3	122825	23.3	0.0			17.94
Tributary	38406.70		5007.48	1221.13	1239.06		1239.15	0.000099	2.8	2830.19	578.55	0.13	99.11		175707	33.3	122725	23.2	-0.5			17.93
Tributary	38376.50		5007.27	1221.14	1239.05		1239.14	0.000098	2.78	2882.02	585.52	0.13	99.11		175806	33.3	122626	23.2	-0.5			17.91
Tributary	38346.30		5007.28	1221.15	1239.04		1239.13	0.000097	2.76	2935.27	596.21	0.13	99.11		175905	33.3	122527	23.2	0.0			17.89
Tributary	38316.10		5007.05	1221.15	1239.03		1239.12	0.000096	2.74	2993.22	620.22	0.13	99.11		176004	33.3	122428	23.2	-0.5			17.88
Tributary	38285.90		5007.04	1221.16	1239.03		1239.11	0.000095	2.72	3056.12	643.79	0.13	99.11		176103	33.4	122329	23.2	-0.5			17.87
Tributary	38255.70		5006.87	1221.17	1239.02		1239.1	0.000094	2.7	3125.45	668.24	0.13	99.11		176203	33.4	122230	23.1	0.0			17.85
Tributary	38225.50		5006.64	1221.17	1239.01		1239.09	0.000093	2.68	3202.24	709.84	0.13	99.11		176302	33.4	122131	23.1	-0.5			17.84
Tributary	38195.30		5006.44	1221.18	1239		1239.08	0.000092	2.66	3289.13	752.17	0.13	99.11		176401	33.4	122032	23.1	-0.5			17.82
Tributary	38165.10		5006.17	1221.19	1239		1239.07	0.00009	2.63	3386.82	806.9	0.13	99.11		176500	33.4	121933	23.1	0.0			17.81
Tributary	38134.89		5006.16	1221.19	1238.99		1239.06	0.000088	2.59	3511.3	894.68	0.13	97.98		176599	33.4	121833	23.1	0.5			17.8
Tributary	38105.00		5005.91	1221.18	1238.98		1239.05	0.000088	2.6	3432.26	813.56	0.13	97.98		176697	33.5	121735	23.1	0.5			17.8
Tributary	38075.10		5005.89	1221.17	1238.97		1239.04	0.000088	2.61	3383.35	778.02	0.13	97.98		176795	33.5	121637	23.0	0.0			17.8
Tributary	38045.20		5005.72	1221.17	1238.96		1239.04	0.000088	2.61	3342.31	756.03	0.13	97.98		176893	33.5	121539	23.0	0.5			17.79
Tributary	38015.40		5005.5	1221.16	1238.95		1239.03	0.000088	2.62	3313.21	866.98	0.13	97.98		176991	33.5	121442	23.0	0.5			17.79
Tributary	37985.50		5005.24	1221.15	1238.94		1239.02	0.000089	2.65	3303.06	910.07	0.13	97.98		177089	33.5	121344	23.0	0.5			17.79
Tributary	37955.70		5005.19	1221.14	1238.93		1239.01	0.000089	2.65	3303.29	923.33	0.13	97.98		177187	33.6	121246	23.0	0.5			17.79
Tributary	37925.80		5004.84	1221.13	1238.92		1239	0.000088	2.65	3312.87	948.04	0.13	97.98		177285	33.6	121148	22.9	0.5			17.79
Tributary	37895.90		5004.64	1221.12	1238.91		1239	0.000087	2.64	3333.49	989.65	0.13	97.98		177383	33.6	121050	22.9	0.5			17.79
Tributary	37866.10		5004.41	1221.11	1238.9		1238.99	0.000086	2.62	3359.86	1015.84	0.12	97.98		177481	33.6	120952	22.9	0.5			17.79
Tributary	37836.20		5004.09	1221.1	1238.9		1238.98	0.000084	2.61	3392.52	1033.67	0.12	97.98		177579	33.6	120854	22.9	0.5			17.8
Tributary	37806.30		5004.19	1221.09	1238.89		1238.97	0.000082	2.58	3426.35	1038.04	0.12	97.98		177677	33.7	120756	22.9	0.5			17.8
Tributary	37776.50		5003.91	1221.08	1238.88		1238.96	0.00008	2.56	3464.91	1044.7	0.12	97.98		177775	33.7	120658	22.9	0.5			17.8
Tributary	37746.60		5003.68	1221.07	1238.87		1238.95	0.000078	2.54	3504.15	1049.66	0.12	97.98		177873	33.7	120560	22.8	0.5			17.8
Tributary	37716.70		5003.39	1221.06	1238.87		1238.94	0.000076	2.51	3544.5	1053.04	0.12	97.98		177971	33.7	120462	22.8	0.5			17.81
Tributary	37686.90		5003.42	1221.05	1238.86		1238.93	0.000074	2.48	3587.51	1055.2	0.12	97.98		178069	33.7	120364	22.8	0.5			17.81
Tributary	37657.00		5003.16	1221.04	1238.85		1238.93	0.000072	2.46	3629.91	1057.85	0.11	97.98		178167	33.7	120266	22.8	0.5			17.81
Tributary	37627.10		5002.87	1221.03	1238.85		1238.92	0.00007	2.44	3674.77	1062.66	0.11	97.98		178265	33.8	120168	22.8	0.5			17.82
Tributary	37597.30		5002.65	1221.02	1238.84		1238.91	0.000068	2.41	3721.37	1067.64	0.11	97.98		178363	33.8	120070	22.7	0.5			17.82
Tributary	37567.40		5002.65	1221.01	1238.84		1238.91	0.000066	2.38	3768.55	1075.39	0.11	97.98		178461	33.8	119972	22.7	0.5			17.83
Tributary	37537.50		5002.41	1221	1238.83		1238.9	0.000064	2.36	3818.99	1081.94	0.11	97.98		178559	33.8	119874	22.7	0.5			17.83
Tributary	37507.70		5002.05	1220.99	1238.83		1238.89	0.000062	2.33	3869.88	1086.14	0.11	97.98		178657	33.8	119776	22.7	0.5			17.84
Tributary	37477.80		5001.77	1220.98	1238.82		1238.89	0.00006	2.3	3920.48	1086.62	0.11	97.98		178755	33.9	119678	22.7	0.0			17.84
Tributary	37447.90		5001.77	1220.98	1238.82		1238.88	0.000059	2.27	3972.58	1084.67	0.1	97.98		178853	33.9	119580	22.6	0.5			17.84
Tributary	37418.10		5001.48	1220.97	1238.81		1238.87	0.000057	2.24	4026.52	1080.99	0.1	97.98		178951	33.9	119482	22.6	0.5			17.84
Tributary	37388.20		5001.24	1220.96	1238.81		1238.87	0.000055	2.21	4079.66	1071.62	0.1	97.98		179049	33.9	119384	22.6	0.5			17.85
Tributary	37358.30		5000.9	1220.95	1238.81		1238.86	0.000053	2.18	4136.77	1099.68	0.1	97.98		179146	33.9	119286	22.6	0.5			17.86
Tributary	37328.50		5000.63	1220.94	1238.8		1238.85	0.000051	2.15	4198.18	1108.44	0.1	97.98		179244	33.9	119188	22.6	0.5			17.86
Tributary	37298.60		5000.42	1220.93	1238.8		1238.85	0.000049	2.12	4265.38	1123.68	0.1	97.98		179342	34.0	119090	22.6	0.5			17.87
Tributary	37268.70		5000.23	1220.92	1238.79		1238.84	0.000048	2.09	4333.94	1133.8	0.09	97.98		179440	34.0	118992	22.5	0.5			17.87
Tributary	37238.90		5000.04	1220.91	1238.79		1238.84	0.000046	2.06	4410.1	1144.71	0.09	97.98		179538	34.0	118894	22.5	0.5			17.88

Tributary	37209.00		5000	1220.9	1238.79		1238.83	0.000044	2.03	4487.56	1151.49	0.09	97.98		179636	34.0	118796	22.5	0.5			17.89
Tributary	37179.20		4999.67	1220.89	1238.78		1238.83	0.000043	2	4570.56	1144.52	0.09	97.98		179734	34.0	118698	22.5	0.5			17.89
Tributary	37149.30		4999.37	1220.88	1238.78		1238.83	0.000042	1.98	4723.75	1468.06	0.09	97.98		179832	34.1	118600	22.5	0.5			17.9
Tributary	37119.40		4999.08	1220.87	1238.78		1238.82	0.00004	1.94	5005.38	1749.7	0.09	97.98		179930	34.1	118502	22.4	0.5			17.91
Tributary	37089.60		4998.64	1220.86	1238.78		1238.82	0.000038	1.9	5396.81	2034.56	0.08	97.98		180028	34.1	118404	22.4	0.5			17.92
Tributary	37059.70		4998.27	1220.85	1238.77		1238.81	0.000035	1.84	5826.84	2119.5	0.08	97.98		180126	34.1	118306	22.4	0.5			17.92
Tributary	37029.80		4998.25	1220.84	1238.77		1238.81	0.000033	1.78	6266.48	2187.93	0.08	97.99		180224	34.1	118208	22.4	0.5			17.93
Tributary	37000.00		4997.77	1220.83	1238.77		1238.8	0.000031	1.72	6710.66	2250.57	0.08	98.96		180322	34.2	118110	22.4	-5.9			17.94
Tributary	36969.80		4996.98	1220.94	1238.77		1238.8	0.000032	1.75	6453.33	2182.98	0.08	98.96		180421	34.2	118011	22.4	-5.3			17.83
Tributary	36939.60		4996.35	1221.04	1238.76		1238.8	0.000033	1.78	6220.03	2117.36	0.08	98.96		180520	34.2	117912	22.3	-5.3			17.72
Tributary	36909.50		4995.94	1221.14	1238.76		1238.79	0.000034	1.81	6006.47	2068.8	0.08	98.96		180619	34.2	117813	22.3	-5.3			17.62
Tributary	36879.30		4995.6	1221.24	1238.75		1238.79	0.000036	1.84	5809.38	2024.89	0.08	98.96		180718	34.2	117714	22.3	-5.3			17.51
Tributary	36849.10		4995.28	1221.34	1238.75		1238.79	0.000037	1.86	5628.94	1968.93	0.08	98.96		180817	34.2	117615	22.3	-5.9			17.41
Tributary	36819.00		4994.8	1221.45	1238.75		1238.79	0.000038	1.89	5479.15	1895.4	0.08	98.96		180916	34.3	117516	22.3	-5.3			17.3
Tributary	36788.80		4994.51	1221.55	1238.74		1238.78	0.000039	1.91	5347.44	1821.23	0.09	98.96		181015	34.3	117417	22.2	-5.3			17.19
Tributary	36758.60		4994.61	1221.65	1238.74		1238.78	0.00004	1.92	5230.96	1748.48	0.09	98.96		181114	34.3	117318	22.2	-5.3			17.09
Tributary	36728.50		4994.27	1221.75	1238.73		1238.77	0.000041	1.93	5130.16	1629.76	0.09	98.96		181213	34.3	117220	22.2	-5.9			16.98
Tributary	36698.30		4993.9	1221.86	1238.73		1238.77	0.000041	1.94	5057.18	1487.05	0.09	98.96		181312	34.3	117121	22.2	-5.3			16.87
Tributary	36668.20		4993.39	1221.96	1238.72		1238.77	0.000045	2.01	5016.01	1383.42	0.09	98.96		181411	34.4	117022	22.2	-5.3			16.76
Tributary	36638.00		4993.39	1222.06	1238.72		1238.77	0.000047	2.05	5013.31	1273.44	0.09	98.96		181510	34.4	116923	22.1	-5.3			16.66
Tributary	36607.80		4992.71	1222.16	1238.71		1238.76	0.000048	2.08	5020.06	1320.54	0.1	98.96		181609	34.4	116824	22.1	-5.9			16.55
Tributary	36577.70		4992.78	1222.27	1238.71		1238.76	0.00005	2.11	5035.92	1370.17	0.1	98.96		181708	34.4	116725	22.1	-5.3			16.44
Tributary	36547.50		4992.37	1222.37	1238.7		1238.75	0.00005	2.11	5058.24	1416.98	0.1	98.96		181807	34.4	116626	22.1	-5.3			16.33
Tributary	36517.30		4992.49	1222.47	1238.7		1238.75	0.000051	2.12	5089.46	1446.87	0.1	98.96		181906	34.5	116527	22.1	-5.3			16.23
Tributary	36487.20		4992	1222.57	1238.69		1238.74	0.000052	2.13	5123.58	1473.42	0.1	98.96		182005	34.5	116428	22.1	-5.3			16.12
Tributary	36457.00		4991.77	1222.67	1238.69		1238.74	0.000052	2.13	5161.02	1502.55	0.1	98.96		182104	34.5	116329	22.0	-5.9			16.02
Tributary	36426.80		4991.55	1222.78	1238.68		1238.73	0.000053	2.13	5204.95	1536.34	0.1	98.96		182203	34.5	116230	22.0	-5.3			15.9
Tributary	36396.70		4991.4	1222.88	1238.68		1238.73	0.000053	2.14	5254.96	1571.75	0.1	98.96		182301	34.5	116131	22.0	-5.3			15.8
Tributary	36366.50		4991.01	1222.98	1238.67		1238.72	0.000054	2.13	5311.48	1607.99	0.1	98.96		182400	34.5	116032	22.0	-5.3			15.69
Tributary	36336.40		4990.48	1223.08	1238.67		1238.72	0.000054	2.13	5372.64	1647.93	0.1	98.96		182499	34.6	115933	22.0	-5.9			15.59
Tributary	36306.20		4990.32	1223.19	1238.66		1238.71	0.000054	2.12	5442.55	1653.82	0.1	98.96		182598	34.6	115834	21.9	-5.3			15.47
Tributary	36276.00		4989.88	1223.29	1238.66		1238.7	0.000054	2.11	5516.41	1677.67	0.1	98.96		182697	34.6	115735	21.9	-5.3			15.37
Tributary	36245.90		4989.87	1223.39	1238.65		1238.7	0.000054	2.1	5596.54	1713.1	0.1	98.96		182796	34.6	115636	21.9	-5.3			15.26
Tributary	36215.70		4989.47	1223.49	1238.65		1238.69	0.000053	2.09	5680.9	1748.16	0.1	98.96		182895	34.6	115537	21.9	-5.9			15.16
Tributary	36185.50		4988.96	1223.6	1238.64		1238.69	0.000053	2.07	5768.62	1781.53	0.1	98.96		182994	34.7	115438	21.9	-5.3			15.04
Tributary	36155.40		4988.26	1223.7	1238.64		1238.68	0.000053	2.06	5858.61	1811.51	0.1	98.96		183093	34.7	115339	21.8	-5.3			14.94
Tributary	36125.20		4988.22	1223.8	1238.63		1238.68	0.000052	2.04	5956.21	1843.95	0.1	98.96		183192	34.7	115240	21.8	-5.3			14.83
Tributary	36095.00		4987.71	1223.9	1238.63		1238.67	0.000052	2.03	6051.97	1875.39	0.1	98.96		183291	34.7	115141	21.8	-5.3			14.73
Tributary	36064.90		4987.52	1224	1238.63		1238.67	0.000051	2.01	6156.71	1908.02	0.1	98.96		183390	34.7	115042	21.8	-5.9			14.63
Tributary	36034.70		4987.2	1224.11	1238.62		1238.66	0.000051	1.99	6262.32	1938.19	0.1	98.96		183489	34.8	114943	21.8	-5.3			14.51
Tributary	36004.60		4986.96	1224.21	1238.62		1238.65	0.00005	1.97	6370.87	1967.19	0.09	98.96		183588	34.8	114844	21.8	-5.3			14.41
Tributary	35974.40		4986.36	1224.31	1238.61		1238.65	0.000049	1.95	6486.99	1999.44	0.09	98.96		183687	34.8	114746	21.7	-5.3			14.3
Tributary	35944.20		4985.85	1224.41	1238.61		1238.64	0.000049	1.93	6603.27	2028.69	0.09	98.96		183786	34.8	114647	21.7	-5.9			14.2
Tributary	35914.10		4985.48	1224.52	1238.6		1238.64	0.000048	1.9	6724.02	2057.19	0.09	98.96		183885	34.8	114548	21.7	-5.3			14.08
Tributary	35883.90		4985.12	1224.62	1238.6		1238.63	0.000047	1.88	6847.73	2090.19	0.09	98.96		183984	34.8	114449	21.7	-5.3			13.98
Tributary	35853.70		4984.51	1224.72	1238.6		1238.63	0.000046	1.86	6974.83	2117.11	0.09	98.96		184083	34.9	114350	21.7	-5.3			13.88
Tributary	35823.60		4984.78	1224.82	1238.59		1238.62	0.000045	1.83	7107.69	2144.99	0.09	98.96		184182	34.9	114251	21.6	-5.9			13.77
Tributary	35793.40		4984.06	1224.93	1238.59		1238.62	0.000045	1.8	7243.17	2173.93	0.09	98.96		184281	34.9	114152	21.6	-5.3			13.66
Tributary	35763.20		4983.46	1225.03	1238.58		1238.61	0.000044	1.78	7379.66	2204.46	0.09	98.96		184380	34.9	114053	21.6	-5.3			13.55
Tributary	35733.10		4983.13	1225.13	1238.58		1238.61	0.000043	1.75	7522.38	2234.67	0.09	98.96		184479	34.9	113954	21.6	-5.3			13.45
Tributary	35702.90		4982.52	1225.23	1238.58		1238.6	0.000042	1.73	7671.36	2277.56	0.09	98.96		184578	35.0	113855	21.6	-5.3			13.35
Tributary	35672.70		4982.82	1225.33	1238.57		1238.6	0.000041	1.7	7825.04	2319.71	0.08	98.96		184677	35.0	113756	21.5	-5.9			13.24
Tributary	35642.60		4981.76	1225.44	1238.57		1238.59	0.00004	1.68	7976.46	2361.98	0.08	98.96		184775	35.0	113657	21.5	-5.3			13.13
Tributary	35612.40		4981.32	1225.54	1238.57		1238.59	0.000039	1.65	8140.58	2402.55	0.08	98.96		184874	35.0	113558	21.5	-5.3			13.03
Tributary	35582.30		4980.95	1225.64	1238.56		1238.58	0.000038	1.62	8308.49	2441.92	0.08	98.96		184973	35.0	113459	21.5	-5.3			12.92
Tributary	35552.10		4980.76	1225.74	1238.56		1238.58	0.000037	1.59	8480.04	2479.42	0.08	98.96		185072	35.1	113360	21.5	-5.9			12.82
Tributary	35521.90		4980.19	1225.85	1238.56		1238.58	0.000036	1.56	8655.7	2515.76	0.08	98.96		185171	35.1	113261	21.5	-5.3			12.71
Tributary	35491.80		4979.65	1225.95	1238.56		1238.57	0.000035	1.53	8832.44	2552.2	0.08	98.96		185270	35.1	113162	21.4	-5.3			12.61
Tributary	35461.60		4979.14	1226.05	1238.55		1238.57	0.000034	1.5	9014.96	2585.66	0.08	98.96		185369	35.1	113063	21.4	-5.3			12.5
Tributary	35431.40		4978.53	1226.15	1238.55		1238.56	0.000033	1.47	9204.56	2612.53	0.08	98.96		185468	35.1	112964	21.4	-5.9			12.4
Tributary	35401.30		4978.05	1226.26	1238.55		1238.56	0.000032	1.44	9389.99	2635.36	0.07	98.96		185567	35.1	112865	21.4	-5.3			12.29
Tributary	35371.10		4977.57	1226.36	1238.54		1238.56	0.000031	1.41	9580.1	2657.91	0.07	98.96		185666	35.2	112766	21.4	-5.3			12.18
Tributary	35340.90		4976.98	1226.46	1238.54		1238.55	0.00003	1.38	9773.8	2680.15	0.07	98.96		185765	35.2	112667	21.3	-5.3			12.08
Tributary	35310.80		4976.63	1226.56	1238.54		1238.55	0.000029	1.35	9968.76	2701.86	0.07	98.96		185864	35.2	112568	21.3	-5.3			11.98
Tributary	35280.60		4976.02	1226.66	1238.54		1238.55	0.000028	1.32	10168.78	2723.41	0.07	98.96		185963	35.2	112469	21.3	-5.9			11.88
Tributary	35250.50		4975.3	1226.77	1238.53		1238.54	0.000027	1.29	10367.17	2744.42	0.07	98.96		186062	35.2	112370	21.3	-5.3			11.76
Tributary	35220.30		4974.66	1226.87	1238.53		1238.54	0.000026	1.26	10573.58	2765.44	0.07	98.96		186161	35.3	112272	21.3	-5.3			11.66
Tributary	35190.10		4974.93	1226.97	1238.53		1238.54	0.000025	1.23	10780.23	2785.77	0.07	98.96		186260	35.3	112173	21.2	-5.3			11.56
Tributary	35160.00		4974.17	1227.07	1238.53		1238.54	0.000024	1.2	10988.42	2806.05	0.06	98.96		186359	35.3	112074	21.2	-5.9			11.46
Tributary	35129.80		4973.65	1227.18	1238.53		1238.53	0.000023	1.17	11195.31	2825.55	0.06	98.96		186458	35.3	111975	21.2	-5.3			11.35
Tributary	35099.60		4972.42	1227.28	1238.52		1238.53	0.000022	1.15	11411.61	2845.03	0.06	98.96		186557	35.3	111876	21.2	-5.3			11.24
Tributary	35069.50		4972.87	1227.38	1238.52		1238.53	0.000022	1.12	11626.83	2864.19	0.06	98.96		186656	35.4	111777	21.2	-5.3			11.14
Tributary	35039.30		4972.17	1227.48	1238.52		1238.53	0.000021	1.09	11842.88	2880.18	0.06	98.96		186755	35.4	111678	21.2	-5.9			11.04
Tributary	35009.10		4970.96	1227.59	1238.52		1238.52	0.00002	1.06	12064.12	2895	0.06	98.96		186854	35.4	111579	21.1	-5.3			10.93
Tributary	34979.00		4971.03	1227.69	1238.52		1238.52	0.000019	1.03	12285.91	2908.22	0.06	98.96		186953	35.4	111480	21.1	-5.3			10.83
Tributary	34948.80		4970.08	1227.79	1238.51		1238.52	0.000018	1	12510.36	2923.29	0.06	98.96		187052	35.4	111381	21.1	-5.3			10.72
Tributary	34918.70		4969.76	1227.89	1238.51		1238.52	0.000017	0.98	12740.36	2936.92	0.05	98.96		187150	35.4	111282	21.1	-5.3			10.62
Tributary	34888.50		4969.4	1227.99	1238.51		1238.52	0.000017	0.95	12968.9	2950.33	0.05	98.96		187249	35.5	111183	21.1	-5.9			10.52
Tributary	34858.30		4968.63	1228.1	1238.51		1238.51	0.000016	0.92	13198.81	2963.76	0.05	98.96		187348	35.5	111084	21.0	-5.3			10.41
Tributary	34828.20		4967.98	1228.2	1238.51		1238.51	0.000015	0.9	13437.46	2980.45	0.05	98.96		187447	35.5	110985	21.0	-5.3			10.31
Tributary	34798.00		4967.05	1228.3	1238.51		1238.51	0.000015	0.88	13675.26	2996.5	0.05	98.96		187546	35.5	110886	21.0	-5.3			10.21
Tributary	34767.80		4966.07	1228.4	1238.51		1238.51	0.000014	0.85	13914.11	3013.61	0.05	98.96		187645	35.5	110787	21.0	-5.9			10.11
Tributary	34737.70		4966.46	1228.51	1238.5		1238.51	0.000014	0.83	14152.64	3029.37	0.05	98.96		187744	35.6	110688	21.0	-5.3			9.99

Tributary	34707.50		4965.01	1228.61	1238.5		1238.51	0.000013	0.81	14396.86	3346.52	0.05	98.96		187843	35.6	110589	20.9	-5.3			9.89
Tributary	34677.30		4965.06	1228.71	1238.5		1238.51	0.000012	0.79	14641.85	3364.25	0.04	98.96		187942	35.6	110490	20.9	-5.3			9.79
Tributary	34647.20		4964.05	1228.81	1238.5		1238.5	0.000012	0.76	14889.88	3379.43	0.04	98.96		188041	35.6	110391	20.9	-5.9			9.69
Tributary	34617.00		4963.78	1228.92	1238.5		1238.5	0.000012	0.74	15133.42	3396.33	0.04	98.96		188140	35.6	110292	20.9	-5.3			9.58
Tributary	34586.90		4962.77	1229.02	1238.5		1238.5	0.000011	0.72	15387.85	3109.94	0.04	98.96		188239	35.7	110193	20.9	-5.3			9.48
Tributary	34556.70		4961.96	1229.12	1238.5		1238.5	0.000011	0.7	15641.19	3126.18	0.04	98.96		188338	35.7	110094	20.9	-5.3			9.38
Tributary	34526.50		4962.35	1229.22	1238.5		1238.5	0.00001	0.68	15896.12	3142.26	0.04	98.96		188437	35.7	109995	20.8	-5.3			9.28
Tributary	34496.40		4961.5	1229.32	1238.5		1238.5	0.00001	0.67	16151.26	3155.86	0.04	98.96		188536	35.7	109896	20.8	-5.9			9.18
Tributary	34466.20		4960.66	1229.43	1238.5		1238.5	0.000009	0.65	16408.55	3171.91	0.04	98.96		188635	35.7	109798	20.8	-5.3			9.07
Tributary	34436.00		4960.09	1229.53	1238.49		1238.5	0.000009	0.63	16663.76	3185.41	0.04	98.96		188734	35.7	109699	20.8	-5.3			8.96
Tributary	34405.90		4959.45	1229.63	1238.49		1238.5	0.000009	0.61	16929.6	3203.51	0.04	98.96		188833	35.8	109600	20.8	-5.3			8.86
Tributary	34375.70		4958.93	1229.73	1238.49		1238.49	0.000008	0.6	17192.2	3221.43	0.04	98.96		188932	35.8	109501	20.7	-5.9			8.76
Tributary	34345.50		4958.12	1229.84	1238.49		1238.49	0.000008	0.58	17454.15	3236.95	0.04	98.96		189031	35.8	109402	20.7	-5.3			8.65
Tributary	34315.40		4957.32	1229.94	1238.49		1238.49	0.000008	0.56	17722.02	3255.63	0.03	98.96		189130	35.8	109303	20.7	-5.3			8.55
Tributary	34285.20		4956.32	1230.04	1238.49		1238.49	0.000007	0.55	17988.08	3275	0.03	98.96		189229	35.8	109204	20.7	-5.3			8.45
Tributary	34255.10		4955.86	1230.14	1238.49		1238.49	0.000007	0.54	18253.41	3293.71	0.03	98.96		189328	35.9	109105	20.7	-5.9			8.35
Tributary	34224.90		4955.06	1230.25	1238.49		1238.49	0.000007	0.52	18527.19	3312.72	0.03	98.96		189427	35.9	109006	20.6	-5.3			8.24
Tributary	34194.77		4953.99	1230.35	1238.49		1238.49	0.000007	0.51	18794.93	3333.46	0.03	98.64	Frewsburg	189526	35.9	108907	20.6	7.5			8.14
Tributary	34164.70		4953.86	1230.21	1238.49		1238.49	0.000007	0.52	18541.75	3330.94	0.03	98.64		189624	35.9	108808	20.6	7.5			8.28
Tributary	34134.60		4953.05	1230.07	1238.49		1238.49	0.000007	0.54	18289.8	3326.05	0.03	98.64		189723	35.9	108710	20.6	7.5			8.42
Tributary	34104.50		4952.42	1229.93	1238.49		1238.49	0.000007	0.55	18029.38	3322.85	0.03	98.64		189821	36.0	108611	20.6	7.5			8.56
Tributary	34074.50		4952.04	1229.79	1238.49		1238.49	0.000008	0.57	17768.68	3319.59	0.03	98.64		189920	36.0	108512	20.6	8.0			8.7
Tributary	34044.40		4951.25	1229.64	1238.48		1238.49	0.000008	0.59	17512.39	3314.01	0.04	98.64		190019	36.0	108414	20.5	7.5			8.84
Tributary	34014.30		4950.29	1229.5	1238.48		1238.49	0.000008	0.61	17261.5	3310.51	0.04	98.64		190117	36.0	108315	20.5	7.5			8.98
Tributary	33984.30		4949.6	1229.36	1238.48		1238.49	0.000009	0.63	17000.39	3306.44	0.04	98.64		190216	36.0	108216	20.5	7.5			9.12
Tributary	33954.20		4949.74	1229.22	1238.48		1238.48	0.000009	0.64	16743.39	3302.2	0.04	98.64		190315	36.0	108118	20.5	7.5			9.26
Tributary	33924.10		4948.8	1229.08	1238.48		1238.48	0.000009	0.66	16493.81	3297.77	0.04	98.64		190413	36.1	108019	20.5	7.5			9.4
Tributary	33894.10		4948	1228.94	1238.48		1238.48	0.00001	0.68	16236.35	3293.08	0.04	98.64		190512	36.1	107920	20.4	7.5			9.54
Tributary	33864.00		4946.67	1228.8	1238.48		1238.48	0.00001	0.7	15978.3	3288.06	0.04	98.64		190611	36.1	107822	20.4	7.5			9.68
Tributary	33833.90		4946.77	1228.66	1238.48		1238.48	0.000011	0.72	15721.81	3281.78	0.04	98.64		190709	36.1	107723	20.4	7.5			9.82
Tributary	33803.90		4945.6	1228.52	1238.48		1238.48	0.000011	0.75	15461.81	3275.75	0.04	98.64		190808	36.1	107625	20.4	7.5			9.96
Tributary	33773.80		4945.94	1228.38	1238.48		1238.48	0.000011	0.77	15202.08	3269.68	0.04	98.64		190906	36.2	107526	20.4	7.5			10.1
Tributary	33743.70		4945.3	1228.24	1238.47		1238.48	0.000012	0.79	14952.62	3262.79	0.04	98.64		191005	36.2	107427	20.3	7.5			10.23
Tributary	33713.70		4944.65	1228.1	1238.47		1238.48	0.000012	0.81	14699.69	3259.44	0.05	98.64		191104	36.2	107329	20.3	7.5			10.37
Tributary	33683.60		4944.01	1227.96	1238.47		1238.47	0.000013	0.84	14435.88	3252.22	0.05	98.64		191202	36.2	107230	20.3	7.5			10.51
Tributary	33653.50		4943.32	1227.82	1238.47		1238.47	0.000013	0.86	14183.51	3245.76	0.05	98.64		191301	36.2	107131	20.3	7.5			10.65
Tributary	33623.50		4942.57	1227.68	1238.47		1238.47	0.000014	0.89	13921.79	3238.71	0.05	98.64		191400	36.2	107033	20.3	8.0			10.79
Tributary	33593.40		4941.77	1227.53	1238.47		1238.47	0.000015	0.92	13668.64	3231.7	0.05	98.64		191498	36.3	106934	20.3	7.5			10.94
Tributary	33563.40		4940.96	1227.39	1238.47		1238.47	0.000015	0.94	13410.8	3224.21	0.05	98.64		191597	36.3	106835	20.2	7.5			11.08
Tributary	33533.30		4940.27	1227.25	1238.46		1238.47	0.000016	0.97	13154.66	3216.57	0.05	98.64		191696	36.3	106737	20.2	7.5			11.21
Tributary	33503.20		4939.68	1227.11	1238.46		1238.47	0.000017	1	12895.66	3211.62	0.05	98.64		191794	36.3	106638	20.2	7.5			11.35
Tributary	33473.20		4939.13	1226.97	1238.46		1238.47	0.000017	1.03	12644.14	3203.01	0.05	98.64		191893	36.3	106540	20.2	7.5			11.49
Tributary	33443.10		4938.44	1226.83	1238.46		1238.46	0.000018	1.06	12382.84	3193.94	0.06	98.64		191992	36.4	106441	20.2	7.5			11.63
Tributary	33413.00		4937.67	1226.69	1238.46		1238.46	0.000019	1.09	12125.08	3184.29	0.06	98.64		192090	36.4	106342	20.1	7.5			11.77
Tributary	33383.00		4936.85	1226.55	1238.45		1238.46	0.000019	1.12	11864.25	3174.08	0.06	98.64		192189	36.4	106244	20.1	7.5			11.9
Tributary	33352.90		4936.8	1226.41	1238.45		1238.46	0.00002	1.15	11609.59	3163.84	0.06	98.64		192287	36.4	106145	20.1	7.5			12.04
Tributary	33322.80		4935.95	1226.27	1238.45		1238.46	0.000021	1.18	11353.47	3152.31	0.06	98.64		192386	36.4	106046	20.1	7.5			12.18
Tributary	33292.80		4935.28	1226.13	1238.45		1238.46	0.000022	1.22	11091.81	3140.51	0.06	98.64		192485	36.5	105948	20.1	7.5			12.32
Tributary	33262.70		4934.84	1225.99	1238.44		1238.45	0.000023	1.25	10842.54	3131.92	0.06	98.64		192583	36.5	105849	20.0	7.5			12.45
Tributary	33232.60		4934.31	1225.85	1238.44		1238.45	0.000024	1.28	10582.44	3118.84	0.06	98.64		192682	36.5	105750	20.0	7.5			12.59
Tributary	33202.60		4933.55	1225.71	1238.44		1238.45	0.000025	1.32	10322.77	3104.4	0.07	98.64		192781	36.5	105652	20.0	7.5			12.73
Tributary	33172.50		4932.98	1225.57	1238.44		1238.45	0.000026	1.35	10067.84	3090.33	0.07	98.64		192879	36.5	105553	20.0	8.0			12.87
Tributary	33142.40		4932.29	1225.42	1238.43		1238.45	0.000027	1.39	9811.24	3074.27	0.07	98.64		192978	36.5	105454	20.0	7.5			13.01
Tributary	33112.40		4931.53	1225.28	1238.43		1238.45	0.000028	1.42	9551.02	3057.28	0.07	98.64		193077	36.6	105356	20.0	7.5			13.15
Tributary	33082.30		4930.91	1225.14	1238.43		1238.44	0.000029	1.46	9295.01	3039.95	0.07	98.64		193175	36.6	105257	19.9	7.5			13.29
Tributary	33052.20		4930.74	1225	1238.42		1238.44	0.00003	1.5	9037	3024.8	0.07	98.64		193274	36.6	105159	19.9	7.5			13.42
Tributary	33022.20		4930	1224.86	1238.42		1238.44	0.000031	1.53	8781.47	3003.78	0.07	98.64		193373	36.6	105060	19.9	7.5			13.56
Tributary	32992.10		4929.12	1224.72	1238.42		1238.44	0.000032	1.57	8528.31	2983.67	0.08	98.64		193471	36.6	104961	19.9	7.5			13.7
Tributary	32962.00		4928.65	1224.58	1238.41		1238.43	0.000033	1.61	8270.48	2959.83	0.08	98.64		193570	36.7	104863	19.9	7.5			13.83
Tributary	32932.00		4927.75	1224.44	1238.41		1238.43	0.000034	1.64	8011.98	2934.41	0.08	98.64		193668	36.7	104764	19.8	7.5			13.97
Tributary	32901.90		4927.14	1224.3	1238.4		1238.43	0.000035	1.68	7762.27	2908.69	0.08	98.64		193767	36.7	104665	19.8	7.5			14.1
Tributary	32871.80		4927.39	1224.16	1238.4		1238.43	0.000036	1.71	7513.27	2879.98	0.08	98.64		193866	36.7	104567	19.8	7.5			14.24
Tributary	32841.80		4926.61	1224.02	1238.4		1238.43	0.000037	1.75	7255.92	2847.55	0.08	98.64		193964	36.7	104468	19.8	7.5			14.38
Tributary	32811.70		4925.93	1223.88	1238.39		1238.42	0.000038	1.79	7001.22	2815.93	0.08	98.64		194063	36.8	104369	19.8	7.5			14.51
Tributary	32781.70		4925.18	1223.74	1238.39		1238.42	0.000039	1.82	6756.3	2782.96	0.08	98.64		194162	36.8	104271	19.7	7.5			14.65
Tributary	32751.60		4924.6	1223.6	1238.38		1238.41	0.000035	1.74	6528.85	2593.37	0.08	98.64		194260	36.8	104172	19.7	7.5			14.78
Tributary	32721.50		4923.93	1223.46	1238.38		1238.41	0.000035	1.75	6309.42	2511.84	0.08	98.64		194359	36.8	104074	19.7	8.0			14.92
Tributary	32691.50		4923.36	1223.31	1238.38		1238.41	0.000036	1.77	6099.53	2431.17	0.08	98.64		194458	36.8	103975	19.7	7.5			15.07
Tributary	32661.40		4922.73	1223.17	1238.37		1238.4	0.000034	1.75	5897.23	2311.86	0.08	98.64		194556	36.8	103876	19.7	7.5			15.2
Tributary	32631.30		4922.87	1223.03	1238.37		1238.4	0.000034	1.75	5717.36	2181.93	0.08	98.64		194655	36.9	103778	19.7	7.5			15.34
Tributary	32601.30		4922.39	1222.89	1238.36		1238.4	0.000034	1.76	5545.07	2083.81	0.08	98.64		194753	36.9	103679	19.6	7.5			15.47
Tributary	32571.20		4921.97	1222.75	1238.36		1238.39	0.000034	1.77	5380.59	1967.87	0.08	98.64		194852	36.9	103580	19.6	7.5			15.61
Tributary	32541.10		4921.1	1222.61	1238.36		1238.39	0.000034	1.78	5225.83	1867.57	0.08	98.64		194951	36.9	103482	19.6	7.5			15.75
Tributary	32511.10		4921.22	1222.47	1238.35		1238.39	0.000034	1.78	5083.37	1749.98	0.08	98.64		195049	36.9	103383	19.6	7.5			15.88
Tributary	32481.00		4920.69	1222.33	1238.35		1238.39	0.000033	1.78	4957.25	1636.58	0.08	98.64		195148	37.0	103284	19.6	7.5			16.02
Tributary	32450.90		4920.36	1222.19	1238.35		1238.38	0.000033	1.78	4831.27	1487.2	0.08	98.64		195247	37.0	103186	19.5	7.5			16.16
Tributary	32420.90		4920.06	1222.05	1238.34		1238.38	0.000032	1.78	4725.65	1330.64	0.08	98.64		195345	37.0	103087	19.5	7.5			16.29
Tributary	32390.80		4919.94	1221.91	1238.34		1238.37	0.000027	1.63	4643.28	1081.95	0.07	98.64		195444	37.0	102988	19.5	7.5			16.43
Tributary	32360.70		4919.89	1221.77	1238.34		1238.37	0.000025	1.59	4585.73	852.52	0.07	98.64		195543	37.0	102890	19.5	7.5			16.57
Tributary	32330.70		4919.52	1221.63	1238.34		1238.37	0.000024	1.57	4558.73	561.83	0.07	98.64		195641	37.1	102791	19.5	7.5			16.71
Tributary	32300.60		4919.43	1221.49	1238.34		1238.36	0.000024	1.56	4553.37	505.12	0.07	98.64		195740	37.1	102693	19.4	8.0			16.85
Tributary	32270.50		4919.21	1221.34	1238.33		1238.36	0.000023	1.55	4557.39	466.67	0.07	98.64		195839	37.1	102594	19.4	7.5			16.99
Tributary	32240.50		4919.11	1221.2	1238.33		1238.36	0.000023	1.54	4568.23	423.5	0.07	98.64		195937	37.1	102495	19.4	7.5			17.13

Tributary	32210.40		4919.04	1221.06	1238.33		1238.36	0.000022	1.52	4592.27	360.21	0.07	98.64		196036	37.1	102397	19.4	7.5			17.27
Tributary	32180.30		4918.99	1220.92	1238.33		1238.35	0.000021	1.51	4623.83	358.89	0.06	98.64		196134	37.1	102298	19.4	7.5			17.41
Tributary	32150.30		4918.9	1220.78	1238.33		1238.35	0.000021	1.5	4656	357.72	0.06	98.64		196233	37.2	102199	19.4	7.5			17.55
Tributary	32120.20		4918.77	1220.64	1238.33		1238.35	0.00002	1.48	4689.14	356.62	0.06	98.64		196332	37.2	102101	19.3	7.5			17.69
Tributary	32090.20		4918.69	1220.5	1238.32		1238.35	0.00002	1.47	4722.11	355.51	0.06	98.64		196430	37.2	102002	19.3	7.5			17.82
Tributary	32060.10		4918.64	1220.36	1238.32		1238.35	0.000019	1.46	4755.14	354.47	0.06	98.64		196529	37.2	101903	19.3	7.5			17.96
Tributary	32030.00		4918.56	1220.22	1238.32		1238.34	0.000019	1.45	4788.36	353.65	0.06	98.64		196628	37.2	101805	19.3	7.5			18.1
Tributary	32000.00		4918.47	1220.08	1238.32		1238.34	0.000018	1.43	4822.01	352.93	0.06	97.09		196726	37.3	101706	19.3	0.5			18.24
Tributary	31970.40		4918.37	1220.07	1238.32		1238.34	0.000019	1.45	4752.89	355.07	0.06	97.09		196823	37.3	101609	19.2	0.0			18.25
Tributary	31940.80		4918.3	1220.07	1238.31		1238.34	0.000019	1.46	4681.41	357.07	0.06	97.09		196920	37.3	101512	19.2	0.5			18.24
Tributary	31911.20		4918.38	1220.06	1238.31		1238.34	0.000019	1.47	4608.62	358.95	0.06	97.09		197018	37.3	101415	19.2	0.5			18.25
Tributary	31881.60		4918.22	1220.05	1238.31		1238.34	0.00002	1.48	4534.5	360.69	0.06	97.09		197115	37.3	101318	19.2	0.5			18.26
Tributary	31852.00		4918.23	1220.04	1238.31		1238.33	0.000021	1.5	4459.19	362.23	0.06	97.09		197212	37.4	101221	19.2	0.0			18.27
Tributary	31822.40		4918.13	1220.04	1238.3		1238.33	0.000021	1.51	4382.07	363.59	0.06	97.09		197309	37.4	101124	19.2	0.5			18.26
Tributary	31792.80		4918.1	1220.03	1238.3		1238.33	0.000022	1.52	4303.84	364.62	0.07	97.09		197406	37.4	101027	19.1	0.5			18.27
Tributary	31763.20		4918.05	1220.02	1238.3		1238.33	0.000022	1.53	4224.18	365.66	0.07	97.09		197503	37.4	100929	19.1	0.0			18.28
Tributary	31733.60		4918.01	1220.02	1238.29		1238.33	0.000023	1.54	4142.8	366.29	0.07	97.09		197600	37.4	100832	19.1	0.5			18.27
Tributary	31704.00		4917.95	1220.01	1238.29		1238.32	0.000024	1.56	4061.3	366.5	0.07	97.09		197697	37.4	100735	19.1	0.5			18.28
Tributary	31674.40		4917.86	1220	1238.29		1238.32	0.000024	1.57	3977.47	365.93	0.07	97.09		197794	37.5	100638	19.1	0.0			18.29
Tributary	31644.80		4917.78	1220	1238.28		1238.32	0.000025	1.58	3893.83	364.59	0.07	97.09		197891	37.5	100541	19.0	0.5			18.28
Tributary	31615.20		4917.7	1219.99	1238.28		1238.32	0.000026	1.59	3809.55	361.96	0.07	97.09		197988	37.5	100444	19.0	0.5			18.29
Tributary	31585.70		4917.44	1219.98	1238.28		1238.31	0.000026	1.6	3728.73	452.64	0.07	97.09		198086	37.5	100347	19.0	0.0			18.3
Tributary	31556.10		4917.62	1219.98	1238.28		1238.31	0.000027	1.6	3658.97	579.39	0.07	97.09		198183	37.5	100250	19.0	0.5			18.3
Tributary	31526.50		4917.53	1219.97	1238.27		1238.31	0.000028	1.61	3603.9	692.85	0.07	97.09		198280	37.6	100153	19.0	0.5			18.3
Tributary	31496.90		4917.41	1219.96	1238.27		1238.31	0.000028	1.61	3563.45	784.36	0.07	97.09		198377	37.6	100056	18.9	0.5			18.31
Tributary	31467.30		4917.32	1219.95	1238.27		1238.3	0.000029	1.6	3554.61	881.92	0.07	97.09		198474	37.6	99959	18.9	0.0			18.32
Tributary	31437.73		4917.16	1219.95	1238.26		1238.3	0.000029	1.6	3638.36	1065.18	0.07	98.27		198571	37.6	99861	18.9	-0.5			18.31
Tributary	31407.70		4916.95	1219.96	1238.26		1238.3	0.00003	1.62	3523.07	854.33	0.07	98.27		198669	37.6	99763	18.9	-0.5			18.3
Tributary	31377.80		4916.78	1219.97	1238.26		1238.29	0.00003	1.63	3483	800.51	0.07	98.27		198768	37.6	99665	18.9	-0.5			18.29
Tributary	31347.80		4916.65	1219.98	1238.25		1238.29	0.000031	1.65	3446.78	753.07	0.08	98.27		198866	37.7	99567	18.9	-0.5			18.27
Tributary	31317.90		4916.62	1219.99	1238.25		1238.29	0.000032	1.66	3412.56	697.09	0.08	98.27		198964	37.7	99468	18.8	-0.5			18.26
Tributary	31287.90		4916.51	1220	1238.25		1238.29	0.000033	1.68	3383.76	639.65	0.08	98.27		199062	37.7	99370	18.8	-0.5			18.25
Tributary	31258.00		4916.5	1220.01	1238.24		1238.28	0.000034	1.7	3360.17	575.84	0.08	98.27		199161	37.7	99272	18.8	-0.5			18.23
Tributary	31228.00		4916.41	1220.02	1238.24		1238.28	0.000035	1.72	3341.93	511.4	0.08	98.27		199259	37.7	99174	18.8	-1.1			18.22
Tributary	31198.10		4916.35	1220.04	1238.23		1238.28	0.000035	1.73	3330.32	444.47	0.08	98.27		199357	37.8	99075	18.8	-0.5			18.19
Tributary	31168.10		4916.28	1220.05	1238.23		1238.27	0.000036	1.75	3323.83	378.18	0.08	98.27		199455	37.8	98977	18.7	-0.5			18.18
Tributary	31138.20		4916.07	1220.06	1238.23		1238.27	0.000037	1.76	3320.68	302.77	0.08	98.27		199554	37.8	98879	18.7	-0.5			18.17
Tributary	31108.20		4916.1	1220.07	1238.22		1238.27	0.000038	1.77	3321.69	305.01	0.08	98.27		199652	37.8	98780	18.7	-0.5			18.15
Tributary	31078.30		4915.96	1220.08	1238.22		1238.26	0.000038	1.78	3321.86	306.66	0.08	98.27		199750	37.8	98682	18.7	-0.5			18.14
Tributary	31048.30		4915.97	1220.09	1238.21		1238.26	0.000039	1.79	3322.53	307.78	0.08	98.27		199848	37.9	98584	18.7	-0.5			18.12
Tributary	31018.30		4915.83	1220.1	1238.21		1238.26	0.00004	1.8	3323.65	308.58	0.08	98.27		199947	37.9	98486	18.7	-0.5			18.11
Tributary	30988.40		4915.85	1220.11	1238.21		1238.25	0.00004	1.81	3324.81	309.18	0.09	98.27		200045	37.9	98387	18.6	-0.5			18.1
Tributary	30958.40		4915.78	1220.12	1238.2		1238.25	0.000041	1.81	3325.67	309.36	0.09	98.27		200143	37.9	98289	18.6	-0.5			18.08
Tributary	30928.50		4915.7	1220.13	1238.2		1238.24	0.000042	1.82	3327.71	309.48	0.09	98.27		200242	37.9	98191	18.6	-0.5			18.07
Tributary	30898.50		4915.62	1220.14	1238.19		1238.24	0.000042	1.83	3328.56	309.33	0.09	98.27		200340	37.9	98093	18.6	-1.1			18.05
Tributary	30868.60		4915.46	1220.16	1238.19		1238.23	0.000043	1.84	3329.94	309.92	0.09	98.27		200438	38.0	97994	18.6	-0.5			18.03
Tributary	30838.60		4915.33	1220.17	1238.19		1238.23	0.000044	1.84	3331.1	310.24	0.09	98.27		200536	38.0	97896	18.5	-0.5			18.02
Tributary	30808.70		4915.18	1220.18	1238.18		1238.23	0.000044	1.85	3332.51	310.44	0.09	98.27		200635	38.0	97798	18.5	-0.5			18
Tributary	30778.70		4915.4	1220.19	1238.18		1238.22	0.000045	1.86	3335.77	369.16	0.09	98.27		200733	38.0	97700	18.5	-0.5			17.99
Tributary	30748.80		4915.23	1220.2	1238.17		1238.22	0.000046	1.86	3342.63	426.6	0.09	98.27		200831	38.0	97601	18.5	-0.5			17.97
Tributary	30718.80		4915.06	1220.21	1238.17		1238.21	0.000046	1.87	3354.16	482.26	0.09	98.27		200929	38.1	97503	18.5	-0.5			17.96
Tributary	30688.90		4914.84	1220.22	1238.16		1238.21	0.000047	1.88	3367.58	535.25	0.09	98.27		201028	38.1	97405	18.4	-0.5			17.94
Tributary	30658.90		4914.84	1220.23	1238.16		1238.21	0.000048	1.88	3385.27	584.03	0.09	98.27		201126	38.1	97306	18.4	-0.5			17.93
Tributary	30629.00		4914.61	1220.24	1238.16		1238.2	0.000048	1.88	3404.11	627.13	0.09	98.27		201224	38.1	97208	18.4	-0.5			17.92
Tributary	30599.00		4914.52	1220.25	1238.15		1238.2	0.000049	1.89	3426.86	669.72	0.09	98.27		201323	38.1	97110	18.4	-0.5			17.9
Tributary	30569.10		4914.25	1220.26	1238.15		1238.19	0.000049	1.89	3452.58	714.81	0.09	98.27		201421	38.1	97012	18.4	-1.1			17.89
Tributary	30539.10		4914.3	1220.28	1238.14		1238.19	0.00005	1.89	3480.84	754.83	0.09	98.27		201519	38.2	96913	18.4	-0.5			17.86
Tributary	30509.20		4914.07	1220.29	1238.14		1238.18	0.000051	1.89	3509.83	793.16	0.09	98.27		201617	38.2	96815	18.3	-0.5			17.85
Tributary	30479.20		4913.81	1220.3	1238.13		1238.18	0.000051	1.89	3545.12	832.13	0.09	98.27		201716	38.2	96717	18.3	-0.5			17.83
Tributary	30449.20		4913.55	1220.31	1238.13		1238.17	0.000051	1.89	3581.85	891.6	0.09	98.27		201814	38.2	96619	18.3	-0.5			17.82
Tributary	30419.30		4913.43	1220.32	1238.13		1238.17	0.000052	1.89	3624.46	953.92	0.09	98.27		201912	38.2	96520	18.3	-0.5			17.81
Tributary	30389.30		4913.15	1220.33	1238.12		1238.16	0.000052	1.89	3668.73	1018.78	0.09	98.27		202010	38.3	96422	18.3	-0.5			17.79
Tributary	30359.40		4913.06	1220.34	1238.12		1238.16	0.000053	1.88	3720.93	1063.99	0.1	98.27		202109	38.3	96324	18.2	-0.5			17.78
Tributary	30329.40		4912.79	1220.35	1238.11		1238.15	0.000053	1.88	3779.2	1118.43	0.1	98.27		202207	38.3	96225	18.2	-0.5			17.76
Tributary	30299.50		4912.49	1220.36	1238.11		1238.15	0.000053	1.87	3842.36	1170.28	0.1	98.27		202305	38.3	96127	18.2	-0.5			17.75
Tributary	30269.50		4912.39	1220.37	1238.1		1238.14	0.000053	1.87	3912.05	1230.5	0.1	98.27		202404	38.3	96029	18.2	-0.5			17.73
Tributary	30239.60		4912	1220.38	1238.1		1238.14	0.000053	1.86	3989.99	1284.16	0.1	98.27		202502	38.4	95931	18.2	-1.1			17.72
Tributary	30209.60		4911.61	1220.4	1238.09		1238.13	0.000053	1.85	4076.37	1327.88	0.1	98.27		202600	38.4	95832	18.2	-0.5			17.69
Tributary	30179.70		4911.34	1220.41	1238.09		1238.13	0.000053	1.83	4168.04	1374.62	0.09	98.27		202698	38.4	95734	18.1	-0.5			17.68
Tributary	30149.70		4910.96	1220.42	1238.09		1238.12	0.000053	1.82	4269.67	1423.74	0.09	98.27		202797	38.4	95636	18.1	-0.5			17.67
Tributary	30119.80		4910.66	1220.43	1238.08		1238.12	0.000053	1.81	4376.28	1475.74	0.09	98.27		202895	38.4	95538	18.1	-0.5			17.65
Tributary	30089.80		4910.25	1220.44	1238.08		1238.11	0.000052	1.79	4496.77	1527.33	0.09	98.27		202993	38.4	95439	18.1	-0.5			17.64
Tributary	30059.90		4910.36	1220.45	1238.07		1238.11	0.000052	1.77	4621.21	1584.75	0.09	98.27		203091	38.5	95341	18.1	-0.5			17.62
Tributary	30029.90		4910.03	1220.46	1238.07		1238.1	0.000051	1.75	4761.33	1644.54	0.09	98.27		203190	38.5	95243	18.0	-0.5			17.61
Tributary	30000.00		4909.64	1220.47	1238.07		1238.1	0.00005	1.72	4913.12	1711.08	0.09	99.42		203288	38.5	95144	18.0	0.5			17.6
Tributary	29969.70		4909.09	1220.46	1238.06		1238.09	0.000052	1.76	4691.39	1609.04	0.09	99.42		203387	38.5	95045	18.0	0.5			17.6
Tributary	29939.30		4908.84	1220.45	1238.05		1238.09	0.000054	1.79	4498.55	1523.96	0.09	99.42		203487	38.5	94946	18.0	0.5			17.6
Tributary	29909.00		4908.32	1220.44	1238.05		1238.08	0.000055	1.82	4325.1	1450.45	0.1	99.42		203586	38.6	94846	18.0	1.1			17.61
Tributary	29878.70		4908.33	1220.42	1238.04		1238.08	0.000058	1.83	4171.27	1391.23	0.1	99.42		203686	38.6	94747	17.9	0.5			17.62
Tributary	29848.40		4907.89	1220.41	1238.03		1238.07	0.000057	1.87	4035.39	1366.25	0.1	99.42		203785	38.6	94647	17.9	0.5			17.62
Tributary	29818.10		4907.58	1220.4	1238.02		1238.06	0.000057	1.9	3915.99	1328.65	0.1	99.42		203884	38.6	94548	17.9	0.5			17.62
Tributary	29787.80		4907.23	1220.39	1238.02		1238.06	0.000056	1.93	3807.07	1286.29	0.1	99.42		203984	38.6	94449	17.9	0.5			17.63
Tributary	29757.50		4906.95	1220.38	1238.01		1238.05	0.000055	1.95	3717.59	1137.06	0.1	99.42		204083	38.7	94349	17.9	1.1			17.63

Tributary	29727.20		4906.69	1220.36	1238		1238.05	0.000054	1.97	3645.19	3045.98	0.1	99.42		204183	38.7	94250	17.9	0.5			17.64
Tributary	29696.90		4906.47	1220.35	1238		1238.04	0.000053	1.98	3583.12	978.69	0.1	99.42		204282	38.7	94150	17.8	0.5			17.65
Tributary	29666.60		4906.2	1220.34	1237.99		1238.04	0.000052	1.99	3531.53	912.03	0.1	99.42		204382	38.7	94051	17.8	0.5			17.65
Tributary	29636.30		4905.85	1220.33	1237.98		1238.03	0.00005	2	3487.03	346.43	0.1	99.42		204481	38.7	93951	17.8	0.5			17.65
Tributary	29606.00		4905.44	1220.32	1237.98		1238.03	0.000049	2	3446.72	778.83	0.09	99.42		204580	38.7	93852	17.8	0.5			17.66
Tributary	29575.70		4905	1220.31	1237.97		1238.02	0.000048	2	3411.6	713.7	0.09	99.42		204680	38.8	93753	17.8	1.1			17.66
Tributary	29545.40		4904.54	1220.29	1237.97		1238.02	0.000047	2	3381.93	645.94	0.09	99.42		204779	38.8	93653	17.7	0.5			17.68
Tributary	29515.10		4904.54	1220.28	1237.96		1238.01	0.000046	2	3357.21	569.3	0.09	99.42		204879	38.8	93554	17.7	0.5			17.68
Tributary	29484.80		4904.05	1220.27	1237.96		1238.01	0.000045	2	3347.22	537.69	0.09	99.42		204978	38.8	93454	17.7	0.5			17.69
Tributary	29454.50		4903.8	1220.26	1237.95		1238.01	0.000044	1.99	3388.78	1002.11	0.09	99.42		205077	38.8	93355	17.7	0.5			17.69
Tributary	29424.20		4903.22	1220.25	1237.95		1238	0.000043	1.99	3480.86	1422.06	0.09	99.42		205177	38.9	93256	17.7	1.1			17.7
Tributary	29393.90		4903.15	1220.23	1237.95		1238	0.000042	1.98	3604.36	1536.96	0.09	99.42		205276	38.9	93156	17.6	0.5			17.72
Tributary	29363.60		4902.7	1220.22	1237.94		1237.99	0.000042	1.97	3729.44	1627.83	0.09	99.42		205376	38.9	93057	17.6	0.5			17.72
Tributary	29333.30		4902.01	1220.21	1237.94		1237.99	0.000041	1.96	3868.47	1723.42	0.09	99.42		205475	38.9	92957	17.6	0.5			17.73
Tributary	29303.00		4902.08	1220.2	1237.94		1237.98	0.00004	1.94	4018.63	1814.09	0.09	99.42		205575	38.9	92858	17.6	0.5			17.74
Tributary	29272.70		4901.61	1220.19	1237.93		1237.98	0.000039	1.92	4173.1	1897.53	0.09	99.42		205674	39.0	92758	17.6	1.1			17.74
Tributary	29242.40		4901.24	1220.17	1237.93		1237.98	0.000038	1.9	4336.41	1976.16	0.08	99.42		205773	39.0	92659	17.5	0.5			17.76
Tributary	29212.10		4900.77	1220.16	1237.93		1237.97	0.000037	1.88	4505.74	2041.43	0.08	99.42		205873	39.0	92560	17.5	0.5			17.77
Tributary	29181.80		4900.27	1220.15	1237.93		1237.97	0.000036	1.86	4688.22	2100.4	0.08	99.42		205972	39.0	92460	17.5	0.5			17.78
Tributary	29151.50		4899.72	1220.14	1237.92		1237.96	0.000035	1.83	4879.96	2156.25	0.08	99.42		206072	39.0	92361	17.5	0.5			17.78
Tributary	29121.20		4898.86	1220.13	1237.92		1237.96	0.000034	1.8	5087.58	2200.57	0.08	99.42		206171	39.0	92261	17.5	1.1			17.79
Tributary	29090.90		4898.54	1220.11	1237.92		1237.96	0.000033	1.77	5311.08	2272.25	0.08	99.42		206271	39.1	92162	17.5	0.5			17.81
Tributary	29060.60		4897.79	1220.1	1237.92		1237.95	0.000033	1.74	5539.26	2351.8	0.08	99.42		206370	39.1	92062	17.4	0.5			17.82
Tributary	29030.30		4897.56	1220.09	1237.92		1237.95	0.000032	1.71	5777.48	2420.59	0.08	99.42		206469	39.1	91963	17.4	0.5			17.83
Tributary	29000.00		4896.77	1220.08	1237.91		1237.94	0.000031	1.68	6019.34	2478.95	0.08	99.42		206569	39.1	91864	17.4	-18.6			17.83
Tributary	28969.70		4896.97	1220.43	1237.91		1237.94	0.000033	1.72	5762.58	2516.62	0.08	99.42		206668	39.1	91764	17.4	-18.1			17.48
Tributary	28939.30		4896.27	1220.77	1237.91		1237.94	0.000035	1.76	5508.04	2557.3	0.08	99.42		206768	39.2	91665	17.4	-18.6			17.14
Tributary	28909.00		4895.58	1221.12	1237.9		1237.94	0.000038	1.8	5251.42	2587.78	0.08	99.42		206867	39.2	91565	17.3	-18.6			16.78
Tributary	28878.70		4895.43	1221.47	1237.9		1237.93	0.000039	1.83	5050.09	2398.33	0.09	99.42		206966	39.2	91466	17.3	-18.6			16.43
Tributary	28848.40		4894.79	1221.82	1237.89		1237.93	0.000042	1.86	4904.75	2368.58	0.09	99.42		207066	39.2	91367	17.3	-18.6			16.07
Tributary	28818.10		4894.75	1222.17	1237.89		1237.93	0.000044	1.89	4778.9	2329.84	0.09	99.42		207165	39.2	91267	17.3	-18.1			15.72
Tributary	28787.80		4894.25	1222.51	1237.88		1237.92	0.000046	1.92	4672.15	2348.69	0.09	99.42		207265	39.3	91168	17.3	-18.6			15.37
Tributary	28757.50		4893.76	1222.86	1237.87		1237.92	0.000049	1.96	4622.48	2678.73	0.09	99.42		207364	39.3	91068	17.2	-18.6			15.01
Tributary	28727.20		4893.04	1223.21	1237.87		1237.92	0.000053	2.01	4603.86	2783.3	0.1	99.42		207464	39.3	90969	17.2	-18.6			14.66
Tributary	28696.90		4892.98	1223.56	1237.86		1237.91	0.000056	2.04	4611.54	2878.18	0.1	99.42		207563	39.3	90869	17.2	-18.6			14.3
Tributary	28666.60		4892.38	1223.91	1237.85		1237.91	0.000064	2.15	4641.79	3050.77	0.11	99.42		207662	39.3	90770	17.2	-18.1			13.94
Tributary	28636.30		4891.5	1224.25	1237.85		1237.9	0.000066	2.16	4692.31	3153.67	0.11	99.42		207762	39.3	90671	17.2	-18.6			13.6
Tributary	28606.00		4890.95	1224.6	1237.84		1237.89	0.000069	2.17	4751.11	3286.2	0.11	99.42		207861	39.4	90571	17.2	-18.6			13.24
Tributary	28575.70		4890.33	1224.95	1237.83		1237.89	0.000071	2.17	4837.87	3348.15	0.11	99.42		207961	39.4	90472	17.1	-18.6			12.88
Tributary	28545.40		4889.69	1225.3	1237.82		1237.89	0.000082	2.3	4901.86	3374.56	0.12	99.42		208060	39.4	90372	17.1	-18.6			12.52
Tributary	28515.10		4889.06	1225.65	1237.82		1237.88	0.000083	2.28	5012.77	3341.81	0.12	99.42		208160	39.4	90273	17.1	-18.1			12.17
Tributary	28484.80		4888.31	1225.99	1237.81		1237.87	0.000084	2.25	5124.79	3279.91	0.12	99.42		208259	39.4	90173	17.1	-18.6			11.82
Tributary	28454.50		4887.72	1226.34	1237.8		1237.86	0.000084	2.22	5241.58	3251.32	0.12	99.42		208358	39.5	90074	17.1	-18.6			11.46
Tributary	28424.20		4887.15	1226.69	1237.8		1237.85	0.000086	2.19	5394.03	3192.32	0.12	99.42		208458	39.5	89975	17.0	-18.6			11.11
Tributary	28393.90		4886.7	1227.04	1237.79		1237.84	0.000085	2.14	5558.38	3068.33	0.12	99.42		208557	39.5	89875	17.0	-18.6			10.75
Tributary	28363.60		4886.23	1227.39	1237.79		1237.83	0.000085	2.09	5726.42	3018.05	0.12	99.42		208657	39.5	89776	17.0	-18.1			10.4
Tributary	28333.30		4885.5	1227.73	1237.78		1237.82	0.000083	2.04	5931.35	2939.25	0.12	99.42		208756	39.5	89676	17.0	-18.6			10.05
Tributary	28303.00		4884.75	1228.08	1237.77		1237.81	0.000082	1.98	6134.85	2975.64	0.11	99.42		208855	39.6	89577	17.0	-18.6			9.69
Tributary	28272.70		4884.08	1228.43	1237.77		1237.8	0.000081	1.91	6353.47	3088.17	0.11	99.42		208955	39.6	89478	16.9	-18.6			9.34
Tributary	28242.40		4883.57	1228.78	1237.76		1237.79	0.000079	1.84	6577.4	3091.28	0.11	99.42		209054	39.6	89378	16.9	-18.6			8.98
Tributary	28212.10		4882.54	1229.13	1237.76		1237.78	0.000078	1.79	6800.6	3086.01	0.11	99.42		209154	39.6	89279	16.9	-18.1			8.63
Tributary	28181.80		4882.69	1229.47	1237.75		1237.77	0.000075	1.71	7029.8	3080.51	0.11	99.42		209253	39.6	89179	16.9	-18.6			8.28
Tributary	28151.50		4881.88	1229.82	1237.74		1237.76	0.000073	1.64	7261.59	3095.09	0.1	99.42		209353	39.7	89080	16.9	-18.6			7.92
Tributary	28121.20		4881.34	1230.17	1237.74		1237.75	0.00007	1.56	7489.22	3006.61	0.1	99.42		209452	39.7	88980	16.9	-18.6			7.57
Tributary	28090.90		4880.56	1230.52	1237.73		1237.75	0.000069	1.5	7722.04	3017.85	0.1	99.42		209551	39.7	88881	16.8	-18.6			7.21
Tributary	28060.60		4880.15	1230.87	1237.73		1237.74	0.000066	1.42	7956.18	3021.32	0.1	99.42		209651	39.7	88782	16.8	-18.1			6.86
Tributary	28030.30		4879.31	1231.21	1237.72		1237.73	0.000064	1.34	8186.9	3022.58	0.09	99.42		209750	39.7	88682	16.8	-18.6			6.51
Tributary	28000.00		4879.32	1231.56	1237.72		1237.73	0.000061	1.26	8420.67	3019.46	0.09	99.42		209850	39.7	88583	16.8	0.0			6.16
Tributary	27969.70		4878.67	1231.56	1237.71		1237.72	0.000062	1.27	8281.26	2953.87	0.09	99.42		209949	39.8	88483	16.8	0.0			6.15
Tributary	27939.30		4878.02	1231.56	1237.7		1237.71	0.000063	1.28	8159.14	2868.58	0.09	99.42		210048	39.8	88384	16.7	0.0			6.14
Tributary	27909.00		4877.26	1231.56	1237.7		1237.71	0.000064	1.28	8052.76	2765.19	0.09	99.42		210148	39.8	88285	16.7	0.0			6.14
Tributary	27878.70		4876.71	1231.56	1237.69		1237.7	0.000065	1.29	7964.5	2620.99	0.09	99.42		210247	39.8	88185	16.7	0.0			6.13
Tributary	27848.40		4876.19	1231.56	1237.69		1237.7	0.000066	1.29	7915.24	2499.19	0.1	99.42		210347	39.8	88086	16.7	0.0			6.13
Tributary	27818.10		4875.58	1231.56	1237.68		1237.69	0.000067	1.3	7877.31	2438.63	0.1	99.42		210446	39.9	87986	16.7	0.0			6.12
Tributary	27787.80		4875.17	1231.56	1237.67		1237.68	0.000068	1.3	7848.78	2403.85	0.1	99.42		210546	39.9	87887	16.6	0.0			6.11
Tributary	27757.50		4874.53	1231.56	1237.67		1237.68	0.000069	1.3	7829.35	2385.59	0.1	99.42		210645	39.9	87787	16.6	0.0			6.11
Tributary	27727.20		4873.73	1231.56	1237.66		1237.67	0.000069	1.31	7812.1	2380.15	0.1	99.42		210744	39.9	87688	16.6	0.0			6.1
Tributary	27696.90		4873.22	1231.56	1237.65		1237.66	0.00007	1.31	7798.71	2377.08	0.1	99.42		210844	39.9	87589	16.6	0.0			6.09
Tributary	27666.60		4872.78	1231.56	1237.65		1237.66	0.000071	1.31	7781.8	2375.5	0.1	99.42		210943	40.0	87489	16.6	0.0			6.09
Tributary	27636.30		4872.17	1231.56	1237.64		1237.65	0.000071	1.31	7768.17	2376.82	0.1	99.42		211043	40.0	87390	16.6	0.0			6.08
Tributary	27606.00		4872.09	1231.56	1237.63		1237.64	0.000072	1.31	7749.74	2375.55	0.1	99.42		211142	40.0	87290	16.5	0.0			6.07
Tributary	27575.70		4871.41	1231.56	1237.63		1237.64	0.000073	1.32	7738.91	2392.06	0.1	99.42		211242	40.0	87191	16.5	0.0			6.07
Tributary	27545.40		4870.8	1231.56	1237.62		1237.63	0.000074	1.32	7725.4	2411.71	0.1	99.42		211341	40.0	87091	16.5	0.0			6.06
Tributary	27515.10		4870.25	1231.56	1237.61		1237.62	0.000075	1.32	7717.65	2433.38	0.1	99.42		211440	40.0	86992	16.5	0.0			6.05
Tributary	27484.80		4869.74	1231.56	1237.6		1237.61	0.000076	1.33	7713.76	2453.16	0.1	99.42		211540	40.1	86893	16.5	0.0			6.04
Tributary	27454.50		4869.24	1231.56	1237.6		1237.61	0.000076	1.33	7711.88	2465.17	0.1	99.42		211639	40.1	86793	16.4	0.0			6.04
Tributary	27424.20		4868.55	1231.56	1237.59		1237.6	0.000077	1.33	7711.39	2488.33	0.1	99.42		211739	40.1	86694	16.4	0.0			6.03
Tributary	27393.90		4868.22	1231.56	1237.58		1237.59	0.000077	1.33	7711.59	2509.19	0.1	99.42		211838	40.1	86594	16.4	0.0			6.02
Tributary	27363.60		4867.62	1231.56	1237.57		1237.58	0.000078	1.32	7714.25	2523.65	0.1	99.42		211937	40.1	86495	16.4	0.0			6.01
Tributary	27333.30		4866.98	1231.56	1237.57		1237.58	0.000078	1.32	7722.95	2539.74	0.1	99.42		212037	40.2	86396	16.4	0.0			6.01
Tributary	27303.00		4866.37	1231.56	1237.56		1237.57	0.000079	1.32	7731.18	2567.3	0.1	99.42		212136	40.2	86296	16.3	0.0			6
Tributary	27272.70		4865.88	1231.56	1237.55		1237.56	0.000079	1.32	7737.49	2602.46	0.1	99.42		212236	40.2	86197	16.3	0.0			5.99
Tributary	27242.40		4865.27	1231.56	1237.54		1237.55	0.00008	1.32	7743.42	2633.89	0.1	99.42		212335	40.2	86097	16.3	0.0			5.98

Tributary	27212.10		4865.21	1231.56	1237.54		1237.55	0.00008	1.32	7768.12	2673.55	0.1	99.42		212435	40.2	85998	16.3	0.0			5.98
Tributary	27181.80		4864.32	1231.56	1237.53		1237.54	0.000081	1.32	7788.19	2708.92	0.1	99.42		212534	40.3	85898	16.3	0.0			5.97
Tributary	27151.50		4863.36	1231.56	1237.52		1237.53	0.000081	1.31	7819.02	2733.19	0.1	99.42		212633	40.3	85799	16.2	0.0			5.96
Tributary	27121.20		4862.5	1231.56	1237.51		1237.52	0.000082	1.31	7853.75	2757.53	0.1	99.42		212733	40.3	85700	16.2	0.0			5.95
Tributary	27090.90		4862.76	1231.56	1237.51		1237.51	0.000081	1.31	7896.44	2774.77	0.1	99.42		212832	40.3	85600	16.2	0.0			5.95
Tributary	27060.60		4862.04	1231.56	1237.5		1237.51	0.000081	1.3	7936.34	2792.51	0.1	99.42		212932	40.3	85501	16.2	0.0			5.94
Tributary	27030.30		4861.26	1231.56	1237.49		1237.5	0.00008	1.29	7981.79	2808.07	0.1	99.42		213031	40.3	85401	16.2	0.0			5.93
Tributary	27000.00		4860.48	1231.56	1237.48		1237.49	0.000079	1.28	8024.2	2824.13	0.1	99.42		213131	40.4	85302	16.2	0.0			5.92
Tributary	26969.70		4859.75	1231.56	1237.47		1237.48	0.000079	1.27	8050.46	2819.04	0.1	99.42		213230	40.4	85202	16.1	0.0			5.91
Tributary	26939.30		4858.92	1231.56	1237.47		1237.48	0.000078	1.26	8083.01	2828.02	0.1	99.42		213329	40.4	85103	16.1	0.0			5.91
Tributary	26909.00		4858.75	1231.56	1237.46		1237.47	0.000078	1.26	8110.52	2837.96	0.1	99.42		213429	40.4	85004	16.1	0.0			5.9
Tributary	26878.70		4857.75	1231.56	1237.45		1237.46	0.000077	1.25	8144.7	2847.47	0.1	99.42		213528	40.4	84904	16.1	0.0			5.89
Tributary	26848.40		4857.03	1231.56	1237.45		1237.45	0.000077	1.24	8188.29	2851.48	0.1	99.42		213628	40.5	84805	16.1	0.0			5.89
Tributary	26818.10		4856.49	1231.56	1237.44		1237.45	0.000076	1.23	8235.59	2851.16	0.1	99.42		213727	40.5	84705	16.0	0.0			5.88
Tributary	26787.80		4855.99	1231.56	1237.43		1237.44	0.000075	1.22	8278.96	2848.97	0.1	99.42		213826	40.5	84606	16.0	0.5			5.87
Tributary	26757.50		4855.49	1231.55	1237.42		1237.43	0.000074	1.22	8335.14	2858.93	0.1	99.42		213926	40.5	84507	16.0	0.0			5.87
Tributary	26727.20		4854.64	1231.55	1237.42		1237.43	0.000073	1.2	8390.67	2873.9	0.1	99.42		214025	40.5	84407	16.0	0.0			5.87
Tributary	26696.90		4853.93	1231.55	1237.41		1237.42	0.000072	1.19	8445.96	2886.48	0.1	99.42		214125	40.6	84308	16.0	0.0			5.86
Tributary	26666.60		4853.25	1231.55	1237.4		1237.41	0.000071	1.18	8508.82	2899.94	0.1	99.42		214224	40.6	84208	15.9	0.0			5.85
Tributary	26636.30		4852.36	1231.55	1237.4		1237.4	0.000069	1.17	8576.19	2908.78	0.09	99.42		214324	40.6	84109	15.9	0.0			5.85
Tributary	26606.00		4851.47	1231.55	1237.39		1237.4	0.000068	1.16	8645.03	2917.35	0.09	99.42		214423	40.6	84009	15.9	0.0			5.84
Tributary	26575.70		4850.6	1231.55	1237.38		1237.39	0.000067	1.14	8707.95	2924.22	0.09	99.42		214522	40.6	83910	15.9	0.0			5.83
Tributary	26545.40		4850.17	1231.55	1237.38		1237.39	0.000065	1.13	8782.35	2933.95	0.09	99.42		214622	40.6	83811	15.9	0.0			5.83
Tributary	26515.10		4849.39	1231.55	1237.37		1237.38	0.000064	1.12	8857	2973.6	0.09	99.42		214721	40.7	83711	15.9	0.0			5.82
Tributary	26484.80		4848.4	1231.55	1237.37		1237.37	0.000063	1.11	8952.65	3139.51	0.09	99.42		214821	40.7	83612	15.8	0.5			5.82
Tributary	26454.50		4847.76	1231.54	1237.36		1237.37	0.000061	1.09	9059.1	3180.4	0.09	99.42		214920	40.7	83512	15.8	0.0			5.82
Tributary	26424.20		4846.55	1231.54	1237.35		1237.36	0.000064	1.12	9175.73	3191.76	0.09	99.42		215019	40.7	83413	15.8	0.0			5.81
Tributary	26393.90		4845.97	1231.54	1237.35		1237.35	0.000062	1.1	9290.09	3195.31	0.09	99.42		215119	40.7	83314	15.8	0.0			5.81
Tributary	26363.60		4845.14	1231.54	1237.34		1237.35	0.000059	1.08	9425.13	3205.72	0.09	99.42		215218	40.8	83214	15.8	0.0			5.8
Tributary	26333.30		4844.79	1231.54	1237.34		1237.34	0.000057	1.06	9555.92	3211.88	0.09	99.42		215318	40.8	83115	15.7	0.0			5.8
Tributary	26303.00		4843.88	1231.54	1237.33		1237.34	0.000055	1.04	9697.13	3215.51	0.08	99.42		215417	40.8	83015	15.7	0.0			5.79
Tributary	26272.70		4843.17	1231.54	1237.33		1237.33	0.000053	1.02	9846.85	3236.37	0.08	99.42		215517	40.8	82916	15.7	0.0			5.79
Tributary	26242.40		4842.25	1231.54	1237.32		1237.33	0.000051	0.99	10001.27	3248.99	0.08	99.42		215616	40.8	82816	15.7	0.0			5.78
Tributary	26212.10		4841.52	1231.54	1237.32		1237.32	0.000048	0.97	10166.13	3261.16	0.08	99.42		215715	40.9	82717	15.7	0.0			5.78
Tributary	26181.80		4840.83	1231.54	1237.31		1237.32	0.000046	0.95	10336.44	3275.22	0.08	99.42		215815	40.9	82618	15.6	0.5			5.77
Tributary	26151.50		4840.1	1231.53	1237.31		1237.31	0.000044	0.93	10511.12	3301.7	0.08	99.42		215914	40.9	82518	15.6	0.0			5.78
Tributary	26121.20		4839.26	1231.53	1237.31		1237.31	0.000042	0.91	10714.48	3350.14	0.07	99.42		216014	40.9	82419	15.6	0.0			5.78
Tributary	26090.90		4838.15	1231.53	1237.3		1237.31	0.00004	0.89	10936.68	3368.43	0.07	99.42		216113	40.9	82319	15.6	0.0			5.77
Tributary	26060.60		4836.77	1231.53	1237.3		1237.3	0.000038	0.86	11174.55	3389.9	0.07	99.42		216213	40.9	82220	15.6	0.0			5.77
Tributary	26030.30		4835.75	1231.53	1237.29		1237.3	0.000035	0.84	11434.68	3430.3	0.07	99.42		216312	41.0	82120	15.6	0.0			5.76
Tributary	26000.00		4835.21	1231.53	1237.29		1237.29	0.000033	0.81	11748.96	3488.59	0.07	99.42		216411	41.0	82021	15.5	0.5			5.76
Tributary	25969.70		4834.35	1231.52	1237.29		1237.29	0.000034	0.81	11723.17	3489.93	0.07	99.42		216511	41.0	81922	15.5	0.5			5.77
Tributary	25939.30		4834.3	1231.51	1237.29		1237.29	0.000034	0.82	11697.71	3505.02	0.07	99.42		216610	41.0	81822	15.5	0.5			5.78
Tributary	25909.00		4833.49	1231.5	1237.28		1237.29	0.000034	0.82	11676.23	3527.12	0.07	99.42		216710	41.0	81723	15.5	0.5			5.78
Tributary	25878.70		4832.49	1231.49	1237.28		1237.28	0.000035	0.82	11648.48	3531.45	0.07	99.42		216809	41.1	81623	15.5	0.5			5.79
Tributary	25848.40		4831.11	1231.48	1237.28		1237.28	0.000035	0.83	11628.24	3530.41	0.07	99.42		216908	41.1	81524	15.4	0.0			5.8
Tributary	25818.10		4829.87	1231.48	1237.27		1237.28	0.000035	0.83	11603.55	3529.26	0.07	99.42		217008	41.1	81425	15.4	0.5			5.79
Tributary	25787.80		4828.96	1231.47	1237.27		1237.27	0.000035	0.83	11576.14	3528.4	0.07	99.42		217107	41.1	81325	15.4	0.5			5.8
Tributary	25757.50		4827.96	1231.46	1237.27		1237.27	0.000035	0.83	11554.78	3527.61	0.07	99.42		217207	41.1	81226	15.4	0.5			5.81
Tributary	25727.20		4827.05	1231.45	1237.26		1237.27	0.000036	0.83	11530.94	3526.53	0.07	99.42		217306	41.2	81126	15.4	0.5			5.81
Tributary	25696.90		4826.53	1231.44	1237.26		1237.26	0.000036	0.84	11507.67	3525.65	0.07	99.42		217406	41.2	81027	15.3	0.5			5.82
Tributary	25666.60		4825.68	1231.43	1237.26		1237.26	0.000036	0.84	11485.97	3524.34	0.07	99.42		217505	41.2	80927	15.3	0.5			5.83
Tributary	25636.30		4824.65	1231.42	1237.25		1237.26	0.000036	0.84	11458.67	3523.81	0.07	99.42		217604	41.2	80828	15.3	0.5			5.83
Tributary	25606.00		4823.64	1231.41	1237.25		1237.25	0.000036	0.84	11436.5	3522.85	0.07	99.42		217704	41.2	80729	15.3	0.5			5.84
Tributary	25575.70		4822.91	1231.4	1237.25		1237.25	0.000037	0.85	11416.23	3521.26	0.07	99.42		217803	41.3	80629	15.3	0.5			5.85
Tributary	25545.40		4822.41	1231.39	1237.24		1237.25	0.000037	0.85	11387.04	3519.77	0.07	99.42		217903	41.3	80530	15.3	0.0			5.85
Tributary	25515.10		4821.49	1231.39	1237.24		1237.24	0.000037	0.85	11358.07	3516.75	0.07	99.42		218002	41.3	80430	15.2	0.5			5.85
Tributary	25484.80		4820.69	1231.38	1237.23		1237.24	0.000037	0.85	11339.08	3514.35	0.07	99.42		218102	41.3	80331	15.2	0.5			5.85
Tributary	25454.50		4819.97	1231.37	1237.23		1237.23	0.000037	0.85	11313.29	3512.4	0.07	99.42		218201	41.3	80231	15.2	0.5			5.86
Tributary	25424.20		4818.79	1231.36	1237.23		1237.23	0.000038	0.86	11293.39	3509.63	0.07	99.42		218300	41.3	80132	15.2	0.5			5.87
Tributary	25393.90		4817.71	1231.35	1237.22		1237.23	0.000038	0.86	11262.78	3506.6	0.07	99.42		218400	41.4	80033	15.2	0.5			5.87
Tributary	25363.60		4816.69	1231.34	1237.22		1237.22	0.000038	0.86	11239.25	3504.12	0.07	99.42		218499	41.4	79933	15.1	0.5			5.88
Tributary	25333.30		4815.54	1231.33	1237.22		1237.22	0.000038	0.86	11217.62	3502.62	0.07	99.42		218599	41.4	79834	15.1	0.5			5.89
Tributary	25303.00		4814.49	1231.32	1237.21		1237.22	0.000039	0.86	11191.43	3498.96	0.07	99.42		218698	41.4	79734	15.1	0.5			5.89
Tributary	25272.70		4813.81	1231.31	1237.21		1237.21	0.000039	0.87	11166.63	3495.1	0.07	99.42		218797	41.4	79635	15.1	0.0			5.9
Tributary	25242.40		4812.86	1231.31	1237.21		1237.21	0.000039	0.87	11146.06	3492.58	0.07	99.42		218897	41.5	79536	15.1	0.5			5.9
Tributary	25212.10		4811.77	1231.3	1237.2		1237.21	0.000039	0.87	11121.48	3496.91	0.07	99.42		218996	41.5	79436	15.0	0.5			5.9
Tributary	25181.80		4811.01	1231.29	1237.2		1237.2	0.000039	0.87	11099.21	3493.68	0.07	99.42		219096	41.5	79337	15.0	0.5			5.91
Tributary	25151.50		4810.22	1231.28	1237.19		1237.2	0.00004	0.87	11072.29	3486.75	0.07	99.42		219195	41.5	79237	15.0	0.5			5.91
Tributary	25121.20		4809.08	1231.27	1237.19		1237.19	0.00004	0.88	11049.24	3484.04	0.07	99.42		219295	41.5	79138	15.0	0.5			5.92
Tributary	25090.90		4808.82	1231.26	1237.19		1237.19	0.00004	0.88	11029.67	3485.6	0.07	99.42		219394	41.6	79038	15.0	0.5			5.93
Tributary	25060.60		4807.98	1231.25	1237.18		1237.19	0.00004	0.88	11007.26	3479.53	0.07	99.42		219493	41.6	78939	15.0	0.5			5.93
Tributary	25030.30		4806.89	1231.24	1237.18		1237.18	0.00004	0.88	10984.51	3476.46	0.07	99.42		219593	41.6	78840	14.9	0.5			5.94
Tributary	25000.00		4805.76	1231.23	1237.17		1237.18	0.000041	0.89	10960.74	3473.93	0.07	99.42		219692	41.6	78740	14.9	0.5			5.94
Tributary	24969.70		4804.46	1231.22	1237.17		1237.17	0.000041	0.89	10938.21	3472.74	0.07	99.42		219792	41.6	78641	14.9	0.0			5.95
Tributary	24939.30		4803.17	1231.22	1237.17		1237.17	0.000041	0.89	10916.97	3469.72	0.07	99.42		219891	41.6	78541	14.9	0.5			5.95
Tributary	24909.00		4802.22	1231.21	1237.16		1237.17	0.000041	0.89	10885.75	3465.1	0.07	99.42		219990	41.7	78442	14.9	0.5			5.95
Tributary	24878.70		4801.23	1231.2	1237.16		1237.16	0.000041	0.89	10876.15	3461.9	0.07	99.42		220090	41.7	78343	14.8	0.5			5.96
Tributary	24848.40		4800.24	1231.19	1237.15		1237.16	0.000042	0.89	10852.64	3461.04	0.07	99.42		220189	41.7	78243	14.8	0.5			5.96
Tributary	24818.10		4798.93	1231.18	1237.15		1237.15	0.000042	0.9	10823.99	3460.7	0.07	99.42		220289	41.7	78144	14.8	0.5			5.97
Tributary	24787.80		4797.65	1231.17	1237.15		1237.15	0.000042	0.9	10802.09	3460.57	0.07	99.42		220388	41.7	78044	14.8	0.5			5.98
Tributary	24757.50		4796.82	1231.16	1237.14		1237.15	0.000042	0.9	10783.17	3460.19	0.07	99.42		220488	41.8	77945	14.8	0.5			5.98
Tributary	24727.20		4796.08	1231.15	1237.14		1237.14	0.000043	0.91	10760.8	3460.06	0.07	99.42		220587	41.8	77845	14.7	0.5			5.99

Tributary	24696.90		4795.45	1231.14	1237.13		1237.14	0.000043	0.91	10740.88	3459.94	0.07	99.42		220686	41.8	77746	14.7	0.0			5.99
Tributary	24666.60		4794.81	1231.14	1237.13		1237.13	0.000043	0.91	10718.6	3459.74	0.07	99.42		220786	41.8	77647	14.7	0.5			5.99
Tributary	24636.30		4794.03	1231.13	1237.13		1237.13	0.000043	0.91	10692.97	3459.76	0.07	99.42		220885	41.8	77547	14.7	0.5			6
Tributary	24606.00		4793.15	1231.12	1237.12		1237.13	0.000044	0.92	10666.15	3459.43	0.07	99.42		220985	41.9	77448	14.7	0.5			6
Tributary	24575.70		4792.11	1231.11	1237.12		1237.12	0.000044	0.92	10647.87	3459.48	0.07	99.42		221084	41.9	77348	14.6	0.5			6.01
Tributary	24545.40		4790.97	1231.1	1237.11		1237.12	0.000044	0.92	10626.89	3459.69	0.08	99.42		221184	41.9	77249	14.6	0.5			6.01
Tributary	24515.10		4789.28	1231.09	1237.11		1237.11	0.000044	0.92	10601.3	3459.88	0.08	99.42		221283	41.9	77149	14.6	0.5			6.02
Tributary	24484.80		4789.67	1231.08	1237.1		1237.11	0.000045	0.93	10579.57	3459.64	0.08	99.42		221382	41.9	77050	14.6	0.5			6.02
Tributary	24454.50		4788.43	1231.07	1237.1		1237.1	0.000045	0.93	10553.53	3457.81	0.08	99.42		221482	41.9	76951	14.6	0.5			6.03
Tributary	24424.20		4787.07	1231.06	1237.1		1237.1	0.000045	0.93	10529.83	3456.71	0.08	99.42		221581	42.0	76851	14.6	0.5			6.04
Tributary	24393.90		4786.02	1231.05	1237.09		1237.1	0.000045	0.93	10513.64	3454.19	0.08	99.42		221681	42.0	76752	14.5	0.0			6.04
Tributary	24363.60		4785.1	1231.05	1237.09		1237.09	0.000046	0.94	10490.84	3451.57	0.08	99.42		221780	42.0	76652	14.5	0.5			6.04
Tributary	24333.30		4784.77	1231.04	1237.08		1237.09	0.000046	0.94	10468.72	3450.15	0.08	99.42		221879	42.0	76553	14.5	0.5			6.04
Tributary	24303.00		4783.7	1231.03	1237.08		1237.08	0.000046	0.94	10446.44	3448.8	0.08	99.42		221979	42.0	76454	14.5	0.5			6.05
Tributary	24272.70		4782.7	1231.02	1237.07		1237.08	0.000046	0.94	10428.02	3446.24	0.08	99.42		222078	42.1	76354	14.5	0.5			6.05
Tributary	24242.40		4781.11	1231.01	1237.07		1237.07	0.000047	0.95	10404.4	3446.17	0.08	99.42		222178	42.1	76255	14.4	0.5			6.06
Tributary	24212.10		4781.02	1231	1237.07		1237.07	0.000047	0.95	10386.74	3442.83	0.08	99.42		222277	42.1	76155	14.4	0.5			6.07
Tributary	24181.80		4779.84	1230.99	1237.06		1237.07	0.000047	0.95	10363.67	3442.34	0.08	99.42		222377	42.1	76056	14.4	0.5			6.07
Tributary	24151.50		4779.01	1230.98	1237.06		1237.06	0.000047	0.95	10349.3	3440.27	0.08	99.42		222476	42.1	75956	14.4	0.5			6.08
Tributary	24121.20		4778.14	1230.97	1237.05		1237.06	0.000048	0.96	10322.97	3435.95	0.08	99.42		222575	42.2	75857	14.4	0.0			6.08
Tributary	24090.90		4777.1	1230.97	1237.05		1237.05	0.000048	0.96	10307.6	3432.84	0.08	99.42		222675	42.2	75758	14.3	0.5			6.08
Tributary	24060.60		4775.76	1230.96	1237.04		1237.05	0.000048	0.96	10280.44	3429.86	0.08	99.42		222774	42.2	75658	14.3	0.5			6.08
Tributary	24030.30		4774.59	1230.95	1237.04		1237.04	0.000048	0.96	10267.81	3428.08	0.08	99.42		222874	42.2	75559	14.3	0.5			6.09
Tributary	24000.00		4773.72	1230.94	1237.03		1237.04	0.000048	0.96	10245.68	3424.67	0.08	99.42		222973	42.2	75459	14.3	0.5			6.09
Tributary	23969.70		4772.99	1230.93	1237.03		1237.03	0.000048	0.96	10235.78	3419.53	0.08	99.42		223073	42.2	75360	14.3	0.5			6.1
Tributary	23939.30		4771.58	1230.92	1237.02		1237.03	0.000049	0.97	10214.03	3412.77	0.08	99.42		223172	42.3	75260	14.3	0.5			6.1
Tributary	23909.00		4770.63	1230.91	1237.02		1237.02	0.000048	0.96	10200.99	3386.95	0.08	99.42		223271	42.3	75161	14.2	0.5			6.11
Tributary	23878.70		4769.77	1230.9	1237.02		1237.02	0.000048	0.96	10187.2	3369.15	0.08	99.42		223371	42.3	75062	14.2	0.5			6.12
Tributary	23848.40		4768.9	1230.89	1237.01		1237.02	0.000048	0.96	10173.54	3354.86	0.08	99.42		223470	42.3	74962	14.2	0.5			6.12
Tributary	23818.10		4768.18	1230.88	1237.01		1237.01	0.000048	0.96	10159.37	3334	0.08	99.42		223570	42.3	74863	14.2	0.0			6.13
Tributary	23787.80		4767.39	1230.88	1237		1237.01	0.000048	0.96	10150.44	3347.49	0.08	99.42		223669	42.4	74763	14.2	0.5			6.12
Tributary	23757.50		4766.11	1230.87	1237		1237	0.000048	0.96	10138.67	3344.83	0.08	99.42		223768	42.4	74664	14.1	0.5			6.13
Tributary	23727.20		4764.92	1230.86	1236.99		1237	0.000048	0.96	10133.18	3342.34	0.08	99.42		223868	42.4	74565	14.1	0.5			6.13
Tributary	23696.90		4764.23	1230.85	1236.99		1236.99	0.000047	0.96	10129.76	3339.83	0.08	99.42		223967	42.4	74465	14.1	0.5			6.14
Tributary	23666.60		4763.27	1230.84	1236.98		1236.99	0.000047	0.96	10123.65	3335.3	0.08	99.42		224067	42.4	74366	14.1	0.5			6.14
Tributary	23636.30		4762.25	1230.83	1236.98		1236.98	0.000048	0.96	10114.77	3334.84	0.08	99.42		224166	42.5	74266	14.1	0.5			6.15
Tributary	23606.00		4761.27	1230.82	1236.97		1236.98	0.000047	0.96	10117.03	3364.17	0.08	99.42		224266	42.5	74167	14.0	0.5			6.15
Tributary	23575.70		4760.07	1230.81	1236.97		1236.97	0.000048	0.96	10116.95	3388.29	0.08	99.42		224365	42.5	74067	14.0	0.5			6.16
Tributary	23545.40		4760.07	1230.8	1236.96		1236.97	0.000048	0.96	10127.07	3418.28	0.08	99.42		224464	42.5	73968	14.0	0.0			6.16
Tributary	23515.10		4758.84	1230.8	1236.96		1236.96	0.000048	0.96	10142.48	3454.55	0.08	99.42		224564	42.5	73869	14.0	0.5			6.16
Tributary	23484.80		4757.49	1230.79	1236.95		1236.96	0.000048	0.96	10162.82	3472.79	0.08	99.42		224663	42.5	73769	14.0	0.5			6.16
Tributary	23454.50		4756.53	1230.78	1236.95		1236.96	0.000048	0.96	10188.47	3517.36	0.08	99.42		224763	42.6	73670	14.0	0.5			6.17
Tributary	23424.20		4755.65	1230.77	1236.95		1236.95	0.000048	0.96	10220.55	3544.81	0.08	99.42		224862	42.6	73570	13.9	0.5			6.18
Tributary	23393.90		4754.62	1230.76	1236.94		1236.95	0.000048	0.96	10266.77	3599.93	0.08	99.42		224961	42.6	73471	13.9	0.5			6.18
Tributary	23363.60		4753.48	1230.75	1236.94		1236.94	0.000047	0.96	10323.41	3667.66	0.08	99.42		225061	42.6	73372	13.9	0.5			6.19
Tributary	23333.30		4752.09	1230.74	1236.93		1236.94	0.000047	0.96	10394.09	3750.89	0.08	99.42		225160	42.6	73272	13.9	0.5			6.19
Tributary	23303.00		4750.57	1230.73	1236.93		1236.93	0.000047	0.95	10503.54	3845.45	0.08	99.42		225260	42.7	73173	13.9	0.5			6.2
Tributary	23272.70		4749.39	1230.72	1236.92		1236.93	0.000046	0.95	10634.34	3926.4	0.08	99.42		225359	42.7	73073	13.8	0.5			6.2
Tributary	23242.40		4748.28	1230.71	1236.92		1236.92	0.000045	0.93	10787.48	3944.26	0.08	99.42		225459	42.7	72974	13.8	0.0			6.21
Tributary	23212.10		4747.18	1230.71	1236.92		1236.92	0.000043	0.92	10952.71	3960.74	0.07	99.42		225558	42.7	72874	13.8	0.5			6.21
Tributary	23181.80		4746.47	1230.7	1236.91		1236.92	0.000042	0.91	11119.13	3994.92	0.07	99.42		225657	42.7	72775	13.8	0.5			6.21
Tributary	23151.50		4745.68	1230.69	1236.91		1236.91	0.000041	0.89	11335.83	4114.62	0.07	99.42		225757	42.8	72676	13.8	0.5			6.22
Tributary	23121.20		4744.53	1230.68	1236.9		1236.91	0.00004	0.88	11628.23	4264.88	0.07	99.42		225856	42.8	72576	13.7	0.5			6.22
Tributary	23090.90		4743.28	1230.67	1236.9		1236.9	0.000038	0.85	11997.22	4401.87	0.07	99.42		225956	42.8	72477	13.7	0.5			6.23
Tributary	23060.60		4741.84	1230.66	1236.9		1236.9	0.000035	0.82	12436.46	4461.31	0.07	99.42		226055	42.8	72377	13.7	0.5			6.24
Tributary	23030.30		4740.43	1230.65	1236.89		1236.9	0.000032	0.79	12917	4519.08	0.06	99.42		226155	42.8	72278	13.7	0.5			6.24
Tributary	23000.00		4739.18	1230.64	1236.89		1236.89	0.000029	0.75	13434.58	4542.73	0.06	99.42	PA State Line	226254	42.9	72178	13.7	1.6			6.25
Tributary	22969.70		4737.57	1230.61	1236.89		1236.89	0.000031	0.78	12977.19	4421.87	0.06	99.42		226353	42.9	72079	13.7	2.1			6.28
Tributary	22939.30		4735.75	1230.57	1236.89		1236.89	0.000033	0.81	12580.81	4283.58	0.06	99.42		226453	42.9	71980	13.6	2.1			6.32
Tributary	22909.00		4736.65	1230.53	1236.88		1236.88	0.000034	0.82	12273.69	4166.02	0.07	99.42		226552	42.9	71880	13.6	2.1			6.35
Tributary	22878.70		4735	1230.49	1236.88		1236.88	0.000035	0.85	12024.3	4095.29	0.07	99.42		226652	42.9	71781	13.6	2.1			6.39
Tributary	22848.40		4733.27	1230.45	1236.87		1236.88	0.000036	0.86	11811.15	4013.58	0.07	99.42		226751	42.9	71681	13.6	1.6			6.42
Tributary	22818.10		4731.77	1230.42	1236.87		1236.88	0.000038	0.88	11635.5	3969.21	0.07	99.42		226850	43.0	71582	13.6	2.1			6.45
Tributary	22787.80		4730.18	1230.38	1236.87		1236.87	0.000039	0.9	11470.31	3955.27	0.07	99.42		226950	43.0	71483	13.5	2.1			6.49
Tributary	22757.50		4728.78	1230.34	1236.86		1236.87	0.000041	0.92	11311.81	3938.24	0.07	99.42		227049	43.0	71383	13.5	2.1			6.52
Tributary	22727.20		4727.76	1230.3	1236.86		1236.86	0.000042	0.94	11159	3919.1	0.07	99.42		227149	43.0	71284	13.5	1.6			6.56
Tributary	22696.90		4726.58	1230.27	1236.85		1236.86	0.000043	0.96	11016.61	3901.42	0.08	99.42		227248	43.0	71184	13.5	2.1			6.58
Tributary	22666.60		4725.34	1230.23	1236.85		1236.86	0.000045	0.98	10882.02	3881.19	0.08	99.42		227348	43.1	71085	13.5	2.1			6.62
Tributary	22636.30		4724.08	1230.19	1236.85		1236.85	0.000046	0.99	10751.41	3856.43	0.08	99.42		227447	43.1	70985	13.4	2.1			6.66
Tributary	22606.00		4723	1230.15	1236.84		1236.85	0.000047	1.01	10633.1	3821.99	0.08	99.42		227546	43.1	70886	13.4	2.1			6.69
Tributary	22575.70		4721.64	1230.11	1236.84		1236.84	0.000048	1.02	10525.14	3786.08	0.08	99.42		227646	43.1	70787	13.4	1.6			6.73
Tributary	22545.40		4720.36	1230.08	1236.83		1236.84	0.000049	1.03	10425.17	3756.77	0.08	99.42		227745	43.1	70687	13.4	2.1			6.75
Tributary	22515.10		4719.43	1230.04	1236.83		1236.83	0.00005	1.04	10330.9	3731.13	0.08	99.42		227845	43.2	70588	13.4	2.1			6.79
Tributary	22484.80		4718.26	1230	1236.82		1236.83	0.00005	1.05	10255.72	3694.73	0.08	99.42		227944	43.2	70488	13.4	2.1			6.82
Tributary	22454.50		4717.24	1229.96	1236.82		1236.82	0.000051	1.06	10184.05	3674.22	0.08	99.42		228044	43.2	70389	13.3	1.6			6.86
Tributary	22424.20		4715.94	1229.93	1236.81		1236.82	0.000051	1.07	10113.75	3654.17	0.08	99.42		228143	43.2	70289	13.3	2.1			6.88
Tributary	22393.90		4714.94	1229.89	1236.81		1236.81	0.000052	1.08	10047.96	3640.04	0.08	99.42		228242	43.2	70190	13.3	2.1			6.92
Tributary	22363.60		4713.66	1229.85	1236.8		1236.81	0.000052	1.09	9987.77	3628.92	0.08	99.42		228342	43.2	70091	13.3	2.1			6.95
Tributary	22333.30		4711.81	1229.81	1236.8		1236.8	0.000053	1.1	9931.79	3615.71	0.08	99.42		228441	43.3	69991	13.3	2.1			6.99
Tributary	22303.00		4710.54	1229.77	1236.79		1236.8	0.000053	1.11	9878.41	3602.76	0.08	99.42		228541	43.3	69892	13.2	1.6			7.02
Tributary	22272.70		4709.98	1229.74	1236.79		1236.79	0.000052	1.1	9835.14	3550.45	0.08	99.42		228640	43.3	69792	13.2	2.1			7.05
Tributary	22242.40		4709.18	1229.7	1236.78		1236.79	0.000052	1.11	9797.08	3515.27	0.08	99.42		228739	43.3	69693	13.2	2.1			7.08
Tributary	22212.10		4708.18	1229.66	1236.78		1236.78	0.000053	1.11	9764.6	3468.06	0.08	99.42		228839	43.3	69594	13.2	2.1			7.12

Tributary	22181.80		4706.84	1229.62	1236.77		1236.78	0.000053	1.12	9748.04	3449.26	0.08	99.42		228938	43.4	69494	13.2	2.1			7.15
Tributary	22151.50		4705.5	1229.58	1236.77		1236.77	0.000053	1.12	9732.61	3443.86	0.08	99.42		229038	43.4	69395	13.1	1.6			7.19
Tributary	22121.20		4704.52	1229.55	1236.76		1236.77	0.000053	1.13	9721.56	3438.73	0.08	99.42		229137	43.4	69295	13.1	2.1			7.21
Tributary	22090.90		4703.54	1229.51	1236.76		1236.76	0.000053	1.13	9704.88	3429.15	0.08	99.42		229237	43.4	69196	13.1	2.1			7.25
Tributary	22060.60		4702.56	1229.47	1236.75		1236.76	0.000052	1.13	9695.54	3417.08	0.08	99.42		229336	43.4	69096	13.1	2.1			7.28
Tributary	22030.30		4701.54	1229.43	1236.75		1236.75	0.000052	1.13	9683.29	3402.66	0.08	99.42		229435	43.5	68997	13.1	1.6			7.32
Tributary	22000.00		4700.17	1229.4	1236.74		1236.75	0.000052	1.13	9672.96	3386.96	0.08	99.42		229535	43.5	68898	13.0	0.0			7.34
Tributary	21969.70		4698.85	1229.4	1236.74		1236.74	0.000053	1.15	9540.9	3335.77	0.08	99.42		229634	43.5	68798	13.0	0.0			7.34
Tributary	21939.30		4697.72	1229.4	1236.73		1236.74	0.000053	1.15	9433.41	3258.79	0.08	99.42		229734	43.5	68699	13.0	0.0			7.33
Tributary	21909.00		4696.58	1229.4	1236.72		1236.73	0.000054	1.15	9365.37	3226.2	0.09	99.42		229833	43.5	68599	13.0	0.0			7.32
Tributary	21878.70		4695.4	1229.4	1236.72		1236.73	0.000054	1.15	9309.02	3189.57	0.09	99.42		229932	43.5	68500	13.0	0.0			7.32
Tributary	21848.40		4695.13	1229.4	1236.71		1236.72	0.000054	1.15	9267.64	3129.8	0.09	99.42		230032	43.6	68401	13.0	0.0			7.31
Tributary	21818.10		4694.14	1229.4	1236.71		1236.72	0.000052	1.13	9241.94	3062.19	0.08	99.42		230131	43.6	68301	12.9	0.0			7.31
Tributary	21787.80		4693.12	1229.4	1236.7		1236.71	0.000051	1.12	9244.17	2991.46	0.08	99.42		230231	43.6	68202	12.9	0.0			7.3
Tributary	21757.50		4691.93	1229.4	1236.7		1236.71	0.000051	1.11	9253.71	2966.25	0.08	99.42		230330	43.6	68102	12.9	0.0			7.3
Tributary	21727.20		4690.83	1229.4	1236.69		1236.7	0.00005	1.1	9271.82	2944.47	0.08	99.42		230430	43.6	68003	12.9	0.0			7.29
Tributary	21696.90		4689.87	1229.4	1236.69		1236.7	0.000049	1.09	9296.08	2926.9	0.08	99.42		230529	43.7	67903	12.9	0.0			7.29
Tributary	21666.60		4688.9	1229.4	1236.68		1236.69	0.000048	1.08	9315.01	2912.4	0.08	99.42		230628	43.7	67804	12.8	0.0			7.28
Tributary	21636.30		4687.8	1229.4	1236.68		1236.69	0.000047	1.07	9343.55	2898.16	0.08	99.42		230728	43.7	67705	12.8	0.0			7.28
Tributary	21606.00		4686.63	1229.4	1236.68		1236.68	0.000046	1.06	9377.26	2876.6	0.08	99.42		230827	43.7	67605	12.8	0.0			7.28
Tributary	21575.70		4685.69	1229.4	1236.67		1236.68	0.000045	1.05	9426.09	2843.7	0.08	99.42		230927	43.7	67506	12.8	0.0			7.27
Tributary	21545.40		4685.24	1229.4	1236.67		1236.67	0.000044	1.03	9477.61	2830.23	0.08	99.42		231026	43.8	67406	12.8	0.0			7.27
Tributary	21515.10		4683.98	1229.4	1236.66		1236.67	0.000043	1.02	9527.77	2818.1	0.08	99.42		231126	43.8	67307	12.7	0.0			7.26
Tributary	21484.80		4684	1229.4	1236.66		1236.66	0.000042	1.01	9579.33	2805.71	0.08	99.42		231225	43.8	67207	12.7	0.0			7.26
Tributary	21454.50		4683.13	1229.4	1236.65		1236.66	0.000041	1	9628.11	2794.78	0.07	99.42		231324	43.8	67108	12.7	0.0			7.25
Tributary	21424.20		4682	1229.4	1236.65		1236.66	0.00004	0.99	9682.81	2785.67	0.07	99.42		231424	43.8	67009	12.7	0.0			7.25
Tributary	21393.90		4680.9	1229.4	1236.65		1236.65	0.000039	0.98	9733.21	2777.7	0.07	99.42		231523	43.8	66909	12.7	0.0			7.25
Tributary	21363.60		4679.88	1229.4	1236.64		1236.65	0.000038	0.97	9792.35	2771.14	0.07	99.42		231623	43.9	66810	12.7	0.0			7.24
Tributary	21333.30		4678.93	1229.4	1236.64		1236.64	0.000037	0.95	9851.73	2758.34	0.07	99.42		231722	43.9	66710	12.6	0.0			7.24
Tributary	21303.00		4678.11	1229.4	1236.64		1236.64	0.000037	0.94	9914.36	2746.64	0.07	99.42		231821	43.9	66611	12.6	0.0			7.24
Tributary	21272.70		4677.29	1229.4	1236.63		1236.64	0.000036	0.93	9974.86	2736.47	0.07	99.42		231921	43.9	66512	12.6	0.0			7.23
Tributary	21242.40		4676.49	1229.4	1236.63		1236.63	0.000035	0.92	10037.37	2733.35	0.07	99.42		232020	43.9	66412	12.6	0.0			7.23
Tributary	21212.10		4675.79	1229.4	1236.63		1236.63	0.000034	0.91	10094.92	2731.18	0.07	99.42		232120	44.0	66313	12.6	0.0			7.23
Tributary	21181.80		4675.1	1229.4	1236.62		1236.63	0.000033	0.9	10166.68	2729.42	0.07	99.42		232219	44.0	66213	12.5	0.0			7.22
Tributary	21151.50		4674.04	1229.4	1236.62		1236.62	0.000033	0.89	10233.59	2728.12	0.07	99.42		232319	44.0	66114	12.5	0.0			7.22
Tributary	21121.20		4672.73	1229.4	1236.62		1236.62	0.000032	0.88	10297.55	2726.89	0.07	99.42		232418	44.0	66014	12.5	0.0			7.22
Tributary	21090.90		4671.64	1229.4	1236.61		1236.62	0.000031	0.87	10362.85	2725.7	0.06	99.42		232517	44.0	65915	12.5	0.0			7.21
Tributary	21060.60		4670.69	1229.4	1236.61		1236.62	0.00003	0.86	10435.19	2724.46	0.06	99.42		232617	44.1	65816	12.5	0.0			7.21
Tributary	21030.30		4669.76	1229.4	1236.61		1236.61	0.00003	0.85	10498.9	2722.41	0.06	99.42		232716	44.1	65716	12.4	0.0			7.21
Tributary	21000.00		4668.84	1229.4	1236.6		1236.61	0.000029	0.84	10566.77	2719.92	0.06	99.42		232816	44.1	65617	12.4	0.0			7.2
Tributary	20969.70		4667.85	1229.4	1236.6		1236.61	0.000036	0.94	9649.6	2641.91	0.07	99.42		232915	44.1	65517	12.4	0.0			7.2
Tributary	20939.30		4666.92	1229.4	1236.6		1236.6	0.000045	1.05	8859.63	2570.82	0.08	99.42		233015	44.1	65418	12.4	0.0			7.2
Tributary	20909.00		4666.32	1229.4	1236.59		1236.6	0.000054	1.16	8153.65	2502.37	0.09	99.42		233114	44.2	65318	12.4	0.0			7.19
Tributary	20878.70		4665.52	1229.4	1236.58		1236.59	0.000065	1.27	7514.03	2429.06	0.09	99.42		233213	44.2	65219	12.4	0.0			7.18
Tributary	20848.40		4664.54	1229.4	1236.57		1236.59	0.000077	1.38	6943.06	2361.5	0.1	99.42		233313	44.2	65120	12.3	0.0			7.17
Tributary	20818.10		4663.8	1229.4	1236.56		1236.58	0.000091	1.5	6413.24	2295.93	0.11	99.42		233412	44.2	65020	12.3	0.0			7.16
Tributary	20787.80		4663.08	1229.4	1236.55		1236.57	0.000107	1.63	5951.47	2111.35	0.12	99.42		233512	44.2	64921	12.3	0.0			7.15
Tributary	20757.50		4662.48	1229.4	1236.54		1236.56	0.000117	1.7	5538.6	2047.44	0.13	99.42		233611	44.2	64821	12.3	-0.5			7.14
Tributary	20727.20		4661.77	1229.41	1236.53		1236.55	0.00013	1.79	5158.5	1973.39	0.13	99.42		233710	44.3	64722	12.3	0.0			7.12
Tributary	20696.90		4660.89	1229.41	1236.51		1236.54	0.00014	1.86	4821.3	1848.47	0.14	99.42		233810	44.3	64623	12.2	0.0			7.1
Tributary	20666.60		4660.11	1229.41	1236.5		1236.53	0.000145	1.9	4538.96	1780.35	0.14	99.42		233909	44.3	64523	12.2	0.0			7.09
Tributary	20636.30		4659.53	1229.41	1236.48		1236.51	0.000151	1.93	4290.59	1620.38	0.14	99.42		234009	44.3	64424	12.2	0.0			7.07
Tributary	20606.00		4659.12	1229.41	1236.46		1236.5	0.000155	1.96	4127.33	1278.68	0.15	99.42		234108	44.3	64324	12.2	0.0			7.05
Tributary	20575.70		4658.63	1229.41	1236.45		1236.48	0.000155	1.96	4054.64	1146.68	0.15	99.42		234208	44.4	64225	12.2	0.0			7.04
Tributary	20545.40		4658.63	1229.41	1236.43		1236.47	0.000157	1.97	4007.39	1083.84	0.15	99.42		234307	44.4	64125	12.1	0.0			7.02
Tributary	20515.10		4658.28	1229.41	1236.42		1236.45	0.000158	1.97	3974.89	1041.08	0.15	99.42		234406	44.4	64026	12.1	0.0			7.01
Tributary	20484.80		4657.89	1229.41	1236.4		1236.44	0.000158	1.98	3953.36	1006.79	0.15	99.42		234506	44.4	63927	12.1	0.0			6.99
Tributary	20454.50		4657.6	1229.41	1236.39		1236.42	0.000159	1.98	3938.61	974.98	0.15	99.42		234605	44.4	63827	12.1	0.0			6.98
Tributary	20424.20		4657.29	1229.41	1236.37		1236.4	0.00016	1.99	3926.91	963.11	0.15	99.42		234705	44.5	63728	12.1	-0.5			6.96
Tributary	20393.90		4656.85	1229.42	1236.35		1236.39	0.00016	1.99	3917.18	954.87	0.15	99.42		234804	44.5	63628	12.1	0.0			6.93
Tributary	20363.60		4656.47	1229.42	1236.34		1236.37	0.00016	1.99	3910.9	947.99	0.15	99.42		234903	44.5	63529	12.0	0.0			6.92
Tributary	20333.30		4656.16	1229.42	1236.32		1236.36	0.00016	1.99	3904.17	941.32	0.15	99.42		235003	44.5	63430	12.0	0.0			6.9
Tributary	20303.00		4655.81	1229.42	1236.31		1236.34	0.000161	1.99	3897.21	935.29	0.15	99.42		235102	44.5	63330	12.0	0.0			6.89
Tributary	20272.70		4655.5	1229.42	1236.29		1236.33	0.00016	1.99	3893.25	929.77	0.15	99.42		235202	44.5	63231	12.0	0.0			6.87
Tributary	20242.40		4655.25	1229.42	1236.28		1236.31	0.000161	1.99	3886.38	924.55	0.15	99.42		235301	44.6	63131	12.0	0.0			6.86
Tributary	20212.10		4654.87	1229.42	1236.26		1236.29	0.00016	1.99	3889.25	919.71	0.15	99.42		235401	44.6	63032	11.9	0.0			6.84
Tributary	20181.80		4654.44	1229.42	1236.24		1236.28	0.00016	1.99	3886.92	914.75	0.15	99.42		235500	44.6	62932	11.9	0.0			6.82
Tributary	20151.50		4654.15	1229.42	1236.23		1236.26	0.00016	1.99	3884.99	908.94	0.15	99.42		235599	44.6	62833	11.9	0.0			6.81
Tributary	20121.20		4653.87	1229.42	1236.21		1236.25	0.000159	1.99	3886.03	903.43	0.15	99.42		235699	44.6	62734	11.9	-0.5			6.79
Tributary	20090.90		4653.64	1229.43	1236.2		1236.23	0.000159	1.98	3883.98	897.47	0.15	99.42		235798	44.7	62634	11.9	0.0			6.77
Tributary	20060.60		4653.33	1229.43	1236.18		1236.21	0.000158	1.98	3887.22	892.71	0.15	99.42		235898	44.7	62535	11.8	0.0			6.75
Tributary	20030.30		4652.88	1229.43	1236.17		1236.2	0.000158	1.98	3885.24	888.12	0.15	99.42		235997	44.7	62435	11.8	0.0			6.74
Tributary	20000.00		4652.53	1229.43	1236.15		1236.18	0.000158	1.98	3883.46	883.83	0.15	99.42		236097	44.7	62336	11.8	1.1			6.72
Tributary	19969.70		4652.3	1229.41	1236.14		1236.17	0.000154	1.96	3908.01	889.21	0.14	99.42		236196	44.7	62236	11.8	0.5			6.73
Tributary	19939.30		4651.98	1229.4	1236.12		1236.15	0.00015	1.94	3936.33	895.09	0.14	99.42		236295	44.8	62137	11.8	1.1			6.72
Tributary	19909.00		4651.59	1229.38	1236.11		1236.14	0.000146	1.93	3957.49	901.17	0.14	99.42		236395	44.8	62038	11.7	1.1			6.73
Tributary	19878.70		4651.3	1229.36	1236.09		1236.12	0.000143	1.91	3980.4	907.19	0.14	99.42		236494	44.8	61938	11.7	1.1			6.73
Tributary	19848.40		4650.95	1229.34	1236.08		1236.11	0.000139	1.88	4011.04	913.35	0.14	99.42		236594	44.8	61839	11.7	0.5			6.74
Tributary	19818.10		4650.59	1229.33	1236.07		1236.1	0.000135	1.86	4039.79	919.43	0.14	99.42		236693	44.8	61739	11.7	1.1			6.74
Tributary	19787.80		4650.25	1229.31	1236.05		1236.08	0.000131	1.84	4067.07	925.57	0.13	99.42		236792	44.8	61640	11.7	1.1			6.74
Tributary	19757.50		4649.91	1229.29	1236.04		1236.07	0.000128	1.82	4092.28	931.77	0.13	99.42		236892	44.9	61541	11.7	0.5			6.75
Tributary	19727.20		4649.64	1229.28	1236.03		1236.06	0.000125	1.8	4119.44	937.82	0.13	99.42		236991	44.9	61441	11.6	1.1			6.75
Tributary	19696.90		4649.36	1229.26	1236.02		1236.05	0.000121	1.77	4147.96	944.06	0.13	99.42		237091	44.9	61342	11.6	1.1			6.76

Tributary	19666.60		4649.07	1229.24	1236		1236.03	0.000118	1.75	4177.97	350.29	0.13	99.42		237190	44.9	61242	11.6	0.5			6.76
Tributary	19636.30		4648.78	1229.23	1235.99		1236.02	0.000115	1.73	4209.68	356.61	0.13	99.42		237290	44.9	61143	11.6	1.1			6.76
Tributary	19606.00		4648.45	1229.21	1235.98		1236.01	0.000111	1.7	4245.14	362.93	0.12	99.42		237389	45.0	61043	11.6	1.1			6.77
Tributary	19575.70		4648.13	1229.19	1235.97		1236	0.000108	1.68	4277.26	369.35	0.12	99.42		237488	45.0	60944	11.5	0.5			6.78
Tributary	19545.40		4647.81	1229.18	1235.96		1235.99	0.000105	1.66	4308.53	375.81	0.12	99.42		237588	45.0	60845	11.5	1.1			6.78
Tributary	19515.10		4647.47	1229.16	1235.95		1235.98	0.000102	1.63	4342.21	382.34	0.12	99.42		237687	45.0	60745	11.5	1.1			6.79
Tributary	19484.80		4647.16	1229.14	1235.94		1235.97	0.000099	1.61	4371.58	388.93	0.12	99.42		237787	45.0	60646	11.5	1.1			6.8
Tributary	19454.50		4646.73	1229.12	1235.93		1235.96	0.000096	1.59	4407.78	395.47	0.12	99.42		237886	45.1	60546	11.5	0.5			6.81
Tributary	19424.20		4646.33	1229.11	1235.92		1235.95	0.000094	1.57	4440.88	1001.46	0.11	99.42		237986	45.1	60447	11.4	1.1			6.81
Tributary	19393.90		4645.96	1229.09	1235.92		1235.94	0.000091	1.54	4476.57	1007.25	0.11	99.42		238085	45.1	60347	11.4	1.1			6.83
Tributary	19363.60		4645.46	1229.07	1235.91		1235.93	0.000088	1.52	4511.94	1012.56	0.11	99.42		238184	45.1	60248	11.4	0.5			6.84
Tributary	19333.30		4644.98	1229.06	1235.9		1235.92	0.000085	1.5	4551.25	1019	0.11	99.42		238284	45.1	60149	11.4	1.1			6.84
Tributary	19303.00		4644.63	1229.04	1235.89		1235.91	0.000083	1.48	4589.32	1023.88	0.11	99.42		238383	45.1	60049	11.4	1.1			6.85
Tributary	19272.70		4644.37	1229.02	1235.88		1235.91	0.00008	1.45	4630.49	1028.72	0.11	99.42		238483	45.2	59950	11.4	0.5			6.86
Tributary	19242.40		4643.98	1229.01	1235.88		1235.9	0.000078	1.43	4671.68	1033.82	0.1	99.42		238582	45.2	59850	11.3	1.1			6.87
Tributary	19212.10		4643.52	1228.99	1235.87		1235.89	0.000076	1.41	4711.49	1039.36	0.1	99.42		238681	45.2	59751	11.3	1.1			6.88
Tributary	19181.80		4643.14	1228.97	1235.86		1235.88	0.000074	1.39	4747.87	1045.51	0.1	99.42		238781	45.2	59652	11.3	0.5			6.89
Tributary	19151.50		4642.75	1228.96	1235.86		1235.88	0.000071	1.37	4792.21	1050.23	0.1	99.42		238880	45.2	59552	11.3	1.1			6.9
Tributary	19121.20		4642.39	1228.94	1235.85		1235.87	0.000069	1.35	4840.08	1046.1	0.1	99.42		238980	45.3	59453	11.3	1.1			6.91
Tributary	19090.90		4642.12	1228.92	1235.84		1235.86	0.000067	1.33	4892.77	1043.48	0.1	99.42		239079	45.3	59353	11.2	1.1			6.92
Tributary	19060.60		4641.81	1228.9	1235.84		1235.86	0.000066	1.31	4939.44	1041.46	0.1	99.42		239179	45.3	59254	11.2	0.5			6.94
Tributary	19030.30		4641.38	1228.89	1235.83		1235.85	0.000064	1.3	4995.36	1045.2	0.09	99.42		239278	45.3	59154	11.2	1.1			6.94
Tributary	19000.00		4640.92	1228.87	1235.82		1235.84	0.000062	1.28	5054.7	1051.17	0.09	99.42		239377	45.3	59055	11.2	0.5			6.95
Tributary	18969.70		4640.07	1228.86	1235.82		1235.84	0.000062	1.28	5045.87	1054.13	0.09	99.42		239477	45.4	58956	11.2	1.1			6.96
Tributary	18939.30		4640.35	1228.84	1235.81		1235.83	0.000061	1.28	5039.06	1063.87	0.09	99.42		239576	45.4	58856	11.1	0.5			6.97
Tributary	18909.00		4639.89	1228.83	1235.81		1235.83	0.000061	1.28	5044.09	1078.9	0.09	99.42		239676	45.4	58757	11.1	0.5			6.98
Tributary	18878.70		4639.34	1228.82	1235.8		1235.82	0.00006	1.28	5043.98	1083.28	0.09	99.42		239775	45.4	58657	11.1	-2.1			6.98
Tributary	18848.40		4638.88	1228.86	1235.79		1235.81	0.00006	1.29	5038.04	1083.06	0.09	99.42		239874	45.4	58558	11.1	1.1			6.93
Tributary	18818.10		4638.56	1228.84	1235.79		1235.81	0.00006	1.29	5037.21	1081.63	0.09	99.42		239974	45.4	58459	11.1	0.5			6.95
Tributary	18787.80		4638.17	1228.83	1235.78		1235.8	0.00006	1.29	5037.01	1080.14	0.09	99.42		240073	45.5	58359	11.1	1.1			6.95
Tributary	18757.50		4637.65	1228.81	1235.78		1235.8	0.00006	1.29	5027.52	1078.06	0.09	99.42		240173	45.5	58260	11.0	0.5			6.97
Tributary	18727.20		4637.26	1228.8	1235.77		1235.79	0.000059	1.29	5035.73	1075.97	0.09	99.42		240272	45.5	58160	11.0	1.1			6.97
Tributary	18696.90		4636.98	1228.78	1235.76		1235.78	0.000059	1.29	5028.93	1073.97	0.09	99.42		240372	45.5	58061	11.0	3.2			6.98
Tributary	18666.60		4636.71	1228.72	1235.76		1235.78	0.000059	1.3	5026.98	1071.54	0.09	99.42		240471	45.5	57961	11.0	1.1			7.04
Tributary	18636.30		4636.34	1228.7	1235.75		1235.77	0.000059	1.3	5020.2	1069.2	0.09	99.42		240570	45.6	57862	11.0	0.5			7.05
Tributary	18606.00		4635.91	1228.69	1235.75		1235.77	0.00006	1.3	5013.4	1066.85	0.09	99.42		240670	45.6	57763	10.9	0.5			7.06
Tributary	18575.70		4635.51	1228.68	1235.74		1235.76	0.00006	1.3	5000.6	1064.26	0.09	99.42		240769	45.6	57663	10.9	1.1			7.06
Tributary	18545.40		4634.98	1228.66	1235.74		1235.76	0.00006	1.3	4994.77	1060.88	0.09	99.42		240869	45.6	57564	10.9	0.5			7.08
Tributary	18515.10		4634.54	1228.65	1235.73		1235.75	0.00006	1.31	4985.46	1057.51	0.09	99.42		240968	45.6	57464	10.9	1.1			7.08
Tributary	18484.80		4634.26	1228.63	1235.72		1235.74	0.00006	1.31	4974.48	1054.3	0.09	99.42		241068	45.7	57365	10.9	0.5			7.09
Tributary	18454.50		4633.92	1228.62	1235.72		1235.74	0.000061	1.31	4958.16	1051.15	0.09	99.42		241167	45.7	57265	10.8	0.5			7.1
Tributary	18424.20		4633.48	1228.61	1235.71		1235.73	0.000061	1.31	4945.55	1048.09	0.09	99.42		241266	45.7	57166	10.8	1.1			7.1
Tributary	18393.90		4633	1228.59	1235.71		1235.73	0.000062	1.32	4931.52	1045.15	0.09	99.42		241366	45.7	57067	10.8	0.5			7.12
Tributary	18363.60		4632.56	1228.58	1235.7		1235.72	0.000062	1.32	4919.95	1042.27	0.09	99.42		241465	45.7	56967	10.8	1.1			7.12
Tributary	18333.30		4632.22	1228.56	1235.69		1235.71	0.000063	1.32	4902.85	1039.31	0.09	99.42		241565	45.8	56868	10.8	0.5			7.13
Tributary	18303.00		4631.9	1228.55	1235.69		1235.71	0.000063	1.32	4888.37	1034.46	0.09	99.42		241664	45.8	56768	10.8	0.5			7.14
Tributary	18272.70		4631.49	1228.54	1235.68		1235.7	0.000064	1.33	4869.43	1031.74	0.09	99.42		241763	45.8	56669	10.7	1.1			7.14
Tributary	18242.40		4631.18	1228.52	1235.67		1235.69	0.000065	1.33	4853.91	1029.24	0.09	99.42		241863	45.8	56570	10.7	0.5			7.15
Tributary	18212.10		4630.92	1228.51	1235.67		1235.69	0.000066	1.33	4832.7	1026.9	0.1	99.42		241962	45.8	56470	10.7	0.5			7.16
Tributary	18181.80		4630.57	1228.5	1235.66		1235.68	0.000067	1.34	4805.89	1024.6	0.1	99.42		242062	45.8	56371	10.7	1.1			7.16
Tributary	18151.50		4630.25	1228.48	1235.65		1235.68	0.000068	1.34	4782.04	1022.71	0.1	99.42		242161	45.9	56271	10.7	0.5			7.17
Tributary	18121.20		4629.85	1228.47	1235.65		1235.67	0.00007	1.35	4751.2	1020.56	0.1	99.42		242261	45.9	56172	10.6	1.1			7.18
Tributary	18090.90		4629.4	1228.45	1235.64		1235.66	0.000071	1.35	4728.56	1018.48	0.1	99.42		242360	45.9	56072	10.6	0.5			7.19
Tributary	18060.60		4629.1	1228.44	1235.63		1235.65	0.000073	1.36	4701.1	1016.42	0.1	99.42		242459	45.9	55973	10.6	0.5			7.19
Tributary	18030.30		4628.75	1228.43	1235.63		1235.65	0.000074	1.36	4672.65	1014.48	0.1	99.42		242559	45.9	55874	10.6	1.1			7.2
Tributary	18000.00		4628.26	1228.41	1235.62		1235.64	0.000076	1.36	4643.67	1012.18	0.1	99.42		242658	46.0	55774	10.6	0.0			7.21
Tributary	17969.70		4627.85	1228.41	1235.61		1235.63	0.000075	1.37	4447.35	918.41	0.1	99.42		242758	46.0	55675	10.5	0.0			7.2
Tributary	17939.30		4627.4	1228.41	1235.6		1235.62	0.000078	1.4	4334.43	861.83	0.1	99.42		242857	46.0	55575	10.5	0.0			7.19
Tributary	17909.00		4627.42	1228.41	1235.59		1235.62	0.000081	1.43	4241.31	847.1	0.1	99.42		242957	46.0	55476	10.5	0.0			7.18
Tributary	17878.70		4627.14	1228.41	1235.58		1235.61	0.000083	1.46	4156.31	832.62	0.11	99.42		243056	46.0	55376	10.5	0.0			7.17
Tributary	17848.40		4626.82	1228.41	1235.58		1235.6	0.000084	1.47	4089.19	808.35	0.11	99.42		243155	46.1	55277	10.5	0.0			7.17
Tributary	17818.10		4626.52	1228.41	1235.57		1235.59	0.000085	1.48	4033.32	787.92	0.11	99.42		243255	46.1	55178	10.5	0.0			7.16
Tributary	17787.80		4626.22	1228.41	1235.56		1235.58	0.000086	1.5	3990.32	773.63	0.11	99.42		243354	46.1	55078	10.4	0.5			7.15
Tributary	17757.50		4625.95	1228.4	1235.55		1235.58	0.000087	1.51	3950.9	762.93	0.11	99.42		243454	46.1	54979	10.4	0.0			7.15
Tributary	17727.20		4625.71	1228.4	1235.54		1235.57	0.000088	1.52	3912.39	753.89	0.11	99.42		243553	46.1	54879	10.4	0.0			7.14
Tributary	17696.90		4625.46	1228.4	1235.53		1235.56	0.000089	1.54	3876.97	746.02	0.11	99.42		243652	46.1	54780	10.4	0.0			7.13
Tributary	17666.60		4625.27	1228.4	1235.52		1235.55	0.00009	1.55	3839.9	739.19	0.11	99.42		243752	46.2	54681	10.4	0.0			7.12
Tributary	17636.30		4625.08	1228.4	1235.51		1235.54	0.000091	1.57	3806.86	732.29	0.11	99.42		243851	46.2	54581	10.3	0.0			7.11
Tributary	17606.00		4624.86	1228.4	1235.5		1235.53	0.000092	1.58	3775.7	723.93	0.11	99.42		243951	46.2	54482	10.3	0.0			7.1
Tributary	17575.70		4624.57	1228.4	1235.49		1235.52	0.000093	1.59	3744.58	716.28	0.11	99.42		244050	46.2	54382	10.3	0.0			7.09
Tributary	17545.40		4624.22	1228.4	1235.48		1235.52	0.000094	1.6	3716.27	709.57	0.11	99.42		244150	46.2	54283	10.3	0.0			7.08
Tributary	17515.10		4623.9	1228.4	1235.47		1235.51	0.000096	1.61	3687.14	703.4	0.12	99.42		244249	46.3	54183	10.3	0.0			7.07
Tributary	17484.80		4623.64	1228.4	1235.46		1235.5	0.000097	1.63	3659	697.86	0.12	99.42		244348	46.3	54084	10.2	0.5			7.06
Tributary	17454.50		4623.44	1228.39	1235.45		1235.49	0.000098	1.64	3631.69	692.9	0.12	99.42		244448	46.3	53985	10.2	0.0			7.06
Tributary	17424.20		4623.22	1228.39	1235.44		1235.48	0.0001	1.65	3604.18	688.64	0.12	99.42		244547	46.3	53885	10.2	0.0			7.05
Tributary	17393.90		4622.91	1228.39	1235.43		1235.47	0.000102	1.67	3572.81	684.79	0.12	99.42		244647	46.3	53786	10.2	0.0			7.04
Tributary	17363.60		4622.62	1228.39	1235.42		1235.46	0.000104	1.69	3538.75	681.77	0.12	99.42		244746	46.4	53686	10.2	0.0			7.03
Tributary	17333.30		4622.4	1228.39	1235.41		1235.45	0.000106	1.7	3515	679.91	0.12	99.42		244845	46.4	53587	10.1	0.0			7.02
Tributary	17303.00		4622.21	1228.39	1235.4		1235.44	0.000109	1.72	3480.37	677.25	0.12	99.42		244945	46.4	53488	10.1	0.0			7.01
Tributary	17272.70		4621.98	1228.39	1235.39		1235.43	0.000112	1.74	3448.52	675.96	0.12	99.42		245044	46.4	53388	10.1	0.0			7
Tributary	17242.40		4621.72	1228.39	1235.38		1235.42	0.000114	1.76	3422.37	675.64	0.13	99.42		245144	46.4	53289	10.1	0.0			6.99
Tributary	17212.10		4621.16	1228.39	1235.37		1235.4	0.000116	1.76	3411.71	676.74	0.13	99.42		245243	46.4	53189	10.1	0.0			6.98
Tributary	17181.80		4621.41	1228.39	1235.35		1235.39	0.000119	1.79	3384.09	681.52	0.13	99.42		245343	46.5	53090	10.1	0.5			6.96

Tributary	17151.50		4621.12	1228.38	1235.34		1235.38	0.000122	1.8	3374.74	696.12	0.13	99.42		245442	46.5	52990	10.0	0.0			6.96
Tributary	17121.20		4620.86	1228.38	1235.33		1235.37	0.000124	1.82	3374.65	724.33	0.13	99.42		245541	46.5	52891	10.0	0.0			6.95
Tributary	17090.90		4620.53	1228.38	1235.32		1235.36	0.000128	1.84	3413.09	835.44	0.13	99.42		245641	46.5	52792	10.0	0.0			6.94
Tributary	17060.60		4620.17	1228.38	1235.31		1235.35	0.000127	1.82	3503.97	851.23	0.13	99.42		245740	46.5	52692	10.0	0.0			6.93
Tributary	17030.30		4619.79	1228.38	1235.3		1235.33	0.000124	1.79	3623.48	864.91	0.13	99.42		245840	46.6	52593	10.0	0.0			6.92
Tributary	17000.00		4619.42	1228.38	1235.29		1235.32	0.00012	1.76	3745.75	872.28	0.13	97.8		245939	46.6	52493	9.9	0.5			6.91
Tributary	16970.10		4619.16	1228.37	1235.27		1235.31	0.000133	1.84	3523.54	842.37	0.13	97.8		246037	46.6	52396	9.9	0.5			6.9
Tributary	16940.30		4618.95	1228.36	1235.25		1235.3	0.000145	1.92	3335.5	811.56	0.14	97.8		246135	46.6	52298	9.9	0.5			6.89
Tributary	16910.50		4618.74	1228.35	1235.23		1235.28	0.00016	2.01	3153.29	789.56	0.15	97.8		246233	46.6	52200	9.9	0.5			6.88
Tributary	16880.70		4618.56	1228.34	1235.21		1235.27	0.000177	2.11	2982.41	768.33	0.16	97.8		246330	46.7	52102	9.9	0.0			6.87
Tributary	16850.90		4618.38	1228.34	1235.19		1235.25	0.000192	2.18	2833.87	735.3	0.16	97.8		246428	46.7	52004	9.8	0.5			6.85
Tributary	16821.10		4618.13	1228.33	1235.17		1235.23	0.000203	2.24	2710.97	697.2	0.17	97.8		246526	46.7	51907	9.8	0.5			6.84
Tributary	16791.30		4617.81	1228.32	1235.14		1235.21	0.000214	2.29	2603.92	651.77	0.17	97.8		246624	46.7	51809	9.8	0.5			6.82
Tributary	16761.50		4617.48	1228.31	1235.12		1235.19	0.000227	2.35	2508.7	636.79	0.18	97.8		246722	46.7	51711	9.8	0.5			6.81
Tributary	16731.70		4617.24	1228.3	1235.09		1235.17	0.00024	2.41	2421.01	623.91	0.18	97.8		246819	46.7	51613	9.8	0.5			6.79
Tributary	16701.80		4617.05	1228.29	1235.06		1235.15	0.000254	2.47	2337.33	612.37	0.18	97.8		246917	46.8	51515	9.8	0.5			6.77
Tributary	16672.00		4616.87	1228.28	1235.04		1235.12	0.000267	2.52	2258.68	598.84	0.19	97.8		247015	46.8	51418	9.7	0.5			6.76
Tributary	16642.20		4616.69	1228.27	1235.01		1235.1	0.000277	2.56	2187.84	578.73	0.19	97.8		247113	46.8	51320	9.7	0.0			6.74
Tributary	16612.40		4616.49	1228.27	1234.97		1235.07	0.00029	2.6	2123.24	566.72	0.2	97.8		247211	46.8	51222	9.7	0.5			6.7
Tributary	16582.60		4616.3	1228.26	1234.94		1235.04	0.000304	2.65	2057.82	556.87	0.2	97.8		247308	46.8	51124	9.7	0.5			6.68
Tributary	16552.80		4616.12	1228.25	1234.91		1235.01	0.000316	2.68	2008.51	531.9	0.2	97.8		247406	46.9	51026	9.7	0.5			6.66
Tributary	16523.00		4615.99	1228.24	1234.88		1234.98	0.000327	2.71	1965.44	518.12	0.21	97.8		247504	46.9	50929	9.6	0.5			6.64
Tributary	16493.20		4615.83	1228.23	1234.84		1234.95	0.000339	2.74	1924.15	506.02	0.21	97.8		247602	46.9	50831	9.6	0.5			6.61
Tributary	16463.40		4615.64	1228.22	1234.8		1234.92	0.000352	2.78	1886.64	498.13	0.22	97.8		247700	46.9	50733	9.6	0.5			6.58
Tributary	16433.50		4615.47	1228.21	1234.77		1234.88	0.000366	2.81	1851.04	491.83	0.22	97.8		247797	46.9	50635	9.6	0.0			6.56
Tributary	16403.70		4615.29	1228.21	1234.73		1234.85	0.000382	2.85	1815.24	485.96	0.22	97.8		247895	46.9	50537	9.6	0.5			6.52
Tributary	16373.90		4615.11	1228.2	1234.68		1234.81	0.000397	2.88	1781.3	480.34	0.23	97.8		247993	47.0	50440	9.6	0.5			6.48
Tributary	16344.10		4614.98	1228.19	1234.64		1234.77	0.000415	2.92	1747.59	472.4	0.23	97.8		248091	47.0	50342	9.5	0.5			6.45
Tributary	16314.30		4614.88	1228.18	1234.6		1234.73	0.000434	2.96	1716.44	465.18	0.24	97.8		248189	47.0	50244	9.5	0.5			6.42
Tributary	16284.50		4614.73	1228.17	1234.55		1234.69	0.000454	3	1685.42	458.54	0.24	97.8		248286	47.0	50146	9.5	0.5			6.38
Tributary	16254.70		4614.52	1228.16	1234.5		1234.64	0.000469	3.05	1650.94	452.83	0.25	97.8		248384	47.0	50048	9.5	0.5			6.34
Tributary	16224.90		4614.36	1228.15	1234.45		1234.6	0.000481	3.09	1623.31	447.43	0.25	97.8		248482	47.1	49951	9.5	0.5			6.3
Tributary	16195.10		4614.26	1228.14	1234.4		1234.55	0.000494	3.13	1594.78	442.26	0.25	97.8		248580	47.1	49853	9.4	0.0			6.26
Tributary	16165.20		4614.15	1228.14	1234.35		1234.5	0.000508	3.18	1566.74	436.21	0.26	97.8		248678	47.1	49755	9.4	0.5			6.21
Tributary	16135.40		4614	1228.13	1234.3		1234.45	0.00052	3.22	1539.92	423.88	0.26	97.8		248775	47.1	49657	9.4	0.5			6.17
Tributary	16105.60		4613.83	1228.12	1234.24		1234.4	0.000531	3.25	1516.71	412.68	0.26	97.8		248873	47.1	49559	9.4	0.5			6.12
Tributary	16075.80		4613.66	1228.11	1234.19		1234.35	0.000545	3.29	1491.85	402.14	0.26	97.8		248971	47.2	49462	9.4	0.5			6.08
Tributary	16046.00		4613.53	1228.1	1234.13		1234.3	0.00056	3.33	1465.77	387.61	0.27	97.8		249069	47.2	49364	9.3	0.5			6.03
Tributary	16016.20		4613.42	1228.09	1234.07		1234.24	0.000575	3.37	1443.03	378.79	0.27	97.81		249167	47.2	49266	9.3	0.5			5.98
Tributary	15986.43		4613.28	1228.08	1234.01		1234.19	0.00059	3.41	1421.63	370.47	0.27	98.07		249264	47.2	49168	9.3	2.2			5.93
Tributary	15956.50		4613.17	1228.04	1233.95		1234.13	0.000604	3.44	1412.69	372.44	0.28	98.07		249362	47.2	49070	9.3	2.7			5.91
Tributary	15926.60		4613.07	1227.99	1233.89		1234.07	0.000617	3.47	1402.8	373.51	0.28	98.07		249460	47.2	48972	9.3	2.2			5.9
Tributary	15896.70		4612.95	1227.95	1233.82		1234.01	0.000633	3.5	1391.89	373.89	0.28	98.07		249559	47.3	48874	9.3	2.2			5.87
Tributary	15866.80		4612.85	1227.91	1233.76		1233.95	0.000651	3.53	1380.69	374.77	0.29	98.07		249657	47.3	48776	9.2	2.7			5.85
Tributary	15836.90		4612.74	1227.86	1233.69		1233.89	0.000668	3.57	1371.6	384.6	0.29	98.07		249755	47.3	48678	9.2	2.2			5.83
Tributary	15807.00		4612.59	1227.82	1233.62		1233.82	0.000687	3.6	1361.47	387.15	0.29	98.07		249853	47.3	48580	9.2	2.7			5.8
Tributary	15777.10		4612.17	1227.77	1233.55		1233.75	0.000705	3.63	1352.63	389.34	0.3	98.07		249951	47.3	48482	9.2	2.2			5.78
Tributary	15747.20		4612.37	1227.73	1233.48		1233.69	0.000724	3.66	1347.01	391.36	0.3	98.07		250049	47.4	48384	9.2	2.7			5.75
Tributary	15717.40		4612.22	1227.68	1233.41		1233.61	0.000745	3.69	1337.76	393.14	0.31	98.07		250147	47.4	48285	9.1	2.2			5.73
Tributary	15687.50		4612.11	1227.64	1233.33		1233.54	0.00077	3.73	1326.91	394.94	0.31	98.07		250245	47.4	48187	9.1	2.7			5.69
Tributary	15657.60		4611.99	1227.59	1233.25		1233.47	0.000795	3.76	1316.99	396.34	0.32	98.07		250343	47.4	48089	9.1	2.2			5.66
Tributary	15627.70		4611.85	1227.55	1233.17		1233.39	0.000812	3.78	1311.53	398.16	0.32	98.07		250441	47.4	47991	9.1	2.7			5.62
Tributary	15597.80		4611.72	1227.5	1233.09		1233.31	0.000835	3.83	1295.17	400	0.32	98.07		250539	47.5	47893	9.1	2.2			5.59
Tributary	15567.90		4611.59	1227.46	1233		1233.23	0.000853	3.87	1282.62	402.17	0.33	98.07		250637	47.5	47795	9.1	2.7			5.54
Tributary	15538.00		4611.46	1227.41	1232.91		1233.14	0.00087	3.92	1272.35	404.76	0.33	98.07		250735	47.5	47697	9.0	2.2			5.5
Tributary	15508.10		4611.32	1227.37	1232.82		1233.06	0.000891	3.97	1261.14	407.8	0.33	98.07		250833	47.5	47599	9.0	2.7			5.45
Tributary	15478.20		4611.22	1227.32	1232.73		1232.97	0.00091	4.01	1252.19	409.23	0.34	98.07		250932	47.5	47501	9.0	2.2			5.41
Tributary	15448.30		4611.12	1227.28	1232.63		1232.88	0.000933	4.06	1242.68	410.23	0.34	98.07		251030	47.5	47403	9.0	2.7			5.35
Tributary	15418.40		4610.99	1227.23	1232.54		1232.79	0.000944	4.1	1234.74	409.65	0.34	98.07		251128	47.6	47305	9.0	2.2			5.31
Tributary	15388.50		4610.87	1227.19	1232.44		1232.7	0.000974	4.16	1227.29	416.11	0.35	98.07		251226	47.6	47207	8.9	2.7			5.25
Tributary	15358.70		4610.77	1227.14	1232.34		1232.61	0.001003	4.22	1218.3	420.77	0.35	98.07		251324	47.6	47109	8.9	2.2			5.2
Tributary	15328.80		4610.66	1227.1	1232.24		1232.51	0.001037	4.28	1213.35	430.59	0.36	98.07		251422	47.6	47011	8.9	2.2			5.14
Tributary	15298.90		4610.55	1227.06	1232.13		1232.41	0.001069	4.34	1213.25	442.12	0.37	98.07		251520	47.6	46912	8.9	2.7			5.07
Tributary	15269.00		4610.44	1227.01	1232.03		1232.31	0.001094	4.38	1219.15	449.82	0.37	98.07		251618	47.7	46814	8.9	2.2			5.02
Tributary	15239.10		4610.29	1226.97	1231.92		1232.21	0.00112	4.42	1227.17	455.7	0.37	98.07		251716	47.7	46716	8.8	2.7			4.95
Tributary	15209.20		4610.13	1226.92	1231.82		1232.1	0.001135	4.44	1242.34	463.46	0.38	98.07		251814	47.7	46618	8.8	2.2			4.9
Tributary	15179.30		4609.98	1226.88	1231.71		1231.99	0.001121	4.42	1267.2	466.03	0.37	98.07		251912	47.7	46520	8.8	2.7			4.83
Tributary	15149.40		4609.82	1226.83	1231.62		1231.89	0.0011	4.38	1296.53	465.84	0.37	98.07		252010	47.7	46422	8.8	2.2			4.79
Tributary	15119.50		4609.66	1226.79	1231.52		1231.78	0.001086	4.35	1320.48	465.54	0.37	98.07		252108	47.7	46324	8.8	2.7			4.73
Tributary	15089.60		4609.53	1226.74	1231.42		1231.67	0.00106	4.3	1344.07	463.48	0.36	98.07		252206	47.8	46226	8.8	2.2			4.68
Tributary	15059.70		4609.38	1226.7	1231.33		1231.57	0.001025	4.23	1376.09	463.95	0.36	98.07		252304	47.8	46128	8.7	2.7			4.63
Tributary	15029.80		4609.23	1226.65	1231.25		1231.47	0.000974	4.13	1416	464.56	0.35	98.07		252403	47.8	46030	8.7	2.2			4.6
Tributary	15000.00		4609.09	1226.61	1231.17		1231.38	0.00092	4.02	1458.66	465.35	0.34	99.42	Russell, PA	252501	47.8	45932	8.7	9.0			4.56
Tributary	14969.70		4608.96	1226.44	1231.05		1231.28	0.001045	4.18	1330.39	342.97	0.36	99.42		252600	47.8	45832	8.7	8.5			4.61
Tributary	14939.30		4608.83	1226.28	1230.93		1231.17	0.001182	4.31	1281.61	329.83	0.38	99.42		252699	47.9	45733	8.7	8.5			4.65
Tributary	14909.00		4608.72	1226.12	1230.8		1231.05	0.001194	4.48	1250.35	312.82	0.38	99.42		252799	47.9	45634	8.6	8.5			4.68
Tributary	14878.70		4608.63	1225.96	1230.67		1230.94	0.001209	4.57	1235.57	306.56	0.39	99.42		252898	47.9	45534	8.6	9.0			4.71
Tributary	14848.40		4608.52	1225.79	1230.55		1230.82	0.001212	4.62	1227.72	302.3	0.39	99.42		252998	47.9	45435	8.6	8.5			4.76
Tributary	14818.10		4608.41	1225.63	1230.42		1230.7	0.001222	4.67	1219.47	298.97	0.39	99.42		253097	47.9	45335	8.6	8.5			4.79
Tributary	14787.80		4608.3	1225.47	1230.3		1230.58	0.001226	4.71	1214.44	296.33	0.39	99.42		253197	48.0	45236	8.6	9.0			4.83
Tributary	14757.50		4608.19	1225.3	1230.17		1230.46	0.001241	4.77	1204.24	294.01	0.39	99.42		253296	48.0	45136	8.5	8.5			4.87
Tributary	14727.20		4608.11	1225.14	1230.05		1230.34	0.001238	4.79	1201.99	292.64	0.39	99.42		253395	48.0	45037	8.5	8.5			4.91
Tributary	14696.90		4608.02	1224.98	1229.93		1230.22	0.001249	4.83	1195.73	290.95	0.4	99.42		253495	48.0	44938	8.5	9.0			4.95

Tributary	14666.60		4607.93	1224.81	1229.8		1230.1	0.001254	4.87	1191.34	289.54	0.4	99.42		253594	48.0	44838	8.5	8.5			4.99
Tributary	14636.30		4607.85	1224.65	1229.67		1229.97	0.001262	4.91	1186.65	288.41	0.4	99.42		253694	48.0	44739	8.5	8.5			5.02
Tributary	14606.00		4607.75	1224.49	1229.55		1229.85	0.001276	4.95	1180.16	287.18	0.4	99.42		253793	48.1	44639	8.5	8.5			5.06
Tributary	14575.70		4607.66	1224.33	1229.42		1229.73	0.001286	4.99	1174.62	285.47	0.4	99.42		253893	48.1	44540	8.4	9.0			5.09
Tributary	14545.40		4607.57	1224.16	1229.29		1229.6	0.001294	5.02	1169.57	283.88	0.41	99.42		253992	48.1	44440	8.4	8.5			5.13
Tributary	14515.10		4607.48	1224	1229.16		1229.47	0.001306	5.06	1163.64	282.36	0.41	99.42		254091	48.1	44341	8.4	8.5			5.16
Tributary	14484.80		4607.37	1223.84	1229.02		1229.35	0.001326	5.11	1156.13	280.96	0.41	99.42		254191	48.1	44242	8.4	9.0			5.18
Tributary	14454.50		4607.26	1223.67	1228.89		1229.21	0.001341	5.16	1149.59	279.63	0.41	99.42		254290	48.2	44142	8.4	8.5			5.22
Tributary	14424.20		4607.15	1223.51	1228.75		1229.08	0.001361	5.21	1142.36	278.46	0.42	99.42		254390	48.2	44043	8.3	8.5			5.24
Tributary	14393.90		4607.03	1223.35	1228.61		1228.95	0.001392	5.27	1132.57	277.4	0.42	99.42		254489	48.2	43943	8.3	9.0			5.26
Tributary	14363.60		4606.96	1223.18	1228.46		1228.81	0.001419	5.33	1123.96	276.45	0.43	99.42		254588	48.2	43844	8.3	8.5			5.28
Tributary	14333.30		4606.9	1223.02	1228.31		1228.67	0.001453	5.4	1114.07	275.7	0.43	99.42		254688	48.2	43745	8.3	8.5			5.29
Tributary	14303.00		4606.82	1222.86	1228.16		1228.53	0.001493	5.48	1102.6	274.36	0.44	99.42		254787	48.3	43645	8.3	9.0			5.3
Tributary	14272.70		4606.74	1222.69	1228		1228.38	0.001544	5.56	1089.97	273.93	0.44	99.42		254887	48.3	43546	8.2	8.5			5.31
Tributary	14242.40		4606.66	1222.53	1227.84		1228.23	0.001604	5.66	1076.26	273.83	0.45	99.42		254986	48.3	43446	8.2	8.5			5.31
Tributary	14212.10		4606.57	1222.37	1227.66		1228.07	0.001678	5.78	1060.85	274.27	0.46	99.42		255086	48.3	43347	8.2	8.5			5.29
Tributary	14181.80		4606.48	1222.21	1227.48		1227.9	0.001777	5.92	1042.23	275.31	0.47	99.42		255185	48.3	43247	8.2	9.0			5.27
Tributary	14151.50		4606.42	1222.04	1227.28		1227.73	0.001896	6.08	1022.19	277.51	0.49	99.42		255284	48.3	43148	8.2	8.5			5.24
Tributary	14121.20		4606.36	1221.88	1227.06		1227.54	0.002056	6.28	999.15	281.61	0.51	99.42		255384	48.4	43049	8.2	8.5			5.18
Tributary	14090.90		4606.29	1221.72	1226.83		1227.34	0.002262	6.51	973.67	286.78	0.53	99.42		255483	48.4	42949	8.1	9.0			5.11
Tributary	14060.60		4606.2	1221.55	1226.55		1227.12	0.002566	6.82	942.39	295.46	0.56	99.42		255583	48.4	42850	8.1	8.5			5
Tributary	14030.30		4606.05	1221.39	1226.27		1227	0.003314	7.62	992.25	562.02	0.64	99.42		255682	48.4	42750	8.1	8.5			4.88
Tributary	14000.00		4605.61	1221.23	1226.3		1226.55	0.001446	5.16	1563.39	585.59	0.42	99.42		255781	48.4	42651	8.1	6.4			5.07
Tributary	13969.70		4605.81	1221.11	1226.17		1226.41	0.001444	5.11	1575.94	590.47	0.42	99.42		255881	48.5	42552	8.1	6.4			5.06
Tributary	13939.30		4605.67	1220.99	1226.03		1226.27	0.001445	5.06	1587.4	596.63	0.42	99.42		255980	48.5	42452	8.0	5.8			5.04
Tributary	13909.00		4605.51	1220.88	1225.9		1226.13	0.001442	5	1601.1	603.82	0.42	99.42		256080	48.5	42353	8.0	6.4			5.02
Tributary	13878.70		4604.97	1220.76	1225.77		1225.99	0.001432	4.93	1617.02	611.67	0.42	99.42		256179	48.5	42253	8.0	6.4			5.01
Tributary	13848.40		4605.25	1220.64	1225.64		1225.85	0.001425	4.87	1632.78	620.93	0.42	99.42		256279	48.5	42154	8.0	6.4			5
Tributary	13818.10		4604.59	1220.52	1225.49		1225.7	0.00143	4.82	1643.49	628.99	0.42	99.42		256378	48.6	42054	8.0	5.8			4.97
Tributary	13787.80		4604.93	1220.41	1225.35		1225.55	0.001446	4.79	1649.62	638.85	0.42	99.42		256477	48.6	41955	7.9	6.4			4.94
Tributary	13757.50		4604.34	1220.29	1225.21		1225.41	0.001446	4.73	1663.03	649.55	0.42	99.42		256577	48.6	41856	7.9	6.4			4.92
Tributary	13727.20		4604.63	1220.17	1225.07		1225.26	0.001447	4.68	1676.66	662.8	0.41	99.42		256676	48.6	41756	7.9	6.4			4.9
Tributary	13696.90		4604.43	1220.05	1224.94		1225.12	0.001447	4.62	1691.95	678	0.41	99.42		256776	48.6	41657	7.9	5.8			4.89
Tributary	13666.60		4604.2	1219.94	1224.8		1224.97	0.001432	4.54	1714.56	702.47	0.41	99.42		256875	48.7	41557	7.9	6.4			4.86
Tributary	13636.30		4603.94	1219.82	1224.66		1224.83	0.001409	4.48	1739.5	724.72	0.41	99.42		256975	48.7	41458	7.9	6.4			4.84
Tributary	13606.00		4603.75	1219.7	1224.52		1224.68	0.001405	4.41	1760.96	742.11	0.4	99.42		257074	48.7	41358	7.8	6.4			4.82
Tributary	13575.70		4603.64	1219.58	1224.39		1224.54	0.001403	4.35	1783.13	765.09	0.4	99.42		257173	48.7	41259	7.8	5.8			4.81
Tributary	13545.40		4603.13	1219.47	1224.25		1224.41	0.001508	4.46	1814.07	786.06	0.42	99.42		257273	48.7	41160	7.8	6.4			4.78
Tributary	13515.10		4603.86	1219.35	1224.12		1224.27	0.001486	4.37	1842.22	805.32	0.41	99.42		257372	48.7	41060	7.8	6.4			4.77
Tributary	13484.80		4603.15	1219.23	1223.99		1224.13	0.001464	4.29	1873.93	827.84	0.41	99.42		257472	48.8	40961	7.8	5.8			4.76
Tributary	13454.50		4602.88	1219.12	1223.85		1223.98	0.001441	4.2	1907.94	850.41	0.4	99.42		257571	48.8	40861	7.7	6.4			4.73
Tributary	13424.20		4602.46	1219	1223.71		1223.84	0.001415	4.1	1943.55	871.9	0.4	99.42		257670	48.8	40762	7.7	6.4			4.71
Tributary	13393.90		4602.52	1218.88	1223.58		1223.7	0.001368	3.98	1989.81	894.99	0.39	99.42		257770	48.8	40663	7.7	6.4			4.7
Tributary	13363.60		4602.28	1218.76	1223.46		1223.57	0.00131	3.85	2048.25	980.74	0.38	99.42		257869	48.8	40563	7.7	5.8			4.7
Tributary	13333.30		4601.97	1218.65	1223.34		1223.44	0.001246	3.71	2125.82	1032.22	0.37	99.42		257969	48.9	40464	7.7	6.4			4.69
Tributary	13303.00		4601.69	1218.53	1223.23		1223.33	0.001331	3.8	2217.19	1061.36	0.38	99.42		258068	48.9	40364	7.6	6.4			4.7
Tributary	13272.70		4601.58	1218.41	1223.13		1223.22	0.001184	3.56	2327.72	1087.98	0.36	99.42		258168	48.9	40265	7.6	6.4			4.72
Tributary	13242.40		4601.08	1218.29	1223.04		1223.12	0.001037	3.33	2453.02	1110	0.34	99.42		258267	48.9	40165	7.6	5.8			4.75
Tributary	13212.10		4601.21	1218.18	1222.96		1223.03	0.000934	3.18	2598.75	1148.78	0.32	99.42		258366	48.9	40066	7.6	6.4			4.78
Tributary	13181.80		4600.9	1218.06	1222.89		1222.94	0.000784	2.94	2757.24	1152.57	0.29	99.42		258466	49.0	39967	7.6	6.4			4.83
Tributary	13151.50		4600.11	1217.94	1222.82		1222.87	0.000654	2.71	2928.17	1160.85	0.27	99.42		258565	49.0	39867	7.6	5.8			4.88
Tributary	13121.20		4600.44	1217.83	1222.77		1222.82	0.000542	2.51	3118.24	1198.1	0.25	99.42		258665	49.0	39768	7.5	6.4			4.94
Tributary	13090.90		4600.1	1217.71	1222.73		1222.77	0.000446	2.31	3332.61	1234.33	0.22	99.42		258764	49.0	39668	7.5	6.4			5.02
Tributary	13060.60		4599.79	1217.59	1222.7		1222.73	0.00037	2.14	3555.13	1264.73	0.2	99.42		258864	49.0	39569	7.5	6.4			5.11
Tributary	13030.30		4599.52	1217.47	1222.67		1222.7	0.000307	1.98	3794.18	1288.56	0.19	99.42		258963	49.0	39469	7.5	5.8			5.2
Tributary	13000.00		4599.14	1217.36	1222.66		1222.67	0.000178	1.54	5398.79	2145.76	0.14	98.83		259062	49.1	39370	7.5	11.8			5.3
Tributary	12969.80		4598.38	1217.14	1222.52		1222.65	0.001366	4.06	2205.98	1311.42	0.39	98.83		259161	49.1	39271	7.4	11.8			5.38
Tributary	12939.70		4598.62	1216.92	1222.33		1222.51	0.001932	4.55	1881.48	1107.19	0.46	98.83		259260	49.1	39172	7.4	11.2			5.41
Tributary	12909.60		4598.36	1216.71	1222.11		1222.31	0.001361	4.7	1720.39	1003.14	0.5	98.83		259359	49.1	39074	7.4	11.8			5.4
Tributary	12879.50		4598.12	1216.49	1221.85		1222.06	0.00256	4.92	1610.05	936.53	0.52	98.83		259458	49.1	38975	7.4	11.8			5.36
Tributary	12849.30		4597.63	1216.27	1221.58		1221.82	0.002778	5.24	1548.68	890.21	0.55	98.83		259557	49.2	38876	7.4	11.2			5.31
Tributary	12819.20		4597.82	1216.06	1221.29		1221.57	0.003041	5.59	1476.16	865.99	0.57	98.83		259655	49.2	38777	7.3	11.8			5.23
Tributary	12789.10		4597.23	1215.84	1220.99		1221.31	0.003098	5.9	1418.78	826.49	0.59	98.83		259754	49.2	38678	7.3	11.8			5.15
Tributary	12759.00		4597.53	1215.62	1220.68		1221.04	0.003196	6.13	1370.67	799.78	0.6	98.83		259853	49.2	38579	7.3	11.8			5.06
Tributary	12728.80		4597.29	1215.4	1220.38		1220.75	0.003187	6.2	1340.18	768.55	0.6	98.83		259952	49.2	38481	7.3	11.2			4.98
Tributary	12698.70		4596.81	1215.19	1220.06		1220.44	0.003233	6.19	1313.82	739.22	0.6	98.83		260051	49.3	38382	7.3	11.8			4.87
Tributary	12668.60		4596.65	1214.97	1219.75		1220.13	0.00328	6.17	1299.51	731.43	0.61	98.83		260149	49.3	38283	7.3	11.8			4.78
Tributary	12638.50		4596.95	1214.75	1219.44		1219.82	0.00333	6.11	1292.22	729.61	0.61	98.83		260248	49.3	38184	7.2	11.2			4.69
Tributary	12608.30		4596.75	1214.54	1219.1		1219.48	0.003442	6.07	1275.26	720.03	0.61	98.83		260347	49.3	38085	7.2	11.8			4.56
Tributary	12578.20		4596.53	1214.32	1218.77		1219.14	0.003471	5.97	1270.11	710.34	0.61	98.83		260446	49.3	37986	7.2	11.8			4.45
Tributary	12548.10		4596.05	1214.1	1218.45		1218.8	0.003389	5.81	1275.78	693.91	0.6	98.83		260545	49.3	37888	7.2	11.2			4.35
Tributary	12518.00		4596.26	1213.89	1218.12		1218.46	0.003335	5.65	1285.58	689.85	0.6	98.83		260644	49.4	37789	7.2	11.8			4.23
Tributary	12487.80		4596.05	1213.67	1217.84		1218.15	0.003205	5.45	1342.46	758.53	0.58	98.83		260742	49.4	37690	7.1	11.8			4.17
Tributary	12457.70		4595.85	1213.45	1217.61		1217.86	0.002671	4.95	1454.99	797.43	0.53	98.83		260841	49.4	37591	7.1	11.2			4.16
Tributary	12427.60		4595.62	1213.24	1217.42		1217.62	0.002046	4.34	1634.61	854.96	0.47	98.83		260940	49.4	37492	7.1	11.8			4.18
Tributary	12397.50		4595.34	1213.02	1217.29		1217.43	0.001468	3.67	1910.05	964.27	0.39	98.83		261039	49.4	37393	7.1	11.8			4.27
Tributary	12367.40		4594.94	1212.8	1217.21		1217.3	0.000899	2.89	2370.77	1108.02	0.31	98.83		261138	49.5	37295	7.1	11.2			4.41
Tributary	12337.20		4594.5	1212.59	1217.18		1217.23	0.000431	2.23	3202.73	1552.86	0.22	98.83		261237	49.5	37196	7.0	11.8			4.59
Tributary	12307.15		4593.95	1212.37	1217.17		1217.19	0.000131	1.43	5427.51	2017.83	0.13	99.73		261335	49.5	37097	7.0	4.2			4.8
Tributary	12276.70		4593.1	1212.29	1217.14		1217.18	0.000212	1.84	4288.87	1915.98	0.16	99.73		261435	49.5	36997	7.0	4.8			4.85
Tributary	12246.30		4592.34	1212.2	1217.1		1217.17	0.000328	2.31	3192.08	1782.02	0.2	99.73		261535	49.5	36898	7.0	4.2			4.9
Tributary	12215.90		4591.86	1212.12	1217.04		1217.14	0.000435	2.67	2273.48	1405.81	0.23	99.73		261635	49.6	36798	7.0	4.8			4.92
Tributary	12185.50		4591.5	1212.03	1216.98		1217.09	0.000472	2.8	1866.38	683.54	0.24	99.73		261734	49.6	36698	7.0	4.2			4.95

Tributary	12155.10		4591.29	1211.95	1216.93		1217.04	0.000477	2.83	1801.8	483.74	0.24	99.73		261834	49.6	36598	6.9	4.2			4.98
Tributary	12124.70		4591.13	1211.87	1216.88		1217	0.00048	2.86	1785.76	460.03	0.24	99.73		261934	49.6	36499	6.9	4.8			5.01
Tributary	12094.30		4590.96	1211.78	1216.83		1216.95	0.000483	2.88	1771.73	451.01	0.24	99.73		262034	49.6	36399	6.9	4.2			5.05
Tributary	12063.90		4590.8	1211.7	1216.78		1216.9	0.000485	2.9	1760.12	442.11	0.25	99.73		262133	49.6	36299	6.9	4.8			5.08
Tributary	12033.50		4590.61	1211.61	1216.73		1216.86	0.000488	2.93	1746.02	433.5	0.25	99.73		262233	49.7	36199	6.9	4.2			5.12
Tributary	12003.10		4590.39	1211.53	1216.68		1216.81	0.000493	2.96	1730.14	425.08	0.25	99.73		262333	49.7	36100	6.8	4.2			5.15
Tributary	11972.70		4590.23	1211.45	1216.63		1216.76	0.000499	2.99	1713.69	417.01	0.25	99.73		262432	49.7	36000	6.8	4.8			5.18
Tributary	11942.30		4590.08	1211.36	1216.58		1216.71	0.000501	3.02	1701.46	409.18	0.25	99.73		262532	49.7	35900	6.8	4.2			5.22
Tributary	11911.90		4589.92	1211.28	1216.53		1216.66	0.000508	3.04	1687.04	402.71	0.25	99.73		262632	49.7	35800	6.8	4.8			5.25
Tributary	11881.50		4589.77	1211.19	1216.48		1216.61	0.000519	3.08	1669.81	397.13	0.26	99.73		262732	49.8	35701	6.8	4.2			5.29
Tributary	11851.10		4589.6	1211.11	1216.42		1216.56	0.000534	3.12	1650.48	391.79	0.26	99.73		262831	49.8	35601	6.7	4.2			5.31
Tributary	11820.70		4589.44	1211.03	1216.37		1216.51	0.000552	3.16	1630.49	386.98	0.26	99.73		262931	49.8	35501	6.7	4.8			5.34
Tributary	11790.30		4589.3	1210.94	1216.31		1216.45	0.000569	3.2	1611.2	382.33	0.27	99.73		263031	49.8	35402	6.7	4.2			5.37
Tributary	11759.90		4589.19	1210.86	1216.25		1216.39	0.000589	3.24	1591.51	378.03	0.27	99.73		263131	49.8	35302	6.7	4.8			5.39
Tributary	11729.50		4589.05	1210.77	1216.18		1216.33	0.000611	3.28	1570.81	374.12	0.28	99.73		263230	49.9	35202	6.7	4.2			5.41
Tributary	11699.10		4588.92	1210.69	1216.12		1216.27	0.000646	3.34	1542.38	370.7	0.28	99.73		263330	49.9	35102	6.6	4.2			5.43
Tributary	11668.70		4588.78	1210.61	1216.05		1216.21	0.000675	3.39	1520.8	367.54	0.29	99.73		263430	49.9	35003	6.6	4.8			5.44
Tributary	11638.30		4588.65	1210.52	1215.98		1216.14	0.000705	3.44	1500.57	364.96	0.29	99.73		263530	49.9	34903	6.6	4.2			5.46
Tributary	11607.90		4588.54	1210.44	1215.9		1216.07	0.000736	3.48	1481.43	363.02	0.3	99.73		263629	49.9	34803	6.6	4.8			5.46
Tributary	11577.50		4588.42	1210.35	1215.82		1215.99	0.000772	3.52	1461.55	361.5	0.31	99.73		263729	49.9	34703	6.6	4.2			5.47
Tributary	11547.10		4588.29	1210.27	1215.74		1215.92	0.000813	3.57	1441.26	360.83	0.31	99.73		263829	50.0	34604	6.6	4.2			5.47
Tributary	11516.70		4588.16	1210.19	1215.66		1215.83	0.000856	3.61	1422.92	361.03	0.32	99.73		263928	50.0	34504	6.5	4.8			5.47
Tributary	11486.30		4588.05	1210.1	1215.57		1215.75	0.000887	3.65	1405.36	357.98	0.33	99.73		264028	50.0	34404	6.5	4.2			5.47
Tributary	11455.90		4587.95	1210.02	1215.47		1215.66	0.000917	3.7	1388.26	354.79	0.33	99.73		264128	50.0	34305	6.5	4.2			5.45
Tributary	11425.50		4587.85	1209.94	1215.38		1215.57	0.000935	3.75	1371.77	348.46	0.33	99.73		264228	50.0	34205	6.5	4.8			5.44
Tributary	11395.10		4587.71	1209.85	1215.28		1215.48	0.000955	3.8	1354.89	342.08	0.34	99.73		264327	50.1	34105	6.5	4.2			5.43
Tributary	11364.70		4587.59	1209.77	1215.18		1215.38	0.000975	3.85	1337.47	335.66	0.34	99.73		264427	50.1	34005	6.4	4.8			5.41
Tributary	11334.30		4587.46	1209.68	1215.08		1215.28	0.000992	3.91	1321.55	329.27	0.35	99.73		264527	50.1	33906	6.4	4.2			5.4
Tributary	11303.90		4587.35	1209.6	1214.97		1215.19	0.001012	3.96	1304.72	322.91	0.35	99.73		264627	50.1	33806	6.4	4.2			5.37
Tributary	11273.50		4587.26	1209.52	1214.87		1215.09	0.001031	4.02	1288.41	316.53	0.35	99.73		264726	50.1	33706	6.4	4.8			5.35
Tributary	11243.10		4587.12	1209.43	1214.76		1214.99	0.001049	4.08	1272.24	310.14	0.36	99.73		264826	50.2	33606	6.4	4.2			5.33
Tributary	11212.70		4586.68	1209.35	1214.65		1214.88	0.001079	4.17	1249.03	301.7	0.36	99.73		264926	50.2	33507	6.3	4.8			5.3
Tributary	11182.30		4586.96	1209.26	1214.54		1214.78	0.001095	4.24	1233.33	295.02	0.37	99.73		265025	50.2	33407	6.3	4.2			5.28
Tributary	11151.90		4586.87	1209.18	1214.42		1214.67	0.001119	4.31	1216.39	289.35	0.37	99.73		265125	50.2	33307	6.3	4.2			5.24
Tributary	11121.60		4586.42	1209.1	1214.3		1214.56	0.001139	4.37	1201.15	283.66	0.37	99.73		265225	50.2	33208	6.3	0.0			5.2
Tributary	11091.20		4586.72	1209.1	1214.18		1214.45	0.001183	4.43	1184.57	280.84	0.38	99.73		265325	50.3	33108	6.3	5.8			5.08
Tributary	11060.80		4586.62	1208.99	1214.05		1214.31	0.001431	4.35	1177.29	315.31	0.41	99.73		265424	50.3	33008	6.3	6.4			5.06
Tributary	11030.40		4586.51	1208.87	1213.92		1214.18	0.001431	4.32	1180.86	320.8	0.41	99.73		265524	50.3	32908	6.2	5.8			5.05
Tributary	11000.00		4586.04	1208.76	1213.83		1214.07	0.001264	4.23	1289.86	572.94	0.39	99.42		265624	50.3	32809	6.2	4.8			5.07
Tributary	10969.70		4586.3	1208.67	1213.7		1213.94	0.00127	4.27	1257.35	438.52	0.39	99.42		265723	50.3	32709	6.2	4.8			5.03
Tributary	10939.30		4586.14	1208.58	1213.57		1213.82	0.001257	4.28	1266.06	449.4	0.39	99.42		265823	50.3	32610	6.2	4.8			4.99
Tributary	10909.00		4586	1208.49	1213.45		1213.7	0.001239	4.28	1278.18	463.35	0.38	99.42		265922	50.4	32510	6.2	4.8			4.96
Tributary	10878.70		4585.86	1208.4	1213.34		1213.58	0.001206	4.26	1296.62	478.87	0.38	99.42		266022	50.4	32411	6.1	4.8			4.94
Tributary	10848.40		4585.73	1208.31	1213.22		1213.47	0.001189	4.26	1312.52	483.39	0.38	99.42		266121	50.4	32311	6.1	4.8			4.91
Tributary	10818.10		4585.63	1208.22	1213.11		1213.35	0.001168	4.25	1329.09	483	0.38	99.42		266220	50.4	32212	6.1	4.8			4.89
Tributary	10787.80		4585.5	1208.13	1213		1213.24	0.001145	4.23	1345.96	482.81	0.37	99.42		266320	50.4	32113	6.1	4.8			4.87
Tributary	10757.50		4585.35	1208.04	1212.89		1213.13	0.001141	4.23	1356.71	482.74	0.37	99.42		266419	50.5	32013	6.1	4.8			4.85
Tributary	10727.20		4585.21	1207.95	1212.78		1213.02	0.001126	4.21	1371.07	482.72	0.37	99.42		266519	50.5	31914	6.0	5.8			4.83
Tributary	10696.90		4585.06	1207.84	1212.67		1212.91	0.001098	4.18	1389.22	482.83	0.37	99.42		266618	50.5	31814	6.0	5.3			4.83
Tributary	10666.60		4584.94	1207.74	1212.57		1212.8	0.001076	4.15	1405.9	482.98	0.36	99.42		266717	50.5	31715	6.0	4.8			4.83
Tributary	10636.30		4584.78	1207.65	1212.47		1212.7	0.001071	4.14	1416.31	483.2	0.36	99.42		266817	50.5	31616	6.0	4.8			4.82
Tributary	10606.00		4584.59	1207.56	1212.36		1212.59	0.001062	4.13	1425.62	483.42	0.36	99.42		266916	50.6	31516	6.0	4.8			4.8
Tributary	10575.70		4584.13	1207.47	1212.26		1212.49	0.001047	4.1	1438.21	483.72	0.36	99.42		267016	50.6	31417	6.0	5.3			4.79
Tributary	10545.40		4584.35	1207.37	1212.17		1212.39	0.001028	4.07	1452.63	484.03	0.35	99.42		267115	50.6	31317	5.9	4.8			4.8
Tributary	10515.10		4584.19	1207.28	1212.07		1212.28	0.001013	4.04	1465.43	484.46	0.35	99.42		267215	50.6	31218	5.9	4.8			4.79
Tributary	10484.80		4584.02	1207.19	1211.98		1212.19	0.000998	4.01	1477.54	484.92	0.35	99.42		267314	50.6	31118	5.9	4.8			4.79
Tributary	10454.50		4583.88	1207.1	1211.88		1212.09	0.000983	3.97	1489.93	485.41	0.35	99.42		267413	50.6	31019	5.9	5.3			4.78
Tributary	10424.20		4583.75	1207	1211.79		1211.99	0.000967	3.93	1502.7	486.06	0.34	99.42		267513	50.7	30920	5.9	4.8			4.79
Tributary	10393.90		4583.62	1206.91	1211.7		1211.9	0.000954	3.9	1513.88	486.71	0.34	99.42		267612	50.7	30820	5.8	4.8			4.79
Tributary	10363.60		4583.48	1206.82	1211.61		1211.8	0.000939	3.86	1525.4	487.64	0.34	99.42		267712	50.7	30721	5.8	4.8			4.79
Tributary	10333.30		4583.28	1206.73	1211.53		1211.71	0.000925	3.81	1536.46	488.65	0.33	99.42		267811	50.7	30621	5.8	5.3			4.8
Tributary	10303.00		4583.1	1206.63	1211.44		1211.62	0.000912	3.77	1546.71	490.15	0.33	99.42		267910	50.7	30522	5.8	4.8			4.81
Tributary	10272.70		4582.99	1206.54	1211.36		1211.53	0.000901	3.73	1556.27	490.79	0.33	99.42		268010	50.8	30423	5.8	4.8			4.82
Tributary	10242.40		4582.81	1206.45	1211.27		1211.44	0.000889	3.69	1564.2	490.37	0.33	99.42		268109	50.8	30325	5.7	3.2			4.82
Tributary	10212.10		4582.57	1206.39	1211.19		1211.35	0.000887	3.69	1568.85	495.21	0.33	99.42		268209	50.8	30224	5.7	5.3			4.8
Tributary	10181.80		4582.4	1206.29	1211.11		1211.27	0.000876	3.6	1578.44	510.4	0.32	99.42		268308	50.8	30124	5.7	4.8			4.82
Tributary	10151.50		4582.24	1206.2	1211.03		1211.18	0.000857	3.55	1592.43	512.85	0.32	99.42		268408	50.8	30025	5.7	5.3			4.83
Tributary	10121.20		4582.1	1206.1	1210.95		1211.1	0.000847	3.5	1603.69	517.46	0.32	99.42		268507	50.9	29925	5.7	5.3			4.85
Tributary	10090.90		4581.92	1206	1210.87		1211.02	0.000836	3.44	1616.43	517.55	0.31	99.42		268606	50.9	29826	5.6	5.8			4.87
Tributary	10060.60		4581.73	1205.89	1210.79		1210.94	0.000816	3.38	1635.39	501.39	0.31	99.42		268706	50.9	29727	5.6	4.8			4.9
Tributary	10030.30		4581.52	1205.8	1210.72		1210.86	0.000798	3.31	1662.15	494.25	0.31	99.42		268805	50.9	29627	5.6	4.8			4.92
Tributary	10000.00		4581.31	1205.71	1210.66		1210.79	0.000761	3.25	1696.86	488.1	0.3	99.42		268905	50.9	29528	5.6	8.0			4.95
Tributary	9969.69		4581.18	1205.56	1210.57		1210.71	0.000828	3.39	1637.85	505.18	0.31	99.42		269004	50.9	29428	5.6	8.0			5.01
Tributary	9939.39		4581.05	1205.41	1210.48		1210.64	0.000888	3.56	1579.79	523.92	0.32	99.42		269104	51.0	29329	5.6	8.0			5.07
Tributary	9909.09		4580.86	1205.26	1210.38		1210.55	0.000945	3.73	1526.61	522.5	0.34	99.42		269203	51.0	29229	5.5	8.0			5.12
Tributary	9878.78		4580.66	1205.11	1210.27		1210.46	0.001006	3.88	1467.26	507.81	0.35	99.42		269302	51.0	29130	5.5	8.0			5.16
Tributary	9848.48		4580.47	1204.96	1210.16		1210.37	0.001023	3.95	1425.63	456.34	0.35	99.42		269402	51.0	29031	5.5	8.0			5.2
Tributary	9818.18		4579.92	1204.81	1210.05		1210.26	0.00102	3.98	1399.65	436.21	0.35	99.42		269501	51.0	28931	5.5	8.0			5.24
Tributary	9787.87		4580.19	1204.66	1209.96		1210.17	0.00099	3.97	1397.47	423.79	0.35	99.42		269601	51.1	28832	5.5	8.0			5.3
Tributary	9757.57		4580.01	1204.51	1209.86		1210.07	0.000977	3.97	1394.81	414.85	0.35	99.42		269700	51.1	28732	5.4	8.0			5.35
Tributary	9727.27		4579.84	1204.36	1209.76		1209.97	0.000955	3.96	1398.66	409.23	0.34	99.42		269799	51.1	28633	5.4	8.0			5.4
Tributary	9696.97		4579.71	1204.21	1209.67		1209.88	0.000931	3.95	1406.02	404.28	0.34	99.42		269899	51.1	28534	5.4	8.0			5.46
Tributary	9666.66		4579.58	1204.06	1209.58		1209.79	0.000908	3.93	1414.19	400.53	0.34	99.42		269998	51.1	28434	5.4	8.0			5.52

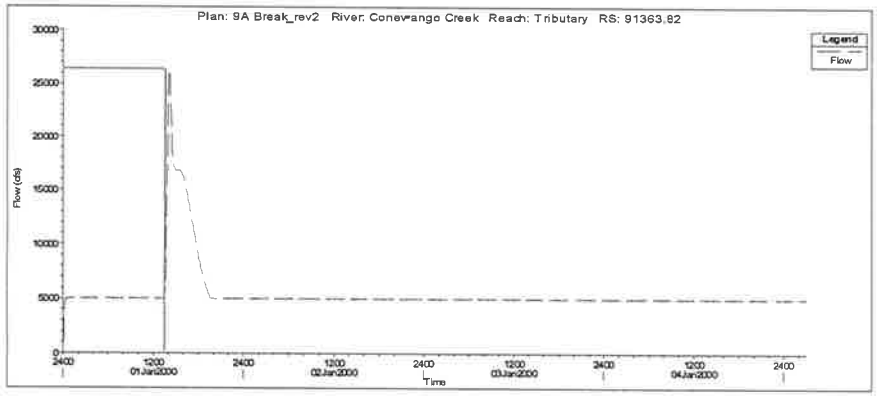
Tributary	9636.36		4579.41	1203.91	1209.5		1209.7	0.000883	3.91	1424.84	397.26	0.33	99.42		270098	51.2	28335	5.4	8.0			5.59
Tributary	9606.06		4579.24	1203.76	1209.41		1209.61	0.000861	3.89	1434.97	394.38	0.33	99.42		270197	51.2	28235	5.3	8.0			5.65
Tributary	9575.75		4579.1	1203.61	1209.33		1209.53	0.000837	3.87	1447.12	391.85	0.32	99.42		270297	51.2	28136	5.3	8.0			5.72
Tributary	9545.45		4578.94	1203.46	1209.25		1209.45	0.000806	3.84	1462.4	389.5	0.32	99.42		270396	51.2	28036	5.3	8.0			5.79
Tributary	9515.15		4578.77	1203.31	1209.18		1209.37	0.000781	3.81	1476.03	387.32	0.31	99.42		270495	51.2	27937	5.3	8.0			5.87
Tributary	9484.84		4578.6	1203.16	1209.11		1209.29	0.000759	3.78	1489.22	385.31	0.31	99.42		270595	51.2	27838	5.3	8.0			5.95
Tributary	9454.54		4578.43	1203.01	1209.04		1209.22	0.000735	3.75	1503.46	383.42	0.31	99.42		270694	51.3	27738	5.3	8.0			6.03
Tributary	9424.24		4578.26	1202.86	1208.97		1209.15	0.000714	3.72	1516.95	381.63	0.3	99.42		270794	51.3	27639	5.2	8.0			6.11
Tributary	9393.93		4578.08	1202.71	1208.9		1209.08	0.000693	3.69	1531.18	379.99	0.3	99.42		270893	51.3	27539	5.2	8.0			6.19
Tributary	9363.63		4577.93	1202.56	1208.84		1209.01	0.000674	3.66	1543.94	378.35	0.29	99.42		270993	51.3	27440	5.2	8.0			6.28
Tributary	9333.33		4577.79	1202.41	1208.77		1208.95	0.000656	3.63	1557.63	376.78	0.29	99.42		271092	51.3	27340	5.2	8.0			6.36
Tributary	9303.03		4577.65	1202.26	1208.71		1208.88	0.000638	3.6	1571.18	375.28	0.29	99.42		271191	51.4	27241	5.2	8.0			6.45
Tributary	9272.72		4577.48	1202.11	1208.65		1208.82	0.000619	3.56	1586.9	373.81	0.28	99.42		271291	51.4	27142	5.1	8.0			6.54
Tributary	9242.42		4577.31	1201.96	1208.6		1208.76	0.000603	3.53	1599.16	372.4	0.28	99.42		271390	51.4	27042	5.1	8.0			6.64
Tributary	9212.12		4577.15	1201.81	1208.54		1208.7	0.000589	3.5	1611.07	371.03	0.28	99.42		271490	51.4	26943	5.1	8.0			6.73
Tributary	9181.81		4576.99	1201.66	1208.49		1208.64	0.000574	3.47	1625.99	369.66	0.27	99.42		271589	51.4	26843	5.1	8.0			6.83
Tributary	9151.51		4576.84	1201.51	1208.43		1208.59	0.000561	3.44	1637.24	368.33	0.27	99.42		271688	51.5	26744	5.1	8.0			6.92
Tributary	9121.21		4576.65	1201.36	1208.38		1208.53	0.000549	3.41	1648.09	367.02	0.27	99.42		271788	51.5	26645	5.0	8.0			7.02
Tributary	9090.90		4576.5	1201.21	1208.33		1208.48	0.000538	3.39	1658.82	365.75	0.27	99.42		271887	51.5	26545	5.0	8.0			7.12
Tributary	9060.60		4576.34	1201.06	1208.28		1208.43	0.000525	3.36	1671.57	364.5	0.26	99.42		271987	51.5	26446	5.0	8.0			7.22
Tributary	9030.30		4576.16	1200.91	1208.23		1208.37	0.000516	3.33	1680.77	363.24	0.26	99.42		272086	51.5	26346	5.0	8.0			7.32
Tributary	9000.00		4576	1200.76	1208.18		1208.32	0.000507	3.31	1688.91	361.27	0.26	99.42		272186	51.6	26247	5.0	3.2			7.42
Tributary	8969.69		4575.83	1200.7	1208.12		1208.27	0.000584	3.46	1585.1	348.64	0.27	99.42		272285	51.6	26147	5.0	3.2			7.42
Tributary	8939.39		4575.64	1200.64	1208.03		1208.21	0.000683	3.64	1481.03	344.02	0.3	99.42		272384	51.6	26048	4.9	3.2			7.39
Tributary	8909.09		4575.46	1200.58	1207.94		1208.14	0.000793	3.81	1381.52	338.84	0.32	99.42		272483	51.6	25949	4.9	3.2			7.36
Tributary	8878.78		4575.32	1200.52	1207.84		1208.06	0.000821	4.05	1288.71	262.95	0.32	99.42		272583	51.6	25849	4.9	2.7			7.32
Tributary	8848.48		4575.21	1200.47	1207.74		1207.98	0.000787	4.18	1262.69	245.85	0.32	99.42		272683	51.6	25750	4.9	3.2			7.27
Tributary	8818.18		4575.11	1200.41	1207.66		1207.9	0.000807	4.24	1243.38	242.4	0.33	99.42		272782	51.7	25650	4.9	3.2			7.25
Tributary	8787.87		4575	1200.35	1207.57		1207.82	0.000829	4.3	1225.41	239.51	0.33	99.42		272881	51.7	25551	4.8	3.2			7.22
Tributary	8757.57		4574.88	1200.29	1207.48		1207.73	0.00085	4.35	1208.82	236.77	0.33	99.42		272981	51.7	25452	4.8	2.7			7.19
Tributary	8727.27		4574.76	1200.24	1207.39		1207.65	0.000874	4.4	1191.85	234.11	0.34	99.42		273080	51.7	25352	4.8	3.2			7.15
Tributary	8696.97		4574.66	1200.18	1207.29		1207.56	0.000897	4.45	1175.7	231.42	0.34	99.42		273180	51.7	25253	4.8	3.2			7.11
Tributary	8666.66		4574.58	1200.12	1207.2		1207.47	0.0009	4.47	1168.84	229.18	0.34	99.42		273279	51.8	25153	4.8	3.2			7.08
Tributary	8636.36		4574.48	1200.06	1207.11		1207.38	0.000933	4.53	1151.29	227.24	0.35	99.42		273379	51.8	25054	4.7	2.7			7.05
Tributary	8606.06		4574.4	1200.01	1207.01		1207.29	0.000943	4.56	1141.78	225.42	0.35	99.42		273478	51.8	24954	4.7	3.2			7
Tributary	8575.75		4574.33	1199.95	1206.91		1207.2	0.000963	4.6	1129.5	223.66	0.36	99.42		273577	51.8	24855	4.7	3.2			6.96
Tributary	8545.45		4574.23	1199.89	1206.8		1207.1	0.000997	4.66	1110.88	220.81	0.36	99.42		273677	51.8	24756	4.7	3.2			6.91
Tributary	8515.15		4574.12	1199.83	1206.7		1207	0.001015	4.7	1099.86	218.79	0.36	99.42		273776	51.9	24656	4.7	3.2			6.87
Tributary	8484.84		4574.04	1199.77	1206.59		1206.9	0.001031	4.73	1089.59	216.8	0.37	99.42		273876	51.9	24557	4.7	2.7			6.82
Tributary	8454.54		4573.95	1199.72	1206.49		1206.8	0.001049	4.76	1079.23	214.98	0.37	99.42		273975	51.9	24457	4.6	3.2			6.77
Tributary	8424.24		4573.85	1199.66	1206.38		1206.7	0.001064	4.79	1070.35	213.47	0.37	99.42		274075	51.9	24358	4.6	3.2			6.72
Tributary	8393.93		4573.75	1199.6	1206.27		1206.59	0.001078	4.82	1062.09	212.04	0.38	99.42		274174	51.9	24258	4.6	3.2			6.67
Tributary	8363.63		4573.66	1199.54	1206.16		1206.48	0.00109	4.85	1054.3	210.56	0.38	99.42		274273	51.9	24159	4.6	2.7			6.62
Tributary	8333.33		4573.57	1199.49	1206.04		1206.37	0.001103	4.88	1046.94	209.23	0.38	99.42		274373	52.0	24060	4.6	3.2			6.55
Tributary	8303.03		4573.46	1199.43	1205.93		1206.26	0.001112	4.9	1040.49	207.98	0.38	99.42		274472	52.0	23960	4.5	3.2			6.5
Tributary	8272.72		4573.36	1199.37	1205.81		1206.15	0.001119	4.92	1034.82	206.77	0.38	99.42		274572	52.0	23861	4.5	3.2			6.44
Tributary	8242.42		4573.26	1199.31	1205.7		1206.04	0.001124	4.94	1029.79	205.61	0.38	99.42		274671	52.0	23761	4.5	2.7			6.39
Tributary	8212.12		4573.18	1199.26	1205.59		1205.93	0.001129	4.96	1025.18	204.51	0.38	99.42		274770	52.0	23662	4.5	3.2			6.33
Tributary	8181.81		4573.12	1199.2	1205.47		1205.82	0.001128	4.97	1022.03	203.45	0.38	99.42		274870	52.1	23563	4.5	3.2			6.27
Tributary	8151.51		4573.04	1199.14	1205.36		1205.71	0.001124	4.97	1019.75	202.43	0.38	99.42		274969	52.1	23463	4.4	3.2			6.22
Tributary	8121.21		4572.94	1199.08	1205.25		1205.6	0.001116	4.97	1018.51	201.46	0.38	99.42		275069	52.1	23364	4.4	2.7			6.17
Tributary	8090.90		4572.84	1199.03	1205.14		1205.49	0.001107	4.97	1017.68	200.52	0.38	99.42		275168	52.1	23264	4.4	3.2			6.11
Tributary	8060.60		4572.75	1198.97	1205.03		1205.38	0.001093	4.96	1018.24	199.55	0.38	99.42		275268	52.1	23165	4.4	2.1			6.06
Tributary	8030.30		4572.7	1198.93	1204.93		1205.27	0.00107	4.94	1021.49	198.5	0.38	99.42		275367	52.2	23065	4.4	4.2			6
Tributary	8000.00		4572.63	1198.85	1204.82		1205.17	0.00105	4.92	1024	197.52	0.37	99.42		275466	52.2	22966	4.3	5.3			5.97
Tributary	7969.69		4572.54	1198.75	1204.72		1205.06	0.001073	4.94	1020.56	198.79	0.38	99.42		275566	52.2	22867	4.3	5.3			5.97
Tributary	7939.39		4572.46	1198.65	1204.61		1204.96	0.001099	4.96	1016.7	200.04	0.38	99.42		275665	52.2	22767	4.3	5.8			5.96
Tributary	7909.09		4572.38	1198.54	1204.5		1204.85	0.00111	4.97	1016.89	201.38	0.38	99.42		275765	52.2	22668	4.3	5.8			5.96
Tributary	7878.78		4572.29	1198.43	1204.39		1204.74	0.001126	4.98	1015.65	202.59	0.38	99.42		275864	52.2	22568	4.3	5.3			5.96
Tributary	7848.48		4572.21	1198.33	1204.27		1204.63	0.001146	4.99	1013.61	203.82	0.39	99.42		275964	52.3	22469	4.3	5.3			5.94
Tributary	7818.18		4572.12	1198.23	1204.16		1204.51	0.001168	5.01	1010.83	205.06	0.39	99.42		276063	52.3	22369	4.2	5.8			5.93
Tributary	7787.87		4572.02	1198.12	1204.04		1204.4	0.001187	5.02	1009.26	206.38	0.39	99.42		276162	52.3	22270	4.2	5.3			5.92
Tributary	7757.57		4571.93	1198.02	1203.92		1204.28	0.001207	5.03	1007.64	207.73	0.4	99.42		276262	52.3	22171	4.2	5.8			5.9
Tributary	7727.27		4571.86	1197.91	1203.8		1204.16	0.001226	5.04	1006.15	209.16	0.4	99.42		276361	52.3	22071	4.2	5.3			5.89
Tributary	7696.97		4571.79	1197.81	1203.68		1204.04	0.001251	5.06	1003.57	210.59	0.4	99.42		276461	52.4	21972	4.2	5.8			5.87
Tributary	7666.66		4571.72	1197.7	1203.55		1203.91	0.001269	5.07	1002.94	212.13	0.4	99.42		276560	52.4	21872	4.1	5.3			5.85
Tributary	7636.36		4571.67	1197.6	1203.43		1203.79	0.001292	5.09	1001.28	213.73	0.41	99.42		276659	52.4	21773	4.1	5.8			5.83
Tributary	7606.06		4571.57	1197.49	1203.3		1203.66	0.001313	5.1	1000.21	215.49	0.41	99.42		276759	52.4	21674	4.1	5.3			5.81
Tributary	7575.75		4571.48	1197.39	1203.16		1203.53	0.001341	5.12	997.88	217.27	0.41	99.42		276858	52.4	21574	4.1	5.3			5.77
Tributary	7545.45		4571.4	1197.29	1203.03		1203.4	0.001365	5.13	996.61	219.17	0.42	99.42		276958	52.5	21475	4.1	5.8			5.74
Tributary	7515.15		4571.31	1197.18	1202.89		1203.26	0.001391	5.15	995.37	221.2	0.42	99.42		277057	52.5	21375	4.0	5.3			5.71
Tributary	7484.84		4571.24	1197.08	1202.75		1203.12	0.001428	5.18	993.51	224.82	0.42	99.42		277157	52.5	21276	4.0	5.8			5.67
Tributary	7454.54		4571.15	1196.97	1202.6		1202.98	0.001468	5.22	991.88	228.74	0.43	99.42		277256	52.5	21176	4.0	5.3			5.63
Tributary	7424.24		4571.07	1196.87	1202.45		1202.83	0.001502	5.24	992.19	233.15	0.43	99.42		277355	52.5	21077	4.0	5.8			5.58
Tributary	7393.93		4570.98	1196.76	1202.28		1202.68	0.001622	5.39	990.52	256.15	0.45	99.42		277455	52.5	20978	4.0	5.3			5.52
Tributary	7363.63		4570.87	1196.66	1202.12		1202.52	0.001659	5.41	998.26	265.11	0.45	99.42		277554	52.6	20878	4.0	5.3			5.46
Tributary	7333.33		4570.78	1196.56	1201.96		1202.36	0.001665	5.37	1008.68	268.07	0.45	99.42		277654	52.6	20779	3.9	5.8			5.4
Tributary	7303.03		4570.71	1196.45	1201.81		1202.19	0.001661	5.33	1020.48	270.82	0.45	99.42		277753	52.6	20679	3.9	5.3			5.36
Tributary	7272.72		4570.63	1196.35	1201.65		1202.03	0.001665	5.3	1030	273.35	0.45	99.42		277852	52.6	20580	3.9	5.8			5.3
Tributary	7242.42		4570.55	1196.24	1201.5		1201.86	0.001644	5.23	1045.29	275.74	0.45	99.42		277952	52.6	20481	3.9	5.3			5.26
Tributary	7212.12		4570.45	1196.14	1201.35		1201.7	0.001642	5.19	1056.25	277.99	0.45	99.42		278051	52.7	20381	3.9	5.8			5.21
Tributary	7181.81		4570.35	1196.03	1201.2		1201.54	0.001596	5.1	1076.08	280.14	0.44	99.42		278151	52.7	20282	3.8	5.3			5.17
Tributary	7151.51		4570.25	1195.93	1201.06		1201.39	0.001547	5	1096.99	284.63	0.43	99.42		278250	52.7	20182	3.8	5.8			5.13

