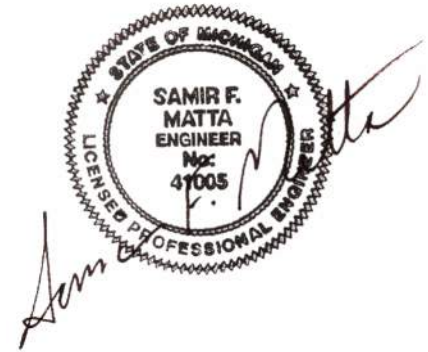


SAFETY INSPECTION REPORT OF LAKE GENEVA DAM ID #617

LAKE GENEVA ASSOCIATION
1114 E. Geneva Drive, City of DeWitt
Clinton County, Michigan
A Significant Hazard Dam

1/22/2021



Lockwood, Andrews
& Newnam, Inc.
A LEO A DALY COMPANY

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NOTE:

The purpose of this inspection is to comply with Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended and associated administrative rules.

This inspection was limited to a visual evaluation, review of previous reports and studies, any figures, construction documents and as constructed plans, when available. The intent of this report is to provide information regarding deficiencies/issues within the structure and to highlight potential elements of concern and not to be used as an in-depth analysis of the structure.

CONCLUSIONS AND RECOMMENDATIONS

Lake Geneva Dam, ID #617, is located in the City of DeWitt, Clinton County, Michigan and is rated as a significant hazard structure. The normal head is about 12 feet and the height of the structure as defined by the Dam Safety Act is 14.4 feet. Overall, the Lake Geneva Dam is in good condition except as noted below. The dam appears to be stable and has the capacity to safely pass the 0.5% chance flood event. Following is a list of recommendations for eliminating deficiencies and bringing the dam into compliance with the Dam Safety Act.

1. Redistribute the riprap in front of the discharge pipe along the downstream end so the full capacity of the pipe is available, and it is readily visible and accessible.



2. Maintain the entire face of the dam free of vegetated growth as to retain good visibility and eliminate the potential of becoming a refuge for animals. Maintain the rip rap as a proper protection of the dam face from wave actions and possible erosion.

3. Preserve the area around the pump enclosure and discharge outlet along the west end of the dam clear and open so they are readily visible and accessible at least from the dam side. (east side)



4. The concrete spalling and cracks

along the south west corner of the outlet structure seem to be worsening. It is recommended that loose and cracked concrete be removed and repairs be made when feasible.



5. There was evidence of some mole activities along the top of the dam that need to be monitored and mitigated so it is not a potential hazard.
6. Establish a regular inspection schedule to check for obvious damage or deficiencies related to the above-mentioned elements.



7. Using on the previously installed stainless steel eyelids, it seems that the structure has settled very slightly since the last inspection. The CMP structure and pipe do not seem to have been affected or show any damage with respect to each other but there is still no knowledge of the condition of the outlet pipe. It is recommended that if the system have been televised that a qualified professional review the footage as to assess the viability of the outlet pipe.



8. Communicate with property owners immediately downstream of the dam the need to alert the Contact Personnel from the Lake Association about any unusual or excessive flows in the stream leading to the river.

Some of the above items are not immediately critical to the stability of the dam. However, Item #1, 4 & 5 should be reviewed and rectified when the weather warms up. The other recommendations could be monitored regularly, and appropriate actions taken if needed as part of recommendation #6 (Regular Inspection Schedule).

PROJECT INFORMATION

Lake Geneva Dam is located in Section 8, City of DeWitt, Clinton County, Michigan. The dam impounds approximately 60 acres and discharges to an unnamed tributary of the Looking Glass River. The structure is designated as significant hazard. It is believed that the dam was constructed in the early 1960's as a recreational amenity for a residential development.

No drawings or design information is on file with the Michigan Department of Environment, Great Lakes and Energy (EGLE), or the owner. Six previous dam safety inspections were prepared by Mr. Leon Cook, P.E. in 1994, Advantage Civil Engineering, Inc. in January 1999 and Wilcox Professional Services, in 2003, 2007 & 2011 and LAN in 2015. These reports should be on file with EGLE.

The dam consists of an outlet control structure and approximately 125 feet of earthen embankment. Level is controlled by a 5' long vertical 36" bituminous coated corrugated metal pipe that is encased in concrete. The concrete encasement forms a 4' x4' square structure. There is a notch formed in the concrete that appears to be constructed for the purpose of stop planks, however, the pipe was never removed to allow flow of water. The outlet pipe is a 21-inch bituminous coated corrugated metal pipe. The 21-inch pipe discharges to the unnamed tributary. There are no drawdown facilities, gates or stop planks.



Inspection of the outlet pipe and the internal of the structure show no obvious signs of settlement or leakage which is a positive sign.

The earthen embankment is approximately 125 feet in length. The crown varies from 16 to 18 feet wide and the upstream and downstream slopes are generally 2 horizontal to 1 vertical and 4 horizontal to 1 vertical respectively.



Lake level is augmented by two wells adjacent to the lake. One well is located along the northwestern corner of the lake and one within the confines of Lake Geneva Park-west. Normal level is difficult to maintain due to evaporation and seepage losses through the embankment and surrounding shoreline, therefore, pumping by the two wells is needed during the summer season to maintain the lake at the desired level.

FIELD INSPECTION

All references in this report to “left” or “right” are based on looking downstream. The benchmark elevation of 100.0 was assumed, as the southwest corner of the concrete outlet control structure, for the purpose of identifying pertinent topographic features of the dam and related appurtenances. No survey work was conducted by LAN for this report; however, field measurements were taken to confirm certain features on site.



