LAKE DETURK DAM
2014 DAM SAFETY INSPECTION REPORT

LAKE DETURK CONSERVANCY DISTRICT
P.O. BOX 1149
Martinsville, IN 46151

PREPARED BY

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Inspection Date: May 13, 2014

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Disclaimer

This report was prepared by Christopher B. Burke Engineering, LLC (CBBEL) for the Lake DeTurk Conservancy District for Lake DeTurk Dam using available data and observed conditions. CBBEL is not responsible for any conditions that could not be inspected during the field examination due to excessive vegetation, inundation, or other visual obstructions.

Information describing possible solutions to problems and concerns, repairs, and emergency actions are intended for guidance only. The dam owner should obtain detailed design plans and specifications from a qualified professional engineer experienced in dam design and construction before performing any repairs or modifications to the dam or its appurtenant works. Only qualified contractors should be employed to install necessary measures.

Permits from state or local agencies may be required to perform dam remedial work or repairs, depending on the magnitude of the repairs. The dam owner should seek professional assistance in determining the need for permits.

Executive Summary

Lake DeTurk Dam is located approximately 2 miles northeast of Martinsville in Morgan County, Indiana in Sections 27 and 34, Township 12N, Range 1E on the Martinsville USGS Quadrangle Map. The dam is an earthen embankment constructed across a tributary to Grassy Fork Creek and has a high hazard classification. The dam is owned by the Lake DeTurk Conservancy District (District).

The embankment is approximately 32 feet high and 590 feet long. Grassyfork Lane is located along the crest and has an average width of 30 feet. The 36-acre lake collects runoff from an approximately 0.6 square mile watershed. The principal spillway is located on the right side of the dam and consists of a drop structure connecting two culvert segments. For purposes of reference, left and right are based on a view looking downstream. The upstream segment is a 30-inch diameter steel pipe with a concrete headwall that outlets into the drop manhole. The downstream segment is located at the base of the drop manhole and is a 48-inch corrugated metal pipe (CMP) with a concrete hood. The emergency spillway is a 50-foot wide open trapezoidal channel with 3H:1V side slopes. The inlet to the emergency spillway consists of five 18-inch CMP pipes located below Grassyfork Lane. There are three existing pipes that can release water from Lake DeTurk. The first is a 6-inch steel pipe that is located near the center of the dam. The second is an 8-inch steel pipe that is located just north of the principal spillway. Both are used as water supply lines for Ozark Fisheries, located immediately downstream of the dam. The third is a 30-inch steel pipe located directly below the principal spillway and is used as a lake drawdown. All three pipes are controlled by valves accessible on the downstream side of the embankment.

Prior to the construction of the Lake DeTurk Dam in its current state, Grassyfork Fisheries maintained an embankment in the same location that was 10 to 15 feet in height. In 1971, final design plans were prepared by David H. Harker, Civil Engineer, for the dam. The dam was constructed sometime thereafter without approval from the Indiana Natural Resources Commission, now the Indiana Department of Natural Resources (IDNR) Division of Water. In 1978, Division of Water informed Grassyfork Fisheries that the dam was in violation of Indiana State law. The following year, Grassyfork Fisheries applied for an after-the-fact Construction in a Floodway Permit. A Certificate of Approval of Construction in a Floodway was issued August 30, 1985 under Docket D-6132.

Until February 2014, Lake DeTurk Dam was classified as a low hazard dam. In January 2013, Christopher B. Burke Engineering, LLC (CBBEL) assisted the District with the preparation of a District Plan. As part of that document, CBBEL completed a hazard classification assessment to determine the hazard level as well as a Preliminary Engineering Report for the rehabilitation of Lake DeTurk Dam. The assessment indicated that the dam should likely be considered high hazard due to the potential loss of life downstream. As a result, the Preliminary Engineering Report analyzed various alternatives for rehabilitating the dam and increasing the spillway capacity to bring it into compliance with IDNR standards for high hazard dams.

CBBEL performed a visual dam safety inspection of Lake DeTurk Dam on May 13, 2014. CBBEL's office is located at 115 W. Washington Street, Suite 1368 South, Indianapolis, Indiana. The inspection was performed by Brian W. McKenna, P.E., Aaron J. Fricke, P.E., and Jeffrey D. Fox, P.E., all three of which have specialized experience in dam design, construction, and inspection. The District was represented during the inspection by Gary Flock, Anna Radue, and Roger Radue.

The May 13, 2014 dam safety inspection revealed that the overall condition of the dam is considered to be **"Conditionally Poor"** based on IDNR rating criteria. This rating reflects the presence of erosion on both the upstream and downstream slopes, concrete deterioration on the principal spillway's inlet headwall and outlet hood, general loss of capacity in all five emergency spillway culverts, and overall lack of spillway system capacity. The dam has received a conditionally poor rating since December 13, 2001 and does not appear to have addressed any recommendations from recent inspections other than routine maintenance. The dam appears to be a stable structure with no obvious deficiencies that would cause concerns for immediate embankment failure. The risk of dam failure is considered to be medium due to inadequate spillway capacity.

Appendix 1 contains the IDNR Dam Inspection Report Form completed by CBBEL for the 2014 safety inspection. This form will be submitted to IDNR along with this report.
In summary, the following repair, maintenance, and monitoring tasks are required to achieve an overall **"Satisfactory"** rating:

Required Repair/Maintenance/Monitoring	Schedule
Clear trees and brush from the right abutment on the upstream slope	Immediately/Ongoing
Clear trees and brush from the right abutment on the downstream slope	Immediately/Ongoing
Clear trees and brush from the left abutment on the downstream slope	Immediately/Ongoing
Clear trees and brush from the outlet of the principal spillway	Immediately/Ongoing
Backfill animal burrows as seen on the upstream slope	Immediately/Ongoing
Remove silt and debris from emergency spillway inlet culverts	Immediately/Ongoing
Monitor depression above the lake drain near the center of the dam	Immediately/Ongoing
Monitor the downstream toe of slope for indications of seepage	Immediately/Ongoing
Place riprap along upstream slope for erosion protection	Within 2 years
Repair/Replace trash rack at inlet to the principal spillway	Within 2 years
Repair concrete headwall and apron at inlet to the principal spillway	Within 2 years
Repair/Replace concrete hood at outlet of the principal spillway	Within 2 years
Repair scarp near the left end of upstream slope	Within 2 years
Abandon lake drains or install new valves on upstream side of embankment	Within 3-5 years
Prepare plans/specs for improvements to the embankment and spillway system	Within 3-5 years

1.0 Background

1.1 History of the Dam

Lake DeTurk Dam is an earthen embankment constructed across a tributary to Grassyfork Creek creating a 36-acre lake that is utilized for recreation and water supply for Ozark Fisheries. The dam is located approximately 2 miles northeast of Martinsville in Morgan County, Indiana. The dam is owned by the Lake DeTurk Conservancy District (District).

According to records obtained from the IDNR, Grassyfork Fisheries originally had an embankment in the current location of the Lake DeTurk Dam that was on the order of 10 to 15 feet in height. In 1970 ATEC Associates completed a subsurface investigation for Grassyfork Fisheries to determine the general subsurface conditions and evaluate the conditions with respect to the construction of a higher embankment. No definite conclusions were made concerning the design and construction of a higher embankment. The underlying soils were found to be generally soft in nature with recommendations for further testing of the compressibility and strength of the material. There are no records of any subsequent geotechnical investigations.

David H. Harker, Civil Engineer, prepared final design plans for Lake DeTurk Dam in November 1971. The dam was constructed sometime thereafter without approval from the Indiana Natural Resources Commission, as required by law; permits are now issued by the IDNR, Division of Water. In 1978, the Division of Water informed Grassyfork Fisheries that the dam was in violation of Indiana State law. The following year, Grassyfork Fisheries applied for an after-the-fact Construction in a Floodway Permit. A Certificate of Approval of Construction in a Floodway wasn't issued until August 30, 1985 under Docket D-6132. The Engineer's Report included as part of this approval indicated that the spillway system could safely pass the runoff resulting from 12.88 inches of rainfall in 6 hours over the contributing watershed. This is equivalent to 50% of the 6-hour Probable Maximum Precipitation (PMP).

Periodic inspection reports by IDNR began on October 6, 1978 and have continued since. The overall condition of the dam was rated fair until the December 13, 2001 inspection when a rating of conditionally poor was given. It has remained conditionally poor through the June 22, 2011 inspection.

There is no recorded evidence of modifications, post construction studies, accidents or failures. It is assumed that the three lake drain pipes, a 6-inch steel pipe located near the center of the embankment, a 8-inch steel pipe located just north of the principal spillway, and a 30-inch steel pipe directly below the principal spillway, were in place prior to the design prepared by Mr. Harker. The 6-inch and 8-inch pipes are still used regularly to supply water to the smaller fish ponds to the east of the dam while the 30-inch pipe below the principal spillway was likely formerly used to drawdown Lake DeTurk. It is not known whether the 30-inch lake drain valve is still operational.

Grassyfork Fisheries was acquired by Ozark Fisheries, Inc. in the early 1970s and currently operates under that name. In 2012, Ozark Fisheries transferred the dam and other real estate assets to the newly formed Lake DeTurk Conservancy District under a legal settlement agreement between the two entities.

Until February 2014, Lake DeTurk Dam was classified as a low hazard dam. In January 2013, CBBEL assisted the Lake DeTurk Conservancy District with the preparation of a District Plan. As part of that document, CBBEL completed a hazard classification assessment to determine the hazard level as well as a Preliminary Engineering Report for the rehabilitation of Lake DeTurk Dam. The assessment indicated that the dam should likely be considered high hazard due to the potential loss of life downstream. As a result, the Preliminary Engineering Report analyzed various alternatives for rehabilitating the dam and increasing the spillway capacity to bring it into compliance with IDNR standards for high hazard dams.

1.2 File Review

Unless otherwise noted, all information presented in this report is from the visual inspection and a review of information contained in IDNR, District, and CBBEL files. The information reviewed included recent aerial photographs, the Martinsville Quadrangle 7.5 minute USGS topographic map, previous dam safety inspection reports, and the 2013 Preliminary Engineering Report prepared by CBBEL.

1.3 Emergency Preparedness

Lake DeTurk Dam is classified as a high hazard structure. CBBEL performed an approximate dam failure flood analysis as part of the 2014 Preliminary Engineering Report and prepared an inundation map. The estimated dam failure flood inundation area includes numerous single-family residences, particularly in the Foxcliff South, and businesses are located in the hazard area downstream of the dam. The hazard area includes the fishery ponds immediately downstream of the dam, portions of Martinsville Golf Club and Foxcliff Golf Club, agricultural land, and forest. Several roads or portions thereof are located within the estimated dam failure flood inundation area, including, but not limited to, Grassy Fork Lane, County Club Road, County Road 175, Carmichael Road, Maple Turn Road, Maple Turn Lane, Norich Place, Southamption Drive, and Old State Road 37. These roads or portions of them may be impassible during and after a dam failure flood. In addition, some structures that are not within the dam failure flood inundation area may have limited or no access due to roads being impassible. It is expected that there could be numerous utilities within the dam failure flood inundation area, including, but not limited to, electric, gas, water, telephone, fiber optics, storm sewer, sanitary sewer, and septic tanks. Many of these utilities may be underground, but damage is still possible.

An Incident and Emergency Action Plan, which includes the inundation map, was being developed at the time of this inspection.

1.4 Hydrology

According to *Lake DeTurk Dam Preliminary Engineering* Report prepared by CBBEL in January 2014, Lake DeTurk has a normal surface area of approximately 36 acres at an elevation of 714.66 feet (NAVD 88) with a corresponding storage volume of roughly 425 acre-feet. The watershed drainage area tributary to the lake is 0.6 square miles (384 acres) and is comprised primarily of deciduous forest, grassland/herbaceous, and developed/open space.

The maximum pool elevation at the crest of the dam is 723.21 feet (NAVD 88), resulting in a surface area of about 46 acres and a storage volume of 755 acre-feet. The principal spillway and emergency spillways are located at elevations 714.66 feet (NAVD 88) and 719.40 feet (NAVD 88), respectively.

Dams classified as high hazard by IDNR are required to safely pass the rainfall runoff from the 100% PMP event without overtopping. A PMP storm event is the Probable Maximum Precipitation that can be expected during specific storm durations. The design storm duration is generally dictated by the size of the dam's watershed. For the location and size of the Lake DeTurk Dam Watershed, the 6-hour Probable Maximum Precipitation (10 square mile basin) is 27.3 inches.

According to the analysis performed by CBBEL as part of the preliminary engineering report, the Lake DeTurk Dam is able to safely pass the runoff from approximately 59% of the PMP before overtopping of the dam embankment at elevation 723.21 feet would occur. This is the apparent lowest point on the dam based on the Holloway Engineering and Surveying survey and is located near the center of the embankment. CBBEL's assessment of the spillway capacity is similar to the IDNR's Engineer's Report included as part of the Construction in a Floodway Permit approval, Docket D-6132.

1.5 Geologic Features

The following narrative describing geologic features is from *Geotechnical Engineering Evaluation of Lake DeTurk Dam*, completed by ATC Associates, Inc. and dated July 12, 2012.

"Lake Deturk Dam is located near the boundary between the New Castle Till Plains and Drainage Ways physiographic subdivision of the Central Till Plain region and the Martinsville Hills subdivision of the Southern Hills and Lowlands region. The New Castle Till Plains and Drainage Way is characterized by a criss-cross pattern of meltwater features that dissect a relatively featureless plain of low relief. The topography of the Martinsville Hills physiographic subdivision is more rugged than the till plains to the north. The dam is located near the southern extent of the Wisconsin Glacial Advance. Such areas often have a complex soil stratigraphy due to the multiple cycles of advancing and retreating of the glacier as well as post-glacial deposition in depressions and drainageways remaining from the glacial period. According to geologic mapping, the depth to bedrock varies significantly within a few miles of the site from less than 50 ft to more than 150 ft below the current ground surface. The upper bedrock at the site is mapped as being

Mississippian Age siltstone, shale, sandstone and lesser amounts of limestone.

There are no known active faults that are likely to produce earthquakes in the immediate vicinity of the site. The Mount Carmel Fault is located in eastern Monroe County approximately twelve miles to the southeast of the site. However, any ground shaking from earthquakes would likely result from fault movements within either the New Madrid Seismic Zone, which is located in southeastern Missouri, or the Wabash Valley Fault System located in southwestern Indiana. Morgan County is within a zone of relatively low seismic risk. For the subsurface conditions at the Lake Deturk Dam site, there is a low probability of "liquefaction" (a phenomenon whereby ground shaking causes a severe loss of soil strength) under any reasonably anticipated ground shaking."

2.0 Observed Conditions

CBBEL personnel performed a visual dam safety inspection of Lake DeTurk Dam on May 13, 2014. CBBEL's office is located at 115 W. Washington Street, Suite 1368 South, Indianapolis, Indiana. The inspection was performed by Brian McKenna, P.E., Aaron J. Fricke, P.E., and Jeffrey Fox, P.E., all three of which have specialized experience in dam design, construction, and inspection. The District was represented during the inspection by Gary Flock, Anna Radue, and Roger Radue.

The weather conditions during the inspection were dry and partly sunny with a temperature of approximately 70 degrees Fahrenheit. The principal spillway was engaged at the time of the inspection as the lake level was just above normal pool.