Tributary	7121.21		4570.16	1195.82	1200.94		1201.24	0.001457	4.85	1152.6	326.76	0.42	99.42		278350	52.7	20083	3.8	5.3			5.12
Tributary	7090.90		4570.04	1195.72	1200.84		1201.1	0.00132	4.63	1236.78	346.06	0.4	99.42		278449	52.7	19983	3.8	5.3			5.12
Tributary	7060.60		4569.9	1195.62	1200.75		1200.98	0.001143	4.34	1345.78	366.61	0.37	99.42		278548	52.8	19884	3.8	5.8			5.13
Tributary	7030.30		4569.74	1195.51	1200.69		1200.88	0.000992	4.04	1541.69	500.25	0.35	99.42		278648	52.8	19785	3.7	5.3			5.18
Tributary	7000.00		4569.59	1195.41	1200.65		1200.78	0.000758	3.47	1831.27	564.03	0.3	99.42		278747	52.8	19685	3.7	5.8			5.24
Tributary	6969.69		4569.41	1195.3	1200.56		1200.7	0.000833	3.57	1765.23	533.99	0.32	99.42		278847	52.8	19586	3.7	6.4			5.26
Tributary	6939.39		4569.21	1195.18	1200.46		1200.61	0.000912	3.65	1710.67	530.86	0.33	99.42		278946	52.8	19486	3.7	5.8			5.28
Tributary	6909.09		4569.05	1195.07	1200.36		1200.52	0.000996	3.74	1636.97	525.68	0.34	99.42		279046	52.8	19387	3.7	5.8			5.29
Tributary	6878.78		4568.85	1194.96	1200.25		1200.42	0.001079	3.81	1609.74	522.55	0.35	99.42		279145	52.9	19287	3.7	5.8			5.29
Tributary	6848.48		4568.65	1194.85	1200.13		1200.31	0.001136	3.92	1561.26	510.92	0.36	99.42		279244	52.9	19188	3.6	5.8			5.28
Tributary	6818.18		4568.45	1194.74	1200.01		1200.2	0.001188	4.01	1515.35	499.7	0.37	99.42		279344	52.9	19089	3.6	5.8			5.27
Tributary	6787.87		4568.28	1194.63	1199.89		1200.09	0.001225	4.07	1474.78	486.04	0.38	99.42		279443	52.9	18989	3.6	5.8			5.26
Tributary	6757.57		4568.16	1194.52	1199.76		1199.97	0.001275	4.14	1433.24	478.18	0.39	99.42		279543	52.9	18890	3.6	6.4			5.24
Tributary	6727.27		4568.03	1194.4	1199.62		1199.84	0.001313	4.2	1395.39	472.2	0.39	99.42		279642	53.0	18790	3.6	5.8			5.22
Tributary	6696.97		4567.89	1194.29	1199.49		1199.72	0.001355	4.25	1357.06	465.42	0.4	99.42		279741	53.0	18691	3.5	5.8			5.2
Tributary	6666.66		4567.74	1194.18	1199.35		1199.58	0.001373	4.26	1325.41	444.17	0.4	99.42		279841	53.0	18592	3.5	5.8			5.17
Tributary	6636.36		4567.61	1194.07	1199.21		1199.45	0.001388	4.28	1300.23	426.07	0.4	99.42		279940	53.0	18492	3.5	5.8			5.14
Tributary	6606.06		4567.48	1193.96	1199.08		1199.31	0.00137	4.24	1291.19	402.84	0.4	99.42		280040	53.0	18393	3.5	5.8			5.12
Tributary	6575.75		4567.33	1193.85	1198.94		1199.17	0.001358	4.22	1286.77	384.91	0.4	99.42		280139	53.1	18293	3.5	5.8			5.09
Tributary	6545.45		4567.21	1193.74	1198.81		1199.04	0.001323	4.17	1295.17	382.41	0.39	99.42		280239	53.1	18194	3.4	5.8			5.07
Tributary	6515.15		4567.1	1193.63	1198.69		1198.91	0.001282	4.12	1305.19	380.56	0.39	99.42		280338	53.1	18094	3.4	6.4			5.06
Tributary	6484.84		4566.96	1193.51	1198.57		1198.78	0.001261	4.09	1309.66	379.11	0.38	99.42		280437	53.1	17995	3.4	5.8			5.06
Tributary	6454.54		4566.83	1193.4	1198.45		1198.66	0.001216	4.03	1324.79	378.16	0.38	99.42		280537	53.1	17896	3.4	5.8			5.05
Tributary	6424.24		4566.69	1193.29	1198.34		1198.54	0.001177	3.98	1337.8	377.46	0.37	99.42		280636	53.2	17796	3.4	5.8			5.05
Tributary	6393.93		4566.55	1193.18	1198.23		1198.43	0.00113	3.92	1354.56	377.16	0.36	99.42		280736	53.2	17697	3.4	5.8			5.05
Tributary	6363.63		4566.43	1193.07	1198.12		1198.32	0.001084	3.86	1372.74	377.08	0.36	99.42		280835	53.2	17597	3.3	5.8			5.05
Tributary	6333.33		4566.29	1192.96	1198.03		1198.21	0.001022	3.78	1397.53	377.19	0.35	99.42		280935	53.2	17498	3.3	5.8			5.07
Tributary	6303.03		4566.16	1192.85	1197.93		1198.11	0.000966	3.71	1422.72	377.52	0.34	99.42		281034	53.2	17399	3.3	6.4			5.08
Tributary	6272.72		4566.01	1192.73	1197.85		1198.02	0.000908	3.63	1450.54	378.08	0.33	99.42		281133	53.2	17299	3.3	5.8			5.12
Tributary	6242.42		4565.49	1192.62	1197.77		1197.93	0.00085	3.55	1480.24	378	0.32	99.42		281233	53.3	17200	3.3	5.8			5.15
Tributary	6212.12		4565.75	1192.51	1197.69		1197.85	0.000793	3.47	1513.54	378.81	0.31	99.42		281332	53.3	17100	3.2	5.8			5.18
Tributary	6181.81		4565.58	1192.4	1197.63		1197.78	0.000737	3.38	1549.17	379.73	0.3	99.42		281432	53.3	17001	3.2	5.8			5.23
Tributary	6151.51		4565.44	1192.29	1197.56		1197.71	0.000677	3.29	1590.12	380.75	0.29	99.42		281531	53.3	16901	3.2	5.8			5.27
Tributary	6121.21		4565.32	1192.18	1197.5		1197.64	0.000626	3.21	1630.23	381.85	0.28	99.42		281630	53.3	16802	3.2	5.8			5.32
Tributary	6090.90		4565.17	1192.07	1197.45		1197.58	0.000578	3.13	1672.36	383.03	0.27	99.42		281730	53.4	16703	3.2	6.4			5.38
Tributary	6060.60		4565.01	1191.95	1197.4		1197.52	0.000531	3.04	1717.95	384.27	0.26	99.42		281829	53.4	16603	3.1	5.8			5.45
Tributary	6030.30		4564.89	1191.84	1197.36		1197.47	0.000487	2.96	1766.45	385.56	0.25	99.42		281929	53.4	16504	3.1	5.8			5.52
Tributary	6000.00		4564.77	1191.73	1197.32		1197.42	0.000445	2.87	1816.57	386.87	0.24	99.42		282028	53.4	16404	3.1	4.2			5.59
Tributary	5969.69		4564.66	1191.65	1197.25		1197.38	0.000508	3.06	1708.9	382.17	0.25	99.42		282128	53.4	16305	3.1	4.8			5.6
Tributary	5939.39		4564.52	1191.56	1197.18		1197.33	0.000571	3.25	1607.26	377.6	0.27	99.42		282227	53.5	16205	3.1	4.8			5.62
Tributary	5909.09		4564.32	1191.47	1197.1		1197.27	0.000646	3.44	1503.73	374.99	0.29	99.42		282326	53.5	16106	3.1	4.2			5.63
Tributary	5878.78		4564.15	1191.39	1197.01		1197.2	0.00073	3.64	1398.06	372.21	0.3	99.42		282426	53.5	16007	3.0	4.8			5.62
Tributary	5848.48		4564.02	1191.3	1196.91		1197.13	0.000814	3.82	1291.17	365.27	0.32	99.42		282525	53.5	15907	3.0	4.8			5.61
Tributary	5818.18		4563.91	1191.21	1196.81		1197.04	0.000874	3.93	1210.49	330.13	0.33	99.42		282625	53.5	15808	3.0	4.2			5.6
Tributary	5787.87		4563.79	1191.13	1196.7		1196.95	0.000923	4.01	1159.6	306.35	0.34	99.42		282724	53.5	15708	3.0	4.8			5.57
Tributary	5757.57		4563.66	1191.04	1196.6		1196.86	0.000966	4.06	1130.45	280.82	0.35	99.42		282823	53.6	15609	3.0	4.8			5.56
Tributary	5727.27		4563.55	1190.95	1196.5		1196.76	0.000998	4.11	1115.73	270.89	0.35	99.42		282923	53.6	15510	2.9	4.2			5.55
Tributary	5696.97		4563.45	1190.87	1196.39		1196.66	0.001031	4.17	1100.1	264.84	0.36	99.42		283022	53.6	15410	2.9	4.8			5.52
Tributary	5666.66		4563.33	1190.78	1196.28		1196.56	0.00105	4.22	1087.34	261.16	0.36	99.42		283122	53.6	15311	2.9	4.8			5.5
Tributary	5636.36		4563.24	1190.69	1196.17		1196.45	0.00107	4.27	1075.86	258.33	0.36	99.42		283221	53.6	15211	2.9	4.2			5.48
Tributary	5606.06		4563.16	1190.61	1196.06		1196.35	0.001094	4.32	1064.52	256.16	0.37	99.42		283321	53.7	15112	2.9	4.8			5.45
Tributary	5575.75		4563.07	1190.52	1195.94		1196.24	0.001118	4.37	1054.46	254.54	0.37	99.42		283420	53.7	15012	2.8	4.8			5.42
Tributary	5545.45		4562.99	1190.43	1195.82		1196.12	0.001144	4.42	1044.62	253.38	0.38	99.42		283519	53.7	14913	2.8	4.2			5.39
Tributary	5515.15		4562.92	1190.35	1195.7		1196.01	0.00118	4.47	1033.5	252.63	0.38	99.42		283619	53.7	14814	2.8	4.8			5.35
Tributary	5484.84		4562.84	1190.26	1195.58		1195.89	0.001212	4.53	1024.11	252.24	0.39	99.42		283718	53.7	14714	2.8	4.2			5.32
Tributary	5454.54		4562.75	1190.18	1195.45		1195.77	0.001252	4.58	1014	252.23	0.39	99.42		283818	53.8	14615	2.8	4.8			5.27
Tributary	5424.24		4562.67	1190.09	1195.31		1195.65	0.001301	4.65	1003.18	254.39	0.4	99.42		283917	53.8	14515	2.7	4.8			5.22
Tributary	5393.93		4562.58	1190	1195.18		1195.52	0.001356	4.72	998.34	280.45	0.41	99.42		284017	53.8	14416	2.7	4.2			5.18
Tributary	5363.63		4562.47	1189.92	1195.04		1195.39	0.001388	4.76	1002.98	290.89	0.41	99.42		284116	53.8	14316	2.7	4.8			5.12
Tributary	5333.33		4562.37	1189.83	1194.9		1195.25	0.001437	4.81	1008.27	303.29	0.42	99.42		284215	53.8	14217	2.7	4.8			5.07
Tributary	5303.03		4562.28	1189.74	1194.76		1195.11	0.001494	4.86	1014.89	308.72	0.43	99.42		284315	53.8	14118	2.7	4.2			5.02
Tributary	5272.72		4562.19	1189.66	1194.61		1194.97	0.001517	4.88	1027.01	310.4	0.43	99.42		284414	53.9	14018	2.7	4.2			4.95
Tributary	5242.42		4562.1	1189.58	1194.47		1194.82	0.001542	4.9	1038.22	311.31	0.43	99.42		284514	53.9	13919	2.6	4.8			4.89
Tributary	5212.12		4562.02	1189.49	1194.33		1194.67	0.001515	4.86	1060.15	312.45	0.43	99.42		284613	53.9	13819	2.6	4.8			4.84
Tributary	5181.81		4561.92	1189.4	1194.19		1194.53	0.001502	4.82	1079.75	313.49	0.43	99.42		284712	53.9	13720	2.6	4.2			4.79
Tributary	5151.51		4561.8	1189.32	1194.06		1194.38	0.001483	4.78	1099.11	314.51	0.42	99.42		284812	53.9	13621	2.6	4.8			4.74
Tributary	5121.21		4561.66	1189.23	1193.93		1194.24	0.001426	4.7	1133.95	350.09	0.41	99.42		284911	54.0	13521	2.6	4.8			4.7
Tributary	5090.90		4561.52	1189.14	1193.82		1194.1	0.001352	4.57	1199.83	394.65	0.4	99.42		285011	54.0	13422	2.5	4.8			4.68
Tributary	5060.60		4561.38	1189.05	1193.71		1193.97	0.001259	4.42	1294.06	452.35	0.39	99.42		285110	54.0	13322	2.5	4.8			4.66
Tributary	5030.30		4561.21	1188.96	1193.63		1193.85	0.001123	4.19	1428.52	508.98	0.37	99.42		285210	54.0	13223	2.5	4.2			4.67
Tributary	5000.00		4561.03	1188.88	1193.56		1193.75	0.001041	4.05	1591.65	551.59	0.36	99.42		285309	54.0	13123	2.5	5.8			4.68
Tributary	4969.69		4560.85	1188.77	1193.46		1193.66	0.001078	4.12	1558.43	550	0.36	99.42		285408	54.1	13024	2.5	5.8			4.69
Tributary	4939.39		4560.66	1188.66	1193.35		1193.56	0.001079	4.11	1525	547.85	0.36	99.42		285508	54.1	12925	2.4	5.8			4.69
Tributary	4909.09		4560.47	1188.55	1193.25		1193.46	0.001097	4.14	1495.16	539.68	0.36	99.42		285607	54.1	12825	2.4	5.8			4.7
Tributary	4878.78		4560.26	1188.44	1193.14		1193.36	0.00112	4.17	1462.97	530.22	0.37	99.42		285707	54.1	12726	2.4	5.8			4.7
Tributary	4848.48		4560.11	1188.33	1193.03		1193.25	0.001137	4.2	1432.67	518.37	0.37	99.42		285806	54.1	12626	2.4	5.8			4.7
Tributary	4818.18		4559.96	1188.22	1192.92		1193.14	0.001165	4.23	1399.71	505.61	0.37	99.42		285906	54.1	12527	2.4	5.8			4.7
Tributary	4787.87		4559.78	1188.11	1192.8		1193.03	0.001174	4.24	1375.5	482.39	0.38	99.42		286005	54.2	12428	2.4	5.8			4.69
Tributary	4757.57		4559.63	1188	1192.69		1192.92	0.001173	4.23	1362.02	457.95	0.38	99.42		286104	54.2	12328	2.3	6.4			4.69
Tributary	4727.27		4559.43	1187.88	1192.58		1192.81	0.001173	4.22	1352.71	399.67	0.38	99.42		286204	54.2	12229	2.3	5.8			4.7
Tributary	4696.97		4559.24	1187.77	1192.46		1192.68	0.001192	4.23	1346.56	399.48	0.38	99.42		286303	54.2	12129	2.3	5.8			4.69
Tributary	4666.66		4559.11	1187.66	1192.34		1192.56	0.001201	4.22	1343.89	399.84	0.38	99.42		286403	54.2	12030	2.3	5.8			4.68
Tributary	4636.36		4558.99	1187.55	1192.22		1192.45	0.001205	4.22	1343.71	400.44	0.38	99.42		286502	54.3	11930	2.3	5.8			4.67

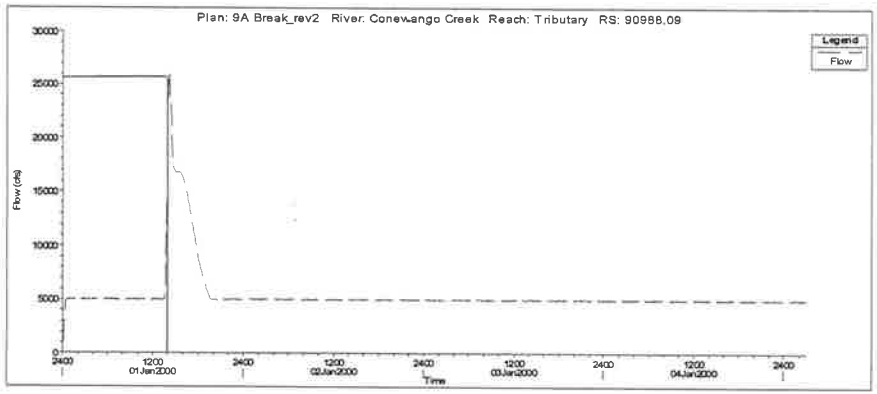
Tributary	4606.06		4558.88	1187.44	1192.1	1192.33	0.00121	4.21	1343	400.98	0.38	99.42		286601	54.3	11831	2.2	5.8			4.66
Tributary	4575.75		4558.76	1187.33	1191.98	1192.21	0.001213	4.2	1341.08	399.32	0.38	99.42		286701	54.3	11732	2.2	5.8			4.65
Tributary	4545.45		4558.62	1187.22	1191.87	1192.09	0.001232	4.2	1336.8	400.12	0.38	99.42		286800	54.3	11632	2.2	5.8			4.65
Tributary	4515.15		4558.5	1187.11	1191.75	1191.97	0.001227	4.18	1339.5	401.03	0.38	99.42		286900	54.3	11533	2.2	5.8			4.64
Tributary	4484.84		4558.39	1187	1191.63	1191.85	0.001244	4.19	1335.26	401.38	0.38	99.42		286999	54.4	11433	2.2	5.8			4.63
Tributary	4454.54		4558.28	1186.89	1191.5	1191.73	0.001247	4.18	1334.27	401.5	0.38	99.42		287099	54.4	11334	2.1	9.0			4.61
Tributary	4424.24		4558.17	1186.72	1191.38	1191.61	0.001232	4.16	1339.59	401.73	0.38	99.42		287198	54.4	11234	2.1	5.8			4.66
Tributary	4393.93		4558.05	1186.61	1191.26	1191.49	0.001239	4.16	1337.05	402.03	0.38	99.42		287297	54.4	11135	2.1	5.8			4.65
Tributary	4363.63		4557.92	1186.5	1191.14	1191.36	0.001282	4.19	1325.45	402.48	0.39	99.42		287397	54.4	11036	2.1	6.4			4.64
Tributary	4333.33		4557.41	1186.38	1191.01	1191.24	0.001287	4.18	1325.18	403.1	0.39	99.42		287496	54.5	10936	2.1	5.8			4.63
Tributary	4303.03		4557.73	1186.27	1190.88	1191.11	0.001305	4.18	1320.68	403.96	0.39	99.42		287596	54.5	10837	2.1	5.8			4.61
Tributary	4272.72		4557.58	1186.16	1190.75	1190.98	0.001325	4.19	1316.03	405.16	0.39	99.42		287695	54.5	10737	2.0	6.4			4.59
Tributary	4242.42		4557.43	1186.04	1190.62	1190.85	0.001343	4.19	1313.2	406.76	0.39	99.42		287794	54.5	10638	2.0	5.8			4.58
Tributary	4212.12		4557.29	1185.93	1190.5	1190.72	0.001361	4.18	1310.97	409.07	0.4	99.42		287894	54.5	10539	2.0	5.8			4.57
Tributary	4181.81		4557.17	1185.82	1190.37	1190.59	0.001361	4.14	1308.7	403.3	0.4	99.42		287993	54.5	10439	2.0	6.4			4.55
Tributary	4151.51		4557.05	1185.7	1190.23	1190.45	0.001372	4.1	1307.22	401.44	0.4	99.42		288093	54.6	10340	2.0	5.8			4.53
Tributary	4121.21		4556.89	1185.59	1190.1	1190.32	0.00138	4.05	1310.3	403.95	0.39	99.42		288192	54.6	10240	1.9	5.8			4.51
Tributary	4090.90		4556.71	1185.48	1189.97	1190.18	0.001366	4.01	1315.3	411.88	0.39	99.42		288292	54.6	10141	1.9	6.4			4.49
Tributary	4060.60		4556.57	1185.36	1189.84	1190.05	0.001343	3.99	1329.29	437.39	0.39	99.42		288391	54.6	10041	1.9	5.8			4.48
Tributary	4030.30		4556.46	1185.25	1189.71	1189.92	0.001297	3.94	1364.57	456.49	0.38	99.42		288490	54.6	9942	1.9	5.8			4.46
Tributary	4000.00		4556.33	1185.14	1189.6	1189.79	0.001226	3.86	1420.58	482.8	0.37	99.42		288590	54.7	9843	1.9	6.4			4.46
Tributary	3969.69		4556.17	1185.02	1189.48	1189.67	0.001228	3.87	1419.92	483	0.37	99.42		288689	54.7	9743	1.8	6.4			4.46
Tributary	3939.39		4556.01	1184.9	1189.36	1189.55	0.001229	3.87	1418.72	431.73	0.37	99.42		288789	54.7	9644	1.8	6.4			4.46
Tributary	3909.09		4555.89	1184.78	1189.23	1189.43	0.001226	3.87	1419	430.83	0.37	99.42		288888	54.7	9544	1.8	6.4			4.45
Tributary	3878.78		4555.77	1184.66	1189.11	1189.31	0.00123	3.87	1417.1	479.72	0.37	99.42		288988	54.7	9445	1.8	5.8			4.45
Tributary	3848.48		4555.61	1184.55	1188.99	1189.19	0.001229	3.88	1416.22	478.56	0.37	99.42		289087	54.8	9345	1.8	6.4			4.44
Tributary	3818.18		4555.46	1184.43	1188.87	1189.07	0.001225	3.87	1416.79	477.69	0.37	99.42		289186	54.8	9246	1.8	6.4			4.44
Tributary	3787.87		4555.3	1184.31	1188.75	1188.94	0.001221	3.87	1416.76	476.55	0.37	99.42		289286	54.8	9147	1.7	6.4			4.44
Tributary	3757.57		4555.17	1184.19	1188.63	1188.82	0.001212	3.87	1419.34	475.7	0.37	99.42		289385	54.8	9047	1.7	6.4			4.44
Tributary	3727.27		4555.03	1184.07	1188.51	1188.71	0.001191	3.85	1424.98	474.67	0.37	99.42		289485	54.8	8948	1.7	6.4			4.44
Tributary	3696.97		4554.88	1183.95	1188.4	1188.59	0.001183	3.85	1427.34	473.86	0.37	99.42		289584	54.8	8848	1.7	5.8			4.45
Tributary	3666.66		4554.75	1183.84	1188.28	1188.47	0.001176	3.84	1429.24	473.07	0.37	99.42		289683	54.9	8749	1.7	6.4			4.44
Tributary	3636.36		4554.2	1183.72	1188.17	1188.36	0.001168	3.84	1431.66	472.3	0.37	99.42		289783	54.9	8650	1.6	6.4			4.45
Tributary	3606.06		4554.51	1183.6	1188.06	1188.24	0.001151	3.82	1440.09	471.38	0.36	99.42		289882	54.9	8550	1.6	6.4			4.46
Tributary	3575.75		4554.35	1183.48	1187.94	1188.13	0.00115	3.82	1442.29	471.52	0.36	99.42		289982	54.9	8451	1.6	6.4			4.46
Tributary	3545.45		4554.2	1183.36	1187.83	1188.02	0.001136	3.81	1446.4	470.2	0.36	99.42		290081	54.9	8351	1.6	5.8			4.47
Tributary	3515.15		4554.04	1183.25	1187.72	1187.9	0.001115	3.78	1456.79	470.47	0.36	99.42		290181	55.0	8252	1.6	6.4			4.47
Tributary	3484.84		4553.9	1183.13	1187.61	1187.79	0.001097	3.77	1463.2	469.48	0.36	99.42		290280	55.0	8152	1.5	6.4			4.48
Tributary	3454.54		4553.77	1183.01	1187.51	1187.69	0.001077	3.75	1470.59	468.67	0.35	99.42		290379	55.0	8053	1.5	6.4			4.5
Tributary	3424.24		4553.6	1182.89	1187.4	1187.58	0.001058	3.73	1477.09	471.19	0.35	99.42		290479	55.0	7954	1.5	6.4			4.51
Tributary	3393.93		4553.41	1182.77	1187.3	1187.48	0.001033	3.71	1488.11	470.57	0.35	99.42		290578	55.0	7854	1.5	6.4			4.53
Tributary	3363.63		4553.24	1182.65	1187.2	1187.38	0.001006	3.68	1500.01	469.86	0.34	99.42		290678	55.1	7755	1.5	5.8			4.55
Tributary	3333.33		4553.1	1182.54	1187.11	1187.28	0.00098	3.65	1512.58	469.31	0.34	99.42		290777	55.1	7655	1.4	6.4			4.57
Tributary	3303.03		4552.99	1182.42	1187.02	1187.18	0.000952	3.62	1525.97	468.85	0.33	99.42		290877	55.1	7556	1.4	6.4			4.6
Tributary	3272.72		4552.86	1182.3	1186.93	1187.09	0.000917	3.58	1545.64	468.44	0.33	99.42		290976	55.1	7457	1.4	6.4			4.63
Tributary	3242.42		4552.73	1182.18	1186.84	1187	0.000881	3.55	1560.46	468.05	0.32	99.42		291075	55.1	7357	1.4	6.4			4.66
Tributary	3212.12		4552.6	1182.06	1186.76	1186.92	0.000853	3.52	1576.49	467.81	0.32	99.42		291175	55.1	7258	1.4	6.4			4.7
Tributary	3181.81		4552.45	1181.94	1186.68	1186.83	0.000825	3.48	1594.24	467.57	0.31	99.42		291274	55.2	7158	1.4	5.8			4.74
Tributary	3151.51		4552.29	1181.83	1186.61	1186.76	0.000795	3.44	1614.25	467.33	0.31	99.42		291374	55.2	7059	1.3	6.4			4.78
Tributary	3121.21		4552.08	1181.71	1186.53	1186.68	0.000758	3.39	1639.64	467.26	0.3	99.42		291473	55.2	6959	1.3	6.4			4.82
Tributary	3090.90		4551.89	1181.59	1186.47	1186.61	0.00072	3.34	1666.7	467.24	0.29	99.42		291572	55.2	6860	1.3	6.4			4.88
Tributary	3060.60		4551.74	1181.47	1186.4	1186.54	0.000689	3.3	1691.36	467.3	0.29	99.42		291672	55.2	6761	1.3	6.4			4.93
Tributary	3030.30		4551.61	1181.35	1186.34	1186.47	0.000655	3.25	1719.29	467.35	0.28	99.42		291771	55.3	6661	1.3	6.4			4.99
Tributary	3000.00		4551.46	1181.23	1186.28	1186.41	0.000619	3.2	1751.65	467.57	0.28	99.42		291871	55.3	6562	1.2	3.7			5.05
Tributary	2969.69		4551.31	1181.16	1186.21	1186.35	0.000653	3.29	1712.01	466.67	0.28	99.42		291970	55.3	6462	1.2	4.2			5.05
Tributary	2939.39		4551.12	1181.08	1186.14	1186.28	0.000689	3.39	1672.19	465.54	0.29	99.42		292070	55.3	6363	1.2	4.2			5.06
Tributary	2909.09		4550.93	1181	1186.06	1186.22	0.000726	3.48	1632.17	464.26	0.3	99.42		292169	55.3	6263	1.2	4.2			5.06
Tributary	2878.78		4550.74	1180.92	1185.98	1186.15	0.000767	3.58	1590.63	462.75	0.31	99.42		292268	55.4	6164	1.2	3.7			5.06
Tributary	2848.48		4550.57	1180.85	1185.9	1186.07	0.000807	3.67	1551.1	460.49	0.31	99.42		292368	55.4	6065	1.1	4.2			5.05
Tributary	2818.18		4550.42	1180.77	1185.81	1185.99	0.000844	3.75	1511.87	455.63	0.32	99.42		292467	55.4	5965	1.1	4.2			5.04
Tributary	2787.87		4550.26	1180.69	1185.71	1185.91	0.000886	3.82	1474.61	450.38	0.33	99.42		292567	55.4	5866	1.1	4.2			5.02
Tributary	2757.57		4550.16	1180.61	1185.62	1185.82	0.000895	3.85	1447.3	435.01	0.33	99.42		292666	55.4	5766	1.1	3.7			5.01
Tributary	2727.27		4550.03	1180.54	1185.54	1185.74	0.000891	3.83	1433.01	418.99	0.33	99.42		292765	55.4	5667	1.1	4.2			5
Tributary	2696.97		4549.84	1180.46	1185.45	1185.65	0.000888	3.83	1427.47	415.28	0.33	99.42		292865	55.5	5568	1.1	4.2			4.99
Tributary	2666.66		4549.68	1180.38	1185.36	1185.56	0.000906	3.86	1415.24	412.46	0.33	99.42		292964	55.5	5468	1.0	4.2			4.98
Tributary	2636.36		4549.56	1180.3	1185.27	1185.47	0.0009	3.85	1414.1	410.42	0.33	99.42		293064	55.5	5369	1.0	3.7			4.97
Tributary	2606.06		4549.38	1180.23	1185.18	1185.39	0.000906	3.86	1409.29	408.94	0.33	99.42		293163	55.5	5269	1.0	4.2			4.95
Tributary	2575.75		4549.22	1180.15	1185.09	1185.3	0.000901	3.86	1409.35	408.03	0.33	99.42		293263	55.5	5170	1.0	4.2			4.94
Tributary	2545.45		4549.13	1180.07	1185.01	1185.21	0.000903	3.86	1407.67	407.56	0.33	99.42		293362	55.6	5070	1.0	4.2			4.94
Tributary	2515.15		4549.03	1179.99	1184.92	1185.12	0.000901	3.85	1410.18	407.4	0.33	99.42		293461	55.6	4971	0.9	3.7			4.93
Tributary	2484.84		4548.91	1179.92	1184.83	1185.03	0.000909	3.86	1407.55	407.58	0.33	99.42		293561	55.6	4872	0.9	4.2			4.91
Tributary	2454.54		4548.74	1179.84	1184.74	1184.94	0.000902	3.85	1408.82	407.2	0.33	99.42		293660	55.6	4772	0.9	4.2			4.9
Tributary	2424.24		4548.59	1179.76	1184.65	1184.86	0.000904	3.85	1409.45	408.47	0.33	99.42		293760	55.6	4673	0.9	4.2			4.89
Tributary	2393.93		4548.44	1179.68	1184.57	1184.77	0.000894	3.83	1415.76	410.23	0.33	99.42		293859	55.7	4573	0.9	3.7			4.89
Tributary	2363.63		4548.26	1179.61	1184.48	1184.68	0.000899	3.84	1416.78	413.92	0.33	99.42		293959	55.7	4474	0.8	4.2			4.87
Tributary	2333.33		4548.1	1179.53	1184.39	1184.59	0.000902	3.84	1420.51	428.23	0.33	99.42		294058	55.7	4374	0.8	4.2			4.86
Tributary	2303.03		4547.98	1179.45	1184.31	1184.51	0.000915	3.87	1430.94	463.18	0.33	99.42		294157	55.7	4275	0.8	4.2			4.86
Tributary	2272.72		4547.86	1179.37	1184.22	1184.42	0.000904	3.84	1452.73	474.5	0.33	99.42		294257	55.7	4176	0.8	3.7			4.85
Tributary	2242.42		4547.32	1179.3	1184.14	1184.33	0.000891	3.82	1485.11	505.18	0.33	99.42		294356	55.7	4076	0.8	4.2			4.84
Tributary	2212.12		4547.58	1179.22	1184.06	1184.25	0.000853	3.75	1542.09	535.81	0.32	99.42		294456	55.8	3977	0.8	4.2			4.84
Tributary	2181.81		4547.33	1179.14	1183.99	1184.17	0.000794	3.63	1618.99	544.98	0.31	99.42		294555	55.8	3877	0.7	4.2			4.85
Tributary	2151.51		4547.14	1179.06	1183.93	1184.09	0.000742	3.52	1691.72	549.91	0.3	99.42		294654	55.8	3778	0.7	3.7			4.87
Tributary	2121.21		4546.95	1178.99	1183.87	1184.02	0.000672	3.37	1781.65	554.74	0.29	99.42		294754	55.8	3679	0.7	4.2			4.88

Tributary	2090.90		4546.69	1178.91	1183.82		1183.95	0.00061	3.22	1875.79	559.36	0.27	99.42		294853	55.8	3579	0.7	4.2			4.91
Tributary	2060.60		4546.45	1178.83	1183.78		1183.89	0.000547	3.07	1979.32	608.2	0.26	99.42		294953	55.9	3480	0.7	4.2			4.95
Tributary	2030.30		4546.23	1178.75	1183.74		1183.84	0.000486	2.91	2116.19	636.85	0.25	99.42		295052	55.9	3380	0.6	3.7			4.99
Tributary	2000.00		4546.03	1178.68	1183.7		1183.79	0.000428	2.76	2274.45	675.22	0.23	99.42		295152	55.9	3281	0.6	3.7			5.02
Tributary	1969.69		4545.83	1178.61	1183.66		1183.75	0.000444	2.82	2200.85	647.97	0.24	99.42		295251	55.9	3181	0.6	3.7			5.05
Tributary	1939.39		4545.55	1178.54	1183.61		1183.71	0.000462	2.88	2136.65	630.6	0.24	99.42		295350	55.9	3082	0.6	3.7			5.07
Tributary	1909.09		4545.32	1178.47	1183.56		1183.66	0.000479	2.93	2077.77	609.01	0.25	99.42		295450	56.0	2983	0.6	3.7			5.09
Tributary	1878.78		4545.13	1178.4	1183.51		1183.62	0.000497	2.99	2034.65	563.16	0.25	99.42		295549	56.0	2883	0.5	3.7			5.11
Tributary	1848.48		4544.93	1178.33	1183.45		1183.57	0.000511	3.04	1998.84	561	0.25	99.42		295649	56.0	2784	0.5	3.7			5.12
Tributary	1818.18		4544.7	1178.26	1183.4		1183.52	0.000529	3.1	1961.13	558.69	0.26	99.42		295748	56.0	2684	0.5	3.7			5.14
Tributary	1787.87		4544.47	1178.19	1183.34		1183.47	0.000549	3.16	1919.45	556.54	0.26	99.42		295848	56.0	2585	0.5	3.2			5.15
Tributary	1757.57		4544.33	1178.13	1183.28		1183.41	0.000567	3.21	1882.8	554.45	0.27	99.42		295947	56.1	2486	0.5	3.7			5.15
Tributary	1727.27		4544.15	1178.06	1183.22		1183.36	0.000594	3.28	1838.57	552.29	0.27	99.42		296046	56.1	2386	0.5	3.7			5.16
Tributary	1696.97		4543.87	1177.99	1183.16		1183.3	0.00061	3.33	1802.06	550.17	0.28	99.42		296146	56.1	2287	0.4	3.7			5.17
Tributary	1666.66		4543.63	1177.92	1183.09		1183.24	0.000632	3.39	1761.26	547.84	0.28	99.42		296245	56.1	2187	0.4	3.7			5.17
Tributary	1636.36		4543.47	1177.85	1183.02		1183.18	0.000655	3.45	1721.1	545.59	0.29	99.42		296345	56.1	2088	0.4	3.7			5.17
Tributary	1606.06		4543.26	1177.78	1182.95		1183.12	0.000679	3.52	1679.28	543.29	0.29	99.42		296444	56.1	1988	0.4	3.7			5.17
Tributary	1575.75		4543.06	1177.71	1182.88		1183.05	0.000704	3.58	1637.52	541.01	0.3	99.42		296543	56.2	1889	0.4	3.2			5.17
Tributary	1545.45		4542.85	1177.65	1182.8		1182.98	0.000733	3.64	1592.97	538.69	0.3	99.42		296643	56.2	1790	0.3	3.7			5.15
Tributary	1515.15		4542.59	1177.58	1182.72		1182.91	0.000757	3.7	1554.69	535.54	0.31	99.42		296742	56.2	1690	0.3	3.7			5.14
Tributary	1484.84		4542.37	1177.51	1182.64		1182.84	0.000782	3.76	1513.29	531.38	0.31	99.42		296842	56.2	1591	0.3	3.7			5.13
Tributary	1454.54		4542.22	1177.44	1182.56		1182.76	0.000799	3.8	1476.64	527.65	0.32	99.42		296941	56.2	1491	0.3	3.7			5.12
Tributary	1424.24		4542.06	1177.37	1182.48		1182.68	0.000821	3.85	1436.28	520.1	0.32	99.42		297041	56.3	1392	0.3	3.7			5.11
Tributary	1393.93		4541.85	1177.3	1182.39		1182.6	0.000842	3.9	1397.49	504.92	0.33	99.42		297140	56.3	1292	0.2	3.7			5.09
Tributary	1363.63		4541.62	1177.23	1182.3		1182.52	0.000862	3.94	1363.37	491.95	0.33	99.42		297239	56.3	1193	0.2	3.2			5.07
Tributary	1333.33		4541.12	1177.17	1182.21		1182.44	0.000882	3.98	1331.51	480.58	0.33	99.42		297339	56.3	1094	0.2	3.7			5.04
Tributary	1303.03		4541.31	1177.1	1182.12		1182.35	0.000894	4.01	1304.29	470.59	0.33	99.42		297438	56.3	994	0.2	3.7			5.02
Tributary	1272.72		4541.15	1177.03	1182.03		1182.26	0.00092	4.05	1272.66	395.4	0.34	99.42		297538	56.4	895	0.2	3.7			5
Tributary	1242.42		4541.03	1176.96	1181.94		1182.17	0.000932	4.07	1257.35	377.1	0.34	99.42		297637	56.4	795	0.2	3.7			4.98
Tributary	1212.12		4540.91	1176.89	1181.84		1182.08	0.000932	4.07	1250.56	319.34	0.34	99.42		297736	56.4	696	0.1	3.7			4.95
Tributary	1181.81		4540.75	1176.82	1181.75		1181.99	0.000952	4.09	1243.15	317.87	0.34	99.42		297836	56.4	597	0.1	3.7			4.93
Tributary	1151.51		4540.61	1176.75	1181.65		1181.89	0.000958	4.11	1239.43	316.61	0.35	99.42		297935	56.4	497	0.1	3.2			4.9
Tributary	1121.21		4540.52	1176.69	1181.55		1181.8	0.000979	4.14	1228.4	315.41	0.35	99.42		298035	56.4	398	0.1	3.7			4.86
Tributary	1090.90		4540.42	1176.62	1181.46		1181.7	0.000988	4.16	1224.59	314.4	0.35	99.42		298134	56.5	298	0.1	3.7			4.84
Tributary	1060.60		4540.28	1176.55	1181.36		1181.6	0.000998	4.17	1220.33	313.4	0.35	99.42		298234	56.5	199	0.0	3.7			4.81
Tributary	1030.30		4540.16	1176.48	1181.26		1181.5	0.001003	4.18	1218.21	312.58	0.35	99.42		298333	56.5	99	0.0	3.7			4.78
Tributary	1000.00		4540.07	1176.41	1181.16	1178.94	1181.41	0.001012	4.19	1214.84	311.84	0.35		Warren, PA/ Allegany River	298432	56.5	0	0.0	#DIV/0!			4.75

HEC-RAS Section	Distance from Dam	Flood Wave Arrival Time	Peak Flood Depth	Peak Flow Velocity	Peak Discharge	Peak Water Surface Elevation	Time of Peak	Notes
	mi	hr:min	ft	ft/sec	ft3/sec	ft	hr:min	
91363.82	0.37	0:00	30.00	21.12	26379.01	1378.94	0:00	Dam 9A
90988.09	0.61	0:10	12.31	25.17	26120.88	1359.36	0:20	Villinova Road/Smith Road Intersection
89210.21	1.71	0:40	9.56	5.70	19583.36	1319.14	1:05	Cemetery Road
85117.09	4.25	1:20	11.87	8.54	16300.60	1297.37	3:00	South Dayton Limits/Catt County Line
83828.57	5.05	2:00	6.52	3.11	16168.33	1292.35	4:00	Center South Dayton
83031.15	5.55	2:40	4.40	5.39	16078.65	1290.00	4:05	South Dayton Limits
74995.16	10.54	6:00	6.82	1.86	11166.57	1276.34	7:00	Cherry Creek Road/ CR 5
68000.00	14.89	8:00	4.34	0.68	7795.42	1273.83	11:00	US 62 - Conewango Valley
58000.00	21.10	9:00	9.69	5.52	5067.25	1265.20	15:00	SR 394
53007.79	24.21	NA	4.80	4.36	5067.24	1254.37	NA	Village of Kennedy
51000.00	25.45	NA	5.44	1.94	5067.14	1249.04	NA	I-86
34194.77	35.89	NA	8.14	0.51	4953.99	1238.49	NA	Frewsburg
23000.00	42.85	NA	6.25	0.75	4739.18	1236.89	NA	PA State Line
15000.00	47.82	NA	4.56	4.02	4609.09	1231.17	NA	Russell, PA
1000.00	56.52	NA	4.75	4.19	4540.07	1181.16	NA	Warren, PA/ Allegany River



Stage1392.9601Jan2000 1400
Flow27909.5001Jan2000 140045004.64



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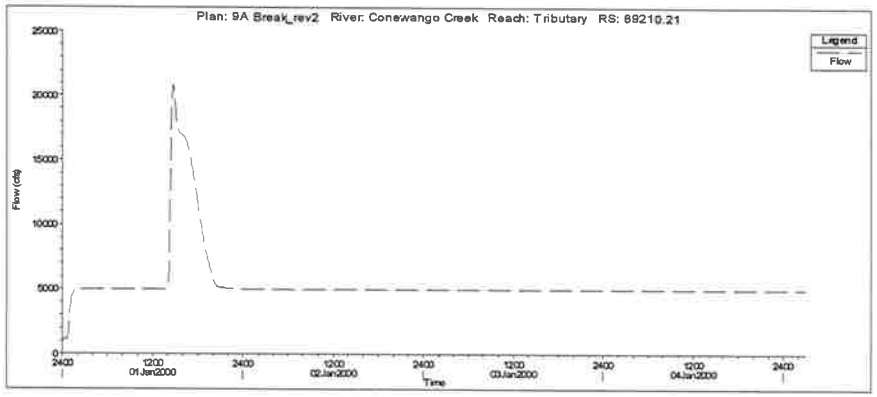
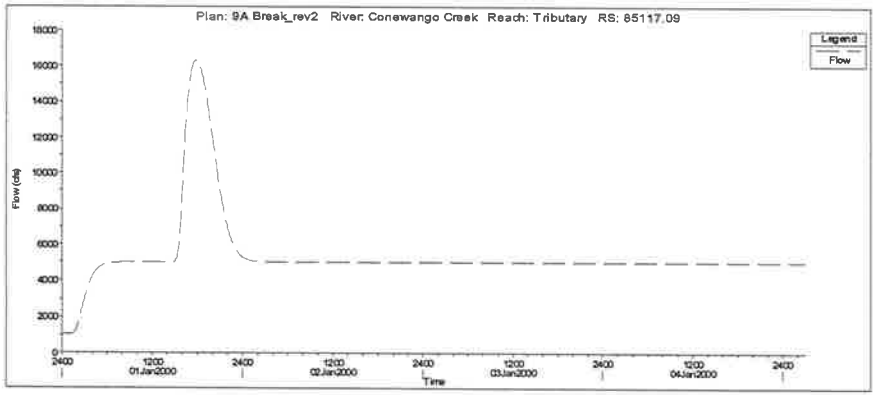
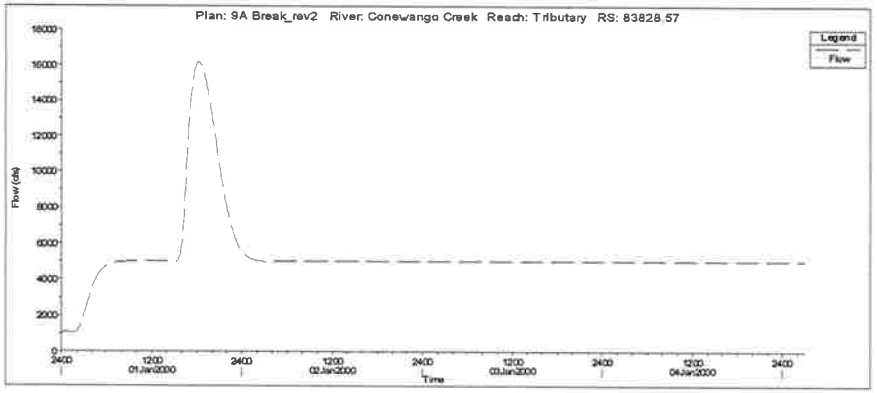
Flow26078.8601Jan2000 141044930.38



Stage1319.1401Jan2000 1500
Flow20863.0401Jan2000 144544665.49



Stage1297.3701Jan2000 1755
Flow16319.5901Jan2000 175043928.10



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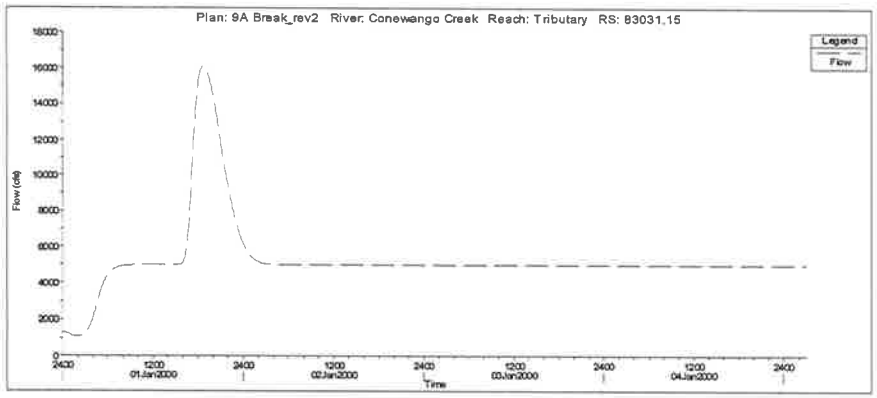
Flow16215.2001Jan2000 181543713.09



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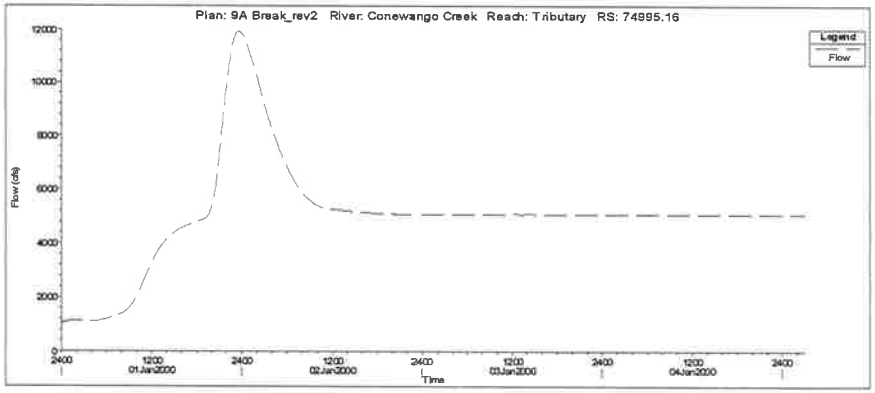
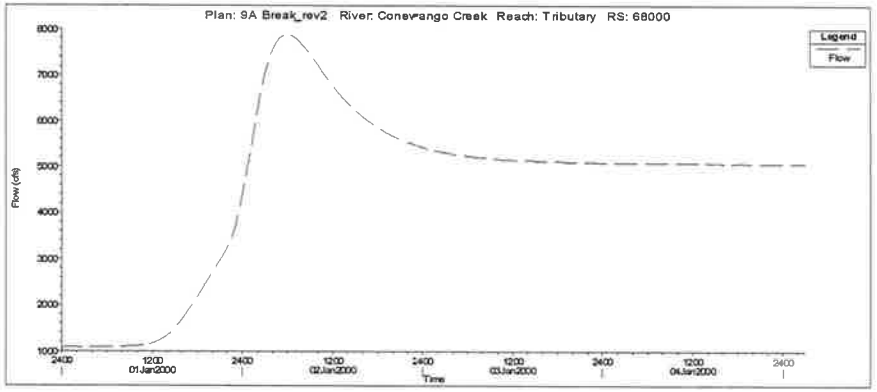
Flow16081.3901Jan2000 184543429.85



Stage1276.3402Jan2000 0105
Flow11937.2601Jan2000 234041450.86



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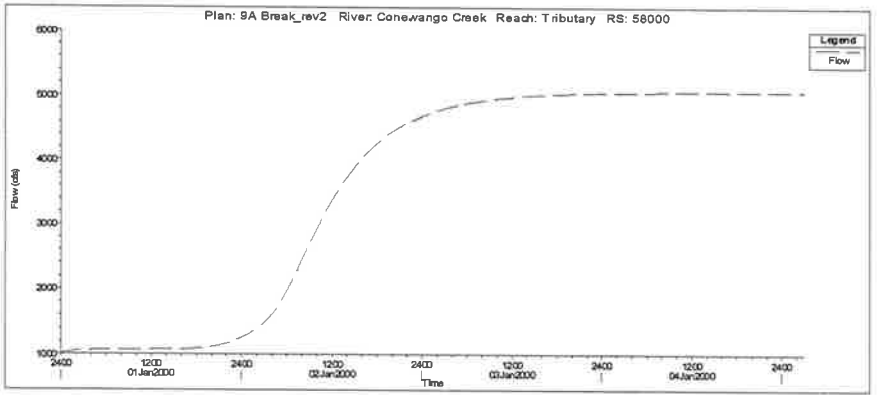
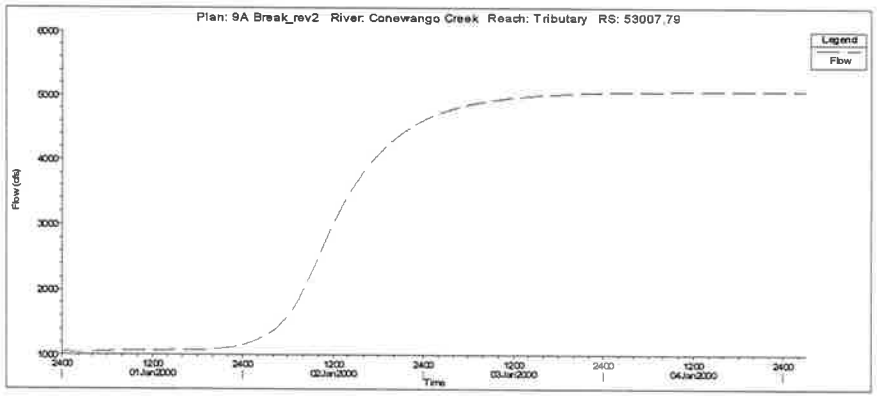
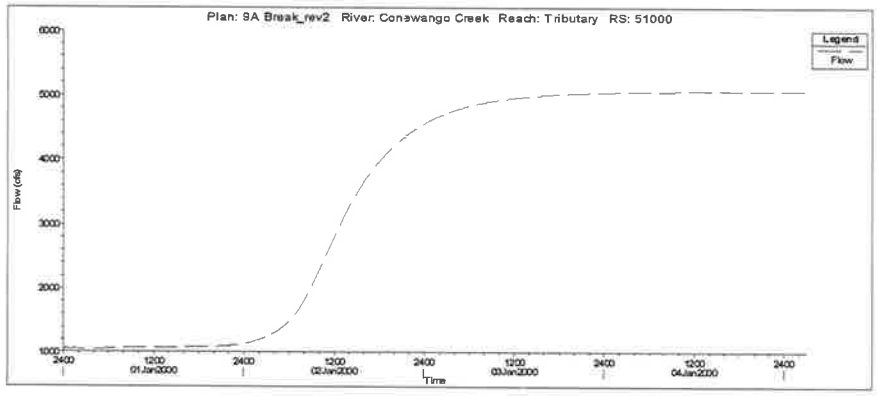
Flow7885.7102Jan2000 060037833.51



Stage1265.2005Jan2000 0055
Flow5067.3505Jan2000 030029476.45



Stage1254.3705Jan2000 0220
Flow5067.3705Jan2000 022528906.46



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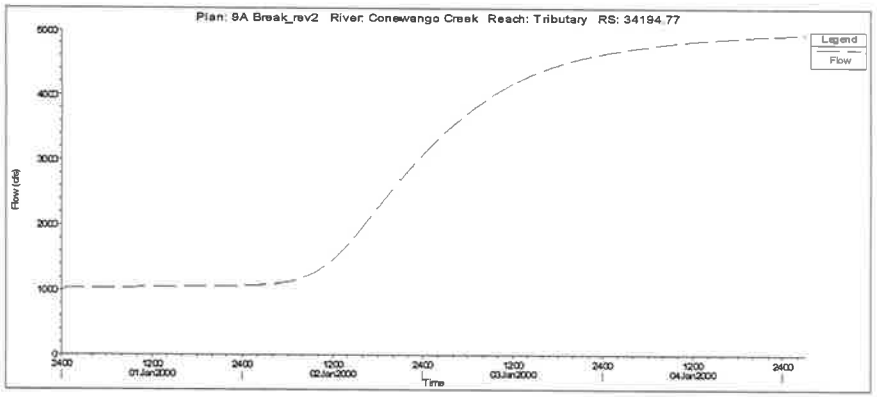
Flow5067.4905Jan2000 020528657.05



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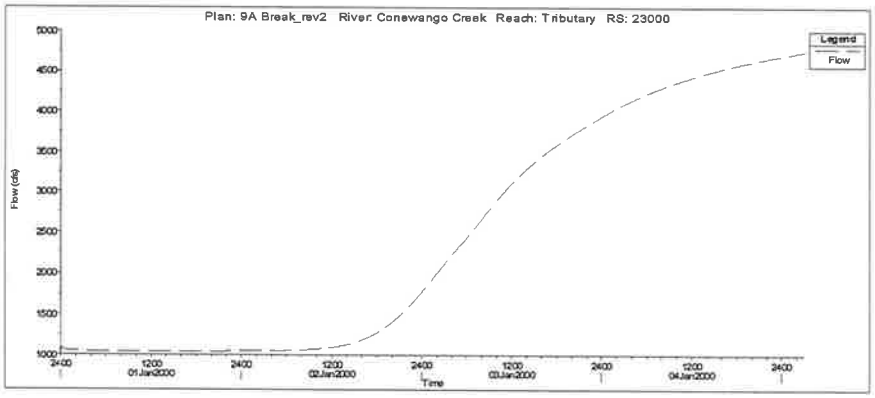
Flow4954.3405Jan2000 025524353.25



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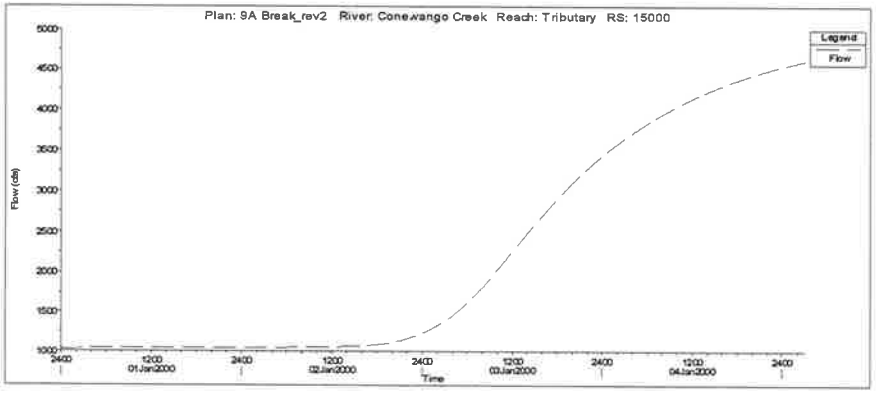
Flow4739.1805Jan2000 030020289.34



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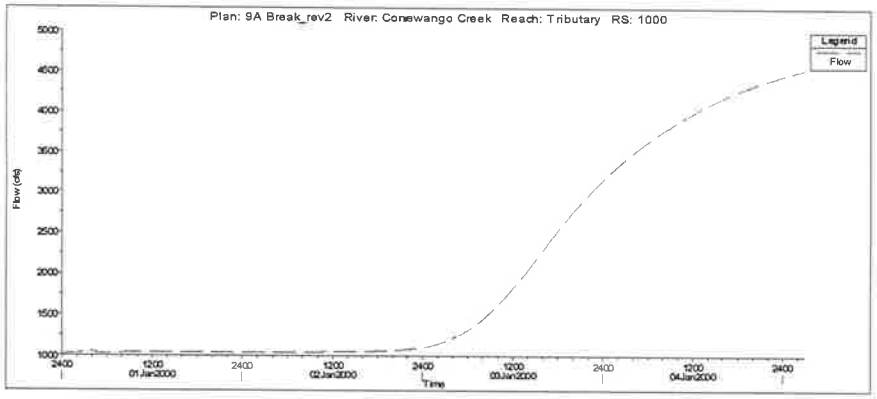
Flow4609.0905Jan2000 030017971.09



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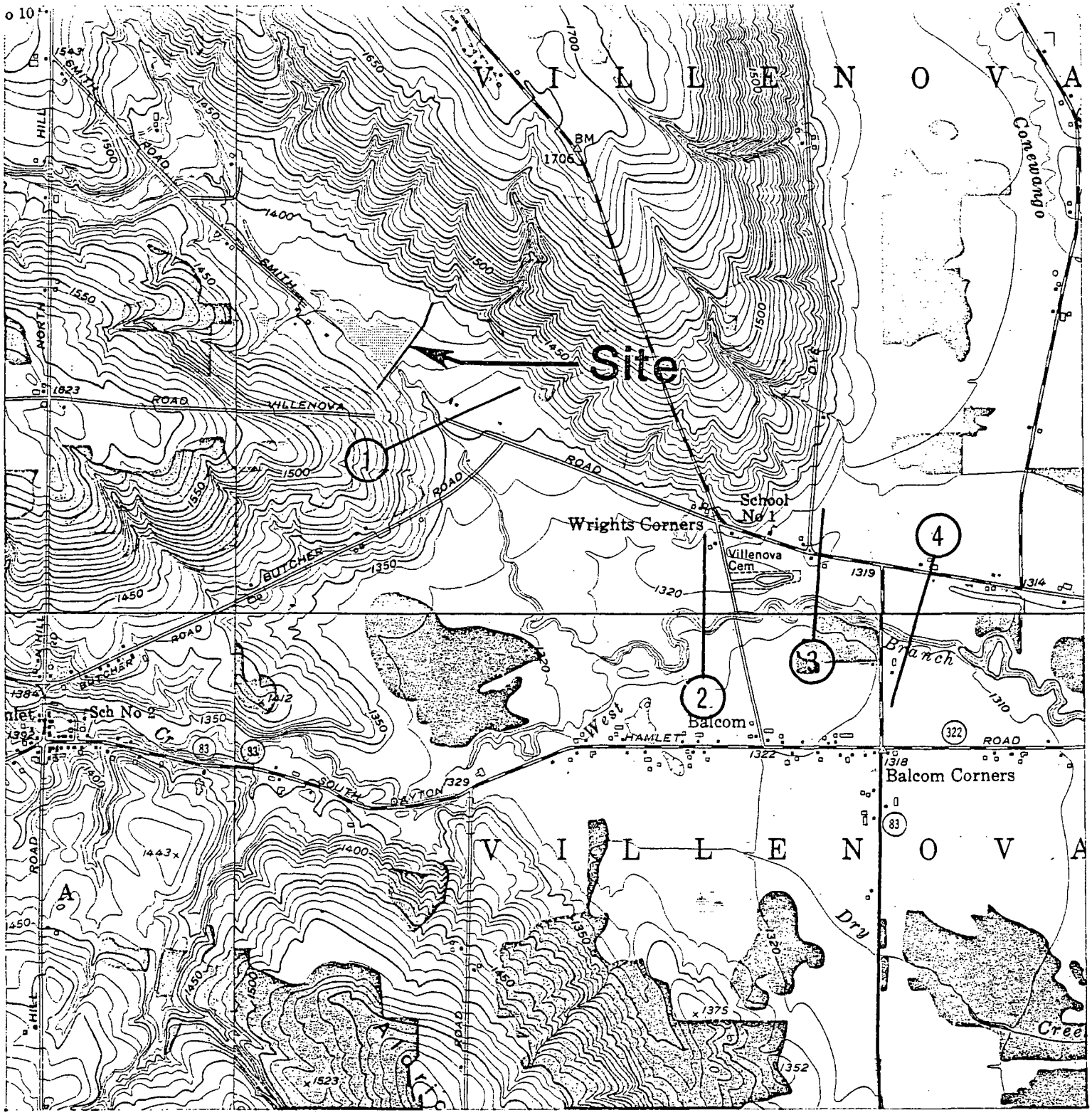
Flow4540.0705Jan2000 030016946.87



Conewango Creek Watershed
(Site 9A)

CROSS SECTION LOCATION PLAN

Scale: 1"=2000' D-2

```
A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF          DAM NY 596
A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFTEY OF CONEWANGO CREEK-SITE 9A
A3       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
B     100        0       15                                    0      -1       4
B1      5
J       1        6        1
J1    0.2      0.4      0.5      0.6      0.8      1.0
K       0  INFLOW                                               1
K1       CALCULATION OF INFLOW HYDROGRAPH
M       1        1      6.0            12.17        0                        1
P       0     22.6      114      124      138      148
T                                                          1.0      0.1
W    4.08     0.63
X     2.0     -.10      2.0
K       1  OUTFLOW                                              1
K1       COMPUTE OUTFLOW HYDROGRAPH FROM DAM NY596
Y                                  1        1
Y1      1                                                -1366.6       -1
Y4   1381     1382     1383     1384     1385     1387     1388     1389     1390     1391
Y41391.8     1392
Y5    118      205      356      467      473      640     1522     2844     4489     6453
Y5   8200     8650
$S   40.6    415.8    611.9    746.2    964.2
$E1366.6     1381   1386.6   1388.7   1391.8
$$1386.6
$D1391.8      2.7      1.5     1590                                    1
K       1        1                                                    1
K1     CHANNEL ROUTING -MOD PULS REACH 0-1
Y                                  1        1
Y1      1
Y6 0.045     0.04     .045     1346     1360      670   0.0116
Y7      0     1360      700     1355     1370     1352     1395     1346     1420     1346
Y7   1430     1352     1700     1360     1701     1360
K       0  INFLOW
K1       COMPUTE RUNOFF FROM ADJACENT WATERSHED
M       1        1     6.17            12.17        0
P       0     22.6      114      124      138      148
T                                                          1.0      0.1
W    3.96     0.63
X      2.     -0.1       2.
K       2 COMBINE
K1       COMBINE HYDROGRAPHS
K       1        2
K1     CHANNEL ROUTING -MOD PULS REACH 1-2
Y                                  1        1
Y1      1
Y6 0.045     0.04    0.045     1308     1330     7600   0.0005
Y7      0     1330      700     1320     1300     1314     1340     1308     1370     1308
Y7   1400     1314     2200     1320     2201     1320
K       1        3                                                    1
K1     CHANNEL ROUTING -MOD PULS REACH 2-3
Y                                  1        1
Y1      1
Y6 0.045     0.04    0.045     1304     1322     1800   0.0022
Y7      0     1320      700     1322      880     1320     1320     1314     1330     1304
Y7   1370     1304     1380     1314     2200     1322
K       1        4
```

```
K1     CHANNEL ROUTING -MOD PULS REACH 3-4
Y                                    1      1
Y1       1
Y6  0.045     0.04    0.045    1302    1318    1500  0.0013
Y7       0     1315     1200    1312    1255    1302    1295    1302    1320    1312
Y7    1900     1315     2900    1318    3000    1318
K       99
A
```

```
OK, SEG #HEC1DB
ENTER PROJECT NUMBER
80166-00.09
INPUT FILE ? NY596
1*********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  26 FEB 79
 *********************************
1                              PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS
                                     RUNOFF HYDROGRAPH AT       INFLOW
                                     ROUTE HYDROGRAPH TO        UTFLOW
                                     ROUTE HYDROGRAPH TO             1
                                     RUNOFF HYDROGRAPH AT       INFLOW
                                     COMBINE  2 HYDROGRAPHS AT OMBINE
                                     ROUTE HYDROGRAPH TO             2
                                     ROUTE HYDROGRAPH TO             3
                                     ROUTE HYDROGRAPH TO             4
                                     END OF NETWORK

1*********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  26 FEB 79
 *********************************

 RUN  DATE: 6/10/
      TIME: 8:55 AM


                    ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF          DAM NY 596
                    HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFTEY OF CONEWANGO CREEK-SITE 9A
                    RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM

                                         JOB SPECIFICATION
          NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
         100       0      15       0       0       0       0      -1       4       0
                                JOPER     NWT   LROPT   TRACE
                                    5       0       0       0


                              MULTI-PLAN ANALYSES TO BE PERFORMED
                                   NPLAN= 1 NRTIO= 6 LRTIO= 1
          RTIOS=   0.20   0.40   0.50   0.60   0.80   1.00


     **********        **********        **********        **********        **********

                                SUB-AREA RUNOFF COMPUTATION

          CALCULATION OF INFLOW HYDROGRAPH
                   ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  INFLOW       0       0       0       0       0       1       0       0

                                     HYDROGRAPH DATA
        IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
```

1	1	6.00	0.00	12.17	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.60	114.00	124.00	138.00	148.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.807

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 4.08 CP=0.63 NTA= 0

RECESSION DATA

STRTQ= 2.00 QRCSN= -0.10 RTIOR= 2.00

UNIT HYDROGRAPH 89 END-OF-PERIOD ORDINATES, LAG= 4.09 HOURS, CP= 0.64 VOL= 1.00

9.	35.	73.	117.	166.	218.	273.	330.	388.	445.
496.	537.	571.	596.	613.	621.	619.	603.	571.	534.
499.	467.	436.	408.	381.	356.	333.	312.	291.	272.
255.	238.	222.	208.	194.	182.	170.	159.	149.	139.
130.	121.	113.	106.	99.	93.	87.	81.	76.	71.
66.	62.	58.	54.	51.	47.	44.	41.	39.	36.
34.	32.	30.	28.	26.	24.	23.	21.	20.	18.
17.	16.	15.	14.	13.	12.	11.	11.	10.	9.
9.	8.	8.	7.	7.	6.	6.	5.	5.	

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.99	23.23	3.76	290432.
										(685.)	(590.)	(95.)	(8224.11)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

COMPUTE OUTFLOW HYDROGRAPH FROM DAM NY596

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
UTFLOW	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1367.	-1

STAGE	1381.00	1382.00	1383.00	1384.00	1385.00	1387.00	1388.00	1389.00	1390.00	1391.00
	1391.80	1392.00								
FLOW	118.00	205.00	356.00	467.00	473.00	640.00	1522.00	2844.00	4489.00	6453.00
	8200.00	8650.00								
CAPACITY=	41.	416.	612.	746.	964.					

ELEVATION= 1367. 1381. 1387. 1389. 1392.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXFL
1386.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1391.8	2.7	1.5	1590.

PEAK OUTFLOW IS 1442. AT TIME 46.00 HOURS

PEAK OUTFLOW IS 4010. AT TIME 44.25 HOURS

PEAK OUTFLOW IS 5116. AT TIME 44.00 HOURS

PEAK OUTFLOW IS 6167. AT TIME 44.00 HOURS

PEAK OUTFLOW IS 8259. AT TIME 43.75 HOURS

PEAK OUTFLOW IS 10423. AT TIME 43.75 HOURS

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 0-1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0450	0.0400	0.0450	1346.0	1360.0	670.	0.01160

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1360.00 700.00 1355.00 1370.00 1352.00 1395.00 1346.00 1420.00 1346.00
1430.00 1352.00 1700.00 1360.00 1701.00 1360.00

STORAGE	0.00	0.31	0.66	1.07	1.52	2.03	2.58	3.18	3.83	5.29
	8.89	14.63	22.51	32.33	43.62	56.35	70.54	86.18	103.27	121.81
OUTFLOW	0.00	61.82	202.41	411.60	688.91	1036.16	1456.09	1951.85	2526.78	3379.65
	4831.06	7216.05	10819.22	16083.62	22936.79	31422.70	41652.64	53738.30	67790.06	83910.67

STAGE	1346.00	1346.74	1347.47	1348.21	1348.95	1349.68	1350.42	1351.16	1351.89	1352.63
	1353.37	1354.10	1354.84	1355.58	1356.32	1357.05	1357.79	1358.53	1359.26	1360.00
FLOW	0.00	61.82	202.41	411.60	688.91	1036.16	1456.09	1951.85	2526.78	3179.65
	4831.06	7216.05	10819.22	16083.62	22936.79	31422.70	41652.64	53738.30	67790.06	83910.67

MAXIMUM STAGE IS 1350.4

MAXIMUM STAGE IS 1353.0

MAXIMUM STAGE IS 1353.5

MAXIMUM STAGE IS 1353.8

MAXIMUM STAGE IS 1354.3

MAXIMUM STAGE IS 1354.8

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

COMPUTE RUNOFF FROM ADJACENT WATERSHED

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	INFLOW	0	0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	6.17	0.00	12.17	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.60	114.00	124.00	138.00	148.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.807

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 3.96 CP=0.63 NTA= 0

RECESSION DATA

STRTQ= 2.00 QRCSN= -0.10 RTIOR= 2.00

UNIT HYDROGRAPH 86 END-OF-PERIOD ORDINATES, LAG= 3.95 HOURS, CP= 0.63 VOL= 1.00

10.	39.	79.	127.	181.	238.	297.	359.	423.	483.
535.	578.	611.	636.	651.	655.	648.	623.	585.	546.
509.	475.	443.	414.	386.	360.	336.	314.	293.	273.
255.	238.	222.	207.	193.	180.	168.	157.	146.	137.
128.	119.	111.	104.	97.	90.	84.	79.	73.	68.
64.	60.	56.	52.	48.	45.	42.	39.	37.	34.
32.	30.	28.	26.	24.	23.	21.	20.	18.	17.
16.	15.	14.	13.	12.	11.	11.	10.	9.	9.
8.	7.	7.	7.	6.	6.				

0
END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.99	23.23	3.76	302347.
										(685.)(590.)(95.)(8561.51)			

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OMBINE		2	0	0	0	0	0	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 1-2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0450	0.0400	0.0450	1308.0	1330.0	7600.	0.00050

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1330.00 700.00 1320.00 1300.00 1314.00 1340.00 1308.00 1370.00 1308.00
1400.00 1314.00 2200.00 1320.00 2201.00 1320.00

STORAGE	0.00	7.42	17.58	30.46	46.06	64.40	102.78	194.86	341.51	542.71
	798.49	1101.25	1423.02	1761.14	2115.64	2486.51	2873.75	3277.35	3697.33	4133.67
OUTFLOW	0.00	34.81	122.06	264.55	468.78	741.57	1195.01	2036.15	3474.30	5687.63
	8833.60	13411.18	19284.59	26214.89	34194.46	43224.27	53310.59	64463.27	76694.53	90018.39
STAGE	1308.00	1309.16	1310.32	1311.47	1312.63	1313.79	1314.95	1316.10	1317.26	1318.42
	1319.58	1320.73	1321.89	1323.05	1324.21	1325.37	1326.52	1327.68	1328.84	1330.00
FLOW	0.00	34.81	122.06	264.55	468.78	741.57	1195.01	2036.15	3474.30	5687.63
	8833.60	13411.18	19284.59	26214.89	34194.46	43224.27	53310.59	64463.27	76694.53	90018.39

MAXIMUM STAGE IS 1316.7

MAXIMUM STAGE IS 1319.1

MAXIMUM STAGE IS 1319.8

MAXIMUM STAGE IS 1320.3

MAXIMUM STAGE IS 1321.3

MAXIMUM STAGE IS 1322.1

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 2-3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0450	0.0400	0.0450	1304.0	1322.0	1800.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1320.00 700.00 1322.00 880.00 1320.00 1320.00 1314.00 1330.00 1304.00
1370.00 1304.00 1380.00 1314.00 2200.00 1322.00

STORAGE	0.00	1.60	3.28	5.03	6.86	8.76	10.73	12.78	14.90	17.09
	19.37	22.34	30.84	45.86	67.40	95.46	130.03	171.21	227.11	303.13
OUTFLOW	0.00	64.04	204.00	402.51	652.86	951.26	1295.30	1683.33	2114.23	2587.25
	3101.86	2742.33	2750.56	3683.55	5422.09	8049.00	11681.41	16538.40	23626.22	32814.54
STAGE	1304.00	1304.95	1305.89	1306.84	1307.79	1308.74	1309.68	1310.63	1311.58	1312.53
	1313.47	1314.42	1315.37	1316.31	1317.26	1318.21	1319.16	1320.10	1321.05	1322.00
FLOW	0.00	64.04	204.00	402.51	652.86	951.26	1295.30	1683.33	2114.23	2587.25
	3101.86	2742.33	2750.56	3683.55	5422.09	8049.00	11681.41	16538.40	23626.22	32814.54

MAXIMUM STAGE IS 1312.9

MAXIMUM STAGE IS 1318.0

MAXIMUM STAGE IS 1318.6

MAXIMUM STAGE IS 1319.2

MAXIMUM STAGE IS 1320.0

MAXIMUM STAGE IS 1320.6

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 3-4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0450	0.0400	0.0450	1302.0	1318.0	1500.	0.00130

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1315.00 1200.00 1312.00 1255.00 1302.00 1295.00 1302.00 1320.00 1312.00
1900.00 1315.00 2900.00 1318.00 3000.00 1318.00

STORAGE	0.00	1.26	2.71	4.36	6.20	8.24	10.47	12.90	15.53	18.35
	21.36	24.58	28.09	40.61	67.62	109.11	164.09	227.82	299.69	375.70
OUTFLOW	0.00	41.90	138.07	281.52	471.35	708.16	993.19	1327.99	1714.31	2154.00
	2648.97	3201.16	3079.56	2419.25	3676.99	6239.80	11044.67	18057.04	26789.14	37336.26
STAGE	1302.00	1302.84	1303.68	1304.53	1305.37	1306.21	1307.05	1307.89	1308.74	1309.58
	1310.42	1311.26	1312.10	1312.95	1313.79	1314.63	1315.47	1316.31	1317.16	1318.00
FLOW	0.00	41.90	138.07	281.52	471.35	708.16	993.19	1327.99	1714.31	2154.00
	2648.97	3201.16	3079.56	2419.25	3676.99	6239.80	11044.67	18057.04	26789.14	37336.26

MAXIMUM STAGE IS 1310.6

MAXIMUM STAGE IS 1314.8

MAXIMUM STAGE IS 1315.2

MAXIMUM STAGE IS 1315.6

MAXIMUM STAGE IS 1316.1

MAXIMUM STAGE IS 1316.6

********** ********** ********** ********** **********

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
				0.20	0.40	0.50	0.60	0.80	1.00
HYDROGRAPH AT	INFLOW	6.00	1	2090.	4179.	5224.	6269.	8359.	10448.
		(15.54)		(59.17)(118.35)(147.93)(177.52)(236.69)(295.87)(					
ROUTED TO	UTFLOW	6.00	1	1442.	4010.	5116.	6167.	8259.	10423.
		(15.54)		(40.82)(113.55)(144.86)(174.62)(233.86)(295.13)(					
ROUTED TO	1	6.00	1	1447.	4013.	5116.	6167.	8261.	10430.
		(15.54)		(40.97)(113.63)(144.86)(174.63)(233.93)(295.34)(					
HYDROGRAPH AT	INFLOW	6.17	1	2187.	4373.	5467.	6560.	8747.	10933.
		(15.98)		(61.92)(123.84)(154.80)(185.76)(247.68)(309.59)(					
2 COMBINED	OMBINE	12.17	1	3025.	8231.	10490.	12645.	16922.	21337.
		(31.52)		(85.66)(233.08)(297.05)(358.07)(479.18)(604.18)(					
ROUTED TO	2	12.17	1	2788.	7451.	9678.	11866.	16222.	20599.
		(31.52)		(78.96)(210.99)(274.06)(336.02)(459.36)(583.30)(					
ROUTED TO	3	12.17	1	2787.	7449.	9676.	11854.	16219.	20605.
		(31.52)		(78.92)(210.94)(274.01)(335.68)(459.26)(583.46)(					
ROUTED TO	4	12.17	1	2785.	7435.	9654.	11856.	16215.	20577.
		(31.52)		(78.87)(210.54)(273.38)(335.72)(459.15)(582.67)(					

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1366.60	1386.60	1391.80
STORAGE	41.	612.	964.
OUTFLOW	118.	607.	8200.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	1387.91	0.00	696.	1442.	0.00	46.00	0.00

0.40	1389.71	0.00	817.	4010.	0.00	44.25	0.00
0.50	1390.32	0.00	860.	5116.	0.00	44.00	0.00
0.60	1390.85	0.00	898.	6167.	0.00	44.00	0.00
0.80	1391.82	0.02	966.	8259.	0.50	43.75	0.00
1.00	1392.24	0.44	995.	10423.	3.50	43.75	0.00

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	1447.	1350.4	46.00
0.40	4013.	1353.0	44.25
0.50	5116.	1353.5	44.00
0.60	6167.	1353.8	44.00
0.80	8261.	1354.3	44.00
1.00	10430.	1354.8	43.75

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	2788.	1316.7	46.25
0.40	7451.	1319.1	45.00
0.50	9678.	1319.8	44.75
0.60	11866.	1320.3	44.50
0.80	16222.	1321.3	44.25
1.00	20599.	1322.1	44.25

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	2787.	1312.9	46.25
0.40	7449.	1318.0	45.00
0.50	9676.	1318.6	44.75
0.60	11854.	1319.2	44.50
0.80	16219.	1320.0	44.50
1.00	20605.	1320.6	44.25

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	2785.	1310.6	46.50
0.40	7435.	1314.8	45.25
0.50	9654.	1315.2	45.00
0.60	11856.	1315.6	44.75
0.80	16215.	1316.1	44.50
1.00	20577.	1316.6	44.25

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

WATERSHED UPSTREAM OF DAM

$$T_p = C_t (L L_{ca})^{0.3} \checkmark$$

$$T_r = \frac{T_p}{5.5} \checkmark$$

$C_t = 2.00$

$C_p = 0.63$

$$T_{PR} = T_p + 0.25 (T_R - T_r)$$

$L = 25\,000' \checkmark = \frac{25000}{5280} = 4.73$ MI ✓

$L_{ca} = 11300' \checkmark = \frac{11300}{5280} = 2.14$ MI ✓

$T_p = 2 (4.73 \times 2.14)^{.3} = 4.01$ hr. ✓

$T_r = \frac{4.01}{5.5} = 0.73$ hr ✓ $\Rightarrow$ $T_R = 1$ hr ✓

$T_{PR} = 4.01 + 0.25 (1 - 0.73) = 4.08$ hr. ✓

WATERSHED UPSTREAM OF DAM

DAM 596 CONEWANGO CREEK SITE 9A REFF. QUAD. PERRYSBORG, N.Y
FORESTVILLE, N.Y.

DISTANCE L & Lca MEAS. WITH MAP MEAS. WHEEL (1" = 2000')

COMPUTATION FOR L DISTANCE

RUN		MEAS. DIST	AVG. DIST	COEF.	L DISTANCE
A	1 =	12.50			
	2 =	12.50			
		25.00 ÷ 2	= 12.50	× 2000'	= 25,000. FT. *

RUN					
B	1 =	8.6			
	2 =	8.7			
		17.3 ÷ 2	= 8.65	× 2000'	= 173,000 FT

COMPUTATION FOR Lca DISTANCE

RUN		MEAS. DIST	AVG. DIST.	COEF.	Lca DISTANCE
A	1 =	5.6			
	2 =	5.7			
		11.3 ÷ 2	= 5.65	× 2000'	= 11,300. FT. *

SUMMARY

*USE RUN A FOR L DISTANCE = 25,000. FT.

*USE RUN A FOR Lca DISTANCE = 11300. FT

ADJACENT WATERSHED

$L = 27000 \text{ ft} \checkmark = \frac{27000}{5280} = 5.11 \text{ MI} \checkmark$

$L_{ca} = 9500 \text{ ft} \checkmark = \frac{9500}{5280} = 1.80 \text{ MI} \checkmark$

$T_p = C_t (L \times L_{ca})^{0.3}$ $\quad C_t = 2.00$ $\quad C_p = 0.63$

$T_p = 2 (5.11 \times 1.80)^{0.3}$

$T_p = 3.89 \text{ hr.} \checkmark$

$T_r = \frac{T_p}{5.5}$

$T_r = \frac{3.89}{5.5} = 0.71 \Longrightarrow T_R = 1 \text{ hr} \checkmark$

$T_{PR} = T_p + 0.25 (T_R - T_r)$

$T_{PR} = 3.89 + 0.25 (1 - 0.71) = 3.96 \text{ hr.} \checkmark$

ADJACENT WATERSHED

DAM 596 CONEWANGO CREEK SITE 9A

REFF. QUAD HAMLET, NY
CHERRY CR., NY
FORESTVILLE, NY
PERRYSBORG, N.Y.

DRAINAGE DISTANCE

DISTANCE L & LCA MEAS. WITH MAP MEAS. WHEEL (1"=2000')

COMPUTATIONS FOR L DISTANCE

RUN		MEAS. DIST	AVG. DIST	COEF.	L DIST.
A	1 =	13.5			
	2 =	13.5			
		27.0	÷ 2 = 13.5	× 2000'	= 27,000 ft. ★

RUN					
B	1 =	12.6			
	2 =	12.7			
		25.2	÷ 2 = 12.65	× 2000	= 25,300 ft

★ L = 27,000ft. USED RUN A

COMPUTATION FOR Lca DISTANCE

RUN		MEAS. DIST.	AVG DIST	COEF.	Lca DIST.
A	1 =	4.8			
	2	4.7			
		9.5	÷ 2 = 4.75	× 2000'	= 9,500 ft. ★

★ Lca = 9,500 ft.

Dam 596 HYDRAULICS

SERVICE SPILLWAY

48" ϕ RCP w/ 4' x 12' Riser

From design report :

$Q_s = 481$ cfs @ Elev. 1386.6

$Q_s = 467$ cfs @ Elev. 1384'

① $Q_s = C_o A_o \sqrt{2gh_o} + 467$ cfs , h_o is Elevs. above Elev. 1384

$A_o = \left[\left(\frac{48}{12}\right)^2 / 4\right]\pi = 12.57$ ft^2

Determine C_o from $\begin{cases} Q = 481 - 467 \\ Q = 14 \text{ cfs} \end{cases}$ and $h_o = 1386.6 - 1384$, $h_o = 2.6'$

From eq. ①

$$C_o = \frac{14}{12.57\sqrt{2 \times 32.2 \times 2.6}} = 0.09$$

Note : Equation ① is only for elevations above elevation 1384. For elevations below 1384 flow are given by design report

$$Q_s = 0.09 \times 12.57\sqrt{2 \times 32.2 \times h} + 467 = 9.08\ h_o^{0.5} + 467 \text{ cfs}$$

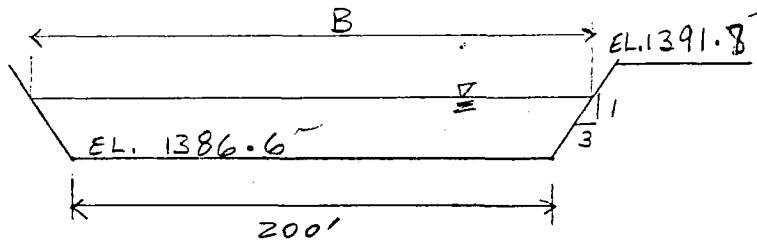
The above formula is used only for elevations above 1384.

SERVICE SPILLWAY

	ELEV.	h_o	Q_s
FROM DESIGN REPORT	1381		118
	1382		205
	1383		356
	1383.5		446
	1384	0	467
	1386.6	2.6	481
	1387	3	483
	1388	4	485
	1389	5	487
	1390	6	489
	1391	7	491
*	1391.8	7.8	492
	1392	8	493
	1393	9	494 Ewit
	1394	10	

* Top of dam

EMERGENCY SPILLWAY



EMERGENCY SPILLWAY SECTION

$S_o = 0.03$

$$Q_c = \sqrt{\frac{g A^3}{B}}$$

for $y = 1'$

$B = (2 \times 3) + 200 = 206'$

$A = \frac{1}{2}(206 + 200) \times 1 = 203 \text{ ft}^2$

$$Q_c = \sqrt{\frac{32.2 \times 203^3}{206}} = 1143.5 \text{ cfs}$$

$$K = \frac{1.49}{n} AR^{2/3} = \frac{1.49}{0.035} 203 \left[\frac{203}{200 + 2(1+9)^{0.5}}\right]^{2/3}$$

$K = 8549$

$$S_c = \left(\frac{1143.5}{8549}\right)^2 = 0.018$$

spillway slope > critical slope $(0.03 > 0.018)$

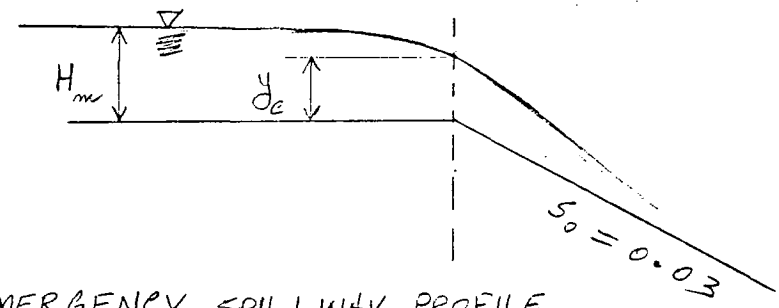
∴ Flow goes through critical depth for $y = 1'$ and also for $y > 1'$

use Table 8-7 from "King and Brater"

$Z = 3/1 = 3$

$b = 200'$

$Q_E = C_2 \, b \, H_m^{1.5}$



EMERGENCY SPILLWAY PROFILE

EMERGENCY SPILLWAY
DISCHARGE – ELEVATION RELATIONSHIP

	H_m	$\frac{H_m Z}{b}$	C_2	Q_E	ELEV.
	0	0	3.09	0 ✓	1386.6
	0.4	0.01	3.11	157 ✓	1387
	1.4	0.02	3.13	1037 ✓	1388
	2.4	0.04	3.17	2357 ✓	1389
	3.4	0.05	3.19	4000 ✓	1390
	4.4	0.07	3.23	5962 ✓	1391
*	5.2	0.08	3.25	7708 ✓	1391.8
	5.4	0.08	3.25	8157 ✓	1392
	6.4	0.10	3.29	10654 ✓	1393
	7.4	0.11	3.32	13366 ✓	1394

* actual top of dam.

CONEWANGO CREEK DAM 596 SITE 9A

$A RAREA RESEVIOR SURFACE AREA

REFF. U.S. DEPT. OF A.S.C.S AS BUILT PLANS DWG. NY-2161-P
SCACE 1" = 200' PLAN X 1/2 REDUCTION = 1" = 400

Eq. $\frac{in^2 \times 400^2 ft^2}{in^2} \times \frac{1 AC}{43,560 ft^2} = AC$

ELEV. 1370

$4.6\ in^2 \times \frac{400^2 ft^2}{in^2} \times \frac{1 AC}{43,560 ft^2} = 16.90$ AC. ✓

ELEV. 1375

$8.28\ in^2 \times \frac{400^2 ft^2}{in^2} \times \frac{1 AC}{43560 ft^2} =$ 30.41 AC. ✓

ELEV. 1380

$12.10\ in^2 \times \frac{400^2 ft^2}{in^2} \times \frac{1 AC}{43,560 ft^2} =$ 44.44 AC. ✓

ELEV. 1385

$16.67\ in^2 \times \frac{400^2 ft^2}{in^2} \times \frac{1 AC}{43,560 ft^2} =$ 51.23 AC. ✓

ELEV. 1390

$19.66\ in^2 \times \frac{400^2 ft^2}{in^2} \times \frac{1 AC}{43,560 ft^2} =$ 72.21 Ac. ✓

ELEV. 1395

$24.0\ in^2 \times \frac{400^2 ft^2}{in^2} \times \frac{1 AC}{43,560 ft^2} =$ 88.15 AC ✓

TOTAL AC = 303.34

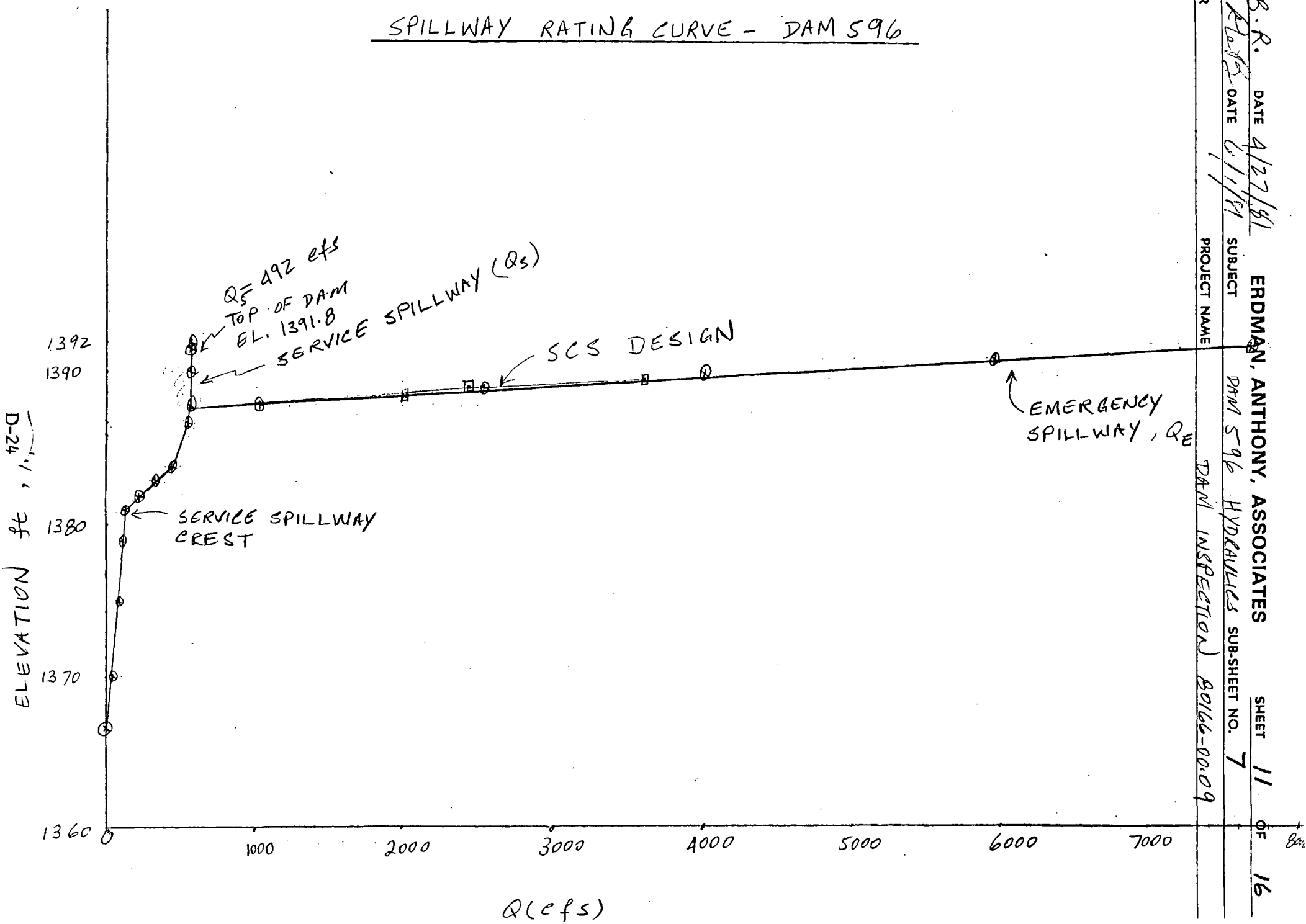
* Used storage values from design report

$Q_S + Q_E$ TOTAL SPILLWAYS DISCHARGE

	ELEV. ft	$Q_S + Q_E$ (cfs)	RESERVOIR SURFACE AREA
	1366.6	0	8.8
	1367	2.5	
	1367.5	8.5	
	1368	16.4	
	1368.77	32	
	1370	49	16.90 AC.
	1375	87	30.41 AC.
	1379	113	
1380	1381	118 116	44.44 AC. 44 AC
	1382	205	
	1383	356	
	1383.5	446	
1385	1384	467 473	51.23 AC
	1386.6	481	59.5 AC.
	1387	640	
1388.1	1388	1522	
	1389	2844 1709	65.5
	1390	4489	72.21 AC
	1391	6453	
*	1391.8	8200	74.5 AC
	1392	8650	
→	1393	11148 pub	
	1394		
	1395		88.15 AC

* TOP OF DAM

SPILLWAY RATING CURVE - DAM 596



OWNER
PROJECT NAME ERDMAN, ANTHONY, ASSOCIATES
SUBJECT DAM 596 HYDRAULICS SUB-SHEET NO. 7 OF 16
DAM INSPECTION B0166-00.09
CKD B.R. DATE 4/27/81
DATE 6/1/81

D-24

VALUES ON $D CARD OF HEC-1

FIELD	VARIABLE	VALUE
0	ID	$D
1	TOPEL	1391.8 ✓
2	CAQD	2.7 ✓
3	EXPD	1.5 ✓
4	DAMWID	1590 ✓

AREA OF THE ADJACENT WATERSHED

$A = 43.0\ in^2$ (scale : 1" = 2000')

$$A = 43\ in^2 \times \frac{2000^2\ ft^2}{in^2} \times \frac{ac}{43560\ ft^2} \times \frac{mile^2}{640\ ac.} = 6.17\ mile^2$$ ✓

Emergency Spillway Capacities

Flood	Q_T	Elev.	Q_{ES}	A	V	Comments
PMF	10,423 ✓	1392.24 ✓	8756 ✓	1075	8.15	> 8.0 ∴ erosion
½ PMF	5,116	1390.32	4628	573	8.08	> 8.0 ∴ erosion

PMF

1392	8157 cfs	$y = 8157 + (.24)(10654 - 8157) = 8756$ cfs ✓
1392.24	Y	
1393	10654 cfs	

Assume $y_n/b < 0.02 \Rightarrow y_n = 0.789\left(\frac{Qn}{b S_o^{1/2}}\right)^{0.6}$

$y_n = 0.789\left(\frac{8756(0.06)}{200(0.03)^{1/2}}\right)^{0.6} = 4.03'$, $y_n/b = \frac{4.03}{200} = 0.02 \neq 0.02$ N.G.

Since y_n/b is not less than 0.02, then it will be found using table 103-1, pg. 8 of Fundamentals of Open Channel Hydraulics by Posey. ✓

$$\frac{Qn}{(b)^{8/3}(S_o)^{1/2}} = \frac{8756(0.06)}{(200)^{8/3}(0.03)^{1/2}} = 0.00222 \checkmark$$

0.00150	0.02
0.00222	y_n/b
0.00298	0.03

$y_n/b = 0.02 + .01\left(\frac{.00072}{.00148}\right) = 0.025$ ✓

$y_n = 0.025(200) = 5.0'$ ✓

$A = (5.0')(200') + 2\left(\frac{1}{2}(5.0')(3)(5.0')\right) = 1075\ ft^2$ ✓

$V = \frac{Q}{A} = \frac{8756\ cfs}{1075\ ft^2} = 8.15\ ft/sec$ ✓

½ PMF

1390	4000
1390.32	Y
1391	5962

$Y = 4000 + 0.32(5962 - 4000) = 4628$ ✓

Assume $y_n/b < 0.02 \Rightarrow y_n = 0.789\left(\frac{Q\,n}{b\,S^{1/2}}\right)^{0.6}$

$y_n = 0.789\left(\frac{4628(0.06)}{200\,(0.03)^{1/2}}\right)^{0.6} = 2.75', \quad y_n/b = 2.75'/200' = 0.14 < 0.02$ (OK) ✓

$A = 2.75'(200') + \frac{1}{2}\left(\frac{1}{4}(2.75')(5)(2.75')\right) = 573\ ft^2$ ✓

$V = \frac{Q}{A} = \frac{4628}{573} = 8.08\ ft/sec$ ✓

CONEWANGO CREEK SITE 9A

REF. U.S. DEP. OF ASCS DESIGN REPORT SHEETS 4 RATING CURVE
SHEET 4 AREA SHEET

DAM TOP ELEV. 1391.8
DAM INV. ELEV. 1353.78

REACH 1 LENGTH = 670'

CROSS SECTION : $\frac{1360}{0}, \frac{1355}{700}, \frac{1352}{1370}, \frac{1346}{1395}, \frac{1346}{1420}, \frac{1352}{1430}, \frac{1360}{1700}, \frac{1360}{1701}$

SLOPE = (DAM INV. - RE. 1 INV.) ÷ REACH LENGTH

1353.8 - 1346 = 7.8 ÷ 670 = 0.0116

REACH 2 LENGTH = 7600'

CROSS SECTION : $\frac{1330}{0}, \frac{1320}{700}, \frac{1314}{1300}, \frac{1308}{1340}, \frac{1308}{1370}, \frac{1314}{1400}, \frac{1320}{2200}, \frac{1320}{2201}$

SLOPE = (1346 - 1308) ÷ 8200 = 0.0046
7600 = 0.005

REACH 3 LENGTH = 1800' ✓

CROSS SECTION ✓ : $\frac{1320}{0}, \frac{1322}{700}, \frac{1320}{880}, \frac{1314}{1320}, \frac{1304}{1330}, \frac{1304}{1370}, \frac{1314}{1380}, \frac{1322}{2200}$

SLOPE = (1308 - 1304) ÷ 1800 = 0.0022

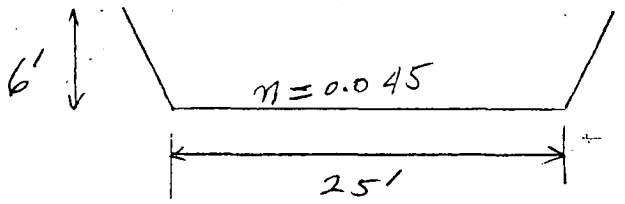
REACH 4 LENGTH = 1500'

CROSS SECTION : $\frac{1315}{0}, \frac{1312}{1200}, \frac{1302}{1255}, \frac{1302}{1295}, \frac{1312}{1320}, \frac{1315}{1900}, \frac{1318}{2900}, \frac{1318}{3000}$

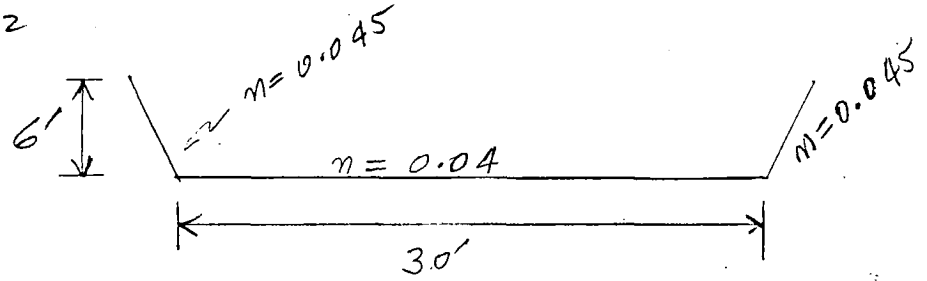
SLOPE = (1304 - 1302) ÷ 1500 = 0.0013

DOWNSTREAM CHANNEL SECTIONS

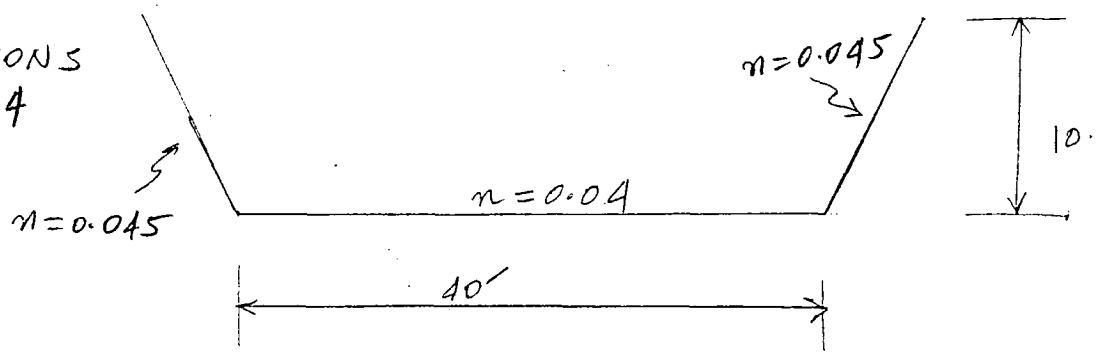
SECTION 1
&
2



SECTION 2



SECTION 3 & 4



CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

(DAM NY596)

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	1391.8	74.6	964
2) Design High Water (Max. Design Pool)	1386.6	59.5	612
3) Auxiliary Spillway Crest	1386.6	59.5	612
4) Pool Level with Flashboards	N/A	—	—
5) Service Spillway Crest	1381.0	8.8	41

DISCHARGES

	Volume (cfs)
1) Average Daily	unknown
2) Spillway @ Maximum High Water	492
3) Spillway @ Design High Water	481
4) Spillway @ Auxiliary Spillway Crest Elevation	481
5) Low Level Outlet (gated reservoir drain)	< 0
6) Total (of all facilities) @ Maximum High Water	8200
7) Maximum Known Flood	unknown
8) At Time of Inspection	31

CREST: ELEVATION: 1391.8

Type: broad-crested ; grassed earth embankment

Width: 16 ft. Length 1590 ft.

Spillover

Location south end of dam

SPILLWAY:

SERVICE		AUXILIARY
1381.0	Elevation	1386.6
conc. pipe w/ riser	Type	excavated channel
48" dia.	Width	200' Bottom width w/ 1V:3H sideslopes
	Type of Control	
✓	Uncontrolled	✓
	Controlled:	
	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
	Chute Length	
	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

HYDROMETEROLOGICAL GAGES:

Type : None

Location: -

Records:

Date - -

Max. Reading - -

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

None

DRAINAGE AREA: 6.0 sq. mi.

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Woodland, pastures, farmlands, very minor development

Terrain - Relief: Rolling

Surface - Soil: Glacial till over shallow bedrock

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

None

Potential Sedimentation problem areas (natural or man-made; present or future)

None at present. The dam was designed for a 50 yr. sediment accumulation.

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

flooding of agricultural lands.

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: None

Elevation: -

Reservoir:

Length @ Maximum Pool ±0.6 (Miles)

Length of Shoreline (@ Spillway Crest) ±0.4 (Miles)

Appendix D

Stability Computations

Foundation Design, P.C.
SOIL • BEDROCK • GROUNDWATER

January 16, 2014

TY Lin International
255 East Avenue
Rochester, New York 14604

Attn: James Guistina, P.E.

Ref: Conewango Creek Watershed Dam 9A
Smith Road, Villenova, New York
Geotechnical Consultation, 3788.9A

Dear Mr. Guistina,

This report summarizes our geotechnical consultation of the earth embankment at Site 9A of the Conewango Creek Watershed Project. This consultation is based on review of your recent inspection observations; the August 1981 Phase I Inspection Report; the 1974 as built Soil Conservation Service Design Plans; and our October visual inspection of the dam. TY Lin International retained Foundation Design, P.C. to provide geotechnical services outlined in our September 6, 2013 *Geotechnical Services Proposal, P3420.0.* We intend this report exclusively for use on this project.

This portion of the Conewango Creek Watershed is located in Chautauqua County, New York. Site 9A is located north of Smith Road in the Town of Villenova, New York.

The dam serves as a floodwater retarding structure. The embankment is 43 feet high and has a length at the crest of 1590 feet. The maximum storage capacity of the dam is 964 acre-feet. The upstream slope is (V:H) 1:3 and the down hill slope is (V:H) 1:2.5.

Our visual observations mirrored yours. We noted rodent holes and minor surface undulations on the embankment. We suspect that the longitudinal undulations on the embankment may be a function of mower action during a time of surface wetness. The grassy vegetation appeared lush and well suited to erosion control. We did observe debris (branches and silt) on the uphill embankment and the inlet structure (trash rack), indicating that the water level had been about six to eight feet higher relatively recently. We did not see signs that this had been detrimental to the function of the dam.

Inlet structure showing debris due to recent 'high' water level

The dam embankment consists of borrow material generated from cut for the overflow spillway and other borrow area adjacent to the dam. The dam embankment material is divided into two zones (I and II). Zone I is the core of the dam and cutoff trench. This zone is comprised

primarily of a low plasticity silt (ML) and silty sand (SM). Zone II makes up the outer (21'+) surface of the dam. This zone consists of silty gravel (GM-GP) intermixed with silt and clay (CL-ML). Design values used for the stability analysis of the dam slope were based on parameters assumed during design and construction of the dam. The design values of the embankment fill include an internal friction angle, Ø, of 31.5° and a cohesion of 100 psf.

Geologic conditions beneath the dam generally consist of near surface fine grained lake deposits over alluvial granular soils. Boring and test pit logs from the predevelopment assessment classify the upper soils as silt. The deeper alluvial deposits consist of silty gravel and sand. Bedrock was not encountered in the exploration program.

We performed slope stability analysis of the downhill and uphill portions of the dam embankment. Our analysis utilized the design parameters derived during the design phase of the project. Our analysis methods were Spencer-Wright and Bishop Simplified. The minimum factor of safety computed was 1.91. This occurred within the silty gravel embankment material, on the downhill slope, under saturated conditions. The recommended long term factor of safety (U.S. Army Corps of Engineers) for earth dams is 1.5.

As part of our seismic stability analysis we reviewed liquefaction, slope stability under seismic loading and geologic mapping of western New York faults.

- We applied a pseudo-static earthquake coefficient of 0.036 (1/2 of site PGA) to our slope analysis. The minimum factor of safety under this scenario was 1.72. The recommended minimum Factor of Safety under seismic load is greater 1.0.
- No active fault zones have been documented in the area. The nearest active fault zone (Clarendon-Linden) is located in Wyoming and Allegany counties, over 40 miles to the northeast. The paleoliquefaction features of this fault indicate that earthquakes larger than Mw 6 have not occurred along this fault complex.

- A liquefaction analysis of the embankment material and underlying native soil has a factor of safety against liquefaction over 5.0.

We found no structural geotechnical issues with the dam. Service related issues include resolving the rodent holes and the mower action as well as cleaning the trash rack. The rodent holes did not show signs of having affected the immediately adjacent embankment. Therefore it is reasonable to fill them with a wet soil/grout mix. Top this backfill with six inches of topsoil to promote surface vegetation. The surface undulations we attribute to mower action did not appear deep enough at this time to be considered 'ruts' requiring filling. We do suggest trying to schedule the mowing around wet periods and varying the mower pattern somewhat. We expect that the mower runs parallel/along the embankment and the operator aligns the mower tires to efficiently cut a 'full deck width'. Consider a half-overlap of the second pass onto the first so that the tire tracks do not align. The trash rack should be cleaned of debris so that it can be fully functional.

This concludes our geotechnical evaluation/assessment of the embankment.

Very truly yours,

FOUNDATION DESIGN, P.C.

James M. Baker, P.E.
President
Enc.

Geotechnical Analysis

Conewango Creek Site 9A Dam

NYS Dam ID: 007-3979

Town of Villanova, County of Chautauqua, State of New York

April 2014

Prepared By:	Prepared For:
T·Y·LIN INTERNATIONAL	CHAUTAUQUA COUNTY · STATE OF NEW YORK · 1811 · BICENTENNIAL · 2011

List

I. Slope Stability Analysis 2
1. Review Objective 2
2. Applied Safety Factor 2
II. Applied Properties 3
1. Soil Properties 3
III. Analysis Results 4
1. Dry Season 4
2. Rainy Season 5

I. Slope Stability Analysis

1. Review Objective

For slope stability check, the site conditions, constructability and economy need to be considered.

2. Applied Safety Factor

Section	Minimum safety factor	
Embankment region	User Defined	FS >= 1.3

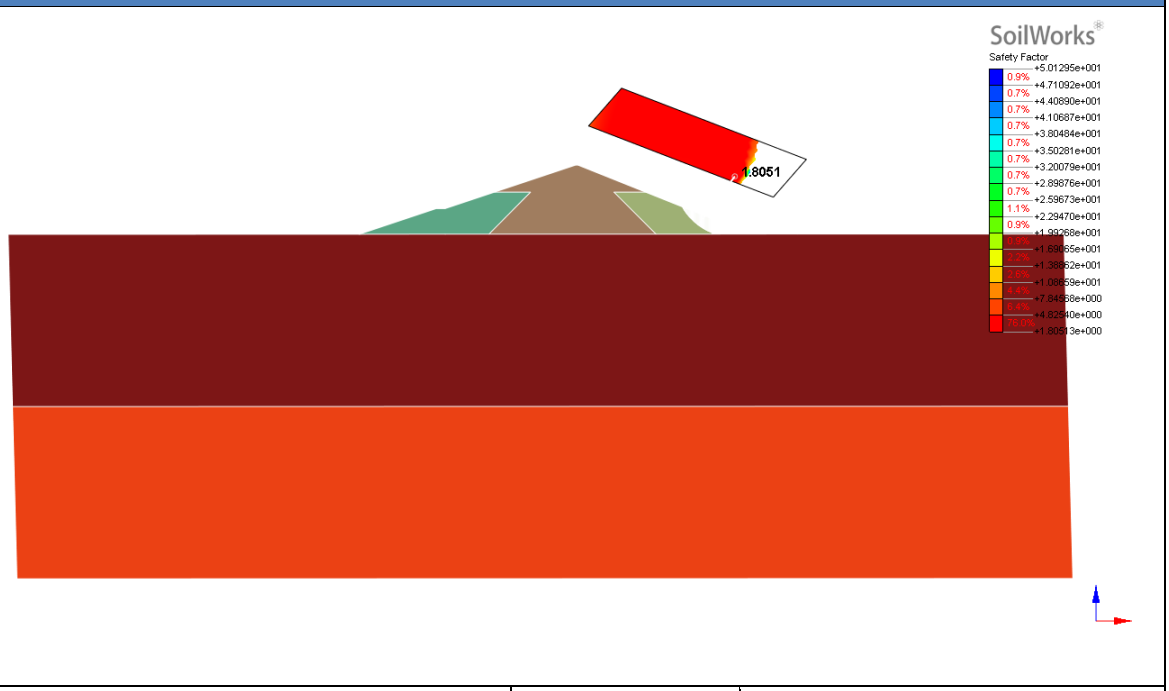
II. Applied Properties

1. Soil Properties

Section	Wet unit weight (kip/ft³)	Saturated unit weight (kip/ft³)	Cohesion (kip/ft²)	Internal friction angle ([deg])	Modulus of elasticity (kip/ft²)	Poisson's ratio
Zone 2	0.110130	0.116496	0.2882	31.50	-	-
Zone 1	0.124771	0.131137	0.3133	25.00	-	-
Weathered Soil	0.116496	0.122861	0.4344	27.80	-	-

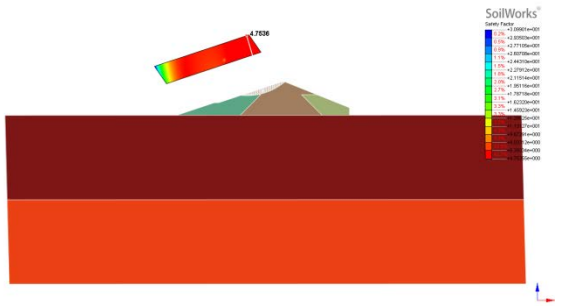
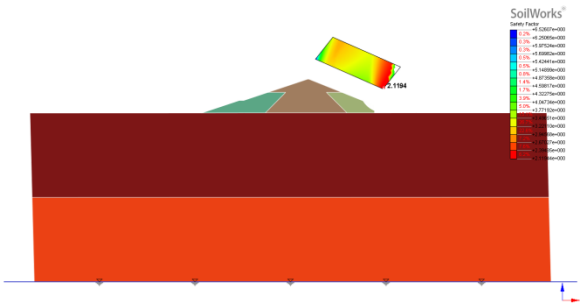
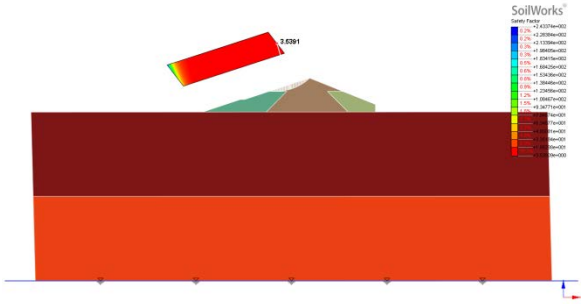
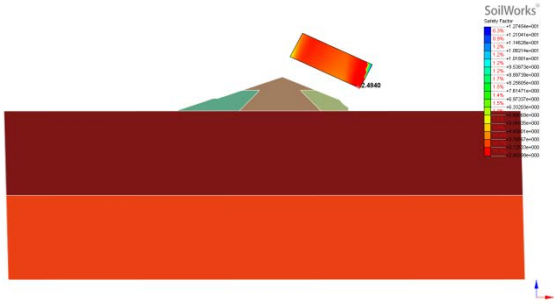
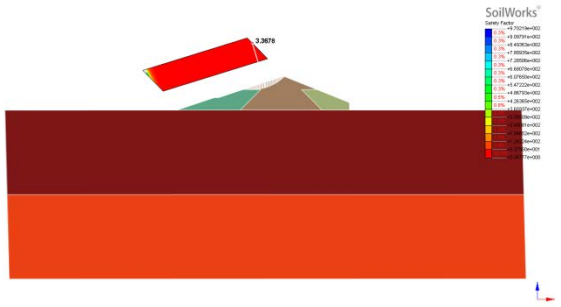
III. Analysis Results

1. Dry Season

Right side full		
		
Standard safety factor	1.300	Evaluation
Analysis safety factor	1.805	**OK**

- Dry season's Embankment region slope stability check : In case of Right side full allowable safety factor 1.3 has been satisfied. Determined to be safe.

2. Rainy Season

Left side full			Right side empty		
					
Standard safety factor	1.300	Evaluation	Standard safety factor	1.300	Evaluation
Analysis safety factor	4.754	**OK**	Analysis safety factor	2.119	**OK**
Left side empty			**Right side after drawdown**		
					
Standard safety factor	1.300	Evaluation	Standard safety factor	1.300	Evaluation
Analysis safety factor	3.539	**OK**	Analysis safety factor	2.484	**OK**
Left side after drawdown					
					
Standard safety factor	1.300	Evaluation			

Analysis safety factor	3.368	**OK**			

- Rainy season's Embankment region slope stability check : In case of Left side full,Right side empty,Left side empty,Right side after drawdown,Left side after drawdown allowable safety factor 1.3 has been satisfied.

Determined to be safe

DESIGN REPORT

CONEWANGO CREEK WATERSHED
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DESIGN SECTION, SYRACUSE, N.Y.

Sheet 1 of 6

This single purpose flood control structure is located on an unnamed tributary to the West branch of Conewango Creek approximately 4 miles WSW of South Dayton in the Town of Villenova. Sheet 5 of this report, together with the Perrysburg 7.5' quadrangle published by the U.S. Geological Survey, may be used to locate this site.

A summary of pertinent design information is given on Sheet 3 of this report.

Criteria and procedures used in this design are given in Soil Conservation Service publications.

This structure is one of 20 proposed floodwater retarding dams in the Conewango Creek Watershed designed to reduce floodwater damage.

Site 9A is designed to retard a 50-yr. frequency storm without discharge occurring in the emergency spillway.

The results of hydrologic and hydraulic computations are given on Sheet 4 of this report.

The structure consists of a zoned, compacted earth fill primarily of gravelly glacial till (GM), and alluvial gravel (GM-GP).

In the floodplain of the foundation, sandy gravel (GM-GP) alluvium overlies lacustrine CL silt and sandy silt deposits. Alluvial gravels and sands underlie the lacustrine materials and glacial till underlies the alluvial materials.

A dense cemented alluvial GM gravel underlies the glacial till of the left abutment and the alluvium and colluvium in the right abutment.

A drainage system is located under the downstream portion of the earth fill to control the phreatic surface and to provide a safe outlet for foundation seepage. A cutoff trench is located on the dam centerline to reduce seepage.

The principal spillway is a drop inlet structure composed of a 2-stage reinforced concrete riser, 48" diameter concrete water pipe, impact basin, and excavated outlet channel.

A vegetated earth emergency spillway with a bottom width of 200' is provided in the left abutment.

U.S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

Element of Structure	Determining Factor	Elev.	Surface Area Acres	Storage		Inflow		Peak Outflow C.F.S.
				AC.FT.	Inches *	Volume In. *	Rate C.F.S.	
Invert of Orifice	50 Yr. Submerged Sediment	1366.6	8.8	40.6	0.13	-	-	-
Crest of Riser	1.00" Storage plus 100 Yr. Total Sediment	1381.0	44.0	415.8 1/	1.30	-	-	114
Crest of Emergency Spillway	50 Yr. Frequency Storm, AMC II	1386.6	59.5	611.9 2/	1.91	-	-	312
Design High Water	ES-1020 Sh. 2 of 5. AMC II **	1388.7	65.5	746.2 2/	2.33	3.56	3178	1709
Top of Dam	ES-1020 Sh. 3 of 5. AMC II **	1391.8	74.5	964.2 2/	3.01	8.80	7938	6941

1/ Includes 14.7 Ac. Ft. of Acr. Sediment Storage.
2/ Excludes 95.8 Ac. Ft. total sediment storage.

* Volume expressed in inches of runoff from controlled watershed of 3840 acres.
** Refer to hydrologic criteria in National Engineering Memo SCS-27 (Rev.).

DESIGN SECTION, SYRACUSE, N.Y.

Sheet 4 of 6

U. S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

42° 25'00

79° 07' 30"

79° 05' 00"

CONEWANGO CR. SITE 9A
N 42°23'05"
E 79°06'58"

42°22'30"

REF. USGS QUAD. 7 1/2' PERRYSBURG N.Y

DESIGN SECTION, SYRACUSE, N.Y.

Sheet 5 of 6

U. S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

Information pertaining to the criteria and procedures referred to in this report may be obtained from Mr. Albert C. Addison, State Conservationist, U. S. Department of Agriculture, Soil Conservation Service, Syracuse, New York.

Design Engineer

for State Conservation Engineer

DESIGN SECTION, SYRACUSE, N Y

March 1, 1972

Mr. Eldred Rich, Chief
Bureau of Water Management
Department of Environmental Conservation
Division of Resource Management Services
50 Wolf Road
Albany, New York 12205

Dear Sir:

Dam at Site 9A
Conewango Creek Watershed Project

The plans, specifications and other data submitted by the Bureau of Water Management, to the Structures Subdivision of the Department of Transportation for the construction by the owner, Conewango Creek Watershed Commission, Court House, Mayville, New York, of a flood water retarding dam located in the Town of Villenova, County of Chautauqua and situated on an unknown tributary of Conewango Creek, have been reviewed.

The design and details pertaining to the soils, foundation and structural features of the dam are satisfactory to us insofar as the safety and stability of the structure are concerned.

The structure has been listed upon our records under the designation of Dam No. 7B-3979 of the Allegheny River Watershed.

Two sets of formally approved plans and specifications are enclosed. Also enclosed are two copies of the Bureau of Soil Mechanics' memorandum to this office stating the Bureau's comments concerning the anticipated soils and foundation conditions at the dam site with a recommendation to be followed during the construction of the structure. The recommendation is shown marked in red on the plans.

Very truly yours,

ORIGINAL SIGNED BY
A. W. MOON

A. W. MOON
Assistant Deputy Chief Engineer

AWM:RCS:MR
Attachments

cc: Wm. P. Hofmann

New York State Department of Environmental Conservation

MEMORANDUM

TB 3979
NY 596

TO: Eldred Rich

FROM: Charles W. Kolak

SUBJECT: Conewango Creek Site 9-A Watershed Project, March 17, 1972

DATE: May 10, 1972

~~In response to the request by the Stream Protection Section of the Bureau of Water Regulation,~~ We have made a hydrologic and hydraulic investigation of the proposed watershed project at Conewango Creek - Site 9A, Hamlet, New York.

The following information was used to evaluate the proposed dam:

1. Application for permit submitted by SCS, Syracuse, New York

2. Contract drawings and specifications submitted by SCS

The design of the auxiliary spillway and the service spillway were reviewed and the following results were obtained:

AUXILIARY SPILLWAY

Hydrology:

Downstream hazard classification is Class "B".

Drainage Area -- 6.00 square miles
Design Flood -- Emergency Spillway Hydrograph for Class "B" Structures
(ES 1020 sheet 2 of 5)
Reference -- "Guidelines for Small Earth Dam Designs" - New York State
Rainfall = 6.2"
CN=77
Runoff 3.7"
Reference -- SCS National Engineering Handbook, Section 4 - Hydrology
Chapter 21

Flood Routing:

The design hydrograph indicates a maximum inflow of 2890 cfs. At 3.00 hours, water will begin spilling over the crest of the auxiliary spillway. The peak discharge occurs at t=5.04 hours with 2335 cfs discharging over the auxiliary spillway and 340 cfs discharging through the service spillway. The reservoir water surface reached an elevation of 1388.95 which will provide more than the required 2 feet of freeboard.

SERVICE SPILLWAY

Hydrology:

Downstream hazard classification is Class "B".

Drainage Area -- 6.00 square miles
Design Flood -- New York State requirement 25-year, 6-hour storm
Reference -- "Guidelines for Small Earth Dam Designs" - New York State and Technical Paper #40, Pg. 42
Rainfall = 3.5"
CN=77
Runoff -- 1.45"
Maximum Q = 1290 cfs
Reference -- SCS National Engineering Handbook, Section 4 - Hydrology Chapter 21

Flood Routing:

The reservoir will have sufficient capacity to store all the runoff from the design flood without discharging in the auxiliary spillway. It was therefore not necessary to go through the flood routing calculations.

CONCLUSION

Auxiliary Spillway:

The auxiliary spillway has sufficient capacity to discharge the design storm and also have ~~1 foot~~ 2 feet of freeboard below the top of the dam.

Service Spillway:

The service spillway has sufficient capacity to retard the design storm without discharge occurring in the auxiliary spillway.

Drawdown:

The reservoir drain inlet is sufficient to drain the reservoir within the drawdown times.

General Comments:

1. A copy of the hydrologic and hydraulic comments that were sent to ~~the Bureau of Water Regulation~~ Frank Dwyer of Water Management are attached.
2. Soil stability analysis and structural comments will be furnished by the Department of Transportation.

CWK:GK/ea

New York State Department of Environmental Conservation

MEMORANDUM

TO: Eldred Rich

FROM: Charles W. Kolak CWK

SUBJECT: Review of Conewango Creek Watershed Project - Site 9A

DATE: March 8, 1972

The hydraulics and hydrology were reviewed for the proposed dam and were found to be satisfactory.

CWK/ea

Appendix E

Emergency Action Plan

Emergency Action Plan (EAP)

Conewango Creek Watershed, Dam No. 9A

National Inventory of Dams (NID) No. NY00596

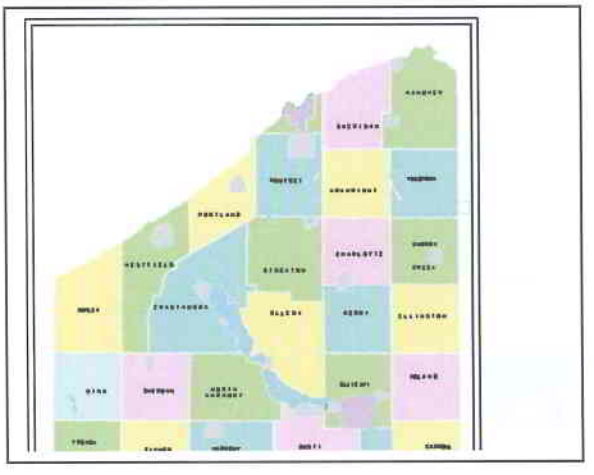
Chautauqua County, New York

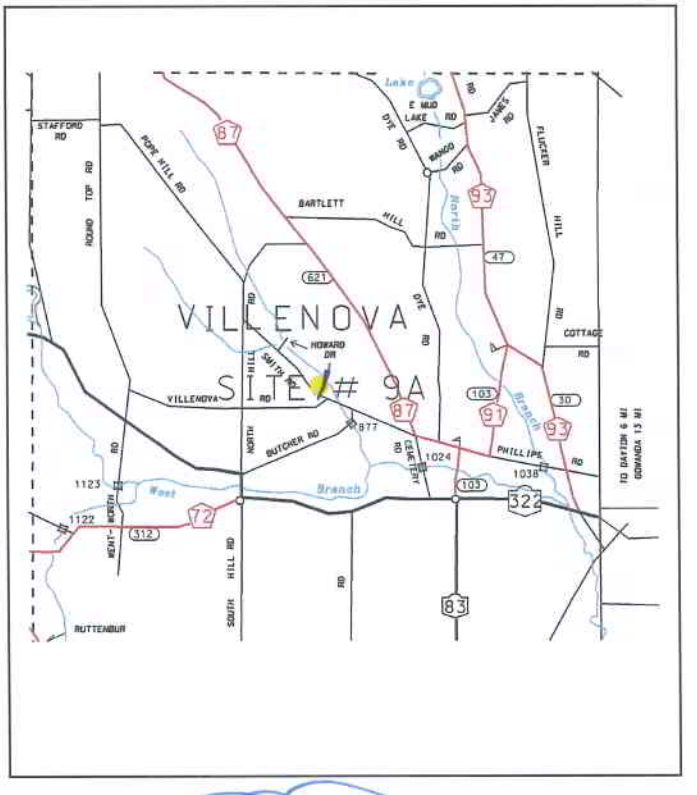
Chautauqua County Conservation District

With assistance from the

U.S. Department of Agriculture

Natural Resources Conservation Service





Reviewed and Updated:

Chair, Chautauqua County Conservation District

5/25/11

Date

Sheriff, Chautauqua County, NY

5/20/2011

Date

Copy ___ of ___

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Basic EAP Data

Purpose

The purpose of this EAP is to reduce the risk of human life loss and injury and minimize property damage during an unusual or emergency event at Conewango Creek Watershed, Dam No. 9A.

Potential Impacted Area

See *Evacuation Map* tab (Appendix B–4) and *People at Risk* tab (Appendix B–5) for the locations and contact information of the following residents and businesses that may be flooded if the dam should fail and the estimated time for the flood wave to travel from the dam to these locations:

1. *David Gregory 804 Smith Rd. Approx. 650'*
2. *Howard Ivett 752 Smith Rd. Approx. 1800'*
3. *Evelyn Hooker Ball Hill Rd. Approx. 3400'*

Dam Description

Height: 43 ft
Built: 1974
Legal Description: Sects. 14 and 23, T13N, R21W
Latitude: 42.3833 Longitude: 79.1161
National Inventory of Dams No.: NY 00596

Drainage Area: 6.14 mi
Hazard Classification: High
Dam Operator: Chautauqua County
Major Property Owner: Everett Wolfe
Dam Designer: NRCS

See detailed design data in *Appendix B* tab.

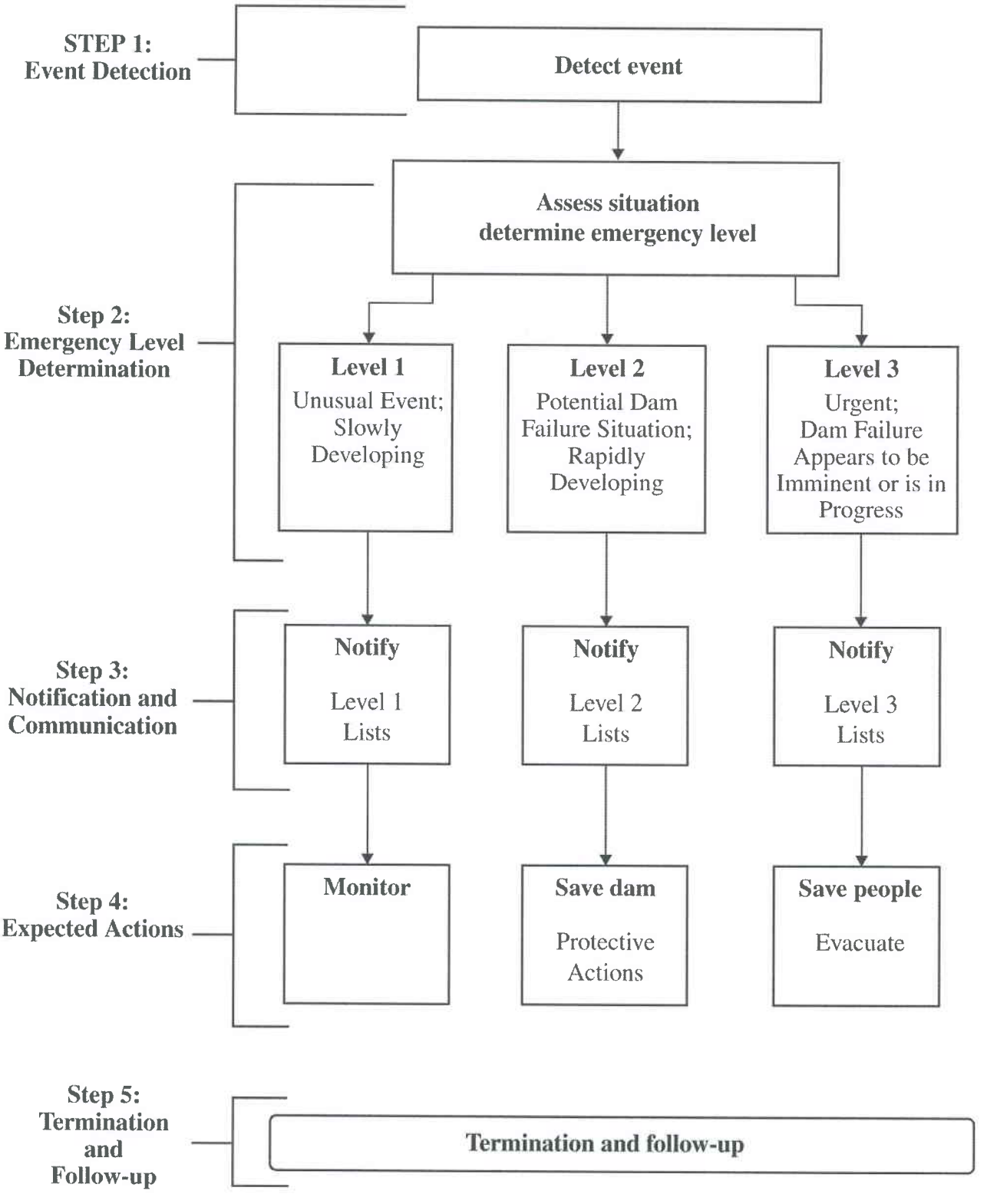
Directions to dam (See *Location and Vicinity Map*; Appendix B–2.)

From NYS Rt. 83N, @ Balcom Corners, go straight through intersection on County Rd. 87. At "T" intersection turn left. Continue on County Rd. 87 to Smith Rd. Turn left onto Smith Road. Go to Dam on right side of the road.

If the main route is flooded take from the northwest side of Hamlet on NYS Rt. 83 South, turn left on North Hill Rd. to Smith Road. Turn right on Smith Road to the Dam.

An alternate route to the dam is from Forestville, take County Rd. 87 South to North Hill Road. Turn right on North Hill Rd. Take North Hill Rd. south to Smith Road. Turn left on Smith Rd. to the dam.

EAP Overview



Roles and Responsibilities

Dam Operator's Representative (Dave Wilson Chaut County Soil & Water)

- As soon as an emergency event is observed or reported, immediately determine the emergency level (see *Emergency Levels* tab).
  - Level 1: unusual event, slowly developing
  - Level 2: potential dam failure situation, rapidly developing
  - Level 3: dam failure appears imminent or is in progress
- Immediately notify the personnel in the order shown on the notification chart for the appropriate level (see *Notification Charts* tab).
- Provide updates of the situation to the police/sheriff dispatcher to assist them in making timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the EAP is reviewed and updated annually and copies of the revised EAP are distributed to all who received copies of the original EAP.

Incident Commander (Sheriff Joseph Gerace)

- Serve as the primary contact person responsible for coordination of all emergency actions.
- When a Level 2 situation occurs: Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
- When a Level 3 situation occurs:
  - Initiate warnings and order evacuation of people at risk downstream of the dam.
  - Notify local emergency management services to carry out the evacuation of people and close roads within the evacuation area (see *Evacuation Map* tab).
- Decide when to terminate the emergency.
- Participate in an annual review and update of the EAP.

Emergency Management Services (Julius Leone, Chaut County EMO)

- Maintain communication with media.
- When a Level 2 situation occurs:
  - Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
  - Alert the public as appropriate.
- When a Level 3 situation occurs:
  - Alert the public.
  - Immediately close roads and evacuate people within the evacuation area (see *Evacuation Map* tab).
- Participate in an annual review and update of the EAP.

Dam Operator's Technical Representatives (NRCS)

- Advise the dam operator of the emergency level determination, if time permits.
- Advise the dam operator of remedial actions to take if Level 2 event occurs, if time permits.

State Dam Safety Agency (Conewango Watershed Commission)

- Advise the dam operator of the emergency level determination, if time permits.
- Advise the dam operator of remedial actions to take if Level 2 event occurs, if time permits.

The Five-step EAP Process

Step 1 Event Detection

This step describes the detection of an unusual or emergency event and provides information to assist the dam operator in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations at or near the dam by government personnel (local, state, or Federal), landowners, visitors to the dam, or the public
- Evaluation of instrumentation data
- Earthquakes felt or reported in the vicinity of the dam
- Forewarning of conditions that may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

See *Guidance for Determining the Emergency Level* table for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

Step 2 Emergency Level Determination

After an unusual or emergency event is detected or reported, the Conservation District Manager or his alternate is responsible for classifying the event into one of the following three emergency levels:

Emergency Level 1—Nonemergency, unusual event, slowly developing:
This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. NRCS technical representatives or state dam safety officials should be contacted to investigate the situation and recommend actions to take. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Sheriff should be informed if it is determined that the conditions may possibly develop into a worse condition that may require emergency actions.

Emergency Level 2—Potential dam failure situation, rapidly developing:
This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The Sheriff should be notified of this emergency situation and placed on alert. The dam operator should closely monitor the condition of the dam and periodically report the status of the situation to the Sheriff. If the dam condition worsens and failure becomes imminent, the Sheriff must be notified immediately of the change in the emergency level to evacuate the people at risk downstream.

If time permits, NRCS and state dam safety officials should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The dam operator should initiate remedial repairs (note local resources that may be available—see Appendix B–1). Time available to employ remedial actions may be hours or days.

This emergency level is also applicable when flow through the earth spillway has or is expected to result in flooding of downstream areas and people near the channel could be endangered. Emergency services should be on alert to initiate evacuations or road closures if the flooding increases.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:
This is an extremely urgent situation when a dam failure is occurring or obviously is about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the earth spillway is causing downstream flooding of people and roads. The Sheriff should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed (see *Evacuation Map* tab).

See the following pages for guidance in determining the proper emergency level for various situations.

Guidance for Determining the Emergency Level

Event	Situation	Emergency level*
Earth spillway flow	Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion	1
	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	2
	Spillway flowing with an advancing headcut that is threatening the control section	3
	Spillway flow that is flooding people downstream	3
Embankment overtopping	Reservoir level is 1 foot below the top of the dam	2
	Water from the reservoir is flowing over the top of the dam	3
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2
	Seepage with discharge greater than 10 gallons per minute	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	2
	Rapidly enlarging sinkhole	3
Embankment cracking	New cracks in the embankment greater than ¼-inch wide without seepage	1
	Cracks in the embankment with seepage	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly proceeding slides of the embankment slopes	3
Instruments	Instrumentation readings beyond predetermined values	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Sabotage/ vandalism	Damage to dam or appurtenance with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	3

* Emergency Level 1: Nonemergency unusual event, slowly developing
* Emergency Level 2: Potential dam failure situation, rapidly developing
* Emergency Level 3: Urgent; dam failure appears imminent or is in progress

Examples of Emergency Situations

The following are examples of conditions that usually constitute an emergency situation that may occur at a dam. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original designed conditions can cause significant flow through the auxiliary spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency-level condition. The groupings are provided as guidance only. Not all emergency conditions may be listed, and the dam operator is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam.

Pre-existing conditions on this dam: There has been a small seepage area near the downstream toe on the north side of the release channel. This was first noticed in the 1990s, but has not changed since that time.

Earth Spillway Flows

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Significant erosion or headcutting of the spillway is occurring, but the rate does not appear to threaten an imminent breach of the spillway crest that would result in an uncontrolled release of the reservoir.
2. Flow through the earth auxiliary spillway is or is expected to cause flooding that could threaten people, homes, and/or roads downstream from the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Significant erosion or headcutting of the spillway is occurring at a rapid rate, and a breach of the control section appears imminent.
2. Flow through the earth auxiliary spillway is causing flooding that is threatening people, homes, and/or roads downstream from the dam.

Embankment Overtopping

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. The reservoir level is within 1 foot from the top of the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. The reservoir level has exceeded the top of the dam, and flow is occurring over the embankment.

Seepage and Sinkholes

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam or settlement of the dam is observed.
4. Reservoir level is falling without apparent cause.
5. The following known dam defects are or will soon be inundated by a rise in the reservoir:
   - Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
   - Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Embankment Movement and Cracking

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam that may eventually result in breaching of the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Sudden or rapidly proceeding slides, settlement, or cracking of the embankment crest, slopes, abutments, and/or foundation, and breaching of the dam appears imminent or is in progress.

Step 3 Notification and Communication

Notification

After the emergency level has been determined, the people on the following notification charts for the appropriate emergency level shall be notified immediately.

Communication

Emergency Level 1—Nonemergency, unusual event; slowly developing:
The Conservation District Manager and NRCS District Conservationist should contact the NRCS State Conservation Engineer and Conewango Watershed Commission. Describe the situation, and request technical assistance on next steps to take.

Emergency Level 2—Emergency event, potential dam failure situation; rapidly developing:
The following message may be used to help describe the emergency situation to the Sheriff or Chautuauqua County emergency management personnel:

"This is _____Identify yourself; name, position)_____.

We have an emergency condition at Conewango Creek Watershed, Dam No.33 , located 1 mile south of Cherry Creek.

We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 2.

We are implementing predetermined actions to respond to a rapidly developing situation that could result in dam failure.

Please prepare to evacuate the area along low-lying portions of Cherry Creek.

Reference the evacuation map in your copy of the Emergency Action Plan.

We will advise you when the situation is resolved or if the situation gets worse.

I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number _____."

Emergency Level 3—Urgent event; dam failure appears imminent or is in progress:
The Sheriff should be contacted immediately and the area evacuated (see *Evacuation Map* tab). The following actions should be taken:

1. Call the Sheriff's dispatch center. Be sure to say, "This is an emergency." They will call other authorities and the media and begin the evacuation. The following message may be used to help describe the emergency situation to the Sheriff or Chautauqua County emergency management personnel:

   "This is an emergency. This is _____Identify yourself; name, position)_____.

   Conewango Creek Watershed Site 9A-Villenova, located 4 miles Northeast of South Dayton, is failing. The downstream area must be evacuated immediately. Repeat, Conewango Creek Watershed, Dam No. Site 9A-Villenova, is failing; evacuate the area along low-lying portions of Villenova.

   We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 3. Reference the evacuation map in your copy of the Emergency Action Plan.

   I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number_____."

2. Do whatever is necessary to bring people in immediate danger (anyone on the dam, downstream from the dam, boating on the reservoir, or evacuees) to safety if directed by the Sheriff.
3. Keep in frequent contact with the Sheriff and emergency services to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.
4. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to re-establish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to re-establish contact with the Sheriff and emergency services.

The following prescripted message may be used as a guide for the Sheriff or Chautauqua County emergency services personnel to communicate the status of the emergency with the public:

Attention: This is an emergency message from the Sheriff. Listen carefully. Your life may depend on immediate action.

Conewango Creek Watershed, Dam No. 9A-Villenova, located 4 miles northeast of South Dayton, is failing. Repeat. Conewango Creek Watershed, Dam No. Site 9A, located 4 miles northeast of South Dayton, is failing.

If you are in or near this area, proceed immediately to high ground away from the valley. Do not travel on Smith Road or return to your home to recover your possessions. You cannot outrun or drive away from the flood wave. Proceed immediately to high ground away from the valley.

Repeat message.

Emergency Level 1 Notifications

Nonemergency
unusual event; slowly developing

Dam Operator's Rep.

Conservation District Manager

David Wilson

716-664-2351 (Office)
716-595-2683 (Home)
(Cell)

(1)

Dam Operator's Technical Reps.

Conewango Watershed

Ken Chase

716-296-5721 (Office)
(Home)
716-499-5721 (Cell)

(2)

State Dam Safety Official

Alon Dominitz

519-402-8185 (Office)
(Home)
518-852-0451 (Cell)

NRCS State Engineer

Peter Wright
441 S. Sallina St.
Suite 354
Syracuse, NY 13202
315-477-6538 (Office)

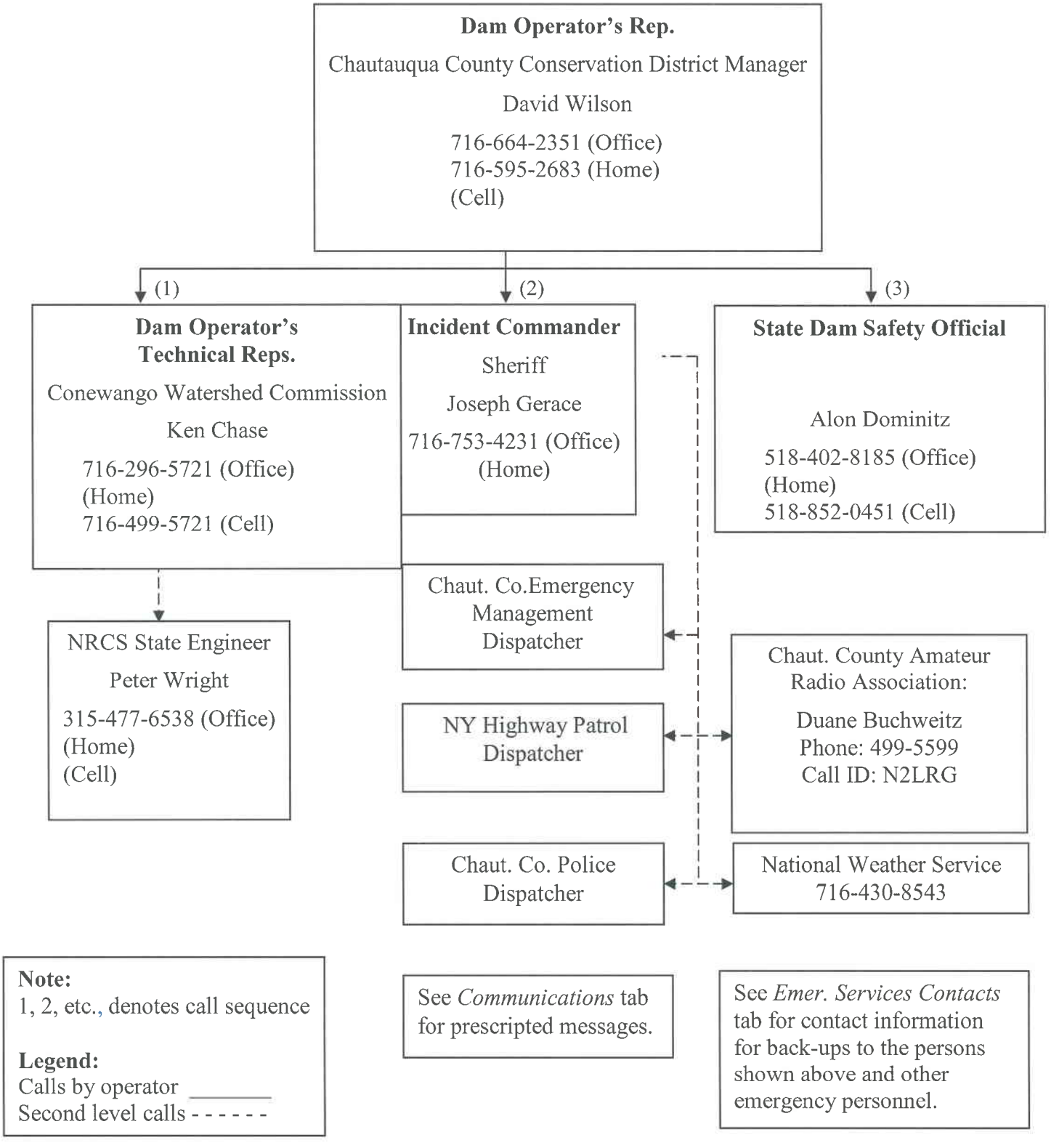
Note:
1, 2, etc., denotes call sequence

Legend:
Calls by operator _____
Second level calls - - - - -

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Level 2 Notifications

Emergency event, potential dam failure situation; rapidly developing



Note:
1, 2, etc., denotes call sequence

Legend:
Calls by operator _____
Second level calls - - - - - -

See *Communications* tab for prescripted messages.

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Level 3 Notifications

Urgent event, dam failure appears imminent or is in progress

Dam Operator's Rep.
Chautauqua County Conservation District Manager
Dave Wilson
716-664-2351 (Office)
716-595-2683 (Home)
(Cell)

(1)

Incident Commander
Chaut. Co. Sheriff
Joseph Gerace
716-753-4231 (Office)
(Home)
(Cell)
or
24-Hour 911

(2)

State Dam Safety Official
Alon Dominitz
518-402-8185 (Office)
(Home)
518-852-0451 (Cell)

(3)

Dam Operator's Technical Reps.
Conewango Watershed
Commission Chairman
Ken Chase
716-296-5721 (Office)
(Home)
716-499-5721 (Cell)

Chaut. Co. Emergency Management Dispatcher

National Weather Service
716-430-8543

NRCS State Engineer
Peter Wright
315-477-6538 (Office)
(Home)
(Cell)

NY Highway Patrol Dispatcher

Coal County Amateur Radio Association:
Duane Buchweitz
Phone: 499-5599
Call ID: N2LRG

Chaut. Co. Police Dispatcher

Note:
1, 2, etc., denotes call sequence

Legend
Calls by operator _____
Second level calls - - - - -

See *Communications* tab for prescripted messages.

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Services Contacts

Agency / Organization	Principal contact	Address	Office telephone number	Alternate telephone numbers
Chautauqua Co. Office of the Executive	County Executive Gregory Edwards	3 North Erie Street Mayville, NY 14757	716-753-4211	
Chautauqua County Conservation District	David Wilson Manager	3542 Turner Rd. Jamestown, NY 14701	716-664-2351	(H) (C)
Chautauqua County Emergency Management Coordinator	Julius J. Leone, Jr.	2 Academy St, Ste A Room 106 Mayville, NY 14757	716-753-4341	716-269-4656
Chautauqua County Sheriff	Joseph Gerace	13 E. Chautauqua St. Mayville, NY 14757	716-753-4900	716-753-4231 (D)
Conewango Watershed Commission	Ken Chase * Chairman	6267 South Rd. Cherry Creek, NY 14723	716-296-5721	(H) 716-499-5721 ©
Department of Transportation	Resident Engineer Cattaraugus Co.	4474 Rt. 353 Salamanca, NY 14779	716-945-4562	
N.Y.S. Police	Zone Sergeant	Rt. 60 Jamestown, NY 14733	716-665-3113	
Natural Resources Conservation Services	Peter Wright State Engineer	441 S. Salina St. STE 354 Syracuse, NY 13202	315-477-6538	
Natural Resources Conservation Service	Steve Perchke Watershed Engineer	USDA Service Center 29 Liberty St. Ste 1 Batavia, NY 14020	585-343-9167 Ext. 2300	585-356-9012
South Dayton Fire Department	Benny Bottita, Jr. Chief	1258 Rt 83 South Dayton, NY 14138	716-988-5153	716-988-5956 (N) 716-499-0471 (C)
State Dam Safety Agency	Alon Dominitz	DEC / Albany	518-402-8185	518-852-0415 (C)
WGRZ-TV Buffalo Channel 2		259 Delaware Ave. Buffalo, NY 14202	716-849-2222	716-849-2220
WIVB/WNLO TV CH4 Buffalo		2077 Elmwood Ave. Buffalo, NY 14207	716-874-4410	News Room 716-874-7333 800-794-3687
WJTN/WWSE Radio Station		2 Orchard Rd. Jamestown NY14701	716-487-1151	716-664-9393
WKBW-TV, Ch 7 Buffalo		7 Broadcast Plaza Buffalo, NY 14202	716-845-6100	
WKZA Radio Station 106.9 FM		106 W. Third St. Jamestown, NY 14701	716-487-1106	716-487-1069

* Back-up to primary contact

Step 4 Expected Actions

If the police or Sheriff receives a 911 call regarding observations of an unusual or emergency event at the dam, they should immediately contact the Conservation District office. After the Conservation District Manager determines the emergency level, the following actions should be taken. If time permits, NRCS and the New York Water Resources Board should be contacted for technical consultation.

Emergency Level 1—Nonemergency, unusual event; slowly developing:

A. The Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS or the New York Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**

B. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

C. The Conservation District Manager should contact NRCS and request technical staff to investigate the situation and recommend corrective actions.

Emergency Level 2—Potential dam failure situation; rapidly developing:

A. The Conservation District Manager should contact the NRCS and the New York Water Resources Board to report the situation and, if time permits, request technical staff to investigate the situation and recommend corrective actions.

B. The Conservation District Manager should contact the sheriff to inform him/her that the EAP has been activated and if current conditions get worse, an emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.

C. Provide updates to the Sheriff and emergency services personnel to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.

D. If time permits, the Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS and the New York Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**

E. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

F. If time permits, the following emergency remedial actions should be taken as appropriate.

Emergency Level 2—Potential dam failure situation; rapidly developing—continued:

Emergency remedial actions

If time permits, the following emergency remedial actions should be considered for Emergency Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with NRCS and the New York Water Resources Board. See *Resources Available* (Appendix B–1) for sources of equipment and materials to assist with remedial actions.

Embankment overtopping

1. If the water level in the reservoir is no longer rising, place sandbags along the low areas of the top of the dam to control wave action, reduce the likelihood of flow concentration during minor overtopping, and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection.

Seepage and sinkholes

1. Open the principal spillway gate to lower the reservoir level as rapidly as possible to a level that stops or decreases the seepage to a nonerosive velocity. If the gate is damaged or blocked, pumping or siphoning may be required.

   Continue lowering the water level until the seepage stops.

2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials such as hay bales, bentonite, soil or rockfill, or plastic sheeting.
3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the gate is damaged or blocked, pumping or siphoning may be required.
2. Repair settlement of the crest by placing sandbags or earth and rockfill materials in the damaged area to restore freeboard.
3. Stabilize slides by placing a soil or rockfill buttress against the toe of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform a field survey to determine if there has been any settlement and movement of the dam embankment, spillway, and low-level outlet works.
3. Drain the reservoir, if required.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

A. The Conservation District Manager shall immediately contact the Sheriff and others shown on the notification chart.

B. The Sheriff shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam (see *Evacuation Map* tab).

C. Emergency management services personnel shall alert the public and immediately evacuate at-risk people and close roads as necessary.

D. The Conservation District Manager shall maintain continuous communication and provide the Sheriff with updates of the situation to assist him/her in making timely decisions concerning warnings and evacuations.

E. The Conservation District Manager should record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

F. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

Step 5 Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Sheriff is responsible for terminating EAP operations and relaying this decision to the Conservation District Manager. It is then the responsibility of each person to notify the same group of contacts that were notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Emergency Level 3 event that has not caused actual dam failure, the NRCS technical representative or the State Dam Safety Officer will inspect the dam or require the inspection of the dam to determine whether any damage has occurred that could potentially result in loss of life, injury, or property damage. If it is determined that conditions do not pose a threat to people or property, the Sheriff will be advised to terminate EAP operations as described above.

The Conservation District Manager shall assure that the *Dam Safety Emergency Situation Report* (Appendix A–3) is completed to document the emergency event and all actions that were taken. The Conservation District shall distribute copies of the completed report to the New York Water Resources Board and the NRCS State Conservation Engineer.

Maintenance—EAP Review and Revision

EAP annual review

The Conservation District Manager will review and, if needed, update the EAP at least once each year. The EAP annual review will include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current. The EAP will be revised if any of the contacts have changed.
- Contacting the local law enforcement agency to verify the phone numbers and persons in the specified positions. In addition, the Conservation District Manager will ask if the person contacted knows where the EAP is kept and if responsibilities described in the EAP are understood.
- Calling the locally available resources to verify that the phone numbers, addresses, and services are current.

Revisions

The Conservation District is responsible for updating the EAP document. The EAP document held by the Conservation District is the master document. When revisions occur, the Conservation District will provide the revised pages and a revised revision summary page to all the EAP document holders. The document holders are responsible for revising outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the revisions.

EAP periodic test

The Conservation District will host and facilitate a periodic test of the EAP at least once every 5 years.

The periodic test will consist of a meeting, including a tabletop exercise, conducted at the Chautauqua County Conservation District office. Attendance should include the Conservation District Manager, key conservation district staff members, NRCS staff, at least one representative of the local law enforcement agency, and others with key responsibilities listed in the EAP. At the discretion of the Conservation District, other organizations that may be involved with an unusual or emergency event at the dam are encouraged to participate. Before the tabletop exercise begins, meeting participants will visit the dam during the periodic test to familiarize themselves with the dam site.

The tabletop exercise will begin with the facilitator presenting a scenario of an unusual or emergency event at the dam. The scenario will be developed prior to the exercise. Once the scenario has been presented, the participants will discuss the responses and actions that they would take to address and resolve the scenario. The narrator will control the discussion, ensuring realistic responses and developing the scenario throughout the exercise. The Conservation District Manager should complete an event log as they would during an actual event.

After the tabletop exercise, the five sections of the EAP will be reviewed and discussed. Mutual aid agreements and other emergency procedures can be discussed. The Conservation District will prepare a written summary of the periodic test and revise the EAP, as necessary.

Record of Holders of Control Copies of this EAP

Copy Number	Organization	Person receiving copy
1	Chautauqua County Conservation District 3542 Turner Rd. Jamestown, NY 14701	Fred Croscut
2	Conewango Watershed Commission NRCS Field Office 6914 Main St. Cherry Creek, NY 14723	Ken Chase
3	NRCS State Office 441 S. Salina St. Ste. 354 Syracuse, NY 13202	Peter Wright
4	Chautauqua County Sheriff's Department 15 E. Chautauqua Mayville, NY 14757	Joseph Gerace
5	Chautauqua County Emergency Management 2 Academy St. Ste. A Room 106 Mayville, NY 14757	Julius J. Leone, Jr.
6	N.Y.S. Police Rt. 60 Jamestown, NY 14701	Zone Sergeant
7	New York Water Resources Board DEC / Albany	Alon Dominitz

Record of Revisions and Updates Made to EAP

Revision Number	Date	Revisions made	By whom

Concurrences

By my signature, I acknowledge that I, or my representative, have reviewed this plan and concur with the tasks and responsibilities assigned herein for me and my organization.

1. _____

Signature *Organization* *Date*

Printed name and title: Fred Croscut, Chair, Chautauqua County Conservation District

2. _____

Signature *Organization* *Date*

Printed name and title: Joseph Gerace, Sheriff, Chautauqua County

3. _____

Signature *Organization* *Date*

Printed name and title: Julius J. Leone, Jr., Emergency Management Coordinator, Chautauqua County

4. _____

Signature *Organization* *Date*

Printed name and title: Ken Chase, District Conservationist, NRCS, Cherry Creek

5. _____

Signature *Organization* *Date*

Printed name and title: _____

6. _____

Signature *Organization* *Date*

Printed name and title: _____

7. _____

Signature *Organization* *Date*

Printed name and title: _____

Appendices—Forms, Glossary, Maps, and Supporting Data

Appendix A

A–1 Contact Checklist

A–2 Unusual or Emergency Event Log Form

A–3 Dam Emergency Situation Report Form

A–4 Glossary of Terms

Appendix B

B–1 Resources Available

B–2 Location and Vicinity Maps

B–3 Watershed Project Map

B–4 Evacuation Map

B–5 Residents/Businesses/Highways at Risk

B–6 Plan View of Dam

B–7 Profile of Principal Spillway

B–8 Reservoir Elevation-Area-Volume and Spillway Capacity Data

B–9 National Inventory of Dams (NID) Data

Appendix A–1

Contact Checklist

Conewango Creek Watershed, Dam No. Site 9A

Chautauqua County, NY Date _____

The following contacts should be made immediately after the emergency level is determined (see pages 7–10 for guidance to determine the appropriate emergency level for a specific situation). The person making the contacts should initial and record the time of the call and who was notified for each contact made. See the *Notification Charts* tab for critical contact information and *Emer. Services Contacts* tab for contact information for other possible emergency services.

Emergency Level 1 (see page 12)	Person Contacted	Time Contacted	Contacted by
___ NRCS District Conservationist	_____	_____	_____
___ NRCS State Conservation Engineer	_____	_____	_____
___ New York Water Resources Board	_____	_____	_____

Emergency Level 2 (see page 13)	Person Contacted	Time Contacted	Contacted by
____ NRCS District Conservationist	_____	_____	_____
____ NRCS State Conservation Engineer	_____	_____	_____
____ New York Water Resources Board	_____	_____	_____
____ Sheriff	_____	_____	_____

Emergency Level 3 (see page 14)	Person Contacted	Time Contacted	Contacted by
____ Sheriff	_____	_____	_____
____ New York Water Resources Board	_____	_____	_____
____ NRCS District Conservationist	_____	_____	_____
____ NRCS State Conservation Engineer	_____	_____	_____

Appendix A–2

Unusual or Emergency Event Log

(to be completed during the emergency)

Dam name: Conewango Creek Watershed Dam #9A County: Chautauqua County

When and how was the event detected?

_____

_____

Weather conditions: _____

_____

General description of the emergency situation:

_____

_____

_____

Emergency level determination: _____ Made by: _____

Actions and Event Progression

Date	Time	Action/event progression	Taken by

Report prepared by: _____ Date: _____

Appendix A–3

Dam Emergency Situation Report

(to be completed following the termination of the emergency)

Dam name: Conewango Creek Watershed, Site 9A

National Inventory of Dams (NID) No.: NY 00596

Dam location: 4 Mile Northeast of South Dayton Chautauqua County Conewango Creek

(City) *(County)* *(Stream/River)*

Date: Time:

Weather conditions: _____

General description of emergency situation:

_____

_____

Area(s) of dam affected:

_____

_____

Extent of dam damage: _____

Possible cause(s): _____

Effect on dam's operation: _____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

_____

_____

Other data and comments:

_____

Observer's name and telephone number: _____

Report prepared by: _____ Date: _____

Appendix A–4
Glossary of Terms

Abutment That part of the valleyside against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.

Acre-foot A unit of volumetric measure that would cover 1 acre to a depth of 1 foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.

Berm A nearly horizontal step (bench) in the upstream or downstream sloping face of the dam.

Boil A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.

Breach An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.

Conduit A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.

Control section A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.

Cross section A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. Also, a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream.

Dam An artificial barrier generally constructed across a watercourse for the purpose of impounding or diverting water.

Dam failure The uncontrolled release of a dam's impounded water.

Dam Operator The person(s) or unit(s) of government with responsibility for the operation and maintenance of dam.

Drain, toe or foundation, or blanket A water collection system of sand and gravel and typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet.

Drainage area (watershed) The geographic area on which rainfall flows into the dam.

Drawdown The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.

Emergency A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.

Emergency Action Plan (EAP)	A formal document identifying potential emergency conditions that may occur at the dam and specifying preplanned actions to minimize potential failure of the dam or minimize failure consequences including loss of life, property damage, and environmental impacts.
Evacuation map	A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.
Filter	The layers of sand and gravel in a drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.
Freeboard	Vertical distance between a stated water level in the reservoir and the top of dam.
Gate, slide or sluice, or regulating	An operable, watertight valve to manage the discharge of water from the dam.
Groin	The area along the intersection of the face of a dam and the abutment.
Hazard classification	A system that categorizes dams (high, significant, or low) according to the degree of their potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or misoperation of a dam.
Height, dam	The vertical distance between the lowest point along the top of the dam and the lowest point at the downstream toe, which usually occurs in the bed of the outlet channel.
Hydrograph, inflow or outflow, or breach	A graphical representation of either the flow rate or flow depth at a specific point above or below the dam over time for a specific flood occurrence.
Incident Commander	The highest predetermined official available at the scene of an emergency situation.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation area or map	The geographic area downstream of the dam that would be flooded by a breach of the dam or other large discharge.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.
Outlet works (principal spillway)	An appurtenant structure that provides for controlled passage of normal water flows through the dam.
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.

Probable Maximum Precipitation (PMP) or Flood (PMF)	The theoretically greatest precipitation or resulting flood that is meteorologically feasible for a given duration over a specific drainage area at a particular geographical location.
Reservoir	The body of water impounded or potentially impounded by the dam.
Riprap	A layer of large rock, precast blocks, bags of cement, or other suitable material, generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.
Risk	A measure of the likelihood and severity of an adverse consequence.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway (auxiliary or emergency)	The appurtenant structure that provides the controlled conveyance of excess water through, over, or around the dam.
Spillway capacity	The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.
Spillway crest	The lowest level at which reservoir water can flow into the spillway.
Tailwater	The body of water immediately downstream of the embankment at a specific point in time.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.

Appendix B–1
Resources Available

Locally available equipment, labor, and materials:
The county has the following resources that can be utilized in the event of an emergency:

Contact: George Spanos, Director County Department of Public Facilities: 716-664-8400
Lester Quinn, HWY. Supervisor Town of Villenova: 716-988-3476 or 988-3678

- Heavy Construction equipment, trucks and manpower.
- Loaders, Trucks, Dozer, Backhoe, etc.

Contact the Chautauqua County Road Department --- see *Emer. Services Contacts* tab.

Other locally available resources include:

Heavy equipment service and rental	**Sand and gravel supply**	**Ready-mix concrete supply**
JSE Excavating 6032 Rt. 83 Cherry Creek, NY 14723 Jim Schimek 716-485-3800	Countryside Sand & Gravel Rt. 62 South Dayton, NY 14138 716-988-3271	LER Concrete, Inc. 1946 New York Ave. Falconer, NY 14733 716-665-4504
Doug Rice Excavating 28 Creek Road Ellington, NY 14732 716-287-3712	Cherry Creek Sand & Gravel PO Box 306 Cherry Creek, NY 14723 716-296-9910	Hanson Aggregates Allen St. Ext. Jamestown, NY 14701 716-665-4620
ADMAR Supply Co., Inc. 1394 Military Road Buffalo, NY 14207 1-800-353-2367	Frew Run Gravel Products 984 Frew Run Road Frewsburg, NY 14738 716-569-4712	JMI Concrete Products Jamestown, NY 14701 716-665-4504

Pumps	Diving contractor	Divers
ADMAR Supply Co. 1394 Military Rd. Buffalo, NY 14207 1-800-353-2367	Buffalo Industrial Diving, Inc 201 Ganson St. Buffalo, NY 14203 716-854-1041	Chautauqua County Emergency Services 2 Academy St. Mayville, NY 14757 716-753-14757
	Chautauqua County WET Mayville Dispatch	NYS Police Divers Falconer Barracks 716-665-3113

Appendix B–2
Location and Vicinity Maps

(Insert map)

Appendix B–3
Watershed Project Map

(Insert map)

Appendix B–4
Evacuation Map

(Insert map)

Appendix B–5
Residents/Businesses/Highways at Risk

A major flood caused by a sudden breach of the dam is estimated to inundate six homes, three businesses, and three highways. These homes and businesses (marked on the evacuation map) are located east of OK Highway 44 and south of Chestnut Street in Rock City.

House/ business no.*	Resident/business	Address	Phone no.	Distance downstream from dam (ft)	Travel time** (hr)	Max water depth above first floor (ft)
1	David Gregory	804 Smith Road Villenova, NY		Approx. 650'		
2	Howard Ivett	752 Smith Road Villenova, NY		Approx.1800'		
3	Evelyn Hooker	Ball Hill Road Villenova, NY		Approx.3400'		

* See Appendix B–4.

** Estimated time for breach wave (peak) to travel from dam to downstream locations

Basis for computation of evacuation area and flooding depths

Breach inundation study completed by NRCS----------

Hydraulic model used: NRCS TR–20 (routing); TR–60 (peak discharge); TR–66 (hydrograph)

Model assumptions:

- ☐ "Sunny Day" Breach (no inflow into the reservoir)
- ☐ Water surface elevation in reservoir prior to breach = _____ (top of dam)

- Total volume of breach hydrograph = _____ acre-ft
- Height of water at time of breach = _____ ft
- Peak breach discharge = _____ ft^3/s
- Downstream area defined by field surveys consisting of 10 cross sections and 3 bridge openings

Appendix B–6
Plan View of Dam

(Insert map)

Appendix B–7
Profile of Principal Spillway

(Insert map)

Appendix B–8
Reservoir Elevation-area-volume and Spillway Capacity Data

CONEWANGO CREEK WATERSHED
DAM NO. 33

Elevation	Reservoir Surface acres	Reservoir Storage acre ft	Spillway Discharge ft^3/s
1682.0	0.0	0.0	0
1684.0	0.3	0.3	0
1686.0	2.0	2.5	0
1688.0	3.7	8.2	0
1690.0	8.6	20.5	0
1692.0	15.9	45.0	0
1694.0	18.7	79.6	9
1696.0	23.5	121.8	0
Principal Spillway Crest			
1697.0	26.2	146.7	0
1698.0	31.1	175.4	45
1700.0	40.8	247.3	76
1702.0	49.3	337.4	82
1704.0	62.0	448.7	87
1706.0	71.4	582.1	92
1708.0	86.7	740.2	97
1710.0	98.6	925.5	102
Auxiliary Spillway Crest			
1712.0	115.0	1139.1	108
1714.0	129.9	1384.0	516
1716.0	145.3	1659.2	2090
1718.0	160.7	1965.2	4437
1720.0	178.8	2304.7	7763
1720.2	180.6	2340.6	7937

Appendix B–9

National Inventory of Dams (NID) Data

Dam name: Conewango Creek Watershed, Dam 9A

State: **New York**

NID ID: **NY 00596**

Longitude: **79.1161**

Latitude: **42.3833**

Geodetic location: _____

County: **Chautauqua**

Stream: **Conewango Creek**

Nearest town: **South Dayton**

Distance to nearest town: **4 mi**

Operator: **Chautauqua County**

Year constructed: **1974**

Max. discharge: **6941 ft^3/s**

Max. storage: **1060acre-ft**

Normal storage: **96 acre-ft**

Surface area: **9 acre**

Drainage area: **6.14 mi^2**

Inspection frequency: **1 yr**

State regulated?: **Yes**

State reg. agency: **NYS-DEC**

Federal funding: **USDA NRCS**

Federal design: **USDA NRCS**

Federal constructed: **USDA NRCS**

Program authority: **PL-556 Flood Control**

Watershed No.: **05010002-010**

Watershed name: **Conewango Creek Watershed**

Service life: **100 yr**

O&M insp. Resp:**Cattaraugus Co. Soil & Water**

O&M insp. current?: **yes**

Population at risk: **601**

Dam height: **43 ft**

Dam length: **1590 ft**

Dam volume: **174,319 yd^3**

Design hazard potential: "C", **High**

Current hazard potential: **"C", High**

Hazard potential class. year: ____

Sediment storage: **96 acre-ft**

Flood storage: **612 acre-ft**

Surcharge storage: ____ **acre-ft**

Other storage: ____ **acre-ft**

Principal spillway type: **Concrete pipe**

Principal spillway conduit diameter: **48 in**

Auxiliary spillway type: **Vegetated earth**

Auxiliary spillway width: **200 ft**

Appendix F

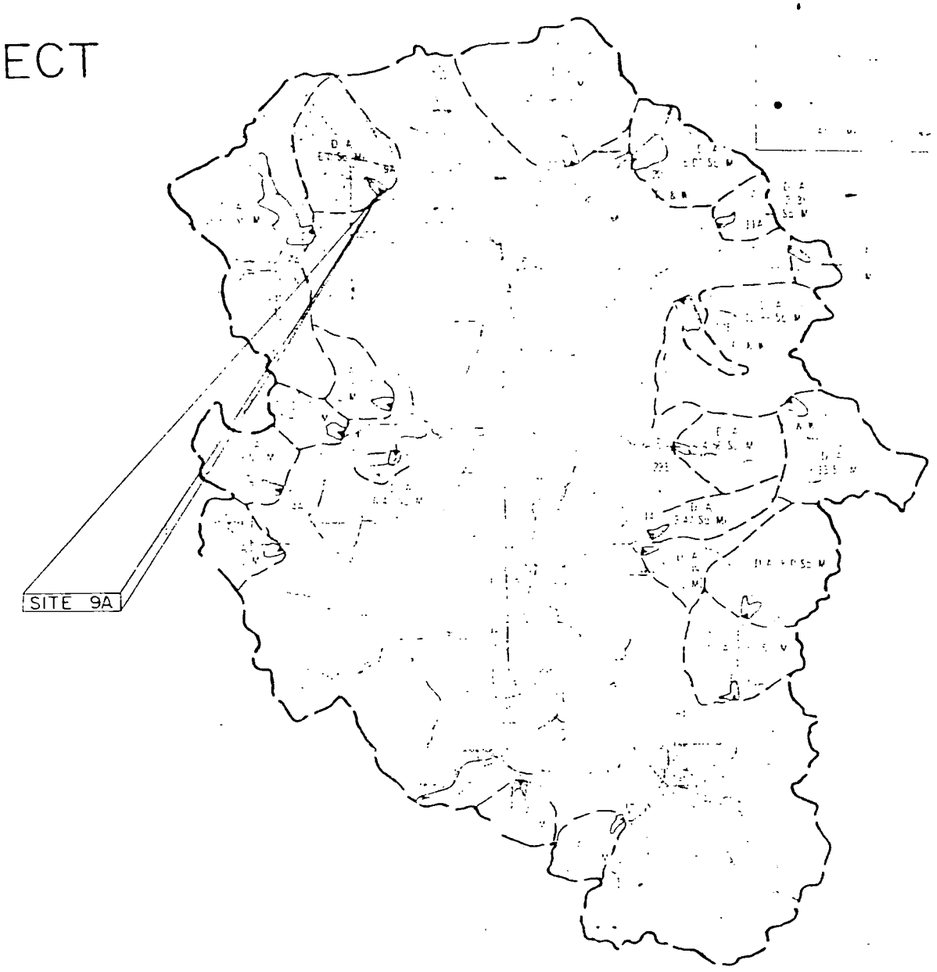
Record Drawings

CONEWANGO CREEK WATERSHED PROJECT

FLOODWATER RETARDING DAM

SITE 9A

DRAINAGE AREA	3840 Acres
FLOOD STORAGE (TO EMERGENCY SPILLWAY CREST)	612 Ac. Ft.
WATER SURFACE AREA (SEDIMENT POOL)	9 Acres
HEIGHT OF DAM	43 ~~42~~ Feet
VOLUME OF FILL	174,319 Cu. Yds.



BUILT UNDER THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT

BY

CONEWANGO CREEK WATERSHED COMMISSION

WITH THE ASSISTANCE OF THE

SOIL CONSERVATION SERVICE

OF THE

U. S. DEPARTMENT OF AGRICULTURE

INDEX

SHEET 1	COVER SHEET
SHEET 2	PLAN OF STORAGE AREA
SHEET 3	PLAN OF STRUCTURAL WORKS
SHEET 4	LAYOUT DATA
SHEET 5	CUTOFF TRENCH EXCAVATION
SHEET 6	EMERGENCY SPILLWAY
SHEET 7	FILL PLACEMENT & PRINCIPAL SPILLWAY EXCAVATION
SHEET 8	DRAINAGE SYSTEM
SHEET 9	DRAINAGE SYSTEM
SHEET 10	PLAN PROFILE OF PRINCIPAL SPILLWAY
SHEET 11	OUTLET CHANNEL & RIPRAP DETAILS
SHEET 12	RISER STRUCTURAL DETAILS
SHEET 13	RISER STRUCTURAL DETAILS
SHEET 14	RISER STRUCTURAL DETAILS
SHEET 15	RISER STRUCTURAL DETAILS
SHEET 16	RISER TRASH RACKS
SHEET 17	48" DIA. CONDUIT DETAILS
SHEET 18	RESERVOIR DRAIN CONDUIT DETAILS
SHEET 19	IMPACT BASIN DETAILS
SHEET 20	IMPACT BASIN DETAILS
SHEET 21	IMPACT BASIN DETAILS
SHEET 22	IMPACT BASIN DETAILS
SHEET 23	IMPACT BASIN DETAILS
SHEET 24	IMPACT BASIN GRATING
SHEET 25	RESERVOIR DRAIN INLET DETAILS
SHEETS 26	FENCING DETAILS —— 27-28-29-30 LOGS OF TEST HOLES

AS BUILT
8/22/74

APRIL 72	SHEETS 2, 3, 5 & 6	
DATE	ITEM	APP'D

REVISION

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK

COVER SHEET

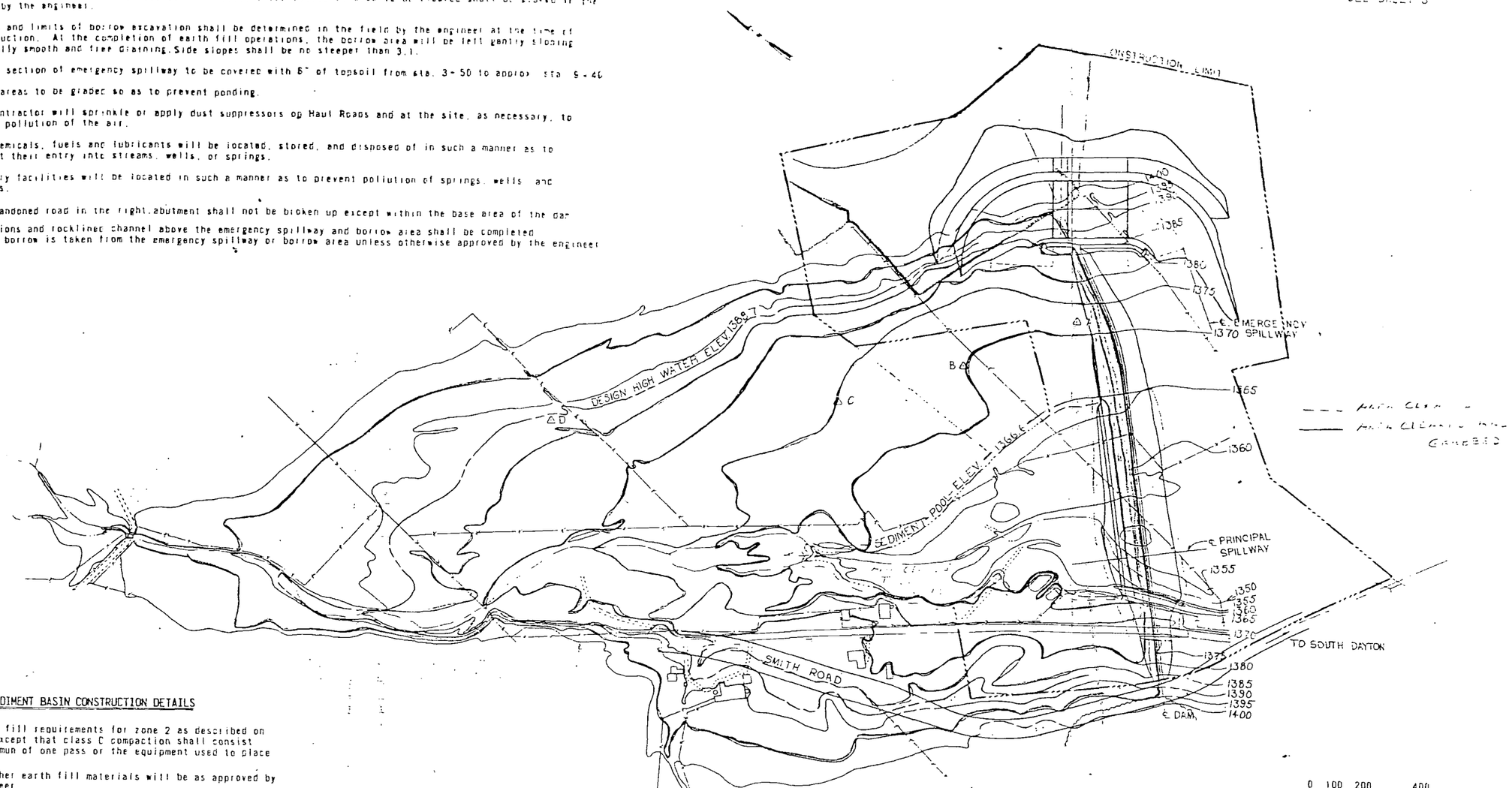
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	J. TOENNIESSEN	11/71	STATE CONSERVATIONIST
Drawn	WILLIAM TURNER	11/71	
Traced			Sheet No. 1
Checked			NY-216:-P

54 B-2

CONSTRUCTION DETAILS

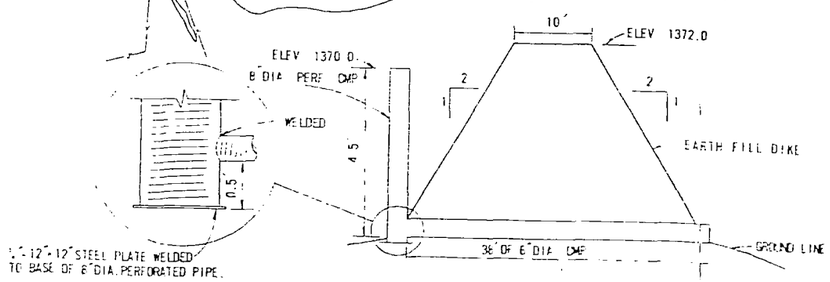
1. Areas under the dam and levee, emergency spillway (including 15 feet outside the cut slopes), dive[illegible] area to be cleared and grubbed. Limits of area to be cleared and grubbed to be staked in the field by the engineer.
2. The waste area and the area upstream from the dam and below elevation 1261 [illegible] on both abutments and in the flood plain shall be cleared ..... Limits of area to be cleared shall be staked in the field by the engineer.
3. Depths and limits of borrow excavation shall be determined in the field by the engineer at the time of construction. At the completion of earth fill operations, the borrow area will be left gently sloping generally smooth and free draining. Side slopes shall be no steeper than 3:1.
4. Bottom section of emergency spillway to be covered with 6" of topsoil from sta. 3+50 to approx. sta. 9+40.
5. Waste areas to be graded so as to prevent ponding.
6. The contractor will sprinkle or apply dust suppressors on Haul Roads and at the site, as necessary, to reduce pollution of the air.
7. All chemicals, fuels and lubricants will be located, stored, and disposed of in such a manner as to prevent their entry into streams, wells, or springs.
8. Sanitary facilities will be located in such a manner as to prevent pollution of springs, wells and streams.
9. The abandoned road in the right abutment shall not be broken up except within the base area of the dam.
10. Diversions and rocklined channel above the emergency spillway and borrow area shall be completed before borrow is taken from the emergency spillway or borrow area unless otherwise approved by the engineer.



SEDIMENT BASIN CONSTRUCTION DETAILS

1. Use earth fill requirements for zone 2 as described on sheet 7 except that class C compaction shall consist of a minimun of one pass or the equipment used to place the fill.
2. Use of other earth fill materials will be as approved by the engineer.
3. Sediment basin location and length as shown is approximate and will be staked in the field by the engineer.

NOTE:
FOR PLAN VIEW OF SEDIMENT BASIN SEE SHEET 3.



SEDIMENT BASIN DETAILS
(NOT TO SCALE)

0 100 200 400
SCALE IN FEET
5' CONTOUR INTERVAL

AS BUILT
8/22/74

APRIL 72	SEDIMENT BASIN-EMERG. SPWY. BENCH	
DATE	ITEM	APPD

REVISION

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
PLAN OF STORAGE AREA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date
Designed	J. TOENNIESSEN	6/71
Drawn	D. BURDICK	6/71
Traced	D. BURDICK	6/71

2 NY-2161-P

B-3

DIVERSION I, II, V
NOT TO SCALE

DIVERSION III, IX
NOT TO SCALE

Constructed by others

WASTE AREA

BORROW AREA

ROCKLINED CHANNEL (NOT TO SCALE)

LEGEND

- PROPERTY LINE
- R.O.W. LINE
- FLOOD PLAIN LIMITS
- BENCH MARK
- DESIGN HIGH WATER
- SEDIMENT POOL
- TEST PIT (UNDISTURBED)
- TEST PIT (DISTURBED & LOOSE)
- DRILL HOLE (UNDISTURBED & COMPACTED)
- CONSTRUCTION LIMITS
- FENCE LINE (PLANNED)
- PAVED ROAD
- DIVERSION (PLANNED)
- POWER LINE

FOUNDATION EXCAVATION DETAILS

SHAPE RIGHT ABUTMENT TO SLOPES AS SHOWN ON SHEETS 4 AND 5 FOR DISTANCES 30FT UPSTREAM AND 130FT DOWNSTREAM FROM ℄ OF DAM TO PROVIDE A SMOOTH DETAIL SURFACE FOR PLACEMENT OF COMPACTED FILL.

DIVERSION AND ROCKLINED CHANNEL CONSTRUCTION DETAILS

1. Final locations and slopes of dive[illegible] and rocklined channel to be staked [illegible] the field by the engineer at the time of construction.
2. The 4:1 side slopes of the [illegible] may be steepened to reduce excavation in certain areas as directed by the engineer.
3. The rock in the rocklined channel shall be well graded between a minimum of [illegible] and a maximum of 18".

℄ OF DAM, TOP WIDTH
℄ OF ELEV. 1391.5
GATE

Monument - Sta. 2+85.10
2" Steel Pipe with Cap
Chiseled "X"
Mfr: Engineer Field Book 1 - Pg. 4

Elevation = Eng. Field Book No. 2, Pg. 12
Elevation = Elev. 1402.59

BENCH MARK DESCRIPTION

BM# 25 ELEV. 1357.18
TOP OF IRON RAILING NORTH SIDE OF BRIDGE EAST CORNER

2' CONTOUR INTERVAL
0 50 100 200
SCALE IN FEET

AS [illegible]
8/22/74

APRIL 72	SEDIMENT BASIN-EMERG. SPWY. BENCH	
DATE	ITEM	APP'D
REVISION		

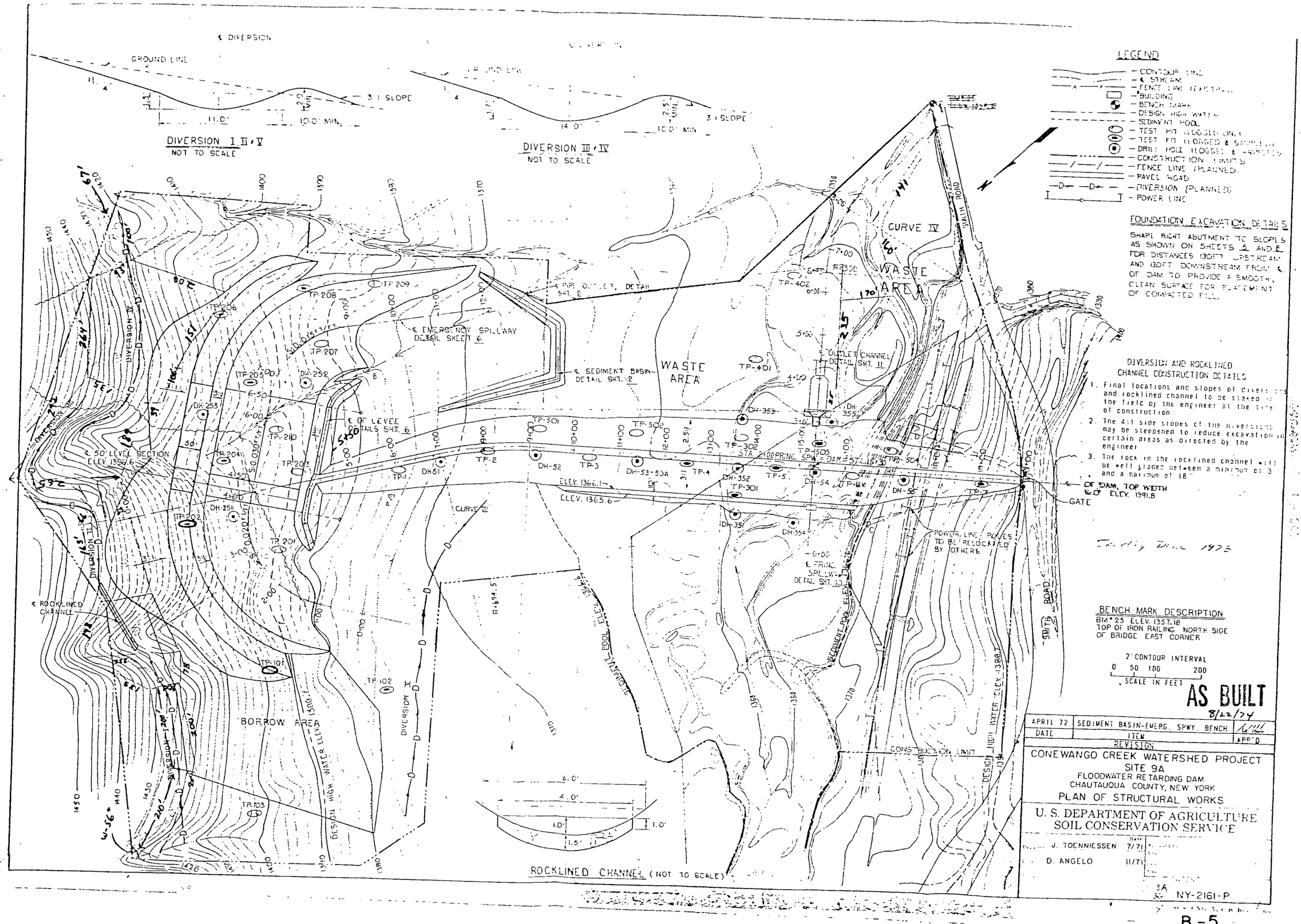
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
PLAN OF STRUCTURAL WORKS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		DATE
J. TOENNIESSEN	7/71	
D. ANGELO	11/71	

SCALE: [illegible]
SHEET 3 OF 33
NY-2161-P

SEE SHEET 3A FOR



LEGEND

- CONTOUR LINE
- ℄ STREAM
- FENCE LINE (EXISTING)
- BUILDING
- BENCH MARK
- DESIGN HIGH WATER EL.
- SEDIMENT POOL
- TEST PIT (LOGGED ONLY)
- TEST PIT (LOGGED & SAMPLED)
- DRILL HOLE (LOGGED & SAMPLED)
- CONSTRUCTION LIMITS
- FENCE LINE (PLANNED)
- PAVED ROAD
- DIVERSION (PLANNED)
- POWER LINE

FOUNDATION EXCAVATION DETAILS

SHAPE RIGHT ABUTMENT TO SLOPES AS SHOWN ON SHEETS 5 AND 6 FOR DISTANCES 130FT UPSTREAM AND 130FT DOWNSTREAM FROM ℄ OF DAM TO PROVIDE A SMOOTH, CLEAN SURFACE FOR PLACEMENT OF COMPACTED FILL.

DIVERSION AND ROCKLINED CHANNEL CONSTRUCTION DETAILS

1. Final locations and slopes of diversions and rocklined channel to be staked in the field by the engineer at the time of construction.
2. The 4:1 side slopes of the diversions may be steepened to reduce excavation in certain areas as directed by the engineer.
3. The rock in the rocklined channel will be well graded between a minimum of 3 and a maximum of 18".