The lake level on December 12, 2020, the date of our inspection, was 31” below the defined benchmark noted above or 97.416’ with no flow passing through the structure. This roughly indicates that the water level is 5’2” below the top of the dam as shown in the picture to the left. The downstream invert of the receiving channel was assumed to be the same or 86.5 producing a normal head of 10.917 feet. It was also noted during our inspection that both augmentation wells that supplement the lake level were off.

As discussed earlier, the outlet control structure consists of a 36-inch bituminous coated corrugated metal pipe (CMP) encased in a 4’x4’ concrete headwall structure. The concrete is in fair condition except for the southwest corner and south side of the structure. Some minor spalling seems to have opened up since the last inspection which will need to be repaired. Loose and

fractured concrete should be removed and cleaned out before new epoxied concrete is used to stabilize the repair areas. However, there is no significant indication of structural instability. If work cannot be completed in timely fashion, the structure should be inspected on a regular basis after each freeze and thaw cycle to ensure that no concrete spalling or further deterioration has taken place.

In order to establish a base layout of the structure, a digital level was used to record the differential slope between all the corners of the structure using the concrete structure with the metal grate. It was confirmed that the southwest corner is about 6-7” higher than the northeast corner of the structure. Two stainless steel eyelids were installed during the previous inspection along the north end of the structure at an elevation that is similar to the elevation of the southwest corner in order to establish a level surface. The measurements taken during this inspection show a slight settlement in the northeast corner.



These controls will continue to be used during future monitoring to assess potential settlements if any. Further monitoring should be performed between inspections.

The 36-inch diameter CMP is in good condition. Where exposed, the bituminous coating has mostly worn away; however, the pipe shows only minor signs of corrosion and is in good condition. The outlet control pipe is a 21-inch bituminous coated CMP and is in good condition. The bituminous coating on this pipe is also worn away where exposed. Leaves and sediments in front of the outlet pipe on the downstream end should be cleaned from the pipe, so the pipe outlet is fully available.



On the right side of the upstream embankment, a homeowner has constructed a wooden deck and wooden seawall in front of the structure. These features obscure the observation of the embankment and could hinder access to the control structure for future maintenance projects but are of no immediate concern. Stone riprap adjacent to the wooden seawall seems to extend left along the majority of the embankment. The bank new stone and riprap addition to the embankment seems to be stable but vegetation needs to be monitored cleaned out as needed in between inspections. Upstream slope was about 2 horizontal to 1 vertical.

The crown varies in width from 16 to 18 feet wide and is grass covered. In general, the crown is in good condition with no indications of settlement, slumping or cracking. However, there is evidence of some mole activities along the top surface that needs to be monitored and addressed before it becomes more severe.

The downstream bank has been cleaned and maintained since our last inspection and seems to be in good shape. The downstream slope was 4 horizontal to 1 vertical for the first 18 feet, then 2.5 horizontal to 1 vertical for the remainder to the toe in the vicinity of the outlet pipe. There were no indications of seepage or erosion at the toe of the slope but riprap stones need to be removed/lowered in front of the outlet pipe so it is exposed and can be fully useable when needed. The receiving channel appeared adequate to accept normal discharge from the dam.



STRUCTURAL STABILITY

There was no evidence of structural instability during the field inspection. As mentioned previously, there is some concern about potential settlement of the concrete structure. The stone and riprap along the bank seem to be holding nicely.

No stability calculations were performed or reviewed as part of this inspection report.

HYDROLOGY AND HYDRAULICS

Lake Geneva Dam is classified as a significant hazard potential structure. In accordance with Part 315, Dam Safety, Natural Resources and Environmental Protection Act, PA 451, of 1994, as amended, this type of structure needs to be able to safely pass a 0.5% chance (200-year) frequency flood event. Flood discharge values were provided by the Hydrologic Studies and Dam Safety Unit of the Michigan Department of Environment, Great Lakes and Energy (EGLE), Water Management Division. A copy of the e-mail response with the estimated values for the structure is contained in appendix B. The watershed area for this structure is estimated to be 0.6 square miles. The 0.5% chance peak inflow is 320 cfs with a flood volume of 96 acre-feet.

The normal lake level for Lake Geneva is assumed to be elevation 99.4 or 6" to 8" below the outlet structure elevation according to Lake Geneva Association personnel. According to Advantage Civil Engineering, Inc., a topographic map provided by the Clinton County Drain Commissioner showed the digitized lake area to be 60 acres at the normal lake elevation. The area of the 103 contour was also digitized by them to be 70 acres. Based on this information, they concluded that the 0.5% chance peak flood elevation is 101.00 assuming no discharge. The low point in the embankment was measured to be 102.5. This provides for 1.5 feet of freeboard which is adequate for this type of structure.

It should be noted that this estimate is conservative considering that no discharge was assumed and that the lake is normally lower than elevation 99.4, due to evaporation and seepage losses.

OPERATION AND MAINTENANCE

Operation and maintenance of the Lake Geneva Dam is the responsibility of the Lake Geneva Association. The primary operational item is inspecting the dam and appurtenances to make sure that they are functioning properly.

Following is a list of items that should be checked periodically and corrected as necessary.