Narrative descriptions of the inspection findings are provided below. The IDNR Inspection Report Form summarizing the inspection findings and containing descriptions of the rating criteria can be found in **Appendix 1**. The IDNR Inspection Report Form from the previous inspection is included **Appendix 2**. Refer to **Appendix 3** for photographs taken the day of the inspection. **Appendix 4** contains the dam inspection checklist completed during the inspection. Refer to the Exhibits section of this report for the USGS Quadrangle Map, aerial photograph site location map, and an inspection summary map.

2.1 Upstream Slope

The upstream slope of the embankment is approximately 3:1 (H:V) from the crest to the shoreline with adequate grass growth cover but no other form of erosion protection. The left end of the embankment is experiencing wave action scarping; approximately 75 feet long and 4 feet high. The right abutment is overgrown with vegetation. Rodent burrows were observed along much of the upstream slope as was rutting. The rutting was approximately 6 inches deep and 12 inches wide and was most likely from mowing equipment. No depressions, sinkholes, cracks, slides, soil sloughs, or other deficiencies were observed. The upstream slope is considered to be **"Acceptable"** according to IDNR rating criteria.

2.2 Crest

The crest of the dam is approximately 30 feet wide and carries Grassyfork Lane approximately 590 feet with guardrail on both the upstream and downstream sides. The asphalt pavement surface exhibited transverse cracks spaced every 15 feet to 30 feet. The road appears to have been constructed with a low point at the center of the dam. There was no other visual evidence of vertical or horizontal alignment problems, instabilities, or deficiencies along the crest. The crest is considered to be **"Acceptable"** according to IDNR rating criteria.

2.3 Downstream Slope

The downstream slope of the embankment is approximately 3:1 (H:V) from the crest to the toe. The slope appears to be in acceptable condition with adequate grass cover. Dense brush was observed along the embankment toe and has begun to encroach at each abutment. As a result of runoff from the low point of the road, an erosion gully was observed near the center of the embankment running from the crest to the toe of the embankment; approximately 6 inches deep and 12 inches wide. A depression was observed near the center of the dam above the lake drain valve; approximately 10 feet by 10 feet and a depth of 1 foot. Settlement might be the result of poorly compacted soils or possibly minor internal erosion around lake drain. Rutting was observed primarily near the embankment crest along the entire downstream slope; approximately 6 inches deep and 12 inches wide. No sinkholes, cracks, slides, soil sloughs, or other deficiencies were found. The downstream slope is considered to be **"Acceptable"** according to IDNR rating criteria.

2.4 Seepage

Wet areas have been observed on previous inspections along the south half of the downstream toe. At the time of our inspection, no wet areas were observed. In addition, no vegetative growth that would suggest the presence of wet conditions was identified. There is no evidence, recorded or field observed, to suggest the existence of a toe drain. Based on these observations, seepage is considered to be **"Acceptable"** according to IDNR rating criteria.

2.5 Spillway System

The principal spillway is a drop structure with two culvert segments. The upstream segment is a 30-inch diameter steel pipe with a concrete headwall. The invert of the upstream segment controls the normal pool of the lake and is partially obstructed by riprap. The trash rack at the upstream pipe's inlet is missing several bars. The headwall and apron at the inlet display some minor to moderate deterioration of the concrete. The downstream culvert segment invert is located at the base of the drop manhole and is a 48-inch CMP with a brick and concrete hood that outlets into Grassy Fork Creek. The concrete hood at the outlet is being undermined and is severely deteriorated with bricks and concrete remnants exposed. Failure of the concrete hood could obstruct the principal spillway outlet significantly reducing its capacity. No other deficiencies were observed. The principal spillway is considered to be **"Deficient"** according to IDNR rating criteria.

The emergency spillway consists of a 50-foot wide trapezoidal channel with a five culvert inlet. These culverts are 18-inch CMP pipes that appear to have some slight deformation likely from the existing road overtop. In addition, all the pipe's inverts are silted to varying degrees. The 50-foot wide channel is relatively free of obstructions with good grass cover that appears to be mowed regularly. No other obstructions, vegetation, or erosion was found. The emergency spillway is considered to be **"Acceptable"** according to IDNR rating criteria.

As noted previously, the existing spillway system is known to lack adequate capacity to safely pass the runoff from the required design storm.

2.6 Lake Drain

There are three existing pipes through the embankment that are open to Lake DeTurk. The first is a 6-inch steel pipe located near the center of the dam. The second is an 8-inch steel pipe located just north of the principal spillway. Both are used as a water supply for Ozark Fisheries and it is unknown how frequently these valves are operated. The third is a 30-inch steel pipe located directly below the principal spillway. All pipes are controlled by valves accessible on the downstream side of the embankment though, none of the valves were operated at the time of the inspection. Visual observation of the valves was completed with only some minor surface rust present. There is no record of the 30-inch valve ever being operated.

While these valves are currently closed and not releasing water, a pressurized condition is created inside these pipes since the shutoff valve is located on the downstream side of the dam. A pressurized pipe extending through the embankment of a dam typically poses a risk to the safety of the dam because of the potential for leakage or a pipe rupture to cause internal erosion of the embankment. For this reason, the condition of these drains is considered to be **"Deficient"** according to IDNR rating criteria.

2.7 Maintenance and Repairs

The dam and spillway system has not received adequate maintenance and repairs through the years. Even though the grass cover along the embankment and emergency spillway channel appears to be regularly mowed, few corrective measures have been made to bring the dam into compliance with IDNR requirements. Many of the deficiencies observed during this inspection have been persistent problems and have been documented in previous inspections. Some items needing maintenance and repairs include the shoreline of the upstream slope, the inlet and outlet protection for the principal spillway, the inlet pipes to the emergency spillway, and the lake drain pressurized pipe conditions. If these deficiencies are not addressed, their condition will likely continue to deteriorate potentially threatening the integrity of the embankment and spillway system. The maintenance and repair condition of the dam is considered to be **"Deficient"** according to IDNR rating criteria. Continued maintenance should be completed as discussed in Section 4.0.

2.8 Overall Condition

The overall condition of the dam is considered to be **"Conditionally Poor"** based on IDNR rating criteria. This rating reflects the severe erosion present on the upstream slope, minor erosion on the downstream slope, severe concrete deterioration present on the principal spillway's inlet headwall and outlet hood, general loss of capacity in all five emergency spillway culverts, and overall lack of spillway system capacity. The dam has received a conditionally poor rating since December 13, 2001 and does not appear to have addressed any recommendations from recent inspections other than routine maintenance. Repair and maintenance is required to achieve a "Satisfactory" rating, as noted on the IDNR Dam Inspection Report Form.

3.0 Risk of Dam Failure

CBBEL utilized the results of the dam inspection to evaluate the potential for dam failure at Lake DeTurk Dam. There are typically two types of dam failures that could occur: Type 1, component failure of a structure that does not result in a significant reservoir release from the lake; and Type 2, uncontrolled breach failure of a structure that results in a significant release. Refer to **Appendix 5** for more details of types of failure and definitions of risk levels. CBBEL evaluated the risk for both types of failures.

In general, the dam appears to have a medium risk of Type 1, component failure, due to the severe erosion on the upstream slope, the spillway system's inadequate capacity, and pressurized condition of the three lake drains. As a result of inadequate spillway system capacity, there is also a medium risk of Type 2, uncontrolled breach failure.

3.1 Risk of dam component failure (Type 1)

CBBEL evaluated the risk for Type 1 component failure at Lake DeTurk Dam after the inspection was completed by considering possible failure of each dam component. The components that were evaluated include the upstream embankment slope, the downstream embankment slope, the embankment crest, the spillway system, the lake drains, and the dam abutments. After considering the dam's current condition and the potential maximum loadings, CBBEL has estimated the risk of failure for each component as follows.

Component	Risk Level
Embankment US slope	medium
Embankment DS slope	low
Embankment crest	low
Spillway system	medium
Lake Drains	medium
Dam abutments	low

3.2 Risk of uncontrolled breach failure (Type 2)

CBBEL evaluated the potential for uncontrolled breach failure at Lake DeTurk Dam after the inspection was completed by considering possible failure modes. Embankment dams such as Lake DeTurk Dam generally have three potential

modes of uncontrolled breach failure: 1) hydraulic failure, 2) seepage failure, and 3) structural failure (see **Appendix 5** for more details). At the present time, Lake DeTurk Dam appears to have a medium risk for uncontrolled breach failure.

The factors that pose a risk to embankment dams and can result in dam failure can be categorized into four groups: 1) structural factors, 2) natural factors, 3) human factors, and 4) operating factors (see **Appendix 5**).

Structural deficiencies that pose a medium risk to the safety of Lake DeTurk Dam were identified during the inspection. These deficiencies are summarized as follows and are discussed in more detail in Section 2.0:

Structural Factors	Risk Level	Failure Mode
Upstream slope erosion	medium	Hydraulic/Structural
Downstream slope erosion	low	Hydraulic/Structural
Concrete deterioration at principal spillway inlet	low	Seepage/Structural
Concrete deterioration at principal spillway outlet	medium	Seepage/Structural
Loss of capacity at emergency spillway	low	Hydraulic/Structural
Inadequate capacity of spillway system	medium	Hydraulic/Structural
Pressurized condition of lake drains	medium	Seepage/Structural

Natural and human risk factors were also considered. Severe storms present a medium risk to Lake DeTurk Dam due to the lack of capacity of the lake and spillway system. It should be noted that there is always some risk for dam failure at all dams, and that risk cannot be completely eliminated.

Natural Factors	Risk Level	Failure Mode
Severe storms	medium	Hydraulic
Earthquakes	low	Structural

Human Factors	Risk Level	Failure Mode
Vandalism	low	Structural
Terrorism	low	Structural

Operating Factors	Risk Level	Failure Mode
Maintenance Practices	medium	Hydraulic/Structural
Access	medium	Hydraulic/Structural
Electrical/Mechanical Equipment	low	Hydraulic/Structural

4.0 Recommendations

This section presents CBBEL's recommendations for action based on the findings of the dam safety inspection, CBBEL's assessment of the risk of dam failure at Lake DeTurk Dam, and CBBEL's assessment of the priority for repairs of each observed deficiency. The recommendations are summarized by dam feature, such as the upstream slope. Based on inspection findings, Lake DeTurk Dam requires repair, maintenance, and monitoring to achieve a "Satisfactory" rating. CBBEL's objective is to make engineering recommendations that minimize the risk of failure to an acceptable level.

4.1 Upstream Slope

- Clear trees and brush from the right abutment on the upstream slope
- Backfill animal burrows as seen on the upstream slope
- Place riprap along the upstream slope for erosion protection
- Repair scarp near the left end of the upstream slope

4.2 Downstream Slope

- Clear trees and brush from the right abutment on the downstream slope
- Clear trees and brush from the left abutment on the downstream slope
- Monitor depression above lake drain near center of the dam on the downstream slope

4.3 Spillway System

- Clear trees and brush from the outlet of the principal spillway
- Repair/Replace trash rack at the inlet to the principal spillway
- Repair concrete headwall and apron at the inlet to the principal spillway
- Repair/Replace concrete hood at the outlet to the principal spillway
- Remove silt and debris from the emergency spillway inlet culverts
- Prepare plans and specifications to increase the spillway system capacity to meet IDNR requirements for high hazard dams

4.4 Seepage

- Monitor the downstream toe of slope for indications of seepage

4.5 Lake Drain

- Abandon lake drains or install new valves on the upstream side of embankment to eliminate pressurized condition through the embankment

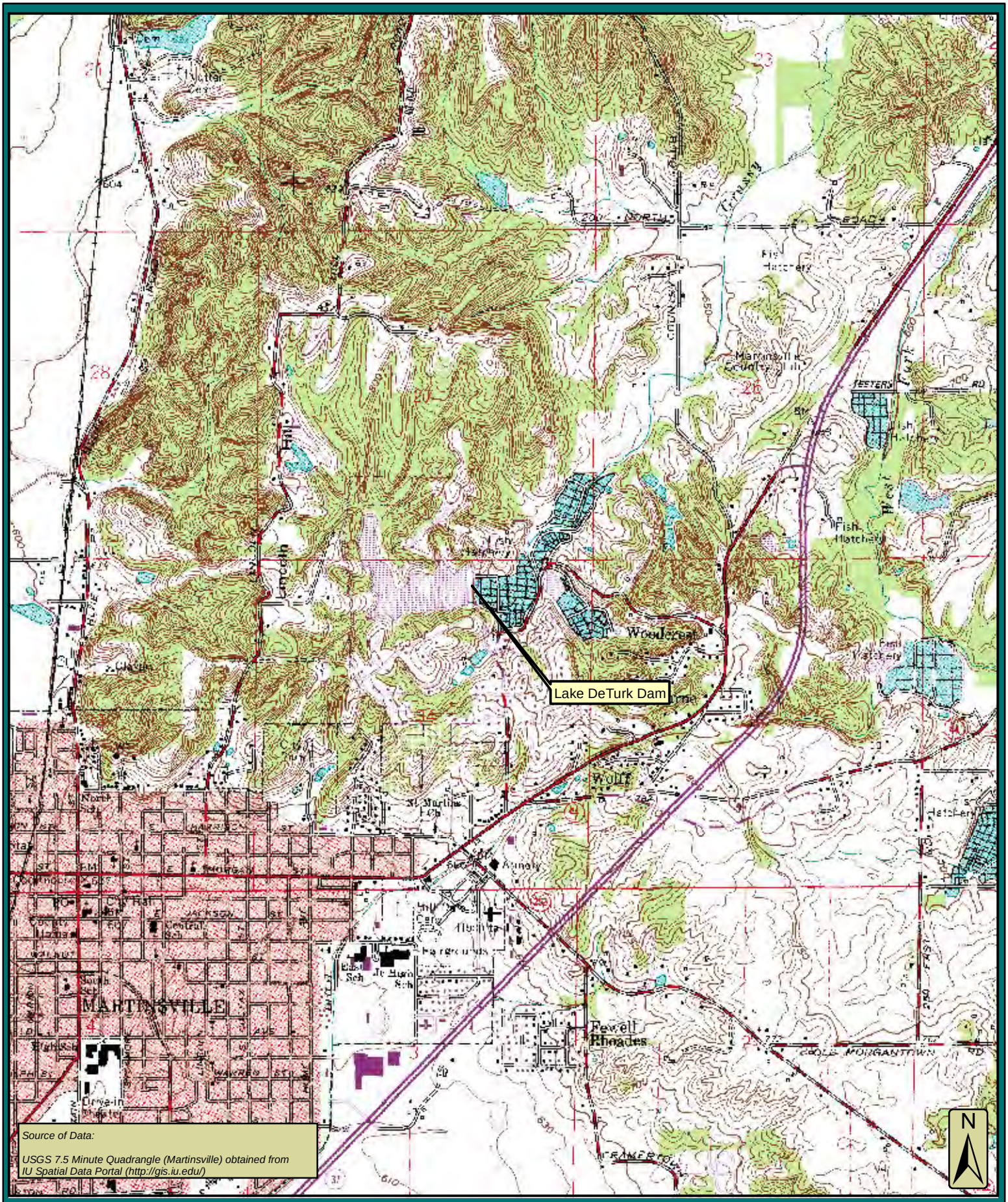
4.6 Maintenance and Repairs

- CBBEL recommends that the owner maintain and monitor the dam and spillway system as described above.

In summary, the following repair, maintenance, and monitoring are required to achieve an overall “Satisfactory” rating and to prevent maintenance items from affecting the safety or performance of the dam.