℄ OF DAM, TOP WIDTH 16.0' ELEV. 1391.8

GATE

Facility Date 1973

BENCH MARK DESCRIPTION

BM # 25 ELEV. 1357.18
TOP OF IRON RAILING NORTH SIDE OF BRIDGE EAST CORNER

2' CONTOUR INTERVAL

0 50 100 200
SCALE IN FEET

AS BUILT
8/22/74

DATE	ITEM	APP'D
APRIL 72	SEDIMENT BASIN-EMERG. SPWY. BENCH	
	REVISION	

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
PLAN OF STRUCTURAL WORKS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		DATE
DESIGNED	J. TOENNIESSEN	7/71
DRAWN	D. ANGELO	11/71
TRACED		
CHECKED		

SHEET NO. 9A NY-2161-P

LAYOUT DATA CURVE I

Δ = 85° 57' T = 186.34'
R = 200' E = 73.35'
D = 28° 39' M = 53.67'
L = 300'

℄ STATION	DEFLECTION ∢	CHORD DIST.
1+00	0° 00'	—
1+50	7° 10'	49.87
2+00	14° 20'	
2+50	21° 29'	
3+00	28° 39'	
3+50	35° 49'	
4+00	42° 58.5'	

LAYOUT DATA CURVE II

Δ = 71° 37 T = 144.31'
R = 200' E = 46.63'
D = 28° 39 M = 37.81'
L = 250'

℄ STATION	DEFLECTION ∢	CHORD DIST.
6+50	0° 00'	—
7+00	7° 10'	49.87
7+50	14° 20'	
8+00	21° 29'	
8+50	28° 39'	
9+00	35° 48.75	

LAYOUT DATA CURVE III

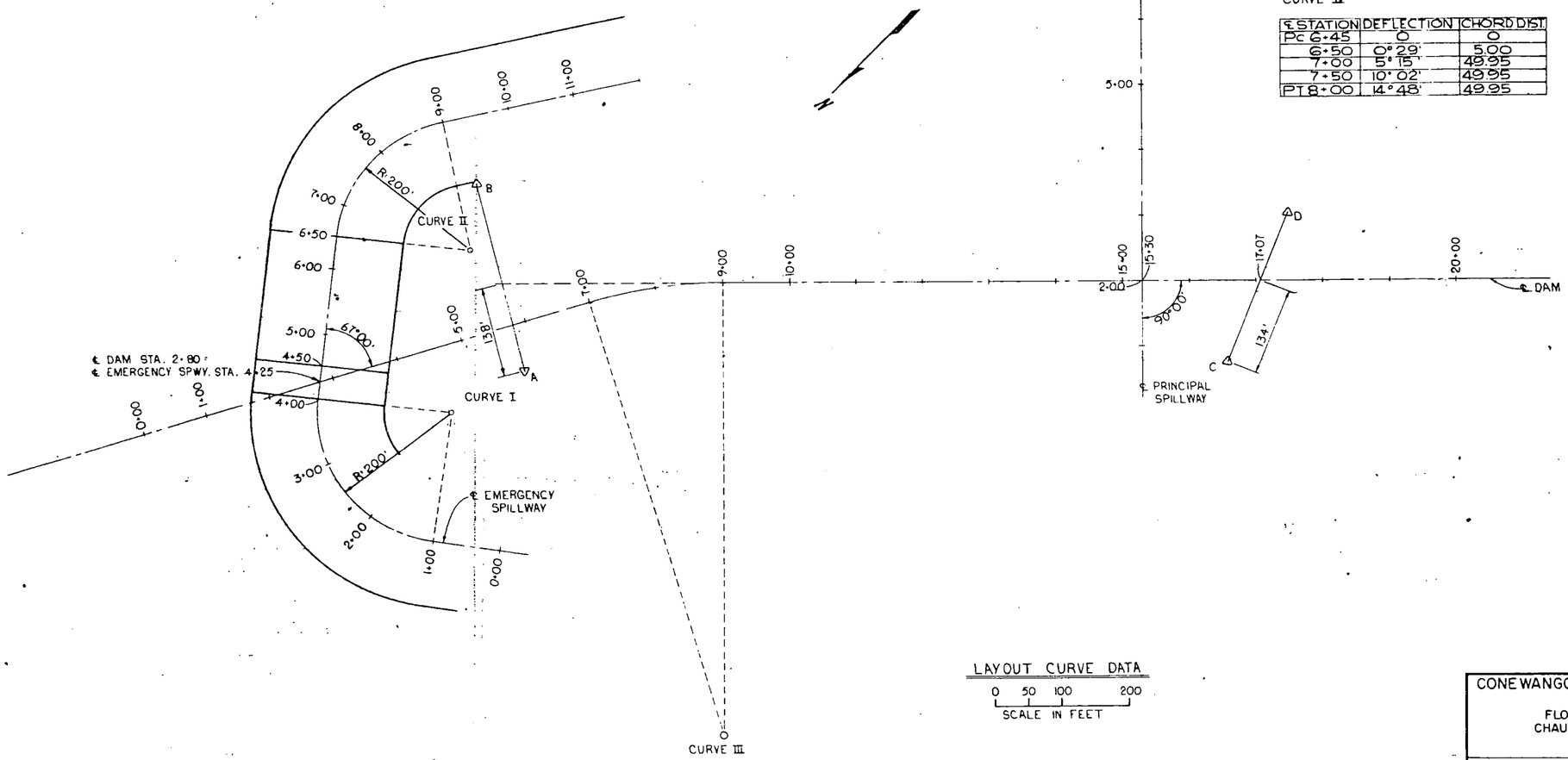
Δ = 16° 30' T = 100.6'
R = 694.5 E = 7.22'
D = 8° 15' M = 7.15'
L = 200.0'

℄ STATION	DEFLECTION ∢	CHORD DIST.
9+00	0° 00'	—
8+50	2° 04'	50.00
8+00	4° 08'	
7+50	6° 11'	
7+00	8° 15'	

LAYOUT DATA CURVE IV

Δ = 29° 36' T = 79.26'
R = 300 E = 10.29'
D = 19° 06' M = 9.95'
L = 155'

℄ STATION	DEFLECTION	CHORD DIST
PC 6+45	0	0
6+50	0° 29'	5.00
7+00	5° 15'	49.95
7+50	10° 02'	49.95
PT 8+00	14° 48'	49.95



LAYOUT CURVE DATA
0 50 100 200
SCALE IN FEET

8/22/74
AS BUILT

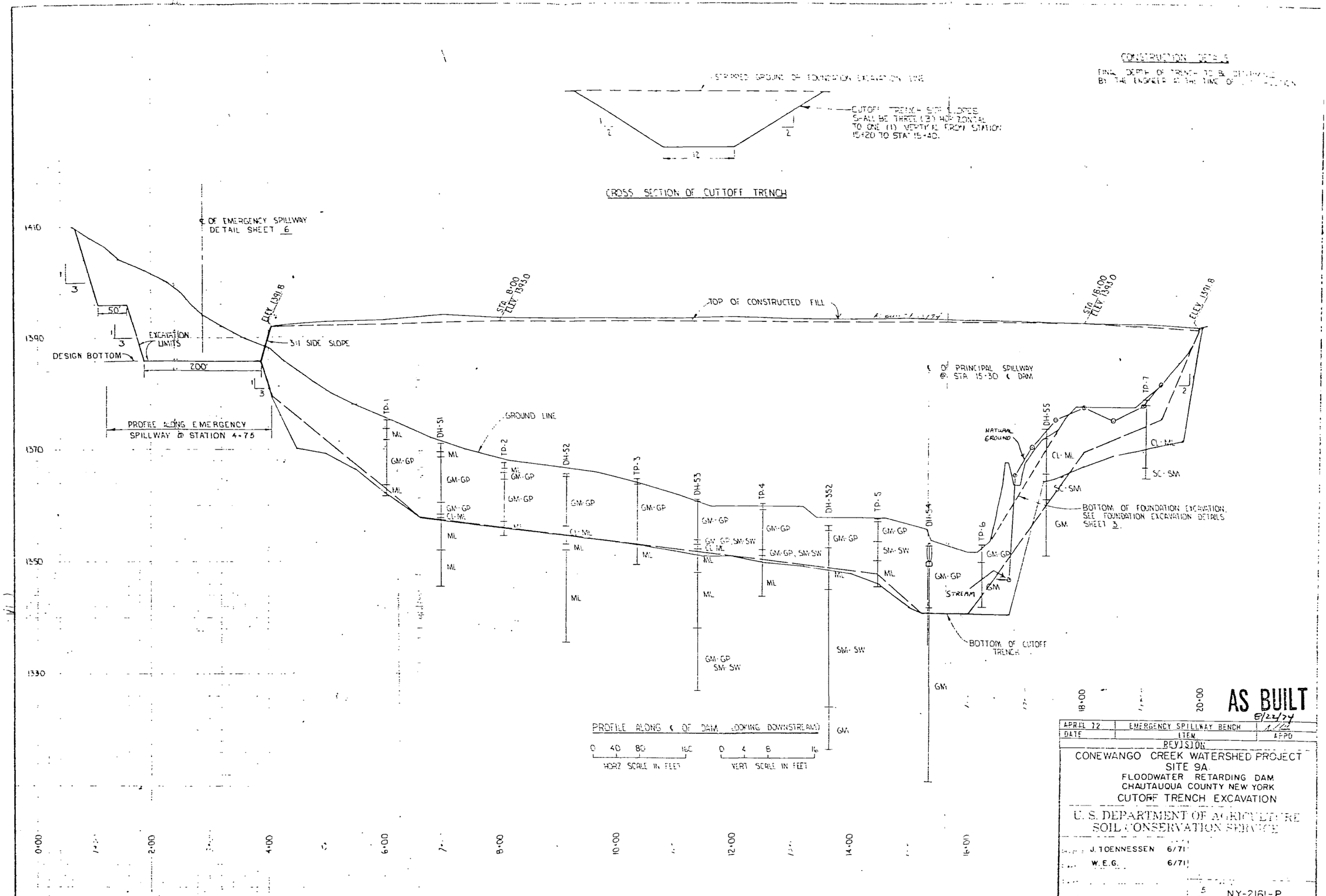
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
LAYOUT DATA

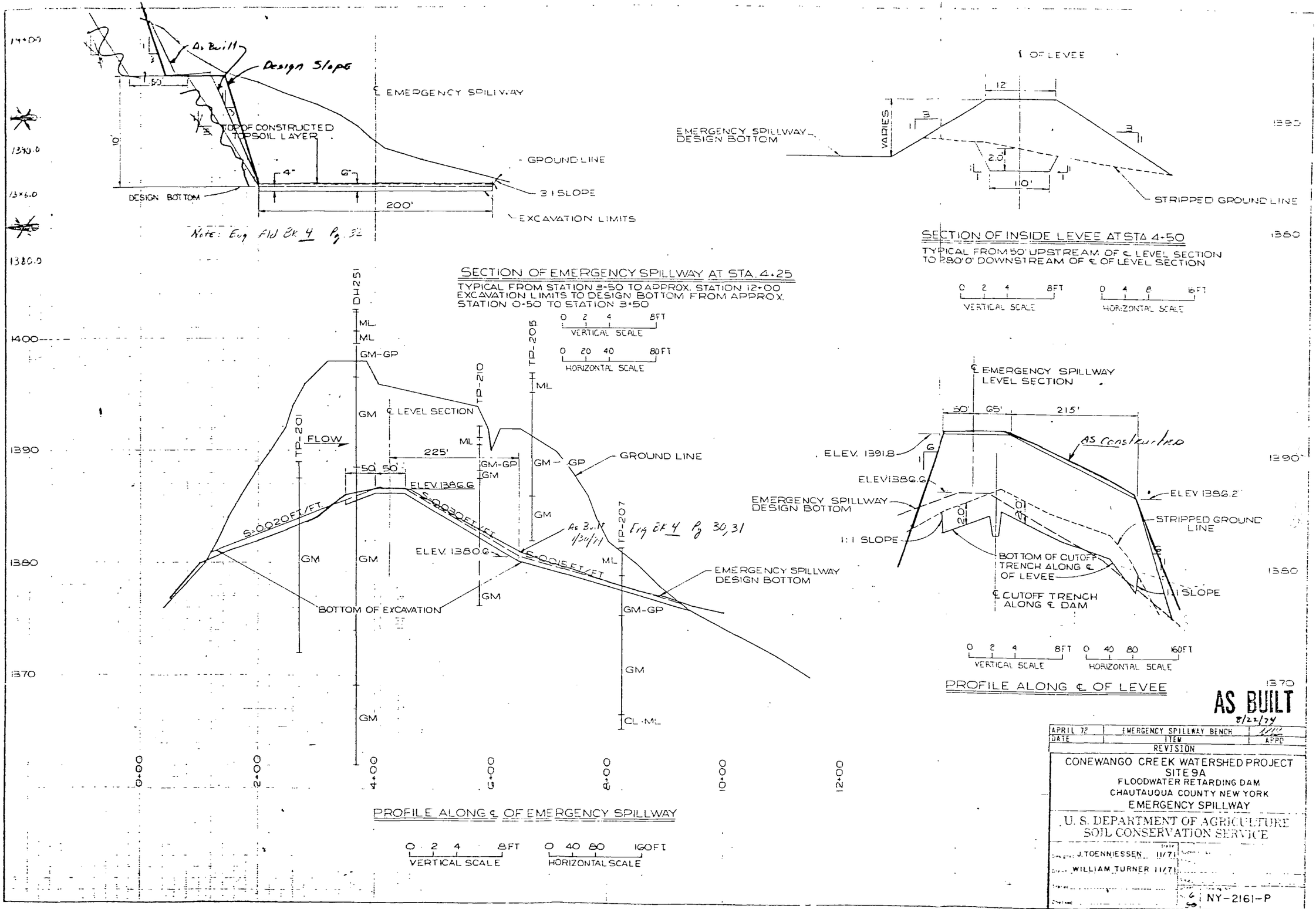
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed J. TOENNIESSEN Date 9/71
Drawn D. ANGELO 9/71
Traced
Checked
Approved By
Title
Title
Sheet No. 4 of 30
Drawing No. NY-2161-P

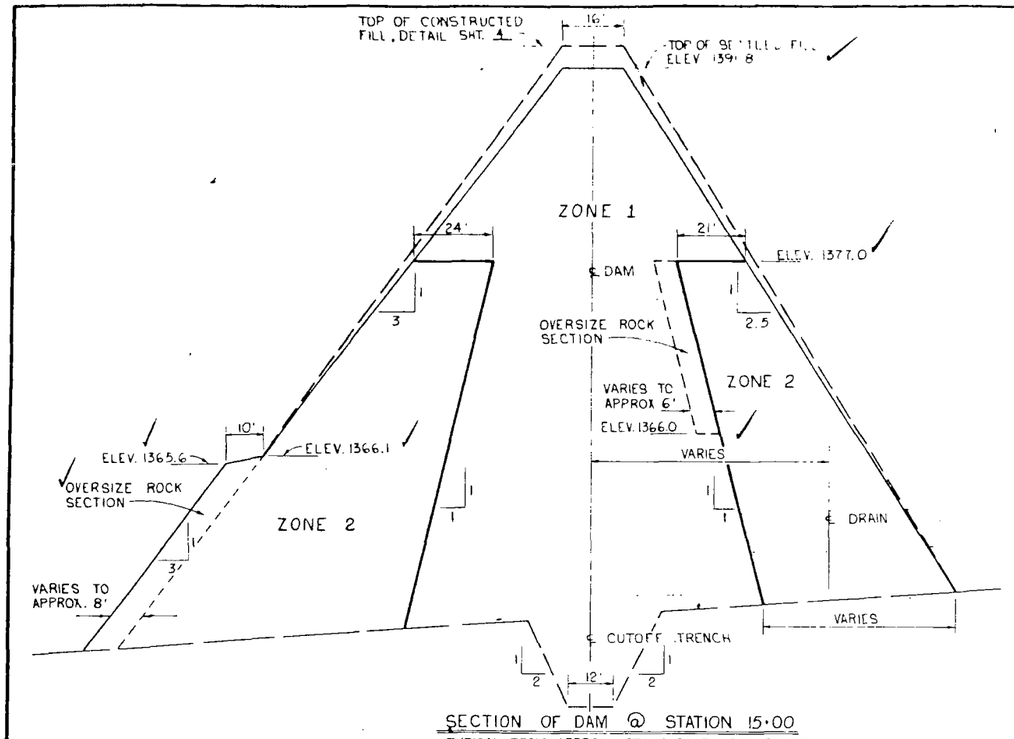
SCS ENG.-313-B Rev. 7-69

B-6


CONSTRUCTION DETAILS
FINAL DEPTH OF TRENCH TO BE DETERMINED BY THE ENGINEER AT THE TIME OF CONSTRUCTION
STRIPPED GROUND OR FOUNDATION EXCAVATION LINE
CUTOFF TRENCH SIDE SLOPES SHALL BE THREE (3) HORIZONTAL TO ONE (1) VERTICAL FROM STATION 15+20 TO STA 15+40.
CROSS SECTION OF CUTOFF TRENCH
℄ OF EMERGENCY SPILLWAY DETAIL SHEET 6
ELEV 1391.8
STA 8+00 ELEV 1393.0
TOP OF CONSTRUCTED FILL
STA 18+00 ELEV 1393.0
ELEV 1391.8
50'
EXCAVATION LIMITS
DESIGN BOTTOM
200'
3:1 SIDE SLOPE
PROFILE ALONG EMERGENCY SPILLWAY @ STATION 4+75
GROUND LINE
℄ OF PRINCIPAL SPILLWAY @ STA 15+30 ℄ DAM
NATURAL GROUND
BOTTOM OF FOUNDATION EXCAVATION. SEE FOUNDATION EXCAVATION DETAILS SHEET 3.
STREAM
BOTTOM OF CUTOFF TRENCH
TP-1
DH-51
TP-2
DH-52
TP-3
DH-53
TP-4
DH-352
TP-5
DH-54
TP-6
DH-55
TP-7
ML
GM-GP
CL-ML
SM-SW
SC-SM
GM
1410
1390
1370
1350
1330
0+00
2+00
4+00
6+00
8+00
10+00
12+00
14+00
16+00
18+00
20+00
PROFILE ALONG ℄ OF DAM (LOOKING DOWNSTREAM)
0 40 80 160
HORZ SCALE IN FEET
0 4 8 16
VERT SCALE IN FEET
AS BUILT
8/22/74
APRIL 72
EMERGENCY SPILLWAY BENCH
DATE
ITEM
APPD
REVISION
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY NEW YORK
CUTOFF TRENCH EXCAVATION
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
J. TOENNESSEN 6/71
W.E.G. 6/71
NY-2161-P



As Built
Design Slope
℄ EMERGENCY SPILLWAY
TOP OF CONSTRUCTED TOPSOIL LAYER
GROUND LINE
3:1 SLOPE
DESIGN BOTTOM
200'
EXCAVATION LIMITS
Note: Eng Fld Bk 4 Pg 32
℄ OF LEVEE
EMERGENCY SPILLWAY DESIGN BOTTOM
VARIES
STRIPPED GROUND LINE
SECTION OF INSIDE LEVEE AT STA 4+50
TYPICAL FROM 50' UPSTREAM OF ℄ LEVEL SECTION TO 280'0' DOWNSTREAM OF ℄ OF LEVEL SECTION
VERTICAL SCALE
HORIZONTAL SCALE
SECTION OF EMERGENCY SPILLWAY AT STA. 4+25
TYPICAL FROM STATION 3+50 TO APPROX. STATION 12+00
EXCAVATION LIMITS TO DESIGN BOTTOM FROM APPROX. STATION 0+50 TO STATION 3+50
VERTICAL SCALE
HORIZONTAL SCALE
℄ LEVEL SECTION
FLOW
225'
ELEV. 1386.6
S=0.020 FT/FT
S=0.030 FT/FT
S=0.015 FT/FT
ELEV. 1380.6
As Built 1/30/74
Eng Bk 4 Pg 30, 31
GROUND LINE
EMERGENCY SPILLWAY DESIGN BOTTOM
BOTTOM OF EXCAVATION
TP-201
TP-210
TP-205
TP-207
PROFILE ALONG ℄ OF EMERGENCY SPILLWAY
VERTICAL SCALE
HORIZONTAL SCALE
℄ EMERGENCY SPILLWAY LEVEL SECTION
ELEV. 1391.8
ELEV 1386.6
ELEV 1386.2
AS Constructed
EMERGENCY SPILLWAY DESIGN BOTTOM
1:1 SLOPE
STRIPPED GROUND LINE
BOTTOM OF CUTOFF TRENCH ALONG ℄ OF LEVEE
℄ CUTOFF TRENCH ALONG ℄ DAM
PROFILE ALONG ℄ OF LEVEE
AS BUILT
8/22/74
APRIL 72 | EMERGENCY SPILLWAY BENCH
DATE | ITEM | APPD
REVISION
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY NEW YORK
EMERGENCY SPILLWAY
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
J. TOENNIESSEN 11/71
WILLIAM TURNER 11/71
NY-2161-P



SECTION OF DAM @ STATION 15+00

TYPICAL FROM APPROX. STA. 4+00 TO STA. 20+00

EARTH FILL REQUIREMENTS

ZONE	MATERIAL 1/	MAX ROCK SIZE 2/	MAX LIFT 3/ THICKNESS	MIN. REQUIRED WATER 4/ CONTENT	COMPACTION 6/ CLASS	COMPACTION 6/ DEFINITION
1	GLACIAL TILL REPRESENTED BY TP 204 From 10.0'-14.4' (SM) TP 206 From 9.0'-16.0' (ML)	6"	9"	2 percentage points below optimum	A	98% standard density by ASTM D 698 method A.
2	ALLUVIAL & COLLUVIAL MATERIALS REPRESENTED BY: TP 7 From 1.0'-12.0' (CL-ML) TP 202 From 5.5'-8.0' (GW-GP) TP 205 From 1.8'-11.0' (GW-GP) TP 205 From 0.5'-1.8' (ML)	6"	9"	Wet 5/	C	Four passes per layer of fill by a smooth wheel vibrating roller at least 72" wide weighing at least one ton (Static Service Weight) per foot of width and capable of exerting a dynamic impact of at least 20,000 pounds at the rate of at least 1,200 times per minute

1/ The placement table indicates estimated use of materials.

2/ a) Maximum rock size in backfill compacted by means of manually directed power tampers or Plate Vibrators shall be 3"
b) Maximum rock size of 18" placed in earth fill shall be raked to the portion of the dam labeled OVERSIZE ROCK SECTION as shown on the drawings.

3/ Maximum lift thickness prior to compaction. The maximum lift thickness of the oversize rock section shall be no greater than 18" prior to compaction.

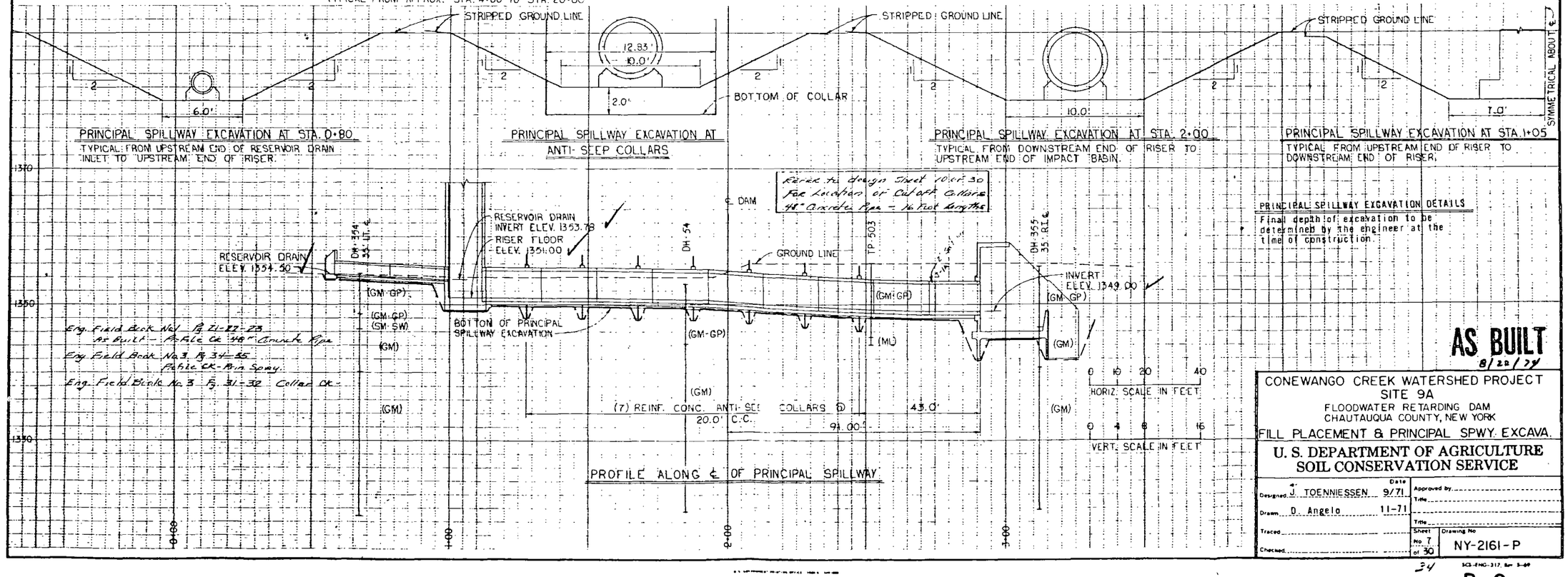
4/ Water content at time of compaction.

5/ Thoroughly wet, but
a) Not more than 12 percent moisture content based on the material passing the #4 sieve, unless modified by the engineer at the time of construction, or
b) Not so wet as to cause adherance of the soil to the wheels or tracks of the equipment, nor to cause bogging down of equipment.

6/ a) For typical ~~compaction curves~~ see sheet 27.
b) Use CLASS C compaction in areas of the dam ~~containing~~ oversize material. This CLASS C compaction shall consist of a minimum of six passes per lift of fill by a tamping roller exerting a min. contact pressure of 450PSI, or equivalent as approved by the engineer. The final number of passes will be determined by the engineer in the field.

CONSTRUCTION DETAILS

1. Zone boundaries are approx. Adjustments will be made by the engineer to utilize all coarse material from the emergency spillway and borrow area.
2. Material placed in the OVERSIZE ROCK SECTIONS shall consist of oversize mat'l raked from the earth fill. These sections shall be essentially free of mat'ls. less than 3". Oversize rock section above Elev. 1366 may be relocated so as to be exposed at the upstream slope of the dam as determined by the engineer.
3. Topsoil that is suitable for use and not used on the specified areas of the emerg spillway shall be incorporated within the slopes of the earth fill as directed by the engineer.



Eng. Field Book No. 1 Pg. 21-22-23
As Built - Public Ck 48" Corrugated Pipe
Eng. Field Book No. 3 Pg. 34-35
Public Ck-Bin Spwy.
Eng. Field Book No. 3 Pg. 31-32 Collar Ck-

AS BUILT 8/22/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK

FILL PLACEMENT & PRINCIPAL SPWY. EXCAVA.

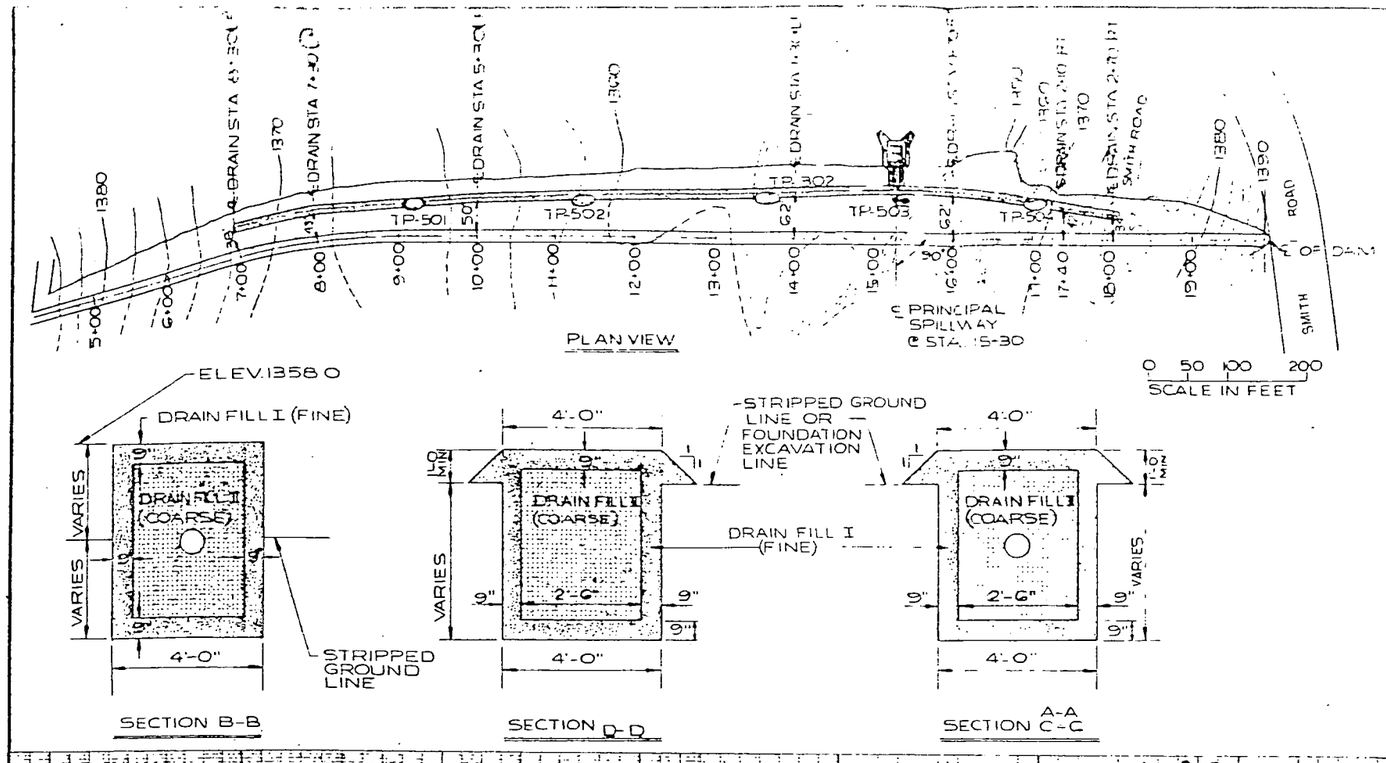
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	
Designed J. TOENNIESSEN	9/71	Approved by:
Drawn D. Angelo	11-71	Title
Traced		Title
Checked		Sheet No. 7 of 30 — Drawing No. NY-2161-P

34

SCS-ENG-317, Apr. 3-69

B-9



DRAINAGE SYSTEM DETAILS

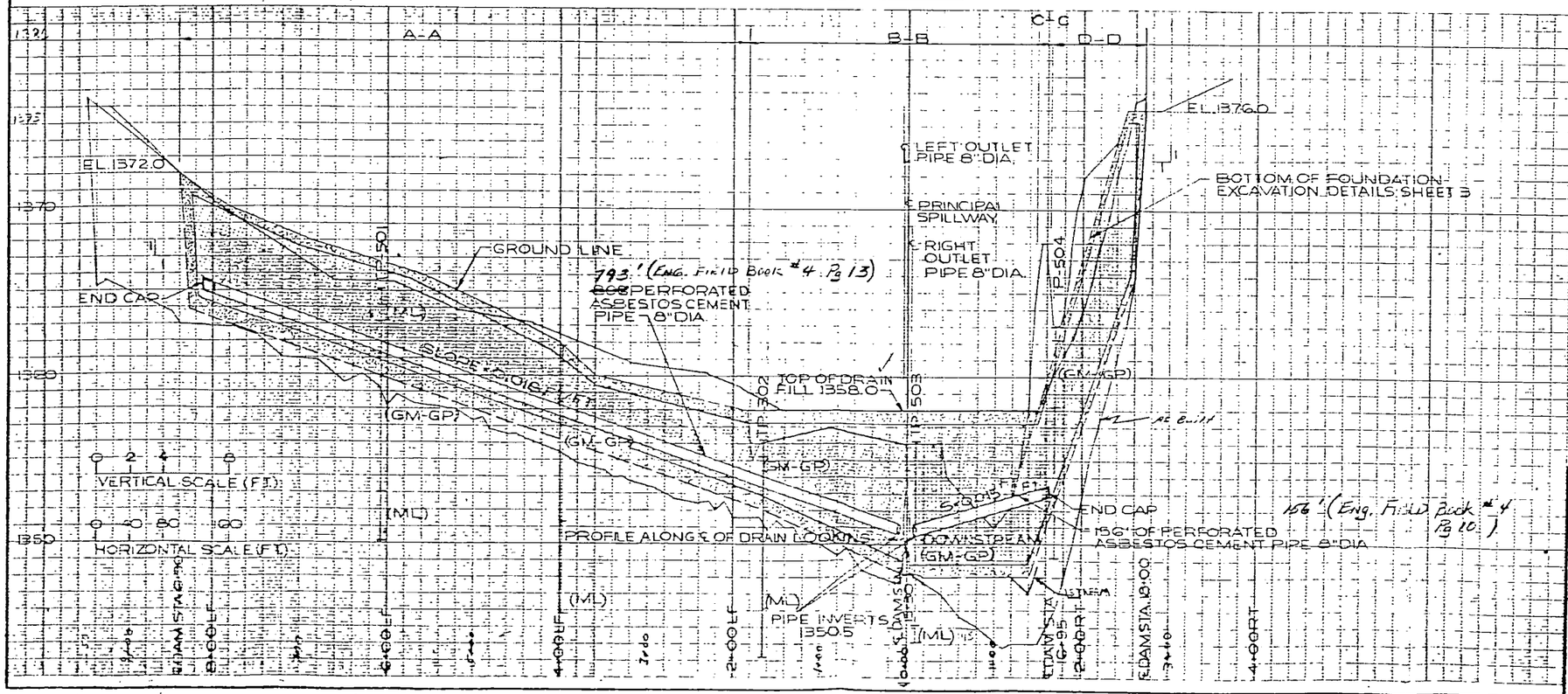
1. PERFORATED DRAIN PIPE SHALL CONFORM TO SPECIFICATION 5-5 AND SHALL BE 8" DIA PRESSURE PIPE, CLASS 200.
2. THE PROFILE AT THE BOTTOM OF ALL EXCAVATION AS SHOWN ARE ONLY APPROXIMATE. THE REQUIRED FINISHED GRADE WILL BE ESTABLISHED IN THE FIELD AT THE TIME OF CONSTRUCTION BY THE ENGINEER.

QUANTITY SUMMARY

928 CU. YDS. DRAIN FILL I (FINE)
847 CU. YDS. DRAIN FILL II (COARSE)
1069 LIN. FT. STRAIGHT SECTION OF PERFORATED ASBESTOS CEMENT PIPE (8" DIA.)
2 END CAPS
2 90° ELBOWS (8" DIA CAST IRON)
6 45° ELBOWS (8" DIA CAST IRON)

GRAIN SIZE DESCRIPTION FOR DRAIN FILL

1. DRAIN FILL I (FINE) SHALL MEET THE GRADATION OF A.S.T.M. C 33-67 FOR FINE AGGREGATE. IN ADDITION, THE PERCENTAGE OF MATERIAL IN DRAIN FILL I FINER THAN A # 200 SIEVE SHALL NOT BE MORE THAN THREE (3) PERCENT.
2. DRAIN FILL II (COARSE) SHALL MEET THE GRADATION OF N.Y.S. D.O.T. COARSE AGGREGATE #1. IN ADDITION, THE PERCENTAGE OF MATERIAL IN DRAIN FILL II FINER THAN A # 200 SIEVE SHALL NOT BE MORE THAN THREE (3) PERCENT



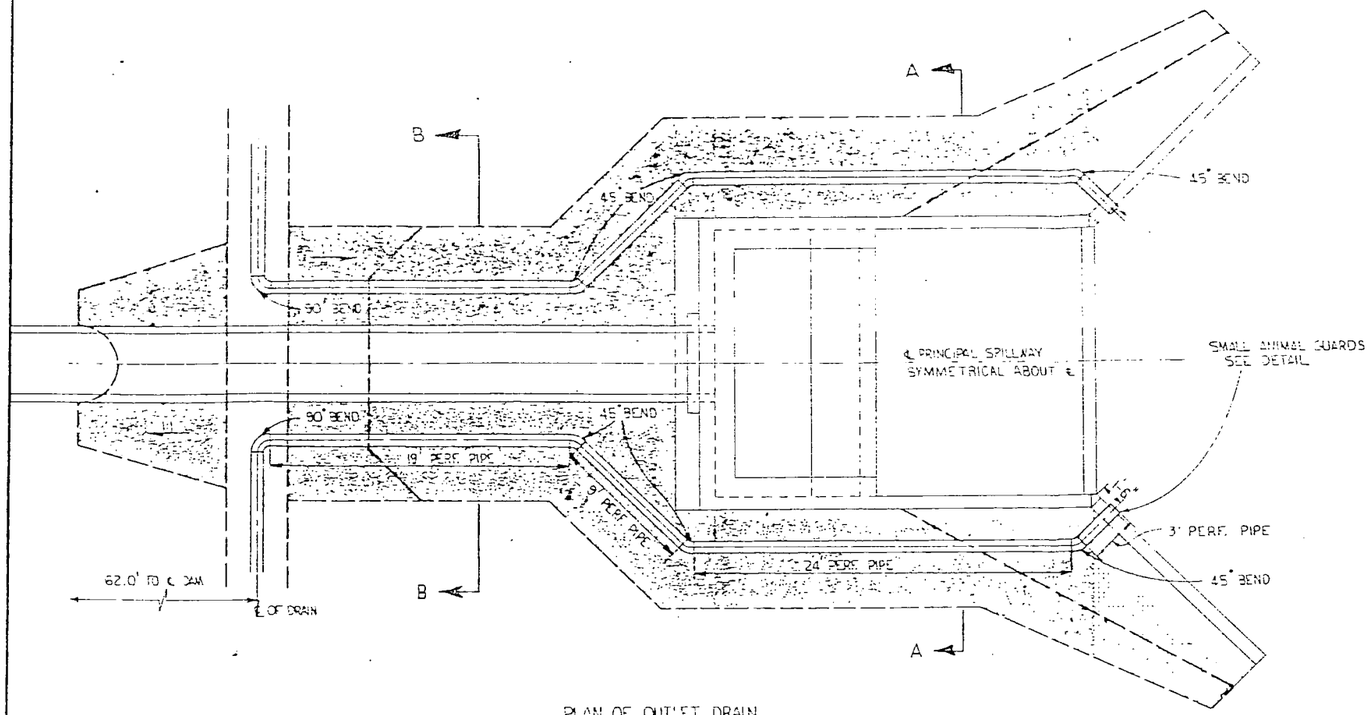
8/22/74

AS BUILT

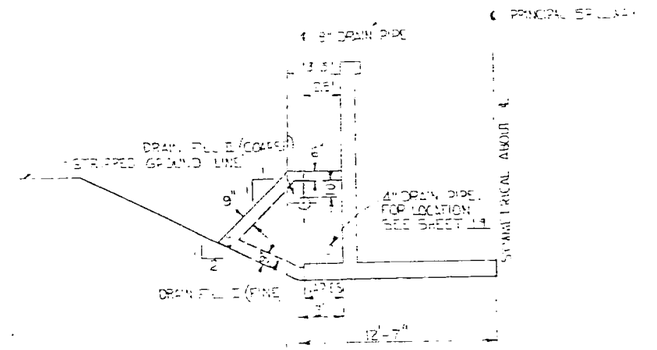
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
DRAINAGE SYSTEM

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

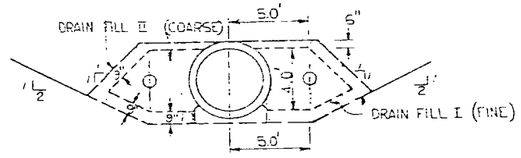
Designed J. TOENNIESSEN	Date 9/71	Approved by
Drawn WILLIAM TURNER	9/71	Title
Traced		Sheet No. 8
Checked		Drawing No. NY-2161-P



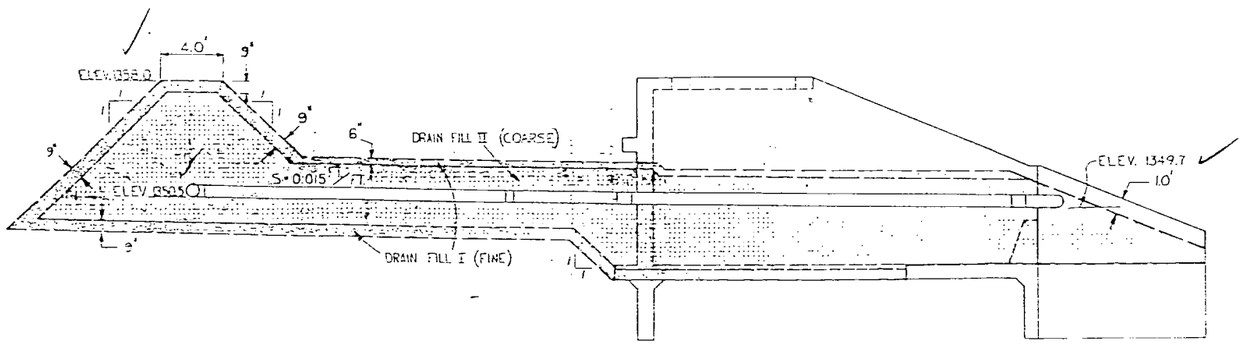
PLAN OF OUTLET DRAIN



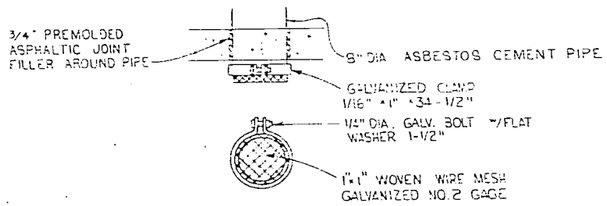
SECTION AA



SECTION BB



TYPICAL SECTION ALONG OUTLET DRAIN



DETAIL OF SMALL ANIMAL GUARD SCREEN & OUTLET OF DRAIN PIPE
(NOT TO SCALE)

0 2.5 5 8 10
SCALE IN FEET

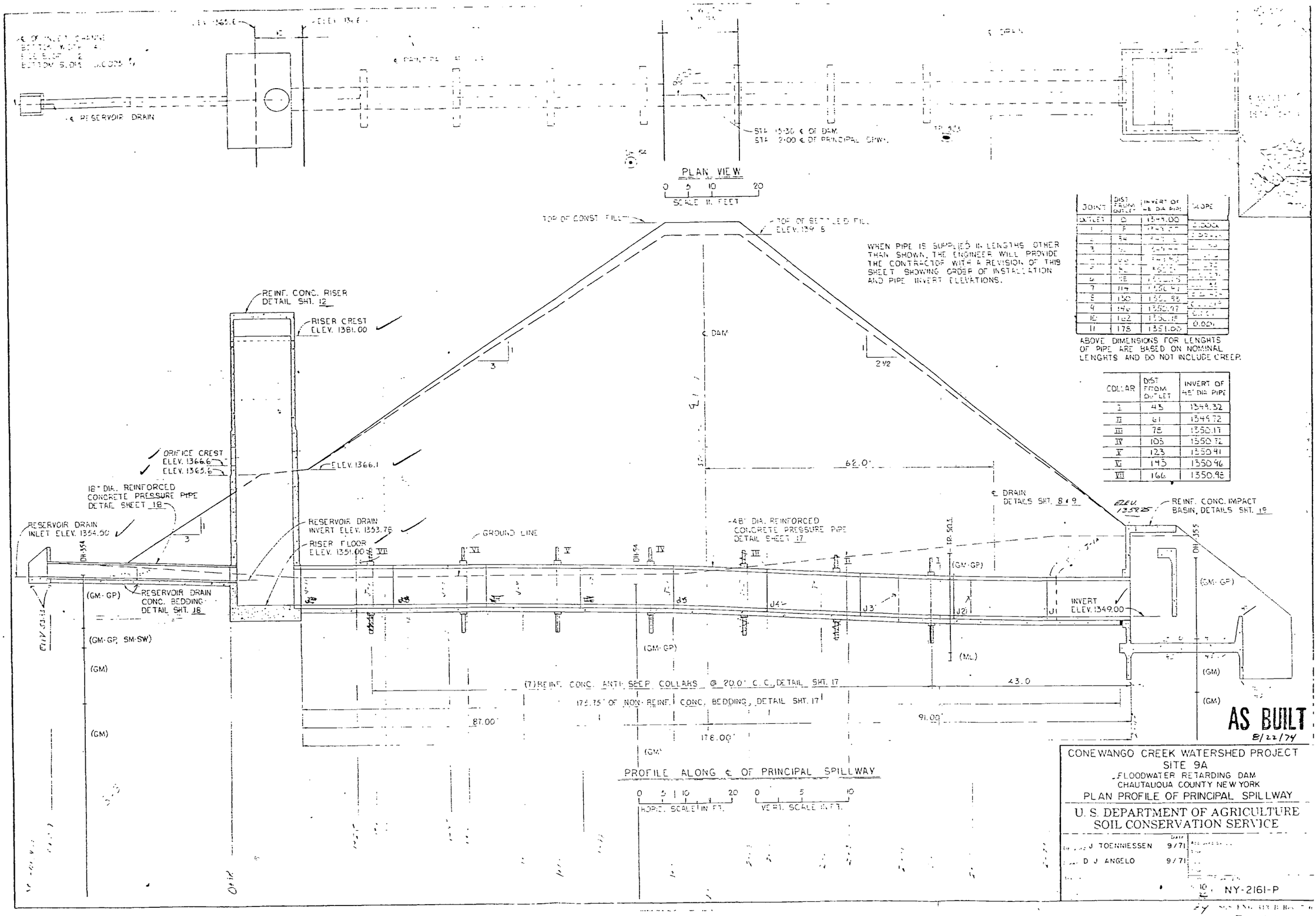
AS BUILT
8/22/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
DRAINAGE SYSTEM

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

J. TOENNIESSEN 9/71
R. G. YOLTON 9/71

NY-2161-P



WHEN PIPE IS SUPPLIED IN LENGTHS OTHER THAN SHOWN, THE ENGINEER WILL PROVIDE THE CONTRACTOR WITH A REVISION OF THIS SHEET SHOWING ORDER OF INSTALLATION AND PIPE INVERT ELEVATIONS.

JOINT	DIST FROM OUTLET	INVERT OF 48" DIA PIPE	SLOPE
OUTLET	0	1349.00	[illegible]
1	[illegible]	[illegible]	[illegible]
2	54	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]
7	114	[illegible]	[illegible]
8	130	1350.93	[illegible]
9	146	1350.97	[illegible]
10	162	1350.15	[illegible]
11	178	1351.00	0.001

ABOVE DIMENSIONS FOR LENGHTS OF PIPE ARE BASED ON NOMINAL LENGHTS AND DO NOT INCLUDE CREEP.

COLLAR	DIST FROM OUTLET	INVERT OF 48" DIA PIPE
I	43	1349.32
II	61	1349.72
III	78	1350.17
IV	103	1350.72
V	123	1350.91
VI	143	1350.96
VII	166	1350.98

AS BUILT
8/22/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY NEW YORK
PLAN PROFILE OF PRINCIPAL SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

J TOENNIESSEN 9/71
D J ANGELO 9/71

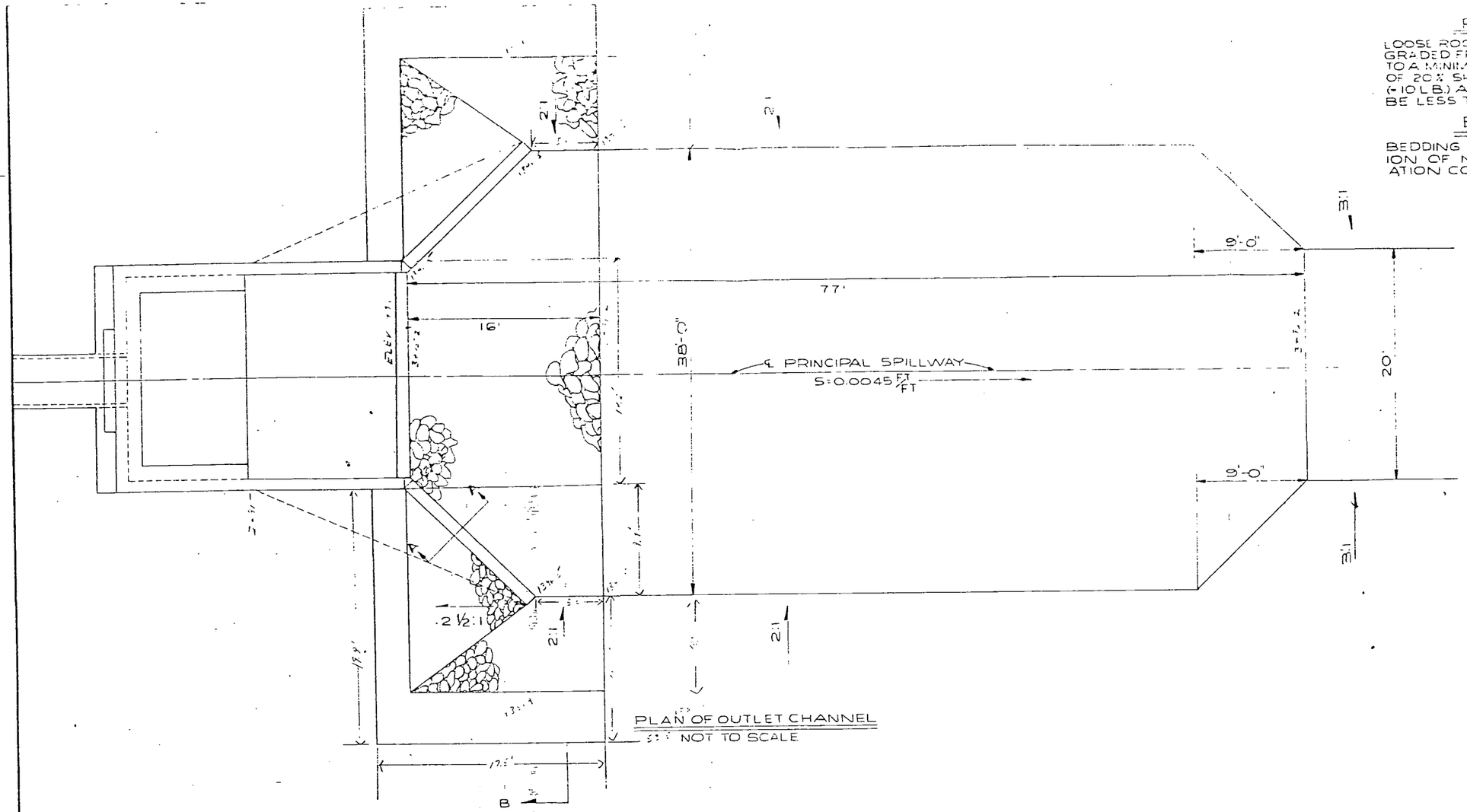
NY-2161-P

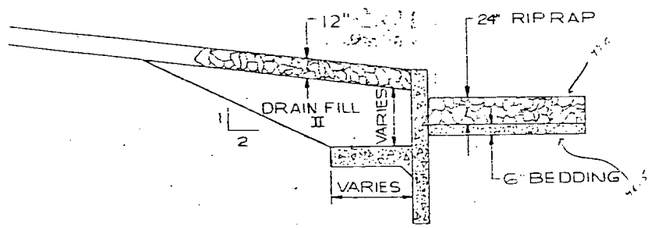
RIP RAP DETAILS

LOOSE ROCK RIP RAP SHALL BE WELL GRADED FROM A MAXIMUM SIZE OF 24" TO A MINIMUM SIZE OF 3" A MAXIMUM OF 20% SHALL BE LESS THAN 6" (=10 LB.) A MAXIMUM OF 60% SHALL BE LESS THAN 12" (= 80 LB.)

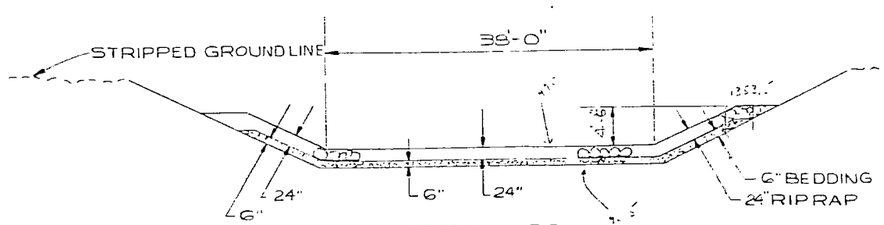
BEDDING DETAILS

BEDDING SHALL MEET THE GRADATION OF NYS DEPT OF TRANSPORTATION COARSE AGGREGATE # 1.





SECTION AA
NOT TO SCALE



SECTION BB
NOT TO SCALE

8/22/74
AS BUILT

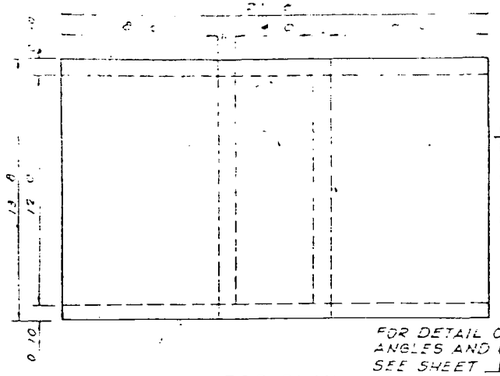
CONEWANGO CREEK WATERSHED
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
OUTLET CHANNEL AND RIPRAP DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	J.D TOENNIESSEN	8-71	Approved By
Drawn	W. TURNER	8-71	Title
Traced			Date
Checked			Sheet No. 11 of 30 sheets

Drawing No. NY-2161-P

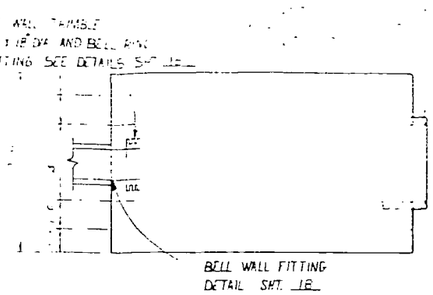
SCS ENG-313 B Rev. 1-69



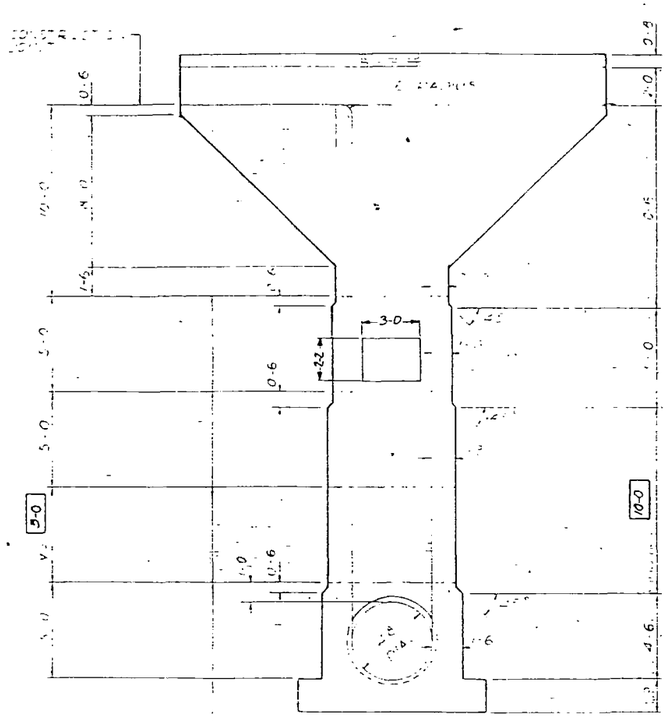
TOP PLAN

MANHOLE ASSEMBLY DETAILS
Circular manhole assembly minimum clear opening 30" Neenah Foundry Company Model R-E4E1-BH with stainless cap screws or approved equivalent

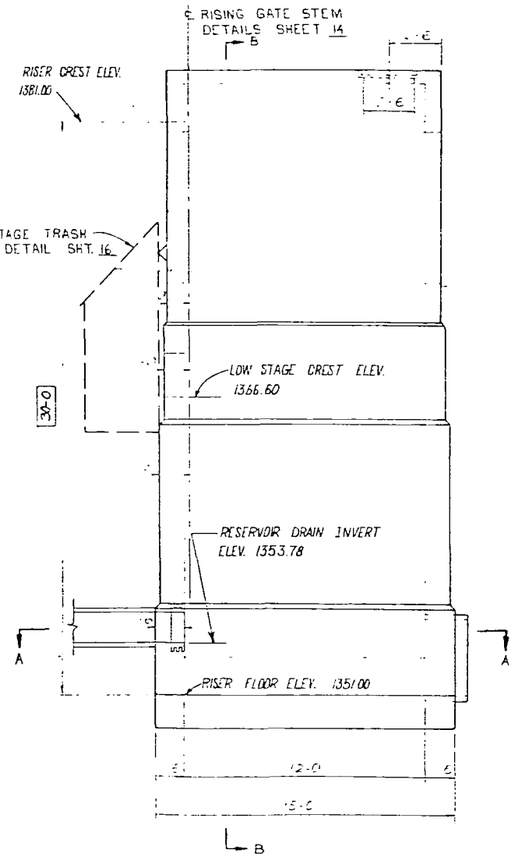
FOR DETAIL OF TRASHRACK ANGLES AND GRATING SEE SHEET 16



SECTION A-A



SECTION B-B



SIDEWALL ELEVATION

STEEL SCHEDULE

MARK	SIZE	QUANTITY	LENGTH	TYPE	B	C	TOTAL LENGTH
A1	6	1	12'-4"				12'-4"
A2	6	1	47'-5"				47'-5"
B1	6	10	5'-6"	2	6'-2"		55'-0"
B2	6	20	11'-0"	2	6'-2"		220'-0"
B3	6	1	6'-5"	2	6'-2"	5'-9"	13'-6"
B11	6	4	5'-0"				182'-0"
B21	6	1	5'-0"				30'-0"
B13	6	2	2'-6"	2	6'-2"	6'-2"	228'-0"
B14	6	1	5'-0"	2	6'-2"		35'-0"
B15	6	1	3'-1"	2	6'-2"		37'-6"
B16	6	4	9'-2"	2	6'-10"	6'-2"	36'-6"
B17	6	4	5'-1"	2	6'-2"	6'-2"	56'-4"
B18	6	2	5'-1"	2	6'-2"	6'-2"	20'-6"
B19	6	1	5'-1"	2	6'-2"	6'-2"	42'-6"
B20	6	82	4'-1"				355'-4"
B22	6	1	3'-1"				30'-1"
B22	6	1	0'-6"				0'-6"
B23	6	1	0'-6"				0'-6"
B24	6	1	5'-0"				5'-0"
B25	6	1	2'-1"				2'-1"
B26	6	2	2'-3"				4'-6"
B27	6	2	2'-9"				5'-6"
T1	5	24	9'-6"	1	—	—	228'-0"
T2	5	8	12'-3"	1	—	—	98'-0"
T3	5	4	8'-6"	1	—	—	34'-0"
T4	5	4	7'-3"	1	—	—	29'-0"
T5	5	4	6'-0"	1	—	—	24'-0"
T6	5	4	4'-9"	1	—	—	19'-0"
T7	5	4	3'-6"	1	—	—	14'-0"
T8	5	4	14'-0"	19	2'-9"	11'-3"	56'-0"
T9	6	16	12'-9"	1	—	—	204'-0"
T10	5	8	12'-9"	1	—	—	102'-0"
T11	5	2	4'-9"	1	—	—	9'-6"
T12	5	2	5'-9"	1	—	—	11'-6"
T13	5	2	8'-3"	1	—	—	16'-6"
T14	5	2	10'-9"	1	—	—	21'-6"
T15	5	2	13'-3"	1	—	—	26'-6"
T16	5	2	15'-9"	1	—	—	31'-6"
T17	5	2	18'-3"	1	—	—	36'-6"
T18	5	2	20'-9"	1	—	—	41'-6"
T19	5	20	9'-9"	1	—	—	195'-0"
T20	5	10	12'-3"	1	—	—	122'-6"
T21	5	4	9'-3"	1	—	—	37'-0"
T22	5	4	8'-0"	1	—	—	32'-0"
T23	5	4	6'-9"	1	—	—	27'-0"
T24	5	4	5'-6"	1	—	—	22'-0"
T25	5	4	4'-3"	1	—	—	17'-0"
T26	5	4	3'-0"	1	—	—	12'-0"
T27	5	4	14'-0"	19	2'-9"	11'-3"	56'-0"
T28	6	32	17'-3"	21	3'-7½"	7'-7½"	350'-0"
T29	5	16	11'-0"	24	3'-6"	7'-6"	176'-0"
T30	5	2	6'-3"	1	—	—	12'-6"
T31	5	2	8'-9"	1	—	—	17'-6"
T32	5	2	11'-3"	1	—	—	22'-6"
T33	5	2	13'-8"	1	—	—	27'-6"
T34	5	2	16'-3"	1	—	—	32'-6"
T35	5	2	18'-9"	1	—	—	37'-6"
T36	5	2	21'-3"	1	—	—	42'-6"
T37	5	4	21'-3"	1	—	—	85'-0"
T38	5	4	21'-3"	1	—	—	85'-0"
T39	5	30	12'-9"	1	—	—	382'-6"
T40	6	5	5'-3"	1	—	—	26'-3"
T41	4	11	21'-3"	1	—	—	233'-9"
T42	4	4	9'-3"	1	—	—	37'-0"
T43	4	11	21'-3"	1	—	—	233'-9"
T44	4	4	9'-3"	1	—	—	37'-0"
T45	5	36	9'-3"	21	1'-10"	7'-5"	333'-0"
T46	5	2	11'-6"	21	1'-11"	9'-7"	23'-0"
T47	5	2	2'-9"	21	0'-11"	1'-10"	5'-6"

AS BUILT 8/22/74

QUANTITIES

STEEL #4 BARS 54 LBS. #5 BARS 3186-0 3323 LBS. #6 BARS 799 0 LBS. 13442.0 LBS.

CONCRETE = 60.4 + 1.7 = 62.0 C.Y. YDS.

LENGTH OF #6 BARS = (3841-1) + LENGTH OF BARS 2 THROUGH R7

STANDARD COVERED RISER	
DESIGN CONSTANTS	f'_c = 4000 PSI f_c = 1600 PSI; n = 8 f_s = 20,000 PSI
STANDARD DWG. NO.	ES 5048-30:5E
DATE 5-58	SHEET 1 OF 4

DRAFTED BY
LOEWER AND ASSOCIATES
ARCHITECTS & ENGINEERS
3720 FARRAGUT AVE KENSINGTON, MD.

0 2 4 6
SCALE IN FEET

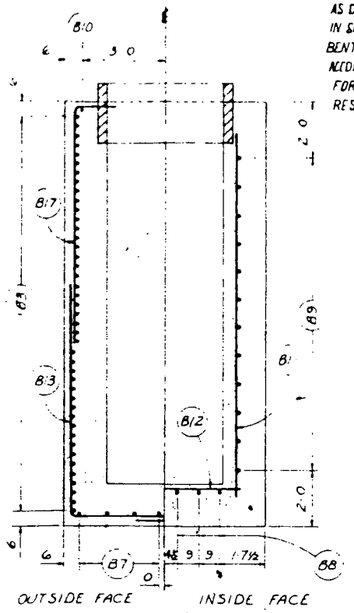
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
RISER STRUCTURAL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

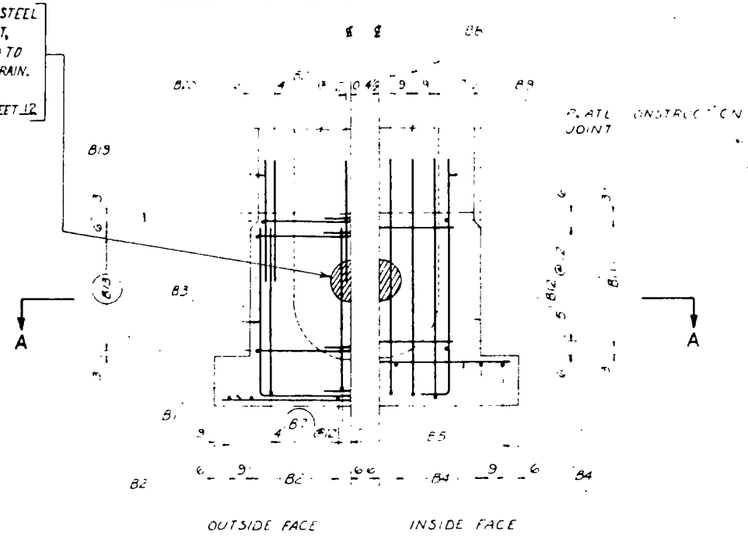
Designed J. TOENNIESSEN 7/71
Drawn R G YOLTON 7/71
Traced
Checked
Approved by
Date
Scale
Drawing No. 12 NY-216I-P

B-14

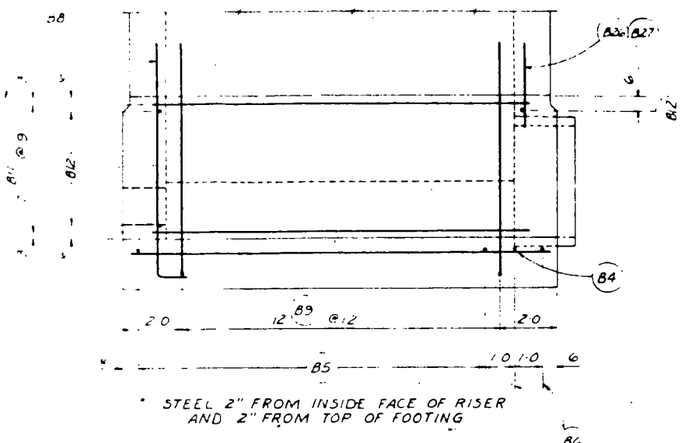
AS DIRECTED BY ENGINEER, STEEL IN SHADED AREA WILL BE CUT, BENT OR MOVED AS REQUIRED TO ACCOMMODATE RESERVOIR DRAIN. FOR EXACT LOCATION OF RESERVOIR DRAIN SEE SHEET 12



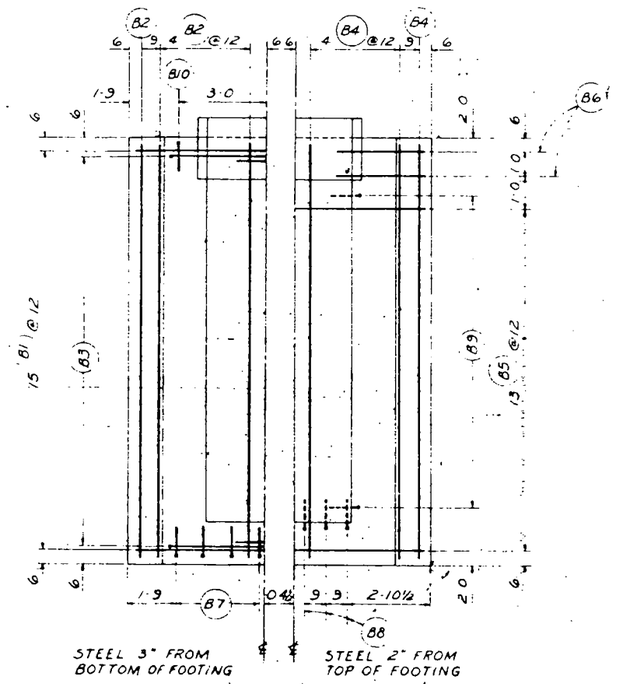
SECTION A-A



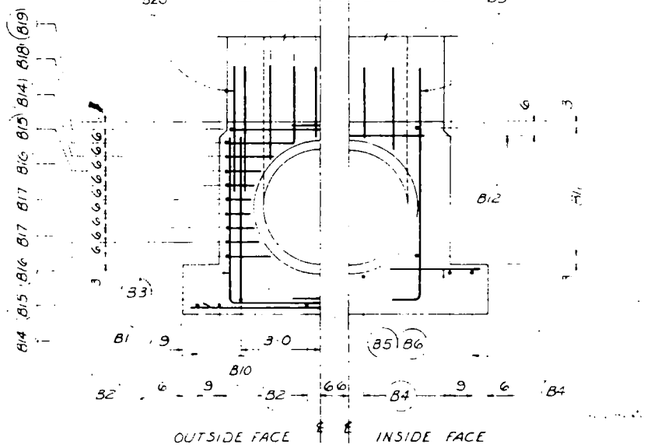
UPSTREAM ELEVATION



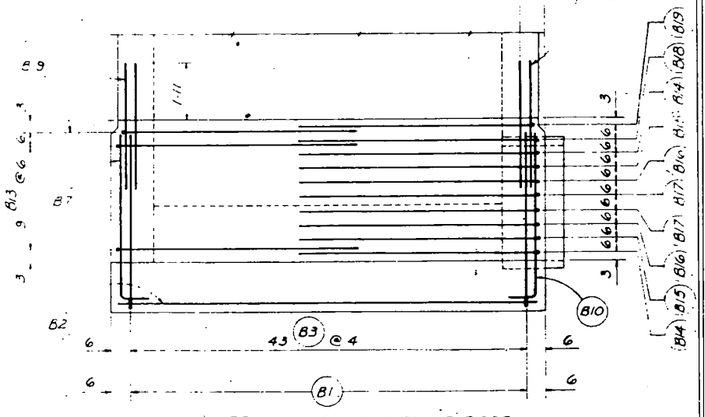
SIDEWALL ELEVATION



FOOTING PLAN



DOWNSTREAM ELEVATION



SIDEWALL ELEVATION

AS BUILT
8/22/74

STANDARD COVERED RISER	
DESIGN CONSTANTS f'_c = 4000 psi f_c = 1600 psi n = 8 f_s = 20,000 psi	
STANDARD DWG. NO. ES-3048-3015E	
DATE 8-68	SHEET 2 OF 4

0 2" 4 6
SCALE IN FEET

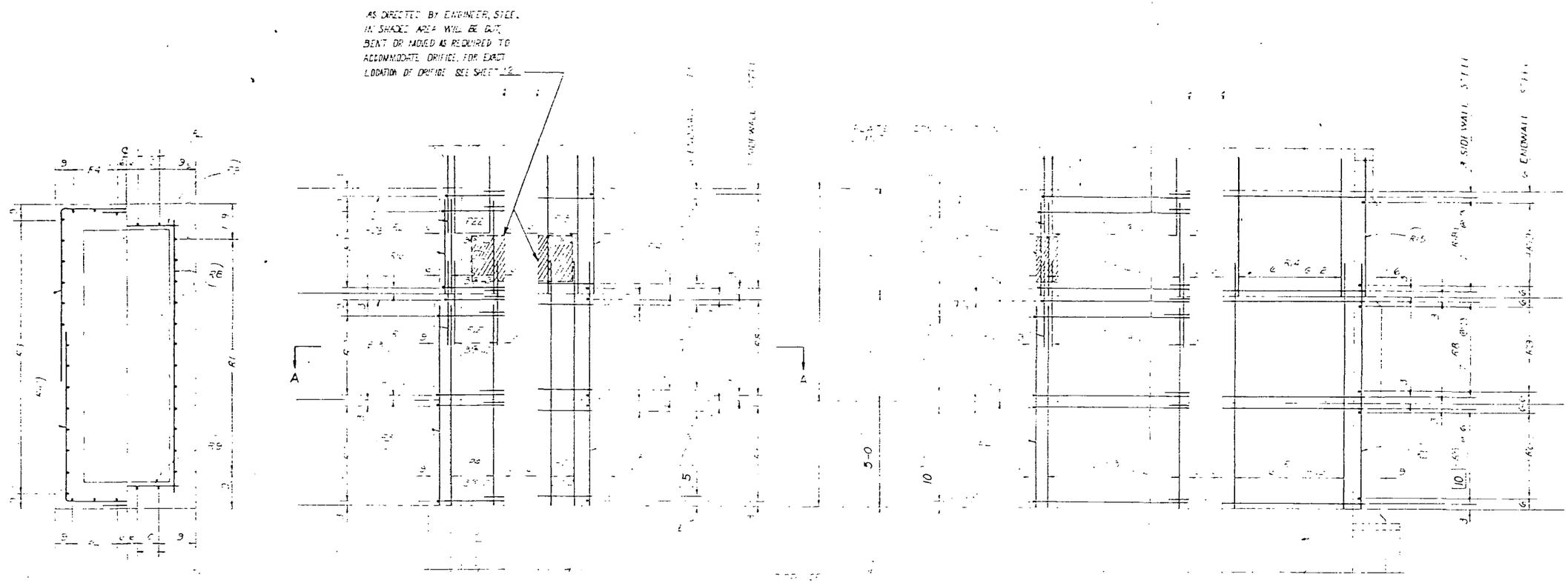
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTUAQUA COUNTY, NEW YORK
RISER STRUCTURAL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Adapted J. Toenniessen	11/21	Approved by	
Drawn		Title	
Traced		Sheet No. 13 of 30	Drawing No. NY-2161-P
Checked			

84

B-15



SECTION A-A

OTHER SECTIONS SIMILAR

ENDWALL ELEVATION

SIDEWALL ELEVATION

CONSTR. JOINT

Continuous thru constr. joint
Splices shall be either
1 Butt welded
2 Lapped 3" and bolted
3 Lapped 3" and fillet welded

CONSTRUCTION DETAILS

1. SPECIFIED BAR DIMENSIONS ARE MEASURED TO OUTSIDE EDGE OF ALL BENDS.
2. RADIUS OF BENDS EQUALS 3 BAR DIAMETERS FOR SIZES EQUALS TO OR LESS THAN #7.
3. THE 2" AND 3" DISTANCE FROM SPECIFIED CONCRETE SURFACE ARE CLEAR DISTANCES. WHERE NOT OTHERWISE SPECIFIED ALL REINFORCING STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MINIMUM OF 3" COVER. ALL REINFORCING STEEL PLACED IN CONCRETE POURED IN FORMS SHALL HAVE A MINIMUM OF 2" CLEAR COVER.
4. ALL EXPOSED EDGES OF CONCRETE TO HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.

SLIDE GATE DETAILS

1. 18" DIA. FLAT FRAME SLIDE GATE
2. CLASS 0-30
3. SLIDE GATE SHALL CONFORM TO SPEC. 573 AND SHALL BE TYPE MHS-1.
4. "E" TYPE WALL THIMBLE 10" DEEP.
5. RISING STEM, STEM GUIDES, AND LIFTING DEVICE SHALL BE SIZED, AND SPACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

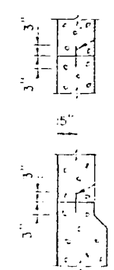


PLATE CONSTR. JOINT

AS BUILT
8/22/74

STANDARD COVERED RISER	
DESIGN CONSTANTS	f'_c = 4000 psi, f_c = [illegible] psi, n = 6, f_s = 2[illegible] psi
STANDARD DWG. NO.	[illegible]
DATE 8-68	SHEET 3 OF 4

0 2 4 6
SCALE IN FEET

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
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CHAUTAUQUA COUNTY, NEW YORK
RISER STRUCTURAL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
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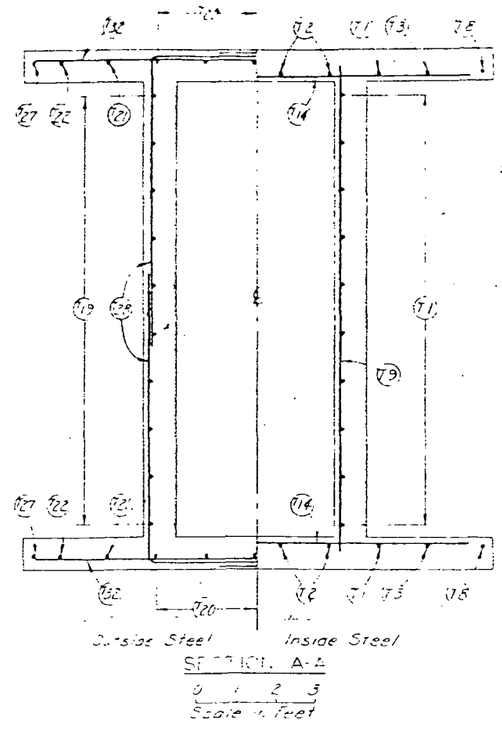
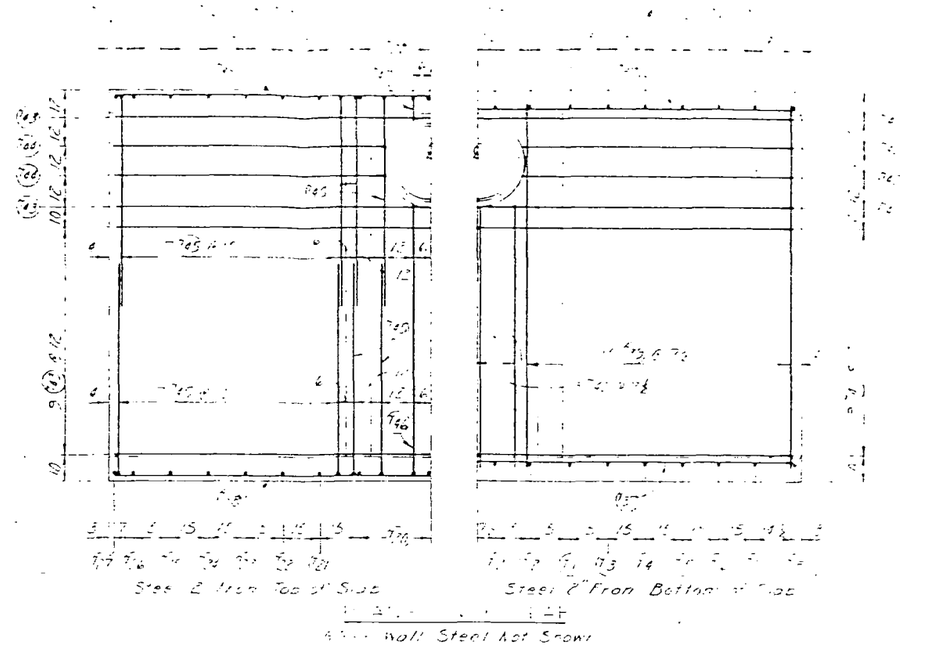
Adapted	J. TOENNIESSEN	7/71
Drawn	R G YOLTON	7/71
Traced		
Checked		

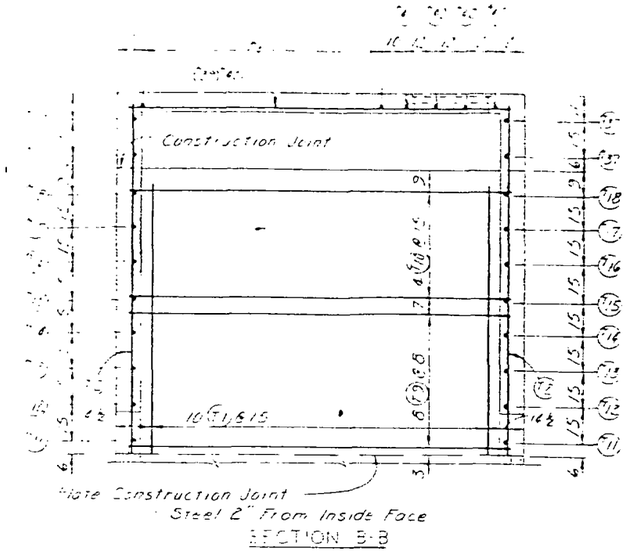
NY-2161-P



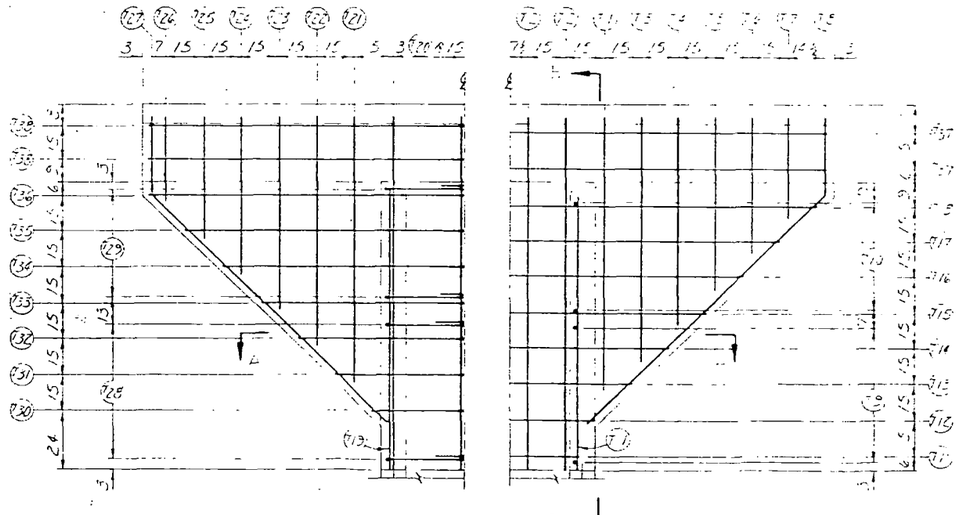
SECTION A-A

0 1 2 3
Scale in Feet



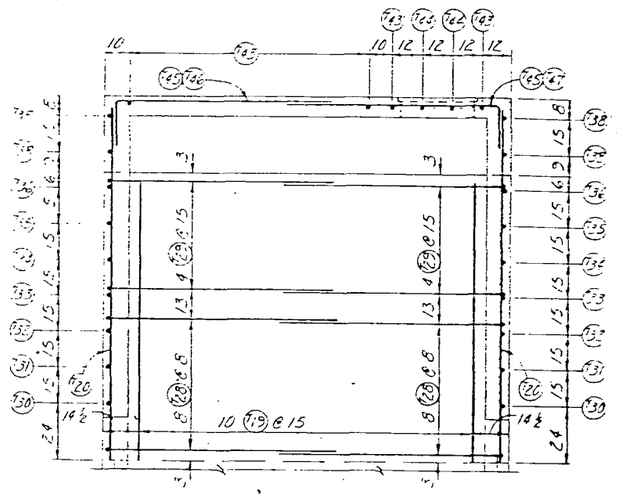


SECTION B-B



FINE WALL ELEVATION

Cover Slab Steel Not Shown

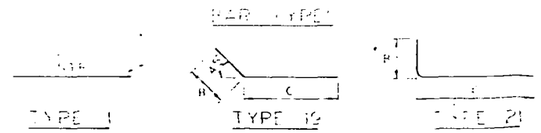


SECTION B-B

0 2 4
Scale in Feet
Unless Otherwise Shown

AS BUILT
8/22/74

STANDARD COVERED RISER	
DESIGN CONSTANTS	f'_c = 4000 psi, f_c = 1500 psi, n = 8, f_s = 20,000 psi
STANDARD DWG. NO.	ES-3048-3015E
DATE	SHEET 4 OF 4



Notes:
1. Bar dimensions are out to out of bar.
2. The 2" and 3" dimensions from face of concrete to steel are clear distances.
3. Radius of bends equals 3 bar diameters for sizes equal to or less than #7.

CONEWANGO CREEK WATERSHED PROJECT
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CHAUTAUQUA COUNTY, NEW YORK
RISER STRUCTURAL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Adapted J. Toennessen 11/71

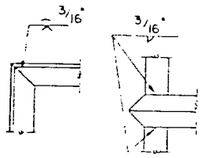
NY-2161-P

LOW STAGE TRASH RACK BILL OF MATERIALS

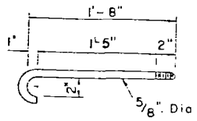
ITEM		SIZE	LENGTH	QUANTITY
Angle	A	3½" x 3½" x ⅜"	1'-0"	2
Angle	B	"	4'-0"	2
Angle	C	"	7'-0"	2
Angle	D	"	5'-7⅞"	2
Angle	E	"	4'-8"	2
Angle	F	"	5'-2½"	2
Angle	G	"	5'-8⅜"	4
Angle	H	"	4'-2 1/16"	8
Angle	J	"	6'-2⅜"	2
Angle	K	"	3'-1"	2
Angle	L	"	1'-9"	2
Hook Bolts		⅝" Dia	2" x 1'-8"	4
Pipe Sleeves		¾" Dia	1'-3"	2
Pipe Sleeves		¾" Dia	6'-10"	2
Angle	(M)	4"x4" x ¼"	5'-8"	1

CONSTRUCTION DETAILS

1. All points of contact between angles to be welded.
2. Low stage trash rack to be galvanized in accordance with Spec 582. If necessary for galvanizing, trash rack may be fabricated in section and bolted with the approval of the Engineer.
3. Material in low stage trash rack shall conform to Spec 581 for structural steel.

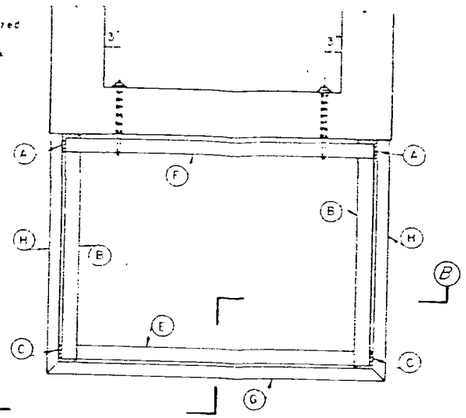


WELDING DETAILS

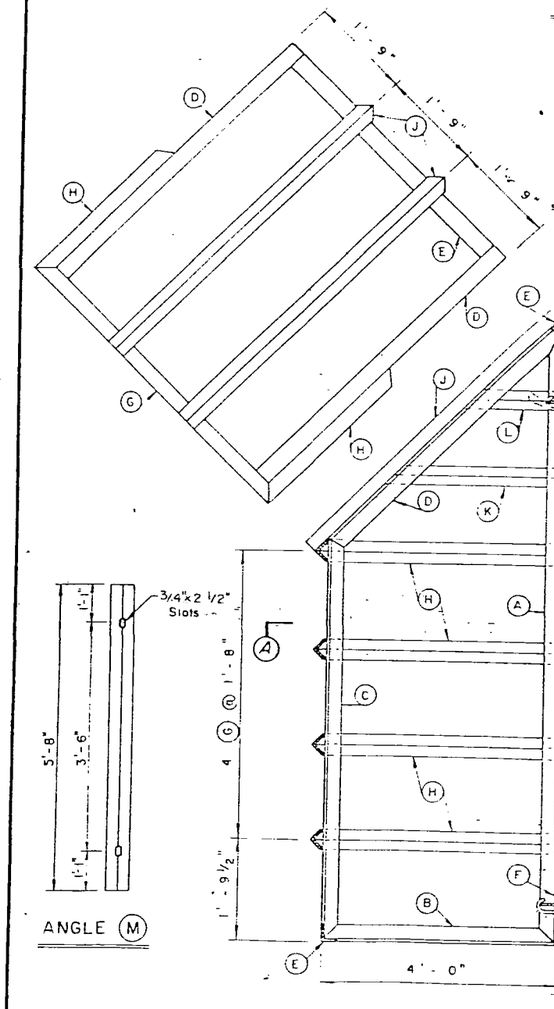


"HOOK" BOLT

supply with washer and Type 2 nut

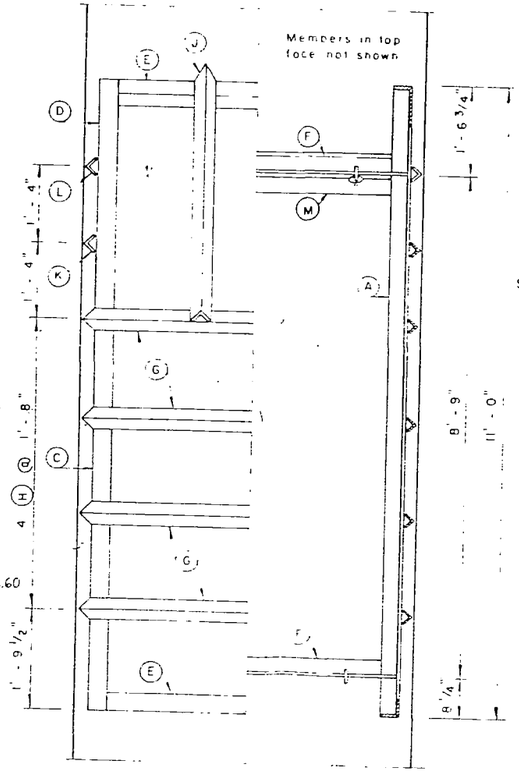


SECTION A A



ANGLE (M)

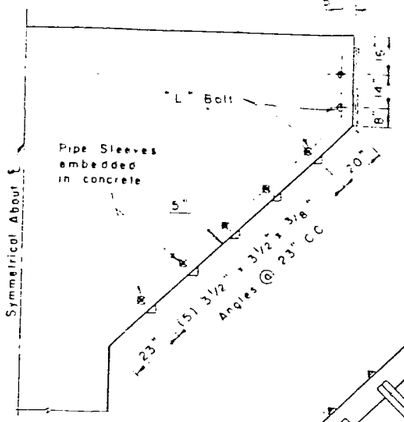
SECTION ON ℄

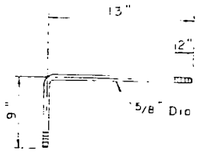


SECTION B B

0 1 2 3 4 Feet
SCALE

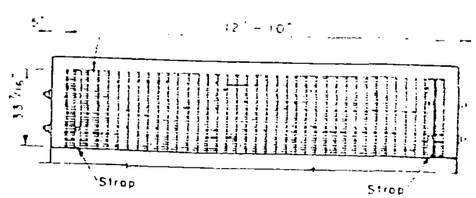
LOW STAGE TRASH RACK DETAILS





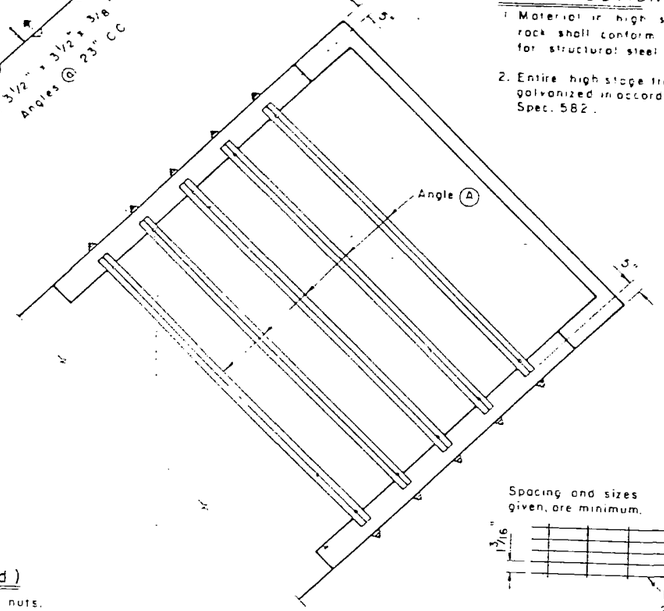
"L" BOLT (Galvanized)

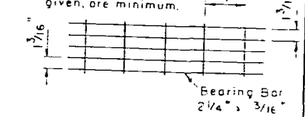
Supply with washers and Type 2 nuts.



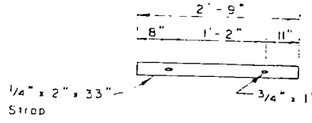
CONSTRUCTION DETAILS

1. Material in high stage trash rack shall conform to Spec 581 for structural steel.
2. Entire high stage trash rack to be galvanized in accordance with Spec. 582.

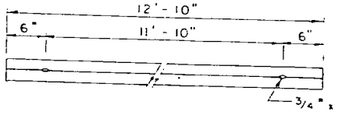




GRATING PANEL



STRAP



ANGLE (A)

HIGH STAGE TRASH RACK DETAILS

0 1 2 3 4 Feet
Scale

HIGH STAGE TRASH RACK BILL OF MATERIALS

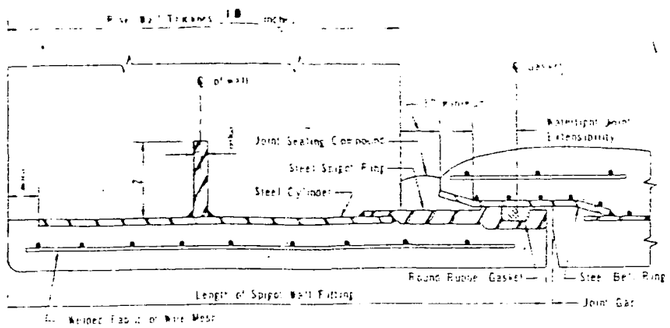
ITEM	SIZE	LENGTH	QUANTITY
Angles (A)	3½" x 3½" x ⅜"	12'-10"	10
Strap	¼" x 2" x 33"	—	4
"L" Bolt	⅝" Dia	9" x 13"	28
Grating Panel	33 7/16" x 12'-10"	—	2
Pipe Sleeves	¾" In Dia	12"	28

AS BUILT
8/22/74

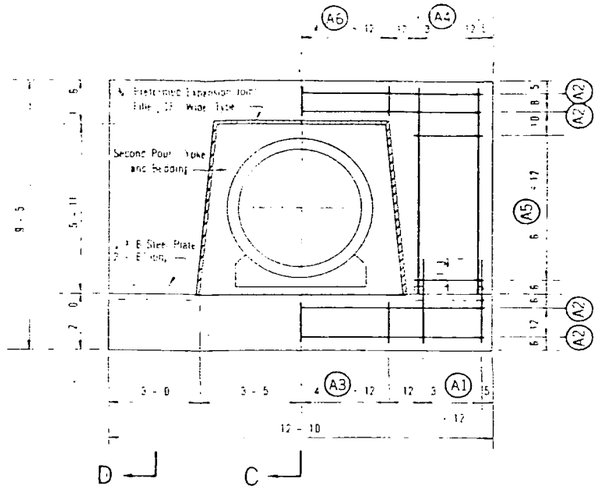
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
RISER TRASH RACKS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	Approved by	
Adopted J. TOENNIESSEN	11/71	Title	
Drawn D.R. Barnes	4/70	Date	
Traced		Sheet No.	
Checked		File No.	NY-2161-P

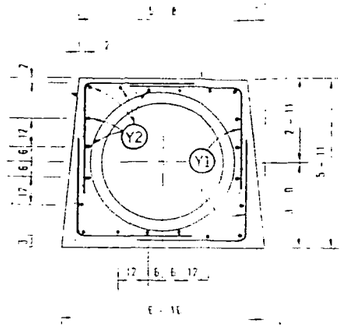


DETAIL A



DETAIL OF ANTI-SEEP COLLAR 7 REQUIRED

Yoke steel not shown



DETAIL OF ANTI-SEEP COLLAR YOKE

STEEL SCHEDULE

Anti-seep Collar and Yoke 7 Required

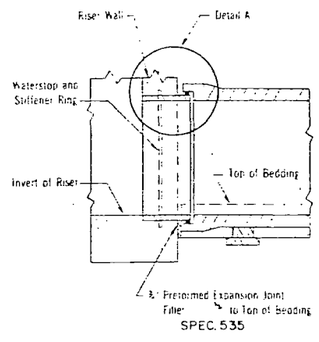
Mark	Size	Quantity Per Collar	Length	Type	Total Weight	
A1	4	6	3 - 0	1	42	126 - 0
A2	4	4	12 - 4	1	28	84 - 4
A3	4	7	1 - 6	1	49	73 - 6
A4	4	6	3 - 2	1	42	301 - 0
A5	4	12	3 - 6	1	84	210 - 0
A6	4	7	1 - 0	1	49	49 - 0
Y1	4	12	6 - 10	2	84	574 - 0
Y2	4	20	1 - 2	1	140	163 - 4

QUANTITIES

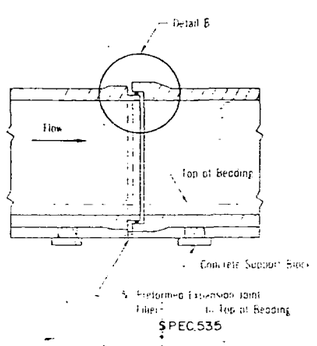
Concrete	Cu. Yds.
Anti-seep Collar including Yoke	
Total Bedding	22.0 cu YDS
Total	21.2 cu YDS
Steel	Pounds
Anti-seep Collar including Yoke 1842-2	1231.

57.46

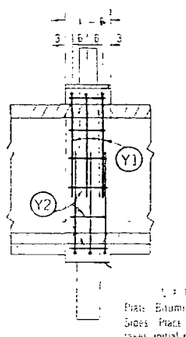
Concrete quantities are based on an outside diameter of pipe of 48 inches



DETAIL OF SPIGOT WALL FITTING

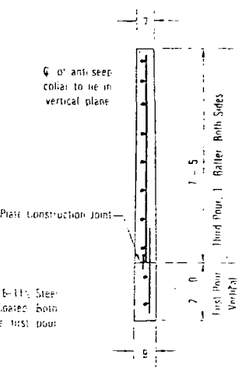


DETAIL OF PIPE JOINT

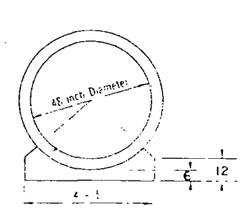


SECTION C-C

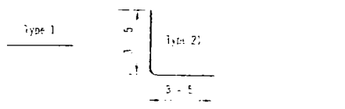
Anti-seep collar steel not shown



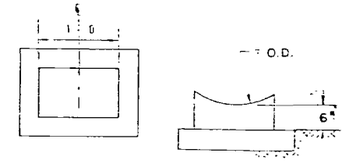
SECTION D-D



DETAIL OF BEDDING



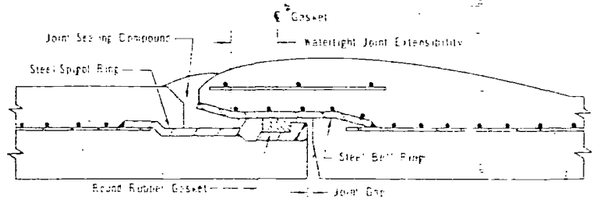
BAR TYPES



SUGGESTED SUPPORT BLOCKS

Sufficient blocks shall be provided to support the pipe to the required line and grade. The Contractor shall determine the number and size of blocks required. Wedges may be used as an alternate

8/22/74
AS BUILT



DETAIL B

JOINT REQUIREMENTS

# OF PIPE SECTIONS	Length of Pipe Sections	Min. Pipe Joint Length	Maximum Joint Limiting Angle	
EACH	feet	inches	radians	degrees
8	20.0	2 3/4	0.050	2°53'
1	18.0	2 3/4	0.050	2°53'

SUPPLY ONE SPIGOT RING WALL FITTING FOR 18' WALL CAST OUTSIDE OF SPIGOT RING WITH CONCRETE ON 18' SECTION

For pipe lengths other than shown, joint requirements will be determined by the Engineer.

When 2 pipe of different lengths are connected, assembling joint shall meet the requirements of the longer pipe.

Prior to the use of other than the joint detail proposed by the manufacturer shall be submitted to the Engineer for approval.

STRENGTH REQUIREMENTS

Inside Diameter of Pipe	Internal Load	External Load	
	Hydrostatic Pressure	Minimum 3 Edge Bearing Strength in Pounds per Lineal Foot of Pipe	
		Applicable Standard Specification	
		AWWA C-301	AWWA C-301
	Head of Water	Load to produce 0.001 inch crack one foot long	Load to produce 0.01 inch crack one foot long
inches	feet		
48	35.4	15,114	

The outside diameter of pipe assumed in design is 57.46 inches. Where the pipe furnished has an outside diameter greater than assumed in design, the three-edge bearing strength of the pipe furnished must not be less than the specified three-edge bearing strength multiplied by the ratio of the outside diameter of the pipe furnished to the outside diameter assumed in design.

STANDARD CONDUIT DETAILS FOR REINFORCED CONCRETE PRESSURE PIPE PRINCIPAL SPILLWAY	
STANDARD DWG. NO. ES-5048-BE	
DATE 2-70	SHEET 1 OF 1

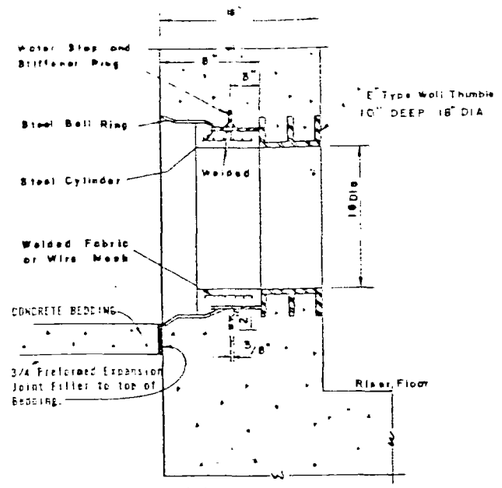
Joint length is the watertight joint extensibility plus joint gap.

The pipe shall be drawn together so that the maximum joint gap does not exceed ½ inch for pipe laid on a straight line. For centered pipe or pipe laid on a curved line, the joint gap at the closest point shall not exceed ½ inch.

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
48" DIA. CONDUIT DETAILS

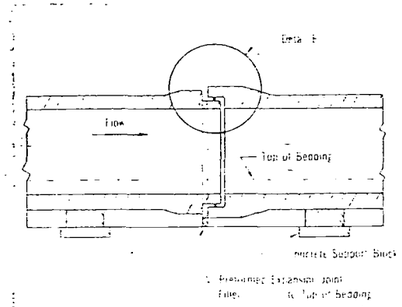
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
J.D. TOENNIESSEN	8-71	Title
Drawn		
W.M. TURNER	8-71	Date
Traced		
Checked		Sheet No. 17 of 17 Sheets
		Drawing No. NY-216-P

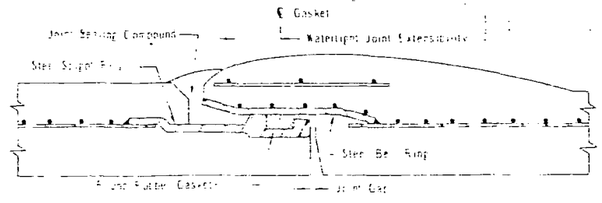


BELL WALL FITTING

W/ "E" TYPE WALL THIMBLE



DETAIL OF PIPE JOINT



DETAIL B

STANDARD CONDUIT DETAILS	
FOR REINFORCED CONCRETE PRESSURE PIPE PRINCIPAL SPILLWAY	
STANDARD DWG NO	ES-5018-BE
DATE 2-70	SHEET 1 OF 1

Joint of length equipped watertight joint material by pipe manufacturer.

The pipe shall be coupled together so that the maximum joint gap does not exceed ¾ inch for pipe laid on a straight line. For centered pipe or pipe laid on a curved line, the joint gap at the closest point shall not exceed ½ inch.

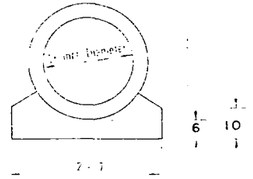
JOINT REQUIREMENTS

No. of PIPE SECTIONS EACH	Length of Pipe Section feet	Min. Joint Gap inches	Min. Joint Opening Angle Degrees & Minutes
2	20.0	2¾"	0.0960 E*30'

For pipe installed prior to placement of backfill material, a filler material shall be placed in the joint gap to prevent the entrance of backfill material into the joint gap.

Where pipe is to be laid on a curve, the number of joints and the joint gap required shall be determined by the Engineer.

Prior to delivery of pipe to the site, the Contractor shall submit proposed method of joint sealing to the Engineer for approval.

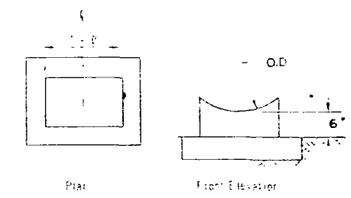


DETAIL OF BEDDING

STRENGTH REQUIREMENTS

Internal Load		External Load	
Min. Rupture Strength Required for Design Load		Min. Three-Edge Bearing Strength Required for Design Load	
Pipe Size	Min. Wall Thickness	Pipe Size	Min. Wall Thickness
inches	inches	inches	inches
18.0	3½.2	4712	

Design load is the sum of the dead load and the live load. The dead load is the weight of the earth fill over the pipe. The live load is the load imposed on the pipe by the wheels of a truck. The design load is 240 lbs. per linear foot per foot of diameter. The three-edge bearing strength is that load which will cause the specified three-edge bearing strength multiplied by the factor of the outside diameter of the pipe to result in the outside diameter assumed in design.



SUGGESTED SUPPORT BLOCKS

Sufficient blocks shall be provided to support the pipe in the required line and grade. The Contractor shall determine the number and size of blocks required. Wedges may be used as an alternate.

8/22/74
AS BUILT

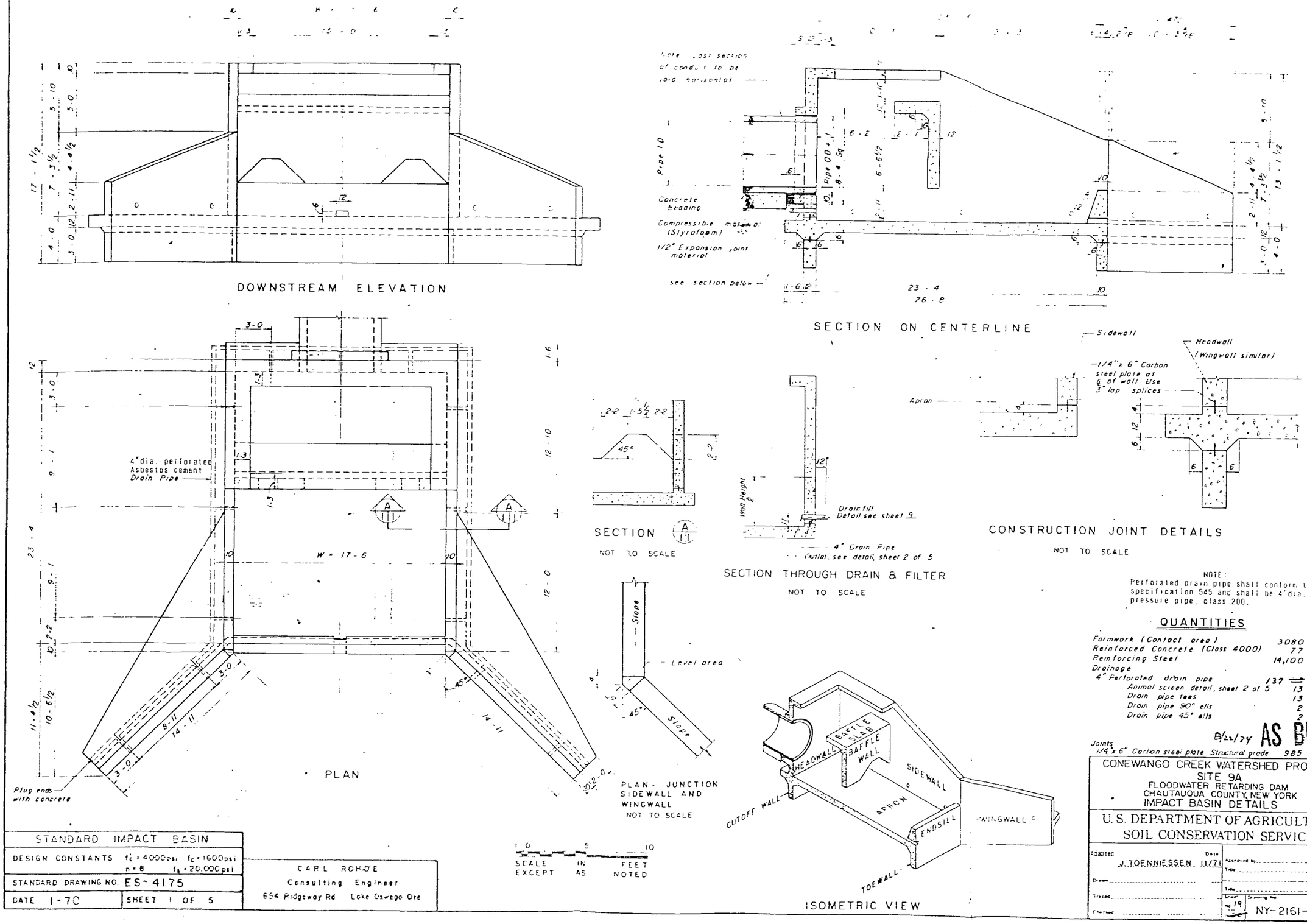
QUANTITIES (THIS SHEET ONLY)

CONCRETE 2.4 Cu Yds.
(NON-REINF.)

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
RESERVOIR DRAIN CONDUIT DETAILS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		Approved by
Designed JULIUS D. TOENNIESSEN	9-71		Title
Drawn WILLIAM TURNER	9-71		Date
Traced		Sheet No. 18	Drawing No. NY-2161-P
Checked			



NOTE:
Perforated drain pipe shall conform to specification 545 and shall be 4" dia. pressure pipe, class 200.

QUANTITIES

Formwork (Contact area)	3080	Sq Ft
Reinforced Concrete (Class 4000)	77	Cu Yds
Reinforcing Steel	14,100	lbs
Drainage		
4" Perforated drain pipe	137	Lin Ft
Animal screen detail, sheet 2 of 5	13	ea
Drain pipe tees	13	ea
Drain pipe 90° ells	2	ea
Drain pipe 45° ells	2	ea
Joints		
1/4" x 6" Carbon steel plate Structural grade	985	lbs

8/22/74 AS BUILT

STANDARD IMPACT BASIN	
DESIGN CONSTANTS f'_c = 4000 psi f_c = 1600 psi n = 8 f_s = 20,000 psi	
STANDARD DRAWING NO. ES-4175	
DATE 1-70	SHEET 1 OF 5

CARL ROHDE
Consulting Engineer
654 Ridgeway Rd Lake Oswego Ore

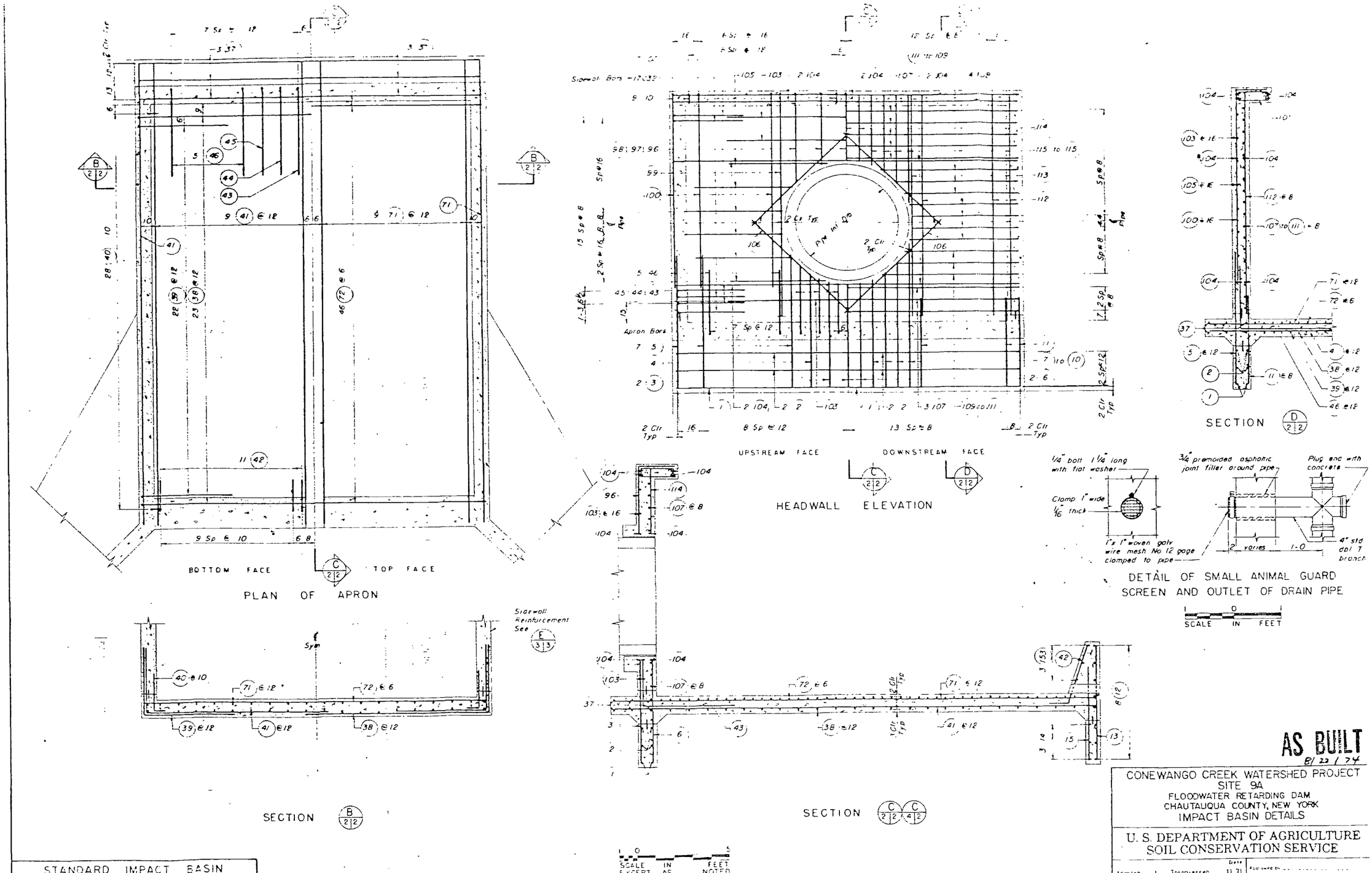
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
IMPACT BASIN DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Adapted J. TOENNIESSEN Date 11/71
Drawn
Traced
Checked
Approved by
Title
Title
Sheet No. 19
Drawing No. NY-2161-P

34

Form SCS 314 November 1955



AS BUILT
8/22/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
IMPACT BASIN DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

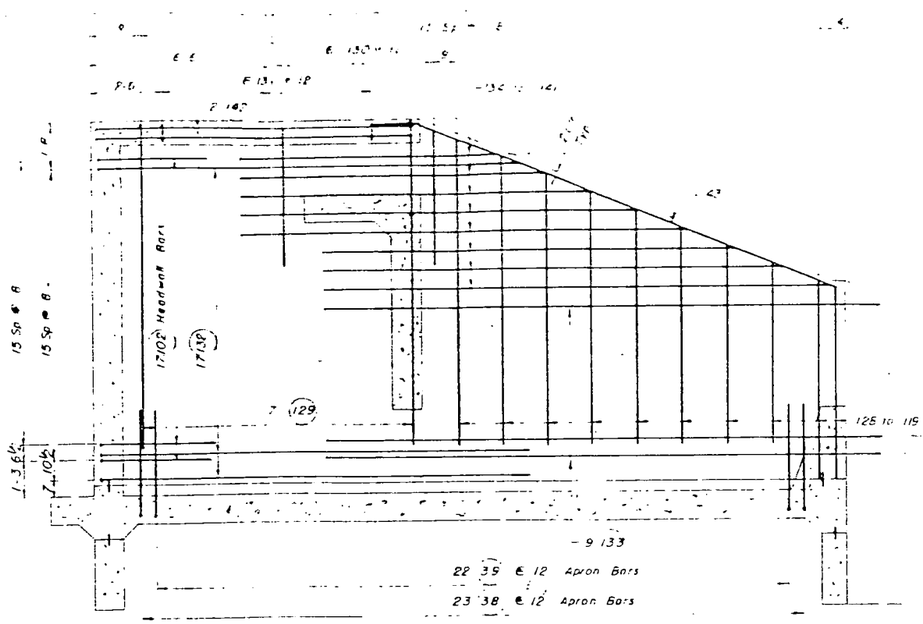
Adapted J. Tosmiessen	Date 11.71
Drawn	
Traced	
Checked	
Approved by	
Title	
Sheet No. 20 of 30	Drawing No. NY-2161 - P

STANDARD IMPACT BASIN	
DESIGN CONSTANTS f'_c = 4000 psi, n = 8	f_c = 1600 psi, f_s = 20,000 psi
STANDARD DRAWING NO. ES-4175	
DATE 1-70	SHEET 2 OF 5

CARL ROHDE
Consulting Engineer
654 Ridgeway Rd Lake Oswego, Ore

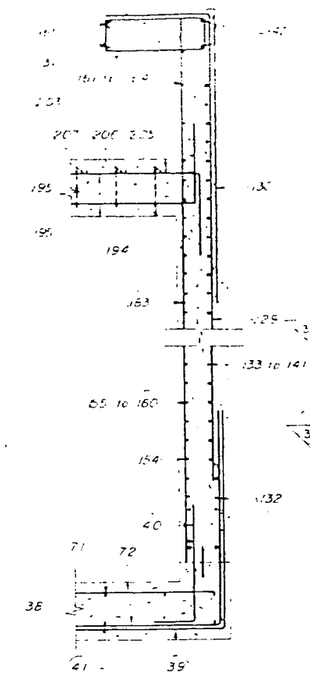
34

B-22



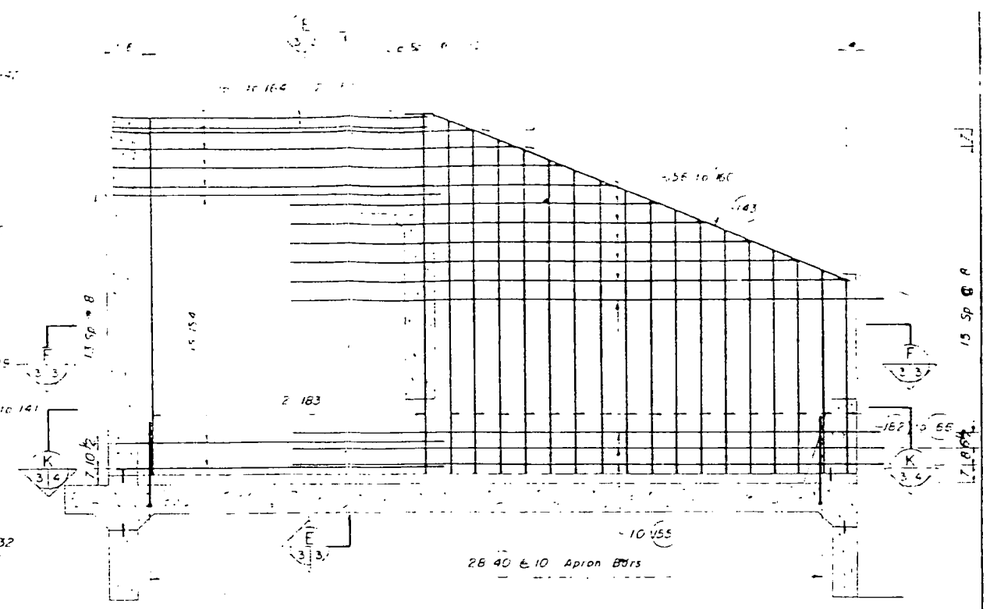
UNEXPOSED FACE

ELEVATION SIDEWALL



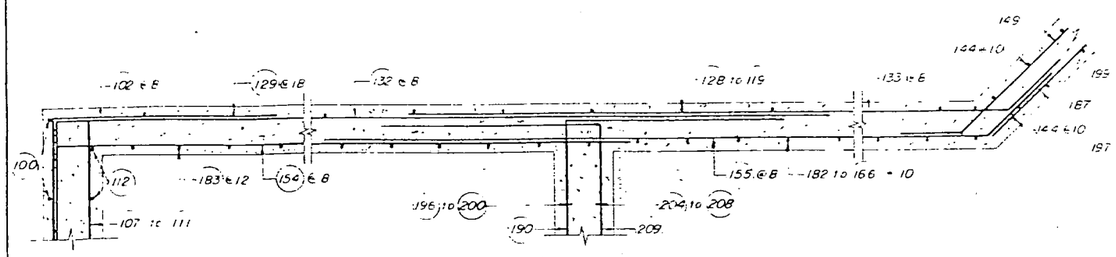
SECTION E 3 3

SCALE 0 1 2 IN FEET



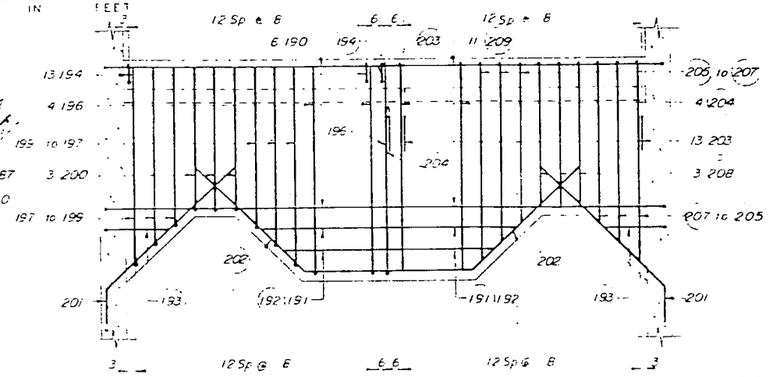
EXPOSED FACE

ELEVATION SIDEWALL



SECTION F 3 3 F 4 3

SCALE 0 1 2 IN FEET

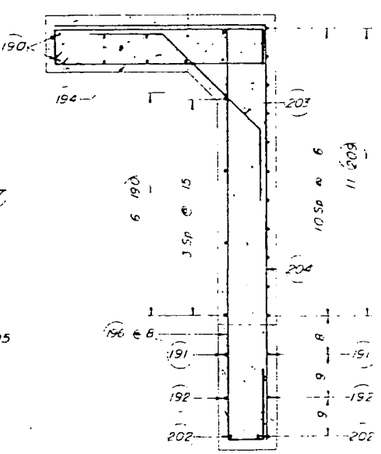


UPSTREAM FACE

DOWNSTREAM FACE

BAFFLE ELEVATION G 3 3

SCALE 0 5 EXCEPT AS NOTED FEET



SECTION G 3 3

SCALE 0 1 2 IN FEET

AS BUILT 8/22/74

STANDARD IMPACT BASIN	
DESIGN CONSTANTS	f'_c = 4000 psi f_c = 1600 psi; n = 8 f = 20,000 psi
STANDARD DRAWING NO ES-4175	
DATE 1-7[illegible]	SHEET 3 OF 5

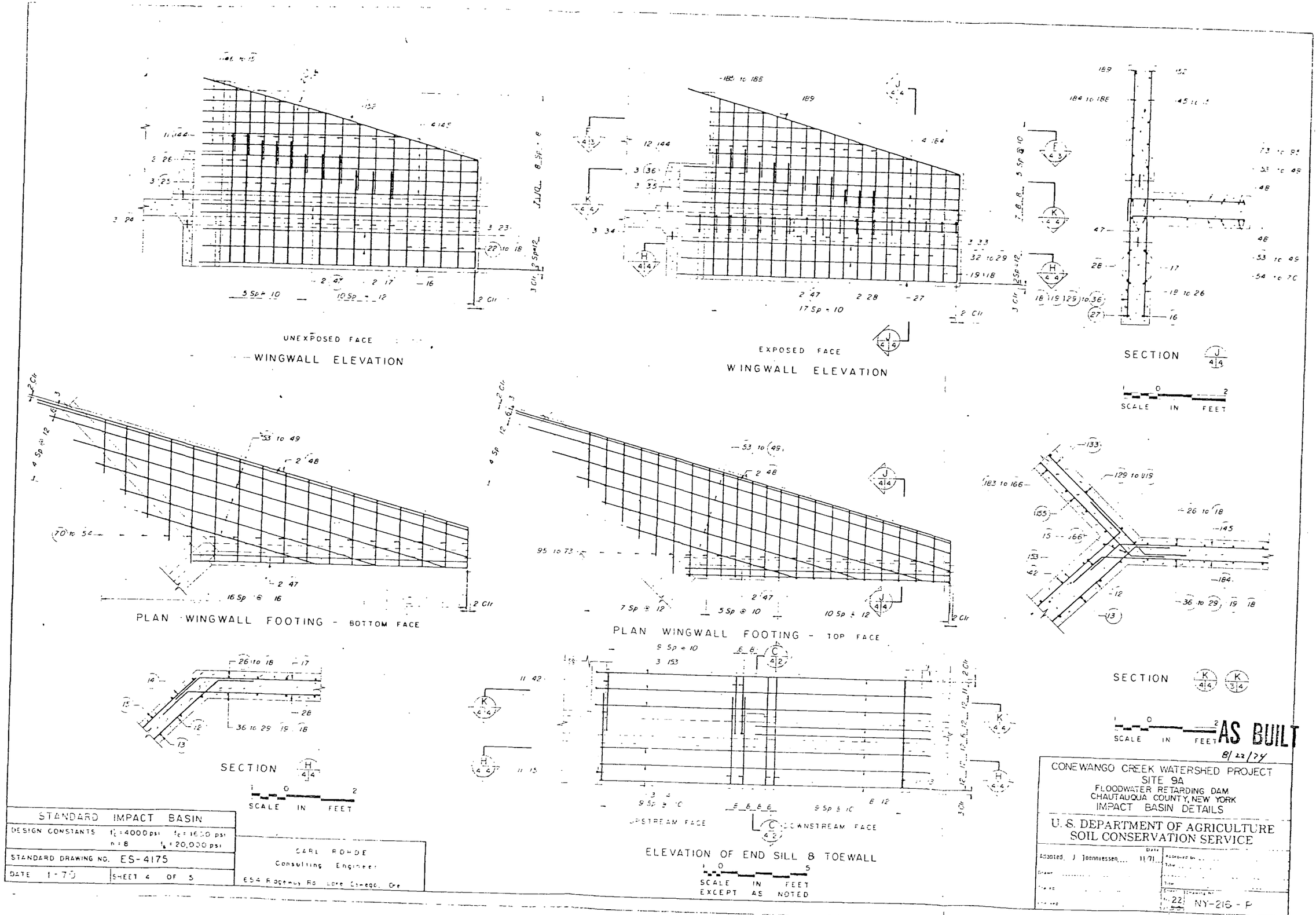
CARL ROHDE
Consulting Engineer
654 Ridgeway Rd Lake Oswego, Ore

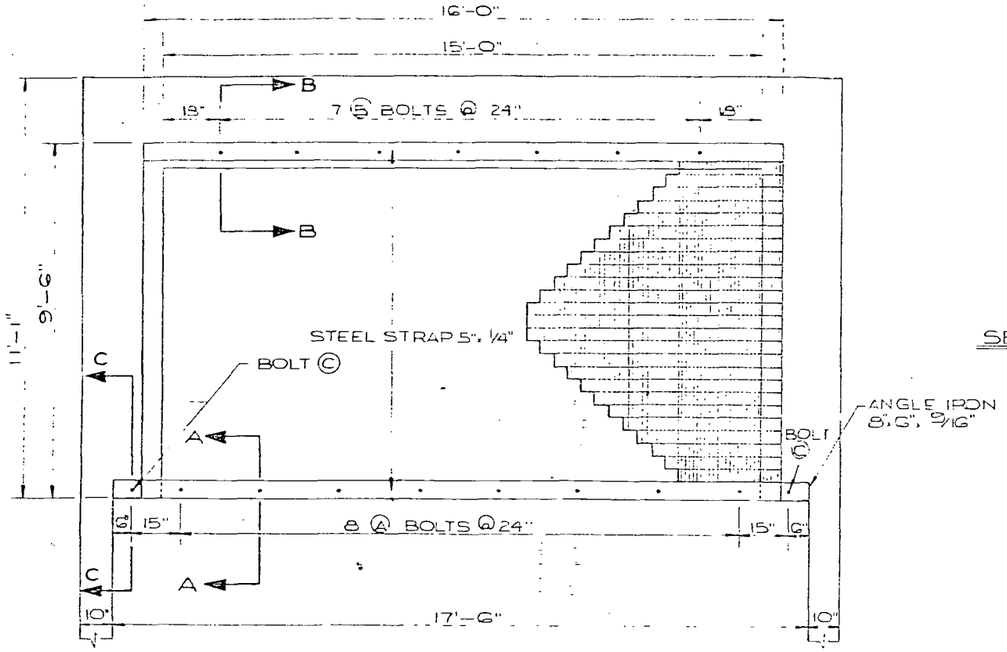
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
IMPACT BASIN DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

J. Tennessen ACCEPTED Date 11-71

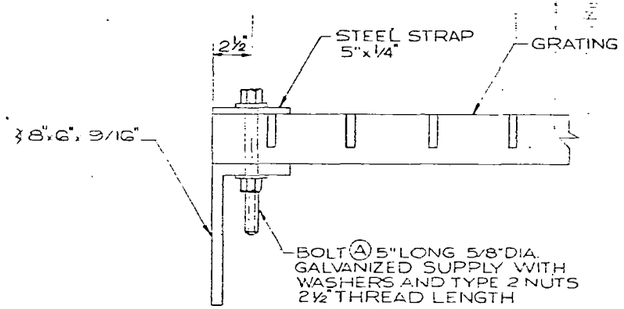
No. 21 NY-2161-P


UNEXPOSED FACE
WINGWALL ELEVATION
EXPOSED FACE
WINGWALL ELEVATION
SECTION J/4|4
SCALE IN FEET
PLAN WINGWALL FOOTING - BOTTOM FACE
PLAN WINGWALL FOOTING - TOP FACE
SECTION K/4|4 K/3|4
SCALE IN FEET
SECTION H/4|4
SCALE IN FEET
UPSTREAM FACE
DOWNSTREAM FACE
ELEVATION OF END SILL & TOEWALL
SCALE IN FEET EXCEPT AS NOTED
AS BUILT
8/22/74
CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
IMPACT BASIN DETAILS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Adapted J. Joenniessen 11/71
22
NY-216 - P
STANDARD IMPACT BASIN
DESIGN CONSTANTS f'c = 4000 psi fc = 1600 psi
n = 8 fs = 20,000 psi
STANDARD DRAWING NO. ES-4175
DATE 1-70
SHEET 4 OF 5
CARL ROHDE
Consulting Engineer
654 Ridgeway Rd. Lake Oswego, Ore.

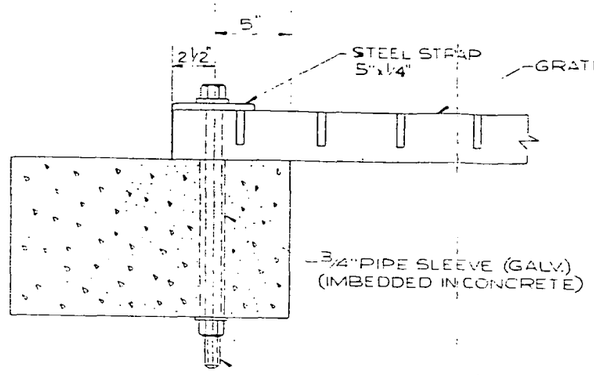


PLAN VIEW

0 1 2 4
SCALE IN FEET.

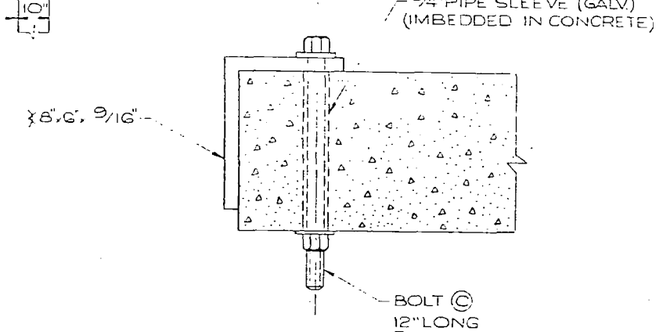


SECTION A-A



SECTION B-B

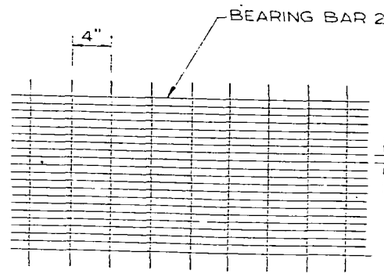
BOLT Ⓑ 14" LONG 5/8" DIA GALVANIZED SUPPLY WITH WASHER AND TYPE 2 NUTS. 2½" THREAD LENGTH



SECTION C-C

IMPACT BASIN GRATING BILL OF MATERIAL

ITEM	SIZE	LENGTH	QUANTITY
GRATING PANEL	1'-6"x2'-0"		1
STRAP	5"x 1/4"	16'-0"	2
ANGLE IRON	8"x6"x 9/16"	17'-6"	1
BOLT Ⓐ	5/8" DIA	5"	8
BOLT Ⓑ	5/8" DIA	14"	7
BOLT Ⓒ	5/8" DIA	12"	2
PIPE SLEEVES	3/4" DIA	10"	9



GRATING PANEL GALVANIZED (NOT TO SCALE)

CONSTRUCTION DETAILS

1. MATERIAL IN IMPACT BASIN GRATING SHALL CONFORM TO SPEC. 581 FOR STRUCTURAL STEEL.
2. ENTIRE IMPACT BASIN GRATING TO BE GALVANIZED IN ACCORDANCE WITH SPEC. 582.

8/22/74
AS BUILT

CONEWANGO CREEK WATERSHED
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
IMPACT BASIN GRATING

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed	J.D. TOENNIESSEN	11/71	Approved
Drawn	WILLIAM TURNER	11/71	Title
Traced			Title
			Sheet No. NY-2161-P

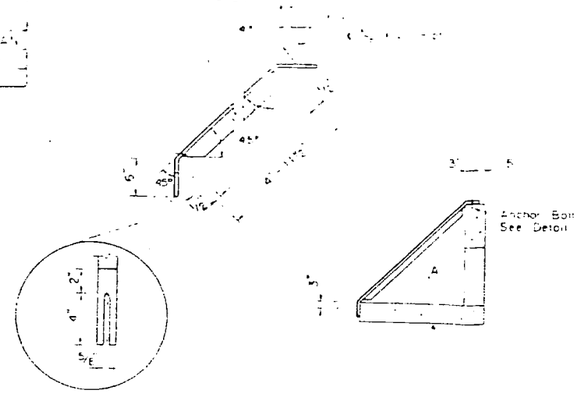
B-25

RESERVOIR DRAIN TRASH RACK BILL OF MATERIALS

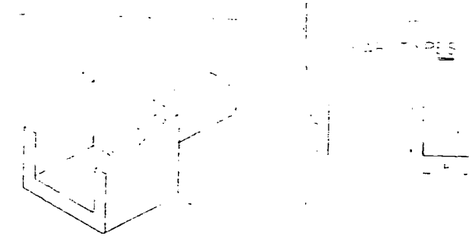
ITEM	SIZE	LENGTH	QUAN.
Angle A	1½" x 1½" x ¼"	5'-1½"	2
Anchor Bolt	½" Dia	2" x 8"	4

CONSTRUCTION DETAILS

1. Material in reservoir drain trash rack shall conform to Spec. 581 for structural steel.
2. Trash rack to be galvanized in accordance with Spec. 582.



TRASH RACK



ISOMETRIC

RESERVOIR DRAIN STEEL SCHEDULE

Mark	Quan.	Size	Length	Type	B	C	Total Length
[illegible]	5	4	3'-7"	1			[illegible]
D-2	4	4	5'-1"	2	2'-9"	2'-6"	2[illegible]
D-3	4	4	6'-0"	2	2'-9"	3'-3"	24.00
D-4	4	4	5'-0"	2	2'-9	2'-3"	20.00
D-5	2	4	2'-11"	2	2'-2"	0'-9"	5.83
D-6	4	4	4'-4"	2	[illegible]	0'-9"	[illegible]
D-7	2	4	4'-6"	2	3'-9"	0'-9"	9.00
D-8	3	4	3'-6"	1			[illegible]

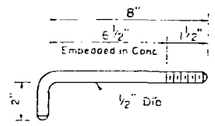
QUANTITIES (This Sheet Only)

STEEL

No. 4 Bar 126.3 x .84 lbs

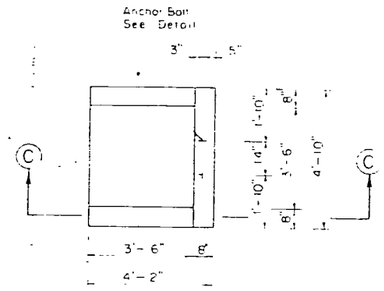
CONCRETE

1.4 Cu. Yds. Reinforced

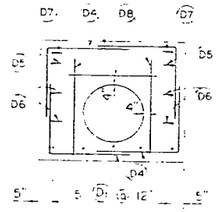


ANCHOR BOLT

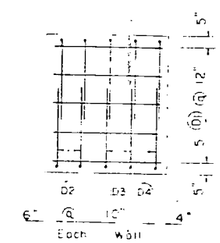
Material to conform to Spec. 581



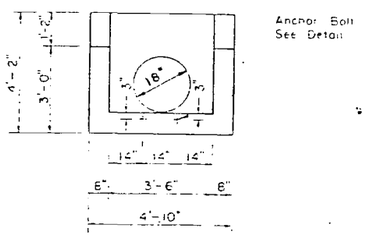
PLAN



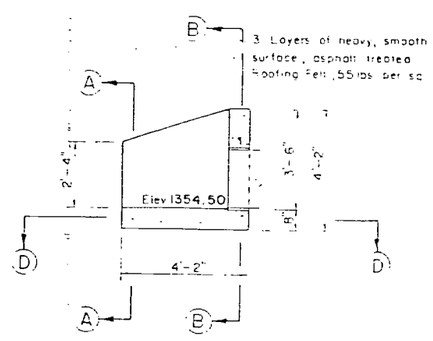
SECTION BB



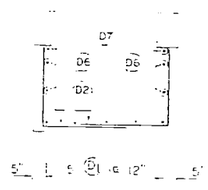
SECTION DD



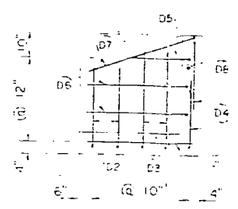
UPSTREAM ELEVATION



SECTION ALONG CENTERLINE



SECTION AA



SECTION CC

REINF. CONCRETE RESERVOIR DRAIN INLET

8/22/74

AS BUILT

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
RESERVOIR DRAIN INLET DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Adapted J. E. POLULECH 3-70
D. J. ANGELO
W. E. GRAJKO Jr. 3-70

25/34 NY-2161-P

MATERIAL DESCRIPTIONS
USDA SOIL TYPE

A

Gravel, sandy, w/little silt (59-5?% gravel, 36-34% sand, 11-5% fines); max size 20", 3-2? +6", 15-6? 3-6"; gray-brown; moist, saturated in parts of flood plain; rapid permeability; non-plastic; medium-dense; alluvial and glacio-fluvial (outwash); DS 303.1 and DS 202.2 (GM-GP)

B

Gravel, sandy, w/little silt (63% gravel, 27% sand, 10% fines); max size 20", 7?-6", 18% 3-6"; brown; moist; rapid permeability; non-plastic; medium-dense; alluvial; DS 205.2 (GM-GP)

C

Sand, gravelly, w/little silt (20% gravel, 69% sand, 11% fines); Max size 2½", brown; moist-sat.; rapid permeability; non-plastic; medium; alluvial; DS 5.1; (SM-SW)

D

Sand, gravelly, w/silt and clay (38% gravel, 45% sand, 17% fines); Max size 8", 3%-3"; gray-brown; moist; moderate permeability; LL=19, PI=5; hard; alluvial; DS 7.2; (SC-SM).

E

Gravel, silty w/sand (33-28% gravel, 27--26% sand, 46-40% fines); max size 15", 3%-6", 8% 3-6"; color grades from brown to gray with depth; moist-wet; permeability varies from impermeable to rapid; non-plastic; dense-very dense; glacial till; DS 204.1 (gray), 206.1 (brown); (GM)

F

Silt and clay, sandy w/gravel (23-25% gravel, 27-25% sand, 53-52% fines); max size 6", 2% +3" brown-yellow brown; moist; moderate permeability; non-plastic to LL=23, PI=6; hard; colluvial; DS 202.1 (ML), 7.1 (CL-ML).

G

Silt and clay, gravelly, w/sand (25% gravel, 19% sand, 56% fines); max size 3"; red-brown; moist; slight permeability; LL=32, PI=11; very stiff; lacustrine; DS 102.1 (CL-ML).

H

Silt, sandy (1% gravel, 38% sand, 61% fines); max size 3/4"; brown; Wet-saturated; rapid permeability; non-plastic; medium-dense; lacustrine; DS 301.2 (ML)

I

Silt, sandy w/gravel (12-11% gravel, 15-12% sand, 76-74% fines); max size 1"; brown-yellow brown; moist; moderate permeability; non-plastic; loose-medium; colluvial; DS 205.1 and "MR" (ML)

J

Silt and clay, sandy (2% gravel, 6% sand, 92% fines); max size 3/4"; brown; moist-saturated; slight-moderate permeability; LL=36, PI=13; very stiff; lacustrine; DS 208.1 (CL-ML).

K

Silt (100% fines); max size 2 mm.; gray and brown; moist-saturated; slight-moderate permeability; non-plastic; dense; lacustrine; DS's 4.1 and 301.1 (ML)

L

Topsoil, gravelly in flood plain; some roots and organic material; brown; moist; medium to rapid permeability; loose; ave. thickness ~ 1.0'.

M

Gravel, sandy w/silt (est. 55% gravel, 30% sand, 15% fines); max. size 20"; 5% +6", 15% 3-6"; grey-brown; moist; rapid permeability; non-plastic; very, very dense (n)) 100); cemented alluvial gravel, stratified. (GM)

BACKHOE PIT LOGS

TP #1, C/L Dam 8/29/68 DBC 1375.2

0.0	1.5	Material	L	(Topsoil)
1.5	3.5	"	I	(ML)
3.5	11.5	"	B	(GM-GP)
11.5	13.5	"	K	(ML)

Note: Dry Pit.

TP #2, C/L Dam 8/29/68 DBC 1367.6

0.0	1.0	Material	L	(Topsoil)
1.0	1.8	"	I	(ML)
1.8	3.0	"	B	(GM-GP)
3.0	10.5	"	A	(GM-GP)
10.5	13.0	"	K	(ML)

Note: Water level @ 10.0'

TP #3, C/L Dam 8/30/68 DBC 1364.8

0.0	1.0	Material	L	(Topsoil)
1.0	11.7	"	A	(GM-GP)
11.7	15.2	"	K	(ML)

Note: Dry pit

TP #4, C/L Dam 8/27/68 DBC 1360.4

0.0	1.0	Material	L (Topsoil)
1.0	8.2	"	A (GM-GP)
8.2	9.2	"	AAC (GM-GP, SM-SW)
9.2	16.5	"	K (ML) D.S. 4.1

Note: Water level @ 8.0'

TP #5, C/L Dam 8/27/68 DBC 1357.8

0.0	0.5	Material	L	(Topsoil)
0.5	4.0	"	A	(GM-GP)
4.0	7.5	"	C	(SM-SW) D.S. 5.1
7.5	12.0	"	K & H	interbeds (ML)

Note: Water level @ 6.7'. Materials K & H are often rhythmically bedded.

TP #6, C/L Dam 8/27/68 DBC 1353.3

0.0	3.0?	Material	A	(GM-GP)
3.0?	11.0	"	M	(GM)

Note: Water level @ surface (pit in stream). Break based on degree of difficulty of digging.

TP #7, C/L Dam 8/27/68 DBC 1379.3

0.0	1.0	Material	L	(Topsoil)
1.0	12.0	"	F	(CL-ML) D.S. 7.1
12.0	14.0	"	D	(SC-SM) D.S. 7.2

Note: Small seep @ 11.0'. Starts to slough @ 9.7'

TP #101, Borrow Area 8/29/ 68 DBC 1397.7

0.0	1.0	Material	L	(Topsoil)
1.0	13.0	"	E	(GM)(brown)

Note: Dry pit.

TP #102, Borrow Area 8/29/68 DBC 1372.1

0.0	1.0	Material	L	(Topsoil)
1.0	2.0	"	I	(ML)
2.0	5.0	"	A	(GM-GP)
5.0	7.0	"	G	(CL-ML) D.S. 102.1
7.0	12.0	"	E	(GM)(brown)

Note: Water level @ 7.0'

TP #103, Borrow Area 8/29/68 DBC 1402.2

0.0	1.0	Material	L	(Topsoil)
1.0	2.5	"	I	(ML)
2.5	6.0	"	B	(GM-GP)
6.0	14.0	"	E	(GM) brown

Note: Dry pit

TP #201 Emergency Spillway 8/29/68 DBC 1389.0

0.0	1.5	Material	L	(Topsoil)
1.5	17.0	"	E	(GM) brown

Note: Dry pit

TP #202 Emergency Spillway 8/29/68 DBC 1414.2

0.0	1.0	Material	L	(Topsoil)
1.0	2.5	"	F	(ML) D.S. 202.1
2.5	5.5	"	I	(ML)
5.5	8.0	"	A	(GM-GP) D.S. 202.2
8.0	16.0	"	E	(GM) brown
16.0	18.0	"	E	(GM) gray

Note: Dry pit

TP #203 Emergency Spillway 8/29/68 DBC 1389.1

0.0	1.0	Material	L	(Topsoil)
1.0	3.0	"	I	(ML)
3.0	7.0	"	B	(GM-GP)
7.0	16.0	"	E	(GM) brown

Note: Slight seep @ 13.0'. Break between materials B and E is not very distinct

TP #204 Emergency spillway 8/29/68 DBC 1401.0

0.0	1.0	Material	L	(Topsoil)
1.0	10.0	"	E	(GM) brown
10.0	14.4	"	E	(GM) gray D.S. 204.1
14.4	17.5	"	E	(GM) brown

Note: Water level at 17.0'. Material E is sandier between 14.4 and 17.5'

TP #205 Emergency Spillway 8/28/68 DBC 1397.1

0.0	0.5	Material	L	(Topsoil)
0.5	1.8	"	I	(ML) D.S. 205.1
1.8	11.0	"	B	(GM-GP) D.S. 205.2
11.0	15.0	"	E	(GM) brown

Note: Dry pit. Soil scientist calls DS 205.1 (Mat'l 1) the B_{21} horizon of the Chenango Fan phase and DS 205.2 (Mat'l B) the IIC_1 horizon of the Chenango Fan phase.

TP #206 Emergency Spillway 8/28/68 DBC 1400.7

0.0	0.7	Material	L	(Topsoil)
0.7	1.8	"	I	(ML)
1.8	9.0	"	B	(GM-GP)
9.0	16.0	"	E	(GM) brown D.S. 206.1

Note: Dry pit

TP #207 Emergency Spillway 8/28/68 DBC 1381.2

0.0	1.0	Material	L	(Topsoil)
1.0	2.5	"	I	(ML)
2.5	6.0	"	B	(GM-GP)
6.0	14.7	"	E	(GM) brown
14.7	16.0	"	J	(CL-ML)

Note: Slight seep @ 14.5'

TP #208 Emergency Spillway 8/28/68 DBC 1384.3

0.0	0.7	Material	L	(Topsoil)
0.7	1.6	"	I	(ML)
1.6	6.7	"	B	(GM-GP)
6.7	12.7	"	E	(GM) brown
12.7	15.0	"	J	(CL-ML) DS 208.1

Note: Water level @ 12.0'. Material E is siltier than usual.

TP #209 Emergency Spillway 8/28/68 DBC 1380.8

0.0	0.8	Material	L	(Topsoil)
0.8	3.5	"	B	(GM-GP)
3.5	7.0	"	E	(GM) brown
7.0	9.8	"	E	(GM, brown
9.8	15.5	"	J	(CL-ML)

Note: Water level @ 9.3'. Material E is siltier than usual (same as in TP208) from 7.0-9.8'. Some cobbles and sandy streaks in material J. Lots of flat, angular 3-6" cobbles near bottom

TP #210 Emergency Spillway 8/29/68 DBC 1392.1

0.0	1.0	Material	L	(Topsoil)
1.0	1.7	"	I	(ML)
1.7	4.0	"	B	(GM-GP)
4.0	4.7	"	E	(GM) brown
4.7	16.0	"	E	(GM) brown

Note: Dry pit. Material E is siltier from 4.0-4.7'.

TP #301 Prin Spwy (Initial) 8/27/68 DBC 1355.4

0.0	0.5	Material	L	(Topsoil)
0.5	4.5	"	A	(GM-GP)
4.5	6.5	"	C	(SM-SW)
6.5	12.0	"	K&H	interbeds (ML) DS 301.1, 301.2

Note: Water level @ 6.5'. Materials K & H are rhythmically bedded, with DS 301.1 representing the finer fraction and DS 301.2 representing the coarser fraction.

TP #302 Prin Spwy (Initial) 8/27/68 DBC 1356.2

0.0	1.0	Material	L	(Topsoil)
1.0	4.0	"	A	(GM-GP)
4.0	13.0	"	K&H	interbeds (ML)

Note: Water level @ 4.0'.

TP#401 Out. Chan. (Initial) 8/30/68 DBC 1357.4

0.0	1.0	Material	L	(Topsoil).
1.0	7.0	"	A	(GM-GP)
7.0	12.0	"	K&H	interbeds (ML)
12.0	15.0	"	A	(GM-GP)

Note: Water level @ 5.4'.

TP #402 Out. Chan. (Initial) 8/30/68 DBC 1351.9

0.0	1.0	Material	L	(Topsoil)
1.0	7.0	"	A	(GM-GP)
7.0	11.0	"	K&H	interbeds (ML)

Note: Water level @ 5.5'.

TP #501 Drain Line 8/28/68 DBC 1[illegible]

0.0	1.0	Material	L	(Topsoil)
1.0	2.0	"	I	(ML)
2.0	12.0	"	A	(GM-GP)
12.0	15.0	"	K	(ML)

Note Water level @ 11.0'

TP #502 Drain Line 8/28/68 DBC 13[illegible].4

0.0	1.0	Material	L	(Topsoil)
1.0	10.5	"	A	(GM-GP)
10.5	16.0	"	K	(ML)

Note: Water level @ 10.0'

TP #503 Drain Line 8/28/68 DBC 13[illegible].3

0.0	11.0	Material	A	(GM-GP) D.S. [illegible]
11.0	12.0	"	K&H	interbeds (ML)

Note: Water level @ 8.7'

TP #504 Drain Line 8/28/68 DBC 1362.1

0.0	1.0	Material	L	(Topsoil)
1.0	5.0	"	A	(GM-GP)
5.0	14.0	"	M	(GM)

Note: Dry pit. Hard digging in Material M. DS "MR" from bank above pit 504. See plan and profiles.

8/22/74
AS BUILT

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
LOGS OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DRAWN Bruce Champion 9-18-68 | APPROVED [illegible] STATE CONS ENGINEER
TITLE GEOLOGIST
TRACED A. Dudley 11-5-69
CHECKED [illegible]

NY-2161-P

DRILL HOLE LOGS

DH #51 C/L Dam 9/13/68 DBC Elev. 1351.0

7	Material L (Topsoil)	0.0	
67	" L (ML)	1.5	
42	" B (GM-GP)	2.5	
35	▼ 5'10" 9/18/68 5 day		
23			
31			
9			
9	1.05 fpd	10.5	
9	" A (GM-GP)	13.6	
30	" J (CL-ML)	15.5	
35			
20	0.23 fpd		
28	" K (ML)		
41		19.0	
46	0.10 fpd		
30	" KAH interbeds (ML)		
3			
20	0.76 fpd	25.5	

DH #52 C/L Dam 9/13-15/68 DBC Elev. 1355.6

12	Material L (Topsoil)	0.0	
43	" A (GM-GP)	0.5	
60	▼ 4'10" 9/18/68 5 day		
32	83.5 fpd		
17			
7		9.3	
21	" J (CL-ML)		
33		12.5	
36	" K (ML)	13.5	
44			
30			
59	0.123 fpd		
69			
29	" KAH interbeds (ML)		
19			
21	0.554 fpd		
22			
23			
32	0.586 fpd	30.6	

Note: Driller noted free water @ 16.5-17' and 28-30'.

DH #53 C/L Dam 9/12/68 DBC Elev. 13[illegible].7

9		0.0	
32	" A (GM-GP)		
29			
17	1.91 fpd		
23	▼ 7'3" 9/18/68 5 day	9.2	
31	" AAG interbeds (GM-GP,SM-SC)	9.4	
31	" J (CL-ML)	10.1	
33	0.300 fpd		
34	" K (ML)		
32		13.5	
21			
25	0.016 fpd		
25	" KAH interbeds (ML)		
26			
37	1.69 fpd		
24			
20		19.5	
23	0.350 fpd		
23			
21	" AAG interbeds (GM-GP,SM-SC)		
16	0.003 fpd		
6			
9			
31	77.8 fpd		
		34.1	

DH #53A C/L Dam 9/18/68 DBC Elev. 1361.2

	Material L (Topsoil)	0.0	
	" A (GM-GP)	6.0	
	▼ 7'3" 9/18/68 5 day	7.7	
	" AAG interbeds (GM-GP,SM-SC)	8.1	
	" J (CL-ML)	8.8	
	" K (ML)	9.[illegible]	
		11.[illegible]	

Note: 3" diam. Shelby sample from 9.5-11.0'. Refusal @ 1000 P.S.I., 1.1' recovery.

DH #54 C/L Dam 9/11-12/68 DBC Elev. 1353.0

13			
36	▼ 2.0' 9/18/68 6 day		
42	35.4 fpd		
46	Material A (GM-GP)		
67			
91			
108/4 Aug.	0.227 fpd		
205			
100/2 Aug.			
155/5 Aug.			
177/4 Aug.	0.122 fpd		
100/2 Aug.			
256/5 Aug.	Material M (GM)		
133			
144/4 Aug.	6.93 fpd		
197/2 Aug.			
211/5 Aug.			
100/2 Aug.			
100/2 Aug.			
Aug.			
111/4	2.88 fpd		
Aug.			
200/5 Aug.			
133/5		42.0	

Note: 2 day water table at 1.7'

DH #[illegible] C/L Dam 9/12/68 DBC Elev. 1374.0

4	Material L (Topsoil)	0.0	
36		1.7	
27	" F (CL-ML)		
28	0.1336pd		
38	▼ 5'0" 9/18/68 6 day		
55	Note: 1 day water level = 8.3'. Caved @ 5'5".	5.0	
43	" D (SC-SM)		
40			
114		10.5	
119			
81	" L (GM)		
139			
89			
70			
192		22.5	

DH #55 Emer. Spwy. 9/11-17/68 DBC Elev. 1400.3

10	Material L (Topsoil)	0.0	
40	" F (ML)	4.1	
32	" J (CL-ML)	5.1	
27	83.4 fpd		
20	" B (GM-GP)		
2-	▼ 6'10" 9/18/68 1 day		
40		9.[illegible]	
55	" E (GM) (brown)		
34			
43		14.1	
33			
27	5.20 fpd		
40			
39			
34	" E (GM) (gray)		
28			
22	0.955 fpd		
35			
25			
26			
33			
47	2.32 fpd	Quick condition 31.5-33.5	
95/4 Aug.			
172/4 Aug.			
155/5 Aug.			
200/5 Aug.			
190/4 Aug.			
133/5			
		33.[illegible]	
	M (GM)		
		47.[illegible]	

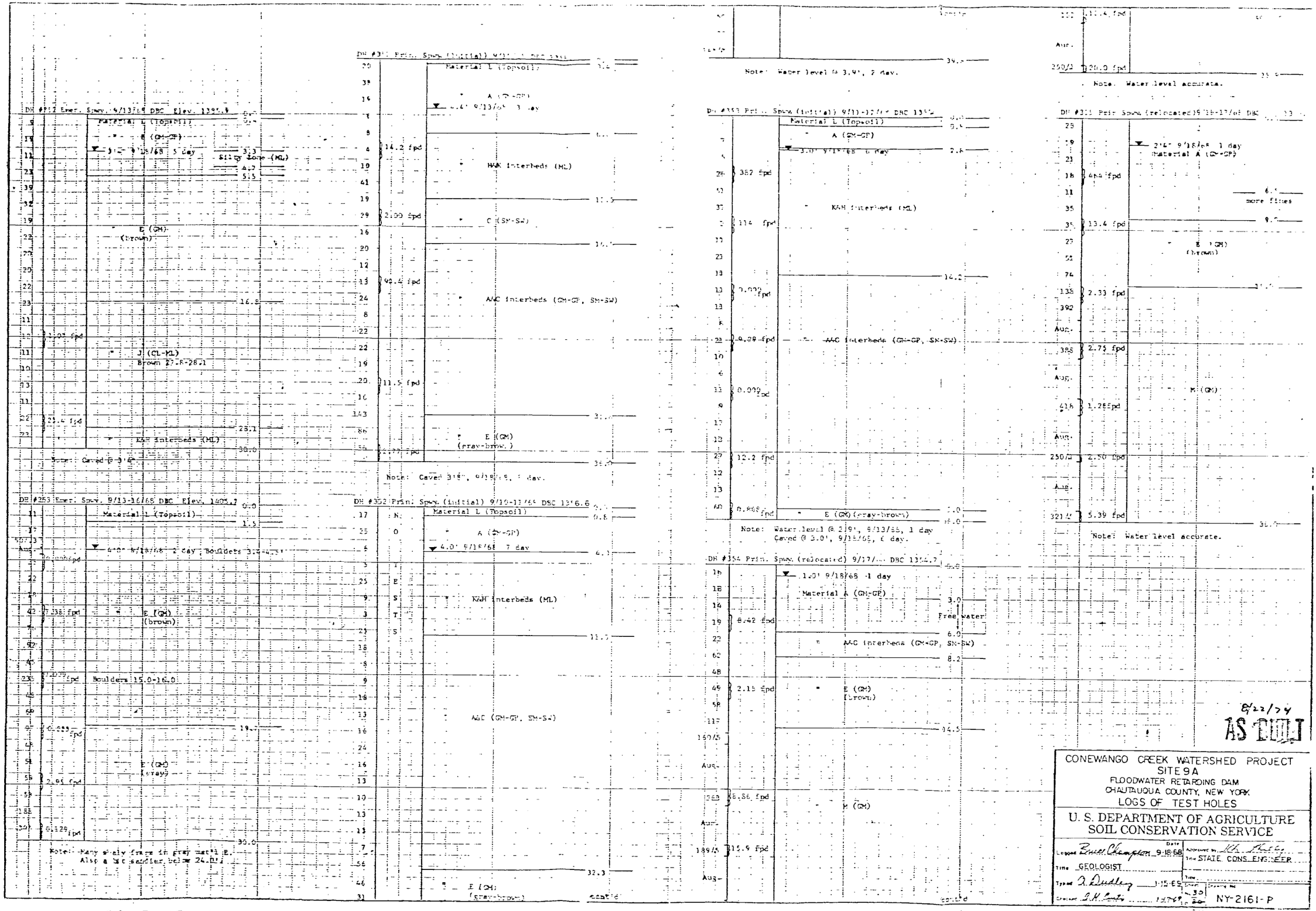
Note: Quick condition 31.5-33.5'. Water level probably not accurate.

8/22/74
AS BUILT

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
LOGS OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Logged	Bruce Thompson 9.18.68	Date	Approved by: [illegible] Title: STATE CONS. ENGINEER
Title	GEOLOGIST		
Typed	A. Dudley 1-15-69		Title
Checked	[illegible] 1-19-69	Sheet No. 29	Drawing No. NY-2161-P



8/22/74

AS BUILT

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
LOGS OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Logged Bruce Champion 9-18-68
Title GEOLOGIST
Typed A. Dudley 1-15-69
Checked J. H. Curtis 1-17-69
Approved by [signature]
Title STATE CONS. ENGINEER
Sheet 30 of 30
Drawing No. NY-2161-P

SLOPE VARIES (3:1 OR FLATTER)

VARIES

8.0

BANK RUN GRAVEL
20' WIDE TREAT
LOCATIONS AS SHOWN
BY SKETCH BELOW

2.5

1/3

EMERGENCY SPILLWAY BENCH

5.0 MIN

EMERGENCY SPILLWAY

(NOT TO SCALE)

SLOPE

1.0'

BANK RUN GRAVEL

2.5'

2.5'

BLIND TILE WITH HAY OR STRAW OR OTHER SUITABLE MATERIAL - MIN. OF 6" OVER TILE

SHAPE BOTTOM OF TRENCH FOR PLACEMENT OF TILE

(NOT TO SCALE)

Alter to Construction Type

Use Method I or II
For Spacing of Tile Trench

TILE LINE GRADE MUST BE UNIFORM FOLLOWING THE EMERGENCY SPILLWAY BENCH SLOPE
MIN. COVER SHALL BE 24"

OUTLET DETAIL

BANK RUN GRAVEL

STEEL PIPE OUTLET WITH RODENT GUARD

TILE LINE

1.0' MIN

20.0'

3/1

EMERGENCY SPILLWAY

(NOT TO SCALE)

WOODS

DISPOSAL AREA

UNOFFICIAL AREA

4.0' SUMP AREA

9.5' SUMP

10% SLOPE

SUMP

RUN

6.0%

6.0%

6.0%

6 FT SPWY.

2400

2400

2400

2400

OUTLET TILE LINE

OUTLET TILE LINE

(OCEAN AREA)

(NOT TO SCALE)

EST. BILL OF MATERIALS

4" TILE LINE PLASTIC	765 L.FT
BANK RUN GRAVEL	441 CU YDS
2 OUTLETS @ 20'EA	
4" STEEL CULVERT PIPE	40 L.FT
RODENT GUARDS	2 NO.
BLINDING MATERIAL	

TILE - CORRUGATED POLYETHYLENE DRAINAGE TUBING - HEAVY DUTY

CONEWANGO CREEK WATERSHED PROJECT
SITE 9A
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY NEW YORK
TILE DRAINAGE EMERGENCY SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed — Date
Drawn A. Gallagher 8/22/74
Traced
Checked
Approved by
Title
Title
Scale — Drawing No.
36
501

8/22/74
AS BUILT

SCS ENG 378-1 Rev. 7-64

Appendix G

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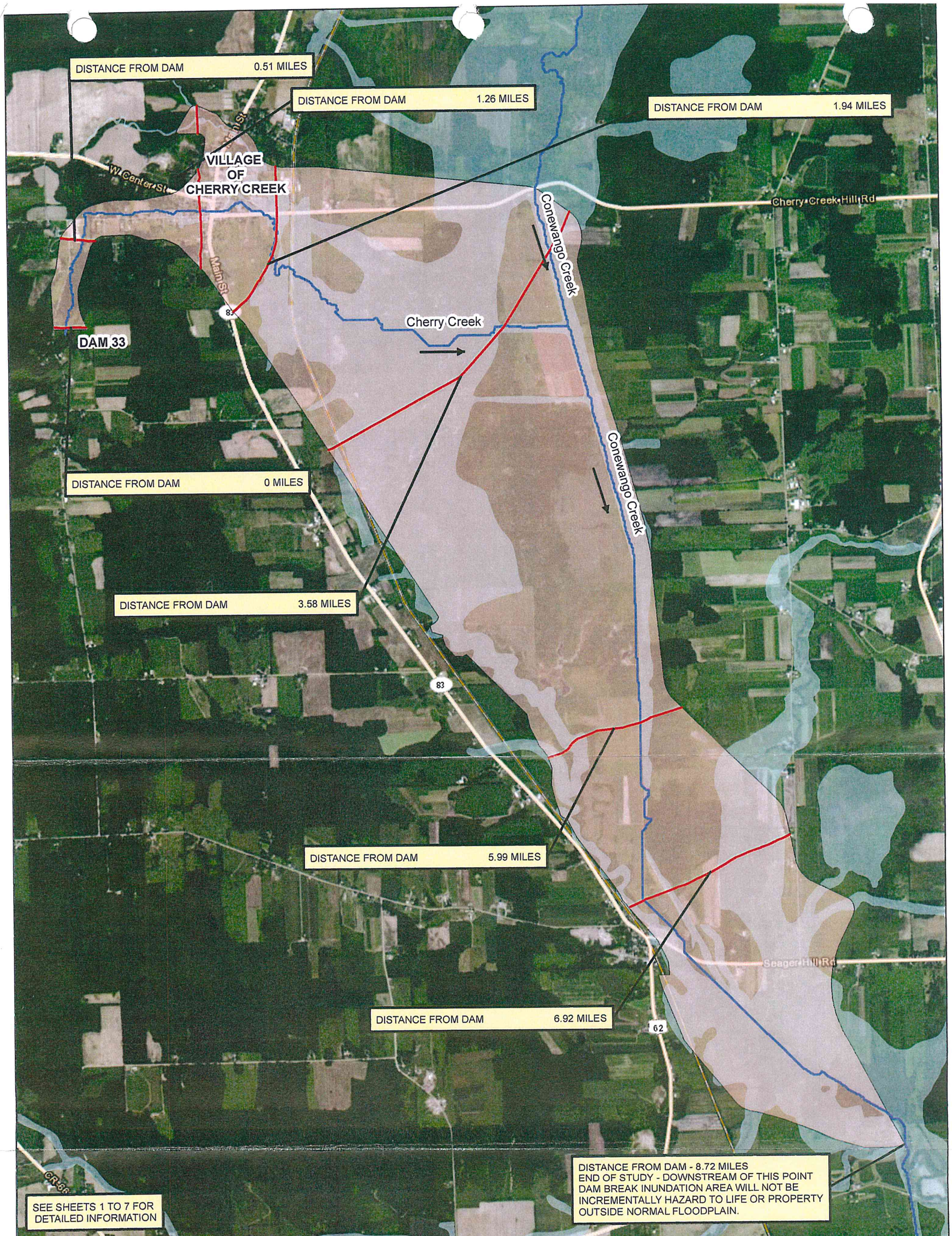
Conewango Creek Watershed Dam 33



DAM BREAK FLOOD INUNDATION MAPPING

OVERALL LAYOUT

CONEWANGO CREEK DAM 33

TY·LIN INTERNATIONAL
255 East Avenue
Rochester, NY 14604
(585) 512-2000

CHAUTAUQUA COUNTY
454 N. Work Street
Falconer, NY 14733
(716) 661-8400

FEBRUARY 2014

SUMMARY OF DAM FAILURE

This map depicts potential inundation areas and flooding conditions that could result from dam failure occurring during large storm events when the reservoir is at maximum pool elevation.

NOTE: The flooding information and inundation areas shown on this map are approximate and should be used only as a guideline for establishing evacuation zones. Actual flooding conditions may differ from those depicted on the map.

Service Layer Credits: Copyright:© 2013 Esri, DeLorme, NAVTEQ, TomTom
Copyright:© 2013 National Geographic Society, i-cubed
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

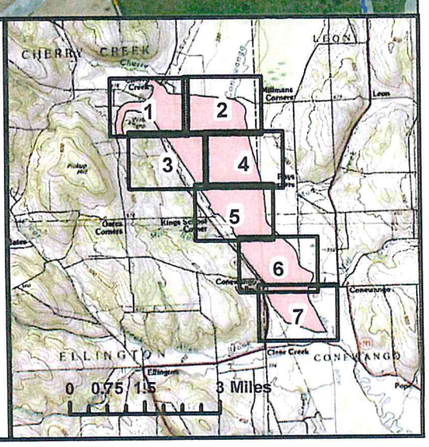
LEGEND

- Flood Inundation Area
- FIS Documented 100 Year Flood*
- Cross-Section
- Stream

*Source of FIS 100 Year Flood: The Q3 Flood Zone Data derived from the Flood Insurance Maps (FIRM) puiblished by the Federal Emergency Management Agency (FEMA); from the NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246

N

0 0.375 0.75 Miles



For Official Use Only – Not for Distribution 8/31/2010

Emergency Action Plan (EAP)

Conewango Creek Watershed, Dam No. 33

National Inventory of Dams (NID) No. NY00581

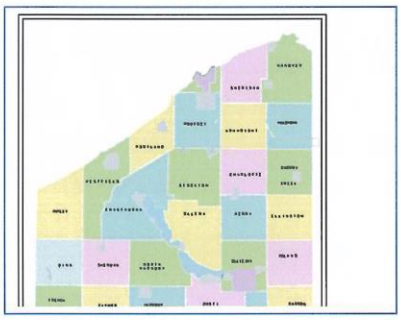
Chautauqua County, New York

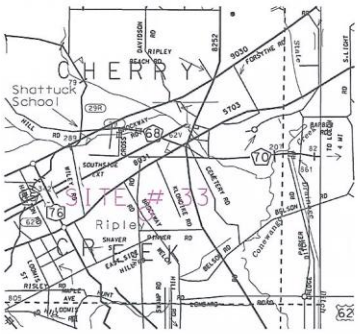
Chautauqua County Conservation District

With assistance from the

U.S. Department of Agriculture

Natural Resources Conservation Service





Insert local area map showing specific location of dam

Reviewed and Updated:

Fred C. Crosset

Chair, Chautauqua County Conservation District

5/25/11

Date

Sheriff, Chautauqua County, NY

5/20/2011

Date

Copy ___ of___

Conewango Creek Watershed, Dam No. 33, Chautauqua County, NY– NID NY00581

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Basic EAP Data

Purpose

The purpose of this EAP is to reduce the risk of human life loss and injury and minimize property damage during an unusual or emergency event at Conewango Creek Watershed, Dam No. 33.

Potential Impacted Area

See Inundation/*Evacuation Mapping* tab (Appendix B–4) and *People at Risk* tab (Appendix B–5) for the locations that may be flooded if the dam should fail and the estimated time for the flood wave to travel from the dam to these locations

Dam Description

Height: 57 ft
Built: 1974
Legal Description: Sects. 14 and 23, T13N, R21W
Latitude: 42.286944 Longitude: 79.114444
National Inventory of Dams No.: NY 00581

Drainage Area: 350 acres
Hazard Classification: High
Dam Operator: Chautauqua County
Maj. Prop. Owner: Richard D. Milks / Crist H. Shelter
Dam Designer: NRCS

See detailed design data in *Appendix B* tab.

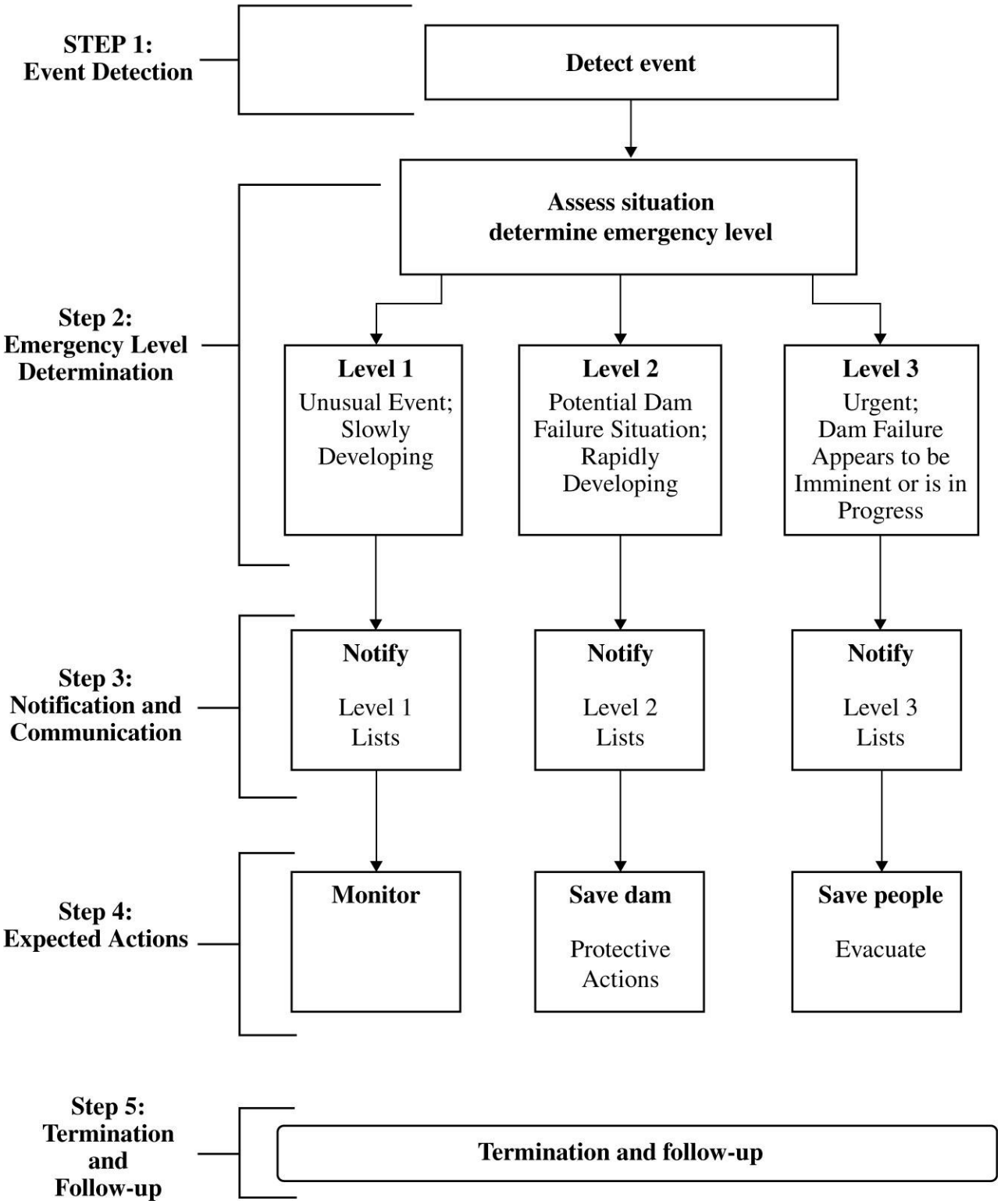
Directions to dam (See *Location and Vicinity Map*; Appendix B–2.)

From blinking light in Cherry Creek heading North on NYS Rt. 83, Turn left on Southside Ave. Take Southside Ave. to Pickup Hill Road. Turn left on Pickup Hill Rd. to the Dam on the left side of the road.

If the main route is flooded head north on NYS Rt. 83 from Conewango Valley, turn left on Pinner Road. Take Pinner Road to intersection of Pickup Hill Road. Turn right on Pickup Hill Rd. to Dam site on right side of road.

Alternate route to the Dam is from main intersection in Ellington, take County Rd. 66 to Risley Rd. Turn right on Risley Rd. to Pickup Hill Rd. Turn left on Pickup Hill Rd. to Dam Site on the right side of road.

EAP Overview



Roles and Responsibilities

Dam Operator's Representative (Chaut County Soil & Water)

- As soon as an emergency event is observed or reported, immediately determine the emergency level (see *Emergency Levels* tab).
  - Level 1: unusual event, slowly developing
  - Level 2: potential dam failure situation, rapidly developing
  - Level 3: dam failure appears imminent or is in progress
- Immediately notify the personnel in the order shown on the notification chart for the appropriate level (see *Notification Charts* tab).
- Provide updates of the situation to the police/sheriff dispatcher to assist them in making timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the EAP is reviewed and updated annually and copies of the revised EAP are distributed to all who received copies of the original EAP.

Incident Commander (Chaut. Co. Sheriff)

- Serve as the primary contact person responsible for coordination of all emergency actions.
- When a Level 2 situation occurs: Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
- When a Level 3 situation occurs:
  - Initiate warnings and order evacuation of people at risk downstream of the dam.
  - Notify local emergency management services to carry out the evacuation of people and close roads within the evacuation area (see *Evacuation Map* tab).
- Decide when to terminate the emergency.
- Participate in an annual review and update of the EAP.

Emergency Management Services (Chaut. County EMS)

- Maintain communication with media.
- When a Level 2 situation occurs:
  - Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
  - Alert the public as appropriate.
- When a Level 3 situation occurs:
  - Alert the public.
  - Immediately close roads and evacuate people within the evacuation area (see *Evacuation Map* tab).
- Participate in an annual review and update of the EAP.

Dam Operator's Technical Representatives (NRCS)

- Advise the dam operator of the emergency level determination, if time permits.
- Advise the dam operator of remedial actions to take if Level 2 event occurs, if time permits.

State Dam Safety Agency (NYSDEC)

- Advise the dam operator of the emergency level determination, if time permits.
- Advise the dam operator of remedial actions to take if Level 2 event occurs, if time permits.

The Five-step EAP Process

Step 1 Event Detection

This step describes the detection of an unusual or emergency event and provides information to assist the dam operator in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations at or near the dam by government personnel (local, state, or Federal), landowners, visitors to the dam, or the public
- Evaluation of instrumentation data
- Earthquakes felt or reported in the vicinity of the dam
- Forewarning of conditions that may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

See *Guidance for Determining the Emergency Level* table for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

Step 2 Emergency Level Determination

After an unusual or emergency event is detected or reported, the Conservation District Manager or his alternate is responsible for classifying the event into one of the following three emergency levels:

Emergency Level 1—Nonemergency, unusual event, slowly developing:
This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. NRCS technical representatives or state dam safety officials should be contacted to investigate the situation and recommend actions to take. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Sheriff should be informed if it is determined that the conditions may possibly develop into a worse condition that may require emergency actions.

Emergency Level 2—Potential dam failure situation, rapidly developing:
This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The Sheriff should be notified of this emergency situation and placed on alert. The dam operator should closely monitor the condition of the dam and periodically report the status of the situation to the Sheriff. If the dam condition worsens and failure becomes imminent, the Sheriff must be notified immediately of the change in the emergency level to evacuate the people at risk downstream.

If time permits, NRCS and state dam safety officials should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The dam operator should initiate remedial repairs (note local resources that may be available—see Appendix B–1). Time available to employ remedial actions may be hours or days.

This emergency level is also applicable when flow through the earth spillway has or is expected to result in flooding of downstream areas and people near the channel could be endangered. Emergency services should be on alert to initiate evacuations or road closures if the flooding increases.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:
This is an extremely urgent situation when a dam failure is occurring or obviously is about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the earth spillway is causing downstream flooding of people and roads. The Sheriff should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed (see *Evacuation Map* tab).

See the following pages for guidance in determining the proper emergency level for various situations.

Guidance for Determining the Emergency Level

Event	Situation	Emergency level*
Earth spillway flow	Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion	1
	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	2
	Spillway flowing with an advancing headcut that is threatening the control section	3
	Spillway flow that is flooding people downstream	3
Embankment overtopping	Reservoir level is 1 foot below the top of the dam	2
	Water from the reservoir is flowing over the top of the dam	3
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2
	Seepage with discharge greater than 10 gallons per minute	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	2
	Rapidly enlarging sinkhole	3
Embankment cracking	New cracks in the embankment greater than ¼-inch wide without seepage	1
	Cracks in the embankment with seepage	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly proceeding slides of the embankment slopes	3
Instruments	Instrumentation readings beyond predetermined values	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Sabotage/ vandalism	Damage to dam or appurtenance with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	3

* Emergency Level 1: Nonemergency unusual event, slowly developing
* Emergency Level 2: Potential dam failure situation, rapidly developing
* Emergency Level 3: Urgent; dam failure appears imminent or is in progress

Examples of Emergency Situations

The following are examples of conditions that usually constitute an emergency situation that may occur at a dam. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original designed conditions can cause significant flow through the auxiliary spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency-level condition. The groupings are provided as guidance only. Not all emergency conditions may be listed, and the dam operator is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam.

Pre-existing conditions on this dam: There has been a small seepage area near the downstream toe on the north side of the release channel. This was first noticed in the 1990s, but has not changed since that time.

Earth Spillway Flows

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Significant erosion or headcutting of the spillway is occurring, but the rate does not appear to threaten an imminent breach of the spillway crest that would result in an uncontrolled release of the reservoir.
2. Flow through the earth auxiliary spillway is or is expected to cause flooding that could threaten people, homes, and/or roads downstream from the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Significant erosion or headcutting of the spillway is occurring at a rapid rate, and a breach of the control section appears imminent.
2. Flow through the earth auxiliary spillway is causing flooding that is threatening people, homes, and/or roads downstream from the dam.

Embankment Overtopping

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. The reservoir level is within 1 foot from the top of the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. The reservoir level has exceeded the top of the dam, and flow is occurring over the embankment.

Seepage and Sinkholes

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam or settlement of the dam is observed.
4. Reservoir level is falling without apparent cause.
5. The following known dam defects are or will soon be inundated by a rise in the reservoir:
   - Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
   - Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Embankment Movement and Cracking

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam that may eventually result in breaching of the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Sudden or rapidly proceeding slides, settlement, or cracking of the embankment crest, slopes, abutments, and/or foundation, and breaching of the dam appears imminent or is in progress.

Step 3 Notification and Communication

Notification

After the emergency level has been determined, the people on the following notification charts for the appropriate emergency level shall be notified immediately.

Communication

Emergency Level 1—Nonemergency, unusual event; slowly developing:
The Conservation District Manager and NRCS District Conservationist should contact the NRCS State Conservation Engineer and Conewango Watershed Commission. Describe the situation, and request technical assistance on next steps to take.

Emergency Level 2—Emergency event, potential dam failure situation; rapidly developing:
The following message may be used to help describe the emergency situation to the Sheriff or Chautuauqua County emergency management personnel:

"This is _____Identify yourself; name, position)_____.

We have an emergency condition at Conewango Creek Watershed, Dam No.33 , located 1 mile south of Cherry Creek.

We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 2.

We are implementing predetermined actions to respond to a rapidly developing situation that could result in dam failure.

Please prepare to evacuate the area along low-lying portions of Cherry Creek.

Reference the evacuation map in your copy of the Emergency Action Plan.

We will advise you when the situation is resolved or if the situation gets worse.

I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number _____."

Emergency Level 3—Urgent event; dam failure appears imminent or is in progress:
The Sheriff should be contacted immediately and the area evacuated (see *Evacuation Map* tab). The following actions should be taken:

1. Call the Sheriff's dispatch center. Be sure to say, "This is an emergency." They will call other authorities and the media and begin the evacuation. The following message may be used to help describe the emergency situation to the Sheriff or Chautauqua County emergency management personnel:

   "This is an emergency. This is _____Identify yourself; name, position)_____.

   Conewango Creek Watershed, Dam No. 33, located 1 mile south of Cherry Creek, is failing. The downstream area must be evacuated immediately. Repeat, Conewango Creek Watershed, Dam No. 33, is failing; evacuate the area along low-lying portions of Cherry Creek.

   We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 3. Reference the evacuation map in your copy of the Emergency Action Plan.

   I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number_____."

2. Do whatever is necessary to bring people in immediate danger (anyone on the dam, downstream from the dam, boating on the reservoir, or evacuees) to safety if directed by the Sheriff.
3. Keep in frequent contact with the Sheriff and emergency services to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.
4. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to re-establish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to re-establish contact with the Sheriff and emergency services.

The following prescripted message may be used as a guide for the Sheriff or Chautauqua County emergency services personnel to communicate the status of the emergency with the public:

Attention: This is an emergency message from the Sheriff. Listen carefully. Your life may depend on immediate action.

Conewango Creek Watershed, Dam No. 33, located 1 miles south of Cherry Creek, is failing. Repeat. Conewango Creek Watershed, Dam No. 33, located 1 mile south of Cherry Creek, is failing.

If you are in or near this area, proceed immediately to high ground away from the valley. Do not travel on Pickup Hill Rd. south of Cherry Creek or return to your home to recover your possessions. You cannot outrun or drive away from the flood wave. Proceed immediately to high ground away from the valley.

Repeat message.

Emergency Level 1 Notifications

Nonemergency
unusual event; slowly developing

Dam Operator's Rep.
Conewango Watershed / Conservation District Manager
Dave Spann (Chaut. Co. Soil & Water)
716-664-2351 x117 (Office)
716-969-5266 (Cell)

(1)

Dam Operator's Technical Reps.
Conewango Watershed
Ken Chase
716-296-5721 (Office)
716-499-5721 (Cell)

(2)

State Dam Safety Official.
DEC Division of Water
Alon Dominitz
518-402-8185 (Office)
518-852-0415 (Cell)

Dam Operator's Technical Reps.
NRCS Watershed Engineer
Batavia Office
585-343-9167 (Office)

Dam Operator's Technical Reps.
Chautauqua County
Dept. of Public Facilities
Drew Rodgers
716-661-8410 (Office)
716-450-4346 (Cell)

Dam Operator's Technical Reps.
NRCS State Engineer
Syracuse Office
315-477-6538 (Office)

Note:
1, 2, etc., denotes call sequence

Legend:
Calls by operator _____
Second level calls - - - - -

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Level 2 Notifications

Emergency event, potential dam failure situation; rapidly developing

Dam Operator's Rep.
Conewango Watershed / Conservation District Manager
Dave Spann (Chaut. Co. Soil & Water)
716-664-2351 x117 (Office)
716-969-5266 (Cell)

(1)

Dam Operator's Technical Reps.
Conewango Watershed
Ken Chase
716-296-5721 (Office)
716-499-5721 (Cell)

Dam Operator's Technical Reps.
Chautauqua County
Dept. of Public Facilities
Drew Rodgers
716-661-8410 (Office)
716-450-4346 (Cell)

Dam Operator's Technical Reps.
NRCS State Watershed Engineer
Batavia Office
585-343-9167

Dam Operator's Technical Reps.
NRCS State Engineer
Syracuse Office
315-477-6538

(2)

Incident Commander
Chautauqua County Sheriff
Jim Quattrone
716-753-4900 (Office)
911 (Emergency)
716-753-4232 (Non-Emergency)

Chautauqua County
Emergency Management
Dispatcher
716-753-4341 (Office)
911 (Emergency)

Chautauqua County
Sherriff's Dispatcher
911 (Emergency)
716-753-4232 (Non-Emergency)

New York State Police
Troop A Zone 3 Jamestown
716-665-3113

(3)

State Dam Safety Official
DEC Division of Water
Alon Dominitz
518-402-8185 (Office)
518-852-0415 (Cell)

Cattaraugus County
Emergency Management
Dispatcher
716-938-2240 (Office)

Ellington Volunteer
Fire Department
716-287-2168(Non-Emergency)
911 (Emergency)

National Weather Service
Judith Levan, Warning
Coordinating Meteorologist
716-565-0103

Note:
1, 2, etc., denotes call sequence

Legend:
Calls by operator _____
Second level calls - - - - - -

See *Communications* tab for prescripted messages.

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Level 3 Notifications

Urgent event, dam failure appears imminent or is in progress

Dam Operator's Rep.
Conewango Watershed / Conservation District Manager
Dave Spann (Chaut. Co. Soil & Water)
716-664-2351 x117 (Office)
716-969-5266 (Cell)

(1)

Incident Commander

Chautauqua County Sheriff

Jim Quattrone

716-453-4900 (Office)
911 (Emergency)
716-753-4232 (Non-Emergency)

Chautauqua County
Emergency Management
Dispatcher
716-753-4341 (Office)
911 (Emergency)

Chautauqua County Sheriff's
Dispatcher
911 (Emergency)
716-753-4232 (Non-Emergency)

New York State Police
Troop A Zone 3 Jamestown
716-665-3113

(2)

State Dam Safety Official
DEC Division of Water

Alon Dominitz

518-402-8185 (Office)
518-852-0415 (Cell)

National Weather Service
Judith Levan, Warning
Coordinating Meteorologist
716-565-0103
716-565-0013 (alt)

Cattaraugus County
Emergency Management
Dispatcher
716-938-2240 (Office)

Ellington Volunteer
Fire Department
716-287-2168(Non-Emergency)
911 (Emergency)

(3)

Dam Operator's Technical Reps.

Conewango Watershed
Ken Chase
716-296-5721 (Office)
716-499-5721 (Cell)

Dam Operator's Technical Reps.

Chautauqua County
Dept. of Public Facilities
Drew Rodgers
716-661-8410 (Office)
716-450-4346 (Cell)

Dam Operator's Technical Reps.

NRCS State Watershed
Engineer
Batavia Office
585-343-9167

Dam Operator's Technical Reps.

NRCS State Engineer

Syracuse Office

315-477-6538

Note:
1, 2, etc., denotes call sequence

Legend
Calls by operator _____
Second level calls - - - - -

See *Communications* tab for prescripted messages.

Emergency Services Contacts

Agency / Organization	Principal contact	Address	Office telephone number	Alternate telephone numbers
Chautauqua County Office of the Executive	George Borrello County Executive	3 North Erie Street Mayville, NY 14757	716-453-4211	716-420-1010 (C)
Chautauqua County Depart. of Public Facilities	Brad Bentley, Director	454 North Work St. Falconer, NY 14733	716-661-8406	716-581-0103 (C)
Chautauqua County Depart. of Public Facilities	Drew Rodgers * Engineer III	454 North Work St. Falconer, NY 14733	716-661-8410	716-450-4346 (C)
Chautauqua County Soil & Water Conservation District	Dave Spann District Field Manager	220 Fluvanna Ave Suite 600 Jamestown, NY 14701	716-664-2351 x117	716-969-5266 (C)
Natural Resources Conservation Service	State Engineer Syracuse Office	4415 S. Salina St, Ste. 354 Syracuse, NY13202	315-447-6538	
Natural Resources Conservation Service	State Watershed Engineer Batavia Office	USDA Service Center 26 Liberty St. Ste 1 Batavia, NY 14020	585-343-9167	
NY State Dam Safety Official – Division of Water	Alon Dominitz	625 Broadway, 4th Floor Albany, NY 12233	518-402-8185	518-852-0415 (C)
Conewango Watershed Commission	Ken Chase, Chairman	6267 South Rd. Cherry Creek, NY 14723	716-296-5721	716-499-5721 (C)
Chautauqua County Emergency Management Coordinator	John Griffith, Director	2 Academy St. Ste A Room 106 Mayville, NY 14757	716-753-4341	716-269-4656
Cattaraugus County Emergency Management Coordinator	Chris Baker Emergency Coordinator	303 Court Street Little Valley, NY 14755	716-938-2240	716-798-0697 (C)
Chautauqua County Sheriff	Jim Quattrone	13 E. Chautauqua St. Mayville, NY 14757	716-753-4900	716-753-4231 (D)
New York Department of Transportation	Resident Engineer Chautauqua County	109 East Chautauqua St. Mayville, NY 14779	716-753-2821	
New York State Police	Zone Sergeant	Rt. 60 Jamestown, NY 14733	716-665-3113	716-699-8783
Ellington Volunteer Fire Department		769 West Main Street Ellington, NY 14732	716-287-2168	
Landowner of Dam No. 33	Richard Milks	203 Crosby Ave. Kenmore, NY 14217		
Landowner of Dam No. 33	Crist Shetler	6458 Pickup Hill Rd. Cherry Creek, NY 14723		
National Weather Service	Judith Levan, Warning Coord. Meteorologist	587 Aero Drive Buffalo, NY 14225	716-565-0103	716-565-0013
Town of Cherry Creek Highway Department	Ken Chase	6267 South Rd. Cherry Creek, NY 14723	716-296-5721	716-499-5721 (C)
WKSN-WHUG-WQFX	2 Orchard Park Road, Jamestown, NY 14701		716-664-2313	

WKSN 106.9 Radio	106 West Third Street, Jamestown, NY 14701	716-487-1106	
WKBW-TV Channel 7	7 Braodcast Plaza, Buffalo, NY 14202	716-845-6100	
WIVB Channel 4/23	2077 Elmwood Ave., Buffalo, NY 14207	716-874-4410	716-874-7333 716-794-3687
WGRZ Channel 2	259 Delaware Ave., Buffalo, NY 14202	176-849-2222	716-849-2220

Step 4 Expected Actions

If the police or Sheriff receives a 911 call regarding observations of an unusual or emergency event at the dam, they should immediately contact the Conservation District office. After the Conservation District Manager determines the emergency level, the following actions should be taken. If time permits, NRCS and the New York Water Resources Board should be contacted for technical consultation.

Emergency Level 1—Nonemergency, unusual event; slowly developing:

A. The Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS or the New York Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**

B. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

C. The Conservation District Manager should contact NRCS and request technical staff to investigate the situation and recommend corrective actions.

Emergency Level 2—Potential dam failure situation; rapidly developing:

A. The Conservation District Manager should contact the NRCS and the New York Water Resources Board to report the situation and, if time permits, request technical staff to investigate the situation and recommend corrective actions.

B. The Conservation District Manager should contact the sheriff to inform him/her that the EAP has been activated and if current conditions get worse, an emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.

C. Provide updates to the Sheriff and emergency services personnel to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.

D. If time permits, the Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS and the New York Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**

E. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

F. If time permits, the following emergency remedial actions should be taken as appropriate.

Emergency Level 2—Potential dam failure situation; rapidly developing—continued:

Emergency remedial actions

If time permits, the following emergency remedial actions should be considered for Emergency Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with NRCS and the New York Water Resources Board. See *Resources Available* (Appendix B–1) for sources of equipment and materials to assist with remedial actions.

Embankment overtopping

1. If the water level in the reservoir is no longer rising, place sandbags along the low areas of the top of the dam to control wave action, reduce the likelihood of flow concentration during minor overtopping, and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection.

Seepage and sinkholes

1. Open the principal spillway gate to lower the reservoir level as rapidly as possible to a level that stops or decreases the seepage to a nonerosive velocity. If the gate is damaged or blocked, pumping or siphoning may be required.

   Continue lowering the water level until the seepage stops.
2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials such as hay bales, bentonite, soil or rockfill, or plastic sheeting.
3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the gate is damaged or blocked, pumping or siphoning may be required.
2. Repair settlement of the crest by placing sandbags or earth and rockfill materials in the damaged area to restore freeboard.
3. Stabilize slides by placing a soil or rockfill buttress against the toe of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform a field survey to determine if there has been any settlement and movement of the dam embankment, spillway, and low-level outlet works.
3. Drain the reservoir, if required.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

A. The Conservation District Manager shall immediately contact the Sheriff and others shown on the notification chart.

B. The Sheriff shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam (see *Evacuation Map* tab).

C. Emergency management services personnel shall alert the public and immediately evacuate at-risk people and close roads as necessary.