- Remove all burrowing animals from the dam embankment. Burrowing animals can decimate the structural stability of embankments.
- Maintain a vigorous growth of grass on the embankment. Mowing the embankments is a good idea as it will help to reduce the potential for burrowing animals and problems associated with trees and brush.
- Keep all trees and brush from getting established along the embankment.
- Keep the outlet structure, pipe and receiving channel clear of debris.

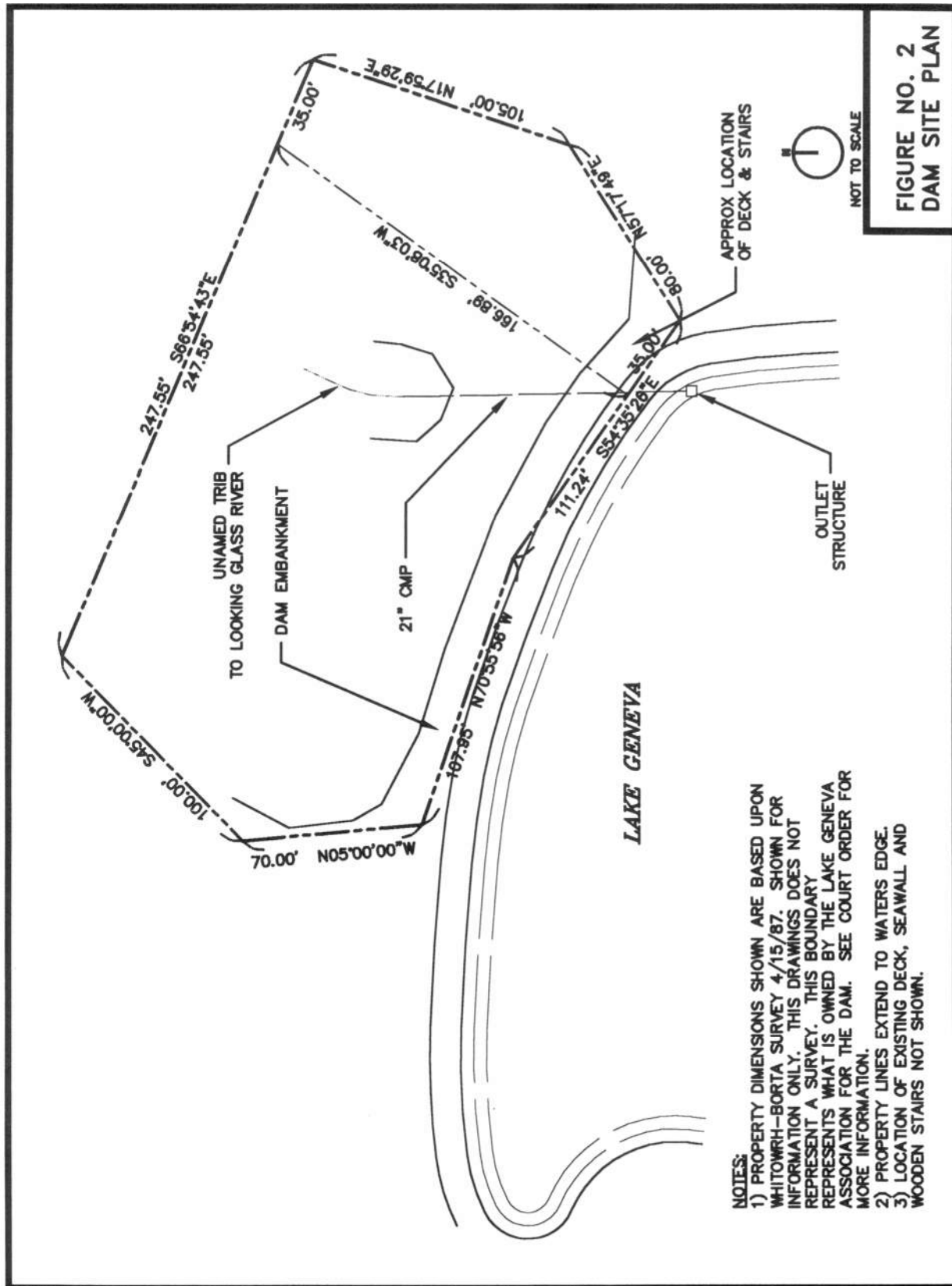
-
- Inspect the outlet structure after each freeze/thaw cycle to ensure no concrete spalling has taken place.
 - Review the stability of the outlet structure as to assure no settlements or damage to the pipe outlet within the structure.

EMERGENCY ACTION PLAN

Lake Geneva Dam is rated as a significant hazard potential dam. Under provisions of the dam safety act, an emergency action plan (EAP) is required. The EAP has been updated and is included in this report as Appendix D. A copy will be forwarded by the Association to the Clinton County Emergency Coordinator and to EGLE for their file.