Required Repair/Maintenance/Monitoring	Schedule
Clear trees and brush from the right abutment on the upstream slope	Immediately/Ongoing
Clear trees and brush from the right abutment on the downstream slope	Immediately/Ongoing
Clear trees and brush from the left abutment on the downstream slope	Immediately/Ongoing
Clear trees and brush from the outlet of the principal spillway	Immediately/Ongoing
Backfill animal burrows as seen on the upstream slope	Immediately/Ongoing
Remove silt and debris from emergency spillway inlet culverts	Immediately/Ongoing
Monitor depression above the lake drain near the center of the dam	Immediately/Ongoing
Monitor the downstream toe of slope for indications of seepage	Immediately/Ongoing
Place riprap along upstream slope for erosion protection	Within 2 years
Repair/Replace trash rack at inlet to the principal spillway	Within 2 years
Repair concrete headwall and apron at inlet to the principal spillway	Within 2 years
Repair/Replace concrete hood at outlet of the principal spillway	Within 2 years
Repair scarp near the left end of upstream slope	Within 2 years
Abandon lake drains or install new valves on upstream side of embankment	Within 3-5 years
Prepare plans/specs for improvements to the embankment and spillway system	Within 3-5 years

EXHIBITS



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PROJECT: Lake DeTurk Dam Safety Inspection	PROJECT NO. 14-0103.00000	APPROX. SCALE 1 " = 2,000 '
TITLE: USGS Quadrangle Map (Selected Portions of Martinsville Quad)		DATE: 05/2014
		EXHIBIT 1

Source of Data:

Aerial Photography: 2012 National Agriculture Inventory Program (NAIP) obtained from IU Spatial Data Portal (http://gis.iu.edu/)

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PROJECT:	Lake DeTurk Dam Safety Inspection	PROJECT NO. 14-0103.00000	APPROX. SCALE 1 " = 2,000 '
TITLE:	Aerial Photograph Site Location Map		DATE: 05/2014
			EXHIBIT 2

Source of Data:

Aerial Photography: 2012 National Agriculture Inventory Program (NAIP) obtained from IU Spatial Data Portal (http://gis.iu.edu/)

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PROJECT:	Lake DeTurk Dam Safety Inspection	PROJECT NO. 14-0103.00000	APPROX. SCALE 1 " = 200 '
TITLE:	Inspection Summary Map		DATE: 05/2014
			EXHIBIT 3

APPENDICES

APPENDIX 1
IDNR DAM INSPECTION REPORT FORM
(May 13, 2014)

Print Form

SUGGESTED DAM INSPECTION REPORT (Refer to pages 5 and 6 for instructions.)

Name of Professional Conducting Inspection	Professional License No. (Indiana)
Jeffrey D. Fox, P.E., Brian W. McKenna, P.E., Aaron J. Fricke, P.E.	PE11100632, PE10504716, PE11100305
Business Address: 115 West Washington Street, Suite 1368, Indianapolis, IN 46204	Phone: (day) 317 - 266 - 8000 (evening) ___ - ___ - ___

Company Name: Christopher B. Burke Engineering, LLC

INSPECTION PREPARATION: Reviewed all pertinent technical documentation related to this dam and site in the State's and the Owner's files: Yes ☒ No ☐ Comment

MULTIDISCIPINARY: I am experienced in the technical disciplines or I am working with other professionals experienced in the technical disciplines to properly inspect this dam and appurtenant works. Technical disciplines, in additional to the general civil engineering, may include geotechnical, geological, hydrologic, structural, and mechanical. Yes ☒ No ☐ Comment

Dam Name	Quad.	Date of Inspection
Lake DeTurk Dam	Martinsville	05 / 13 / 2014

State Dam ID	Permit (if unapproved see pg. 6)	County	Sec.	T.	R.	Last Inspection
55-76	D-6132	Morgan	34	12 N	1 E	06 / 22 / 2011

Owners Name	Owner's Phone
Lake DeTurk Conservancy District	( )

Address/Zip Code: P.O. Box 1149, Martinsville, IN 46151

Contact's Name	Contact's Phone	Spillway Width	Ft. FBD.
Ronald Reinhart	(day) ___ - ___ - ___ (evening) ___ - ___ - ___	Top 50' Bot.	5

Hazard	Drainage Area	Surface Area	Height	Crest Length	Crest Width	Inlet Below Crest	Slope
High	0.6 MI^2	36 AC	32 FT	590 FT	30 FT	10 FT	Up 3:1 Down 3:1

FIELD CONDITIONS OBSERVED

Water Level - Below Dam Crest 5 Ft.

Ground Moisture Condition: Dry ☒ Wet ☐ Snowcover ☐ Other

DRAWDOWN STRUCTURE

☒ Yes ☐ None

Comment 3-Pipes (6", 8", and 30")

MONITORING ☐ Yes ☒ None [☐ Gage Rod ☐ Piezometers ☐ Seepage Weirs ☐ Survey Monuments ☐ Other]

Comments

A UPSTREAM SLOPE

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (A-1) None ☐ (A-2) Riprap - Missing, Sparse, Displaced, Weathered ☒ (A-3) Wave Erosion-with Scarps ☐ (A-4) Cracks-with Displacement ☐ (A-5) Sinkhole ☐ (A-6) Appears Too Steep ☐ (A-7) Depressions or Bulges ☐ (A-8) Slides ☒ (A-9) Animal Burrows ☒ (A-10) Trees, Brush, Briars ☒ (A-11) Other Rutting

Comments:

A-3: The north end of the embankment is experiencing wave action scarping; approximately 75 feet long and 4 feet high.

A-9: Animal burrows observed along entire slope.

A-10: The right abutment is overgrown with vegetation

A-11: Rutting was observed along the entire slope.

B CREST

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (B-1) None ☐ (B-2) Ruts or Puddles ☐ (B-3) Erosion ☒ (B-4) Cracks with Displacement ☐ (B-5) Sinkholes ☐ (B-6) Not Wide Enough ☒ (B-7) Low Area ☐ (B-8) Misalignment ☐ (B-9) Inadequate Surface Drainage ☐ (B-10) Trees, Brush, Briars ☐ (B-11) Other

Comments:

B-4: The asphalt pavement surface exhibited transverse cracks spaced every 15 feet to 30 feet.

B-7: The road appears to have been constructed with a low point at the center of the dam.

Spillway Width refers to the open channel (typically the emergency or auxiliary spillway) at the control section.
Ft. FBD. refers to the vertical distance from the emergency (auxiliary) spillway control section to the lowest point of the crest of the dam.
Inlet Below Crest refers to the vertical distance from the inlet of the principal spillway to the crest of the dam.

DAM NAME Lake DeTurk Dam STATE DAM I.D. 55-76 DATE 05 / 13 / 14

C DOWNSTREAM SLOPE

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (C-1) None ☐ (C-2) Livestock Damage ☒ (C-3) Erosion or Gullies ☐ (C-4) Cracks with Displacement ☐ (C-5) Sinkholes ☐ (C-6) Appears too Steep ☒ (C-7) Depression or Bulges ☐ (C-8) Slide ☐ (C-9) Soft Areas ☒ (C-10) Trees, Brush, Briars ☐ (C-11) Animal Burrows ☒ (C-12)Other Rutting

Comments:

C-3: An erosion gully was observed near the center of the embankment, 6" deep by 12" wide, from crest to toe.
C-7: A depression was observed near the center of the dam above the lake drain; 10' long by 10' wide by 1' deep.
C-10: Dense brush was observed along the embankment toe and has begun to encroach at each abutment.
C-12: Rutting was observed along the entire slope, primarily near the embankment crest; 6" deep by 12" wide.

D SEEPAGE

GOOD (NONE)	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☒ (D-1) None ☐ (D-2) Saturated Embankment Area ☐ (D-3) Seepage Exits on Embankment ☐ (D-4) Seepage Exits at Point Source ☐ (D-5) Seepage Area at Toe ☐ (D-6) Flow Adjacent to Outlet ☐ (D-7) Seepage Clear/Muddy

[**DRAIN OUTFALLS SEEN** X No ___ Yes ☐ (D-8) Flow Clear/Muddy ☐ (D-9) Dry/Obstructed]

☐ (D-10) Other _____ Describe location of drains and indicate amount and quality of discharge.

Comments:

E PRINCIPAL SPILLWAY

GOOD	☐
ACCEPTABLE	☐
DEFICIENT	☒
POOR	☐

DESCRIPTION: Drop structure with two culvert segments; 30" steel upstream and 48" CMP downstream

PROBLEMS NOTED: ☐ (E-1) None ☒ (E-2) Deterioration ☐ (E-3) Separation ☒ (E-4) Cracking ☐ (E-5) Inlet, Outlet Deficiency ☐ (E-6) Stilling Basin Inadequacies ☒ (E-7) Trash Rack ☒ (E-8) Other Trees, Brush

Comments:

E-2 & E-4: The upstream concrete headwall and apron exhibit minor to severe concrete cracking and deterioration while the concrete hood on the downstream end has severely deteriorated.
E-7: The trash rack at the upstream inlet is a steel bar grate that is missing several bars.
E-8: Dense brush was observed at the outlet of the principal spillway restricting inspection and maintenance.

F AUXILIARY SPILLWAY

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

DESCRIPTION: 50 feet wide trapezoidal channel with a 5-18" CMP culvert inlet

PROBLEMS NOTED: ☐ (F-1) None ☐ (F-2) No Auxiliary Spillway Found ☐ (F-3) Erosion-with Backcutting ☐ (F-4) Crack with Displacement ☐ (F-5) Appears to be Structurally Inadequate ☐ (F-6) Appears too Small ☐ (F-7) Inadequate Freeboard ☒ (F-8) Flow Obstructed ☐ (F-9) Concrete Deteriorated/Undermined ☒ (F-10) Other Pipe Deformation

Comments:

F-8: All five CMP pipes at the spillway inlet appear to have varying degrees of siltation reducing overall capacity.
F-10: All five CMP pipes and their metal end sections appear to have some deformation likely the result of the road overtop.

G MAINTENANCE AND REPAIRS

GOOD	☐
ACCEPTABLE	☐
DEFICIENT	☒
POOR	☐

PROBLEMS NOTED: ☐ (G-1) None ☐ (G-2) Access Road Needs Maintenance ☐ (G-3) Cattle Damage ☒ (G-4) Spillway Obstruction ☒ (G-5) Brush, Weeds, Tall Grass, on Upstream Slope, Crest, Downstream Slope, Toe ☐ (G-6) Trees on Upstream Slope, Crest, Downstream Slope ☐ (G-7) Rodent Activity on Upstream Slope, Crest, Downstream Slope, Toe ☒ (G-8) Deteriorated Concrete-Facing, Outlet, Spillway ☒ (G-9) Gate and/or Drawdown Need Repair ☒ (G-10) Other Erosion

Comments:

See attached.

H OVERALL CONDITIONS

Based on this inspection and recent file review, the overall surficial condition is determined to be: ☐ (H-1) Satisfactory ☐ (H-2) Fair ☒ (H-3) Conditionally Poor ☐ (H-4) Poor ☐ (H-5) Unsatisfactory

IMPORTANT: IF THIS RATING IS DIFFERENT THAN PREVIOUS IDNR RATING, PLEASE ATTACH EXPLANATION AND REASONS FOR CHANGE ON PAGE 4.

DAM NAME Lake DeTurk Dam STATE DAM I.D. 55-76 DATE 05 / 13 / 14

RECOMMENDATIONS AND ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

MAINTENANCE-MINOR REPAIR-MONITORING

☒ (1) Provide Additional Erosion Protection: Riprap on upstream slope
☒ (2) Mow: Mow dam regularly so that adequate grass height is maintained
☒ (3) Clear Trees and/or Brush From: Rt abutment on u/s and d/s slope; Lt abutment on d/s slope; along toe of d/s slope; spillway outlet
☒ (4) Initiate Rodent Control Program and Properly Backfill Existing Holes: Along upstream slope
☒ (5) Repair: Principal spillway inlet trash rack/headwall/apron; principal spillway outlet hood; scarp along upstream slope
☐ (6) Provide Surface Drainage For:
☒ (7) Monitor: Depression/erosion gully on d/s slope; rutting on u/s and d/s slope; pavement cracks along embankment crest
☒ (8) Other: Remove silt/debris from 5 CMP pipes at emergency spillway inlet
☒ (9) Other: Abandon lake drains or install new valves on upstream side of embankment to relieve pressurized condition

ENGINEERING-EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO:

(Plans & Specifications must be approved by State prior to construction.)

☒ (10) Prepare Plans and Specifications for the Rehabilitation of the Dam: Repair embankment deficiencies and increase capacity of spillways
☒ (11) Prepare As-Built Drawings of: Improvements made to the dam and spillway system
☐ (12) Perform a Geotechnical Investigation to Evaluate the Stability of the Dam:
☐ (13) Perform a Hydrologic Study to Determine Required Spillway Size:
☐ (14) Prepare Plans and Specifications for an Adequate Spillway:
☐ (15) Set up a Monitoring Program:
☐ (16) Refer to Unapproved Status of Dam:
☒ (17) Develop an Emergency Action Plan: Being developed as part of grant program through Indiana Dept. of Homeland Security
☐ (18) Other:
☐ (19) Other:

Recommended schedule for upgrades/comments (Please prioritize and note importance of each item.)

ITEM	SCHEDULE	IMPORTANCE
Clear trees and brush from the right abutment on the upstream slope	Immediately/Ongoing	Low
Clear trees and brush from the right abutment on the downstream slope	Immediately/Ongoing	Low
Clear trees and brush from the left abutment on the downstream slope	Immediately/Ongoing	Low
Clear trees and brush from the outlet of the principal spillway	Immediately/Ongoing	Low
Backfill animal burrows as seen on the upstream slope	Immediately/Ongoing	Low
Remove silt and debris from emergency spillway inlet culverts	Immediately/Ongoing	Medium
Monitor depression above the lake drain near the center of the dam	Immediately/Ongoing	Low
Monitor the downstream toe of slope for indications of seepage	Immediately/Ongoing	Low
Place riprap along upstream slope for erosion protection	Within 2 years	Medium
Repair/Replace trash rack at inlet to the principal spillway	Within 2 years	Medium
Repair concrete headwall and apron at inlet to the principal spillway	Within 2 years	Medium
Repair/Replace concrete hood at outlet of the principal spillway	Within 2 years	High
Repair scarp near the left end of upstream slope	Within 2 years	High
Abandon lake drains or install new valves on upstream side of embankment	Within 3-5 years	Medium
Prepare plans/specs for improvements to the embankment and spillway system	Within 3-5 years	High

Photographs ☒ Attachments ☒

ENGINEER'S INSTRUCTION Instructed owner on the safety concerns with the structure and how to monitor and inspect the dam and appurtenant works in the interim period between the regulatory two-year inspections. Yes ☒ No ☐

Comment

Professional Engineer's Signature Jeffrey A. Fox Date 6/26/2014

Reviewed By Ronald Rickert Chairman, Lake DeTurk Conservancy District Date 6/26/2014
Owner/Owner's Representative

EXPLANATION FOR CHANGE IN RATINGS (Describe all repairs, upgrades or improvements made if dam conditions and rating have improved since the last inspection. Describe deteriorating conditions if ratings have worsened.)

REASONS FOR RATING CHANGE:

PREVIOUS RECOMMENDATIONS FOR MAINTENANCE, REPAIRS, AND UPGRADES:

HAVE THEY BEEN PERFORMED ☐ YES ☒ NO (If no, please explain:)

It does not appear that any repairs based on previous recommendations have been made.