D. The Conservation District Manager shall maintain continuous communication and provide the Sheriff with updates of the situation to assist him/her in making timely decisions concerning warnings and evacuations.

E. The Conservation District Manager should record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

F. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

Step 5 Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Sheriff is responsible for terminating EAP operations and relaying this decision to the Conservation District Manager. It is then the responsibility of each person to notify the same group of contacts that were notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Emergency Level 3 event that has not caused actual dam failure, the NRCS technical representative or the State Dam Safety Officer will inspect the dam or require the inspection of the dam to determine whether any damage has occurred that could potentially result in loss of life, injury, or property damage. If it is determined that conditions do not pose a threat to people or property, the Sheriff will be advised to terminate EAP operations as described above.

The Conservation District Manager shall assure that the *Dam Safety Emergency Situation Report* (Appendix A–3) is completed to document the emergency event and all actions that were taken. The Conservation District shall distribute copies of the completed report to the New York Water Resources Board and the NRCS State Conservation Engineer.

Maintenance—EAP Review and Revision

EAP annual review

The Department of Public Facilities will review and, if needed, update the EAP at least once each year. The EAP annual review will include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current. The EAP will be revised if any of the contacts have changed.
- Contacting the local law enforcement agency to verify the phone numbers and persons in the specified positions.
- Calling the locally available resources to verify that the phone numbers, addresses, and services are current.

Revisions

The Department of Public Facilities will be responsible for updating the EAP document. The EAP document held by the Department of Public Facilities will be the master document. When revisions occur, the Department of Public Facilities will provide the revised pages and a revised revision summary page to all the EAP document holders. The document holders are responsible for revising outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the revisions.

EAP periodic test

The Department of Facilities will host and facilitate a periodic test of the EAP at least once every 5 years.

The periodic test will consist of a meeting, including a tabletop exercise, conducted at the Chautauqua County Emergency Management office. Attendance should include the Department of Public Facilities, Emergency Management personnel, Conewango Watershed Committee Chairman, Conservation District Manager, key conservation district staff members, NRCS staff, at least one representative of the local law enforcement agency, and others with key responsibilities listed in the EAP. At the discretion of the Department of Public Facilities, other organizations that may be involved with an unusual or emergency event at the dam are encouraged to participate. Before the tabletop exercise begins, meeting participants will visit the dam during the periodic test to familiarize themselves with the dam site.

The tabletop exercise will begin with the facilitator presenting a scenario of an unusual or emergency event at the dam. The scenario will be developed prior to the exercise. Once the scenario has been presented, the participants will discuss the responses and actions that they would take to address and resolve the scenario. The narrator will control the discussion, ensuring realistic responses and developing the scenario throughout the exercise. The Conservation District Manager should complete an event log as they would during an actual event.

After the tabletop exercise, the five sections of the EAP will be reviewed and discussed. Mutual aid agreements and other emergency procedures can be discussed. The Department of Public Facilities will prepare a written summary of the periodic test and revise the EAP, as necessary.

Record of Holders of Control Copies of this EAP

Copy Number	Organization	Person receiving copy
1	Chautauqua County DPF 454 North Work Street Falconer, NY 14733	Drew Rodgers
2	Chautauqua County Soil & Water Conservation District 220 Fluvanna Avenue Suite 600 Jamestown, NY 14701	Dave Spann
3	Conewango Watershed Commission NRCS Field Office 6914 Main St. Cherry Creek, NY 14723	Ken Chase
4	Chautauqua County Sheriff's Department 15 E. Chautauqua Mayville, NY 14757	Jim Quattrone
5	Chautauqua County Emergency Management Services 2 Academy St., Ste. A Room 106 Mayville, NY 14757	John Griffith
6	N.Y.S. Police Rt. 60 Jamestown, NY 14701	Zone Sergeant
7	NRCS State Office 441 S. Salina St. Ste. 354 Syracuse, NY 13202	State Engineer
8	New York State Dam Safety 625 Broadway, 4th Floor Albany, NY 12233	Alon Dominitz
9	NYSOEM Headquarters Planning Section 1220 Washington Ave., Bldg. 22 Albany, NY 12226	Chris Pounds

Record of Revisions and Updates Made to EAP

Revision Number	Date	Revisions made	By whom
1	8/2017	**Basic EAP Data** – revised Potential Impacted Area Statement **Basic EAP Data** – revised Dam Description drainage area and major property owners **Roles and Responsibilities** – removed specific names and replaced with agency names **Emergency Level 1 Notifications** – updated names, agencies, and contact information **Emergency Level 2 Notifications** – updated names, agencies, and contact information **Emergency Level 3 Notifications** – updated names, agencies, and contact information **Maintenance – EAP Review and Revision** – modified plan to change EAP review, revision, and upkeep from Conservation District Manager to Department of Public Facilities **Record Holders of Control Copies of this EAP** – updated names, agencies, and contact information. Added NYSOEM **Appendix B-2** – added location map from Engineering Assessment **Appendix B-3** – added watershed project map from Engineering Assessment **Appendix B-4** – added inundation mapping from Engineering Assessment **Appendix B-5** – updated Residents/Businesses/Highway at Risk and basis of evacuation area and flooding depths **Appendix B-6** – added plan view of dam from Engineering Assessment. **Appendix B-7** – added profile of principal spillway **Appendix B-8** – updated Reservoir Elevation-Area-	D. Rodgers, CCDPF

		Volume and Spillway Capacity Data from Engineering Assessment **Appendix B-9** – updated dam information from Engineering Assessment	
2	12/31/2018	**Emergency Level 2 & 3 Notifications; Emergency Services Contacts; Record of Holders** – updated names and/or contact information **Appendix B1** – updated names	Drew Rodgers

Concurrences

By my signature, I acknowledge that I, or my representative, have reviewed this plan and concur with the tasks and responsibilities assigned herein for me and my organization.

1._____

Signature *Organization* *Date*

Printed name and title:

2. _____

Signature *Organization* *Date*

Printed name and title:

3._____

Signature *Organization* *Date*

Printed name and title:

4._____

Signature *Organization* *Date*

Printed name and title:

5._____

Signature *Organization* *Date*

Printed name and title: _____

6._____

Signature *Organization* *Date*

Printed name and title:_____

7._____

Signature *Organization* *Date*

Printed name and title: _____

Appendices—Forms, Glossary, Maps, and Supporting Data

Appendix A

A–1 Contact Checklist

A–2 Unusual or Emergency Event Log Form

A–3 Dam Emergency Situation Report Form

A–4 Glossary of Terms

Appendix B

B–1 Resources Available

B–2 Location and Vicinity Maps

B–3 Watershed Project Map

B–4 Evacuation Map

B–5 Residents/Businesses/Highways at Risk

B–6 Plan View of Dam

B–7 Profile of Principal Spillway

B–8 Reservoir Elevation-Area-Volume and Spillway Capacity Data

B–9 National Inventory of Dams (NID) Data

Appendix A–1

Contact Checklist

Conewango Creek Watershed, Dam No. 33

Chautauqua County, NY Date _____

The following contacts should be made immediately after the emergency level is determined (see pages 7–10 for guidance to determine the appropriate emergency level for a specific situation). The person making the contacts should initial and record the time of the call and who was notified for each contact made. See the *Notification Charts* tab for critical contact information and *Emer. Services Contacts* tab for contact information for other possible emergency services.

Emergency Level 1 (see page 12)	Person Contacted	Time Contacted	Contacted by
___ NRCS District Conservationist	_____	_____	_____
___ NRCS State Conservation Engineer	_____	_____	_____
___ New York Water Resources Board	_____	_____	_____

Emergency Level 2 (see page 13)	Person Contacted	Time Contacted	Contacted by
____ NRCS District Conservationist	_____	_____	_____
____ NRCS State Conservation Engineer	_____	_____	_____
____ New York Water Resources Board	_____	_____	_____
____ Sheriff	_____	_____	_____

Emergency Level 3 (see page 14)	Person Contacted	Time Contacted	Contacted by
____ Sheriff	_____	_____	_____
____ New York Water Resources Board	_____	_____	_____
____ NRCS District Conservationist	_____	_____	_____
____ NRCS State Conservation Engineer	_____	_____	_____

Appendix A–2

Unusual or Emergency Event Log

(to be completed during the emergency)

Dam name: Conewango Creek Watershed Dam #33 County: Chautauqua County

When and how was the event detected?

_____

_____

Weather conditions: _____

_____

General description of the emergency situation:

_____

_____

_____

Emergency level determination: _____ Made by: _____

Actions and Event Progression

Date	Time	Action/event progression	Taken by

Report prepared by: _____ Date: _____

Appendix A–3

Dam Emergency Situation Report

(to be completed following the termination of the emergency)

Dam name: Conewango Creek Watershed, Site 33

National Inventory of Dams (NID) No.: NY 00581

Dam location: 1 Mile South of Cherry Creek Chautauqua County Conewango Creek

(City) *(County)* *(Stream/River)*

Date: Time:

Weather conditions: _____

General description of emergency situation:

_____

_____

Area(s) of dam affected:

_____

_____

Extent of dam damage: _____

Possible cause(s): _____

Effect on dam's operation: _____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

_____

_____

Other data and comments:

_____

Observer's name and telephone number: _____

Report prepared by: _____ Date: _____

Appendix A–4
Glossary of Terms

Abutment That part of the valleyside against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.

Acre-foot A unit of volumetric measure that would cover 1 acre to a depth of 1 foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.

Berm A nearly horizontal step (bench) in the upstream or downstream sloping face of the dam.

Boil A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.

Breach An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.

Conduit A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.

Control section A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.

Cross section A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. Also, a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream.

Dam An artificial barrier generally constructed across a watercourse for the purpose of impounding or diverting water.

Dam failure The uncontrolled release of a dam's impounded water.

Dam Operator The person(s) or unit(s) of government with responsibility for the operation and maintenance of dam.

Drain, toe or foundation, or blanket A water collection system of sand and gravel and typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet.

Drainage area (watershed) The geographic area on which rainfall flows into the dam.

Drawdown The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.

Emergency A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.

Emergency Action Plan (EAP)	A formal document identifying potential emergency conditions that may occur at the dam and specifying preplanned actions to minimize potential failure of the dam or minimize failure consequences including loss of life, property damage, and environmental impacts.
Evacuation map	A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.
Filter	The layers of sand and gravel in a drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.
Freeboard	Vertical distance between a stated water level in the reservoir and the top of dam.
Gate, slide or sluice, or regulating	An operable, watertight valve to manage the discharge of water from the dam.
Groin	The area along the intersection of the face of a dam and the abutment.
Hazard classification	A system that categorizes dams (high, significant, or low) according to the degree of their potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or misoperation of a dam.
Height, dam	The vertical distance between the lowest point along the top of the dam and the lowest point at the downstream toe, which usually occurs in the bed of the outlet channel.
Hydrograph, inflow or outflow, or breach	A graphical representation of either the flow rate or flow depth at a specific point above or below the dam over time for a specific flood occurrence.
Incident Commander	The highest predetermined official available at the scene of an emergency situation.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation area or map	The geographic area downstream of the dam that would be flooded by a breach of the dam or other large discharge.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.
Outlet works (principal spillway)	An appurtenant structure that provides for controlled passage of normal water flows through the dam.
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.

Probable Maximum Precipitation (PMP) or Flood (PMF)	The theoretically greatest precipitation or resulting flood that is meteorologically feasible for a given duration over a specific drainage area at a particular geographical location.
Reservoir	The body of water impounded or potentially impounded by the dam.
Riprap	A layer of large rock, precast blocks, bags of cement, or other suitable material, generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.
Risk	A measure of the likelihood and severity of an adverse consequence.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway (auxiliary or emergency)	The appurtenant structure that provides the controlled conveyance of excess water through, over, or around the dam.
Spillway capacity	The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.
Spillway crest	The lowest level at which reservoir water can flow into the spillway.
Tailwater	The body of water immediately downstream of the embankment at a specific point in time.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.

Appendix B–1
Resources Available

Locally available equipment, labor, and materials:
The county has the following resources that can be utilized in the event of an emergency:

Contact: Brad Bentley, Director County Department of Public Facilities: 716-664-8400
Ken Chase, Town of Cherry Creek, HWY. Supervisor: 716-296-5721 or 716-499-5721

- Heavy Construction equipment, trucks and manpower.
- Loaders, Trucks, Dozer, Backhoe, etc.

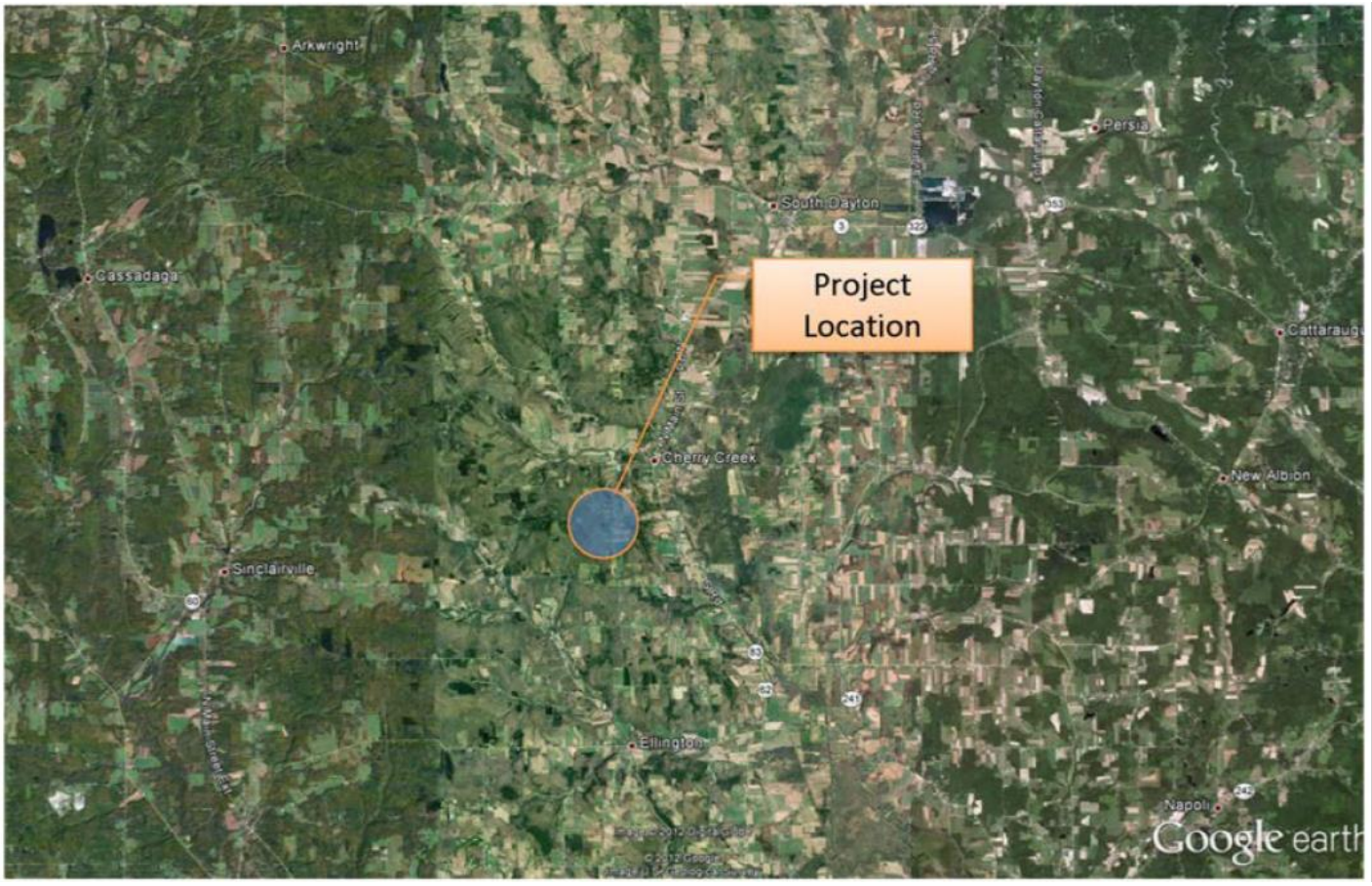
Contact the Chautauqua County Road Department --- see *Emer. Services Contacts* tab.

Other locally available resources include:

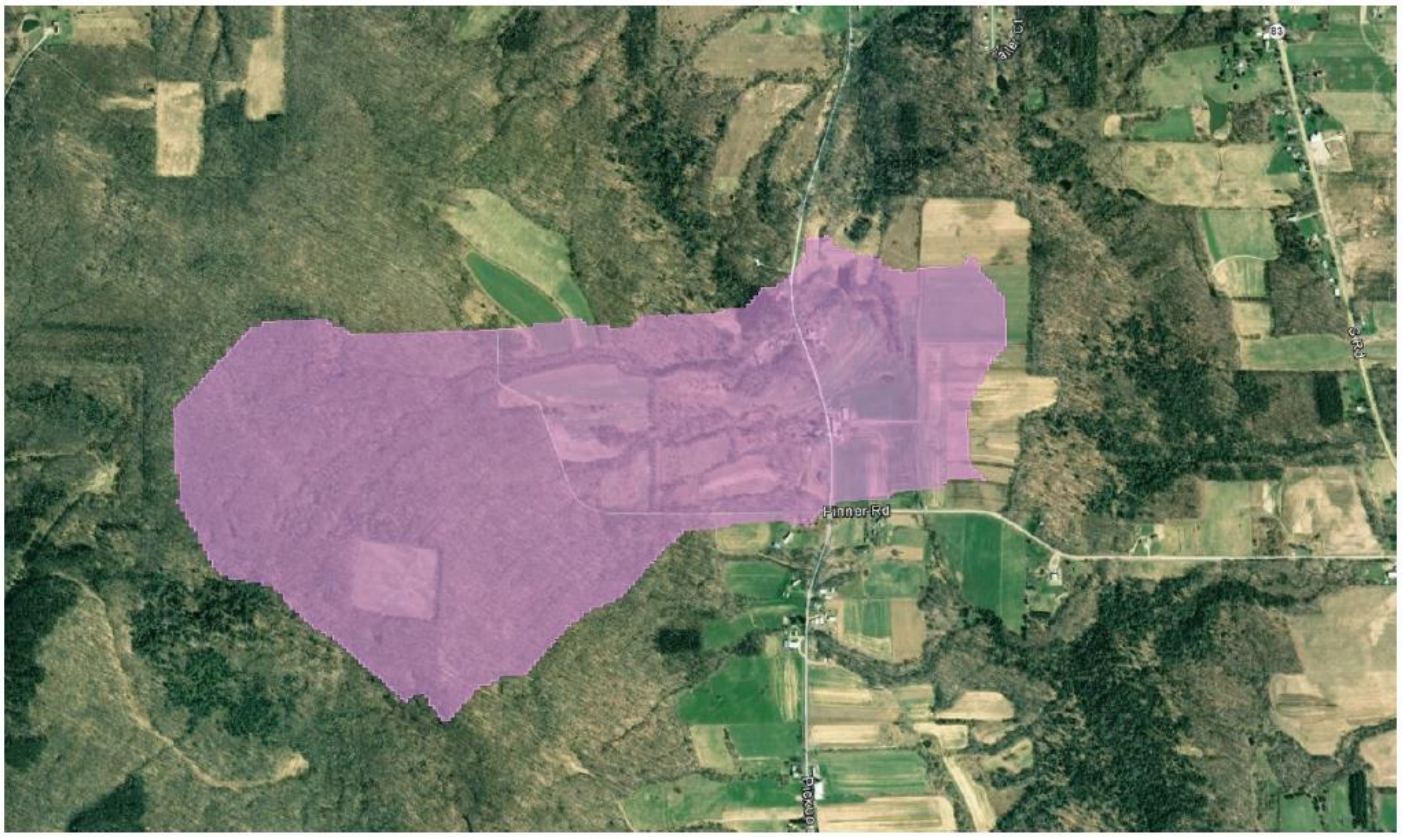
Heavy equipment service and rental	**Sand and gravel supply**	**Ready-mix concrete supply**
JSE Excavating 6032 Rt. 83 Cherry Creek, NY 14723 Jim Schimek 716-485-3800	Countryside Sand & Gravel Rt. 62 South Dayton, NY 14138 716-988-3271	LER Concrete, Inc. 1946 New York Ave. Falconer, NY 14733 716-665-4504
Doug Rice Excavating 28 Creek Road Ellington, NY 14732 716-287-3712	Cherry Creek Sand & Gravel PO Box 306 Cherry Creek, NY 14723 716-296-9910	Hanson Aggregates Allen St. Ext. Jamestown, NY 14701 716-665-4620
ADMAR Supply Co., Inc. 1394 Military Road Buffalo, NY 14207 1-800-353-2367	Frew Run Gravel Products 984 Frew Run Road Frewsburg, NY 14738 716-569-4712	JMI Concrete Products Jamestown, NY 14701 716-665-4504

Pumps	Diving contractor	Sand bags
ADMAR Supply Co. 1394 Military Rd. Buffalo, NY 14207 1-800-353-2367	Buffalo Industrial Diving, Inc 201 Ganson St. Buffalo, NY 14203 716-854-1041	Chautauqua County Emergency Services 2 Academy St. Mayville, NY 14757 716-753-14757
	Chautauqua County WET Mayville Dispatch	

Appendix B–2
Location and Vicinity Maps



Appendix B–3
Watershed Project Map



Appendix B–4
Inundation/Evacuation Mapping

Appendix B–5
Residents/Businesses/Highways at Risk

A major flood caused by a sudden breach of the dam is estimated to inundate the areas shown in Appendix B-4. Specific residents that have higher potential of inundation are listed below.

House/ business no.*	Resident/business	Address	Phone no.	Distance downstream from dam (ft)	Travel time** (hr)	Max water depth (ft)
	Michael Chudy	6690 Pickup Hill Rd.		.5 miles	4 min	4 ft
	Empire Livestock Marketing, LLC	6732 Southside Ave Ext.		0.5 miles	4 min	4 ft
	Village of Cherry Creek			0.6 mi -2.0mi	4 min-41min	4 ft – 1ft
	Bryant Hurlbut	490 Cherry Creek-Leon Road		2.0 mi -3.5mi	41min -3hrs	1 ft-2 ft
	David Stalker	400 Cherry Creek-Leon Road		2.0 mi -3.5mi	41min -3hrs	1 ft-2 ft
	Kenneth Thoman	399 Cherry Creek-Leon Road		2.0 mi -3.5mi	41min -3hrs	1 ft-2 ft
	Kenneth Priest	388 Cherry Creek-Leon Road		2.0 mi -3.5mi	41min -3hrs	1 ft-2 ft
	Joseph Nelson	386 Cherry-Creek-Leon Road		2.0 mi -3.5mi	41min -3hrs	1 ft-2 ft
	Jack Borton	334 Cherry Creek-Leon Road		2.0 mi -3.5mi	41min -3hrs	1 ft-2 ft
	Norbert J. Koch Revocable	Cherry Creek-Leon Road		2.0 mi -3.5mi	41min -3hrs	1 ft-2 ft

* See Appendix B–4.

** Estimated time for breach wave (peak) to travel from dam to downstream locations

Basis for computation of evacuation area and flooding depths

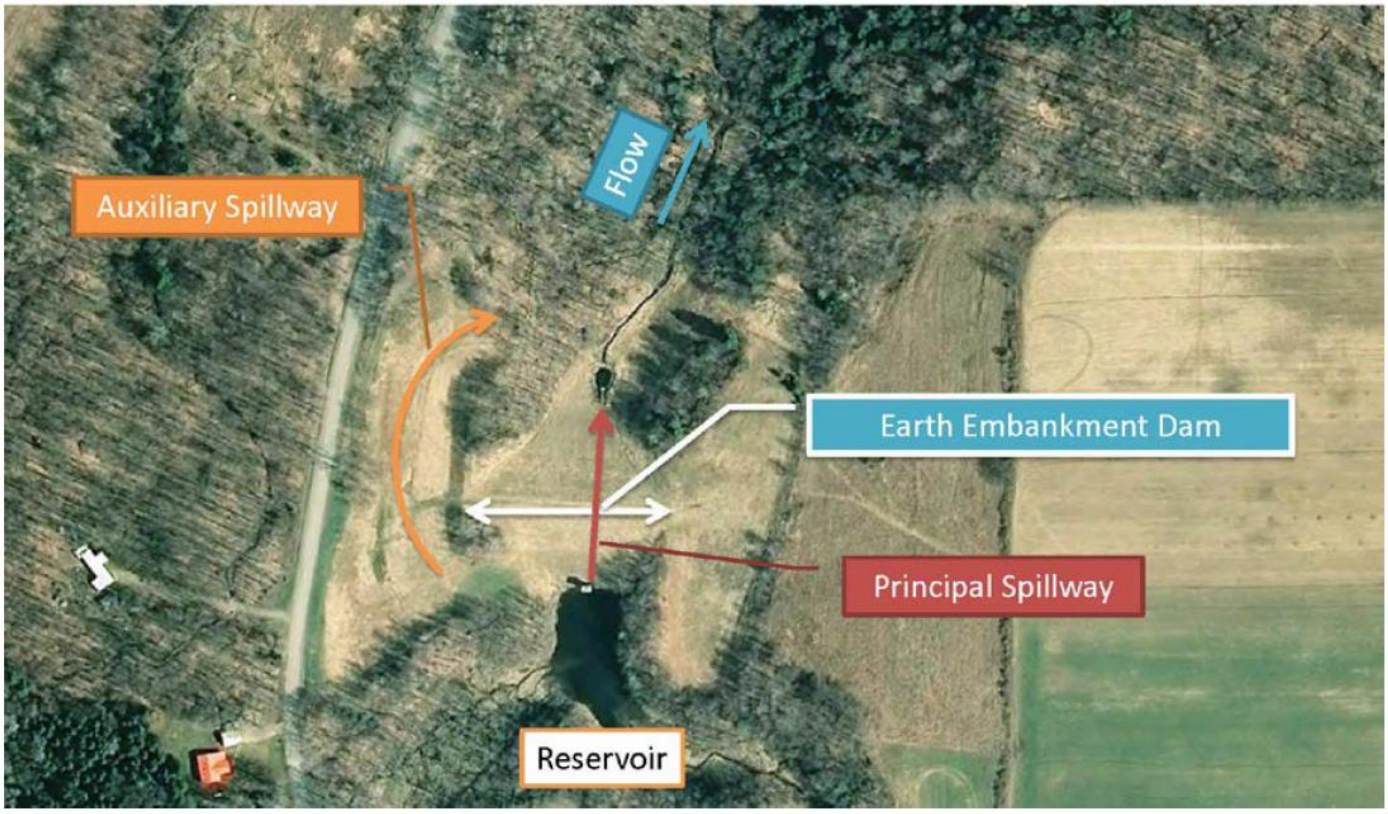
Breach inundation study completed by T.Y. Lin Internarial October 2013

Hydraulic model used: HEC-RAS (routing); HEC-HMS (peak discharge); HEC-HMS (hydrograph)

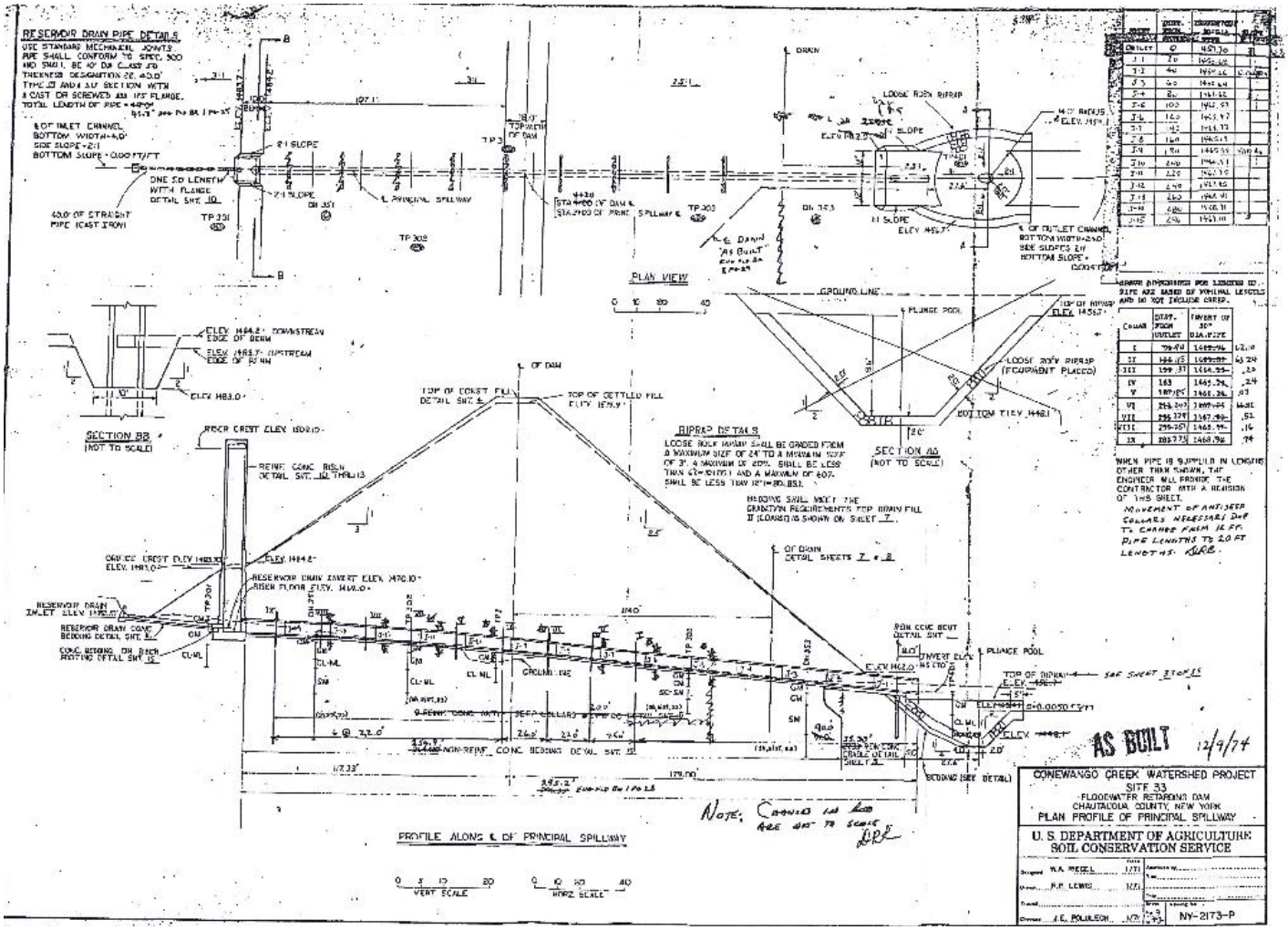
Model assumptions:

- X "Sunny Day" Breach (no inflow into the reservoir)
- X Water surface elevation in reservoir prior to breach = 1519.9 (top of dam)
- X Total volume of breach hydrograph = 1451.8 acre-ft
- X Height of water at time of breach = 1519.9 ft
- X Peak breach discharge = 8,804.3 ft^3/s
- ☐ Downstream area defined by field surveys consisting of __ cross sections and __ bridge openings

Appendix B–6
Plan View of Dam



Appendix B–7
Profile of Principal Spillway



Appendix B–8
Reservoir Elevation-area-volume and Spillway Capacity Data

CONEWANGO CREEK WATERSHED
DAM NO. 33

Elevation	Reservoir Surface Area (Ac)	Reservoir Total Storage (ac-ft)	Combined Total Discharge (cfs)
Low Stage Inlet			
1483.7	0.76	0.00	0.0
1484	0.79	0.23	1.2
1485	0.90	1.08	2.4
1486	1.01	2.03	3.2
1487	1.11	3.09	3.8
1488	1.22	4.26	4.4
1489	1.32	5.53	4.8
1490	1.43	6.91	5.3
1491	1.58	8.41	5.7
1492	1.73	10.07	6.1
1493	1.89	11.88	6.4
1494	2.04	13.84	6.8
1495	2.19	15.96	7.1
1496	2.34	18.22	7.4
1497	2.49	20.64	7.7
1498	2.65	23.21	8.0
1499	2.80	25.93	8.2
1500	2.95	28.81	8.5
1501	3.11	31.84	8.8
1502	3.27	35.03	9.0
1503	3.44	38.38	9.3
1504	3.60	41.90	9.5
1505	3.76	45.58	9.7
1506	3.92	49.42	9.9
1507	4.08	53.42	10.2
1508	4.25	57.59	10.4
1509	4.41	61.92	10.6
Riser Crest (1509.01)			
1510	4.57	66.41	50.5
1511	4.90	71.14	121.5
Auxiliary Spillway (1511.14)			
1512	5.22	76.20	163.3
1513	5.55	81.58	395.3
1514	5.87	87.29	756.4
1515	6.20	93.33	1228.2
1516	6.53	99.69	1810.9
1517	6.85	106.38	2501.4
1517.9	7.15	112.68	3210.7
Design High Water (1517.9)			
1518	7.18	113.40	3290.7
1519	7.50	120.74	4197.4

1519.9	7.80	127.62	5100.6
Top of Dam (1519.9)			
1520	7.83	128.41	5206.9

Appendix B–9
National Inventory of Dams (NID) Data

Dam name: **Conewango Creek Watershed, Site 33**

State: **New York**

NID ID: **NY 00581**

Longitude: **79.114444**

Latitude: **42.286944**

Geodetic location: _____

County: **Chautauqua**

Stream: **Conewango Creek**

Nearest town: **Cherry Creek**

Distance to nearest town: **1 mi**

Operator: **Chautauqua County**

Year constructed: **1974**

Max. discharge: **5,113 ft^3/s**

Max. storage: **128 acre-ft**

Normal storage: **4 acre-ft**

Surface area: **1 acre**

Drainage area: **350 acres**

Inspection frequency: **1 yr**

State regulated?: **Yes**

State reg. agency: **NYS-DEC**

Federal funding: **USDA NRCS**

Federal design: **USDA NRCS**

Federal constructed: **USDA NRCS**

Program authority: **PL-556 Flood Control**

Watershed No.: **05010002-010**

Watershed name: **Conewango Creek Watershed**

Service life: **100 yr**

O&M insp. Resp: **Chaut. / Cattaraugus Co. Soil & Water**

O&M insp. current?: **yes**

Population at risk: **1064**

Dam height: **57 ft**

Dam length: **325 ft**

Dam volume: **61,361 yd^3**

Design hazard potential: **High**

Current hazard potential: **"C", High**

Hazard potential class. year: ____

Sediment storage: ____ **acre-ft**

Flood storage: **175 acre-ft**

Surcharge storage: ____ **acre-ft**

Other storage: ____ **acre-ft**

Principal spillway type: **Concrete pipe**

Principal spillway conduit diameter: **30 in**

Auxiliary spillway type: **Vegetated earth**

Auxiliary spillway width: **50 ft**

Dam Assessment Report

Conewango Creek Site 33 Dam

NYS Dam ID: 007-3917

Town of Cherry Creek, County of Chautauqua, State of New York

February 2014

Prepared By:	Prepared For:
T·Y LIN INTERNATIONAL	
STATE OF NEW YORK JAMES ROBERT GUISTINA 084113 LICENSED PROFESSIONAL ENGINEER	Signature of Owner: George Spanos
James R. Guistina, PE **NYS License: 084113**	**George Spanos, PE** **Director of Public Works, Chautauqua County**

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I. Introduction

A. Location

The Conewango Creek Watershed Project Site 33 is located east of Pickup Hill Road approximately 1.2 miles (via public roads) southwest of the Village of Cherry Creek, New York.

Figure I-I: Conewango 33 Dam Location

B. Description of Dam and Appurtenant Structures

1. General Description

The Conewango Creek Watershed Project Site 33 consists of an earth dam, with a principal spillway outlet pipe passing through the embankment and an auxiliary spillway passing around the western abutment of the dam. The dam consists of a zoned compacted earth embankment which is 57 feet high, having a crest width of 18 feet and crest length of 325 feet. The upstream slope is 1 vertical on 3 horizontal and the downstream slope is 1 vertical on 2.5 horizontal. The crest, downstream slope and

upper two-thirds of the upstream slope between the normal pool elevation and the crest are grass covered. The lower third of the upstream slope is not vegetated. There is a cutoff trench under the centerline of the dam which presumably was excavated to bedrock in accordance with the recommendations of the original Design Report. Typical sections of this cutoff are shown in the record plans included in the Appendix along with sections taken in 2013 by instrument survey verifying the record plan data.

The principal spillway includes the following components: a rectangular reinforced concrete riser structure with an orifice at elevation 1483.7 (MSL) (1483.24 NAVD 88) and riser crest at elevation 1509.1 (MSL) (1508.64 NAVD 88), a 30 inch I.D. reinforced concrete pressure pipe outlet and a riprap lined plunge pool cut into bedrock at the outlet end of the pipe. The reservoir drain is a 10 inch diameter cast iron pipe extending 40 feet into the reservoir from the base of the riser structure. A manually operated vertical slide gate mechanism mounted on the top of the riser structure controls the flow through the reservoir drain. The auxiliary spillway is in a cut section and has a bottom width of 50 feet.

The internal drainage system consists of drain trenches cut into the foundation material. The drain trenches are filled with a two-zone filter material and roughly parallel the abutment-embankment contact. Seepage from the drain trenches is collected in two 8 inch diameter perforated asbestos cement pipes which are surrounded by the filter materials and are parallel to the dam axis 114 feet downstream from the dam centerline. The perforated sections terminate near the principal spillway outlet pipe where solid 8 inch diameter asbestos cement pipe bends 90 degrees and outlets to the plunge pool parallel to and either side of the principal spillway outlet pipe.

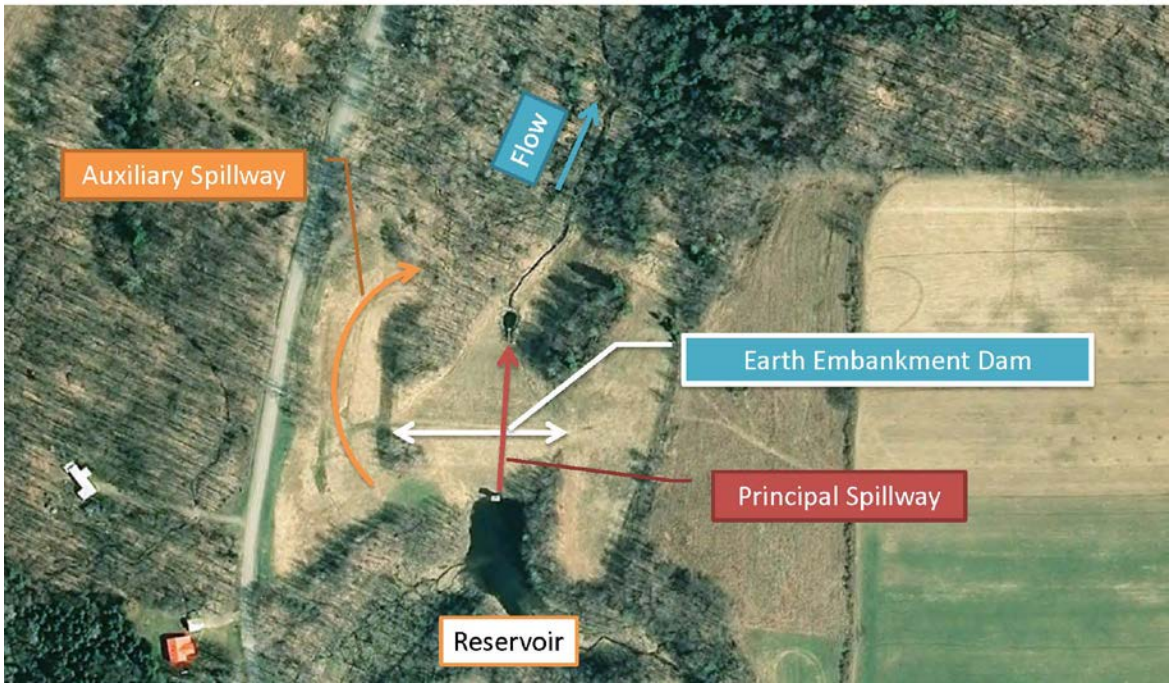


Figure I-II: Anatomy of Conewango 33 Dam

Site 33 Dam Overview			
Drainage Area	350 Acres (0.55 sq mi)		
Discharge at Dam (cfs)			
Pool at Top of Dam	**Record Drawings**	**2014 Analysis**	**Delta**
A: Principle Spillway 1st Stage	11	13	2
B: Principle Spillway 2nd Stage	163	136	-27
C: Auxiliary Spillway Discharge	4,950	4,965	15
E: Combined Spillway Discharge	5,113	5,101	-12
Elevations	**(Datum Change ^{ft}) = 0.456**		
	AS BUILT DATA		**2013 SURVEY**
	NGVD 29 (FT)	**NAVD 88 (FT)**	**NAVD 88 (FT)**
A: Top of Dam	1519.90	1519.44	1519.44
B: Auxiliary Spillway Crest	1511.60	1511.14	1511.14
C: Principal Spillway Crest	1483.70	1483.24	1483.61
D: Riser Crest Elevation	1509.10	1508.64	1509.01
Reservoir Surface Area			
A: Top of Dam	7.9 Acres		
B: Crest of Riser	4.4 Acres		
Storage Capacity			
A: Top of Dam	128.3 Acre-Feet		
B: Principle Spillway Crest	64.8 Acre-Feet		
Dam			
Embankment Type	Compacted Earthen Fill		
Embankment Length	325 ft		
Slopes (V:H)			
A: Upstream	1:3		
B: Downstream	1:2.5		
Crest Elevation	1519.9 ft NGVD, 1519.44 NAVD 88, 1519.44 SURVEY		
Crest Width	18 ft		
Spillways			
A: Principle	Reinforced Concrete pipe, 30” I.D. Near the center of the reservoir in a concrete cradle. Rectangular Concrete drop inlet structure upstream with an uncontrolled outlet downstream.		
B: Auxiliary Spillway	Excavated channel, 50 ft in width. With 1:3 side slopes.		
Plunge Pool (Principle and Aux.	Natural stream channel lined with rip-rap		
Reservoir Drain	Cast Iron, 10” O.D. with a vertical slide gate.		

Table I-1: Site 33 Overview

C. Dam Function

This Dam provides flood water storage for the Conewango Creek basin. It provides storage for 350 acres of runoff and releases it slowly through the two stage principle spillway system.

D. Ownership and Design

The Dam is owned by the County of Chautauqua and maintained by Cattaraugus and Chautauqua County Soil & Water. The person of contact is:

George Spanos, P.E.
Chautauqua County, Department of the Public Facilities
454 N. Work St.
Falconer, NY 14733
716-661-8400
SpanosG@co.chautauqua.ny.us

The dam was designed by the U.S. Department of Agriculture Soil Conservation Service (USDA). For this assessment, a set of "as-built" contract drawings was provided by the Soil Conservation Service (SCS, now NRCS) in Syracuse, New York. "As-built" dam cross sections, geotechnical design and analysis data, and supervision of construction reports can be found at the U.S. Department of Agriculture- Soil Conservation Service, Design Section, Syracuse, New York. The dam was constructed in 1974. The contractor's name is unknown.

E. Recent Updates to Structure

No major updates have been made to this structure since construction.

II. Hazard Classification Evaluation

A. Changes in Downstream Development

Original design documents classified Site 33 as a Class B, or intermediate hazard dam. This classification has since been updated by NYSDEC to a high hazard or Class C dam due to changes in the classification system and not a result of the changes that have occurred downstream which are minor for this site.

B. Classification Recommendation

The dam is classified as a "high" hazard due to the presence of a number of homes along the downstream channel and the crossing of State Route 83 in the Village of Cherry Creek.

Under New York State Department of Environmental Conservation (NYSDEC) guidelines this dam is classified as a Class C dam due to a potential loss of human life if the dam was to fail. Inundation maps are contained in the appendices of this report and filed with the Emergency Action Plan for this dam.

III. Visual Safety Inspection Report Summary

A. Findings

1. General Overview

On May 23, 2012 two representatives from TY-Lin International, Jim Guistina, P.E. and Sara Gilbert, P.E. (licensed engineers in the State of New York) evaluated the conditions, took photographs and recorded observations of the main dam and appurtenant structures. The completed inspection forms are included in Appendix B. The weather was sunny and clear, and the temperature was in the eighties. The water in the reservoir was generally calm. The water surface at the time of the inspection was several feet below the auxiliary spillway crest. A small amount of water was passing through the principle spillway. A subsequent annual inspection was performed on May 15th 2013, updates on maintenance work performed since 2012 are included in Appendix B and summarized at the end of this section.

2. Crest

The width of the crest is approximately 18 feet wide and is grassed lined on a well compacted subsurface. The crest is used as a walking path to access the dam and for vehicle access. The crest is generally flat and was observed to be in good condition with minor ruts and undulations from vehicles. The horizontal alignment of the dam is good and does not show signs of movement.

3. Embankment

The upstream embankment is approximately 57 feet high and 325 feet long. The embankment is compact earthen material with meadow grass as an erosion inhibitor. There are areas of slight irregularity along the downstream face at multiple locations but evidence of movement was not noted.

Photo III-1: Upstream Face

It did not appear that any of the deficiencies observed would compromise the structural integrity of the dam.

Photo III-2: Upstream Face Looking West, Note Vegetation at SW Abutment

Large vegetation is encroaching upon the upstream face and the auxiliary spillway embankment (Southwest Abutment). Significant erosion was not found along the shoreline or along the upstream toe but some accumulated debris was noted.

Photo III-3: Downstream Face Looking West, Note Northwest abutment wet area

The downstream face is also compact earthen embankment with meadow grass used as armor. The slope is a uniform 1:2.5 slope with minor points of settling. Substantial dampness was encountered in the northwest groin area. This is a result of drainage being allowed to flow off the adjacent hillside into the groin.

Photo III-4: Downstream Face

There was no obvious area of dampness near the downstream side toe. And no settlement was noted across the embankment near the principal spillway tunnel.

4. Spillway

The principal spillway appeared to be in satisfactory condition. Some minor spalling of the concrete on the riser was noted and also on the low level outlet structure. There are areas of efflorescence on the outlet pipe that are leading to concrete deterioration. Also, the concrete cradle does not extend to the end of the outlet pipe leaving the pipe unsupported at the end and thus exposed to more rapid deterioration and higher risk of failure.

Photo III-5: Low-Level Outlet Structure

Photo III-6: Low Level Outlet Cradle

Photo III-7: Riser (Photo 0065)

The auxiliary spillway appears to be in good condition. There are two areas of the spillway that have been repaired with stone. There are areas of erosion that have occurred near the control section due to runoff from the surrounding topography.

Photo III-8: Auxiliary erosion at control section

5. Downstream Channel, Plunge Pool

The downstream channel is a narrow channel passing through a narrow valley. Minor erosion has taken place below the concrete saddle of the lower spillway

outlet. Some rip-rap has also become dislodged just past the concrete apron of the spillway and should be replaced before erosion becomes an issue.

Photo III-9: Principal spillway (Photo 0028)

6. Reservoir

The shore of the reservoir generally is a steep hillside down to the shoreline. It appears to be stable and in good condition with the exception of the east shore where slides appear to have occurred. There is no visible sign of sedimentation problems in the reservoir area.

Photo III-10: Site 33 Reservoir, Note slide on left.

Evaluation of Observations

The following deficiencies were noted during the inspection:

- Northwest abutment groin acting as drainage for adjacent hillside.
- Principal spillway outlet has efflorescence and the concrete cradle is not supported at the end.
- Slides have occurred on the east shore of reservoir.
- Some Rip Rap has become dislodged in outlet channel.
- Debris accumulation on the upstream toe.
- Erosion at control section of auxiliary spillway.

Work Completed in 2013

In May 2013 a follow up inspection was competed to confirm work that had been completed by county forces over the year.

Work Completed during 2012-2013:

- Minor Debris Removed from around the site
- Addressed tile line in auxiliary spillway to stop wet areas from forming
- Brush and trees removed from island between dam and auxiliary spillway.
- Brush around outlet pipe removed.
- Bare spots in spillway have been hydro-seeded.

Recommended work to complete:

- Principal spillway outlet has efflorescence and the concrete cradle is not supported at the end.
- Some Rip Rap has been dislodged in outlet channel.

IV. Hydrologic/Hydraulic

A. Drainage Basin Characteristics

Delineation of the watershed draining into the reservoir pool area was accomplished using the USGS mapping available at www.usgs.gov. The drainage area measures approximately 350 acres and consists primarily of woodlands and open fields. The relief in the area consists of a continuous, moderately steep hill that forms into a gorge near the reservoir. The average slope of the drainage basin is approximately 10 percent.

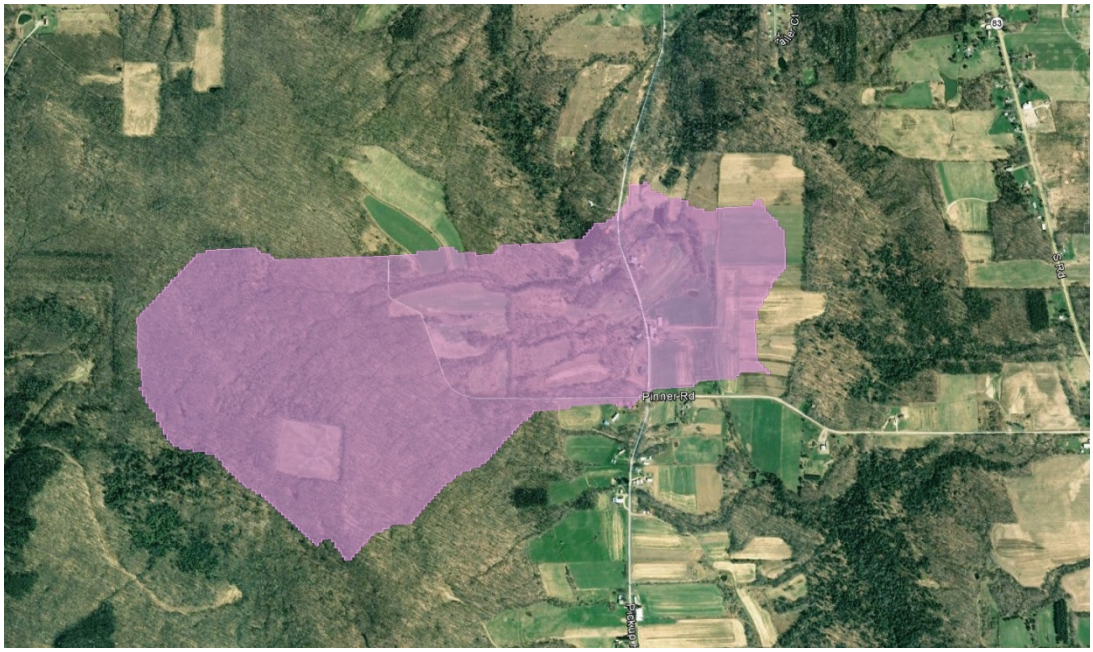


Figure IV-I: Dam 33 Watershed

B. Analysis Criteria

The analysis of the floodwater retarding capability completed in 2013 for this report was performed using the Corps of Engineers HEC-HMS v.3.5 computer program. This program developed an inflow hydrograph based upon the "Clark Unit Hydrograph" along with SCS Curve Number loss method for this dam. The spillway design flood selected for analysis was dependent on regulations to be placed in accordance with the recommended guidelines of NYSDEC and NRCS. See tables below for criteria. Appendix C contains the full calculations.

Class C Dams – **NYSDEC** (From Guidelines for Design of Dams – 1989, NYSDEC)

[Values for Chautauqua County] – HMR-51[1] and TP-40[2] and TP-29[3]

Mode		Design Flood (SDF)	Min Storm Duration (hr)*	Value (in)	Freeboard (ft)
Small Dams	Principal Spillway Design	25-year	6	3.0[2]	N/A
	Auxiliary Spillway Design	50% PMF		12.5[1] – 10 mi^2	1
Large Dams	Principal Spillway Design	100-year		3.72[3]	N/A
	Auxiliary Spillway Design	50% PMF		12.5[1] – 10 mi^2	2

Class C Dams (High Hazard) –**NRCS** (From TR-60 – Earth Dams and Reservoirs, USDA, NRCS – 2005)

[Values for Chautauqua County] – HMR-51[1] and TP-40[2] and TP-29[3] and TR-60[4]

Mode	Design Flood (SDF)	Min Storm Duration*	Freeboard (ft)	Value (in)	
Principal Spillway Design	100-year	10 day	N/A	8.0[4]	
Auxiliary Spillway Design	P100 + 0.26(PMP-P100)	24 hr & 6 hr MIN		24 Hour Storms** 11.6[1,2] – 10mi^2	6 Hour Storms** 9.12[1,2] – 10mi^2
Freeboard Requirement	PMP	24 hr & 6 hr MIN	1	24 Hour Storms 31[1,2] – 10mi^2	6 Hour Storms 24.5[1,2] – 10mi^2

**Based on 100-yr value of 3.7 for 6h duration and 5.0 for 24h duration.

C. Spillway Capacity

The outlet works at Site 33 consists of 2 spillways. One concrete, 30" diameter pipe (principal) and one 50' wide grass lined auxiliary spillway. The service spillway has a crest of 1483.7 feet (MSL) (1483.24 NAVD 88) and the auxiliary spillway has a crest of 1511.6 feet (MSL) (1511.14 NAVD 88) (Auxiliary storage of 20 feet).

Spillway Capacities at Top of Dam-1519.9 ft (MSL)/1519.44 (NAVD 88)		
	Record Plans	**2014 Analysis**
Service Spillway	163 cfs	136 cfs
Auxiliary Spillway	4,950 cfs	4,965 cfs
Combined Spillways	5,113 cfs	5,101 cfs

Table IV-1: Spillway Capacities

Using the design storm events the following analysis was determined:

Auxiliary Spillway Operation During Storm Events- RECORD PLANS			
	Peak Inflow	**Peak Outflow**	**Elevation (MSL)**
Auxiliary Spillway (Old PMF)	2,035 cfs	2,029 cfs	1513.7 feet

Table IV-2: Auxiliary Spillway Capacities – Record Plans

Auxiliary Spillway Operation During Storm Events – 2014 Analysis			
	Peak Inflow	**Peak Outflow**	**Elevation (NAVD 88)**
NYSDEC 50% PMF	860 cfs	850 cfs	1514.14
NRCS P100+0.26(PMP-P100)	647 cfs	630 cfs	1513.64
NRCS Freeboard (PMF)	2,234 cfs	2,137 cfs	1516.84 (2.6 ft Freeboard)

Table IV-3: Auxiliary Spillway Capacities – 2014 Analysis

The spillway does have the capacity for discharging the peak outflow from all design storm events.

Total Stage Discharge for the principal spillway is recorded in the table below:

Spillway Discharge Time	
Stage 1519.9	100 hours
Stage 1509.0	98 hours
Stage 1485.0	4 hours
Pond Drain from Normal Pool Stage 1483.7	4.3 hours

Table IV-4: Spillway Discharge Time

Spillway discharge times are within allowable parameters for both NYSDEC and NRCS regulations.

NYSDEC Requirement Table (NAVD)					
PRINCIPAL SPILLWAY			AUXILIARY SPILLWAY		
Principal Spillway 100-year Storm Peak Inflow	Principal Spillway Capacity	Freeboard to Auxiliary Spillway	Auxiliary Spillway Flood 50% PMF Peak Inflow	Auxiliary Spillway Capacity	Freeboard to Top of Dam
130.20 cfs.	136 cfs.	**25.10**	860 cfs.	4,965 cfs.	**5.30**
Auxiliary Spillway Elevation	Water Surface Elevation	Freeboard To Auxiliary Spillway	Top Of Dam Elevation	Water Surface Elevation	Freeboard To Top Of Dam
1511.14	1486.04	**25.10**	1519.44	1514.14	**5.30**

NRCS Requirement Table (NAVD)								
PRINCIPAL SPILLWAY			AUXILIARY SPILLWAY			FREEBOARD REQUIREMENT		
Principal Spillway 100-year Storm Peak Inflow	Principal Spillway Capacity	Freeboard to Auxiliary Spillway	Auxiliary Spillway 24HR P100+0.26 (PMP-P100) Peak Inflow	Auxiliary Spillway Capacity	Freeboard to Top of Dam	Freeboard Requirement (PMF) Peak Inflow		Freeboard to Top of Dam
234.70 cfs.	136 cfs.	**12.30**	647 cfs.	4,965 cfs.	**5.80**	2234.00 cfs.		**2.60**
Auxiliary Spillway Elevation	Water Surface Elevation	Freeboard To Auxiliary Spillway	Top Of Dam Elevation	Water Surface Elevation	Freeboard To Top Of Dam	Top Of Dam Elevation	Water Surface Elevation	Freeboard To Top Of Dam
1511.14	1498.84	**12.30**	1519.44	1513.64	**5.80**	1519.44	1516.84	**2.60**

Table IV-5: NYSDEC and NRCS Requirements

D. Reservoir Capacity

The normal water surface is set at or near 1483.7 ft (MSL) (1483.24 NAVD 88) the crest of the principal spillway. Storage for that elevation is 4.0 acre-feet. At the top of crest (1519.9 ft MSL) (1519.44 NAVD 88), the total storage capacity of the dam is 128.4 acre feet. Table IV-6 shows the surface area of the Site 33 Dam at select stages. All areas and volumes were calculated based on current Chautauqua County Orthoimagery and survey where available.

Reservoir Area and Volume per Stage		
Stage (ft) MSL	Surface Area (Acres)	Total Storage (Acre-ft)
1483.7	0.76	3.07
1509.1	4.41	61.92
1511.6	4.90	71.14
1513.8	5.55	81.58
1519.9	7.83	128.41

Table IV-6- Reservoir Volume and Area

E. Floods of Record

There are no floods of record that equal or surpass the design storm.

F. Overtopping Potential

The maximum capacity of the spillways is 5,101 cfs which is greater than all of the design outflows by a minimum of almost 25%. Preliminary results from the updated hydrology indicate overtopping will not occur during any design storm. Based on hydraulic modeling overtopping will not occur.

G. Overall Hydrologic/Hydraulic Evaluation

The spillways on this dam are assessed as adequate under current NYSDEC and NRCS regulations.

V. Structural Stability

A. Visual Observations

Visual observations of the dam did not reveal any obvious signs of movement or distress.

B. Instrumental Survey

Survey was taken at the dam in August 2014 to verify if any changes in the dam had occurred. The following elevations were confirmed:

Elevations	(Datum Change [ft]) = 0.456		
	NGVD 29 (FT)	NAVD 88 (FT)	SURVEY (FT)
A: Top of Dam	1519.9	1519.44	1519.44
B: Auxiliary Spillway Crest	1511.6	1511.14	1511.14
C: Principal Spillway Crest	1483.7	1483.24	1483.61
D: Riser Crest Elevation	1509.1	1508.64	1509.01

Table V-1- Reservoir Volume and Area

Derived from the survey data in the above table, the dam has shown no signs of settlement and is therefore still functioning as designed.

C. Data Review and Stability Evaluation

The dam embankment consists of borrow material generated from cut for the overflow spillway, located along Pickup Hill Road and other borrow area adjacent to the dam. The dam embankment material is divided into two zones (I and II). Zone I is the core of the dam and cutoff trench. This zone is comprised primary of a low plasticity silt (ML). Zone II makes up the outer (30'+) surface of the dam. This zone consists primary of silty gravel (GM) with less than 20 percent fines. Design values used for the stability analysis of the dam slope were based on consolidated-undrained triaxial shears tests of remolded specimens. Below is a table outlining these values.

Zone/Material	Friction Angle/Degrees	Cohesion/psf
Zone I/Silty Gravel (GM)	28.5	375
Zone II/ Silt (ML)	26.5	800

Table V-2- Reservoir Volume and Area

Geologic conditions beneath the dam generally consist of alluvial granular soils over glacial till then shale and siltstone bedrock. Boring and test pit logs from the predevelopment assessment classify the upper soils as silty sand and gravel. The deeper glacial till deposits consist of silt and clay with sand. Shale and siltstone bedrock was encountered at the boring locations. Core samples of the bedrock were thinly bedded (RQD 0%).

We performed slope stability analysis of the downhill and uphill portions of the dam embankment. Our analysis utilized the design parameters derived during the design phase of the project. Our analysis methods were Spencer-Wright and Bishop Simplified. The minimum factor of safety computed was 1.90. This occurred within the silty gravel embankment material, on the downhill slope, under saturated conditions. The recommended long term factor of safety (U.S. Army Corps of Engineers) for earth dams is 1.5.

As part of our seismic stability analysis we reviewed liquefaction, slope stability under seismic loading and geologic mapping of western New York faults.

We applied a pseudo-static earthquake coefficient of 0.036 (1/2 of site PGA) to our slope analysis. The minimum factor of safety under this scenario was 1.75. The recommended minimum Factor of Safety under seismic load is greater than 1.0.

A liquefaction analysis of the embankment material and underlying native soil has a factor of safety against liquefaction over 5.0.

No active fault zones have been documented in the area. The nearest active fault zone (Clarendon-Linden) is located in Wyoming and Allegany counties, over 40 miles to the northeast. We found no structural geotechnical issues with the dam.

Figure V-1 below shows the most recent survey taken in 2013 in which no settlement of the embankment nor spillways was evident. The dam is geometrically functioning as designed.

The full report is available in the Appendix D.

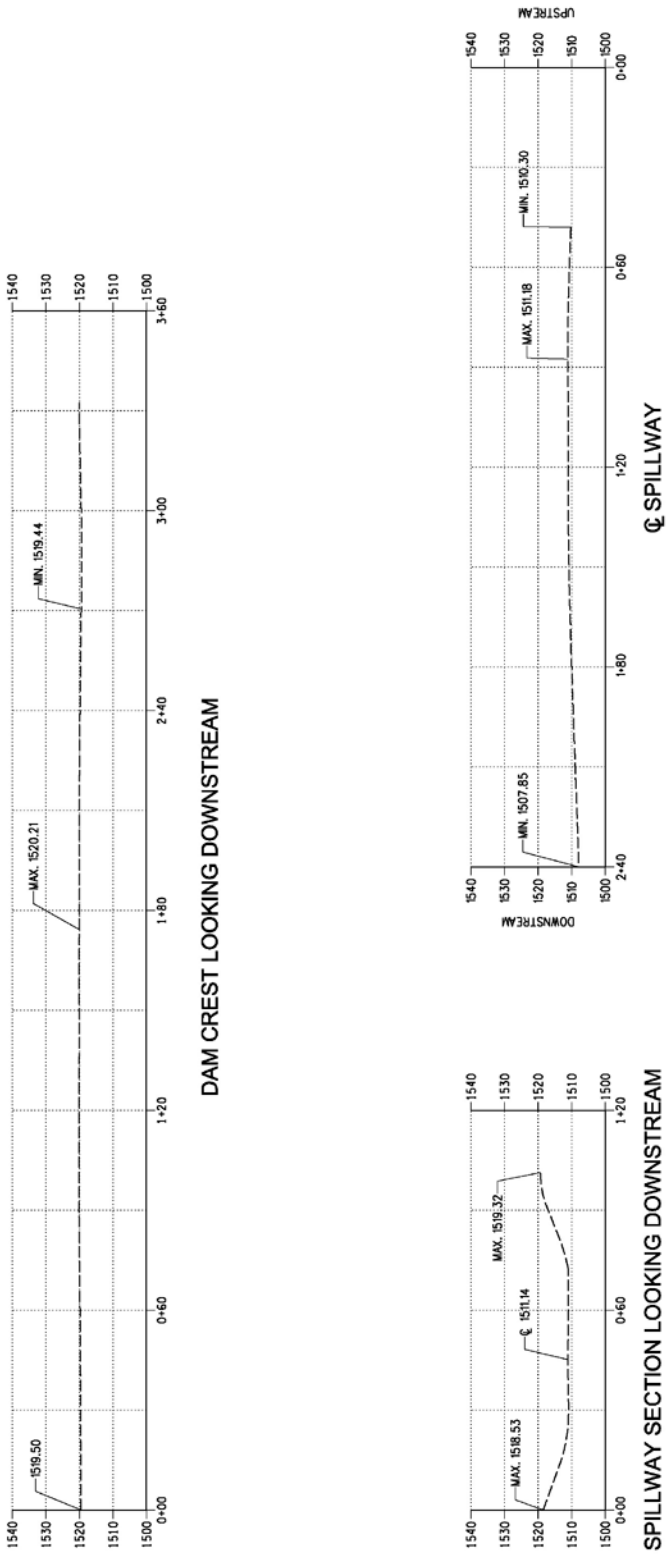


Figure V-I: Dam and Spillway Profiles

VI. Evaluation of Outlet Works and Operating Procedure

A. Procedure for Draining Reservoir

Water release from the lake is through the 30 in. reinforced concrete outlet pipe. There is also a 10" cast iron pipe with a vertical slide gate that can be used to drain the reservoir.

B. Maintenance of Dam

The dam is maintained by Cattaraugus and Chautauqua County Soil & Water. Grass on the embankment is mowed regularly. Other minor maintenance functions are performed as necessary, an annual maintenance report is generated and is attached in Appendix B.

C. Warning System in Effect

No apparent warning system is present.

D. Evaluation

Maintenance procedures and operating procedures appear to be satisfactory and up to date.

VII. Emergency Action Plan Evaluation

A. Review

An Emergency Action Plan has been completed for Site 33 Dam per NYSDEC regulations. The plan was last updated in 2011 and is currently up-to-date. An inundation map has been completed and there is a current emergency notification chart with clear responsibilities of who should be contacted, notification procedures, emergency identification/classification and preventative actions. A table Top Exercise has been conducted in the past year.

The county is responsible for updating and maintaining this "living" document as conditions and emergency contacts change and will be looked at on an annual basis.

Recommendations on the EAP include:

- Number and create a log of all EAP's in circulation. This is semi-classified information and should be treated as such for national security.
- The EAP should be clearly dated, labeled and tabbed for quick reference, a RED three-ring binder is recommended for protection and easy access/updating of the report.
- Organize an orientation seminar for local citizens and local officials
- Organize a Table-Top Exercise with local officials every 5 years.
- Be sure local officials have numbered, updated copies.

VIII. Conclusion

A. Assessment

1. Safety

The Dam Assessment inspection of the Site 33 Dam did not reveal conditions which constitute a hazard to human life or property. No signs of serious instability were observed on the earth embankment. The stability analysis which was performed for the spillways on this dam indicates that conditions are acceptable. The spillway capacities can discharge the current NYSDEC ½ PMF event along with the two NRCS storm events without overtopping.

2. Adequacy of Information

The information available from State, Local and Federal sources for the generation of this report was adequate.

3. Need for Additional Investigation

- None at this time.

4. Urgency for Repairs/Changes

- None at this time

B. Recommended Measures

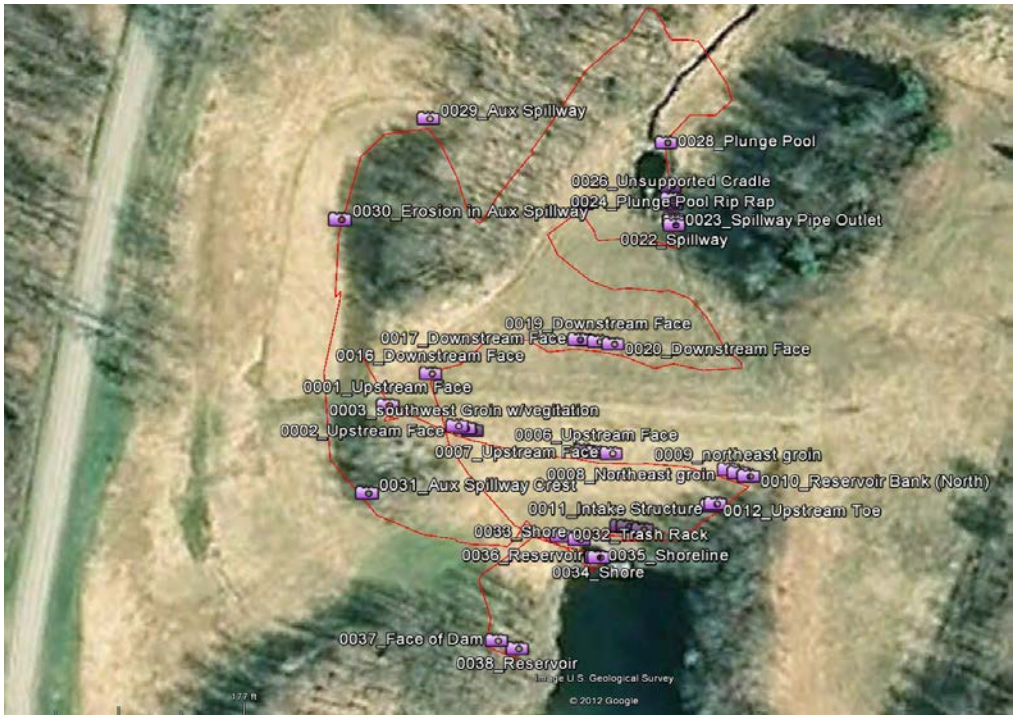
- County should observe and monitor the principle spillway outlet pipe for continued deterioration.
- Fill shall be placed under the end at the outlet pipe cradle that exceeds ground to prevent failure. The fill should then be armored.
- Replace dislodged rip-rap in the outlet channel.
- Maintain Debris that collect on reservoir shoreline.
- Dredging of reservoir should be completed to ensure normal pool capacity and to ensure the drain will work as necessary.
- Update the Emergency Action Plan (EAP) on an annual basis. Other EAP related recommendations include:
    - Number and create a log of all EAP's in circulation. This is semi-classified information and should be treated as such for national security.
    - The EAP should be clearly dated, labeled and tabbed for quick reference, a RED three-ring binder is recommended for protection and easy access/updating of the report.
    - Organize an orientation seminar for locals and local officials.
    - Organize a Table-Top Exercise with local officials every 5 years.
    - Be sure local officials have numbered, updated copies.

Appendix A

Photographs

Conewango 33 – Photo Log

Photo Log Index



TY·LIN INTERNATIONAL

Conewango 33 – Photo Log

0001: Upstream Face

0002: Upstream Face

Conewango 33 – Photo Log

0003: Southwest Groin w/ Vegetation

0004: Reservoir

Conewango 33 – Photo Log

0005: Reservoir

0006: Upstream Face

Conewango 33 – Photo Log

0007: Upstream Face

0008: Northeast Groin

Conewango 33 – Photo Log

0009: Northeast Groin

0010: Reservoir Bank (North)

Conewango 33 – Photo Log

0011: Intake Structure

0012: Upstream Toe

Conewango 33 – Photo Log

0013: Small Rodent Hole on Upstream Bank

0014: Reservoir

Conewango 33 – Photo Log

0015: Reservoir Bank

0016: Downstream Face

Conewango 33 – Photo Log

0017: Downstream Face

0018: Downstream Channel

Conewango 33 – Photo Log

0019: Downstream Face

0020: Downstream Face

Conewango 33 – Photo Log

0021: Downstream Face, Erosion From Drainage

0022: Spillway

Conewango 33 – Photo Log

0023: Spillway Pipe Outlet

0024: Plunge Pool RipRap

Conewango 33 – Photo Log

0025: Pipe Outlet

0026: Unsupported Cradle

Conewango 33 – Photo Log

0027: Pipe Outlet

0028: Plunge Pool

Conewango 33 – Photo Log

0029: Aux Spillway

0030: Erosion at Aux Spillway

Conewango 33 – Photo Log

0031: Aux Spillway Crest

0032: Trash Rack

Conewango 33 – Photo Log

0033: Shore

0034: Shore

Conewango 33 – Photo Log

0035: Shoreline

0036: Reservoir

Conewango 33 – Photo Log

0037: Face of Dam

0038: Reservoir

Appendix B

Inspection Documents

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	Item No.	CONDITION	OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
		EMBANKMENT 1 OF 2				
CREST	1	**SURFACE CRACKING**	None found			
	2	**CAVE IN, ANIMAL BURROW**	None found			
	3	**LOW AREA (S)**	Minor			
	4	**HORIZONTAL ALIGNMENT**	Ok			
	5	**RUTS AND/OR PUDDLES**	None noted			X
	6	**VEGETATION CONDITION**	heavy			
	7					
	8					
UPSTREAM SLOPE	9	**SLIDE, SLOUGH, SCARP**	SE corner, Dry slough			
	10	**SLOPE PROTECTION**	None			X
	11	**SINKHOLE, ANIMAL BURROW**	Burrow, w.p. 58			
	12	**EMB/ABUT CONTACT**	Trees should be cleared back (± 10'?) w.p. 53 (SW Corner)			X
	13	**EROSION**	minor			X
	14	**VEGETATION CONDITION**	General debris (woody) heavy, dense, long			X
	15		See note			
	16					

Additional Comments (refer to Item No. if applicable)

W.P. 53 start — Side of dam EMB/ABUT is acting as a drain for adjacent uphill embankment.

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	Item No.	CONDITION	OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
		EMBANKMENT 2 OF 2				
DOWNSTREAM SLOPE	17	**WET AREA (S) (NO FLOW)**	None noted			
	18	**SEEPAGE**	None noted			
	19	**SLIDE, SLOUGH, SCARP**	Slough SW side @ EMB/ABUT, minor slough w.p. 62			
	20	**EMB/ABUT CONTACT**	None noted			
	21	**CAVEIN/ ANIMAL BURROW**	None noted			X
	22	**EROSION**	None noted			
	23	**UNUSUAL MOVEMENT**	None noted			
	24	**VEGETATION CONDITION**	None noted			
INSTRUMENTATION	25	**PIZOMETERS/ OBSERVATION WELL**	Not Applicable			
	26	**STAFF GAUGE AND RECORDER**	Not Applicable			
	27	**WEIRS**	Not Applicable			
	28	**SURVEY MONUMENTS**	Not Applicable			
	29	**DRAINS**	Not Applicable			
	30	**FREQUENCY READINGS**	Not Applicable			
	31	**LOCATION OF RECORDS**	Not Applicable			
	32					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	Item No.	CONDITION	OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATI	REPAIR
		DOWNSTREAM AREA AND MISC.				
DOWNSTREAM SLOPE	36	**ABUTMENT LEAKAGE**	None noted			
	37	**FOUNDATION SEEPAGE**	None noted			
	38	**SLIDE, SLOUGH, SCARP**	None noted			
	39	**DRAINAGE SYSTEM**	None noted			
	40					
	41					
	42					
	43					
MISC	44	**RESERVOIR SLOPES**	Slopes are unstable, some bare, w.p. 68, erosion noted			
	45	**ACCESS ROADS**	Appear adequate			
	46	**SECURITY DEVICES**	None noted			
	47					
	48					
	49					
	50					
	51					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	SPILLWAYS 1 OF 2			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATION	MONITOR	INVESTIGATE	REPAIR
ERODIBLE CHANNEL	51	SLIDE, SLOUGH, SCARP	Not Applicable			
	52	EROSION	Not Applicable			
	53	VEGETATION CONDITION	Not Applicable			
	54	DEBRIS	Not Applicable			
	55					
	56					
NON-ERODIBLE CHANNEL	57	SIDEWALLS	None Noted			
	58	CHANNEL FLOOR	None Noted			X
	59	UNUSUAL MOVEMENT	None Noted			
	60	APPROACH AREA	None Noted			
	61	WEIR OR CONTROL	None Noted			
	62	DISCHARGE AREA	None Noted			
	63					
DROP INLET	64	INTAKE STRUCTURE	Not Applicable			
	65	TRASHRACK	Not Applicable			
	66	STILLING BASIN	Not Applicable			
	67					
	68					
	69					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: May 24, 2012

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina, P.E..

AREA INSPECTED	OUTLET WORKS			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATION	MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	36	INTAKE STRUCTURE	None noted	X		
	37	TRASHRACK	None noted			
	38	STILLING BASIN	Looks Ok			
	39	PRIMARY CLOSURE	None			
	40	SECONDARY CLOSURE	None			
	41	CONTROL MECHANISM	None			
	42	OUTLET PIPE	Rip Rap moved away from under encasement, minor spalling			
	43	OUTLET TOWER	None			
	44	EROSION ALONG DAM TOE	None			
	45	SEEPAGE	None			
	46	UNUSUAL MOVEMENT	None			
	47					
	48					
	49					
	50					
	51					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	Item No.	CONDITION	EMBANKMENT 1 OF 2 OBSERVATION	CHECK ACTION NEEDED ✓ MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACKING				
	2	CAVE IN, ANIMAL BURROW				
	3	LOW AREA (S)	Appears Flat			
	4	HORIZONTAL ALIGNMENT				
	5	RUTS AND/OR PUDDLES	None Noted			
	6	VEGITATION CONDITION	Meadow grass			
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP				
	10	SLOPE PROTECTION				
	11	SINKHOLE, ANIMAL BURROW				
	12	EMB/ABUT CONTACT				
	13	EROSION	Erosion channel at SW grain			
	14	VEGITATION CONDITION	Meadow grass			
	15		Remove trees at West abutment			
	16		Encroaching shore line and [redacted] grain			

Additional Comments (refer to Item No. if applicable)

TY·LIN INTERNATIONAL

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	Item No.	CONDITION	EMBANKMENT 2 OF 2 OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA (S) (NO FLOW)	At grams			
	18	SEEPAGE				
	19	SLIDE, SLOUGH, SCARP				
	20	EMB/ABUT CONTACT				
	21	CAVEIN/ ANIMAL BURROW	Some rodent runs			
	22	EROSION	Minor erosion			
	23	UNUSUAL MOVEMENT	None noted			
	24	VEGITATION CONDITION	Seems good			
INSTRUMENTATION	25	PIZOMETERS/ OBSERVATION WELL				
	26	STAFF GAUGE AND RECORDER				
	27	WEIRS				
	28	SURVEY MONUMENTS				
	29	DRAINS				
	30	FREQUENCEY READINGS				
	31	LOCATION OF RECORDS				
	32					

Additional Comments (refer to Item No. if applicable)

Monitor wet grams

ruts & tire spins along bottom of DS slope ... About 100 FT up

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	DOWNSTREAM AREA AND MISC.			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATION	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	36	ABUTMENT LEAKAGE				
	37	FOUNDATION SEEPAGE				
	38	SLIDE, SLOUGH, SCARP				
	39	DRAINAGE SYSTEM				
	40					
	41					
	42					
	43					
MISC	44	RESERVOIR SLOPES				
	45	ACCESS ROADS				
	46	SECURITY DEVICES				
	47					
	48					
	49					
	50					
	51					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	Item No.	CONDITION	SPILLWAYS (_____ OF _____) OBSERVATION	CHECK ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
ERODABLE CHANNEL	51	SLIDE, SLOUGH, SCARP				
	52	EROSION	Some bare spots Aux spillway [illegible] west			
	53	VEGITATION CONDITION				
	54	DEBRIS				
	55					
	56					
NON-ERRODABLE CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
DROP INLET	64	INTAKE STRUCTURE	Good condition			
	65	TRASHRACK	Minor Debris			
	66	STILLING BASIN				
	67					
	68					
	69					

Additional Comments (refer to Item No. if applicable)

Name of Dam: Conewango Creek Site 33 Dam

Date of Inspection: 5/____/13

Owner: Chautauqua County

Inspectors: TY-LIN International - J. Guistina P.E.

AREA INSPECTED	OUTLET WORKS			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATION	MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	36	INTAKE STRUCTURE				
	37	TRASHRACK				
	38	STILLING BASIN				
	39	PRIMARY CLOSURE				
	40	SECONDARY CLOSURE				
	41	CONTROL MECHANISM				
	42	OUTLET PIPE				
	43	OUTLET TOWER				
	44	EROSION ALONG DAM TOE				
	45	SEEPAGE				
	46	UNUSUAL MOVEMENT				
	47					
	48					
	49					
	50					
	51					

Additional Comments (refer to Item No. if applicable)

2013 Conewango Creek Watershed Maintenance Report

Robert M. Shenk
Cattaraugus County SWCD

2013 Conewango Creek Watershed
Maintenance Work on the
Watershed Structures

This is a brief report of the annual work that was done on the Conewango Creek Watershed structures over the spring, summer and fall of 2013. This watershed covers parts of both Cattaraugus and Chautauqua Counties. It will include the Inspection, mowing and maintenance work for the normal function of these structures.

This season the inspection was done on the 15th of May with interested parties from Cattaraugus County, Chautauqua County, NRCS (Natural Resources Conservation Service) staff, members of the Conewango Watershed Commission, staff from T Y Lin International and District staff from both Counties. T Y Lin International is the engineering firm that both Counties hired to do the 10 year inspection and help complete the Emergency Action Plans for all of the sites. This inspection is part of the requirements that were put out by DEC. The details of this year's work will be discussed on a per site basis.

The sites were mowed by Mow-Con, LLC of West Seneca. The mowing this year was done on a one-year contract and was done so that with a new contract for the Watershed Commission being worked on, next season's contract would go back to a two-year contract with help from the Cattaraugus County SWCD. There are 8 sites to be mowed in the watershed, approximately 50 acres in all. It was done on the 7th and 8th of August and they started at Site 16A on Walker Road in the Town of Conewango. The weather was not a concern mowing this season and there were no major problems doing the work. This winter, I will be putting together a new mowing package and getting it out to the contractors. It will go back to a two-year contract.

There are still concerns about the wetness on the south end of the structure at Site 3 in the Town of Ellington. I did make plans to get the Soil Scientists from NRCS back down to take another look at the site. The Ground Penetrating Radar was used to try to find the source of all the water and get an idea of how to deal with it and keep it off the dam. The best idea that could be determined from this test was that the surface water needed to be addressed before a determination could be made about the ground water. I will address this again in the report for that site.

NRCS is still trying to do the research that they need to upgrade Site 13 (New Albion Lake) from a Class "B" hazard dam to a Class "C" hazard structure. This has been going on for some time. We have done surveys of the upstream area, taken sediment surveys of the surrounding area and now they are looking at the buildings downstream to determine what is and is not in the floodway if the dam was ever to breach. This work was being done at NRCS's State level. This summer, we received a phone call from them requiring a letter of support for this project before any more work could be done. We told them that this was something that would have to come from the County Legislature because that is where the funding, if any were to be spent, was going to come from and that it should be their decision. It was referred to the County. We have not heard from them in some time.

As for the 10 year Engineering Assessment, T Y Lin was contacted by DEC with regards to needing proof that the structures have not settled since construction. They were talking about having to have borings done to prove this had not happened. Our Engineer thought that this could be proved

without the expense of having borings done. So I got hold of NRCS and we used their GPS survey equipment and surveyed all of the sites of concern from August 21st through the 23rd. We took shots along the top of the dams, at the inlet and outlet of the principal spillway and did a cross-section survey over the top of each of the dams. With my last conversation with the Engineer, that should answer DEC's concerns. This operation saved a large expense not having to hire a contractor to do borings. He is also working on the inundation maps for the sites. With these completed, we should be in good shape as to being in compliance with DEC's requirements.

This year, members of the Commission, both Counties and the District have been working on the new contract that the Commission has between Cattaraugus and Chautauqua Counties. There were some things that were needed to be reworded and reworked. We worked on it for most of the summer and fall. This will give the Commission a little more control of the operation and maintenance concerns and less work for the Counties and will let us (the District) work with the Commission to do the work.

The maintenance work this season was completed by Bill Bognar from Little Valley. This would be the second year of his 2-year contract for the work. In the past, we have had a time getting Mr. Bognar to do the work in a timely fashion. This season was a quite different story. He called and wanted to do the work in early September and I did everything I could to start as soon as possible. The work for the Conewango sites was done on the 17th through 19th of September. Most of the required work from the inspections was completed and the sites look very good this year. I will be working on a new contract for the next two years maintenance work over the winter to be out for bid in the spring.

In conclusion, all of the major work from this season's inspection was completed in a timely manner. Everything looks good going into the winter months. I have been checking all of the sites this fall and winter so far. There should be no problems through the winter. I will as usual, keep track of things throughout the winter months and take care of anything that arises. The Conewango sites will be due for the DEC to inspect them this coming year. I am looking forward to them seeing the work that has been done over the past two seasons, get their reactions and comments and see what will need to be done in the future to keep them functioning as needed.

Site 33, Pickup Hill Road, Town of Cherry Creek-

Inspection- The inspection was done on the 15th of May with the rest of the sites. The work to do that was discussed was:

1) Minor debris to be removed.
2) Address the tile line in the secondary spillway.
3) Remove trees and brush from the tail dike at the inlet to the secondary spillway.
4) Remove brush from around the outlet pipe.

Mowing- The site was mowed on the morning of the 8th of August. It had rained overnight and the site was a little on the slippery side. He had problems coming out of the groins on both sides. He was very careful and finished the site without any issues.

Maintenance Work- We spent most of the day of the 18th of September working on this site. We dug some of the stone off of the top of the tile and replaced it with dirt that was brought by the Town Highway Dept. and packed it in. We then regraded the area around the tile. They repaired the ruts in the spillway as well. Then, they removed all of the trees and brush from the tail dike at the inlet to the spillway. The brush around the outlet pipe was removed as well. A couple weeks later, I got hold of Chautauqua County SWCD and we used their hydro-seeder to seed and mulch everything we could reach. The area that we could not reach with the seeder, I did by hand. The site looks great, but different from what it has.

We had some heavy rain and snow melt just before Christmas. Between Ken Chase and myself, we kept a pretty close eye on them and everything worked as designed. Water came up and went down with no issues.

Tail Dike at Site 33

Tile Repair at Site 33

United States Department of Agriculture

Natural Resources Conservation Service

Campus Boulevard
Suite 200
Newtown Square, PA 19073

Subject: ENG -- Ground-Penetrating Radar (GPR) Assistance

Date: 6 July 2004

To: Joseph Richard DelVecchio
State Conservationist
USDA-NRCS,
The Galleries of Syracuse
441 S. Salina St., Suite 354
Syracuse, NY 13202-2450

Purpose:
Lake sedimentation surveys were completed on seven flood-control reservoirs in western Cattaraugus and eastern Chautauqua counties, New York, using ground-penetrating radar (GPR).

Participants:
Stan Bishop, Cattaraugus County DPW, Ellicottville, NY
Brian Davis, District Manager, Cattaraugus County Soil & Water Conservation District, Ellicottville, NY
Jim Doolittle, Research Soil Scientist, USDA-NRCS, Newtown Square, PA
Robert Hartrick, Area Conservationists, USDA-NRCS, Batavia, NY
Christopher Henry, Civil Engineer, USDA-NRCS, Syracuse, NY
Steve Perschke, Area Engineer, USDA-NRCS, Batavia, NY
Benjamin Reckahn, Student Trainee Soil Conservationist, USDA-NRCS, Jamestown, NY
Bob Shenk, District Technician, Cattaraugus County Soil & Water Conservation District, Ellicottville, NY
Dave Sullivan, Geologist, USDA-NRCS, Syracuse, NY

Activities:
All field activities were completed during the period of 14 to 16 June 2004.

Survey Area:
Ground-penetrating radar surveys were completed on seven flood-control reservoirs in western Cattaraugus and eastern Chautauqua counties, New York. These surveys were conducted as part of the National Dam Rehabilitation Program. The reservoirs surveyed in Cattaraugus County included floodwater retarding structures numbers 1, 2, 3, 4, 5, and 16. Floodwater retarding structure Number 1 is located on Ischua Creek in Machias Township. Structures numbers 2 and 3 are located on Johnson Creek in Farmersville Township. Structure Number 4 is located on Saunders Creek in Franklinville Township. Structure Number 5 is located on Gates Creek in Lyndon Township. Structure Number 16 is located on Elm Creek in Napoli Township. In addition, structure Number 33, located on a tributary to Cherry Creek in Cherry Creek Township, Chautauqua County, was also surveyed. These watersheds are underlain by Upper Devonian shales, sandstones, and siltstones of the Conewago, Conneaut, and Canadaway formations. Principal soils on the bottomlands include Canadice and Birdsall (see Table 1). Principal soils on the surrounding uplands include Lordstown, Volusia, and Mardin (see Table 1).

Table 1
Taxonomic Classification of the Principal Soils in the Study Areas

Birdsall	Coarse-silty, mixed, active, nonacid, mesic Typic Humaquepts
Canadice	Fine, illitic, mesic Typic Endoaqualfs
Lordstown	Coarse-loamy, mixed, active, mesic Typic Dystrudepts
Mardin	Coarse-loamy, mixed, active, mesic Typic Fragiudepts
Volusia	Fine-loamy, mixed, active, mesic Aeric Fragiaquepts

Equipment:

The radar unit is the TerraSIRch Subsurface Interface Radar (SIR) System-3000 (here after referred to as the SIR System-3000), manufactured by Geophysical Survey Systems, Inc.[1] Morey (1974), Doolittle (1987), and Daniels (1996) have discussed the use and operation of GPR. The SIR System-3000 consists of a digital control unit (DC-3000) with keypad, SVGA video screen, and connector panel. A 10.8-volt lithium-ion rechargeable battery powers the system. The SIR System-3000 weighs about 9 lbs (4.1 kg) and is backpack portable. A 120 MHz antenna was used in sedimentation surveys described in this report. This antenna provided adequate depth (greater than 4 m) and acceptable resolution of subsurface features.

The RADAN for Windows (version 5.0) software program developed by Geophysical Survey Systems, Inc, was used to process the radar records.[1] Processing included setting the initial pulse to time zero, color table and transformation selection, and range gain adjustments.

The position of each radar observation points was measured with a Trimble AG114 GPS Receiver.[1] The receiver was operated in the manual mode. All coordinates were expressed in terms of latitude and longitude. Coarse outlines of most reservoirs were obtained by walking the perimeter shoreline and manually recording waypoints with a Garmin GPSMAP 76 receiver.[1]

To help summarize the results of this study, the SURFER for Windows, version 8.0, developed by Golden Software, Inc., was used to construct two-dimensional simulations.[1] Grids were created using kriging methods with an octant search.

Background:

Presently, more than fifty percent of the dams constructed by the former USDA-Soil Conservation Service are older than 34 years and more than 1,800 will exceed their 50-year design life within the next 10 years (Caldwell, 2000). Many dams are in need of immediate rehabilitation. One of the primary issues in dam rehabilitation is reservoir sedimentation. Sedimentation is the major cause of the reduction in reservoir storage capacity. As part of a statewide assessment program, the USDA-NRCS is determining the volume of sediments deposited within selected reservoirs. The primary objectives of lake sedimentation surveys are to determine current reservoir capacity, ascertain changes in storage volume, and determine the volume of accumulated sediments. Secondary objectives include estimation of lateral and longitudinal deposition of sediments and annual yield rates.

Conventional methods for conducting lake sedimentation surveys are slow and labor intensive. Acoustic equipment (fathometer) has been used to facilitate some reservoir surveys. However, this technology can not resolve gradational contacts nor penetrate layers of aquatic vegetation and organic materials. Recently, ground-penetrating radar (GPR) has been used to survey lakes (Haeni et al., 1987, Izbicki and Parker, 1991; Mellett, 1995; Moorman and Michel, 1997; Sellmann et al., 1992; Truman et al., 1991) and stream channels (Spicer et al., 1997). The present study integrates GPS and GPR technologies for bathymetric surveys. The use of GPS is less labor intensive and time consuming than conventional positioning methods.

Survey Procedures:

The SIR System-3000 was mounted in a boat and the 120 MHz antenna was towed alongside in an inflatable raft. The boat and raft made multiple traverses across each reservoir. Locations of traverse lines were arbitrary and were continuously adjusted to lake conditions and geometry, and drift. Observation points for both GPS and GPR were simultaneously recorded at intervals of about 10 or 15 seconds. Intervals varied with the length of traverse and the speed of advance.

In general, surveys were limited to areas with water depths in excess of about 20 inches. The outboard motor would foul and the boat would drag bottom in areas with shallower water depths. As a consequence, large areas of most reservoirs were to shallow to be surveyed.

Where possible, shorelines were walked and GPS observations were recorded to document boundaries of the reservoirs. Water depths and thickness of sediments were assumed to be zero at these locations. This method was inaccurate as departures from the shoreline occurred in areas with dense vegetation, debris, saturated soils, and steep escarpments.

Calibration of GPR:

Ground-penetrating radar is a time scaled system. This system measures the time that it takes electromagnetic energy to travel from the antenna to an interface (e.g., lake bottom, stratigraphic layer) and back. To convert the travel time into a depth scale, either the velocity of pulse propagation or the depth to a reflector must be known. The relationships among depth (D), two-way pulse travel time (T), and velocity of propagation (V) are described in the following equation (Morey, 1974):

$$V = 2D/T \qquad [1]$$

---

[1] Manufacturer's names are provided for specific information; use does not constitute endorsement.

The velocity of propagation is principally affected by the dielectric permittivity (E) of the filed material(s) according to the equation (Morey, 1974):

$$E = (C/V)^2 \qquad [2]$$

Where C is the velocity of propagation in a vacuum (0.3 m/nanosecond). Velocity is expressed in meters per nanosecond (ns). A nanosecond is one billionth of a second. The amount and physical state of water (temperature dependent) have the greatest effect on the dielectric permittivity of a material. The dielectric permittivity of air and water are 1 and 81, respectively.

Based on previous studies, the water was assumed to have a velocity of propagation of 0.033 m/ns and a dielectric permittivity of 80. The electrical properties of lake bottom sediments are variable. The inaccessibility of lake bottom sediments to multiple direct measurements made determinations of propagation velocities impractical. As a consequence, the propagation velocity was estimated from electrical properties of known, similar sediments. Moorman and Michel (1997) reported that conversions of travel times to depths using this method have a margin of uncertainty of less than 15 percent. Base on a referenced value for saturated silts (Daniels, 1996), the bottom sediments were assumed to have a velocity of propagation of about 0.06 m/ns and a dielectric permittivity of 25.

On radar profiles, reflections from interfaces spaced closer than one half wavelength apart are indistinguishable due to constructive and destructive interference (Daniels, 1996). Daniels (1996) used the following equation to show the relationship between velocity of propagation (v), antenna center frequency (f), and wavelength (λ):

$$\lambda = v/f \qquad [3]$$

Equation [3] shows that the propagated wavelength will decrease with decreasing propagation velocity and increasing antenna frequency. With a 120 MHz antenna, using equation [3] and average velocities of 0.033 and 0.060 m/ns resulted in wavelengths of about 47 and 50 cm through water and saturated silts, respectively. Layers spaced closer than these intervals are difficult to distinguish on radar records.

Interpretations:

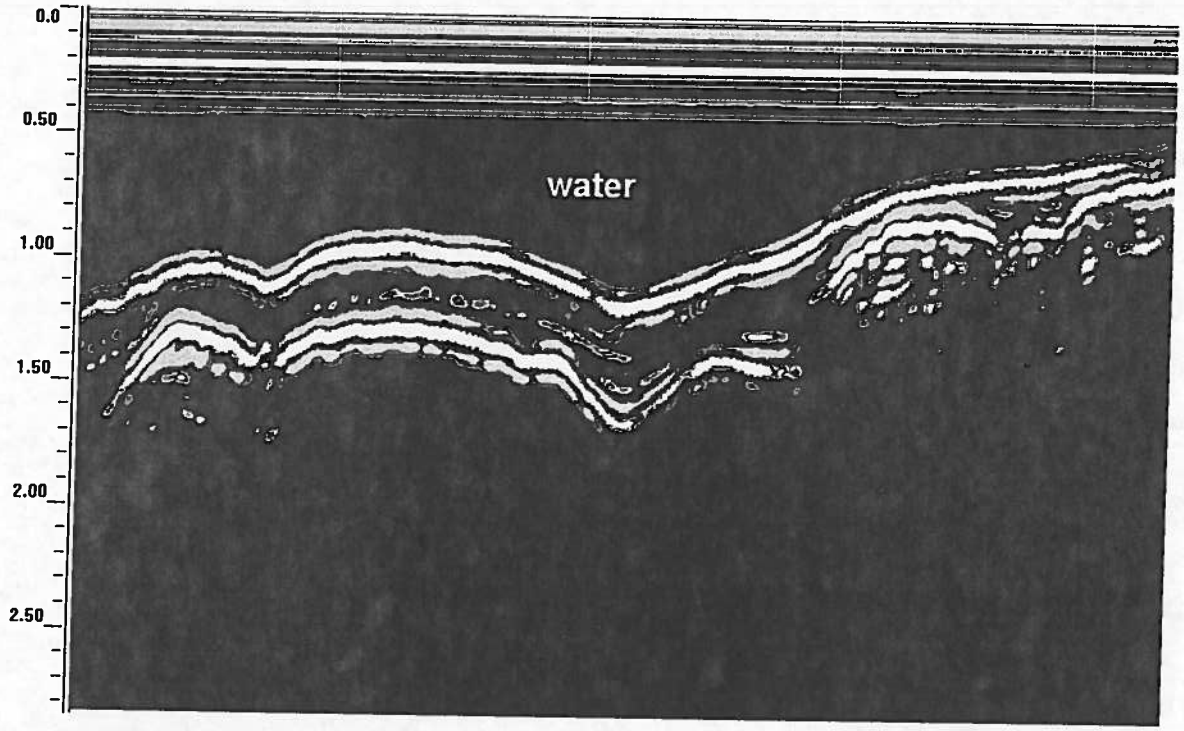


Figure 1. Representative radar record from Reservoir #2 that was collected with a 120 MHz antenna.

All radar records were of good interpretative quality. Figure 1 is a representative radar record from Reservoir #2. The depth scale is expressed in meters and is plotted on the left-hand side of the figure. Although the radar provides a continuous bathymetric profile of the lake, measurements of the water depth were restricted to observation points (white vertical lines at the top of the radar

profile). On this radar record, these lin[illegible]ere spaced at a time interval of 10 seconds. T[illegible]rong horizontal reflector at the top of the radar record represents the reflectio[illegible]om the lake's surface and its multiples. The firs[illegible]eries of high amplitude bands (colored grey, white, grey) represents the lake bottom. In this radar record, this interface varies in depth from about 0.6 to 1.2 m. The second group of high amplitude (also colored grey, white, grey), closely spaced multiple bands represents the base of the post-impoundment sediments and the contact with the original bottom materials.

With the120 MHz antenna the lake-bottom sediments were penetrated. The sediments consist of recent deposits. As no borings were made through these sediments at the time of this survey, the identity of these layers were not verified and the thickness of lake bottom sediments was estimated, but not measured. These layers were characterized as consisting principally of saturated silty sediments. This is of course is an oversimplification, but is useful to approximate the relative thickness of the post-impoundment sediments.

A task of this investigation was to identify the lake bottom and the base of the post-impoundment sediments on each radar record. The interface separating water from saturated sediments was easily identified and trace laterally on all radar records. The interpreted base of the post-impoundment sediments was identified as the deepest continuous high amplitude reflection. Although an E_r of 25 and an average velocity of 0.060 m/ns were used to determine the general thickness of the underlying saturated post-impoundment silty sediments, saturated silts are known to have E_r that ranges from 10 to 40 (Conyers and Goodman, 1997).

Results:

Seven reservoirs were surveyed in a 2.5 day period. Although GPR provides a continuous record of subsurface lake features, data were interpreted at only the geo-referenced GPR observation points. A total of 773 GPR observation points were recorded. For each reservoir, the number of observation points varied with the size of the reservoir and the area accessible to the boat. Basic statistics for the radar interpretations of water depths within each reservoir are listed in Table 2. Within the reservoirs surveyed, interpreted water depths ranged from 0.36 to 3.83 m. These are relatively small and shallow reservoirs. The greatest depths were recorded in Reservoir #16 (3.83 m) and Reservoir #2 (3.47 m). The area surveyed in Reservoir #2 had the greatest averaged water depth (2.41 m). The shallowest averaged water depths were recorded in Reservoir #1 (0.71 m), Reservoir #33 (1.04 m) and Reservoir #5 (1.17 m).

Table 2
Basic Statistics for Water Depths in each of the Reservoirs.
(with the exception of number of observations, all data are in m).

	#1	#2	#3	#4	#5	#33	#16
NUMBER	87	96	151	113	97	25	204
AVERAGE	0.76	2.41	1.55	1.57	1.17	1.04	1.76
SD	0.15	0.71	0.62	0.62	0.58	0.20	0.95
MIN	0.49	0.55	0.40	0.45	0.36	0.70	0.38
MAX	1.19	3.47	2.75	2.97	2.54	1.29	3.83
25% TILE	0.64	1.88	1.02	1.08	0.74	0.89	0.90
75% TILE	0.87	2.99	2.17	2.05	1.52	1.21	2.41

Table 3
Basic Statistics for Sediment Thickness in each of the Reservoirs.
(with the exception of number of observations, all data are in m).

	#1	#2	#3	#4	#5	#33	#16
NUMBER	87	96	151	113	97	25	204
AVERAGE	0.63	0.64	0.56	1.08	0.74	0.88	0.81
SD	0.45	0.38	0.20	0.29	0.37	0.27	0.29
MIN	0.00	0.00	0.11	0.39	0.21	0.45	0.22
MAX	2.11	1.96	1.36	1.70	1.87	1.36	1.66
25% TILE	0.30	0.41	0.45	0.92	0.45	0.69	0.60
75% TILE	0.94	0.75	0.65	1.26	1.00	1.11	1.01

Basic statistics for the radar interpretations of post-impoundment sediment thickness within each reservoir are listed in Table 3. Within the reservoirs surveyed, interpreted sediment thickness ranged from 0.00 to 2.11 m. As mentioned in the *Calibration of GPR* section, the minimum resolution of the 120 MHz antenna is about 50 cm in saturated silty sediments. As a consequence,

estimations of sediment layers that are less than 50 cm thick are speculative and subject to error. Both the shallowest (0.00 m) and greatest (2.11 m) thickness of post-impoundment sediments were recorded in Reservoir #1. However, the greatest averaged thickness of post-impoundment sediments (1.08 m) was observed in reservoir # 4. The shallowest averaged thickness (0.56 m) of post-impoundment sediments was observed in reservoir # 3.

Plots of the interpreted radar data can be found at the end of this report. In each plot, a gradational spectrum between two colors has been assigned to individual water depth or sediment thickness levels. In each plot the color bar interval is 0.25 m. The locations of the observation points are also in each plot. With the exception of Dam #1, the approximate outline of each reservoir is shown. These outlines were achieved by walking the perimeter of the reservoir with a GPS receiver. For Dam #1, only the survey limits, defined by accessible navigation depths, are shown. As evident in each of plots, large areas of each reservoir could not be navigated with the survey boat or surveyed with the raft mounted GPR at the time of the survey. In general, areas of thickness post-impoundment sediments are located in the deepest portions of each reservoir and conform to the locations of former stream channels.

Discussion:

Major sources of measurement error are variations in the velocity of propagation through water and post-impoundment sediments. In addition, errors in identifying the base of the post-impoundment sediments may have occurred in areas with alluvial sediments that predated the impoundment of water. The dielectric contrast between water and the post-impoundment sediments was abrupt and contrasting. This characteristic provided a most easily identifiable interface on radar records. Though less contrasting the contrast between the saturated low-density post-impoundment sediments and the higher-density pre-impoundment materials is substantial and this interface was identifiable on most radar records. However, misidentification of the base of the post-impoundment sediments could result in significant error in the estimation of sedimentation. Some reservoirs are situated on areas formerly occupied by alluvial soils. These soils have layers of sediment that may be confused with post-impoundment sediments. As the textural composition and moisture content of the post-impoundment sediments is unknown, the sediments were presumed to be saturated silts with an estimated dielectric permittivity of 25. Ancillary coring data would have greatly increased our knowledge of the composition, dielectric properties, and thickness of the post-impoundment sediments. In the absence of this data, estimations of the sediment thickness are constrained and subject to error.

Recommended Action:

1. If additional reservoirs are to be surveyed with GPR, winter operations should be considered. During winter months, reservoirs would be frozen and shallow areas could be more comprehensibly surveyed with GPR. The use of a snowmobile or snowshoes should be considered.

2. A copy of the spreadsheet of the GPS and GPR data has been forwarded by e-mail to Chris Henry.

It was my pleasure to work in New York and with members of your fine staff.

With kind regards,

Jim Doolittle
Research Soil Scientist
National Soil Survey Center

cc:

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W. Tuttle, Soil Scientist (Geophysical), USDA-NRCS-NSSC, P.O. Box 974, Federal Building, Room 206, 207 West Main Street, Wilkesboro, NC 28697

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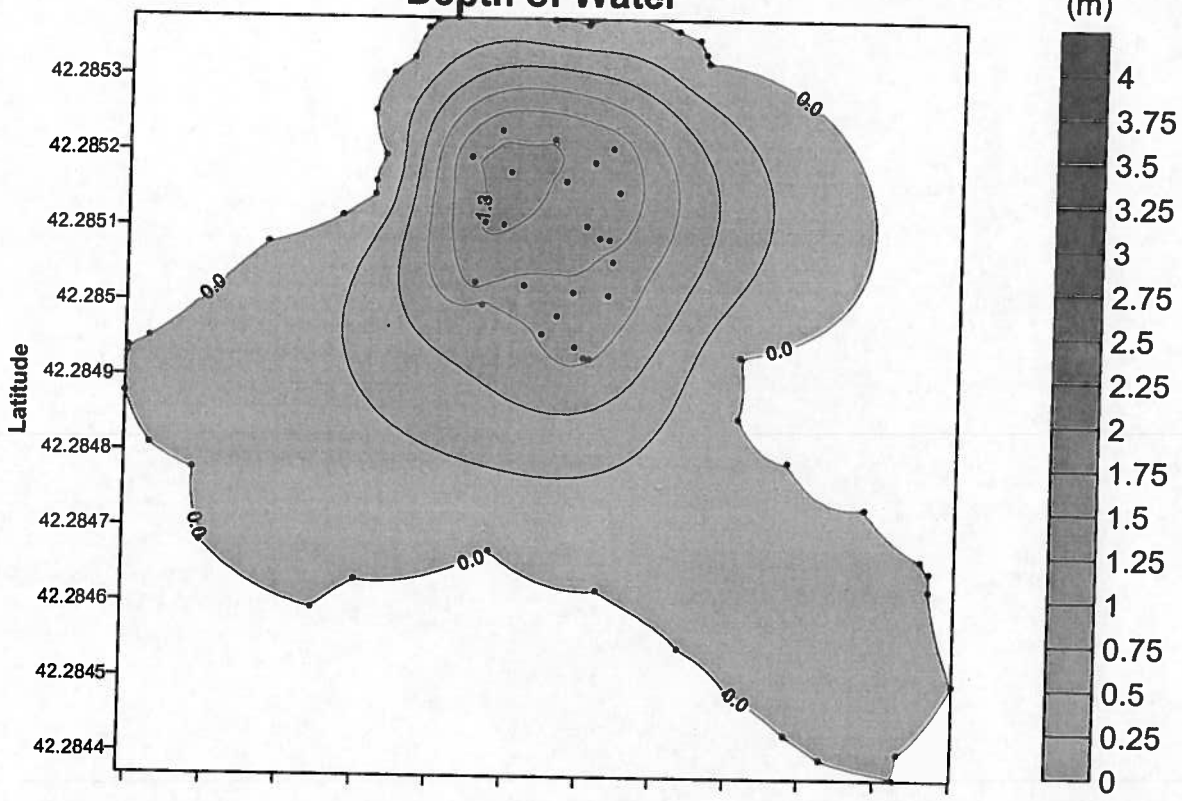
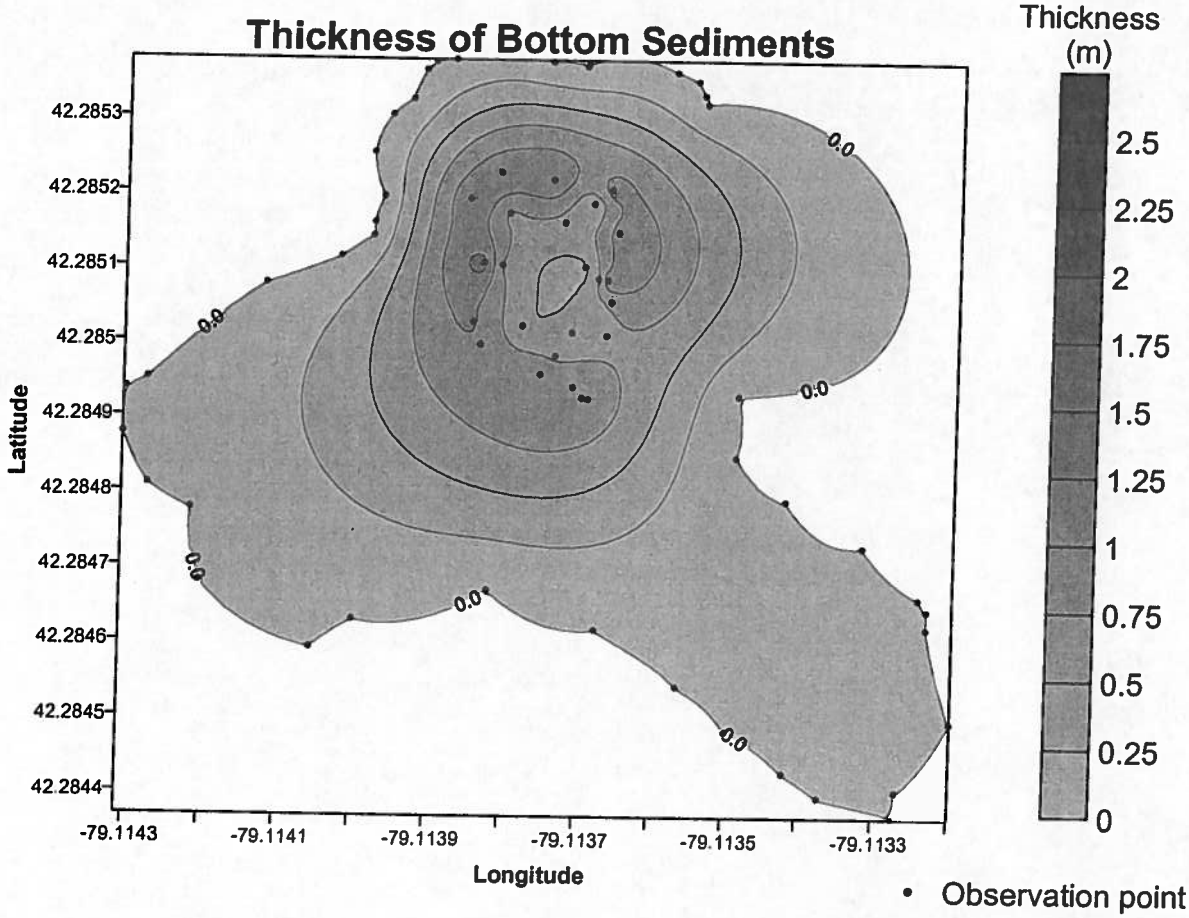
DAM #33
CHAUTAUQUA COUNTY, NEW YORK

Depth of Water



Thickness of Bottom Sediments



• Observation point

OPERATION AND MAINTENANCE PLAN

AND

OPERATION AND MAINTENANCE AGREEMENT

FOR

CONEWANGO CREEK WATERSHED

FLOODWATER RETARDING STRUCTURE

SITE 33

TOWN OF CHERRY CREEK

SPONSORED BY:

COUNTY OF CHAUTAUQUA
CHAUTAUQUA COUNTY SOIL & WATER DISTRICT
COUNTY OF CATTARAUGUS
CATTARAUGUS COUNTY SOIL & WATER DISTRICT

PREPARED WITH ASSISTANCE FROM
NATURAL RESOURCES CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FEBRUARY 2009

OPERATION AND MAINTENANCE PLAN

CONEWANGO CREEK SITE 33

FLOOD WATER RETENTION STRUCTURE

General

The Sponsor and NRCS agree to carry out the terms of this agreement for the operation and maintenance of the practices in the State of New York. This structure is a part of the original Conewango Creek Watershed Plan that was approved March 1959 and the Supplemental Watershed Plan approved on April 1966 under the authority of Public Law 83-566.

This plan defines responsibilities for operating, inspecting, and maintaining the Conewango Creek floodwater retarding structure Site 33. These responsibilities shall remain in effect for the program life of 100 years from the original date the structure is determined complete (1974) by the Natural Resources Conservation Service (NRCS) (Expiration Year 2074). After the expiration of this O&M Plan the Sponsors will not be eligible for any Federal technical or financial assistance administered by NRCS, unless Conewango Creek Site 33 is upgraded to the most recent NRCS dam safety criteria and the O&M Plan is recertified to current Federal dam safety criteria. After the expiration date of this O&M Plan, the Sponsors will remain liable for the health and safety of the general public and related infrastructure resulting from the failure of the Conewango Creek Site 33 flood control structure. This liability shall remain in force until the structure is removed.

Description of Practice

Floodwater retarding structure Conewango Creek Site 33 is located approximately 1 mile south of the Village of Cherry Creek on an unnamed tributary to Cherry Creek in Chautauqua County, New York. This structure was designed as a high hazard dam. The dam is jointly owned by the County of Cattaraugus (County Legislature and the Soil and Water Conservation District) and County of Chautauqua (County Legislature and the Soil and Water Conservation District). The dam is a homogenous earth structure, 315 feet long, with a height of 57 feet. The principal spillway inlet is a rectangular concrete drop box, 14.2 feet by 9.2 feet, 43.6 feet high. The spillway outlet is a 30 inch diameter AWWA C-301 pipe with a stilling basin. A 50 feet wide grassed auxiliary spillway is located on the left abutment.

Duration of O&M Requirements

Beginning with the date of acceptance of the works of improvement in whole or in part, the term of this agreement is for the evaluated life of the measure (100 years). The

expiration date is determined to be 2074, unless amended by mutual agreement between the sponsors and the NRCS.

Estimated Annual O&M Costs

The Cattaraugus and Chautauqua County Legislatures are responsible for financing the operation and maintenance activities for the Conewango Creek Site 33 floodwater retarding structure. Funds for these activities will be obtained from tax revenues collected by the Cattaraugus and Chautauqua County Legislatures and will be held in an operation and maintenance escrow account until needed. It is estimated that the average annual cost of maintenance will be $ 8,500 (2008 Dollars) for this structure. Estimated annual O&M costs are as follows (unused amounts will be added to escrow account each year)

Vegetation (mowing, liming, fertilizing)	$2,000
Debris Removal	$ 500
Concrete Repair/Replacement	$ 500
Metal works (trash racks, railings, grating, drainage)	$ 500
Engineering Evaluation and Record Keeping	$ 2,000
Unforeseen and Long term Maintenance (escrow account)	$ 3,000
	$ 8,500/Yr

Operation

For the floodwater retarding structure (FWRS) to serve its purpose of flood control, no human operation will be necessary. Flood control is provided by the size of the principal spillway pipe limiting the outflow and causing the storage of floodwater in the flood pool behind the dam. As the storm recedes, the limited outflow continues until the stored floodwater is discharged. The principal spillway discharge, when the flood pool is at its maximum elevation (1513.8 mean sea level), is 351 cubic feet per second. The Conewango Creek Site 33 Dam is a high hazard structure (Hazard Class High)

The Conewango Watershed Commission will be responsible for all operation activities. The Conewango Watershed Commission will assist in the coordination of any required reservoir drawdown and other operation activities to be coordinated with other structures in the watershed.

Maintenance

It is the responsibility of the Conewango Watershed Commission to ensure that the following operation and maintenance items, as a minimum, are addressed annually. The Cattaraugus County Soil and Water Conservation District will conduct the inspections.

Required funds for maintenance will be obtained from tax revenues collected by the County of Cattaraugus and the County of Chautauqua in the state of New York

All materials used in the maintenance and repair of any component of the dam shall be equal or better quality than shown on the original plans and specifications. Maintenance activities that involve work in the stream channel, including the inlet channel, the concrete pipe and appurtenances, and the outlet channel, will be carried out between May 15 and October 1 to avoid adverse impact on the fishery.

Maintenance along the dam embankment and reservoir shoreline, portions of the inlet structure (riser), concrete pipe and outlet structures will be below the water surface. Maintenance of these structures may require dewatering involving the operation of the slide gate to lower the water level for short periods of time to complete the needed maintenance. Maintenance of these structures may also require the use of temporary barriers or coffer dams, pumps, temporary plugs in the concrete pipe, or similar items.

The principal spillway slide gate shall be opened and closed each year during the annual inspection, as a minimum, to ensure proper operation. The opening and closing of the principal spillway slide gate shall be documented on the annual and formal inspection report.

The following is a list of items needing specific inspection and maintenance. Each item will be discussed in detail in the next section.

1. Principal spillway (Inlet Riser and Outlet Structure)
2. Embankment and drainage system
3. Emergency Spillway
4. Access
5. Sediment Flood Pool

The following detailed operation and maintenance items will require annual attention unless otherwise noted.

1. Principal Spillway

    a. All metal work shall be visually inspected, repaired, or replaced if it is damaged or improperly removed. All painted surfaces shall be cleaned and painted when rust starts to appear or the paint system shows signs of peeling or heavy oxidation.

    b. Interior of conduit shall be visually inspected every five years. Any seepage through the pipe joints, cracking, and excessive pipe settlement and joint gaps shall be brought to the attention of NRCS.

    c. Trash racks shall be kept free from trees, logs, trash, debris, and other obstacles which will interfere with the proper functioning of the structure. Trash racks shall be checked after all high water conditions.

d. Riprap at inlet and outlet shall be replaced or rearranged as needed to provide the intended erosion control.

e. Outlet channel erosion or siltation will be corrected as needed to restore the outlet channel to the design grade and cross section.

f. Concrete will be visually inspected for cracks, spalls, misalignment, or structural breakage. Spalls deeper than 1-inch and cracks less than 0.25 inch shall be repaired with cement mortar and sealing compound respectively. Cracks greater than 0.25 inch, and misalignments of more than 0.5 inch, and any structural breakage shall be measured and repaired in accordance with NRCS recommendations. Exposed joints shall be visually inspected. Any joint where the sealing compound or joint filler is missing shall be repaired with materials similar to that used in the original construction. Any joints found to have opened more than 1-inch shall be measured and promptly repaired in accordance with NRCS recommendations

g. The principal spillway slide gate valve will be kept in working order. At a minimum, each gate slide valve shall be operated at each annual inspection. Excessive force shall not be used when operating gates. Repair or replace all non-functional hardware such as stem guides, anchors, and anchor bolts. Slide gate valves are not expected to retain operational capability for the design life of the dam and are anticipated to be replaced. Timing for replacement should be evaluated during annual O&M inspections.

h. Woody vegetation, trees, and large shrubs on the outlet channel area, and within 10 feet of all concrete structures shall be controlled by spraying or removal. This vegetation shall be killed or removed before it reaches 1 foot in height, or 1 inch in diameter (stalks of woody growth). All pesticide applications shall be done in accordance with applicable Federal, State, local, or tribal laws and regulations.

2. Embankment and Drainage System

a. Any soils removed from the embankment by erosion, slips, settlement, vandalism, rodents, vehicles or other causes shall be replaced on the original cross-section slopes and grades. All earthfill shall be approved material that is compacted and graded to prevent ponding or concentrated drainage. These areas shall be re-vegetated as soon as practical to ensure vigorous vegetated growth.

b. Fertilizer and lime shall be applied as needed to maintain vigorous growth of vegetation. Application rates will be based on soil tests

c. Holes created by animals shall be filled, compacted, graded, and re-vegetated.

d. Areas of sparse vegetation, including areas damaged by erosion, freezing, or drought shall be reseeded, fertilized, and limed as necessary to return area to vigorous growth and cover.

e. Riprap in gutters shall be replaced or rearranged as necessary to provide the intended erosion control.

f. Drain system piping outlets shall be: kept clear of blockage, clean and operational. Animal guards shall be visually inspected and replaced as needed. Visual inspection of drainage water (sediments or clear) will be made.

g. Woody vegetation, weeds, trees, and shrubs on the embankment shall be controlled by annual mowing, spraying or removal. This vegetation shall be killed or removed before it reaches 1 foot in height, or 1 inch in diameter (stalks of woody growth). All pesticide application shall be done in accordance with applicable Federal, State, local, or tribal laws and regulations.

h. The embankment shall be mowed at a frequency that prevents the establishment of woody vegetation. Mowing will be done after July 15 to protect ground nesting birds.

3. Auxiliary Spillway

a. Any material that restricts the full flow capacity or creates the potential for a discontinuity in the flow of the auxiliary spillway shall be removed as soon as possible.

b. All soils removed from the spillway by erosion, slips, settlement, vandalism, rodents, vehicles or other causes shall be replaced on the original slopes and grades. All earthfill shall be approved material that is compacted and graded to prevent ponding or concentrated drainage. Theses areas shall be re-vegetated as soon as practical to ensure vigorous vegetated growth.

c. Fertilizer and lime shall be applied as needed to maintain vigorous growth of vegetation. Application rates will be based on soil tests.

d. Holes created by animals shall be filled, compacted, graded, and re-vegetated.

e. Areas of sparse vegetation, including areas damaged by erosion, freezing, or drought shall be reseeded, fertilized, and limed as necessary to return the area to vigorous growth and cover.

f. Woody vegetation, weeds, trees, and shrubs on the spillway shall be controlled by annual mowing, spraying or removal. This vegetation shall be killed or removed before it reaches 1 foot in height, or 1 inch in diameter (stalks of woody growth). All pesticide application shall be done in accordance with applicable Federal, State, local, or tribal laws and regulations.

g. The spillway shall be mowed at a frequency that prevents the establishment of woody vegetation. Mowing will be done after July 15 to protect ground nesting birds. The mowed height of vegetation shall be no less than 3 inches and no greater than 6 inches.

h. Ruts or pathways created by foot or vehicle traffic will be revegetated to provide uniform vegetative cover in the spillway.

4. Access

    a. Access to the site shall be maintained.

5. Sediment Flood Pool

    a. Visually inspect the sediment flood pool for elevation of sediment and note on inspection report whether sediment is above or below the normal pool water line. If more than 1 ac-ft of sediment is above the normal pool water line, notify NRCS as soon as possible.

    b. The auxiliary spillway, principal spillway, and both slopes of the dam shall be kept clear of trees, logs, debris, trash, and other obstacles, which will interfere with the proper functioning of the structure.

Personnel

All personnel involved in conducting inspections and performing O&M activities shall be properly trained and equipped. NRCS may assist in training sponsor employees. NRCS may provide employees to accompany the sponsor during subsequent O&M inspections, if requested by the sponsors and if NRCS resources are available.

Inspections

Four types of inspections are required to ensure that the flood control structure functions and performs as designed in a safe manner.

1. **Monitoring** of the dam will be accomplished to identify and report abnormal conditions between scheduled inspections. This surveillance may be accomplished by any person, including landowners, O&M personnel, NRCS personnel, or others who visit or observe the site. Any unusual circumstances should be reported immediately to the sponsor or appropriate official for follow-up.

2. **Special** inspections will be conducted immediately following severe storms, earthquakes, initial filing of the reservoir, vandalism, any flow in the auxiliary spillway, or other significant events. Upon the occurrence of a special event, the sponsors shall notify the NYSDEC Dam Safety Section and NRCS Field and State Offices. A follow-up written report of the special inspection shall be forwarded to the NYSDEC Dam Safety Section and NRCS Field and State Offices.

3. **Annual** inspections will be accomplished in May (or prior to vegetative growth obscuring the ground surface) by properly trained personnel using an inspection checklist approved by NRCS. An NRCS engineer may participate in the annual inspection, if NRCS resources are available. A written report of the annual inspection shall be forwarded to the NYSDEC Dam Safety Section, the NRCS Watershed, Field and State Office.

4. **Formal** inspections shall be conducted at least once every 5 years. These inspections are to be accomplished under the leadership of a New York registered professional engineer with experience in dam engineering and may include soil and hydraulic specialists as needed. The State Dam Safety Section of NYDEC will be invited to participate in this inspection. The purpose of the inspection is to determine the safety and structural integrity of the dam, and to determine whether the dam meets the current NRCS and New York State Dam Safety criteria. The inspection criteria will include the following:

    a. Data Review and Analysis

        - Review all data related to the design and construction. Data that is unavailable, inadequate, or questionable shall be noted

        - Determine if the dam is in compliance with current NRCS, State Dam Safety, and other applicable criteria and policy. NRCS criteria are detailed in TR60 and may be determined by modeling with the NRCS SITES software.

        - Review the O&M Plan, previous inspection reports, and O&M history

        - Review the Emergency Action Workplan

b. Field Examination

- Complete a through visual inspection of all components (underwater inspections may be necessary)

- Inspect the principal spillway. A remotely controlled camera may be necessary to inspect the conduit

- Evaluate the downstream area to determine the current hazard classification

- Perform inspection in compliance with OSHA requirements

- Determine compliance with requirements of easements and landrights documents

- Determine if slopes, grades, and groundcover of the site has been modified from the original design. Where modification has occurred determine if modification has occurred with NRCS and NYDEC Dam Safety Section approval.

c. Contents of Inspection Report

- Summary of data reviewed and analyzed

- Visual inspection findings, including the inspection checklist

- Photographs, sketches, and maps

- Current hazard classification

- Adequacy of the Emergency Action Workplan

- Evaluation of data collected

- Determination if dam meets current NRCS and State Dam Safety criteria

- Required corrective action

- Evaluation of O&M Plan

d. Review and Distribution of Inspection Report

- Formal inspection reports shall be submitted to the NRCS State Conservation Engineer for review

- On approval of the report by the NRCS State Conservation Engineer, the report will be forwarded to the NYDEC Dam Safety Office

- Reports indicating serious deficiencies shall be forwarded to the NRCS State Conservationist for appropriate action

- A copy of each formal inspection report shall be filed with NRCS, the Sponsor(s) and NYDEC Dam Safety Section

Records

The Conewango Watershed Commission shall maintain the following records in a permanent file at the Chautauqua County DPW or other location where records can be maintained for the design life duration: a record of significant actions taken; the cost of performance and completion dates; as-built drawings; permits; inspection reports, and related material. Copies of all inspection reports shall be provided to the NRCS State Conservation Engineer and the NYDEC Dam Safety Office. The Conewango Watershed Commission shall also maintain a permanent file of the NRCS design books, as-built drawings, and other design related items.

Hazard Concerns

This structure is classified as a high hazard dam by NRCS and the NYDEC Dam Safety Section. The specific hazard concerns associated with Conewango Creek Site 33 are located in the downstream flood area.

The Emergency Action Plan for this structure outlines a sequential list of contingencies to be followed in the event this structure is subject to imminent failure or periods of high water flow. The Conewango Watershed Commission is responsible for ensuring that this plan is reviewed and updated annually. Copies of the original and sub-sequential updated plans shall be provided to the NRCS State Conservation Engineer and the NYDEC Dam Safety Section.

Violations

If NRCS determines that the Conewango Watershed Commission has failed to comply with the provisions of this O&M Plan, the County of Cattaraugus and the County of Chautauqua agrees to reimburse the Federal government for the financial assistance provided for the installation of Conewango Creek Site 33. The Federal government also shall have the right to take any further action it deems necessary as per the O&M agreement.

OPERATION AND MAINTENANCE ANNUAL INSPECTION REPORT
FOR FLOODWATER RETAINING STRUCTURES

Watershed _____ Inspection Date _____

Dam Identification No. _____ Report Date _____

FWRS Sponsors _____

O&M Responsible Organization: Cattaraugus County Soil & Water District

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YES" responses need explanation added to "Remarks" section. (ie: What? Where? Extent?)
"NO" responses indicate problems not observed during inspection.
Non-applicable items should be lined out.

Inspection Item	Yes	No	Remarks
1. Previous Year Inspection			
a. Are prior year O&M action items completed			
2. General Conditions			
a. Alterations to dam			
b. Development in downstream floodplain			
c. Development around reservoir			
2. Embankment			
a. Is vegetative cover inadequate			
b Are trees growing on either slope			
c. Is brush/weed control needed			
d. Are trees growing at waterline			
e. Is drift debris present			
f. Are cracks, settlement, or bulges present			
g. Are animal burrows present			
h. Are trails present			
3. Front Slope Protection			
a. Any wave damage observed			
b. Is riprap inadequate			
c. Are rodent holes present			

Inspection Item	Yes	No	Remarks
4. Inlet Structure and Gate Valves			
a. Does concrete exhibit deterioration			
b. Is concrete reinforcement exposed			
c. Was leakage observed inside inlet			
d. Any corrosion of metal appurtenances			
e. Is debris guard obstructed			
f. Is debris guard corroded			
g. Is gate stem broken or bent			
h. Are components missing			
i. Was gate determined not operational			Date gate last operated:
j. Has inlet been modified to alter water surface			
5. Principal Spillway Conduit			
a. Is concrete conduit deteriorated			
b. Is metal conduit corroded			
c. Was leakage observed at pipe joints			
6. Auxiliary Spillway			
a. Is vegetative cover inadequate			
b. Any animal trails observed			
c. Any vehicular trails observed			
d. Is flow area obstructed			
e. Is control section disturbed			
7. Principal Spillway Release Channel			
a. Does scour hole appear unstable			
b. Any boils observed			
c. Is riprap inadequate			
d. Any seepage observed			
e. Is conduit outlet submerged			
f. Is conduit outlet not properly supported			
g. Is outlet channel obstructed			
h. Is outlet channel degrading			
i. Is foundation drain submerged			
j. Is foundation drain rodent barrier missing			
k. Is foundation drain not functional			
8. Perimeter Fence			
a. Is fence inadequate			
b. Are gates open			
9. Easements/landrights			
a. Are terms of landrights out of compliance			

Inspection Item	Yes	No	Remarks
b. Are landrights boundaries being encroached upon			

ACTION TAKEN: (Identify all work performed in the preceding 12 months by the sponsors and/or NRCS, Including approximate cost and date completed).

ACTIONS NEEDED: (Identify items by priority: Low –next 12 months; High – as soon as possible), (Indicate date assistance requested; technical or financial).

Sponsor Representative **NRCS Engineering Representative**

OPERATION AND MAINTENANCE AGREEMENT

THIS AGREEMENT made on this _____ day of _____, 2009, is between the Natural Resources Conservation Service, United States Department of Agriculture, hereinafter referred to as NRCS, and the following organizations, hereinafter referred to as the Sponsor.

County of Cattaraugus, New York
Cattaraugus County Soil & Water Conservation District
County of Chautauqua, New York

THIS AGREEMENT replaces and supercedes the Operation and Maintenance Agreement signed by the Soil Conservation Service (SCS), United States Department of Agriculture (USDA) and the Conewango Watershed Commission dated 31 May 1968. This plan may be revised by mutual consent of all signatory parties.

The project measures covered by this agreement are identified as follows:

Conewango Creek Site 33 floodwater retarding structure located on an unnamed tributary to Cherry Creek approximately 1 mile south of Cherry Creek, New York

The Sponsors' responsibility for O&M began when the structure was determined complete by NRCS (1974). This responsibility shall include the replacement of any component of the structure as needed. This O&M Agreement remains in effect for the program life of 100 years from the date the last structure covered by this Agreement is completed (2074), as determined by NRCS. After the expiration of this O&M Agreement, the Sponsors may still continue to be liable until the structure is removed or modified to eliminate potential hazards.

I. GENERAL

A. The Sponsor shall:

1. Complete all maintenance, repair, or replacement activities within a reasonable time after the identification of such need:

2. Obtain prior NRCS approval of all plans, designs, and specifications for any planned alterations to the structure or for deviating from the O&M plan.

3. Be responsible for the replacement of structure components that have a design life of less duration than the program life of the structure as specified in the O&M Plan.

4. Prohibit the installation of any structure or facility that will interfere with the operation and maintenance of the structure.

5. Notify NRCS of any proposed agreement with other parties for the operation or maintenance of all or any part of the structure, and provide NRCS with a copy of the executed agreement. Such agreement will not negate the Sponsors' responsibilities as stated in this agreement.

6. Comply with property management standards set forth in the NRCS Contracts, Grants, and Cooperative Agreements Manual, the National Watershed Manual, and all applicable Federal, State, local, and tribal laws and regulations.

7. Provide NRCS personnel or its agents the right of free access to the structure site at any reasonable time for the purpose of carrying out the terms of the agreement.

8. Comply with Federal, State, local, and tribal laws and regulation in the operation and maintenance of the structure; and

9. Consider air and water quality, sediment control, and other environmental concerns in the operation and maintenance of the structure.

10. Be responsible for inspecting, operating and performing, or having performed, all operation, maintenance, and replacement activities associated with floodwater retarding structure Conewango Creek Site 33 and their components, as described in the O&M Plan.

11. Assure that the Emergency Action Plan is prepared for Conewango Creek Site 33 floodwater retarding structure and that the EAP is reviewed and updated annually.

12. Establish an escrow account for operation, maintenance, and replacement of structure/components.

B. NRCS will:

1. Upon request from the Sponsor and to the extent that NRCS resources permit, provide consultative assistance in the operation, maintenance, and replacement of practices.

II. OPERATION AND MAINTENANCE PLAN (O&M PLAN)

1. An O&M Plan for each practice included in this agreement is attached to and becomes a part of this agreement.

2. The O&M Plan shall be reviewed every five (5) years and revised as required to include any revisions to NRCS regulations and Federal, State, and local laws.

III. INSPECTIONS AND REPORTS

1. The Sponsor will inspect the practices during the month of May as specified in the O&M Plan.

2. NRCS or Federal land administrating agency may inspect the practices at any reasonable time during the period covered by this agreement. At the discretion of the State Conservationist, NRCS personnel may assist the Sponsor in inspections.

3. A written report will be made within 30 days from the date the inspection was conducted of each inspection and provided to the following:

   NRCS State Office
   NRCS Watershed Office
   NRCS Field Office
   New York State DEC Dam Safety Office

4. The Sponsor responsible for O&M of specific structures shall retain a record of all inspections and O&M performed including costs and completion dates. Records shall be made available to NRCS upon request.

IV. TIME AND RESPONSIBILITY

1. The Sponsor's responsibility shall continue until the expiration of the evaluated life of all the installed project practices. This does not relieve the Sponsor's liability which continues throughout the life of the measure or until the measure is modified to remove potential loss of life or property.

V. RECORDS

1. The Sponsor shall maintain in a centralized location all project documents including plans and specifications, as-built plans and specifications, design books, and records of all inspections and significant actions taken, cost of

performance and completion date with respect to operation and maintenance. NRCS may inspect these records at any reasonable time during the term of the agreement or as required by New York State regulations.

CATTARAUGUS COUNTY

By: _____

Title: _____

Date: _____

CATTARAUGUS COUNTY SOIL & WATER CONSERVATION DISTRICT

By: _____

Title: _____

Date: _____

CHAUTAUQUA COUNTY

By: _____

Title: _____

Date: _____

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

By: _____

Title: _____

Date: _____

NRCS
Natural Resources
Conservation Service
United States Department of Agriculture

Conewango Site 33
Inspection Summary

August 2005

Cutting Edge Group, LLC
14 Walkup Cutoff Road
Lake George, New York

Introduction

- Cutting Edge Group, LLC was hired by the USDA NRCS to perform inspections of flood control structures in various watersheds in New York State. Each inspection included a general visual inspection of each site as well as a detailed CCTV inspection of each structure.

General Observations

- Conewango Site 33 appeared to be well maintained. The earthen dike was well vegetated with hay, clover and various wild flowers. There was minimal woody vegetation as the mowing appears to have limited its advancement.
- The exterior of the inlet structures was in very good shape with minimal cracking and spalling observed. The metal structures appear to be sound and properly anchored

The Inlet Structure at Conewango Site 33

General Observations Continued

- The exterior of the outlet structures were in good condition with no cracking and spalling observed. Some minor pitting was observed which is consider a non-structural issue.

The Outlet Structure

CCTV Summary

- The equipment used to perform the CCTV inspections was an ARIES Saturn III. This system properly equipped can be used for the inspection of pipes from 4 inches to 200 inches in diameter. The camera was mounted on an all terrain carrier.
- The video monitor and carrier control system was transported to the outlet structure with a 6 wheel drive cub cadet ATV

Equipment used

Equipment used

Conewango Site 33

Municipal Services, Inc.
Fort Edward, NY 12828
Tel: 518/747-8079 Fax: 518/746-1795

Project Information

Project Name:	Contact :	Date:
Flood Control Structures	**Chris Henry**	**08/02/05**

Client:	**USDA-NRCS**
Contact:	**Chris Henry**
Position:	**Civil Engineer**
Road:	**441 S. Salina St. - Suite 354**
Town:	**Syracuse, NY**
County:	**Onondaga**
Telephone:	**315/477-6544**
Fax:	**315/477-6505**
Mobile:	
Email:	

Site:	
Contact:	
Position:	
Road:	
Town:	
County:	
Telephone:	
Fax:	
Mobile:	
Email:	

Contractor:	**Municipal Services, Inc.**
Contact:	**Mark A. Reynolds**
Position:	**President**
Road:	**268 Broadway**
Town:	**Fort Edward, NY 12828**
Telephone:	**518/747-8079**
Fax:	**518/746-1795**
Mobile:	**518/857-7420**
Email:	**mark@municipalsvcs.com**

Municipal Services, Inc.
Fort Edward, NY 12828
Washington
Tel: 518/747-8079, Fax: 518/746-1795

Inspection report

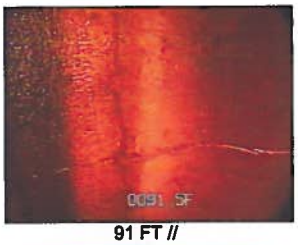
Date:	P.O.#	Weather:	Surveyed By:	section number:	PSR:
08/02/2005		1 Dry	N. Higginson	8	
Total Pipe Length:	**Survey Customer:**	**System Owner:**	**Clean Date:**	**Pre-Cleaned:**	**Map Grid #:**
300ft	USDA-NRCS	USDA-NRCS		N No Pre-Cleaning	

Street: Flood Control Structure	Flow Control:	Start MH: Outfall
City: Cherry Creek, NY	Year Renewed	End MH: Inlet
Location Code: Conewango -Site 33	Tape/Media #: 7	pipe length: 300 ft

Reason for inspection: F Routine Assessment	Dia/Height: C Circular 30"
Use of Sewer: Dam Outlet	Material: RCP Reinforced Concrete Pipe Pipe Length:
Drain. Area:	Lining Method:
	Category:

Remark::

1:750	position	code	observation
Outfall	0.00	ADP	Discharge Point, Remark: Outfall
	91.00	CC	Crack Circumferential, from 07 to 10 o´clock
	91.00	CC	Crack Circumferential, from 03 to 05 o´clock
Inlet	300.00	AOC	Special Chamber, Remark: Inlet Chamber



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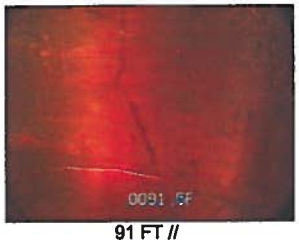

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QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
1200	0000	2	0	2	1	0	1

CCTV observations

- Some minor cracks were observed during the inspection of the reinforced concrete outlet pipes. The location of these cracks are noted on the log.
- The pipe length at Conewango site 33 was approximately 300 LF. The pipe was relatively free from debris.
- An inspection of the interior of the inlet structures revealed no problems.

Conclusions

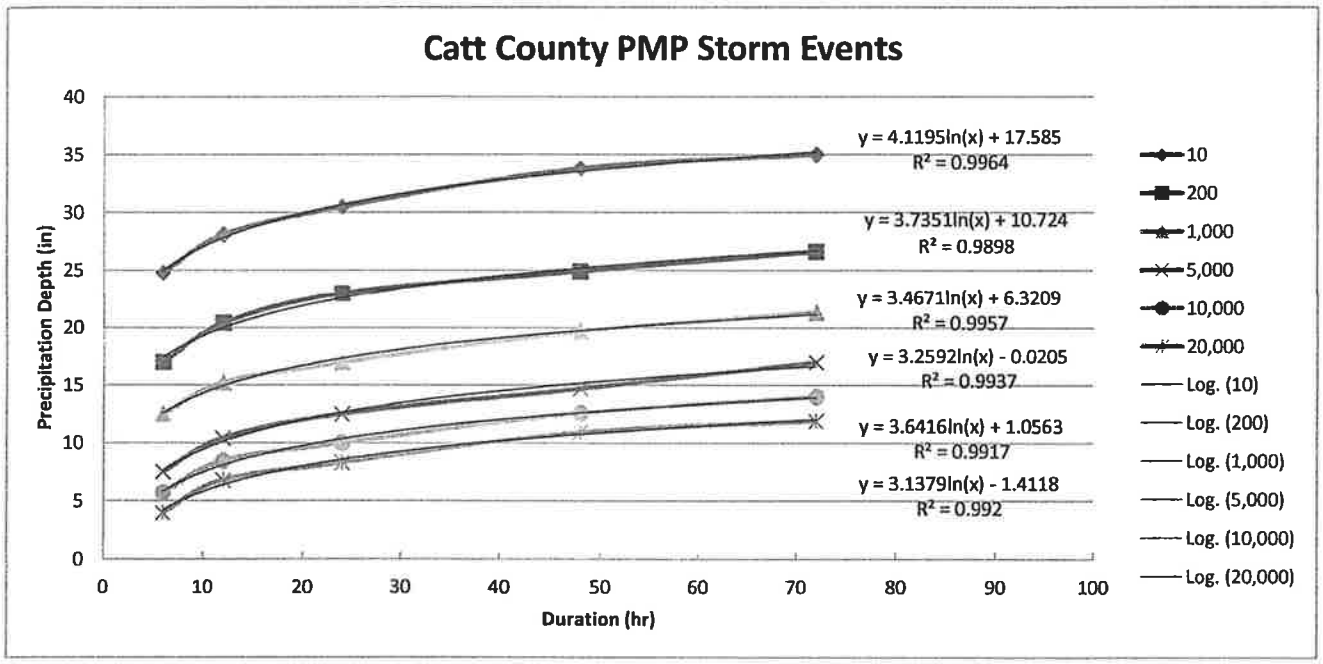
- The following conclusions are made regarding Conewango Site 33.
  - All structures at site 33 are in good condition.
  - Some minor cracks are noted on the log. These cracks should be monitored periodically to ensure that they do not get worse.

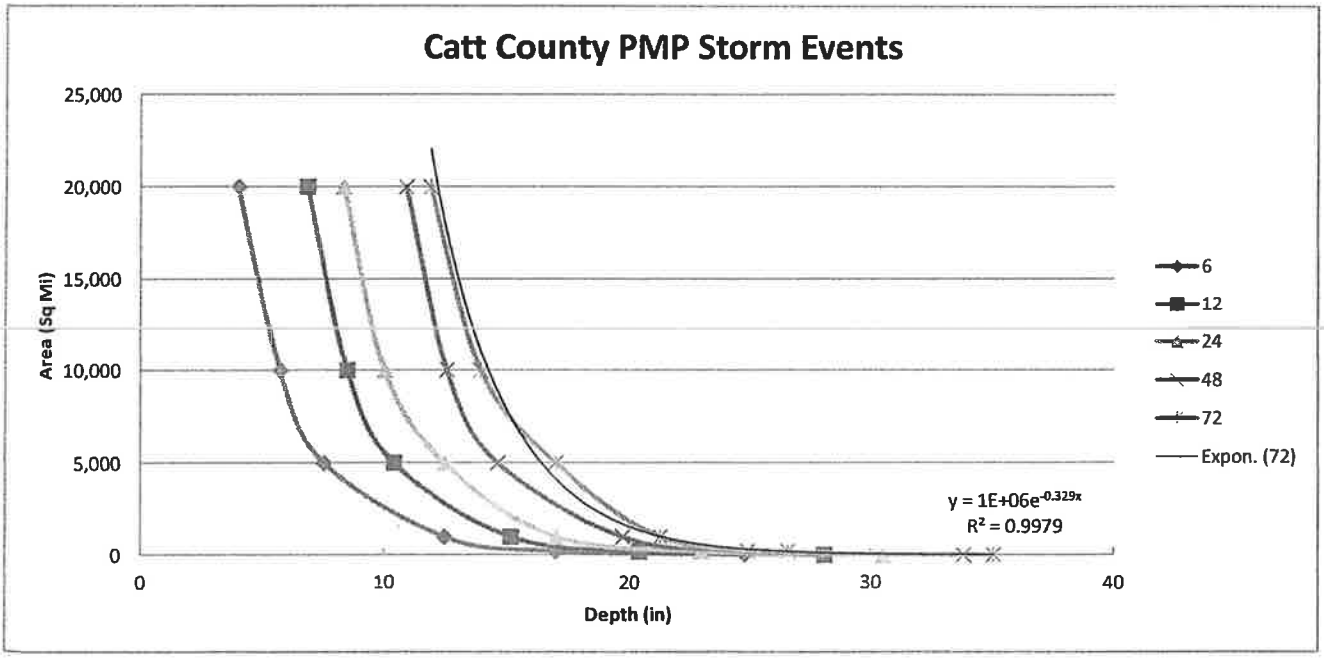
Appendix C

Hydraulic/Hydrologic Engineering Calcs

PMP in inches for Chautauqua County

Area (sq mi)	10	200	1,000	5,000	10,000	20,000
Duration (hr)						
6	24.8	17	12.5	7.5	5.7	4
12	28.1	20.4	15.2	10.4	8.45	6.8
24	30.5	23	17	12.5	10	8.3
48	33.8	24.9	19.7	14.7	12.6	10.9
72	35	26.6	21.3	17	14	11.9





Note	Contour (1927 Datum)	Max_Contou (1988)	AREA from Record Drawings (SF)	USGS Areas (1927 Datum) Acre	Area_SF GIS (SF)	Pond Surface Area (SF)	Pond Surface Area (Acre)	Volume per Contour (Acre*FT)	Total Storage from Record Drawings (ACRE-FT)	Total Storage ARC GIS (Acre*FT)
	1470.456	1470.00								
	1471.456	1471.00								
Drain Inlet	1472.120	1471.66	0.00						0.000	
	1472.456	1472.00								
	1473.456	1473.00								
Low Point Reservoir (Original Construction)	1474.456	1474.00								
	1475.456	1475.00								
	1476.456	1476.00								
	1477.456	1477.00								
	1478.456	1478.00								
Low Point of Reservoir Current	1479.456	1479.00								
	1480.456	1480.00		0.10						
	1481.456	1481.00								
	1482.456	1482.00								
	1483.456	1483.00								
1st Stage Principal Spillway Crest/Normal Pool	1483.700	1483.24	0.70						0.000	
	1484.456	1484.00								
	1485.456	1485.00								
	1486.456	1486.00								
	1487.456	1487.00			108.33	108.33	0.00	0.002		0.002
	1488.456	1488.00			2321.18	2,429.51	0.06	0.056		0.058
	1489.456	1489.00			9905.47	12,334.97	0.28	0.283		0.341
	1490.456	1490.00		0.66	9039.00	21,373.97	0.49	0.491		0.832
	1491.456	1491.00			7419.32	28,793.30	0.66	0.661		1.493
	1492.456	1492.00			6531.27	35,324.57	0.81	0.811		2.304
	1493.456	1493.00			7923.56	43,248.13	0.99	0.993		3.297
	1494.456	1494.00			7332.46	50,580.59	1.16	1.161		4.458
	1495.456	1495.00			9459.46	60,040.05	1.38	1.378		5.836
	1496.456	1496.00			10214.98	70,255.03	1.61	1.613		7.449
	1497.456	1497.00			10844.65	81,099.68	1.86	1.862		9.311
	1498.456	1498.00			9322.46	90,422.14	2.08	2.076		11.387
	1499.456	1499.00			9446.68	99,868.82	2.29	2.293		13.680
	1500.456	1500.00		2.92	8539.50	108,408.32	2.49	2.489		16.168
	1501.456	1501.00			7295.98	115,704.30	2.66	2.656		18.824
	1502.456	1502.00			7042.82	122,747.12	2.82	2.818		21.642
	1503.456	1503.00			6785.30	129,532.41	2.97	2.974		24.616
	1504.456	1504.00			6752.62	136,285.03	3.13	3.129		27.745
	1505.456	1505.00			6857.80	143,142.84	3.29	3.286		31.031
	1506.456	1506.00			7446.61	150,589.44	3.46	3.457		34.488
	1507.456	1507.00			10848.76	161,438.20	3.71	3.706		38.194
	1508.456	1508.00			10974.10	172,412.30	3.96	3.958		42.152
2nd Stage Riser Intake	1509.100	1508.64	4.40						64.800	
	1509.456	1509.00			11997.83	184,410.13	4.23	4.233		46.385
	1510.456	1510.00		5.00	10529.17	194,939.30	4.48	4.475		50.861
	1511.456	1511.00			10379.32	205,318.62	4.71	4.713		55.574
Aux Spillway Crest	1511.600	1511.14	4.90						76.400	
	1512.456	1512.00			10479.69	215,798.31	4.95	4.954		60.528
	1513.456	1513.00			10073.15	225,871.46	5.19	5.185		65.713
	1514.456	1514.00			10191.31	236,062.76	5.42	5.419		71.133
	1515.456	1515.00			10821.57	246,884.33	5.67	5.668		76.800
	1516.456	1516.00			12788.83	259,673.16	5.96	5.961		82.762
	1517.456	1517.00			14322.17	273,995.33	6.29	6.290		89.052
	1518.456	1518.00			19499.31	293,494.63	6.74	6.738		95.789
	1519.456	1519.00			30119.58	323,614.21	7.43	7.429		103.219
Top of Dam	1519.900	1519.44	7.90						128.300	
	1520.456	1520.00		8.83	33653.02	357,267.23	8.20	8.202		111.420

Totals								111.420	128.300	

Hydraulic Parameters for HEC-HMS Model

Assume SCS Clark Unit Hydrograph is used for estimating DA inflows.

Area is Agricultural and inputs below are taken for USGS NY Stream Stats for Dam 33 Watershed

Time of Concentration

$A := 0.52$ Area of Watershed (sq mi)

$S := 447$ Main Watercourse Slope (ft/mi)

$L := 1.42$ Main Channel Stream Length (mi)

$L_{ca} := 0.5$ Distance from concentration point along L to a point on L that is perpendicular to the watershed centroid. For Rectangular shaped WS it can assume to be 0.5L (mi)

$RTIMP := 1\%$ Impervious Area of Watershed

TYPE := Agricultural / Urban TYPE = 1

$$T_c := \begin{cases} 7.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.2} & \text{if TYPE} = 1 \\ \left(3.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}^{0.25} \cdot S^{-0.14} \cdot RTIMP\right) & \text{otherwise} \end{cases} = 1.827$$ Time of Concentration (hr)

Storage Coefficient

$R := 0.37 \cdot T_c^{1.11} \cdot L^{0.80} \cdot A^{-0.57} = 1.388$ Storage Coefficient (hr)

Time of Concentration DAM 33

Assume River V= 5 ft/sec
Assume Overland V= 2 ft/sec

W 100

Longest flow path =	7677.75602	FT
River Flow =	243.596553	FT
Overland Flow =	7434.15947	FT

Tc River =	0.01	hr
Tc Overland =	1.03	hr
Tc Total =	1.05	hr

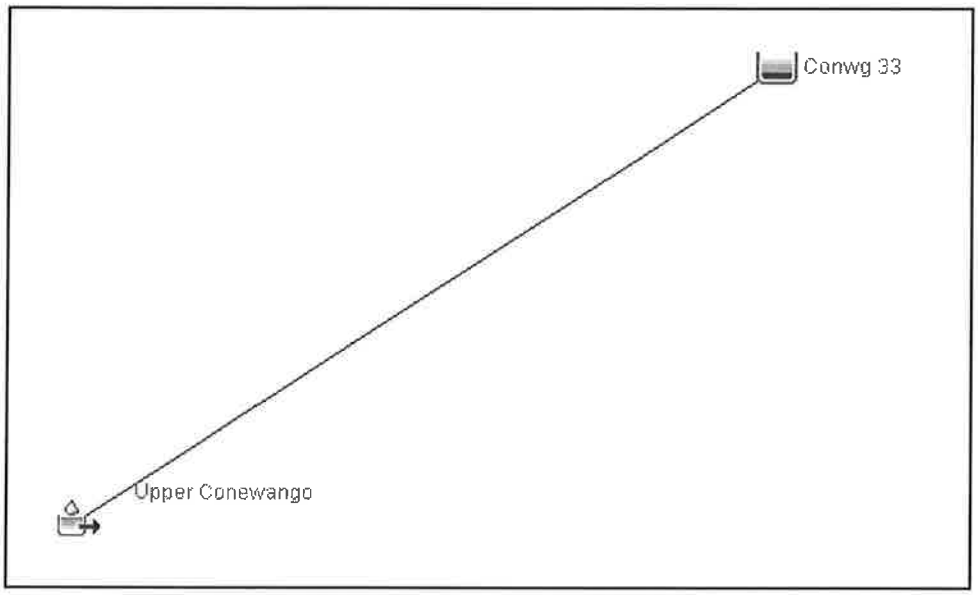
Chataqua County Dam 33 Hec HMS Results

Hec HMS Version 3.5

I. Dam Elevations

- Princp. Spillway (ft): 1469.1 (Normal Pool Elev.)
- Auxillary Spillway(ft): 1511.6
- Dam Top (ft): 1519.9

II. Basin Model Schematic



III. Sub-Basins Input

Upper Conewango

- Area (mi2): 0.54
- Loss Method: SCS Curve Number
- Curve Number: 77
- % Impervious: 0.1
- Transform Method: Clark Unit Hydrograph
- Time Conc. (Hr): 1.827
- Storage Coef. (Hr): 1.994

VI. Reservoir Input

Reservoir

- Discharge Method: Outflow Structures
- Initial Elev. (ft): 1483.7

- Tailwater: Assume None
- Spillways:
  - Outlet: Culvert, Main Direction, Circular Concrete Pipe
    - Length (ft): 295
    - Diameter (ft): 2.5
    - Inlet Elev (ft): 1469.1 (Actual=1351')
    - Ent Coef.: 0.1
    - Outlet Elev. (ft): 1457.7 (Actual=1349')
    - Exit Coef.: 0.1
    - Manning No.: 0.014

  - Spillway: Broad Crested, Auxillary Direction
    - Elev. (ft): 1511.6
    - Length (ft): 50
    - Coef.: 3.2

  - Dam Top: Level Overflow, Main Direction
    - Elev. (ft): 1519.9
    - Length (ft): 325
    - Coef.: 3.2

- Storage:

Elev. (ft)	Area (Ac)
1469	0.0001
1483.7	0.7
1495	1.38
1500	2.49
1505	3.29
1510	4.48
1515	5.67
1520	8.2

VI. Meterlogic Models

NRCS 24hr Formula

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 1 day
- Intensity Position: 25%
- Storm Area (mi2) 0.55
- Max Precp. (in): 11.75

NRCS 6hr Formula

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 6 hours
- Intensity Position: 25%
- Storm Area (mi2) 0.55
- Max Precp. (in): 9.23

NRCS 24hr PMF

- Method: Frequency Storm
- Intensity Duration: 15 minutes
- Storm Duration: 1 day
- Intensity Position: 50%
- Storm Area (mi2) 0.55
- Max Precp. (in): 30.68

NRCS 6hr PMF

- Method: Frequency Storm
- Intensity Duration: 15 minutes
- Storm Duration: 6 hours
- Intensity Position: 25%
- Storm Area (mi2) 0.55
- Max Precp. (in): 24.97

NRCS Princp Spillway

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 10 days
- Intensity Position: 25%
- Storm Area (mi2) 0.55
- Max Precp. (in): 8

NYSDEC 100-yr

- Method: Frequency Storm
- Intensity Duration: 1 hour
- Storm Duration: 6 hours
- Intensity Position: 25%
- Storm Area (mi2) 0.55
- Max Precp. (in): 3.7

NYSDEC 50% PMF

- Method: Frequency Storm
- Intensity Duration: 15 minutes
- Storm Duration: 6 hours
- Intensity Position: 25%
- Storm Area (mi2) 0.55
- Max Precp. (in): 12.49

VI. Control

- 5 days, 15 minute time interval

VII. Results

NYSDEC Principal Spillway

- Watershed Basin: Conw33
- Meterlogic Model: NYSDEC 100-yr

- Results Summary

Project: Conew 33 Simulation Run: DEC Prinp Spill

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Princ & Aux
End of Run: 05Jan2000, 12:00 Meteorologic Model: NYSDEC 100yr
Compute Time: 07Oct2013, 15:38:38 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Conewango	0.53769	130.2	01Jan2000, 15:30	45.3
Conwg 33	0.53769	97.8	01Jan2000, 16:45	48.7

- Reservoir Summary

Project: Conew 33
Simulation Run: DEC Prinp Spill Reservoir: Conwg 33

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Princ & Aux
End of Run: 05Jan2000, 12:00 Meteorologic Model: NYSDEC 100yr
Compute Time: 07Oct2013, 15:38:38 Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	130.2 (CFS)	Date/Time of Peak Inflow :	01Jan2000, 15:30
Peak Outflow :	97.8 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 16:45
Total Inflow :	45.3 (AC-FT)	Peak Storage :	6.4 (AC-FT)
Total Outflow :	48.7 (AC-FT)	Peak Elevation :	1486.5 (FT)

- Conclusion

For the 100-yr storm frequency event to discharge utilizing only the principle spillway, the resulting maximum ponding elevation in the reservoir is 1486.5 which is below the auxillary spillway. Therefore the principle spillway has adequate capacity.

NYSDEC Auxillary Spillway

- Watershed Basin: Conw33
- Meterlogic Model: NYSDEC 50% PMF

- Results Summary

Project: Conew 33 Simulation Run: DEC Aux Spill

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Aux Only
End of Run: 05Jan2000, 12:00 Meteorologic Model: NYSDEC 50% PMF
Compute Time: 07Oct2013, 15:38:36 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Conewango	0.53769	859.3	01Jan2000, 15:15	272.2
Conwg 33	0.53769	0.0	01Jan2000, 12:00	0.0

- Reservoir Summary

Project: Conew 33
Simulation Run: DEC Aux Spill Reservoir: Conwg 33

Start of Run:	01Jan2000, 12:00	Basin Model:	Dam 33A Aux Only
End of Run:	05Jan2000, 12:00	Meteorologic Model:	NYSDEC 50% PMF
Compute Time:	07Oct2013, 15:38:36	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	859.3 (CFS)	Date/Time of Peak Inflow :	01Jan2000, 15:15
Peak Outflow :	0.0 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 12:00
Total Inflow :	9.49 (IN)	Peak Storage :	81.8 (AC-FT)
Total Outflow :	0.00 (IN)	Peak Elevation :	1514.6 (FT)

- Conclusion

For the 50% PMF storm event to discharge utilizing only the auxillary spillway, the resulting maximum ponding elevation in the reservoir is 1514.6 which provides 5.3 ft of freeboard. The NYSDEC freeboard requirement is 2 ft, therefore the design is adequate.

NRCS Principal Spillway

- Watershed Basin: Conw33
- Meterlogic Model: NRCS Princp Spillway

- Results Summary

Project: Conew 33 Simulation Run: NRCS Prinp Spill

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Princ & Aux
End of Run: 05Jan2000, 12:00 Meteorologic Model: NRCS Prinp Spill
Compute Time: 07Oct2013, 15:43:51 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Conewango	0.53769	234.7	04Jan2000, 01:45	113.0
Conwg 33	0.53769	119.4	04Jan2000, 04:00	116.1

- Reservoir Summary

Project: Conew 33
Simulation Run: NRCS Prinp Spill Reservoir: Conwg 33

Start of Run:	01Jan2000, 12:00	Basin Model:	Dam 33A Princ & Aux
End of Run:	05Jan2000, 12:00	Meteorologic Model:	NRCS Prinp Spill
Compute Time:	07Oct2013, 15:43:51	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	234.7 (CFS)	Date/Time of Peak Inflow :	04Jan2000, 01:45
Peak Outflow :	119.4 (CFS)	Date/Time of Peak Outflow :	04Jan2000, 04:00
Total Inflow :	113.0 (AC-FT)	Peak Storage :	23.2 (AC-FT)
Total Outflow :	116.1 (AC-FT)	Peak Elevation :	1499.3 (FT)

- Conclusion

For the 100-yr storm frequency event to discharge utilizing only the principle spillway, the resulting maximum ponding elevation in the reservoir is 1499.3 which is below the auxillary spillway. *Therefore the principle spillway has adequate capacity.*

NRCS Auxillary Spillway (24 hr Min. Storm Duration)

- Watershed Basin: Conw33
- Meterlogic Model: NRCS 24hr Formula

- Results Summary

Project: Conew 33 Simulation Run: NRCS Aux Spill 24hr

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Aux Only
End of Run: 05Jan2000, 12:00 Meteorologic Model: NRCS 24hr Formula
Compute Time: 07Oct2013, 15:38:38 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Conewango	0.53769	646.5	01Jan2000, 19:45	252.1
Conwg 33	0.53769	0.0	01Jan2000, 12:00	0.0

- Reservoir Summary

Project: Conew 33
Simulation Run: NRCS Aux Spill 24hr Reservoir: Conwg 33

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Aux Only
End of Run: 05Jan2000, 12:00 Meteorologic Model: NRCS 24hr Formula
Compute Time: 07Oct2013, 15:38:38 Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow : 646.5 (CFS) Date/Time of Peak Inflow : 01Jan2000, 19:45
Peak Outflow : 0.0 (CFS) Date/Time of Peak Outflow : 01Jan2000, 12:00
Total Inflow : 252.1 (AC-FT) Peak Storage : 79.2 (AC-FT)
Total Outflow : 0.0 (AC-FT) Peak Elevation : 1514.1 (FT)

- Conclusion

For the NRCS Aux. Spillway 24hr storm event to discharge utilizing only the auxillary spillway, the resulting maximum ponding elevation in the reservoir is 1514.1 which provides 5.8 ft of freeboard, therefore the auxillary design is adequate.

NRCS Auxillary Spillway (6 hr Min. Storm Duration)

- Watershed Basin: Conw33
- Meterlogic Model: NRCS 6hr Formula

- Results Summary

Project: Conew 33 Simulation Run: NRCS Aux Spill 6hr

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Aux Only
End of Run: 05Jan2000, 12:00 Meteorologic Model: NRCS 6hr Formula
Compute Time: 07Oct2013, 15:38:38 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Conewango	0.53769	553.1	01Jan2000, 15:30	183.7
Conwg 33	0.53769	0.0	01Jan2000, 12:00	0.0

- Reservoir Summary

Project: Conew 33
Simulation Run: NRCS Aux Spill 6hr Reservoir: Conwg 33

Start of Run:	01Jan2000, 12:00	Basin Model:	Dam 33A Aux Only
End of Run:	05Jan2000, 12:00	Meteorologic Model:	NRCS 6hr Formula
Compute Time:	07Oct2013, 15:38:38	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	553.1 (CFS)	Date/Time of Peak Inflow :	01Jan2000, 15:30
Peak Outflow :	0.0 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 12:00
Total Inflow :	183.7 (AC-FT)	Peak Storage :	77.9 (AC-FT)
Total Outflow :	0.0 (AC-FT)	Peak Elevation :	1513.9 (FT)

- Conclusion

For the NRCS Aux. Spillway 6hr storm event to discharge utilizing only the auxillary spillway, the resulting maximum ponding elevation in the reservoir is 1513.9 which provides 6.0 ft of freeboard, therefore the auxillary design is adequate.

NRCS Freeboard (24 hr Min. Storm Duration)

- Watershed Basin: Conw33
- Meterlogic Model: NRCS 24hr PMF

- Results Summary

Project: Conew 33 Simulation Run: NRCS Freebrd 24hr

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Aux Only
End of Run: 05Jan2000, 12:00 Meteorologic Model: NRCS 24 Hour PMF
Compute Time: 07Oct2013, 15:38:39 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Conewango	0.53769	2234.0	02Jan2000, 01:45	784.2
Conwg 33	0.53769	0.0	01Jan2000, 12:00	0.0

- Reservoir Summary

Project: Conew 33
Simulation Run: NRCS Freebrd 24hr Reservoir: Conwg 33

Start of Run:	01Jan2000, 12:00	Basin Model:	Dam 33A Aux Only
End of Run:	05Jan2000, 12:00	Meteorologic Model:	NRCS 24 Hour PMF
Compute Time:	07Oct2013, 15:38:39	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	2234.0 (CFS)	Date/Time of Peak Inflow :	02Jan2000, 01:45
Peak Outflow :	0.0 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 12:00
Total Inflow :	784.2 (AC-FT)	Peak Storage :	99.8 (AC-FT)
Total Outflow :	0.0 (AC-FT)	Peak Elevation :	1517.3 (FT)

- Conclusion

For the NRCS Freeboard 24hr requirement the resulting maximum ponding elevation in the reservoir is 1517.3 which provides 2.6 ft of freeboard, therefore the freeboard requirement is met.

NRCS Freeboard (6 hr Min. Storm Duration)

- Watershed Basin: Conw33
- Meterlogic Model: NRCS 6hr PMF

- Results Summary

Project: Conew 33 Simulation Run: NRCS Aux Spill 6hr

Start of Run: 01Jan2000, 12:00 Basin Model: Dam 33A Aux Only
End of Run: 05Jan2000, 12:00 Meteorologic Model: NRCS 6hr Formula
Compute Time: 07Oct2013, 15:38:38 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Conewango	0.53769	553.1	01Jan2000, 15:30	183.7
Conwg 33	0.53769	0.0	01Jan2000, 12:00	0.0

- Reservoir Summary

Project: Conew 33
Simulation Run: NRCS Freebrd 6hr Reservoir: Conwg 33

Start of Run:	01Jan2000, 12:00	Basin Model:	Dam 33A Aux Only
End of Run:	05Jan2000, 12:00	Meteorologic Model:	NRCS 6 hr PMF
Compute Time:	07Oct2013, 15:38:39	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	1990.9 (CFS)	Date/Time of Peak Inflow :	01Jan2000, 15:15
Peak Outflow :	0.0 (CFS)	Date/Time of Peak Outflow :	01Jan2000, 12:00
Total Inflow :	621.7 (AC-FT)	Peak Storage :	96.9 (AC-FT)
Total Outflow :	0.0 (AC-FT)	Peak Elevation :	1516.9 (FT)

- Conclusion

For the NRCS Freeboard 6hr requirement the resulting maximum ponding elevation in the reservoir is 1516.9 which provides 3.0 ft of freeboard, therefore the freeboard requirement is met.

Hydrologic and Hydraulic Methodology for Chautauqua County Dams

The following is an algorithm of the assumptions and methodologies used for analyzing the Class C dams for Chautauqua County. Each Dam will be analyses using current NRCS methodology and NYSDEC methodology for Spillway and Freeboard Design. Dam Break Analysis will assume a failure for both piping and flood event.

Hydrology

HEC-HMS will be used for determining the hydrology for each basin. This will be used in combination with GEO-HMS for topography and routing of each storm (geometry).

HEC-HMS Runs for different hydrology (Geometry remains the same):

- To Meet DEC Criteria:
  - Principal Spillway
  - Auxiliary Spillway
- To Meet NRCS Criteria:
  - Principal Spillway
  - Auxiliary Spillway
  - Freeboard

Design Criteria:

Class C Dams – **NYSDEC** (From Guidelines for Design of Dams – 1989, NYSDEC)

[Values for Chautauqua County] – HMR-51[1] and TP-40[2] and TP-29[3]

Mode		Design Flood (SDF)	Min Storm Duration (hr)*	Value (in)	Freeboard (ft)
Small Dams	Principal Spillway Design	25-year	6	3.0[2]	N/A
	Auxiliary Spillway Design	50% PMF		12.5[1] – 10 mi^2 8.25 – 200 mi^2 6.25 – 1000 mi^2	1
Large Dams	Principal Spillway Design	100-year		3.72[3]	N/A
	Auxiliary Spillway Design	50% PMF		12.5[1] – 10 mi^2 8.25 – 200 mi^2 6.25 – 1000 mi^2	2

*Note: If Tc is greater than Storm duration, storm shall be adjusted as necessary.

Class C Dams (High Hazard) –**NRCS** (From TR-60 – Earth Dams and Reservoirs, USDA, NRCS – 2005)

[Values for Chautauqua County] – HMR-51[1] and TP-40[2] and TP-29[3] and TR-60[4]

Mode	Design Flood (SDF)	Min Storm Duration*	Freeboard (ft)	Value (in)	
Principal Spillway Design	100-year	10 day	N/A	8.0[4]	
Auxiliary Spillway Design	P100 + 0.26(PMP-P100)	24 hr & 6 hr MIN		24 Hour Storms** $11.6^{1,2}$ – 10mi^2 9.61 – 200 mi^2 8.05 – 1000 mi^2	6 Hour Storms** $9.12^{1,2}$ – 10mi^2 7.12 – 200 mi^2 5.95 – 1000 mi^2
Freeboard Requirement	PMP	24 hr & 6 hr MIN	1	24 Hour Storms $31^{1,2}$ – 10mi^2 23 – 200 mi^2 17 – 1000 mi^2	6 Hour Storms $24.5^{1,2}$ – 10mi^2 16.8– 200 mi^2 12.3– 1000 mi^2

*Note: If Tc is greater than Storm duration, storm shall be adjusted as necessary.

**Based on 100-yr value of 3.7 for 6h duration and 5.0 for 24h duration.

Dam Break

A dam break is generally achieved in one of two ways, Sunny Day Failure (Piping) or a Flood Event. Both events will be looked at in this study.

Software and method:

Determination of software to be used will coincide with the Compaction Factor equation to determine if a Level Pool method (HEC-HMS) is acceptable for analysis or if Dynamic Hydraulic Routing (HEC-RAS) will be necessary. This relies heavily on reservoir size. The following equations will be used to determine the method:

$F_c * F_t \Rightarrow 0.41$ Then level pool routing is an appropriate method and HEC-HMS may be used for a breach analysis combined with an unsteady state HEC-RAS model to develop inundation mapping downstream.

$$F_c = H/L$$

$$F_t = \frac{c * t}{L}$$

H= Average Dam Height (ft)

L=Dam Length (ft)

$c = g * D^{0.5}$

D = H/2

$t = 0.015 h_w$ (hours)

h_w = Height of Water behind dam (or to bottom of break) **(m)**

Inundations areas will be marked for sunny day dam failure, spillway design flood and spillway design flood plus dam failure, unless the extent of inundation is not appreciably different.

Flood Routing:

Flood Routing will use the latest orthoimagry mapping available from COGIR , NYS or USGS. Mapping will be developed using ARC GIS with the GEO-RAS interface for inundation.

Distance of the flood routing will be until the sunny day failure and spillway design flood plus dam failure equal (within 1') the spillway design flood for effects on downstream areas. Also, the routing will be discontinued if the flood wave reaches a major river such as the Allegany.

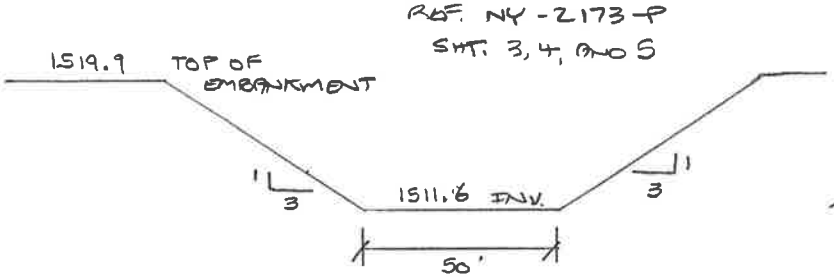
T·Y·LIN INTERNATIONAL

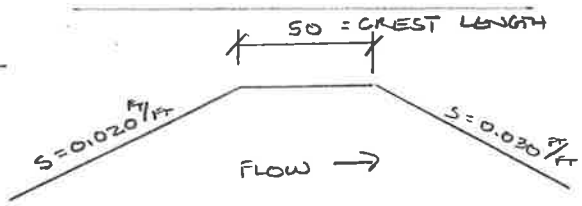
PROJECT DAM ASSESSMENT - SITE 33	JOB NO.	SHEET	OF
ITEM SPILLWAY CAPACITY CHECK	DESIGNER RMA	DATE 12/5/13	
	CHECKER	DATE	
		GRID 1/10"	

SITE 33 OUTLET WORKS

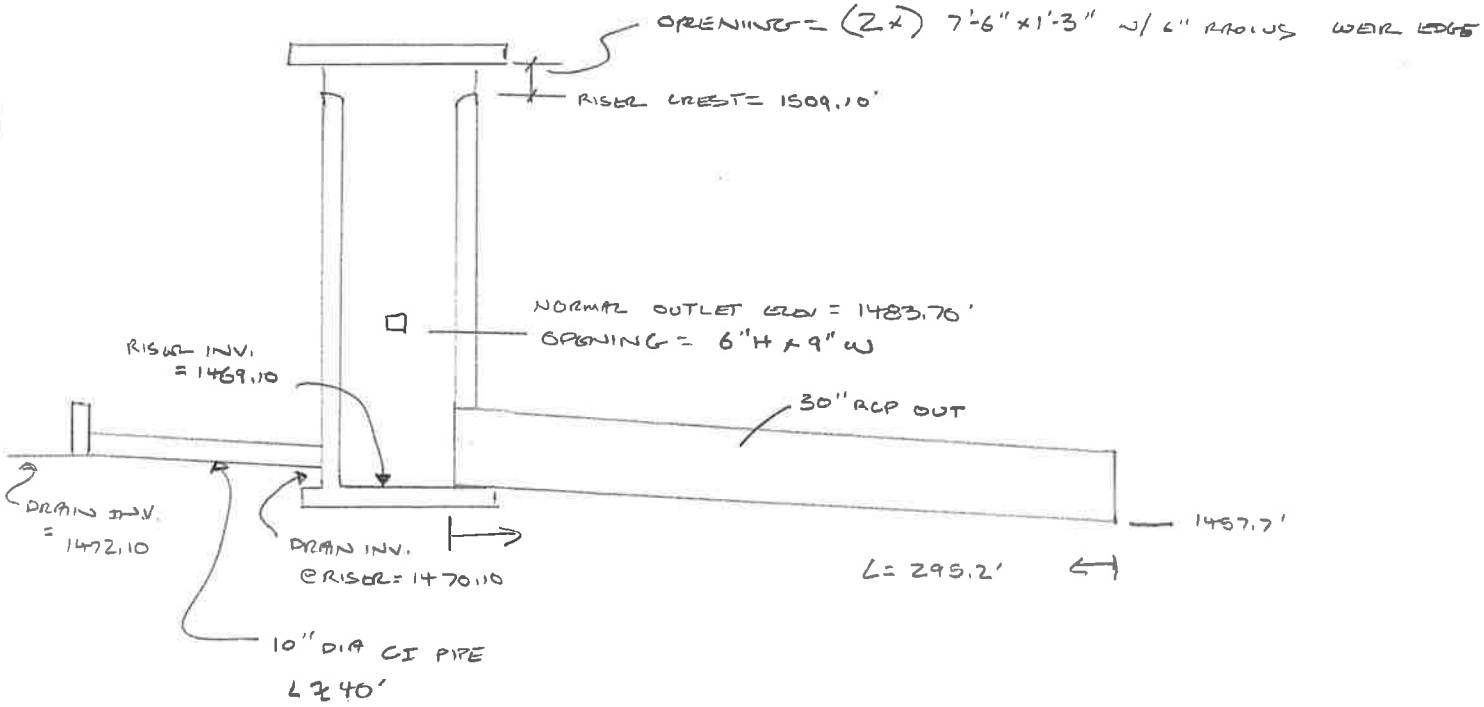
AUX. SPILLWAY: GRASS LINED TRAPAZOIDAL CHANNEL

REF. NY-2173-P
SHT. 3, 4, AND 5





PRINCIPLE SPILLWAY AND DRAIN: DROP INLET; REF. NY-2173-P
SHT. 9, 10, AND 15



Method for Determining Principle Spillway Discharge:

1. Determine known values:

   A_o = area of pipe opening
   L = length of pipe
   S_o = slope of pipe
   b = width of weir

2. Select Coefficients:

   C_d = coefficient of orifice discharge
   C = weir discharge coefficient
   k_e = entrance loss coefficient
   n = manning's roughness coefficient

3. Method for determining orifice flow:

   $$Q_o = C_d \cdot A_o \cdot \sqrt{2 \cdot g \cdot h}$$

4. Method for determining weir flow:

   $$Q_w = C \cdot b \cdot h^{3/2}$$

5. Method for determining pipe discharge:

   Note: from investigation the pipe will flow full with outlet control for the full headwater range of interest.

   $$H = HW - h_o + L \cdot S_o$$

   $$Q_p = A_o \cdot \sqrt{\frac{2 \cdot g \cdot H}{1 + k_e + \frac{29 \cdot n^2 \cdot L}{R^{4/3}}}}$$

Method for Determining Auxiliary Spillway Discharge:

1. Determine known values:

   S=channel slope
   b_c=channel bottom width
   z=channel side slope ratio: h/v

2. Assume a critical depth of flow in the discharge channel.

   D_c

3. Compute the flow area at the critical depth for a trapezoidal channel section.

   $A_c = (b_c + z \cdot D_c) \cdot D_c$

4. Compute the flow surface width at the critical section.

   $T = b + z \cdot D_c$

5. Compute the flow rate at the critical section.

   $Q_c = \sqrt{\frac{g \cdot A_c^3}{T}}$

6. Compute the hydraulic radius at the critical section.

   $R_c = \frac{A_c}{b + z \cdot \sqrt{(z \cdot D_c)^2 + D_c^2}}$

7. Compute the critical slope using manning's equation.

   $Q_c = \frac{1.49}{n} \cdot A_c \cdot R_c^{2/3} \cdot \sqrt{S_c}$ → is re-written as: → $S_c = \left[\frac{Q_c \cdot n}{1.49 \cdot A_c \cdot R^{2/3}}\right]^2$

8. Check the actual slope (S) vs. the critical slope (Sc). If S>Sc, then the flow passes through the critical depth in the channel, and the headwater elevation may be determined as the total energy at the critical section. (Note: Approach velocity and friction loss are neglected)

9. Compute the velocity at the critical section.

   $V_c = \frac{Q_c}{A_c}$

10. Compute the headwater depth.

    $D_{HW} + \frac{V_{HW}^2}{2 \cdot g} = D_c + \frac{V_c^2}{2 \cdot g} + h_f$

    $Neglect\ approach\ velocity: \rightarrow V_{HW} = 0$

    $Neglect\ friction\ loss: \rightarrow h_f = 0$

    $D_{HW} = D_c + \frac{V_c^2}{2 \cdot g}$

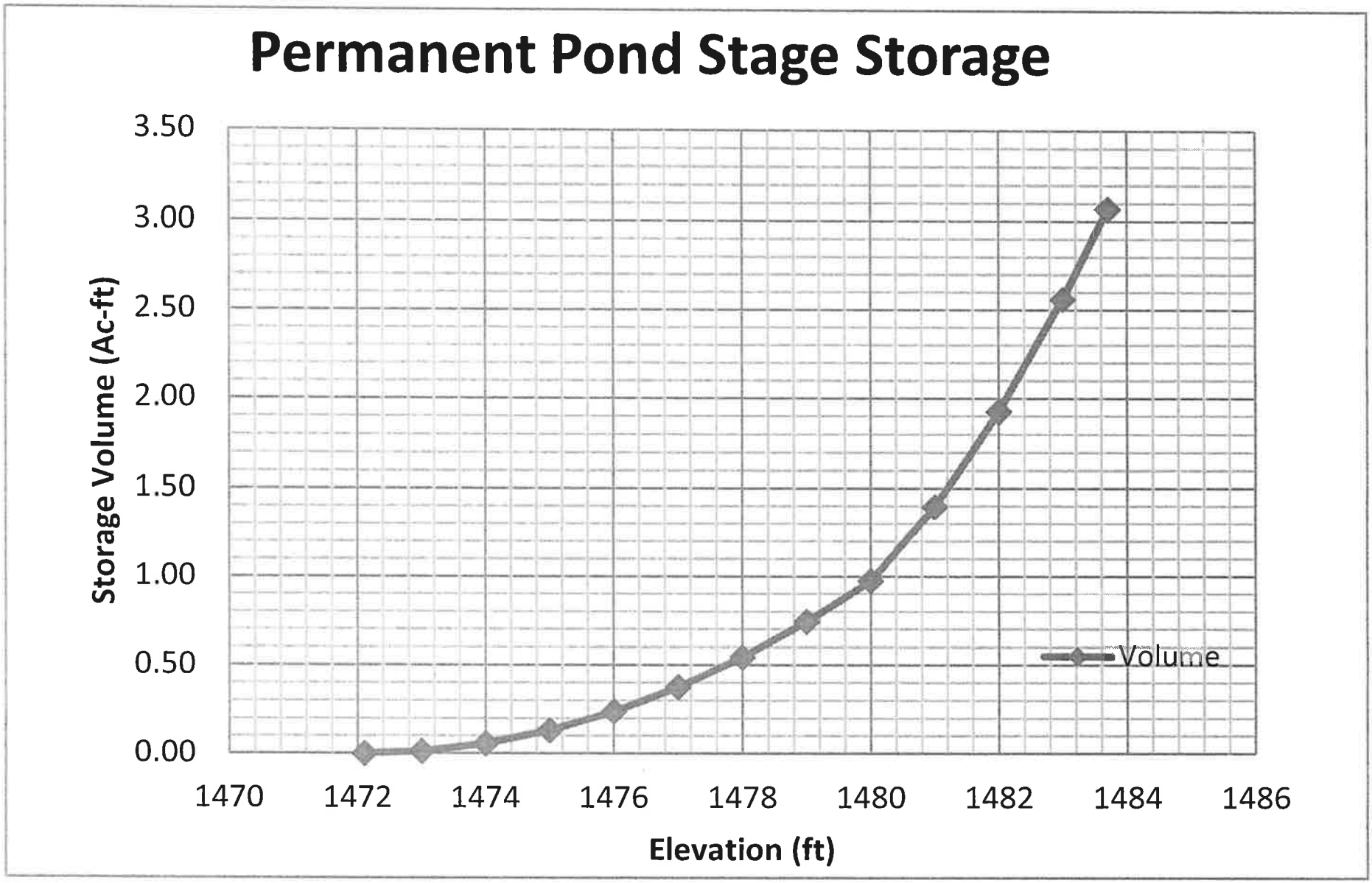
11. A trial and error process is used to determine the critical depth that corresponds to a desired headwater elevation for the discharge stages.