APPENDIX A

Figures



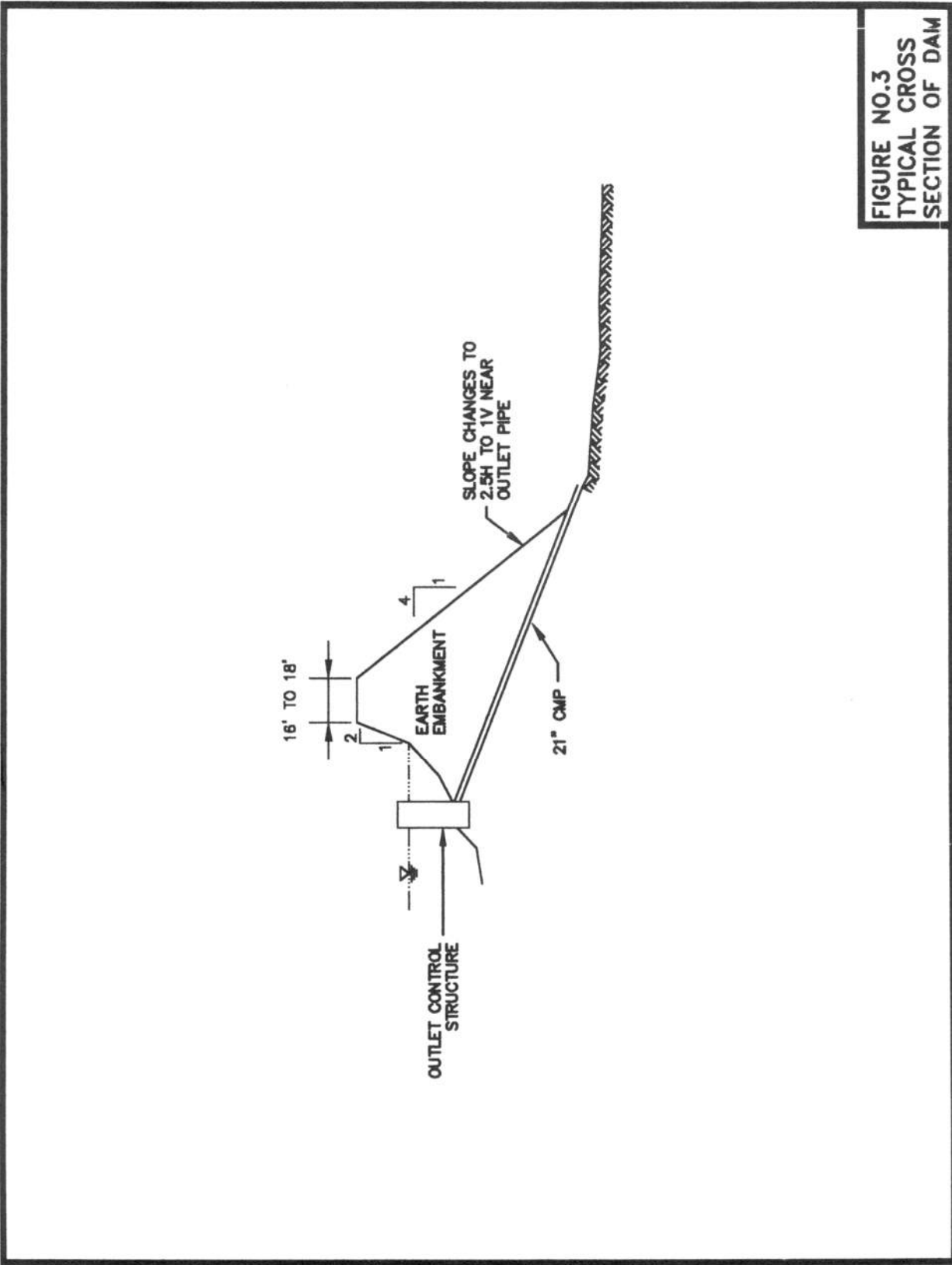
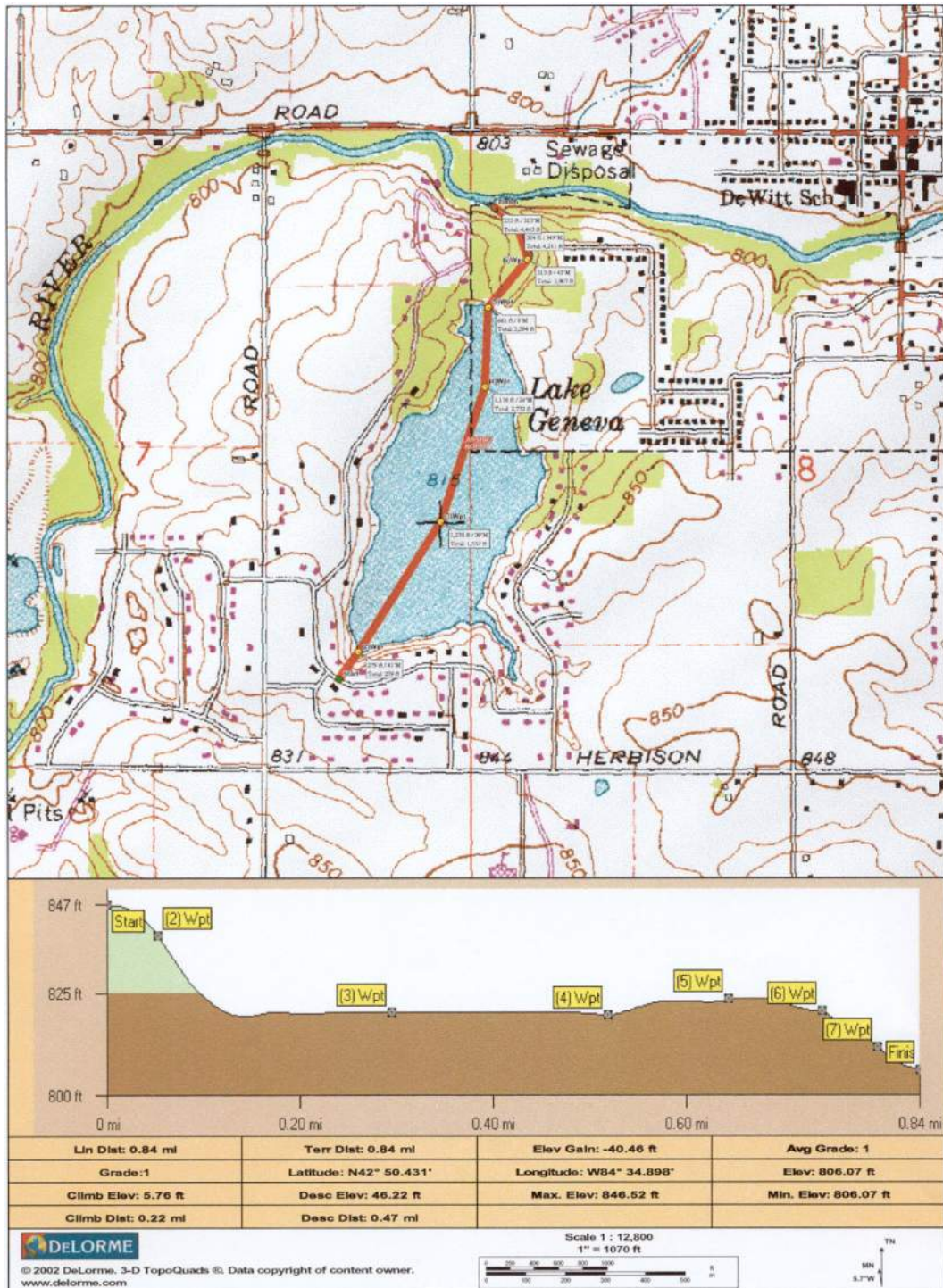