Supporting Documentation

Photographs ☒ Attachments ☒ Calculations ☐ Drawings ☐ Other ☐

Comments:

2014 Lake DeTurk Dam Safety Inspection Memo

INSTRUCTIONS FOR COMPLETING DAM VISUAL INSPECTION REPORT

1. Complete all items that are applicable; if not applicable, write in "N/A". For concrete dams, complete all applicable items and use "comments" section to cover items not included in the check boxes. Also indicate that the dam is concrete in the comments section.

2. Use page 6 to determine ratings of each dam component (items A through G) and for Overall Conditions (Item H).

3. Please write legibly and concisely.

4. Inspector must be knowledgeable with the type of dam, materials, and components being inspected. If not, qualified assistance shall be engaged.

5. The inspector shall review the dam owner's and IDNR project files prior to the inspection. Previous inspection reports shall be closely reviewed for previous problems and deficiencies.

6. If the ratings of the components (items A through G) or the Overall Conditions (item H) of the dam have changed since the last inspection, please complete page 4. If a rating has improved, dam repairs, improvements, analyses, or maintenance must have been performed and documented on page 4.

7. For a dam to have a satisfactory "Overall Conditions" rating, it must have no existing or potential dam safety deficiencies recognized. Safe performance is expected under all anticipated loading conditions, including infrequent hydrologic events (PMP for high hazard dams) and seismic events. The dam owner's project files must contain hydrologic and hydraulic analyses of the dam and its spillways to verify performance. The files must also contain slope stability analyses to verify embankment stability under full reservoir conditions and rapid-draw down conditions. The dam and all of its components must meet current IDNR and design standards. "Normal" deficiencies such as minor erosion, minor seepage, or normal concrete aging may not make a dam unsatisfactory or unacceptable. For a satisfactory "Overall Conditions" rating to be assigned, items A through G generally should all have a "good" rating; however, in some cases an "acceptable" rating may be satisfactory if the "Problems Noted" are minor, or "normal" conditions, such as minor erosion rills, small puddles on crest, or if grass needs mowed, but is in good condition.

8. An inspection report form must be submitted to IDNR along with a formal technical inspection report as described in Chapter 4.0 of Part 3 of the Indiana Dam Safety Inspection Manual.

9. Please sign and date this page in the space below to verify that you have read and understand these instructions.

Inspector's Signature: _____ Date: 6/26/2014

GUIDELINES FOR DETERMINING CONDITIONS

CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, PRINCIPAL SPILLWAY, AUXILIARY SPILLWAY

GOOD	ACCEPTABLE	DEFICIENT	POOR
In general, this part of the structure has a good appearance, and conditions observed in this area do not appear to threaten the safety of the dam.	Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.	Continued deterioration and/or unusual loading may threaten the safety of the dam.	Conditions observed in this area appear to threaten the safety of the dam. Conditions observed in this area are unacceptable.

CONDITIONS OBSERVED - APPLIES TO SEEPAGE

GOOD (NONE)	ACCEPTABLE	DEFICIENT	POOR
No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.	Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.	Excessive seepage exists at areas other than drain outfalls and other designed drains. Seepage needs to be evaluated. Increased flow and/or continued deterioration in seepage conditions may threaten the safety of the dam.	Excessive seepage conditions observed appear to threaten the safety of the dam and is unacceptable. Examples: 1) Designed drain or seepage flows have increased without increase in reservoir level. 2) Drain or seepage flows contain sediment. i.e., muddy water or particles in jar samples. 3) Widespread seepage, concentrated seepage or ponding appears to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

GOOD	ACCEPTABLE	DEFICIENT	POOR
Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.	Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.	Level of maintenance of the dam needs significant improvement. Major repairs may be required. Continued neglect of maintenance may threaten the safety of the dam.	Dam does not receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam. Level of maintenance is unacceptable.

OVERALL CONDITIONS

SATISFACTORY - No existing or potential dam safety deficiencies recognized. Safe performance is expected under all anticipated loading conditions, including such events as infrequent hydrologic and/or seismic events. Project Files contain necessary hydrologic, and other engineering calculations to verify dam safety and performance.

FAIR - No existing dam safety deficiencies are recognized for normal loading conditions. Infrequent hydrologic and/or seismic events would probably result in a dam safety deficiency.

CONDITIONALLY POOR - A potential safety deficiency is recognized for unusual loading conditions which may realistically occur during the expected life of the structure. CONDITIONALLY POOR may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency; further investigations and studies are necessary.

POOR - A potential dam safety deficiency is clearly recognized for normal loading conditions. Immediate actions to resolve the deficiency are recommended; reservoir restrictions may be necessary until problem resolution.

UNSATISFACTORY - A dam safety deficiency exists for normal conditions. Immediate remedial action is required for problem resolution.

HAZARD CLASSIFICATIONS OF DAMS (STRUCTURE)

LOW HAZARD- A structure the failure of which may damage farm buildings, agricultural land, or local roads

SIGNIFICANT HAZARD- A structure the failure of which may damage isolated homes and highways, or cause the temporary interruption of public utility services.

HIGH HAZARD-A structure the failure of which may cause the loss of life and serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads.

UNAPPROVED STATUS OF DAM

A dam that has been given an unapproved status (see entry for permit) means that plans, construction specifications, hydraulic analyses, and/or a geotechnical investigation on your dam, proving the safety of the structure, have not been received and approved by the Indiana Department of Natural Resources (IDNR). IDNR records indicate that no progress has been made to secure this approval. The fact that the dam is inspected under the Regulation of Dams Act (IC 14-27-7.5) in no way alters the illegal status of the structures.

If your dam is indicated to be unapproved, it is requested that your engineer contact the Indiana Department of Natural Resources,

G. Maintenance and Repairs

G-4: Emergency spillway inlet pipes are silted reducing overall capacity and need to be cleaned.

G-5: The right abutment of the upstream slope is overgrown with vegetation and needs to be cleared. Dense brush, observed along downstream toe as well as left and right abutments of the downstream slope, needs to be cleared.

G-8: The upstream headwall and apron as well as the downstream hood have varying degrees of concrete deterioration and need to be repaired or replaced.

G-9: The three lake drains exist in a pressurized condition creating a potential risk for internal erosion as a result of pipe rupture. Valves for these drains should be constructed on the upstream side of the embankment allowing the existing valves on the downstream side to be opened, relieving the pressurized state through the embankment.

G-10: No protection exists on the upstream slope and a large area has eroded near the shoreline. The erosion will continue until it is repaired.

APPENDIX 2
PREVIOUS IDNR DAM INSPECTION REPORT FORM
(June 22, 2011)

EARTH DAM VISUAL INSPECTION REPORT

Select to Reset Form

Indiana Department of Natural Resources
Division of Water, Dam Safety Section
402 West Washington Street, Room W264
Indianapolis, Indiana 46204
Telephone: (317)232-4160 or toll free *(within Indiana)* 1-877-928-3755

Dam Name: Lake Deturk dam			Quad.: Martinsville		Date of Inspection: 06 / 22 / 2011
State Dam ID: 55-76	Permit: D-6132	County: Morgan	Sec. 34 T. 12 N R. 1 E		Last Inspection: 04 / 20 / 2006
Owners Name: Ozark Fisheries, Incorporated					Owner's Phone: (573) 765-3227
Address/Zip Code: 1100 Ozark Fisheries Road Stoutland, MO 65567					Owners E-mail Address: larry@ozarkfisheries.com
Contact's Name: Lawrence B. Cleveland			Contact's Phone: (573) 774-0444	Spillway Width: Top Bot. 40	Ft. FBD.: 5.0

Hazard	Drainage Area	Surface Area	Height	Crest Length	Crest Width	Inlet Below Crest	Slope
Low	0.6 MI²	29.0 AC	30 FT	590 FT	25 FT	9 FT	Up 3:1 Down 4:1

FIELD CONDITIONS OBSERVED

Water Level - Below Dam Crest ____ Ft.

Ground Moisture Condition: Dry ☐ Wet ☑ Snowcover ____ Other ____

DRAWDOWN STRUCTURE

☑ Yes ☐ None

Comment *two drawdowns. See pg.2

MONITORING ☐ Yes ☑ None

☐ Gage Rod ☐ Piezometers ☐ Seepage Weirs ☐ Survey Monuments ☐ Other Comments ____

NOTICE TO OWNERS: PLEASE READ BOTH SIDES OF THESE TWO PAGES AND FOLLOW RECOMMENDATIONS MADE HEREIN.

This visual inspection notes the obvious surficial problems of your dam and appurtenant works. This is not a detailed engineering evaluation. There may be serious defects and/or design deficiencies with your dam that may render your dam unsafe during unusual conditions such as high pool levels and/or earthquake loading. Since you are liable for any property damage, injury or loss of life resulting from failure of your dam, you should consult with an engineer experienced in dam design about the current safety of your dam.

OWNER INSPECTION: The owner (or owner's representative) should inspect this dam routinely under normal conditions and more frequently under unusual loading conditions.

A UPSTREAM SLOPE

GOOD ☐ ACCEPTABLE ☑ DEFICIENT ☐ POOR ☐

PROBLEMS NOTED: ☐ (A-1) None ☐ (A-2) Riprap - Missing, Sparse, Displaced, Weathered ☐ (A-3) Wave Erosion-with Scarps ☐ (A-4) Cracks-with Displacement ☐ (A-5) Sinkhole ☐ (A-6) Appears Too Steep ☐ (A-7) Depressions or Bulges ☐ (A-8) Slides ☐ (A-9) Animal Burrows ☑ (A-10) Trees, Brush, Briars ☐ (A-11) Other ____

Comments: (A-10) Trees located along right (South) contact area.

B CREST

GOOD ☑ ACCEPTABLE ☐ DEFICIENT ☐ POOR ☐

PROBLEMS NOTED: ☑ (B-1) None ☐ (B-2) Ruts or Puddles ☐ (B-3) Erosion ☐ (B-4) Cracks with Displacement ☐ (B-5) Sinkholes ☐ (B-6) Not Wide Enough ☐ (B-7) Low Area ☐ (B-8) Misalignment ☐ (B-9) Inadequate Surface Drainage ☐ (B-10) Trees, Brush, Briars ☐ (B-11) Other ____ Comments: ____

*Blacktop road with guard rails along each side

C DOWNSTREAM SLOPE

GOOD ☐ ACCEPTABLE ☑ DEFICIENT ☐ POOR ☐

PROBLEMS NOTED: ☐ (C-1) None ☐ (C-2) Livestock Damage ☑ (C-3) Erosion or Gullies ☐ (C-4) Cracks with Displacement ☐ (C-5) Sinkholes ☐ (C-6) Appears too Steep ☐ (C-7) Depression or Bulges ☐ (C-8) Slide ☑ (C-9) Soft Areas ☑ (C-10) Trees, Brush, Briars ☐ (C-11) Animal Burrows ☐ (C-12) Other ____

Comments: (C-3) Along left side (North) of principal outlet. Minor erosion along left (North) contact area. (C-9) Along the entire length of the toe area extending upslope about 10 ft. (C-10) Trees and brush around outlet basin, Right (South) contact area, and Left (North) contact area.

D SEEPAGE

GOOD (NONE) ☐ ACCEPTABLE ☑ DEFICIENT ☐ POOR ☐

PROBLEMS NOTED: ☐ (D-1) None ☑ (D-2) Saturated Embankment Area ☐ (D-3) Seepage Exits on Embankment ☐ (D-4) Seepage Exits at Point Source ☐ (D-5) Seepage Area at Toe ☐ (D-6) Flow Adjacent to Outlet ☑ (D-7) Seepage Clear/Muddy [DRAIN OUTFALLS SEEN ☑ No ☐ Yes ☐ (D-8) Flow Clear/Muddy ☐ (D-9) Dry/Obstructed] ☑ (D-10) Other ____ Describe location of drains and indicate amount and quality of discharge.

Comments: (D-2) Along toe area extending upslope about 10 ft. (D-7) Seepage, Clear, around manhole extending downslope along drawdown #1 to outlet basin (D-10) See page #2 Additional Comments

If following box is checked, see additional comments added to Page 2 of 4. ☑

ADDITIONAL COMMENTS

*Drawdown #1 is located on on the right, downstream slope below the manhole access. Drawdown #2 is located in the center of the downstream slope.

(D-10) Recommend owner's professional engineer experienced in dam design & construction evaluate all saturated areas on downstream slope and develop a plan to properly abandon the old drawdown #1 structure that is located below the manhole access.

(G-4) Recommend removing all silt/debris from emergency spillway pipes.

(G-6) Recommend all trees/cattails within 25 feet of dam be killed with a herbicide, safe for use around fish, then cut & remove from dam. Recommend all trees 6" diameter & greater be removed under the direct supervision of owner's professional engineer experienced in dam design & construction. Once all trees are removed establish a sod forming grass and begin an annual mowing program to keep woody growth in check.

(G-8) Recommend owner's professional engineer experienced in dam design & construction evaluate the erosion & prepare plans for repair/control of the erosion for the area left (North) of the principal spillway outlet box, after the removal of the trees/brush in the outlet basin area.

(G-10)Recommend placing riprap over a filter stone bedding or geo-textile fabric in erosion area on the downstream slope along the left (North) contact area to reduce the chance of increased erosion damage.

AUTHORITY OF THE STATE OF INDIANA

I.C. 14-28 Chapter 1 "**Flood Control**" - Section 1 "**Legislative Intent**"-

Sec. 1 The following are declared:

(1) The loss of lives and property caused by floods and the damage resulting from floods is a matter of deep concern to Indiana affecting the life, health, and convenience of the people and the protection of property. To prevent and limit floods, all flood control works and structures and the alteration of natural or present watercourses of all rivers and streams in Indiana should be regulated, supervised, and coordinated in design, construction, and operation according to sound and accepted engineering practices so as to best control and minimize the extent of floods and reduce the height and violence of floods.

(2) The channels and that part of the flood plains of rivers and streams that are the floodways should not be inhabited and should be kept free and clear of interference or obstructions that will cause any undue restriction of the capacity of the floodways.

(3) The water resources of Indiana that have been diminishing should be accumulated, preserved, and protected to prevent any loss or waste beyond reasonable and necessary use.

(4) A master plan or comprehensive plan for the entire state to control floods and to accumulate, preserve, and protect the water resources should be investigated, studied, and prepared, policy and practices should be established, and the necessary works should be constructed and placed in operation.

I.C. 14-28 Chapter 1 "**Flood Control**" - Section 8 "**Right of entry upon premises**"-

Sec. 8 The commission and the commission's agents, engineers, surveyors, and other employees may enter upon any land or water in Indiana for the purpose of making an investigation, an examination, or a survey provided by this chapter.

UNAPPROVED STATUS OF DAM

A dam that has been given an unapproved status (see entry for permit) is one in which plans, construction specifications, hydraulic analyses, and geotechnical investigations have not been received and approved by the Department of Natural Resources. The Flood Control Act (IC 14-28), as amended, requires the Commission to adopt rules for the purpose of administration of the Commission's powers and duties. The Commission has adopted rule 312 IAC 10 entitled "Flood Plain Management" that requires in Rule 4 (312 IAC 10-4-1) "License requirement for construction in a floodway"

Section 1 (a) Except as otherwise provided in IC 14-28-1 or this article, a license from the department is required to erect, make, use, maintain, suffer, or permit a structure, obstruction, deposit, or excavation in or on a floodway.