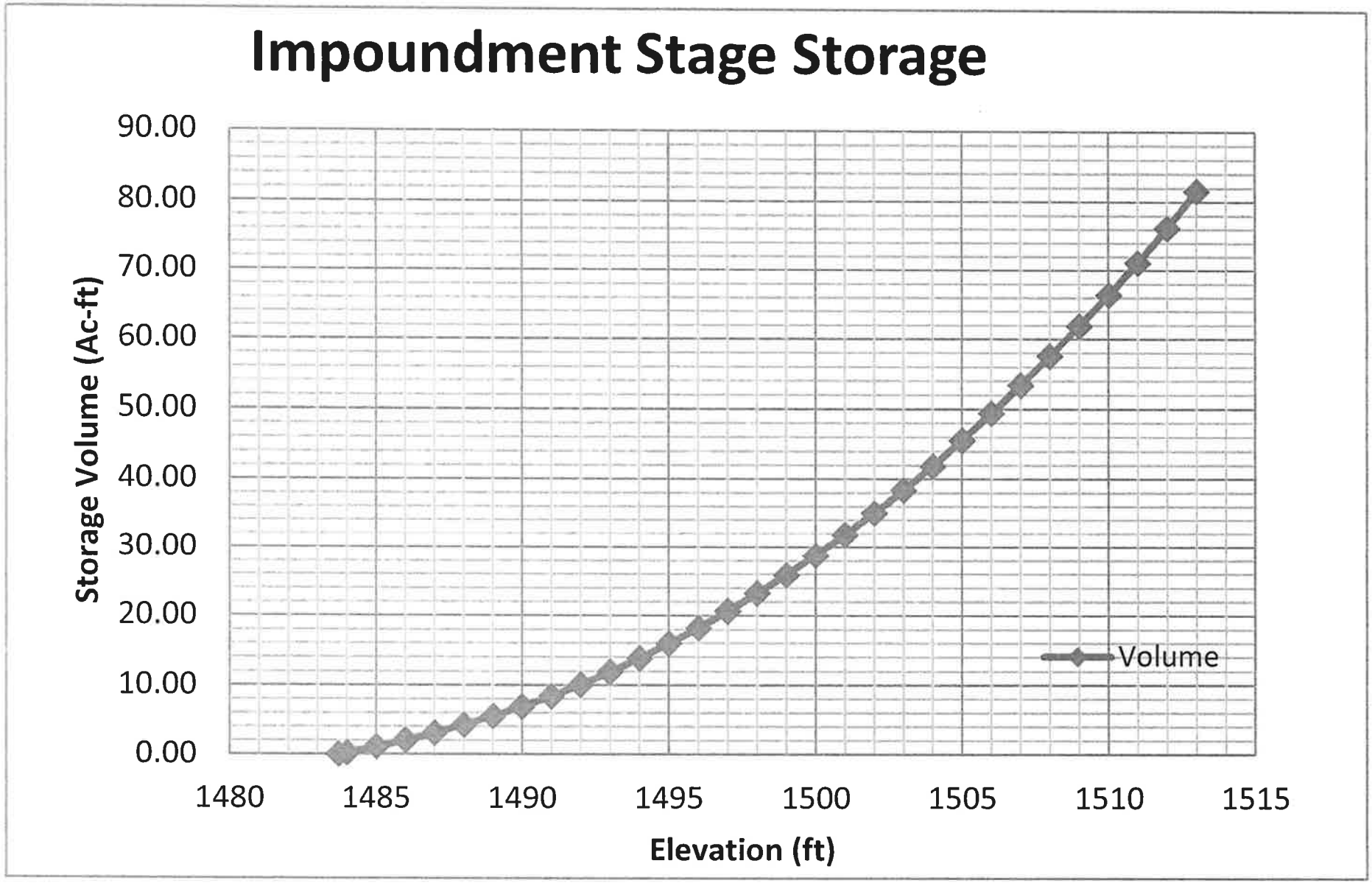
Headpond Elevation-Area Data From As-Built Survey Map

note	Elevation	Area(sf)	Area (Ac)
measured area from as-built record map	1480	15,933	0.37
measured area from as-built record map	1490	62,399	1.43
measured area from as-built record map	1500	128,456	2.95
measured area from as-built record map	1510	198,862	4.57
measured area from as-built record map	1520	341,086	7.83

Elevation-Area Data Expanded

				Cum Vol (Ac-ft)		
note	Elevation	Area(Ac)	Inc Vol (Ac-ft)	Pond	Impound.	
assumed area=0	1472.1	-	0.00	0.00	-	drain invert
interpolated area	1473	0.04	0.01	0.01	-	
interpolated area	1474	0.09	0.04	0.06	-	
interpolated area	1475	0.14	0.07	0.13	-	
interpolated area	1476	0.18	0.11	0.24	-	
interpolated area	1477	0.23	0.14	0.37	-	
interpolated area	1478	0.28	0.17	0.54	-	
interpolated area	1479	0.32	0.20	0.74	-	
measured area-assume pyramid volume below	1480	0.37	0.23	0.97	-	
interpolated area	1481	0.48	0.42	1.40	-	
interpolated area	1482	0.58	0.53	1.93	-	
interpolated area	1483	0.69	0.64	2.56	-	
interpolated area	1483.7	0.76	0.51	3.07	0.00	pwsel
interpolated area	1484	0.79	0.23	-	0.23	
interpolated area	1485	0.90	0.85	-	1.08	
interpolated area	1486	1.01	0.95	-	2.03	
interpolated area	1487	1.11	1.06	-	3.09	
interpolated area	1488	1.22	1.17	-	4.26	
interpolated area	1489	1.32	1.27	-	5.53	
measured area-calculated end-area volume	1490	1.43	1.38	-	6.91	
interpolated area	1491	1.58	1.51	-	8.41	
interpolated area	1492	1.73	1.66	-	10.07	
interpolated area	1493	1.89	1.81	-	11.88	
interpolated area	1494	2.04	1.96	-	13.84	
interpolated area	1495	2.19	2.11	-	15.96	
interpolated area	1496	2.34	2.27	-	18.22	
interpolated area	1497	2.49	2.42	-	20.64	
interpolated area	1498	2.65	2.57	-	23.21	
interpolated area	1499	2.80	2.72	-	25.93	
measured area-calculated end-area volume	1500	2.95	2.87	-	28.81	
interpolated area	1501	3.11	3.03	-	31.84	
interpolated area	1502	3.27	3.19	-	35.03	
interpolated area	1503	3.44	3.36	-	38.38	
interpolated area	1504	3.60	3.52	-	41.90	
interpolated area	1505	3.76	3.68	-	45.58	
interpolated area	1506	3.92	3.84	-	49.42	
interpolated area	1507	4.08	4.00	-	53.42	
interpolated area	1508	4.25	4.17	-	57.59	
interpolated area	1509	4.41	4.33	-	61.92	riser inlet
measured area-calculated end-area volume	1510	4.57	4.49	-	66.41	
interpolated area	1511	4.90	4.73	-	71.14	
interpolated area	1512	5.22	5.06	-	76.20	
interpolated area	1513	5.55	5.39	-	81.58	
interpolated area	1514	5.87	5.71	-	87.29	
interpolated area	1515	6.20	6.04	-	93.33	
interpolated area	1516	6.53	6.36	-	99.69	
interpolated area	1517	6.85	6.69	-	106.38	
interpolated area	1517.9	7.15	6.30	-	112.68	des. hw
interpolated area	1518	7.18	0.72	-	113.40	
interpolated area	1519	7.50	7.34	-	120.74	
interpolated area	1519.9	7.80	6.89	-	127.62	top of dam
measured area-calculated end-area volume	1520	7.83	0.78	-	128.41	


Permanent Pond Stage Storage
Storage Volume (Ac-ft)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1470
1472
1474
1476
1478
1480
1482
1484
1486
Elevation (ft)
Volume


Impoundment Stage Storage
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Storage Volume (Ac-ft)
1480
1485
1490
1495
1500
1505
1510
1515
Elevation (ft)
Volume

Principle Spillway Stage Discharge Computation

Orifice Information

W	0.75	ft
H	0.5	ft
Cd	0.7	sq edge
Inv=	1483.7	ft

Riser Inlet Information

W	7.5	ft
HT	1.25	ft
Weir C	3.1	
Cd	0.7	
# Openings	2	
Inv=	1509.1	ft

Culvert Information

D	2.5	ft
L	295.2	ft
Inv up	1469.1	ft
Inv dn	1457.7	ft
n	0.012	
Ke	0.5	
R	0.625	
So	0.038618	

Note	Pond Elevation	Stage	Orifice Discharge	Riser Inlet Discharge	Total Q to Culvert	Outlet Pipe Capacity at satge HW			Stage Discharge	Control type
						H	V	Q		
Normal Pool	1483.7	0	**0**	0	0				0	orifice
	1485	1.3	**2.40**	0	2.40				2.40	orifice
	1486	2.3	**3.19**	0	3.19				3.19	orifice
	1487	3.3	**3.83**	0	3.83				3.83	orifice
	1488	4.3	**4.37**	0	4.37				4.37	orifice
	1489	5.3	**4.85**	0	4.85				4.85	orifice
	1490	6.3	**5.29**	0	5.29				5.29	orifice
	1491	7.3	**5.69**	0	5.69				5.69	orifice
	1492	8.3	**6.07**	0	6.07				6.07	orifice
	1493	9.3	**6.42**	0	6.42				6.42	orifice
	1494	10.3	**6.76**	0	6.76				6.76	orifice
	1495	11.3	**7.08**	0	7.08				7.08	orifice
	1496	12.3	**7.39**	0	7.39				7.39	orifice
	1497	13.3	**7.68**	0	7.68				7.68	orifice
	1498	14.3	**7.97**	0	7.97				7.97	orifice
	1499	15.3	**8.24**	0	8.24				8.24	orifice
	1500	16.3	**8.50**	0	8.50				8.50	orifice
	1501	17.3	**8.76**	0	8.76				8.76	orifice
	1502	18.3	**9.01**	0	9.01				9.01	orifice
	1503	19.3	**9.25**	0	9.25				9.25	orifice
	1504	20.3	**9.49**	0	9.49				9.49	orifice
	1505	21.3	**9.72**	0	9.72				9.72	orifice
	1506	22.3	**9.95**	0	9.95				9.95	orifice
	1507	23.3	**10.17**	0	10.17				10.17	orifice
	1508	24.3	**10.38**	0	10.38				10.38	orifice
	1509	25.3	**10.60**	0	10.60				10.60	orifice
inv riser inlet	1509.1	25.4	**10.62**	0	10.62	34.3	24.09	118.24	10.62	orifice
riser wier flow	1510	26.3	10.80	39.70	**50.51**	35.2	24.40	119.78	50.51	weir
riser wier flow	1510.35	26.65	10.87	64.99	**75.86**	35.55	24.52	120.37	75.86	weir
riser orifice flow	1511	27.3	11.01	145.18	156.19	36.2	24.75	**121.47**	121.47	pipe
	1512	28.3	11.21	179.37	190.57	37.2	25.09	**123.14**	123.14	pipe
	1513	29.3	11.40	208.01	219.41	38.2	25.42	**124.78**	124.78	pipe
	1514	30.3	11.60	233.15	244.75	39.2	25.75	**126.40**	126.40	pipe
	1515	31.3	11.79	255.84	267.63	40.2	26.08	**128.00**	128.00	pipe
	1516	32.3	11.97	276.67	288.65	41.2	26.40	**129.59**	129.59	pipe
	1517	33.3	12.16	296.04	308.20	42.2	26.72	**131.15**	131.15	pipe
design high water	1517.9	34.2	12.32	312.45	324.77	43.1	27.00	**132.54**	132.54	pipe
	1518	34.3	12.34	314.22	326.56	43.2	27.03	**132.69**	132.69	pipe
	1519	35.3	12.52	331.41	343.92	44.2	27.34	**134.22**	134.22	pipe
top of dam	1519.9	36.2	12.67	346.14	358.82	45.1	27.62	**135.58**	135.58	pipe
	1520	36.3	12.69	347.74	360.43	45.2	27.65	**135.73**	135.73	pipe

Auxiliary Spillway Stage Discharge Computation

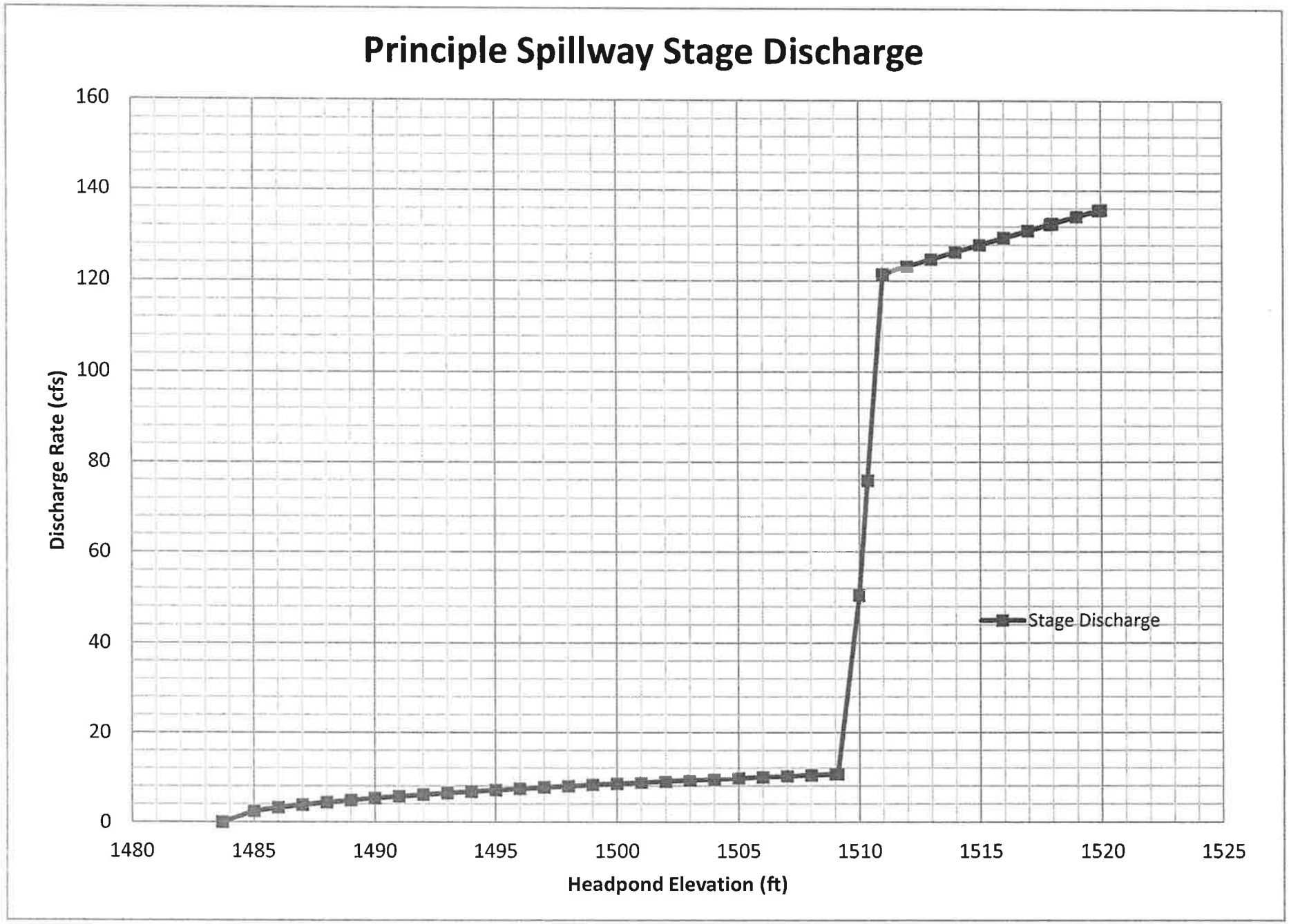
Spillway Information

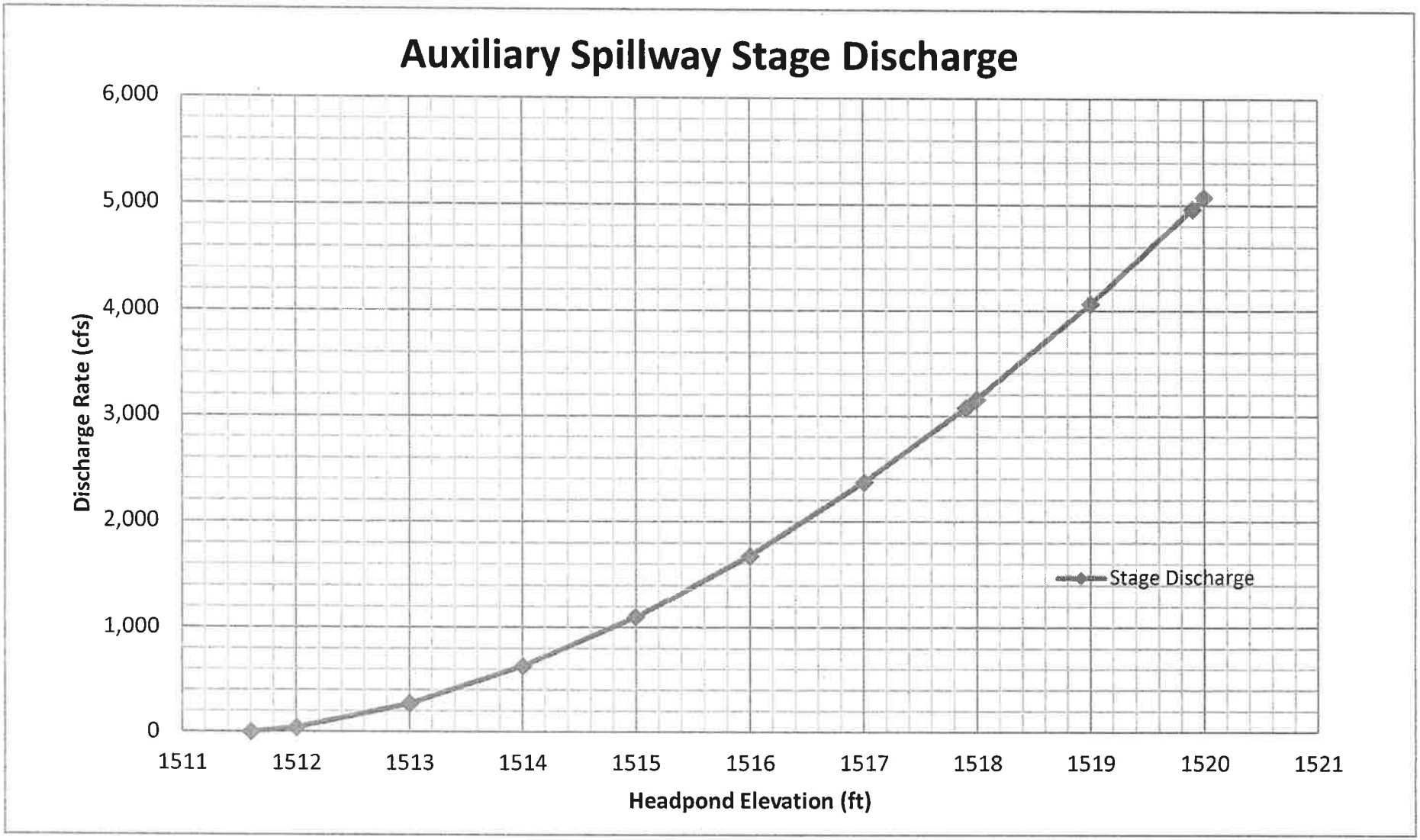
b	50	ft
z	3	
n	0.04	
s	0.030	ft/ft
Inv	1511.6	ft

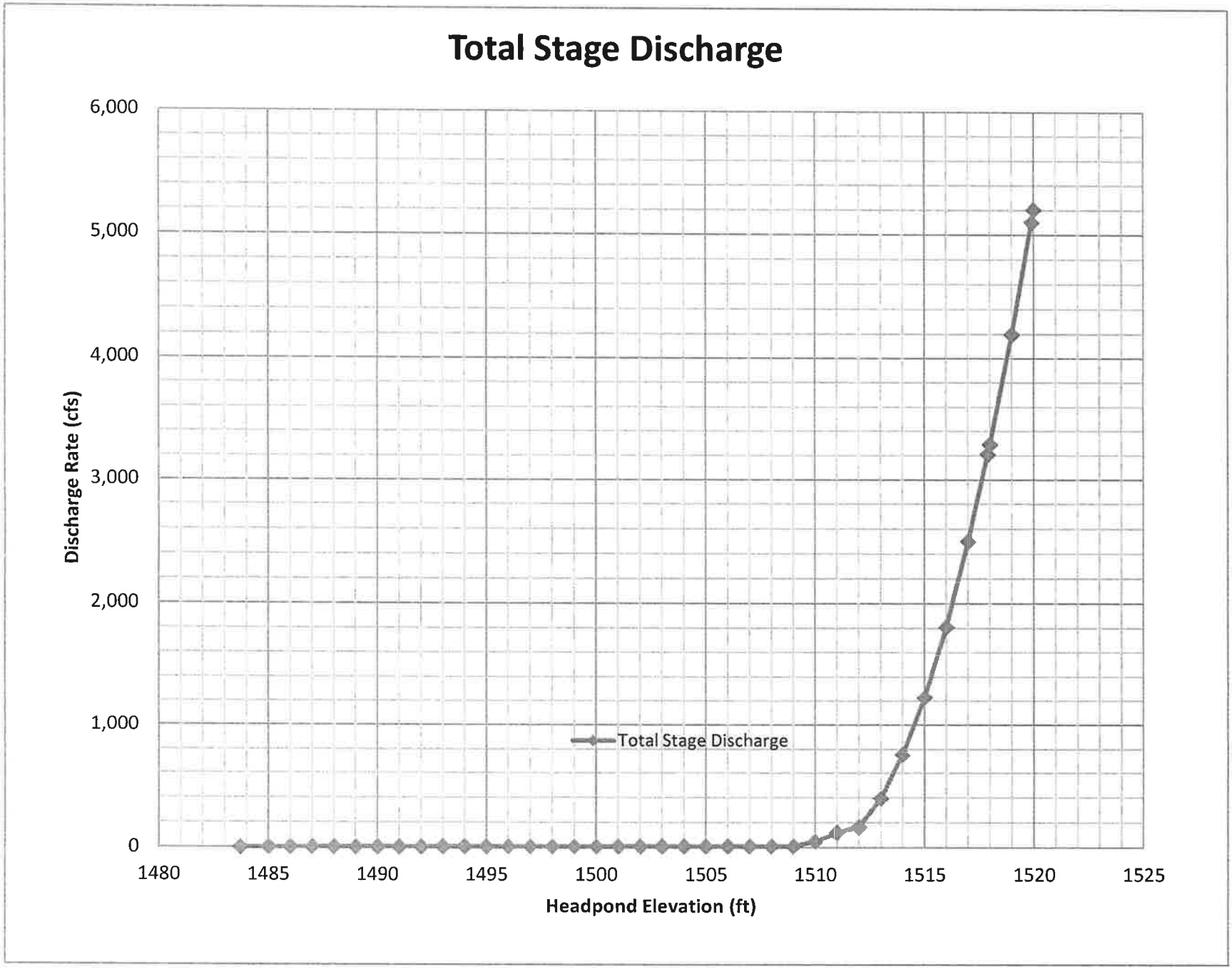
Dc (ft)	Ac (sq ft)	T (ft)	Qc (cfs)	Rc (ft)	Sc (ft/ft)	check	Vc (ft/sec)	HW (ft)	Pond Elev.
0	0.00	0.00	**0**	0	0	0	0	0	1511.60
0.27	13.72	51.62	**40.1**	0.27	0.036	subcritical	2.93	0.40	1512.00
0.95	50.21	55.70	**270.5**	0.90	0.024	ok	5.39	1.40	1513.00
1.645	90.37	59.87	**630.0**	1.50	0.020	ok	6.97	2.40	1514.00
2.35	134.07	64.10	**1,100.2**	2.07	0.018	ok	8.21	3.40	1515.00
3.07	181.77	68.42	**1,681.3**	2.62	0.017	ok	9.25	4.40	1516.00
3.8	233.32	72.80	**2,370.2**	3.15	0.016	ok	10.16	5.40	1517.00
4.46	282.67	76.76	**3,078.2**	3.61	0.015	ok	10.89	6.30	1517.90
4.53	288.06	77.18	**3,158.0**	3.66	0.015	ok	10.96	6.40	1518.00
5.275	347.23	81.65	**4,063.2**	4.17	0.015	ok	11.70	7.40	1519.00
5.945	403.28	85.67	**4,965.0**	4.60	0.014	ok	12.31	8.30	1519.90
6.02	409.72	86.12	**5,071.2**	4.65	0.014	ok	12.38	8.40	1520.00

Total Stage Discharge

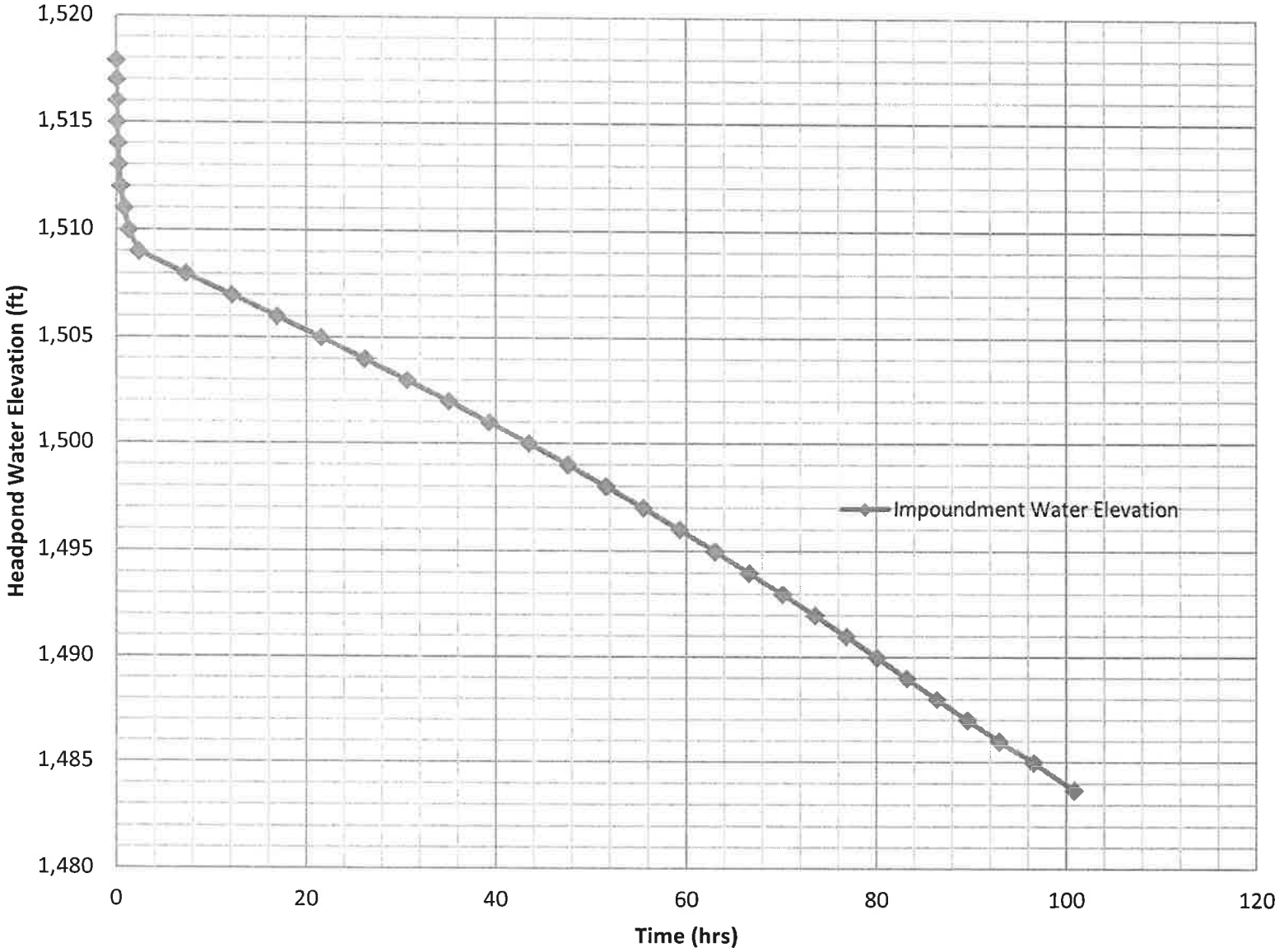
		Discharge (cfs)			Storage	Time to drain (hr)	
Note	Stage	Principle	Auxiliary	Total	(Ac-ft)	Stage	cum(hr)
normal pool	1483.7	0.0	0.0	**0.0**	0.00	0	100.81
	1485	2.4	0.0	**2.4**	0.85	4.27	96.55
	1486	3.2	0.0	**3.2**	0.95	3.61	92.94
	1487	3.8	0.0	**3.8**	1.06	3.35	89.59
	1488	4.4	0.0	**4.4**	1.17	3.23	86.36
	1489	4.8	0.0	**4.8**	1.27	3.17	83.19
	1490	5.3	0.0	**5.3**	1.38	3.15	80.04
	1491	5.7	0.0	**5.7**	1.51	3.20	76.84
	1492	6.1	0.0	**6.1**	1.66	3.31	73.53
	1493	6.4	0.0	**6.4**	1.81	3.41	70.12
	1494	6.8	0.0	**6.8**	1.96	3.51	66.61
	1495	7.1	0.0	**7.1**	2.11	3.61	63.00
	1496	7.4	0.0	**7.4**	2.27	3.71	59.29
	1497	7.7	0.0	**7.7**	2.42	3.81	55.48
	1498	8.0	0.0	**8.0**	2.57	3.90	51.57
	1499	8.2	0.0	**8.2**	2.72	4.00	47.58
	1500	8.5	0.0	**8.5**	2.87	4.09	43.49
	1501	8.8	0.0	**8.8**	3.03	4.19	39.30
	1502	9.0	0.0	**9.0**	3.19	4.29	35.02
	1503	9.3	0.0	**9.3**	3.36	4.39	30.63
	1504	9.5	0.0	**9.5**	3.52	4.48	26.14
	1505	9.7	0.0	**9.7**	3.68	4.58	21.57
	1506	9.9	0.0	**9.9**	3.84	4.67	16.89
	1507	10.2	0.0	**10.2**	4.00	4.76	12.13
	1508	10.4	0.0	**10.4**	4.17	4.85	7.28
riser inlet	1509	10.6	0.0	**10.6**	4.33	4.94	2.34
	1510	50.5	0.0	**50.5**	4.49	1.08	1.26
	1511	121.5	0.0	**121.5**	4.73	0.47	0.79
	1512	123.1	40.1	**163.3**	5.06	0.37	0.41
	1513	124.8	270.5	**395.3**	5.39	0.16	0.25
	1514	126.4	630.0	**756.4**	5.71	0.09	0.16
	1515	128.0	1,100.2	**1,228.2**	6.04	0.06	0.10
	1516	129.6	1,681.3	**1,810.9**	6.36	0.04	0.06
	1517	131.1	2,370.2	**2,501.4**	6.69	0.03	0.02
design High water	1517.9	132.5	3,078.2	**3,210.7**	6.30	0.02	0.00
	1518	132.7	3,158.0	**3,290.7**	0.72	0.00	-
	1519	134.2	4,063.2	**4,197.4**	7.34	0.02	-
top of dam	1519.9	135.6	4,965.0	**5,100.6**	6.89	0.02	-
	1520	135.7	5,071.2	**5,206.9**	0.78	0.00	-


Principle Spillway Stage Discharge
160
140
120
100
80
60
40
20
0
Discharge Rate (cfs)
1480
1485
1490
1495
1500
1505
1510
1515
1520
1525
Headpond Elevation (ft)
Stage Discharge


Auxiliary Spillway Stage Discharge
6,000
5,000
4,000
3,000
2,000
1,000
0
Discharge Rate (cfs)
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
Headpond Elevation (ft)
Stage Discharge


Total Stage Discharge
6,000
5,000
4,000
3,000
2,000
1,000
0
Discharge Rate (cfs)
Total Stage Discharge
1480
1485
1490
1495
1500
1505
1510
1515
1520
1525
Headpond Elevation (ft)

Spillway Discharge Time



Pond Drain Stage Discharge Computation

Drain Information

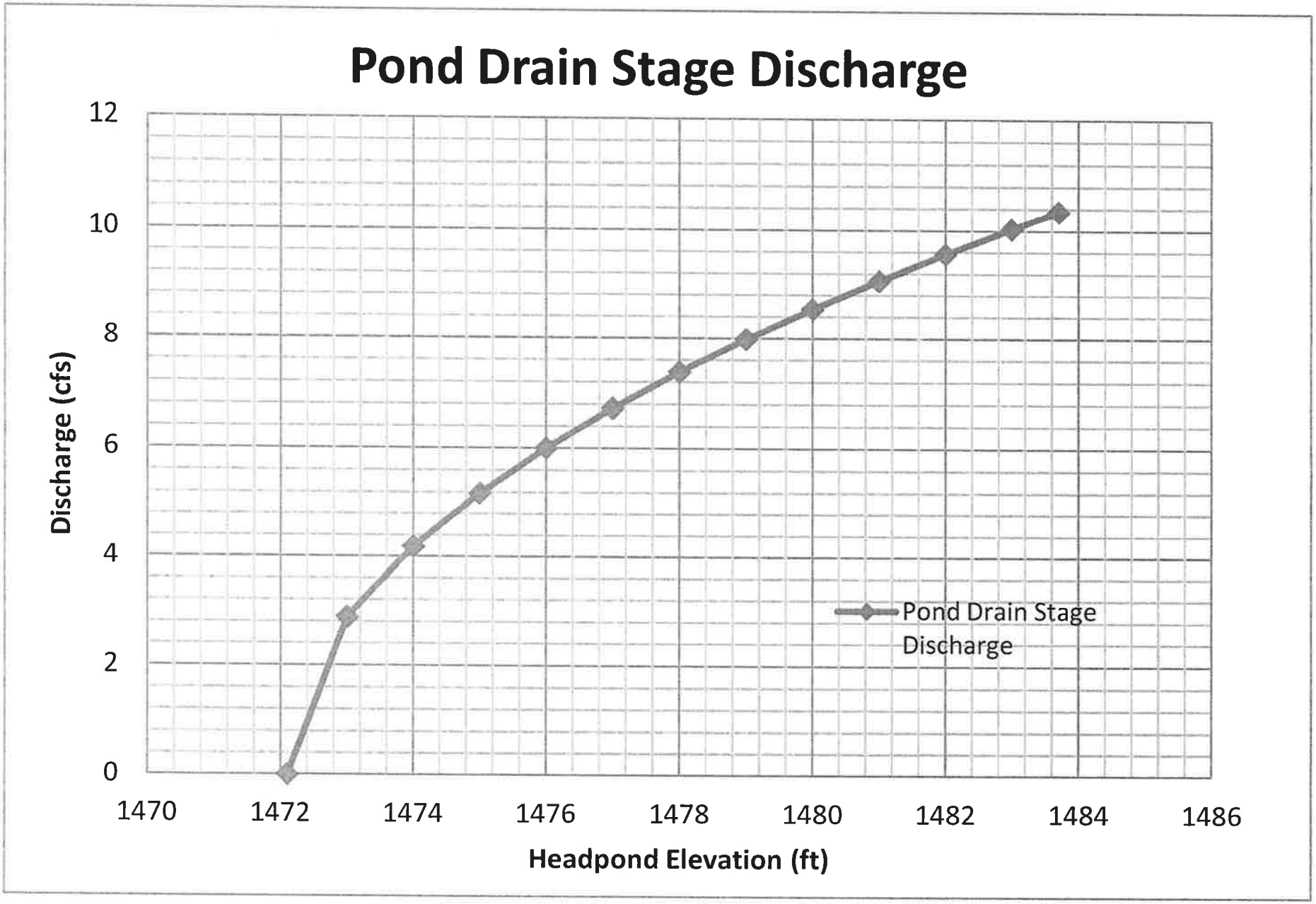
D	0.83	ft
L	40	ft
n	0.013	
Inv US	1472.1	ft
Inv DS	1470.1	ft
Ke	0.5	headwall
Cd	0.7	headwall
TW	0	free discharge

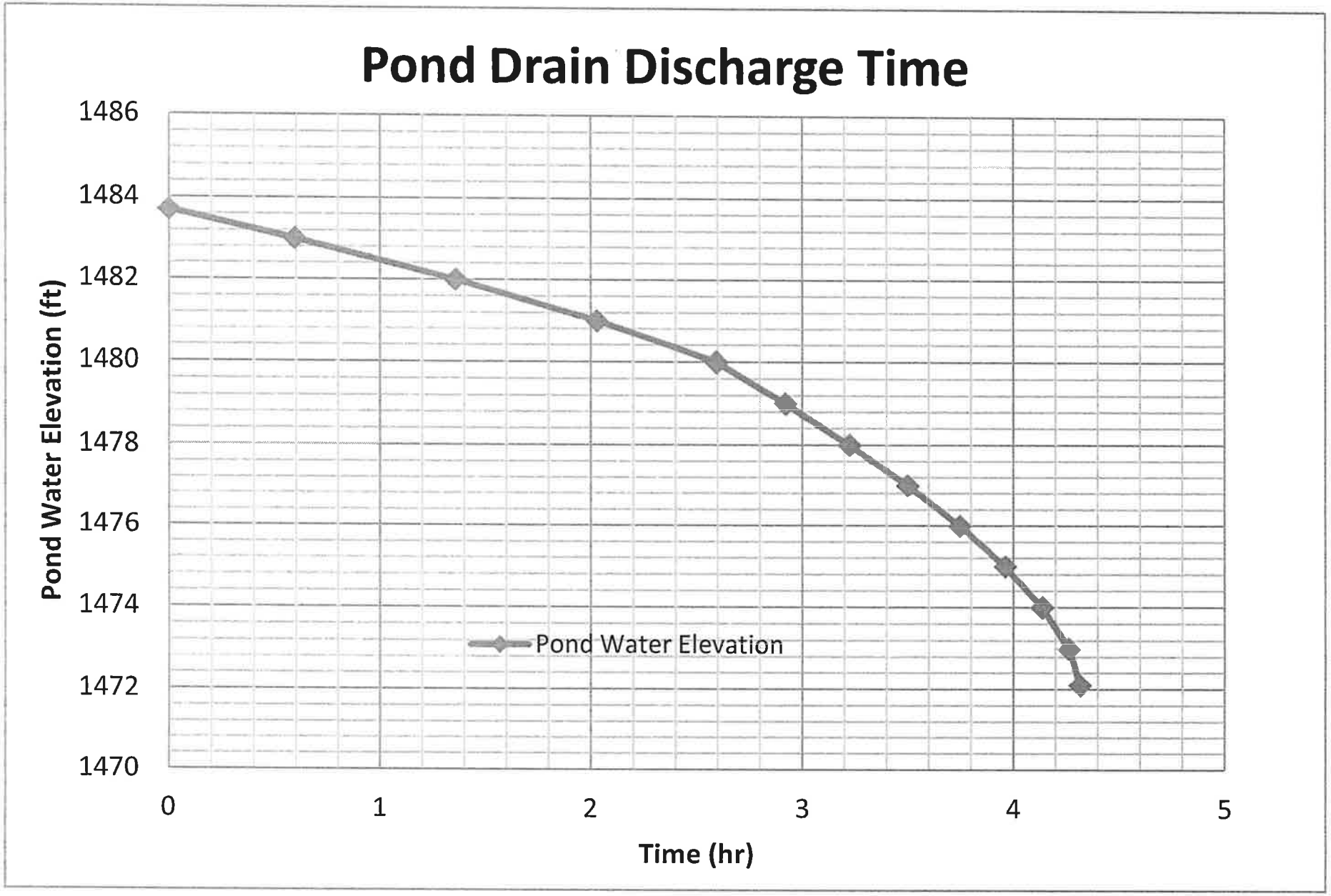
Compute

S	0.05	ft/ft
A	0.541045	ft^2
R	3.78494	ft

Determine Pond Drain Stage-Discharge

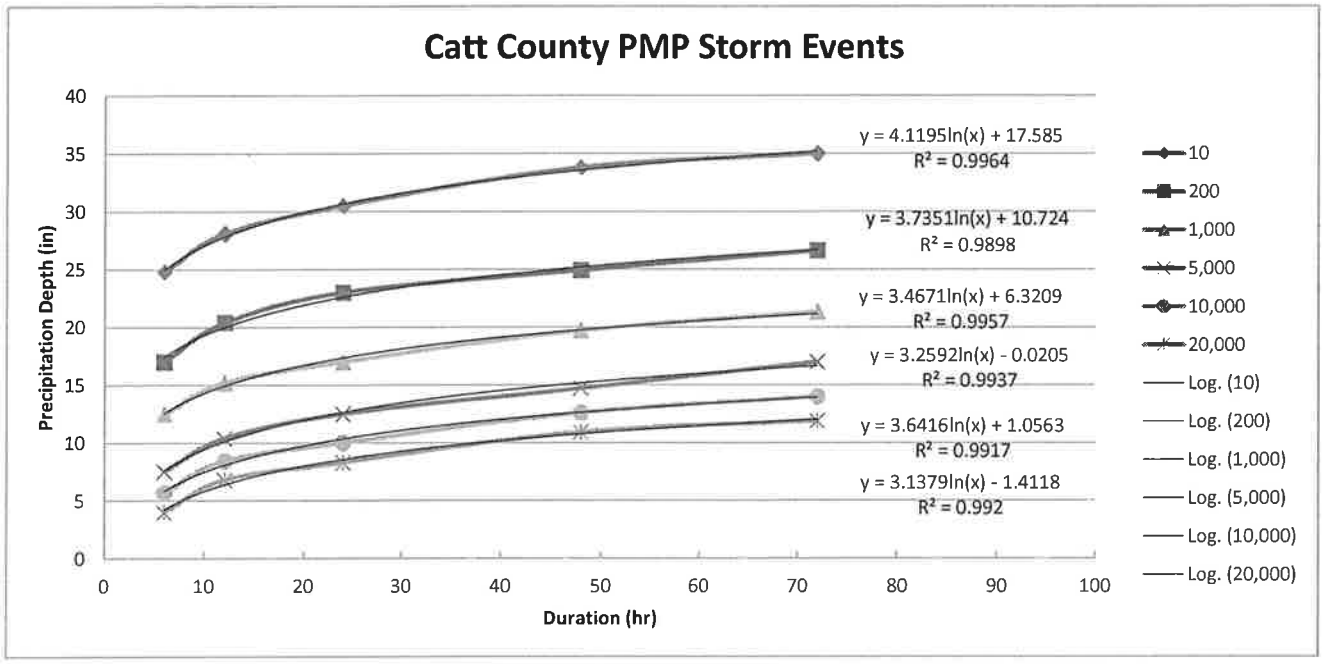
			IC	OC			Storage	Time to Drain (hr)	
Note	Pond Elev	HW (ft)	Qic (cfs)	H (ft)	Qoc (cfs)	Q control	(Ac-ft)	Stage	Cum
drain inlet	1472.1	0	0	1.17	3.79	0	0.00	0	4.31
	1473	0.9	2.88	2.07	5.04	2.88	0.01	0.05	4.26
	1474	1.9	4.19	3.07	6.14	4.19	0.04	0.13	4.14
	1475	2.9	5.18	4.07	7.07	5.18	0.07	0.18	3.96
	1476	3.9	6.00	5.07	7.90	6.00	0.11	0.21	3.75
	1477	4.9	6.73	6.07	8.64	6.73	0.14	0.25	3.50
	1478	5.9	7.38	7.07	9.32	7.38	0.17	0.28	3.22
	1479	6.9	7.98	8.07	9.96	7.98	0.20	0.30	2.92
	1480	7.9	8.54	9.07	10.56	8.54	0.23	0.33	2.59
	1481	8.9	9.07	10.07	11.13	9.07	0.42	0.56	2.03
	1482	9.9	9.56	11.07	11.67	9.56	0.53	0.67	1.36
	1483	10.9	10.03	12.07	12.18	10.03	0.64	0.77	0.59
normal pool	1483.7	11.6	10.35	12.77	12.53	10.35	0.51	0.59	0

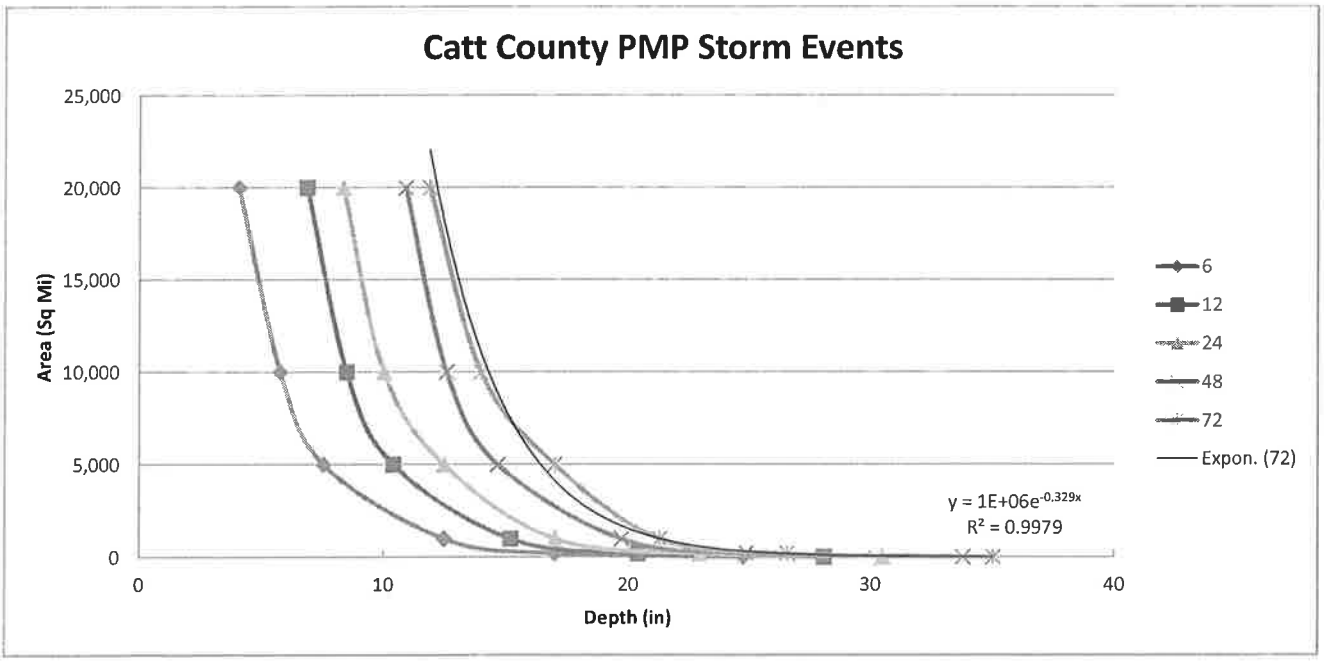

Pond Drain Stage Discharge
Discharge (cfs)
0
2
4
6
8
10
12
1470
1472
1474
1476
1478
1480
1482
1484
1486
Headpond Elevation (ft)
Pond Drain Stage Discharge


Pond Drain Discharge Time
1486
1484
1482
1480
1478
1476
1474
1472
1470
Pond Water Elevation (ft)
0
1
2
3
4
5
Time (hr)
Pond Water Elevation

PMP in inches for Chautauqua County

Area (sq mi)	10	200	1,000	5,000	10,000	20,000
Duration (hr)						
6	24.8	17	12.5	7.5	5.7	4
12	28.1	20.4	15.2	10.4	8.45	6.8
24	30.5	23	17	12.5	10	8.3
48	33.8	24.9	19.7	14.7	12.6	10.9
72	35	26.6	21.3	17	14	11.9





Hydraulic Parameters for HEC-HMS Model

Assume SCS Clark Unit Hydrograph is used for estimating DA inflows.

Area is Agricultural and inputs below are taken for USGS NY Stream Stats for Dam 33 Watershed

Time of Concentration

$A := 0.52$ Area of Watershed (sq mi)

$S := 447$ Main Watercourse Slope (ft/mi)

$L := 1.42$ Main Channel Stream Length (mi)

$L_{ca} := 0.5$ Distance from concentration point along L to a point on L that is perpendicular to the watershed centroid. For Rectangular shaped WS it can assume to be 0.5L (mi)

$RTIMP := 1\%$ Impervious Area of Watershed

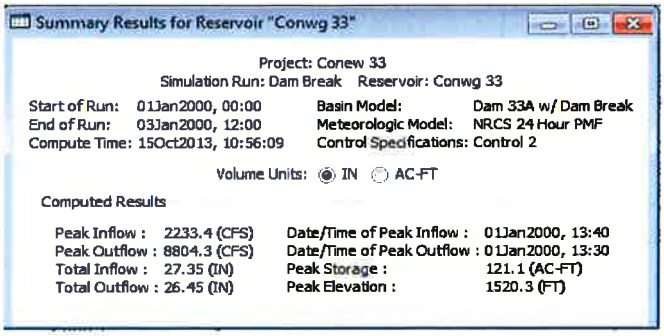
TYPE := Argricultural / Urban TYPE = 1

$$T_c := \begin{cases} 7.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}{}^{0.25} \cdot S^{-0.2} & \text{if TYPE = 1} \\ \left(3.2 \cdot A^{0.1} \cdot L^{0.25} \cdot L_{ca}{}^{0.25} \cdot S^{-0.14} \cdot RTIMP\right) & \text{otherwise} \end{cases} = 1.827$$ Time of Concentration (hr)

Storage Coefficient

$R := 0.37 \cdot T_c{}^{1.11} \cdot L^{0.80} \cdot A^{-0.57} = 1.388$ Storage Coefficient (hr)

From Hec-HMS



Date	Time	Inflow (cfs)	Storage (Acre-ft)	Elevation	Outflow (cfs)	Total Time Lapse (min)
1-Jan-00	0:00	0	0	1464	0	0
1-Jan-00	0:10	0	0	1465	0	10
1-Jan-00	0:20	0	0	1465	0	20
1-Jan-00	0:30	0	0	1465.2	0	30
1-Jan-00	0:40	0	0	1465.4	0	40
1-Jan-00	0:50	0	0	1465.9	0	50
1-Jan-00	1:00	0	0	1466.6	0	60
1-Jan-00	1:10	0	0	1467.7	0	70
1-Jan-00	1:20	0	0	1469	0	80
1-Jan-00	1:30	0	0	1469	0	90
1-Jan-00	1:40	0	0	1469	0	100
1-Jan-00	1:50	0	0	1469	0	110
1-Jan-00	2:00	0	0	1469	0	120
1-Jan-00	2:10	0	0	1469	0	130
1-Jan-00	2:20	0	0	1469	0	140
1-Jan-00	2:30	0	0	1469	0	150
1-Jan-00	2:40	0	0	1469	0	160
1-Jan-00	2:50	0	0	1469	0	170
1-Jan-00	3:00	0	0	1469	0	180
1-Jan-00	3:10	0.1	0	1469	0	190
1-Jan-00	3:20	0.1	0	1469	0	200
1-Jan-00	3:30	0.1	0	1469	0	210
1-Jan-00	3:40	0.2	0	1469	0	220
1-Jan-00	3:50	0.3	0	1469.1	0	230
1-Jan-00	4:00	0.5	0	1469.1	0	240
1-Jan-00	4:10	0.8	0	1469.1	0	250
1-Jan-00	4:20	1.2	0	1469.2	0	260
1-Jan-00	4:30	1.7	0.1	1469.2	0.1	270
1-Jan-00	4:40	2.3	0.1	1469.4	0.3	280
1-Jan-00	4:50	3	0.1	1469.5	0.7	290
1-Jan-00	5:00	3.9	0.1	1469.6	1.3	300

1-Jan-00	5:10	4.8	0.2	1469.8	2.2	310
1-Jan-00	5:20	5.9	0.2	1469.9	3.3	320
1-Jan-00	5:30	7.1	0.3	1470.1	4.5	330
1-Jan-00	5:40	8.4	0.3	1470.2	5.9	340
1-Jan-00	5:50	9.7	0.3	1470.4	7.3	350
1-Jan-00	6:00	11.2	0.4	1470.5	8.8	360
1-Jan-00	6:10	12.7	0.4	1470.6	10.4	370
1-Jan-00	6:20	14.4	0.4	1470.8	12.1	380
1-Jan-00	6:30	16.2	0.4	1470.9	13.8	390
1-Jan-00	6:40	18.1	0.5	1471	15.7	400
1-Jan-00	6:50	20.2	0.5	1471.2	17.5	410
1-Jan-00	7:00	22.3	0.5	1471.3	19.4	420
1-Jan-00	7:10	24.7	0.6	1471.5	21.6	430
1-Jan-00	7:20	27.2	0.6	1471.7	23.8	440
1-Jan-00	7:30	29.8	0.7	1471.9	26.2	450
1-Jan-00	7:40	32.6	0.7	1472.1	28.7	460
1-Jan-00	7:50	35.5	0.8	1472.3	31	470
1-Jan-00	8:00	38.5	0.8	1472.6	33.5	480
1-Jan-00	8:10	41.7	0.9	1472.9	36.2	490
1-Jan-00	8:20	45	1	1473.2	38.9	500
1-Jan-00	8:30	48.5	1.1	1473.6	41.7	510
1-Jan-00	8:40	52.1	1.2	1474	44.6	520
1-Jan-00	8:50	55.9	1.3	1474.5	47.6	530
1-Jan-00	9:00	59.9	1.4	1475	50.7	540
1-Jan-00	9:10	64.1	1.5	1475.5	53.9	550
1-Jan-00	9:20	68.7	1.7	1476.2	57.3	560
1-Jan-00	9:30	73.7	1.9	1476.9	60.9	570
1-Jan-00	9:40	79.1	2	1477.6	64.7	580
1-Jan-00	9:50	85	2.3	1478.5	68.7	590
1-Jan-00	10:00	91.5	2.5	1479.5	73	600
1-Jan-00	10:10	98.7	2.8	1480.7	77.6	610
1-Jan-00	10:20	106.6	3.1	1482	82.6	620
1-Jan-00	10:30	115.2	3.4	1483.5	87.9	630
1-Jan-00	10:40	124.8	3.8	1484.1	89.9	640
1-Jan-00	10:50	135.4	4.4	1484.6	91.6	650
1-Jan-00	11:00	147.5	5.1	1485.3	93.8	660
1-Jan-00	11:10	161.3	5.9	1486.1	96.3	670
1-Jan-00	11:20	177.6	6.9	1487	98.9	680
1-Jan-00	11:30	197.2	8.1	1488.2	101	690
1-Jan-00	11:40	221.6	9.5	1489.6	103.6	700
1-Jan-00	11:50	253.6	11.4	1491.4	106.7	710
1-Jan-00	12:00	307.9	13.7	1493.8	110.6	720
1-Jan-00	12:10	416.9	17.2	1496.1	114.5	730
1-Jan-00	12:20	591.9	22.5	1498.9	118.8	740
1-Jan-00	12:30	814.6	30.5	1502.1	123.6	750

1-Jan-00	12:40	1067.8	41.8	1505.7	128.8	760
1-Jan-00	12:50	1337.8	56.5	1509.5	134.1	770
1-Jan-00	13:00	1605.8	74.9	1513.3	139.1	780
1-Jan-00	13:10	1844.9	96.7	1516.9	143.8	790
1-Jan-00	13:20	2034.7	121.1	1520.3	494.1	800
1-Jan-00	13:30	2166.9	96	1516.8	8804.3	810
1-Jan-00	13:40	2233.4	5.9	1486.1	2207.6	820
1-Jan-00	13:50	2224.3	5.9	1486.1	2241.2	830
1-Jan-00	14:00	2147.3	5.8	1486	2153.8	840
1-Jan-00	14:10	2038.8	5.7	1485.9	2098.3	850
1-Jan-00	14:20	1926.3	5.5	1485.6	1982.5	860
1-Jan-00	14:30	1815.1	5.2	1485.4	1870.6	870
1-Jan-00	14:40	1707.4	5	1485.2	1761.1	880
1-Jan-00	14:50	1604.2	4.8	1485	1655.9	890
1-Jan-00	15:00	1506.2	4.6	1484.8	1555.2	900
1-Jan-00	15:10	1413.4	4.4	1484.6	1459.8	910
1-Jan-00	15:20	1326	4.2	1484.4	1369.7	920
1-Jan-00	15:30	1243.7	4	1484.2	1284.9	930
1-Jan-00	15:40	1166.5	3.8	1484	1205.1	940
1-Jan-00	15:50	1094	3.6	1483.8	1130.3	950
1-Jan-00	16:00	1026	3.5	1483.7	1055.3	960
1-Jan-00	16:10	962.3	3.4	1483.6	1024.6	970
1-Jan-00	16:20	902.6	3.4	1483.4	933.3	980
1-Jan-00	16:30	846.7	3.3	1483.2	865.9	990
1-Jan-00	16:40	794.5	3.3	1483	783	1000
1-Jan-00	16:50	745.7	3.3	1482.9	759.4	1010
1-Jan-00	17:00	700.2	3.2	1482.7	693.1	1020
1-Jan-00	17:10	657.9	3.2	1482.6	667.7	1030
1-Jan-00	17:20	618.6	3.2	1482.5	614.4	1040
1-Jan-00	17:30	581.9	3.2	1482.4	588.8	1050
1-Jan-00	17:40	547.8	3.1	1482.2	545.6	1060
1-Jan-00	17:50	516.1	3.1	1482.2	521	1070
1-Jan-00	18:00	486.5	3.1	1482	485.6	1080
1-Jan-00	18:10	459	3.1	1482	462.6	1090
1-Jan-00	18:20	433.3	3	1481.9	433.2	1100
1-Jan-00	18:30	409.3	3	1481.8	412	1110
1-Jan-00	18:40	386.8	3	1481.7	387.3	1120
1-Jan-00	18:50	365.8	3	1481.6	367.9	1130
1-Jan-00	19:00	346.1	3	1481.5	346.8	1140
1-Jan-00	19:10	327.6	2.9	1481.5	329.3	1150
1-Jan-00	19:20	310.3	2.9	1481.4	311.2	1160
1-Jan-00	19:30	294.1	2.9	1481.3	295.5	1170
1-Jan-00	19:40	278.9	2.9	1481.3	279.8	1180
1-Jan-00	19:50	264.7	2.9	1481.2	265.9	1190
1-Jan-00	20:00	251.5	2.9	1481.1	252.4	1200

1-Jan-00	20:10	239.1	2.9	1481.1	240.1	1210
1-Jan-00	20:20	227.6	2.8	1481	228.5	1220
1-Jan-00	20:30	216.8	2.8	1481	217.8	1230
1-Jan-00	20:40	206.8	2.8	1480.9	207.6	1240
1-Jan-00	20:50	197.4	2.8	1480.9	198.3	1250
1-Jan-00	21:00	188.7	2.8	1480.8	189.4	1260
1-Jan-00	21:10	180.5	2.8	1480.8	181.2	1270
1-Jan-00	21:20	172.8	2.8	1480.7	173.5	1280
1-Jan-00	21:30	165.7	2.8	1480.7	166.3	1290
1-Jan-00	21:40	158.9	2.8	1480.7	159.6	1300
1-Jan-00	21:50	152.6	2.7	1480.6	153.3	1310
1-Jan-00	22:00	146.7	2.7	1480.6	147.4	1320
1-Jan-00	22:10	141.2	2.7	1480.5	141.8	1330
1-Jan-00	22:20	136	2.7	1480.5	136.6	1340
1-Jan-00	22:30	131.1	2.7	1480.5	131.6	1350
1-Jan-00	22:40	126.4	2.7	1480.4	127	1360
1-Jan-00	22:50	122	2.7	1480.4	122.5	1370
1-Jan-00	23:00	117.8	2.7	1480.4	118.3	1380
1-Jan-00	23:10	113.8	2.7	1480.4	114.3	1390
1-Jan-00	23:20	109.8	2.7	1480.3	110.4	1400
1-Jan-00	23:30	105.8	2.7	1480.3	106.4	1410
1-Jan-00	23:40	99.2	2.7	1480.2	100.4	1420
1-Jan-00	23:50	90.7	2.6	1480.2	92.2	1430
2-Jan-00	0:00	87.6	2.6	1480.1	87.7	1440
2-Jan-00	0:10	85.1	2.6	1480.1	85.7	1450
2-Jan-00	0:20	82.7	2.6	1480.1	83.2	1460
2-Jan-00	0:30	80.2	2.6	1480	80.8	1470
2-Jan-00	0:40	77.3	2.6	1480	78.1	1480
2-Jan-00	0:50	74.1	2.6	1479.9	75.3	1490
2-Jan-00	1:00	70.5	2.5	1479.8	74.1	1500
2-Jan-00	1:10	66.6	2.5	1479.5	72.9	1510
2-Jan-00	1:20	62.3	2.4	1479.1	71.1	1520
2-Jan-00	1:30	58	2.2	1478.5	68.6	1530
2-Jan-00	1:40	53.6	2.1	1477.8	65.6	1540
2-Jan-00	1:50	49.2	1.9	1477.1	62.2	1550
2-Jan-00	2:00	45.1	1.7	1476.4	58.4	1560
2-Jan-00	2:10	41.4	1.6	1475.6	54.3	1570
2-Jan-00	2:20	38	1.4	1474.9	50.1	1580
2-Jan-00	2:30	34.8	1.2	1474.2	45.9	1590
2-Jan-00	2:40	31.9	1.1	1473.6	41.7	1600
2-Jan-00	2:50	29.3	1	1473.1	37.7	1610
2-Jan-00	3:00	26.9	0.9	1472.6	33.9	1620
2-Jan-00	3:10	24.6	0.8	1472.3	30.5	1630
2-Jan-00	3:20	22.6	0.7	1472	27.2	1640
2-Jan-00	3:30	20.7	0.6	1471.7	24.4	1650

2-Jan-00	3:40	19	0.6	1471.5	22	1660
2-Jan-00	3:50	17.4	0.6	1471.4	20	1670
2-Jan-00	4:00	15.9	0.5	1471.2	18.3	1680
2-Jan-00	4:10	14.6	0.5	1471.1	16.7	1690
2-Jan-00	4:20	13.4	0.5	1471	15.2	1700
2-Jan-00	4:30	12.2	0.4	1470.9	13.9	1710
2-Jan-00	4:40	11.2	0.4	1470.8	12.7	1720
2-Jan-00	4:50	10.2	0.4	1470.7	11.6	1730
2-Jan-00	5:00	9.4	0.4	1470.6	10.7	1740
2-Jan-00	5:10	8.6	0.4	1470.6	9.8	1750
2-Jan-00	5:20	7.8	0.4	1470.5	9	1760
2-Jan-00	5:30	7.2	0.3	1470.4	8.3	1770
2-Jan-00	5:40	6.5	0.3	1470.4	7.6	1780
2-Jan-00	5:50	6	0.3	1470.3	7	1790
2-Jan-00	6:00	5.4	0.3	1470.3	6.4	1800
2-Jan-00	6:10	5	0.3	1470.2	5.9	1810
2-Jan-00	6:20	4.5	0.3	1470.2	5.4	1820
2-Jan-00	6:30	4.1	0.3	1470.1	4.9	1830
2-Jan-00	6:40	3.8	0.3	1470.1	4.5	1840
2-Jan-00	6:50	3.4	0.2	1470	4.2	1850
2-Jan-00	7:00	3.1	0.2	1470	3.8	1860
2-Jan-00	7:10	2.8	0.2	1470	3.5	1870
2-Jan-00	7:20	2.6	0.2	1469.9	3.2	1880
2-Jan-00	7:30	2.3	0.2	1469.9	2.9	1890
2-Jan-00	7:40	2.1	0.2	1469.8	2.7	1900
2-Jan-00	7:50	1.9	0.2	1469.8	2.5	1910
2-Jan-00	8:00	1.7	0.2	1469.8	2.3	1920
2-Jan-00	8:10	1.5	0.2	1469.7	2.1	1930
2-Jan-00	8:20	1.4	0.2	1469.7	1.9	1940
2-Jan-00	8:30	1.2	0.2	1469.7	1.7	1950
2-Jan-00	8:40	1.1	0.2	1469.7	1.6	1960
2-Jan-00	8:50	1	0.2	1469.6	1.4	1970
2-Jan-00	9:00	0.9	0.1	1469.6	1.3	1980
2-Jan-00	9:10	0.8	0.1	1469.6	1.2	1990
2-Jan-00	9:20	0.7	0.1	1469.6	1.1	2000
2-Jan-00	9:30	0.6	0.1	1469.5	1	2010
2-Jan-00	9:40	0.5	0.1	1469.5	0.9	2020
2-Jan-00	9:50	0.5	0.1	1469.5	0.8	2030
2-Jan-00	10:00	0.4	0.1	1469.5	0.7	2040
2-Jan-00	10:10	0.3	0.1	1469.5	0.7	2050
2-Jan-00	10:20	0.3	0.1	1469.4	0.6	2060
2-Jan-00	10:30	0.2	0.1	1469.4	0.5	2070
2-Jan-00	10:40	0.2	0.1	1469.4	0.5	2080
2-Jan-00	10:50	0.2	0.1	1469.4	0.4	2090
2-Jan-00	11:00	0.1	0.1	1469.4	0.4	2100

2-Jan-00	11:10	0.1	0.1	1469.4	0.3	2110
2-Jan-00	11:20	0.1	0.1	1469.3	0.3	2120
2-Jan-00	11:30	0	0.1	1469.3	0.3	2130
2-Jan-00	11:40	0	0.1	1469.3	0.2	2140
2-Jan-00	11:50	0	0.1	1469.3	0.2	2150
2-Jan-00	12:00	0	0.1	1469.3	0.2	2160
2-Jan-00	12:10	0	0.1	1469.3	0.2	2170
2-Jan-00	12:20	0	0.1	1469.3	0.2	2180
2-Jan-00	12:30	0	0.1	1469.3	0.1	2190
2-Jan-00	12:40	0	0.1	1469.3	0.1	2200
2-Jan-00	12:50	0	0.1	1469.2	0.1	2210
2-Jan-00	13:00	0	0.1	1469.2	0.1	2220
2-Jan-00	13:10	0	0.1	1469.2	0.1	2230
2-Jan-00	13:20	0	0.1	1469.2	0.1	2240
2-Jan-00	13:30	0	0.1	1469.2	0.1	2250
2-Jan-00	13:40	0	0.1	1469.2	0.1	2260
2-Jan-00	13:50	0	0.1	1469.2	0.1	2270
2-Jan-00	14:00	0	0.1	1469.2	0.1	2280
2-Jan-00	14:10	0	0	1469.2	0.1	2290
2-Jan-00	14:20	0	0	1469.2	0.1	2300
2-Jan-00	14:30	0	0	1469.2	0.1	2310
2-Jan-00	14:40	0	0	1469.2	0.1	2320
2-Jan-00	14:50	0	0	1469.2	0	2330
2-Jan-00	15:00	0	0	1469.2	0	2340
2-Jan-00	15:10	0	0	1469.2	0	2350
2-Jan-00	15:20	0	0	1469.2	0	2360
2-Jan-00	15:30	0	0	1469.2	0	2370
2-Jan-00	15:40	0	0	1469.2	0	2380
2-Jan-00	15:50	0	0	1469.2	0	2390
2-Jan-00	16:00	0	0	1469.2	0	2400
2-Jan-00	16:10	0	0	1469.2	0	2410
2-Jan-00	16:20	0	0	1469.2	0	2420
2-Jan-00	16:30	0	0	1469.2	0	2430
2-Jan-00	16:40	0	0	1469.2	0	2440
2-Jan-00	16:50	0	0	1469.2	0	2450
2-Jan-00	17:00	0	0	1469.2	0	2460
2-Jan-00	17:10	0	0	1469.2	0	2470
2-Jan-00	17:20	0	0	1469.2	0	2480
2-Jan-00	17:30	0	0	1469.2	0	2490
2-Jan-00	17:40	0	0	1469.2	0	2500
2-Jan-00	17:50	0	0	1469.2	0	2510
2-Jan-00	18:00	0	0	1469.2	0	2520
2-Jan-00	18:10	0	0	1469.2	0	2530
2-Jan-00	18:20	0	0	1469.2	0	2540
2-Jan-00	18:30	0	0	1469.2	0	2550

2-Jan-00	18:40	0	0	1469.2	0	2560
2-Jan-00	18:50	0	0	1469.2	0	2570
2-Jan-00	19:00	0	0	1469.2	0	2580
2-Jan-00	19:10	0	0	1469.2	0	2590
2-Jan-00	19:20	0	0	1469.2	0	2600
2-Jan-00	19:30	0	0	1469.2	0	2610
2-Jan-00	19:40	0	0	1469.2	0	2620
2-Jan-00	19:50	0	0	1469.2	0	2630
2-Jan-00	20:00	0	0	1469.2	0	2640
2-Jan-00	20:10	0	0	1469.1	0	2650
2-Jan-00	20:20	0	0	1469.1	0	2660
2-Jan-00	20:30	0	0	1469.1	0	2670
2-Jan-00	20:40	0	0	1469.1	0	2680
2-Jan-00	20:50	0	0	1469.1	0	2690
2-Jan-00	21:00	0	0	1469.1	0	2700
2-Jan-00	21:10	0	0	1469.1	0	2710
2-Jan-00	21:20	0	0	1469.1	0	2720
2-Jan-00	21:30	0	0	1469.1	0	2730
2-Jan-00	21:40	0	0	1469.1	0	2740
2-Jan-00	21:50	0	0	1469.1	0	2750
2-Jan-00	22:00	0	0	1469.1	0	2760
2-Jan-00	22:10	0	0	1469.1	0	2770
2-Jan-00	22:20	0	0	1469.1	0	2780
2-Jan-00	22:30	0	0	1469.1	0	2790
2-Jan-00	22:40	0	0	1469.1	0	2800
2-Jan-00	22:50	0	0	1469.1	0	2810
2-Jan-00	23:00	0	0	1469.1	0	2820
2-Jan-00	23:10	0	0	1469.1	0	2830
2-Jan-00	23:20	0	0	1469.1	0	2840
2-Jan-00	23:30	0	0	1469.1	0	2850
2-Jan-00	23:40	0	0	1469.1	0	2860
2-Jan-00	23:50	0	0	1469.1	0	2870
3-Jan-00	0:00	0	0	1469.1	0	2880
3-Jan-00	0:10	0	0	1469.1	0	2890
3-Jan-00	0:20	0	0	1469.1	0	2900
3-Jan-00	0:30	0	0	1469.1	0	2910
3-Jan-00	0:40	0	0	1469.1	0	2920
3-Jan-00	0:50	0	0	1469.1	0	2930
3-Jan-00	1:00	0	0	1469.1	0	2940
3-Jan-00	1:10	0	0	1469.1	0	2950
3-Jan-00	1:20	0	0	1469.1	0	2960
3-Jan-00	1:30	0	0	1469.1	0	2970
3-Jan-00	1:40	0	0	1469.1	0	2980
3-Jan-00	1:50	0	0	1469.1	0	2990
3-Jan-00	2:00	0	0	1469.1	0	3000

3-Jan-00	2:10	0	0	1469.1	0	3010
3-Jan-00	2:20	0	0	1469.1	0	3020
3-Jan-00	2:30	0	0	1469.1	0	3030
3-Jan-00	2:40	0	0	1469.1	0	3040
3-Jan-00	2:50	0	0	1469.1	0	3050
3-Jan-00	3:00	0	0	1469.1	0	3060
3-Jan-00	3:10	0	0	1469.1	0	3070
3-Jan-00	3:20	0	0	1469.1	0	3080
3-Jan-00	3:30	0	0	1469.1	0	3090
3-Jan-00	3:40	0	0	1469.1	0	3100
3-Jan-00	3:50	0	0	1469.1	0	3110
3-Jan-00	4:00	0	0	1469.1	0	3120
3-Jan-00	4:10	0	0	1469.1	0	3130
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3-Jan-00	4:40	0	0	1469.1	0	3160
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3-Jan-00	5:10	0	0	1469.1	0	3190
3-Jan-00	5:20	0	0	1469.1	0	3200
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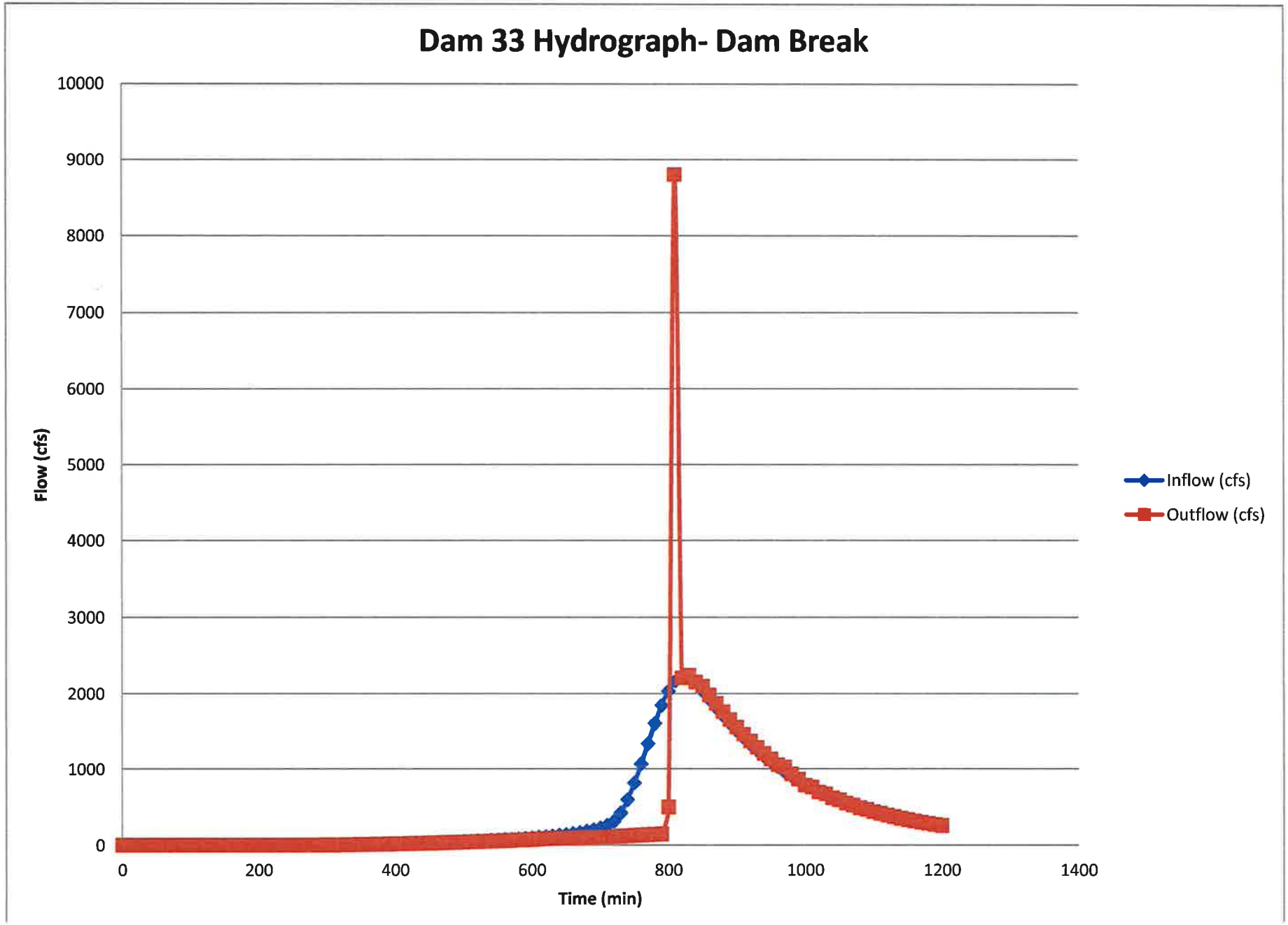
3-Jan-00	8:20	0	0	1469.1	0	3380
3-Jan-00	8:30	0	0	1469.1	0	3390
3-Jan-00	8:40	0	0	1469.1	0	3400
3-Jan-00	8:50	0	0	1469.1	0	3410
3-Jan-00	9:00	0	0	1469.1	0	3420
3-Jan-00	9:10	0	0	1469.1	0	3430
3-Jan-00	9:20	0	0	1469.1	0	3440
3-Jan-00	9:30	0	0	1469.1	0	3450

3-Jan-00	9:40	0	0	1469.1	0	3460
3-Jan-00	9:50	0	0	1469.1	0	3470
3-Jan-00	10:00	0	0	1469.1	0	3480
3-Jan-00	10:10	0	0	1469.1	0	3490
3-Jan-00	10:20	0	0	1469.1	0	3500
3-Jan-00	10:30	0	0	1469.1	0	3510
3-Jan-00	10:40	0	0	1469.1	0	3520
3-Jan-00	10:50	0	0	1469.1	0	3530
3-Jan-00	11:00	0	0	1469.1	0	3540
3-Jan-00	11:10	0	0	1469.1	0	3550
3-Jan-00	11:20	0	0	1469.1	0	3560
3-Jan-00	11:30	0	0	1469.1	0	3570
3-Jan-00	11:40	0	0	1469.1	0	3580
3-Jan-00	11:50	0	0	1469.1	0	3590
3-Jan-00	12:00	0	0	1469.1	0	3600


Dam 33 Hydrograph- Dam Break
Flow (cfs)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
200
400
600
800
1000
1200
1400
Time (min)
Inflow (cfs)
Outflow (cfs)

Dam Break Estimate for Dam 33

Assumptions:

- *Earthen Embankment Dam, Assumed to be primarily Sand and easily erodable material*
- *Assume trapezoidal failure*
- *Only Analyses under flood conditions since under normal conditions the pond is mostly dry*
- *Assume Average Attenuation*

Reference:

- *DEC Guidelines for Dams*
- *Dam Safety Guidelines Technical Note 1 - Washington State Department of Ecology (Oct 2007) 92-55E*

$E_{crest} := 1519.9ft$ $E_{toe} := 1519.9ft - 57ft = 1462.9\,ft$ *Elevations of Dam Crest and Toe*

$H_b := 40ft$ *Breach Depth*

$Freeboard := 2ft$ *Height from Top of Dam to Water Surface Elevation under consideration.*

$H_w := H_b - Freeboard = 38 \cdot ft$ *Height of Water in the Dam*

$V_w := 128acre \cdot ft$ *Volume of Dam at water surface elevation under consideration.*

$Z_1 := 3$ *Side Slope on upstream face (Z1:1)*

$Z_2 := 2.5$ *Side Slope on downstream face*

$Z_3 := Z_1 + Z_2 = 5.5$

$C := 14ft$ *Crest Width of Dam*

$Z_b := 1$ *Failure Slope (Assumed) (1:1)*

Breach Characteristics

$BFF := V_w \cdot H_w = 4864 \cdot acre \cdot ft^2$ *Eqn 1 : Wash State*

$V_m := 3.75 \cdot \left(\frac{BFF}{acre \cdot ft^2} \right)^{0.77} \cdot yd^3 = 2588.31 \cdot yd^3$ *Volume of Dirt Moved by the break (Eqn 2)*

$W_b := \frac{V_m - H_b^2 \left(C \cdot Z_b + H_b \cdot Z_b \cdot \frac{Z_3}{3} \right)}{H_b \cdot \left(C + H_b \cdot \frac{Z_3}{2} \right)} = -14.082\,ft$ *Width of Breach (Eqn 3)*

$\tau := 0.020 \cdot \left(\frac{V_m}{yd^3} \right)^{0.36} \cdot hr = 0.339 \cdot hr$ *Time to Breach*

Dam Peak Discharge

$S_a := 7.9$ *Surface area of Pond at Flood Stage (acre)*

$W := \frac{W_b + Z_b \cdot H_w}{ft} = 23.918$

$A := 23.4 \cdot \frac{S_a}{W} = 7.729$

$Q_p := 3.1 \cdot W \cdot \left(\frac{H_w}{ft} \right)^{1.5} \cdot \left(\frac{A}{A + \frac{\tau}{hr} \cdot \sqrt{\frac{H_w}{ft}}} \right)^3 \cdot \frac{ft^3}{sec} = 8477.495 \cdot \frac{ft^3}{sec}$ *Peak Discharge from Pond (Eqn 7)*

Attenuation

Determine Flows at Point x (Qx) Downstream. Use Attenuation Charts 5a

Qp	8477.495448 cfs

Mile Point	Flow Ratio	Qx (cfs)
0	1	8477.50
1	0.95	8053.62
2	0.9	7629.75
3	0.85	7205.87
4	0.8	6782.00
5	0.75	6358.12
6	0.7	5934.25
7	0.65	5510.37
8	0.6	5086.50
9	0.55	4662.62
10	0.5	4238.75
11	0.45	3814.87
12	0.4	3391.00

Q_p

Wave Velocity from Dam

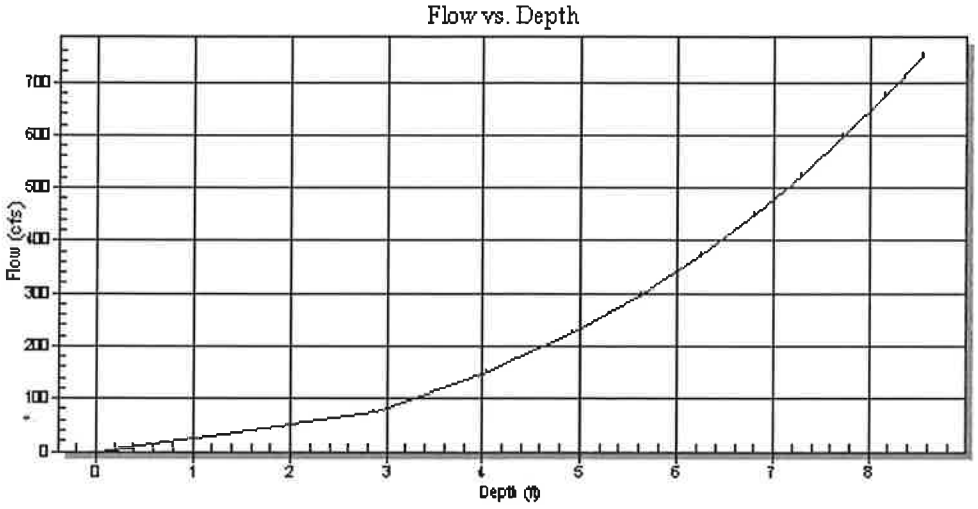
$$V := 2.4 \frac{ft}{sec}$$

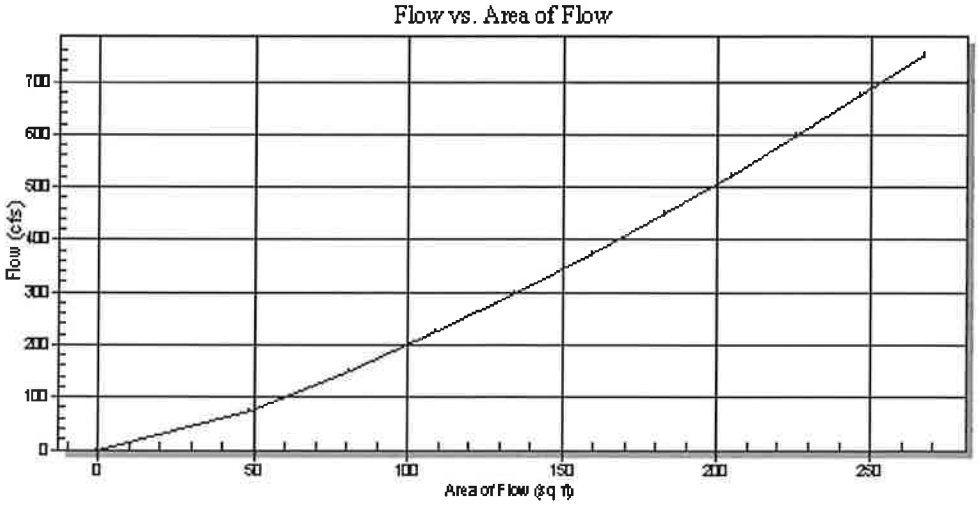
From Table 7, assume a velocity of 2.4 ft/sec based on bed slope of 10 ft/mi and a Type 2 channel.

Inundation Area shall be based on A = Qx/V

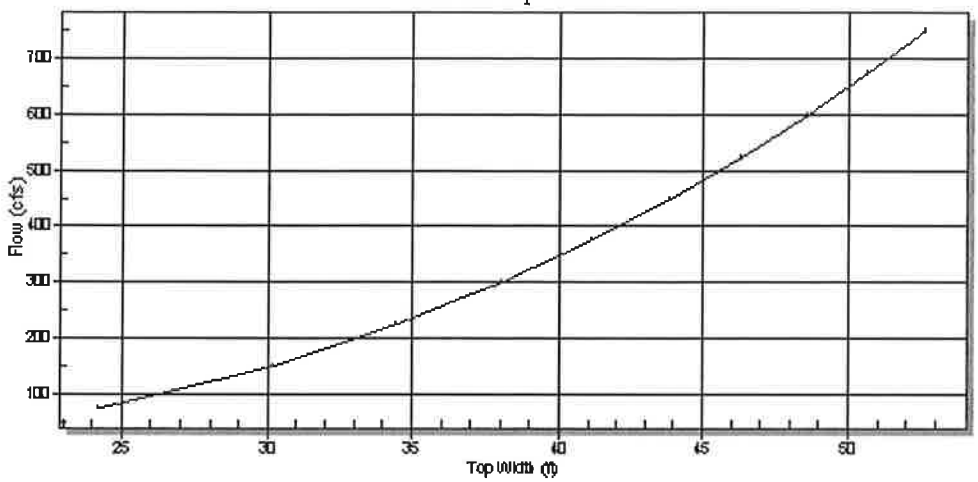
Flow Curves

Assuming a 10' wide channel, 0.0001 ft/ft slope, mannings 0.0150, 3:1 slope and 2:1 slope respectively:

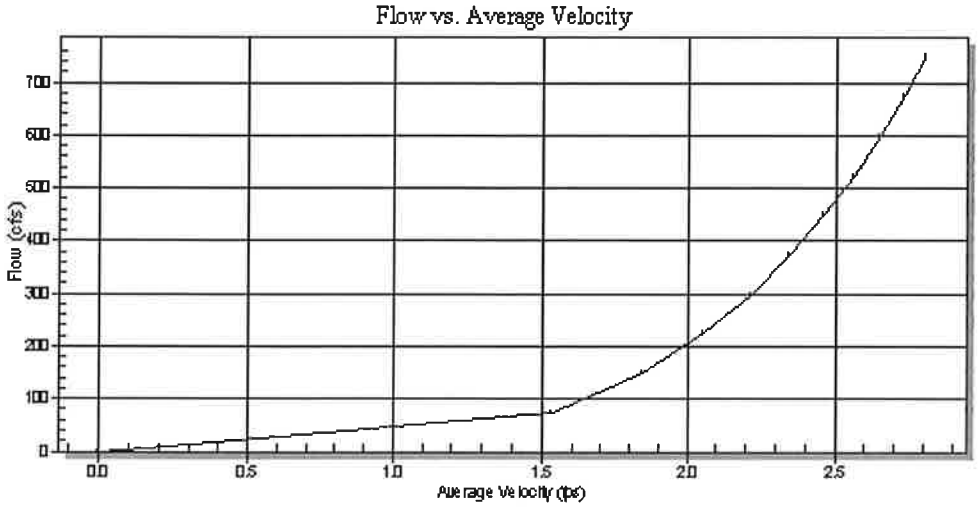




Flow vs. Top Width



Flow vs. Average Velocity



Reach	River Sta		Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Length Chnl	Notes	Distance from Dam 33		Distance from End of Model		Slope	Average Slope/mi		Flood Depth
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)		ft	mi	ft	mi	(ft/mi)	Per Section		ft
Combined	25565.12		8804.3	1482.22	1489.63	1490.43	1493.93	0.01471	18.76	936.77	172.58	1.25	51.97				67508	12.8	168.7			7.41
Combined	25549.20		8756.07	1480.56	1487.76	1490.03	1495.33	0.027424	25.41	771.43	157.31	1.71	51.97		0	0.0	67456	12.8	168.7			7.2
Combined	25533.44		8718.26	1478.9	1485.97	1489.14	1497.62	0.054256	35	723.96	158.93	2.39	72.03		52	0.0	67404	12.8	284.4			7.07
Combined	25511.40		8653.63	1475.02	1482.01	1485.5	1493.83	0.05419	34.97	708.23	156.39	2.39	72.03		124	0.0	67332	12.8	284.4			6.99
Combined	25489.50		8589.27	1471.14	1478.13	1481.69	1489.83	0.052154	34.53	716.64	164.56	2.35	72.03		196	0.0	67260	12.7	284.4			6.99
Combined	25467.58		8538.79	1467.26	1473.49	1477.25	1488.32	0.075234	38.57	659.24	189.46	2.77	50.44		268	0.1	67188	12.7	385.2			6.23
Combined	25452.20		8533.65	1463.58	1470.03	1473.91	1485.41	0.076029	39.46	659.61	181.57	2.79	50.44		319	0.1	67138	12.7	384.2			6.45
Combined	25436.83		8524.86	1459.91	1466.42	1470.23	1482.4	0.08087	40.75	676.11	194.69	2.88	76		369	0.1	67087	12.7	390.4			6.51
Combined	25413.60		8507.28	1454.29	1461.02	1464.98	1477.85	0.080164	41.66	666.85	192.97	2.89	76		445	0.1	67011	12.7	390.4			6.73
Combined	25390.50		8481.97	1448.67	1455.51	1459.69	1474.21	0.085324	43.62	637.53	190.87	2.99	76		521	0.1	66935	12.7	390.4			6.84
Combined	25367.33		8445.91	1443.05	1450.49	1454.34	1466.11	0.065128	40.55	708.28	198.51	2.65	90.77		597	0.1	66859	12.7	299.0			7.44
Combined	25339.60		8404.46	1437.91	1444.86	1449.32	1460.5	0.06354	37.96	598.07	147.56	2.59	90.77		688	0.1	66769	12.6	298.4			6.95
Combined	25312.00		8397.31	1432.78	1439.29	1443.57	1454.53	0.062947	35.91	552.22	142.76	2.54	90.77		778	0.1	66678	12.6	298.4			6.51
Combined	25284.30		8385.4	1427.65	1433.82	1437.69	1448.16	0.060856	33.86	528.01	143.87	2.47	90.77		869	0.2	66587	12.6	298.4			6.17
Combined	25256.60		8369.57	1422.52	1428.24	1432.09	1442.67	0.065952	33.22	490.09	145.16	2.54	90.77		960	0.2	66496	12.6	298.4			5.72
Combined	25229.01		8347.25	1417.39	1423.44	1426.44	1433.64	0.042959	27.79	568.68	157.45	2.07	91.05		1051	0.2	66405	12.6	176.9			6.05
Combined	25201.20		8319.59	1414.34	1419.79	1422.26	1428.02	0.041161	25	605.53	173.02	1.98	91.05		1142	0.2	66314	12.6	176.9			5.45
Combined	25173.50		8300.91	1411.29	1416.26	1418.29	1423.01	0.040082	22.83	652.51	188.75	1.92	91.05		1233	0.2	66223	12.5	176.9			4.97
Combined	25145.75		8295.24	1408.24	1412.83	1414.47	1418.37	0.038999	20.98	709	204.66	1.86	99.47		1324	0.3	66132	12.5	181.5			4.59
Combined	25115.40		8285.04	1404.82	1409.41	1411.17	1415.29	0.038695	21.09	665.65	203.62	1.86	99.47		1423	0.3	66033	12.5	181.0			4.59
Combined	25085.10		8270.03	1401.41	1405.96	1407.8	1412.09	0.038764	21.16	623.61	200.65	1.86	99.47		1523	0.3	65933	12.5	181.0			4.55
Combined	25054.80		8249.65	1398	1402.54	1404.29	1408.61	0.0368	20.79	601.69	200.71	1.81	99.47		1622	0.3	65834	12.5	181.0			4.54
Combined	25024.40		8214.44	1394.59	1398.76	1400.93	1406.03	0.047634	22.43	558.75	252.15	2.04	99.47		1722	0.3	65734	12.4	181.0			4.17
Combined	24994.16		8209.85	1391.18	1395.29	1396.55	1399.56	0.032724	18.56	826.38	271.07	1.69	96.42		1821	0.3	65635	12.4	176.3			4.11
Combined	24964.70		8196.67	1387.96	1392.38	1393.85	1397.24	0.032274	19.52	806.48	278.52	1.7	96.42		1918	0.4	65539	12.4	176.3			4.42
Combined	24935.30		8178.95	1384.74	1389.48	1391.19	1394.99	0.032202	20.6	790.25	286.86	1.72	96.42		2014	0.4	65442	12.4	175.8			4.74
Combined	24905.90		8128.27	1381.53	1386.65	1388.49	1392.64	0.031225	21.5	791.54	292.9	1.72	96.42		2111	0.4	65346	12.4	176.3			5.12
Combined	24876.60		8121.76	1378.31	1383.79	1386.02	1390.62	0.0326	23.08	781.07	302.91	1.78	96.42		2207	0.4	65249	12.4	175.8			5.48
Combined	24847.21		8094.59	1375.1	1380.84	1382.85	1387.87	0.033971	24.36	953.2	496.06	1.83	98.47		2303	0.4	65153	12.3	151.7			5.74
Combined	24817.20		8044.76	1372.27	1377.77	1379.76	1384.42	0.033956	23.58	958.38	521.96	1.82	98.47		2402	0.5	65054	12.3	151.7			5.5
Combined	24787.10		8023.29	1369.44	1374.7	1376.56	1381.12	0.034921	23.12	967.32	560.27	1.83	98.47		2500	0.5	64956	12.3	151.7			5.26
Combined	24757.10		7972.79	1366.61	1371.61	1373.36	1377.65	0.035782	22.52	994.07	614.05	1.83	98.48		2599	0.5	64857	12.3	151.7			5
Combined	24727.15		7954.7	1363.78	1368.58	1370.04	1373.66	0.033501	21.11	1253.75	883.68	1.76	73.25		2697	0.5	64759	12.3	117.5			4.8
Combined	24704.80		7933.68	1362.15	1367.04	1368.09	1370.32	0.024363	18.36	1643.64	882.96	1.51	73.25		2771	0.5	64686	12.3	117.5			4.89
Combined	24682.50		7903.32	1360.52	1364.83	1366.06	1369.06	0.037665	21.11	1435.16	841.75	1.84	73.25		2844	0.5	64612	12.2	117.5			4.31
Combined	24660.17		7817.33	1358.89	1363.58	1363.84	1365.44	0.018061	15.67	2031.61	1039.67	1.29	89.79		2917	0.6	64539	12.2	151.1			4.69
Combined	24632.80		7770.18	1356.32	1360.93	1361.94	1365.43	0.031899	20.06	1277.76	802.68	1.7	89.79		3007	0.6	64449	12.2	151.7			4.61
Combined	24605.40		7735.59	1353.74	1358.36	1359.94	1362.86	0.030614	19.14	1005.96	501.14	1.65	89.79		3097	0.6	64360	12.2	151.7			4.62
Combined	24578.00		7729.35	1351.16	1355.77	1357.5	1360.38	0.030801	18.64	848.91	414.33	1.65	89.79		3186	0.6	64270	12.2	151.1			4.61
Combined	24550.70		7718.6	1348.59	1353.18	1354.7	1357.75	0.03086	18.09	742.91	361.31	1.64	89.79		3276	0.6	64180	12.2	151.7			4.59
Combined	24523.30		7704.99	1346.01	1350.61	1351.92	1354.95	0.029991	17.34	673.77	310.81	1.6	89.79		3366	0.6	64090	12.1	151.1			4.6
Combined	24495.90		7696.94	1343.44	1348.01	1349.27	1352.2	0.030307	16.84	618.08	272.52	1.6	89.79		3456	0.7	64000	12.1	151.7			4.57
Combined	24468.50		7691.28	1340.86	1345.62	1346.65	1349.17	0.025136	15.41	627.66	251.04	1.46	89.79		3546	0.7	63911	12.1	151.1			4.76
Combined	24441.22		7678.41	1338.29	1344.12	1344	1345.98	0.009634	11.15	859.18	259.78	0.94	93.1		3635	0.7	63821	12.1	39.1			5.83
Combined	24412.80		7638.03	1337.6	1343.21	1343.19	1345.1	0.010086	11.3	882.67	286.15	0.96	93.1		3728	0.7	63728	12.1	38.6			5.61
Combined	24384.40		7632.24	1336.92	1342.21	1342.41	1344.21	0.011454	11.74	906.88	357.07	1.01	93.1		3822	0.7	63635	12.1	38.6			5.29
Combined	24356.00		7620.31	1336.24	1341.15	1341.44	1343.14	0.012807	11.99	986.6	397.12	1.06	93.1		3915	0.7	63542	12.0	38.6			4.91
Combined	24327.70		7577.03	1335.56	1339.74	1340.24	1341.89	0.018258	12.94	979.78	431.74	1.24	93.1		4008	0.8	63448	12.0	38.6			4.18
Combined	24299.34		7561.13	1334.88	1339.11		1339.86	0.007755	8.8	1638.93	561.89	0.82	84.07		4101	0.8	63355	12.0	60.3			4.23
Combined	24273.70		7496.73	1333.92	1338.33		1339.28	0.008271	9.41	1487.52	537.94	0.85	84.07		4185	0.8	63271	12.0	60.3			4.41
Combined	24248.00		7487.49	1332.96	1337.51	1337.27	1338.67	0.008831	9.97	1371.91	525.79	0.88	84.07		4269	0.8	63187	12.0	60.3			4.55
Combined	24222.40		7421.89	1332	1336.63	1336.53	1337.99	0.009395	10.44	1242.16	501.18	0.92	84.07		4353	0.8	63103	12.0	59.7			4.68
Combined	24196.80		7430.44	1331.05	1335.64	1335.78	1337.3	0.010886	11.2	1087.11	468.04	0.98	84.07		4437	0.8	63019	11.9	60.3			4.59
Combined	24171.20		7485.58	1330.09	1334.59	1334.82	1336.49	0.012471	11.82	959.57	385.75	1.05	84.07		4521	0.9	62935	11.9	60.3			4.5
Combined	24145.59		7464.14	1329.13	1333.47	1333.81	1335.64	0.014772	12.53	857.79	338.54	1.14	86.85		4605	0.9	62851	11.9	74.8			4.34
Combined	24119.10		7431.54	1327.9	1332.21	1332.73	1334.44	0.015026	12.63	853.63	367.37	1.14	86.85		4692	0.9	62764	11.9	74.8			4.31
Combined	24092.60		7395.57	1326.67	1330.94	1331.46	1333.18	0.015267	12.66	867.29	394.61	1.15	86.85		4779	0.9	62677	11.9	74.8			4.27
Combined	24066.10		7358.1	1325.44	1329.67	1330.21	1331.85	0.015347	12.59	892.08	408.34	1.15	86.85		4866	0.9	62590	11.9	74.8			4.23
Combined	24039.70		114.63	1324.21	1328.39		1328.39	0.000004	0.2	931.68	434.22	0.02	86.85		4953	0.9	62504	11.8	74.8			4.18
Combined	24013.20		7328.18	1322.98	1327.05	1327.54	1329.12	0.016628	12.59	968.59	472.03	1.19	86.85		5040	1.0	62417	11.8	74.8			4.07
Combined	23986.76		7302.95	1321.75	1325.95	1326.26	1327.52	0.013185	11.38	1234.03	636.48	1.06	92.16		5126	1.0	62330	11.8	45.8			4.2
Combined	23958.60		7258.14	1320.95	1324.91	1325.03	1326.32	0.013432	11.07	1259.36	584.47	1.06	92.16		5219	1.0	62238	11.8	46.4			3.96
Combined	23930.50		7250.35	1320.14	1323.89	1323.91	1325.1	0.013344	10.65	1340.07	593.58	1.05	92.16		5311	1.0	62146	11.8	46.4			3.75
Combined	23902.40		7231.06	1319.33	1322.83	1322.72	1323.87	0.013608	10.27	1410.51	612.61	1.05	92.16		5403	1.0	62053	11.8	45.8			3.5
Combined	23874.40		7200.1	1318.53	1321.76	1321.51	1322.64	0.013816	9.82	1481.76	636.5	1.04	92.16		5495	1.0	61961	11.7	46.4			3.23
Combined	23846.30		7188.3	1317.72	1320.7	1320.26	1321.43	0.013859	9.31	1559.34	662.35	1.03	92.16		5587	1.1	61869	11.7	45.8			2.98
Combined	23818.20		7154.42	1316.92	1319.64	1318.9	1320.22	0.013539	8.67	1643.85	689.15	1	92.16		5679	1.1	61777	11.7	46.4			2.72
Combined	23790.13		7142.68	1316.11	1318.63	1317.45	1319.07	0.012364	7.86	1763.31	715.82	0.94	97.73		5771	1.1	61685	11.7	63.8			2.52
Combined	23760.30		7105.44	1314.93	1317.46	1316.53	1317.93	0.012483	8.03	1787.35	773.22	0.95	97.73		5869	1.1	61587	11.7	63.8			2.53
Combined	23730.50		7089.61	1313.75	1316.29	1315.53	1316.78	0.012605	8.19	1819.47	831.34	0.96	97.73		5967	1.1	61489	11.6	63.2			2.54
Combined	23700.70		7051.47	1312.58	1315.11	1314.48	1315.61	0.01272	8.31	1852.87	889.79	0.97	97.73		6065	1.1	61392	11.6	63.8			2.53
Combined	23670.90		7002.3	1311.4	1313.92	1313.39	1314.43	0.012818	8.4	1885.42	946.88	0.97	97.73		6162	1.2	61294	11.6	63.8			2.52
Combined	23641.10		6981.96	1310.22	1312.71	1312.18	1313.23	0.01311	8.51	1913.63	1001.85	0.99	97.73		6260	1.2	61196	11.6	63.8			2.49
Combined	23611.40		6939.87	1309.04	1311.48	1311.1	1312.01	0.013492	8.59	1932.13	1050.74	1	97.73		6358	1.2	61098	11.6	63.2			2.44
Combined	23581.60		6898.07	1307.87	1310.24	1309.91	1310.76	0.013779	8.59	1951.18	1088.06	1.01	97.73		6456	1.2	61001	11.6	63.8			2.37
Combined	23551.80		6852.67	1306.69	1309	1308.71	1309.51	0.014135	8.6	1979.79	1145.43	1.02	97.73		6553	1.2	60903	11.5	63.8			2.31
Combined	23522.04		6794.01	1305.51	1308.06		1308.4	0.00857	7.22	2437.94	1343.77	0.81	93.76		6651	1.3	60805	11.5	42.2			2.55
Combined	23493.40		6732.56	1304.76	1307.3		1307.65	0.008441	7.16	2417.98	1284.61	0.8	93.76		6745	1.3	60711	11.5	42.2			2.54

Combined	23464.80		6673.94	1304.01	1306.52		1306.88	0.009046	7.31	2413.77	1398.48	0.83	93.76		6839	1.3	60618	11.5	41.7			2.51
Combined	23436.30		6615.97	1303.27	1305.71		1306.06	0.009183	7.21	2415.38	1424.66	0.83	93.76		6932	1.3	60524	11.5	42.2			2.44
Combined	23407.70		6563.05	1302.52	1304.91		1305.25	0.009317	7.11	2424.1	1454.02	0.83	93.76		7026	1.3	60430	11.4	42.2			2.39
Combined	23379.10		6546.97	1301.77	1304.11		1304.43	0.009595	7.03	2435.31	1488.41	0.84	93.76		7120	1.3	60336	11.4	42.2			2.34
Combined	23350.50		6499.51	1301.02	1303.3		1303.6	0.00975	6.88	2453.33	1519.76	0.84	93.76		7214	1.4	60243	11.4	42.2			2.28
Combined	23321.90		6456.2	1300.27	1302.48		1302.76	0.009904	6.71	2483.37	1561.41	0.84	93.76		7307	1.4	60149	11.4	42.2			2.21
Combined	23293.40		6436.79	1299.52	1301.72		1301.94	0.008846	6.21	2655.37	1642.22	0.79	93.76		7401	1.4	60055	11.4	42.2			2.2
Combined	23264.80		6419.63	1298.77	1300.4	1299.78	1300.71	0.021725	7.55	2137.35	1842.48	1.16	93.76		7495	1.4	59961	11.4	41.7			1.63
Combined	23236.20		6400.96	1298.03	1298.62	1297.73	1298.77	0.023347	3.83	2204.28	1841.52	1	93.76		7589	1.4	59868	11.3	42.2			0.59
Combined	23207.68		6336.92	1297.28	1297.54		1297.56	0.00126	0.45	5171.4	1722.32	0.2	99.05		7682	1.5	59774	11.3	16.0			0.26
Combined	23177.40		6233.48	1296.98	1297.26		1297.29	0.001403	0.5	4961.54	1719.01	0.21	99.05		7781	1.5	59675	11.3	15.5			0.28
Combined	23147.20		6233.48	1296.69	1296.99		1297.02	0.001576	0.57	4763.51	1721.05	0.23	99.05		7881	1.5	59576	11.3	15.5			0.3
Combined	23117.10		6154.81	1296.4	1296.71		1296.74	0.001767	0.63	4558.82	1718.19	0.24	99.05		7980	1.5	59477	11.3	16.0			0.31
Combined	23086.90		6133.19	1296.1	1296.45		1296.48	0.001995	0.71	4368.19	1720.83	0.26	99.05		8079	1.5	59378	11.2	15.5			0.35
Combined	23056.70		6017.11	1295.81	1296.17		1296.21	0.00223	0.79	4172.75	1713.65	0.28	99.05		8178	1.5	59279	11.2	16.0			0.36
Combined	23026.50		5960.57	1295.51	1295.91		1295.94	0.00248	0.88	3992.88	1699.17	0.3	99.05		8277	1.6	59180	11.2	15.5			0.4
Combined	22996.30		5872.22	1295.22	1295.64		1295.68	0.002738	0.98	3828.64	1695.95	0.32	99.05		8376	1.6	59080	11.2	15.5			0.42
Combined	22966.10		5387.26	1294.93	1295.42		1295.45	0.002555	1.06	3726.39	1745.53	0.32	99.05		8475	1.6	58981	11.2	16.0			0.49
Combined	22935.90		5306.31	1294.63	1295.22		1295.26	0.002645	1.2	3689.82	1808.69	0.33	99.05		8574	1.6	58882	11.2	15.5			0.59
Combined	22905.70		5161.3	1294.34	1295.03		1295.06	0.002658	1.28	3662.07	1843.9	0.34	99.05		8673	1.6	58783	11.1	15.5			0.69
Combined	22875.50		5022.28	1294.05	1294.83		1294.86	0.002676	1.36	3635.13	1926.06	0.34	99.05		8772	1.7	58684	11.1	16.0			0.78
Combined	22845.30		4951.7	1293.75	1294.64		1294.67	0.002746	1.55	3618.39	2004.57	0.36	99.05		8871	1.7	58585	11.1	15.5			0.89
Combined	22815.10		4823.68	1293.46	1294.44		1294.47	0.00274	1.73	3606.05	2082.98	0.37	99.05		8970	1.7	58486	11.1	16.0			0.98
Combined	22784.90		4703.59	1293.16	1294.24		1294.27	0.002722	1.89	3612.05	2238.41	0.38	99.05		9069	1.7	58387	11.1	15.5			1.08
Combined	22754.80		4595.3	1292.87	1294.04		1294.07	0.003294	2.26	3626.7	2311.12	0.42	99.05		9168	1.7	58288	11.0	15.5			1.17
Combined	22724.60		4541.1	1292.58	1293.84		1293.87	0.003176	2.38	3638.32	2310.83	0.42	99.05		9267	1.8	58189	11.0	16.0			1.26
Combined	22694.40		4456.71	1292.28	1293.63		1293.66	0.003039	2.48	3641.63	2313.4	0.42	99.05		9366	1.8	58090	11.0	15.5			1.35
Combined	22664.20		4422.81	1291.99	1293.42		1293.45	0.003031	2.6	3623.49	2320.94	0.42	99.05		9465	1.8	57991	11.0	15.5			1.43
Combined	22634.00		4392.94	1291.7	1293.19		1293.22	0.003084	2.73	3582.29	2322.61	0.43	99.05		9564	1.8	57892	11.0	16.0			1.49
Combined	22603.80		4362.93	1291.4	1292.96		1292.99	0.003176	2.87	3526.21	2321.69	0.44	99.05		9663	1.8	57793	10.9	15.5			1.56
Combined	22573.60		4310.61	1291.11	1292.72		1292.76	0.00324	3	3468.53	2323.84	0.45	99.05		9762	1.8	57694	10.9	16.0			1.61
Combined	22543.40		4257.67	1290.81	1292.49		1292.53	0.003288	3.12	3412.8	2320.73	0.46	99.05		9862	1.9	57595	10.9	15.5			1.68
Combined	22513.20		4228.42	1290.52	1292.26		1292.3	0.003369	3.25	3358.33	2318.21	0.47	99.05		9961	1.9	57496	10.9	15.5			1.74
Combined	22483.00		4176.97	1290.23	1292.02		1292.07	0.003403	3.36	3307.23	2315.95	0.47	99.05		10060	1.9	57397	10.9	16.0			1.79
Combined	22452.80		4126.17	1289.93	1291.79		1291.84	0.003431	3.47	3254.01	2308.61	0.48	99.05		10159	1.9	57298	10.9	15.5			1.86
Combined	22422.60		4075.66	1289.64	1291.55		1291.61	0.003455	3.57	3203.12	2313.63	0.48	99.05		10258	1.9	57199	10.8	15.5			1.91
Combined	22392.40		4025.11	1289.35	1291.32		1291.38	0.003478	3.67	3152.49	2336.03	0.49	99.05		10357	2.0	57099	10.8	16.0			1.97
Combined	22362.30		3975.17	1289.05	1291.08		1291.15	0.003505	3.77	3098.45	2339.97	0.49	99.05		10456	2.0	57000	10.8	15.5			2.03
Combined	22332.10		3925.3	1288.76	1290.85		1290.92	0.003512	3.86	3049.01	2341.55	0.49	99.05		10555	2.0	56901	10.8	16.0			2.09
Combined	22301.90		3876.44	1288.46	1290.61		1290.69	0.003503	3.94	2994.74	2319.95	0.5	99.05		10654	2.0	56802	10.8	15.5			2.15
Combined	22271.70		3828.5	1288.17	1290.37		1290.45	0.003496	4.01	2942.25	2285.82	0.5	99.05		10753	2.0	56703	10.7	15.5			2.2
Combined	22241.50		3784.11	1287.88	1290.13		1290.22	0.003511	4.1	2890.62	2277.38	0.5	99.05		10852	2.1	56604	10.7	16.0			2.25
Combined	22211.30		3743.53	1287.58	1289.89		1289.98	0.00351	4.17	2830.54	2233.65	0.5	99.05		10951	2.1	56505	10.7	15.5			2.31
Combined	22181.10		3707.01	1287.29	1289.63		1289.73	0.003524	4.28	2765.06	2160.17	0.51	99.05		11050	2.1	56406	10.7	15.5			2.34
Combined	22150.90		3688.25	1287	1289.37		1289.48	0.003646	4.35	2685.37	2084.34	0.52	99.05		11149	2.1	56307	10.7	16.0			2.37
Combined	22120.70		3656.46	1286.7	1289.09		1289.21	0.003789	4.45	2584.14	2001.64	0.53	99.05		11248	2.2	56208	10.6	15.5			2.39
Combined	22090.50		3626.59	1286.41	1288.81		1288.92	0.003603	4.36	2505.45	1781.06	0.51	99.05		11347	2.2	56109	10.6	16.0			2.4
Combined	22060.30		3598.08	1286.11	1288.53		1288.65	0.003612	4.39	2458.28	1722.32	0.52	99.05		11446	2.2	56010	10.6	15.5			2.42
Combined	22030.10		3583.84	1285.82	1288.26		1288.37	0.003654	4.45	2405.74	1673.51	0.52	99.05		11545	2.2	55911	10.6	15.5			2.44
Combined	22000.00		3570.34	1285.53	1287.98		1288.1	0.003714	4.5	2361.37	1634.1	0.52	99.05		11644	2.2	55812	10.6	16.0			2.45
Combined	21969.80		3558.6	1285.23	1287.69		1287.82	0.003856	4.59	2304.26	1599.57	0.53	99.05		11743	2.3	55713	10.6	15.5			2.46
Combined	21939.60		3549.06	1284.94	1287.38		1287.52	0.004123	4.73	2225.2	1557.78	0.55	99.05		11843	2.3	55614	10.5	15.5			2.44
Combined	21909.42		3535.85	1284.65	1287.05		1287.2	0.00456	4.92	2113.34	1494.12	0.58	95.25		11942	2.3	55515	10.5	28.3			2.4
Combined	21880.30		3527.62	1284.14	1286.68		1286.85	0.004709	5.13	2036.89	1474.09	0.59	95.25		12037	2.3	55419	10.5	28.3			2.54
Combined	21851.30		3511.21	1283.63	1286.31		1286.51	0.004839	5.33	1968.54	1462.52	0.6	95.25		12132	2.3	55324	10.5	28.3			2.68
Combined	21822.30		3492.38	1283.12	1285.94		1286.16	0.004893	5.5	1905.41	1458.12	0.61	95.25		12227	2.3	55229	10.5	28.3			2.82
Combined	21793.20		3472.05	1282.61	1285.58		1285.83	0.004848	5.63	1862.4	1458.65	0.61	95.25		12323	2.3	55134	10.4	28.3			2.97
Combined	21764.20		3460.37	1282.1	1285.23		1285.5	0.004732	5.72	1827.48	1463.37	0.61	95.25		12418	2.3	55038	10.4	28.3			3.13
Combined	21735.20		3450.64	1281.59	1284.87		1285.16	0.004626	5.82	1796.66	1468.04	0.61	95.25		12513	2.3	54943	10.4	28.3			3.28
Combined	21706.20		3444.1	1281.08	1284.49		1284.82	0.004672	5.98	1727.5	1473.38	0.61	95.25		12608	2.3	54848	10.4	28.3			3.41
Combined	21677.10		3432.54	1280.57	1284.09		1284.47	0.004917	6.24	1625.68	1467.51	0.63	95.25		12704	2.3	54753	10.4	28.3			3.52
Combined	21648.10		3424.96	1280.06	1283.68		1284.12	0.005161	6.49	1523.58	1452.35	0.65	95.25		12799	2.4	54657	10.4	28.3			3.62
Combined	21619.10		3412.29	1279.55	1283.26	1282.38	1283.77	0.005413	6.74	1413.94	1426.74	0.67	95.25		12894	2.4	54562	10.3	28.3			3.71
Combined	21590.00		3396.54	1279.04	1282.82	1282.16	1283.41	0.005861	7.08	1272.14	1387.38	0.7	95.25		12989	2.5	54467	10.3	28.3			3.78
Combined	21561.00		3357.11	1278.53	1282.38	1281.76	1283.05	0.006156	7.33	1137.61	1331.26	0.71	95.25		13085	2.5	54372	10.3	28.3			3.85
Combined	21532.00		3335.6	1278.02	1281.97	1281.41	1282.69	0.006096	7.42	1055.5	1321.22	0.71	95.25		13180	2.5	54276	10.3	28.3			3.95
Combined	21502.90		3324.31	1277.51	1281.55	1280.66	1282.26	0.005755	7.31	965.69	1076.66	0.7	95.25		13275	2.5	54181	10.3	28.3			4.04
Combined	21473.90		3313.95	1277	1281.1	1280.19	1281.73	0.005158	6.99	879.05	938.73	0.66	95.25		13370	2.5	54086	10.2	27.7			4.1
Combined	21444.90		3306.15	1276.5	1280.67	1279.71	1281.29	0.00493	6.92	831.02	828.54	0.65	95.25		13466	2.6	53991	10.2	28.3			4.17
Combined	21415.80		3271.74	1275.99	1280.34	1279.18	1280.9	0.004103	6.52	882.45	855.29	0.6	95.25		13561	2.6	53895	10.2	28.3			4.35
Combined	21386.80		3198.94	1275.48	1280.09	1278.67	1280.54	0.003077	5.9	1015.22	1066.2	0.52	95.25		13656	2.6	53800	10.2	28.3			4.61
Combined	21357.81		3168.25	1274.97	1279.93		1280.26	0.002145	5.2	1301.7	1228.39	0.44	96.37		13751	2.6	53705	10.2	6.0			4.96
Combined	21328.40		3139.9	1274.86	1279.74		1280.08	0.002161	5.2	1295.32	1305.63	0.44	96.37		13848	2.6	53609	10.2	5.5			4.88
Combined	21299.00		3100.25	1274.76	1279.56		1279.93	0.002344	5.39	1305.66	1381.49	0.46	96.37		13944	2.6	53512	10.1	5.5			4.8
Combined	21269.60		3076.07	1274.66	1279.37		1279.73	0.002315	5.33	1318.34	1410.51	0.46	96.37		14040	2.7	53416	10.1	6.0			4.71
Combined	21240.30		3063.97	1274.55	1279.14		1279.51	0.002422	5.38	1278.79	1327	0.47	96.37		14137	2.7	53319	10.1	5.5			4.59
Combined	21210.90		3055.13	1274.45	1278.91		1279.29	0.002537	5.44	1245.08	1179.19	0.48	96.37		14233	2.7	53223	10.1	6.0			4.46
Combined	21181.50		3048.2	1274.34	1278.7		1279.07	0.002598	5.44	1245.01	1066.3	0.48	96.37		14330	2.7	53127	10.1	5.5			4.36
Combined	21152.20		3035.82	1274.24	1278.49		1278.81	0.002467	5.24	1260.32	938.16	0.47	96.37		14426	2.7	53030	10.0	5.5			4.25
Combined	21122.80		3029.16	1274.14	1278.27		1278.58	0.0025	5.2	1283.85	804.17	0.47	96.37		14522	2.8	52934	10.0	6.0			4.13
Combined	21093.40		3017.25	1274.03	1278.05		1278.35	0.002494	5.13	1321.16	812.53	0.47	96.37		14619	2.8	52838	10.0	5.5			4.02
Combined	21064.00		3005.42	1273.93	1277.84		1278.12	0.002499	5.06	1354.96	821.52	0.46	96.37		14715	2.8	52741	10.0	6.0			3.91
Combined	21034.70		2993.55	1273.82	1277.62		1277.89	0.002492	4.99	1369.4	835.15	0.46	96.37		14811	2.8	52645	10.0	5.5			3.8

Combined	21005.30		2987.42	1273.72	1277.41		1277.66	0.002502	4.92	1423.23	844.21	0.46	96.37		14908	2.8	52548	10.0	5.5			3.69
Combined	20975.90		2976.74	1273.62	1277.18		1277.42	0.002526	4.85	1452.21	852.64	0.46	96.37		15004	2.8	52452	9.9	6.0			3.56
Combined	20946.50		2972.1	1273.51	1276.96		1277.18	0.002553	4.79	1481.25	862.28	0.46	96.37		15101	2.9	52356	9.9	5.5			3.45
Combined	20917.20		2963.31	1273.41	1276.74		1276.95	0.002565	4.71	1513.21	883.26	0.46	96.37		15197	2.9	52259	9.9	5.5			3.33
Combined	20887.80		2953.39	1273.31	1276.53		1276.72	0.002555	4.61	1550.99	917.09	0.46	96.37		15293	2.9	52163	9.9	6.0			3.22
Combined	20858.40		2936.35	1273.2	1276.32		1276.49	0.002486	4.47	1600.56	963.39	0.45	96.37		15390	2.9	52067	9.9	5.5			3.12
Combined	20829.00		2908.2	1273.1	1276.12		1276.27	0.002378	4.29	1662.07	1074.41	0.44	96.37		15486	2.9	51970	9.8	6.0			3.02
Combined	20799.70		2873.9	1272.99	1275.94		1276.07	0.002189	4.06	1749.94	1096.78	0.42	96.37		15582	3.0	51874	9.8	5.5			2.95
Combined	20770.30		2825.06	1272.89	1275.79		1275.89	0.001986	3.78	1862.64	1225.4	0.39	96.37		15679	3.0	51778	9.8	5.5			2.9
Combined	20740.90		2758.79	1272.79	1275.65		1275.73	0.001625	3.44	2064.76	1770.27	0.36	96.37		15775	3.0	51681	9.8	6.0			2.86
Combined	20711.60		2679.2	1272.68	1275.55		1275.61	0.001264	3.04	2407.71	2169.59	0.32	96.37		15871	3.0	51585	9.8	5.5			2.87
Combined	20682.20		2645.8	1272.58	1275.47		1275.51	0.000957	2.66	2862.51	2569.36	0.28	96.37		15968	3.0	51488	9.8	6.0			2.89
Combined	20652.85		2614.22	1272.47	1275.41		1275.44	0.000687	2.28	3525	2985.84	0.23	98.5		16064	3.0	51392	9.7	4.3			2.94
Combined	20622.80		2594.21	1272.39	1275.35		1275.38	0.000731	2.36	3305.18	2847.17	0.24	98.5		16163	3.1	51294	9.7	4.8			2.96
Combined	20592.80		2568.12	1272.3	1275.29		1275.32	0.000775	2.45	3104.08	2739.55	0.25	98.5		16261	3.1	51195	9.7	4.3			2.99
Combined	20562.70		2551.62	1272.22	1275.22		1275.26	0.000833	2.54	2901.46	2638.85	0.26	98.5		16360	3.1	51097	9.7	4.8			3
Combined	20532.70		2524.03	1272.13	1275.15		1275.19	0.000884	2.62	2709.97	2508.88	0.27	98.5		16458	3.1	50998	9.7	4.8			3.02
Combined	20502.70		2511.29	1272.04	1275.07		1275.12	0.000948	2.71	2532.15	2493.33	0.28	98.5		16557	3.1	50900	9.6	4.3			3.03
Combined	20472.70		2494.13	1271.96	1274.99		1275.04	0.001015	2.79	2392.66	2245.04	0.29	98.5		16655	3.2	50801	9.6	4.8			3.03
Combined	20442.70		2483	1271.87	1274.91		1274.97	0.001088	2.88	2289.57	2250.31	0.3	98.5		16754	3.2	50703	9.6	4.3			3.04
Combined	20412.60		2468.49	1271.79	1274.82		1274.88	0.001157	2.95	2252.52	2118.28	0.3	98.5		16852	3.2	50604	9.6	4.8			3.03
Combined	20382.60		2451.89	1271.7	1274.72		1274.79	0.001229	3.02	2268.64	2447.32	0.31	98.5		16951	3.2	50506	9.6	4.8			3.02
Combined	20352.60		2447.43	1271.61	1274.62		1274.69	0.001308	3.08	2327.39	2741.35	0.32	98.5		17049	3.2	50407	9.5	4.8			3.01
Combined	20322.60		2433.36	1271.53	1274.52		1274.59	0.00138	3.13	2400.97	2942.52	0.33	98.5		17148	3.2	50309	9.5	4.8			2.99
Combined	20292.60		2426.69	1271.44	1274.41		1274.49	0.001442	3.16	2471.55	2952.54	0.34	98.5		17246	3.3	50210	9.5	4.3			2.97
Combined	20262.50		2412.79	1271.36	1274.3		1274.37	0.001504	3.17	2555.15	2884.26	0.34	98.5		17345	3.3	50112	9.5	4.8			2.94
Combined	20232.50		2407.38	1271.27	1274.18		1274.25	0.001577	3.18	2627.29	2955.85	0.35	98.5		17443	3.3	50013	9.5	4.8			2.91
Combined	20202.50		2395.42	1271.18	1274.05		1274.12	0.001648	3.19	2700.87	3087.9	0.35	98.5		17542	3.3	49915	9.5	4.3			2.87
Combined	20172.50		2388.31	1271.1	1273.93		1274	0.001689	3.15	2791.06	3187.42	0.36	98.5		17640	3.3	49816	9.4	4.8			2.83
Combined	20142.40		2375.81	1271.01	1273.8		1273.87	0.001724	3.11	2896.31	3377.48	0.36	98.5		17739	3.4	49718	9.4	4.3			2.79
Combined	20112.40		2352.8	1270.93	1273.67		1273.73	0.001653	2.96	3017.39	3413.27	0.35	98.5		17837	3.4	49619	9.4	4.8			2.74
Combined	20082.40		2275.57	1270.84	1273.55		1273.6	0.001453	2.71	3158.85	3445.24	0.32	98.5		17936	3.4	49521	9.4	4.8			2.71
Combined	20052.40		2130.94	1270.75	1273.46		1273.48	0.001107	2.32	3378.69	3490.68	0.28	98.5		18034	3.4	49422	9.4	4.3			2.71
Combined	20022.40		2032.95	1270.67	1273.38		1273.4	0.000819	1.96	3685.22	3565.87	0.24	98.5		18133	3.4	49324	9.3	4.8			2.71
Combined	19992.30		1966.34	1270.58	1273.33		1273.34	0.000609	1.68	4075.87	3743.89	0.21	98.5		18231	3.5	49225	9.3	4.3			2.75
Combined	19962.30		1940.72	1270.5	1273.29		1273.3	0.000446	1.43	4534.92	3825.33	0.18	98.5		18330	3.5	49127	9.3	4.8			2.79
Combined	19932.30		1915.72	1270.41	1273.26		1273.27	0.000323	1.21	5045.62	3817.53	0.15	98.5		18428	3.5	49028	9.3	4.8			2.85
Combined	19902.30		1900.31	1270.32	1273.24		1273.24	0.000234	1.03	5583.34	3800.71	0.13	98.5		18527	3.5	48930	9.3	4.3			2.92
Combined	19872.30		1888.58	1270.24	1273.22		1273.23	0.000172	0.89	6141.51	3790.94	0.11	98.5		18625	3.5	48831	9.2	4.8			2.98
Combined	19842.20		1884.57	1270.15	1273.21		1273.21	0.00013	0.77	6714.38	3784.96	0.1	98.5		18724	3.5	48733	9.2	4.3			3.06
Combined	19812.20		1874.17	1270.07	1273.2		1273.2	0.000099	0.68	7303.48	3788.58	0.08	98.5		18822	3.6	48634	9.2	4.8			3.13
Combined	19782.24		1870.94	1269.98	1273.19		1273.19	0.000077	0.6	7899.53	3785.85	0.07	99.94		18921	3.6	48536	9.2	1.1			3.21
Combined	19751.70		1867.66	1269.96	1273.18		1273.19	0.000098	0.69	7180.96	3757.75	0.08	99.94		19021	3.6	48436	9.2	0.5			3.22
Combined	19721.30		1861.92	1269.95	1273.17		1273.18	0.000123	0.79	6503.6	3754.78	0.09	99.94		19121	3.6	48336	9.2	1.1			3.22
Combined	19690.80		1858.5	1269.93	1273.16		1273.16	0.000161	0.95	5850.03	3745.77	0.11	99.94		19221	3.6	48236	9.1	0.5			3.23
Combined	19660.30		1853.43	1269.92	1273.14		1273.15	0.00021	1.11	5229.94	3741.14	0.13	99.94		19320	3.7	48136	9.1	1.1			3.22
Combined	19629.90		1841.52	1269.9	1273.12		1273.12	0.000285	1.31	4623.72	3724.88	0.15	99.94		19420	3.7	48036	9.1	0.5			3.22
Combined	19599.40		1839.24	1269.89	1273.08		1273.09	0.000402	1.57	4035.01	3703.87	0.18	99.94		19520	3.7	47936	9.1	1.1			3.19
Combined	19569.00		1830.51	1269.87	1273.04		1273.06	0.000566	1.94	3441.7	3691.96	0.22	99.94		19620	3.7	47836	9.1	1.1			3.17
Combined	19538.50		1818.73	1269.85	1272.98		1273.01	0.000717	2.2	2952.62	3326.7	0.25	99.94		19720	3.7	47736	9.0	0.5			3.13
Combined	19508.00		1799.5	1269.84	1272.92		1272.95	0.000831	2.37	2586.06	3018.13	0.27	99.94		19820	3.8	47636	9.0	1.1			3.08
Combined	19477.60		1782.89	1269.82	1272.84		1272.88	0.00084	2.38	2416.5	2598.56	0.27	99.94		19920	3.8	47536	9.0	0.5			3.02
Combined	19447.10		1764.87	1269.81	1272.77		1272.81	0.000799	2.4	2348.44	2444.41	0.27	99.94		20020	3.8	47436	9.0	1.1			2.96
Combined	19416.60		1730.11	1269.79	1272.71		1272.74	0.000729	2.29	2339.66	2389.94	0.26	99.94		20120	3.8	47336	9.0	0.5			2.92
Combined	19386.20		1709.14	1269.78	1272.65		1272.68	0.000661	2.19	2365.27	2344.64	0.24	99.94		20220	3.8	47236	8.9	1.1			2.87
Combined	19355.70		1671.61	1269.76	1272.6		1272.63	0.000546	2	2439.35	2272.72	0.22	99.94		20320	3.8	47136	8.9	0.5			2.84
Combined	19325.30		1637.84	1269.75	1272.56		1272.58	0.00044	1.87	2542.13	2301.35	0.21	99.94		20420	3.9	47036	8.9	1.1			2.81
Combined	19294.80		1608.2	1269.73	1272.53		1272.54	0.000359	1.7	2681.41	2346.65	0.19	99.94		20520	3.9	46937	8.9	1.1			2.8	
Combined	19264.30		1580.91	1269.71	1272.5		1272.51	0.000287	1.53	2850.36	2407.27	0.17	99.94		20620	3.9	46837	8.9	0.5			2.79	
Combined	19233.90		1562.34	1269.7	1272.48		1272.49	0.000222	1.36	3040.28	2478.3	0.15	99.94		20720	3.9	46737	8.9	1.1			2.78	
Combined	19203.40		1541.23	1269.68	1272.46		1272.47	0.000168	1.24	3250.45	2503.55	0.13	99.94		20820	3.9	46637	8.8	0.5			2.78	
Combined	19172.90		1524.95	1269.67	1272.45		1272.45	0.000125	1.08	3485.63	2538.06	0.12	99.94		20920	4.0	46537	8.8	1.1			2.78	
Combined	19142.52		1517.32	1269.65	1272.44		1272.44	0.000097	0.96	3728	2575.24	0.1	97.36		21019	4.0	46437	8.8	0.0			2.79	
Combined	19112.80		1506.98	1269.65	1272.43		1272.43	0.000097	0.96	3703.51	2572.66	0.1	97.36		21117	4.0	46339	8.8	0.5			2.78	
Combined	19083.10		1504.29	1269.64	1272.42		1272.43	0.000098	0.97	3682.26	2568.18	0.1	97.36		21214	4.0	46242	8.8	0.0			2.78	
Combined	19053.40		1494.14	1269.64	1272.42		1272.42	0.000098	0.97	3661.63	2564.49	0.1	97.36		21312	4.0	46145	8.7	0.0			2.78	
Combined	19023.80		1484.33	1269.64	1272.41		1272.41	0.000099	0.97	3639.86	2559.95	0.1	97.36		21409	4.1	46047	8.7	0.5			2.77	
Combined	18994.10		1477.58	1269.63	1272.4		1272.4	0.000099	0.97	3615.08	2554.67	0.1	97.36		21506	4.1	45950	8.7	0.0			2.77	
Combined	18964.40		1477.28	1269.63	1272.39		1272.4	0.000101	0.98	3593.08	2550.36	0.1	97.36		21604	4.1	45853	8.7	0.0			2.76	
Combined	18934.70		1465.93	1269.63	1272.38		1272.39	0.000101	0.97	3572.79	2545.95	0.1	97.36		21701	4.1	45755	8.7	0.5			2.75	
Combined	18905.10		1459.02	1269.62	1272.38		1272.38	0.000102	0.98	3551.76	2541.04	0.1	97.36		21798	4.1	45658	8.6	0.0			2.76	
Combined	18875.40		1456.89	1269.62	1272.37		1272.37	0.000104	0.99	3520.23	2534.71	0.11	97.36		21896	4.1	45561	8.6	0.0			2.75	
Combined	18845.70		1445.73	1269.62	1272.36		1272.36	0.000104	0.98	3499.68	2529.33	0.11	97.35		21993	4.2	45463	8.6	0.5			2.74	
Combined	18816.00		1443.48	1269.61	1272.35		1272.35	0.000106	0.99	3476.1	2524.34	0.11	97.36		22090	4.2	45366	8.6	0.0			2.74	
Combined	18786.40		1437.18	1269.61	1272.34		1272.35	0.000106	0.99	3457.35	2518.69	0.11	97.36		22188	4.2	45268	8.6	0.5			2.73	
Combined	18756.70		1432.8	1269.6	1272.33		1272.34	0.000107	1	3434.58	2514.55	0.11	97.36		22285	4.2	45171	8.6	0.0			2.73	
Combined	18727.00		1419.22	1269.6	1272.33		1272.33	0.000107	0.99	3409.82	2507.21	0.11	97.36		22382	4.2	45074	8.5	0.0			2.73	
Combined	18697.30		1417.19	1269.6	1272.32		1272.32	0.000109	1	3388.77	2502.05	0.11	97.36		22480	4.3	44976	8.5	0.5			2.72	
Combined	18667.70		1403.85	1269.59	1272.31		1272.31	0.000109	1	3363.51	2493.44	0.11	97.36		22577	4.3	44879	8.5	0.0			2.72	
Combined	18638.00		1405.68	1269.59	1272.3		1272.3	0.000111	1.01	3339.47	2481.39	0.11	97.36		22675	4.3	44782	8.5	0.0			2.71	
Combined	18608.30		1398.54	1269.59	1272.29		1272.3	0.000111	1.01	3317.3	2469.84	0.11	97.36		22772	4.3	44684	8.5	0.5			2.7	
Combined	18578.60		1396.49	1269.58	1272.28		1272.29	0.000113	1.01	3295.26	2458.18	0.11	97.36		22869	4.3	44587	8.4	0.0			2.7	
Combined	18549.00		1389.75	1269.58	1272.27		1272.28	0.000114	1.02	3268.93	2443.31	0.11	97.36		22967	4.3	44490	8.4	0.0			2.69	

Combined	18519.30		1331.47	1269.58	1272.26		1272.27	0.000114	1.02	3242.32	2428.49	0.11	97.36		23064	4.4	44392	8.4	0.5			2.68
Combined	18489.60		1376.22	1269.57	1272.26		1272.26	0.000115	1.02	3222.52	2414.85	0.11	97.36		23161	4.4	44295	8.4	0.0			2.69
Combined	18459.90		1374.76	1269.57	1272.25		1272.25	0.000117	1.02	3202.57	2411.14	0.11	97.36		23259	4.4	44198	8.4	0.5			2.68
Combined	18430.30		1356.92	1269.56	1272.24		1272.24	0.000117	1.03	3177.39	2398	0.11	97.36		23356	4.4	44100	8.4	0.0			2.68
Combined	18400.60		1335.29	1269.56	1272.23		1272.23	0.000119	1.03	3150.35	2381.7	0.11	97.36		23453	4.4	44003	8.3	0.0			2.67
Combined	18370.90		1356.24	1269.56	1272.22		1272.22	0.000119	1.03	3128.06	2367	0.11	97.36		23551	4.5	43905	8.3	0.5			2.66
Combined	18341.20		1350.55	1269.55	1272.21		1272.21	0.00012	1.03	3107.24	2357.06	0.11	97.36		23648	4.5	43808	8.3	0.0			2.66
Combined	18311.60		1349.01	1269.55	1272.2		1272.2	0.000122	1.04	3082.4	2342.94	0.11	97.36		23746	4.5	43711	8.3	0.0			2.65
Combined	18281.90		1342.12	1269.55	1272.19		1272.19	0.000123	1.04	3053.88	2324.12	0.11	97.36		23843	4.5	43613	8.3	0.5			2.64
Combined	18252.20		1336.67	1269.54	1272.18		1272.18	0.000124	1.04	3032.6	2310.45	0.11	97.36		23940	4.5	43516	8.2	0.0			2.64
Combined	18222.50		1337.77	1269.54	1272.17		1272.17	0.000126	1.05	3005.54	2297.17	0.12	97.36		24038	4.6	43419	8.2	0.0			2.63
Combined	18192.90		1328.71	1269.54	1272.16		1272.16	0.000127	1.05	2984.37	2283.54	0.12	97.36		24135	4.6	43321	8.2	0.5			2.62
Combined	18163.20		1326.58	1269.53	1272.15		1272.15	0.000128	1.06	2955.71	2262.04	0.12	97.36		24232	4.6	43224	8.2	0.0			2.62
Combined	18133.50		1321.46	1269.53	1272.14		1272.14	0.000129	1.06	2931.61	2240.71	0.12	97.36		24330	4.6	43127	8.2	0.5			2.61
Combined	18103.80		1315.52	1269.52	1272.13		1272.13	0.00013	1.06	2905.78	2231.9	0.12	97.36		24427	4.6	43029	8.1	0.0			2.61
Combined	18074.21		1314.36	1269.52	1272.12		1272.12	0.000133	1.07	2879.1	2217.99	0.12	98.83		24524	4.6	42932	8.1	0.0			2.6
Combined	18044.00		1310.83	1269.52	1272.1		1272.11	0.000134	1.07	2877.58	2236.83	0.12	98.83		24623	4.7	42833	8.1	0.0			2.58
Combined	18013.90		1300.32	1269.52	1272.09		1272.1	0.000134	1.07	2867.82	2246.38	0.12	98.83		24722	4.7	42734	8.1	-0.5			2.57
Combined	17983.80		1301.34	1269.53	1272.08		1272.09	0.000136	1.07	2861.63	2262.94	0.12	98.83		24821	4.7	42635	8.1	0.0			2.55
Combined	17953.70		1300.44	1269.53	1272.07		1272.07	0.000138	1.07	2857.79	2280.26	0.12	98.83		24920	4.7	42537	8.1	0.0			2.54
Combined	17923.60		1290.33	1269.53	1272.05		1272.06	0.000138	1.07	2849.63	2299.33	0.12	98.83		25019	4.7	42438	8.0	0.0			2.52
Combined	17893.40		1285.33	1269.53	1272.04		1272.05	0.000139	1.07	2843.44	2316.63	0.12	98.83		25117	4.8	42339	8.0	0.0			2.51
Combined	17863.30		1285.14	1269.53	1272.03		1272.03	0.000141	1.07	2837.55	2327.09	0.12	98.83		25216	4.8	42240	8.0	0.0			2.5
Combined	17833.20		1283.14	1269.53	1272.01		1272.02	0.000144	1.08	2826.68	2345.15	0.12	98.83		25315	4.8	42141	8.0	0.0			2.48
Combined	17803.10		1280.36	1269.53	1272		1272.01	0.000145	1.08	2822.9	2363.09	0.12	98.83		25414	4.8	42042	8.0	0.0			2.47
Combined	17772.90		1277.51	1269.53	1271.99		1271.99	0.000146	1.08	2817.22	2378.83	0.12	98.83		25513	4.8	41944	7.9	-0.5			2.46
Combined	17742.80		1275.31	1269.54	1271.97		1271.98	0.000148	1.08	2814.07	2402.43	0.12	98.83		25612	4.9	41845	7.9	0.0			2.43
Combined	17712.70		1265.44	1269.54	1271.96		1271.97	0.000148	1.08	2807.31	2420.41	0.12	98.83		25710	4.9	41746	7.9	0.0			2.42
Combined	17682.60		1264.44	1269.54	1271.95		1271.95	0.00015	1.08	2801.14	2434.44	0.12	98.83		25809	4.9	41647	7.9	0.0			2.41
Combined	17652.50		1261.84	1269.54	1271.93		1271.94	0.000151	1.08	2798.44	2447.91	0.12	98.83		25908	4.9	41548	7.9	0.0			2.39
Combined	17622.30		1255.04	1269.54	1271.92		1271.93	0.000151	1.08	2798.46	2468.22	0.12	98.83		26007	4.9	41449	7.9	0.0			2.38
Combined	17592.20		1249.63	1269.54	1271.91		1271.91	0.000152	1.07	2792.58	2482.58	0.12	98.83		26106	4.9	41351	7.8	0.0			2.37
Combined	17562.10		1250.44	1269.54	1271.89		1271.9	0.000154	1.08	2788.81	2496.14	0.12	98.83		26205	5.0	41252	7.8	-0.5			2.35
Combined	17532.00		1241.6	1269.55	1271.88		1271.89	0.000154	1.07	2785.82	2514.15	0.12	98.83		26303	5.0	41153	7.8	0.0			2.33
Combined	17501.80		1240.61	1269.55	1271.87		1271.87	0.000155	1.07	2785.38	2526.59	0.12	98.83		26402	5.0	41054	7.8	0.0			2.32
Combined	17471.70		1236.12	1269.55	1271.85		1271.86	0.000156	1.07	2784.68	2542.08	0.12	98.83		26501	5.0	40955	7.8	0.0			2.3
Combined	17441.60		1229.86	1269.55	1271.84		1271.85	0.000156	1.08	2785.31	2558.33	0.12	98.83		26600	5.0	40856	7.7	0.0			2.29
Combined	17411.50		1228.94	1269.55	1271.83		1271.83	0.000157	1.06	2786.98	2577.07	0.13	98.83		26699	5.1	40758	7.7	0.0			2.28
Combined	17381.40		1219.9	1269.55	1271.82		1271.82	0.000155	1.05	2789.37	2592.87	0.12	98.83		26797	5.1	40659	7.7	0.0			2.27
Combined	17351.20		1214.29	1269.55	1271.8		1271.81	0.000155	1.05	2793.85	2610.7	0.12	98.83		26896	5.1	40560	7.7	-0.5			2.25
Combined	17321.10		1208.04	1269.56	1271.79		1271.8	0.000155	1.04	2797.66	2634.69	0.12	98.83		26995	5.1	40461	7.7	0.0			2.23
Combined	17291.00		1207.03	1269.56	1271.78		1271.79	0.000156	1.04	2799.33	2652.7	0.12	98.83		27094	5.1	40362	7.6	0.0			2.22
Combined	17260.90		1198.96	1269.56	1271.77		1271.77	0.000154	1.03	2804.56	2671.48	0.12	98.83		27193	5.2	40263	7.6	0.0			2.21
Combined	17230.80		1186.29	1269.56	1271.76		1271.76	0.000151	1.02	2813.25	2693.72	0.12	98.83		27292	5.2	40165	7.6	0.0			2.2
Combined	17200.60		1187.33	1269.56	1271.74		1271.75	0.000152	1.02	2825.88	2721.79	0.12	98.83		27390	5.2	40066	7.6	0.0			2.18
Combined	17170.50		1177.58	1269.56	1271.73		1271.74	0.000151	1.01	2835.46	2779.45	0.12	98.83		27489	5.2	39967	7.6	0.0			2.17
Combined	17140.40		1172.65	1269.56	1271.72		1271.73	0.00015	1	2843.95	2795.21	0.12	98.83		27588	5.2	39868	7.6	0.0			2.16
Combined	17110.30		1165.25	1269.56	1271.71		1271.71	0.000148	0.99	2855.57	2809.78	0.12	98.83		27687	5.2	39769	7.5	-0.5			2.15
Combined	17080.10		1146.15	1269.57	1271.7		1271.7	0.000142	0.97	2875.84	2833.72	0.12	98.83		27786	5.3	39670	7.5	0.0			2.13
Combined	17050.00		1147	1269.57	1271.69		1271.69	0.000141	0.96	2893.49	2853.29	0.12	98.83		27885	5.3	39572	7.5	0.0			2.12
Combined	17019.90		1136.64	1269.57	1271.68		1271.68	0.000141	0.96	2908.82	2946.34	0.12	98.83		27983	5.3	39473	7.5	0.0			2.11
Combined	16989.80		1128.76	1269.57	1271.67		1271.67	0.000141	0.95	2931.48	3055.33	0.12	98.83		28082	5.3	39374	7.5	0.0			2.1
Combined	16959.70		1114.28	1269.57	1271.66		1271.66	0.000136	0.93	2960.86	3079.78	0.11	98.83		28181	5.3	39275	7.4	0.0			2.09
Combined	16929.50		1103.66	1269.57	1271.65		1271.65	0.00013	0.91	2996.01	3098.79	0.11	98.83		28280	5.4	39176	7.4	0.0			2.08
Combined	16899.40		1097.97	1269.57	1271.64		1271.64	0.000125	0.89	3033.54	3122.36	0.11	98.83		28379	5.4	39077	7.4	-0.5			2.07
Combined	16869.30		1085.55	1269.58	1271.63		1271.63	0.000122	0.87	3069.7	3192.4	0.11	98.83		28478	5.4	38979	7.4	0.0			2.05
Combined	16839.20		1067.54	1269.58	1271.62		1271.63	0.000114	0.84	3109.5	3195.19	0.1	98.83		28576	5.4	38880	7.4	0.0			2.04
Combined	16809.00		1061.87	1269.58	1271.62		1271.62	0.000109	0.82	3153.11	3200.3	0.1	98.83		28675	5.4	38781	7.3	0.0			2.04
Combined	16778.90		1046.23	1269.58	1271.61		1271.61	0.000102	0.79	3196.4	3202.55	0.1	98.83		28774	5.4	38682	7.3	0.0			2.03
Combined	16748.80		1036.77	1269.58	1271.6		1271.6	0.000096	0.77	3243.17	3204.61	0.1	98.83		28873	5.5	38583	7.3	0.0			2.02
Combined	16718.70		1027.7	1269.58	1271.59		1271.6	0.000091	0.75	3287.41	3204.31	0.09	98.83		28972	5.5	38484	7.3	0.0			2.01
Combined	16688.60		1014.7	1269.58	1271.59		1271.59	0.000085	0.72	3334.12	3207	0.09	98.83		29071	5.5	38386	7.3	-0.5			2.01
Combined	16658.40		1008.21	1269.59	1271.58		1271.58	0.000081	0.7	3382.37	3207.32	0.09	98.83		29168	5.5	38287	7.3	0.0			1.99
Combined	16628.30		993.65	1269.59	1271.58		1271.58	0.000076	0.67	3426.07	3205.77	0.09	98.83		29267	5.5	38188	7.2	0.0			1.99
Combined	16598.20		986.03	1269.59	1271.57		1271.57	0.000072	0.65	3477.71	3205.73	0.08	98.83		29367	5.5	38089	7.2	0.0			1.98
Combined	16568.10		970.72	1269.59	1271.56		1271.57	0.000057	0.63	3527.32	3206.4	0.08	98.83		29466	5.5	37990	7.2	0.0			1.97
Combined	16537.90		971.8	1269.59	1271.56		1271.56	0.000064	0.62	3575.21	3205.7	0.08	98.83		29565	5.5	37892	7.2	0.0			1.97
Combined	16507.80		965.79	1269.59	1271.56		1271.56	0.000061	0.6	3623.86	3204.51	0.08	98.83		29664	5.5	37793	7.2	0.0			1.97
Combined	16477.70		955.85	1269.59	1271.55		1271.55	0.000057	0.58	3672.1	3202.8	0.07	98.83		29762	5.3	37694	7.1	-0.5			1.96
Combined	16447.60		944.58	1269.6	1271.55		1271.55	0.000053	0.56	3726.13	3201.65	0.07	98.83		29861	5.7	37595	7.1	0.0			1.95
Combined	16417.50		944.41	1269.6	1271.54		1271.54	0.000051	0.55	3775.23	3202.93	0.07	98.83		29960	5.7	37496	7.1	0.0			1.94
Combined	16387.30		937.07	1269.6	1271.54		1271.54	0.000048	0.53	3825.97	3200.54	0.07	98.83		30059	5.7	37397	7.1	0.0			1.94
Combined	16357.20		929.68	1269.6	1271.53		1271.54	0.000046	0.51	3878.13	3198.62	0.07	98.83		30158	5.7	37299	7.1	0.0			1.93
Combined	16327.10		925.8	1269.6	1271.53		1271.53	0.000043	0.5	3931.77	3196.84	0.06	98.83		30257	5.7	37200	7.0	0.0			1.93
Combined	16297.00		917.33	1269.6	1271.53		1271.53	0.000041	0.48	3987.58	3196.64	0.06	98.83		30355	5.7	37101	7.0	0.0			1.93
Combined	16266.80		911.57	1269.6	1271.52		1271.53	0.000039	0.47	4032.86	3195.26	0.06	98.83		30454	5.8	37002	7.0	0.0			1.92
Combined	16236.70		909.37	1269.6	1271.52		1271.52	0.000037	0.46	4084.04	3192.45	0.06	98.83		30553	5.8	36903	7.0	-0.5			1.92
Combined	16206.60		908.88	1269.61	1271.52		1271.52	0.000035	0.45	4136.33	3189.81	0.06	98.83		30652	5.8	36804	7.0	0.0			1.91
Combined	16176.50		897.88	1269.61	1271.52		1271.52	0.000033	0.43	4190.67	3189.88	0.06	98.83		30751	5.8	36706	7.0	0.0			1.91
Combined	16146.40		898.76	1269.61	1271.51		1271.51	0.000032	0.42	4245.34	3187.05	0.05	98.83		30850	5.8	36607	6.9	0.0			1.9
Combined	16116.20		890	1269.61	1271.51		1271.51	0.00003	0.41	4297.23	3183.88	0.05	98.83		30948	5.9	36508	6.9	0.0			1.9
Combined	16086.10		889.38	1269.61	1271.51		1271.51	0.000029	0.4	4345.5	3181.89	0.05	98.83		31047	5.9	36409	6.9	0.0			1.9
Combined	16056.00		889.05	1269.61	1271.51		1271.51	0.000028	0.39	4394.72	3178.16	0.05	98.83		31146	5.9	36310	6.9	0.0			1.9

Combined	16025.90		885.42	1269.61	1271.5		1271.5	0.000026	0.38	4449.35	3177.91	0.05	98.83		31245	5.9	36211	6.9	-0.5			1.89
Combined	15995.70		882.95	1269.62	1271.5		1271.5	0.000025	0.37	4497.8	3173.62	0.05	98.83		31344	5.9	36113	6.8	0.0			1.88
Combined	15965.60		873.22	1269.62	1271.5		1271.5	0.000024	0.36	4541.04	3170.01	0.05	98.83		31443	6.0	36014	6.8	0.0			1.88
Combined	15935.50		872.84	1269.62	1271.5		1271.5	0.000023	0.36	4595.24	3165.38	0.05	98.82		31541	6.0	35915	6.8	0.0			1.88
Combined	15905.43		868.43	1269.62	1271.5		1271.5	0.000022	0.35	4644.98	3162.83	0.05	99.79		31640	6.0	35816	6.8	0.0			1.88
Combined	15875.00		873.04	1269.62	1271.49		1271.5	0.000023	0.35	4610.64	3160.49	0.05	99.79		31740	6.0	35716	6.8	0.0			1.87
Combined	15844.60		866.55	1269.62	1271.49		1271.49	0.000023	0.35	4584.58	3159.94	0.05	99.79		31840	6.0	35617	6.7	0.0			1.87
Combined	15814.10		866.37	1269.62	1271.49		1271.49	0.000023	0.36	4550.15	3156.91	0.05	99.79		31940	6.0	35517	6.7	0.5			1.87
Combined	15783.70		864.75	1269.61	1271.49		1271.49	0.000024	0.36	4517.58	3152.83	0.05	99.79		32039	6.1	35417	6.7	0.0			1.88
Combined	15753.30		862.84	1269.61	1271.49		1271.49	0.000024	0.36	4493.92	3151.89	0.05	99.79		32139	6.1	35317	6.7	0.0			1.88
Combined	15722.90		857.92	1269.61	1271.48		1271.49	0.000024	0.37	4458.81	3148.24	0.05	99.79		32239	6.1	35217	6.7	0.0			1.87
Combined	15692.50		856.54	1269.61	1271.48		1271.48	0.000025	0.37	4430.55	3144.58	0.05	99.79		32339	6.1	35118	6.7	0.0			1.87
Combined	15662.10		855.4	1269.61	1271.48		1271.48	0.000025	0.37	4395.49	3140.82	0.05	99.79		32438	6.1	35018	6.6	0.0			1.87
Combined	15631.60		852.24	1269.61	1271.48		1271.48	0.000026	0.38	4365.72	3140.66	0.05	99.79		32538	6.2	34918	6.6	0.0			1.87
Combined	15601.20		852.11	1269.61	1271.48		1271.48	0.000026	0.38	4334.17	3136.36	0.05	99.79		32638	6.2	34818	6.6	0.0			1.87
Combined	15570.80		842.78	1269.61	1271.47		1271.47	0.000026	0.38	4302.23	3133.35	0.05	99.79		32738	6.2	34718	6.6	0.5			1.86
Combined	15540.40		847.14	1269.6	1271.47		1271.47	0.000027	0.39	4270.39	3129.19	0.05	99.79		32838	6.2	34619	6.6	0.0			1.87
Combined	15510.00		842.14	1269.6	1271.47		1271.47	0.000027	0.39	4246.16	3128.54	0.05	99.79		32937	6.2	34519	6.5	0.0			1.87
Combined	15479.60		841.8	1269.6	1271.47		1271.47	0.000028	0.39	4209.88	3124.35	0.05	99.79		33037	6.3	34419	6.5	0.0			1.87
Combined	15449.10		839.36	1269.6	1271.46		1271.47	0.000029	0.4	4174.05	3119.93	0.05	99.79		33137	6.3	34319	6.5	0.0			1.86
Combined	15418.70		838.97	1269.6	1271.46		1271.46	0.000029	0.4	4146.38	3115.77	0.05	99.79		33237	6.3	34219	6.5	0.0			1.86
Combined	15388.30		830.51	1269.6	1271.46		1271.46	0.000029	0.4	4111.68	3114.3	0.05	99.79		33337	6.3	34120	6.5	0.0			1.86
Combined	15357.90		834.95	1269.6	1271.46		1271.46	0.00003	0.41	4083.47	3110.06	0.05	99.79		33436	6.3	34020	6.4	0.0			1.86
Combined	15327.50		828.19	1269.6	1271.45		1271.46	0.000031	0.41	4052.14	3105.29	0.05	99.79		33536	6.4	33920	6.4	0.5			1.85
Combined	15297.10		827.78	1269.59	1271.45		1271.45	0.000031	0.42	4021.85	3102.01	0.05	99.79		33636	6.4	33820	6.4	0.0			1.86
Combined	15266.60		829.23	1269.59	1271.45		1271.45	0.000032	0.42	3989.59	3100.8	0.05	99.79		33736	6.4	33720	6.4	0.0			1.86
Combined	15236.20		822.65	1269.59	1271.45		1271.45	0.000032	0.42	3961.92	3096.48	0.06	99.79		33836	6.4	33621	6.4	0.0			1.86
Combined	15205.80		826.53	1269.59	1271.44		1271.45	0.000034	0.43	3928.86	3091.65	0.06	99.79		33935	6.4	33521	6.3	0.0			1.85
Combined	15175.40		821	1269.59	1271.44		1271.44	0.000034	0.43	3894.93	3086.84	0.06	99.79		34035	6.4	33421	6.3	0.0			1.85
Combined	15145.00		818.6	1269.59	1271.44		1271.44	0.000035	0.44	3869.35	3084.69	0.06	99.79		34135	6.5	33321	6.3	0.0			1.85
Combined	15114.60		819.26	1269.59	1271.44		1271.44	0.000036	0.44	3834.96	3079.82	0.06	99.79		34235	6.5	33222	6.3	0.0			1.85
Combined	15084.20		818.2	1269.59	1271.43		1271.43	0.000037	0.45	3802.17	3074.87	0.06	99.79		34334	6.5	33122	6.3	0.5			1.84
Combined	15053.70		814.12	1269.58	1271.43		1271.43	0.000037	0.45	3777.68	3072.41	0.06	99.79		34434	6.5	33022	6.3	0.0			1.85
Combined	15023.30		813.37	1269.58	1271.43		1271.43	0.000038	0.46	3744.03	3069.19	0.06	99.79		34534	6.5	32922	6.2	0.0			1.85
Combined	14992.90		807.73	1269.58	1271.42		1271.42	0.000039	0.46	3708	3062.97	0.06	99.79		34634	6.6	32822	6.2	0.0			1.84
Combined	14962.50		808.15	1269.58	1271.42		1271.42	0.000039	0.46	3680.86	3057.25	0.06	99.79		34734	6.6	32723	6.2	0.0			1.84
Combined	14932.10		803.09	1269.58	1271.42		1271.42	0.00004	0.47	3651.79	3051.44	0.06	99.79		34833	6.6	32623	6.2	0.0			1.84
Combined	14901.70		806.96	1269.58	1271.41		1271.42	0.000041	0.47	3618.53	3048.13	0.06	99.79		34933	6.6	32523	6.2	0.0			1.83
Combined	14871.20		803.5	1269.58	1271.41		1271.41	0.000042	0.48	3591.48	3041.7	0.06	99.79		35033	6.6	32423	6.1	0.0			1.83
Combined	14840.80		803.88	1269.58	1271.41		1271.41	0.000043	0.48	3556.83	3035.07	0.06	99.79		35133	6.7	32323	6.1	0.5			1.83
Combined	14810.40		802.1	1269.57	1271.4		1271.41	0.000044	0.49	3527.7	3025.42	0.06	99.79		35233	6.7	32224	6.1	0.0			1.83
Combined	14780.00		798.78	1269.57	1271.4		1271.4	0.000044	0.49	3502.17	2999.39	0.06	99.79		35332	6.7	32124	6.1	0.0			1.83
Combined	14749.60		796.93	1269.57	1271.4		1271.4	0.000045	0.49	3472.25	2975.75	0.06	99.79		35432	6.7	32024	6.1	0.0			1.83
Combined	14719.20		798.62	1269.57	1271.39		1271.39	0.000046	0.5	3446.04	2949.8	0.07	99.79		35532	6.7	31924	6.0	0.0			1.82
Combined	14688.70		798.05	1269.57	1271.39		1271.39	0.000046	0.5	3418.19	2926.31	0.07	99.79		35632	6.7	31824	6.0	0.0			1.82
Combined	14658.30		792.6	1269.57	1271.39		1271.39	0.000047	0.5	3393.4	2910.53	0.07	99.79		35732	6.8	31725	6.0	0.0			1.82
Combined	14627.90		795.41	1269.57	1271.38		1271.38	0.000048	0.51	3369.44	2898.86	0.07	99.79		35831	6.8	31625	6.0	0.0			1.81
Combined	14597.50		790.29	1269.57	1271.38		1271.38	0.000048	0.51	3343.07	2885.57	0.07	99.79		35931	6.8	31525	6.0	0.5			1.81
Combined	14567.10		793.08	1269.56	1271.37		1271.38	0.000049	0.51	3319.22	2875	0.07	99.79		36031	6.8	31425	6.0	0.0			1.81
Combined	14536.70		788.34	1269.56	1271.37		1271.37	0.00005	0.52	3298.74	2865.81	0.07	99.79		36131	6.8	31326	5.9	0.0			1.81
Combined	14506.20		789.72	1269.56	1271.37		1271.37	0.000051	0.52	3272.07	2853.74	0.07	99.79		36230	6.9	31226	5.9	0.0			1.81
Combined	14475.80		787.43	1269.56	1271.36		1271.36	0.000052	0.52	3246.01	2843.81	0.07	99.79		36330	6.9	31126	5.9	0.0			1.8
Combined	14445.40		786.94	1269.56	1271.36		1271.36	0.000052	0.53	3229.17	2835.92	0.07	99.79		36430	6.9	31026	5.9	0.0			1.8
Combined	14415.00		784.24	1269.56	1271.35		1271.35	0.000053	0.53	3200.11	2824.58	0.07	99.79		36530	6.9	30926	5.9	0.0			1.79
Combined	14384.60		786.86	1269.56	1271.35		1271.35	0.000055	0.54	3179.19	2816.51	0.07	99.79		36630	6.9	30827	5.8	0.0			1.79
Combined	14354.20		783.46	1269.56	1271.34		1271.35	0.000055	0.54	3154.76	2805.93	0.07	99.79		36729	7.0	30727	5.8	0.5			1.78
Combined	14323.70		780.71	1269.55	1271.34		1271.34	0.000056	0.54	3136.34	2799.93	0.07	99.79		36829	7.0	30627	5.8	0.0			1.79
Combined	14293.30		781.18	1269.55	1271.34		1271.34	0.000058	0.55	3108.93	2791.02	0.07	99.79		36929	7.0	30527	5.8	0.0			1.79
Combined	14262.90		782.59	1269.55	1271.33		1271.33	0.000059	0.56	3086.84	2783.34	0.07	99.79		37029	7.0	30427	5.8	0.0			1.78
Combined	14232.50		779.14	1269.55	1271.33		1271.33	0.000059	0.56	3066.54	2775.39	0.07	99.79		37129	7.0	30328	5.7	0.0			1.78
Combined	14202.10		778.02	1269.55	1271.32		1271.32	0.000061	0.56	3042.6	2768.87	0.07	99.79		37228	7.1	30228	5.7	0.0			1.77
Combined	14171.70		778.37	1269.55	1271.32		1271.32	0.000062	0.57	3023.35	2761.56	0.08	99.79		37328	7.1	30128	5.7	0.0			1.77
Combined	14141.30		775.47	1269.55	1271.31		1271.31	0.000063	0.57	2996.09	2753.61	0.08	99.79		37428	7.1	30028	5.7	0.0			1.76
Combined	14110.80		777.75	1269.55	1271.31		1271.31	0.000065	0.58	2971.31	2746.85	0.08	99.79		37528	7.1	29928	5.7	0.5			1.76
Combined	14080.40		776.59	1269.54	1271.3		1271.3	0.000066	0.58	2954.15	2741.38	0.08	99.79		37628	7.1	29829	5.6	0.0			1.76
Combined	14050.00		774.8	1269.54	1271.3		1271.3	0.000067	0.59	2928.89	2735.55	0.08	99.79		37727	7.1	29729	5.6	0.0			1.76
Combined	14019.60		775.41	1269.54	1271.29		1271.29	0.000069	0.6	2903.97	2728.42	0.08	99.79		37827	7.2	29629	5.6	0.0			1.75
Combined	13989.20		773.8	1269.54	1271.29		1271.29	0.000068	0.59	2882.92	2719.89	0.08	99.79		37927	7.2	29529	5.6	0.0			1.75
Combined	13958.80		772.92	1269.54	1271.28		1271.28	0.000069	0.59	2863.76	2691.91	0.08	99.79		38027	7.2	29430	5.6	0.0			1.74
Combined	13928.30		772.92	1269.54	1271.27		1271.28	0.00007	0.6	2836.69	2661.05	0.08	99.79		38127	7.2	29330	5.6	0.0			1.73
Combined	13897.90		772.35	1269.54	1271.27		1271.27	0.000072	0.6	2816.04	2635.76	0.08	99.79		38226	7.2	29230	5.5	0.0			1.73
Combined	13867.50		769.9	1269.54	1271.26		1271.26	0.000072	0.6	2799.03	2611.13	0.08	99.79		38326	7.3	29130	5.5	0.5			1.72
Combined	13837.10		770.44	1269.53	1271.26		1271.26	0.000074	0.61	2775.7	2590.3	0.08	99.79		38426	7.3	29030	5.5	0.0			1.73
Combined	13806.70		769.99	1269.53	1271.25		1271.25	0.000075	0.61	2761.51	2583.63	0.08	99.79		38526	7.3	28931	5.5	0.0			1.72
Combined	13776.30		769.82	1269.53	1271.25		1271.25	0.000077	0.62	2738.93	2575.82	0.08	99.79		38625	7.3	28831	5.5	0.0			1.72
Combined	13745.80		768.82	1269.53	1271.24		1271.24	0.000078	0.63	2720.47	2568.48	0.08	99.79		38725	7.3	28731	5.4	0.0			1.71
Combined	13715.40		768.07	1269.53	1271.23		1271.23	0.00008	0.63	2697.14	2551	0.09	99.79		38825	7.4	28631	5.4	0.0			1.7
Combined	13685.00		766.6	1269.53	1271.23		1271.23	0.000081	0.63	2674.11	2537.13	0.09	99.79		38925	7.4	28531	5.4	0.0			1.7
Combined	13654.60		767.31	1269.53	1271.22		1271.22	0.000083	0.64	2657.42	2524.11	0.09	99.79		39025	7.4	28432	5.4	0.0			1.69
Combined	13624.20		766.25	1269.53	1271.21		1271.21	0.000084	0.64	2637.45	2510.2	0.09	99.79		39124	7.4	28332	5.4	0.5			1.68
Combined	13593.80		766.45	1269.52	1271.21		1271.21	0.000085	0.65	2618.04	2496.65	0.09	99.79		39224	7.4	28232	5.3	0.0			1.69
Combined	13563.30		765.35	1269.52	1271.2		1271.2	0.000087	0.65	2599.86	2481.29	0.09	99.79		39324	7.4	28132	5.3	0.0			1.68
Combined	13532.90		764.26	1269.52	1271.19		1271.19	0.000088	0.65	2576.25	2468.16	0.09	99.79		39424	7.5	28032	5.3	0.0			1.67

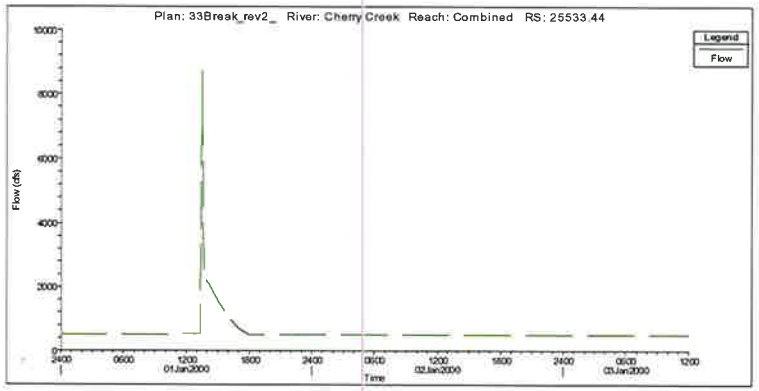
Combined	13502.50		765.02	1269.52	1271.18		1271.19	0.00009	0.66	2554.95	2455.93	0.09	99.79		39524	7.5	27933	5.3	0.0			1.66
Combined	13472.10		764.37	1269.52	1271.18		1271.18	0.000092	0.66	2538.11	2443.03	0.09	99.79		39623	7.5	27833	5.3	0.0			1.66
Combined	13441.70		763.84	1269.52	1271.17		1271.17	0.000094	0.67	2514.7	2429.32	0.09	99.79		39723	7.5	27733	5.3	0.0			1.65
Combined	13411.30		763.55	1269.52	1271.16		1271.16	0.000095	0.67	2495.31	2415.64	0.09	99.79		39823	7.5	27633	5.2	0.0			1.64
Combined	13380.80		763.34	1269.52	1271.15		1271.15	0.000098	0.68	2476.98	2409.89	0.09	99.79		39923	7.6	27534	5.2	0.5			1.63
Combined	13350.40		762.89	1269.51	1271.14		1271.15	0.0001	0.69	2453.51	2399.88	0.09	99.79		40023	7.6	27434	5.2	0.0			1.63
Combined	13320.00		762.12	1269.51	1271.14		1271.14	0.000103	0.69	2431.34	2390.1	0.1	99.79		40122	7.6	27334	5.2	0.0			1.63
Combined	13289.60		761.39	1269.51	1271.13		1271.13	0.000105	0.7	2410.56	2380.08	0.1	99.79		40222	7.6	27234	5.2	0.0			1.62
Combined	13259.20		761.53	1269.51	1271.12		1271.12	0.000108	0.71	2387.77	2374.72	0.1	99.79		40322	7.6	27134	5.1	0.0			1.61
Combined	13228.80		760.6	1269.51	1271.11		1271.11	0.000111	0.71	2363.25	2363.77	0.1	99.79		40422	7.7	27035	5.1	0.0			1.6
Combined	13198.40		760.68	1269.51	1271.1		1271.1	0.000114	0.72	2341.59	2353.61	0.1	99.79		40521	7.7	26935	5.1	0.0			1.59
Combined	13167.90		760.15	1269.51	1271.09		1271.09	0.000118	0.73	2315.52	2347.01	0.1	99.79		40621	7.7	26835	5.1	0.0			1.58
Combined	13137.50		760.15	1269.51	1271.08		1271.08	0.000121	0.74	2289.74	2336.47	0.1	99.79		40721	7.7	26735	5.1	0.5			1.57
Combined	13107.10		758.94	1269.5	1271.07		1271.07	0.000124	0.74	2269.41	2326.8	0.1	99.79		40821	7.7	26635	5.0	0.0			1.57
Combined	13076.70		757.68	1269.5	1271.05		1271.06	0.000129	0.75	2237.31	2314.63	0.11	99.79		40921	7.8	26536	5.0	0.0			1.55
Combined	13046.30		758.1	1269.5	1271.04		1271.04	0.000134	0.76	2210.43	2308.08	0.11	99.79		41020	7.8	26436	5.0	0.0			1.54
Combined	13015.90		758.52	1269.5	1271.03		1271.03	0.000138	0.77	2185.59	2296	0.11	99.79		41120	7.8	26336	5.0	0.0			1.53
Combined	12985.40		758.15	1269.5	1271.02		1271.02	0.000145	0.79	2152.84	2284.16	0.11	99.79		41220	7.8	26236	5.0	0.0			1.52
Combined	12955.00		757.41	1269.5	1271		1271.01	0.000151	0.8	2122.32	2273.26	0.11	99.79		41320	7.8	26136	5.0	0.0			1.5
Combined	12924.60		757.83	1269.5	1270.99		1270.99	0.000158	0.81	2090.7	2263.18	0.12	99.79		41420	7.8	26037	4.9	0.0			1.49
Combined	12894.20		756.76	1269.5	1270.97		1270.98	0.000165	0.82	2055.34	2251.09	0.12	99.79		41519	7.9	25937	4.9	0.5			1.47
Combined	12863.80		757.03	1269.49	1270.96		1270.96	0.00016	0.81	2018.06	2230.11	0.12	99.79		41619	7.9	25837	4.9	0.0			1.47
Combined	12833.40		756.88	1269.49	1270.94		1270.94	0.000162	0.81	1986.95	2160.8	0.12	99.79		41719	7.9	25737	4.9	0.0			1.45
Combined	12802.90		755.99	1269.49	1270.93		1270.93	0.000162	0.8	1955.33	2078.29	0.12	99.79		41819	7.9	25638	4.9	0.0			1.44
Combined	12772.50		755.82	1269.49	1270.91		1270.91	0.000161	0.79	1928.49	1987.53	0.12	99.79		41919	7.9	25538	4.8	0.0			1.42
Combined	12742.10		755.51	1269.49	1270.9		1270.9	0.000166	0.8	1900.04	1945.47	0.12	99.78		42018	8.0	25438	4.8	0.0			1.41
Combined	12711.74		755.56	1269.49	1270.88		1270.88	0.000171	0.81	1874.15	1900.78	0.12	98.85		42118	8.0	25338	4.8	3.7			1.39
Combined	12681.60		754.71	1269.42	1270.86		1270.87	0.000173	0.83	1875.22	1933.44	0.12	98.85		42217	8.0	25239	4.8	3.7			1.44
Combined	12651.40		754.08	1269.35	1270.85		1270.85	0.000175	0.86	1877.3	1967.17	0.12	98.85		42316	8.0	25140	4.8	3.2			1.5
Combined	12621.30		753.98	1269.29	1270.83		1270.84	0.000178	0.88	1875.93	1997.71	0.13	98.85		42415	8.0	25042	4.7	3.7			1.54
Combined	12591.20		753.74	1269.22	1270.82		1270.82	0.00018	0.9	1877.93	2026.97	0.13	98.85		42513	8.1	24943	4.7	3.7			1.6
Combined	12561.00		753.5	1269.15	1270.81		1270.81	0.000182	0.93	1880.46	2060.37	0.13	98.85		42612	8.1	24844	4.7	3.2			1.66
Combined	12530.90		753.05	1269.09	1270.79		1270.8	0.000183	0.94	1882.97	2094.1	0.13	98.85		42711	8.1	24745	4.7	3.7			1.7
Combined	12500.80		753.44	1269.02	1270.78		1270.78	0.000186	0.97	1884.4	2129.88	0.13	98.85		42810	8.1	24646	4.7	3.7			1.76
Combined	12470.70		753.19	1268.95	1270.77		1270.77	0.000187	0.99	1889.31	2164.59	0.13	98.85		42909	8.1	24547	4.6	3.2			1.82
Combined	12440.50		752.82	1268.89	1270.76		1270.76	0.000189	1.01	1887.66	2191.37	0.13	98.85		43008	8.1	24448	4.6	3.7			1.87
Combined	12410.40		752.92	1268.82	1270.75		1270.75	0.000192	1.03	1886.82	2231.22	0.13	98.85		43107	8.2	24350	4.6	3.7			1.93
Combined	12380.30		752.21	1268.75	1270.73		1270.74	0.000192	1.05	1891.85	2301.33	0.13	98.85		43205	8.2	24251	4.6	3.2			1.98
Combined	12350.10		752.39	1268.69	1270.72		1270.73	0.000196	1.07	1888.45	2384.15	0.14	98.85		43304	8.2	24152	4.6	3.7			2.03
Combined	12320.00		752.28	1268.62	1270.71		1270.71	0.000198	1.1	1888.64	2415.36	0.14	98.85		43403	8.2	24053	4.6	3.7			2.09
Combined	12289.90		751.92	1268.55	1270.7		1270.7	0.000202	1.12	1881.68	2439.13	0.14	98.85		43502	8.2	23954	4.5	3.2			2.15
Combined	12259.70		752.14	1268.49	1270.68		1270.69	0.000205	1.14	1877.63	2464.64	0.14	98.85		43601	8.3	23855	4.5	3.7			2.19
Combined	12229.60		751.92	1268.42	1270.67		1270.67	0.00021	1.17	1864.3	2485.96	0.14	98.85		43700	8.3	23757	4.5	3.7			2.25
Combined	12199.50		751.26	1268.35	1270.65		1270.66	0.000216	1.2	1849.64	2508.02	0.15	98.85		43799	8.3	23658	4.5	3.2			2.3
Combined	12169.40		751.33	1268.29	1270.64		1270.64	0.000221	1.23	1836.76	2523.49	0.15	98.85		43897	8.3	23559	4.5	3.7			2.35
Combined	12139.20		751.19	1268.22	1270.62		1270.62	0.000227	1.26	1818	2540.19	0.15	98.85		43996	8.3	23460	4.4	3.7			2.4
Combined	12109.10		751.34	1268.15	1270.6		1270.61	0.000236	1.29	1795.97	2555.42	0.15	98.85		44095	8.4	23361	4.4	3.2			2.45
Combined	12079.00		750.71	1268.09	1270.58		1270.59	0.000247	1.33	1763.14	2566.08	0.16	98.85		44194	8.4	23262	4.4	3.7			2.49
Combined	12048.80		750.6	1268.02	1270.56		1270.56	0.00026	1.38	1732.57	2587.11	0.16	98.85		44293	8.4	23163	4.4	3.7			2.54
Combined	12018.70		750.22	1267.95	1270.54		1270.54	0.000275	1.43	1698.34	2607.35	0.17	98.85		44392	8.4	23065	4.4	3.2			2.59
Combined	11988.60		749.87	1267.89	1270.52		1270.52	0.000289	1.48	1666.37	2632.44	0.17	98.85		44490	8.4	22966	4.3	3.7			2.63
Combined	11958.40		749.73	1267.82	1270.5		1270.51	0.000302	1.52	1640.26	2659.15	0.17	98.85		44589	8.4	22867	4.3	3.7			2.68
Combined	11928.30		749.76	1267.75	1270.48		1270.49	0.000318	1.58	1607.52	2685.91	0.18	98.85		44688	8.5	22768	4.3	3.2			2.73
Combined	11898.20		749.55	1267.69	1270.46		1270.47	0.00033	1.62	1583.49	2714.12	0.18	98.85		44787	8.5	22669	4.3	3.7			2.77
Combined	11868.10		749.49	1267.62	1270.44		1270.46	0.000335	1.65	1554.13	2714.37	0.19	98.85		44886	8.5	22570	4.3	3.7			2.82
Combined	11837.90		749.06	1267.55	1270.43		1270.44	0.000337	1.67	1530.69	2692.59	0.19	98.85		44985	8.5	22471	4.3	3.7			2.88
Combined	11807.80		748.9	1267.48	1270.41		1270.43	0.000342	1.7	1505.97	2679.58	0.19	98.85		45084	8.5	22373	4.2	3.2			2.93
Combined	11777.70		748.91	1267.42	1270.39		1270.41	0.000347	1.72	1481.22	2663.88	0.19	98.85		45182	8.6	22274	4.2	3.7			2.97
Combined	11747.50		749.04	1267.35	1270.37		1270.39	0.000335	1.7	1458.48	2570.77	0.19	98.85		45281	8.6	22175	4.2	3.7			3.02
Combined	11717.40		749.08	1267.28	1270.36		1270.37	0.000336	1.72	1440.24	2436.8	0.19	98.85		45380	8.6	22076	4.2	3.2			3.08
Combined	11687.30		748.82	1267.22	1270.34		1270.36	0.000336	1.73	1428.54	2431.38	0.19	98.85		45479	8.6	21977	4.2	3.7			3.12
Combined	11657.20		748.61	1267.15	1270.32		1270.34	0.000336	1.74	1412.93	2424.13	0.19	98.85		45578	8.6	21878	4.1	3.7			3.17
Combined	11627.00		748.77	1267.08	1270.3		1270.32	0.00034	1.76	1391.75	2416.81	0.19	98.85		45677	8.7	21780	4.1	3.2			3.22
Combined	11596.90		748.66	1267.02	1270.27		1270.3	0.000345	1.79	1371.7	2417.56	0.19	98.85		45776	8.7	21681	4.1	3.7			3.25
Combined	11566.80		748.42	1266.95	1270.25		1270.27	0.00035	1.81	1352.22	2428.76	0.19	98.85		45874	8.7	21582	4.1	3.7			3.3
Combined	11536.60		748.57	1266.88	1270.23		1270.25	0.000356	1.84	1328.8	2429.88	0.2	98.85		45973	8.7	21483	4.1	3.2			3.35
Combined	11506.50		748.48	1266.82	1270.2		1270.23	0.000367	1.87	1298.51	2424.82	0.2	98.85		46072	8.7	21384	4.1	3.7			3.38
Combined	11476.40		748.34	1266.75	1270.17		1270.2	0.00038	1.91	1260.85	2412.24	0.2	98.85		46171	8.7	21285	4.0	3.7			3.42
Combined	11446.20		748.26	1266.68	1270.14		1270.17	0.000396	1.96	1220.86	2401.13	0.21	98.85		46270	8.8	21186	4.0	3.2			3.46
Combined	11416.10		747.72	1266.62	1270.1		1270.14	0.000422	2.03	1165.01	2376.02	0.21	98.85		46369	8.8	21088	4.0	3.7			3.48
Combined	11386.00		747.84	1266.55	1270.06		1270.1	0.00045	2.1	1110.56	2357.99	0.22	98.85		46467	8.8	20989	4.0	3.7			3.51
Combined	11355.90		747.32	1266.48	1270.02		1270.07	0.000478	2.17	1054.35	2331.18	0.23	98.85		46566	8.8	20890	4.0	3.2			3.54
Combined	11325.70		747.14	1266.42	1269.98		1270.03	0.000512	2.24	996.11	2309.98	0.23	98.85		46665	8.8	20791	3.9	3.7			3.56
Combined	11295.60		747.07	1266.35	1269.94		1270	0.000545	2.32	938.22	2283.63	0.24	98.85		46764	8.8	20692	3.9	3.7			3.59
Combined	11265.50		746.47	1266.28	1269.9		1269.97	0.000575	2.39	884.83	2270.46	0.25	98.85		46863	8.8	20593	3.9	3.2			3.62
Combined	11235.30		746.24	1266.22	1269.87		1269.93	0.000599	2.44	840.77	2252.33	0.25	98.85		46962	8.8	20494	3.9	3.7			3.65
Combined	11205.20		746.09	1266.15	1269.83		1269.91	0.000621	2.49	797.73	2264.62	0.26	98.85		47061	8.8	20396	3.9	3.7			3.68
Combined	11175.10		746.07	1266.08	1269.8		1269.88	0.000631	2.52	767.06	2292.83	0.26	98.85		47159	8.9	20297	3.8	3.2			3.72
Combined	11144.90		745.32	1266.02	1269.77		1269.85	0.000635	2.54	738.79	2280.8	0.26	98.85		47258	9.0	20198	3.8	3.7			3.75
Combined	11114.80		745.54	1265.95	1269.75		1269.83	0.000625	2.53	721.05	2275.71	0.26	98.85		47357	9.0	20099	3.8	3.7			3.8
Combined	11084.70		745.46	1265.88	1269.72		1269.8	0.000614	2.52	705	2270.81	0.26	98.85		47456	9.0	20000	3.8	3.2			3.84
Combined	11054.60		745.22	1265.82	1269.7		1269.78	0.000602	2.51	688.5	2268.82	0.26	98.85		47555	9.0	19901	3.8	3.7			3.88
Combined	11024.40		745.07	1265.75	1269.67		1269.76	0.000586	2.49	676.61	2262.22	0.25	98.85		47654	9.0	19803	3.8	3.7			3.92

Combined	10994.34		745.16	1265.68	1269.65	1269.73	0.000571	2.47	660.99	2259.64	0.25	98.94		47753	9.0	19704	3.7	0.0			3.97
Combined	10964.10		745.23	1265.68	1269.62	1269.71	0.000597	2.51	602.62	1893.57	0.26	98.94		47851	9.1	19605	3.7	0.0			3.94
Combined	10934.00		744.88	1265.68	1269.6	1269.68	0.000617	2.54	573.65	1875.02	0.26	98.94		47950	9.1	19506	3.7	0.5			3.92
Combined	10903.80		744.94	1265.67	1269.57	1269.66	0.000625	2.54	556.36	1502.49	0.26	98.94		48049	9.1	19407	3.7	0.0			3.9
Combined	10873.70		744.87	1265.67	1269.53	1269.62	0.000643	2.56	546.36	1352.23	0.26	98.94		48148	9.1	19308	3.7	0.5			3.86
Combined	10843.50		744.61	1265.66	1269.5	1269.58	0.000617	2.5	543.98	1114.94	0.26	98.94		48247	9.1	19209	3.6	0.0			3.84
Combined	10813.40		744.58	1265.66	1269.46	1269.54	0.000614	2.47	550.21	791.79	0.26	98.94		48346	9.2	19110	3.6	0.0			3.8
Combined	10783.20		744.45	1265.66	1269.43	1269.5	0.00061	2.45	560.61	756.26	0.26	98.94		48445	9.2	19011	3.6	0.5			3.77
Combined	10753.10		744.67	1265.65	1269.39	1269.46	0.000606	2.42	568.3	724.57	0.26	98.94		48544	9.2	18912	3.6	0.0			3.74
Combined	10722.90		744.29	1265.65	1269.34	1269.41	0.000603	2.4	576.93	698.94	0.25	98.94		48643	9.2	18813	3.6	0.0			3.69
Combined	10692.70		744.37	1265.65	1269.3	1269.37	0.000606	2.38	581.65	675.27	0.25	98.94		48742	9.2	18714	3.5	0.5			3.65
Combined	10662.60		744.35	1265.64	1269.25	1269.32	0.000606	2.36	585.45	646.66	0.25	98.94		48841	9.3	18615	3.5	0.0			3.61
Combined	10632.40		744.33	1265.64	1269.2	1269.26	0.000615	2.35	586.26	623.6	0.25	98.94		48940	9.3	18516	3.5	0.0			3.56
Combined	10602.30		744.34	1265.64	1269.13	1269.2	0.000632	2.35	583.76	597.43	0.26	98.94		49039	9.3	18417	3.5	0.5			3.49
Combined	10572.10		744.3	1265.63	1269.08	1269.14	0.000645	2.35	583.2	584.82	0.26	98.94		49138	9.3	18319	3.5	0.0			3.45
Combined	10542.00		744.28	1265.63	1269.02	1269.08	0.000663	2.35	582.15	573.84	0.26	98.94		49237	9.3	18220	3.5	0.0			3.39
Combined	10511.80		744.31	1265.63	1268.96	1269.02	0.000684	2.35	580.67	564.65	0.26	98.94		49336	9.3	18121	3.4	0.5			3.33
Combined	10481.70		744.25	1265.62	1268.89	1268.95	0.000698	2.34	581.13	556.06	0.27	98.94		49435	9.4	18022	3.4	0.0			3.27
Combined	10451.50		744.18	1265.62	1268.83	1268.89	0.000718	2.34	579.99	548.35	0.27	98.94		49533	9.4	17923	3.4	0.0			3.21
Combined	10421.30		744.23	1265.62	1268.77	1268.83	0.000739	2.34	579.29	540.7	0.27	98.94		49632	9.4	17824	3.4	0.5			3.15
Combined	10391.20		744.19	1265.61	1268.71	1268.76	0.00076	2.34	576.73	532.07	0.28	98.94		49731	9.4	17725	3.4	0.0			3.1
Combined	10361.00		744.09	1265.61	1268.64	1268.7	0.000781	2.34	575.63	525.35	0.28	98.94		49830	9.4	17626	3.3	0.0			3.03
Combined	10330.90		743.99	1265.61	1268.58	1268.63	0.000817	2.34	570.66	518.13	0.28	98.94		49929	9.5	17527	3.3	0.5			2.97
Combined	10300.70		744.08	1265.6	1268.51	1268.56	0.000846	2.35	566.99	511.68	0.29	98.94		50028	9.5	17428	3.3	0.0			2.91
Combined	10270.60		744.11	1265.6	1268.43	1268.48	0.000895	2.37	559.14	503.71	0.29	98.94		50127	9.5	17329	3.3	0.0			2.83
Combined	10240.40		743.96	1265.6	1268.35	1268.41	0.000947	2.38	551.95	496.49	0.3	98.94		50226	9.5	17230	3.3	0.5			2.75
Combined	10210.20		743.97	1265.59	1268.27	1268.32	0.001017	2.41	540.52	487.45	0.31	98.94		50325	9.5	17131	3.2	0.0			2.68
Combined	10180.10		743.51	1265.59	1268.17	1268.23	0.001117	2.45	530.04	558.37	0.32	98.94		50424	9.5	17032	3.2	0.0			2.58
Combined	10149.90		743.45	1265.59	1268.06	1268.12	0.001247	2.49	537.42	672.02	0.34	98.94		50523	9.6	16933	3.2	0.5			2.47
Combined	10119.80		743.27	1265.58	1267.96	1268.01	0.001304	2.46	580.58	870.61	0.34	98.94		50622	9.6	16834	3.2	0.0			2.38
Combined	10089.60		743.1	1265.58	1267.87	1267.91	0.001104	2.2	692.69	978.13	0.31	98.94		50721	9.6	16736	3.2	0.0			2.29
Combined	10059.50		742.88	1265.58	1267.81	1267.83	0.000776	1.8	845.21	1032.92	0.26	98.94		50820	9.6	16637	3.2	0.5			2.23
Combined	10029.30		742.86	1265.57	1267.77	1267.78	0.000483	1.41	1030.67	1069.05	0.2	98.94		50919	9.6	16538	3.1	0.0			2.2
Combined	9999.20		742.77	1265.57	1267.74	1267.75	0.000292	1.09	1242.91	1112.08	0.16	98.94		51018	9.7	16439	3.1	0.5			2.17
Combined	9969.05		742.35	1265.56	1267.72	1267.73	0.000179	0.85	1494.26	1192.81	0.12	98.94		51117	9.7	16340	3.1	0.0			2.16
Combined	9938.89		742.51	1265.56	1267.71	1267.71	0.000109	0.67	1792.23	1271	0.1	98.94		51215	9.7	16241	3.1	0.0			2.15
Combined	9908.74		742.33	1265.56	1267.7	1267.71	0.000065	0.52	2151.99	1354.7	0.07	98.94		51314	9.7	16142	3.1	0.5			2.14
Combined	9878.58		742.42	1265.55	1267.7	1267.7	0.000039	0.4	2579.31	1452.32	0.06	98.94		51413	9.7	16043	3.0	0.0			2.15
Combined	9848.43		742.35	1265.55	1267.7	1267.7	0.000022	0.31	3246.84	1688.69	0.04	99.65		51512	9.8	15944	3.0	0.2			2.15
Combined	9818.05		742.26	1265.49	1267.7	1267.7	0.000036	0.4	2764.51	1610.3	0.06	99.65		51612	9.8	15844	3.0	0.2			2.21
Combined	9787.68		742.58	1265.43	1267.69	1267.69	0.000056	0.51	2330.83	1468.42	0.07	99.65		51712	9.8	15745	3.0	0.2			2.26
Combined	9757.30		742.29	1265.37	1267.68	1267.69	0.000089	0.65	1967.68	1376.39	0.09	99.65		51811	9.8	15645	3.0	0.2			2.31
Combined	9726.93		742.26	1265.31	1267.67	1267.68	0.000142	0.83	1640.91	1289.5	0.11	99.65		51911	9.8	15545	2.9	0.2			2.36
Combined	9696.56		742.38	1265.25	1267.65	1267.66	0.000225	1.05	1348.93	1203.11	0.14	99.65		52011	9.9	15446	2.9	0.2			2.4
Combined	9666.18		742.22	1265.19	1267.63	1267.64	0.000343	1.31	1083.94	1112.02	0.18	99.65		52110	9.9	15346	2.9	0.2			2.44
Combined	9635.81		742.21	1265.13	1267.59	1267.6	0.000452	1.51	873.94	914.45	0.2	99.65		52210	9.9	15246	2.9	0.2			2.46
Combined	9605.44		742.15	1265.07	1267.54	1267.56	0.000513	1.61	747.22	671.17	0.22	99.65		52309	9.9	15147	2.9	0.2			2.47
Combined	9575.06		742.17	1265.01	1267.49	1267.51	0.000528	1.63	704.98	480.85	0.22	99.65		52409	9.9	15047	2.8	0.2			2.48
Combined	9544.69		742.19	1264.95	1267.44	1267.46	0.000531	1.63	701.25	471.89	0.22	99.65		52509	9.9	14947	2.8	0.2			2.49
Combined	9514.31		742.15	1264.89	1267.39	1267.41	0.000533	1.63	697.86	468.1	0.22	99.65		52608	10.0	14848	2.8	0.2			2.5
Combined	9483.94		742.15	1264.83	1267.34	1267.36	0.000536	1.63	693.65	463.4	0.22	99.65		52708	10.0	14748	2.8	0.2			2.51
Combined	9453.57		742.08	1264.77	1267.29	1267.31	0.000541	1.63	689.73	459.58	0.22	99.65		52808	10.0	14649	2.8	0.2			2.52
Combined	9423.19		742.07	1264.71	1267.24	1267.26	0.000544	1.64	685.84	455.21	0.22	99.65		52907	10.0	14549	2.8	0.2			2.53
Combined	9392.82		742.05	1264.65	1267.19	1267.21	0.000548	1.64	681.63	451	0.22	99.65		53007	10.0	14449	2.7	0.2			2.54
Combined	9362.45		742.09	1264.59	1267.13	1267.16	0.000551	1.64	678.19	446.99	0.22	99.65		53107	10.1	14350	2.7	0.2			2.54
Combined	9332.07		742.07	1264.53	1267.08	1267.11	0.000556	1.64	673.92	442.6	0.22	99.65		53206	10.1	14250	2.7	0.2			2.55
Combined	9301.70		742.03	1264.47	1267.03	1267.06	0.000558	1.64	671.25	439.01	0.22	99.65		53306	10.1	14150	2.7	0.2			2.56
Combined	9271.33		741.97	1264.41	1266.98	1267	0.000563	1.65	667.11	434.71	0.23	99.65		53406	10.1	14051	2.7	0.2			2.57
Combined	9240.95		742.01	1264.35	1266.93	1266.95	0.000568	1.65	662.54	430.25	0.23	99.65		53505	10.1	13951	2.6	0.2			2.58
Combined	9210.58		741.95	1264.29	1266.88	1266.9	0.000573	1.65	659.11	426.66	0.23	99.65		53605	10.2	13851	2.6	0.2			2.59
Combined	9180.21		742.02	1264.22	1266.82	1266.85	0.000577	1.66	655.68	422.47	0.23	99.65		53705	10.2	13752	2.6	0.2			2.6
Combined	9149.83		741.91	1264.16	1266.77	1266.8	0.00058	1.65	652.7	418.3	0.23	99.65		53804	10.2	13652	2.6	0.2			2.61
Combined	9119.46		741.93	1264.1	1266.72	1266.74	0.000585	1.66	649.26	414.56	0.23	99.65		53904	10.2	13552	2.6	0.2			2.62
Combined	9089.09		741.85	1264.04	1266.67	1266.69	0.000589	1.66	645.44	410.03	0.23	99.65		54004	10.2	13453	2.5	0.2			2.63
Combined	9058.71		741.94	1263.98	1266.61	1266.64	0.000599	1.67	640.83	406.57	0.23	99.65		54103	10.2	13353	2.5	0.2			2.63
Combined	9028.34		741.93	1263.92	1266.56	1266.59	0.0006	1.67	637.98	402.44	0.23	99.65		54203	10.3	13253	2.5	0.2			2.64
Combined	8997.97		741.9	1263.86	1266.51	1266.53	0.000602	1.69	634.05	398.16	0.23	99.65		54302	10.3	13154	2.5	0.2			2.65
Combined	8967.59		741.84	1263.8	1266.45	1266.48	0.000603	1.7	630.97	394.84	0.23	99.65		54402	10.3	13054	2.5	0.2			2.65
Combined	8937.22		741.85	1263.74	1266.4	1266.43	0.000605	1.71	627.39	390.96	0.23	99.65		54502	10.3	12954	2.5	0.2			2.66
Combined	8906.85		741.87	1263.68	1266.35	1266.37	0.000603	1.72	624.81	386.96	0.23	99.65		54601	10.3	12855	2.4	0.2			2.67
Combined	8876.47		741.8	1263.62	1266.29	1266.32	0.000604	1.73	621.64	383.86	0.23	99.65		54701	10.4	12755	2.4	0.2			2.67
Combined	8846.10		741.82	1263.56	1266.24	1266.27	0.000603	1.75	618.76	380.17	0.23	99.65		54801	10.4	12656	2.4	0.2			2.68
Combined	8815.72		741.72	1263.5	1266.19	1266.22	0.000603	1.76	615.84	377.05	0.23	99.65		54900	10.4	12556	2.4	0.2			2.69
Combined	8785.35		741.74	1263.44	1266.13	1266.16	0.000601	1.76	613.78	373.49	0.23	99.65		55000	10.4	12456	2.4	0.2			2.69
Combined	8754.98		741.75	1263.38	1266.08	1266.11	0.000602	1.77	610.57	370.07	0.24	99.65		55100	10.4	12357	2.3	0.2			2.7
Combined	8724.60		741.75	1263.32	1266.03	1266.06	0.000602	1.78	608.14	367.57	0.24	99.65		55199	10.5	12257	2.3	0.2			2.71
Combined	8694.23		741.76	1263.26	1265.97	1266	0.000605	1.79	604.83	364.43	0.24	99.65		55299	10.5	12157	2.3	0.2			2.71
Combined	8663.86		741.71	1263.2	1265.92	1265.95	0.000605	1.79	602.91	362.21	0.24	99.65		55399	10.5	12058	2.3	0.2			2.72
Combined	8633.48		741.69	1263.14	1265.87	1265.9	0.000606	1.8	599.9	359.06	0.24	99.65		55498	10.5	11958	2.3	0.2			2.73
Combined	8603.11		741.7	1263.08	1265.81	1265.84	0.000605	1.81	597.28	356.14	0.24	99.65		55598	10.5	11858	2.2	0.2			2.73
Combined	8572.74		741.71	1263.02	1265.76	1265.79	0.000608	1.82	594.45	353.78	0.24	99.65		55698	10.5	11759	2.2	0.2			2.74
Combined	8542.36		741.64	1262.96	1265.7	1265.73	0.00061	1.83	591.38	350.87	0.24	99.65		55797	10.6	11659	2.2	0.2			2.74
Combined	8511.99		741.68	1262.9	1265.65	1265.68	0.000608	1.83	589.53	348.13	0.24	99.65		55897	10.6	11559	2.2	3.2			2.75

Combined	8481.62		741.7	1262.84	1265.59		1265.63	0.000612	1.84	586.32	345.71	0.24	99.65		55997	10.6	11460	2.2	3.2			2.75
Combined	8451.24		741.6	1262.78	1265.54		1265.57	0.000614	1.85	583.14	342.91	0.24	99.65		56096	10.6	11360	2.2	3.2			2.76
Combined	8420.87		741.63	1262.72	1265.48		1265.52	0.000616	1.85	580.56	340.77	0.24	99.65		56196	10.6	11260	2.1	3.2			2.76
Combined	8390.50		741.61	1262.66	1265.43		1265.45	0.000616	1.86	578.49	338.01	0.24	99.65		56295	10.7	11161	2.1	3.2			2.77
Combined	8360.12		741.56	1262.6	1265.37		1265.41	0.000615	1.86	576.02	335.41	0.24	99.65		56395	10.7	11061	2.1	3.2			2.77
Combined	8329.75		741.54	1262.54	1265.32		1265.35	0.000619	1.87	572.92	333.2	0.24	99.65		56495	10.7	10961	2.1	3.2			2.78
Combined	8299.37		741.56	1262.48	1265.26		1265.3	0.000621	1.88	569.85	330.42	0.24	99.65		56594	10.7	10862	2.1	3.2			2.78
Combined	8269.00		741.57	1262.42	1265.21		1265.24	0.00062	1.88	568.08	327.96	0.24	99.65		56694	10.7	10762	2.0	3.2			2.79
Combined	8238.63		741.55	1262.36	1265.15		1265.19	0.000623	1.89	565.37	325.82	0.24	99.65		56794	10.8	10663	2.0	3.2			2.79
Combined	8208.25		741.5	1262.3	1265.1		1265.13	0.000625	1.89	562.65	323.35	0.24	99.65		56893	10.8	10563	2.0	3.2			2.8
Combined	8177.88		741.53	1262.24	1265.04		1265.08	0.000627	1.9	560.05	321.34	0.24	99.65		56993	10.8	10463	2.0	3.2			2.8
Combined	8147.51		741.54	1262.18	1264.99		1265.02	0.000626	1.9	558.19	318.96	0.24	99.65		57093	10.8	10364	2.0	3.7			2.81
Combined	8117.13		741.47	1262.11	1264.93		1264.97	0.000624	1.91	556.26	316.38	0.24	99.65		57192	10.8	10264	1.9	3.2			2.82
Combined	8086.76		741.48	1262.05	1264.88		1264.91	0.000626	1.92	553.8	314.42	0.24	99.65		57292	10.9	10164	1.9	3.2			2.83
Combined	8056.39		741.49	1261.99	1264.82		1264.86	0.000628	1.92	551.25	312.08	0.24	99.65		57392	10.9	10065	1.9	3.2			2.83
Combined	8026.01		741.48	1261.93	1264.76		1264.8	0.000628	1.92	549.56	310.18	0.24	99.65		57491	10.9	9965	1.9	3.2			2.83
Combined	7995.64		741.44	1261.87	1264.71		1264.75	0.000629	1.93	547.01	308.06	0.24	99.65		57591	10.9	9865	1.9	3.2			2.84
Combined	7965.27		741.42	1261.81	1264.65		1264.69	0.000633	1.94	544.03	305.69	0.25	99.65		57691	10.9	9766	1.8	3.2			2.84
Combined	7934.89		741.35	1261.75	1264.6		1264.63	0.000634	1.94	541.72	303.85	0.25	99.65		57790	10.9	9666	1.8	3.2			2.85
Combined	7904.52		741.43	1261.69	1264.54		1264.58	0.000635	1.95	539.59	301.41	0.25	99.65		57890	11.0	9566	1.8	3.2			2.85
Combined	7874.15		741.34	1261.63	1264.48		1264.52	0.000633	1.95	537.73	299.35	0.25	99.65		57990	11.0	9467	1.8	3.2			2.85
Combined	7843.77		741.36	1261.57	1264.43		1264.47	0.000637	1.96	535.04	297.41	0.25	99.65		58089	11.0	9367	1.8	3.2			2.86
Combined	7813.40		741.37	1261.51	1264.37		1264.41	0.000638	1.96	532.82	295.38	0.25	99.65		58189	11.0	9267	1.8	3.2			2.86
Combined	7783.03		741.33	1261.45	1264.31		1264.35	0.00064	1.97	530.42	293.57	0.25	99.65		58288	11.0	9168	1.7	3.2			2.86
Combined	7752.65		741.3	1261.39	1264.26		1264.3	0.00064	1.97	528.63	291.58	0.25	99.65		58388	11.1	9068	1.7	3.2			2.87
Combined	7722.28		741.32	1261.33	1264.2		1264.24	0.000643	1.98	525.73	289.13	0.25	99.65		58488	11.1	8968	1.7	3.2			2.87
Combined	7691.90		741.32	1261.27	1264.14		1264.18	0.000646	1.98	523.21	287.31	0.25	99.65		58587	11.1	8869	1.7	3.2			2.87
Combined	7661.53		741.24	1261.21	1264.08		1264.13	0.000649	1.99	520.73	285.41	0.25	99.65		58687	11.1	8769	1.7	3.2			2.87
Combined	7631.16		741.28	1261.15	1264.03		1264.07	0.000646	1.99	519.61	283.52	0.25	99.65		58787	11.1	8670	1.6	3.2			2.88
Combined	7600.78		741.25	1261.09	1263.97		1264.01	0.000649	1.99	517.13	281.77	0.25	99.65		58886	11.2	8570	1.6	3.2			2.88
Combined	7570.41		741.25	1261.03	1263.91		1263.95	0.000651	2	514.72	279.84	0.25	99.65		58986	11.2	8470	1.6	3.2			2.88
Combined	7540.04		741.2	1260.97	1263.85		1263.9	0.000654	2.01	512.08	277.71	0.25	99.65		59086	11.2	8371	1.6	3.2			2.88
Combined	7509.66		741.27	1260.91	1263.8		1263.84	0.000653	2.01	510.65	275.96	0.25	99.65		59185	11.2	8271	1.6	3.2			2.89
Combined	7479.29		741.18	1260.85	1263.74		1263.78	0.000656	2.01	508.29	274.16	0.25	99.65		59285	11.2	8171	1.5	3.2			2.89
Combined	7448.92		741.22	1260.79	1263.68		1263.72	0.000659	2.02	505.74	272.39	0.25	99.65		59385	11.2	8072	1.5	3.2			2.89
Combined	7418.54		741.19	1260.73	1263.62		1263.67	0.000662	2.02	503.28	270.66	0.25	99.65		59484	11.3	7972	1.5	3.2			2.89
Combined	7388.17		741.19	1260.67	1263.57		1263.61	0.00066	2.02	502.14	269	0.25	99.65		59584	11.3	7872	1.5	3.2			2.9
Combined	7357.80		741.15	1260.61	1263.51		1263.55	0.000661	2.03	500.05	266.95	0.25	99.65		59684	11.3	7773	1.5	3.2			2.9
Combined	7327.42		741.07	1260.55	1263.45		1263.49	0.000664	2.03	497.61	265.19	0.25	99.65		59783	11.3	7673	1.5	3.2			2.9
Combined	7297.05		741.15	1260.49	1263.39		1263.44	0.000668	2.04	495.21	263.55	0.25	99.65		59883	11.3	7573	1.4	3.2			2.9
Combined	7266.68		741.06	1260.43	1263.33		1263.38	0.000666	2.04	493.98	261.99	0.25	99.65		59983	11.4	7474	1.4	3.2			2.9
Combined	7236.30		741.13	1260.37	1263.28		1263.32	0.000669	2.04	491.88	260.42	0.25	99.65		60082	11.4	7374	1.4	3.2			2.91
Combined	7205.93		741.12	1260.31	1263.22		1263.26	0.000673	2.05	489.43	258.78	0.25	99.65		60182	11.4	7274	1.4	3.2			2.91
Combined	7175.55		741.1	1260.25	1263.16		1263.21	0.000671	2.05	487.87	257.18	0.25	99.65		60281	11.4	7175	1.4	3.2			2.91
Combined	7145.18		741.05	1260.19	1263.1		1263.15	0.00067	2.06	485.8	254.56	0.25	99.65		60381	11.4	7075	1.3	3.2			2.91
Combined	7114.81		741.08	1260.13	1263.04		1263.09	0.000669	2.06	484.43	252.58	0.25	99.65		60481	11.5	6975	1.3	3.2			2.91
Combined	7084.43		741.07	1260.07	1262.99		1263.03	0.000669	2.06	482.57	250.54	0.25	99.65		60580	11.5	6876	1.3	3.2			2.92
Combined	7054.06		741.09	1260.01	1262.93		1262.98	0.000669	2.06	480.65	248.6	0.25	99.65		60680	11.5	6776	1.3	3.2			2.92
Combined	7023.69		741.05	1259.94	1262.87		1262.92	0.000666	2.06	479.38	246.68	0.25	99.65		60780	11.5	6677	1.3	3.2			2.93
Combined	6993.31		740.99	1259.88	1262.81		1262.86	0.000664	2.06	478.17	244.78	0.25	99.65		60879	11.5	6577	1.2	3.2			2.93
Combined	6962.94		741.04	1259.82	1262.76		1262.8	0.000664	2.07	475.58	242.1	0.25	99.65		60979	11.5	6477	1.2	3.2			2.94
Combined	6932.56		741.02	1259.76	1262.7		1262.75	0.000659	2.07	474.59	240.33	0.25	99.65		61079	11.6	6378	1.2	3.2			2.94
Combined	6902.19		740.99	1259.7	1262.64		1262.69	0.00066	2.07	472.54	238.48	0.25	99.65		61178	11.6	6278	1.2	3.2			2.94
Combined	6871.82		741	1259.64	1262.58		1262.63	0.000658	2.07	471.64	236.65	0.25	99.65		61278	11.6	6178	1.2	3.2			2.94
Combined	6841.44		740.97	1259.58	1262.52		1262.57	0.000658	2.07	469.99	234.67	0.25	99.65		61378	11.6	6079	1.2	3.2			2.94
Combined	6811.07		740.97	1259.52	1262.47		1262.51	0.000655	2.07	468.13	232.78	0.25	99.65		61477	11.6	5979	1.1	3.2			2.95
Combined	6780.70		740.98	1259.46	1262.41		1262.46	0.000657	2.07	466.55	230.9	0.25	99.65		61577	11.7	5879	1.1	3.2			2.95
Combined	6750.32		740.99	1259.4	1262.35		1262.4	0.000654	2.07	465.57	229.17	0.25	99.65		61677	11.7	5780	1.1	3.2			2.95
Combined	6719.95		740.96	1259.34	1262.29		1262.34	0.000653	2.07	463.56	225.64	0.25	99.65		61776	11.7	5680	1.1	3.2			2.95
Combined	6689.58		740.91	1259.28	1262.23		1262.28	0.000649	2.07	462.35	224.58	0.25	99.65		61876	11.7	5580	1.1	3.2			2.95
Combined	6659.20		740.93	1259.22	1262.17		1262.22	0.000647	2.07	460.91	222.63	0.25	99.65		61976	11.7	5481	1.0	3.2			2.95
Combined	6628.83		740.92	1259.16	1262.11		1262.16	0.000644	2.07	459.83	220.59	0.25	99.65		62075	11.8	5381	1.0	3.2			2.95
Combined	6598.45		740.9	1259.1	1262.06		1262.1	0.000643	2.07	458.07	218.44	0.25	99.65		62175	11.8	5281	1.0	3.2			2.96
Combined	6568.08		740.88	1259.04	1262		1262.05	0.000642	2.07	456.45	216.44	0.25	99.65		62274	11.8	5182	1.0	3.2			2.96
Combined	6537.71		740.9	1258.98	1261.94		1261.99	0.00064	2.07	454.95	214.47	0.25	99.65		62374	11.8	5082	1.0	3.2			2.96
Combined	6507.33		740.88	1258.92	1261.88		1261.93	0.000639	2.07	453.22	212.42	0.25	99.65		62474	11.8	4982	0.9	3.2			2.96
Combined	6476.96		740.84	1258.86	1261.82		1261.87	0.000636	2.07	452.13	210.24	0.25	99.65		62573	11.9	4883	0.9	3.2			2.96
Combined	6446.59		740.86	1258.8	1261.76		1261.81	0.000632	2.06	451.03	208.35	0.25	99.65		62673	11.9	4783	0.9	3.2			2.96
Combined	6416.21		740.88	1258.74	1261.7		1261.75	0.000632	2.07	449.44	207	0.25	99.65		62773	11.9	4684	0.9	3.2			2.96
Combined	6385.84		740.89	1258.68	1261.64		1261.69	0.000634	2.07	447.82	206.05	0.25	99.65		62872	11.9	4584	0.9	3.2			2.96
Combined	6355.47		740.85	1258.62	1261.58		1261.63	0.000634	2.07	446.63	204.99	0.25	99.65		62972	11.9	4484	0.8	3.2			2.96
Combined	6325.09		740.84	1258.56	1261.52		1261.57	0.000636	2.08	445.04	204.06	0.25	99.65		63072	11.9	4385	0.8	3.2			2.96
Combined	6294.72		740.83	1258.5	1261.46		1261.51	0.000638	2.08	443.53	203.15	0.25	99.65		63171	12.0	4285	0.8	3.2			2.96
Combined	6264.34		740.84	1258.44	1261.4		1261.45	0.000641	2.09	441.77	202.21	0.25	99.65		63271	12.0	4185	0.8	3.2			2.96
Combined	6233.97		740.85	1258.38	1261.34		1261.39	0.000642	2.09	440.42	201.17	0.25	99.65		63371	12.0	4086	0.8	3.2			2.96
Combined	6203.60		740.85	1258.32	1261.28		1261.33	0.000641	2.09	439.47	200.32	0.25	99.65		63470	12.0	3986	0.8	3.2			2.96
Combined	6173.22		740.85	1258.26	1261.22		1261.27	0.000643	2.1	437.77	199.42	0.25	99.65		63570	12.0	3886	0.7	3.2			2.96
Combined	6142.85		740.8	1258.2	1261.15		1261.21	0.000646	2.1	436.12	198.54	0.25	99.65		63670	12.1	3787	0.7	3.2			2.95
Combined	6112.48		740.84	1258.14	1261.09		1261.15	0.000647	2.11	434.79	197.54	0.25	99.65		63769	12.1	3687	0.7	3.2			2.95
Combined	6082.10		740.82	1258.08	1261.03		1261.09	0.000649	2.11	433.15	196.67	0.25	99.65		63869	12.1	3587	0.7	3.2			2.95
Combined	6051.73		740.8	1258.02	1260.97		1261.03	0.000652	2.12	431.5	195.8	0.25	99.65		63969	12.1	3488	0.7	3.2			2.95
Combined	6021.36		740.78	1257.96	1260.91		1260.96	0.000655	2.12	429.74	194.93	0.25	99.65		64068	12.1	3388	0.6	3.2			2.95
Combined	5990.98		740.8	1257.9	1260.85		1260.9	0.000656	2.13	428.59	194.1	0.25	99.65		64168	12.2	3288	0.6	3.7			2.95

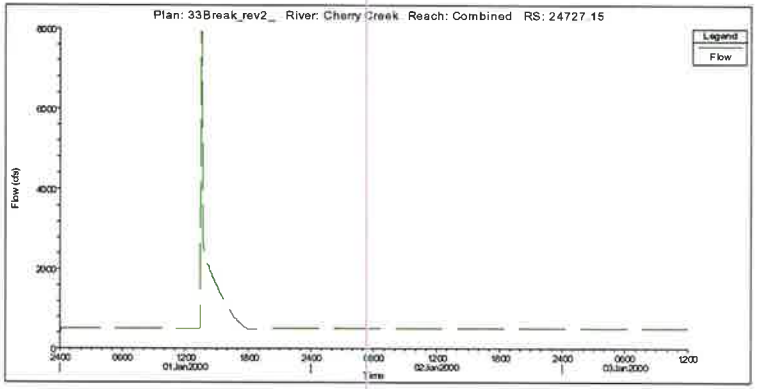
Combined	5960.61		740.78	1257.83	1260.79		1260.84	0.000654	2.13	427.78	193.16	0.25	99.65		64267	12.2	3189	0.6	3.2			2.96
Combined	5930.23		740.78	1257.77	1260.73		1260.78	0.000656	2.13	426.19	192.33	0.25	99.65		64367	12.2	3089	0.6	3.2			2.96
Combined	5899.86		740.76	1257.71	1260.66		1260.72	0.000659	2.14	424.45	191.48	0.26	99.65		64467	12.2	2989	0.6	3.2			2.95
Combined	5869.49		740.73	1257.65	1260.6		1260.66	0.000663	2.15	422.68	190.64	0.26	99.65		64566	12.2	2890	0.5	3.2			2.95
Combined	5839.11		740.76	1257.59	1260.54		1260.6	0.000664	2.15	421.33	189.64	0.26	99.65		64666	12.2	2790	0.5	3.2			2.95
Combined	5808.74		740.75	1257.53	1260.48		1260.53	0.000668	2.16	419.42	188.79	0.26	99.65		64766	12.3	2691	0.5	3.2			2.95
Combined	5778.37		740.74	1257.47	1260.42		1260.47	0.000672	2.16	417.7	187.98	0.26	99.65		64865	12.3	2591	0.5	3.2			2.95
Combined	5747.99		740.76	1257.41	1260.35		1260.41	0.000675	2.17	416.02	187.18	0.26	99.65		64965	12.3	2491	0.5	3.2			2.94
Combined	5717.62		740.69	1257.35	1260.29		1260.35	0.000674	2.17	415.04	186.31	0.26	99.65		65065	12.3	2392	0.5	3.2			2.94
Combined	5687.25		740.72	1257.29	1260.23		1260.29	0.000678	2.18	413.37	185.53	0.26	99.65		65164	12.3	2292	0.4	3.2			2.94
Combined	5656.87		740.72	1257.23	1260.17		1260.22	0.000682	2.18	411.54	184.72	0.26	99.65		65264	12.4	2192	0.4	3.2			2.94
Combined	5626.50		740.72	1257.17	1260.1		1260.16	0.000686	2.19	409.73	183.93	0.26	99.65		65364	12.4	2093	0.4	3.2			2.93
Combined	5596.12		740.73	1257.11	1260.04		1260.1	0.00069	2.2	408.03	183.03	0.26	99.65		65463	12.4	1993	0.4	3.2			2.93
Combined	5565.75		740.72	1257.05	1259.97		1260.03	0.000695	2.2	406.05	182.22	0.26	99.65		65563	12.4	1893	0.4	3.2			2.93
Combined	5535.38		740.74	1256.99	1259.91		1259.97	0.0007	2.21	404.09	181.42	0.26	99.65		65663	12.4	1794	0.3	3.2			2.92
Combined	5505.00		740.7	1256.93	1259.84		1259.91	0.000707	2.22	401.79	180.58	0.26	99.65		65762	12.5	1694	0.3	3.2			2.91
Combined	5474.63		740.71	1256.87	1259.78		1259.84	0.000708	2.22	400.54	179.74	0.26	99.65		65862	12.5	1594	0.3	3.2			2.91
Combined	5444.26		740.67	1256.81	1259.71		1259.78	0.000715	2.23	398.27	178.92	0.27	99.65		65962	12.5	1495	0.3	3.2			2.9
Combined	5413.88		740.73	1256.75	1259.65		1259.71	0.000724	2.24	395.83	178.07	0.27	99.65		66061	12.5	1395	0.3	3.2			2.9
Combined	5383.51		740.7	1256.69	1259.58		1259.64	0.000732	2.25	393.39	177.23	0.27	99.65		66161	12.5	1295	0.2	3.2			2.89
Combined	5353.14		740.7	1256.63	1259.51		1259.57	0.000741	2.27	390.93	176.28	0.27	99.65		66260	12.5	1196	0.2	3.2			2.88
Combined	5322.76		740.68	1256.57	1259.44		1259.51	0.000751	2.28	388.2	175.41	0.27	99.65		66360	12.6	1096	0.2	3.2			2.87
Combined	5292.39		740.71	1256.51	1259.37		1259.44	0.000764	2.29	385.13	174.5	0.27	99.65		66460	12.6	996	0.2	3.2			2.86
Combined	5262.01		740.7	1256.45	1259.3		1259.37	0.000777	2.31	382.09	173.6	0.28	99.65		66559	12.6	897	0.2	3.2			2.85
Combined	5231.64		740.67	1256.39	1259.23		1259.29	0.000787	2.32	379.21	172.63	0.28	99.65		66659	12.6	797	0.2	3.2			2.84
Combined	5201.27		740.69	1256.33	1259.15		1259.22	0.000803	2.34	375.93	171.67	0.28	99.65		66759	12.6	698	0.1	3.2			2.82
Combined	5170.89		740.69	1256.27	1259.08		1259.15	0.000822	2.36	372.1	170.67	0.28	99.65		66858	12.7	598	0.1	3.2			2.81
Combined	5140.52		740.69	1256.21	1259		1259.07	0.000845	2.38	367.8	169.61	0.29	99.65		66958	12.7	498	0.1	3.2			2.79
Combined	5110.15		740.68	1256.15	1258.92		1258.99	0.000872	2.41	363.13	168.44	0.29	99.65		67058	12.7	399	0.1	3.2			2.77
Combined	5079.77		740.7	1256.09	1258.83		1258.91	0.0009	2.44	358.42	167.3	0.3	99.65		67157	12.7	299	0.1	3.2			2.74
Combined	5049.40		740.68	1256.03	1258.74		1258.82	0.000938	2.48	352.76	166.07	0.3	99.65		67257	12.7	199	0.0	3.2			2.71
Combined	5019.02		740.69	1255.97	1258.65		1258.73	0.000982	2.52	346.47	164.75	0.31	99.63		67357	12.8	100	0.0	3.2			2.68
Combined	4988.66		740.63	1255.91	1258.55	1257.15	1258.64	0.001032	2.56	339.89	163.28	0.32			67456	12.8	0	0.0	#DIV/0!			2.64

HEC-RAS Section	Distance from Dam	Flood Wave Arrival Time	Peak Flood Depth	Peak Flow Velocity	Peak Discharge	Peak Water Surface Elevation	Time of Peak	Notes
	mi	hr:min	ft	ft/sec	ft3/sec	ft	hr:min	
25533.44	0.01	0:00	30.00	35.00	8718.26	1485.97	0:00	0.00
24727.15	0.51	0:04	4.80	21.11	7954.70	1368.58	0:04	0.00
23522.04	1.26	0:13	2.55	7.22	6794.01	1308.06	0:13	0.00
22422.60	1.94	0:41	1.91	3.57	4075.66	1291.55	0:41	0.00
19782.24	3.58	1:10	3.21	0.60	1870.94	1273.19	3:10	0.00
15905.43	5.99	1:40	1.88	0.35	868.43	1271.50	7:30	0.00
14415.00	6.92	5:00	1.79	0.53	784.24	1271.35	11:00	0.00



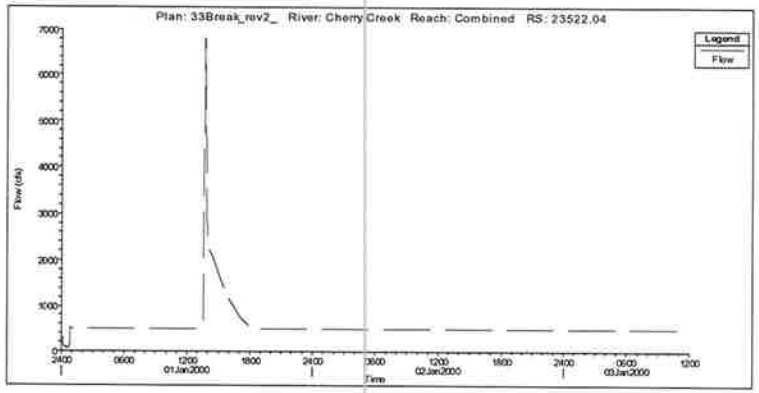
Stage1485.9701Jan2000 1330
Flow8718.2601Jan2000 13302869.55 1330 start

$0.0227 \frac{mi}{min} = 2 \frac{ft}{s}$



Stage1368.5701Jan2000 1334
Flow7907.4501Jan2000 13332867.08 1324 − 1333 ?