Figure No. 4: Area Topography



APPENDIX B

MDEQ Flood Discharge Correspondence

From: deq-wrd-qreq <deq-wrd-qreq@michigan.gov>
Sent: Tuesday, November 24, 2015 4:03 PM
To: Matta, Samir
Subject: RE: flood or low flow discharge request (ContentID - 168812)

This reply is being sent via email only.

We have estimated the flood frequency discharges requested in your email of November 11, 2015 (Process No. 20150557), as follows:

Tributary to Looking Glass River at Lake Geneva Dam, Dam ID 617, Section 8, T5N, R2W, DeWitt Township, Clinton County, has a drainage area of 0.6 square miles. The design discharge for this dam is the 0.5% chance (200-year) flood. The 0.5% chance peak flow is estimated to be 320 cubic feet per second. The 0.5% chance flood volume is estimated to be 96 acre-feet. (Watershed Basin No. 14B Looking Glass).

Please include a copy of this letter with your inspection report or any subsequent application for permit. These estimates should be confirmed by our office if an application is not submitted within one year. If you have any questions concerning the discharge estimates, please contact Ms. Susan Greiner, Hydrologic Studies and Dam Safety Unit, at 517-284-5579, or by email at: GreinerS@michigan.gov. If you have any questions concerning the hydraulics or the requirements for the dam safety inspection report, please contact Mr. Luke Trumble of our Dam Safety Program at 517-420-8923, or by email at: TrumbleL@michigan.gov.

Low flows will be provided in a separate email.

From: deq-wrd-qreq <deq-wrd-qreq@michigan.gov>
Sent: Wednesday, November 11, 2016 2:51 PM
To: Samir Matta
Subject: flood or low flow discharge request (ContentID - 168812)

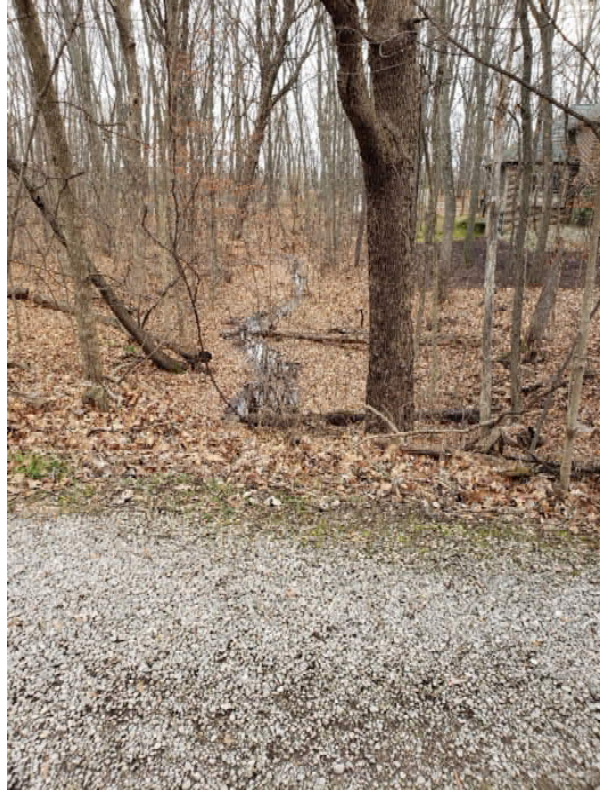
This message has been automatically generated. Thank you for your discharge request. If any information in the confirmation e-mail is in error, please forward the entire email, with corrections, to DEQ-WRD-QREQ@michigan.gov, leaving the subject line intact. If you do not receive a confirmation e-mail, we did not receive your e-mail requesting discharge information. Please forward your discharge request information directly to DEQ-WRD-QREQ@michigan.gov. The requested discharges will be sent to you via e-mail. Discharge requests are normally processed within 30 days. Please do not call to check on the status of your request if it has been less than 30 days. If you do not hear from us within this time frame, please call Ms. Susan Greiner at 517-284-5579.