If this form indicates an unapproved status, our records do not show that progress has been made to secure the required license. The fact that the dam is inspected under the Indiana Code (IC 14-27-7.5) "Regulation of Dams" in no way alters the alleged illegal status of the structure(s). If your dam is indicated to be unapproved, it is requested that you contact the Indiana Department of Natural Resources, Division of Water, to discuss the resolution of the unapproved status of this dam.

DAM NAME Lake Deturk dam STATE DAM I.D. 55-76 DATE 06 / 22 / 2011

E PRINCIPAL SPILLWAY

GOOD	
ACCEPTABLE	✓
DEFICIENT	
POOR	

DESCRIPTION: 30" smooth pipe with a concrete headwall. *Concrete headwall has been repaired, and inlet area has been covered with riprap

PROBLEMS NOTED: ☐ (E-1) None ☑ (E-2) Deterioration ☐ (E-3) Separation ☑ (E-4) Cracking ☐ (E-5) Inlet, Outlet Deficiency ☑ (E-6) Stilling Basin Inadequacies ☐ (E-7) Trash Rack ☐ (E-8) Other

Comments: (E-2)&(E-4) Concrete outlet box culvert is showing deterioration, cracking, and spauling. (E-6) Trees in outlet basin, and on top of outlet box culvert, Erosion along left side of outlet box culvert.

F AUXILIARY SPILLWAY

GOOD	
ACCEPTABLE	✓
DEFICIENT	
POOR	

DESCRIPTION: Cut channel left (North) of contact area with five (5) 16" CMP under access road.
* Two of the damaged inlet colars have been replaced.

PROBLEMS NOTED: ☐ (F-1) None ☐ (F-2) No Auxiliary Spillway Found ☐ (F-3) Erosion-with Backcutting ☐ (F-4) Crack with Displacement ☐ (F-5) Appears to be Structurally Inadequate ☐ (F-6) Appears too Small ☐ (F-7) Inadequate Freeboard ☑ (F-8) Flow Obstructed ☐ (F-9) Concrete Deteriorated/Undermined ☐ (F-10) Other

Comments (F-8) Left two pipes are partially silted in, may restrict flow.

G MAINTENANCE AND REPAIRS

GOOD	
ACCEPTABLE	✓
DEFICIENT	
POOR	

PROBLEMS NOTED: ☐ (G-1) None ☐ (G-2) Access Road Needs Maintenance ☐ (G-3) Cattle Damage ☑ (G-4) Spillway Obstruction ☐ (G-5) Brush, Weeds, Tall Grass, on Upstream Slope, Crest, Downstream Slope, Toe ☑ (G-6) Trees on Upstream Slope, Crest, Downstream Slope ☐ (G-7) Rodent Activity on Upstream Slope, Crest, Downstream Slope, Toe ☑ (G-8) Deteriorated Concrete-Facing, Outlet, Spillway ☐ (G-9) Gate and/or Drawdown Need Repair ☑ (G-10) Other

Comments: See page #2 Additional Comments

H OVERALL CONDITIONS

Based on this inspection and recent file review, the overall surficial condition is determined to be: ☐ (H-1) Satisfactory ☐ (H-2) fair ☑ (H-3) Conditionally Poor ☐ (H-4) Poor ☐ (H-5) Unsatisfactory

Remarks: *Slopes of dam are well mowed. Overall condition of dam may change with the completion of the maintenance and repair items listed and talked about with the owner.

ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

MAINTENANCE-MINOR REPAIR-MONITORING

☑ (1) Provide Additional Erosion Protection: In areas where trees/brush are removed
☑ (2) Mow: Continue with the mowing program
☑ (3) Clear Trees and/or Brush From: Wihtin 25 ft. of dam in the contact areas, and around principal spillway outlet
☐ (4) Initiate Rodent Control Program and Properly Backfill Existing Holes:
☑ (5) Repair: Left wingwall of concrete box culvert outlet
☐ (6) Provide Surface Drainage For:
☑ (7) Monitor: Seepage along toe area and around manhole access for increased flow or change in color from clear to muddy. Report any changes.
☐ (8) Other:
☑ (9) Other: Remove silt/debris from emergency spillway pipes

ENGINEERING-EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO:

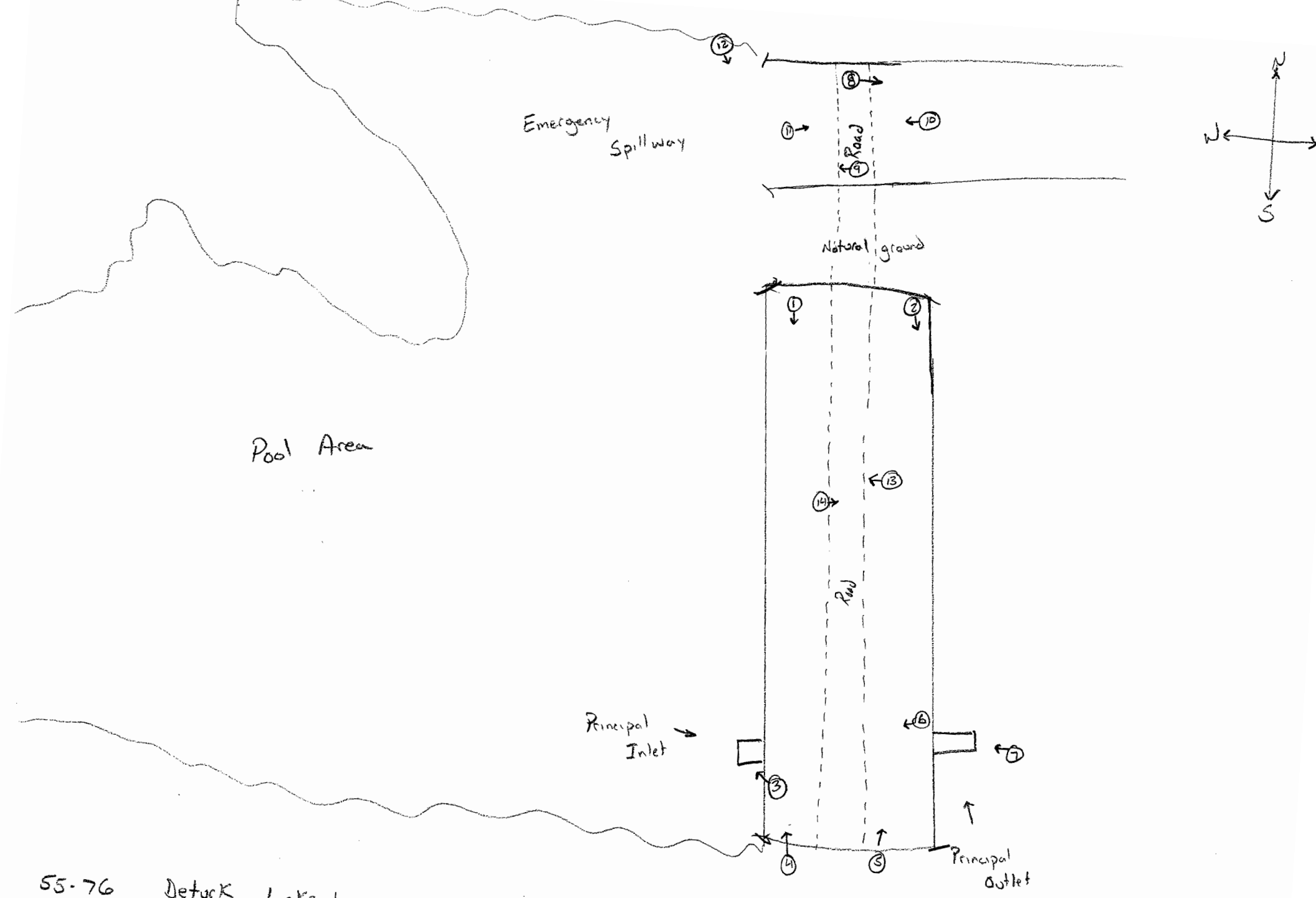
(Plans & Specifications must be approved by State prior to construction.)

☐ (10) Prepare Plans and Specifications for the Rehabilitation of the Dam:
☐ (11) Prepare As-Built Drawings of:
☐ (12) Perform a Geotechnical Investigation to Evaluate the Stability of the Dam:
☐ (13) Perform a Hydrologic Study to Determine Required Spillway Size:
☐ (14) Prepare Plans and Specifications for an Adequate Spillway:
☐ (15) Set up a Monitoring Program:
☐ (16) Refer to Unapproved Status of Dam:
☐ (17) Develop an Emergency Action Plan:
☑ (18) Other: (G-8) Recommend owner's professional engineer experienced in dam design & construction evaluate the erosion & prepare plans for
☑ (19) Other: repair/control of the erosion for the area left (North) of the principal spillway outlet box, after the removal of the trees/brush in the outlet basin area. (D-10) See page #2 Additional Comments

Inspectors Signature Brandon Mescall Reviewed By Date ___/___/___

☑ Technician ☐ Engineer ☐ Geologist Owner/Owner's Representative

The State of Indiana, by providing this dam inspection report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of this dam rests with the owner, who should perform or have performed frequent inspections of this dam.