$\frac{0.51mi}{0.0227} = 22min$



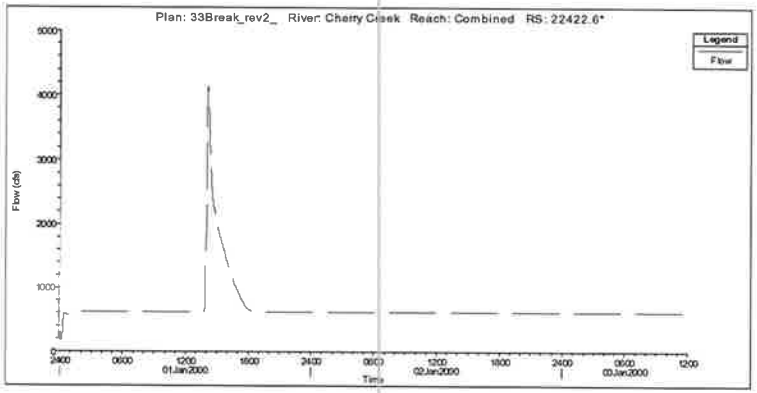
Stage1308.0601Jan2000 1343
Flow6816.1701Jan2000 13432841.32

1335 - 1343

1335
- 1330
5min
arrival

1343
- 1330
13 min peak

1.26mi / 0.0227 = 56min peak



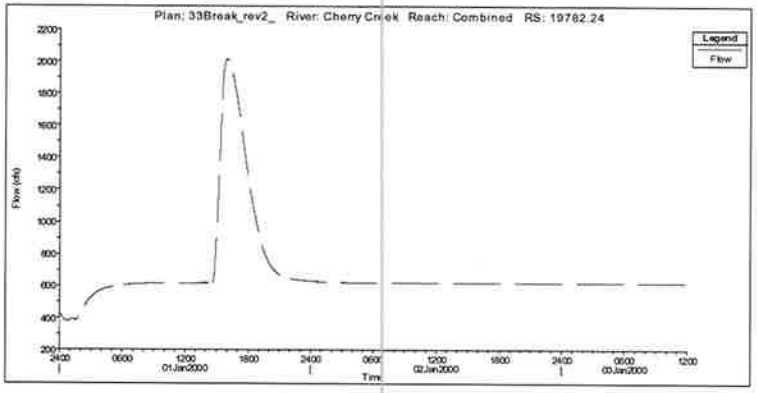
Stage1291.5501Jan2000 1411
Flow4129.8001Jan2000 14093394.69

1357 - 1409

1357
- 1330
27min
arrival

1409
- 1330
39min peak

1.94mi / 0.0227 = 1hr 25min peak



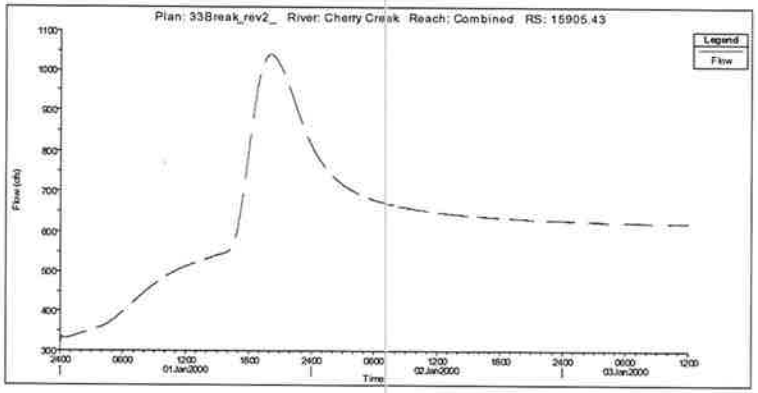
Stage1273.1901Jan2000 1641
Flow2014.1301Jan2000 16003346.54

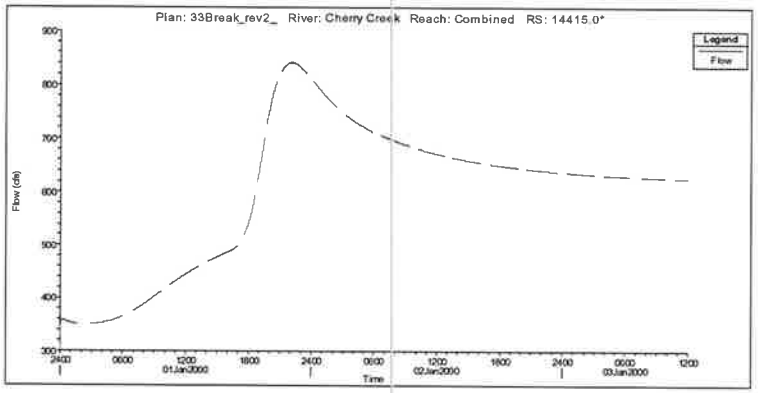
1454 - 1559

1454
- 1330
1hr 24min
arrival

1559
- 1330
2hr 29min

3.58mi / 0.0227 = 2hr 38 min peak





Stage1271.5001Jan2000 2301
Flow1040.1401Jan2000 20093096.08 1654 - 2003

1654
-1330
3hr 24min
arrival

2003
-1330
6hr 33min peak

$\frac{5.99\text{mi}}{0.0227}$ = 4hr 24min peak

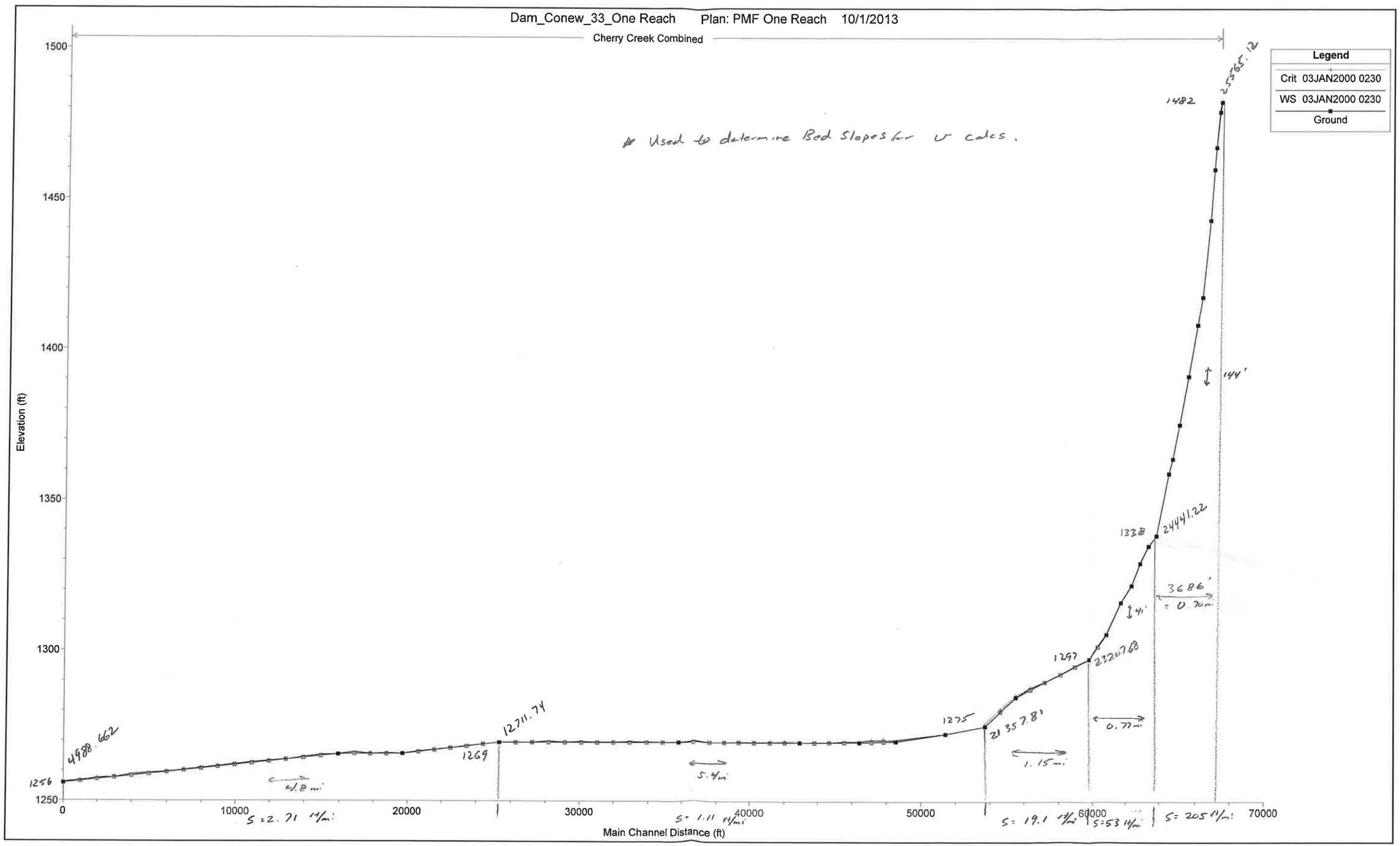
Stage1271.3502Jan2000 0108
Flow841.3101Jan2000 22132976.56 1736 - 2206

1736
-1330
4hr 6min
arrival

2206
-1330
8hr 36 min peak

$\frac{6.92}{0.0227}$ = 5hr 5 min peak

SYA LINES IN (MI) From Source.



* Used to determine Bed Slopes for U calcs.

1 mi = 5280'

1 mi = 1609.3 m

Dam_Conew_33_One Reach Plan: PMF One Reach 10/16/2013

Cherry Creek Combined

Legend

WS Max WS

Ground

Elevation (ft)

1500

1450

1400

1350

1300

1250

0 10000 20000 30000 40000 50000 60000 70000

Main Channel Distance (ft)

529.... 559.... 5899.... 6203.... 6507.... 6811.... 7114.... 7418.... 7722.... 8026.0* 8329.7* 8633.4* 8937.22* 9240.95* 9544.69* 9848.429* 10134.9* 10421.3* 10707.8* 10994.34* 11280.5* 11566.8* 11853.0* 12139.2* 12425.5* 12711.74 13002.0* 13292.4* 13582.7* 13873.0* 14163.4* 14453.7* 14744.0* 15034.4* 15324.7* 15615.0* 15905.43 16176.5* 16447.6* 16718.7* 16989.8* 17260.9* 17532.0* 17803.1* 18074.21 18341.2* 18608.3* 18875.4* 19142.52 19355.7* 19569.* 19782.24 20652.85 21357.81 21633.6* 21909.42 22169.0* 22428.7* 22688.3* 22948.0* 23207.68 23522.04 23790.13 23986.76 24299.34 24660.17 24847.21 25145.75 25367.33 25565.12

THOMSEN ASSOCIATES
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

CHECK LIST FOR DAMS HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

AREA-CAPACITY DATA:

		Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1)	Top of Dam	1519.9	7.9	137.9
2)	Design High Water (Max. Design Pool)	1513.8	5.4	97.3
3)	Auxiliary Spillway Crest	1511.6	4.9	86.0
4)	Pool Level with Flashboards	N.A.	N.A.	N.A.
5)	Service Spillway Crest	1509.1	4.4	74.4
6)	Orifice Crest	1493.7	0.7	9.6

DISCHARGES

		Volume (cfs)
1)	Average Daily	Unknown
2)	Spillway @ Maximum High Water (TOP OF DAM)	163
3)	Spillway @ Design High Water	156
4)	Spillway @ Auxiliary Spillway Crest Elevation	148
5)	Low Level Outlet at Normal Pool	5
6)	Total (of all facilities) @ Maximum High Water	5113
7)	Maximum Known Flood	Unknown

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CREST: ELEVATION: 1519.9

Type: Zoned Earth Embankment

Width: 18 Length: 317 feet

Spillover Concrete Riser Structure & Auxiliary Spillway

Location Riser Structure on Upstream Embankment Slope near Maximum section of Dam, Auxiliary Spillway at West End of Dam

SPILLWAY:

PRINCIPAL		EMERGENCY
Orifice Crest - 1483.7 Riser Crest - 1509.1	Elevation	1511.6
Concrete Riser Structure w/ orifice	Type	Grass lined Earthen Channel
	Width	50 feet

Type of Control

Yes	Uncontrolled	Yes
	Controlled:	
	Type (Flashboards; gate)	
	Number	
	Size/Length	

Invert Material Topsoil over generally fine grained silt, sands and clay

Anticipated Length of operating service 17 hours at PMF event

295.2 (Pipe Length) Chute Length 50' @ Level Control Section

Not Applicable Height Between Spillway Crest & Approach Channel Invert (Weir Flow) 2% Entrance Slope

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~~OUTLET STRUCTURES~~/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate ✓ Sluice _____ Conduit _____ Penstock _____

Shape: Circular (Cast Iron Pipe)

Size: 10"

Elevations: Entrance Invert 1472.1

Exit Invert 1470.1

Tailrace Channel: Elevation Not Applicable

HYDROMETEROLOGICAL GAGES:

Type: NONE KNOWN TO BE IN THE AREA

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: NONE

Method of Controlled Releases (mechanisms):

Reservoir Drain with Manually operated slide gate

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CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

DRAINAGE AREA: 350 Acres (0.53 Sq Miles)

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Wooded

Terrain - Relief: Moderate to Steep

Surface - Soil: Varies between glacio-lacustrine silt & clay & dense glacial till

Runoff Potential (existing or planned extensive alterations to existing surface or subsurface conditions)

None Planned

Potential Sedimentation problem areas (natural or man-made; present or future)

Normal Pool is designed as a 50 year Sediment Pool

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

None

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: None

Elevation:

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB [illegible]

SHEET NO. _____ OF _____

CALCULATED BY P. S. DATE 6/5/90

CHECKED BY _____ DATE _____

SCALE _____

Drainage Area = 0.53 sq. mile

Estimation of Lag Time (tp)

$tp = C_t (.955)(L \cdot L_c)^{.3} + .25\, t_R = 1.1 (.955)(1.21 \times .6)^{.3} + .25(.20)$

$= 1.00$ hr.

Slope of the basin $= \frac{1950 - 1500}{4200} \times 100 = 10.7\%$

Check of Lag time

Using Linsley, Kohler & Paulhus Equn.,

$$\text{Lag } (tp) = 0.72 \left(\frac{L \cdot L_c}{\sqrt{S}} \right)^{.38} = 0.72 \left(\frac{1.21 \times .6}{\sqrt{.107}} \right)^{.38}$$

$= 0.97$ hr.

In HEC-1 input tp = 1 hr. & Cp = 0.63 were used to develop snyder's unit hydrographs.

Probable Maximum Precipitation

From Hydrometeorological Report #33, Probable Maximum Precipitation = 22.6 inches (For 200 sq. mile - 24 hr. duration)

Depth - Area - Duration Relationship (Zone 2)

6 hr. - 116%
12 hr. - 127%
24 hr. - 141%

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JOB HYDROLOGIC STUDY DAM # NY 581
SHEET NO. _____ OF _____
CALCULATED BY P.S. DATE 6/5/80
CHECKED BY _____ DATE _____
SCALE _____

STAGE - STORAGE DATA

ELEVATION (ft.)	Surface Area (Acres)	Avg. Area (Acres)	Incremental Storage (Acre-ft.)	Total Storage (Acre-ft.)	Remarks
1483.7	0.7			0	Surface Areas are directly taken from S.C.S. design report since they are computed with better contour maps.
1509.1	4.4	2.55	64.8	64.8	
1511.6	4.9	4.65	11.6	76.4	
1513.8	5.4	5.15	11.3	87.7	
1519.9	7.9	6.65	40.6	128.3	

NOTE: Storage for other stages for HEC-1 input were interpolated from Stage - Storage Curve.

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JOB HYDROLOGIC STUDY DAM # NY 531
SHEET NO. _____ OF _____
CALCULATED BY T.K. DATE 6/5/80
CHECKED BY P.S. DATE 6/9/80
SCALE _____

STAGE - DISCHARGE COMPUTATION

Normal Pool Elevation - 1493.7	Size of Orifice - 0.75' x 0.5'
Elev. of Crest of riser - 1509.1	Size of Outlet pipe - 30" Φ, S_o = .038
Emergency spillway Elvn. - 1511.6	Length of pipe - 295.2', n = .012
Elevn. of top of dam - 1519.9	El. @ Inlet of pipe - 1469.1
Elevn. of Tailwater - 1454.1	Riser opening - 7.5' x 1.25' (2)

Assumptions:

(1) A constant coefficient of discharge of 0.7 was assumed to compute discharge through orifice.

(2) To compute the discharge through the riser, weir flow equation was used for reservoir stage below the top of riser. For all reservoir stage above the top of the riser orifice flow equation was used.

(3) Coefficient of Weir = 3.1

(4) Bureau of Public Roads Hydraulic Engineering Circular #5 was used to compute headwater from the pipe assuming inlet and outlet control. Long hand calculations were made to compute headwater beyond the limit of the chart.

(5) On computing discharge through emergency spillway, approach velocity and friction loss were ignored.

(6) Tailwater Elevation was ignored since the outlet pipe is discharging into a plunge pool.

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JOB HYDROLOGIC STUDY DAM # NY 591
SHEET NO. _____ OF _____
CALCULATED BY T.K. DATE 6/5/80
CHECKED BY P.S. DATE 6/9/80
SCALE _____

STAGE-DISCHARGE COMPUTATIONS (CONT'D.)

ELEV.	STAGE	ORIFICE	INLET CONTROL		OUTLET CONTROL			CONTROL	RISER & PIPE		EMER. SPILLWAY	TOTAL
		DISCHARGE	HW/D	HW	$\frac{d_c+d}{2}$	H	HW	HW	H	DISCHARGE	DISCHARGE	DISCHARGE
ft	ft	C.f.s.		ft.	ft.	ft.	ft.	ft.	ft.	C.f.s.	C.f.s.	C.f.s.
1483.7	0											0
1485.7	2	2.8	–	–			–					2.8
1487.7	4	4.0	–	–			–					4.0
1489.7	6	5.0	–	–			–					5.0
1491.7	8	5.9	–	–			–					5.9
1493.7	10	6.6	–	–			–					6.6
1495.7	12	7.2	–	–			–					7.2
1497.7	14	7.8	0.52	1.30			–					7.8
1499.7	16	8.4	0.53	1.32			–					8.4
1501.7	18	8.9	0.57	1.42			–					8.9
1503.7	20	9.4	0.58	1.45			–					9.4
1505.7	22	9.8	0.59	1.47			–					9.8
1507.7	24	10.3	0.6	1.5	1.8	–	–	1.5				10.3
1509.7	26	10.7	1.4	3.5	2.15	2.4	–	3.5	0.6	21.6		32.3
1511.7	28	3.1		31.2	2.5	49.95	41.05	41.05	1.97 Pipe	147.8 Control	4.9	155.7

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JOB HYDROLOGIC STUDY DAM # NY 541

SHEET NO. _____ OF _____

CALCULATED BY T.K. DATE 6/5/80

CHECKED BY P.S. DATE 6/9/80

SCALE _____

STAGE-DISCHARGE COMPUTATIONS (CONTD.)

ELEV.	STAGE	ORIFICE	INLET CONTROL		OUTLET CONTROL				CONTROL	RISER & PIPE		EMER. SPILLWAY	TOTAL
		DISCHARGE	HW/D	HW	$\frac{d_c+d}{2}$	H	HW		HW	#	DISCHARGE	DISCHARGE	DISCHARGE
ft.	ft.	C.f.s.		ft.	ft.	ft.	ft.		ft.	ft.	C.f.s.	C.f.s.	C.f.s.
1513.7	30			-	2.5	53.5	44.6		44.6	44.6	156	500	656
1515.7	32			-	2.5	55.5	46.6		46.6	46.6	157	1500	1657
1517.7	34			-	2.5	57.5	48.6		48.6	48.6	160	2900	3060
1519.7	36			-	2.5	59.5	50.6		50.6	50.6	162	4800	4962
1519.9	36.2			-	2.5	59.7	50.8		50.8	50.8	163	4950	5113

FORM 204-1 Available from NEBS Inc., Groton, Mass. 01450

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB

SHEET NO. OF

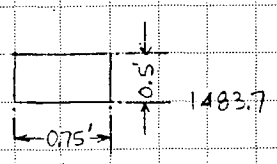
CALCULATED BY T.K. DATE 6/6/80

CHECKED BY P.S. DATE 6/9/80

SCALE

SAMPLE CALCULATIONS

ORIFICE DISCHARGE

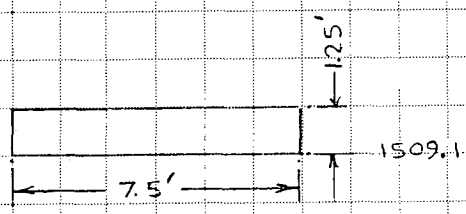


Stage @ 1501.7

$Q = CA\sqrt{2gH} = .7 \times .75 \times .5' \sqrt{64.4 \times 17.75}$

$= 8.9$ c.f.s.

RISER DISCHARGE



Stage @ 1511.7

$Q = CA\sqrt{2gH}$

$= 0.7 \times 2 \times 7.5 \times 1.25 \sqrt{64.4 \times 1.98}$

$= 148.2$ c.f.s.

Computed head with Q = 148 c.f.s. indicates that the orifice will be submerged. Therefore, the orifice discharge will be greatly reduced. By trial & error the total combined discharge through orifice & riser was computed. Total discharge of 151 c.f.s. was assumed and head water HW (Inlet & outlet control) were computed.

Controlling HW (Outlet Control) = 40.4 ft.

Water Surface El in the riser box = 1469.1 + 41.05 = 1510.15

Discharge thru orifice,

$Q = CA\sqrt{2g\Delta H}$ $\quad \Delta H = 1511.7 - 1510.15 = 1.55$

$= 0.7 \times .375 \sqrt{64.4 \times 1.55}$

$= 2.6$ c.f.s.

∴ Total discharge thru riser & orifice = 148.2 + 2.6 = 150.8 c.f.s.

Discharge through Emergency Spillway

$Q = CLH^{3/2} = 3.1(50)(.1)^{3/2} = 4.9$ c.f.s.

Total Discharge @ El. 1511.7 = 150.8 + 4.9 = 155.7 c.f.s.

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SCALE _____

PIPE CONTROL

At stage of 1513.7 the computed headwater with combined discharge (orifice and spillway) was more than the stage. Therefore, it was assumed pipe controls and it is outlet control.

$HW = 1513.7 - 1469.1 = 44.6$

$HW = H + h_o - LS_o \quad \therefore H = 44.6 - 2.5 + 11.4 = 53.5$

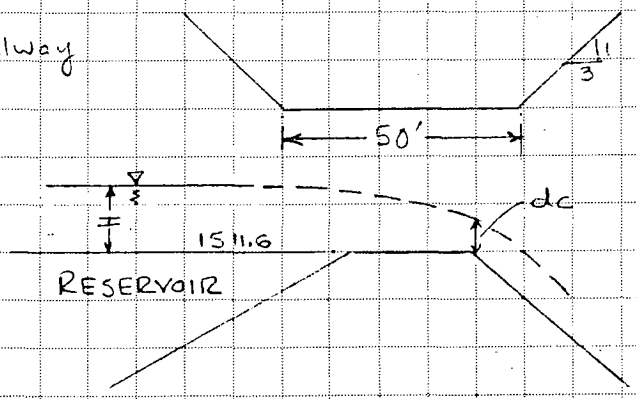
$$H = \left(1 + K_e + \frac{29n^2L}{R^{4/3}}\right) V^2/2g$$

$$53.5 = \left(1 + .1 + \frac{29(.012)^2 \times 295}{(1.62)^{4/3}}\right) V^2/2g, \quad 53.5 = 3.4\, V^2/2g$$

$V = 31.8'/sec \qquad Q = A \times V = 1.908 \times 31.8 = 156$ c.f.s.

EMERGENCY SPILLWAY

Discharge thru Emergency Spillway



$H = 1513.7 - 1511.6 = 2.10$

Neglecting approach velocity and friction loss

$H = dc + \frac{Vc^2}{2g}$

Computations involve assuming a discharge through the spillway and calculate dc & $Vc^2/2g$ to balance two sides of the equation.

Table 8-5 of King & Brater "Handbook of Hydraulics was used to compute dc.

assume $Q = 500$ c.f.s. $\quad k'_c = .028 \quad dc/b = .029$

$\therefore dc = .029(50) = 1.45'$, $\quad Vc = 500/78.8 = 6.34'/sec \quad Vc^2/2g = 0.62$

$\therefore dc + Vc^2/2g = 1.45 + 0.62 = 2.07 = 2.1$

$\therefore$ Total Discharge @ 1513.7 $= 156 + 500 = 656$ c.f.s.

K+E 10 X 10 TO THE INCH • 7 X 10 INCHES
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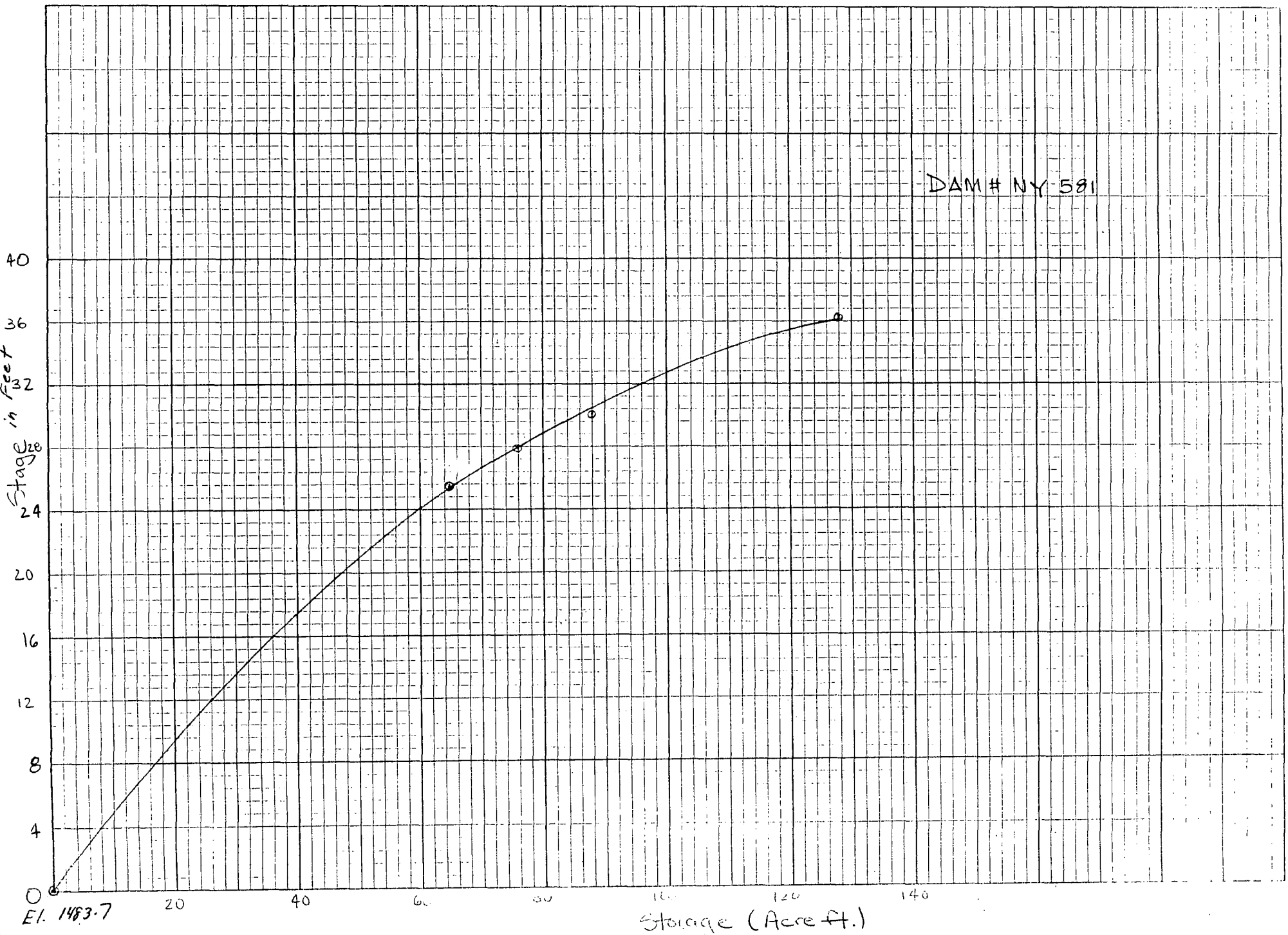
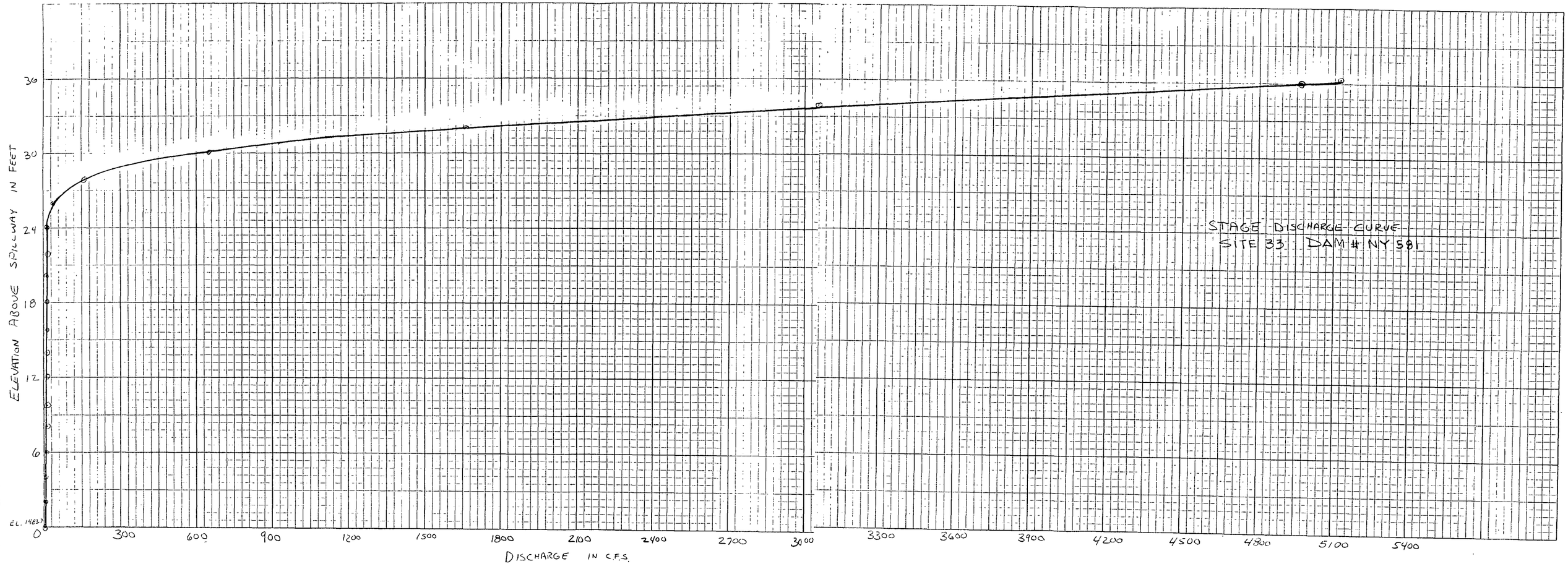
Site 33 Stage vs. Storage





46 0782
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10 X 10 TO THE INCH • 7 X 10 INCHES

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1                A1                ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
    2                A2              HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF NY 581
    3                A3                RATIOS OF PMF ROUTED THROUGH THE RESERVOIR
    4                B     150       0       12        0        0        0        0        0        0        0
    5                B1      5
    6                J       1       6        1
    7                J1     .2      .35      .50      .65      .80        1
    8                K       0       1        0        0        0        0        1
    9                K1        CALCULATION OF INFLOW HYDROGRAPH
   10                M       1       1       .53       0       .53       0        0        0        0        0
   11                P               22.6     116      127      141       0        0        0        0
   12                T       0       0        0        0        0        0        1       .1        0        0
   13                W    1.00      .63
   14                X      -2      -.1        2
   15                K       1       2        0        0        0        0        1        0        0        0
   16                K1        ROUTING OF INFLOW HYDROGRAPH
   17                Y       0       0        0        1        1
   18                Y1      1       0        0        0        0        0       -1
   19                Y2      0    12.5       31     47.5       60     67.8       76     85.5       96      108
   20                Y2    126     128
   21                Y3      0       5      7.8      9.4     10.3     32.3      155      654     1657     3060
   22                Y3   4962    5113
   23                K      99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
END OF NETWORK	

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

          TIME OF EXECUTION      30-JUL-80    11:33:50
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF NY 581
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	12	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1

RTIOS= 0.20 0.35 0.50 0.65 0.80 1.00

```
**********          **********          **********          **********          **********
```

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	0.53	0.00	0.53	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.60	116.00	127.00	141.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.00 CP=0.63 NTA= 0

RECESSION DATA
STRTQ= -2.00 QRCSN= -0.10 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.82 AND R= 4.39 INTERVALS

UNIT HYDROGRAPH 27 END-OF-PERIOD ORDINATES, LAG= 0.99 HOURS, CP= 0.63 VOL= 1.00

18.	64.	125.	181.	214.	214.	183.	146.	116.	92.
73.	58.	46.	37.	29.	23.	19.	15.	12.	9.
7.	6.	5.	4.	3.	2.	2.			

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	0.12	1	0.03	0.00	0.03	1.
1.01	0.24	2	0.03	0.00	0.03	1.
1.01	0.36	3	0.03	0.00	0.03	1.
1.01	0.48	4	0.03	0.00	0.03	1.
1.01	1.00	5	0.03	0.00	0.03	1.
1.01	1.12	6	0.03	0.00	0.03	1.
1.01	1.24	7	0.03	0.00	0.03	1.
1.01	1.36	8	0.03	0.00	0.03	1.
1.01	1.48	9	0.03	0.00	0.03	1.
1.01	2.00	10	0.03	0.00	0.03	1.
1.01	2.12	11	0.03	0.00	0.03	0.
1.01	2.24	12	0.03	0.00	0.03	0.
1.01	2.36	13	0.03	0.00	0.03	0.
1.01	2.48	14	0.03	0.00	0.03	0.
1.01	3.00	15	0.03	0.00	0.03	0.
1.01	3.12	16	0.03	0.00	0.03	0.
1.01	3.24	17	0.03	0.00	0.03	0.
1.01	3.36	18	0.03	0.00	0.03	0.
1.01	3.48	19	0.03	0.00	0.03	0.
1.01	4.00	20	0.03	0.00	0.03	0.
1.01	4.12	21	0.03	0.00	0.03	0.
1.01	4.24	22	0.03	0.00	0.03	0.
1.01	4.36	23	0.03	0.00	0.03	0.
1.01	4.48	24	0.03	0.00	0.03	0.
1.01	5.00	25	0.03	0.00	0.03	0.
1.01	5.12	26	0.03	0.00	0.03	0.
1.01	5.24	27	0.03	0.00	0.03	0.
1.01	5.36	28	0.03	0.00	0.03	0.
1.01	5.48	29	0.03	0.00	0.03	0.
1.01	6.00	30	0.03	0.01	0.03	0.
1.01	6.12	31	0.07	0.05	0.02	1.
1.01	6.24	32	0.07	0.05	0.02	5.
1.01	6.36	33	0.07	0.05	0.02	11.
1.01	6.48	34	0.07	0.05	0.02	19.
1.01	7.00	35	0.07	0.05	0.02	29.
1.01	7.12	36	0.07	0.05	0.02	39.
1.01	7.24	37	0.07	0.05	0.02	47.
1.01	7.36	38	0.07	0.05	0.02	54.
1.01	7.48	39	0.07	0.05	0.02	59.
1.01	8.00	40	0.07	0.05	0.02	63.
1.01	8.12	41	0.07	0.05	0.02	66.
1.01	8.24	42	0.07	0.05	0.02	69.
1.01	8.36	43	0.07	0.05	0.02	71.
1.01	8.48	44	0.07	0.05	0.02	73.
1.01	9.00	45	0.07	0.05	0.02	74.
1.01	9.12	46	0.07	0.05	0.02	75.
1.01	9.24	47	0.07	0.05	0.02	76.
1.01	9.36	48	0.07	0.05	0.02	77.
1.01	9.48	49	0.07	0.05	0.02	77.
1.01	10.00	50	0.07	0.05	0.02	78.
1.01	10.12	51	0.07	0.05	0.02	78.
1.01	10.24	52	0.07	0.05	0.02	78.
1.01	10.36	53	0.07	0.05	0.02	78.
1.01	10.48	54	0.07	0.05	0.02	78.
1.01	11.00	55	0.07	0.05	0.02	79.
1.01	11.12	56	0.07	0.05	0.02	79.
1.01	11.24	57	0.07	0.05	0.02	79.
1.01	11.36	58	0.07	0.05	0.02	79.
1.01	11.48	59	0.07	0.05	0.02	79.
1.01	15.12	76	0.80	0.78	0.02	875.
1.01	15.24	77	1.43	1.41	0.02	932.
1.01	15.36	78	3.98	3.96	0.02	1066.
1.01	15.48	79	1.28	1.26	0.02	1313.
1.01	16.00	80	0.64	0.62	0.02	1615.
1.01	16.12	81	0.59	0.57	0.02	1883.
1.01	16.24	82	0.59	0.57	0.02	2035.
1.01	16.36	83	0.59	0.57	0.02	2027.
1.01	16.48	84	0.59	0.57	0.02	1888.
1.01	17.00	85	0.59	0.57	0.02	1711.
1.01	17.12	86	0.46	0.44	0.02	1558.
1.01	17.24	87	0.46	0.44	0.02	1429.
1.01	17.36	88	0.46	0.44	0.02	1317.
1.01	17.48	89	0.46	0.44	0.02	1217.
1.01	18.00	90	0.46	0.44	0.02	1129.
1.01	18.12	91	0.05	0.03	0.02	1046.
1.01	18.24	92	0.05	0.03	0.02	958.
1.01	18.36	93	0.05	0.03	0.02	858.
1.01	18.48	94	0.05	0.03	0.02	744.
1.01	19.00	95	0.05	0.03	0.02	625.
1.01	19.12	96	0.05	0.03	0.02	512.
1.01	19.24	97	0.05	0.03	0.02	418.
1.01	19.36	98	0.05	0.03	0.02	342.
1.01	19.48	99	0.05	0.03	0.02	282.
1.01	20.00	100	0.05	0.03	0.02	234.
1.01	20.12	101	0.05	0.03	0.02	201.
1.01	20.24	102	0.05	0.03	0.02	187.
1.01	20.36	103	0.05	0.03	0.02	175.
1.01	20.48	104	0.05	0.03	0.02	163.
1.01	21.00	105	0.05	0.03	0.02	152.
1.01	21.12	106	0.05	0.03	0.02	142.
1.01	21.24	107	0.05	0.03	0.02	132.
1.01	21.36	108	0.05	0.03	0.02	124.
1.01	21.48	109	0.05	0.03	0.02	115.
1.01	22.00	110	0.05	0.03	0.02	108.
1.01	22.12	111	0.05	0.03	0.02	100.
1.01	22.24	112	0.05	0.03	0.02	94.
1.01	22.36	113	0.05	0.03	0.02	87.
1.01	22.48	114	0.05	0.03	0.02	82.
1.01	23.00	115	0.05	0.03	0.02	76.
1.01	23.12	116	0.05	0.03	0.02	71.
1.01	23.24	117	0.05	0.03	0.02	66.
1.01	23.36	118	0.05	0.03	0.02	62.
1.01	23.48	119	0.05	0.03	0.02	58.
1.02	0.00	120	0.05	0.03	0.02	54.
1.02	0.12	121	0.00	0.00	0.00	52.
1.02	0.24	122	0.00	0.00	0.00	50.
1.02	0.36	123	0.00	0.00	0.00	46.
1.02	0.48	124	0.00	0.00	0.00	43.
1.02	1.00	125	0.00	0.00	0.00	40.
1.02	1.12	126	0.00	0.00	0.00	38.
1.02	1.24	127	0.00	0.00	0.00	35.
1.02	1.36	128	0.00	0.00	0.00	33.
1.02	1.48	129	0.00	0.00	0.00	31.
1.02	2.00	130	0.00	0.00	0.00	29.
1.02	2.12	131	0.00	0.00	0.00	27.
1.02	2.24	132	0.00	0.00	0.00	25.
1.02	2.36	133	0.00	0.00	0.00	23.
1.02	2.48	134	0.00	0.00	0.00	22.

GEORLAND - JOHNSON ENGINEERS, INC.

1.01	12.00	60	0.07	0.05	0.02	79.	1.02	3.00	135	0.00	0.00	0.00	20.
1.01	12.12	61	0.42	0.40	0.02	85.	1.02	3.12	136	0.00	0.00	0.00	19.
1.01	12.24	62	0.42	0.40	0.02	108.	1.02	3.24	137	0.00	0.00	0.00	18.
1.01	12.36	63	0.42	0.40	0.02	152.	1.02	3.36	138	0.00	0.00	0.00	16.
1.01	12.48	64	0.42	0.40	0.02	216.	1.02	3.48	139	0.00	0.00	0.00	15.
1.01	13.00	65	0.42	0.40	0.02	291.	1.02	4.00	140	0.00	0.00	0.00	14.
1.01	13.12	66	0.50	0.48	0.02	368.	1.02	4.12	141	0.00	0.00	0.00	13.
1.01	13.24	67	0.50	0.48	0.02	438.	1.02	4.24	142	0.00	0.00	0.00	12.
1.01	13.36	68	0.50	0.48	0.02	500.	1.02	4.36	143	0.00	0.00	0.00	12.
1.01	13.48	69	0.50	0.48	0.02	556.	1.02	4.48	144	0.00	0.00	0.00	11.
1.01	14.00	70	0.50	0.48	0.02	606.	1.02	5.00	145	0.00	0.00	0.00	10.
1.01	14.12	71	0.63	0.61	0.02	652.	1.02	5.12	146	0.00	0.00	0.00	9.
1.01	14.24	72	0.63	0.61	0.02	696.	1.02	5.24	147	0.00	0.00	0.00	9.
1.01	14.36	73	0.63	0.61	0.02	741.	1.02	5.36	148	0.00	0.00	0.00	8.
1.01	14.48	74	0.63	0.61	0.02	786.	1.02	5.48	149	0.00	0.00	0.00	8.
1.01	15.00	75	0.63	0.61	0.02	831.	1.02	6.00	150	0.00	0.00	0.00	7.
									SUM	25.65	22.84	2.81	39843.
										(652.)	(580.)	(71.)	(1128.23)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2035.	1084.	332.	266.	39835.
CMS	58.	31.	9.	8.	1128.
INCHES		19.03	23.30	23.31	23.31
MM		483.46	591.78	591.96	591.96
AC-FT		538.	658.	658.	658.
THOUS CU M		663.	812.	812.	812.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	2.	4.	6.	8.	9.	11.	12.	13.
13.	14.	14.	15.	15.	15.	15.	15.	15.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
17.	22.	30.	43.	58.	74.	88.	100.	111.	121.
130.	139.	148.	157.	166.	175.	186.	213.	263.	323.
377.	407.	405.	378.	342.	312.	286.	263.	243.	226.
209.	192.	172.	149.	125.	102.	84.	68.	56.	47.
40.	37.	35.	33.	30.	28.	26.	25.	23.	22.
20.	19.	17.	16.	15.	14.	13.	12.	12.	11.
10.	10.	9.	9.	8.	8.	7.	7.	6.	6.
5.	5.	5.	4.	4.	4.	4.	3.	3.	3.
3.	2.	2.	2.	2.	2.	2.	2.	2.	1.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	407.	217.	66.	53.	7967.
CMS	12.	6.	2.	2.	226.
INCHES		3.81	4.66	4.66	4.66
MM		96.69	118.36	118.39	118.39
AC-FT		108.	132.	132.	132.
THOUS CU M		133.	162.	162.	162.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

0.	2.	4.	7.	10.	14.	16.	19.	21.	22.
23.	24.	25.	25.	26.	26.	27.	27.	27.	27.
27.	27.	27.	27.	28.	28.	28.	28.	28.	28.
30.	38.	53.	75.	102.	129.	153.	175.	195.	212.
228.	244.	259.	275.	291.	306.	326.	373.	459.	565.
659.	712.	709.	661.	599.	545.	500.	461.	426.	395.
366.	335.	300.	260.	219.	179.	146.	120.	99.	82.
70.	66.	61.	57.	53.	50.	46.	43.	40.	38.
35.	33.	31.	29.	27.	25.	23.	22.	20.	19.
18.	17.	16.	15.	14.	13.	12.	11.	11.	10.
9.	9.	8.	8.	7.	7.	6.	6.	5.	5.
5.	4.	4.	4.	4.	3.	3.	3.	3.	2.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	712.	380.	116.	93.	13942.
CMS	20.	11.	3.	3.	395.
INCHES		6.66	8.15	8.16	8.16
MM		169.21	207.12	207.19	207.19
AC-FT		188.	230.	230.	230.
THOUS CU M		232.	284.	284.	284.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	2.	5.	10.	15.	19.	24.	27.	29.	31.
33.	34.	36.	36.	37.	38.	38.	38.	39.	39.
39.	39.	39.	39.	39.	39.	39.	39.	39.	39.
43.	54.	76.	108.	146.	184.	219.	250.	278.	303.
326.	348.	370.	393.	416.	438.	466.	533.	656.	808.
942.	1017.	1013.	944.	856.	779.	714.	658.	608.	564.
523.	479.	429.	372.	312.	256.	209.	171.	141.	117.
100.	94.	87.	82.	76.	71.	66.	62.	58.	54.
50.	47.	44.	41.	38.	35.	33.	31.	29.	27.
26.	25.	23.	22.	20.	19.	18.	16.	15.	14.
13.	12.	12.	11.	10.	9.	9.	8.	8.	7.
7.	6.	6.	5.	5.	5.	4.	4.	4.	4.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1017.	542.	166.	133.	19918.
CMS	29.	15.	5.	4.	564.
INCHES		9.52	11.65	11.65	11.65
MM		241.73	295.89	295.98	295.98
AC-FT		269.	329.	329.	329.
THOUS CU M		332.	406.	406.	406.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

1.	1.	1.	1.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	3.	7.	12.	19.	25.	31.	35.	38.	41.
43.	45.	46.	47.	48.	49.	49.	50.	50.	50.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
55.	70.	99.	140.	189.	239.	285.	325.	361.	394.
424.	453.	481.	511.	540.	569.	606.	693.	853.	1050.
1224.	1323.	1317.	[illegible]	[illegible]	[illegible]	929.	856.	791.	734.
680.	623.	557.	484.	406.	333.	[illegible]	222.	[illegible]	152.

McFARLAND - JOHNSON ENGINEERS, INC.

130.	122.	114.	106.	99.	92.	86.	80.	75.	70.
65.	61.	57.	53.	49.	46.	43.	40.	37.	35.
34.	32.	30.	28.	26.	24.	23.	21.	20.	19.
17.	16.	15.	14.	13.	12.	11.	11.	10.	9.
9.	8.	8.	7.	7.	6.	6.	5.	5.	5.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1323.	705.	216.	173.	25893.
CMS	37.	20.	6.	5.	733.
INCHES		12.37	15.14	15.15	15.15
MM		314.25	384.66	384.78	384.78
AC-FT		350.	428.	428.	428.
THOUS CU M		431.	528.	528.	528.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 5

1.	1.	1.	1.	1.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	4.	8.	15.	23.	31.	38.	43.	47.	50.
53.	55.	57.	58.	59.	60.	61.	61.	62.	62.
62.	62.	63.	63.	63.	63.	63.	63.	63.	63.
68.	86.	121.	172.	233.	295.	350.	400.	445.	485.
522.	557.	593.	629.	665.	700.	745.	853.	1050.	1292.
1507.	1628.	1621.	1510.	1369.	1246.	1143.	1053.	973.	903.
837.	766.	686.	595.	500.	410.	334.	274.	225.	187.
161.	150.	140.	130.	122.	114.	106.	99.	92.	86.
80.	75.	70.	65.	61.	57.	53.	49.	46.	43.
41.	40.	37.	35.	32.	30.	28.	26.	24.	23.
21.	20.	19.	17.	16.	15.	14.	13.	12.	11.
11.	10.	9.	9.	8.	8.	7.	7.	6.	6.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1628.	868.	265.	212.	31868.
CMS	46.	25.	8.	6.	902.
INCHES		15.23	18.64	18.64	18.64
MM		386.77	473.42	473.57	473.57
AC-FT		430.	527.	527.	527.
THOUS CU M		531.	650.	650.	650.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 6

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	5.	11.	19.	29.	39.	47.	54.	59.	63.
66.	69.	71.	73.	74.	75.	76.	77.	77.	78.
78.	78.	78.	78.	79.	79.	79.	79.	79.	79.
85.	108.	152.	216.	291.	368.	438.	500.	556.	606.
652.	696.	741.	786.	831.	875.	932.	1066.	1313.	1615.
1883.	2035.	2027.	1888.	1711.	1558.	1429.	1317.	1217.	1129.
1046.	958.	858.	744.	625.	512.	418.	342.	282.	234.
201.	187.	175.	163.	152.	142.	132.	124.	115.	108.
100.	94.	87.	82.	76.	71.	66.	62.	58.	54.
52.	50.	46.	43.	40.	38.	35.	33.	31.	29.
27.	25.	23.	22.	20.	19.	18.	16.	15.	14.
13.	12.	12.	11.	10.	9.	9.	8.	8.	7.

CFS	2035.	1084.	332.	266.	39835.
CMS	58.	31.	9.	8.	1128.
INCHES		19.03	23.30	23.31	23.31
MM		483.46	591.78	591.96	591.96
AC-FT		538.	658.	658.	658.
THOUS CU M		663.	812.	812.	812.

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HYDROGRAPH ROUTING

ROUTING OF INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

STORAGE	0.00	12.50	31.00	47.50	60.00	67.80	76.00	85.50	96.00	108.00
	126.00	128.00								
OUTFLOW	0.00	5.00	7.80	9.40	10.30	32.30	155.00	654.00	1657.00	3060.00
	4962.00	5113.00								

STATION 2, PLAN 1, RTIO 1

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	3.	3.	3.	3.	4.	4.	5.	5.	5.
6.	6.	6.	7.	7.	8.	8.	8.	9.	9.
10.	10.	17.	41.	111.	166.	246.	263.	257.	244.
228.	211.	193.	173.	154.	145.	133.	121.	108.	96.
84.	74.	66.	59.	53.	48.	43.	39.	36.	33.
32.	31.	31.	30.	29.	29.	28.	27.	27.	26.
25.	25.	24.	23.	23.	22.	21.	21.	20.	19.
19.	18.	17.	17.	16.	16.	15.	15.	14.	14.
13.	13.	12.	12.	11.	11.	10.	10.	10.	10.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
2.	2.	2.	2.	2.	3.	3.	3.	3.	4.
4.	4.	4.	5.	5.	5.	5.	5.	6.	6.
6.	6.	7.	7.	8.	9.	10.	12.	14.	15.
17.	20.	22.	25.	29.	32.	32.	35.	39.	44.
50.	56.	62.	68.	73.	76.	78.	78.	78.	78.

McDARLAND - JOHNSON, ENGINEERS, INC.

77.	77.	77.	76.	76.	75.	75.	74.	73.	72.
71.	71.	70.	70.	69.	69.	69.	68.	68.	68.
68.	67.	67.	67.	67.	67.	66.	66.	66.	66.
65.	65.	65.	65.	64.	64.	64.	64.	63.	63.
63.	63.	63.	62.	62.	62.	62.	62.	61.	61.
61.	61.	61.	60.	60.	60.	60.	60.	60.	60.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	263.	117.	37.	29.	4391.
CMS	7.	3.	1.	1.	124.
INCHES		2.06	2.57	2.57	2.57
MM		52.20	65.17	65.25	65.25
AC-FT		58.	72.	73.	73.
THOUS CU M		72.	89.	90.	90.

MAXIMUM STORAGE = 78.

STATION 2, PLAN 1, RTIO 2

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	2.	2.	2.	3.
3.	3.	3.	3.	3.	3.	4.	4.	4.	4.
4.	4.	5.	5.	5.	6.	6.	6.	7.	7.
8.	8.	9.	9.	9.	10.	10.	18.	49.	151.
424.	582.	663.	682.	642.	600.	553.	509.	469.	434.
402.	371.	339.	303.	265.	225.	187.	155.	145.	133.
120.	109.	99.	90.	82.	76.	69.	64.	59.	55.
51.	47.	44.	41.	38.	35.	33.	32.	31.	31.
30.	30.	29.	29.	28.	27.	27.	26.	25.	25.
24.	23.	23.	22.	21.	21.	20.	19.	19.	18.
17.	17.	16.	16.	15.	15.	14.	14.	13.	13.

STOR

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

3.	3.	4.	4.	4.	5.	5.	6.	6.	6.
7.	7.	8.	8.	8.	9.	9.	10.	10.	10.
11.	11.	12.	13.	14.	16.	18.	21.	24.	27.
31.	34.	38.	43.	47.	52.	57.	63.	69.	76.
81.	84.	86.	86.	85.	84.	84.	83.	82.	81.
81.	80.	79.	79.	78.	77.	77.	76.	75.	75.
74.	73.	72.	72.	71.	71.	70.	70.	70.	69.
69.	69.	69.	68.	68.	68.	68.	68.	67.	67.
67.	67.	67.	66.	66.	66.	66.	66.	65.	65.
65.	65.	64.	64.	64.	64.	63.	63.	63.	63.
63.	62.	62.	62.	62.	62.	61.	61.	61.	61.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	682.	300.	86.	69.	10315.
CMS	19.	8.	2.	2.	292.
INCHES		5.26	6.03	6.03	6.03
MM		133.67	153.14	153.29	153.29
AC-FT		149.	170.	170.	170.
THOUS CU M		183.	210.	210.	210.

MAXIMUM STORAGE = 86.

STATION 2, PLAN 1, RTIO 3

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
2.	2.	2.	2.	2.	3.	3.	3.	3.	4.
4.	4.	4.	5.	5.	5.	5.	5.	5.	5.
5.	6.	6.	6.	6.	7.	7.	8.	8.	9.
9.	10.	10.	14.	32.	117.	252.	402.	519.	648.
845.	964.	1009.	982.	909.	828.	756.	695.	645.	609.
570.	528.	483.	433.	378.	321.	268.	221.	181.	153.
143.	133.	124.	115.	107.	100.	93.	87.	81.	75.
70.	65.	61.	57.	53.	49.	46.	43.	40.	37.
35.	33.	32.	32.	31.	31.	30.	29.	29.	28.
27.	27.	26.	25.	25.	24.	23.	23.	22.	21.
21.	20.	19.	19.	18.	17.	17.	16.	16.	15.

McDARLAND - JOHNSON, ENGINEERS, INC.

STOR

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	2.	3.	3.
4.	4.	5.	6.	6.	7.	7.	8.	8.	9.
10.	10.	11.	11.	12.	12.	13.	14.	14.	15.
15.	16.	17.	18.	20.	23.	26.	30.	34.	39.
44.	49.	55.	61.	68.	73.	78.	81.	83.	85.
88.	89.	89.	89.	88.	87.	87.	86.	85.	85.
84.	83.	82.	81.	80.	79.	78.	77.	77.	76.
75.	75.	74.	73.	73.	72.	72.	71.	71.	71.
70.	70.	70.	69.	69.	69.	69.	69.	68.	68.
68.	68.	68.	68.	67.	67.	67.	67.	67.	66.
66.	66.	66.	65.	65.	65.	65.	64.	64.	64.
64.	63.	63.	63.	63.	63.	62.	62.	62.	62.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1009.	478.	135.	108.	16256.
CMS	29.	14.	4.	3.	460.
INCHES		8.38	9.50	9.51	9.51
MM		212.94	241.36	241.56	241.56
AC-FT		237.	268.	269.	269.
THOUS CU M		292.	331.	331.	331.

MAXIMUM STORAGE = 89.

STATION 2, PLAN 1, RTIO 4

OUTFLOW

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	2.	2.
2.	2.	3.	3.	3.	3.	4.	4.	4.	5.
5.	5.	5.	5.	5.	6.	6.	6.	6.	6.
6.	6.	6.	7.	7.	8.	8.	9.	9.	10.
10.	23.	84.	210.	401.	494.	551.	610.	734.	926.
1112.	1254.	1312.	1277.	1182.	1076.	983.	903.	833.	771.
714.	659.	616.	574.	535.	498.	348.	287.	236.	195.

MOORLAND · JOHNSON, ENGINEERS, INC

89.	83.	78.	73.	68.	63.	59.	55.	52.	48.
45.	43.	40.	38.	35.	33.	32.	32.	31.	31.
30.	29.	29.	28.	27.	27.	26.	25.	25.	24.
23.	23.	22.	21.	21.	20.	19.	19.	18.	17.

STOR

2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	2.	3.	3.	4.	4.
5.	6.	7.	7.	8.	9.	9.	10.	11.	12.
12.	13.	14.	15.	16.	16.	17.	18.	19.	19.
20.	21.	22.	24.	27.	30.	34.	39.	45.	51.
57.	64.	71.	77.	81.	82.	84.	85.	86.	88.
90.	92.	92.	92.	91.	90.	89.	88.	87.	87.
86.	86.	85.	84.	82.	81.	80.	79.	78.	77.
76.	76.	75.	75.	74.	74.	73.	73.	72.	72.
72.	71.	71.	70.	70.	70.	70.	69.	69.	69.
69.	68.	68.	68.	68.	68.	68.	68.	67.	67.
67.	67.	67.	66.	66.	66.	66.	65.	65.	65.
65.	64.	64.	64.	64.	63.	63.	63.	63.	63.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1312.	652.	185.	148.	22206.
CMS	37.	18.	5.	4.	629.
INCHES		11.45	12.98	12.99	12.99
MM		290.87	329.72	329.99	329.99
AC-FT		324.	367.	367.	367.
THOUS CU M		399.	452.	453.	453.

MAXIMUM STORAGE = 92.

STATION 2, PLAN 1, RTIO 5

OUTFLOW

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	2.	2.	2.
3.	3.	3.	4.	4.	4.	5.	5.	5.	5.
5.	6.	6.	6.	6.	6.	6.	6.	7.	7.

McFARLAND - JOHNSON, ENGINEERS, INC.

7.	7.	7.	8.	8.	8.	9.	9.	10.	18.
71.	209.	430.	540.	605.	652.	714.	789.	932.	1143.
1369.	1544.	1615.	1572.	1455.	1325.	1210.	1111.	1025.	948.
879.	811.	736.	653.	589.	508.	426.	352.	290.	239.
200.	173.	156.	151.	145.	139.	133.	126.	119.	113.
106.	100.	94.	88.	83.	77.	72.	68.	63.	59.
55.	52.	49.	46.	43.	41.	38.	36.	33.	32.
32.	31.	31.	30.	29.	29.	28.	27.	27.	26.
25.	25.	24.	23.	23.	22.	21.	21.	20.	19.

STOR

2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	3.	4.	5.	5.
6.	7.	8.	9.	10.	11.	12.	13.	14.	14.
15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
25.	26.	28.	30.	33.	37.	43.	49.	55.	63.
70.	77.	81.	83.	85.	85.	86.	87.	88.	91.
93.	95.	96.	95.	94.	93.	91.	90.	89.	89.
88.	87.	86.	85.	84.	83.	81.	80.	79.	78.
77.	76.	76.	76.	75.	75.	75.	74.	74.	73.
73.	72.	72.	72.	71.	71.	70.	70.	70.	70.
69.	69.	69.	69.	69.	68.	68.	68.	68.	68.
68.	67.	67.	67.	67.	67.	66.	66.	66.	66.
65.	65.	65.	65.	64.	64.	64.	64.	63.	63.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1615.	828.	235.	188.	28163.
CMS	46.	23.	7.	5.	798.
INCHES		14.54	16.46	16.48	16.48
MM		369.29	418.19	418.52	418.52
AC-FT		411.	465.	466.	466.
THOUS CU M		507.	574.	574.	574.

MAXIMUM STORAGE = 96.

STATION 2, PLAN 1, RTIO 6

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	2.	3.
3.	4.	4.	4.	5.	5.	5.	5.	6.	6.
6.	6.	6.	7.	7.	7.	7.	7.	7.	8.
8.	8.	8.	8.	9.	9.	10.	13.	53.	194.
458.	589.	674.	753.	802.	847.	897.	987.	1165.	1429.
1718.	1955.	2029.	1959.	1802.	1639.	1510.	1389.	1281.	1186.
1099.	1013.	920.	815.	700.	606.	521.	435.	361.	298.
249.	216.	195.	179.	166.	155.	151.	146.	140.	134.
127.	121.	114.	107.	101.	95.	89.	84.	78.	73.
69.	65.	61.	58.	54.	51.	48.	45.	42.	39.
37.	34.	32.	32.	31.	31.	30.	30.	29.	28.
28.	27.	26.	26.	25.	24.	24.	23.	22.	21.

STOR

2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	3.	3.	4.	4.	5.	6.	7.
8.	9.	10.	11.	12.	13.	15.	16.	17.	18.
19.	20.	22.	23.	24.	25.	26.	28.	29.	30.
31.	33.	35.	38.	42.	47.	53.	61.	69.	77.
82.	84.	86.	87.	87.	88.	88.	89.	91.	94.
97.	99.	99.	99.	97.	96.	94.	93.	92.	91.
90.	89.	88.	87.	86.	85.	83.	81.	80.	79.
78.	77.	77.	76.	76.	76.	76.	75.	75.	75.
74.	74.	73.	73.	72.	72.	72.	71.	71.	71.
70.	70.	70.	69.	69.	69.	69.	69.	68.	68.
68.	68.	68.	68.	67.	67.	67.	67.	67.	66.
66.	66.	66.	65.	65.	65.	65.	64.	64.	64.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2029.	1059.	301.	241.	36115.
CMS	57.	30.	9.	7.	1023.
INCHES		18.60	21.11	21.13	21.13
MM		472.33	536.27	536.68	536.68
AC-FT		525.	596.	597.	597.
THOUS CU M		648.	736.	736.	736.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 0.20	RATIO 2 0.35	RATIO 3 0.50	RATIO 4 0.65	RATIO 5 0.80	RATIO 6 1.00
HYDROGRAPH AT	1	0.53	1	407.	712.	1017.	1323.	1628.	2035.
	(	1.37)	(	11.52)(	20.16)(	28.81)(	37.45)(	46.09)(	57.61)(
ROUTED TO	2	0.53	1	263.	682.	1009.	1312.	1615.	2029.
	(	1.37)	(	7.46)(	19.33)(	28.58)(	37.16)(	45.73)(	57.47)(

Appendix D

Stability Computations

Foundation Design, P.C.
SOIL • BEDROCK • GROUNDWATER

January 16, 2014

TY Lin International
255 East Avenue
Rochester, New York 14604

Attn: James Guistina, P.E.

Ref: Conewango Creek Watershed Dam 33
Pickup Hill Road, Cherry Creek, New York
Geotechnical Consultation, 3788.33

Dear Mr. Guistina,

This report summarizes our geotechnical consultation of the earth embankment at Site 33 of the Conewango Creek Watershed Project. This consultation is based on review of your recent inspection observations; the July 1980 Phase I Inspection Report; the 1974 as built Soil Conservation Service Design Plans; and our October visual inspection of the dam. TY Lin International retained Foundation Design, P.C. to provide geotechnical services outlined in our September 6, 2013 *Geotechnical Services Proposal, P3420.0.* We intend this report exclusively for use on this project.

The Conewango Creek Watershed is located in Chautauqua County, New York. Site 33 is located east of Pickup Hill Road south west of the Village of Cherry Creek, New York.

The dam serves as a floodwater retarding structure. The embankment is 57 feet high and has a length at the crest of 325 feet. The maximum storage capacity of the dam is 128.3 acre-feet. The upstream slope is (V:H) 1:3 and the down hill slope is (V:H) 1:2.5.

Our visual observation mirrored yours. We noted water/seepage along the interface of the embankment and the native soil on both the east and west ends, more so on the east end. Note that there were some heavy rain showers the night before our site visit, so we are not sure if the seepage is 'regular' or 'intermittent'. Dense grassy vegetation indicates that erosion has not been an issue herein. We noted that the mowing technique used on the downhill face has resulted in some rutting of the surface topsoil. It appears that the mowers travel down the embankment, mark a sharp turn at the bottom to cross the embankment, then make a similar turn to travel up the embankment. These sharp turns are disturbing the topsoil.

Downhill face looking east. Surface disturbance appears to be from mower

The dam embankment consists of borrow material generated from cut for the overflow spillway, located along Pickup Hill Road and other borrow area adjacent to the dam. The dam embankment material is divided into two zones (I and II). Zone I is the core of the dam and cutoff trench. This zone is comprised primary of a low plasticity silt (ML). Zone II makes up the outer (30'+) surface of the dam. This zone consists primary of silty gravel (GM) with less than 20

percent fines. Design values used for the stability analysis of the dam slope were based on consolidated-undrained triaxial shears tests of remolded specimens. Below is a table outlining these values.

Zone/Material	Friction Angle/Degrees	Cohesion/psf
Zone I/Silty Gravel (GM)	28.5	375
Zone II/ Silt (ML)	26.5	800

Geologic conditions beneath the dam generally consist of alluvial granular soils over glacial till then shale and siltstone bedrock. Boring and test pit logs from the predevelopment assessment classify the upper soils as silty sand and gravel. The deeper glacial till deposits consist of silt and clay with sand. Shale and siltstone bedrock was encountered at the boring locations. Core samples of the bedrock were thinly bedded (RQD 0%).

We performed slope stability analysis of the downhill and uphill portions of the dam embankment. Our analysis utilized the design parameters derived during the design phase of the project. Our analysis methods were Spencer-Wright and Bishop Simplified. The minimum factor of safety computed was 1.90. This occurred within the silty gravel embankment material, on the downhill slope, under saturated conditions. The recommended long term factor of safety (U.S. Army Corps of Engineers) for earth dams is 1.5.

As part of our seismic stability analysis we reviewed liquefaction, slope stability under seismic loading and geologic mapping of western New York faults.

- We applied a pseudo-static earthquake coefficient of 0.036 (1/2 of site PGA) to our slope analysis. The minimum factor of safety under this scenario was 1.75. The recommended minimum Factor of Safety under seismic load is greater 1.0.

- A liquefaction analysis of the embankment material and underlying native soil has a factor of safety against liquefaction over 5.0.
- No active fault zones have been documented in the area. The nearest active fault zone (Clarendon-Linden) is located in Wyoming and Allegany counties, over 40 miles to the northeast.

We found no structural geotechnical issues with the dam. This concludes our geotechnical evaluation/assessment of the embankment.

Very truly yours,

FOUNDATION DESIGN, P.C.

James M. Baker, P.E.
President
Enc.

Geotechnical Analysis

Conewango Creek Site 33 Dam

NYS Dam ID: 007-3917

Town of Cherry Creek, County of Chautauqua, State of New York

April 2014

Prepared By:	Prepared For:
T·Y·LIN INTERNATIONAL	CHAUTAUQUA COUNTY · STATE OF NEW YORK · 1811 · BICENTENNIAL · 2011

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I. Slope Stability Analysis

1. Review Objective

For slope stability check, the site conditions, constructability and economy need to be considered.

2. Applied Safety Factor

Section	Minimum safety factor	
Embankment region	User Defined	FS >= 1.3

II. Applied Properties

1. Soil Properties

Section	Wet unit weight (kip/ft^3)	Saturated unit weight (kip/ft^3)	Cohesion (kip/ft^2)	Internal friction angle ([deg])	Modulus of elasticity (kip/ft^2)	Poisson's ratio
GM-Zone2_alluvial	0.134500	0.140500	0.3750	28.50	-	-
ML_Zone1_Till	0.121000	0.128500	0.8000	26.50	-	-
Weathered Rock	0.129227	0.135593	0.6370	29.50	-	-
Class V Rock	0.138776	0.145142	1.7753	30.00	-	-

III. Analysis Results

1. Dry Season

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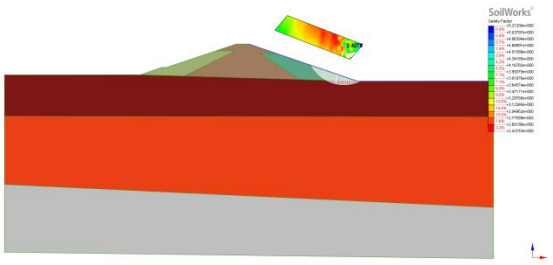
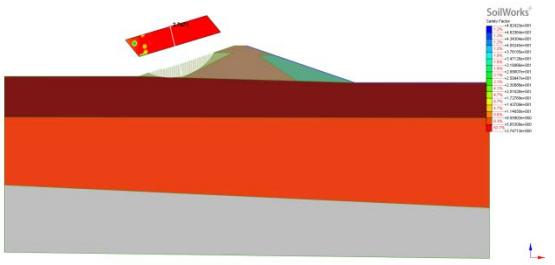
<tr><td colspan="3">  </td><td colspan="3">  </td></tr>
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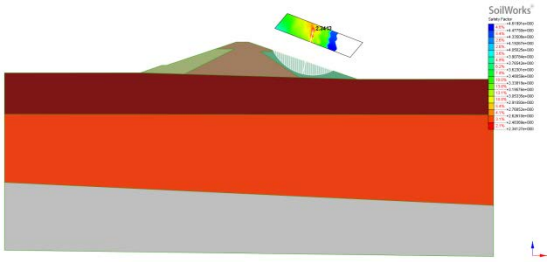
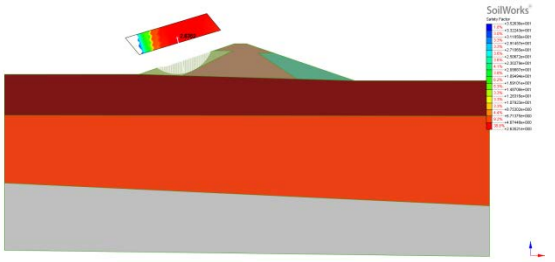
<tr><td colspan="3">  </td><td colspan="3">  </td></tr>
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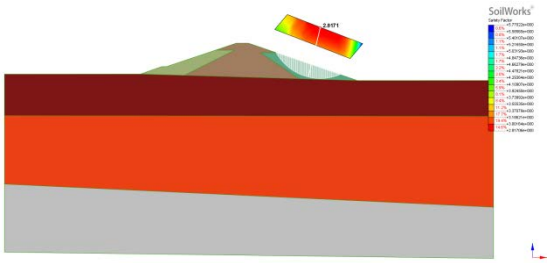
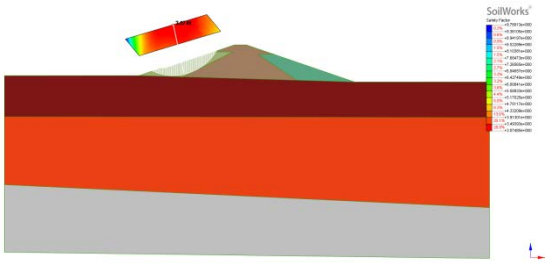
<tr><td colspan="3">  </td><td colspan="3">  </td></tr>
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Standard safety factor	1.300	Evaluation	Standard safety factor	1.300	Evaluation
Analysis safety factor	2.817	**OK**	Analysis safety factor	3.075	**OK**

- Dry season's Embankment region slope stability check : In case of right side before drawdown,left side before drawdown,right side after drawdown,left side after drawdown,right side empty,left side empty allowable safety factor 1.3 has been satisfied. Determined to be safe.

Sheet ... of ____

10-59

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

Cherry Creek 7½ min. quadrangle

State New York County Chautauqua ; ___ ¼, ___ ¼, Sec. ___, T ___ R ___ ; Watershed Conewango Creek

Subwatershed Cherry Creek Fund class WP-08-2 (FP-2, WP-1, etc.) Site number 33 Site group 1 Structure class c

Investigated by Bruce Champeon, Geol. (signature and title), Equipment used See general information (Type, size, make, model, etc.), Date 11/17-12/18/69

SITE DATA

Drainage area size .47 sq. mi., 300 acres. Type of structure Earth Fill Dam Purpose Floodwater retarding

Direction of valley trend (downstream) north Maximum height of fill 57 feet. Length of fill 320 feet.

Estimated volume of compacted fill required 41,700 yards; excavation from spillway, 17,050 c.y.

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
50-yr Sediment	3.3	0.7	15.7
Floodwater	89.4	5.44	45.8

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Allegany Plateau Topography rolling Attitude of beds: Dip essentially horizontal Strike 1% SW NW

Steepness of abutments: Left 30-68 percent; Right 47-190 percent. Width of floodplain at centerline of dam 65 feet

General geology of site: The site is located on an unnamed tributary of Cherry Creek approximately 4,900 feet southwest of the center of the village of Cherry Creek. The stream is approximately 330 feet east of Pickup Hill Road.

Bedrock is the Northeast shale, a medium gray shale with some interbedded medium gray siltstone, and is of upper Upper Devonian age.

During the last glaciation (Wisconsin) the small stream-cut valley was slightly widened and deepened by ice. As the ice sheet waned, valley-flanking kame terrace deposits of the Findley recessional moraine formed between the valley walls and the glacier in the large Conewango valley. Later, the remaining ice of the highlands stagnated leaving the major part of the region mantled with the Kent ground moraine deposits.

Site 33 is wholly within the area of Kent ground moraine, but is less than 1000' from the area mapped as kame terrace deposits.

The materials at the site seem to belong to both areas and may represent a ...sitional zone between the two, or more likely they represent minor fluctuations of the ...erally stationary margin of the ice sheet.

Modern alluvial gravel is found in the flood plain.

(2)

The supplemental borrow area east of Pickup Hill Road contains SM and ML glacial tills, GM glacial outwash gravel and some ML glacio-lacustrine sediments. Topsoil covers the area to about an average depth of one foot. The upper part of the left abutment where it is less steep has topsoil over glacial till and glacio-lacustrine CL-ML's and ML's. The steeper part of the left abutment as you approach the stream has a few feet of glacial till over very highly weathered bedrock. The steepest portion has no till, just badly weathered bedrock over fairly sound shales and siltstones. Topsoil is continuous over this whole abutment.

The flood plain is thinly mantled with topsoil over 4-6 feet of dirty alluvial gravel in the GM-GP-GW range. This gravel covers 4-5 feet of either gray or brown often silty till. Bedrock is at approximately a 10 foot depth underneath the flood plain.

Topsoil covers the entire right abutment except for the extremely steep 190% slope adjacent to the stream. Bedrock on the right abutment is very highly weathered to a depth of from 1-6 feet. Beyond that it is fairly sound. The upper part of the right abutment has 6-10 feet of glacial till over bedrock.

The right emergency spillway area contains an assortment of glacial tills, glacial outwash sands and gravels, and glacio-lacustrine CL-ML's and ML's. Bedrock in the emergency spillway is found at depths of 4-20 feet.

GENERAL INFORMATION

Backhoe work began November 17, 1969 and was finished on November 20, 1969. Twenty pits were dug with a Schield-Bantam, crawler-type, cable operated backhoe with a maximum digging depth of approximately twenty feet. Large bag samples were collected and processed in the soils laboratory in the Syracuse State Office; also several were shipped to the SML in Lincoln for further testing.

Drilling work began December 5, 1969 and was finished December 18, 1969. Holes were drilled with one trailer-mounted Acker Hillbilly rotary drill rig and one truck-mounted Acker power auger. A small John Deere bulldozer was used for mobilization between holes. Samples were obtained with a 2" O.D. split spoon sampler in conjunction with standard penetration tests, mostly of a 2' drive. Holes were advanced with casing and roller bits. Recovery was logged and stored in sealed wide-mouthed Mason jars. Bedrock was cored with an NX double-tube core barrel with diamond bit. The core was logged and stored in standard NX wooden core boxes. Water pressure tests were donducted in three holes along the centerline of dam.

Because the hazard classification was changed from class "b" to class "c" and bedrock was quite shallow in the emergency spillway, it was decided to investigate a supplemental borrow area on the left hand side of the dam between the dam and the road. Five additional pits were dug on December 17 with a rubber-tired John Deere backhoe and loader. These pits were also sampled and the materials processed in the soils lab in Syracuse.

BRIEF MATERIAL DESCRIPTIONS

CONEWANGO 33

A Glacial outwash and stream channel gravel, found in the borrow area, emergency spillway, and flood plain. 50-70% gravel, 10-20% slightly-moderately plastic fines. Not highly permeable. GP-GM-GW

B Road fill gravel, much like A, but with many roots, logs and much brush. GM

C Glacial outwash sand found only in one drill hole in the emergency spillway (DH 254) SM

D Mostly brown glacial till (sand and silt) found in the borrow area, top of both abutments, emergency spillway, and above rock in the flood plain. Ranges from SC-SM to CL-ML.

E Grayish glacial till, more clayey than D, and found only in the flood plain.

F Highly weathered bedrock found mostly on the steep abutment slopes. Ranges from SC-SM to CL-ML, rips easily.

G Glacio-lacustrine CL-ML found in the upper part of the left abutment and in the emergency spillway.

H Weathered glacial till found beneath topsoil in borrow area, upper part of both abutments, and the emergency spillway. Non-plastic ML.

I Glacio-lacustrine ML found in the borrow area, upper part of the left abutment, and the emergency spillway. Non-plastic.

J Topsoil covering the area except for the steepest part of the right abutment.

K Thinly bedded shale and limestone bedrock found everywhere but the borrow area. Usually weathered in the top few feet. Hopefully rippable in most cases.

(44)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS-376B
REV. 2-64
SHEET ____ OF ____

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Centerline of Dam

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
			UNDISTURBED	DISTURBED	
	EXPLORATION	SAMPLING	(STATE TYPE)	LARGE	SMALL
Backhoe	4	2	0	3 bag	0
Drill Rig	3	3	3 NX Core	0	16 jar
TOTAL	7	5	3 NX Core	3 bag	16 jar

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

Topsoil averages about 0.8' under the embankment except the very steep 190% pe on the right abutment. Subsoil (weathered till H, ML) underlies topsoil on the upper slopes with brown till D, CL-ML to GC-GM, under subsoil. Some areas of glacio-lacustrine silts and clays and outwash sands and gravels are found high upon the abutments.

On the steeper slopes weathered bedrock F, (CL-ML) covers shale and siltstone bedrock.

In the floodplain alluvial and road-fill gravels cover gray and brown tills which rest on bedrock. Logs and brush are found along the bottom of the road fill which is found between the stream and the right abutment.

The steep slopes weep water nearly everywhere. In the flood plain water levels are at 1463 $\pm$ 0.5' in all holes along the centerline.

Bedrock recovery was acceptable in most cases, however, the RQD was low.

No areas of critically low blow counts occur anywhere below the first couple of feet.

Permeability is highest in the alluvial gravel but is not excessive.

Pressure tests were run in three holes. Results are tabulated in the summary sheet near the end of the narrative section of the report.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS-376B
REV. 2-64
SHEET ____ OF ____

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Drain Line

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
			UNDISTURBED	DISTURBED	
	EXPLORATION	SAMPLING	(STATE TYPE)	LARGE	SMALL
Backhoe	3	2	0	2 bag	0
TOTAL	3	2	0	2 bag	0

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

The drain line profile is essentially the same as the centerline of dam file except that the till D is found on the right side only and does not occur under the whole flood plain.

Seepage occurs all along the steep banks. Water levels were 1460.8 in TP 502 and 1459.0 in TP 303.

Bedrock was at 1356 ± 0.5' in the two holes near the stream, and is slightly shallower than at the centerline.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS-376B
REV. 2-64
SHEET ____ OF ____

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Principal Spillway and Outlet Channel

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
	EXPLORATION	SAMPLING	UNDISTURBED (STATE TYPE)	DISTURBED LARGE	DISTURBED SMALL
Backhoe	4	0	0	0	0
Drill Rig	3	3	3 NX Core	0	18 jar
TOTAL	7	3	3 NX Core	0	18 jar

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

Topsoil is from 0.4-0.8' thick in all holes.

The general sequence of materials is a road fill gravel (B), GM, over alluvial gravel (A), GM-GW, which covers either gray or brown till (E or D) CL-ML, resting on bedrock (K).

The road fill has logs and brush near the bottom and the alluvial gravel is the most permeable material, but not excessively so.

Bedrock hovers around 1456' in the upper 2/3 of the spillway and drops to around 1450' in the lower 1/3.

Water levels are apparently controlled by the creek in most cases.

Blow counts range from 13-140, but most are from 20-55.

DH 352 was pressure tested and the results tabulated in the summary sheet near the end of the narrative.

Bedrock recovery was good, but the RQD was low.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS-376B
REV. 2-64
SHEET ____ OF ____

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Emergency Spillway

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
	EXPLORATION	SAMPLING	UNDISTURBED (STATE TYPE)	DISTURBED LARGE	DISTURBED SMALL
Backhoe	8	3	0	6 bag	0
Drill Rig	4	4	4 NX Core	0	20 jar
TOTAL	12	7	4 NX Core	6 bag	20 jar

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

Topsoil covers the spillway area to about 0.6' in depth. Beneath this is from of subsoil, weathered till H (ML).

Glacial till D and outwash gravel A make up most of the remaining material. However, smaller areas of glacio-lacustrine silts and clays occur also, the most noticeable being an apparently continuous layer of I, (ML) along the outer profile.

Bedrock elevations are fairly consistent except near the steeper slopes.

Blow counts range from 12-40, discounting those near bedrock and near the surface.

Water is usually absent, except for a couple of minor seeps.

No pressure tests were run in the spillway holes.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS-376B
REV. 2-64
SHEET ____ OF ____

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Borrow Area

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
			UNDISTURBED	DISTURBED	
	EXPLORATION	SAMPLING	(STATE TYPE)	LARGE	SMALL
Backhoe	5	4	0	4 bag	0
TOTAL	5	4	0	4 bag	0

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

The pits were dug between the dam and Pickup Hill road to the west. No graphic information was available, so they were not surveyed and plotted. They cover the entire field and show about 1.0' of topsoil over 1.5-3.5' of subsoil H.

Two pits show material A, alluvial or outwash gravel to 10'. Of the other three two show till D and the other glacio-lacustrine CL-ML, I.

Only one pit (104) showed minor seepage.

INTERPRETATIONS AND CONCLUSIONS

CONEWANGO 33

Centerline of Dam

The upper part of the left abutment around TP 1 is glacial till (D and H), with areas of glacio-lacustrine silts and clays (G and I). Bedrock is fairly shallow (6.5') in DH 51 and comes closer to the surface as you go down the slope towards the stream. The steep part of the slope is highly weathered bedrock (F) over shales and siltstones (K). Topsoil (J) covers the abutment to an average depth of about 0.8'.

The flood plain shows road fill (B) and alluvial gravel (A) over glacial tills (D and E) which cover bedrock (K). Topsoil (J) is thin. Bedrock is at about 9' across the flood plain.

The lower part of the right abutment is highly weathered bedrock (F) over shallow shales and siltstone (K). The upper part has tills (D and H) over bedrock (K).

Water is apparent only in the flood plain where the creek controls the water table and on the steep slopes which are constantly weeping because of slowly draining bedrock. This made these slopes extremely slippery all the time of the investigation.

Blow counts are adequate over the entire site. No consolidation or differential settlement should occur because of soft foundations.

I would suggest removal of all of the old road fill material (B), since it contains large amounts of brush and logs, apparently used to protect the road bed from stream erosion. This amounts to about 1200 c.y. of material to be removed.

If we adhere to what seems to have become the standard practice of flattening abutment slopes to 2:1, this means cutting the right abutment back 24 to 40' horizontally, depending upon the elevation of the bottom of the cutoff or principal spillway trench.

Looking at the centerline of dam profile, it appears that a positive cutoff could be achieved by bottoming in the glacial till (D and E). However, the till doesn't extend across the flood plain along the drain line. Since the possibility exists that the interpretation on the centerline may be incorrect and that the till may <u>not</u> extend completely across the flood plain, I suggest that the cutoff extend to sound rock, which should be around the 12' depth.

Consideration should be given to either stripping the material on the abutment down to sound rock or providing a cutoff through weathered materials and into sound rock.

The abutments wept continuously and were always wet and slippery, probably due to ground water carrying silt and clay from the weathering bedrock in the abutments. This condition probably will persist after construction and may keep the embankment-abutment interface wetter than normal. I suggest considering some type of drainage to handle this water.

Centerline of Dam (cont'd)

Pressure tests of rock core holes showed losses of about 1 to 13 fpd at various pressures and depths. This leakage should be either cutoff or a drain provided to intercept it.

Some type of pump and trench system will be needed to keep the principal spillway cutoff and drain line trenches dry during excavation and construction.

The gravel in the flood plain is not extremely stable on steep slopes so some caving and sloughing should be expected. It should be more stable when the water table is lowered.

The steepness of the abutments and the relief involved (about 90') indicates that the ramps (haul roads) from the spillway and borrow area will have to be quite long to reduce the slope to a workable grade during the earlier stages of construction. That is, these roads will extend quite a ways up and down the valley; therefore the construction limits on the land rights maps should reflect this.

Embankment

Several materials will be available for the embankment: alluvial gravel A, outwash sand C, glacial till D and E, highly weathered bedrock F, glacio-lacustrine silts and clays G and I, weathered till H, topsoil J, and bedrock K. I suggest spoiling road fill B because of the large amount of brush mixed in with it.

Amounts of C and G are small and represent only a minor part of the spillway excavation.

Analysis of the grain size curves shows three general groups. I suggest placement of these grouped materials as follows: fine grained materials G, H, and I in an impervious central core; coarse, cleaner gravel A in the outer parts of the dam; and materials C, D, E, F in the area between the other two.

Normal side slopes probably will suffice.

There are no soft areas in the foundation that will contribute to differential settlement. However, the steepness of the right abutment results in having a section of fill at least 57' high only 8' away from a section that is 38' high. More settlement will occur in the higher section than the lower and cracking due to differential consolidation within the embankment could result. The materials are not highly susceptible to cracking though.

Establishing vegetation should not present any problem.

Drain Line

Rotten, highly weathered bedrock F occurs on both abutments. The flood plain shows alluvial gravel A and road fill B over bedrock. Some till D is found under the ditch on the right side of the flood plain.

I suggest carrying the drain to sound bedrock over its entire length, since rock is shallow anyway. The drain should extend beyond permanent pool elevation to pick up any seepage that comes through the abutment unless it is cutoff by the core trench.

Drain Line (cont'd)

The drain will be in contact with materials A (502.1) and F (501.1), as well as the embankment materials. The grain size curves show representative samples of each material.

No natural filter material is available at the site.

Principal Spillway

There were no alternate locations considered because the valley is so narrow anyway.

Thin topsoil covers road fill B. Beneath this alluvial gravel A over tills D or E and bedrock.

Since I have previously suggested removing all the road fill material, I don't believe any further excavation is necessary. This way we could kill two birds with one stone by removing an undesirable material and excavating the spillway trench at the same time. However, it appears that the present location is too close to the steep right abutment. I suggest that the spillway be moved roughly 25' left and possibly cocked a little to more nearly conform with the alignment of the present channel. Backfill with good till D.

A lot of water will have to be removed while the trench is open, so probably some kind of pump and trench system would be best.

Camber should be minimal because there are no soft materials present.

Outlet Channel

The outlet channel will be constructed mostly in alluvial gravel A. Presently this is subject to erosion during flood flows, but after the dam is constructed, the proposed outlet discharges and velocities should not erode the natural alluvial gravels.

If the channel needs to be very deep, some sloughing and caving should be expected.

There might be enough large siltstone flags ripped out to serve as riprap, but the low RQD indicates that probably the rock would not pass the soundness or LA abrasion tests. Also the flaggy shape would not be well suited for riprap, since the thickness of the flags would be only 2-4".

Emergency Spillway

Estimated quantities of available excavation are as follows: A - 1820 c.y., GHI - 5280 c.y., CDEF - 4485 c.y., J - 1020 c.y., K - 2130 c.y.

The RQD of cores seems to indicate that the bedrock will be rippable, at least for the most part. The one tough spot might be near TP 208, where there is over 8' of rock above grade.

Emergency Spillway (cont'd)

Silt I and sand C will be exposed on the cut slope. These might be a bit unstable under wet conditions,- which were not observed. Most pits were quite dry and showed little or no seepage.

Oversize (+6") waste material can be placed on the outer slope of the embankment near the downstream toe.

Borrow Area

The lack of topographic information in the borrow area makes it difficult to accurately portray borrow area profiles and quantities. On a basis of ten-foot deep holes over an approximate area of 1 1/2 acres we have the following quantities: of available borrow: A - 6140 c.y., D - 6335 c.y., HI - 8470 c.y., J - 2420 c.y.

This leaves us a little short of material but I expect we can go the knob just north of the borrow area and can excavate to a depth greater than ten feet. I don't expect to find anything there we haven't seen yet someplace.

Probably the natural moisture is a bit below optimum since most pits don't show any seepage.

GEOLOGY REPORT

JAN. 1959

SITE #33
CONEWANGO WATERSHED
CHAUTAUQUA COUNTY S&WCD
NEW YORK

SUPPLEMENTAL REPORT

LEFT EMERGENCY SPILLWAY

APPROVAL:

Richard L Phillips

Richard L. Phillips
State Conservation Engineer

PREPARED BY:

D Bruce Champeon

D. Bruce Champeon
Geologist

REVIEWED BY:

B. S. Ellis

Bernard S. Ellis
Senior Staff Geologist

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. NY-2173(A) SHEET 1 OF 15 DATE 2/9/71

GENERAL INFORMATION

Since a large quantity of bedrock was present in the proposed right emergency spillway excavation, it was decided to fully investigate the feasibility of moving the emergency spillway to the left side of the embankment. Five pits had been dug in the general area of the left spillway, but they were not located in the right places to give the needed information. Also, these pits were only ten feet deep because they were intended as borrow area pits.

Eight backhoe pits were dug with a Schield-Bantam, crawler type, cable-operated backhoe with a maximum digging depth of about twenty feet. Six large bag samples were collected and processed in Syracuse.

Four drill holes were drilled with a truck-mounted CME rotary drill rig. Samples were obtained with a 2" OD split-spoon sampler in conjunction with standard penetration tests, mostly of a 2' drive. Holes were advanced with 6" OD hollow stem flight augers. Recovery was logged and stored in sealed wide-mouth Mason type jars. Five jar samples were processed for correlation purposes.

All field work was done from 12/21/70 to 12/23/70.

The present design shows 35,500 c.y. of spillway excavation available and 46,500 c.y. of embankment fill needed, leaving 11,000 c.y. to be obtained from a borrow area, probably in the area of the old right spillway.

The initial report was prepared in March 1970 and covered all aspects of the site. This report adds a discussion of the new left emergency spillway and revises the borrow and embankment discussions. This report must be used in conjunction with the original. The material designations remain the same as the old ones.

S. DEPARTMENT OF AGRICULTURE
OIL CONSERVATION SERVICE

FORM SCS-376B
REV. 2-64
SHEET 1 OF 2

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Left Emergency Spillway

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
			UNDISTURBED	DISTURBED	
	EXPLORATION	SAMPLING	(STATE TYPE)	LARGE	SMALL
Backhoe	13	9	0	10 bag	0
Drill Rig	4	4	0	0	38 jar
	17	13	0	10 bag	38 jar
TOTAL					

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

Topsoil "J" averages 0.9', but ranges in thickness from 0.3' to 1.5'. Beneath topsoil "J" lies from 1.0' to 3.5' of weathered ablation till subsoil "H" (ML). No material "H" was found in TP215.

Three other types of materials are present:

1) Poorly stratified, ice-contact, glaciofluvial gravel or sand "A" that may classify as any of the following (GP-GM, SC-SM, GC-GM, SM, GM). Has less than 20% fines.
2) Sandy, ice-contact glacial till "D" that may classify as SM, SC-SM, or CL-ML. Has 40-55% fines.
3) Glaciofluvial sands and silts "C" interbedded with glaciolacustrine sands, silts, and clays "G" and "I".

Glacial till "D" is found mainly beneath "H" but above grade in the upper part of the inlet section, level section, and upper part of the outlet section. This material ranges from 3-15' thick and may be lensed or interbedded with other materials.

The gravel "A" is found mainly in the outlet section beneath "H" all the way to and below grade. It also extends beneath "D" near the level section and is still at and below grade.

3

S. DEPARTMENT OF AGRICULTURE
OIL CONSERVATION SERVICE

FORM SCS-376B
REV. 2-64
SHEET 2 OF 2

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Left Emergency Spillway (cont'd)

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
	EXPLORATION	SAMPLING	UNDISTURBED (STATE TYPE)	DISTURBED LARGE	DISTURBED SMALL
TOTAL					

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

Most of the finer glaciofluvial sands and silts "C" and the glaciolacustrine materials "G" and "I" are found above and below grade at the level section and the inlet section. Minor amounts of "C" are found scattered elsewhere.

Bedrock "K" was found 21' below grade in DH258.

Water levels indicate that the gravel is well drained since little water was observed in these pits or holes. The inlet section holes showed fairly high water levels or seepage levels, mostly in till or the sands and glaciolacustrine fine grained materials.

Blow counts range from 9-67 discounting topsoil and the one blow count near bedrock. Most are above 20.

INTERPRETATIONS AND CONCLUSIONS

Left Emergency Spillway

Estimated quantities of excavation are as follows:
A-20,000 c.y., CD-8800 c.y., HI-4200 c.y., J topsoil)-1800 c.y. Approximately 700 c.y. of +6" material is excluded from the above figures.

All materials will be exposed at one place or another on the cutslope. The vast majority of grade will fall in material "A" and the rest will be in "C" except for very minor areas that will be in "I".

Some special consideration may need to be given to seeding the spillway, since the fines content is below 16% in gravel "A", and the area is generally dry. The inlet section is wetter and in till or lacustrines with plenty of fines.

I should point out that the profiles as shown probably present a more simplified story of deposition than really exists. The following quote should show why - "Ice-contact stratified drift shows, through details of form or internal character, that is accumulated in contact with glacier ice. Internally, three general characteristics distinguish it from outwash: (1) extreme range and abrupt changes in grain size, (2) included bodies of till, and (3) deformation. . . . . Whether accumulation takes place upon, against, or underneath the wasting terminal zone of the glacier, it is likely to be sporadic and irregular, with no intervening distance to smooth out diurnal and seasonal differences in rate of melting and release of sediment. The same site may successively see a rushing stream, a quiet pool, a small avalanche of boulders, and actual overriding by ice, folding or faulting the layers of sediment or smearing till on them . . . . . In such a place anything can happen, and it usually does.[1]"

Borrow Area

Most of the old right emergency spillway above rock will probably be used as additional borrow. The estimated quantities of excavation available are as follows: A-1800 c.y., CD-4500 c.y., GHI-5300 c.y. Approximately 200 c.y. of +6" material is excluded from the above figures.

The present land rights map may be a bit restrictive if the borrow area has to be expanded. Some consideration should be given to enlarging the land rights if necessary. As far as materials are concerned, there is no reason this area can not be expanded.

This area is also generally dry. Little seepage was observed.

Embankment

Every material will be available for use in the embankment, with the possible exceptions of bedrock K, which might not be excavated, and road fill B, which should be spoiled because of the large amount of brush in it. Only minor amounts of E and F will be available.

[1]Flint, Richard Foster, 1957, Glacial and Pleistocene Geology, John Wiley & Sons, London, p. 146.

Analysis of the grain size curves shows three general groups. I suggest placement of these grouped materials as follows: fine grained GHI in the impervious central core; coarse, clean gravel A in the outer parts of the dam; and CD in the area between the other two.

It may be necessary to add moisture to the gravel "A" to get it up to optimum moisture.

Establishing vegetation may require a seed mix set up for low moisture and few fines, since the gravel "A" will be on the outside of the embankment.

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE - Soil Mechanics Laboratory

800 "J" Street, Lincoln, Nebraska 68508

SUBJECT: ENG 22-5, New York WP-08, Conewango Creek Site No. 33 (Chautauqua County)

DATE: September 14, 1970

TO: Richard L. Phillips, State Conservation Engineer
SCS, Syracuse, New York

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 2 sheets.
2. Form SCS-355A, Triaxial Shear Test Data, 2 sheets.
3. Form SCS-352, Compaction and Penetration Resistance, 4 sheets.
4. Form SCS-372A & B, Placement of Earth Fill Materials, 3 sheets.
5. Form SCS-357, Summary - Slope Stability Analysis, 2 sheets.
6. Form SCS-130, Drain Materials, 1 sheet.
7. Investigational Plans and Profiles.

INTRODUCTION

Proposed Site 33 is located in the Allegany Plateau physiographic area where the topography is described as rolling. This is a class "c" dam with a maximum height of 57' and will contain approximately 41,700 cubic yards of fill.

DISCUSSION OF DATA

FOUNDATION MATERIALS

A. Bedrock. Bedrock on this site is a medium gray shale with some interbedded gray siltstone and occasional limy sandstone beds. The shale is Northeast shale of Upper Devonian age. The shale is usually very weathered in the top few feet.

B. Classification. The upper part of the left abutment has glacial till and glacio-lacustrine CL-ML's and ML's underneath the topsoil. Samples 1.1 and 1.2 from this area were tested at the Syracuse lab. Sample 1.1 classified as a CL (LL = 31, PI = 11) with 82% fines. Sample 1.2 classified as a nonplastic ML with 92% fines.

The steeper part of the left abutment has a few feet of glacial till overlying very highly weathered bedrock. The glacial till disappears at about the permanent pool elevation.

Across the floodplain about 4' to 6' of dirty alluvial gravels are present. These soils were logged as GM, GP, and GW. About 4' to 5' of silty till underlie the alluvium and serve as the bedrock contact. Sample 502.1 from the alluvium classified as a GW-GM with 68% gravel and only 8% fines.

Topsoil covers the entire right abutment except for the extremely steep slope adjacent to the stream channel. Bedrock on the right abutment is very highly weathered to a depth of 1' to 6'. The upper portion of this abutment has about 6' to 10' of glacial till over bedrock. Sample 4.1 from the weathered bedrock classified as a CL-ML (LL = 26, PI = 7) with 50% fines. Emergency spillway samples 206.1 through 206.4 represent the glacial till and classified as GP-GM, GM, and ML soils.

C. Dry Density and Blow Count. Standard penetration tests were made in several holes. Blow counts were relatively high and ranged from 9 to 153.

D. Consolidation. Settlement in the foundation materials is expected to be very minor based on blow counts and classifications.

E. Permeability. Field pressure tests were made at three locations in the bedrock materials. In DH-51 in the left abutment, the permeability rate varied from 2.3 to 5.5 ft/day. In DH-302 in the floodplain, the rate was between 0.8 and 3.0 ft/day. In DH-53 in the right abutment, the permeability rate ranged from 4.1 to 13.2 ft/day. The alluvial gravels are expected to have at least moderate permeability rates.

F. Shear Strength. No undisturbed samples were submitted from the foundation for shear testing. Based on the information available, the shear strength of the foundation materials was assumed to be no weaker than the embankment materials.

EMBANKMENT MATERIALS

A. Classification. There are about seven types of materials available to construct the dam. These are summarized in the following tabulation:

Type	Description	Location	Class
G	Glacio-lacustrine	℄ dam, E. Spwy.	CL-ML, CL
H	Glacial till	Borrow, E. Spwy.	ML
I	Glacio-lacustrine	℄ dam, Borrow, E. Spwy.	ML
C	Outwash	E. Spwy.	SM
D	Glacial till	Borrow, E. Spwy.	GM, SM, SC, CL-ML
F	Highly weathered bedrock	℄ dam, Drain Line	CL-ML, ML
A	Outwash and alluvium	Borrow, E. Spwy, Drain Line	GP-GC, GC, GP-GM, GW-GM

B. Compacted Dry Densities. Four large samples were submitted to the Laboratory for testing. The results are shown below for Standard Proctor effort on the minus No. 4 fraction:

Field No.	Laboratory No.	Type	Class	Max. γ_d pcf	w_o %
101.1	71W46	A	GC	122.0	12.0
102.1	71W47	D	GM	122.0	10.5
103.1	71W48	H	ML	107.5	16.0
104.1	71W49	I	ML	111.0	13.5

C. Consolidation. An average consolidation potential of 1.5% is estimated for Types G, H, and I materials. Settlement in the embankment materials was estimated to be 0.9' at the maximum section.

D. Permeability. Type A materials are expected to be the most permeable embankment soils and are suggested for placement in the outer zones of the fill.

E. Shear Strength. Consolidated undrained triaxial shear tests were made on Samples 102.1 (71W47) and 103.1 (71W48). The 1.4" test specimens were remolded to 95% of maximum D-698-A dry density at close to optimum moisture content. The specimens were allowed to soak to saturation and then tested. The results are shown below:

Field Sample	Class	Type	Test γ_d (pcf)	% Saturation	ϕ (Deg.)	c (psf)
102.1	GM	D	116.5	91	28.5	375
103.1	ML	H	102.0	94	26.5	800

SLOPE STABILITY ANALYSIS

A modification of the Swedish circle method was used to check the slope stability analysis of the dam. Refer to Form SCS-357 (2 sheets) for a detailed summary of the analysis. No unusual conditions were encountered and the proposed slopes are adequate.

CONCLUSIONS AND RECOMMENDATIONS

A. Cutoff. A cutoff extending to sound bedrock across the floodplain is recommended. It should also extend up the abutments to approximate elevation 1485'. From there to the top of the dam, a depth sufficient

to remove any loose surface disturbances, roots, etc., should be satisfactory. A 20' wide bottom with 2:1 side slopes is suggested.

Backfilling with Types G, H, or I soils compacted to 95% of D-698-A dry density is also suggested.

The SML also concurs in the geologist's suggestion to remove all of the old road fill material (Type B). This fill contains a large amount of old brush and logs. Only 1200 cubic yards of this material are involved.

B. Principal Spillway. The proposed alignment crosses the centerline of dam near the base of the right abutment. Topsoil, old road fill, alluvial gravel, and tills in that order overlie bedrock. As previously discussed, removal of the road fill is recommended. This leaves only about 5' to 7' of alluvium and till under the maximum section. Settlement was estimated as 0.2' based on the limited foundation information available. No joint gap problems are anticipated.

Consideration should be given to moving the conduit closer to the stream channel and away from the steep right abutment.

A camber of 0.2' is suggested.

An effective ϕ angle of 30° is recommended for conduit loading computations.

C. Drainage. In order to control seepage through the foundation materials, it is recommended that a pipe and filter trench drain be installed across the floodplain and up the abutments to approximate elevation 1500'. Locate the trench at a c/b ratio of 0.7. The trench should extend down to bedrock at all locations except between elevations 1490' and 1500' in the left abutment. Bottoming the trench in the SM soils (Type D) between these elevations should be adequate.

Refer to Form SCS-130 for a satisfactory gradation of the filter materials. The coarse filter shown should be satisfactory for use against Type A & B foundation soils and Type A embankment soils. However, a finer filter such as ASTM C33 is needed against Type F foundation materials.

D. Embankment Design.

1. Placement of Materials. Refer to Forms SCS-372A & B (3 sheets) for recommended placement and control of the embankment materials.

2. Slopes. The proposed 3:1 slopes upstream with a 10' wide berm at elevation 1483.7' are satisfactory. The proposed $2\frac{1}{2}$:1 slopes downstream are also satisfactory.

3. Overfill. An overfill of 1.1' is suggested across the floodplain to allow for residual settlement of the foundation and embankment.

E. Shaping of the Right Abutment. In order to reduce the possibilities of harmful differential settlement in the area near the base of the right abutment, it is recommended the slopes be flattened to 2:1.

Prepared by:

Charles H. McElroy

Reviewed and Approved by:

Lorn P. Dunnigan
Head
Soil Mechanics Laboratory

Attachments

cc:
Richard L. Phillips (1)
Bernard S. Ellis, Geologist, Syracuse, N. Y.
J. S. Wicks, Little Valley, N. Y.
N. F. Bogner, Upper Darby, Pa.

41,700 cu yd Floodwater Retarding

SOIL CONSERVATION SERVICE

LABORATORY DATA

NEW YORK — Conewango Creek Site: 33

LABORATORY SERVICE NUMBER	FIELD NUMBER	LOCATION AND DESCRIPTION	DEPTH	FIELD CLASSIFICATION	MECHANICAL ANALYSIS — GRAIN SIZE DISTRIBUTION EXPRESSED AS PERCENT FINER BY DRY WEIGHT: FINES 0.002 mm	0.005	0.02	0.05	#200 0.074	SAND #140 0.105	#60 0.250	#40 0.42	#20 0.84	#10 2.0	#4 4.76	GRAVEL 3/8" 9.525	1/2" 12.7	3/4" 19.05	1" 25.4	1 1/2" 38.1	3" 76.2	ATTERBERG LIMITS L.L.	P.I.	UNIFIED CLASSIFICATION	SOLUBLE SALTS %	DISPERSION %	MOISTURE-DENSITY RELATIONSHIPS: STANDARD / MODIFIED — SERVE NO.	MAX. γ_d pcf	OPT. %	UNDISTURBED SAMPLE DATA γ_d g/cc	%	Gs	SPECIAL TESTS
71W																																	
46	101.1	Borrow A material L. Bag	4-10'	GM-GP	5	8	12	15	15	17	15	17	22	29	40	51	[illegible]	[illegible]	70	82	95	28	7	GC		13							
		A Material; Alluvial gravel																															
		7,960 c.y.																									DRY DENSITY < NO. 4	(1)	122.0	12.0			
		Gradation from Syracuse Lab						9	10	10	12	14	23	35	44	49	57	64	93	87*		30	8	GP-GC	(Field Tested)								
										*Corrected for 13% + 3"																							
47	102.1	Borrow D material L. Bag	3-10'	SM	7	12	22	34	40	44	51	55	59	64	69	75	77	80	82	84	100	18	2	GM		43							
		D Material; Glacial Till																															
		9,970 c.y.																									DRY DENSITY < NO. 4	(2)	122.0	10.5			
		Gradation from Syracuse Lab			13	23	38	44	48	56	59	63	67	72	77	80	83	85	89	90*			NP	SM-GM	(Field Tested)								
										*Corrected for 10% + 5"																							
48	103.1	Borrow H material L. Bag	1-3'	ML	11	17	28	72	77	79	82	83	85	87	90	93	95	97	99	100		25	3	ML		28							
		H Material; Glacial Till																															
		9,050 c.y.																									DRY DENSITY < NO. 4	(3)	107.5	16.0			
		Gradation from Syracuse Lab			14	20	44	70	77	79	81	82	85	87	90	93	94	98	100				NP	ML	(Field Tested)								
49	104.1	Borrow I material L. Bag	4.5-10'	ML	11	17	41	76	90					100								20	2	ML		24	(4)	111.0	13.5				
		I Material; Glacio-lacustrine silts & clays																															
		4020 c.y.																															
		Gradation from Syracuse Lab			12	17	36	80	90	95				98	98	99	99	100					NP	ML	(Field Tested)								

SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY DATA
Sheet 2 of 2

New York

LABORATORY SAMPLE NUMBER	FIELD NUMBER	LOCATION AND DESCRIPTION		DEPTH	FIELD CLASSIFICATION	MECHANICAL ANALYSIS GRAIN SIZE DISTRIBUTION EXPRESSED AS PERCENT FINER BY DRY WEIGHT — FINES: 0.002 mm	0.005	0.02	0.05	#200 0.074	SAND: #140 0.105	#60 0.250	#40 0.42	#20 0.84	#10 2.0	#4 4.76	GRAVEL: 3/8" 9.525	1/2" 12.7	3/4" 19.05	1" 25.4	1 1/2" 38.1	3" 76.2	ATTERBERG LIMITS: L.L.	P.I.	UNIFIED CLASSIFICATION	SOLUBLE SALTS %	DISPERSION %	MOISTURE-DENSITY RELATIONSHIPS ☐ STANDARD ☐ MODIFIED: CURVE NO.	MAX. γ_d p.c.f.	w_o %	UNDISTURBED SAMPLE DATA: γ_d g/cc	w_o %	G_s	SPECIAL TESTS
–	1.1	& Dam } G	Glacio-Lacustrine	4'-8'		32	44	64	77	88	94	96	97	98	98	98	98	98	98	98	98	98	98	31	11	CL								
–	203.1	E. Spwy. }	" "	4.5'		15	23	41	57	63	66	72	76	80	85	90	95	97	100					24	5	CL-ML								
–	103.1	Borrow } H	Glacial Till	1'-3'	✓	14	20	44	70	77	79	81	82	85	87	90	93	96	98	98	99			NP		ML	ML							
–	206.1	E. Spwy. }	" "	3.2'		10	16	45	73	80	81	83	85	87	90	93	96	97	99	100				NP		ML								
–	1.2	& Dam }	Glacio-Lacustrine	5'-13'		19	25	46	85	92	96	98	98	99	99	100								NP		ML								
–	104.1	Borrow } I	" "	4.5-10'	✓	12	17	38	80	90	95	98	98	98	99	99				100				NP		ML	ML							
–	206.4	E. Spwy. }	" "	12'		6	9	22	50	66	72	92	93	94	95	96	97	98	98	99	99	100		NP		ML								
–	254.5	E. Spwy. } C	Outwash	26'-28'				17	29	27	29	36	58	84	93	97	98	98	100					NP		SM								
–	102.1	Borrow }	Glacial Till	3'-10'	✓		14	25	42	48	52	62	66	70	74	80	86	88	92	94	98	100		NP		SM	SM							
–	205.1	E. Spwy. } D	" "	8'-11'		12	16	33	42	46	49	56	60	64	68	76	82	85	90	92	96	100		21	13	SC								
–	306.3	E. Spwy. }	" "	9'		16	22	37	52	55	53	62	65	69	74	81	87	90	94	95	98	100		24	5	CL-ML								
–	4.1	& Dam } F	Highly wea. bedrk.	8'		17	24	43	48	50	51	55	58	61	65	75	82	85	90	92	97	100		26	7	CL-ML								
–	501.1	Drain }	" " "	3.7-3'		13	22	43	58	63	63	64	64	65	67	68	72	77	79	83	89	100		30	6	ML								
–	101.1	Borrow }	Outwash	4'-10'	✓		6	9	10	10	11	13	16	21	27	40	51	58	64	72	88	100		30	8	SP-SC	SC							
–	206.2	E. Spwy. } A	"	6'			6	10	11	11	12	13	16	27	36	51	69	78	79	83	92	100		34	9	GP-GM		V						
–	502.1	Drain }	Alluvium	3'						8	8	10	10	14	23	32	41	46	56	64	80	100		42	12	GM-SM								
		* Tested at Cornell																																

Form SCS 355 A
Rev 6-65

LABORATORY NO. [illegible]

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	TRIAXIAL SHEAR TEST

PROJECT and STATE: [illegible] CREEK SITE 33 NEW YORK		SAMPLE LOCATION: [illegible] D MATERIAL	
FIELD SAMPLE NO.: 102.1	DEPTH: 5-10'	GEOLOGIC ORIGIN: Glacial Till	
TYPE OF SAMPLE: COMPACTED	TESTED AT: SMIL-LINCOLN	APPROVED BY: CHMc	DATE: 9/70

INDEX TEST DATA

USCS GM ; LL 18 ; PI 2
% FINER (mm): 0.002 7 ; 0.005 12 ;
0.074 (#200) 40
G_s (-#4) 2.70 ; G_s (+#4) ____
STANDARD: γ_d MAX. 122.0 pcf; w_o 10.5 %
MODIFIED: γ_d MAX. ____ pcf; w_o ____ %

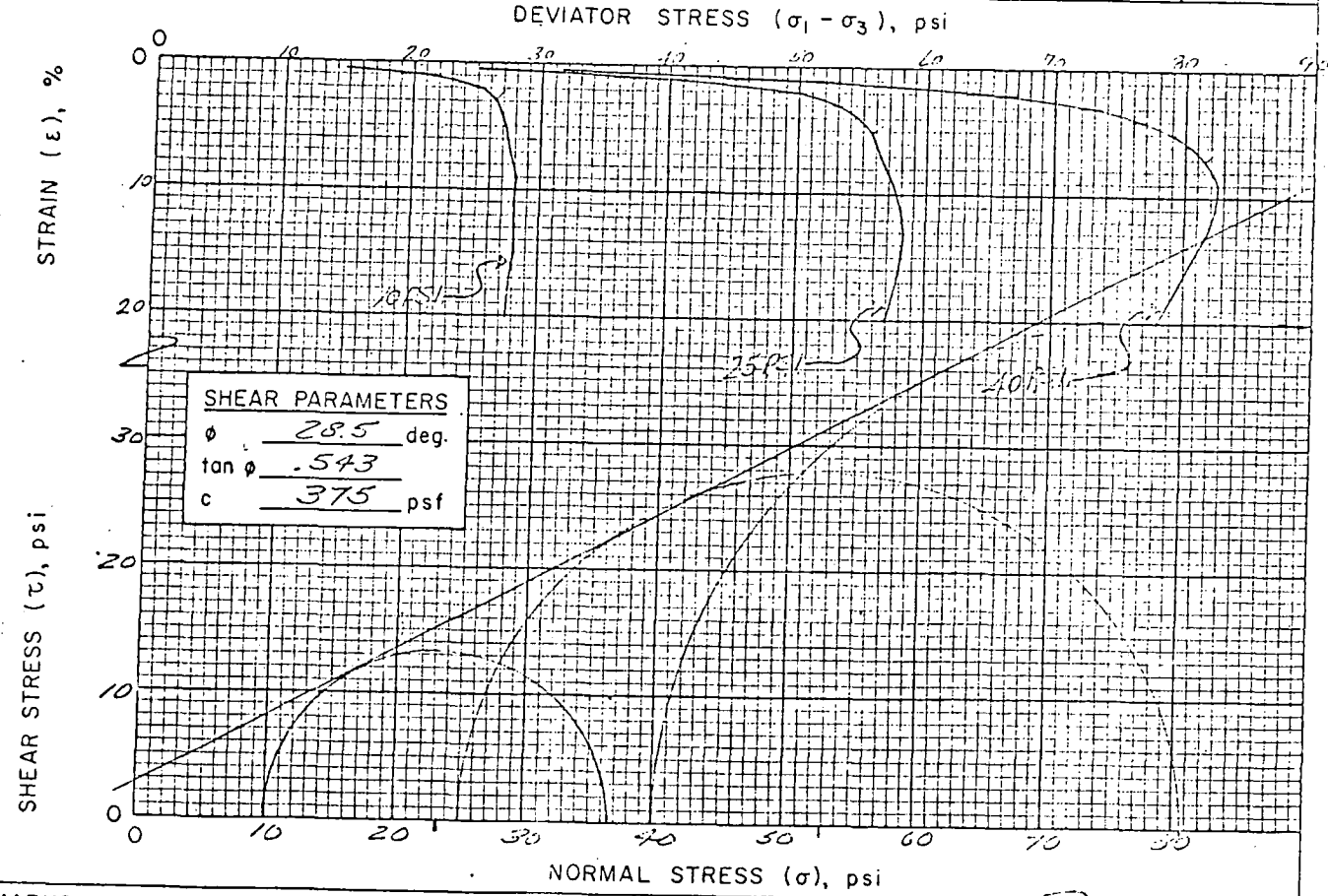
SPECIMEN DATA

HEIGHT 3.0 "; DIAMETER 1.4 "
MATERIALS TESTED PASSED #4 SIEVE
METHOD OF PREPARATION STATIC MOLDED IN 3 LIFTS (SHAKED)
MOLDING MOISTURE 13.2 %
MOLDED AT 74.2 % OF γ_d MAXIMUM

TYPE OF TEST

UU ☐
CU ☑
$\overline{CU}$ ☐
CD ☐

DRY DENSITY INITIAL pcf ☑ g/cc ☐	DRY DENSITY CONSOLIDATED pcf ☑ g/cc ☐		MOISTURE CONTENT, % START OF TEST	DEG. OF SAT. AT START OF TEST	END OF TEST	TIME OF CONSOLIDATION (hrs.)	MINOR PRINCIPAL STRESS σ_3 (psi)	DEVIATOR STRESS $\sigma_1 - \sigma_3$ (psi)	AXIAL STRAIN AT FAILURE, ε (%)
113.9	113.3		14.7	89.6	14.0	16.18	10	26.5	3.0
115.5	119.1		15.8	92.9	14.2	16.42	25	55.6	5.0
117.3	120.3		14.5	89.5	13.2	16.20	40	81.4	7.0



REMARKS

[illegible]

Form SCS 355A
Rev. 6-65

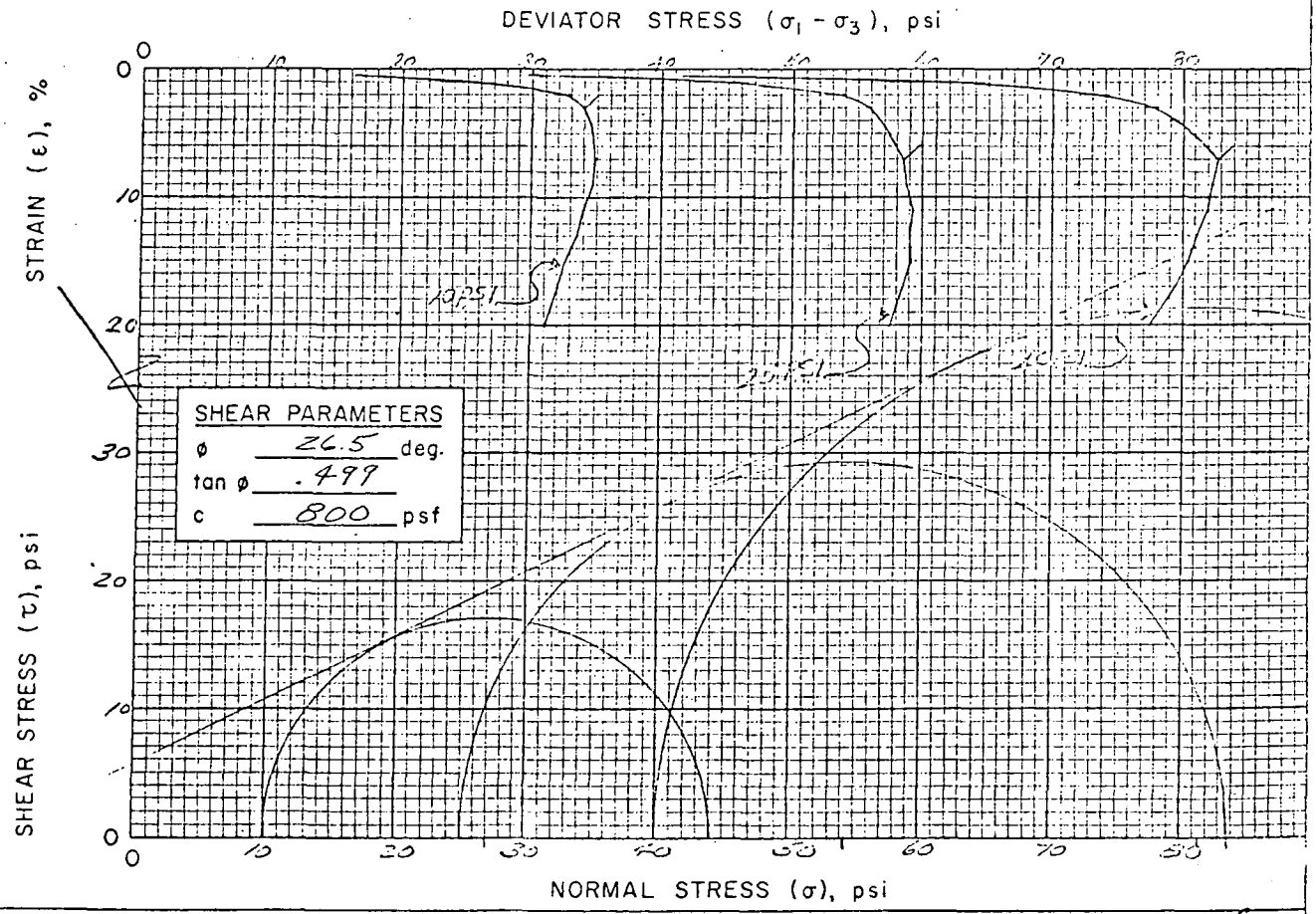
LABORATORY NO. 71W48

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	TRIAXIAL SHEAR TEST

PROJECT and STATE: Conewango Creek Site 33 New York		SAMPLE LOCATION: Borrow & Material	
FIELD SAMPLE NO.: 103.1	DEPTH: 1-3'	GEOLOGIC ORIGIN: Glacial Till	
TYPE OF SAMPLE: Compacted	TESTED AT: SML-Lincoln	APPROVED BY: CHMc	DATE: 9/70

INDEX TEST DATA	SPECIMEN DATA	TYPE OF TEST
USCS ML ; LL 25 ; PI 3	HEIGHT 3.0 "; DIAMETER 1.4 "	UU ☐
% FINER (mm): 0.002 11 ; 0.005 17 ; 0.074 (#200) 77	MATERIALS TESTED PASSED #4 SIEVE	CU ☑
G_s (-#4) 2.69 ; G_s (+#4)	METHOD OF PREPARATION Static molded in 2 lifts (Sealed)	$\overline{CU}$ ☐
STANDARD: γ_d MAX. 107.5 pcf; w_o 16.0 %	MOLDING MOISTURE 18.1 %	CD ☐
MODIFIED: γ_d MAX. ____ pcf; w_o ____ %	MOLDED AT 94.8 % OF γ_d MAXIMUM	

DRY DENSITY INITIAL pcf ☑ g/cc ☐	DRY DENSITY CONSOLIDATED pcf ☑ g/cc ☐		MOISTURE CONTENT, % START OF TEST	DEG. OF SAT. AT START OF TEST	END OF TEST	TIME OF CONSOLIDATION (hrs.)	MINOR PRINCIPAL STRESS σ_3 (psi)	DEVIATOR STRESS $\sigma_1 - \sigma_3$ (psi)	AXIAL STRAIN AT FAILURE, ε (%)
102.4	103.2		22.7	95.4	22.2	16.27	10	34.0	3.0
101.7	103.7		22.8	94.2	21.7	16.15	25	58.5	7.0
102.0	104.9		22.7	93.8	21.0	15.82	40	82.7	7.0



REMARKS Tested @ 94.9% std

GNB

Form SCS 352
Rev 5-65

LABORATORY NO 71446

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Canawango Creek #33, New York

FIELD SAMPLE NO	LOCATION	DEPTH
101.1	Borrow A Material	4-10'

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
Glacial outwash	SML-LINCOLN	CHM	9/70

CLASSIFICATION GC LL 28 PI 9

MAX. PARTICLE SIZE INCLUDED IN TEST ¼-#4 "

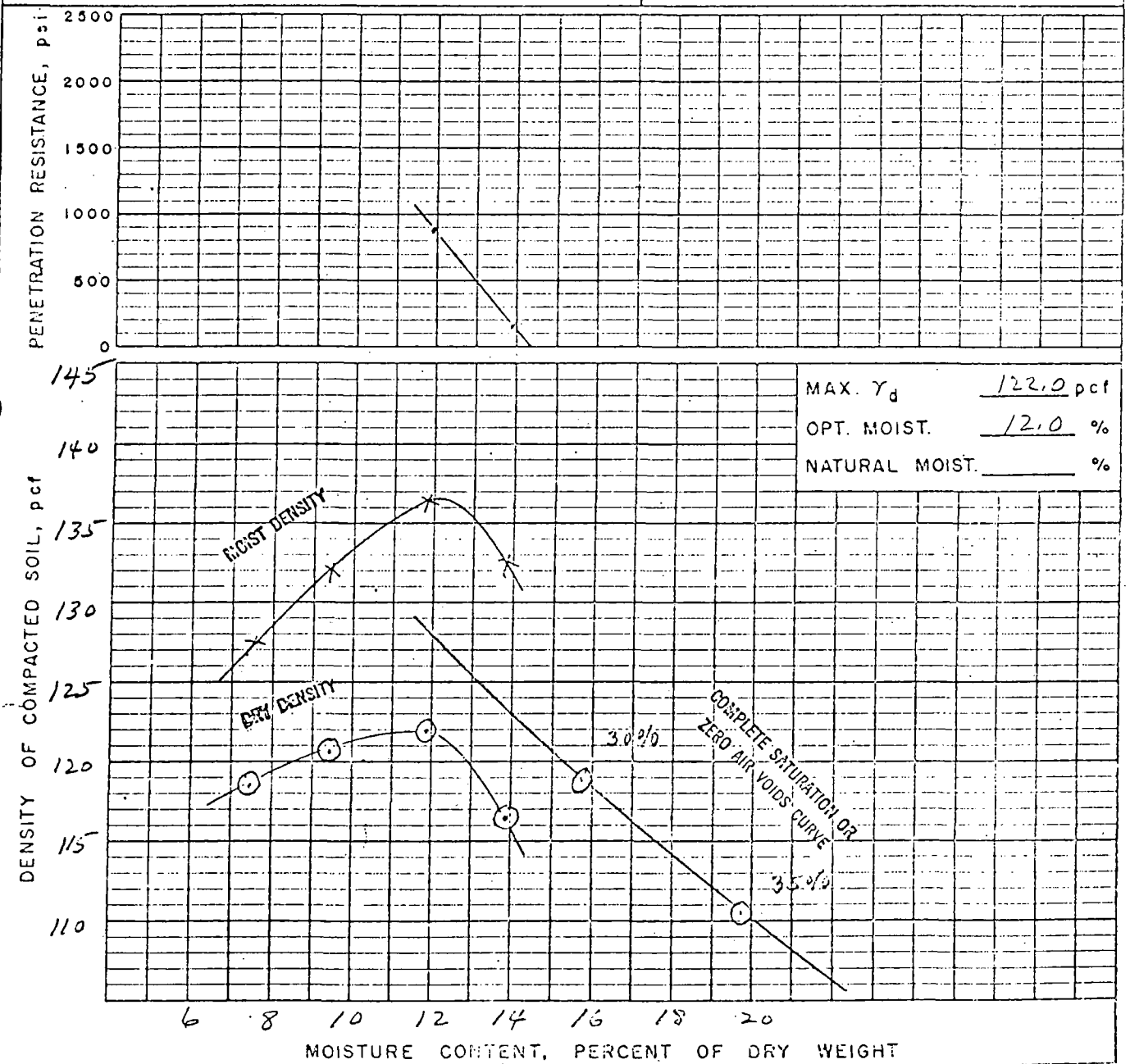
SPECIFIC GRAVITY (G_s) { MINUS NO. 4 2.72; PLUS NO. 4 2.65

CURVE NO. 1 OF 4

STD. (ASTM D-698) ☒; METHOD A

MOD. (ASTM D-1557) ☐; METHOD ____

OTHER TEST ☐ (SEE REMARKS)



REMARKS

CURVE IS FOR THE MINUS NO. 4 FRACTION

GRADATION OF TOTAL SAMPLE

< NO. 200 16 %; < NO. 4 40 %; < 6 IN. 100 %

Form SCS-352
Rev. 5-63

LABORATORY NO. 11447

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Conewango Creek #33, New York

FIELD SAMPLE NO.	LOCATION	DEPTH
152.1	Borrow D Material	3-10'

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
Glacial Till	SML-LINCOLN	CHMc	9/70

CLASSIFICATION GM LL 18 PI 2

MAX. PARTICLE SIZE INCLUDED IN TEST 2" #4

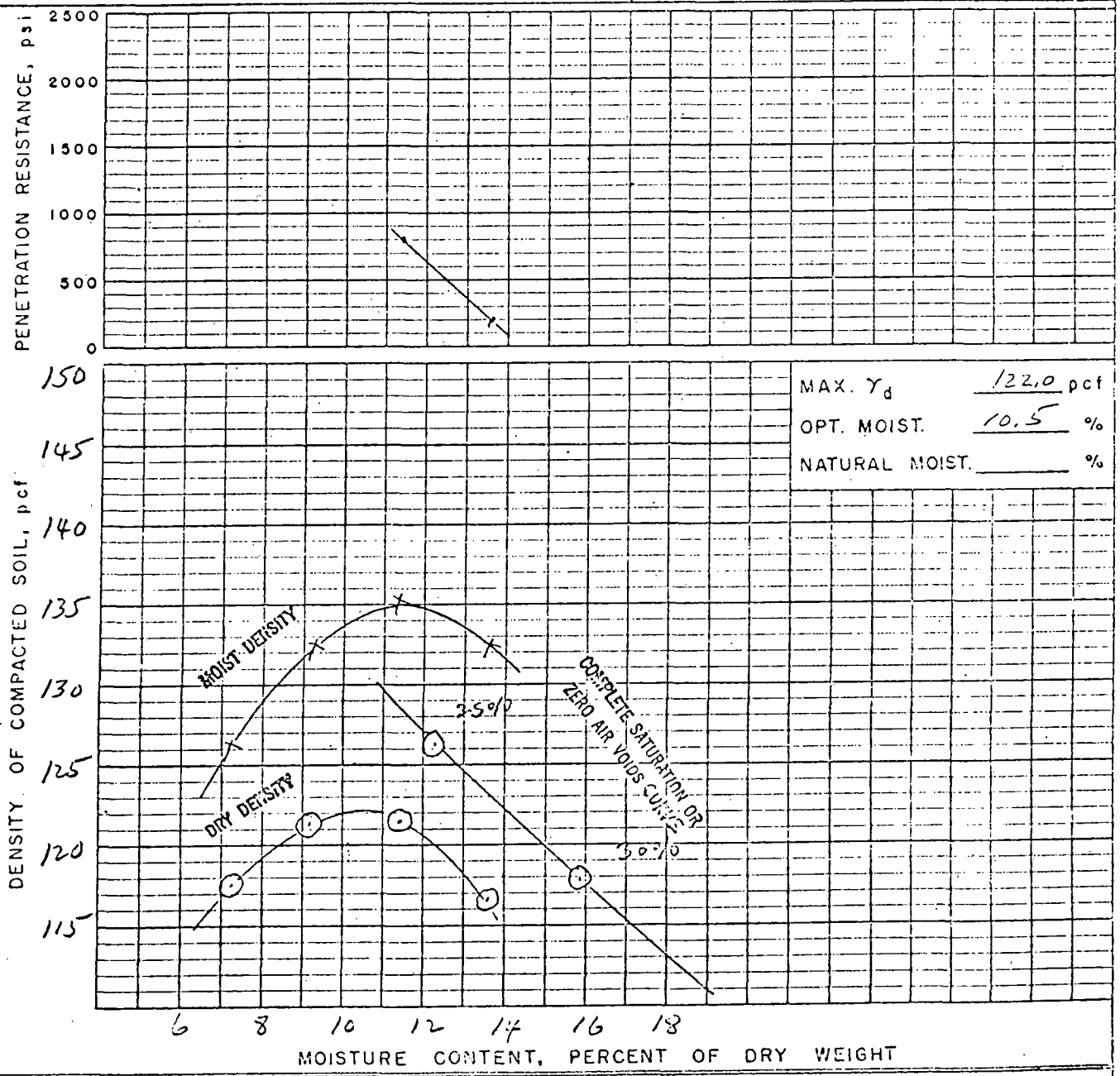
SPECIFIC GRAVITY (G_s) { MINUS NO. 4 2.70; PLUS NO. 4 2.64

CURVE NO. 2 OF 4

STD. (ASTM D-698) ☒; METHOD A

MOD. (ASTM D-1557) ☐; METHOD

OTHER TEST ☐ (SEE REMARKS)



MAX. γ_d 122.0 pcf

OPT. MOIST. 10.5 %

NATURAL MOIST. ____ %

REMARKS

CURVE IS FOR THE MINUS NO. 4 FRACTION

GRADATION OF TOTAL SAMPLE

< NO. 200 40 %; < NO. 4 69 %; < 6 in. 100 %

LABORATORY No. 7048

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Conewango Creek, New York.

FIELD SAMPLE NO	LOCATION	DEPTH
103.1	Borrow H Material.	1-3'.

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
Glacial Till	SML-LINCOLN	CHMc	9/70

CLASSIFICATION ML LL 25 PI 3

MAX. PARTICLE SIZE INCLUDED IN TEST < #4 "

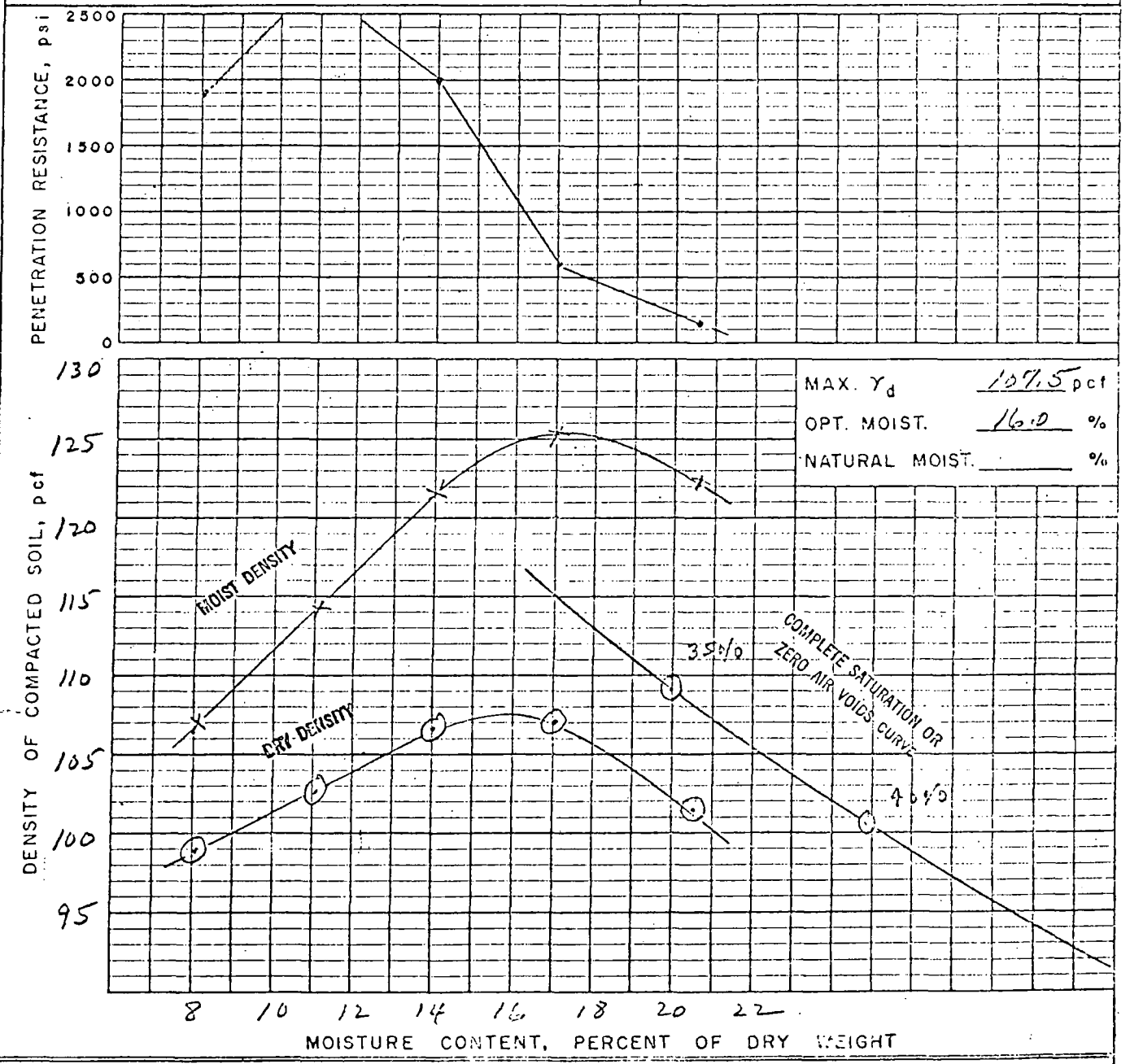
SPECIFIC GRAVITY (G_s) { MINUS NO. 4 2.69; PLUS NO. 4 2.64

CURVE NO. 3 OF 4

STD. (ASTM D-698) ☒; METHOD A

MOD. (ASTM D-1557) ☐; METHOD _____

OTHER TEST ☐ (SEE REMARKS)



REMARKS

CURVE IS FOR THE MINUS NO. 4 FRACTION

GRADATION OF TOTAL SAMPLE

< NO. 200 77 %; < NO. 4 90 %; < 1½ IN. 100 %

Form SCS 352
Rev 5-65

LABORATORY NO 71049

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Conewango Creek #33, New York

FIELD SAMPLE NO: 104.1 | LOCATION: Borrow I Material | DEPTH: 4.5-10'

GEOLOGIC ORIGIN: Glacio-Lacustrine | TESTED AT: SML-LINCOLN | APPROVED BY: CHMc | DATE: 9/70

CLASSIFICATION ML LL 20 PI 2

MAX. PARTICLE SIZE INCLUDED IN TEST < #4 "

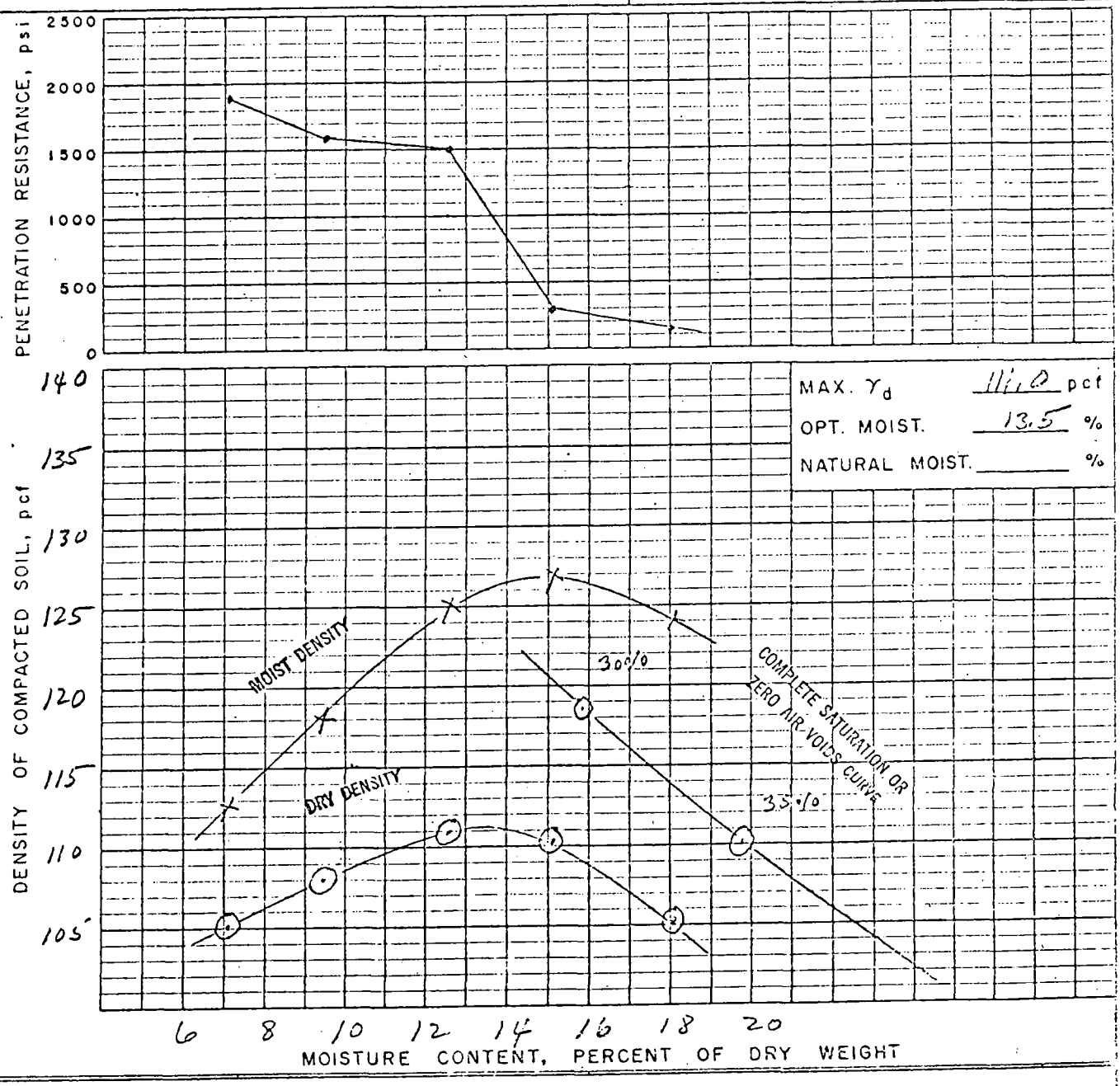
SPECIFIC GRAVITY (G_s) { MINUS NO. 4 2.72 ; PLUS NO. 4 ____

CURVE NO. 4 OF 4

STD. (ASTM D-698) ☑; METHOD A

MOD. (ASTM D-1557) ☐; METHOD ____

OTHER TEST ☐ (SEE REMARKS)



REMARKS

Form SCS 372-A
10-65

MATERIALS TESTING REPORT

U. S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

PLACEMENT OF EARTH FILL MATERIALS

PROJECT and STATE: Onondaga Creek Site 33, N.Y.
BY: CHME
DATE: 9/70

Embankment Zone No.	Type	Location	Average Depth (ft.) From	Average Depth (ft.) To	Description (Origin, Group No., Hardness, Classification, etc.)	Recommended Compaction Requirements: Class	Degree of Compaction (%)	Moisture Limits (%) ± Optimum From	Moisture Limits (%) ± Optimum To	Control Test ASTM Designation	Control Test ASTM Method	Reference Compaction Test: Sample No. Field	Sample No. Lab.	Maximum Density (pcf)	Optimum Moisture (%)
1	G	E Dam	4	8	CL; Glacio-Lacustrine; clay; moderately plastic	A	95	-2	+	D-698	A	1.1	—	—	—
1	G	E. Spwy	4.5		CL-ML; Glacio-Lacustrine; sandy-silty clay; slightly plastic	A	95	-1	+	D-698	A	203.1	—	—	—
1	H	Borrow	1	3	ML; Glacial Till; silt; non-plastic to slightly plastic; Curve ③	A	95	opt.	+	D-698	A	103.1	48	107.5	16.0
1	H	E. Spwy.	3.2		ML; (same)	A	95	opt.	+	D-698	A	206.1	—	—	—
1	I	E Dam	8	13	ML; Glacio-Lacustrine; silt; non-plastic	A	95	opt.	+	D-698	A	1.2	—	—	—
1	I	Borrow	4.5	10	ML; Glacio-Lacustrine; silt; non-plastic to sl. plastic; Curve ④	A	95	opt.	+	D-698	A	104.1	49	111.0	13.5
1	I	E. Spwy.	12		ML; Glacio-Lacustrine; silt; nonplastic	A	95	opt.	+	D-698	A	206.4	—	—	—
2	C	E. Spwy.	7.6	12.3	SM; Outwash; silty sand; nonplastic	A	95	opt.	+	D-698	A	254.5	—	—	—
2	D	Borrow	3	10	GM; Glacial Till; silty, sandy gravel; nonplastic to sl. plastic; Curve ②	A	95	opt.	+	D-698	A	102.1	47	122.0	10.5

REMARKS

Sheet 1 of 3

Form SCS 372 A
10-65

U.S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

MATERIALS TESTING REPORT

PLACEMENT OF EARTH FILL MATERIALS

PROJECT and STATE: Creekwood Creek, Site 33, N.Y.

BY: CHMc

DATE: 9/70

Embankment Zone No.	FILL MATERIALS: Type	Location	Average Depth (ft.) From	Average Depth (ft.) To	Description (Origin, Group No., Hardness, Classification, etc.)	RECOMMENDED COMPACTION REQUIREMENTS: Class	Degree of Compaction (%)	Moisture Limits (%) ±Optimum From	Moisture Limits (%) ±Optimum To	Control Test ASTM Designation	Control Test ASTM Method	REFERENCE COMPACTION TEST: Sample No. Field	Sample No. Lab.	Maximum Density (pcf)	Optimum Moisture (%)
2	D	E. Spwy.	8	11	SC; Glacial Till; clayey sand; moderately plastic	A	95	opt	+	D-698	A	205.1	—	—	1
2	D	E. Spwy.	9		CL-ML; Glacial Till; Silty, sandy clay; slightly plastic	A	95	opt.	+	D-698	A	206.3	—	—	1
2	F	E Dom	8		SC-SM; Highly wea. bedrock; slightly plastic	A	95	opt.	+	D-698	A	4.1	—	—	1
2	F	Drain Line	0.7	3	ML; (same)	A	95	opt.	+	D-698	A	501.1	—	—	1
3	A	Borrow	4	10	GP-GC; Outwash; Clayey-silty gravel; slightly plastic; Curve ①	*						101.1	46	122.0	12.0
3	A	E. Spwy.	6'		GP-GM; Outwash; slightly plastic;	*						206.2	—	—	1
3	A	Drain Line	3'		GW-GM; Alluvium; relatively clean silty gravel; moderately plastic	*						502.1	—	—	1

REMARKS

* Use a method specification that will produce a minimum mass density equaled to 95% D-698A dry density corrected for 40% rock.

Form SCS 357
Rev 6-65

MATERIALS TESTING REPORT | U.S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE

SUMMARY - SLOPE STABILITY ANALYSIS

PROJECT and STATE: CONEVVANGO CREEK SITE 33 NEW YORK

METHOD OF ANALYSIS: SWEDISH CIRCLE

ANALYZED AT: SYR L LINCOLN

APPROVED BY:

DATE: 8-17-70

SOURCE AND USE OF MATERIALS	CLASSIFICATION	ADOPTED DESIGN DATA							REMARKS
		γ_d (pcf)	γ_m (pcf)	γ_{sat} (pcf)	γ_{sub} (pcf)	ϕ (deg.)	tan ϕ	c (psf)	
① EMBANKMENT	GM	124.0	134.5	140.5	78.0	28.5	.543	375	CORRECTED FOR 31% HXX
② EMBANKMENT	ML	105.0	121.0	128.5	66.0	26.5	.499	800	CORRECTED FOR 10% ROCK
③									
④									
⑤									
⑥									
⑦									
⑧									

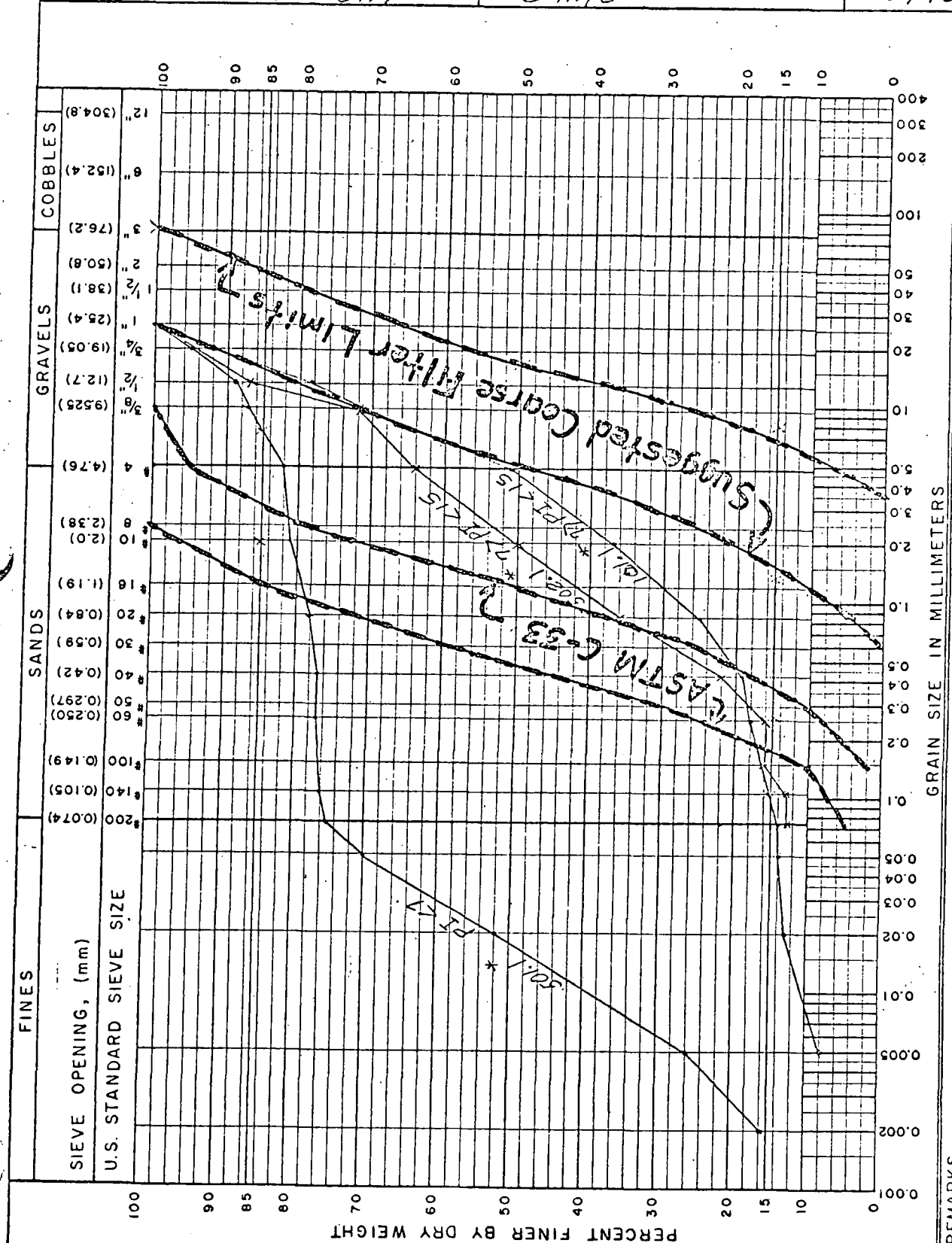
TRIAL NO.	SLOPE	CONDITIONS	F_s
		MAXIMUM SECTION	
1 UP	3:1	FULL DRAWDOWN - NO BERM - ARC CUT FROM OPPOSITE	
.		SLOPE THRU EMB. (28.5°-375) ONLY	1.72
1A UP	3:1	FULL DRAWDOWN - NO BERM - ARC CUT FROM OPPOSITE	
		SLOPE THRU EMB. (26.5°-800) ONLY	2.2
2 UP	3:1	SAME CONDITIONS AS TRIAL #1	1.79
3 UP	3:1	SAME CONDITIONS AS TRIAL #1	1.76
4 DN	2½:1	DRAIN @ % = 0.5 - NO BERM - ARC CUT FROM OPPOSITE	
		SLOPE THRU EMB. (28.5°-375) ONLY	1.92
5 DN	2½:1	SAME CONDITIONS AS TRIAL #4	2.0
6 DN	2½:1	SAME CONDITIONS AS TRIAL #4	2.1

Form SCS 130
5-65

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	DRAIN MATERIALS

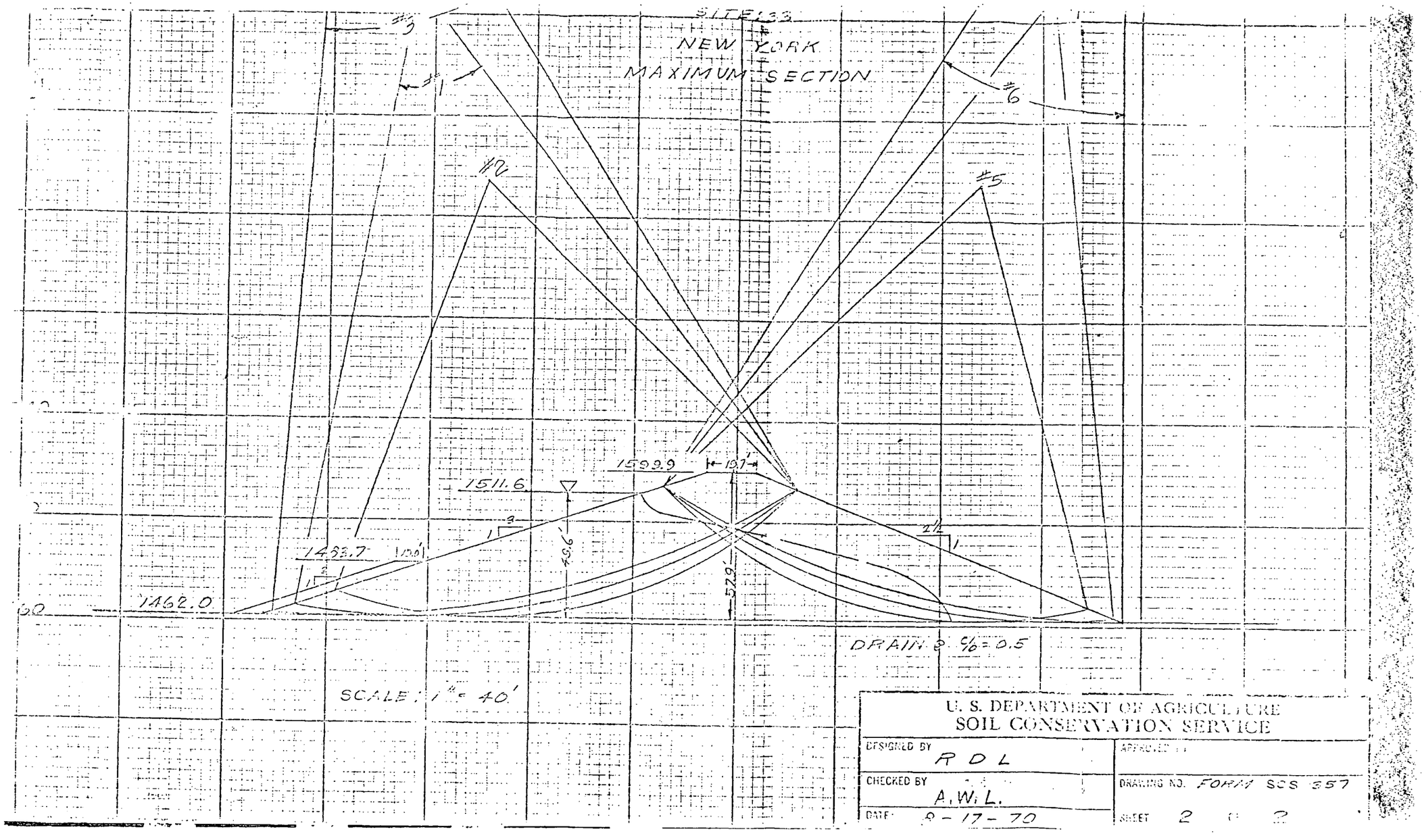
PROJECT and STATE: Conewango Creek, Site 33, New York

DESIGNED AT: SML - Lincoln | BY: CHMc | DATE: 9/70



REMARKS: * Regraded to minus 1"

USDA-SCS-HYATTSVILLE, MD. 1967


SITE 33
NEW YORK
MAXIMUM SECTION
#1
#2
#3
#5
#6
1599.9
19.7'
1511.6
1483.7
1462.0
49.6'
57.9'
DRAIN @ C/O = 0.5
SCALE: 1" = 40'
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
DESIGNED BY
R D L
CHECKED BY
A. W. L.
DATE: 8-17-70
APPROVED BY
DRAWING NO. FORM SCS 357
SHEET 2 OF 2

Appendix E

Emergency Action Plan

Emergency Action Plan (EAP)

Conewango Creek Watershed, Dam No. 33

National Inventory of Dams (NID) No. NY00581

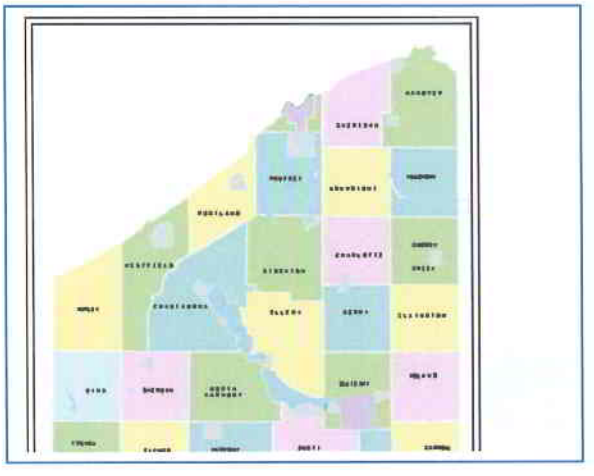
Chautauqua County, New York

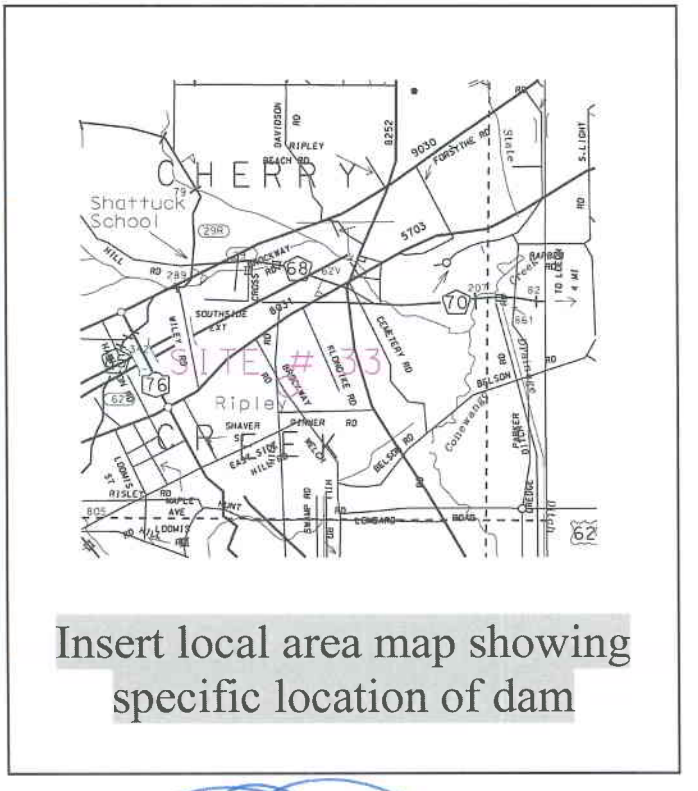
Chautauqua County Conservation District

With assistance from the

U.S. Department of Agriculture

Natural Resources Conservation Service





Insert local area map showing specific location of dam

Reviewed and Updated:

Fred C. Crossett

Chair, Chautauqua County Conservation District

5/25/11

Date

Sheriff, Chautauqua County, NY

5/20/2011

Date

Copy ___ of___

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Basic EAP Data

Purpose

The purpose of this EAP is to reduce the risk of human life loss and injury and minimize property damage during an unusual or emergency event at Conewango Creek Watershed, Dam No. 33.

Potential Impacted Area

See *Evacuation Map* tab (Appendix B–4) and *People at Risk* tab (Appendix B–5) for the locations and contact information of the following residents and businesses that may be flooded if the dam should fail and the estimated time for the flood wave to travel from the dam to these locations:

1. *Donald Yahn 6690 Pickup Hill Rd. >1500' from dam*
2. *Cherry Creek Livestock Auction 6732 Pickup Hill >1500' from dam*
3. *Empire Livestock Marketing LLC 797 Southside Ave. >1500' from dam*

Dam Description

Height: 57 ft
Built: 1974
Legal Description: Sects. 14 and 23, T13N, R21W
Latitude: 42.286944 Longitude: 79.114444
National Inventory of Dams No.: NY 00581

Drainage Area: 1 mi
Hazard Classification: High
Dam Operator: Chautauqua County
Major Property Owner: Richard D. Milk
Dam Designer: NRCS

See detailed design data in *Appendix B* tab.

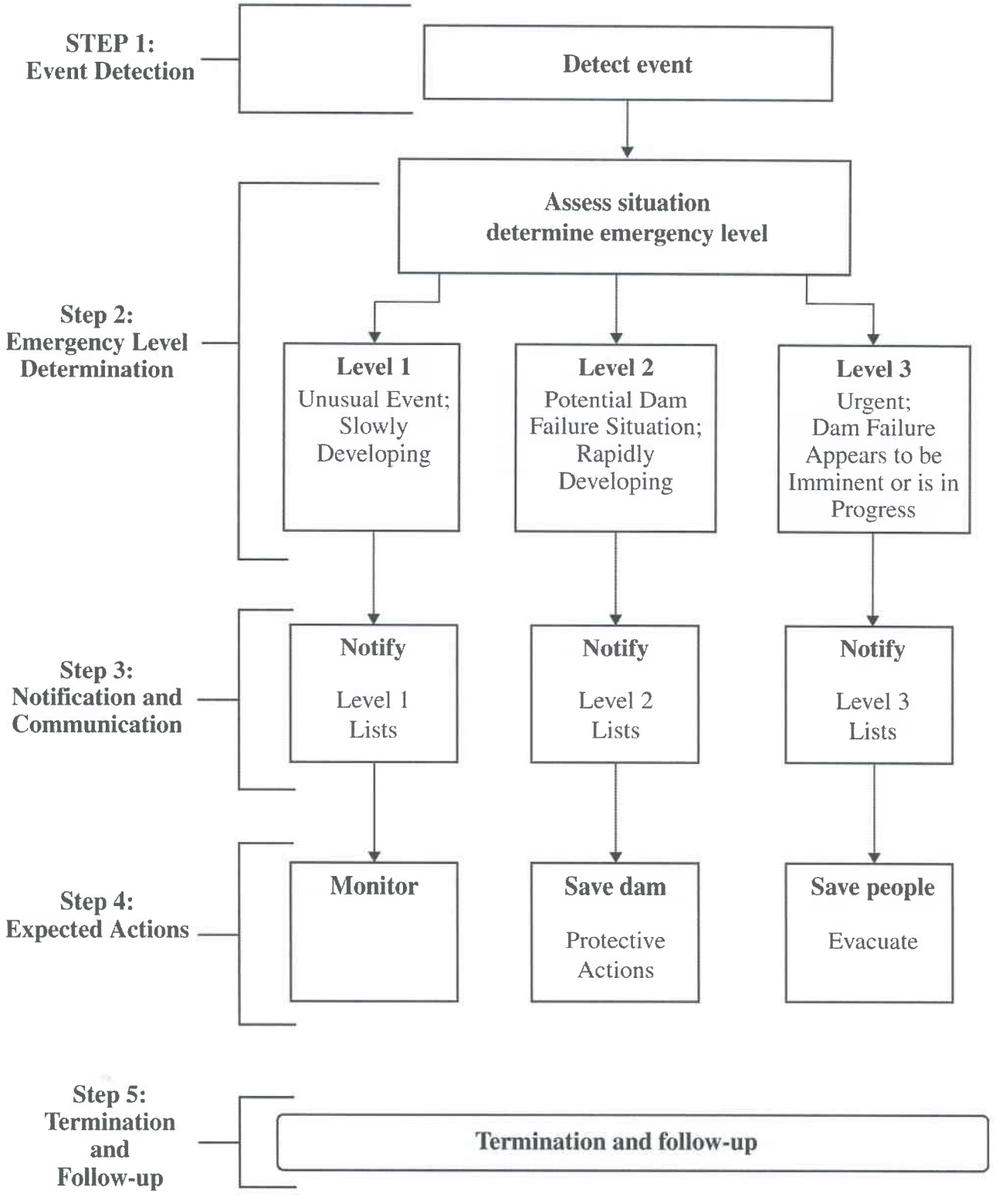
Directions to dam (See *Location and Vicinity Map*; Appendix B–2.)

From blinking light in Cherry Creek heading North on NYS Rt. 83, Turn left on Southside Ave. Take Southside Ave. to Pickup Hill Road. Turn left on Pickup Hill Rd. to the Dam on the left side of the road.

If the main route is flooded head north on NYS Rt. 83 from Conewango Valley, turn left on Pinner Road. Take Pinner Road to intersection of Pickup Hill Road. Turn right on Pickup Hill Rd. to Dam site on right side of road.

Alternate route to the Dam is from main intersection in Ellington, take County Rd. 66 to Risley Rd. Turn right on Risley Rd. to Pickup Hill Rd. Turn left on Pickup Hill Rd. to Dam Site on the right side of road.

EAP Overview



Roles and Responsibilities

Dam Operator's Representative (Dave Wilson Chaut County Soil & Water)

- As soon as an emergency event is observed or reported, immediately determine the emergency level (see *Emergency Levels* tab).
  - Level 1: unusual event, slowly developing
  - Level 2: potential dam failure situation, rapidly developing
  - Level 3: dam failure appears imminent or is in progress
- Immediately notify the personnel in the order shown on the notification chart for the appropriate level (see *Notification Charts* tab).
- Provide updates of the situation to the police/sheriff dispatcher to assist them in making timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the EAP is reviewed and updated annually and copies of the revised EAP are distributed to all who received copies of the original EAP.

Incident Commander (Sheriff Joseph Gerace)

- Serve as the primary contact person responsible for coordination of all emergency actions.
- When a Level 2 situation occurs: Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
- When a Level 3 situation occurs:
  - Initiate warnings and order evacuation of people at risk downstream of the dam.
  - Notify local emergency management services to carry out the evacuation of people and close roads within the evacuation area (see *Evacuation Map* tab).
- Decide when to terminate the emergency.
- Participate in an annual review and update of the EAP.

Emergency Management Services (Julius Leone, Chaut County EMO)

- Maintain communication with media.
- When a Level 2 situation occurs:
  - Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
  - Alert the public as appropriate.
- When a Level 3 situation occurs:
  - Alert the public.
  - Immediately close roads and evacuate people within the evacuation area (see *Evacuation Map* tab).
- Participate in an annual review and update of the EAP.

Dam Operator's Technical Representatives (NRCS)

- Advise the dam operator of the emergency level determination, if time permits.
- Advise the dam operator of remedial actions to take if Level 2 event occurs, if time permits.

State Dam Safety Agency (Conewango Watershed Commission)

- Advise the dam operator of the emergency level determination, if time permits.
- Advise the dam operator of remedial actions to take if Level 2 event occurs, if time permits.

The Five-step EAP Process

Step 1 Event Detection

This step describes the detection of an unusual or emergency event and provides information to assist the dam operator in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations at or near the dam by government personnel (local, state, or Federal), landowners, visitors to the dam, or the public
- Evaluation of instrumentation data
- Earthquakes felt or reported in the vicinity of the dam
- Forewarning of conditions that may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

See *Guidance for Determining the Emergency Level* table for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

Step 2 Emergency Level Determination

After an unusual or emergency event is detected or reported, the Conservation District Manager or his alternate is responsible for classifying the event into one of the following three emergency levels:

Emergency Level 1—Nonemergency, unusual event, slowly developing:
This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. NRCS technical representatives or state dam safety officials should be contacted to investigate the situation and recommend actions to take. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Sheriff should be informed if it is determined that the conditions may possibly develop into a worse condition that may require emergency actions.

Emergency Level 2—Potential dam failure situation, rapidly developing:
This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The Sheriff should be notified of this emergency situation and placed on alert. The dam operator should closely monitor the condition of the dam and periodically report the status of the situation to the Sheriff. If the dam condition worsens and failure becomes imminent, the Sheriff must be notified immediately of the change in the emergency level to evacuate the people at risk downstream.

If time permits, NRCS and state dam safety officials should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The dam operator should initiate remedial repairs (note local resources that may be available—see Appendix B–1). Time available to employ remedial actions may be hours or days.

This emergency level is also applicable when flow through the earth spillway has or is expected to result in flooding of downstream areas and people near the channel could be endangered. Emergency services should be on alert to initiate evacuations or road closures if the flooding increases.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:
This is an extremely urgent situation when a dam failure is occurring or obviously is about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the earth spillway is causing downstream flooding of people and roads. The Sheriff should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed (see *Evacuation Map* tab).

See the following pages for guidance in determining the proper emergency level for various situations.

Guidance for Determining the Emergency Level

Event	Situation	Emergency level*
Earth spillway flow	Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion	1
	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	2
	Spillway flowing with an advancing headcut that is threatening the control section	3
	Spillway flow that is flooding people downstream	3
Embankment overtopping	Reservoir level is 1 foot below the top of the dam	2
	Water from the reservoir is flowing over the top of the dam	3
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2
	Seepage with discharge greater than 10 gallons per minute	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	2
	Rapidly enlarging sinkhole	3
Embankment cracking	New cracks in the embankment greater than ¼-inch wide without seepage	1
	Cracks in the embankment with seepage	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly proceeding slides of the embankment slopes	3
Instruments	Instrumentation readings beyond predetermined values	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Sabotage/ vandalism	Damage to dam or appurtenance with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	3

* Emergency Level 1: Nonemergency unusual event, slowly developing
* Emergency Level 2: Potential dam failure situation, rapidly developing
* Emergency Level 3: Urgent; dam failure appears imminent or is in progress

Examples of Emergency Situations

The following are examples of conditions that usually constitute an emergency situation that may occur at a dam. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original designed conditions can cause significant flow through the auxiliary spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency-level condition. The groupings are provided as guidance only. Not all emergency conditions may be listed, and the dam operator is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam.

Pre-existing conditions on this dam: There has been a small seepage area near the downstream toe on the north side of the release channel. This was first noticed in the 1990s, but has not changed since that time.

Earth Spillway Flows

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Significant erosion or headcutting of the spillway is occurring, but the rate does not appear to threaten an imminent breach of the spillway crest that would result in an uncontrolled release of the reservoir.
2. Flow through the earth auxiliary spillway is or is expected to cause flooding that could threaten people, homes, and/or roads downstream from the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Significant erosion or headcutting of the spillway is occurring at a rapid rate, and a breach of the control section appears imminent.
2. Flow through the earth auxiliary spillway is causing flooding that is threatening people, homes, and/or roads downstream from the dam.

Embankment Overtopping

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. The reservoir level is within 1 foot from the top of the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. The reservoir level has exceeded the top of the dam, and flow is occurring over the embankment.

Seepage and Sinkholes

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam or settlement of the dam is observed.
4. Reservoir level is falling without apparent cause.
5. The following known dam defects are or will soon be inundated by a rise in the reservoir:
   - Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
   - Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Embankment Movement and Cracking

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam that may eventually result in breaching of the dam.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

1. Sudden or rapidly proceeding slides, settlement, or cracking of the embankment crest, slopes, abutments, and/or foundation, and breaching of the dam appears imminent or is in progress.

Step 3 Notification and Communication

Notification

After the emergency level has been determined, the people on the following notification charts for the appropriate emergency level shall be notified immediately.

Communication

Emergency Level 1—Nonemergency, unusual event; slowly developing:
The Conservation District Manager and NRCS District Conservationist should contact the NRCS State Conservation Engineer and Conewango Watershed Commission. Describe the situation, and request technical assistance on next steps to take.

Emergency Level 2—Emergency event, potential dam failure situation; rapidly developing:
The following message may be used to help describe the emergency situation to the Sheriff or Chautuauqua County emergency management personnel:

"This is _____Identify yourself; name, position)_____.

We have an emergency condition at Conewango Creek Watershed, Dam No.33 , located 1 mile south of Cherry Creek.

We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 2.

We are implementing predetermined actions to respond to a rapidly developing situation that could result in dam failure.

Please prepare to evacuate the area along low-lying portions of Cherry Creek.

Reference the evacuation map in your copy of the Emergency Action Plan.

We will advise you when the situation is resolved or if the situation gets worse.

I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number _____."

Emergency Level 3—Urgent event; dam failure appears imminent or is in progress:
The Sheriff should be contacted immediately and the area evacuated (see *Evacuation Map* tab). The following actions should be taken:

1. Call the Sheriff's dispatch center. Be sure to say, "This is an emergency." They will call other authorities and the media and begin the evacuation. The following message may be used to help describe the emergency situation to the Sheriff or Chautauqua County emergency management personnel:

   "This is an emergency. This is _____Identify yourself; name, position)_____.

   Conewango Creek Watershed, Dam No. 33, located 1 mile south of Cherry Creek, is failing. The downstream area must be evacuated immediately. Repeat, Conewango Creek Watershed, Dam No. 33, is failing; evacuate the area along low-lying portions of Cherry Creek.

   We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 3. Reference the evacuation map in your copy of the Emergency Action Plan.

   I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number_____."

2. Do whatever is necessary to bring people in immediate danger (anyone on the dam, downstream from the dam, boating on the reservoir, or evacuees) to safety if directed by the Sheriff.
3. Keep in frequent contact with the Sheriff and emergency services to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.
4. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to re-establish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to re-establish contact with the Sheriff and emergency services.

The following prescripted message may be used as a guide for the Sheriff or Chautauqua County emergency services personnel to communicate the status of the emergency with the public:

Attention: This is an emergency message from the Sheriff. Listen carefully. Your life may depend on immediate action.

Conewango Creek Watershed, Dam No. 33, located 1 miles south of Cherry Creek, is failing. Repeat. Conewango Creek Watershed, Dam No. 33, located 1 mile south of Cherry Creek, is failing.

If you are in or near this area, proceed immediately to high ground away from the valley. Do not travel on Pickup Hill Rd. south of Cherry Creek or return to your home to recover your possessions. You cannot outrun or drive away from the flood wave. Proceed immediately to high ground away from the valley.

Repeat message.

Emergency Level 1 Notifications

Nonemergency
unusual event; slowly developing

Dam Operator's Rep.

Conservation District Manager

David Wilson

716-664-2351 (Office)
716-595-2683 (Home)
(Cell)

(1)

Dam Operator's Technical Reps.

Conewango Watershed

Ken Chase

716-296-5721 (Office)
(Home)
716-499-5721 (Cell)

(2)

State Dam Safety Official

Alon Dominitz

519-402-8185 (Office)
(Home)
518-852-0451 (Cell)

NRCS State Engineer

Peter Wright
441 S. Sallina St.
Suite 354
Syracuse, NY 13202
315-477-6538 (Office)

Note:
1, 2, etc., denotes call sequence

Legend:
Calls by operator _____
Second level calls - - - - -

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Level 2 Notifications

Emergency event, potential dam failure situation; rapidly developing

Dam Operator's Rep.
Chautauqua County Conservation District Manager
David Wilson
716-664-2351 (Office)
716-595-2683 (Home)
(Cell)

(1)

Dam Operator's Technical Reps.
Conewango Watershed Commission
Ken Chase
716-296-5721 (Office)
(Home)
716-499-5721 (Cell)

NRCS State Engineer
Peter Wright
315-477-6538 (Office)
(Home)
(Cell)

(2)

Incident Commander
Sheriff
Joseph Gerace
716-753-4231 (Office)
(Home)

Chaut. Co.Emergency Management Dispatcher

NY Highway Patrol Dispatcher

Chaut. Co. Police Dispatcher

(3)

State Dam Safety Official
Alon Dominitz
518-402-8185 (Office)
(Home)
518-852-0451 (Cell)

Chaut. County Amateur Radio Association:
Duane Buchweitz
Phone: 499-5599
Call ID: N2LRG

National Weather Service
716-430-8543

Note:
1, 2, etc., denotes call sequence

Legend:
Calls by operator _____
Second level calls - - - - - -

See *Communications* tab for prescripted messages.

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Level 3 Notifications

Urgent event, dam failure appears imminent or is in progress

Dam Operator's Rep.
Chautauqua County Conservation District Manager
Dave Wilson
716-664-2351 (Office)
716-595-2683 (Home)
(Cell)

(1)

Incident Commander
Chaut. Co. Sheriff
Joseph Gerace
716-753-4231 (Office)
(Home)
(Cell)
or
24-Hour 911

(2)

State Dam Safety Official
Alon Dominitz
518-402-8185 (Office)
(Home)
518-852-0451 (Cell)

(3)

Dam Operator's Technical Reps.
Conewango Watershed
Commission Chairman
Ken Chase
716-296-5721 (Office)
(Home)
716-499-5721 (Cell)

Chaut. Co. Emergency Management Dispatcher

National Weather Service
716-430-8543

NRCS State Engineer
Peter Wright
315-477-6538 (Office)
(Home)
(Cell)

NY Highway Patrol Dispatcher

Coal County Amateur Radio Association:
Duane Buchweitz
Phone: 499-5599
Call ID: N2LRG

Chaut. Co. Police Dispatcher

Note:
1, 2, etc., denotes call sequence

Legend
Calls by operator _____
Second level calls - - - - -

See *Communications* tab for prescripted messages.