Requestor: Samir Matta
Company: Lockwood, Andrews and Newnam, Inc.
Address: 2121 University Park Drive, Suite 100

City: Okemos, MI
Zip: 48864
Phone: 517-819-2367
Date: 11-11-15
F0.5percent: Yes
FlowExceedanceCurve: Yes
ContactAgency: Other
ContactPerson:
Watercourse: Unnamed tributary to the Looking Glass River, Outlet of Lake Geneva Dam, Dam ID 617
LocalName:
CountyLocation: Clinton
CityorTownship: Dewitt
Section: 8
Town: 5N
Range: 2W
Location: Outlet of Lake Geneva Dam, Dam ID 617
FFR1: Dam

APPENDIX C

Photographs











APPENDIX D

Emergency Action Plan

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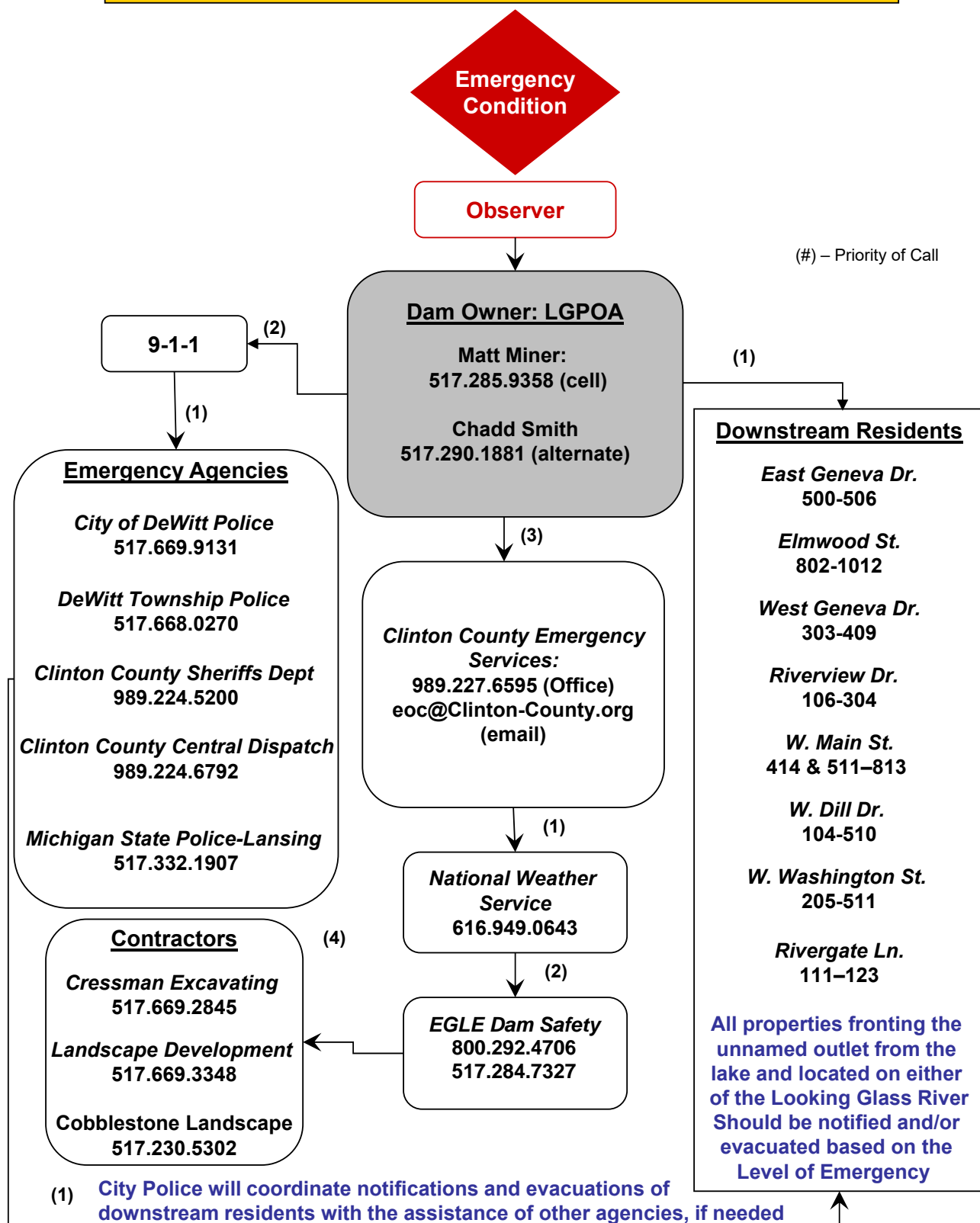
EMERGENCY TERMINATION

APPENDIX A

Lake Geneva & Surroundings

NOTE: LAN's update of this Emergency Plan was limited to the verification of contacts and emergency phone numbers and to elements associated with the accuracy of information related to physical features only. No hydraulic evaluation or analysis was performed to verify the accuracy of the information presented by Advantage Civil Engineering, Inc.

Lake Geneva Dam Notification Flowchart



INTRODUCTION

PURPOSE

The purpose of this Emergency Action Plan (EAP) is to safeguard lives and reduce damage to the property of the citizens of Clinton County, who live along the Looking Glass River, in the event of failure of Lake Geneva Dam or flooding caused by large flow releases from the dam. This EAP was developed by Advantage Civil Engineering, Inc. in 1999 and was updated by Wilcox Professional Services, LLC in 2003, 2007 and 2011 and LAN in 2015.