55-76 Deturk Lake dam

June 22, 2011 BCM

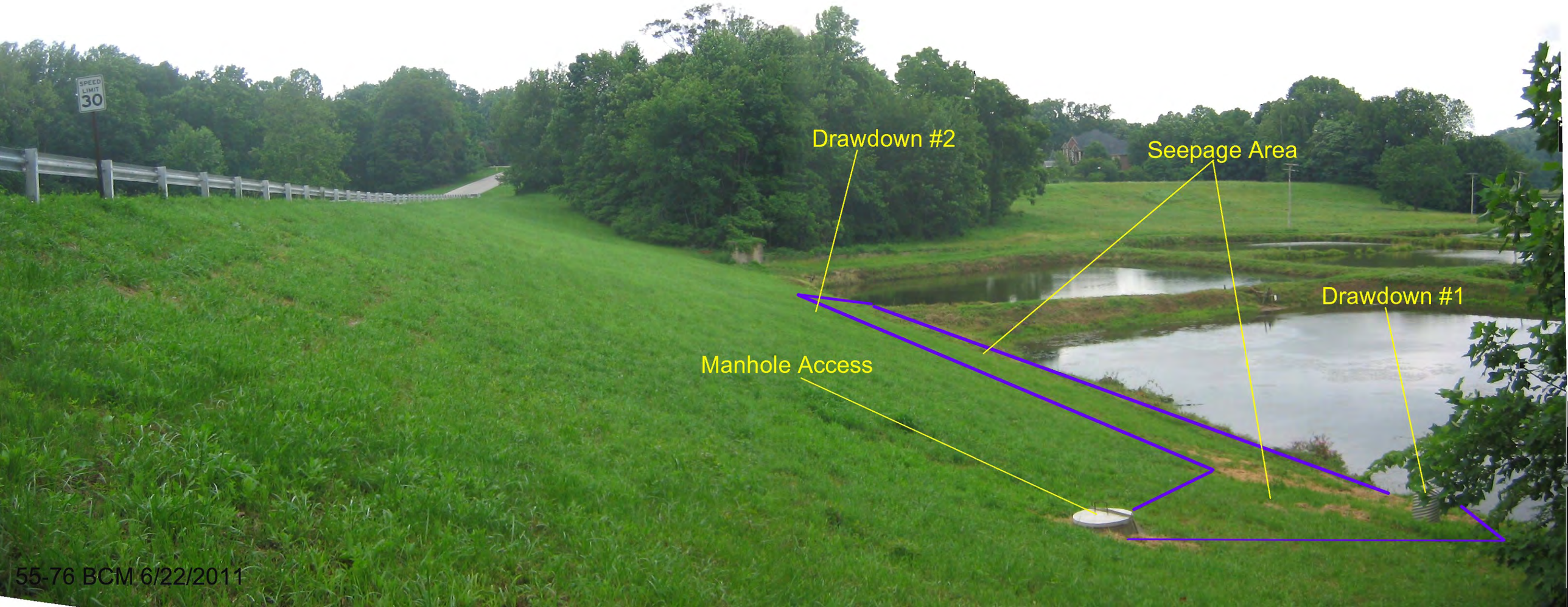

55-76 BCM 6/22/2011

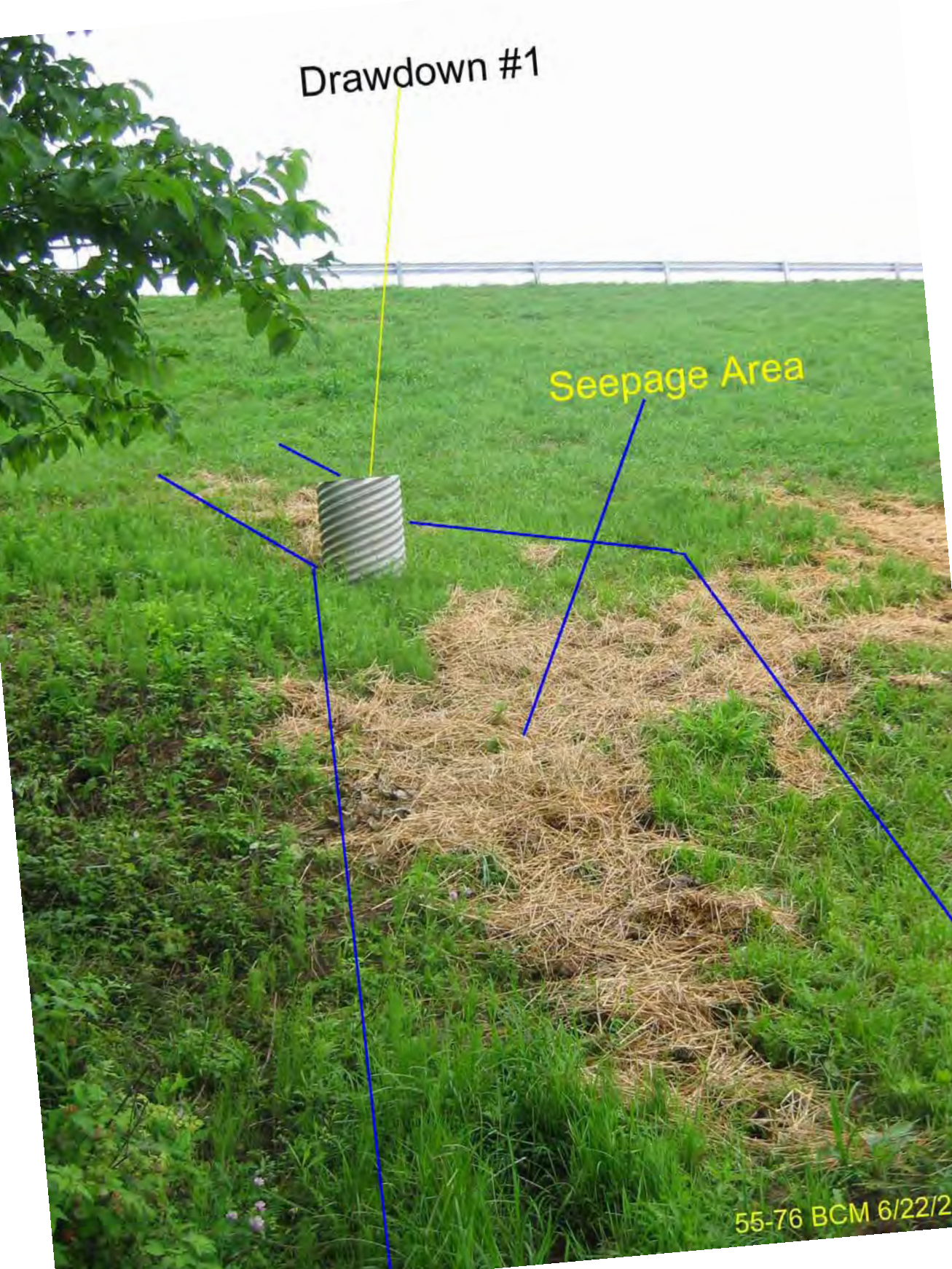
Upstream Slope

Upstream Slope

Downstream Slope

Downstream Slope

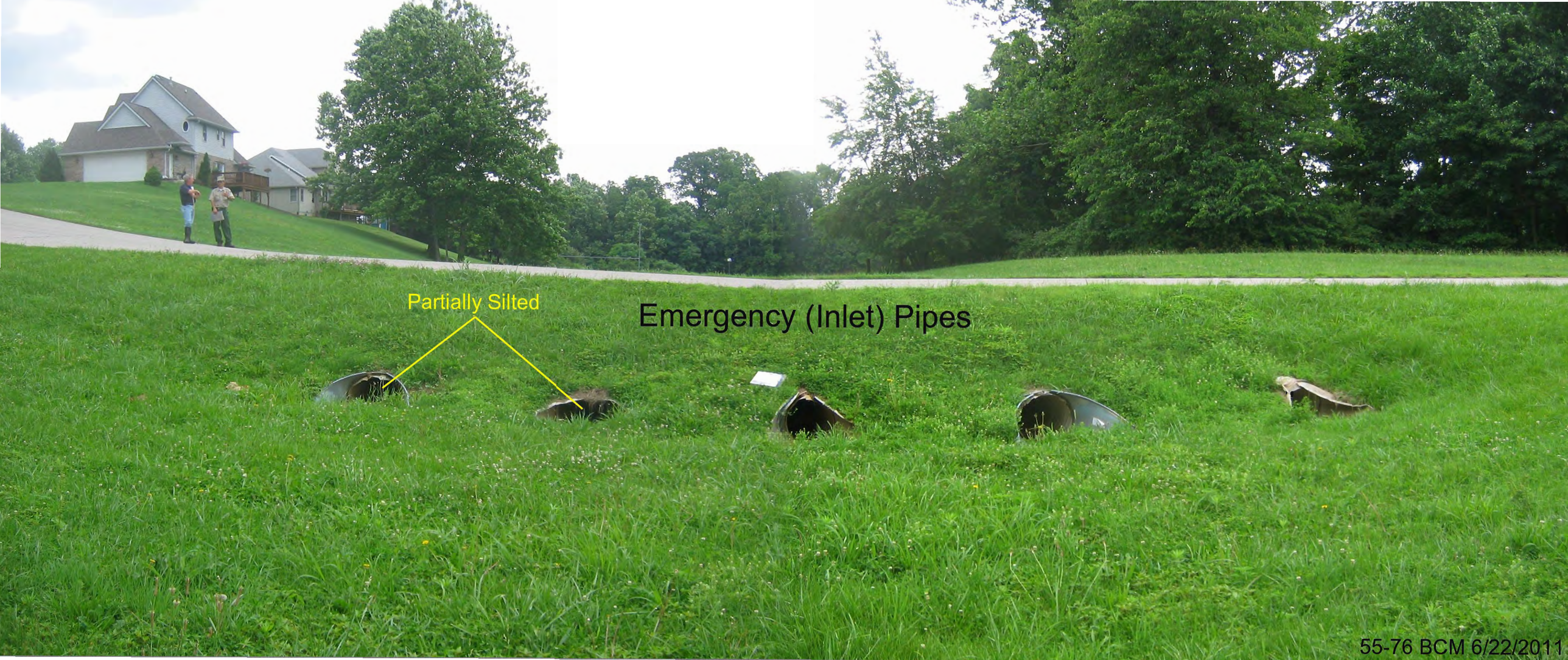



Drawdown #1
Seepage Area
55-76 BCM 6/22/2


Principal Inlet
Repaired Headwall
55-76 BCM 6/22/2011


Principal Outlet
Erosion Area
55-76 BCM 6/22/2011


Emergency Inlet
55-76 BCM 6/22/2011


Partially Silted
Emergency (Inlet) Pipes
55-76 BCM 6/22/2011


Emergency (Outlet) Pipes
Partially Silted
55-76 BCM 6/22/2011


Emergency Outlet
Public Sewer Access
55-76 BCM 6/22/2011


Upstream
55-76 BCM 6/22/2011


Downstream
Fisheries Utility Building
55-76 BCM 6/22/2011

APPENDIX 3
INSPECTION PHOTOGRAPHS
(May 13, 2014)

Top Left:	Upstream slope from south end of dam. Uniform slope with adequate grass cover. No slope protection present.
Top Right	Upstream slope from north end of dam. Uniform slope with adequate grass cover. No slope protection present.
Bottom Left:	Animal burrows typical along upstream slope.
Bottom Right:	Upstream slope near north end. Wave action scarping approximately 75 feet long and 4 feet high.

Top Left:	Upstream slope from south end of dam. Rutting observed along entire slope likely from mowing.
Top Right	Upstream slope near south end of dam. Dense brush and trees have overgrown the right abutment.
Bottom Left:	Principal spillway inlet on upstream slope. Adequate riprap protection around headwall.
Bottom Right:	Principal spillway inlet on upstream slope. Pipe is partially obstructed by riprap, trash rack is missing bars, and headwall and apron has varying degrees of concrete deterioration.

Top Left:	Embankment crest from the north end of dam. Asphalt pavement appears adequate with only minor longitudinal and transverse cracking.
Top Right	Embankment crest from the north end of dam. Asphalt pavement appears adequate with only minor longitudinal and transverse cracking.
Bottom Left:	Embankment crest guardrail located on both the upstream and downstream side. Guardrail shows no signs of instability only minor dents and surface rust.
Bottom Right:	Asphalt cracking typical along entire embankment crest.

Top Left:	Downstream slope from the south end of dam. Uniform slope with adequate grass cover.
Top Right	Downstream slope from the north end of dam. Uniform slope with adequate grass cover.
Bottom Left:	Downstream slope near south end of dam. Dense brush and trees have overgrown the right abutment.
Bottom Right:	Downstream slope near north end of dam. Dense brush and trees have overgrown the left abutment.

Top Left:	Downstream slope near south end of dam. Dense brush has overgrown the toe of the embankment.
Top Right	Downstream slope near center of dam. Depression area observed above lake drain. Approximately 10 feet long by 10 feet wide and 1-foot deep.
Bottom Left:	Downstream slope near center of dam. Rutting observed along entire slope likely from mowing.
Bottom Right:	Principal spillway outlet near south end of dam. Severe deterioration and undermining of the concrete hood. Dense brush and trees have overgrown the outlet area.

Top Left:	Emergency spillway inlet near north end of dam. Upstream inlet channel has adequate grass cover and is free of obstructions. CMP culverts and metal end sections have varying degrees of deformation and siltation.
Top Right	Emergency spillway inlet near north end of dam. Downstream channel has adequate grass cover. CMP culverts and metal end sections have varying degrees of deformation and siltation. A sanitary manhole is located in the center of the spillway channel.
Bottom Left:	Emergency spillway channel looking downstream. Adequate grass cover present.
Bottom Right:	Emergency spillway channel looking upstream. Adequate grass cover present.

APPENDIX 4
DAM INSPECTION CHECKLIST
(May 13, 2014)

Lake DeTurk

Dam Safety Inspection Checklist

Complete All Portions of This Section (Pre-inspection)
Date of Inspection: 5/13/2014
Name of Dam: Lake DeTurk Dam File Number: 14-0103.00000
EAP: (yes, no) OM&I: (yes, no)

Review Inventory - Highlight missing information (Pre -inspection)
Owner=s Name(s): Lake DeTurk Conservancy District
Address: PO Box 1149
City: Martinsville State: IN Zip (+4): 46151

Telephone (Home): Telephone (Work):
Contact Person: Ronald Reinhart, Chair Telephone:
Designed By: David H. Harker, Civil Engineer
Constructed By:
Year Completed: 1971 - 1978 Plans Available (Yes, No) (location):
Purpose of dam: Recreation for LDCD; Water Supply to Ozark Fisheries

Interview with Owner (at the site):
Owner/Representative present: (Yes, No) Name(s): Roger Radue / Anna Radue

Double check address, telephone #, purpose (check ->) G
How long have you owned dam - previous name/owner? 2 yrs

EAP/OM&I: up-dated-(yes, no) & location: Currently being developed
Operate lake drain (times per year, accessibility):

Mowing (times per year):
Prior problems (wet areas, erosion, slides):

Repair or modification (what & when): None known

Failure/Incident/Breach (max. pool):

Downstream hazard status (recent changes): High Hazard as of Feb. 2014

Do you know the in-depth details of the construction of your dam? (If yes - ask next three questions, if no - go to Field Information Section)
Core trench material and location:
Volume of fill (earth or rock) in dam:
Foundation (earth or rock) of dam:

Field Information (while at site)
Pool Elevation (during inspection): x Normal Pool Time: 8:00 (a.m. p.m.)
Site Conditions(temp., weather, ground moisture): 70°F, Partly Sunny, Dry

Inspection Party: Brian W. McKenna, Jeffrey D. Fox, Aaron J. Fincke
Maximum Height: 30 ft (measured or inventory appears correct)
Normal Pool Surface Area: 360 AC (measured or inventory appears correct)

Required Action

UPSTREAM SLOPE

Gradient: Horizontal: 3 Vertical: 1 (est, meas.)

None | Monitor | Maintenance | Engineer

☑ ***VEGETATION*** [no problem]

☑ Trees: Quantity: (<5, sparse, dense) — ☐ ☐ ☑ ☐

Diameter: (<6", 6-12", >12")

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Notes:

2 Left Abutment Maintenance Req'd.

☑ Brush: Quantity: (sparse, dense) — ☐ ☐ ☑ ☐

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Notes:

Remove Old Vegetation From Embankment

☑ Ground Cover: Type: (grass, crown vetch) Other: — ☑ ☐ ☐ ☐

Quantity: (bare, sparse, adequate, dense)

Appearance: (too tall, too short, good)

Notes:

☑ ***SLOPE PROTECTION*** [no problem, could not inspect thoroughly]

☑ None — ☑ ☐ ☐ ☐

☐ Riprap: Average Diameter: — ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:

☐ Wave Berm: — ☐ ☐ ☐ ☐

Vegetation: (adequate, bare, sparse, improper vegetation)

Notes:

☐ Concrete Slabs: (cracked, settlement, undermined, voids, deteriorated, vegetation) — ☐ ☐ ☐ ☐

Notes:

☐ Other: — ☐ ☐ ☐ ☐

Notes:

☑ ***EROSION*** [no problem, could not inspect thoroughly]

☑ Wave Erosion (Beaching): Scarp: Length: 75 ft Height: 3/4 of Bank — ☐ ☐ ☑ ☐

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Notes: 90% of U/S slope 4' Above N.S.E near toe => Grade Change

☐ Runoff Erosion (Gullies): Quantity: — ☐ ☐ ☐ ☐

Depth: Width: Length:

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Notes/Causes:

☐ ***INSTABILITIES*** [no problem, could not inspect thoroughly]

☐ Slides: Transverse Length: Longitudinal Length: — ☐ ☐ ☐ ☐

Scarp: Width: Length:

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Crack: Width: Depth:

Notes/Causes

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other — ☐ ☐ ☐ ☐

Quantity: Length: Width: Depth:

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Notes/Causes:

None | Monitor | Maintenance | Engineer

Required Action

Required Action

None | Monitor | Maintenance | Engineer

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ ***OTHER*** [no problem, could not inspect thoroughly]
☑ Rodent Burrows: (few, numerous) ☐ ☐ ☑ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes:

☑ Ruts: ☐ ☑ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Depth: 6" Width 1' Length: 90%
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) Mower

☐ Other: ☐ ☐ ☐ ☐
Notes:

CREST Length: 590 ft Width: 30 ft (est. meas.)

☐ ***VEGETATION*** [no problem] Paved ☑ ☐ ☐ ☐
☐ Trees: Quantity: (<5, sparse, dense)
Diameter: (<6", 6-12", >12")
Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)
Notes:

☐ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐
Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)
Notes:

☐ Ground Cover: Type: (grass, crown vetch) Other: ☐ ☐ ☐ ☐
Quantity: (bare, sparse, adequate, dense)
Appearance: (too tall, too short, good)
Notes:

☑ ***EROSION*** (no problem, could not inspect thoroughly]
☐ Runoff Erosion (Gullies): Quantity: Depth: Width: Length: ☑ ☐ ☐ ☐
Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)
Notes/Causes:

None | Monitor | Maintenance | Engineer

Required Action

Required Action

None | Monitor | Maintenance | Engineer

☒ ***ALIGNMENT*** [no problem, could not inspect thoroughly]

☒ Vertical: ☒ Low Area: at center of dam — ☐ ☐ ☒ ☐

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Elevation Difference: Length:

Notes/Causes: Appears to have been constructed with low spot in road · causing erosion gully

☐ Horizontal: — ☐ ☐ ☐ ☐

Notes/Causes:

☒ ***WIDTH*** [no problem]

☐ Too Narrow

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) — ☑ ☐ ☐ ☐

Notes/Causes:

☒ ***INSTABILITIES*** [no problem, could not inspect thoroughly]

☒ Cracks: ☒ Transverse ☐ Longitudinal ☐ Other — ☐ ☐ ☒ ☐

Quantity: Length: Width: Depth:

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Notes/Causes: pavement cracks spaced every 15'-30' along crest

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other — ☐ ☐ ☐ ☐

Quantity: Length: Width: Depth:

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky — ☐ ☐ ☐ ☐

Size: Height: Depth:

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky — ☐ ☐ ☐ ☐

Size: Height: Depth:

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Notes/Causes:

☒ ***OTHER*** [no problem, could not inspect thoroughly]

☐ Rodent Burrows: (few, numerous) — ☑ ☐ ☐ ☐

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Notes:

☐ Ruts: — ☐ ☐ ☐ ☐

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Depth: Width Length:

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☒ Other: — ☒ ☐ ☐ ☐

Notes: guardrail on both sides

None | Monitor | Maintenance | Engineer

Required Action

Required Action

DOWNSTREAM SLOPE Gradient: Horizontal: 3 Vertical: 1 (est, meas.)