See *Emer. Services Contacts* tab for contact information for back-ups to the persons shown above and other emergency personnel.

Emergency Services Contacts

Agency / Organization	Principal contact	Address	Office telephone number	Alternate telephone numbers
Chautauqua Co. Office of the Executive	County Executive Gregory Edwards	3 North Erie Street Mayville, NY 14757	716-753-4211	716-450-1199
Chautauqua County Depart. Public Facilities	George Spanos Director	454 N. Work Street Falconer, NY 14733	716-661-8406	716-499-6048
Chautauqua County Conservation District	Dave Wilson * Manager	3542 Turner Rd. Jamestown, NY 14701	716-664-2351	(C) 716-450-4433
Chautauqua County Emergency Management Coordinator	Julius J. Leone, Jr.	2 Academy St, Ste A Room 106 Mayville, NY 14757	716-753-4341	716-269-4656
Chautauqua County Sheriff	Joseph Gerace	13 E. Chautauqua St. Mayville, NY 14757	716-753-4900	716-753-4231 (D)
Cherry Creek Fire Department	Jim Abbey Chief	1133 Boutwell Hill Cherry Creek, NY 14723	716-296-8906	716-499-6687 (C)
Conewango Watershed Commission	Ken Chase * Chairman	6267 South Rd. Cherry Creek, NY 14723	716-296-5721	(H) 716-499-5721 ©
Department of Transportation	Resident Engineer Chautauqua Co	4474 Rt. 353 Salamanca, NY 14779	716-753-2821	
Landowner of Dam No. 33	Richard D. Milks	282 Knowlton Ave. Kenmore, NY 14217		
N.Y.S. Police	Zone Sergeant	Rt. 60 Jamestown, NY 14733	716-665-3113	
National Weather Service			716-430-8543	
Natural Resources Conservation Services	Peter Wright State Engineer	441 S. Salina St. STE 354 Syracuse, NY 13202	315-477-6538	
Natural Resources Conservation Service	Steve Perchke Watershed Engineer	USDA Service Center 29 Liberty St. Ste 1 Batavia, NY 14020	585-343-9167 Ext. 2300	585-356-9012
State Dam Safety Agency	Alon Dominitz	DEC / Albany	518-402-8185	518-852-0415 (C)
WJTN/WWSE Radio Station		2 Orchard Rd. Jamestown NY14701	716-487-1151	716-664-9393
WKZA Radio Station 106.9 FM		106 W. Third St. Jamestown, NY 14701	716-487-1106	716-487-1069

* Back-up to primary contact

Step 4 Expected Actions

If the police or Sheriff receives a 911 call regarding observations of an unusual or emergency event at the dam, they should immediately contact the Conservation District office. After the Conservation District Manager determines the emergency level, the following actions should be taken. If time permits, NRCS and the New York Water Resources Board should be contacted for technical consultation.

Emergency Level 1—Nonemergency, unusual event; slowly developing:

A. The Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS or the New York Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**

B. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

C. The Conservation District Manager should contact NRCS and request technical staff to investigate the situation and recommend corrective actions.

Emergency Level 2—Potential dam failure situation; rapidly developing:

A. The Conservation District Manager should contact the NRCS and the New York Water Resources Board to report the situation and, if time permits, request technical staff to investigate the situation and recommend corrective actions.

B. The Conservation District Manager should contact the sheriff to inform him/her that the EAP has been activated and if current conditions get worse, an emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.

C. Provide updates to the Sheriff and emergency services personnel to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.

D. If time permits, the Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS and the New York Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**

E. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

F. If time permits, the following emergency remedial actions should be taken as appropriate.

Emergency Level 2—Potential dam failure situation; rapidly developing—continued:

Emergency remedial actions

If time permits, the following emergency remedial actions should be considered for Emergency Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with NRCS and the New York Water Resources Board. See *Resources Available* (Appendix B–1) for sources of equipment and materials to assist with remedial actions.

Embankment overtopping

1. If the water level in the reservoir is no longer rising, place sandbags along the low areas of the top of the dam to control wave action, reduce the likelihood of flow concentration during minor overtopping, and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection.

Seepage and sinkholes

1. Open the principal spillway gate to lower the reservoir level as rapidly as possible to a level that stops or decreases the seepage to a nonerosive velocity. If the gate is damaged or blocked, pumping or siphoning may be required.

   Continue lowering the water level until the seepage stops.
2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials such as hay bales, bentonite, soil or rockfill, or plastic sheeting.
3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the gate is damaged or blocked, pumping or siphoning may be required.
2. Repair settlement of the crest by placing sandbags or earth and rockfill materials in the damaged area to restore freeboard.
3. Stabilize slides by placing a soil or rockfill buttress against the toe of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform a field survey to determine if there has been any settlement and movement of the dam embankment, spillway, and low-level outlet works.
3. Drain the reservoir, if required.

Emergency Level 3—Urgent; dam failure appears imminent or is in progress:

A. The Conservation District Manager shall immediately contact the Sheriff and others shown on the notification chart.

B. The Sheriff shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam (see *Evacuation Map* tab).

C. Emergency management services personnel shall alert the public and immediately evacuate at-risk people and close roads as necessary.

D. The Conservation District Manager shall maintain continuous communication and provide the Sheriff with updates of the situation to assist him/her in making timely decisions concerning warnings and evacuations.

E. The Conservation District Manager should record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.

F. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

Step 5 Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Sheriff is responsible for terminating EAP operations and relaying this decision to the Conservation District Manager. It is then the responsibility of each person to notify the same group of contacts that were notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Emergency Level 3 event that has not caused actual dam failure, the NRCS technical representative or the State Dam Safety Officer will inspect the dam or require the inspection of the dam to determine whether any damage has occurred that could potentially result in loss of life, injury, or property damage. If it is determined that conditions do not pose a threat to people or property, the Sheriff will be advised to terminate EAP operations as described above.

The Conservation District Manager shall assure that the *Dam Safety Emergency Situation Report* (Appendix A–3) is completed to document the emergency event and all actions that were taken. The Conservation District shall distribute copies of the completed report to the New York Water Resources Board and the NRCS State Conservation Engineer.

Maintenance—EAP Review and Revision

EAP annual review

The Conservation District Manager will review and, if needed, update the EAP at least once each year. The EAP annual review will include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current. The EAP will be revised if any of the contacts have changed.
- Contacting the local law enforcement agency to verify the phone numbers and persons in the specified positions. In addition, the Conservation District Manager will ask if the person contacted knows where the EAP is kept and if responsibilities described in the EAP are understood.
- Calling the locally available resources to verify that the phone numbers, addresses, and services are current.

Revisions

The Conservation District is responsible for updating the EAP document. The EAP document held by the Conservation District is the master document. When revisions occur, the Conservation District will provide the revised pages and a revised revision summary page to all the EAP document holders. The document holders are responsible for revising outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the revisions.

EAP periodic test

The Conservation District will host and facilitate a periodic test of the EAP at least once every 5 years.

The periodic test will consist of a meeting, including a tabletop exercise, conducted at the Chautauqua County Conservation District office. Attendance should include the Conservation District Manager, key conservation district staff members, NRCS staff, at least one representative of the local law enforcement agency, and others with key responsibilities listed in the EAP. At the discretion of the Conservation District, other organizations that may be involved with an unusual or emergency event at the dam are encouraged to participate. Before the tabletop exercise begins, meeting participants will visit the dam during the periodic test to familiarize themselves with the dam site.

The tabletop exercise will begin with the facilitator presenting a scenario of an unusual or emergency event at the dam. The scenario will be developed prior to the exercise. Once the scenario has been presented, the participants will discuss the responses and actions that they would take to address and resolve the scenario. The narrator will control the discussion, ensuring realistic responses and developing the scenario throughout the exercise. The Conservation District Manager should complete an event log as they would during an actual event.

After the tabletop exercise, the five sections of the EAP will be reviewed and discussed. Mutual aid agreements and other emergency procedures can be discussed. The Conservation District will prepare a written summary of the periodic test and revise the EAP, as necessary.

Record of Holders of Control Copies of this EAP

Copy Number	Organization	Person receiving copy
1	Chautauqua County Conservation District 3542 Turner Rd. Jamestown, NY 14701	Fred Croscut
2	Conewango Watershed Commission NRCS Field Office 6914 Main St. Cherry Creek, NY 14723	Ken Chase
3	NRCS State Office 441 S. Salina St. Ste. 354 Syracuse, NY 13202	Peter Wright
4	Chautauqua County Sheriff's Department 15 E. Chautauqua Mayville, NY 14757	Joseph Gerace
5	Chautauqua County Emergency Management 2 Academy St. Ste. A Room 106 Mayville, NY 14757	Julius J. Leone, Jr.
6	N.Y.S. Police Rt. 60 Jamestown, NY 14701	Zone Sergeant
7	New York Water Resources Board DEC / Albany	Alon Dominitz

Record of Revisions and Updates Made to EAP

Revision Number	Date	Revisions made	By whom

Concurrences

By my signature, I acknowledge that I, or my representative, have reviewed this plan and concur with the tasks and responsibilities assigned herein for me and my organization.

1. _____

Signature *Organization* *Date*

Printed name and title: Fred Croscut, Chair, Chautauqua County Conservation District

2. _____

Signature *Organization* *Date*

Printed name and title: Joseph Gerace, Sheriff, Chautauqua County

3. _____

Signature *Organization* *Date*

Printed name and title: Julius J. Leone, Jr., Emergency Management Coordinator, Chautauqua County

4. _____

Signature *Organization* *Date*

Printed name and title: Ken Chase, District Conservationist, NRCS, Cherry Creek

5. _____

Signature *Organization* *Date*

Printed name and title: _____

6. _____

Signature *Organization* *Date*

Printed name and title: _____

7. _____

Signature *Organization* *Date*

Printed name and title: _____

Appendices—Forms, Glossary, Maps, and Supporting Data

Appendix A

A–1 Contact Checklist

A–2 Unusual or Emergency Event Log Form

A–3 Dam Emergency Situation Report Form

A–4 Glossary of Terms

Appendix B

B–1 Resources Available

B–2 Location and Vicinity Maps

B–3 Watershed Project Map

B–4 Evacuation Map

B–5 Residents/Businesses/Highways at Risk

B–6 Plan View of Dam

B–7 Profile of Principal Spillway

B–8 Reservoir Elevation-Area-Volume and Spillway Capacity Data

B–9 National Inventory of Dams (NID) Data

Appendix A–1

Contact Checklist

Conewango Creek Watershed, Dam No. 33

Chautauqua County, NY Date _____

The following contacts should be made immediately after the emergency level is determined (see pages 7–10 for guidance to determine the appropriate emergency level for a specific situation). The person making the contacts should initial and record the time of the call and who was notified for each contact made. See the *Notification Charts* tab for critical contact information and *Emer. Services Contacts* tab for contact information for other possible emergency services.

Emergency Level 1 (see page 12)	Person Contacted	Time Contacted	Contacted by
___ NRCS District Conservationist	_____	_____	_____
___ NRCS State Conservation Engineer	_____	_____	_____
___ New York Water Resources Board	_____	_____	_____

Emergency Level 2 (see page 13)	Person Contacted	Time Contacted	Contacted by
____ NRCS District Conservationist	_____	_____	_____
____ NRCS State Conservation Engineer	_____	_____	_____
____ New York Water Resources Board	_____	_____	_____
____ Sheriff	_____	_____	_____

Emergency Level 3 (see page 14)	Person Contacted	Time Contacted	Contacted by
____ Sheriff	_____	_____	_____
____ New York Water Resources Board	_____	_____	_____
____ NRCS District Conservationist	_____	_____	_____
____ NRCS State Conservation Engineer	_____	_____	_____

Appendix A–2

Unusual or Emergency Event Log

(to be completed during the emergency)

Dam name: Conewango Creek Watershed Dam #33 County: Chautauqua County

When and how was the event detected?

_____

_____

Weather conditions: _____

_____

General description of the emergency situation:

_____

_____

_____

Emergency level determination: _____ Made by: _____

Actions and Event Progression

Date	Time	Action/event progression	Taken by

Report prepared by: _____ Date: _____

Appendix A–3

Dam Emergency Situation Report

(to be completed following the termination of the emergency)

Dam name: Conewango Creek Watershed, Site 33

National Inventory of Dams (NID) No.: NY 00581

Dam location: 1 Mile South of Cherry Creek Chautauqua County Conewango Creek

(City) *(County)* *(Stream/River)*

Date: Time:

Weather conditions: _____

General description of emergency situation:

_____

_____

Area(s) of dam affected:

_____

_____

Extent of dam damage: _____

Possible cause(s): _____

Effect on dam's operation: _____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

_____

_____

Other data and comments:

_____

Observer's name and telephone number: _____

Report prepared by: _____ Date: _____

Appendix A–4
Glossary of Terms

Abutment That part of the valleyside against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.

Acre-foot A unit of volumetric measure that would cover 1 acre to a depth of 1 foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.

Berm A nearly horizontal step (bench) in the upstream or downstream sloping face of the dam.

Boil A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.

Breach An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.

Conduit A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.

Control section A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.

Cross section A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. Also, a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream.

Dam An artificial barrier generally constructed across a watercourse for the purpose of impounding or diverting water.

Dam failure The uncontrolled release of a dam's impounded water.

Dam Operator The person(s) or unit(s) of government with responsibility for the operation and maintenance of dam.

Drain, toe or foundation, or blanket A water collection system of sand and gravel and typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet.

Drainage area (watershed) The geographic area on which rainfall flows into the dam.

Drawdown The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.

Emergency A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.

Emergency Action Plan (EAP)	A formal document identifying potential emergency conditions that may occur at the dam and specifying preplanned actions to minimize potential failure of the dam or minimize failure consequences including loss of life, property damage, and environmental impacts.
Evacuation map	A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.
Filter	The layers of sand and gravel in a drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.
Freeboard	Vertical distance between a stated water level in the reservoir and the top of dam.
Gate, slide or sluice, or regulating	An operable, watertight valve to manage the discharge of water from the dam.
Groin	The area along the intersection of the face of a dam and the abutment.
Hazard classification	A system that categorizes dams (high, significant, or low) according to the degree of their potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or misoperation of a dam.
Height, dam	The vertical distance between the lowest point along the top of the dam and the lowest point at the downstream toe, which usually occurs in the bed of the outlet channel.
Hydrograph, inflow or outflow, or breach	A graphical representation of either the flow rate or flow depth at a specific point above or below the dam over time for a specific flood occurrence.
Incident Commander	The highest predetermined official available at the scene of an emergency situation.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation area or map	The geographic area downstream of the dam that would be flooded by a breach of the dam or other large discharge.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.
Outlet works (principal spillway)	An appurtenant structure that provides for controlled passage of normal water flows through the dam.
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.

Probable Maximum Precipitation (PMP) or Flood (PMF)	The theoretically greatest precipitation or resulting flood that is meteorologically feasible for a given duration over a specific drainage area at a particular geographical location.
Reservoir	The body of water impounded or potentially impounded by the dam.
Riprap	A layer of large rock, precast blocks, bags of cement, or other suitable material, generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.
Risk	A measure of the likelihood and severity of an adverse consequence.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway (auxiliary or emergency)	The appurtenant structure that provides the controlled conveyance of excess water through, over, or around the dam.
Spillway capacity	The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.
Spillway crest	The lowest level at which reservoir water can flow into the spillway.
Tailwater	The body of water immediately downstream of the embankment at a specific point in time.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.

Appendix B–1
Resources Available

Locally available equipment, labor, and materials:
The county has the following resources that can be utilized in the event of an emergency:

Contact: George Spanos, Director County Department of Public Facilities: 716-664-8400
Ken Chase, Town of Cherry Creek, HWY. Supervisor: 716-296-5721 or 716-499-5721

- Heavy Construction equipment, trucks and manpower.
- Loaders, Trucks, Dozer, Backhoe, etc.

Contact the Chautauqua County Road Department --- see *Emer. Services Contacts* tab.

Other locally available resources include:

Heavy equipment service and rental	**Sand and gravel supply**	**Ready-mix concrete supply**
JSE Excavating 6032 Rt. 83 Cherry Creek, NY 14723 Jim Schimek 716-485-3800	Countryside Sand & Gravel Rt. 62 South Dayton, NY 14138 716-988-3271	LER Concrete, Inc. 1946 New York Ave. Falconer, NY 14733 716-665-4504
Doug Rice Excavating 28 Creek Road Ellington, NY 14732 716-287-3712	Cherry Creek Sand & Gravel PO Box 306 Cherry Creek, NY 14723 716-296-9910	Hanson Aggregates Allen St. Ext. Jamestown, NY 14701 716-665-4620
ADMAR Supply Co., Inc. 1394 Military Road Buffalo, NY 14207 1-800-353-2367	Frew Run Gravel Products 984 Frew Run Road Frewsburg, NY 14738 716-569-4712	JMI Concrete Products Jamestown, NY 14701 716-665-4504

Pumps	Diving contractor	Sand bags
ADMAR Supply Co. 1394 Military Rd. Buffalo, NY 14207 1-800-353-2367	Buffalo Industrial Diving, Inc 201 Ganson St. Buffalo, NY 14203 716-854-1041	Chautauqua County Emergency Services 2 Academy St. Mayville, NY 14757 716-753-14757
	Chautauqua County WET Mayville Dispatch	

Appendix B–2
Location and Vicinity Maps

(Insert map)

Appendix B–3
Watershed Project Map

(Insert map)

Appendix B–4
Evacuation Map

(Insert map)

Appendix B–5
Residents/Businesses/Highways at Risk

A major flood caused by a sudden breach of the dam is estimated to inundate six homes, three businesses, and three highways. These homes and businesses (marked on the evacuation map) are located east of OK Highway 44 and south of Chestnut Street in Rock City.

House/ business no.*	Resident/business	Address	Phone no.	Distance downstream from dam (ft)	Travel time** (hr)	Max water depth above first floor (ft)
1	Donald Yahn	6690 Pickup Hill Rd. Cherry Creek, NY		>1,500		
2	Cherry Creek Livestock Auction	6732 Pickup Hill Rd Cherry Creek, NY	716-296-5041	>1,500		
3	Empire Livestock Marketing, LLC	797 Southside Ave. Cherry Creek, NY	716-296-5041	>1,500		

* See Appendix B–4.

** Estimated time for breach wave (peak) to travel from dam to downstream locations

Basis for computation of evacuation area and flooding depths

Breach inundation study completed by NRCS----------

Hydraulic model used: NRCS TR–20 (routing); TR–60 (peak discharge); TR–66 (hydrograph)

Model assumptions:

- ☐ "Sunny Day" Breach (no inflow into the reservoir)
- ☐ Water surface elevation in reservoir prior to breach = _____ (top of dam)

- Total volume of breach hydrograph = _____ acre-ft
- Height of water at time of breach = _____ ft
- Peak breach discharge = _____ ft^3/s
- Downstream area defined by field surveys consisting of 10 cross sections and 3 bridge openings

Appendix B–6
Plan View of Dam

(Insert map)

Appendix B–7
Profile of Principal Spillway

(Insert map)

Appendix B–8
Reservoir Elevation-area-volume and Spillway Capacity Data

CONEWANGO CREEK WATERSHED
DAM NO. 33

Elevation	Reservoir Surface acres	Reservoir Storage acre ft	Spillway Discharge ft^3/s
1682.0	0.0	0.0	0
1684.0	0.3	0.3	0
1686.0	2.0	2.5	0
1688.0	3.7	8.2	0
1690.0	8.6	20.5	0
1692.0	15.9	45.0	0
1694.0	18.7	79.6	9
1696.0	23.5	121.8	0
Principal Spillway Crest			
1697.0	26.2	146.7	0
1698.0	31.1	175.4	45
1700.0	40.8	247.3	76
1702.0	49.3	337.4	82
1704.0	62.0	448.7	87
1706.0	71.4	582.1	92
1708.0	86.7	740.2	97
1710.0	98.6	925.5	102
Auxiliary Spillway Crest			
1712.0	115.0	1139.1	108
1714.0	129.9	1384.0	516
1716.0	145.3	1659.2	2090
1718.0	160.7	1965.2	4437
1720.0	178.8	2304.7	7763
1720.2	180.6	2340.6	7937

Appendix B–9
National Inventory of Dams (NID) Data

Dam name: **Conewango Creek Watershed, Site 33**

State: **New York**

NID ID: **NY 00581**

Longitude: **79.114444**

Latitude: **42.286944**

Geodetic location: _____

County: **Chautauqua**

Stream: **Conewango Creek**

Nearest town: **Cherry Creek**

Distance to nearest town: **1 mi**

Operator: **Chautauqua County**

Year constructed: **1974**

Max. discharge: **656 ft^3/s**

Max. storage: **128acre-ft**

Normal storage: **4 acre-ft**

Surface area: **1 acre**

Drainage area: **1 mi^2**

Inspection frequency: **1 yr**

State regulated?: **Yes**

State reg. agency: **NYS-DEC**

Federal funding: **USDA NRCS**

Federal design: **USDA NRCS**

Federal constructed: **USDA NRCS**

Program authority: **PL-556 Flood Control**

Watershed No.: **05010002-010**

Watershed name: **Conewango Creek Watershed**

Service life: **100 yr**

O&M insp. Resp:**Cattaraugus Co. Soil & Water**

O&M insp. current?: **yes**

Population at risk: **1064**

Dam height: **57 ft**

Dam length: **325 ft**

Dam volume: **61,361 yd^3**

Design hazard potential: **High**

Current hazard potential: **"C", High**

Hazard potential class. year: ____

Sediment storage: ____ **acre-ft**

Flood storage: **175 acre-ft**

Surcharge storage: ____ **acre-ft**

Other storage: ____ **acre-ft**

Principal spillway type: **Concrete pipe**

Principal spillway conduit diameter: **30 in**

Auxiliary spillway type: **Vegetated earth**

Auxiliary spillway width: **65 ft**

Appendix F

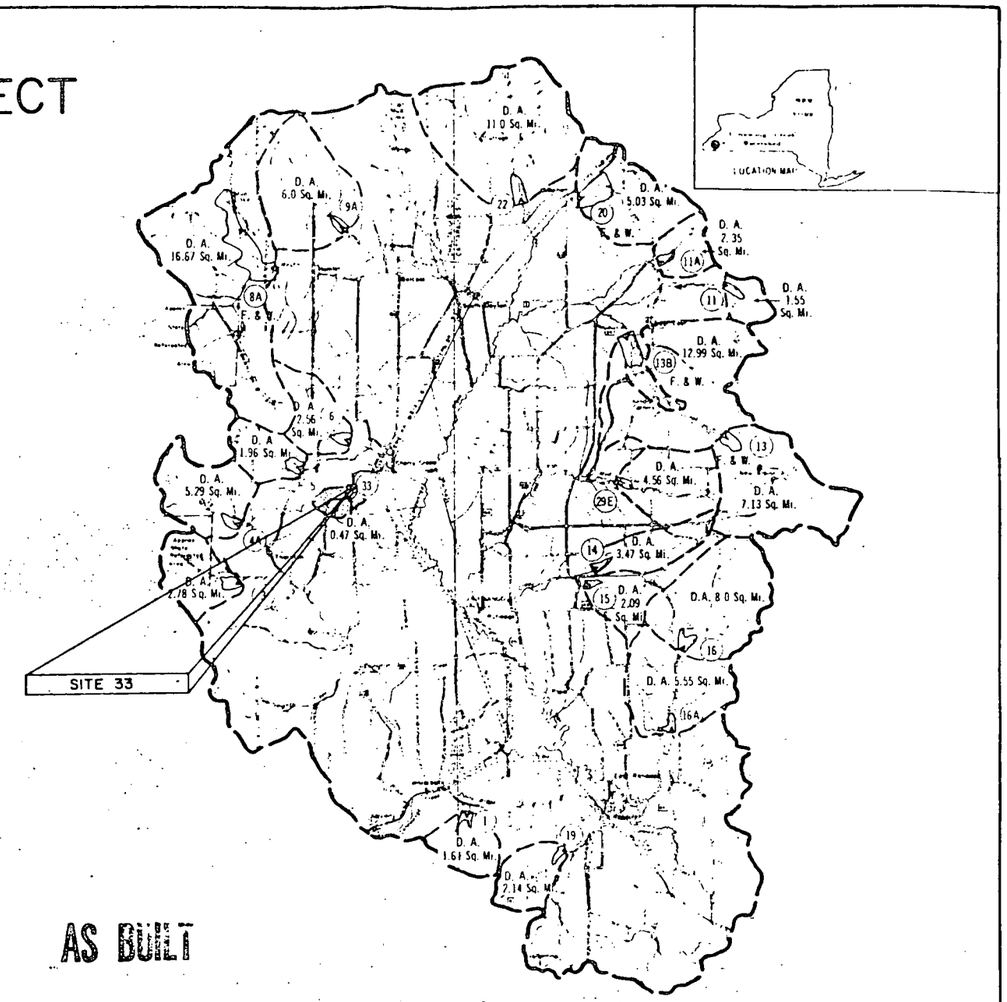
Record Drawings

CONEWANGO CREEK WATERSHED PROJECT

FLOODWATER RETARDING DAM

SITE 33 AS BUILT

DRAINAGE AREA	300 Acres
FLOOD STORAGE (TO EMERGENCY SPILLWAY CREST)	68 Ac.Ft.
WATER SURFACE AREA (SEDIMENT POOL)	0.7 Acres
HEIGHT OF DAM	57 Feet
VOLUME OF FILL	~~54,100~~ 50,676 Cu.Yds.



BUILT UNDER THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT

BY

CONEWANGO CREEK WATERSHED COMMISSION

WITH THE ASSISTANCE OF THE

SOIL CONSERVATION SERVICE

OF THE

U. S. DEPARTMENT OF AGRICULTURE

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SHEET 2 PLAN OF STORAGE AREA
SHEET 3 PLAN OF STRUCTURAL WORKS
SHEET 4 CUTOFF TRENCH EXCAVATION
SHEET 5 EMERGENCY SPILLWAY
SHEET 6 FILL PLACEMENT AND PRINCIPAL SPILLWAY EXCAVATION
SHEET 7 DRAINAGE SYSTEM DETAILS
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SHEET 9 PLAN PROFILE OF PRINCIPAL SPILLWAY
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AS BUILT

AS BUILT

AS BUILT
12/9/74

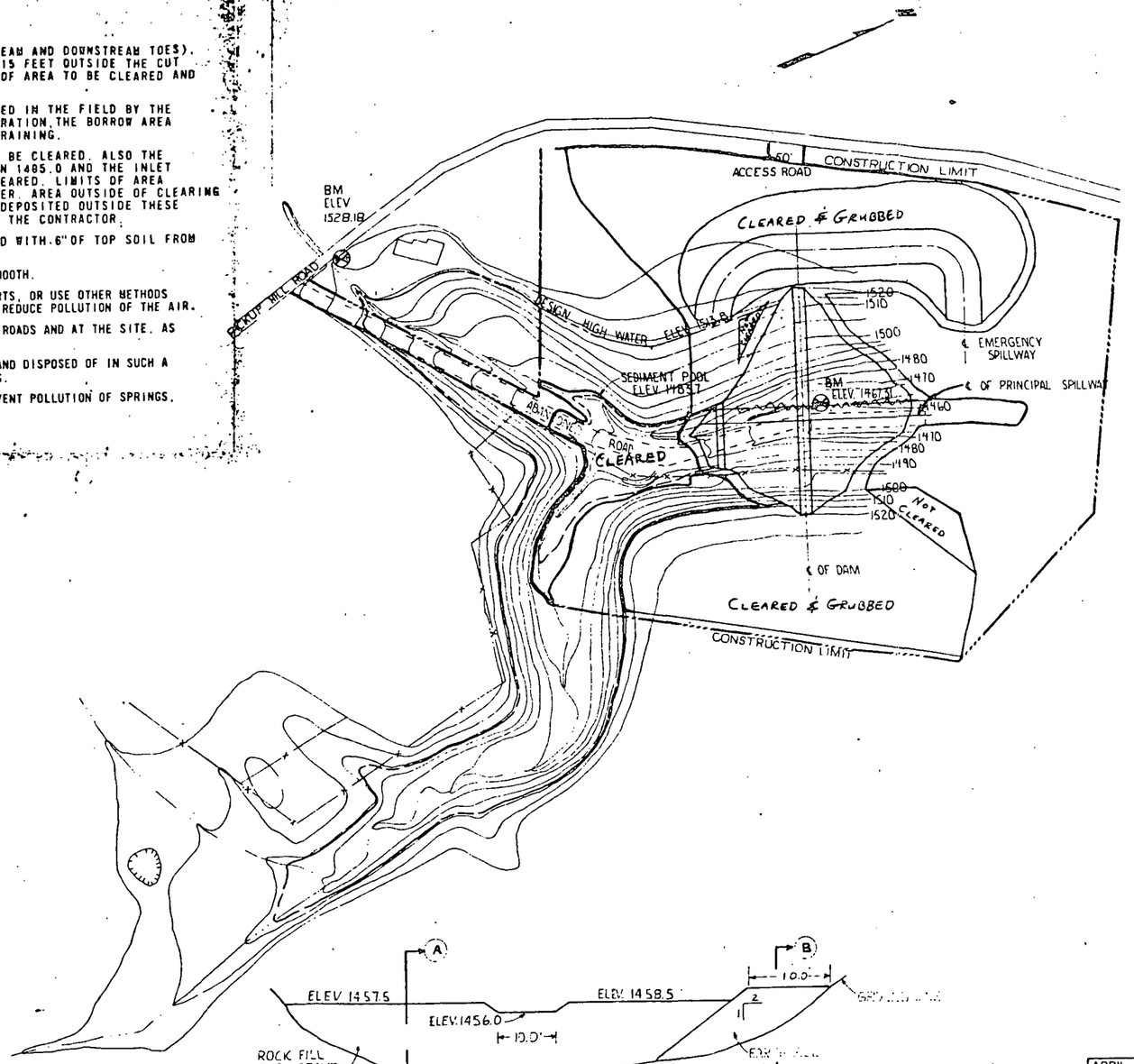
CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
COVER SHEET

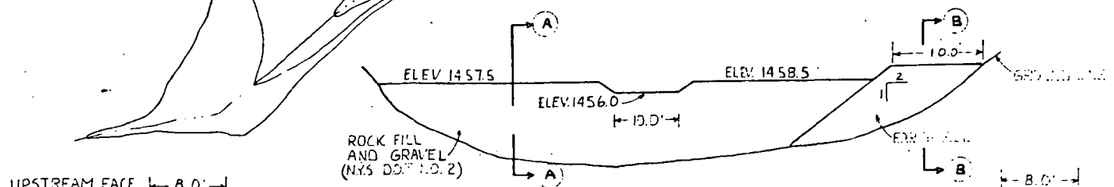
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

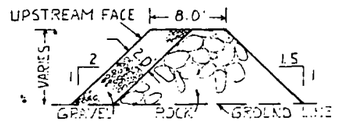
Designed W.A. RIEGEL Date 12/70	Approved by STATE CONSERVATION ENGINEER
Drawn	Title Glenn E. Stuck
Traced	Title HEAD, ENG & W/S PLAN. UNIT
Checked Lee Beck 3/71	Sheet No. 1 of ~~23~~ 32 — Drawing No. NY-2173-P

CONSTRUCTION DETAILS

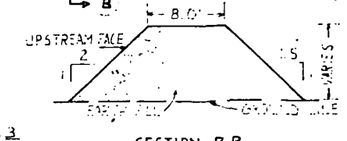
1. AREAS UNDER THE DAM (INCLUDING 15 FEET OUTSIDE THE UPSTREAM AND DOWNSTREAM TOES), AND SEDIMENT BASIN, AND IN EMERGENCY SPILLWAY (INCLUDING 15 FEET OUTSIDE THE CUT SLOPE), AND BORROW AREA TO BE CLEARED AND GRUBBED. LIMITS OF AREA TO BE CLEARED AND GRUBBED SHALL BE STAKED IN THE FIELD BY THE ENGINEER.
2. DEPTHS AND LIMITS OF BORROW EXCAVATION SHALL BE DETERMINED IN THE FIELD BY THE ENGINEER AS REQUIRED. AT THE COMPLETION OF EARTHFILL OPERATION, THE BORROW AREA SHALL BE LEFT GENTLY SLOPING, GENERALLY SMOOTH AND FREE DRAINING.
3. AREAS UPSTREAM FROM DAM AND BELOW ELEVATION 1485.0 SHALL BE CLEARED. ALSO THE AREA 50.0' WIDE ON THE LEFT ABUTMENT BORDERED BY ELEVATION 1485.0 AND THE INLET CHANNEL OF THE EMERGENCY SPILLWAY (EXTENDED) IS TO BE CLEARED. LIMITS OF AREA TO BE CLEARED SHALL BE STAKED IN THE FIELD BY THE ENGINEER. AREA OUTSIDE OF CLEARING AND GRUBBING LIMITS SHALL BE LEFT UNDISTURBED. MATERIAL DEPOSITED OUTSIDE THESE LIMITS BY THE CONSTRUCTION OPERATIONS WILL BE REMOVED BY THE CONTRACTOR.
4. BOTTOM SECTION OF THE EMERGENCY SPILLWAY IS TO BE COVERED WITH 6" OF TOP SOIL FROM STATION 1+50 TO APPROXIMATELY 5+80.
5. WASTE AREAS SHALL BE GRADED TO BE FREE DRAINING AND GENERALLY SMOOTH.
6. THE CONTRACTOR SHALL CONSTRUCT TEMPORARY BRIDGES, INSTALL CULVERTS, OR USE OTHER METHODS APPROVED BY THE ENGINEER WHERE HAUL ROADS CROSS LIVE STREAMS TO REDUCE POLLUTION OF THE AIR.
7. THE CONTRACTOR SHALL SPRINKLE OR APPLY DUST SUPPRESSORS ON HAUL ROADS AND AT THE SITE, AS NECESSARY, TO REDUCE POLLUTION OF THE AIR.
8. ALL CHEMICALS, FUELS, AND LUBRICANTS SHALL BE LOCATED, STORED, AND DISPOSED OF IN SUCH A MANNER AS TO PREVENT THEIR ENTRY INTO STREAMS, WELLS, OR SPRINGS.
9. SANITARY FACILITIES SHALL BE LOCATED IN SUCH A MANNER AS TO PREVENT POLLUTION OF SPRINGS, WELLS, AND STREAMS.







SECTION A-A



SECTION B-B

SEDIMENT BASIN CONSTRUCTION DETAILS

1. SEDIMENT BASIN LOCATION AND LENGTH AS SHOWN ON SH. 3 IS APPROXIMATE AND WILL BE STAKED IN THE FIELD BY THE ENGINEER.
2. EARTH FILL COMPACTION SHALL BE MADE BY A MINIMUM OF ONE PASS OF VEHICLE USED FOR PLACING MATERIAL.
3. SOURCE OF EARTH FILL USED FOR SEDIMENT BASIN WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.

QUANTITIES

LOOSE ROCK RIP RAP	10 CY
NYS D.O.T. NO 2 GRAVEL	60 CY
EARTH FILL	30 CY

5' CONTOUR INTERVAL

0 50 100 200

SCALE IN FEET

AS BUILT 12/1/74

APRIL 72	SEDIMENT BASIN DETAILS	
DATE	ITEM	APP'D
	REVISION	

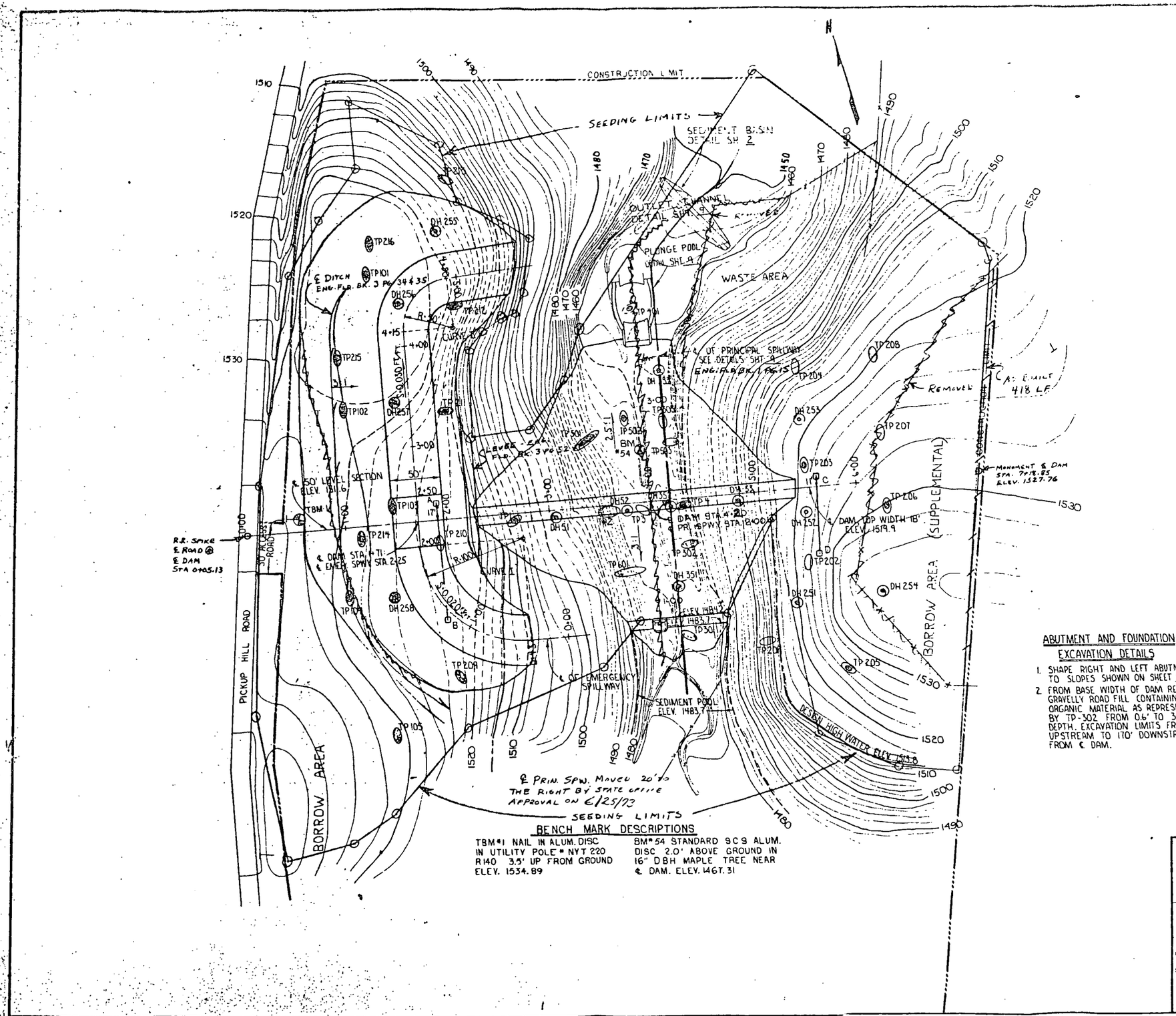
CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
PLAN OF STORAGE AREA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

W.A. RIEGEL	2-71	
W. GRAJKO JR.	11/69	
D.M.C.	6/69	

2 NY-2173-P

~~35~~ 32 NYS SCS-APRIL 1969



BENCH MARK DESCRIPTIONS

TBM#1 NAIL IN ALUM. DISC IN UTILITY POLE # NYT 220 R140 3.5' UP FROM GROUND ELEV. 1534.89

BM#54 STANDARD SCS ALUM. DISC 2.0' ABOVE GROUND IN 16" DBH MAPLE TREE NEAR ℄ DAM. ELEV. 1467.31

LEGEND

- CONTOUR LINE
- ℄ STREAM
- FENCE LINE
- BENCH MARK
- DESIGN HIGH WATER
- SEDIMENT POOL
- HUB
- FENCE LINE (EXISTING)
- ROAD
- TEST PIT (LOGGED ONLY)
- TEST PIT (LOGGED & SAMPLED)
- DRILL HOLE (LOGGED & SAMPLED)
- CONSTRUCTION LIMIT
- FENCE LINE (PLANNED)
- CLEARING LIMIT
- DESIGN HIGH WATER

CURVE I LAYOUT DATA

Δ = 90°00' T = 100.0
R = 100.0 E = 41.42
D = 57°18 M = 29.29
L = 157.0

℄ STA	DEFLECT ∠	CHORD DIST
2+00	0°00	—
1+75	7°10	24.94
1+50	14°19	24.94
1+25	21°29	24.94
1+00	28°39	24.94
0+75	35°49	24.94
0+43	45°00	31.93

CURVE II LAYOUT DATA

Δ = 85°57' T = 46.57
R = 50.0 E = 18.33
D = 114°36' M = 13.41
L = 75.0

℄ STA	DEFLECT ∠	CHORD DIST
4+15	0°00	—
4+40	14°20	24.74
4+65	28°39	24.74
4+90	42°58	24.74

ABUTMENT AND FOUNDATION EXCAVATION DETAILS

1. SHAPE RIGHT AND LEFT ABUTMENTS TO SLOPES SHOWN ON SHEET 4.
2. FROM BASE WIDTH OF DAM REMOVE GRAVELLY ROAD FILL CONTAINING ORGANIC MATERIAL AS REPRESENTED BY TP-302 FROM 0.6' TO 3.0' DEPTH. EXCAVATION LIMITS FROM 60' UPSTREAM TO 170' DOWNSTREAM FROM ℄ DAM.

SOILS DETAILS

SEE SHEETS 18, 19, 20, 21 FOR DESCRIPTION OF TEST PITS AND DRILL HOLES.

0 25 50 100
SCALE IN FEET

2' CONTOURS

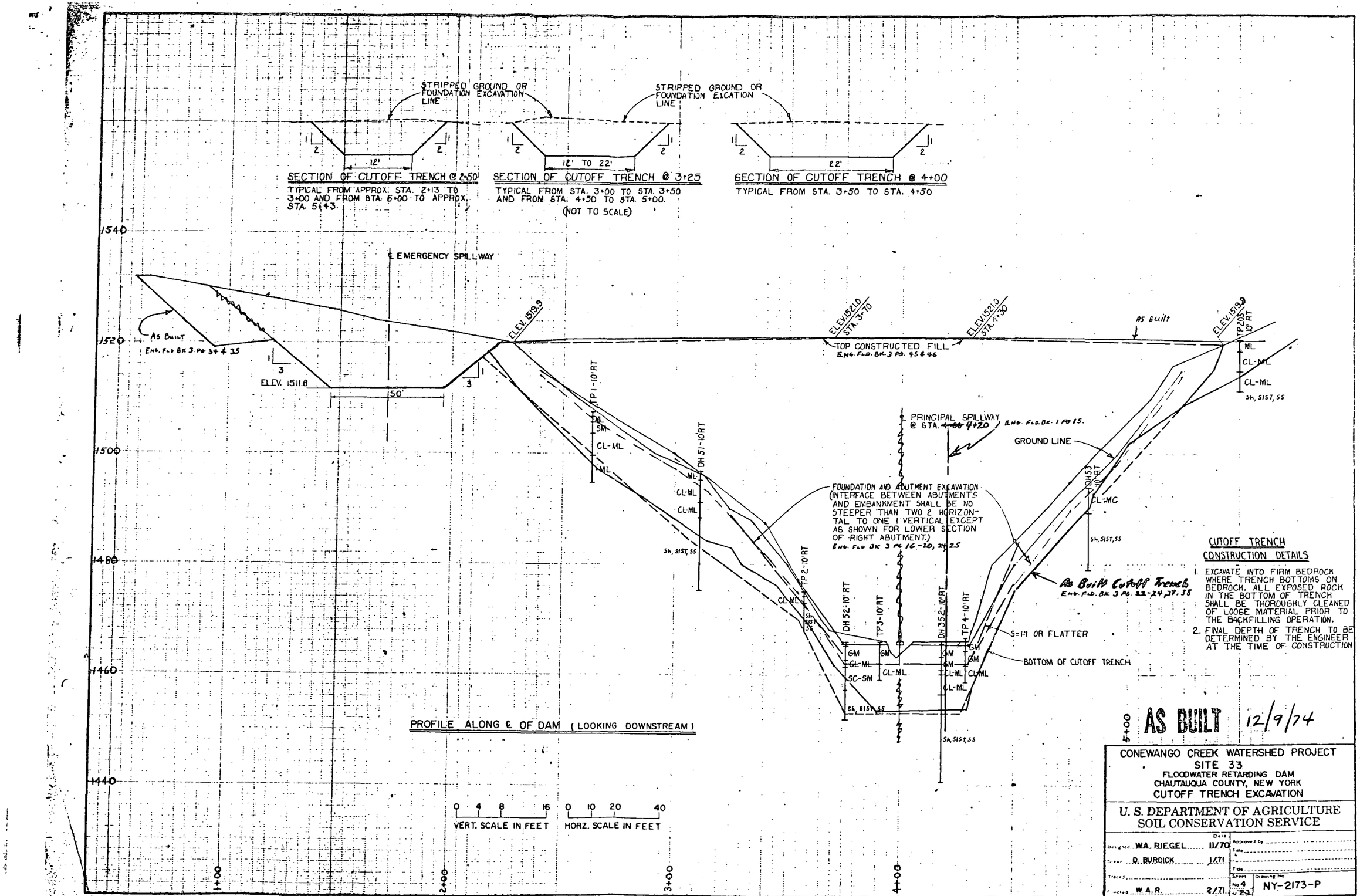
AS BUILT 12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
PLAN OF STRUCTURAL WORKS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date
W. A. RIEGEL	12-70
D. ANGELO	1-71
W. E. GRAJKO, Jr.	1-71
J. DE VITA III	6-69

Sheet 3 Drawing No. NY-2173-P



PROFILE ALONG ℄ OF DAM (LOOKING DOWNSTREAM)

0 4 8 16 VERT. SCALE IN FEET

0 10 20 40 HORZ. SCALE IN FEET

CUTOFF TRENCH CONSTRUCTION DETAILS

1. EXCAVATE INTO FIRM BEDROCK WHERE TRENCH BOTTOMS ON BEDROCK. ALL EXPOSED ROCK IN THE BOTTOM OF TRENCH SHALL BE THOROUGHLY CLEANED OF LOOSE MATERIAL PRIOR TO THE BACKFILLING OPERATION.
2. FINAL DEPTH OF TRENCH TO BE DETERMINED BY THE ENGINEER AT THE TIME OF CONSTRUCTION

AS BUILT 12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
CUTOFF TRENCH EXCAVATION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed W.A. RIEGEL	Date 11/70	Approved by	
Drawn D. BURDICK	1/71	Title	
Traced		Title	
Checked W.A.R.	2/71	Sheet No 4 of 23	Drawing No NY-2173-P

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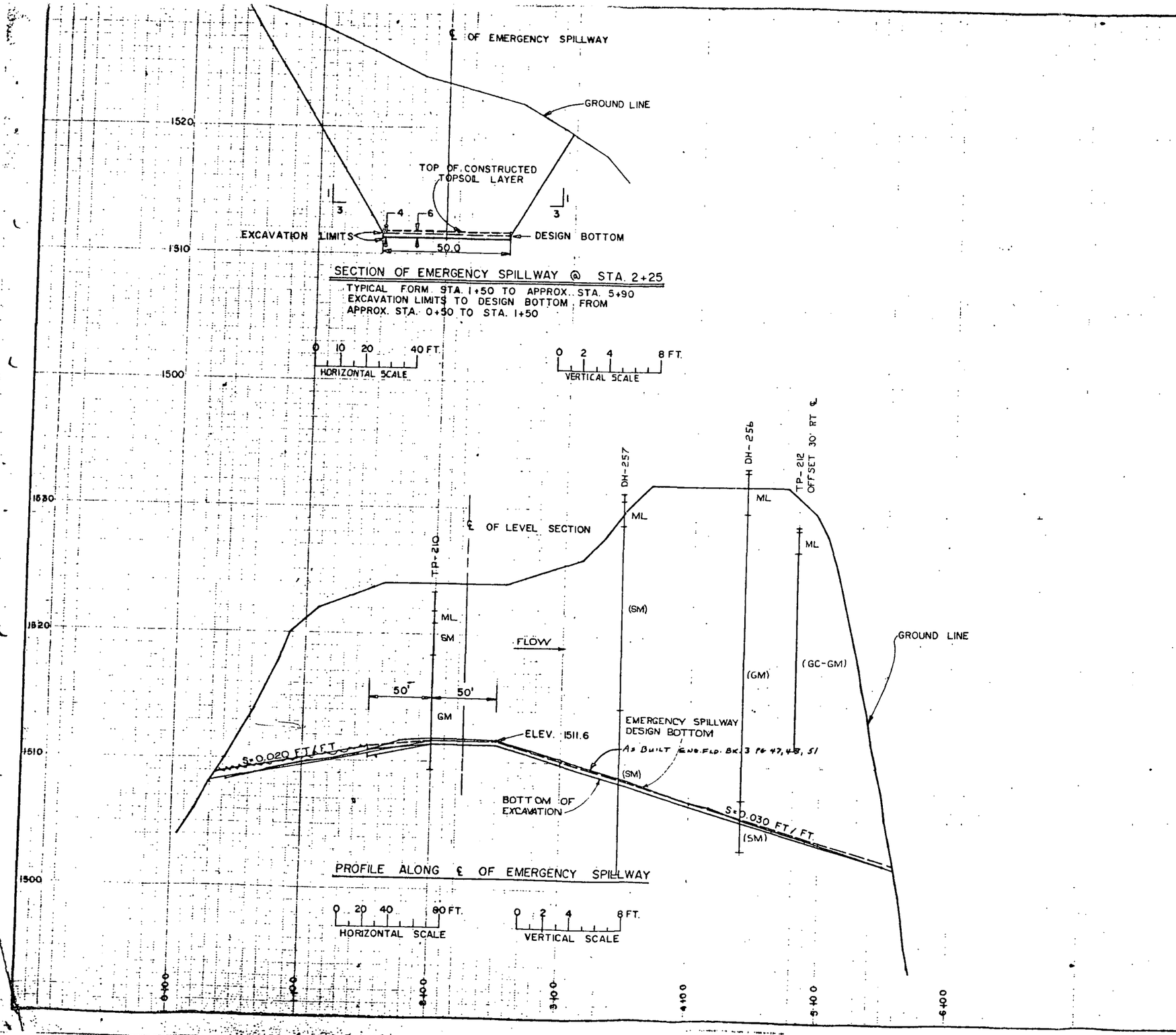


SECTION OF EMERGENCY SPILLWAY @ STA. 2+25

TYPICAL FORM STA. 1+50 TO APPROX. STA. 5+90
EXCAVATION LIMITS TO DESIGN BOTTOM FROM
APPROX. STA. 0+50 TO STA. 1+50

PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

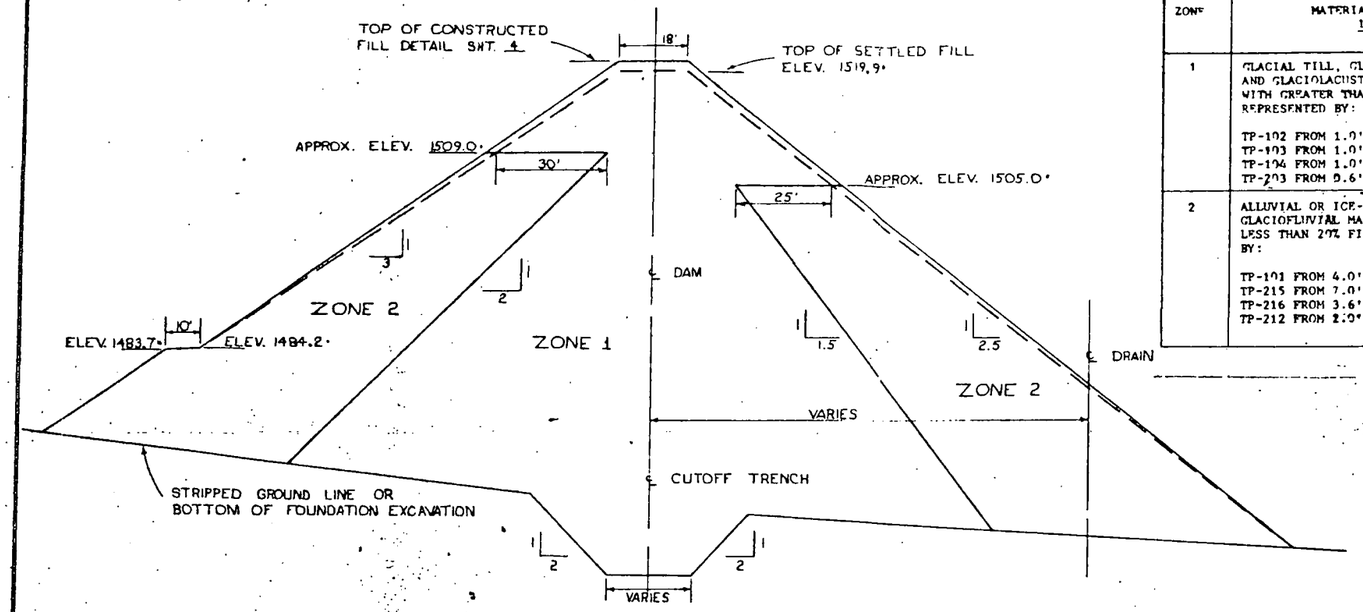
AS BUILT 12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
EMERGENCY SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

W.A. RIEGEL 12/70
W. MAVINS 12/70

5 NY-2173-P



SECTION OF DAM AT STATION 4+25 (NOT TO SCALE)

TYPICAL FROM APPROX. STA. 2+30 TO APPROX. STA. 5+40

EARTH FILL REQUIREMENTS

ZONE	MATERIAL 1/	MAX. ROCK SIZE 2/	MAX. LIFT THICKNESS 3/	MIN. REQUIRED WATER CONTENT 4/	COMPACTION 5/ CLASS	COMPACTION 5/ DEFINITION
1	GLACIAL TILL, GLACIOFLUVIAL, AND GLACIOLACUSTRINE MATERIALS WITH GREATER THAN 20% FINES REPRESENTED BY: TP-102 FROM 1.0' TO 10.0' TP-103 FROM 1.0' TO 9.5' TP-104 FROM 1.0' TO 10.0' TP-203 FROM 0.6' TO 5.5'	6"	9"	2 PERCENTAGE POINTS BELOW OPTIMUM	A	95% STANDARD DENSITY BY ASTM D-698 METHOD A
2	ALLUVIAL OR ICE-CONTACT GLACIOFLUVIAL MATERIALS WITH LESS THAN 20% FINES REPRESENTED BY: TP-101 FROM 4.0' TO 10.0' TP-215 FROM 7.0' TO 16.5' TP-216 FROM 3.6' TO 16.5' TP-212 FROM 2.0' TO 17.5'	6"	9"	WET 5/	C	FOUR PASSES PER LAYER OF FILL BY A SMOOTH WHEEL VIBRATING ROLLER AT LEAST 72"WIDE, WEIGHING AT LEAST ONE TON (STATIC SERVICE WEIGHT) PER FOOT OF WIDTH AND CAPABLE OF EXERTING A DYNAMIC IMPACT OF AT LEAST 20,000 POUNDS AT THE RATE OF AT LEAST 1,200 BLOWS PER MINUTE.

1/ THE PLACEMENT TABLE INDICATES ESTIMATED USE OF MATERIALS.

2/ MAXIMUM ROCK SIZE PLACED IN BACKFILL COMPACTED BY MEANS OF HAND TAMPING OR MANUALLY DIRECTED POWER TAMPERS OR PLATE VIBRATORS SHALL BE 3".

3/ MAXIMUM LIFT THICKNESS PRIOR TO COMPACTION.

4/ WATER CONTENT AT TIME OF COMPACTION.

5/ THOROUGHLY WET BUT:

a. NOT MORE THAN 1% MOISTURE CONTENT ON THE MATERIAL PASSING THE #4 SIEVE UNLESS MODIFIED BY THE ENGINEER AT THE TIME OF CONSTRUCTION.

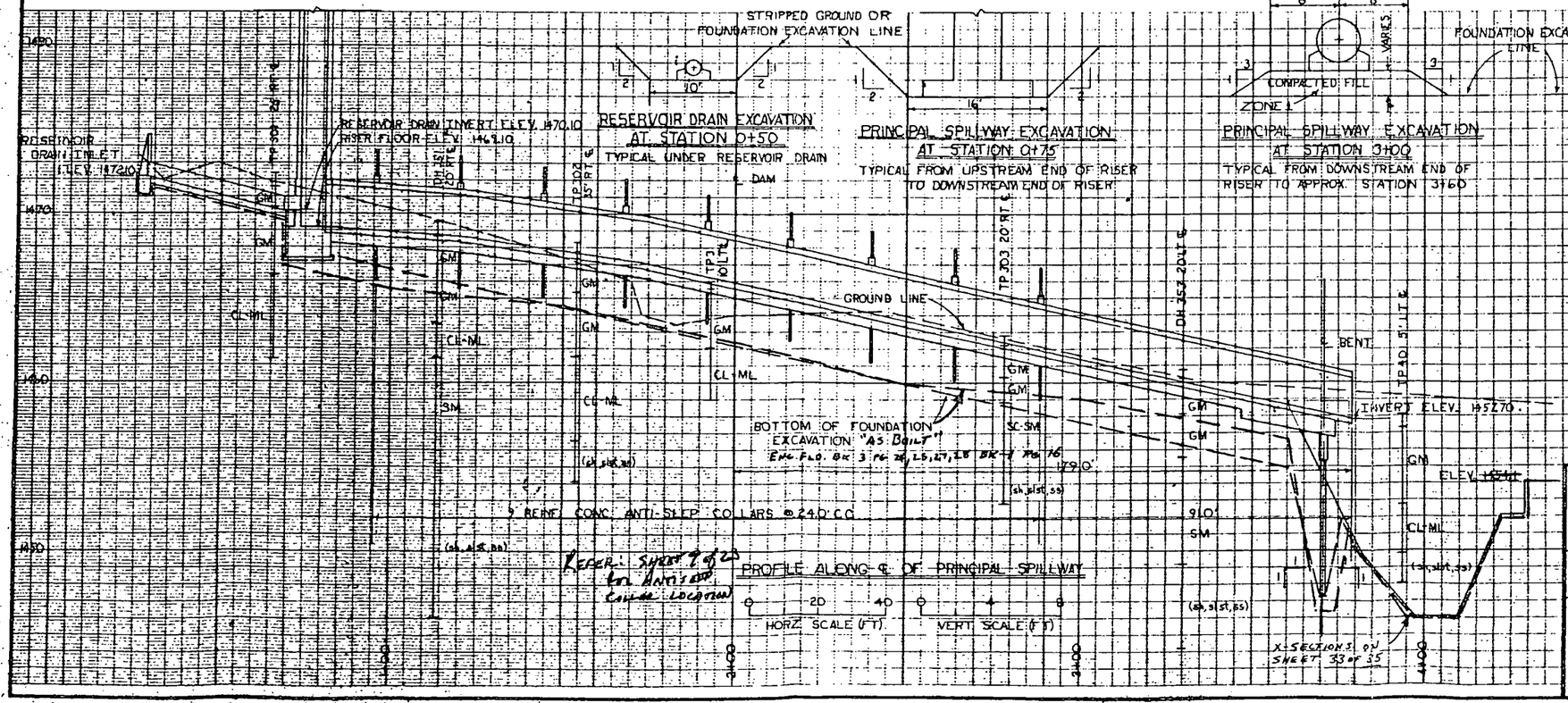
OR: b. NOT SO WET AS TO CAUSE ADHERENCE OF THE SOIL TO THE WHEELS OR TRACKS OF EQUIPMENT, NOR TO CAUSE BOGGING DOWN OF EQUIPMENT.

6/ FOR TYPICAL COMPACTION CURVES SEE SHEET 22

CONSTRUCTION DETAILS

1. ZONE 2 BOUNDARIES INDICATED ARE APPROXIMATE. ADJUSTMENTS WILL BE MADE BY THE ENGINEER TO PERMIT THE CONTRACTOR TO UTILIZE ALL COARSE MATERIAL (LESS THAN 20% FINES) FROM REQUIRED EXCAVATIONS, WITHIN THE NEAT LINES OF THE EMBANKMENT.

2. TOPSOIL THAT IS SUITABLE FOR USE AND NOT USED ON THE SPECIFIED AREA OF THE EMERGENCY SPILLWAY SHALL BE INCORPORATED WITHIN THE SLOPES OF THE EARTH FILL AS DIRECTED BY THE ENGINEER.



PRINCIPAL SPILLWAY EXCAVATION DETAILS

THE PROFILES AT THE BOTTOM OF ALL EXCAVATIONS AS SHOWN ARE ONLY APPROXIMATE. THE REQUIRED FINISHED GRADES WILL BE ESTABLISHED IN THE FIELD BY THE ENGINEER AT THE TIME OF CONSTRUCTION.

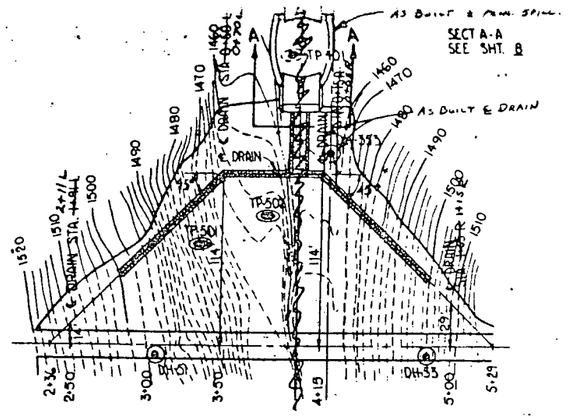
AS BUILT 12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
FILL PLACEMENT & PRIN. SPWY. EXCAVATION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	W.A. RIEGEL	1/71	Approved by
Drawn	R.P. LEWIS	1/71	Title
Traced			Title
Checked			Sheet No. 6 of 23 — Drawing No. NY-2173-P

3532



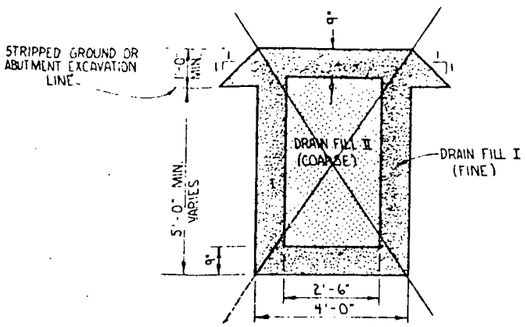
PLAN VIEW

0 25 50 100

SCALE IN FEET

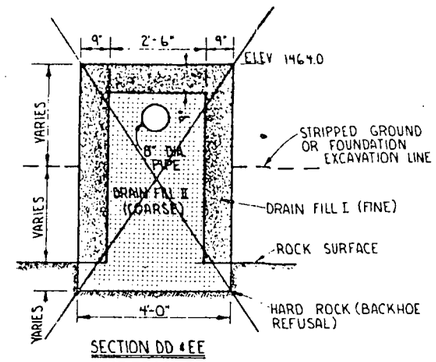
GRAIN SIZE DISTRIBUTION TABLE FOR DRAIN FILL

DRAIN FILL I (FINE)		DRAIN FILL II (COARSE)	
SIEVE NO.	% PASSING	SIEVE NO.	% PASSING
3"		3"	100
1"		1½"	87-100
⅜"	100	1"	77-100
#4	44-100	¾"	70-98
8	80-100	⅜"	42-78
16	50-85	#4	15-50
30	25-60	8	0-22
50	10-30	16	0-3
100	0-10		
200	0-3		



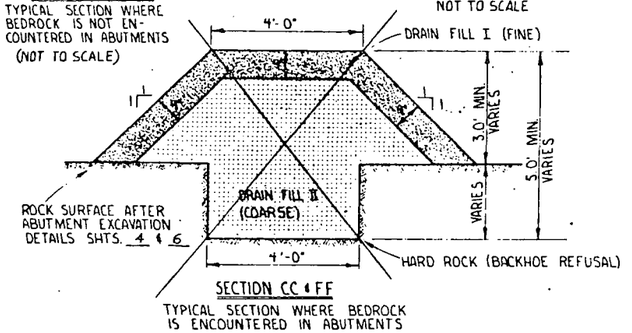
SECTION BB ℄ GG

TYPICAL SECTION WHERE BEDROCK IS NOT ENCOUNTERED IN ABUTMENTS (NOT TO SCALE)



SECTION DD ℄ EE

NOT TO SCALE



SECTION CC ℄ FF

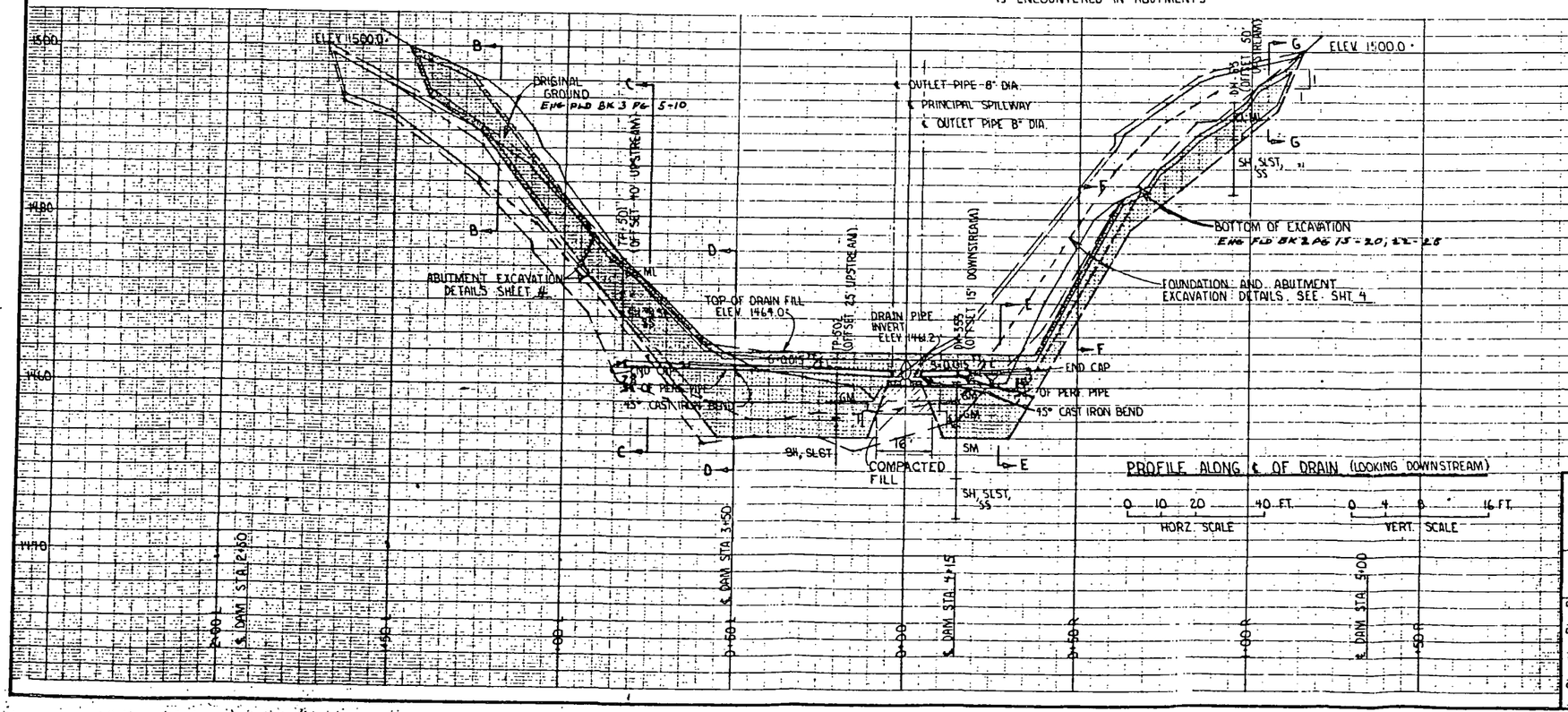
TYPICAL SECTION WHERE BEDROCK IS ENCOUNTERED IN ABUTMENTS

DRAINAGE SYSTEM DETAILS

1. ASBESTOS CEMENT DRAIN PIPE SHALL CONFORM TO SPECIFICATION 545 AND SHALL BE 8" DIA. PRESSURE PIPE CLASS 200, TYPE II
2. THE PROFILES AT THE BOTTOM OF ALL EXCAVATIONS AS SHOWN ARE ONLY APPROXIMATE. THE REQUIRED FINISHED GRADES WILL BE ESTABLISHED IN THE FIELD BY THE ENGINEER AT THE TIME OF CONSTRUCTION.

QUANTITY SUMMARY

191 ~~160~~ CU. YDS. DRAIN FILL I (FINE)
418 ~~250~~ CU. YDS. DRAIN FILL II (COARSE)
182 ~~175~~ LIN. FT. STRAIGHT SECTION OF 8" DIA. PERFORATED ASBESTOS CEMENT PIPE.
26 LIN. FT. STRAIGHT SECTION OF 8" DIA. NON-PERFORATED ASBESTOS CEMENT PIPE.
2 END CAPS
2 45° BEND - 8" DIA. CAST IRON
1 ~~2~~ 90° BEND - 8" DIA. CAST IRON



PROFILE ALONG ℄ OF DRAIN (LOOKING DOWNSTREAM)

0 10 20 40 FT. HORZ. SCALE

0 4 8 16 FT. VERT. SCALE

AS BUILT
12/9/74

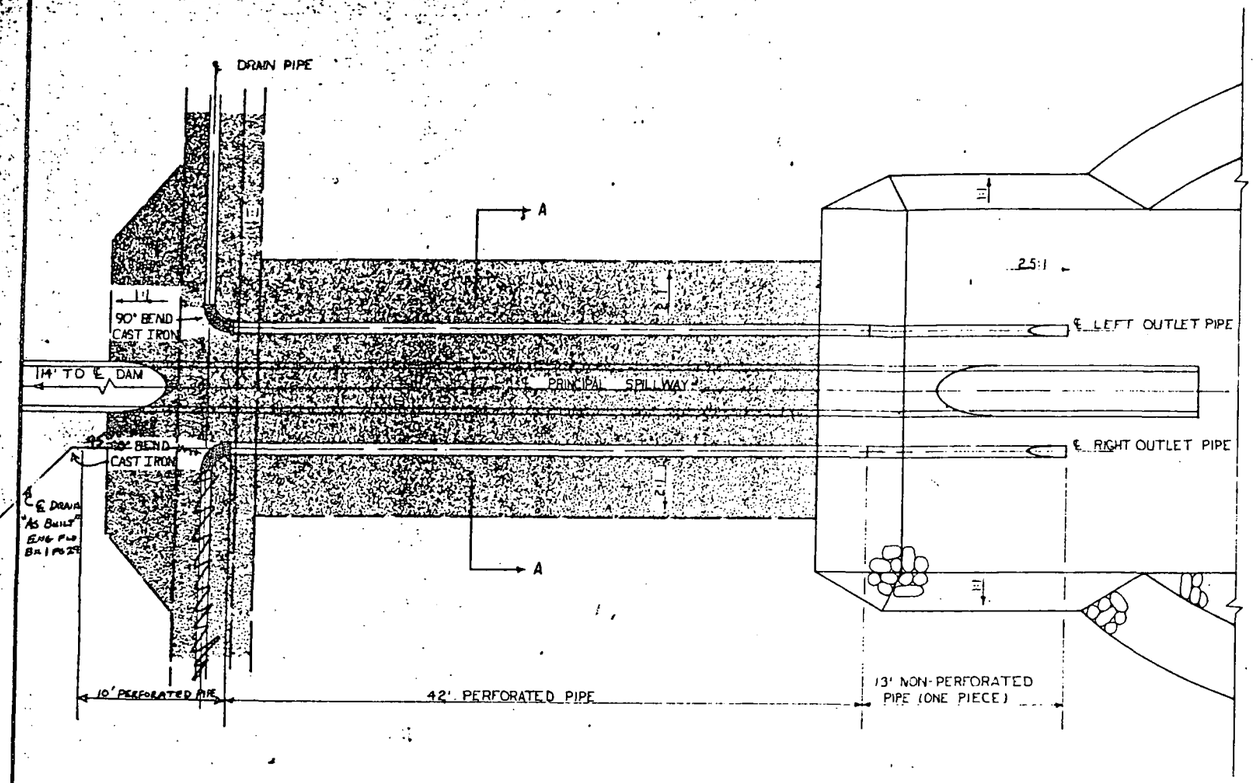
CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
DRAINAGE SYSTEM DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

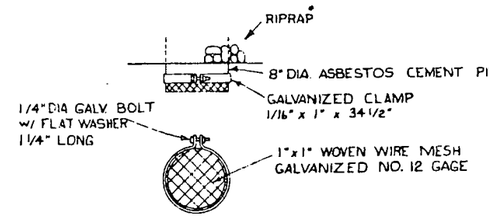
Designed	Date	Approved by
W. A. R.	12-70	Title
Drawn W. E. G.	1-71	
Traced		Title
Checked		Sheet No. 7 of 23
		Drawing No. NY-2173-P

3932

Form SCS-117 (November 1955)

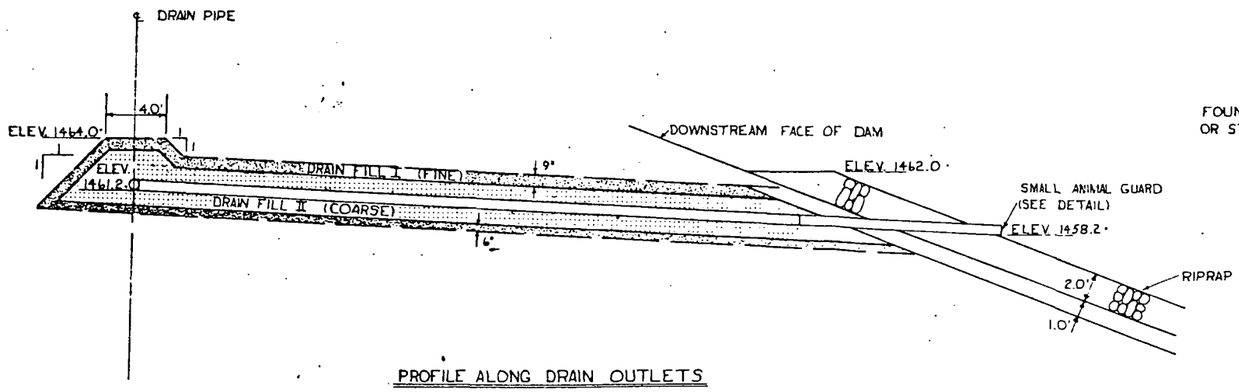


PLAN OF DRAIN OUTLETS



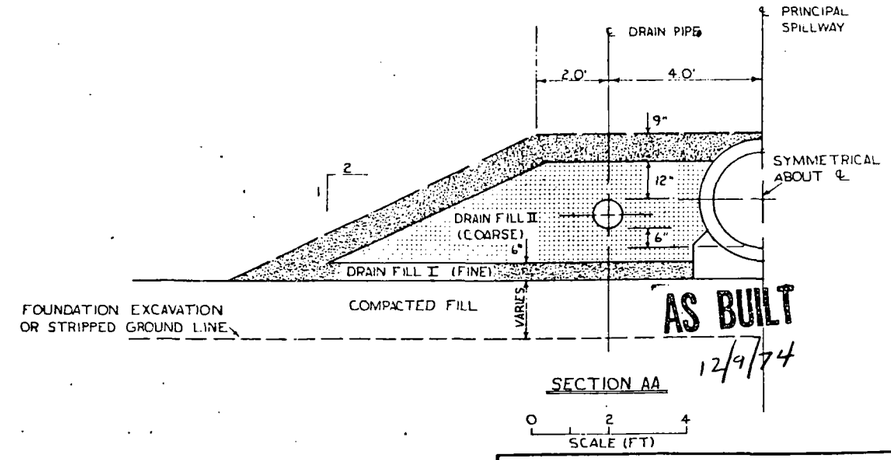
SMALL ANIMAL GUARD DETAILS

2-REQUIRED



PROFILE ALONG DRAIN OUTLETS

0 5 10
SCALE (FT.)



AS BUILT
12/9/74

SECTION AA

0 2 4
SCALE (FT)

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
DRAINAGE SYSTEM

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

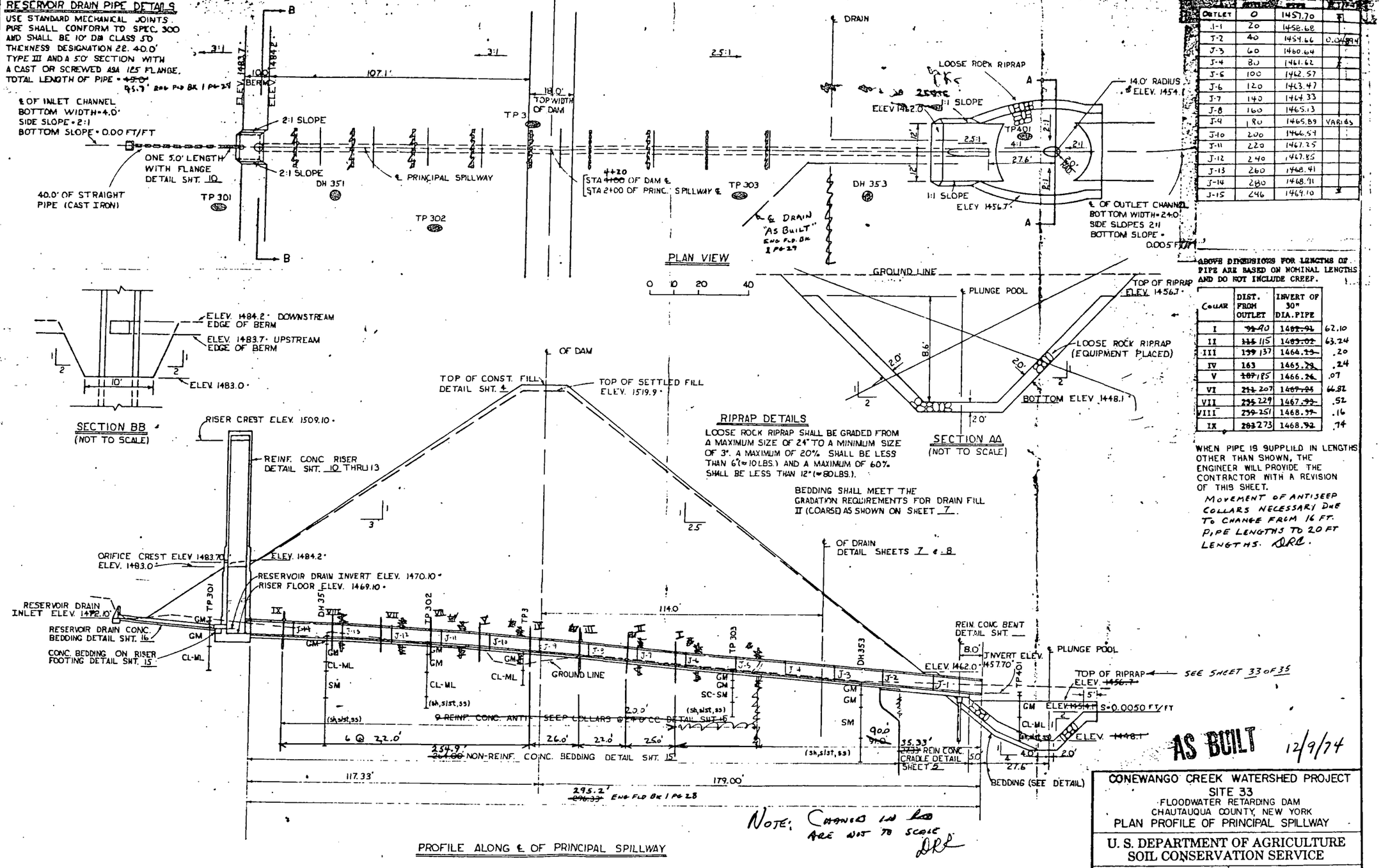
		Date
Designed	W.A. RIEGEL	1/71
Drawn	R.P. LEWIS	1/71
Traced		
Checked	W.A.R.	2/71

Sheet 8 of 23 — Drawing No. NY-2173-P

~~35~~ 32 SCS 31 (APRIL 1963)

RESERVOIR DRAIN PIPE DETAILS

USE STANDARD MECHANICAL JOINTS. PIPE SHALL CONFORM TO SPEC. 300 AND SHALL BE 10' DIA CLASS 50 THICKNESS DESIGNATION 22. 40.0' TYPE III AND A 50' SECTION WITH A CAST OR SCREWED ASA 125 FLANGE. TOTAL LENGTH OF PIPE = ~~45.0'~~ 95.7' ENG FLD BK 1 PG 28



JOINT	DIST. FROM OUTLET	INVERT OF 30" DIA PIPE	SLOPE
OUTLET	0	1457.70	
J-1	20	1458.68	
J-2	40	1459.66	0.0049
J-3	60	1460.64	
J-4	80	1461.62	
J-5	100	1462.57	
J-6	120	1463.47	
J-7	140	1464.33	
J-8	160	1465.13	
J-9	180	1465.89	VARIES
J-10	200	1466.59	
J-11	220	1467.25	
J-12	240	1467.85	
J-13	260	1468.41	
J-14	280	1468.91	
J-15	296	1469.10	

ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

COLLAR	DIST. FROM OUTLET	INVERT OF 30" DIA. PIPE	
I	~~92.90~~	~~1462.91~~	62.10
II	~~115~~ 115	~~1463.02~~	63.24
III	~~139~~ 137	~~1464.23~~	.20
IV	163	~~1465.23~~	.24
V	~~187~~ 185	~~1466.26~~	.07
VI	~~211~~ 207	~~1467.25~~	66.81
VII	~~235~~ 229	~~1467.92~~	.52
VIII	~~259~~ 251	~~1468.39~~	.16
IX	~~283~~ 273	~~1468.92~~	.74

WHEN PIPE IS SUPPLIED IN LENGTHS OTHER THAN SHOWN, THE ENGINEER WILL PROVIDE THE CONTRACTOR WITH A REVISION OF THIS SHEET.

MOVEMENT OF ANTISEEP COLLARS NECESSARY DUE TO CHANGE FROM 16 FT. PIPE LENGTHS TO 20 FT LENGTHS. DRL.

RIPRAP DETAILS

LOOSE ROCK RIPRAP SHALL BE GRADED FROM A MAXIMUM SIZE OF 24" TO A MINIMUM SIZE OF 3". A MAXIMUM OF 20% SHALL BE LESS THAN 6" (≈10 LBS.) AND A MAXIMUM OF 60% SHALL BE LESS THAN 12" (≈80 LBS.).

BEDDING SHALL MEET THE GRADATION REQUIREMENTS FOR DRAIN FILL II (COARSE) AS SHOWN ON SHEET 7.

NOTE: CHANGES IN ℄ ARE NOT TO SCALE DRL

AS BUILT 12/9/74

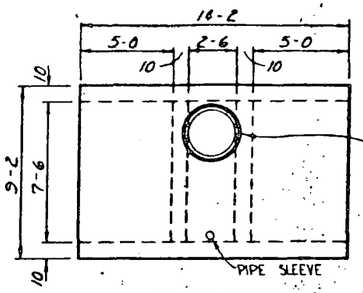
CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
PLAN PROFILE OF PRINCIPAL SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	W.A. RIEGEL	1/71	Approved by:
Drawn	R.P. LEWIS	1/71	Title:
Traced			Title:
Checked	J.E. POLULECH	1/71	Sheet No. 9 of ~~23~~ 32

Drawing No. NY-2173-P

SCS-313-C (9-64)

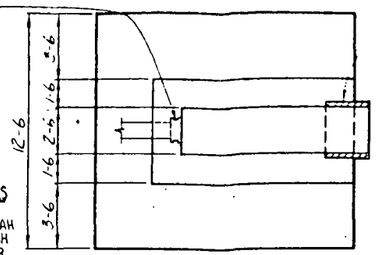


PLAN-TOP

"C" TYPE WALL THIMBLE 8" DEEP 10" DIA BOLTED TO FLANGE. SEE DETAIL I.

MANHOLE ASSEMBLY DETAILS

CIRCULAR MANHOLE ASSEMBLY MIN. CLEAR OPENING 30" NEENAH FOUNDRY CO. MODEL R-6961-HH W/ STAINLESS CAP SCREWS OR APPROVED EQUIVALENT.



SECTION B-B

Splice Wall Fitting DETAIL SHEET 13

CONSTR. JOINT

1/4" x 6" Carbon steel plate, to conform to Spec. 581 Continuous thru constr. joint. Splices shall be either:
1. Butt welded
2. Lapped 3" and bolted
3. Lapped 3" and fillet welded

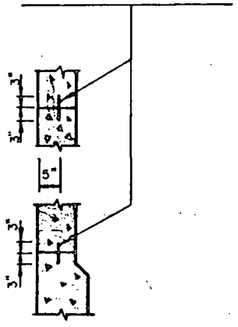
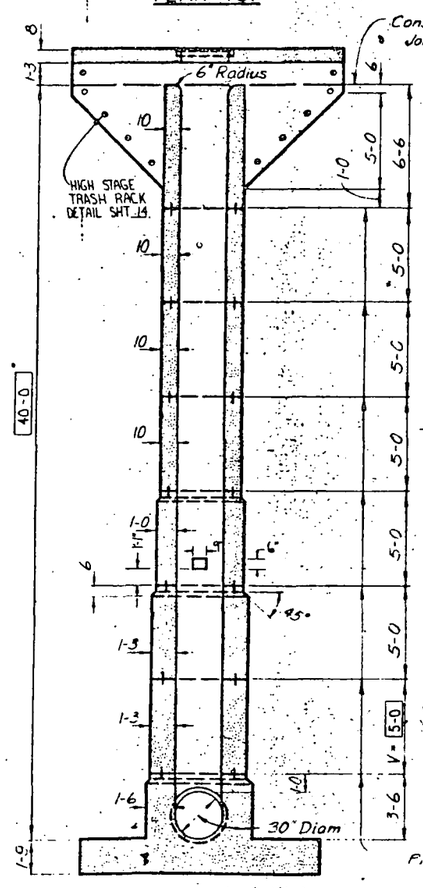
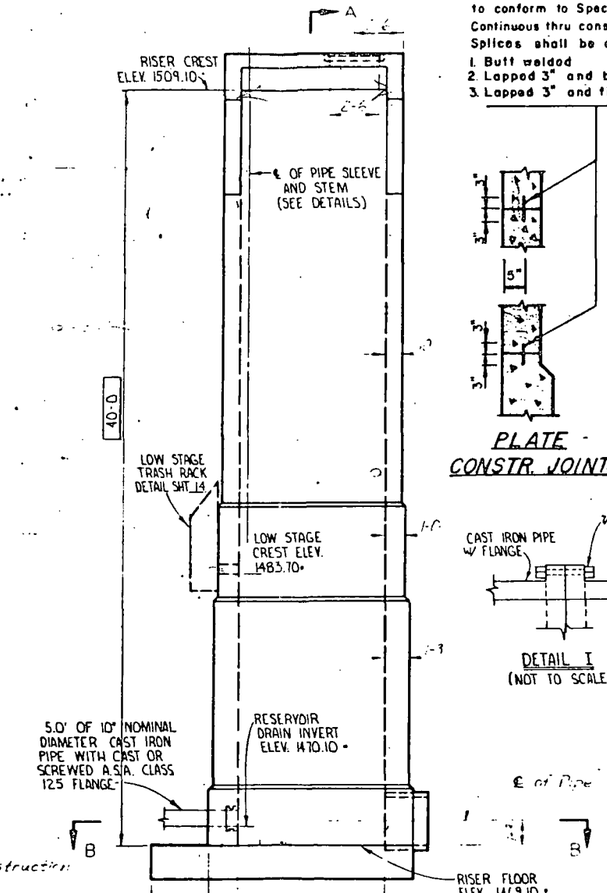


PLATE CONSTR. JOINT



SECTION A-A

Plate Construction Joints



SIDE ELEVATION

DETAIL I
(NOT TO SCALE)

SLIDE GATE DETAILS

1. 10" DIA. FLAT FRAME SLIDE GATE.
2. CLASS O-41
3. SLIDE GATE TO CONFORM TO SPEC 573 AND SHALL BE TYPE MHS-1.
4. "C" TYPE WALL THIMBLE 8" DEEP
5. RISER STEM, STEM GUIDES AND LIFTING DEVICE SHALL BE SIZED AND SPACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
6. HOLES DRILLED IN BACK FLANGE OF WALL THIMBLE BY GATE MANUFACTURER ACCORDING TO A.S.A. CLASS 125 FLANGE SPECIFICATIONS
   DIA OF BOLT CIRCLE 14¼"
   DIA OF BOLT HOLES 1"
   NO. OF BOLT HOLES 12

QUANTITIES

Steel:			
#4 Bars	520.0 Lin. Ft.	347	Lbs.
#5 Bars	4007.0 Lin. Ft.	4180	Lbs.
#6 Bars	2112.9 Lin. Ft.	4075	Lbs.
#7 Bars	413.9 Lin. Ft.	845	Lbs.
	Total	9447	Lbs.

Total Concrete = (47.43) + (1.16 V) = (47.43) + (1.16 × 5.0) = 53.2 Cu. Yds.

CONSTRUCTION DETAILS

1. SPECIFIED BAR DIMENSIONS ARE MEASURED TO OUTSIDE EDGE OF ALL BENDS.
2. RADIUS OF BENDS EQUALS 3 BAR DIAMETERS FOR SIZES EQUAL TO OR LESS THAN #7. RADIUS OF BENDS EQUALS 4 BAR DIAMETERS FOR #8 AND #9 BARS.
3. THE 2" AND 3" DISTANCE FROM SPECIFIED CONCRETE SURFACES ARE CLEAR DISTANCES. WHERE NOT OTHERWISE SPECIFIED ALL REINFORCING STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MINIMUM OF 3" COVER. ALL REINFORCING STEEL PLACED IN CONCRETE POURED IN FORMS SHALL HAVE A MINIMUM OF 2" CLEAR COVER.
4. ALL EXPOSED EDGES OF CONCRETE TO HAVE A ¾" CHAMFER UNLESS OTHERWISE NOTED.

STEEL SCHEDULE

Mark	Size	Quantity	Length	Type	B	C	Total Length	Mark	Size	Quantity	Length	Type	B	C	Total Length
B1	#6	14	12-0	1			168-0	R29	#5	20	6-9	1			135-0
B2	#6	13	13-0	1			169-0	R30	#5	20	8-0	21	2-9	5-3	160-0
B3	#7	40	8-0	21	3-8	6-4	320-0								
B4	#6	14	13-0	1			182-0								
B5	#6	16	12-0	1			192-0								
B6	#6	4	5-3	1			21-0								
B7	#6	7	5-3	21	1-0	4-3	36-9								
B8	#6	19	7-9	21	1-0	6-9	147-3								
B9	#6	10	8-6	1			85-0								
B10	#6	5	3-6	1			17-6								
B11	#6	3	2-9	1			8-3	T1	#5	18	6-0	1			108-0
B12	#6	2	2-9	1			5-6	T2	#5	6	8-0	1			48-0
B13	#6	6	4-4	1			26-0	T3	#5	4	4-9	1			19-0
B14	#7	20	4-8	1			93-4	T4	#5	4	3-6	1			14-0
B15	#5	10	7-0	21	1-1	5-11	70-0	T5	#5	4	2-3	1			9-0
B16	#5	14	9-3	21	3-4½	5-10½	129-6	T6	#5	4	9-0	19	2-0	7-0	36-0
B17	#5	4	8-9	21	3-1½	5-7½	35-0	T7	#5	12	8-3	1			99-0
								T8	#5	2	3-3	1			6-6
								T9	#5	2	5-9	1			11-6
								T10	#5	2	10-9	1			21-6
								T11	#5	2	13-3	1			26-6
								T12	#5	14	6-9	1			87-6
								T13	#5	6	8-0	1			48-0
								T14	#5	4	6-0	1			24-0
R1	#6	22	11-9	1			258-6	T15	#5	4	4-9	1			19-0
R2	#5	20	8-6	1			170-0	T16	#5	4	3-6	1			14-0
R3	#6	10	3-6	1			35-0	T17	#5	4	2-3	1			9-0
R4	#6	28	9-9	1			273-0	T18	#5	4	9-0	19	2-0	7-0	36-0
R5	#6	40	9-3	21	3-4	5-11	370-0	T19	#5	24	8-0	21	2-9	5-3	192-0
R6	#4	20	8-6	1			170-0	T20	#5	2	3-3	1			6-6
R7	#6	10	3-6	1			35-0	T21	#5	2	5-9	1			11-6
R8	#6	26	4-0	1			104-0	T22	#5	2	8-3	1			16-6
R9	#5	36	8-9	21	3-1½	5-7½	315-0	T23	#5	2	10-9	1			21-6
R10	#5	4	8-3	21	2-10½	5-4½	33-0	T24	#5	2	13-3	1			26-6
R11	#5	22	6-9	1			148-6	T25	#5	4	13-9	1			55-0
R12	#6	14	8-3	1			115-6	T26	#5	4	13-9	1			55-0
R13	#5	10	3-6	1			35-0	T27	#4	14	8-3	1			115-6
R14	#5	26	4-6	1			117-0	T28	#5	2	4-9	1			9-6
R15	#5	20	3-8	1			73-4	T29	#4	7	13-9	1			96-3
R16	#6	36	8-9	21	3-1	5-8	315-0	T30	#4	4	5-3	1			21-0
R17	#6	4	8-3	21	2-10½	5-4½	33-0	T31	#5	24	6-9	21	1-6	5-3	162-0
R18	#5	20	11-9	1			235-0	T32	#5	2	6-6	21	1-6	5-0	13-0
R19	#6	14	8-3	1			115-6	T33	#5	2	2-6	21	1-6	1-0	5-0
R20	#5	8	3-3	1			26-0	T34	#4	7	13-9	1			96-3
R21	#5	20	11-9	1			235-0	T35	#4	4	5-3	1			21-0
R22	#5	40	8-0	21	2-9	5-3	320-0								
R23	#5	10	8-3	1			82-6								
R24	#5	8	3-3	1			26-0								
R25	#5	28	8-0	21	2-9	5-3	224-0								
R26	#5	60	6-9	1			135-0								
R27	#5	8	8-3	1			66-0								
R28	#5	8	3-3	1			26-0								

BAR TYPES

AS BUILT 12/4/74

0 2 4 6
Scale in Feet

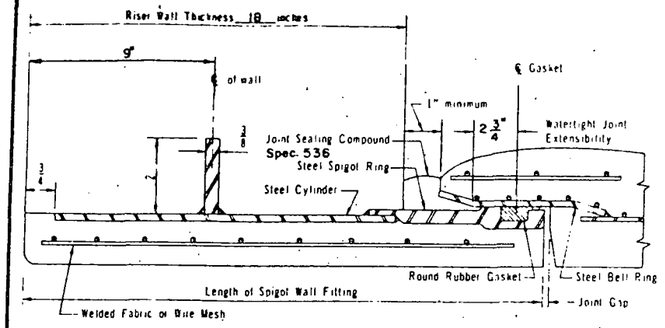
CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
RISER STRUCTURAL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Adapted	W.A. RIEGEL	12-70	Approved by:
Drawn			Title:
Traced			Title:
Checked	J.E.P.	12-70	Sheet No. 10 of 23 — Drawing No. NY-2173-P

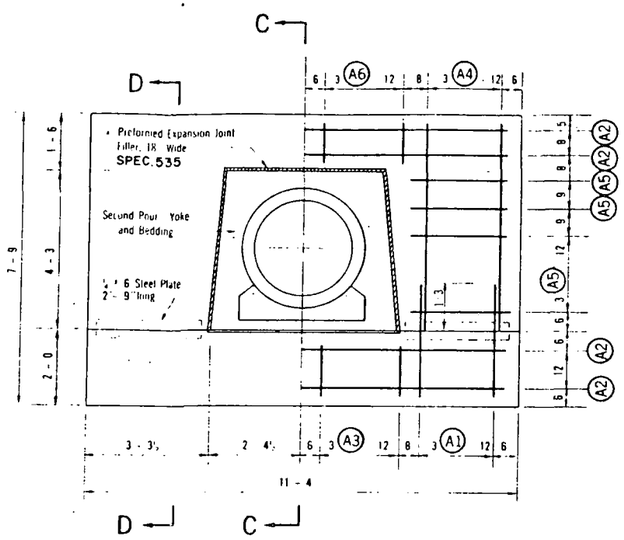
35
32

FORM SCS 313 (APRIL 1963)



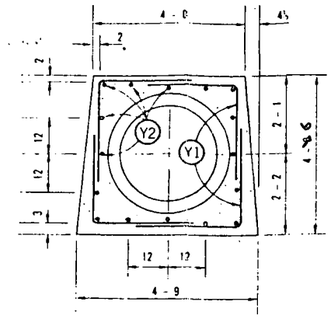
DETAIL A

SUPPLY ONE (1) SPIGOT RING WALL FITTING FOR 18" WALL.



DETAIL OF ANTI-SEEP COLLAR (9 REQ'D)

Yoke steel not shown.



DETAIL OF ANTI-SEEP COLLAR YOKE

STEEL SCHEDULE

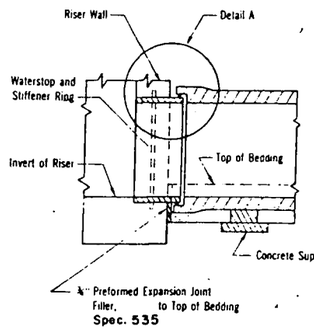
Anti-seep Collar and Yoke, 9 Required

Mark	Size	Quantity per Collar	Length	Type	Total Quantity	Total Length
A1	4	6	3 - 0	1	54	162 - 0
A2	4	4	10 - 10	1	36	390 - 0
A3	4	6	1 - 6	1	54	81 - 0
A4	4	6	5 - 6	1	54	297 - 0
A5	4	10	2 - 9	1	90	247 - 6
A6	4	6	1 - 0	1	54	54 - 0
Y1	4	12	5 - 2	21	108	558 - 0
Y2	4	16	1 - 2	1	144	168 - 0

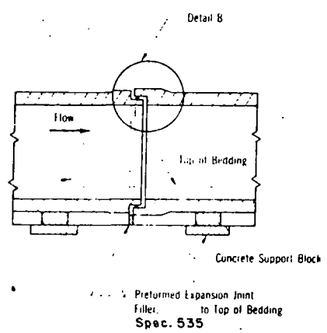
QUANTITIES

Concrete	Cu. Yds.
Anti-seep Collar including Yoke (REINFORCED) Total	~~18.7~~ 20.0
Bedding (NON-REINFORCED) Total	~~25.1~~ 22.2
Steel	**Pounds**
Anti-seep Collar including Yoke 1957'-6"	1308

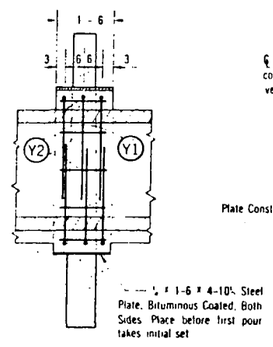
Concrete quantities are based on an outside diameter of pipe of 38.76 inches
Steel quantities do not change with outside diameter of pipe.



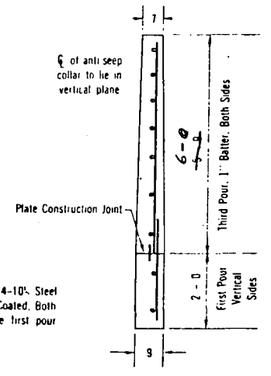
DETAIL OF SPIGOT WALL FITTING



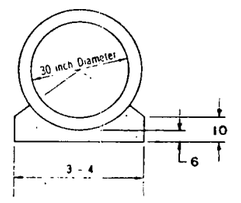
DETAIL OF PIPE JOINT



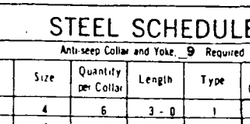
SECTION C-C



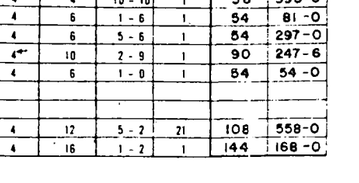
SECTION D-D



DETAIL OF BEDDING



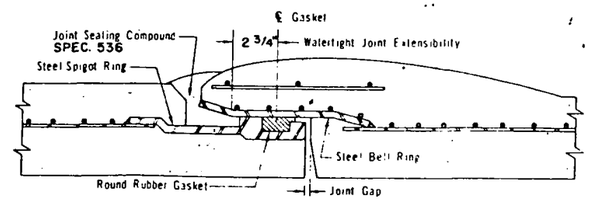
BAR TYPES



SUGGESTED SUPPORT BLOCKS

Sufficient blocks shall be provided to support [illegible] the required line and grade. The [illegible] shall determine the number and size required. Wedges may be used as an alternate.

AS BUILT 12/9/74



DETAIL B

JOINT REQUIREMENTS

No. Pipe Sections	Length of Pipe Section,	Minimum Joint Length	Minimum Joint Limiting Angle	
Ea	feet	inches	radians	degrees
18	16.0'	4 1/2	.0720	4° 07'
1	8.0'	4 1/2	.0720	4° 07'

Cast Outside Of Spigot Ring With Concrete On One 16.0' Section

For pipe length other than shown, joint requirements will be determined by the Engineer.

Where pipes of different length are connected, adjoining pipes shall meet the requirements of the longer pipe.

Prior to delivery of pipe, the pipe joint detail proposed for use shall be submitted to the Engineer for approval.

STRENGTH REQUIREMENTS

Inside Diameter of Pipe	Internal Load	External Load	
	Hydrostatic Pressure	Minimum 3-Edge Bearing Strength in Pounds per Lineal Foot of Pipe	
		Applicable Standard Specification	
		AWWA C-301	
	Head of Water	Load to produce 0.001 inch crack one foot long	
inches	feet		
30.0	55.0	19,146 Lbs.	

The outside diameter of pipe assumed in design is 38.76 inches. Where the pipe furnished has an outside diameter greater than assumed in design, the three-edge bearing strength of the pipe furnished must not be less than the specified three-edge bearing strength multiplied by the ratio of the outside diameter of the pipe furnished to the outside diameter assumed in design.

STANDARD CONDUIT DETAILS
FOR
REINFORCED CONCRETE PRESSURE PIPE
PRINCIPAL SPILLWAY

STANDARD DWG. NO. ES-5030-BE

DATE 2-70 SHEET 1 OF 1

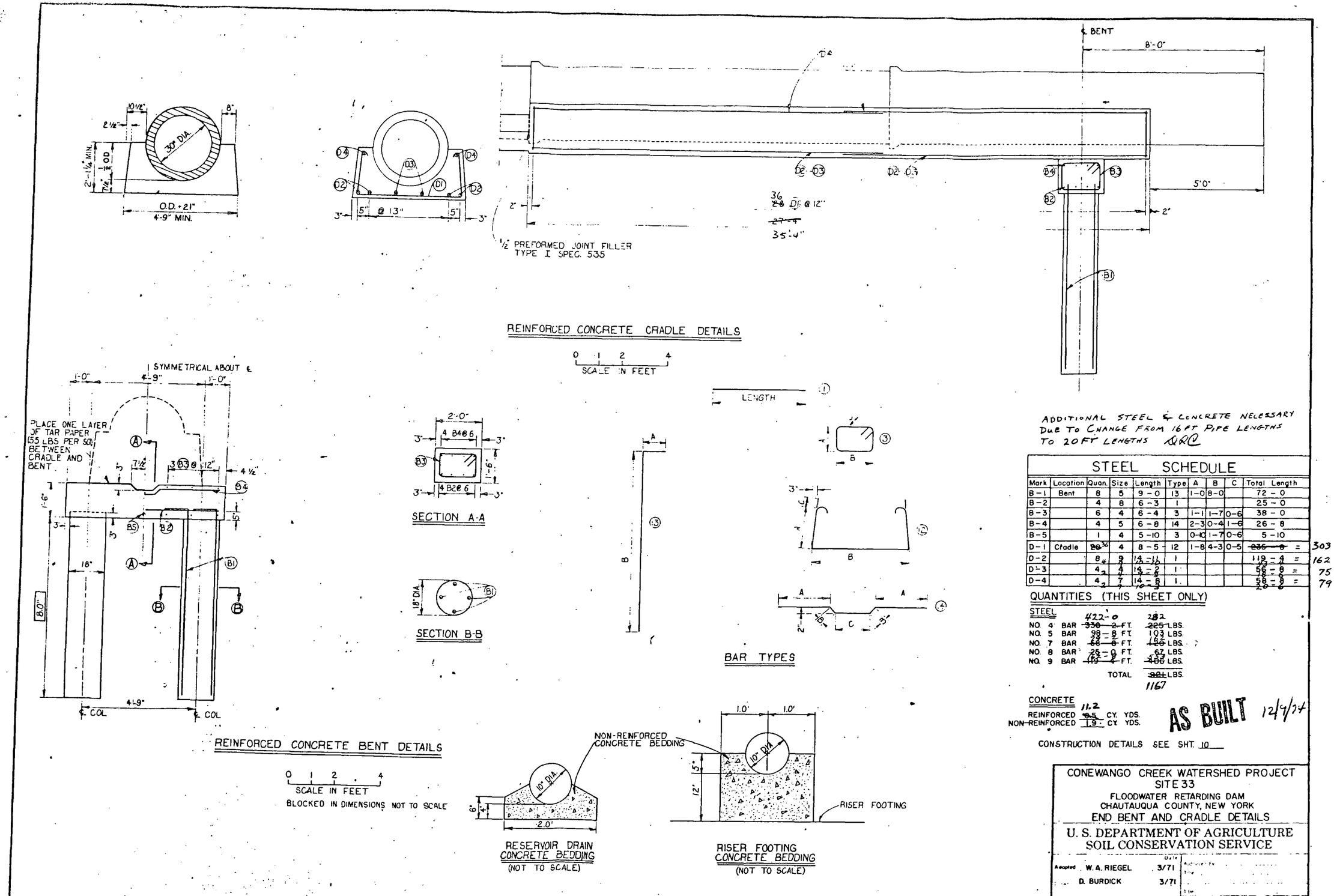
Joint length equals watertight joint extensibility plus joint gap.

The pipe shall be drawn together so that the maximum joint gap does not exceed ¼ inch for pipe laid on a straight line. For cambered pipe or pipe laid on a curved line, the joint gap at the closest point shall not exceed ¼ inch.

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY NEW-YORK
CONDUIT DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Adopted	Date	Approved by
W.A. RIEGEL	3/71	Title
Drawn		
Traced		Title
Checked S.C.Y.	Sheet No 15 of ~~23~~ 35	Drawing No NY-2173-P



REINFORCED CONCRETE CRADLE DETAILS

SECTION A-A

SECTION B-B

BAR TYPES

REINFORCED CONCRETE BENT DETAILS

BLOCKED IN DIMENSIONS NOT TO SCALE

RESERVOIR DRAIN CONCRETE BEDDING (NOT TO SCALE)

RISER FOOTING CONCRETE BEDDING (NOT TO SCALE)

ADDITIONAL STEEL & CONCRETE NECESSARY DUE TO CHANGE FROM 16 FT PIPE LENGTHS TO 20 FT LENGTHS DRC

STEEL SCHEDULE

Mark	Location	Quan.	Size	Length	Type	A	B	C	Total Length	
B-1	Bent	8	5	9-0	13	1-0	8-0		72-0	
B-2		4	8	6-3	1				25-0	
B-3		6	4	6-4	3	1-1	1-7	0-6	38-0	
B-4		4	5	6-8	14	2-3	0-4	1-6	26-8	
B-5		1	4	5-10	3	0-10	1-7	0-6	5-10	
D-1	Cradle	~~20~~ 36	4	8-5	12	1-8	4-3	0-5	~~235-8~~ =	303
D-2		8 4	9 7	14-11 10-10	1				119-4 =	162
D-3		4 2	4 4	14-2 9-3	1				56-8 =	75
D-4		4 2	7 7	14-8 10-3	1				58-8 =	79

QUANTITIES (THIS SHEET ONLY)

STEEL

NO. 4	BAR	~~330-2~~ 422-0 FT.	~~225~~ 282 LBS.
NO. 5	BAR	98-8 FT.	103 LBS.
NO. 7	BAR	~~68-8~~ 78-2 FT.	~~126~~ 162 LBS.
NO. 8	BAR	25-0 FT.	67 LBS.
NO. 9	BAR	~~119-4~~ 162-8 FT.	~~486~~ 533 LBS.
		TOTAL	~~921~~ 1167 LBS.

CONCRETE

REINFORCED ~~8.5~~ 11.2 CY. YDS.
NON-REINFORCED 1.9 CY. YDS.

AS BUILT 12/9/74

CONSTRUCTION DETAILS SEE SHT. 10

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
END BENT AND CRADLE DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Adapted W. A. RIEGEL 3/71
D. BURDICK 3/71
S.C.Y.
16 ~~23~~ ~~35~~ 32
NY-2173-P

SCS-313B (APRIL 1963)

BACAMON PIT LOGS

TP #1. C/L Dam. 11/20/69. DBC. 1347.7

0.0	-	1.0	Topsoil
1.0	-	2.0	Silt, sandy Max. size < 3" Approx. 5% gravel, 20% sand, and 75% non-plastic fines. Orange-brown; moist; slightly permeable; soft; till; ML
2.0	-	4.0	Sand, silty, gravelly Max. size 10" - flaggy siltstones Approx 3% +6", 7% 3-6", 90% matrix (which is approx. 25% gravel, 30% sand, and 45% slightly plastic fines). Brown; moist; very slightly permeable; very stiff; till; SM.
4.0	-	8.0	Silt & Clay, sandy Max. size < 3" Approx. 10% gravel, 20% sand, and 70% moderately plastic fines. Brown; moist; very slightly permeable; hard; glacio-lacustrine; CL-ML. D.S. 1.1 (CL-ML)
8.0	-	13.0+	Silt, w/sand Max. size < 3" Approx. 5% gravel, 10% sand, and 85% non-plastic fines. Brown; moist; slightly permeable; medium density; inter-bedded; glacio-lacustrine: (ML) D.S. 1.2 (ML) Note: No seepage observed.

TP #2 Bank. C/L Dam. 11/18/69. DBC. 1477.

0.0	-	0.7	Topsoil
0.7	-	2.0	Clayey silt, sandy, gravelly Max. size 10" - Flaggy siltstone Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 20% gravel, 20% sand, and 60% moderately plastic fines). Light brown; wet, very slightly permeable; very stiff; flat-lying flags; very highly weathered bedrock, "C" horizon; CL-ML
2.0	-	2.0+	Bedrock Clay shale & siltstone; highly weathered, olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian. Note: Water seeping from practically everywhere.

TP #2 Fl.Pl., C/L Dam. 11/18/69. DBC. 1466.0

0.0	-	1.0	Topsoil
1.0	-	4.0	Gravel, silty, sandy Max. size 18" - flaggy siltstone Approx. 10% +6", 15% 3-6", and 75% matrix (which is approx 50% gravel, 30% sand, and 20% slightly-moderately plastic fines). Brown; moist-wet @ 3.4'; slightly permeable; very stiff-hard; flat-lying flags; alluvial-colluvial; GM.
4.0	-	4.0+	Bedrock Clay shale & siltstone; highly weathered, olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian. Note: Gravel quite silty. Water @ creek level, 3.4'

TP #3. C/L Dam. 11/18/69. DBC. 1446.0

0.0	-	0.5	Topsoil
0.5	-	4.0	Gravel, sandy w/silt Max. size 19" - flaggy SR siltstones Approx. 10% +6", 15% 3-6", 75% matrix (which is approx. 60% gravel, 25% sand, and 15% slightly plastic fines). Brown; moist-wet @ 2.5'; slightly permeable; very stiff; flat-lying flags; alluvial; GM
4.0	-	7.0 +	Silt & Clay, gravelly, sandy Max. size 8" - varies Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines). Gray-brown; wet; very slightly permeable; hard; till; CL-ML Note: Water @ creek level, 2.5'

TP #4 Bank. C/L Dam. 11/18/69. DBC. 1480.

0.0	-	1.0	Topsoil
1.0	-	11.0	Clayey silt, gravelly, sandy Max. size 9" - flaggy siltstone Approx 1% +6", 4% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines). Light brown; wet; very slightly permeable; very stiff; very highly weathered bedrock, "c" horizon; CL-ML. D.S. 4.1 (SC-SM)
11.0	-	22.0+	Silt & Clay, gravelly, sandy Max. size 8" - flaggy SR siltstone Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines). Gray w/brown; wet; very slightly permeable; hard; till; CL-ML Note: Bad rock is not over till; the side of the pit slopes less steep than the bank. Water seeping @ 1.3'.

TP #4 Fl.Pl., C/L Dam. 11/18/69. DBC. 1466.0

0.0	-	0.5	Topsoil
0.5	-	2.3	Gravel, sandy, silty Max. size 10" - flaggy siltstones Approx. 10% +6", 15% 3-6", 75% matrix (which is approx. 50% gravel, 30% sand, and 20% slightly plastic fines). Gray-brown; moist-wet @ 1.0', slightly permeable; very stiff; road fill; GM.
2.3	-	5.0	Gravel, sandy, silty Max. size 16" - flaggy siltstones Approx. 10% +6", 15% 3-6", 75% matrix (which is approx. 60% gravel, 25% sand, and 15% slightly plastic fines). Brown; wet; slightly permeable; very stiff; flat-lying flags; alluvial; GM
5.0	-	8.0 +	Silt & Clay, gravelly, sandy Max. size 6" Approx. 5% 3-6", and 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines). Gray-brown; wet; very slightly permeable; hard; till; CL-ML Note: Seeps everywhere. Many old trees, logs, brush, etc. around the 2.3' level. Served as base for road fill.

TP #101. Borrow Area. 12/17/69. DBC.

0.0	-	1.0	Topsoil
1.0	-	4.0	Silt, sandy Max size 5" Approx 2% 3-6", 98% matrix (which is approx 10% gravel, 15% sand, and 75% very slightly plastic fines). Orange-brown; moist; slightly permeable; soft; till; ML
4.0	-	10.0 +	Gravel, sandy w/silt Max. size 15" - mostly siltstone flags, few SR sed. cobbles Approx. 6% +6", 9% 3-6", 85% matrix (which is approx. 60% gravel, 25% sand, and 15% slightly plastic fines). Brown; moist; slightly-moderately permeable; medium density; poorly stratified; outwash; GM. D.S. 101.1 (GM-GP) Note: No seepage

TP #102. Borrow Area. 12/17/69. DBC

0.0	-	1.0	Topsoil
1.0	-	3.0	Silt, sandy Max. size 4" Approx. 1% 3-6", 99% matrix (which is approx. 10% gravel, 15% sand, and 75% very slightly plastic fines). Orange-brown; moist; slightly permeable; soft; till; ML
3.0	-	10.0 +	Sand, silty, gravelly Max. size 8" - flaggy siltstones Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 25% gravel, 30% sand, and 45% slightly plastic fines). Brown; moist; slightly permeable; medium density; till; SM. D.S. 102.1 (SM) Note: No seepage

TP #103. Borrow Area. 12/17/69. DBC

0.0	-	1.0	Topsoil
1.0	-	3.0	Silt, sandy Max. size 5" Approx 2% 3-6", 98% matrix (which is approx. 10% gravel, 15% sand, and 75% very slightly plastic fines) Orange-brown; moist; slightly permeable; soft; till; ML D.S. 103.1 (ML)
3.0	-	9.8+	Sand, silty, gravelly Max. size 8" - flaggy siltstones Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 25% gravel, 30% sand, and 45% slightly plastic fines). Brown; moist; slightly permeable; medium density; till; SM. Note: No seepage

TP #104. Borrow Area. 12/17/69. DBC

0.0	-	1.0	Topsoil
1.0	-	4.5	Silt, sandy Max. size 4" Approx. 1% 3-6", 99% matrix (which is approx. 10% gravel, 15% sand, and 75% very slightly plastic fines). Orange-brown; moist; slightly permeable; soft; till; ML
4.5	-	10.0 +	Silt, w/sand Max. size < 3" Approx. 5% gravel, 10% sand, and 85% non-plastic fines. Brown; moist-wet @ 5'; slightly permeable; medium density; very poorly stratified; glacio-lacustrine; ML D.S. 104.1 (ML) Note: Seepage @ 5'

TP #105. Borrow Area. 12/17/69. DBC

0.0	-	1.0	Topsoil
1.0	-	2.5	Silt, sandy Max. size 5" Approx. 1% 3-6", 99% matrix,(which is approx. 10% gravel, 15% sand, and 75% very slightly plastic fines). Orange-brown; moist; slightly permeable; soft; till; ML
2.5	-	10.0 +	Gravel, sandy w/silt Max. size 16" - mostly flaggy siltstones, few SR sed. cobbles Approx. 5% +6", 10% 3-6", 85% matrix (which is approx. 50% gravel, 30% sand, and 20% slightly plastic fines). Brown; moist; slightly-moderately permeable; medium density; poorly stratified; outwash; GM Note: No seepage. More gravel w/depth.

TP #201. Emer. Spwy., 11/20/69. DBC. 1592.1

0.0	-	0.4	Topsoil
0.4	-	2.0	Silt, sandy Max. size 5" Approx. 2% 3-6", 98% matrix (which is approx. 10% gravel, 15% sand, and 75% very slightly plastic fines). Orange-brown; moist; slightly permeable; medium density; till; ML
2.0	-	5.0	Silt & Clay, gravelly Max. size 8" - Broken shale and siltstone flags Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 30% gravel, 15% sand, and 55% moderately plastic fines). Brown; wet; very slightly permeable; hard; shows bedding; very highly weathered bedrock, "C" horizon; CL-ML
5.0	-	5.0+	Bedrock Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian. Note: Pit dug from top of bank. No "C" horizon on lower end of pit, just topsoil over poor bedrock. Water seeping @ 1.7'

TP #202. Emer. Spwy., 11/20/69. DBC. 1523.6

0.0	-	0.4	Topsoil
0.4	-	1.5	Silt, sandy Max. size < 3" Approx. 10% gravel, 15% sand, and 75% slightly plastic fines) Orange-brown; moist; slightly permeable; soft; till; ML
1.5	-	3.8	Silt & Clay, sandy w/gravel Max. size. 15" - flaggy siltstones Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 20% gravel, 25% sand, and 55% slightly-moderately plastic fines). Lt. olive-gray; moist; very slightly permeable; hard; till; CL-ML
3.8	-	5.8	Gravel, sandy w/silt Max. size 10" - varies, mostly SR siltstones Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 50% gravel, 35% sand, and 15% slightly plastic fines). Brown; moist; slightly-moderately permeable; medium density; outwash; GM
5.8	-	8.0	Silt, w/sand Max. size < 3" Approx. 5% gravel, 10% sand, and 85% non-plastic fines. Brown; moist; slightly permeable; medium density; glacio-lacustrine; ML.
8.0	-	9.0	Siltstone,flags Max. size 30" Approx. 50% +6", 20% 3-6", 30% matrix (which is approx. 15% gravel, 25% sand, and 60% moderately plastic fines) Lt. brown; moist; very slightly permeable; very dense; bedrock, CL-ML
9.0	-	9.0+	Bedrock Clay shale & siltstone; moderately weathered; gray-brown; soft to moderately hard; thin bedding fractured; filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian Note: No seepage. Zone from 8.0-9.0'is bedrock w/fracture fillings, but ripped up w/backhoe in up to 30" flags.

AS BUILT

12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
LOGS OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Logged B. CHAMPEON Date 11-12-69
Checked
Typed B. CHAMPEON 2/16/70
Approved by STATE CONS. ENGINEER
Drawing No. NY-2173-G

TP #203. Emer. Spwy., 11/18/69. DEC. 1526.2

0.0 – 0.4 Topsoil

0.4 – 1.3 Silt, sandy
Max. size 3"
Approx. 1% 3-6", 99% matrix (which is approx. 15% gravel, 20% sand, and 64% slightly plastic fines).
Orange-brown; dry; slightly permeable; medium density; till; ML

1.3 – 3.5 Gravel, silty clayey, sandy
Max. size 20" - Flaggy siltstones
Approx. 12% +6", 3% 3-6", 80% matrix (which is approx. 30% gravel, 25% sand, and 45% slightly-moderately plastic fines)
Lt. brown; dry; slightly permeable; hard; till; GC-GM

3.5 – 3.5+ Bedrock
Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: No seepage

TP #204. Emer. Spwy. 11/19/69. DEC. 1512.2

0.0 – 0.4 Topsoil

0.4 – 1.3 Silt, sandy
Max. size 3"
Approx. 1% 3-6", 99% matrix (which is approx. 15% gravel, 20% sand, 64% slightly plastic fines).
Orange-brown; dry; slightly permeable; medium density; till; ML

1.3 – 3.5 Gravel, silty clayey, sandy
Max. size 20" - Flaggy siltstones
Approx. 12% +6", 3% 3-6", 80% matrix (which is approx. 30% gravel, 25% sand, and 45% slightly-moderately plastic fines)
Lt. brown; dry; slightly permeable; hard; till; GC-GM

3.5 – 3.5+ Bedrock
Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: No seepage

TP #205. Emer. Spwy. 11/20/69. DEC. 1526.2

0.0 – 0.5 Topsoil

0.5 – 2.0 Silt, sandy
Max. size < 3"
Approx. 10% gravel, 20% sand, and 70% slightly plastic fines.
Lt. brown; moist; slightly permeable; soft; till; ML

2.0 – 4.0 Silt & Clay, sandy, gravelly
Max. size 8" - Flaggy siltstones
Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 20% gravel, 25% sand, and 55% slightly-moderately plastic fines).
Lt. brown; moist; very slightly permeable; very stiff; till; CL-ML

4.0 – 6.0 Gravel, sandy
Max. size 14" - varies - mostly SR siltstone
Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 45% gravel, 40% sand, and 15% slightly plastic fines).
Brown; moist; moderately permeable; medium density; very poorly stratified; outwash; GM

6.0 – 8.0 Silt, sandy
Max. size < 3"
Approx. 10% gravel, 30% sand, and 60% non-plastic fines.
Brown; moist; slightly permeable; medium density; Irreg. stratified; glacio-lacustrine; ML

8.0 – 11.0 Silt, sandy gravelly
Max. size 10" - Flaggy siltstones
Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 20% gravel, 35% sand, and 45% slightly plastic fines).
Brown; moist; slightly permeable; very stiff; till; SM
D.S. 205.1 (SC-SM)

11.0 – 12.5 Siltstone Flags
Max. size 36"
Approx. 50% +6", 20% 3-6", 30% matrix (which is approx. 15% gravel, 25% sand, and 60% moderately plastic fines).
Brown; moist; very slightly permeable; very dense; bedrock; CL-ML

12.5 – 12.5+ Bedrock
Clay shale & siltstone; moderately weathered; gray-brown; soft to moderately hard; thin bedded; fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: No seepage. Zone from 11.0-12.5' is bedrock w/fracture fillings, but was ripped up w/backhoe in up to 36" flags.

TP #206. Emer. Spwy., 11/18/69. DEC. 1511.4

0.0 – 0.6 Topsoil

0.6 – 3.5 Silt, sandy
Max. size < 3"
Approx. 10% gravel, 20% sand, and 70% slightly plastic fines.
Lt. brown; moist; slightly permeable; soft; till; ML.
D.S. 206.1 (ML)

3.5 – 7.3 Gravel, sandy w/silt
Max. size 12" - varies - mostly SR siltstones
Approx. 5% +6", 7% 3-6", 90% matrix (which is approx. 45% gravel, 40% sand, and 15% very slightly plastic fines)
Brown; moist; slightly-moderately permeable; medium density; very poorly stratified; outwash; GM.
D.S. 206.2 (GM-GP)

7.3 – 10.5 Silt & Clay, sandy, gravelly
Max. size 14" - Flaggy siltstones
Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines)
Lt. olive-gray; moist; very slightly permeable; hard; till; CL-ML. D.S. 206.3 (CL-ML)

10.5 – 13.3 Silt, sandy
Max. size < 3"
Approx. 10% gravel, 30% sand, and 60% non-plastic fines.
Brown; moist; slightly permeable; medium density; irregularly stratified; glacio-lacustrine; ML.
D.S. 206.4 (ML)

13.3 – 14.5 Gravel, sandy, silty
Max. size 10" - varies - mostly SR siltstones
Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 45% gravel, 35% sand, and 20% very slightly plastic fines).
Brown; moist; slightly-moderately permeable; medium density; very poorly stratified; outwash; GM

14.5 – 16.0 Gravel, silty, sandy
Max. size 20" - Flaggy siltstones
Approx. 5% +6", 10% 3-6", 85% matrix (which is approx. 30% gravel, 25% sand, and 45% moderately plastic fines)
Brown; moist; very slightly permeable; hard; till; GM

16.0 – 16.0+ Bedrock
Clay shale & siltstone; moderately weathered; gray-brown; soft to moderately hard; thin bedded; fractured, filled w/CL-ML; essentially horizontal; Northeast shale, upper Upper Devonian.

Note: Very slight seep @ 6'

TP #207. Emer. Spwy., 11/19/69. DEC. 1526.3

0.0 – 0.4 Topsoil

0.4 – 3.3 Silt, sandy
Max. size 5"
Approx. 2% 3-6", 98% matrix (which is approx. 15% gravel, 25% sand, and 60% slightly plastic fines).
Lt. Brown; moist; slightly permeable; soft; till; ML

3.3 – 7.0 Gravel, sandy w/silt
Max. size 14" - varies - mostly SR siltstone
Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 30% gravel, 35% sand, and 15% very slightly plastic fines).
Brown; moist; slightly-moderately permeable; medium density; very poorly stratified; outwash; GM

7.0 – 11.5 Silt, sandy
Max. size < 3"
Approx. 10% gravel, 30% sand, and 60% non-plastic fines.
Brown; moist; slightly permeable; irregularly stratified; glacio-lacustrine; ML

11.5 – 11.5+ Bedrock
Clay shale & siltstone; moderately weathered; gray-brown; soft to moderately hard; thin bedded; fractured, filled w/CL-ML; essentially horizontal; Northeast shale, upper Upper Devonian.

Note: No seepage.

TP #208. Emer. Spwy., 11/19/69. DEC. 1520.4

0.0 – 0.4 Topsoil

0.4 – 1.8 Silt, sandy
Max. size < 3"
Approx. 15% gravel, 25% sand, and 60% slightly plastic fines.
Orange-brown; moist; slightly permeable; soft; till; ML.

1.8 – 4.0 Gravel, silty, clayey, sandy
Max. size 16" - Flaggy siltstones
Approx. 10% +6", 5% 3-6", 85% matrix (which is approx. 30% gravel, 25% sand, and 45% slightly-moderately plastic fines).
Lt. brown; dry, slightly permeable; hard; till; GC-GM.

4.0 – 4.0+ Bedrock
Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: No seepage.

TP #301. Prin. Spwy., 11/18/69. DEC. 1473.4

0.0 – 0.8 Topsoil

0.8 – 2.0 Gravel, sandy, silty
Max. size 8" - Flaggy siltstones
Approx. 10% +6", 15% 3-6", 75% matrix (which is approx. 50% gravel, 30% sand, and 20% slightly plastic fines)
Gray-brown; moist; slightly permeable; very stiff; road fill; GM

2.0 – 6.0 Gravel, sandy, silty
Max. size 20" - Flaggy siltstones
Approx. 10% +6", 15% 3-6", 75% matrix (which is approx. 60% gravel, 25% sand, and 15% slightly plastic fines)
Brown; moist-wet @ 3.8'; slightly permeable; very stiff; flat lying flags; alluvial; GM

6.0 – 11.0+ Silt & Clay, gravelly, sandy
Max. size 6"
Approx. 5% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines)
Gray; wet; very slightly permeable; hard; till; CL-ML

Note: Moderate seepage @ 3.8'. Little brush @ ± 2.0'

TP #302 Bunk. Prin. Spwy., 11/18/69. DEC. 1477

0.0 – 1.0 Topsoil

1.0 – 10.5 Clayey silt, gravelly, sandy
Max. size 9" - Flaggy siltstone
Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines).
Lt. brown; wet; very slightly permeable; very stiff; very highly weathered bedrock, "C" horizon; CL-ML

10.5 – 15.8 Silt & Clay, gravelly, sandy
Max. size 7" - Flaggy SR siltstone
Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines).
Gray w/brown; wet; very slightly permeable; hard; till; CL-ML

15.8 – 15.0+ Bedrock
Clay shale & siltstone; modrately weathered; gray-brown; soft to moderately hard; thin bedded; fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: Water level @ 16.5'. Difficult digging in 15.8-18' zone.

TP #302. Fl.Pl.. Prin. Spwy., 11/18/69. DEC. 1468.3

0.0 – 0.6 Topsoil

0.6 – 3.0 Gravel, sandy, silty
Max. size 8" - Flaggy siltstones
Approx. 10% +6", 15% 3-6", 75% matrix (which is approx 50% gravel, 30% sand, and 20% slightly plastic fines)
Gray-brown; moist; slightly permeable; very stiff; road fill; GM

3.0 – 6.8 Gravel, sandy, silty
Max. size 16" - Flaggy siltstones
Approx. 10% +6", 15% 3-6", 75% matrix (which is approx 60% gravel, 25% sand, and 15% slightly plastic fines)
Brown; moist-wet @ 4.3'; slightly permeable; very stiff; flat lying flags; alluvial; GM

6.8 – 11.8 Silt & Clay, gravelly, sandy
Max. size 8" - Flaggy siltstones
Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines).
Gray; wet; very slightly permeable; hard; till; CL-ML

11.8 – 14.2+ Bedrock
Clay shale & siltstone; moderately weathered; gray-brown; soft to moderately hard; thin bedded; fractured, filled w/CL-ML; essentially horizontal; Northeast shale, upper Upper Devonian

Note: Moderate seepage @ 4.3'. Difficult digging below 12'. Brush & logs @ ± 3'.

TP #303. Prin. Spwy., 11/18/69. DEC. 1461.6

0.0 – 0.6 Topsoil

0.6 – 3.5 Gravel, sandy, silty
Max. size 12" - Flaggy siltstones
Approx. 10% +6", 15% 3-6", 75% matrix (which is approx 50% gravel, 30% sand, and 20% slightly plastic fines)
Gray-brown; moist; slightly permeable; very stiff; road fill; GM

3.5 – 4.0 Gravel, sandy, silty
Max. size 10" - Flaggy siltstones
Approx. 10% +6", 15% 3-6", 75% matrix (which is approx. 60% gravel, 25% sand, and 15% slightly plastic fines)
Brown; moist; slightly permeable; very stiff; flat lying flags; alluvial; GM

4.0 – 7.0 Sand, silty, gravelly
Max. size 10" - Flaggy siltstones
Approx. 2% +6", 6% 3-6", 92% matrix (which is approx 25% gravel, 30% sand, and 45% moderately plastic fines)
Brown; wet; very slightly permeable; hard; till; SC-SM.

7.0 – 10.0+ Bedrock
Clay shale & siltstone; moderately weathered; gray-brown; soft to moderately hard; thin bedded; fractured, filled w/CL-ML; essentially horizontal; Northeast shale, upper Upper Devonian.

Note: Moderate seepage @ 3.8'. This till slightly sandier and less plastic than gray till. Hard digging beyond 8.5'. Many logs and branches in 0.0-2.5'.

TP #401. Stream Channel. 11/18/69. DEC. 1459.1

0.0 – 0.8 Topsoil

0.8 – 5.3 Gravel, sandy, silty
Max. size 15"- Flaggy siltstones
Approx. 10% +6", 15% 3-6", 75% matrix (which is approx. 60% gravel, 25% sand, and 15% slightly plastic fines).
Brown; wet; slightly-moderately permeable; very stiff; flat lying flags; alluvial; GM

5.3 – 8.2 Silt & Clay, gravelly, sandy
Max. size 8" - Flaggy siltstones
Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines).
Gray-brown; wet; very slightlypermeable; hard; till; CL-ML

8.2 – 10.0 Bedrock
Clay shale & siltstone; moderately weathered; gray-brown; soft to moderately hard; thin bedded; fractured, filled w/CL-ML; essentially horizontal; Northeast shale, upper Upper Devonian

Note: Water @ creek level, 0.8'

TP #501. Drain Line. 11/18/69. DEC. 1475

0.0 – 0.7 Topsoil

0.7 – 3.0 Silt & Clay, gravelly, sandy
Max. size 7" - Flaggy shale and siltstone
Approx. 4% +6", 11% 3-6", 85% matrix (which is approx. 30% gravel, 15% sand, and 55% moderately plastic fines)
Light brown; wet; very slightly permable; very stiff; very highly weathered bedrock, "c" horizon; CL-ML
D.S. 501.1 (CL-ML)

3.0 – 3.0+ Bedrock
Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: Bedrock @ 3' @ top of pit and @ 6' @ bottom of pit. Seepage @ 0.7'

AS BUILT
12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
LOGS OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Logged	B. CHAMPEON 11-12-69	Approved by	STATE CONS. ENGINEER
Drawn		Title	
Traced		Date	
Checked	B. CHAMPEON 2/4/70	Sheet No.	20 of 29
		Drawing No.	NY-2173-G

SCS-ENG-6 (APRIL 1963)

TP #502. Drain Line. 11/18/69. DBC. 1492.4

0.0 - 0.4 Topsoil

0.4 - 6.0 Gravel, sandy, silty
Max. size 18" - Flaggy siltstones
Approx. 10% +6", 18% 3-6", 72% matrix (which is approx. 60% gravel, 25% sand, and 15% slightly plastic fines).
Brown; moist-wet @ 1.5'; slightly permeable; very stiff-hard; flat-lying flags; alluvial; GM. P.S. 502.1 (GM-GC)

6.0 - 6.0+ Bedrock
Clay shale & siltstone; moderately weathered; gray-brown; soft to moderately hard; thin bedded; fractured, filled w/CL-ML; essentially horizontal; Northeast shale, upper Upper Devonian.

Note: Water @ creek level, 1.5'

TP #503 Bank. Drain Line. 11/18/69. DBC. 1474.3

0.0 - 1.0 Topsoil

1.0 - 1.8 Clayey Silt, gravelly, sandy
Max. size 9" - Flaggy siltstone
Approx. 15% +6", 4% 3-6", 96% matrix (which is approx. 25% gravel, 20% sand, and 55% moderately plastic fines).
Light brown; moist-wet @ 1.2'; very slightly permeable; very stiff; very highly weathered bedrock, "C" horizon; CL-ML

1.8 - 1.8+ Bedrock
Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: Bedrock is @ 3.3' in bottom of pit. Seepage @ 1.2'.

TP #503 Ditch. Drain Line. 11/18/69. DBC. 1451

0.0 - 5.5 Silt & Clay, gravelly, sandy
Max. size 8" - Flaggy SS siltstone
Approx. 15% +6", 4% 3-6", 95% matrix (which is approx. 15% gravel, 20% sand, and 53% moderately plastic fines).
Brown-y/grays wet; very slightly permeable; hard; till; CL-ML

5.5 - 5.5+ Bedrock
Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: No topsoil. Water in ditch.

TP#60. Bank. Other. 11/18/69. DBC. 1482

0.0 - 0.7 Topsoil

0.7 - 1.6 Clayey Silt, sandy, gravelly
Max. size 9" - Flaggy siltstone
Approx. 1% +6", 4% 3-6", 95% matrix (which is approx. 20% gravel, 20% sand, and 60% moderately plastic fines).
Light brown; wet; very slightly permeable; very stiff; flat-lying flags; very highly weathered bedrock, "C" horizon; CL-ML

1.6 - 1.6+ Bedrock
Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: Water seeping from practically everywhere.

TP #601 Fl. Pl., Other. 11/18/69. DBC. 1470.0

0.0 - 1.0 Topsoil

1.0 - 4.0 Gravel, silty, sandy
Max. size 24" - Flaggy siltstone
Approx. 10% +6", 15% 3-6", 75% matrix (which is approx. 50% gravel, 30% sand, and 20% slightly-moderately plastic fines).
Brown; moist-wet @ 3.4'; slightly permeable; very stiff-hard; flat-lying flags; alluvial-colluvial; GM.

4.0 - 4.0+ Bedrock
Clay shale & siltstone; highly weathered; olive-brown; soft; laminated; highly fractured, filled w/CL-ML; essentially horizontal; Northeast shale; upper Upper Devonian.

Note: Gravel is siltier than usual. Water @ creek level, 3.4'

DRILL HOLE LOGS

CONEWANGO 33

DH 51 C/L Dam. 12/3-11/69. DBC. 1427.7 — 0.0

2 — Topsoil — 1.0

11 — Silt, sandy
Approx. 5% gravel, 20% sand, 75% non-plastic fines
Orange-brown; moist; slightly permeable; stiff, N=11; till; ML — 2.5

9 — Sand, silty, gravelly
Approx. 25% gravel, 30% sand, 45% slightly-moderately plastic fines
26 — Gray-brown; moist; very slightly permeable; stiff- very stiff, N=9-26; till; CL-ML — 6.5

153 — Clayey silt, sandy, gravelly
EH — Approx. 20% gravel, 20% sand, 60% moderately plastic fines
EH — Lt. brown; wet; very slightly permeable; hard, N=153; very highly weathered bedrock, "C" horizon; CL-ML
113/.3 — 9.3

MX — Bedrock - interbedded shale and siltstone w/few fine-gr. limy sandstone zones w/occ. biotite mica; silty clayey texture, occ. sandy; moderately weathered, occ. high
MX — down to 14' then essentially non-weathered below 14'; weathered zones are olive green to olive brown, rest is
MX — gray except for lighter limy parts; mod. soft to very hard; mostly laminated, few thin beds, occ. massive
MX — shale on limy sandstone; some highly weathered clay and silt seams; highly fractured to ± 13', mod below that; essentially horizontal, regional dip and strike, Northeast shale, upper Upper Devonian. — 22.5

Note: ▽ @ 12' on 12/11/69, @ 4' on 12/15/69, @ surface on 12/18/69.
Run 1 9.2-12.8' 100% Rec 0% RQD
2 12.8-16.5' 100% 34%
3 16.5-17.5' 70% 0%
4 17.5-22.5' 100% 50%
Largest whole core piece, 8"

Pressure test results

17.5-22.5	30 psi	4.17 fpd 1/
	20 psi	3.49 fpd 2/
	10 psi	2.37 fpd 3/
12.5-17.5	20 psi	5.52 fpd
	10 psi	2.98 fpd

1/ 1 qt. loss up outer pipe in 27 sec.
2/ " 37 sec.
3/ " 63 sec.

DH 52 C/L Dam. 12/16-17/69. DBC. 1465.9 — 0.0

Topsoil — 0.7

20 — Gravel, sandy, silty
Approx. 50% gravel, 30% sand, 20% slightly plastic fines
24 — Brown; moist-wet @ 2.8'; slightly permeable; very stiff, N=20-24; alluvial-colluvial; GM — 3.2

28 — Silt and clay, gravelly, sandy
Approx. 25% gravel, 20% sand, 55% moderately plastic fines
Gray; wet; very slightly permeable; very stiff, N=28; till; CL-ML — 4.3

58 — Sand, silty gravelly
81 — Approx. 25% gravel, 30% sand, 45% moderately plastic fines
67/.5 — Brown; wet; very slightly permeable; hard, N=58-81; till; SC-SM — 8.5

EH — Bedrock - interbedded shale and siltstone, not limy; silty and clayey texture; moderately weathered; olive
MX — green-olate gray; moderately soft-hard, breaks along bedding planes; laminated, few thin beds w/occasional clay and silt seams; fractures into 1/4-3" pieces; some staining; core very fragmental; essentially horizontal; regional strike and dip; Northeast shale, upper Upper Devonian. — 14.0

Note: ▽ @ 2.8' on 12/18/69
Run 1 9.0-14.0' 58% rec. 0% RQD
Largest whole core piece, 3".

DH 53 C/L Dam. 12/15/69. DBC. 1494.0 — 0.0

10 — Clayey silt, gravelly sandy
49 — Approx. 25% gravel, 20% sand, 55% moderately plastic fines
119 — Lt. brown; wet; very slightly permeable; stiff-hard; N=10-119; very highly weathered bedrock, "C" horizon; CL-ML — 4.5

74/.5 — Bedrock - interbedded shale and siltstone, w/few fine-gr. limy sandstone zones w/occ. biotite mica; silty clayey texture, occ. sandy; moderately weathered to 8', then essentially non-weathered below 8'; weathered zones are olive green-brown, rest is gray
MX — except for lighter limy parts; moderately soft-very hard; mostly laminated, few thin beds, occ. massive, some cross-bedding; mostly tight fractures, some staining on fracture surfaces, only 1 or 2
MX — small CL-ML seams; fracture frequency 0.5" to 3.5"; regional strike and dip, essentially horizontal; Northeast shale, upper Upper Devonian. — 15.0

Note: ▽ @ 7' on 12/15/69, @ 6' on 12/16/69.
Run 1 5.0-10.0' 62% Rec. 0% RQD
2 10.0-15.0' 100% Rec. 0% RQD

Largest whole core piece, 3.5"

Pressure test results

10.0-15.0	30 psi	4.13 fpd
	20 psi	4.58 fpd
	10 psi	5.40 fpd
5.0-10.0	20 psi	12.1 fpd 4/
	10 psi	13.2 fpd 5/

4/ Leaking badly around casing
5/ "

Initial encounter w/water @ 4.5'

DH 251 Emer. Splwy. 12/18/69. DBC. 1519.0 — 0.0

Topsoil — 1.0

2 — Silt, sandy
Approx. 10% gravel, 15% sand, 75% slightly plastic fines
Lt. brown to orange brown; moist; slightly permeable; soft, N=2; till; ML — 2.8

40 — Silt and clay, sandy w/gravel
39 — Approx. 20% gravel, 25% sand, 55% slightly-moderately plastic fines.
Brown-gray; moist; very slightly permeable; hard, N=39-40; till; CL-ML — 5.5

NX — Bedrock - sandy siltstone, no lime, w/occ. biotite mica to 8.5', then poor shale and siltstone from 8.5-10.5'; fine-grained to silty texture; moderate-non weathered in upper zone, then highly weathered in lower zone; grayish-tan; very hard to 8.5'; then moderately soft; laminated to thin bedded; mostly CL-ML below 8.5'; good rock breaks in 3/4" to 2" fragments; essentially horizontal, regional strike and dip; Northeast shale, upper Upper Devonian. — 10.5

Note: No water.
Run 1 5.5-10.5' 62% Rec. 0% RQD
Largest whole core piece, 2"
No return water, casing loose on bottom.

DH 252 Emer. Splwy. 12/17-18/69. DBC. 1522.0 — 0.0

Topsoil — 0.8

6 — Silt, sandy
15 — Approx. 10% gravel, 15% sand, 75% slightly plastic fines
Lt. brown; moist; slightly permeable; medium-stiff; N=6-15; till; ML — 3.4

12 — Silt, sandy, gravelly
36 — Approx. 20% gravel, 25% sand, 55% slightly plastic fines
Brown; moist; very slightly permeable; stiff-hard; N=12-36; till; ML. — 8.0

MX — Bedrock - sandy siltstone, no lime, occ. biotite mica; uncompetent shale and siltstone zone 10-12.5'; fine-grained
MX — to silty texture; incompetent beds show high-moderate weathering, others essentially non-weathered; grayish tan to
MX — olive brown; moderately soft to very hard; mostly laminated few thin beds, occ. massive; occ. highly weathered clay and silt seams @ 10-11'; core is good 9-10', very poor 10-11'; rest is fractured into 1/2-2" chunks; regional strike and dip, essentially horizontal; Northeast shale, upper Upper Devonian. — 18.0

Note: Run 1 8.0-11.0 77% Rec. 35% RQD
2 11.0-16.0 80% Rec. 0% RQD
3 16.0-18.0 100% Rec. 0% RQD

Largest whole core piece, 5"
Lost drilling water at start because casing a bit too short to get good seating.

DH 253 Emer. Splwy. 12/17/69. DBC. 1519.1 — 0.0

Topsoil — 0.8

4 — Silt, sandy
20 — Approx. 15% gravel, 20% sand, 65% slightly plastic fines
Lt. brown-orange brown; moist; slightly permeable; medium-very stiff, N=4-20; till; ML — 3.2

95/.8 — Gravel, silty, sandy
Approx. 20% gravel, 25% sand, 45% slightly plastic fines
Mottled brown; moist; slightly permeable; hard, N=95/.8; till; GM — 5.3

MX — Bedrock - clay shale and siltstone; clayey - silty texture; highly-moderately weathered; olive brown; soft-medium soft; laminated bedding; many CL-ML seams; very poor core; regional dip and strike, essentially horizontal; Northeast shale, upper Upper Devonian. — 10.0

Note: Run 1 5.0-10.0' 36% rec. 0% RQD
Largest whole core piece, 3/4"
No water

DH 354 Emer. Splwy. 12/[illegible]/69. DBC. [illegible] — 0.0

Topsoil — 0.8

8 — Silt, sandy
24 — Approx. 15% gravel, 20% sand, 65% slightly plastic fines
Lt. brown-orange brown; moist; slightly permeable; stiff-very stiff, N=8-24; till; ML — 3.5

29 — Gravel, silty, sandy
17 — Approx. 30% gravel, 25% sand, 45% slightly plastic fines
Mottled brown; moist; slightly permeable; very stiff, N=17-29; till; GM — 7.6

18 — Sand, silty
18 — Approx. 5% gravel, 70% sand, 25% non-plastic fines
Brown; moist; moderately permeable; medium density, N=18; poorly stratified outwash; SM — 12.3

13 — Silt, sandy
12 — Approx. 5% gravel, 15% sand, 80% non-plastic fines
28 — Brown; moist; slightly permeable; medium density, N=12-28; glacio-lacustrine; ML — 17.5

29 — Gravel, silty, sandy
Approx. 30% gravel, 25% sand, 45% slightly plastic fines
Mottled brown; moist; slightly permeable; very stiff; N=29; till; GM — 20.0

NX — Bedrock - sandy siltstone, no lime, occ. biotite mica; fine grained to silty texture; essentially non-weathered; grayish tan; very hard; thin bedded, shows some cross-bedding, occ. laminae of darker silts; usually tight fractures on 2-4" spacing; little staining, core fresh looking, not fragmental; regional strike and dip, ensentially horizontal; Northeast shale, upper Upper Devonian. — 25.0

Note: Run 1, 20.0-25.0', 90% Rec, 8% RQD
Lost water from the start. Driller says 6" void @ 24.0-24.5'. No water table.
Largest whole core piece, 4"

DH 351 Prin. Splwy. 12/11-12/69. DBC. 1469.5 — 0.0

Topsoil — 0.8

40 — Gravel, sandy, silty
Approx. 50% gravel, 30% sand, 20% slightly plastic fines
Gray-brown; moist; slightly permeable; hard, N=40; road fill; GM — 2.5

28 — Gravel, sandy, silty
26 — Approx. 60% gravel, 25% sand, 15% slightly plastic fines
Brown; moist-wet @ 3'; slightly permeable; very stiff, N=26-28; alluvial; GM — 6.0

34 — Silt and clay, gravelly, sandy
Approx. 25% gravel, 20% sand, 55% moderately plastic fines
Gray; wet; very slightly permeable; hard, N=34; till; CL-ML — 8.0

55 — Sand, silty, gravelly
125 — Approx. 25% gravel, 30% sand, 45% slightly plastic fines
140 — Brown; wet; very slightly permeable; very stiff, N=55-140; till; SM — 13.5

NX — Bedrock - interbedded shale and siltstone; silty-clayey texture; mostly moderately weathered; olive brown above 18', gray below; moderately soft to very hard; mostly laminated some thin beds; few highly weathered clay and silt seams; fractures into 1/2-2" blocks along bedding planes; regional strike and dip, essentially horizontal; Northeast shale, upper Upper Devonian. — 23.5

Note: Run 1, 13.5-18.5', 78% Rec., 0% RQD
2, 18.5-23.5, 78% Rec., 0% RQD

Largest whole core piece, 3"
Water @ 4.5', 12/12/69 and @ 3.0', 12/18/69.
Brush at bottom of road fill.

AS BUILT
12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
LOGS OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Logged B. CHAMPEON Date 11-3/69
Drawn
Typed A. Dunlap 3/5/70
Checked B. CHAMPEON 3/6/70
Approved by
Title STATE CONS. ENGINEER
Title
Sheet No. 21 of 29 Drawing No. NY-2173-G

3532 SCS-TP-158 (APRIL 1961)

DH 352 Prin. Spillw., 12/10-11/69, EGL 1464.1 — 0.0

Topsoil — 0.4

Gravel, sandy silty
Approx. 50% gravel, 30% sand, 20% slightly plastic fines
Gray-brown; moist; slightly permeable; very stiff; R=20; road fill; GM
20 — 3.0

Gravel, sandy, silty
Approx. 60% gravel, 25% sand, 15% slightly plastic fines
Brown; moist-wet @ 3'; slightly permeable; very stiff, R=17-20; alluvial; GM
21 — 6.2

Silt and clay, gravelly, sandy
Approx. 25% gravel, 20% sand, 55% moderately plastic fines
Grey-brown; wet; very slightly permeable; stiff, R=13; till; CL-ML
13 — 6.0

Silt and clay, gravelly, sandy
Approx. 25% gravel, 20% sand, 55% moderately plastic fines
Gray; wet; very slightly permeable; very stiff, R=26-28; till; CL-ML
29
26 — 8.5

Bedrock – interbedded shale and siltstone, light areas of fine grained limy sandstone w/occ. biotite mica; silty and clayey texture, occ. sandy; moderately weathered, occ. high; essentially non-weathered from 13' down; weathered areas olive green, rest is gray except for white limy parts; moderately soft to very hard; mostly laminated, few thin beds, occ. massive, nearly cyclic shales on 5' thick limy beds; occ. highly weathered CL-ML seams; highly fractured in places, much improvement near bottom; regional dip and strike, essentially horizontal; Northeast shale, upper Upper Devonian.
RX
RX
RX — 15.6

Note: Rm 1 10.6-15.6 74% Rec. 0% RQD
2 15.6-20.6 94% Rec. 0% RQD
3 20.6-25.6 96% Rec. 40% RQD
Largest whole core piece, 13"
Water at 3.0', 12/11/69, and at 2. 0, 12/18/69.
Some brush around 2.8'

Pressure tests

20.0-25.0	40 psi	2.96 fpd
	30 psi	2.54 fpd
	20 psi	1.80 fpd
	10 psi	1.76 fpd
15.0-20.0	30 psi	0.70 fpd
	20 psi	0.72 fpd
	10 psi	0.76 fpd
10.0-15.0	25 psi	2.12 fpd
	15 psi	2.41 fpd

DH 353 Prin. Spillw., 12/15/69, EGL 1460.7 — 0.0

Topsoil — 0.5

Gravel, sandy silty
Approx. 50% gravel, 30% sand, 20% slightly plastic fines
Gray-brown; moist; slightly permeable; very stiff; R=24; road fill; GM
24 — 2.6

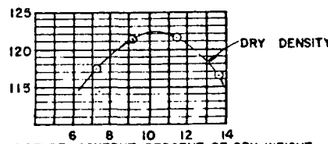
Gravel, sandy, silty
Approx. 60% gravel, 25% sand, 15% slightly plastic fines
Brown; moist-wet @ 3'; slightly permeable; very stiff, R=17-20; alluvial; GM
17
20 — 5.2

Sand, silty, gravelly
Approx. 25% gravel, 30% sand, 45% slightly plastic fines
Brown; wet; very slightly permeable; hard, R=43-53; till; SM
33
52
43 — 11.5

Bedrock – interbedded shale and siltstone, lighter limy areas in fine-grained sandstone w/occ. biotite mica; silty and clayey texture; moderately weathered; olive brown; moderately soft to hard; mostly laminated, some thin beds; occ. thin highly weathered CL-ML seams; most fractures are 1/4-1½" in spacing, with little filling; regional strike and dip, essentially horizontal; Northeast shale, upper Upper Devonian.
RX — 16.5

Note: Rm 1, 11.5-16.5', 54% Rec., 0% RQD
Largest whole core piece, 1½".
Water @ 5.5', 12/15/69
Small amount of brush at ± 2.6'.

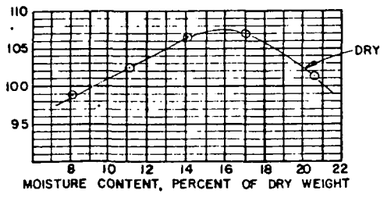
WEIGHT OF COMPACTED SOIL IN LBS / CU.FT.



MOISTURE CONTENT, PERCENT OF DRY WEIGHT

COMPACTION CURVE
FIELD SAMPLE NO. 102.1
LABORATORY CLASSIFICATION – GM

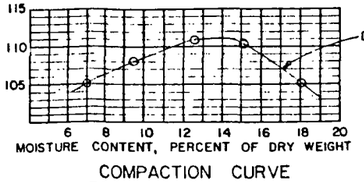
WEIGHT OF COMPACTED SOIL IN LBS / CU. FT.



MOISTURE CONTENT, PERCENT OF DRY WEIGHT

COMPACTION CURVE
FIELD SAMPLE NO. 103.1
LABORATORY CLASSIFICATION – ML

WEIGHT OF COMPACTED SOIL IN LBS / CU. FT.



MOISTURE CONTENT, PERCENT OF DRY WEIGHT

COMPACTION CURVE
FIELD SAMPLE NO. 104.1
LABORATORY CLASSIFICATION – ML

LEGEND

TEST HOLE NUMBERING SYSTEM

	Test Pit (TP)	Drill Hole (DH)
Centerline of dam	1-49	50-99
Borrow Area	101-149	150-199
Emergency Spillway	201-249	250-299
Centerline of Outlet Structure	301-349	350-399
Outlet Channel	401-449	450-499
Drain Line	501-549	550-599
Other	601-649	650-699

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOLS

- GW Well graded gravels; gravel-sand mixtures
- GP Poorly graded gravels
- GM Silty gravels; gravel-sand-silt mixtures
- GC Clayey gravels; gravel-sand-clay mixtures
- SW Well graded sands; sand-gravel mixtures
- SP Poorly graded sands
- SM Silty sands; sand-silt mixtures
- SC Clayey sands; sand-clay mixtures
- ML Silts; silty, v. fine sands or clayey silts
- CL Clays of low to medium plasticity; silty, sandy or gravelly clays
- CH Clays of high plasticity; fat clays
- MH Elastic silts; micaceous or diato aceous silts
- OL Organic silts and organic silty clays of low plasticity
- OH Organic clays or silts of medium to high plasticity

Note: Classifications shown in the logs are based on lab tests of samples representative of that material (ASTM D2487-66T). Significant deviations from normal are noted in the logs.

Key to Drill Hole (DH) Logs

N	k	Material (USCS)	Depth (ft)
21		N= Number of blows required for 1 ft. standard penetration using 2" O.D. split spoon sampler, 140 lb. weight and 30" drop. (ASTM D 1586)	
26			
DBS RB		Dry ballast sa mpler Roller bit to advance hole & wash boring	
64			
AUC		Hole advanced by auzer	
NX		Rock core, 2 1/8" diameter	
88%	4.21 fpd	Percent rock core recovery i each drill run. Permeability test (fpd) = k	

AS BUILT
12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
FLOODWATER RETARDING DAM
CHAUTAUQUA COUNTY, NEW YORK
LOGS OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Logged	B. CHAMPEON	Date 11-12/69	Approved by STATE CONS. ENGINEER
Drawn	W. MAVINS		Title
Traced	D. Hadley	3/5/70	Sheet 22 of 24
Checked	B. CHAMPEON	3/11/70	Drawing No. NY-2173-G

SCS-ENG-GRAPHIC (APRIL 1965)

TP #209. Front. Assoc. 12/21/70. EC. 1535.8

0.0 - 1.0 Topsoil - average - varies 0.6 - 1.3'.

1.0 - 8.3 Silt, sandy, gravelly
Max. size 10" - SR Sed. Chls
Approx. 1% +6", 1% 3-6", 98% matrix (which is approx. 15% gravel, 20% sand and 65% very slightly plastic fines)
Mottled gray-brown; moist; slightly permeable; medium density; homogeneous; weathered till; ML

8.3 - 14.1 Sand and silt w/gravel
Max. size 12" - SA Flaggy, Sed. Chls
Approx. 15+6", 15%3-6", 85% matrix (which is approx. 5% gravel, 60% sand and 35% non-plastic fines)
Brown; moist-wet; slightly-moderately permeable; medium density
Interbeds of glacio-lacustrine; SM, SP, coarse ML

14.1 - 14.7+ Silt & Clay, sandy w/gravel
Max. size 4" - SR-SA Sed. Chls
Approx. 1% 3-6", 99% matrix (which is approx. 10% gravel, 20% sand and 70% moderately plastic fines)
Brown and gray; wet; very slightly permeable; hard density
Interbeds of glacio-lacustrine; SM, ML & CL

NOTE: Seeps and pipes in cleaner sands. Occasional till-like layers lensed in sands. Apt to seep at any depth below 2.3'. Pit has fairly smooth sides. Caves in coarser layers. No representative sample of 2.3-14.1 possible.

TP #210. Front. Assoc. 12/21/70. EC. 1533.9

0.0 - 1.5 Topsoil

1.5 - 8.5 Silt, sandy, w/gravel
Max. size 5" - SR Sed. Chls
Approx. 1% 3-6", 99% matrix (which is approx. 10% gravel, 20% sand and 70% slightly plastic fines)
Orange-brown; moist; slightly permeable; soft density; homogeneous; weathered till; ML

8.5 - 8.0 Sand, silty, gravelly
Max. size 8" - SA flaggy, Sed. Chls
Approx. 1% +6", 1% 3-6", 98% matrix (which is approx. 55% gravel, 45% sand and 40% very slightly plastic fines)
Brown; moist; slightly permeable; medium density; homogeneous; till; SM

8.0 - 14.0+ Gravel, sandy, silty
Max. size 14" - SR Sed. Chls & Eldrs
Approx. 2% +6", 4% 3-6", 94% matrix (which is approx. 50% gravel, 30% sand and 20% non-plastic fines)
Brown; moist-wet; slightly-moderately permeable; medium density; lensed; mixed till and glacio-fluvial; GM

NOTE: Seeps slightly nearly everywhere below 5' but no marked seepage zones. Caves in cleaner zones. Extremely mixed-up area. Sides of pit quite rough.

TP #211. Front. Assoc. 12/22/70. EC. 1523.7

0.0 - 0.9 Topsoil

0.9 - 2.0 Silt, gravelly, sandy
Max. size 10" - SR Sed. Chls
Approx. 1% +6", 3% 3-6", 96% matrix (which is approx. 30% gravel, 10% sand and 60% slightly plastic fines)
Orange-brown; moist; slightly permeable; soft density; homogeneous; weathered till; ML.

2.0 - 14.5+ Gravel, sandy, silty
Max. size 8" - SR Sed. Chls
Approx. 1% +6", 2% 3-6", 97% matrix (which is approx. 45% gravel, 35% sand and 20% very slightly plastic fines)
Brown; moist-wet @ 11'; moderately permeable; loose-medium density; lensed; glacio-fluvial; GM
D.S. 211.1 @ 12'. (SC-SM)

NOTE: Heavy seepage @ 11' from uphill side. Dirtier in 2-3' zone, est. 40-30-30%. Caves.

TP #212. Front. Assoc. 12/22/70. EC. 1528.8

0.0 - 0.3 Topsoil, very thin and stony.

0.3 - 2.0 Silt, sandy, gravelly
Max. size 10" - SR Sed. Chls
Approx. 2% +6", 2% 3-6", 96% matrix (which is approx. 30% gravel, 10% sand and 60% slightly plastic fines)
Orange-brown; moist; slightly permeable; soft density; homogeneous; weathered till; ML.

2.0 - 17.5+ Gravel, sandy, silty
Max. size 24" - SR-SA Sed. Chls & Eldrs
Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 50% gravel, 35% sand and 15% very slightly plastic fines)
Brown; moist; moderately permeable; medium density; lensed; glacio-fluvial; GM
D.S. 212.1 @ 9'. (GC-GM)

NOTE: No water. Caves.

TP #213. Front Assoc. 12/21/70. EC. 1534.5

0.0 - 1.0 Topsoil

1.0 - 3.4 Silt, sandy w/gravel
Max. size 9" - SA Sed. Chls
Approx. 3% +6", 4% 3-6", 94% matrix (which is approx. 10% gravel, 20% sand and 70% slightly plastic fines)
Orange-brown; moist; slightly permeable; soft density; homogeneous; weathered till; ML.

3.4 - 16.5+ Gravel, sandy, silty
Max. size 18" - SR-SA Sed. Chls & Eldrs
Approx. 2% +6", 3% 3-6", 95% matrix (which is approx. 40% gravel, 15% sand and 15% very slightly plastic fines)
Brown; moist; moderately permeable; medium density; lensed; glacio-fluvial; GM

NOTE: No water. Caves. Power +3° than 212.

TP #214. Front Assoc. 12/22/70. EC. 1526.9

0.0 - 1.0 Topsoil.

1.0 - 4.0 Silt, sandy, w/gravel
Max. size 5" - SA Sed. Chls
Approx. 2% 3-6", 98% matrix (which is approx. 10% gravel, 20% sand and 70% slightly plastic fines)
Orange-brown; moist; moderately permeable; soft density; homogeneous; weathered till; ML
D.S. 214.1 @ 8'. (ML)

4.0 - 7.5 Gravel, sandy, silty
Max. size 10" - SR Sed. Chls
Approx. 2% +6", 4% 3-6", 94% matrix (which is approx. 50% gravel, 30% sand and 20% very slightly plastic fines)
Brown; moist; slightly permeable; medium density; very poorly stratified; glacio-fluvial; GM

7.5 - 9.5 Sand, silty w/gravel
Max. size 7" - SR Sed. Chls
Approx. 1% +6", 2% 3-6", 97% matrix (which is approx. 10% gravel, 60% sand and 30% very slightly plastic fines)
Brown; moist-wet @ 8'; slightly permeable; medium density; interbeds of glacio-lacustrine; SM and ML

9.5 - 16.5+ Silt & Clay, sandy w/gravel
Max. size 4"
Approx. 1% 3-6", 99% matrix (which is approx. 10% gravel, 15% sand and 75% slightly-moderately plastic fines)
Gray; wet; very slightly permeable; stiff density; interbeds of glacio-lacustrine; CL and ML
D.S. 214.2 @ 12'. (CL-ML)

NOTE: Moderate seepage @ 8'. Sand from 7.5-9.5 pipes readily. Caves a bit, but not too badly.

TP #215. Front Assoc. 12/22/70. EC. 1533.9

0.0 - 1.0 Topsoil

1.0 - 7.0 Sand, silty, gravelly
Max. size 8" - SA-SR sed. Chls
Approx. 1% +6", 2% 3-6", 97% matrix (which is approx. 20% gravel, 35% sand and 45% very slightly plastic fines)
Mottled brown; moist; slightly permeable; medium density; homogeneous; till; SM

7.0 16.5+ Gravel, sandy, silty
Max. size 18" - SR Sed Chls & Eldrs
Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 45% gravel, 35% sand and 20% non-plastic fines)
Brown; moist; moderately permeable; medium density; very poorly stratified and interbedded; glacio-fluvial; GM
D.S. 215.1 @ 9'. (SM)

NOTE: No seepage. Caves a bit.

TP #216. Front Assoc. 12/22/70. EC. 1533.8

0.0 - 1.0 Topsoil

1.0 - 2.3 Silt, sandy, gravelly
Max. size 6" - SA Sed. Chls
Approx. 2% 3-6", 98% matrix (which is approx. 20% gravel, 20% sand and 60% slightly plastic fines)
Mottled brown; moist; slightly permeable; soft density; homogeneous; weathered till; ML

2.3 - 3.6 Sand, silty w/gravel
Max. size 2"
Approx. 200% matrix (which is approx. 10% gravel, 65% sand and 25% non-plastic fines)
Brown; moist; moderately permeable; medium density; stratified; glacio-fluvial; SM

3.6 - 16.5+ Gravel, sandy w/silt
Max. size 20" - SR Sed Chls & Eldrs
Approx. 3% +6", 7% 3-6", 90% matrix (which is approx. 60% gravel, 30% sand and 10% very slightly plastic fines)
Brown; moist; rapidly permeable; medium density; very poorly stratified; glacio-fluvial; GM-GP
D.S. 216.1 @ 9'. (GC-GM-GP)

NOTE: Oversize increases w/depth. Caves. No water.

DH #255. Left Rear Smry. 12/21/70. EC. 1525.3

		0.0
	Brown topsoil	
		0.6
5 Aug	Silt, sandy w/gravel - est. 10% gravel, 20% sand, 70% non-plastic fines; orange-brown; moist; slightly permeable; soft, N=5; weathered glacial till; ML	
		4.0
12 Aug 41 Aug 83 57 Aug 51 67 102 Aug 128	Gravel, sandy, silty - est. 65% gravel, 40% sand, 15% non-plastic fines; brown to gray-brown; moist; drier w/depth; slightly to moderately permeable; medium to very dense, N=12-128; very poorly stratified ice-contact glaciofluvial deposits; GM to SM	
		26.0

DH #256. Left Rear Smry. 12/22-23/70. EC. 1533.4

		0.0
	Brown topsoil	
		0.3
5 Aug	Silt, sandy, w/gravel - est. 10% gravel, 20% sand, 70% non-plastic fines; light brown; moist; slightly permeable; soft, N=5; weathered glacial till; ML	
		3.5
37 Aug 20 Aug 43 49 40 66 Aug 46	Gravel, sandy, silty - est. 50% gravel, 35% sand, 15% very slightly plastic fines; brown to gray-brown; moist; drier w/depth; slightly to moderately permeable; medium to very dense, N=20-66; very poorly stratified ice-contact glaciofluvial deposits; GM to SM P.S. 256.4 (GM)	
		26.0
39 47	Sand, silty - est. 5% gravel, 60% sand, 35% nonplastic fines; brown; moist; moderately permeable; dense, N=39-47; poorly stratified ice-contact glaciofluvial deposits; SM P.S. 256.9 (SM)	
		30.0

DH #257. Left Rear Smry. 12/22/70. EC. 1531.3

		0.0
	Brown topsoil	
		0.6
5 Aug	Silt, sandy, w/gravel - est. 10% gravel, 20% sand, 70% non-plastic fines; orange-brown; moist; slightly permeable; soft, N=5; weathered glacial till; ML	
		2.5
14 Aug 10 Aug 15	Sand, silty, gravelly - est. 20% gravel, 55% sand, 25% non-plastic fines; brown; moist; slightly permeable; stiff, N=10-15; ice-contact glacial till; SM P.S. 257.2 (SM) ▼ 16.0'	
		17.0
20 30 62 34 25 30 32	Gravel, sandy, silty - est. 45% gravel, 40% sand, 15% non-plastic fines; brown to gray-brown; moist but drier w/depth; slightly to moderately permeable; medium to very dense, N=20-62; ice-contact glaciofluvial deposits; GM P.S. 257.8 (SM)	
		30.0

DH #258. Left Rear Smry. 12/21/70. EC. 1525.9

		0.0
	Brown topsoil	
		0.4
9 Aug	Silt, sandy w/gravel - est. 10% gravel, 20% sand, 70% non-plastic fines; light brown; moist; slightly permeable; stiff, N=9; weathered glacial till; ML ▼ 2.0'	
		2.0
9 Aug 22 Aug	Sand, silty, gravelly - est. 20% gravel, 55% sand, 25% non-plastic fines; brown; moist; slightly permeable; stiff to very stiff, N=9-22; occasional ML and CL-ML interbeds; ice contact glacial till; SM	
		13.0
46 Aug 28 Aug	Silt, sandy - est. 5% gravel, 35% sand, 60% non-plastic fines; gray; wet; slightly permeable; very stiff to hard, N=28-46; very poorly stratified ice-contact glaciolacustrine deposits; some SM interbeds; ML P.S. 258.4 (ML)	
		25.4
32 Aug	Sand, silty - est. 5% gravel, 60% sand, 35% non-plastic fines; brown; moist; moderately permeable; dense, N=32; poorly stratified ice-contact glaciofluvial deposits; SM	
		30.0

CONT'D

DH #258. Left Rear Smry. 12/21/70. EC. 1525.9 (cont'd)

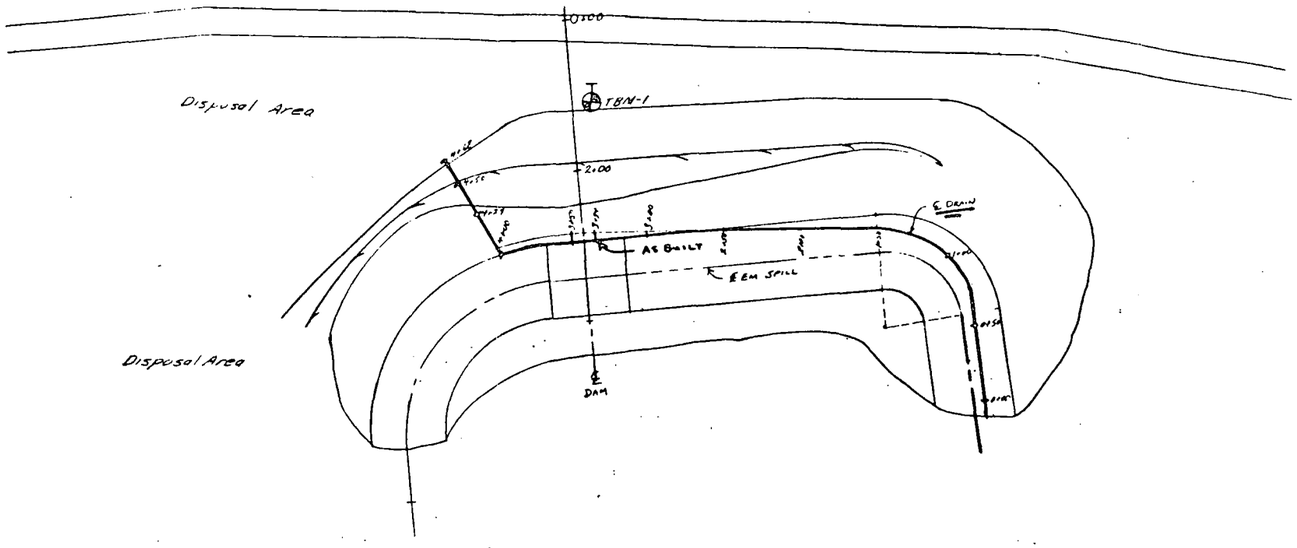
20 Aug 134	Silt and clay, sandy - est. 10% gravel, 15% sand, 75% slightly to moderately plastic fines; gray; moist; very slight permeability; hard, N=30; stratified ice contact glaciolacustrine deposits; some SM interbeds; CL-ML	
		33.7
Aug	Bedrock - shale and siltstone - moderately weathered (not cored). (ch & plot)	
		37.0

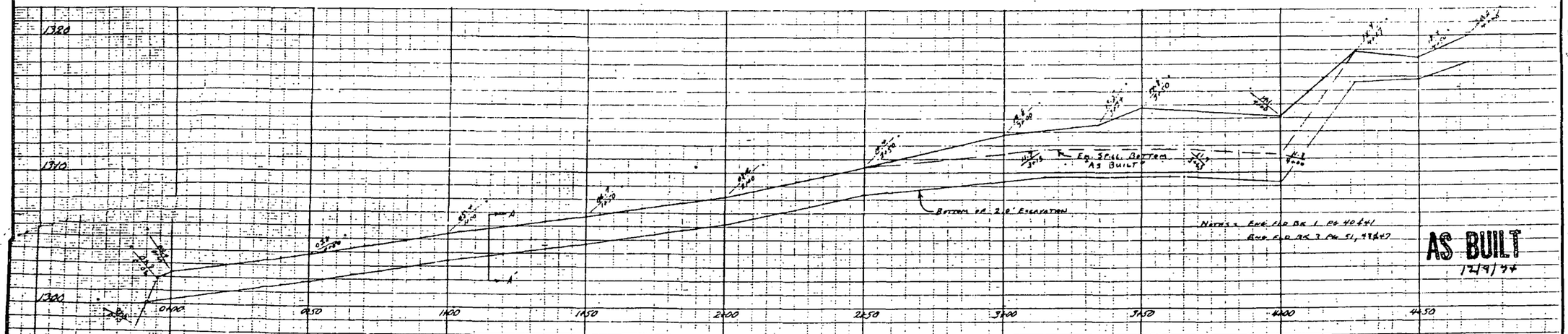
AS BUILT
12/9/74

CONEWANGO CREEK WATERSHED PROJECT
SITE 33
TEST PIT AND DRILL HOLE LOGS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

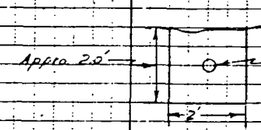
Logged B Chapman Date 12-70 Approved by
Typed J Whaley 1-71 Title STATE CONS. ENGR.
Traced B Chapman 1-71 Sheet No. 23 of 23 Drawing No. NY-2173-G





AS BUILT
12/9/94

Scale 1" = 50'



Notes
20' of 4" Corrigated metal pipe
468' of 4" HD Perforated plastic pipe
Trench to be excavated and backfilled with #2 stone
Slipping area to be excavated and filled with #2 stone
Seeding - No lime or fertilizer
Seed per Acre:
6# Smooth Brome Grass
7½# Kentucky 31 Tall Fescue
½# Redtop
2# Reed Canary Grass
2# Birdsfoot Trefoil
Mulch per Acre - 2 Ton
Seedbed preparation by backblading

CONEWANGO CREEK WATERSHED
SITE 33
Emergency Spillway Tile Drain

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by	
Drawn		Title	
Traced		Title	
Checked		Sheet No. 30	Drawing No. 32

Form SCS 317 (November 1955)

Appendix G

Bibliography

Works Cited

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2. **State of New York Department of Environmental Conservation.** *Guidelines for Design of Dams.* 1985 rev. 1989.

Fredonia Reservoir Dam

EMERGENCY ACTION PLAN
FOR
FREDONIA RESERVOIR DAM

NYSDEC Dam I.D. Number: 003-1102

Dam Location: 42° 23' 50''N 79° 18'36''W

Town/County: Town of Pomfret/Chautauqua County

Owner/Operator: The Village of Fredonia
Address: 9-11 Church Street
PO Box 31
Fredonia, NY 14063

Prepared By: Joshua T. Myers
Emergency Manager / Fire Chief
Address: **80W Main St**
Fredonia, NY 14063

Date: September 2010

Revision Dates: * **1st Revision:** February 2013
2nd Revision: February 201
3rd Revision: October 2018
4th Revision: April 2022
5th Revision: September 2023

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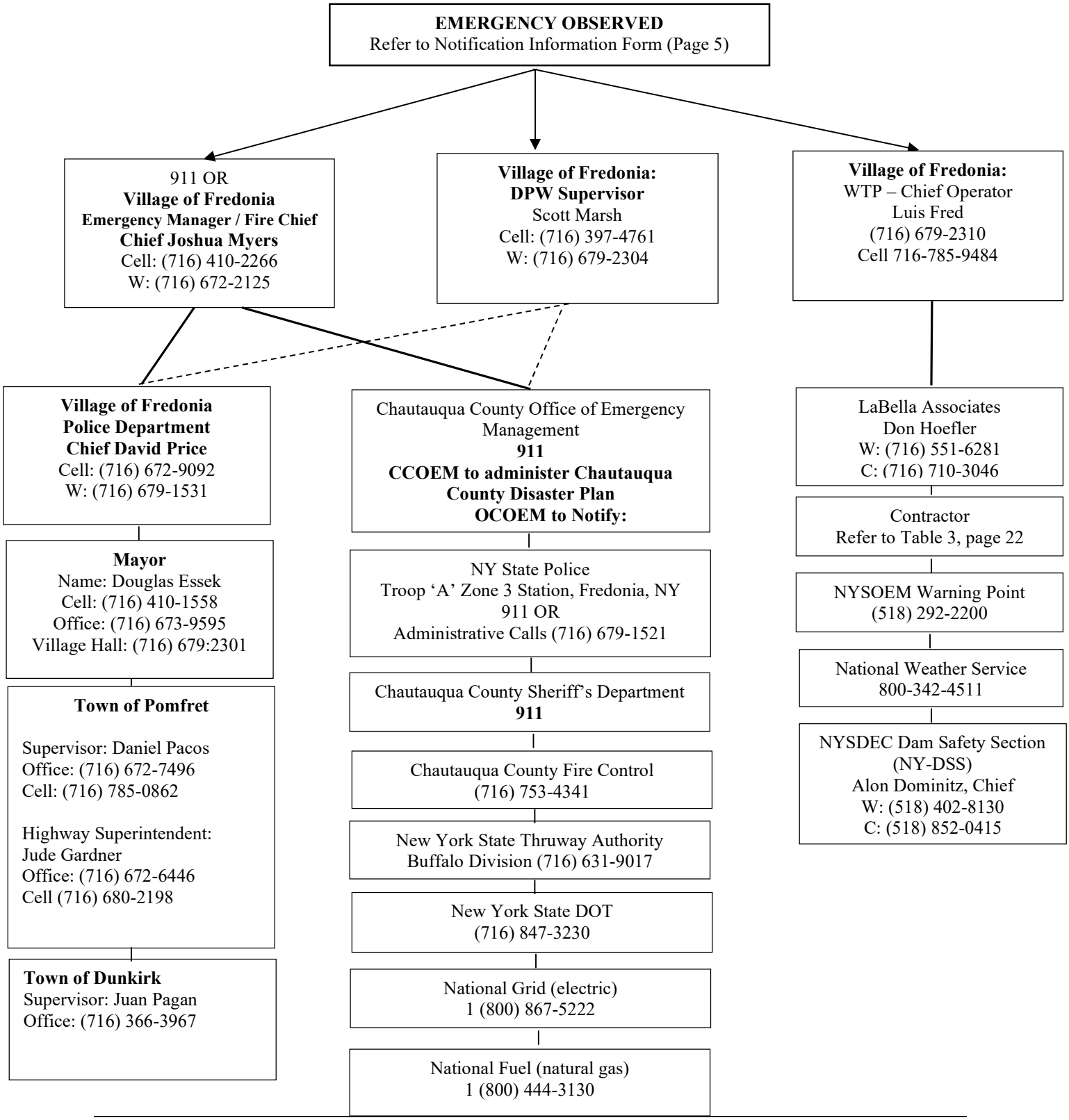
I. Emergency Notification

Figure 1
EMERGENCY NOTIFICATION FLOWCHART



I. Emergency Notification

EMERGENCY NOTIFICATION INFORMATION

Dam Emergency Information for
the Three Emergency Conditions

Name of person reporting information: _____

Affiliation: _____

Phone Number: _____

Name and file number of dam: Fredonia Reservoir Dam 003-1102

Location of dam

County: Chautauqua

Municipality: Town of Pomfret

Stream: Canadaway Creek

Road(s): Spoden Road

Time and date of dam emergency: _____

Type of dam emergency [circle one]: Advisory Warning Emergency

Phone appropriate parties:

"This is (your name, title and affiliation). There is a dam (Advisory, Warning or Emergency) condition at the Fredonia Reservoir Dam. Observation was at (time). The situation is (explain condition). What is your anticipated time of arrival at the dam and what are my instructions?" (Refer to Site Description, page 7 for directions to the dam).

II. Statement of Purpose

Purpose:

The purpose of this Emergency Action Plan is to establish procedures necessary to protect life and property in areas that could be affected by the failure of the Fredonia Reservoir Dam or the uncontrolled release of stored water.

Scope:

This Emergency Action Plan:

1. Establishes a plan for a monitoring system which can activate the Emergency Action Plan, consistent with the Inspection & Maintenance (I&M) Plan.
2. Identifies the officials, organizations, agencies and their respective responsibilities for implementing the Plan.
3. Identifies those areas, residences, facilities and roads that could potentially be affected by the failure of the Fredonia Reservoir Dam or the uncontrolled release of stored water.

III. Project Description

Project Site Description

Dam Name: Fredonia Reservoir Dam Hazard Classification: Type "C" (High Hazard)

NY DEC Id: 003-1102 Federal Id: NY 00749

City/Town: Town of Pomfret County: Chautauqua

Location/Access: Fredonia Reservoir Dam is located at the northern end of Fredonia Reservoir, near Spoden Road and Route 60. Access to the dam is available through a locked security gate and driveway off Spoden Road.

Latitude: 42°23'48" N Longitude: 79°18'37" W

River/Stream: West Branch of Canadaway Creek

Quad Sheet: Dunkirk, NY Nearest City/Town: Fredonia

Height (ft): 80 Normal Surface (ac): 48

Length (ft): 520 Normal Capacity (ac-ft): 1,024

Dam Type: Earth fill w/riprap facing on D/S slope and Concrete Core

Maximum Capacity (ac-ft): 1,733

Spillway: Concrete Ogee Spillway Capacity (cfs): 3,000

Dike: None Drainage Area (sqr mls): 5.6

Outlet other than spillway: 12-inch outlet line to water treatment plant

Purpose/Operation of Dam: Water Supply & Recreational Lake

Instrumentation: Staff gage located on intake structure. NOTE: Structure located approx. 100' offshore.

Method of Emergency Drawdown (Method of emptying reservoir in event of an emergency): 12-inch outlet line to water treatment plant (blow off located near tunnel).

III. Project Description

Figure 2
Site Location Map

IV. Emergency Detection, Evaluation, and Classification

Emergency Condition Identification

As the major objective of dam emergency planning is to save lives and minimize damage, the timely identification of emergency conditions by trained personnel becomes paramount. Procedures to identify emergency conditions are established herein. Three (3) dam emergency conditions of increasing severity have been identified and are described below.

DAM ADVISORY CONDITION (Condition C)

A Dam Advisory Condition is a situation where an unusual problem or situation has occurred, but a failure of the dam is not imminent. Examples of a Dam Advisory Condition are:

- Any undocumented or unusual spring
- Any sign of piping
- Any sign of slumping
- Any sinkhole
- Any unusual crack
- Any unusual wet spot or boggy area
- Any seismic event regardless of how slight
- Any obstruction in the spillway
- Evidence of damage due to vandalism at any structure(s)
- Bomb threat
- A civil disorder near the reservoir structure(s)
- Any aircraft accident near the reservoir structure(s)

Required responses are:

(Refer to *Emergency Notification Flow Chart*, page 4)

- Notify Chautauqua County EMO
- Notify O'Brien & Gere Engineers, Inc.
- Notify NYSDEC-DSS
- Investigation
- Assessment and response

DAM WARNING CONDITION (Condition B)

A Dam Warning Condition is any developing or occurring event or circumstance which is or may adversely affect the integrity of the dam but is considered controllable. The Dam Warning Condition has the potential of evolving into a Dam Emergency Condition. Examples of Dam Warning Conditions are:

- Water level of the lake has risen to one foot (1 ft) below the dam crest and continues to rise.
- Any developing erosion, settlement, or upheaval occurring on the downstream faces or at the toes of the dam and is considered to be controllable
- Any undocumented leakage through any dam structure considered to be controllable

IV. Emergency Detection, Evaluation, and Classification

Required responses are:
(Refer to *Emergency Notification Flow Chart*, page 4)
- Notify Fredonia EMO
- Notify Chautauqua County EMO
- Notify LaBella Associates, Engineering Firm
- Notify NYSDEC-DSS
- Investigation
- Assessment and response

DAM EMERGENCY CONDITION (Condition A)

A Dam Emergency Condition is defined as one or more of the following situations:

- Water has overtopped the earth embankment, or is expected to overtop within the next hour
- Any uncontrollable erosion, settlement, or upheaval occurring on the downstream slope or at the toe of the dam
- Any uncontrollable leakage through any dam structure

Required responses are:
(Refer to *Emergency Notification Flow Chart*, page 4)

CONTACT EVERYONE LISTED ON THE NOTIFICATION FLOWCHART

- Commence emergency actions
- Issue public warning and begin evacuation

V. General Responsibilities Under the EAP

Dam Owner/Operator Responsibilities:

During any of the three (3) emergency conditions:

1. Identification of the emergency condition.
2. Notification of the Emergency Management Offices (EMOS) and New York Department of Environmental Conservation, Dam Safety Section (NYSDEC-DSS) (refer to the *Emergency Notification Flow Chart* on page 4).
   Person responsible for the notification: Joshua Myers
3. Implementation and direction of emergency repairs.
4. Update the emergency status to the EMOS and NY-DSS.
   Person responsible for the updates: Joshua Myers
5. Provisions for security measures at the dam.
6. Provision of technical assistance to EMO officials, when necessary.
7. Reporting termination of emergency situation on-site at the dam.

In non-emergency conditions, owner/operator must also provide for:

1. Routine maintenance and operations of the dam.
2. Routine surveillance of the dam.
3 Routine inspection of the dam.
4. Annual review and updating of the EAP.

EAP Coordinator Responsibility

Once the dam owner/operator has designated an EAP Coordinator, that person shall be responsible for EAP related activities including:

1. Inclusion and distribution of document revisions.
2. Establish training seminars.
3. Coordinate EAP exercises.
4. Serve as the Village of Fredonia contact person for any EAP-related Inquiries.

EAP COORDINATOR NAME: Joshua Myers
PHONE NUMBER: (716) 672-2125

Municipalities, Emergency Fire and Police Responsibilities:

1. Warn the public of emergency conditions at the dam.
2. Implement and direct required evacuations of threatened areas.
3. Establish reception centers for evacuated people.
4. Secure and control access to evacuated areas.
5. Conduct rescue and recovery operations as required.
6. Determination and declaration of termination of emergency/disaster response activities off-site.

Chautauqua County OEM Responsibilities:

Provide overall coordination and resource management of county response activities in support of local and county government, as appropriate. For example, this could include:

1. Pass warning of emergency conditions at the dam to all affected municipalities.
2. Provide assistance to municipalities to help fulfill the emergency responsibilities.

.

V. General Responsibilities Under the EAP

NYS-OEM Responsibilities:
Provides overall coordination of state response activities, which are supplement to local efforts, as appropriate. For example, such efforts could include:

1. Provision of assistance to the affected municipalities and counties (when requested and beyond local authority capabilities).
2. Coordination of specialized assistance.
3. Notification of appropriate State agencies.

NYSDEC-DSS Responsibilities:

1. Provide technical assistance to the dam owner/operator.
2. Assist in the evaluation and resolution of potential emergency conditions.
3. Has the authority to direct the owner/operator to take necessary safety measures.

Termination
The Village of Fredonia is responsible for evaluating a declared emergency condition and should consult with the NYSDEC-DSS that an emergency condition no longer exists on-site at the dam.

Recovery

The basic goal of the recovery phase is to demobilize and return to the pre-emergency situation. The Village of Fredonia is responsible for implementing all actions necessary to achieve this goal on-site at the Fredonia Reservoir Dam.

The Village of Fredonia is responsible for directing all on-site recovery activities. The basic recovery actions common to the three dam emergency conditions are:

- Secure access to emergency site;
- Restore basic facilities and services;
- Assess damage;
- Long term remedial measures which may require permits may be needed;
- A Post Incident Report describing the conditions which led to the emergency must be submitted to the NYSDEC-DSS within five (5) days. (See Attachment D or http://www.dec.ny.gov/lands/4991.html)

VI. Preparedness

Emergency Notification Directory

1. Dam Owner: Village of Fredonia

   Contact Person: Mayor Doug Essek

   Address: 9-11 Church St.

   Phone: (716) 679-2307 24-hour No.: (716) 410-1558

2. Emergency Response Commander: Joshua Myers or Luis Fred

   Address: 80 W. Main St, Fredonia NY, 14063

   Phone: (716) 672-2125 24-hour No.: (716) 672-2125

3. EAP Development Crew

   Supervisor: Joshua Myers

   Phone: (716) 672-2125 24-hour No.: (716) 672-2125

4. Maintenance & Operations Crew

   Supervisor: Scott Marsh

   Phone: (716) 679-2304 24-hour No. (716) 397-4761

   Crew: Phone No.

5. Inspectors

   Name: Luis Fred - Chief Operator Phone No. 716-785-9484

6. Owner's Consulting Engineers

   Name: LaBella Associates, Engineering Firm

   Contact Person: Don Hoefler

   Address: 300 Pearl Street, Suite 130, Buffalo NY, 14202

   Phone No.: W: (716) 551-6281 C: (716) 710-3046

VI. Preparedness

7. Municipalities

Municipality	Phone No.	Police No.
Village of Fredonia	O: (716) 679-2302 C: (716) 680-5770	(716) 679-1531 or 911
Town of Pomfret	(716) 672-6888	911
Town of Dunkirk	(716) 366-3967	911

8. County

	Phone No.	24-hour No.
Chautauqua County OEM	911	911
Chautauqua County Highway Dept.	(716) 761-6171	911

9. State Agencies

Agency	Phone No.	24-hour No.
NYS-OEM	(518) 292-2200	(518) 292-2200
NYSDEC-DSS – Alon Dominitz	(518) 402-8185	(518) 587-5941
NY-DOT (Region 5, Buffalo. Regional Director Alan E. Taylor)		(716) 847-3238

VI. Preparedness

Emergency Operation Center (EOC)

Address/Location:

Village Hall
9-11 Church Street
P.O. Box 31
Fredonia, New York 14063

Contact Person: Mayor Doug Essek
Village Hall: (716) 679 - 2302

Location and Direction to Owner's Emergency Operation Center from nearest State or County Highway:
North of US Route 20

Access:
Church Street Entrance

VI. Preparedness

Figure 3
Emergency Operations Center

VI. Preparedness

Surveillance Checklist for Enhanced Monitoring During an Emergency

Observation	Response	Location: Reservoir	Upstream Slope	Crest	Downstream Face (West)	Downstream Face (East)	Left Abutment	Right Abutment	Spillway	Outlet
Normal	0									
Not Inspected	-									
Overtopping of Crest	3	■	■		■	■	■	■	■	■
Uncontrollable Settlement	3	■								
Uncontrollable Heave or Erosion	3	■								■
Uncontrollable Leakage	3	■	■	■						
Dislocation/Movement of Structures	2	■	■							
Water Level Within 1 foot of Crest and Rising	2		■		■	■	■	■	■	■
Controllable Settlement	2	■								
Controllable Heave or Erosion	2	■								■
Controllable Leakage	2	■	■	■						
Piping (Turbid Seepage)	1	■	■	■					■	■
Sloughing, Slumping, Animal Burrows	1	■							■	■
Sinkhole	1	■							■	■
Wet Spot or Boggy Area	1	■							■	■
Seismic Event	1									
Spillway Obstruction	1	■	■	■	■	■	■	■		■
Cracking	1	■								
Other (explain below)	1									

Key:		Condition Observed/Follow Response	■	n/a to Location

Response Key/Guide

0. No Action, Continue Inspection
1. Dam Advisory Condition, Condition C
2. Dam Warning Condition, Condition B
3. Dam Emergency Condition, Condition A

VI. Preparedness

Emergency Repair Resources

It will be the responsibility of the Village of Fredonia to maintain a current list of emergency response contractors and suppliers who agree to be contacted during an emergency condition for equipment, materials and repairs.

The first source of emergency repair assistance, materials and equipment is from the on-site stocked materials, equipment, and maintenance crew.