DESCRIPTION OF DAM

Lake Geneva Dam is located in Section 8, City of DeWitt, Clinton County, Michigan. The dam impounds approximately 60 acres and discharges to an unnamed tributary of the Looking Glass River. The structure is designated as significant hazard. It is believed that the dam was constructed in the early 1960's as a recreational amenity for residential development. The dam consists of an outlet control structure and approximately 125 feet of earthen embankment. Level is controlled by a vertical 36" corrugated metal pipe that is encased in concrete. The concrete encasement forms a 4' x4' square structure. The outlet pipe is a 21-inch corrugated metal pipe. The 21-inch pipe discharges to the unnamed tributary. The structural height of the dam as measured from the top of the embankment to the invert of the receiving stream is roughly 16 feet. The normal head is about 12 to 13 feet and the height of the dam as defined by the Dam Safety Act is 14.4 feet.

HAZARD AREA

The flood inundation map, developed by Advantage Civil Engineering, Inc., that illustrates the area of potential flooding during a "wet weather" failure is contained in appendix A. A "sunny day" failure would most likely be less severe once it reached the Looking Glass River. This inundation map was based upon limited calculations and analyses by Advantage and should be used as a guideline and not as a definitive boundary for potential flooding. The height of the flood wave near the unnamed tributary to the Looking Glass River was based upon the 4/9 rule which approximates the flood wave to be 4/9 of the structural height of the dam. The flood wave for Lake Geneva was estimated to be about 8 feet. The peak discharge from a dam break is estimated to be 700 cubic feet per second (cfs). For comparison purposes, the 100-year discharge of the Looking Glass River in the vicinity of Lake Geneva is 2,865 cfs.

In general, a failure of the dam could have a significant impact on the Looking Glass river floodplain, both upstream and downstream. Lake Geneva is located within the City of DeWitt and could impact residents of the City as well as DeWitt Township. If a dam break occurred during the 100-year peak flow in the Looking Glass River, the additional flow would essentially equate to a 500-year flood event.

It should be pointed out that tributary drainage area for Lake Geneva is 0.6 square miles while the tributary drainage area for the Looking Glass River in the vicinity of Lake Geneva is 234 square miles. It is not likely that a failure of the Lake Geneva Dam would occur at the same time as a large flood event on the Looking Glass River. Also, the flows from a dam failure would have

a tendency to attenuate once it reached the Looking Glass River. Therefore, the flood inundation area illustrated on the included map is similar to a 100-year floodplain.

RESPONSIBILITIES

The Lake Geneva Association (the Association) is responsible for all operation and maintenance activities associated with the dam. In addition, the Association is responsible for implementing this emergency plan as well as keeping the plan updated and current.

COORDINATION

Emergency action is a coordinated effort between the Lake Geneva Association and the appropriate state, county and local agencies. In the event that an emergency situation develops, the Association will contact the Clinton County Central Dispatch Center by dialing 911. The initial emergency coordination will be handled by the 911 dispatcher. When identifying an emergency situation, the Association should follow the following format:

Alert: Failure and/or flooding is not imminent, but a more serious condition could develop.

Warning: Failure and/or flooding is imminent.

The Association will be responsible for coordination and management of on-site activities, such as preventative actions discussed later in this plan.

EVACUATION

The City of DeWitt Police Department will be responsible for coordinating evacuation.

RECORDS

The Association is responsible for keeping a data base of available records concerning the dam. The records should include but are not limited to: design drawings; past inspection reports; and updated copies of the emergency action plan.

EMERGENCY CONDITIONS

Emergency conditions can develop at a dam at any time and usually when you least expect it. In general, dam failure can be classified as either “wet weather” or “sunny day” failures. Following is a brief description of these types of failure mechanisms.

WET WEATHER FAILURE

Wet weather failures normally occur during a large flood event. A large flood event can develop due to excessive runoff caused by large precipitation events, snow melt and/or the combination of rain and snow melt. Recent evaluations of the Lake Geneva Dam indicate that it has adequate spillway capacity to pass the 0.5% chance (200-year) flood event, however, if the spillway or discharge pipe were to become clogged during a large flood event, it is possible that the embankment could be overtopped which may lead to catastrophic failure of the dam. Furthermore, heavy precipitation or snow melt can cause a rapid rise in reservoir level which causes an increase in internal pressures in the embankment. This can lead to internal erosion (piping) of the embankment or sudden shifting or settlement of the embankment.

SUNNY DAY FAILURE

Sunny Day failures occur during a period of little or no precipitation or snow melt. Sunny day failures can be caused by internal piping of the embankment, earthquakes, vandalism or plugging of the outlet with debris. Wave action from wind or boats as well as burrowing animals can have an effect on the structural stability of the embankment.

Either “wet weather” or “sunny day” failures can lead to slow or rapid failures. Association members should make periodic inspections of the dam, especially during and after large flood events to check for potential problems.

EMERGENCY ACTIONS

Once an emergency situation has been identified, the Lake Geneva Association should begin the notification process immediately as indicated on the Emergency Action Telephone List contained within this document.

NOTIFICATION

The notification process should begin with calling 911 and alerting the dispatcher to the current status of the emergency. After 911 contact, the Association should evaluate the seriousness of the emergency. If the situation warrants, a contractor should be contacted to assist in stopping or mitigating the failure. EGLE Dam Safety personnel should be contacted and consulted with in making the determinations of the emergency.