None | Monitor | Maintenance | Engineer

☑ ***VEGETATION*** [no problem]

☐ Trees: Quantity: (<5, sparse, dense) ☐ ☐ ☐
Diameter: (<6", 6-12", >12")
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes:

☑ Brush: Quantity: (sparse, dense) ☐ ☐ ☒ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes: Brush starting to grow along toe due to steep slope from fish ponds; Brush starting to encroach at each abutment

☑ Ground Cover: Type: (grass, crown vetch) Other: ☒ ☐ ☐ ☐
Quantity: (bare, sparse, adequate, dense)
Appearance: (too tall, too short, good)
Notes:

☒ ***EROSION*** [no problem, could not inspect thoroughly]

☒ Runoff Erosion (Gullies): Quantity: Depth: 6" Width: 12" Length: ☐ ☐ ☒ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes: Erosion gully noted that starts at low spot in edge of pavement and continues to toe of dam near outlet of lake drain

☒ ***INSTABILITIES*** [no problem, could not inspect thoroughly]

☐ Slides: Transverse Length: Longitudinal Length: ☐ ☐ ☐ ☐
Scarp: Width: Length:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Crack: Width: Depth:
Notes/Causes

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☒ Depressions ☐ Hummocky ☐ ☐ ☒ ☐
Size: 10'x10' Height: Depth: ~1'
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) just above drain valve
Notes/Causes: Internal erosion around lake drain could be causing settlement

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

None | Monitor | Maintenance | Engineer

Required Action

Required Action

None | Monitor | Maintenance | Engineer

☒ ***OTHER*** [no problem, could not inspect thoroughly]

☐ Rodent Burrows: (few, numerous) ☐ ☐ ☐ ☐

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Notes:

☒ Ruts: ☐ ☒ ☐ ☐

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) mostly at top

Depth: Width Length:

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) mowing equipment

☐ Other: ☐ ☐ ☐ ☐

Notes:

☐ ***SEEPAGE*** [no problem, could not inspect thoroughly]

☐ Wet Area ☐ Flow ☐ Boil ☐ Sinkhole ☐ ☐ ☐ ☐

Flow Rate _____ Size: _____

Location: _____

☐ Aquatic Vegetation ☐ None

☐ Rust Colored Deposits ☐ None

☐ Sediment in Flow ☐ None

☐ Other: _____

Notes/Causes: _____

☐ Wet Area ☐ Flow ☐ Boil ☐ Sinkhole ☐ ☐ ☐ ☐

Flow Rate _____ Size: _____

Location: _____

☐ Aquatic Vegetation ☐ None

☐ Rust Colored Deposits ☐ None

☐ Sediment in Flow ☐ None

☐ Other: _____

Notes/Causes: _____

☒ ***EMBANKMENT DRAINS*** [none, none found, no problem, could not inspect thoroughly]

Type: ☐ Toe Drain ☐ Relief Wells ☐ Other: _____ ☑ ☐ ☐ ☐

Flow Rate: _____ Size: _____ Number: _____

Location: _____

Notes: _____

☒ ***MONITORING INSTRUMENTATION*** [none, none found, no problem, could not inspect thoroughly]

☐ None Found ☐ Piezometers ☐ Weirs/Flumes ☐ Other ☑ ☐ ☐ ☐

☐ Periodic Inspections by: _____

Notes: _____

None | Monitor | Maintenance | Engineer

Required Action

Required Action

PRINCIPAL SPILLWAY

☑ ***GENERAL INLET*** [no problem, could not inspect thoroughly] — None ☐ Monitor ☐ Maintenance ☐ Engineer ☐

☐ Anti-Vortex Plate [None] Dimensions: _____ (adequate, too small,) ☐ ☐ ☐ ☐

Type: (steel, concrete, aluminum, stainless steel, corrugated metal wood, other): _____

Deterioration: (missing sections, rusted, collapsed) _____

Notes: _____

☐ Flash Boards [None] ☐ ☐ ☐ ☐

Type: (metal, wood): _____

Deterioration: _____

Notes: _____

☑ Trashrack [None] Opening Size: _____ (adequate, too small, too large) ☐ ☐ ☑ ☐

Type: (metal bars, fence, screen, concrete, baffle, other): _____

Deterioration: (broken bars, missing sections, rusted, collapsed) _____

Notes: _____

☐ ***INLET OBSTRUCTION*** [no problem, could not inspect thoroughly]

☑ Debris: (leaves, trash, logs, branches, ice) RIPRAP ☐ ☐ ☑ ☐

☐ Trees: Quantity: (<5, sparse, dense) ☐ ☐ ☐ ☐

Diameter: (<6", 6-12", >12")

Location: (entire inlet, lt side, rt side, middle, see dwg)

Notes:

☐ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg)

Notes:

☐ Other:(beaver activity, trashrack opening too small, partially/completely blocked, i.e.) ☐ ☐ ☐ ☐

Notes:

☐ ***INLET MATERIALS*** [no problem, could not inspect thoroughly]

☑ Metal

(loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) ☐ ☑ ☐ ☐

Dimensions: 36"

Location: _____

Notes/Causes: _____

☑ Concrete

(bug holes, hairline crack, efflorescence) ☐ ☐ ☑ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☑ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☑ ☐

Dimensions/Location: _____

Notes/Causes: HEADWALL DETERIORATION => MINOR
APRON CRACKING => SEVERE

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location: _____

Notes/Causes: _____

☐ Plastic ☐ ☐ ☐ ☐

(deterioration, cracking, deformation) _____

Dimensions: _____

Location: _____

Notes/Causes: _____

None Monitor Maintenance Engineer

Required Action

Required Action

None Monitor Maintenance Engineer

☐ Earthen

☐ Ground Cover: Type: (grass, crown vetch) Other: ☐ ☐ ☐ ☐

Quantity: (bare, sparse, adequate, dense)

Appearance: (too tall, too short, good)

Notes:

☐ Erosion: (wave, surface runoff) ☐ ☐ ☐ ☐

Description (height/depth/length/etc):

Notes:

☐ Ruts: ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg)

Depth: Width Length:

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:

☐ Rock-Cut (weathered, erosion) ☐ ☐ ☐ ☐

Description:

Notes:

☐ Other: ☐ ☐ ☐ ☐

☐ ***OTHER INLET PROBLEMS*** [no problem, could not inspect thoroughly]

☐ Mis-Alignment:(pipe, chute, sidewall, headwall) ☐ Pipe Deformation ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Other: ☐ ☐ ☐ ☐

☐ ***OPEN CHANNEL CONTROL SECTION*** [no problem, could not inspect] **Width** (est., ms.) **Brdth** (est., ms.) ☐ ☐ ☐ ☐

Notes:

☑ ***OUTLET OBSTRUCTION*** [no problem, could not inspect thoroughly]

☐ Debris: (leaves, trash, logs, branches, ice) ☐ ☐ ☐ ☐

☑ Trees: Quantity: (<5, sparse, dense) ☐ ☐ ☑ ☐

Diameter: (<6", 6-12", >12")

Location: (entire outlet, lt side, rt side, middle, see dwg)

Notes:

☑ Brush: Quantity: (sparse, dense) ☐ ☐ ☑ ☐

Location:(entire outlet, lt side, rt side, middle, see dwg)

Notes:

Required Action

☐ Other:(beaver activity, partially/completely blocked, i.e.) ☐ ☐ ☐ ☐

None Monitor Maintenance Engineer

Notes:

{Upstream Slope, Crest, Downstream Slope, Seepage, **Principal Spillway-Inlet/Outlet**, Emergency Spillway, Lake Drain}

Required Action

☒ ***OUTLET MATERIALS*** [no problem, could not inspect thoroughly]

☐ Metal (loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) _____ ☐ ☐ ☐ ☐ (None, Monitor, Maintenance, Engineer)

Dimensions: _____

Location: _____

Notes/Causes: _____

☒ Concrete

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☒

Dimensions/Location:

Notes/Causes: Outlet Structure is deteriorated and undermined

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location: _____

Notes/Causes: _____

☐ Plastic (deterioration, cracking, deformation) _____ ☐ ☐ ☐ ☐

Dimensions: _____

Location: _____

Notes/Causes: _____

☐ Earthen

☐ Ground Cover: Type: (grass, crown vetch) Other: ☐ ☐ ☐ ☐

Quantity: (bare, sparse, adequate, dense)

Appearance: (too tall, too short, good)

Notes:

☐ Erosion: (other, surface runoff) ☐ ☐ ☐ ☐

Description (width/depth/length/etc): _____

Notes: _____

☐ Ruts: ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg)

Depth: Width Length:

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:

☐ Rock-Cut (weathered, erosion) _____

Description/Notes: _____ ☐ ☐ ☐ ☐

☐ Other: _____ ☐ ☐ ☐ ☐

☒ ***OTHER OUTLET PROBLEMS*** [no problem, could not inspect thoroughly]

☐ Mis-Alignment:(pipe, chute, sidewall, headwall) ☐ Pipe Deformation _____ ☐ ☐ ☐ ☐ (None, Monitor, Maintenance, Engineer)

Location/Description: _____

Notes/Causes: _____

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description: _____

Notes/Causes: _____

☒ Undermining: _____ ☐ ☐ ☐ ☒

Location/Description: _____

Notes/Causes: _____

☐ Other: _____ ☐ ☐ ☐ ☐

{Upstream Slope, Crest, Downstream Slope, Seepage, **Principal Spillway-Outlet**, Emergency Spillway, Lake Drain}

Required Action

Required Action

None Monitor Maintenance Engineer

OUTLET EROSION CONTROL STRUCTURE (Stilling Basins)

☒ None ☐ ☐ ☐ ☐

☐ (endwall/headwall, plunge pool, impact basin, flip bucket, USBR, baffled chute, rock lined channel) ☐ ☐ ☐ ☐

Notes:

Components (baffle blocks, chute blocks, endsill)

☐ ***MATERIAL*** [no problem, could not inspect thoroughly]

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:

☐ Concrete

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

☐ ***OTHER*** [no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐

☐ Mis-Alignment: (sidewall, headwall, entire struct.)

Location:

Description:

Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location:

Description:

Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐

Location:

Description:

Notes/Causes:

☐ Other: ☐ ☐ ☐ ☐

☒ ***DRAINS*** [none, none found, no problem, could not inspect thoroughly] (See ***SEEPAGE*** Section for Toe Drains & Relief Wells)

Type: ☐ Weep Holes ☒ Relief Drains ☐ Other: ☐ ☒ ☐ ☐

Flow Rate: Size: Number:

Location: primary spillway riser

Notes:

Type: ☐ Weep Holes ☒ Relief Drains ☐ Other: ☐ ☒ ☐ ☐

Flow Rate: Size: Number:

Location: embankment toe - 1 near spillway and 1 near middle

Notes:

None Monitor Maintenance Engineer

Required Action

EMERGENCY SPILLWAY

Required Action: None | Monitor | Maint. | Engineer

☐ None Found ☐ ☐ ☐ ☐

☒ ***GENERAL INLET*** (no problem, could not inspect thoroughly]

☐ Anti-Vortex Plate [None] Dimensions: _____ (adequate, too small,) ☐ ☐ ☐ ☐

Type: (steel, concrete, aluminum, stainless steel, corrugated metal wood, other): _____

Deterioration: (missing sections, rusted, collapsed) _____

Notes: _____

☐ Flash Boards [None] ☐ ☐ ☐ ☐

Type: (metal, wood): _____

Deterioration: _____

Notes: _____

☐ Trashrack [None] Opening Size: _____ (adequate, too small, too large) ☐ ☐ ☐ ☐

Type: (metal bars, fence, screen, concrete, baffle, other): _____

Deterioration: (broken bars, missing sections, rusted, collapsed) _____

Notes: _____

☑ ***INLET OBSTRUCTION*** [no problem, could not inspect thoroughly]

☑ Debris: (leaves, trash, logs, branches, ice) Grass clippings / Leaves at culvert inlets ☐ ☐ ☑ ☐

☐ Trees: Quantity: (<5, sparse, dense) ☐ ☐ ☐ ☐

Diameter: (<6", 6-12", >12")

Location: (entire inlet, lt side, rt side, middle, see dwg)

Notes:

☐ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg)

Notes:

☐ Other:(beaver activity, trashrack opening too small, partially/completely blocked, i.e.) _____ ☐ ☐ ☐ ☐

Notes:

☒ ***INLET MATERIALS*** [no problem, could not inspect thoroughly]

☒ Metal culverts under road - 5 18" CMP

(loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) General Loss of capacity in all pipes ☐ ☐ ☑ ☐

Dimensions/Location: Metal end sections deformed/broken

Notes/Causes:

☐ Concrete

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

☐ Plastic ☐ ☐ ☐ ☐

(deterioration, cracking, deformation)

Dimensions/Location:

Notes/Causes:

Required Action

None | Monitor | Maintenance | Engineer

☐ Earthen

☐ Ground Cover: Type: (grass, crown vetch) Other: ☐ ☐ ☐ ☐

Quantity: (bare, sparse, adequate, dense)

Appearance: (too tall, too short, good)

Notes:

☐ Erosion: (wave, surface runoff) _____ ☐ ☐ ☐ ☐

Description (height/depth/length/etc): _____

Notes: _____

☐ Ruts: ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg)

Depth: Width Length:

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:

☐ Rock-Cut (weathered, erosion) ☐ ☐ ☐ ☐

Description: _____

Notes: _____

☐ Other: _____ ☐ ☐ ☐ ☐

☐ ***OTHER INLET PROBLEMS*** [no problem, could not inspect thoroughly]

☐ Mis-Alignment:(channel, chute, sidewall, headwall) ☐ Pipe Deformation _____ ☐ ☐ ☐ ☐

Location/Description: _____

Notes/Causes: _____

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description: _____

Notes/Causes: _____

☐ Undermining: ☐ ☐ ☐ ☐

Location/Description: _____

Notes/Causes: _____

☐ Other: _____ ☐ ☐ ☐ ☐

☑ ***OPEN CHANNEL CONTROL SECTION*** [no problem, could not inspect] **Width** 50 (es., ms.) **Brdth** (est., ms.)

Notes: WELL MAINTAINED; ADEQUATE GRASS COVER ☑ ☐ ☐ ☐

☐ ***OUTLET OBSTRUCTION*** [no problem, could not inspect thoroughly]

☐ Debris: (leaves, trash, logs, branches, ice) _____ ☐ ☐ ☐ ☐

☐ Trees: Quantity: (<5, sparse, dense) _____ ☐ ☐ ☐ ☐

Diameter: (<6", 6-12", >12")

Location: (entire outlet, lt side, rt side, middle, see dwg)

Notes:

☐ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐

Location:(entire outlet, lt side, rt side, middle, see dwg)

Notes:

Required Action

☐ Other:(beaver activity, partially/completely blocked, i.e.) ☐ ☐ ☐ ☐

Notes:

None | Monitor | Maintenance | Engineer

{Upstream Slope, Crest, Downstream Slope, Seepage, Principal Spillway, **Emergency Spillway-Inlet/Outlet**, Lake Drain}

Required Action

None Monitor Maint. Engineer

☐ ***OUTLET MATERIALS*** [no problem, could not inspect thoroughly]

☐ Metal (loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) ☐ ☐ ☐ ☐

Dimensions:

Location:

Notes/Causes:

☐ Concrete (bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

☐ Plastic (deterioration, cracking, deformation) ☐ ☐ ☐ ☐

Dimensions:

Location:

Notes/Causes:

☐ Earthen

☐ Ground Cover: Type: (grass, crown vetch) Other: ☐ ☐ ☐ ☐

Quantity: (bare, sparse, adequate, dense)

Appearance: (too tall, too short, good)

Notes:

☐ Erosion: (other, surface runoff) ☐ ☐ ☐ ☐

Description (width/depth/length/etc):

Notes:

☐ Ruts: ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg)

Depth: Width Length:

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:

☐ Rock-Cut (weathered, erosion)

Description: ☐ ☐ ☐ ☐

Notes:

☐ Other: ☐ ☐ ☐ ☐

☐ ***OTHER OUTLET PROBLEMS*** [no problem, could not inspect thoroughly]

☐ Mis-Alignment:(channel, chute, sidewall, headwall) ☐ Pipe Deformation ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

None Monitor Maintenance Engineer

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Other: ☐ ☐ ☐ ☐

{Upstream Slope, Crest, Downstream Slope, Seepage, Principal Spillway, **Emergency Spillway-Outlet**, Lake Drain}

Required Action

Required Action

None Monitor Maint. Engineer

OUTLET EROSION CONTROL STRUCTURE (Stilling Basins)

☐ None ☐ ☐ ☐ ☐

☐ (endwall/headwall, plunge pool, impact basin, flip bucket, USBR, baffled chute, rock lined channel) ☐ ☐ ☐ ☐