Table 1 provides a list of available on-site resources and equipment. Tables 2 and 3 provide a list of available off-site materials and contractors. Several types of potential services, materials and equipment have been identified as potentially important for emergency repairs including:

- Concrete
- Cement grout
- Geotextiles
- Lumber
- Pipes
- Sand bags
- Sand, gravel, riprap
- Crane services and equipment
- Excavation services and equipment
- Pumps

VI. Preparedness

TABLE 1
FREDONIA RESERVOIR DAM
AVAILABLE ON-SITE MATERIALS & EQUIPMENT

Materials:
Gravel
Assorted Stone

Equipment:
1-Loader
1-Backhoe
3-Dump Trucks
1-Vacuum Truck

VI. Preparedness

TABLE 2
FREDONIA RESERVOIR DAM
AVAILABLE OFF-SITE MATERIALS

ITEM CONTRACTOR	LOCATION	PHONE
Sand and Gravel:		
Tri James	Sinclairville, NY	716 962-4408
Gernatt	Hanover, NY	716 549-0551
Concrete and Concrete Grouting:		
Hanson Aggregates Dunkirk Ready Mix	10500 Bennett Rd	716 366-6444
Concrete Pipe:		
Vellano Brothers	Lancaster, NY	716 684-7222
Lumber:		
Chautauqua Brick	67 Orchard St	716 672-4300
Fredrickson Builders Supply	320 Maple Ave	716 535-3100
ADD Lumber	Dunkirk, NY	716 366-1622
Sandbags:		
Chautauqua County Department of Public Facilities		716 761-6171
Geotextiles:		
Vellano Brothers	Lancaster, NY	716 684-7222
Tool Rental:		
United Rental		716 681-3000
Electrical Supplies:		
Scott Electric Supply	355 Central Ave	716 672-5168

VI. Preparedness

TABLE 3
FREDONIA RESERVOIR DAM
AVAILABLE CONTRACTORS

SERVICE CONTRACTOR	LOCATION	PHONE
General Site Contractors:		
S St George Enterprises		716 672-2488
John V Danforth Co	Tonawanda, NY	716 832-2386
Pipeline Contractors:		
S St George Enterprises		716 672-2488
Tree Removal:		
Selig Tree Service	5821 Colt Rd	716 792-9663
Great Lakes Tree Service	7741 Gun Club Rd	716 326-3798
Electrical Contractors:		
BECC Electric		716 679-4466
Pisa Electric		716 679-2232
Crane Service Contractors:		
Benchley Contracting & Crane Rental	3800 Middle Rd	716 363-1004
Diving Contractors:		
Allen Marine Services	770 River Rd	716 362-0674

VII. Inundation Maps

Description

Overview of Inundation Area: The inundation area below the Fredonia Reservoir Dam follows the West Branch of the Canadaway Creek approximately 2 miles to the Village of Fredonia. The inundated area extends through the Town of Pomfret, the Village of Fredonia and the Town of Dunkirk. Table 4 below summarizes peak water surface elevations in the West Branch of the Canadaway Creek at the cross sections shown in Figures 4A-4C during the 50% Probable Maximum Flood (PMF) with Breach condition, and with the Sunny Day ("Normal Pool") with Breach condition.

Table 4

West Branch Canadaway Creek Peak Water Surface Elevations

			W. Br. Canadaway Creek Peak Elevation (ft) with Breach Condition	
Cross Section	Cross Section Location	Distance from Fredonia Reservoir Dam (mi.)	50% PMF	Sunny Day (Normal Pool)
Fredonia Reservoir Dam	Fredonia Reservoir Dam	0.00	1045.6	1037.3
XSEC A	500 ft upstream of filtration plant	0.25	991.7	986.7
XSEC B	Junction of unnamed stream and Canadaway Creek	0.73	867.1	862.1
XSEC C	1000 ft upstream of Loana Road	1.80	811.6	807.0
XSEC D	60 ft upstream of Liberty Street Bridge	3.01	771.9	767.5
XSEC E	100 ft upstream of Water Street Bridge	4.08	724.3	719.1
XSEC F	220 ft upstream of RT 20 Bridge	3.31	722.0	717.9
XSEC G	620 ft upstream of Risley Street Bridge	4.79	697.2	694.6
XSEC H	200 ft upstream of Matteson Street Bridge (Van Buren Road)	5.78	663.6	654.8
XSEC I	200 ft Downstream Route 90	6.65	621.8	615.4
XSEC J	1800 ft Upstream of Lake Erie	8.09	687.2	581.5

Figure 5

INUNDATION MAPS

FOR

FREDONIA RESERVOIR DAM

VIII. Appendices

Appendix A. Plans for Training, Exercising, Updating and Posting

The following offers guidance to those drafting the four important subsections in Appendix A to an EAP: training, exercising, updating and posting. The EAP is to provide appropriate training concerning the activation and implementation of the EAP. Exercises associated with that training, including the Orientation Meeting with local responders and stake holders, are to be regularly carried out in order to solicit input, establish roles during an emergency situation, and facilitate reliable responses to emergencies. Based on these training and exercising activities, and any other information obtained, the EAP is to be updated at least annually, and more frequently as necessary in order to accurately reflect conditions in and near the dam. Finally, the Notification Flowchart is to be posted in appropriate locations in order to provide ready access to it during an emergency situation.

In general, administrative, simple or other minor updates to the EAP for a Class C dam can be completed by the dam owner, and do not require the services of a PE. Examples of updates that would not generally require the services of a PE include:

- Administrative updates to names and phone numbers in the notification flow chart;
- Administrative or other simple updates, changes, or enhancements to, preparedness provisions;
- Simple or minor updates to the inundation map or evacuation map which do not result in a change to the inundation area, such as the addition of one new home in a residential area that is already on the inundation map.

The Village of Fredonia may seek a determination from the Department's Dam Safety Section regarding whether an update to an EAP needs to be developed by a PE. In any event, updates must be submitted by the applicable regulatory deadline (see 6 NYCRR Subpart 673.7).

The Department's Dam Safety Section may review and require changes to any part of an EAP at any time to protect life, property or natural resources. As part of such a review, the Department may require that updates to the EAP for a Class C dam be performed under the direction of, or be reviewed by, a PE retained by the Village.

Training

The EAP Coordinator of the dam is responsible for the training of all personnel involved in the implementation of the EAP. Training of personnel involved in implementation of the EAP is to ensure that they are thoroughly familiar with all elements of the plan, the availability of material and equipment, and their responsibilities and duties under the EAP.

Technically qualified personnel should be trained in problem detection and evaluation and appropriate remedial (emergency and non-emergency) measures. This training is essential for proper evaluation of developing situations at all levels of responsibility which, initially, is usually based on on-site observations. A sufficient number of Village of Fredonia personnel should be trained to provide adequate coverage at all times.

Training courses should be held within two (2) months of the implementation of the EAP. Follow-up training sessions should be held annually. The following should be part of the training:

VIII. Appendices

Appendix A. Plans for Training, Exercising, Updating and Posting

1. For Normal Operations:
   - Instruction on the location, purpose, and operations of the dam structure components
   - Demonstration of normal dam conditions and operations
   - Instruction on visual inspection procedures for the weekly/monthly inspections
   - Hands-on training with communications equipment

2. For Emergency Condition Identification:
   - Review of Emergency Action Plan
   - Instruction on visually detecting an emergency warning sign
   - Review of conditions which would indicate an emergency including proper identification of the type of emergency
   - Instruction on interpreting the visual inspection checklists to detect an emergency situation

3. For Emergency Communications:
   - Instruction on proper use of communications equipment
   - Instruction on appropriate individuals to contact, as well as the time to call them and the order in which calls should be made
   - Instruction on appropriate message to convey

4. Emergency Response Actions:
   - Instruction on the role of each worker in response actions
   - Instruction on dam emergency response actions to be taken for each type of emergency situation
   - Instruction on obtaining and utilizing on and off-site emergency supplies
   - Instruction on assessing the end of the dam emergency
   - Instruction on proper communications for notifying the appropriate individuals of the emergency termination
   - Instruction on obtaining and utilizing on and off-site emergency supplies.
   - Instruction on determining the end of a dam emergency.
   - Instruction on proper communications for notifying the appropriate individuals of the emergency termination.
   - Instruction on the appropriate dam emergency recovery activities.

Exercising

Develop scenarios for the various emergency conditions and exercise the state of training and readiness of key personnel responsible for actions during an emergency in order to make sure that they know and understand the procedures to be followed and actions required.

Emergency response exercises should be held annually and should simulate an emergency situation in which the worker is tested on emergency condition notification, emergency communications, and emergency response skills. The exercise, whenever possible, should include participation by both the dam owner and the affected state and local emergency management officials. The exercises should be evaluated both orally and in writing and the EAP should be revised to correct any deficiencies noted.

VIII. Appendices

Appendix A. Plans for Training, Exercising, Updating and Posting

Updating

A regular review of the adequacy of the EAP should be conducted at intervals not to exceed one year, and should be coordinated with the Annual Test. The review should evaluate the accuracy of the EAP's notification flow charts, flood inundation area, depictions of downstream development, and the EAP text. The review should determine whether any revisions to the current EAP are necessary. If, as a result of the annual review, no revisions are necessary, a written statement to this effect should be provided to each recipient of the original EAP, including the DEC's DSS. The EAP should be updated, and the updates should be distributed promptly when changes are required. EAP personnel or telephone number changes should be recorded and distributed as they occur.

Posting of the Notification Flowchart

An up-to-date copy of the Notification Flowchart should be posted in prominent locations at the dam site and local emergency operations center.

The flowchart should be posted at each phone and radio transmitter at the dam and at all other desirable locations. The locations of the posted flowcharts should be indicated below.

List of Location of Notification Flowchart:

Village of Fredonia

- Village of Fredonia Fire Department
- Village of Fredonia Emergency Manager
- Village Hall Administrators Office
- Chautauqua County EMS Office
- Village Police Station –Dispatch
- All Phones at Fredonia Water Plant
- Chautauqua County Sheriff Department

VIII. Appendices
Appendix B. Definitions

Definitions

The following words and terms, as used in this plan, shall have the following meanings, unless the context clearly indicates otherwise.

DAM - Any artificial dike, levee or other barrier, together with appurtenant works, which is constructed for the purpose of impounding water on a permanent or temporary basis, that raises the water level five feet or more above the usual, mean, low water height when measured from the downstream toe-of-dam to the emergency spillway crest or, in the absence of an emergency spillway, the top-of-dam.

DRAWDOWN - Lowering of lake/reservoir level through the use of flood gates, low level outlets, etc.

EMERGENCY - A condition in which the occurrence of a significant hazard to life or property is occurring.

EMERGENCY ACTION PLAN (EAP) - Established procedures necessary to minimize threat to life and damage to property in the event of a dam failure related release.

EMERGENCY CONDITION - Any of the four conditions identified in the Emergency Condition Identification section.

EMERGENCY OPERATIONS CENTER (EOC) - The command post from which emergency operations are coordinated. Must contain a telephone/communication line or be close to one.

EMERGENCY MANAGEMENT OFFICE (EMO) - All the involved emergency management agencies (State, County or local) which would be involved in an emergency response.

FAILURE - An incident resulting in the uncontrolled release of water from an operating dam.

FILE NUMBER - New York State identification number for the dam.

HAZARD CLASSIFICATION - Classification of potential hazard a dam failure would cause downstream of the dam.

> **Class "A"** – Dam failure will damage nothing more than isolated farm buildings, undeveloped lands or township or county roads.
>
> **Class "B"** – Dam failure can damage homes, main highways, minor railroads, or interrupt use or service of relatively important public utilities.
>
> **Class "C"** – Dam failure can cause loss of life, serious damage to homes, industrial or commercial buildings, important public utilities on main highways, and railroads.

VIII. Appendices
Appendix B. Definitions

INUNDATION - Area that would be directly affected by flood waters resulting from a catastrophic dam failure.

NY File No. - New York State Identification Number for the dam.

NY-DSS - New York Department of Environmental Protection, Dam Safety Section.

NY-EMO - New York State Police, Emergency Management Office.

OUTLET - An opening through which water can be freely discharged from a lake/reservoir for a particular purpose.

OWNER/OPERATOR - Person/entity who owns, controls, operates, maintains, manages the dam.

PIPING - The progressive development of internal erosion by seepage, appearing downstream as a hole or seam discharging water that contains soil particles.

SINKHOLE - Any unusual subsidence.

SLUMPING - The movement of a mass of earth along and/or down a slope. In embankments and abutments, this involves the separation of a portion of the slope from the surrounding material.

SPILLWAY - A waterway/structure designed to convey excess water from a reservoir/lake without endangering the safety of the dam.

SPILLWAY DESIGN FLOOD (SDF) - The flood associated with the spillway design storm upon which the hydraulic capacity of the spillway structure is designed.

Approval and Distribution

Any revisions to the EAP should be furnished to all individuals and entities to whom the original EAP was distributed, including the DEC/DSS. Each party receiving an EAP should be provided with a receipt form to return to the distributor of the EAP (Village of Fredonia). The signed receipt should be phrased in a manner that will help assure that all parties are aware of and understand the EAP and agree to their assigned roles should an emergency occur. A standard distribution letter and receipt is included as Appendix C for reference.

The Promulgation and Concurrence Form is also to be completed or revised when the dam owner makes revisions to the EAP. When a new EAP is developed, or new inundation maps are issued, or the Notification Flowchart is modified to add parties, the dam owner is to notify DEC/DSS that the new or revised EAP has been completed by submitting a new Promulgation and Concurrence Form.

Document Holders

DOCUMENT HOLDER	NUMBER OF COPY
Village of Fredonia	1-5
Chautauqua County Office of Emergency Management	6
Town of Pomfret	7
Town of Dunkirk	8
NY-DSS (DEC Dam Safety Section)	9
NY-EMO (State Police EMO)	10
LaBella Associates, Engineering Firm	11-12
ENB Insurance Agency Inc	13

VIII. Appendices
Appendix C. Approval and Distribution of the EAP

Standard Distribution Letter & Receipt for REVISIONS

(Date)

(Name of EAP document holder)
(Company or affiliation)
(Mailing address)

Re: Fredonia Reservoir Dam
NY File No. 003-1102

Dear (Name of EAP holder):

The Village of Fredonia has revised the Emergency Action Plan for the Fredonia Reservoir Dam located within the Town of Pomfret, Chautauqua County. The EAP is a public safety regulatory required document. The (year) revisions are described in the REVISION SUMMARY.

Please insert the new material with the revision date in your controlled copy and remove the obsolete material (the effective dates generally are printed at the lower right corner of the pages). Please acknowledge your receipt of your controlled copy distribution by returning the obsolete pages to the undersigned with the attached acknowledgment, signed and dated.

We appreciate your continued cooperation in the revisions of the EAP. Should you have any recommendations or questions regarding the EAP, please do not hesitate to contact the undersigned.

Sincerely,

Mayor Douglas Essek
Village of Fredonia

I acknowledge receipt of the (revision date) revision to the Fredonia Reservoir Dam EAP and have inserted the revision pages in my controlled copy. This EAP will be maintained at the designated location for use in the event of a drill or actual emergency declaration.

Controlled Document holder name: _____Document No: _____

Signature: _____Date: _____

Dam Post-Incident Report

6 NYCRR Part 673 requires Dam Owners to submit a written report to NYSDEC when either of the following incidents occurs at a Class C – High Hazard or a Class B – Intermediate Hazard dam:

1) Activation of the Emergency Action Plan; or
2) Flow through an erodible auxiliary spillway.

Submit the completed form within 5-days of the end of the incident to:

NYSDEC –Dam Safety Section
625 Broadway, 4th floor
Albany, NY 12233-3504
phone: (518) 402-8185
fax: (518) 402-9029

NYS Dam ID #: 003-1102 **Date of Incident:** ____/____/____

Dam Name: Fredonia Reservoir Dam
Reservoir/Impoundment Name: Fredonia Reservoir

Location (County, Town/City/Village, Street, latitude, longitude): Chautauqua County, Town of Pomfret, off of Spoden Road (small side road of Rt. 60), 42° 23' 50''N 79° 18'36''W

Description of incident and cause(s):

Start date, time of incident: ___/__/___, ___:___(AM)(PM)

Was the Emergency Action Plan activated? (Yes)(No) If so, when?: ___/__/___, ___:___(AM)(PM)

Has the Emergency ended? (Yes)(No) If so, when?: ___/__/___, ___:___(AM)(PM)

~~Did flow pass through an erodible Auxiliary Spillway? (Yes)(No)~~ **Not Applicable to this Site**

Duration of overflow: _____ Maximum depth of flow above spillway crest:_____

Spillway condition: _____

Immediate responses to incident: _____

Long term responses to incident: _____

Dam Owner Contact Information

Name:	Village of Fredonia
Mailing Address:	9-11 Church Street PO Box 31 Fredonia, NY 14063
Phone:	(716) 679-2302 or (716) 673-9595
Fax:	(716) 679-0860

Promulgation and Concurrence

VIII. Appendices
Appendix D. Standard Forms

I, the undersigned, on the date indicated, have reviewed the Emergency Action Plan (EAP) for the Fredonia Reservoir Dam, DEC ID# 003-1102. I have received the concurrence of the necessary emergency managers, who are listed below.

_____ _____
Dam Owner Date

Name	Title	Organization

Date of most recent Orientation Meeting: _____

Certification of Promulgation and Concurrence

I certify under penalty of law that the answers and information provided in and with this Promulgation and Concurrence Form were prepared by me or under my direction or supervision. The answers and information I submit are, to the best of my knowledge and belief, true, accurate, and complete.

This Certification must be signed by an individual who is the EAP coordinator, on his or her own behalf.

Name: _____

Title: _____

Company: _____

Signature: _____ Date: _____

FREDONIA RESERVOIR ENGINEERING ASSESSMENT

VILLAGE OF FREDONIA, CHAUTAUGUA COUNTY NEW YORK

State ID: 003-1102

Prepared by:	*Prepared for:*
	Scott Marsh (Owner)
Jeff Wackowski, P.E. **LaBella Associates, D.P.C.** **300 State Street, Suite 201** **Rochester, New York 14614**	**Village of Fredonia** **Water Bureau** **9254 Fredonia Stockton Road** **Fredonia, NY 14063**

LaBella Project No.: 2223374

December 21, 2022

NOTE

This report is written using **U.S. Customary Units** unless otherwise noted.

The professional services provided in this report include only the specific geotechnical aspects of the subsurface conditions at the site. The subsurface soil profile and design parameters provided in this report are estimated based on the results of the soil borings conducted by others as indicated by: the boring logs, visual classification of the recovered soil and/or rock samples, geotechnical laboratory results (where applicable), analytical laboratory results (where applicable) and/or generally published soil and/or rock property correlations. Actual subsurface conditions beyond the soil borings and below the depths explored may vary, as well as subsurface conditions encountered in the field during and/or as a result of construction activity. If actual conditions vary from those presented in this report, the geotechnical engineer should be notified to identify if the recommendations provided herein are still applicable.

Please contact the undersigned Geotechnical Engineer with questions regarding the information provided herein.

This report was prepared by
LaBella Associates, D.P.C.

Written by:

Donald Lucas, P.M.P.
Project Manager
(electronic or copied signature unless in blue ink)

Reviewed by:

Jeff Wackowski, P.E.
Structural Engineer
(electronic or copied signature unless in blue ink)

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A – DAM SAFETY INSPECTION FORMS
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1.0 INTRODUCTION & FACILITY DESCRIPTION

LaBella Associates, D.P.C. (LaBella) is pleased to present this Engineering Assessment Report that contains information pertaining to the Village of Fredonia's Reservoir. The New York State Compilation of Codes, Rules, and Regulations Part 673.13 states that an engineering assessment shall be performed, and an engineering assessment report must be submitted to the New York State Department of Environmental Conservation (DEC), Dam Safety Section at a minimum frequency of every 10 years for dams that have been assigned a hazard classification of class B or C.

Fredonia's Reservoir is located in the Village of Fredonia, NY and is owned and operated by the Village of Fredonia Water Bureau. The reservoir was placed in service in 1938 to provide potable water to the Village of Fredonia. The current dam and spillway supersede an 1896 constructed spillway located upstream and indicated by the remaining intake structure. The intake structure was constructed within the embankment of the 1896 spillway and remains in the original location.

The reservoir watershed is approximately 5.7 square miles. The reservoir is created by a natural basin contained and controlled by a dam (State ID 003-1102). The dam is comprised of two earthen embankments (East and West) and a concrete spillway. The concrete spillway contains 3 distinct sections; an ogee-shaped dam approximately 75 wide is the main control structure, a gradual sloping spillway contained by training walls that narrows the spillway, and a stepped outfall portion. The spillway discharges to the Canadaway Creek.

The Fredonia Reservoir has been classified as a Class C High Hazard dam because a dam failure may result in widespread or serious damage to homes, main highways, industrial or commercial buildings, or loss of human life. The previous Engineering Assessment Report (EA) was prepared by O'Brien & Gere Engineers, Inc. in 2012. This report serves to comply with the DEC regulation requiring an EA update at the next 10-year interval.

2.0 INFORMATION REVIEWED

To identify possible repair and/or replacement alternatives, LaBella reviewed several reports, drawings and calculations to gain an understanding of the existing conditions and how the reservoir was constructed. Provided below are the items reviewed:

Source	Description
1	2012 Engineering Assessment – Fredonia Reservoir Dam, December 2012, *O'Brien & Gere Engineers, Inc.*
2	Evaluation of Alternatives – Fredonia Reservoir Dam, November 2016, *O'Brien & Gere Engineers, Inc.*
3	NYSDEC Routine Inspection – Fredonia Reservoir Dam, October 2019, *New York State Department of Environmental Conservation (NYSDEC)*

3.0 DAM SAFETY INSPECTION

On August 25, 2022, LaBella conducted the Safety Inspection at the Fredonia Reservoir. Staff present included Jeff Wackowski P.E., Structural Engineer, Tom Zaso, Geotechnical Engineer, Don Lucas, Project Manager, and Chad Scorse, Junior Engineer. Personnel from the Village of Fredonia also attended parts of the inspection. An inspection form was utilized and is located in Appendix A, which details field observations and findings.

3.1 STRUCTURAL OBSERVATIONS

The concrete ogee gravity dam shows signs of minor deterioration. We observed cracks along its length, sealant missing from joints, minor spalling on its upstream face, and delamination on the surface of the dam toe and approximately mid-height between the toe and the crest. Heavy vegetation was present on the west abutment wall. We observed spalling, delamination, cracking, and efflorescence throughout the east and west abutments walls, upstream and downstream of the dam.

Portal openings were cut into both abutment walls downstream of the dam. The saw-cuts extend beyond the openings into the base of the walls and the spillway deck. No joint sealant has been applied to these cuts. We observed cracks across the spillway deck throughout its length. Large cracks and deflections are present in the spillway blocks.

4.0 HAZARD CLASSIFICATION RECONNAISSANCE & REVIEW

The Fredonia Reservoir is currently classified as a Class C (high hazard) dam. The hazard classification review performed by LaBella Associates included an evaluation of the existing hazard classification consisting of: a field visit on August 25, 2022; a review of Part 673.5 concerning hazard classification review; and a review of the inundation mapping provided in the January 2010 Malcolm Pirnie Emergency Action Plan. Review of recent aerial photography indicates no major changes or development within the downstream delineated inundation area. There is no evidence indicating the hazard classification should be changed. The Class C classification remains appropriate.

5.0 GEOTECHNICAL ASSESSMENT

The Geotechnical assessments and recommendations found within this section are based on the review of previous records submitted to LaBella and the field inspection performed on August 25, 2022. If additional information is needed Labella may need to advance new test borings and perform a new survey of existing conditions around the dam.

5.1 RECORDS REVIEWED

A review of pertinent records provided to Labella as part of this Engineering Assessment (EA) report are listed in the table below:

Document Name	Document Date	Responsible Party
2012 Engineering Assessment Fredonia Reservoir Dam (State ID No. 003-1102)	December 2012	O'Brien & Gere
Evaluation of Alternatives Fredonia Reservoir Dam (State ID: 003-1102)	November 2016	O'Brien & Gere
2019 Routine Inspection Fredonia Dam, Class C State ID#003-1102	February 11,2020	New York State Department of Environmental Conservation

5.2 SUMMARY OF FINDINGS

Eastern Embankment: As shown in Photos 1, 4, 5, and 37 of the Field Assessment Photo Log vegetative growth along with mature trees are shown on the downstream slope. The overgrowth restricted access to the entire downstream slope and therefore, previous events of documented seepage at the base of the

embankment were only able to be observed in a limited fashion. Minor seepage was observed at the toe of the slope and should be monitored periodically to check for changes to rate or color of seepage water.

Western Embankment: As shown in Photos 1, 6, and 21 of the Field Assessment Photo Log vegetative growth along with mature trees are shown on the downstream slope. The overgrowth restricted access to the entire downstream slope and therefore, previous events of documented seepage at the base of the embankment were only able to be observed in a limited fashion.

5.3 RECOMMENDATIONS

Remove all deleterious growth from the dam including removal of trees, stumps, brush, and growth other than grass in accordance with New York State Department of Environmental Conservation *"An owners Guidance Manual for the inspection and Maintenance of Dams in New York State"*. Root systems will also need to be removed to the maximum practical extent. The void which results from removing the root systems shall be backfilled with competent material as outlined in the dam's original design documents, which were not provided to LaBella. Growth of grass should be encouraged after clearing efforts have been completed on all segments of the dam to prevent erosion by surface runoff. After the Eastern and Western downstream embankments have been cleared Labella will conduct an additional inspection on the newly exposed areas. Future undesirable growth should be removed by cutting or spraying, as part of an annual maintenance program.

6.0 HYDROLOGIC AND HYDRAULIC ASSESSMENT

Obrien & Gere's "2012 Engineering Assessment of the Fredonia Reservoir Dam" provided a detailed summary of the hydrologic and hydraulic conditions at the dam. The 2012 Assessment referenced the following previous hydrologic and hydraulic assessments:

- "Fredonia Reservoir Safe Yield Improvement Study, Phase 1 (Draft)" by HARZA Engineering Company, Inc., November 1999
- "Evaluation of the Fredonia Reservoir Dam Spillway Memorandum" by Obrien & Gere Engineers, Inc., September 2003

Obrien & Gere also provided alternatives for increasing the spillway capacity in their November 2016 "Evaluation of Alternatives: Fredonia Reservoir Dam" Study.

As part of the 2022 Engineering Assessment, LaBella reviewed the 2012 Assessment and the 2016 Study to independently verify the engineering methods used and determine if the Fredonia Reservoir Dam meets all current NYSDEC guidelines and regulations related to hydraulics and hydrology.

6.1 SPILLWAY CAPACITY

Per NYDEC Guidelines, the regulatory Spillway Design Flood (SDF) is 50% of the Probable Maximum Flood (PMF) for Class C Dams. The 2012 Assessment references the 1999 HARZA Study for determination of the flow over the spillway for the 50% PMF. The 1999 Study used the National Oceanic and Atmospheric Administration's (NOAA) Hydrometeorological Report No.51 (HMR-51) to determine the amount of rainfall associated with the 50% PMF. USACE's HEC-1 software was then used to create a hydrologic model to route the rainfall through the reservoir.

The procedure described above follows the guidance described in Section 5 of NYSDEC's "Guidelines for Design of Dams." The peak outflow resulting from the 50% PMF was determined to be 10,500 cfs. Since the HMR-51 analysis is still the accepted practice for determining the amount of rainfall associated with the 50% PMR, the design storm is the same today (2022) as it was for the 1999 and 2012 reports.

The HARZA study also evaluated the capacity of the spillway system. The existing spillway is an ogee-shaped concrete section. It is 75' long with a crest elevation of 1037.0'. The concrete outlet channel narrows from 70' to 40' in width approximately 50' downstream of the crest. The results of the analysis indicate the dam will be overtopped during the 50% PMF. The predicted maximum water surface elevation during the 50% PMF is 1046.3'. This is approximately 1.5' above the dam crest. HARZA also used a procedure developed by the US Bureau of Reclamation (USBR) to estimate the capacity of the concrete outlet channel. They determined its capacity was approximately 3000 cfs. Flow greater than that overtops the outlet channel's training walls.

The tables below provide key characteristics of the Fredonia Reservoir Dam and results of the HEC-1 hydraulic analysis.

Fredonia Reservoir Dam Characteristics

Spillway Length	75'
Top of Embankment Elev.	1044.8'
Spillway Crest Elev.	1037'
Spillway Flow resulting from 50% PMF	10,281 cfs.
Max. Flow before Overtopping Embankment	5,882 cfs.

Results of Spillway Capacity Analysis

Reservoir Storage at Elev. Of 1037.00	899 ac-ft
Reservoir Storage at Elev. Of 1044.80	1,325 ac-ft
Water Surface Elev. in Reservoir During SDF	1046.3'

The information above shows the Fredonia Reservoir Dam does not meet NYSDEC's requirements for spillway capacity. The existing spillway has the capacity to convey less than 30% of the flow generated by the PMF prior, to overtopping the dam.

As detailed in Obrien & Gere's 2016 Study, some options for increasing the capacity of the spillway include raising the dam crest and installation of a new labyrinth spillway.

LaBella conducted a structural stability analysis of the concrete ogee gravity dam based on existing conditions. The dam was analyzed under four different loading conditions; Normal Pond, Ice Condition, Significant Design Flood (50% of the Peak Maximum Flood), and Normal Pond + Seismic Loading.

The analysis shows:

- The dam is structurally stable under Normal Pond Conditions
- The dam fails in sliding, cracking, and overturning analysis under the Ice Condition
- The dam fails in sliding, cracking, and floatation under the Significant Design Flood Condition
- The dam fails in sliding under the Normal Pond + Seismic Condition*

- *The seismic analysis does not consider the dam to be restrained from sliding by the spillway deck or abutment walls

6.2 DRAWDOWN ANALYSIS

NYSDEC regulations require all reservoirs to have a low-level outlet (LLO) with sufficient capacity to discharge 90 percent of the storage below the lowest spillway crest within 14 days, assuming no inflow into the reservoir. A tunnel excavated into the shale bedrock beneath the Eastern Embankment houses the 12" piping that conveys water from the Fredonia Reservoir to the treatment plant. The piping connects to a blow-off valve. The drawdown analysis detailed in Obrien & Gere's 2012 Assessment assumed the drawdown was discharged though the 12" pipe by opening the valves outside of the tunnel to direct flow through the blowoff valve instead of to the Treatment Plant. Drawdown through the lower intake was assumed.

Head losses through the system were calculated to develop stage versus discharge relationships for the system. The drawdown analysis was modeled using a program designed with Microsoft Visual Basic for Applications.

The table below contains excerpts from the 2012 Assessment, showing the relationship between drawdown, storage volume and discharge.

Low Level Outlet Stage versus Discharge

Time (days)	Drawdown (ft)	Pool Elevation (ft)	Storage Volume (ac-ft)	Discharge (cfs)
0	0	1,037.00	828.60	0
1	0.53	1,036.47	809.68	9.52
2	1.05	1,035.95	790.85	9.47
14	**6.68**	**1,030.32**	**571.89**	**8.96**
15	6.97	1,030.03	554.13	8.94
35	20.47	1,016.53	222.98	7.59
36	**22.00**	**1,015.00**	**199.48**	**7.42**

31% of the total storage in the reservoir can be drawn down in 14 days. The system can draw down approximately 76% of the total storage by the 36th day. The remaining 24% of the storage cannot be discharged from the reservoir because it is located upstream of the original dam and beneath the lower intake.

The information above shows that the Fredonia Reservoir Dam LLO does not meet the NYSDEC requirement of 90% drawdown in less than 14 days.

7.0 EMERGENCY ACTION PLAN

The Emergency Action Plan is considered complete and adequate. LaBella has updated the EAP Notification Flowcharts to reflect updated and current contact information in accordance with the following table.

Title	Name	Phone Number
Department of Public Works - Supervisor	Scott Marsh	Office: (716) 679-2304
Village of Fredonia – Mayor	Doug Essek	Office: (716) 410-1558 Village Hall: (716) 679-2301
New York State Department of Transportation - Region 5 Director	Francis Cirillo	Office: (716) 847-3238
LaBella Project Manager Contact Information	Don Lucas	Office: (585) 295-6699 Cellular: (585) 233-0792
New York State Department of Environmental Conservation Dam Safety Section Department Chief	Donald Canestrari P.E.	Office: (518) 402-8138 Backup Contact: Bureau of Flood Protection and Dam Safety: (518) 402-8151
New York State Police	N/A	Emergency: 911
Fredonia Police Department	David Price	Emergency: 911 Direct: (716) 679-1531
Fredonia Fire Department	Joshua Myers	Emergency: 911 Direct: (716) 672-2124
Chautauqua County Sheriff's Department	N/A	Direct Line: (716) 753-4341 Direct Line: 911

8.0 INSPECTION AND MAINTENANCE PLAN

The Inspection and Maintenance Plan is considered complete and adequate for continued safe operation of the Fredonia Reservoir Dam. LaBella recommends that the Village of Fredonia continue the tasks as described in the Inspection and Maintenance Plan.

The Inspection and Maintenance Plan also indicates that the Village of Fredonia shall consult with a licensed engineer experienced in dam safety every (2) years to complete a dam safety inspection. LaBella agrees with this statement and recommends the regular safety inspections by a licensed engineer continue.

The Instrumentation, Maintenance Operations, and Emergency Operations Guidelines are considered appropriate and complete.

9.0 CONCLUSIONS

LaBella found the dam serving Fredonia Reservoir is deficient of NYSDEC Guidance relating specifically to spillway capacity. The current construction and design of the dam does not align with expectations as defined by NYSDEC for a Class C High-Hazard Dam.

The Village of Fredonia Reservoir Dam does comply with the majority of NYSDEC Part 673 Dam Safety Regulations as shown in the table below.

Summary of Conformance with NYSDEC Part 673 Dam Safety Regulations

Regulation	Description of Regulation	Compliance
673.5 Hazard Classification	Dams shall have a properly assigned Hazard Classification according to the potential impacts of a dam failure.	Complies; dam classified as a Class C
673.6 Inspection, Operation & Maintenance	Owners of a Class C dam shall develop and fully implement a written Inspection and Maintenance Plan by August 19, 2010	Complies; the Inspection and Maintenance Plan is considered complete and adequate
673.7 Emergency Action; Emergency Action Plan	Owners of a Class C dam shall prepare an EAP and annual updates thereof	Complies; the EAP is complete and adequate. It shall be updated with current contact information.
673.8 Annual Certification	Owners of a Class C dam shall submit to the Dam Safety Section an Annual Certification by January 31 of each year	Complies; the Village of Fredonia submits the Annual Certification
673.9 Notification of Auxiliary Spillway Flow	Owners of a Class C dam shall notify the department in writing within five calendar days of any flow in an erodible auxiliary spillway	Complies
673.10 Recordkeeping and Response to Request for Records	The Owner of a dam shall keep available and in good order all available records	Complies
673.12 Safety Inspections	Owners of a Class C dam shall undertake Safety Inspections on a regular basis as identified in the I&M Plan	Complies; the I&M Plan details the frequency and nature of dam safety inspections
673.13 Engineering Assessments	Owners of a Class C dam shall perform Engineering Assessment by August 19, 2015 and a minimum of every 10-years thereafter	Complies; the Village of Fredonia completed the original Engineering Assessment in 2012 and is submitting this EA update in 2022.

9.1 RECOMMENDATIONS

LaBella Associates recommends that The Village of Fredonia continue to progress towards compliance with NYSDEC expectations for Spillway Capacity and Drawdown Capability.

LaBella recommends the following structural repairs to the dam in its current condition:

- Epoxy-inject cracks in dam and abutment walls that exhibit efflorescence
- Apply sealant to joints and extended saw-cuts in dam, spillway deck, and abutment walls
- Remove loose and delaminated concrete material from dam surface and abutment walls

- Apply concrete repair mortar to areas of spalling and where delaminated material has been removed on dam surface, spillway deck, and abutment walls

LaBella recommends the following maintenance items be completed:

- Remove vegetation from both embankments and maintain
- Remove vegetation from abutment walls and maintain

LaBella recommends:

- A Hydrology Report be completed assessing the current state of the water shed, reservoir capacity and spillway flow characteristics.

10.0 REFERENCES

1) NYSDEC (1989) Guidelines for Design of Dams (NYSDEC Guidelines), January 1985, rev. January 1989.
2) 6 CRR-NY 673 NYSDEC Dam Safety Regulations
3) NYSDEC (2010) DOW 3.1.3 – Emergency Action Plans for Dams (DEC Program Policy), June, 2010.
4) NYSDEC (2011) DOW TOGS 3.1.4 – Guidance for Dam Engineering Assessment Reports (DEC Program Policy), March 2011.
5) NYSDEC DOW TOGS 3.1.5 – Guidance for Dam Hazard Classification (DEC Program Policy), DRAFT.

APPENDIX A

DAM SAFETY INSPECTION FORMS

FOR-001

LaBella
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FIELD OBSERVATION REPORT FOR 2223374

Project: Fredonia Reservoir Dam Engineering Assessment
9254 Fredonia Stockton Road
Fredonia, NY 14063

Project No.: 2223374
Date Issued: 11/9/2022

Owner:
Village of Fredonia

Architect / Engineer:
LaBella Associates, D.P.C.

300 State Street
Rochester, New York 14614

Date:	08/25/2022	
Time:	9:00 am	
Weather:	Clear	
Temp, °F	80, °F	
Present:	Jeff Wackowski, PE	LaBella
	Don Lucas	LaBella
	Tom Zazo	LaBella
	Chad Scorse	LaBella

FIELD OBSERVATIONS:

Dam

- Minor surface scour
- Sealant missing in control joints
- Minor delamination at joint to Spillway Deck
- Horizontal crack with efflorescence alone western half of toe
- Crack with spalling on upstream face of dam at water level
- Joint with toe widened with no sealant at eastern end of dam
- Heavier scouring with exposed large aggregate at eastern end of toe
- Delamination Sounded
    - At eastern end of toe-to-deck area
    - At western end of toe-to-deck area
    - Approximately 20 feet from west abutment wall, mid height of dam surface

Spillway Deck

- Minor cracks throughout deck
- Large aggregate exposed throughout deck
- Large 3/8-inch crack across deck north of stoplog portals
- Heavy deterioration, cracking, and spalling in deck along east abutment wall north of stoplog portals

West Abutment Wall

- Cracking with efflorescence east face of wall cap, south of dam
- Localized spalls and spiderweb cracking east face for wall, south of dam
- 3-inch bulge in east face of concrete wall cap above dam crest
- Joint between abutment wall and cap above dam crest
- Cracks with efflorescence, east face above dam crest
- Crack in east face of wall from dam crest to concrete cap
- Parge loss along joint between wall and concrete cap, east face, above dam toe
- Heavy vegetation over top of wall and along east face from dam toe to stoplog portal
- Cracking with efflorescence east face south of stoplog portal
- Saw-cuts from construction of stoplog portals extend beyond wall opening along wall base and deck – no sealant present
- Unused expansion anchors located in concrete opening at stoplog portal

East Abutment Wall

- Spalling, cracking, and efflorescence along cold joint between wall and concrete cap, both faces of wall, south end
- Hairline spiderweb cracking along top of wall at south end
- Cracks extending across top of wall cap, +/- 1/16-inches wide, +/- 12-inches apart
- Heavy cracking, spalling, efflorescence, and delamination along west face of wall above dam crest
- Spiderweb cracking with efflorescence along west face of concrete wall cap at south end of dam toe
- Spalling, concrete bulging, and parge loss at cold joint between west face of wall and concrete cap above dam toe
- +/- 1/32" wide crack with efflorescence, full height, from dam toe to cap
- +/- 3-32" wide crack with efflorescence, full height, between dam toe and stoplog portal
- Saw-cuts from construction of stoplog portals extend beyond wall opening along wall base and deck – no sealant present
- Heavy spalling at edge of stoplog portal, east face, both sides of opening
- 2 unused expansion anchors located on north side of portal opening

Respectfully submitted,
LABELLA ASSOCIATES, D.P.C.

Jeff Wackowski, PE
Structural Engineer

Name of Dam: Fredonia Reservoir Dam Inspectors Initials: TJZ Insp. date: 25-Aug-22

AREA INSPECTED	WESTERN EMBANKMENT			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
CREST	1	Surface Cracking	None Observed	X		
	2	Sinkhole, Animal Burrow	None Observed	X		
	3	Settlement/Low Area(s)	None Observed	X		
	4	Erosion Gullies	None Observed	X		
	5	Ruts and/or Puddles	None Observed	X		
	6	Wet Areas/Seepage	None Observed	X		
	7	Bare Areas	None Observed	X		
	8	Excessive Brush/Vegetation	None Observed	X		
	9	Trees	None Observed	X		
	10	Other	Top of concrete "core" wall is visible	X		
UPSTREAM SLOPE	11	Slide, Slough, Scarp	None Observed	X		
	12	Surface Cracking	None Observed	X		
	13	Emb.-Abut Contact	Good	X		
	14	Sinkhole, Animal Burrow	None Observed	X		
	15	Erosion Gullies	None Observed	X		
	16	Wet Areas/Seepage	None Observed	X		
	17	Bare Areas	None Observed	X		
	18	Excessive Brush/Vegetation	Brush is not excessive, vegetation in this area has been managed	X		
	19	Trees	None Observed	X		
	20	Other	Toe of slope consists of cobbles embedded in soil at the edge of the water	X		

DOWNSTREAM SLOPE	21	Slide, Slough, Scarp	None Observed	X		
	22	Surface Cracking	None Observed	X		
	23	Emb.-Abut Contact	Good	X		
	24	Sinkhole, Animal Burrow	None Observed	X		
	25	Erosion Gullies	None Observed	X		
	26	Wet Areas/Seepage	Minor Seepage observed at base/toe of the embankment		X	
	27	Bare Areas	None Observed	X		
	28	Excessive Brush/Vegetation	The brush/vegetation covering this area has grown up and is excessive			X
	29	Trees	There are many immature trees covering the face of this slope			X
	30	Other	A groundwater monitor well was observed at the base/toe of the embankment		X	

Additional Comments (Refer to Item No. if applicable)

26-The minor seepage at the toe was observed, however, much of the slope could not be completely observed due to existing overgrowth

28-Brush and deleterious vegetation will need to be removed from the downstream slope face

29-Trees will need to be removed from the downstream slope face; Root systems will also need to be removed to the maximum practical extent. The void which results from removing the root systems shall be backfilled with competent material as outlined in the dam's original design documents.

30-Groundwater monitor well need to be measured during our next site visit.

Name of Dam: Fredonia Reservoir Dam Inspectors Initials: TJZ Insp. date: 25-Aug-22

AREA INSPECTED	EASTERN EMBANKMENT			CHECK ACTION NEEDED		
	Item No.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
CREST	31	Surface Cracking	None Observed	X		
	32	Sinkhole, Animal Burrow	None Observed	X		
	33	Settlement/Low Area(s)	None Observed	X		
	34	Erosion Gullies	None Observed	X		
	35	Ruts and/or Puddles	None Observed	X		
	36	Wet Areas/Seepage	None Observed	X		
	37	Bare Areas	None Observed	X		
	38	Excessive Brush/Vegetation	None Observed	X		
	39	Trees	None Observed	X		
	40	Other	"Two-track" gravel drive is in-place on part of the crest; top of concrete "core" wall observed within a portion of the crest	X		
UPSTREAM SLOPE	41	Slide, Slough, Scarp	None Observed	X		
	42	Surface Cracking	None Observed	X		
	43	Emb.-Abut Contact	Good	X		
	44	Sinkhole, Animal Burrow	None Observed	X		
	45	Erosion Gullies	None Observed	X		
	46	Wet Areas/Seepage	None Observed	X		
	47	Bare Areas	Minor bare areas observed			X
	48	Excessive Brush/Vegetation	Brush is not excessive, vegetation in this area has been managed	X		
	49	Trees	None Observed	X		
	50	Other	Toe of slope consists of cobbles embedded in soil at the edge of the water	X		

DOWNSTREAM SLOPE	51	Slide, Slough, Scarp	None Observed	X		
	52	Surface Cracking	None Observed	X		
	53	Emb.-Abut Contact	Good	X		
	54	Sinkhole, Animal Burrow	None Observed	X		
	55	Erosion Gullies	None Observed	X		
	56	Wet Areas/Seepage	Minor Seepage observed at base/toe of the embankment		X	
	57	Bare Areas	None Observed	X		
	58	Excessive Brush/Vegetation	The brush/vegetation covering this area has grown up and is excessive			X
	59	Trees	There are some immature trees within this area			X
	60	Other	A groundwater monitor well was observed at the base/toe of the embankment		X	

Additional Comments (Refer to Item No. if applicable)

56-The minor seepage at the toe was observed, however, much of the slope could not be completely observed due to existing overgrowth

58-Brush and deleterious vegetation will need to be removed from the downstream slope face

59- Some trees near the crest have been cut down, they will need to be cleared and the stumps removed per the NYSDEC Guidance Manual. Root systems will also need to be removed to the maximum practical extent. The void which results from removing the root systems shall be backfilled with competent material as outlined in the dam's original design documents.

60-Groundwater monitor well need to be measured during our next site visit.

APPENDIX B

PHOTOGRAPHS

LaBella

Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment		
Location	Fredonia, New York	**Date**	23 Sept 2022
Client	Village of Fredonia	**Page**	1 of 14
		Project No.	2223374

LaBella Associates, DPC, has been retained to complete an update to the Fredonia Reservoir Engineering Assessment in accordance with New York State Compilation of Codes, Rules and Regulations Part 637.13.

I. INSPECTION PERSONNEL

Names, organizations, and roles of personnel present for the field safety inspection are included in Table 1.

Name	Organization	Role
Alison Wahl	Village of Fredonia	Reservoir Operator
Don Lucas	LaBella Associates	Project Manager
Chad Scorse	LaBella Associates	Assistant Project Manager
Tom Zaso	LaBella Associates	Sr. Geotechnical Engineer
Jeff Wackowski	LaBella Associates	Structural Engineer
Doug Hastings	LaBella Associates	Hydraulic Engineer

II. FIELD INSPECTION SUMMARY:

1. Inspection team walked the Eastern & Western embankment at crest and toe to observe existing conditions.
2. Water related vaults and structures within/adjacent to reservoirs were also observed
3. Findings/observations were documented in inspection forms and photographs. A selection of representative photos is included in Section III.

III. PHOTOS:

Photo 1 – General aerial view of reservoir/spillway

Photo 2 – Aerial view of spillway

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment		
Location	Fredonia, New York	**Date**	23 Sept 2022
Client	Village of Fredonia	**Page**	2 of 14
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Photo 3 – Spillway looking North

Photo 4 – Eastern embankment

Photo 5 – Eastern embankment and intake

Photo 6 – Western embankment

Photo 7 – View of intake structure

Photo 8 – View of spillway

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment	**Date**	23 Sept 2022
Location	Fredonia, New York	**Page**	3 of 14
Client	Village of Fredonia	**Project No.**	2223374

Photo 9 – Aerial view of eastern spillway wall

Photo 10 – Aerial view of eastern spillway wall and steps

Photo 11 – Aerial view of western spillway wall

Photo 12 – Aerial view of western spillway wall and steps

Photo 13 – View of eastern spillway lower wall

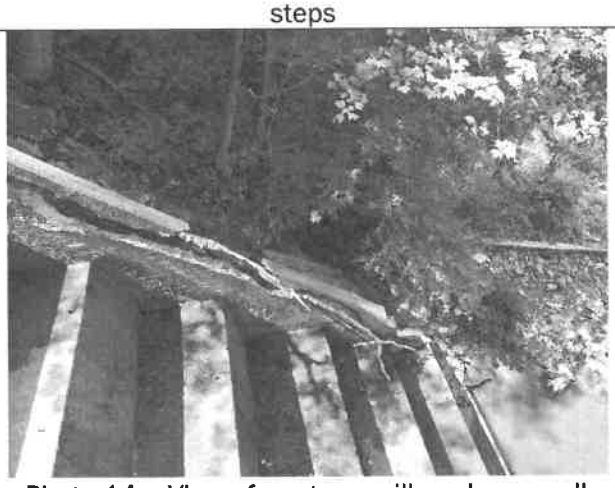

Photo 14 – View of western spillway lower wall

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment	**Date**	23 Sept 2022
Location	Fredonia, New York	**Page**	4 of 14
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Photo 15 – View of spillway steps

Photo 16 – View of spillway steps

Photo 17 – Full view of spillway steps

Photo 18 – Aerial view of the lower spillway steps

Photo 19 – Crest of the spillway

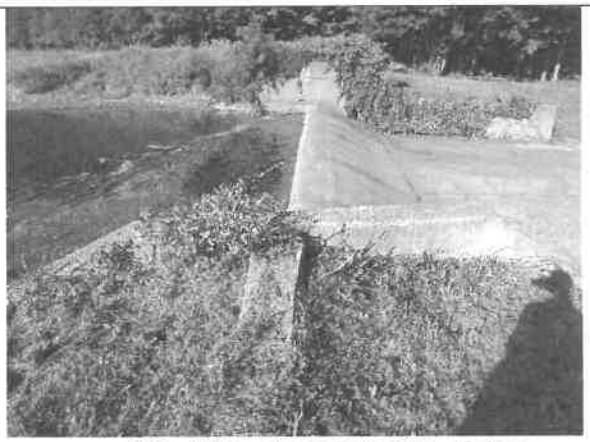

Photo 20 – View of eastern side of dam

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment	**Date**	23 Sept 2022
Location	Fredonia, New York	**Page**	5 of 14
Client	Village of Fredonia	**Project No.**	2223374

Photo 21 – View of spillway looking west

Photo 22 – View of spillway with overgrowth

Photo 23 – Inside the eastern dam wall

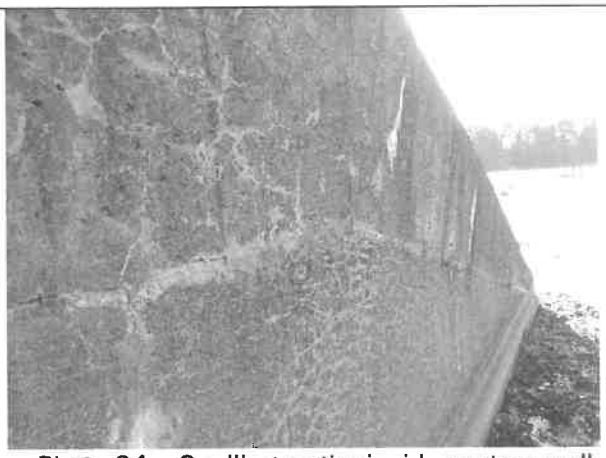

Photo 24 – Spalling on the inside eastern wall

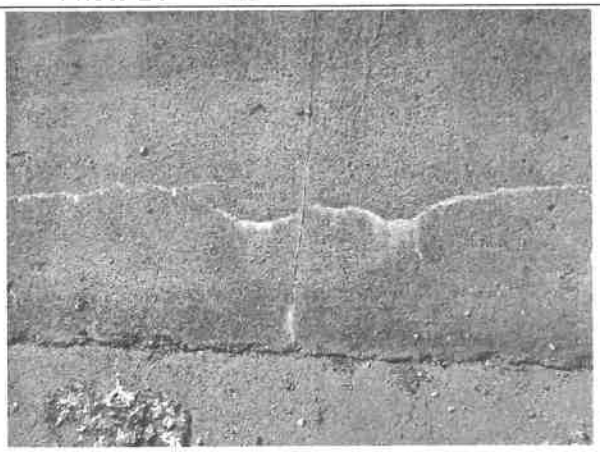

Photo 25 – Eastern Wall, sealant missing in control joints

Photo 26 – Upstream face of dam, crack with spalling

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment	**Date**	23 Sept 2022
Location	Fredonia, New York	**Page**	6 of 14
Client	Village of Fredonia	**Project No.**	2223374

Photo 27 – Close view of concrete spalling on eastern wall

Photo 28 – Crack on eastern dam wall

Photo 29– Western dam wall overgrowth

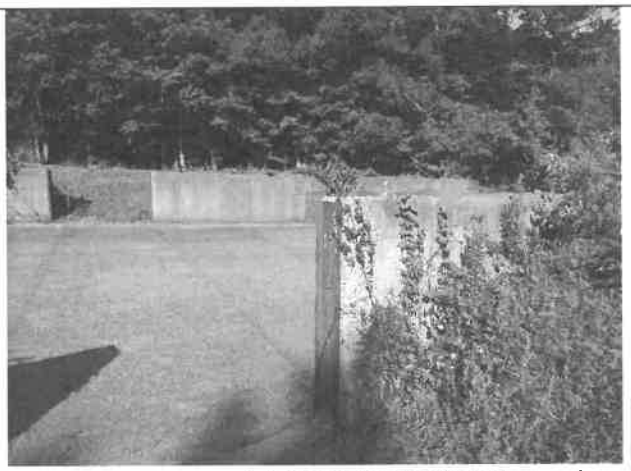

Photo 30 – View of eastern stop log channel

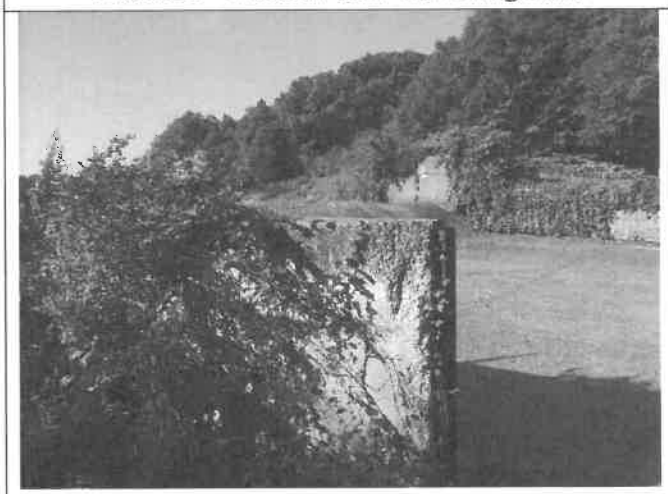

Photo 31 – View of concrete spalling on eastern stop log channel

Photo 32 – View of inside western spillway wall

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment		
Location	Fredonia, New York	**Date**	23 Sept 2022
Client	Village of Fredonia	**Page**	7 of 14
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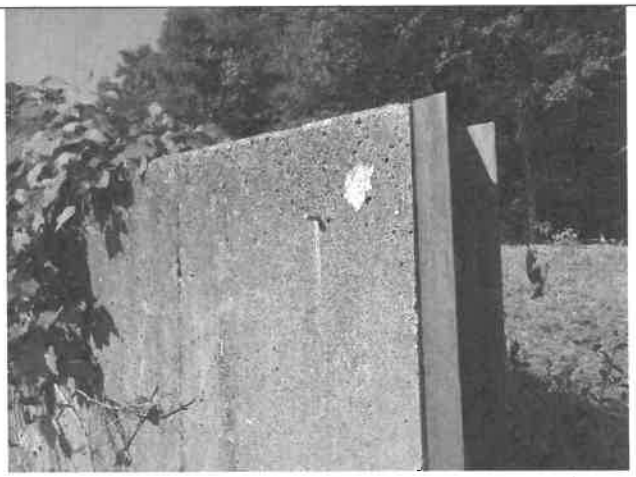

Photo 33 – View of western stop log channel. Good condition.

Photo 34 – View of western stop log channel. Good condition.

Photo 35 – Outside view of stop log channel. Good condition

Photo 36 – Base of stop log channel

Photo 37 – View of inside the east spillway wall. Spalling visible

Photo 38 – View of inside east spillway wall. Cracking and spalling visible

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment		
Location	Fredonia, New York	**Date**	23 Sept 2022
Client	Village of Fredonia	**Page**	8 of 14
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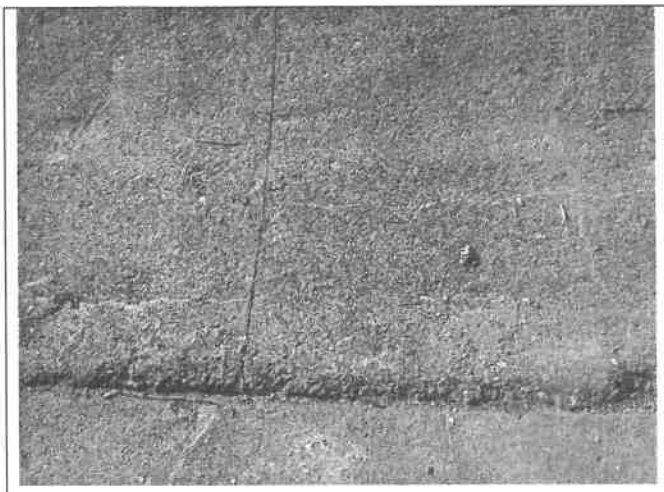

Photo 39 – Spillway, heavy scouring, exposed large aggregate

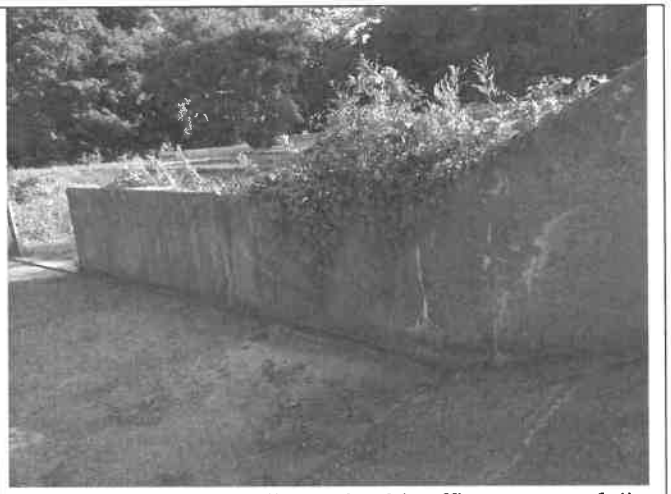

Photo 40 – East wall, crack with efflorescence full height

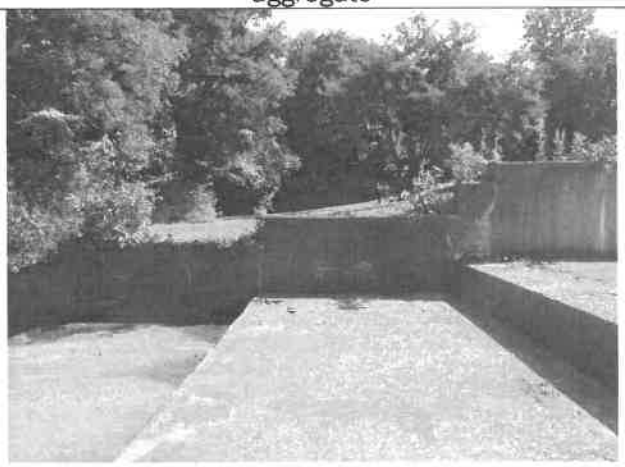

Photo 41 – View of east spillway wall

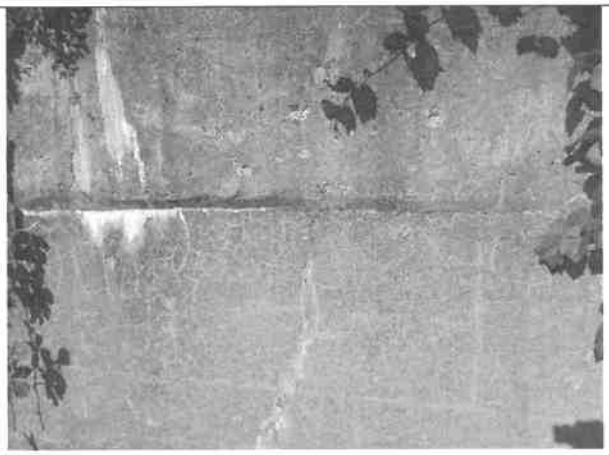

Photo 42 – View of spalling on western spillway wall

Photo 43 – View of west spillway wall. Overgrowth and spalling visible

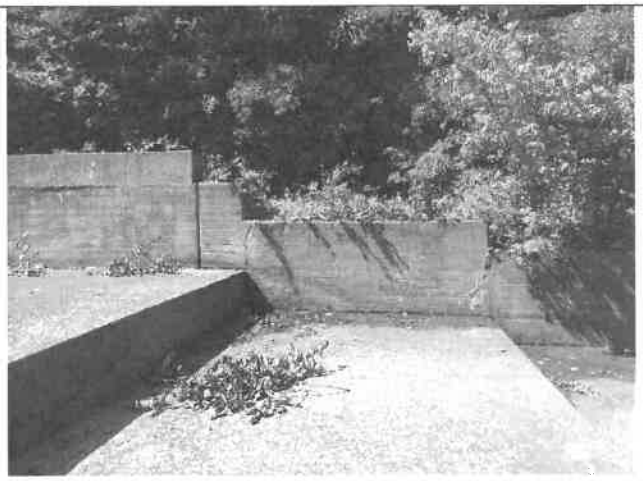

Photo 44 – West spillway wall concrete joint

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Field Assessment Photo Log

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Photo 45 – Western spillway wall crack

Photo 46 – View of eastern spillway wall joint. Visible deterioration

Photo 47 – View of eastern spillway wall spalling and overgrowth

Photo 48 – View of deteriorated concrete western wall

Photo 49 – Slight cracking at the base of the eastern spillway wall

Photo 50 – Cracking and spalling of spillway step and eastern wall

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment	**Date**	23 Sept 2022
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Photo 51 – Cracking of step on eastern wall

Photo 52 – Cracking of step on eastern wall

Photo 53 – Spillway surface cracks

Photo 54 – View of cracks on steps near west wall

Photo 55 – Crack at base of the east wall

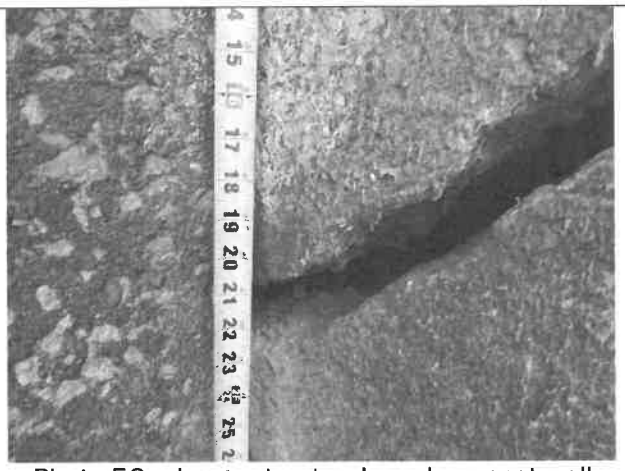

Photo 56 – Large structural crack on east wall

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment		
Location	Fredonia, New York	**Date**	23 Sept 2022
Client	Village of Fredonia	**Page**	11 of 14
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Photo 57 – Concrete separation/settling

Photo 58 – Spalling on east wall looking downstream

Photo 59 – View of severe cracking on eastern wall looking upstream

Photo 60 – View of cracked and spalled eastern spillway wall

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment		
Location	Fredonia, New York	**Date**	23 Sept 2022
Client	Village of Fredonia	**Page**	12 of 14
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Photo 61 – Outside eastern spillway wall. Showing exposed rebar.

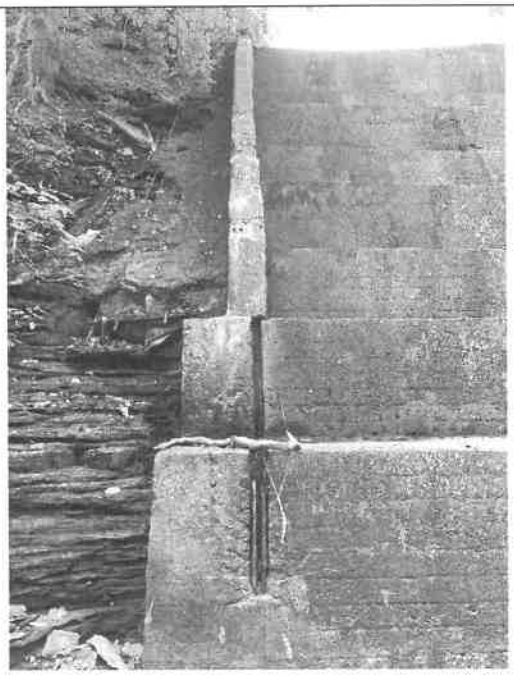

Photo 62 – View of east spillway wall. Visible cracking. Wall pulling away from steps

Photo 63 – View of western spillway wall. Extreme breakdown of wall exposing rebar

Photo 64 – Western wall with fallen tree

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment	**Date**	23 Sept 2022
Location	Fredonia, New York	**Page**	13 of 14
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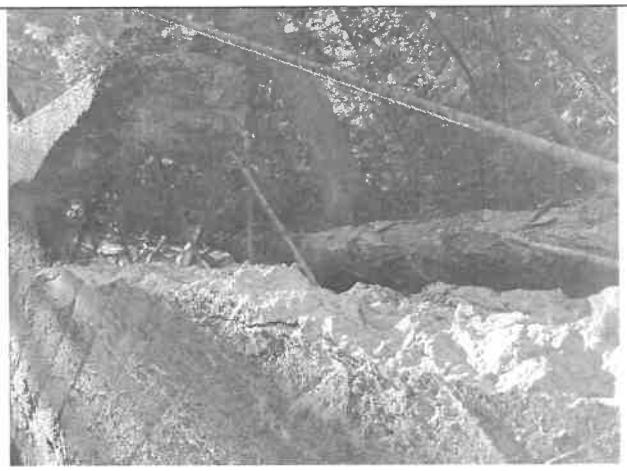

Photo 65 – View of exposed rebar on western wall

Photo 66 – View of outside western wall

Photo 67 – View of outside the western wall

Photo 68 – Bottom steps of the spillway. Good condition

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Field Assessment Photo Log

Project	Fredonia Reservoir Dam Engineering Assessment		
Location	Fredonia, New York	**Date**	23 Sept 2022
Client	Village of Fredonia	**Page**	14 of 14
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Photo 69 – Full bottom view of spillway steps

Photo 70 – Full bottom view of spillway steps

IV. WEATHER:
Sunny, 60's - 70's °F

ATTACHMENTS:
None

APPENDIX C

STRUCTURAL CALCULATIONS

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PROJECT: Fredonia Reservoir
PROJECT NO: 2223374
SUBJECT: Spillway Overturning

SHEET: 1 OF 12
DATE: 11/8/2022
BY: JTW

Spillway Geometric Properties

Crest Elevation	CE =	1037.0	ft	
Base Elevation	BE =	1028.0	ft	
Tail Slab Thickness	st =	0.6667	ft	
Spillway Width	L =	75	ft	
Spillway Total Depth	H =	9.0	ft	
Spillway Toe Depth	Htoe =	4.0	ft	
Spillway Toe Length	Ltoe =	2.0	ft	
Spillway Crest Length	Lcrest =	3.5	ft	
Spillway Slope Length	Lslope =	8.75	ft	
Length Upstream Sheet Pile	LshUp =	3.5	ft	
Length Downstream Sheet Pile	LshDn =	12.25	ft	
Sheet Pile Location	Lsp =	10.75	ft	
Sheet Pile Efficiency	esp =	0		1 = no cutoff : 0 = full cutoff

Soil & Water Conditions

Soil Depth	dsoil =	4.0	ft	
Silt Depth	dsilt =	2.0	ft	
Water Density	yw =	62.4	pcf	
Concrete Density	yc =	150	pcf	
Saturated Soil Density	ysoil =	120	pcf	
Saturated Silt Density	ysiltv =	120	pcf	
Saturated Silt Density	ysilth =	85	pcf	
Soil Angle of Internal Friction	ϕs =	30	deg	
Soil / Concrete Friction Angle	ϕf =	25	deg	
Allowable Soil Bearing Pressure	qallow =	6000	psf	
Cohesion Soil / Concrete	csc =	0	psi	

Foundation Calculations

Active Lateral Soil Pressure Coeff.	ka =	0.3333	=(1-SIN(RADIANS(φs)))/(1+SIN(RADIANS(φs)))
Passive Lateral Soil Pressure Coeff.	kp =	1.5	=0.5*(1+SIN(RADIANS(φs)))/(1-SIN(RADIANS(φs)))
At-Rest Lateral Soil Pressure Coeff.	ko =	0.5	=1-SIN(RADIANS(φs))

Spillway Geometry Calculations

Crest Area	Ac =	17.5	sq.ft	=(H-Htoe)*Lcrest
Slope Area	As =	21.875	sq.ft	=0.5*Lslope*(H-Htoe)
Base Area	Ab =	57.0	sq.ft	=Htoe*(Ltoe+Lcrest+Lslope)
Crest Area COGx	COGc =	12.5	ft	=Ltoe+Lslope+0.5*Lcrest
Slope Area COGx	COGs =	7.8333	ft	=Ltoe+(2/3)*Lslope
Base Area COGx	COGb =	7.125	ft	=(Ltoe+Lslope+Lcrest)/2
Total Dam Area	Adam =	96.38	sq.ft	=Ac+As+Ab
Total Spillway Weight	Wdam =	14456.25	lbs/ft	=Adam*yc

Force Locations

Spillway COGx	COGx =	8.262	ft	=((Ac/Adam)*COGc)+((As/Adam)*COGs)+((Ab/Adam)*COGb)
Spillway COGy	COGy =	4.315	ft	=((Ac/Adam)*(Htoe+H/2))+((As/Adam)*(Htoe+H/3))+((Ab/Adam)*Htoe/2)
Water Surcharge Height	Hwsh =	5	ft	=(CE-(BE+dsoil))
Water Surcharge Moment Arm	Wsa =	6.5	ft	=(CE-BE)-Hwsh/2
Slab Surcharge Ht to Moment Arm	Hrtw =	1.667	ft	=(Htoe-st)/2
Water Over Crest COG from Toe	COGwc =	12.5	ft	=Ltoe+Lslope+0.5*Lcrest
Water Over Slope COG from Toe	COGws =	6.375	ft	=Ltoe+Lslope*0.5
Water Over Toe COG from Toe	COGwt =	1	ft	=Ltoe/2

Soil Lateral Driving Forces

Soil Lateral Force	Fsoil =	153.6	plf	=0.5*(ysoil-yw)*ka*dsoil^2
Soil Height to Moment Arm	Hsoil =	1.3333	ft	=dsoil/3
Soil Overturning Moment	Msoil =	0.205	kip_ft/ft	=(Fsoil*Hsoil)/1000
Silt Lateral Force	Fsilt =	170.0	plf	=0.5*(ysilth)*dsilt^2
Silt Height to Moment Arm	Hsilt =	4.6667	ft	=(dsilt/3)+dsoil
Silt Overturning Moment	Msilt =	0.793	kip_ft/ft	=(Fsilt*Hsilt)/1000
Silt Surcharge Lateral Force	Fss =	320.0	plf	=ysiltv*dsilt*ka*dsoil
Silt Surcharge Ht to Moment Arm	Hss =	2.0	ft	=dsoil/2
Silt Surcharge Overturning Moment	Mss =	0.640	kip_ft/ft	=(Fss*Hss)/1000

Soil Lateral Restoring Forces

Toe Soil Lateral Force	Frsoil =	-479.990	plf	=-0.5*(ysoil-yw)*kp*(Htoe-st)^2
Toe Soil Height to Moment Arm	Hrsoil =	1.111	ft	=(Htoe-st)/3
Toe Soil Restoring Moment	Mrsoil =	-0.533	kip_ft/ft	=Frsoil*Hrsoil/1000
Tail Slab Surcharge	Frss =	-250.010	plf	=-0.5*st*yc*kp*(Htoe-st)
Slab Surcharge Ht to Moment Arm	Hrss =	1.667	ft	=(Htoe-st)/2
Tail Slab Restoring Moment	Mrss =	-0.417	kip_ft/ft	=Frss*Hrss/1000

Permanent Vertical Forces

Base Length	Lbase =	14.25	ft	=Ltoe+Lslope+Lcrest
Base Center of Rotation	COR =	7.125	ft	=Lbase/2
Spillway Self Weight	Wdam =	14456	lbs/ft	=Wdam
Spillway COG from Toe	COGd =	8.2618	ft	=COGx
Moment at COR: Self Weight	Mdam =	-16.434	kip_ft/ft	=Wdam*(COR-COGx)/1000

Net Overturning About Toe

Moments about Toe:

Dam Self Weight	Mdamt =	-119.434	k_ft/ft	=-(Wdam*COGx)/1000

Normal Pond Condition

Water Elevation	Wnp =	1037.0	ft	
Tailwater Elevation	Wtnp =	1031.3	ft	

Lateral Overturning Forces

Water Lateral Force	Fwnp =	2527.2	plf	=0.5*yw*(MIN(Wnp,CE)-BE)^2
Water Height to Moment Arm	Hwnp =	3.000	ft	=((MIN(Wnp,CE)-BE)/3)
Water Surcharge	Fwwnp =	0.000	plf	=MAX((Wnp-CE)*yw,0)*Hwsh
Water Overturning Moment	Mwnp =	7.582	kip_ft/ft	=(Fwnp*Hwnp+Fwwnp*Wsa)/1000

Lateral Restoring Forces

Tail Water Lateral Force	Frtwnp =	-339.768	plf	=-0.5*yw*MIN(MAX(Wtnp-BE,0),Htoe)^2
Tail Water Lateral Moment Arm	Twmanp =	1.100	ft	=MIN(MAX(Wtnp-BE,0),Htoe)/3
Tail Water Surcharge	TWsnp =	0.000	plf	=-Htoe*yw*MAX(0,(Wtnp-(BE+Htoe)))
Tail Water Restoring Moment	Mrtwnp =	-0.374	kip_ft/ft	=((Frtwnp*Twmanp)+(TWsnp*(Htoe/2)))/1000

Vertical Forces

Water Weight Over Crest	Wvcnp =	0	lbs/ft	=MAX(Wnp-CE,0)*yw*Lcrest
Moment at COR: Water Over Crest	Mwvcnp =	0.000	kip_ft/ft	=Wvcnp*(COR-COGwc)/1000
Water Weight Over Slope	Wvsnp =	0	lbs/ft	=IF(Wnp>CE,MAX(((Wnp-Wtnp)/2),0)*yw*Lslope,0)
Moment at COR: Water Over Slope	Mwvsnp =	0.000	kip_ft/ft	=Wvsnp*(COR-COGws)/1000
Water Weight Over Tail	Wvtnp =	0	lbs/ft	=IF(Wnp>CE,MAX(Wnp-CE,0)*yw*Lcrest,0)
Moment at COR: Water Over Tail	Mwvtnp =	0.00	kip_ft/ft	=Wvtnp*(COR-COGwt)/1000

Uplift Forces

Difference in Water Surface Elev.	DWnp =	5.70	ft	=(1-esp)*(Wnp-Wtnp)
Presumed Uplift Slope	Usnp =	0.400	ft/ft	=DWnp/Lbase
Uplift Upstream of Sheetpile	Uunp =	1965.60	lbs/ft	=yw*(Wnp-BE)*(Lbase-Lsp)
Upstream Uplift Location	Xuunp =	12.500	ft	=Lbase-(Lbase-Lsp)/2
Moment at COR: Uplift Upstream	Muunp =	10.565	kip_ft/ft	=Uunp*(Xuunp-COR)/1000
Uplift Downstream of Sheetpile	Utnp =	4125.42	lbs	=0.5*yw*((1-esp)*(Wnp-BE)+(Wtnp-BE))*Lsp
Downstream Uplift Location	Xudnp =	6.205	ft	=2*Lsp*(0.5*(Wtnp-BE)+(1-esp)*(Wnp-BE))/(3*((Wtnp-BE)+(1-esp)*(Wnp-BE)))
Moment at COR: Uplift Downstream	Mudnp =	-3.794	kip_ft/ft	=Utnp*(Xudnp-COR)/1000

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PROJECT: Fredonia Reservoir
PROJECT NO: 2223374
SUBJECT: Spillway Overturning

SHEET: 4 OF 12
DATE: 11/8/2022
BY: JTW

Normal Pond Stability

High Water Moment	Mnp =	-1.767	kip_ft/ft	=(Mwnp+Msoil+Msilt+Mss+Mrsoil+Mrss+Mrtwnp+Mdam+Mwvcnp+Mwvsnp+Mwvtnp+Muunp+Mudnp)
High Water Vertical Force	Pnp =	8.365	klf	=(Wdam+Wvcnp+Wvsnp+Wvtnp-Uunp-Utnp)/1000
High Water Sliding Force	Vnp =	2.101	klf	=(Fwnp+Fwwnp+Fsoil+Fsilt+Fss+Frsoil+Frss+Frtwnp)/1000

Forces and Resistance

High Water Overturning Moment	Munp =	-132.504	kip_ft	=Mnp*L
Total Vertical Force	Punp =	627.392	kips	=Pnp*L
Total Sliding Force	Vunp =	157.577	kips	=Vnp*L

Sliding Check

Sliding Resitance	SRnp =	292.56	kips	=Punp*TAN(RADIANS(φf))
Sliding Factor of Safety	FOSsnp =	1.86		=SRnp/Vunp
				Pass: FOS > 1.25

Overturning & Cracking Check

Allowable Resultant Location for Cracking and Stability is in the Middle 1/3 : +/- 1/6 from the COR

Resultant Location	e_allow =	2.38	ft	=Lbase/6
Resultant Relative to COR	eRnp =	-0.211	ft	=Munp/Punp
				Pass: Resultant < allowable

Floatation Check

Flotation	FOSfnp =	2.373		=Wdam/(Uunp+Utnp+Wvcnp+Wvsnp+Wvtnp)
				OK: FOS > 1.3

Soil Pressure

Overturning Soil Bearing Pressure	qnp =	0.76	ksf	=(2*Punp)/(3*L*((Lbase/2)-eRnp))
				OK: q < qallow

Net Overturning About Toe

Moments about Toe:

Water Over Crest	Mtwcnp =	0.000	k_ft/ft	=-(Wvcnp*COGwc)/1000
Water Over Slope	Mtwsnp =	0.000	k_ft/ft	=-(Wvsnp*COGws)/1000
Water Over Toe	Mtwtnp =	0.000	k_ft/ft	=-(Wvtnp*COGwt)/1000
Upstream Uplift	Mtuunp =	24.570	k_ft/ft	=(Uunp*Xuunp)/1000
Downstream Uplift	Mtdunp =	25.599	k_ft/ft	=(Utnp*Xudnp)/1000
High Water Total Moment about Toe	MtNP =	0.00	k_ft/ft	=MAX(Mdamt+Mwnp+Msoil+Msilt+Mss+Mrsoil+Mrss+Mrtwnp+Mtwcnp+Mtwsnp+Mtwtnp+Mtuunp+Mtdun

Ice Condition

Ice Lateral Load	Fi =	5000	plf	12" Layer of Ice at Crest: 5000 plf per USACE
Ice Height to Moment Arm	Hi =	8.5	ft	=CE-0.5-BE
Ice Overturning Moment	Mi =	42.500	kip_ft/ft	=Fi*Hi/1000
Water Elevation with Ice	Wi =	1037.0	ft	
Tailwater Elevation	Wti =	1031.3	ft	
Water Lateral Force	Fwi =	2527.2	plf	=0.5*yw*(MIN(Wi,CE)-BE)^2
Water Height to Moment Arm	Hwi =	3.000	ft	=((MIN(Wi,CE)-BE)/3)
Water Surcharge Lateral Force	Fwsi =	0.0	plf	=MAX((Wi-CE)*yw,0)*Hwsh
Water Overturning Moment	Mwi =	7.582	kip_ft/ft	=(Fwi*Hwi+Fwsi*Wsa)/1000

Uplift Forces - Ice Condition

Difference in Water Surface Elev.	DWi =	5.70	ft	=(1-esp)*(Wi-Wti)
Presumed Uplift Slope	Usi =	0.400	ft/ft	=DWi/Lbase
Uplift Upstream of Sheetpile	Uui =	1965.60	plf	=yw*(Wi-BE)*(Lbase-Lsp)
Upstream Uplift Location	Xuui =	12.500	ft	=Lbase-(Lbase-Lsp)/2
Moment at COR: Uplift Upstream	Muui =	10.565	kip_ft/ft	=Uui*(Xuui-COR)/1000
Uplift Downstream of Sheetpile	Udi =	4125.42	plf	=0.5*yw*((1-esp)*(Wi-BE)+(Wti-BE))*Lsp
Downstream Uplift Location	Xudi =	6.205	ft	=2*Lsp*(0.5*(Wti-BE)+(1-esp)*(Wi-BE))/(3*((Wti-BE)+(1-esp)*(Wi-BE)))
Moment at COR: Uplift Downstream	Mudi =	-3.794	kip_ft/ft	=Udi*(Xudi-COR)/1000

Ice Condition Stability

Ice Condition Moment	*Mti* =	41.107031	*kip_ft/ft*	*=(Mi+Mwi+Msoil+Msilt+Mss+Mrsoil+Mrss+Mdam+Muui+Mudi)*
Ice Condition Vertical Force	*Pti* =	8.36523	*klf*	*=(Wdam-Uui-Udi)/1000*
Ice Condition Sliding Force	*Vti* =	7.1010316	*klf*	*=(Fi+Fwi+Fwsi+Fsoil+Fsilt+Fss+Frsoil+Frss+Frtwnp)/1000*

Forces and Resistance

Ice Total Overturning Moment	*Mui* =	3083.0273	*kip_ft*	*=Mti*L*
Total Vertical Force	*Pui* =	627.39225	*kip_ft*	*=Pti*L*
Total Sliding Force	*Vui* =	532.57737	*kip_ft*	*=Vti*L*

Sliding Check

Sliding Resitance	*SRi* =	292.56	*kips*	*=Pui*TAN(RADIANS(φf))*
Sliding Factor of Safety	*FOSsi*=	0.55		*=SRi/Vui*
				Fail: FOS < 1.25

Overturning & Cracking Check

Allowable Resultant Location for Cracking and Stability is in the Middle 1/3 : +/- 1/6 from the COR

Resultant Location	*e_allow* =	2.375	*ft*	*=Lbase/6*
Resultant Relative to COR	*eRi* =	4.914	*ft*	*=Mui/Pui*
				Fail: Resultant > allowable

Floatation Check

Flotation	*FOSfi* =	2.373		*=Wdam/(Uui+Udi)*
				OK: FOS > 1.3

Soil Pressure

Overturning Soil Bearing Pressure	*qi* =	2.52	*ksf*	*=(2*Pui)/(3*L*((Lbase/2)-eRi))*
				OK: q < qallow

Net Overturning About Toe

Moments about Toe:

Ice Upstream Uplift	*Mtiuu* =	24.570	*k_ft/ft*	*=(Uui*Xuui)/1000*
Ice Downstream Uplift	*Mtidu* =	25.599	*k_ft/ft*	*=(Udi*Xudi)/1000*
Ice Cond. Total Moment about Toe	*MtIce* =	0.00	*k_ft/ft*	*=MAX(Mdamt+Mi+Mwi+Msoil+Msilt+Mss+Mrsoil+Mrss+Mrtwnp+Mtwcnp+Mtwsnp+Mtwtnp+Mtiuu+Mtidu,*

SDF 50% of PMF

Water Elevation	*Wsdf =*	1046.5	*ft*	
Tailwater Elevation	*Wtsdf =*	1038.5	*ft*	
Lateral Overturning Forces				
Water Lateral Force	*Fwsdf =*	2527.2	*plf*	*=0.5*yw*(MIN(Wsdf,CE)-BE)^2*
Water Height to Moment Arm	*Hwsdf =*	3.00	*ft*	*=((MIN(Wsdf,CE)-BE)/3)*
Water Surcharge	*Fwwsdf =*	2964	*plf*	*=MAX((Wsdf-CE)*yw,0)*Hwsh*
Water Overturning Moment	*Mwsdf =*	26.848	*kip_ft/ft*	*=(Fwsdf*Hwsdf+Fwwsdf*Wsa)/1000*
Lateral Restoring Forces				
Tail Water Lateral Force	*Frtwsdf =*	-499.200	*plf*	*=-0.5*yw*MIN(MAX(Wtsdf-BE,0),Htoe)^2*
Tail Water Moment Arm	*TWmasdf =*	1.333	*ft*	*=MIN(MAX(Wtsdf-BE,0),Htoe)/3*
Tail Water Surcharge	*TWssdf =*	-1622.400	*plf*	*=-Htoe*yw*MAX(0,Wtsdf-(BE+Htoe))*
Tail Water Restoring Moment	*Mrtwsdf =*	-3.910	*kip_ft/ft*	*=(Frtwsdf*TWmasdf+TWssdf*(Htoe/2))/1000*
Vertical Forces				
Water Weight Over Crest	*Wvcsdf =*	2074.8	*lbs/ft*	*=MAX(Wsdf-CE,0)*yw*Lcrest*
Moment at COR: Water Over Crest	*Mwvcsdf =*	-11.152	*kip_ft/ft*	*=Wvcsdf*(COR-COGwc)/1000*
Water Weight Over Slope	*Wvssdf =*	2184	*lbs/ft*	*=IF(Wsdf>CE,MAX(((Wsdf-Wtsdf)/2),0)*yw*Lslope,0)*
Moment at COR: Water Over Slope	*Mwvssdf =*	1.638	*kip_ft/ft*	*=Wvssdf*(COR-COGws)/1000*
Water Weight Over Tail	*Wvtsdf =*	2074.8	*lbs/ft*	*=IF(Wsdf>CE,MAX(Wsdf-CE,0)*yw*Lcrest,0)*
Moment at COR: Water Over Tail	*Mwvtsdf =*	12.71	*kip_ft/ft*	*=Wvtsdf*(COR-COGwt)/1000*
Uplift Forces				
Difference in Water Surface Elev.	*DWsdf =*	8.00	*ft*	*=(1-esp)*(Wsdf-Wtsdf)*
Presumed Uplift Slope	*Ussdf =*	0.561	*ft/ft*	*=DWsdf/Lbase*
Uplift Upstream of Sheetpile	*Uusdf =*	4040.40	*lbs/ft*	*=yw*(Wsdf-BE)*(Lbase-Lsp)*
Upstream Uplift Location	*Xuusdf =*	12.500	*ft*	*=Lbase-(Lbase-Lsp)/2*
Moment at COR: Uplift Upstream	*Muusdf =*	21.717	*kip_ft/ft*	*=Uusdf*(Xuusdf-COR)/1000*
Uplift Downstream of Sheetpile	*Udsdf =*	9726.60	*lbs/ft*	*=0.5*yw*((1-esp)*(Wsdf-BE)+(Wtsdf-BE))*Lsp*
Downstream Uplift Location	*Xudsdf =*	5.869	*ft*	*=2*Lsp*(0.5*(Wtsdf-BE)+(1-esp)*(Wsdf-BE))/(3*((Wtsdf-BE)+(1-esp)*(Wsdf-BE)))*
Moment at COR: Uplift Downstream	*Mudsdf =*	-12.214	*kip_ft/ft*	*=Udsdf*(Xudsdf-COR)/1000*

SDF 50% PMF Stability

High Water Moment	*Msdf* =	19.889	*kip_ft/ft*	*=(Mwsdf+Msoil+Msilt+Mss+Mrsoil+Mrss+Mrtwsdf+Mdam+Mwvcsdf+Mwvssdf+Mwvtsdf+Muusdf+Mudsdf)*
High Water Vertical Force	*Psdf* =	7.023	*klf*	*=(Wdam+Wvcsdf+Wvssdf+Wvtsdf-Uusdf-Udsdf)/1000*
High Water Sliding Force	*Vsdf* =	4.906	*klf*	*=(Fwsdf+Fwwsdf+Fsoil+Fsilt+Fss+Frsoil+Frss+Frtwsdf)/1000*

Forces and Resistance

High Water Overturning Moment	*Musdf* =	1491.663	*kip_ft*	*=Msdf*L*
Total Vertical Force	*Pusdf* =	526.714	*kips*	*=Psdf*L*
Total Sliding Force	*Vusdf* =	367.91997	*kips*	*=Vsdf*L*

Sliding Check

Sliding Resitance	*SRsdf* =	245.61	*kips*	*=Pusdf*TAN(RADIANS(φf))*
Sliding Factor of Safety	*FOSssdf* =	0.67		*=SRsdf/Vusdf*
				Fail: FOS < 1.25

Overturning & Cracking Check

Allowable Resultant Location for Cracking and Stability is in the Middle 1/3 : +/- 1/6 from the COR

Resultant Location	*e_allow* =	2.38	*ft*	*=Lbase/6*
Resultant Relative to COR	*eRsdf* =	2.832	*ft*	*=Musdf/Pusdf*
				Fail: Resultant > allowable

Floatation Check

Flotation	*FOSfsdf* =	0.719		*=Wdam/(Uusdf+Udsdf+Wvcsdf+Wvssdf+Wvtsdf)*
				FAIL: FOS < 1.3

Soil Pressure

Overturning Soil Bearing Pressure	*qsdf* =	1.09	*ksf*	*=(2*Pusdf)/(3*L*((Lbase/2)-eRsdf))*
				OK: q < qallow

Net Overturning About Toe

Moments about Toe:

Water Over Crest	*Mtwcsdf* =	-25.935	*k_ft/ft*	*=-(Wvcsdf*COGwc)/1000*
Water Over Slope	*Mtwssdf* =	-13.923	*k_ft/ft*	*=-(Wvssdf*COGws)/1000*
Water Over Toe	*Mtwtsdf* =	-2.075	*k_ft/ft*	*=-(Wvtsdf*COGwt)/1000*
Upstream Uplift	*Mtuusdf* =	50.505	*k_ft/ft*	*=(Uusdf*Xuusdf)/1000*
Downstream Uplift	*Mtdusdf* =	57.088	*k_ft/ft*	*=(Udsdf*Xudsdf)/1000*
High Water Total Moment about Toe	*MtSDF* =	0.00	*k_ft/ft*	*=MAX(Mdamt+Mwsdf+Msoil+Msilt+Mss+Mrsoil+Mrss+Mrtwsdf+Mtwcsdf+Mtwssdf+Mtwtsdf+Mtuusdf+Mt*

Normal Pool & Seismic

Water Elevation	We =	1037.0	ft	
Tailwater Elevation	Wte =	1031.3	ft	

Lateral Overturning Forces

Water Lateral Force	Fwe =	2527.2	plf	=0.5*yw*(MIN(We,CE)-BE)^2
Water Height to Moment Arm	Hwe =	3.00	ft	=((MIN(We,CE)-BE)/3)
Water Surcharge	Fwwe =	0	plf	=MAX((We-CE)*yw,0)*Hwsh
Water Overturning Moment	Mwe =	7.582	kip_ft/ft	=(Fwe*Hwe+Fwwe*Wsa)/1000

Seismic Overturning Forces

Soil Site Classification		D		Assumed - Default
Seismic Importance Factor	Ie =	1.5		Risk Category IV - Public Utility Facility
Design Spectral Coeff at .2 s	S_ds =	0.11		ASCE/SEI 7-22
Design Spectral Coeff at 1 s	S_d1 =	0.051		ASCE/SEI 7-22
Seismic Design Category		A		
Peak Ground Acceleration	PGA =	0.0696	g	Geotechnical Assessment
MCEr Acceleration	MCEr =	0.20	g	ASCE/SEI 7-22
Response Modification Factor	Re =	1.25		ASCE 7-16 Table 15.4-2
Seismic Base Shear	V =	4336.88	lbs/ft	=MCEr*Wdam*Ie
Dam Weight Seismic Base Moment	Mde =	18.71	k_ft/ft	=(V*COGy)/1000

US Army Corps of Engineers - Stability Analysis of Concrete Structures

Soil Horizontal Seismic Coeff.	khe =	0.15		=(ysoil/(ysoil-yw))*PGA
Dynamic Soil Seismic	Dkae =	0.11		=0.75*khe
Dynamic Active Earth Pressure Coeff.	Kae =	0.44		=ka+Dkae
Dynamic Active Earth Pressure	DPae =	1036.91	plf	=Dkae+0.5*(ysoil-yw)*(dsilt+dsoil)^2
Seismic Active Earth Pressure	Pa =	153.60	plf	=Fsoil
Soil Resultant Height	hs =	2.00	ft	=(dsilt+dsoil)/3
Soil Seismic Resultant Height	hdse =	3.60	ft	=0.6*(dsoil+dsilt)
Total Resultant Height	hse =	3.39	ft	=(Pa*hs+DPae*hdse)/(DPae+Pa)
Total Soil Seismic Pressure	Pae =	1190.51	plf	=DPae+Pa
Soil Seismic Base Moment	Mse =	1.19	k_ft/ft	=(Pae+hse)/1000
Water Height	Hw =	9.00	ft	=We-BE
Hydrodynamic Force	Pwd =	205.21	plf	= (7/12)*PGA*yw*Hw^2
Seismic Hydrodynamic Resultant	hws =	3.60	ft	=0.4*Hw
Water Seismic Base Moment	Mwes =	0.74	k_ft/ft	=(Pwd*hws)/1000

Lateral Restoring Forces

Tail Water Lateral Force	Frtwe =	-339.768	plf	=-0.5*yw*MIN(MAX(Wte-BE,0),Htoe)^2
Tail Water Moment Arm	TWmae =	1.100	ft	=MIN(MAX(Wte-BE,0),Htoe)/3
Tail Water Surcharge	TWse =	0.000	plf	=-Htoe*yw*MAX(0,Wte-(BE+Htoe))
Tail Water Restoring Moment	Mrtwe =	-0.374	kip_ft/ft	=(Frtwe*TWmae+TWse*(Htoe/2))/1000

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PROJECT: Fredonia Reservoir
PROJECT NO: 2223374
SUBJECT: Spillway Overturning

SHEET: 10 OF 12
DATE: 11/8/2022
BY: JTW

Vertical Forces

Water Weight Over Crest	Wvce =	0	lbs/ft	=MAX(We-CE,0)*yw*Lcrest
Moment at COR: Water Over Crest	Mwvce =	0.000	kip_ft/ft	=Wvce*(COR-COGwc)/1000
Water Weight Over Slope	Wvse =	0	lbs/ft	=IF(We>CE,MAX(((We-Wte)/2),0)*yw*Lslope,0)
Moment at COR: Water Over Slope	Mwvse =	0.000	kip_ft/ft	=Wvse*(COR-COGws)/1000
Water Weight Over Tail	Wvte =	0	lbs/ft	=IF(We>CE,MAX(We-CE,0)*yw*Lcrest,0)
Moment at COR: Water Over Tail	Mwvte =	0.00	kip_ft/ft	=Wvte*(COR-COGwt)/1000

Uplift Forces

Difference in Water Surface Elev.	DWe =	5.70	ft	=(1-esp)*(We-Wte)
Presumed Uplift Slope	Use =	0.400	ft/ft	=DWe/Lbase
Uplift Upstream of Sheetpile	Uue =	1965.60	lbs/ft	=yw*(We-BE)*(Lbase-Lsp)
Upstream Uplift Location	Xuue =	12.500	ft	=Lbase-(Lbase-Lsp)/2
Moment at COR: Uplift Upstream	Muue =	10.565	kip_ft/ft	=Uue*(Xuue-COR)/1000
Uplift Downstream of Sheetpile	Ude =	4125.42	lbs/ft	=0.5*yw*((1-esp)*(We-BE)+(Wte-BE))*Lsp
Downstream Uplift Location	Xude =	6.205	ft	=2*Lsp*(0.5*(Wte-BE)+(1-esp)*(We-BE))/(3*((Wte-BE)+(1-esp)*(We-BE)))
Moment at COR: Uplift Downstream	Mude =	-3.794	kip_ft/ft	=Ude*(Xude-COR)/1000

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PROJECT: Fredonia Reservoir
PROJECT NO: 2223374
SUBJECT: Spillway Overturning

SHEET: 11 OF 12
DATE: 11/8/2022
BY: JTW

Normal Pond & Seismic

High Water Moment	Me =	17.882	kip_ft/ft	=(Mwe+Mde+Mse+Mwes+Mss+Mrsoil+Mrss+Mrtwe +Mdam+Mwvce+Mwvse+Mwvte+Muue+Mude)
High Water Vertical Force	Pe =	8.365	klf	=(Wdam+Wvce+Wvse+Wvte-Uue-Ude)/1000
High Water Sliding Force	Ve =	7.510	klf	=(Fwe+Fwwe+V+Pae+Pwd+Fwwe+Fss+Frsoil+Frss+F rtwe)/1000

Forces and Resistance

High Water Overturning Moment	Mue =	1341.164	kip_ft	=Me*L
Total Vertical Force	Pue =	627.392	kips	=Pe*L
Total Sliding Force	Vue =	563.252	kips	=Ve*L

Sliding Check

Sliding Resitance	SRe =	292.56	kips	=Pue*TAN(RADIANS(φf))
Sliding Factor of Safety	FOSse =	0.52		=SRe/Vue
				Fail: FOS < 1.25

Overturning & Cracking Check

Allowable Resultant Location for Cracking and Stability is in the Middle 1/3 : +/- 1/6 from the COR

Resultant Location	e_allow =	2.38	ft	=Lbase/6
Resultant Relative to COR	eRe =	2.138	ft	=Mue/Pue
				Pass: Resultant < allowable

Floatation Check

Flotation	FOSfe =	2.373		=Wdam/(Uue+Ude+Wvce+Wvse+Wvte)
				OK: FOS > 1.3

Soil Pressure

Overturning Soil Bearing Pressure	qe =	1.12	ksf	=(2*Pue)/(3*L*((Lbase/2)-eRe))
				OK: q < qallow

Net Overturning About Toe

Moments about Toe:

Water Over Crest	Mtwce =	0.000	k_ft/ft	=-(Wvce*COGwc)/1000
Water Over Slope	Mtwse =	0.000	k_ft/ft	=-(Wvse*COGws)/1000
Water Over Toe	Mtwte =	0.000	k_ft/ft	=-(Wvte*COGwt)/1000
Upstream Uplift	Mtuue =	24.570	k_ft/ft	=(Uue*Xuue)/1000
Downstream Uplift	Mtdue =	25.599	k_ft/ft	=(Ude*Xude)/1000
High Water Total Moment about Toe	Mte =	0.00	k_ft/ft	=MAX(Mdamt+Mwe+Msoil+Msilt+Mss+Mrsoil+Mrss+ Mrtwe+Mtwce+Mtwse+Mtwte+Mtuue+Mtdue,0)

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PROJECT: Fredonia Reservoir
PROJECT NO: 2223374
SUBJECT: Spillway Overturning

SHEET: 12 OF 12
DATE: 11/8/2022
BY: JTW

Stability Summary

Normal Pond

Sliding Factor Of Safety	*FOSsnp*	1.86	*Pass: FOS > 1.25*
Resultant Relative to COR	*eRnp*	-0.211	*Pass: Resultant < allowable*
Flotation Check	*FOSfnp*	2.373	*OK: FOS > 1.3*
Soil Pressure	*qnp*	0.76	*OK: q < qallow*
Total Moment About Toe	*MtNP*	0.00	*OK*

Ice Condition

Sliding Factor Of Safety	*FOSsi*	0.55	*Fail: FOS < 1.25*
Resultant Relative to COR	*eRi*	4.914	*Fail: Resultant > allowable*
Flotation Check	*FOSfi*	2.373	*OK: FOS > 1.3*
Soil Pressure	*qi*	2.52	*OK: q < qallow*
Total Moment About Toe	*Mti*	41.11	*Fail M>0*

SDF 50% of PMF

Sliding Factor Of Safety	*FOSssdf*	0.67	*Fail: FOS < 1.25*
Resultant Relative to COR	*eRsdf*	2.832	*Fail: Resultant > allowable*
Flotation Check	*FOSfsdf*	0.719	*FAIL: FOS < 1.3*
Soil Pressure	*qsdf*	1.09	*OK: q < qallow*
Total Moment About Toe	*Mtsdf*	0.00	*OK*

Normal Pond & Seismic

Sliding Factor Of Safety	*FOSse*	0.52	*Fail: FOS < 1.25*
Resultant Relative to COR	*eRe*	2.138	*Pass: Resultant < allowable*
Flotation Check	*FOSfe*	2.373	*OK: FOS > 1.3*
Soil Pressure	*qe*	1.12	*OK: q < qallow*
Total Moment About Toe	*Mte*	0.00	*OK*

Emergency Action Plan (EAP)

Fredonia Reservoir Dam

Village of Fredonia, Chautauqua County, New York

NYSDEC Dam Identification No. 003-1102

Latitude: 42° 23' 50"N
Longitude: 79° 18'38"W

Prepared for:
Village of Fredonia
Water Bureau
9254 Fredonia Stockton Road
Fredonia, NY 14063

Prepared by:
LaBella Associates, D.P.C.
300 State Street, Suite 201
Rochester, New York 14614

December 2022
LaBella Project Number: 222374

EMERGENCY SUMMARY

In the event of a potential emergency condition at the Fredonia Reservoir Dam contact the:

Village of Fredonia Chief Operator
at
(716) 467-3022
or
911

The following general steps should then be performed:

Step 1: Secure your personal safety.

Step 2: Identify and Contact a qualified official

Step 3: Implement the specific instructions provided by the qualified official.

Step 4: Begin written documentation of the specific conditions observed, time of day, weather, and actions being taken to address the emergency condition

EMERGENCY ACTION PLAN
for the
FREDONIA RESERVIOR DAM
VILLAGE OF FREDONIA, NEW YORK

REVISION SHEET

This copy of the Emergency Action Plan (EAP) included the following revisions:

Revision No.	Date	Description of Revision
0	9/2010	Original Emergency Action Plan (EAP)
1	12/2012	Submission of NYSDEC Engineering Assessment
2	10/30/2019	Routine Dam Inspection
3	11/2022	Submission of NYSDEC Engineering Assessment

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1.0 Notification Flowcharts

This section outlines the necessary emergency personnel to be contacted and coordinated within the **Village of Fredonia, New York** and affiliated emergency management personnel in the event of an Emergency, Warning, or Advisory Condition associated with the Fredonia Reservoir Dam. The levels of alert are defined in detail in Section 4.0 - Emergency Detection, Evaluation, and Classification; however, a general summary of each level is provided below with reference to the appropriate Emergency Notification Flowchart.

- **EMERGENCY CONDITION: Failure is imminent or has occurred**. This alert level is for the most severe emergency condition where a partial or catastrophic failure of the Fredonia Reservoir Dam has occurred, is occurring, or is most likely unavoidable.
- **WARNING CONDITION**: **Potential failure situation is developing**. This alert level is for a significantly dangerous emergency condition that is developing (or continuing to develop) at the Fredonia Reservoir Dam that poses a risk to human life and/or property.
- **ADVISORY CONDITION**: **Non-failure** emergency condition. This alert level is for the least severe emergency or pre-emergency condition that threatens the safe operation of the Fredonia Reservoir Dam, but that does not yet pose a significant threat to human life and/or property.

Section 4.0 of this manual should be referenced for more specific guidelines on emergency detection, persons authorized to declare an emergency condition, condition evaluations, and classifications

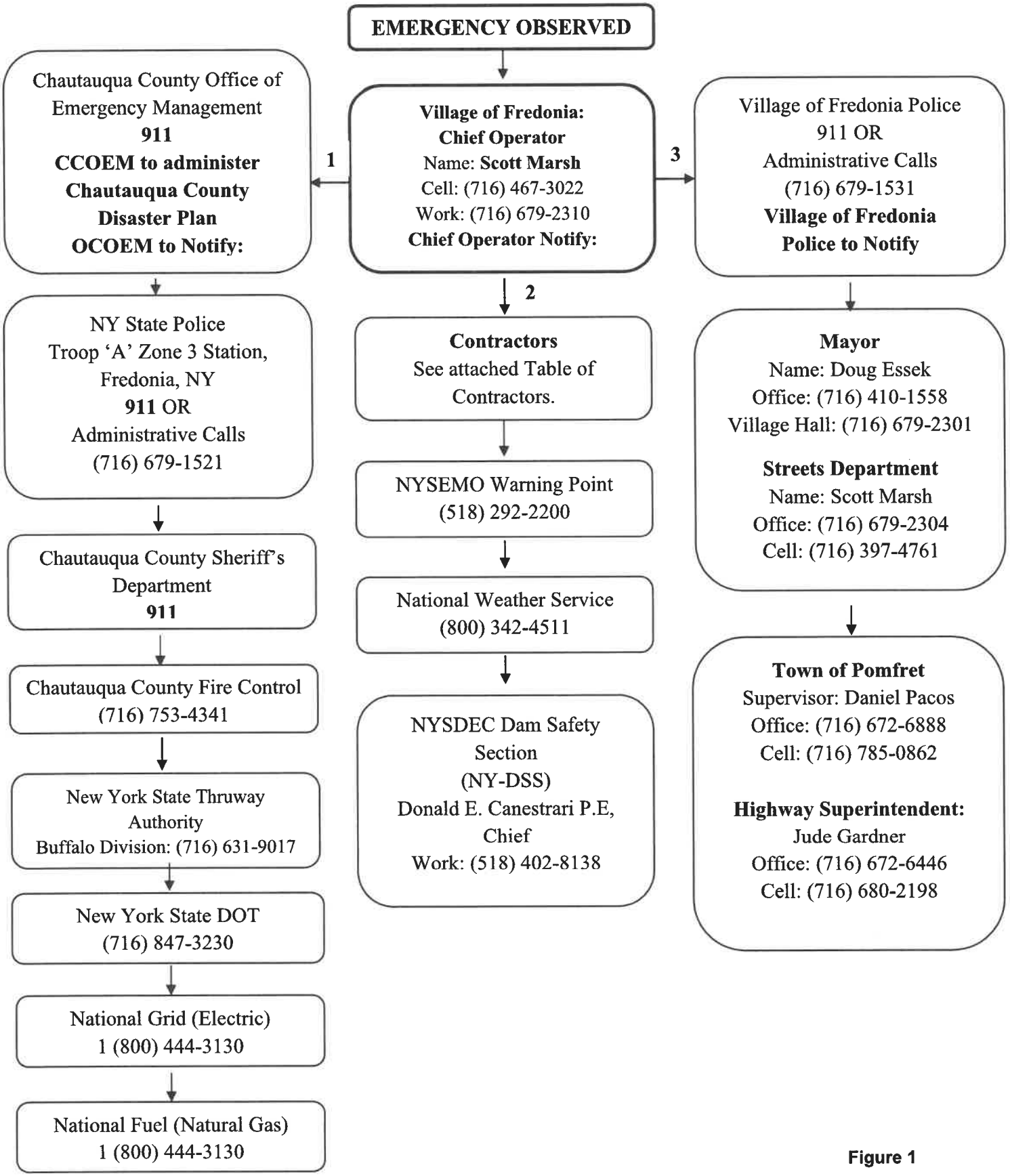

EMERGENCY OBSERVED
Village of Fredonia:
Chief Operator
Name: Scott Marsh
Cell: (716) 467-3022
Work: (716) 679-2310
Chief Operator Notify:
1
Chautauqua County Office of Emergency Management
911
CCOEM to administer Chautauqua County Disaster Plan
OCOEM to Notify:
NY State Police
Troop 'A' Zone 3 Station,
Fredonia, NY
911 OR
Administrative Calls
(716) 679-1521
Chautauqua County Sheriff's Department
911
Chautauqua County Fire Control
(716) 753-4341
New York State Thruway Authority
Buffalo Division: (716) 631-9017
New York State DOT
(716) 847-3230
National Grid (Electric)
1 (800) 444-3130
National Fuel (Natural Gas)
1 (800) 444-3130
2
Contractors
See attached Table of Contractors.
NYSEMO Warning Point
(518) 292-2200
National Weather Service
(800) 342-4511
NYSDEC Dam Safety Section
(NY-DSS)
Donald E. Canestrari P.E,
Chief
Work: (518) 402-8138
3
Village of Fredonia Police
911 OR
Administrative Calls
(716) 679-1531
Village of Fredonia
Police to Notify
Mayor
Name: Doug Essek
Office: (716) 410-1558
Village Hall: (716) 679-2301
Streets Department
Name: Scott Marsh
Office: (716) 679-2304
Cell: (716) 397-4761
Town of Pomfret
Supervisor: Daniel Pacos
Office: (716) 672-6888
Cell: (716) 785-0862
Highway Superintendent:
Jude Gardner
Office: (716) 672-6446
Cell: (716) 680-2198

Figure 1

Emergency Notification Information

Dam Emergency Information for the Three Emergency Conditions

Name of person reporting information:_____

Affiliation:_____

Phone Number:_____

Name and file number of dam: Fredonia Reservoir Dam 003-1102

Location of Dam

County: Chautauqua

Municipality: Town of Pomfret

Stream: Canadaway Creek

Road(s): Spoden Road

Time and date of dam emergency:_____

Type of dam emergency [Circle once]: **Advisory** **Warning** **Emergency**

Phone appropriate parties:

"This is (your name, title, and affiliation). There is a dam (Advisory, Warning or Emergency) condition at the Fredonia Reservoir Dam. Observation was at (time). The situation is (explain condition). What is your anticipated time of arrival at the dam and what are my instructions?"

2.0 Introduction

This section provides an overview of the Emergency Action Plan (EAP) and its components.

2.1 Statement of Purpose

The purpose of this manual is to document pre-planned emergency actions to be taken by the Village and affiliated emergency management to help save lives and reduce property damage in the event of an actual or potential failure at the Fredonia Reservoir Dam. This EAP contains guidelines for actions required to identify, mitigate, and respond to various types of emergencies associated with the Fredonia Reservoir Dam, including a dam failure.

This EAP for the Fredonia Reservoir Dam was prepared by LaBella Associates D.P.C for the Village in October 2022. This EAP has been prepared to increase the emergency preparedness of the village.

This plan was prepared in accordance with the guidelines provided by the Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners (FEMA April, 2004) and 6 NYCRR Part 673, New York State Dam Safety Rules and Regulations and should be updated annually beginning November 2010.

2.2 Scope of the Emergency Action Plan

The scope of this manual includes plans to be followed in the event of a potential dam failure or emergency incident resulting from natural and man-made causes. Possible natural causes include overtopping of the embankment dam from sustained high winds, severe storms producing extreme runoff volumes at high rates, earthquakes, and other seepage and stability related causes. Possible man-made causes include vandalism, acts of terrorism, and unintentional erroneous operation. This manual is intended to define responsibilities and emergency procedures to help mitigate potential consequences of an event if it were to occur. In addition, this manual will help to identify conditions that may affect the integrity of the Fredonia Reservoir Dam, where failure or an uncontrolled release of impounded water from the reservoir would likely cause loss of life, injuries, or significant property damage. The sections of this manual are summarized as follows:

- **Section 1.0, Notification Flowcharts**. This section outlines the necessary emergency personnel to be contacted and/or coordinated with the Village administrators in the event of an Emergency Condition, Warning Condition, and Advisory Condition. Detailed descriptions of these alert levels are provided in Section 4.0, Emergency Detection, Evaluation, and Classification.
- **Section 2.0, Introduction.** This section provides an overview of the EAP components, the purpose of each, and affiliated emergency management organizations/personnel.

- **Section 3.0, Project Description**. This section provides general background and a site description for the Fredonia Reservoir Dam.
- **Section 4.0, Emergency Detection, Evaluation, and Classification**. This section outlines steps to evaluate the situation(s) or triggering event(s) that would initiate or require an emergency condition to be declared. This section differentiates emergency conditions between the three established alert levels to ensure that the appropriate course of action is taken based on the urgency of the situation.
- **Section 5.0, General Responsibilities**. This section outlines the responsibilities assigned to Village personnel (the dam owner/operator) and to a limited degree the roles and responsibilities of federal, state, and local emergency management agencies. These responsibilities include, but are not necessarily limited to, notification, evacuation, termination of the emergency response, and the EAP coordination; so that effective, timely action can be taken should an emergency occur at the dam.
- **Section 6.0, Preparedness**. This section provides an outline for information on important actions that can be taken to mitigate or alleviate the potential for and potential effects of a dam failure or an uncontrolled reservoir release (or other emergency incident), thus facilitating a planned response to emergencies before they occur.
- **Section 7.0, Fredonia Dam Inundation Map**. This section includes a map that graphically delineates the areas that would become flooded as a result of a specific storm event or as a result of a dam failure. This map should be used by the Village and emergency management officials to facilitate the timely notification and evacuation of areas that would likely be affected by a dam failure or flood condition.
- **Appendices**. Included in the appendices are supplemental and supporting information used in the development of this EAP, as well as associated materials pertaining to the approval of this EAP. The appendices also include references to other important documents related to the analysis, design, inspection, operation, and maintenance of the Fredonia Reservoir Dam.

2.3 Affiliated Agencies

Affiliated agencies provide critical communications and coordination and have specific responsibilities in the event of a dam failure that could potentially threaten the public, disrupt highway traffic and/or require the evacuation of residents and the traveling public. In most instances, these agencies have the statutory responsibility for warning, evacuation, and post-flood actions. For the Fredonia Reservoir Dam, these agencies include, but may not be limited to the following:

- New York State Police – Troop 'A' Zone 3 Station Fredonia, NY
- New York State Department of Transportation – Region 5
- New York State Thruway Authority – Buffalo Division
- Village of Fredonia Police
- Chautauqua County Sherriff's Department
- Chautauqua County Fire Control

3.0 Project Description

Attribute	Value
Dam Name	Fredonia Reservoir Dam
Hazard Classification	Type "C" (High Hazard)
NY DEC ID #	003-1102
Federal ID #	NY 00749
Year Constructed	1938
Latitude	42°23'50"N
Longitude	79°18'38"W
River/Stream	West Branch of Canadaway Creek
Type of Dam	Earth Embankment with Concrete Core
Dam Elevation (ft)	1,037
Max Capacity (ac-ft)	1,733
Normal Capacity (ac-ft)	1,024
Height (ft)	80
Length (ft)	520
Type of Spillway	Concrete Ogee
Spillway Capacity (cfs)	3,000
Drainage Area (sqr mls)	5.6
Purpose/Operation of Dam	Water Supply & Recreational Lake

Location/Access: Fredonia Reservoir Dam is located at the northern end of the Fredonia Reservoir, near Spoden Road and Route 60. Access is available through a locked gate and driveway off Spoden Rd.

Other Water Outlets: The reservoir has a 12 – inch outlet line to the water treatment plant.

Instrumentation: Staff gages are located on the intake structure approximately 100 ft of shore.

Method of Emergency Drawdown: 12-inch outlet line to water treatment plant (blow off located near tunnel).

Fredonia Reservoir Site Map

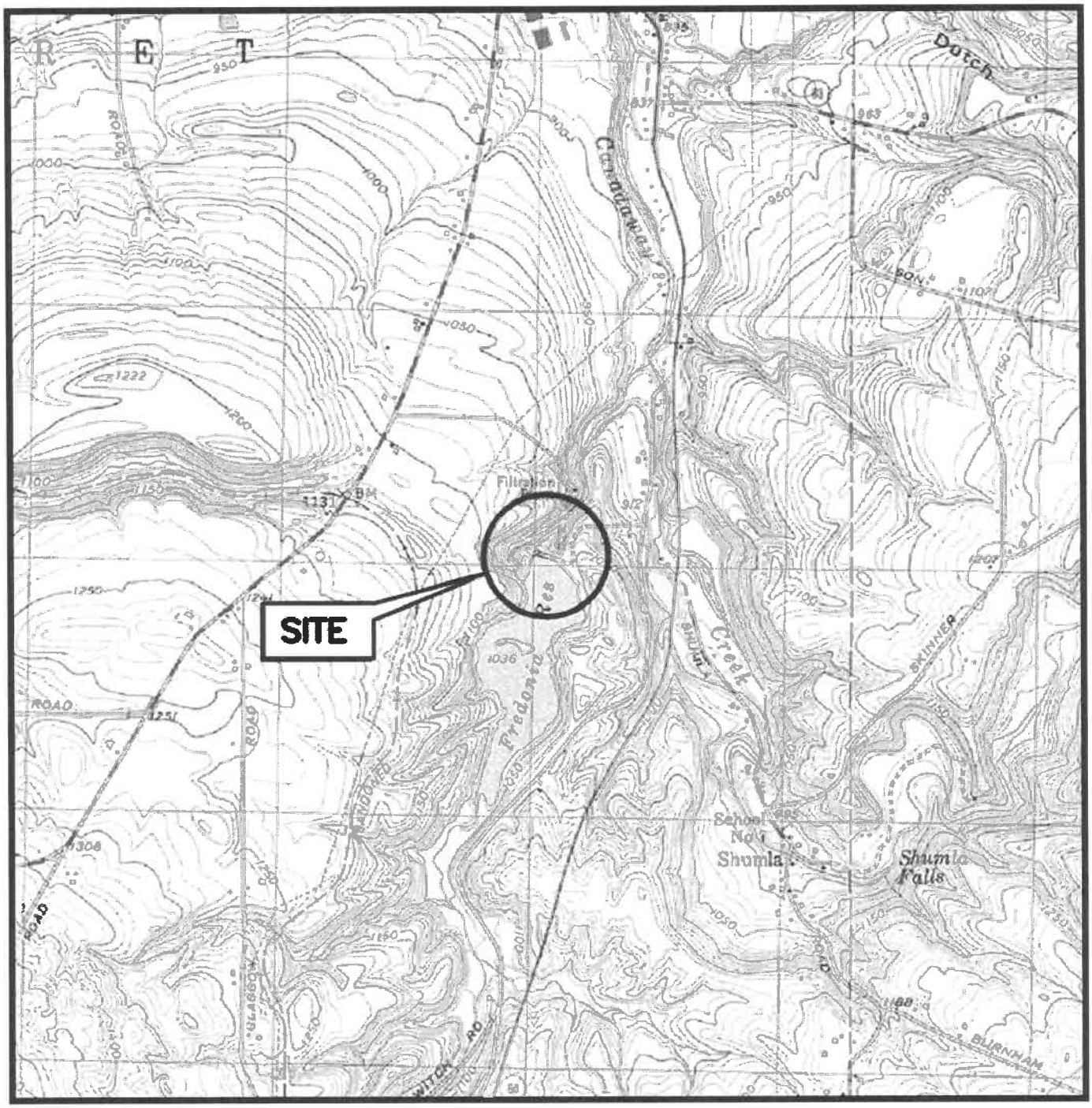


Figure 2

4.0 Emergency Classification

This section establishes procedures for identifying impending or existing emergencies affecting the integrity of the Fredonia Reservoir Dam. This section will provide guidance for the identification and classification of emergencies due to significant settlement of the dam, seepage, major flooding, earthquakes, damage to the outlet works, sabotage, and/or other situations that could result in an uncontrolled release of the reservoir. Each occurrence has three levels of severity described, as follows:

DAM EMERGENCY CONDITION:

A Dam Emergency Condition shall be declared when an actual emergency (i.e. failure of the Fredonia Reservoir Dam) has occurred, is occurring, or is most likely unavoidable. This is the most sever condition and requires immediate notification and evacuation.

A Dam Emergency Condition is defined as one or more of the following situations:

- Water has overtopped the earth embankment or is expected to overtop within the next hour.
- Any uncontrollable erosion, settlement, or upheaval occurring on the downstream slope or at the toe of the dam.
- Any uncontrollable leakage through any dam structure.

Required Responses are:

- Refer to ***Emergency Notification Flow Chart***, page 6)
- Contact everyone listed on the notification flowchart.
    - Begin emergency response actions.
    - Issue public warning and begin evacuation.

DAM WARNING CONDITION:

A Dam Warning Condition shall be declared when the occurrence of a significant danger to human life and/or property is possible and if the observed conditions at the Fredonia Reservoir dam continue to worsen. This condition indicates developing danger is occurring and requires immediate corrective action. Village staff should immediately access the cause of the imminent failure and determine if the cause can be remedied/repaired.

A Dam Warning Condition can be defined as one or more of the following situations:

- Water level of the lake has risen to one foot (1ft) below the dam crest and continues to rise.

- Any developing erosion, settlement, or upheaval occurring on the downstream faces or toe of the dam and is considered to be controllable.

Required Responses are:

- Notify Chautauqua County EMO
- Notify NYSDEC-DSS
- Investigation
- Assessment and Response

DAM ADVISORY CONDITION:

A Dam Advisory Condition shall be declared in a pre-emergency condition, which impending danger or some existing threat to the safe operation of the Fredonia Reservoir Dam is identified. An advisory condition implies that no significant damage to property is expected to occur. This is the least severe condition and presents no immediate danger but could lead to eventual failure of the dam if corrective actions are not taken.

A dam advisory condition can be defined as one or more of the following situations:

- Any undocumented or unusual spring
- Any sign of piping
- Any sign of slumping or sinkhole
- Any Unusual cracks
- Any unusual wet spot or boggy area
- Any seismic event
- Any obstruction to the spillway
- Any obstruction due to vandalism
- Bomb threat
- A civil disorder near the reservoir structure

Required responses are:

- Notify Chautauqua County EMO
- Notify NYSDEC-DSS
- Investigation
- Assessment and Response

5.0 General Responsibilities

This section outlines the responsibilities of the organization that are to be anticipated to be involved in implementing this EAP so that effective, timely action can be taken should an occurrence or emergency develop at the dam. Specifically, this includes responsibilities of the Village (dam owner/operator), police department, fire department, country sheriff's department, local officials, county emergency management, and other identified parties. All of the above entities are responsible to thoroughly read and familiarize key personal with this EAP and maintain a readily available and up to date copy of the plan.

Dam Owner/Operator Responsibilities:

During any of the three (3) emergency conditions:

1. Identification of the emergency condition.
2. Notification of the Emergency Management Offices (EMOS) & New York Department of Environmental Conservation, Dam Safety Section (NYSDEC-DSS) (refer to the *Emergency Notification Flow Chart* on page 6).
   Person responsible for the notification: Scott Marsh
3. Implementation and direction of emergency repairs.
4. Update the emergency status to the EMOS and NY-DSS.
   Person responsible for the updates: Scott Marsh
5. Provisions for security measures at the dam.
6. Provision of technical assistance to EMO officials, when necessary.
7. Reporting termination of emergency on-site at the dam.

In non-emergency conditions, owner/operator must also provide for:

1. Routine maintenance and operations of the dam.
2. Routine surveillance of the dam.
3. Routine inspection of the dam.
4. Annual review and updating of the EAP.

EAP Coordinator Responsibility

Once the dam owner/operator has designated an EAP Coordinator, that person shall be responsible for EAP related activities including:

1. Inclusion and distribution of document revisions.
2. Establish training seminars.
3. Coordinate EAP exercises.
4. Serve as the Village of Fredonia contact person for any EAP related Inquiries.

EAP COORDINATOR NAME: Alison Holbrook
PHONE NUMBER: (716) 679-2310

Municipalities, Emergency Fire and Police Responsibilities:

1. Warn the public of emergency conditions at the dam.
2. Implement and direct required evacuations of threatened areas.
3. Establish reception centers for evacuated people.
4. Secure and control access to evacuated areas.
5. Conduct rescue and recovery operations as required.
6. Determination and declaration of termination of emergency/disaster response activities off-site.

Chautauqua County OEM Responsibilities:

Provide overall coordination and resource management of county response activities in support of local and county government, as appropriate. For example, this could include:

1. Pass warning of emergency conditions at the dam to all affected municipalities.
2. Aid municipalities to help fulfill the emergency responsibilities.

NYS-OEM Responsibilities:

Provides overall coordination of state response activities, which are supplement to local efforts, as appropriate. For example, such efforts could include:

1. Provision of assistance to the affected municipalities and counties (when requested and beyond local authority capabilities).
2. Coordination of specialized assistance.
3. Notification of appropriate State agencies.

NYSDEC-DSS Responsibilities:

1. Provide technical assistance to the dam owner/operator.
2. Assist in the evaluation and resolution of potential emergency conditions.
3. Has the authority to direct the owner/operator to take necessary safety measures.

Termination

The Village of Fredonia is responsible for evaluating a declared emergency condition and should consult with the NYSDEC-DSS that an emergency condition no longer exists on-site at the dam.

Recovery

The basic goal of the recovery phase is to demobilize and return to the pre-emergency situation. The Village of Fredonia is responsible for implementing all actions necessary to achieve this goal on-site at the Fredonia Reservoir Dam.

The Village of Fredonia is responsible for directing all on-site recovery activities. The basic recovery actions common to the three dam emergency conditions are:

- Secure access to emergency site.
- Restore basic facilities and services.
- Assess damage.
- Long term remedial measures which may require permits may be needed.
- A Post Incident Report describing the conditions which led to the emergency must be submitted to the NYSDEC-DSS within five (5) days. (See Attachment D or http://www.dec.ny.gov/lands/4991.html)

6.0 Preparedness

Emergency Notification Directory

1. Dam Owner: Village of Fredonia

   Contact Person: Scott Marsh – Chief Operator

   Address: 9-11 Church St.

   Phone: (716) 679-2310 24-hour No.: (716) 467-3022

2. Maintenance & Operations Crew Supervisor: TBD

   Phone: _____ 24-hour No.: _____

3. Inspectors: Reservoir and Water Treatment Staff

4. Owners Consulting Engineers

   Name: LaBella Associated D.P.C

   Contact Person: Don Lucas

   Address: 300 State Street

   Phone No.: (585) 454-6110

5. Municipalities

Municipality	Phone No,	Police No.
Village of Fredonia	O: (716) 679-2302 C: (716) 680-5770	(716) 679-1531 or 911
Town of Pomfret	(716) 672-6888	911
Town of Dunkirk	(716) 366-3967	911

6. County

	Phone No,	24 Hour No.
Chautauqua County OEM	911	911
Chautauqua County Highway Dept	(716) 761-6171	911

7. State Agencies

Agency	Phone No,	24 Hour No.
NYS-OEM	(518) 292-2200	(518) 292-2200
NYSDEC-DSS – Donald Canestrari	(518) 402-8138	(518) 587-5941
NY-DOT (Region 5, Buffalo, Regional Director Francis Cirillo)		(716) 847-3238

Emergency Operation Center (EOC)

Address/Location

Village Hall
9-11 Church Street
P.O Box 31
Fredonia, New York 14063

Contact Person: Scott Marsh
Village Hall (716) 679-2310

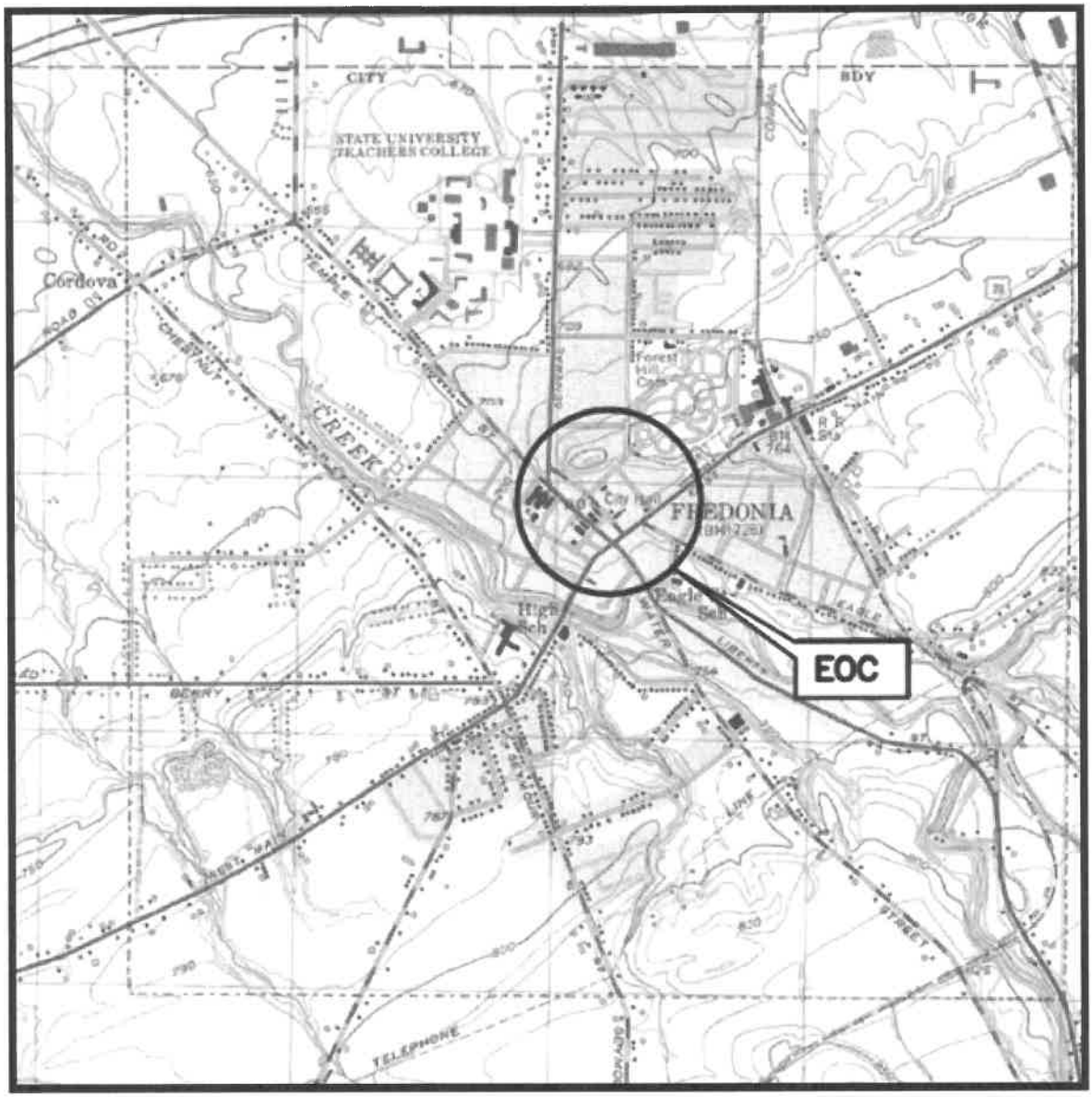


Figure 3

Surveillance Checklist for the Fredonia Reservoir Dam

Observation	Response	Location								
		Reservoir	Upstream Slope	Crest	Downstream Face	Downstream Face	Left Abutment	Right Abutment	Spillway	Outlet
Normal	0									
Not Inspected	-									
Overtopping of Crest	3	■	■		■	■	■	■	■	■
Uncontrollable Settlement	3	■								
Uncontrollable Heave or Erosion	3	■								■
Uncontrollable Leakage	3	■	■	■						
Dislocation/Movement of Structures	2	■	■							
Water Level Within 1 foot of Crest and Rising	2		■		■	■	■	■	■	■
Controllable Settlement	2	■								
Controllable Heave or Erosion	2	■								■
Controllable Leakage	2	■	■	■						
Piping (Turbid Seepage)	1	■	■	■					■	■
Sloughing, Slumping, Animal Burrows	1	■							■	■
Sinkhole	1	■							■	■
Wet Spot or Boggy Area	1	■							■	■
Seismic Event	1									
Spillway Obstruction	1	■	■	■	■	■	■	■		■
Cracking	1	■								
Other (explain below)	1									

Key:		Condition Observed/Follow Response	■	N/A to Location

Response Key/Guide

0. No Action, Continue Inspection
1. Dam Advisory Condition
2. Dam Warning Condition
3. Dam Emergency Condition

Emergency Repair Resources

It will be the responsibility of the Village of Fredonia to maintain a current list of emergency response contractors and suppliers who agree to be contacted during an emergency condition for equipment, materials, and repairs.

The first source of emergency repair assistance, materials and equipment is from the on-site stocked materials, equipment, and maintenance crew.

Table 1 provides a list of available on-site resources and equipment. Tables 2 and 3 provide a list of available off-site materials and contractors. Several types of potential services, materials and equipment have been identified as potentially important for emergency repairs including:

- Concrete
- Cement Grout
- Geotextiles
- Lumber
- Pipes
- Sand Bags
- Sand, gravel, riprap
- Crane services and equipment
- Excavation services and equipment
- Pumps

Table 01
Available On-Site Materials & Equipment

Materials:
Gravel
Assorted Stones

Equipment:
1-Loader
1-Backhoe
3-Dump Trucks
1-Vacuum Truck

Table 02

Fredonia Reservoir Dam Available Off-Site Materials

Item	Contractor	Location	Phone
Sand and Gravel			
	Tri James	Sinclairville, NY	716-962-4408
	Gernatt	Hanover, NY	716-549-0551
Concrete and Concrete Grouting			
	Hanson Aggregates Dunkirk Ready Mix	10500 Bennet Rd	716-366-6444
Concrete Pipe			
	Vellano Brothers	Lancaster, NY	716-684-7222
Lumber			
	Chautauqua Brick	67 Orchard St	716-672-4300
	Fredrickson Builders Supply	320 Maple Ave	716-535-3100
	ADD Lumber	Dunkirk, NY	716-366-1622
Sand Bags			
	Chautauqua County Department of Public Facilities		
Geotextiles			
	Vellano Brothers	Lancaster, NY	716-684-7222

Table 03

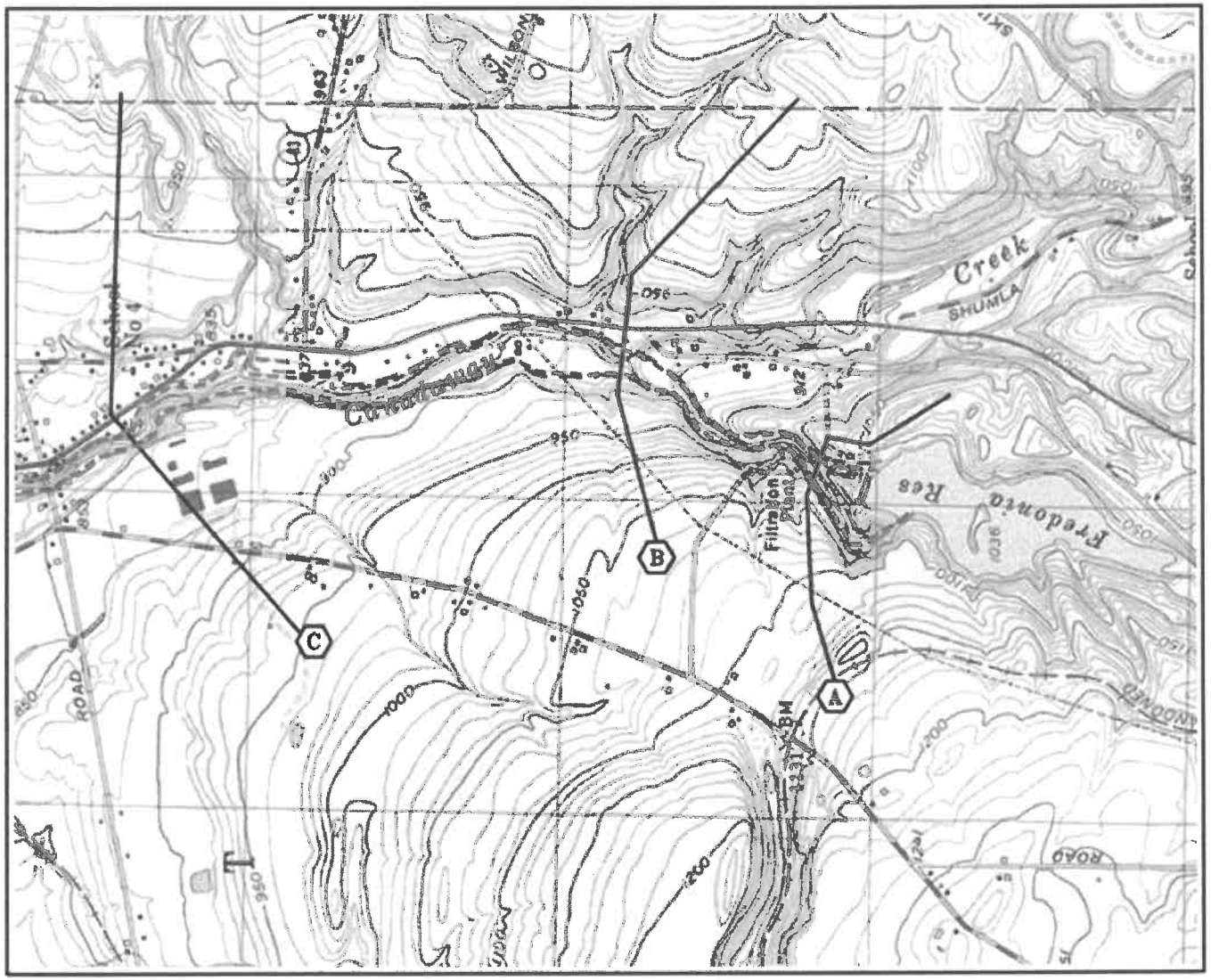
Fredonia Reservoir Dam Available Contractors

Service	Contractor	Location	Phone
General Site Contractors			
	S St George Enterprises		716-672-2488
	John V Danforth Co	Tonawanda, NY	716-832-2386
Pipeline Contractors			
	S St George Enterprises		716-672-2488
Tree Removal			
	Kravitz Tree Service	72 Cottage St	716-640-0597
	Great Lakes Tree Service	7741 Gun Club Rd	716-326-3798
Electrical Contractors			
	BECC Electric		716-679-4466
	Ahlstrom Schaeffer Electric	Jamestown, NY	716-665-6510
Crane Service Contractors			
	Benchley Contracting & Crane Rental	3800 Middle Rd	716-363-1004
Diving Contractors			
	Allen Marine Services	770 River Rd	716-362-0674

7.0 Fredonia Reservoir Dam Inundation Maps

Description

Overview of Inundation Area: The inundation area below the Fredonia Reservoir Dam follows the West Branch of the Canadaway Creek approximately 2 miles to the Village of Fredonia. The inundation area extends through the Town of Pomfret, the Village of Fredonia, and the Town of Dunkirk. Table 4 below summarizes peak water surface elevations in the West Branch of the Canadaway Creek at the cross sections shown in Figures 4A-4C during the 50% Probable Maximum Flood (PMF) with Breach condition, and with the Sunny Day ("Normal Pool") with Breach condition.



LEGEND

— — 50% PMF W/BREACH

- - - - 50% PMF W/O BREACH & SUNNY DAY FAILURE

NOTE:
INUNDATION LIMITS FOR 50% PMF W/O BREACH AND SUNNY DAY FAILURE ARE NEARLY COINCIDENT.

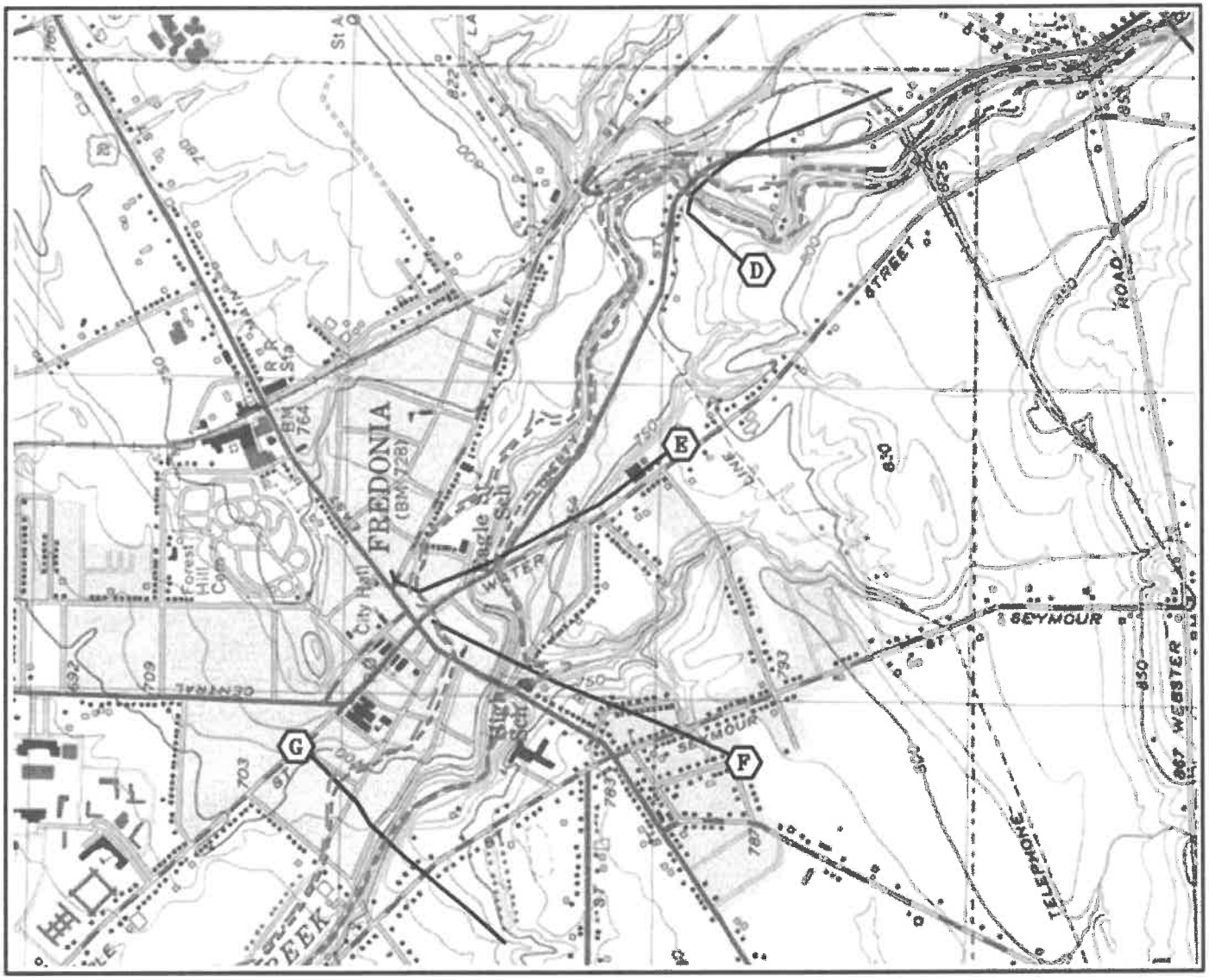
VILLAGE OF FREDONIA
FREDONIA RESERVOIR DAM
FREDONIA, NEW YORK

DAM BREAK
INUNDATION LIMITS

1000' 0 1000'
1"=1000'

FILE NO. 1207.42985.IL-FRED04.DWG

Figure 4A



LEGEND

— — 50% PMF W/BREACH

- - - - 50% PMF W/O BREACH & SUNNY DAY FAILURE

NOTE:
INUNDATION LIMITS FOR 50% PMF W/O BREACH AND SUNNY DAY FAILURE ARE NEARLY COINCIDENT.

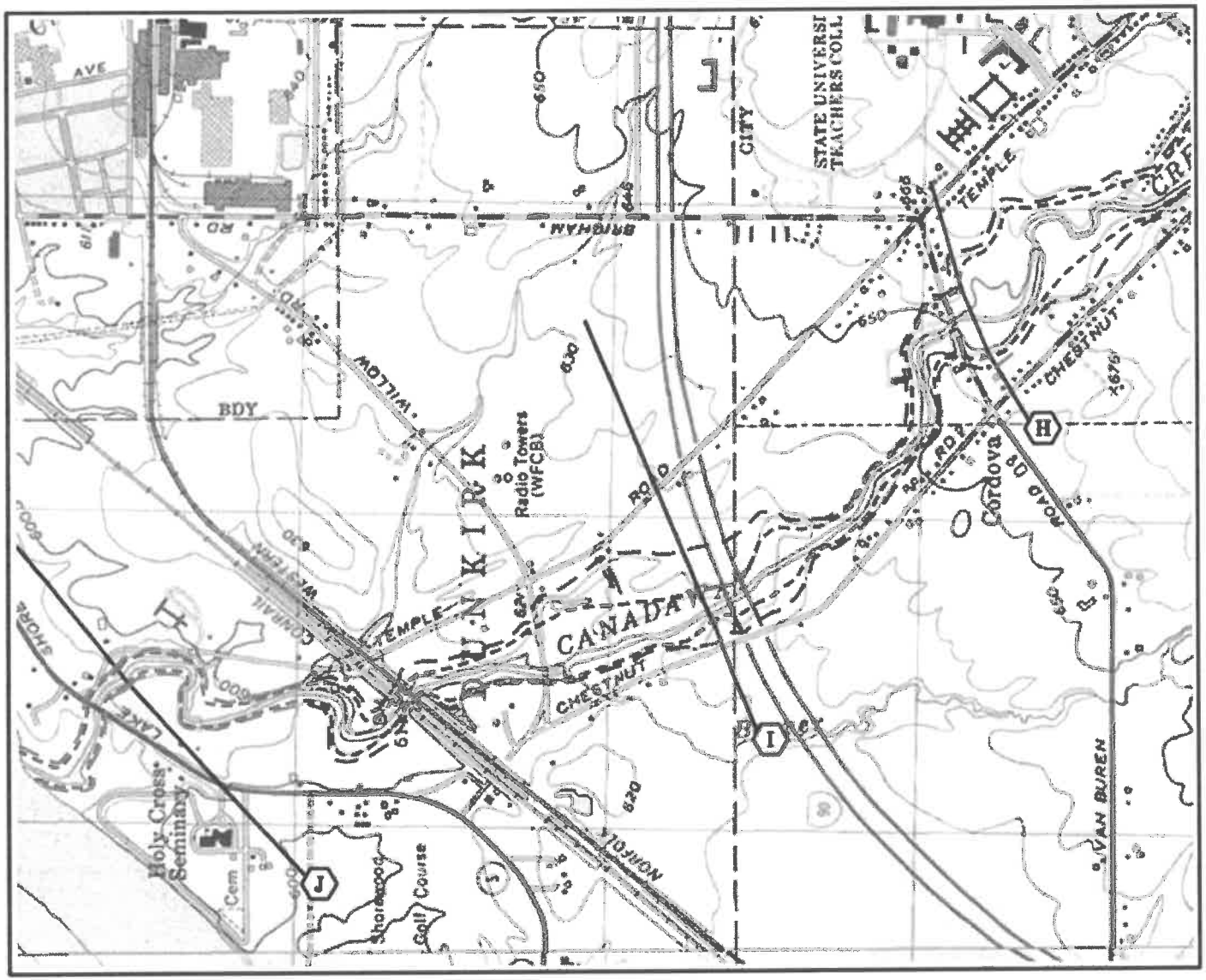
VILLAGE OF FREDONIA
FREDONIA RESERVOIR DAM
FREDONIA, NEW YORK

DAM BREAK
INUNDATION LIMITS

1000' 0 1000'
1"=1000'

FILE NO. 1207.42985.IL-FRED04.DWG

Figure 4B



LEGEND

— — 50% PMF W/BREACH

- - - - 50% PMF W/O BREACH & SUNNY DAY FAILURE

NOTE:
INUNDATION LIMITS FOR 50% PMF W/O BREACH AND SUNNY DAY FAILURE ARE NEARLY COINCIDENT.

VILLAGE OF FREDONIA
FREDONIA RESERVOIR DAM
FREDONIA, NEW YORK

DAM BREAK
INUNDATION LIMITS

1000' 0 1000'
1"=1000'

FILE NO. 1207.42985.IL-FRED04.DWG

Figure 4C

LaBella
Powered by partnership.

Fredonia Reservoir Dam Inspection & Maintenance Plan
DEC ID# 003-1102

The Village of Fredonia
Fredonia, New York

Prepared for:
Village of Fredonia Water Bureau
9254 Fredonia Stockton Road
Fredonia, NY 14063

Prepared by:
LaBella Associates, D.P.C.
300 State Street, Suite 201
Rochester, NY 14614

December 2022

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Figures

1. Site Location Map
2. Site Map

Appendices

A. Completed Checklists
B. Maintenance Inspection Checklists (Blank)
C. Continuing Maintenance Checklists (Blank)
D. NYSDEC Inspection Checklists (Blank)
E. Miscellaneous Correspondence

PART I: BACKGROUND DATA

1. GENERAL

A record of routine and corrective maintenance performed by the Village of Fredonia (Village) will be kept and included as part of this Plan. This Plan will contain an ongoing record of relevant correspondence regarding Dam Compliance History. It shall include correspondence from the NYSDEC DSS regarding compliance issues, dam classification or reclassification, and professional services. This I&M Plan should be reviewed and updated annually.

Appendices A, B, C and D contain inspection and maintenance checklists for the Fredonia Reservoir Dam.

Completed forms (see Part II of this Plan for inspection requirements and procedures, and information on record keeping) will be placed in Appendix A, "Completed Checklists."

Appendix B contains blank "Maintenance Inspection" checklists.

Appendix C contains blank "Continuing Maintenance" checklists.

Appendix D contains blank NYSDEC DSS Dam Inspection Checklists and Annual Certification Forms.

Appendix E contains correspondence and contract information regarding general maintenance and material purchases for the Fredonia Reservoir Dam. Any new correspondence or contract data will be copied and included in this section.

2. DAM DATA

Dam Name: Fredonia Reservoir Dam Dam State Identification Number: 003-1102

Federal Energy Regulatory Commission Identification Number, if applicable: N/A

Dam Hazard Classification: Class 'C' High Hazard

Date of Last Hazard Class Verification: N/A

Dam Location: County: Chautauqua Town/City/Village: Village of Fredonia
Latitude: 42°23'50.0" N Longitude: 79°18'38.0" W

Dam Type: Earth-fill with Riprap Facing on D/S Slope and Concrete Core Wall

Year of Original Construction: 1937 Year of last construction activity: None

Name of last Engineer and Builder:
Fretts, Tallamy & Senior Engineers (Engineer) Unknown (Builder)

Dam Use(s): Public Water Source

Dam Owner Name: The Village of Fredonia
Dam Owner Mailing Address: 9-11 Church Street PO Box 31 Fredonia, NY 14063
Dam Owner Telephone Number: (716) 679-2304
Dam Owner E-Mail: smarsh@netsync.net

Reservoir and Stream (inflow and outflow) name and class (and/or navigability?):
Canadaway Creek

Associated wetlands and other natural resources of special concern:
None

Dam height (ft): 80
Crest Length (ft): 520
Dam Crest width (ft): 12
Maximum Impoundment Volume (gallons): 278 million

All Counties/Towns/Cities/Villages within downstream inundation zone:
Village of Fredonia, the eastern edge of Town of Pomfret and Town of Dunkirk

Normal Pool Elevation: EL. 1037.0

Auxiliary/Emergency Spillway Elevation: None

Maximum Design Water Surface Elevation: EL. 1044.0 (Crest of dam) (SDF is 50% PMF, it overtops the dam by 1.0 ft)

3. GLOSSARY OF TERMS

The following terms are provided so that the Village of Fredonia personnel will be familiar with terms relating to the dams.

- **Abutment** – That part of the natural ground against which a dam is constructed. Right and left abutments are those respective sides of an observer looking downstream.
- **Appurtenant Structures** – Ancillary features of a dam, such as the outlet pipe, spillway and sluicegate.
- **Crest** – The term "crest of dam" is synonymous with "top of dam".
- **Dam** – A barrier built across a watercourse for impounding water.
- **Drainage Area** – The area that drains naturally to a body of water.
- **Embankment** – A slope of fill material, usually earth or rock, that is longer than it is high, or the sloping side of a dam.
- **Homogeneous Earth fill Dam** – An embankment dam constructed of similar earth material throughout.
- **Freeboard** – The vertical distance between a known water surface elevation and the top of a dam.
- **Normal Water Level** – The lowest level of the spillway over which water normally flows.
- **Outlet Pipes** – The opening at the dam through which water can be freely discharged from the reservoir.
- **Piping** – The progressive development of internal erosion by seepage, appearing downstream as a hole or seam discharging water that contains soil particles.
- **Probable Maximum Precipitation (PMP)** – The maximum amount of precipitation that can be expected to occur over a drainage basin.
- **Probable Maximum Flood (PMF)** – The flood that may be expected from the severest combination of critical meteorologic and hydrologic conditions possible for the particular region. It is the flood resulting from the PMP.
- **Reservoir Area** – The surface area of the lake when filled to the normal water level.
- **Riprap** – A layer of large stones, broken rock, or pre-cast blocks placed in random fashion on the slope of an embankment dam, on a reservoir shore, or in the channel as a protection against wave action or erosion. Very large riprap is sometimes referred to as armoring.
- **Seepage** – The internal movement of water that may take place through small spaces in a dam, its foundation, or its abutments.
- **Sluice Gate** – A gate controlling the outflow of water from the reservoir.
- **Spillway** – A structure over which normal or flood flows are discharged.
- **Toe of Dam** – The junction of the downstream face of a dam with the ground surface also referred to as downstream toe.

PART II: INSPECTION, OPERATION AND MAINTENANCE

1. GENERAL

A well-organized Inspection & Maintenance program will protect a dam against deterioration and prolong its life. All components of the dam including the embankment, the spillway, and the reservoir are susceptible to damaging deterioration over time. The cost of a proper I&M program is miniscule compared to the cost of major repairs or reconstruction of the dam after a failure. This plan establishes a basic I&M program based primarily on systematic inspections by the Village of Fredonia. During each inspection, the "Maintenance Inspection" checklist found in Appendix B of this Plan shall be used. The completed checklist shall be dated and signed by the "Inspector" and incorporated into Appendix A of this Plan.

This Plan is intended as a guide for the Village and outlines the proper procedures for conducting routine I&M for the Fredonia Reservoir Dam. The Village shall appoint a key person (Inspector), who will perform routine inspections. A continuous record of I&M for Fredonia Reservoir Dam must be maintained. The Designated Inspectors List (Part II, Section 2) lists the Officials and various contractors. This section must be updated periodically pending a change in the Inspectors.

At least two (2) copies of this Plan shall be always kept by the Village. One copy shall be maintained by the Water Department and one copy shall be maintained by the DPW. All correspondence and dam checklists shall be reproduced in triplicate and distributed for inclusion into the Plans. If requested by the DSS, one (1) copy of this Plan along with all updates and inclusions shall be forwarded to:

New York State Department of Environmental Conservation
Dam Safety Section
625 Broadway
Albany, NY 12233-0001

This section of the Plan has been prepared to provide the Inspector with a simple and systematic method for inspecting, operating, and maintaining the dam. For the most part, I&M for the dam involves observation rather than evaluation. The following sections provide a step-by-step procedure to assist the Inspector in performing all duties in a rational and orderly manner. The Inspector must become familiar with the background information in Part I of this Plan and the Location and Site maps found in the "Figures" section.

2. DESIGNATED INSPECTOR LIST

This section must be updated periodically to reflect the names and telephone numbers of the Inspectors appointed by the Town of Greece.

Responsible Party	**Telephone Numbers**
Doug Essek (Mayor)	W: (716) 679-2301
Inspection Supervisor	
Scott Marsh	W: (716) 679-2310
	C: (716)-467-3022
Maintenance/Operations Supervisor	
TBD	W:
	C:

Inspector(s):

_____

_____

3. INSPECTION FREQUENCY AND SCHEDULE

3.1 PLAN REVIEW

Location and General Site Plans for the Fredonia Reservoir Dam are presented in the Figures section of this Plan. The Inspector shall review available plans prior to conducting an inspection of the dam.

3.2 SIZE AND HAZARD CLASSIFICATION

The Fredonia Reservoir Dam is classified as a Size **Large,** Class 'C' (**High** Hazard) structure.

3.3 INSPECTIONS, CERTIFICATIONS, AND ENGINEERING ASSESSMENTS: FREQUENCY AND SCHEDULE

Current NYSDEC DSS Dam Safety Regulations (Section 673.6) mandate that Dam Safety Inspections be performed for Class 'C' and 'B' structures on a regular schedule defined in the dam's Inspection & Maintenance Plan. In accordance with DSS regulations, a Dam Safety Inspections of Fredonia Reservoir Dam will be performed every two years.

The Village of Fredonia shall perform a quarterly informal 'Maintenance Inspection". The "Maintenance Inspection" checklist found in Appendix B shall be completed during the inspection. Completed forms shall be added to Appendix A, the "Completed Checklists"" section of this Plan, and copies forwarded to the NYSDEC DSS (see Part II, Section 1) if requested.

All maintenance items identified in the inspections shall be completed within one (1) year of the inspection. In addition, continuing maintenance shall be performed on a routine basis and as needed after a major storm event. Blank "Continuing Maintenance" Checklists are included as Appendix C, these should be completed when maintenance is performed.

The Village of Fredonia is required to submit an Annual Certification for the Fredonia Reservoir Dam by January 31 of each year in accordance with Part 673.8. Class C dam owners shall certify ownership; the location and hazard classification of the dams; that the Inspection & Maintenance Plan is current and being implemented; and that the Emergency Action Plan is current. Any pages updating the Emergency Action Plan shall be included with the Annual Certification. Blank certification forms are included in Appendix B.

The Village of Fredonia is required to submit an Engineering Assessment for the Fredonia Reservoir Dam by December 2022 and every ten years thereafter in accordance with Part 673.13. The Engineering Assessment will include a full safety inspection, an evaluation of the dam, including its function, structural/slope stability and spillway capacity and a conclusion as to whether the dam is in a safe condition and any recommended changes in hazard classification. The Engineering Assessment must be performed by a professional engineer licensed in New York.

A schedule of the necessary Maintenance Inspections, Dam Safety Inspections, Engineering Assessments, and certifications necessary through 2024 is listed in Table 3.1 below. A record of when the quarterly Informal Maintenance Inspections were performed shall be kept in Table 3.2. A copy of Table 3.2 is also included in Appendix A, the Village may cross out Table 3.2 and use the table in Appendix A instead.

Table 3.1: Schedule of Inspections, Engineering Assessments and Certifications through 2034.

INSPECTION TYPE	FREQUENCY/DATE	PERFORMED/PRODUCED BY
Informal – Post Significant Storm Event	As Needed	Village of Fredonia
Informal – Quarterly Maintenance	Quarterly	Village of Fredonia (See Table 3.2 below)
Technical – Dam Safety	Bi-Annual:	Professional Engineer (insert firm and completed date) below
	2024	
	2026	
	2028	
	2030	
	2034	
Technical – Engineering Assessment	10-Year Cycle	Professional Engineer (insert firm and completed date) below
	2022	LaBella Associates D.P.C (August 2022)
	2032	

Table 3.2: Record of Informal Maintenance Inspections (Cross out if Table A.1 is used)

INSPECTION TYPE	Year/Quarter	PERFORMED BY
Informal – Post Significant Storm Event	As Needed	Village of Fredonia
Informal – Quarterly Maintenance NOTE – Engineering Assessment due this year	2022	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance	2023	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance NOTE – Dam Safety Inspection due this year	2024	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance	2025	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance NOTE – Dam Safety Inspection due this year	2026	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	

4. TOOLS AND EQUIPMENT

The following is a list of recommended equipment for routine I&M procedures and inspections.

- A clipboard, a pencil and the "Maintenance Inspection" and "Continuing Maintenance" checklists – blank checklists are included in Appendices B&C.
- A standard 6-foot collapsible ruler.
- A camera – photographs or observed portions of the dam will provide a measure of performance when comparing past and present maintenance practices or conditions.
- A probe – any stiff light stick or rod with a blunt tip of sufficient strength to penetrate soil. The probe can provide information on conditions below the surface of the dam such as the depth and softness of a saturated area.
- A weed whacker – can be used to clear non-visible areas and to perform routine maintenance on embankments.
- A flashlight – a flashlight can be used to observe the inside of subsurface drains.

Maintenance at the Fredonia Reservoir Dam may include heavy equipment including the following:

- Chain saw;
- Stump grinder;
- Wheelbarrow;
- Backhoe; and,
- Dump truck

Sources of the following materials should be identified for immediate use if warranted by the inspection:

- Native, silty sand for filling erosion rills and gullies.
- Topsoil mixture, fertilizer and seed.
- Large stone riprap for emergency repairs caused by erosion.
- Synthetic geofabric netting and stakes to prevent seed and topsoil from blowing away.

5. RECORD KEEPING

5.1. INSPECTION PROGRAM

All inspection records should be retained in a permanent file. Only through the establishment and maintenance of records can the evolutionary behavior of a dam be monitored and assessed. Inspection Reports shall be kept on file at the Village of Fredonia Water Filtration Plant. Completed checklists shall be kept in Appendix A of this Plan and copies forwarded to the NYSDEC, if requested.

Photographs are vitally important because they serve to provide a pictorial history of the evolving characteristics of the dam. Pictures can illustrate that some observed conditions, such as seepage and foundation movement, have existed for many years and have reached a state of equilibrium. Photographs should be taken of any deficiencies noted in the inspection. Select digital photographs should be printed, dated, and a brief description provided. CD's or other electronic storage media such as a memory stick should be used to store the photos.

5.2. MAINTENANCE PROGRAM

As in the case of inspection records, the compiling of detailed maintenance records should be a priority. A record should be kept of all maintenance activities. The data should be recorded by the person responsible for maintenance and should always include the date and time that the maintenance was performed. Maintenance records should include activities such as clearing debris from the spillway, tree removal, repairing erosion, exercising outlet gates, cleaning, lubrication, etc. Completed checklists shall be kept in Appendix A of this Plan.

6. INSPECTION PROCEDURES

The following procedures should be followed for an inspection of the Fredonia Reservoir Dam:

Eastern Embankment

A. The crest: Walk along the top of the eastern embankment from one end to the other and look for erosion, puddles, settlement, cracks in the surface or animal burrows, etc.

B. The upstream face: Walk along the upstream face of the eastern embankment and observe erosion, puddles or wet areas, slumps, woody vegetation or animal burrows.

C. The downstream face: Walk along the downstream face of the eastern embankment in a zigzag, top to bottom fashion to observe any erosion, puddles or wet areas, slumps, woody vegetation or animal.

Western Embankment

A. The crest: Walk along the top of the western embankment from one end to the other and look for erosion, puddles, settlement, cracks in the surface or animal burrows, etc.

B. The upstream face: Walk along the upstream face of the western and observe erosion, puddles or wet areas, slumps, woody vegetation or animal burrows.

C. The downstream face: Walk along the downstream face of the western embankment in a zigzag, top to bottom fashion to observe any erosion, puddles or wet areas, slumps, woody vegetation or animal.

Spillway

A. The training walls: Walk along the length of the spillway training walls to observe the condition of the concrete. Note the width, length, direction and location of all observed cracks and vegetative growth in the concrete; note the depth, size and location of any spalled areas; note any horizontal deflection or vertical settlement of the walls; and note any location where rust stains, efflorescence or exposed steel rebar is observed.

B. The spillway slab: Walk along the length of the spillway to observe the condition of the concrete slab. Note the size and location of any observed cracks and vegetative growth in the concrete, areas of settlement or heave of the slab and any spalled areas; note the location of any exposed steel rebar and debris or other obstruction on the slab.

The "Maintenance Inspection" checklist included in Appendix B should be copied and completed every time an informal (Maintenance) inspection is performed. Completed forms shall be stored in Appendix A ("Completed Checklists") of this Plan. Informal inspections shall be performed by the Village quarterly. The Village of Fredonia shall direct maintenance operations as necessary after each inspection.

7. OPERATION AND ROUTINE MAINTENANCE

The New York Department of Environmental Conservation Dam Safety Section requires that the dam owner maintain the facility and all appurtenant structures in a safe condition such that the facility will not endanger life, health, safety, or property located above and below the facility. Maintenance is an ongoing process, which should never be neglected during the life of the dam. Consistent inspections and maintenance will prevent minor deficiencies from becoming major hazards.

The listing of maintenance items for the Fredonia Reservoir Dam can be divided into the following four (4) major areas:

1. Embankment Maintenance
2. Outlet Maintenance
3. Spillway Maintenance
4. Miscellaneous Maintenance

Technical guidance for proper corrective actions and remedial measures to be performed to correct any observed deficiencies are provided in Part 4 of this section of the I&M Plan.

There are three (3) general categories of maintenance: immediate maintenance, corrective maintenance, and continuing maintenance. Accordingly, each of the maintenance conditions should be determined during inspections.

"Continuing Maintenance" checklists for the dam are found in Appendix C. Village of Fredonia personnel who perform maintenance on the structure shall use and complete these forms. Completed "Continuing Maintenance" checklists shall be kept in Appendix A of this Plan and copies forwarded to the NYSDEC if requested.

7.1. IMMEDIATE MAINTENANCE

Immediate maintenance issues demand immediate attention, require notification of the Dam Safety Section, and must be performed under the supervision of a New York state licensed professional engineer. Immediate maintenance usually requires construction equipment and professional guidance. The following conditions are examples of immediate maintenance:

a) A severe slope failure.
b) A breach or near breach caused by severe progressive erosion.
c) Overtopping of the crest by upstream or downstream waters.
d) Deterioration of the outlet culvert.
e) Increasing uncontrolled seepage through the embankment.
f) A blocked spillway or outlet channel.

7.2. CORRECTIVE MAINTENANCE

Corrective maintenance should be performed as soon as possible after an inspection and may require a Dam Safety Permit. Examples of corrective maintenance are listed below:

a) Clearing of trees, shrubs and underbrush on the dam embankment, crest, or near the spillway.
b) Filling eroded areas of gullies and seeding to stabilize the area.
c) Repairing or greasing the stem of the outlet gate.
d) Removal of burrowing animals and filling the holes.

Corrective maintenance may be performed by the Village of Fredonia personnel with some technical guidance.

7.3. CONTINUING MAINTENANCE

Continuing maintenance occurs on a regular basis and may be performed during informal (Maintenance) inspections. Continuing maintenance includes:

a) Removing small shrubs or underbrush on the dam embankment.
b) Removing debris from spillways.
c) Filling small, eroded gullies.
d) Filling ruts caused by pedestrian traffic along the crest.
e) Removing accumulated trash and debris.
f) Removal of burrowing animals and their dens from the dam.
g) Fertilizing and over seeding grass areas.
h) Mowing grass areas.
i) Observation of any wet areas, springs or potential seepage in embankments.

Continuing maintenance can be performed by the Inspector or by Village of Fredonia personnel on an ongoing basis.

Some technical guidance for maintenance follows.

7.4. TECHNICAL GUIDANCE

7.4.1. Embankment Maintenance

- Erosion

There are many different causes of surface erosion of an earth dam. Examples include vehicles or maintenance equipment causing ruts on the crest or embankments of the dam, and runoff waters forming erosion gullies on the upstream and downstream slopes. Damage of this nature must be repaired on a continual basis. The size of erosion gullies can increase greatly with slight amounts of rainfall. Early detection of erosion channels can facilitate necessary repairs of refilling, regrading, and revegetation. Minor erosion is easily repaired.

The first consideration is to use new soil that resists erosion. The new soil should not contain vegetation, organic matter, trash, or large rock fragments. In addition, the new soil should be neither too wet nor too dry but should contain enough moisture to enable good compaction. Prior to placing new soil, the repair area must be prepared by removing all unsuitable material such as loose soil, brush, roots, trash, or large rocks. Finally, the new soil should be placed in thin layers, approximately 6 inches, and tamped until firm. In order to prevent future erosion, consideration should be given to protecting the repaired area with erosion resistant rock, riprap, sturdy vegetation erosion control matting or other appropriate material.

- Slides, Sloughs and Heaves

Slides, sloughs, and heaves may be caused by embankment or foundation movement, soil weakening due to water infiltration, locally steep slopes, wave action, or an unusual increase in load on the dam (such as an earthquake, high pool level, rapid lowering of pool level or additional dead weight on the embankment). These conditions can be harmful because they may expose an interior portion of the embankment directly to the elements. These conditions should be brought to the attention of an engineer immediately, if significant, or documented in detail at the next inspection if only minor.

- Vegetation Control

All portions of the dam should be kept clear of unwanted vegetation growth such as trees, bushes, and high brush. Overgrowth can obscure the view of the embankment and prevent a thorough inspection. Weeds can discourage the growth of desirable grasses. Some root systems can decay, providing a conduit for water to pass through and potentially lead to a piping failure. Large trees could be uprooted during a storm and the resulting void left by the root system could lead to breaching of the dam. Root systems can also cause uplift of structures.

Mowing should be performed on a routine basis and overgrowth should be kept under control. Heavy brush and trees should be cut back a minimum of 20 feet from the limits of the embankment and the discharge channel should be kept clear. Light brush should be cut as required.

- Rodent Control

Rodents such as groundhogs, woodchucks, muskrats, and beavers are naturally attracted to ponded water such as reservoirs and detention basins. Animal burrows are easily recognized in the spring because fresh soil is generally found at the mouth of the burrows. Groundhogs or woodchucks usually burrow into the downstream embankment slope forming tunnels and dens inside the dam above the phreatic surface. These passageways not only decrease the stability of the dam, but also could become conduits during flooding periods leading to a breach of the dam. Beavers often build dens along the upstream embankment slope and into the dam. They also have been known to block spillways with their own dams. Constant removal of cuttings placed in spillways is necessary.

If burrows are found, the animals should be removed and the burrow refilled. Burrows can be filled with a slurry mixture of earth (90%) and cement (10%). The burrow entrance should then be covered with well-compacted earth and vegetation reestablished.

- Sinkholes

Sinkholes can be caused by internal or external erosion of material or by rodent activity. Sinkholes are harmful in that they expose an interior portion of the embankment to the elements and may indicate an unstable condition. Sinkholes should be reported immediately if the condition has not been observed previously. Mere backfilling of sinkholes, without adequate investigation into the underlying cause, often masks a serious problem within the dam.

- Seepage

The appearance of seepage on the downstream slope, abutments, or downstream areas during periods of storm flows when there is water stored in the Fredonia Reservoir Dam will be a cause for concern.

The type and quantity of seepage should be studied. If the water is clear, it should be monitored closely for any changes in color and quantity. If the water is muddy or murky, material may be eroding from inside the embankment and a potentially dangerous situation may develop. Uncontrolled seepage through an embankment can cause the movement of fine soil particles, creating internal voids, and may lead to a piping failure. Piping is a serious condition, which can lead to failure of the dam. This can cause a weakening of the soil mass and can result in springs, sand boils, abutment failures, and upstream and downstream slope failure. A piping condition should be evaluated by a professional engineer. These types of problems require immediate attention.

Seepage may at times exit some distance downstream from the dam. Generally speaking, the further seepage exits from the dam, the lower the potential for concern. However, it is important that all areas of seepage related to the dam be monitored for changes.

- Wet or Boggy Areas

Wet areas with no measurable flow can be caused by a developed seepage path reaching an external surface, or ponded rainfall or snowmelt on the surface. Wet areas may indicate an unstable condition if the cause is seepage. The observation must be noted and reported immediately if significant.

- Boils

Boils are caused by seepage existing under pressure and may indicate a serious danger. Boils typically occur in areas downstream of the dam. In boils, material is often being piped and measures must be taken to filter and discharge the seepage in a controlled manner. The cause of the boil and a permanent remedy usually requires the consultation of an engineer.

- Settlement

Settlement is the vertical movement of the ground surface due to consolidation of the underlying soils. Typically, normal settlement decreases with time starting from the time an embankment is constructed. The majority of the total settlement, under normal conditions, will occur during or soon after construction. Continued settlement or an increased rate of settlement, sometime after construction, is an indication of an underlying problem.

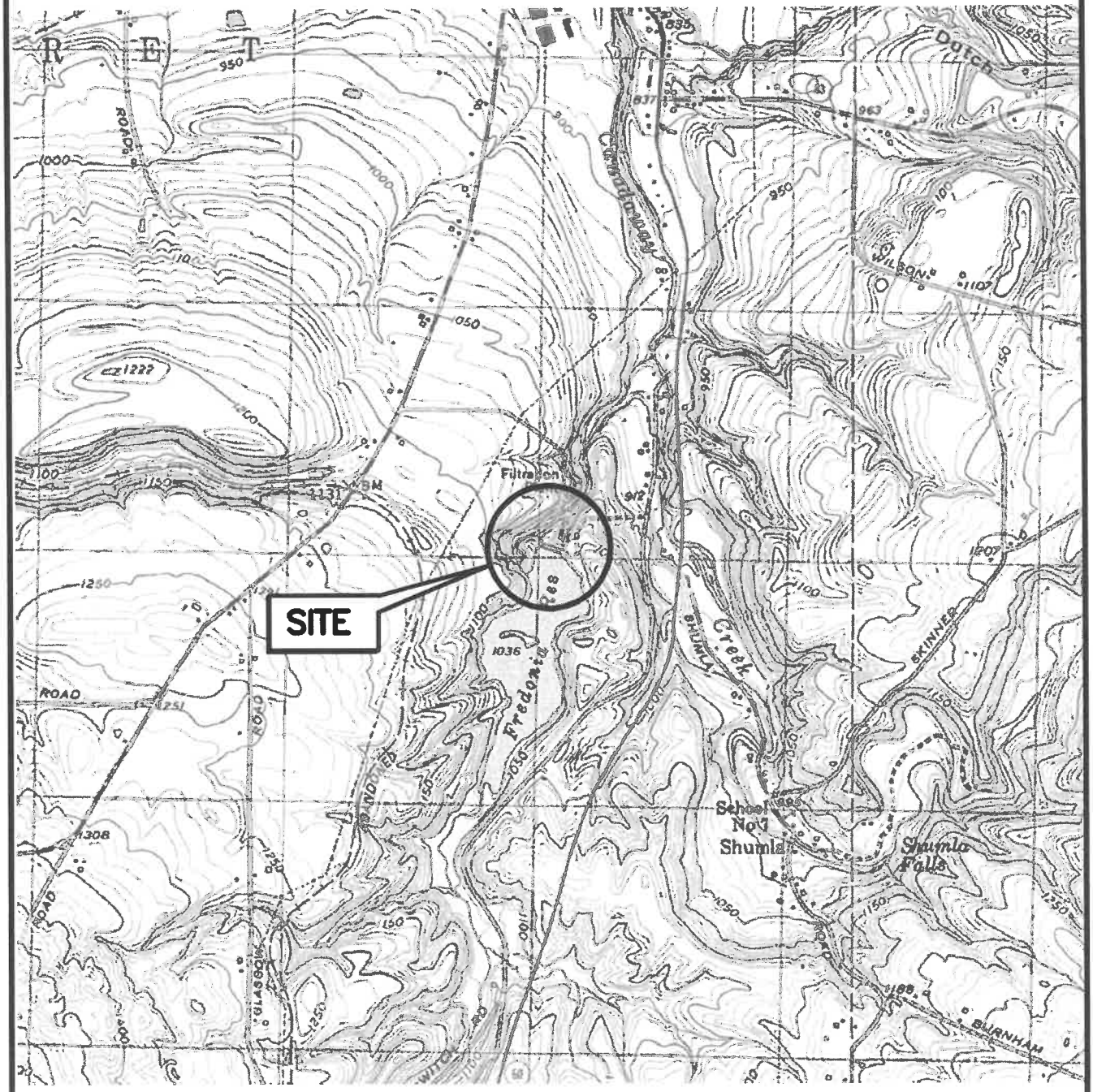
7.4.2. Spillway Maintenance

- Flow Obstruction

The service spillway should be kept clear of any obstructions which could lessen its discharge capacity.

Figures

nsuRE 1



ADAPTED FROM: DUNKIRK, N.Y.U.S.G.S. 7.5 MIN. QUAD

FREDONIA RESEROIR DAM
VILLAGE OF FREDONIA
FREDONIA, NEW YORK
NY Dam File No. 003-1102

QUADRANGLE LOCATION

PROJECT SITE LOCATION MAP

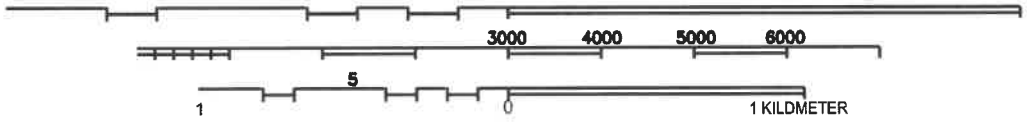


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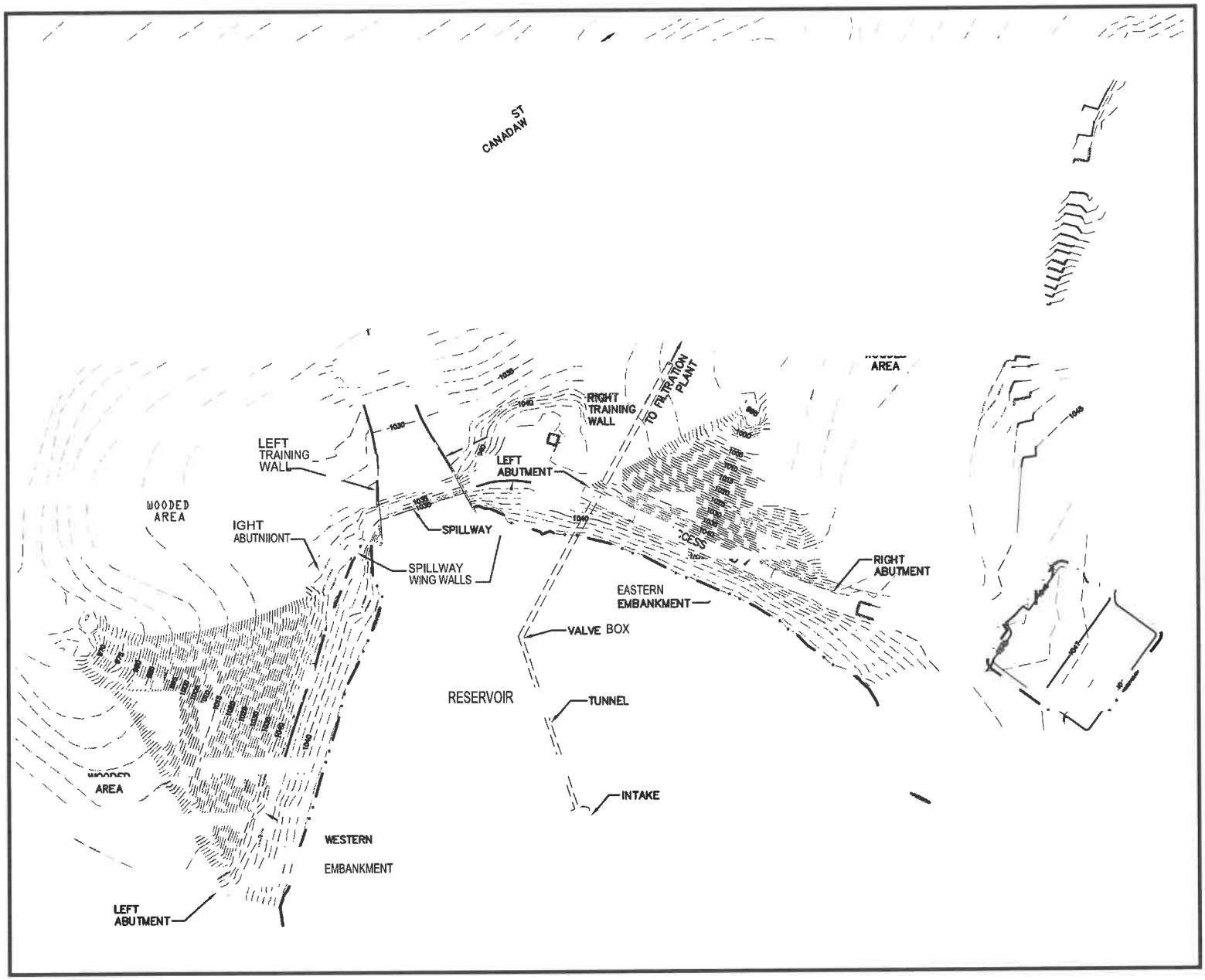
FIGURE 2



VLLAGE OF FREDONIA
FREDONIA RESERVOIR
DAM INSPECI0N AND
MAINTENANCE PLAN
TOWN OF POMFRET
CHAUTAUQUA
COUNTY,
NEW YORK

SITE MAP

80 0 80
1"=80'

1207.42985-F02
JULY 2010

Appendix A

Completed Checklists

Table A.1: Record of Informal Maintenance Inspections
(If used here instead of Table 3.2, cross out Table 3.2)

INSPECTION TYPE	Year/Quarter	PERFORMED BY
Informal – Post Significant Storm Event	As Needed	Village of Fredonia
Informal – Quarterly Maintenance NOTE – Engineering Assessment due this year	2022	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance	2023	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance NOTE – Dam Safety Inspection due this year	2024	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance	2025	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance NOTE – Dam Safety Inspection due this year	2026	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance	2027	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance NOTE – Dam Safety Inspection due this year	2028	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	
Informal – Quarterly Maintenance	2029	Village of Fredonia (Initial Below)
	Q1	
	Q2	
	Q3	
	Q4	

Appendix B

Maintenance Inspection Checklists (Blank)

Inspection & Maintenance Plan for Fredonia Reservoir Dam
Maintenance Inspection Checklist

Dam Name: Fredonia Reservoir Dam				**NY File No.: 003-1102**
Inspection Crew:				**Date:**
Weather:				
Directions: 1. Mark an "X" in yes, no or N/A column and note any unusual condition.				
Observed Item	**Yes**	**No**	**N/A**	**Dimensions, Locations, Comments, Etc.**
Eastern Embankment				
Crest: (Walk along top of embankment from one end to the other)				
a) Observed ruts or holes? (how big?)				
b) Observed settlement?				
c) Observed erosion gullies?				
d) Observed wet areas or seepage?				
e) Observed bare areas?				
f) Trees (how many)?				
g) Excessive vegetation				
h) Animal burrows?				
i) Other conditions?				
Upstream Slope: (start at top and walk up and down slope across entire embankment)				
a) Observed ruts or holes? (how big?)				
b) Observed settlement?				
c) Observed erosion gullies?				
d) Observed wet areas or seepage?				
e) Observed bare areas?				
f) Trees (how many)?				
g) Excessive vegetation?				
h) Animal burrows?				
i) Other conditions?				
Downstream Slope: (start at top and walk up and down slope across entire embankment)				
a) Observed ruts or holes? (how big?)				
b) Observed settlement?				
c) Observed erosion gullies?				
d) Observed wet areas or seepage?				
e) Observed bare areas?				
f) Trees (how many)?				
g) Excessive vegetation?				
h) Animal burrows?				
i) Other conditions?				
Recommendation for Maintenance:				

Inspection & Maintenance Plan for Fredonia Reservoir Dam
Maintenance Inspection Checklist

Dam Name: Fredonia Reservoir Dam				**NY File No.: 003-1102**
Inspection Crew:				**Date:**
Weather:				
Directions: 1. Mark an "X" in yes, no or N/A column and note any unusual condition.				
Observed Item	**Yes**	**No**	**N/A**	**Dimensions, Locations, Comments, Etc.**
Spillway				
Training Walls: (Walk along the length of the spillway)				**S**
a) Observed cracks or spalls? (how big? location?)				
b) Observed settlement or deflection? (how much? location?)				
c) Observed vegetative growth? (location?)				
d) Observed efflorescence or rust stains? (location?)				
e) Observed exposed steel rebar? (location?)				
Spillway Crest and Slab: (Walk along the length of the spillway)				
f) Observed cracks or spalls? (how big? location?)				
g) Observed settlement or deflection? (how much? location?)				
h) Observed vegetative growth? (location?)				
i) Observed efflorescence or rust stains? (location?)				
j) Observed exposed steel rebar? (location?)				
Recommendation for Maintenance:				

Inspection & Maintenance Plan for Fredonia Reservoir Dam
Maintenance Inspection Checklist

Dam Name: Fredonia Reservoir Dam				**NY File No.: 003-1102**
Inspection Crew:				**Date:**
Weather:				
Directions: 1. Mark an "X" in yes, no or N/A column and note any unusual condition.				
Observed Item	**Yes**	**No**	**N/A**	**Dimensions, Locations, Comments, Etc.**
Western Embankment				
Crest: (Walk along top of embankment from one end to the other)				
a) Observed ruts or holes? (how big?)				
b) Observed settlement?				
c) Observed erosion gullies?				
d) Observed wet areas or seepage?				
e) Observed bare areas?				
f) Trees (how many)?				
g) Excessive vegetation				
h) Animal burrows?				
i) Other conditions?				
Upstream Slope: (start at top and walk up and down slope across entire embankment)				
a) Observed ruts or holes? (how big?)				
b) Observed settlement?				
c) Observed erosion gullies?				
d) Observed wet areas or seepage?				
e) Observed bare areas?				
f) Trees (how many)?				
g) Excessive vegetation?				
h) Animal burrows?				
i) Other conditions?				
Downstream Slope: (start at top and walk up and down slope across entire embankment)				
a) Observed ruts or holes? (how big?)				
b) Observed settlement?				
c) Observed erosion gullies?				
d) Observed wet areas or seepage?				
e) Observed bare areas?				
f) Trees (how many)?				
g) Excessive vegetation?				
h) Animal burrows?				
i) Other conditions?				
Recommendation for Maintenance:				

Inspection & Maintenance Plan for Fredonia Reservoir Dam
Maintenance Inspection Checklist

Dam Name: Fredonia Reservoir Dam				**NY File No.: 003-1102**
Inspection Crew:				**Date:**
Weather:				
Directions: 1. Mark an "X" in yes, no or N/A column and note any unusual condition.				
Observed Item	**Yes**	**No**	**N/A**	**Dimensions, Locations, Comments, Etc.**
Additional Recommendation for Maintenance:				
Sketches:				

Appendix C

Continuing Maintenance Checklists (Blank)

Inspection & Maintenance Plan for Fredonia Reservoir Dam
Continuing Maintenance Checklist

Dam Name: Fredonia Reservoir Dam			**NY File No.: 003-1102**
Maintenance Crew:			**Date:**
Weather:			
Directions: 1. Mark an "X" in yes or no column and note any unusual condition.			
Observed Item	**Yes**	**No**	**Dimensions, Locations, Comments, Etc.**
Eastern Embankment			
Crest:			
a) Remove trash			
b) Fill ruts and holes			
c) Vegetation control (mow, remove trees and shrubs, etc.)			
d) Fill and compact animal burrows (remove rodents)			
e) Fertilize and seed grass areas			
Upstream Slope:			
a) Remove trash			
b) Fill ruts and holes			
c) Vegetation control (mow, remove trees and shrubs, etc.)			
d) Fill and compact animal burrows (remove rodents)			
e) Fertilize and seed grass areas			
Downstream Slope:			
a) Remove trash			
b) Fill ruts and holes			
c) Vegetation control (mow, remove trees and shrubs, etc.)			
d) Fill and compact animal burrows (remove rodents)			
e) Fertilize and seed grass areas			
Spillway			
a) Remove trash			
b) Repair cracks in slab			
c) Repair cracks in training walls			
Notes:			

Inspection & Maintenance Plan for Fredonia Reservoir Dam
Continuing Maintenance Checklist

Dam Name: Fredonia Reservoir Dam			**NY File No.: 003-1102**
Maintenance Crew:			**Date:**
Weather:			
Directions: 1. Mark an "X" in yes or no column and note any unusual condition.			
Observed Item	**Yes**	**No**	**Dimensions, Locations, Comments, Etc.**
Western Embankment			
Crest:			
a) Remove trash			
b) Fill ruts and holes			
c) Vegetation control (mow, remove trees and shrubs, etc.)			
d) Fill and compact animal burrows (remove rodents)			
f) Fertilize and seed grass areas			
Upstream Slope:			
a) Remove trash			
b) Fill ruts and holes			
c) Vegetation control (mow, remove trees and shrubs, etc.)			
d) Fill and compact animal burrows (remove rodents)			
g) Fertilize and seed grass areas			
Downstream Slope:			
a) Remove trash			
b) Fill ruts and holes			
c) Vegetation control (mow, remove trees and shrubs, etc.)			
d) Fill and compact animal burrows (remove rodents)			
e) Fertilize and seed grass areas			
Notes:			

Appendix D

NYSDEC Inspection Checklists (Blank)

NAME OF DAM: Fredonia Reservoir Dam **NYSDEC I.D. NO.: 003-1102** **INSPECTION DATE: _____**

DAM INSPECTION CHECKLIST
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DAM SAFETY SECTION

NAME OF DAM: Fredonia Reservoir Dam NYSDEC I.D. NO.: 003-1102

LOCATION: Fredonia (Village) Chautauqua (County)

DEC CLASSIFICATION DATA: Large (Size) C (High) (HAZARD)

PERSONS PRESENT AT INSPECTION

NAME	TITLE / POSITION	REPRESENTING

DATE OF INSPECTION: _____

WEATHER: _____

TEMPERATURE: _____

This is to certify that the above dam has been inspected and the following are the results of this inspection

_____
SIGNATURE OF REGISTERED PROFESSIONAL ENGINEER

NAME OF DAM: Fredonia Reservoir Dam NYSDEC I.D. NO.: 003-1102 INSPECTION DATE: _____

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
EAST EMBANKMENT 1 OF 2						
CREST	1E	SURFACE CRACKING				
	2E	SINKHOLE, ANIMAL BURROW				
	3E	LOW AREA(S)				
	4E	HORIZONTAL ALIGNMENT				
	5E	RUTS AND/OR PUDDLES				
	6E	VEGETATION CONDITION				
	7E					
	8E					
UPSTREAM SLOPE	9E	SLIDE SLOUGH, SCARP				
	10E	SLOPE PROTECTION				
	11E	SINKHOLE, ANIMAL BURROW				
	12E	EMBANKMENT. ABUT. CONTACT				
	13E	EROSION				
	14E	VEGETATION CONDITION				
	15E	RUTS AND/OR PUDDLES				
	16E					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Fredonia Reservoir Dam NYSDEC I.D. NO.: 003-1102 INSPECTION DATE: _____

AREA INSPECTED	EAST EMBANKMENT 2 OF 2			CHECK ( ) ACTION NEEDED		
	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17E	WET AREA(S) (NO FLOW)				
	18E	SEEPAGE				
	19E	SLIDE, SLOUGH, SCARP				
	20E	EMB. ABUT. CONTACT				
	21E	SINKHOLE ANIMAL BURROW				
	22E	EROSION				
	23E	UNUSUAL MOVEMENT				
	24E	VEGETATION CONDITION				
	25E					
	26E					
INSTRUMENTATION	27E	PIEZOMETERS/OBSERV. WELLS				
	28E	STAFF GAUGE AND RECORDER				
	29E	WEIRS				
	30E	SURVEY MONUMENTS				
	31E	DRAINS				
	32E	FREQUENCY OF READINGS				
	33E	LOCATION OF RECORDS				
	34E					
	35E					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE

NAME OF DAM: Fredonia Reservoir Dam NYSDEC I.D. NO.: 003-1102 INSPECTION DATE: _____

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
WEST EMBANKMENT 1 OF 2						
CREST	1W	SURFACE CRACKING				
	2W	SINKHOLE, ANIMAL BURROW				
	3W	LOW AREA(S)				
	4W	HORIZONTAL ALIGNMENT				
	5W	RUTS AND/OR PUDDLES				
	6W	VEGETATION CONDITION				
	7W					
	8W					
UPSTREAM SLOPE	9W	SLIDE SLOUGH, SCARP				
	10W	SLOPE PROTECTION				
	11W	SINKHOLE, ANIMAL BURROW				
	12W	EMBANKMENT. ABUT. CONTACT				
	13W	EROSION				
	14W	VEGETATION CONDITION				
	15W	RUTS AND/OR PUDDLES				
	16W					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Fredonia Reservoir Dam NYSDEC I.D. NO.: 003-1102 INSPECTION DATE: _____

AREA INSPECTED	WEST EMBANKMENT 2 OF 2			CHECK ( ) ACTION NEEDED		
	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17W	WET AREA(S) (NO FLOW)				
	18W	SEEPAGE				
	19W	SLIDE, SLOUGH, SCARP				
	20W	EMB. ABUT. CONTACT				
	21W	SINKHOLE ANIMAL BURROW				
	22W	EROSION				
	23W	UNUSUAL MOVEMENT				
	24W	VEGETATION CONDITION				
	25W					
	26W					
INSTRUMENTATION	27W	PIEZOMETERS/OBSERV. WELLS				
	28W	STAFF GAUGE AND RECORDER				
	29W	WEIRS				
	30W	SURVEY MONUMENTS				
	31W	DRAINS				
	32W	FREQUENCY OF READINGS				
	33W	LOCATION OF RECORDS				
	34W					
	35W					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE

NAME OF DAM: Fredonia Reservoir Dam NYSDEC I.D. NO.: 003-1102 INSPECTION DATE: _____

AREA INSPECTED	DOWNSTREAM AREA AND MISC. 1 OF 1			CHECK ( ) ACTION NEEDED		
	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM AREA	36	ABUTMENT LEAKAGE	None observed			
	37	FOUNDATION SEEPAGE	None observed.			
	38	SLIDE, SLOUGH, SCARP	None observed			
	39	DRAINAGE SYSTEM	Design drawings show 3-foot-thick stone drainage layer within embankment, presence of stone found during subsurface investigation. No discharge pipes to collect intercepted seepage found			
	40					
	41					
	42	DOWNSTREAM HAZARD DESCRIPTION	Suburban development. Park Ridge Hospital is located immediately downstream of embankment			
	43	DATE OF LAST UPDATE OF EMERGENCY PLAN	None, currently under development			
MISCELLANEOUS	44	RESERVOIR SLOPES	N/A			
	45	ACCESS ROADS	Access driveways from Deschel Drive (west) and Ridgeway Avenue (east). Both access roads in good condition			
	46	SECURITY DEVICES	Gate across access road from Deschel Drive, chain link fence and gate along Ridgeway Avenue entrance. Both in good condition			
	47					
	48					
	49					
	50					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE

NAME OF DAM: Fredonia Reservoir Dam NYSDEC I.D. NO.: 003-1102 INSPECTION DATE: _____

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
		SPILLWAYS (MAIN, AUXILIARY AND SIDE CHANNEL) 1 OF 1				
ERODIBLE CHANNEL	51	SLIDE, SLOUGH, SCARP				
	52	EROSION				
	53	VEGETATION CONDITION				
	54	DEBRIS				
	55					
	56					
NON-ERODIBLE CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63	LOW FLOW RELEASE				
	64					
DROP INLET	65	INTAKE STRUCTURE				
	66	TRASHRACK				
	67	STILLING BASIN				
	68	OUTLET STRUCTURE				

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE

NAME OF DAM: Fredonia Reservoir Dam NYSDEC I.D. NO.: 003-1102 INSPECTION DATE: _____

AREA INSPECTED	OUTLET WORKS 1 OF 1			CHECK ( ) ACTION NEEDED		
	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE				
	71	TRASHRACK				
	72	STILLING BASIN				
	73	PRIMARY CLOSURE				
	74	SECONDARY CLOSURE				
	75	CONTROL MECHANISM				
	76	OUTLET PIPE				
	77	OUTLET TOWER				
	78	EROSION ALONG DAM TOE				
	79	SEEPAGE				
	80	UNUSUAL MOVEMENT				

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE

Appendix E

Miscellaneous Correspondence