PREVENTATIVE ACTIONS

Depending on the type of failure and the degree to which it has progressed, it may be possible to perform preventative measures to stop or slow the progress of the failure. This normally requires the assistance of a contractor that has sufficient equipment and access to materials. The association should keep an updated list of several different contractors that could be available during an emergency situation.

Possible preventative actions include:

- Placing sandbags to temporarily increase freeboard
- Installing additional culverts to provide additional hydraulic capacity
- Installing steel sheet piling to serve as a temporary cut-off wall
- Placing additional fill where needed
- A controlled breach of the embankment section

EVACUATION

As indicated above, the City of DeWitt Police Department is responsible for coordinating evacuation efforts as necessary. An inundation map that illustrates the area of potential flooding should be used as a general guideline for performing the evacuations.

EMERGENCY TERMINATION

The Lake Geneva Association is responsible for determining the end of an emergency situation. However, the Association is encouraged to consult with EGLE and the Clinton County Emergency Coordinator before terminating the emergency.

DISASTER RESPONSE

The City of DeWitt Police Department, in consultation with the Clinton County Emergency Management Coordinator, will evaluate a proper timetable for the termination of both the evacuation and the disaster response activities.

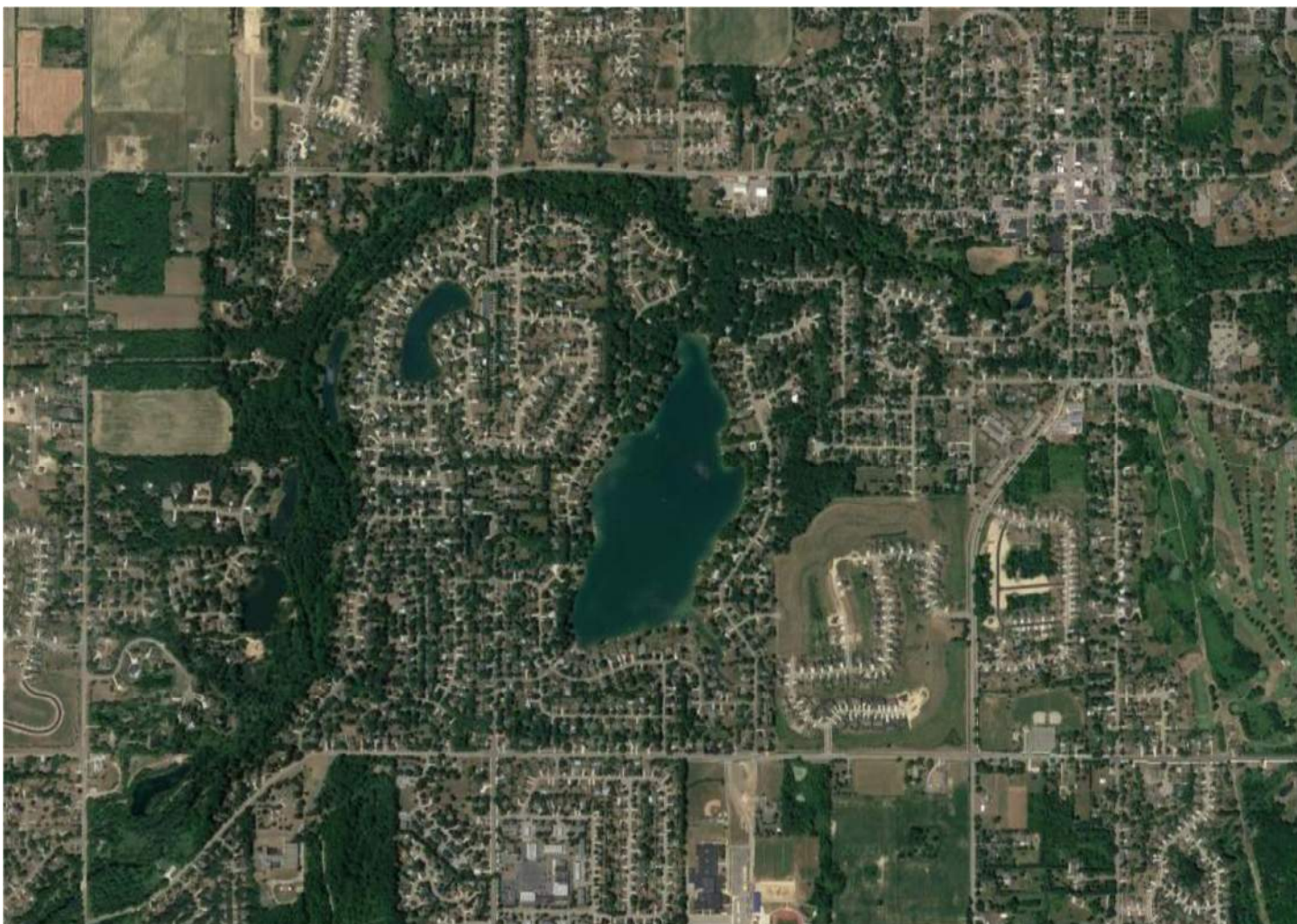
CRITIQUE AND AFTER-ACTION REPORT

Should an emergency situation occur, a critique should be conducted including all participants and interested parties, with the results being used to revise and improve the emergency plan.

APPENDIX A

Lake Geneva & Surroundings





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Milpitas
Orange
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