Notes:

Components (baffle blocks, chute blocks, endsill)

☐ ***MATERIAL*** [no problem, could not inspect thoroughly]

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:

☐ Concrete

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

☐ ***OTHER*** [no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐

☐ Mis-Alignment:(sidewall, headwall)

Location:

Description:

Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location:

Description:

Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐

Location:

Description:

Notes/Causes:

☐ Other: ☐ ☐ ☐ ☐

☐ ***DRAINS*** [none, none found, no problem, could not inspect thoroughly] (See ***SEEPAGE*** Section for Toe Drains & Relief Wells)

Type: ☐ Weep Holes ☐ Relief Drains ☐ Other: ☐ ☐ ☐ ☐

Flow Rate: Size: Number:

Location:

Notes:

Type: ☐ Weep Holes ☐ Relief Drains ☐ Other: ☐ ☐ ☐ ☐

Flow Rate: Size: Number:

Location:

Notes:

None Monitor Maintenance Engineer

Required Action

Required Action

None | Monitor | Maint. | Engineer

LAKE DRAIN

☑ ***GENERAL***

☐ None Found ☐ Does not have one — ☐ ☐ ☐ ☐

☑ Type of Lake Drain (isolated control/intake tower, valve vault ~~w/ outlet~~ conduit, valve in riser/drop inlet, siphon) — ☐ ☑ ☐ ☐

Notes: Valves used as Water Supply

☐ Operated During Inspection (yes, no) — ☐ ☐ ☐ ☐

Notes:

☐ ***ACCESS TO VALVE/SLUICE GATE*** [no problem, could not inspect thoroughly] — ☐ ☐ ☐ ☐

☐ Type (not accessible, from shore, boat, walkway, other)

Notes:

☐ Walkway/Platform:

☐ Concrete Deterioration ☐ Cracks (platform, piers, end supports, railing) — ☐ ☐ ☐ ☐

Location:

Notes:

☐ Wood Deterioration — ☐ ☐ ☐ ☐

Notes:

☐ Metal Deterioration — ☐ ☐ ☐ ☐

(minor, moderate, extensive, other)

Notes:

☑ ***LAKE DRAIN COMPONENTS*** [no problem, could not inspect thoroughly]

☐ Concrete Structure — ☐ ☐ ☐ ☐

Location:

Description: (deterioration, misalignment, cracks):

Notes/Causes:

☑ Valve Control (Operating Device) — ☐ ☑ ☐ ☐

☐ No Operating Device ☐ No Stem ☐ Bent/Broken Stem ☐ Other

Notes/Operability:

☐ Valve / Sluice Gate — ☐ ☐ ☐ ☐

☐ Metal Deterioration: (surface rust, minor, moderate, extensive, other)

Location:

Flow Rate:

Notes/Causes:

☐ Misalignment — ☐ ☐ ☐ ☐

Notes/Causes:

☐ Leakage - Flow Rate: — ☐ ☐ ☐ ☐

Notes/Causes:

☐ Valve / Sluice Gate — ☐ ☐ ☐ ☐

☐ Metal Deterioration: (surface rust, minor, moderate, extensive, other)

Location:

Flow Rate:

Notes/Causes:

☐ Misalignment - Notes/Causes: — ☐ ☐ ☐ ☐

Required Action

☐ Leakage - Flow Rate: — ☐ ☐ ☐ ☐

Notes/Causes:

None | Monitor | Maintenance | Engineer

Required Action

None | Monitor | Maintenance | Engineer

☐ Outlet Conduit

☐ Metal:(loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out) ☐ ☐ ☐ ☐

Location:

Notes/Causes:

☐ Concrete (bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

☐ Plastic:(deterioration, cracking) ☐ ☐ ☐ ☐

Location:

Notes/Causes:

☐ Conduit Deformation ☐ Mis-Alignment: ☐ ☐ ☐ ☐

Location:

Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Vegetation (trees, brush) ☐ ☐ ☐ ☐

Notes:

☐ Other: ☐ ☐ ☐ ☐

Notes:

☐ Energy Dissipator

☐ Type (endwall, plunge pool, impact basin, stilling basin, rock-lined channel, none) ☐ ☐ ☐ ☐

Notes:

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no))

Notes:

☐ Concrete (bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

☐ Mis-Alignment: ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

Required Action

☐ Other: ☐ ☐ ☐ ☐

Notes:

None | Monitor | Maintenance | Engineer

APPENDIX 5
EMBANKMENT DAM FAILURE MODES AND RISK FACTORS

Failure Modes of Embankment Dams

IDNR classifies dam failures in two categories: Type 1, component failure of a structure that does not result in a significant reservoir release; and, Type 2, uncontrolled breach failure of a structure that results in a significant reservoir release.

Type 1 failures include localized seepage and structural failures of dam components that do not breach the dam into the reservoir. Type 1 failures are generally local failures of a dam feature, such as an embankment slide that does not breach the crest, a spillway structural failure, a piping condition in its early stage of formation, a trash rack failure, or settlement on an earth dam embankment that does not extend to the water level. Type 1 failures are critical, require immediate attention, and may lead to a Type 2 failure. However, they do not result in a significant release of reservoir water and generally do not pose an immediate dam safety risk.

Type 2 failures are failures that do result in a significant release of the reservoir and may eventually result in a dam breach with total release of the reservoir. There are three general categories of Type 2 failures: (1) hydraulic failures, (2) seepage failures, and (3) structural failures. Type 2 failures often result from Type 1 failures that were improperly corrected or were ignored.

Embankment dams have three potential modes for Type 2, uncontrolled breach failure:

1. hydraulic failure (dam overtopping, wave erosion, dam toe erosion, severe erosion)

2. seepage failure (pervious reservoir rim or bottom, pervious foundation, pervious dam, leaking conduits, cracks in dam, piping through dam or along conduits, inappropriate vegetation, windblown trees, animal burrows)

3. structural failure (dam and foundation slides, dam failure, dam settlement, spillway cracks or failure)

The presence of any of these conditions poses a degree of risk for dam failure, however, failure typically will not occur until the conditions become severe enough to allow water to flow out of the reservoir in an uncontrolled manner. Therefore, when the dam deficiencies are minor and do not threaten the stability or safety of the dam, the risk of dam failure is low. If the deficiencies are serious and do pose a likely threat to the dam safety, the risk of dam failure is high.

Risk Factors that can Cause Dam Failure

The factors that pose a risk to embankment dams can be categorized into four groups:

1. structural factors (design, construction, and condition of embankment, foundation, abutments, and spillways)

2) natural factors (earthquakes, storms, floods, landslides, sedimentation)

3) human factors (vandalism, terrorism, mistakes, operational mismanagement)

4) operating factors (poor maintenance practices, lack of operator training, poor access, lack of proper inspection program, reliability of electrical and mechanical equipment)

For purposes of this report, the potential risk of dam failure is defined as follows:

Low risk – the dam or its appurtenant works has a minor deficiency that does not pose an imminent threat to the dam safety. However, if left unattended, these deficiencies may progress and ultimately lead to a dam failure. Low risk conditions should be monitored and/or repaired within 4 years. If the deficiency is minor and is progressing very slowly, it may be appropriate to monitor the condition, and reassess it every year. In some cases it may be appropriate to complete the repairs immediately and be done with it. If the dam is a high hazard dam, a shorter time limit for performing low risk repairs may be warranted to ensure that the work will be completed before the next formal technical safety inspection. Repairs or correction of low risk deficiencies are typically a low priority. A minor deficiency with a low risk of dam failure may be assigned a medium priority repair schedule if the deficiency makes it impossible or difficult to perform a visual inspection. An example of this is excessive vegetation of the embankment; the excessive vegetation may present a low risk of dam failure, but because it prevents a proper visual inspection, removal of the brush may be assigned a medium or high priority.

Medium risk - the dam or its appurtenant works has a deficiency that lies between minor and serious. Medium risk conditions should be corrected as soon as possible, but no later than 3 years. Corrective repairs may need to be performed sooner if the deficiency is progressing rapidly. Repairs or correction of medium risk deficiencies are typically a medium priority.

High risk – the dam or its appurtenant works has a severe deficiency that poses an imminent threat to the dam safety. The dam will fail if the deficiency is not corrected. High risk conditions must be corrected within 1 year. Repairs or correction of high risk deficiencies are typically a high priority.

The risk assessment should always be tempered with the potential downstream safety hazards. A minor deficiency on a low hazard dam may have a lower priority for repair than the same deficiency on a high hazard dam.

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July 7, 2014

Mr. Ronald Reinhart
Lake DeTurk Conservancy District
P.O. Box 1149
Martinsville, Indiana 46151

Re: High Hazard Dam Inspection Report
Lake DeTurk Dam
Dam ID # 55-76 - Morgan County

Dear Mr. Reinhart,

Particular information regarding your biennial inspection report on the Lake DeTurk Dam is included in the following list:

1. Field Date that inspection was performed: May 13, 2014.
2. Next biennial inspection is due to be received in this office before: July 01, 2016
3. Report was received in this office on: July 1, 2014
4. Engineering Firm performing inspection was: Christopher B. Burke Engineering, LLC - Indianapolis, Indiana
5. Professional Engineer signing report: Jeffrey D. Fox, P.E. - PE11100632
6. Your engineer rated the overall condition of the dam as: "Conditionally Poor"
7. Engineer recommendations were provided. *Please review the two attachments to this letter that restate and highlight the recommendations presented by your engineer. The Dam Safety Act (I.C. 14-27-7.5) anticipates that you will follow the recommendations and schedules given by your engineer.*
8. Report should be in compliance with regulation and should include all below listed tabular items to be minimally acceptable to the DNR. Items indicated below as incomplete or missing should be included in future submittals. References to the Indiana Dam Safety Inspection Manual are shown in **Bold Type**. A checked box indicates that your report included the recommended item(s).

    a. An inspection checklist prepared by the consultant in a form like found in **Appendix B of Part 3,** or the form in Appendix B. ☑

    b. An IDNR Dam Inspection Report Form (2007 edition) pages 1 thru 6 as shown in **Appendix C of Part 3.** ☑

    c. A field sketch, as shown in **Appendix D of Part 3,** of the Dam Embankment or annotated drawing or aerial photo. ☑ - *Inspection Summary Map (Exhibit 3)*

    d. A Narrative in the report that follows the Sample Outline as shown in **Appendix E of Part 3.** ☑

    e. Photographs should be taken for documentation of conditions and included in the inspection report as discussed in **Part 3 – Chapter 4.2. "DOCUMENTING THE INSPECTION"** ☑

    f. An IDNR Dam Inspection Report should be submitted as a bound paper document and also as an electronic document in PDF format. ☑

Guidance and advice given by your consulting professional engineer (firm) is most important and valuable. Recommendations for dam maintenance improvements and dam structural improvements to raise the dam to a safer condition should be considered in your long term budgeting and operational planning. Your engineer's recommendations and schedules presented in the inspection report are also included in the attachments to this letter. The Dam Safety Act (I.C. 14-27-7.5) anticipates that you will follow the recommendations given by your engineer. It is further expected that the presented schedules will be met.

All recommendations made by your engineer that require a change in the characteristics of the dam must be performed under the direction of the engineer and only after a Permit for Construction in a Floodway has been obtained from IDNR. Normal maintenance work does not require a permit. All work requiring a change in the characteristics of the dam are generally those that, (1) alter the hydraulic capacity of the spillway system, or (2) change the stability of the embankment, or (3) lessen the safety of the dam temporarily during construction. It is suggested that you consult with this office before beginning any work recommended by your engineer that you feel may need a permit.

Please feel free to contact me at (317) 234-1061 or at our toll free number (877) 928-3755, if you have any questions regarding your dam.

Respectfully,

Ronald M. Carter

Ronald M. Carter, P.E.
Dam Safety Section
Division of Water

Enclosures: Database report – "Scheduled Recommended Tasks to Do"
Copy of page 12 of the 2014 Inspection Report by CBBEL

cc: Christopher B. Burke Engineering, LLC - Indianapolis, Indiana
High Hazard Dam File # 55-76

cc: via e-mail - All Board Members and Attorney

Scheduled Recommended Tasks To Do
LAKE DETURK DAM

County	Deadline Date	State Id	Dam Name	Next Inspection Date = 5/13/2016	Done	Completion Date

Morgan

Recommendation Track Code = 55-76_INSPC_5/13/2014_1

	6/1/2016	55-76	LAKE DETURK DAM	No

Description: Taken from 2014 Inspection report recommendations section prepared by Christopher B. Burke Engineering, LLC
(See pages 10, 11, and 12 of the 2014 Inspection Report)

1. Clear trees and brush from the right abutment on the upstream slope immediately and ongoing.
2. Clear trees and brush from the right abutment on the downstream slope immediately and ongoing.
3. Clear trees and brush from the left abutment on the downstream slope immediately and ongoing.
4. Clear trees and brush from the outlet of the principal spillway immediately and ongoing.
5. Backfill animal burrows as seen on the upstream slope immediately and ongoing.
6. Remove silt and debris from emergency spillway inlet culverts immediately and ongoing.
7. Monitor depression above the lake drain near the center of the dam immediately and ongoing.
8. Monitor the downstream toe of slope for indications of seepage immediately and ongoing.
9. Place riprap along upstream slope for erosion protection within 2 years.
10. Repair/Replace trash rack at inlet to the principal spillway within 2 years.
11. Repair concrete headwall and apron at inlet to the principal spillway within 2 years.
12. Repair and or replace concrete hood at outlet of the principal spillway within 2 years.
13. Repair scarp near the left end of upstream slope within 2 years.
14. Abandon lake drains or install new valves on upstream side of embankment within 3 to 5 years.
15. Prepare plans and specs for improvements to the embankment and spillway system within 3 to 5 years.

Notes: Items 14 and 15 to be completed by June 2019 or earlier. (3 to 5 years)

Recommendation Track Code = 55-76_INSPC_5/13/2014_2

	7/1/2016	55-76	LAKE DETURK DAM	No

Description: A biennial inspection should be made in May of 2016 or earlier and the engineer prepared and certified Inspection Report should be submitted to IDNR Water Division before July 1, 2016. The Inspection Report should be submitted as a bound paper copy and also as an electronic copy in PDF format.

Notes:

Required Repair/Maintenance/Monitoring	Schedule
Clear trees and brush from the right abutment on the upstream slope	Immediately/Ongoing
Clear trees and brush from the right abutment on the downstream slope	Immediately/Ongoing
Clear trees and brush from the left abutment on the downstream slope	Immediately/Ongoing
Clear trees and brush from the outlet of the principal spillway	Immediately/Ongoing
Backfill animal burrows as seen on the upstream slope	Immediately/Ongoing
Remove silt and debris from emergency spillway inlet culverts	Immediately/Ongoing
Monitor depression above the lake drain near the center of the dam	Immediately/Ongoing
Monitor the downstream toe of slope for indications of seepage	Immediately/Ongoing
Place riprap along upstream slope for erosion protection	Within 2 years
Repair/Replace trash rack at inlet to the principal spillway	Within 2 years
Repair concrete headwall and apron at inlet to the principal spillway	Within 2 years
Repair/Replace concrete hood at outlet of the principal spillway	Within 2 years
Repair scarp near the left end of upstream slope	Within 2 years
Abandon lake drains or install new valves on upstream side of embankment	Within 3-5 years
Prepare plans/specs for improvements to the embankment and spillway system	Within 3-5 years

Copy of page 12 from the 2014 Inspection Report