CORDRY LAKE DAM (7-1)

2023 Dam Safety Inspection Report

Brown County, IN | February 2024

Inspection Date: October 24, 2023

CBB BURKE

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2023 DAM SAFETY INSPECTION REPORT

BROWN COUNTY, IN

FEBRUARY 2024
INSPECTION DATE: OCTOBER 24, 2023

Prepared for:

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DISCLAIMER

This report was prepared by Christopher B. Burke Engineering, LLC (Burke) for the Cordry-Sweetwater Conservancy District (CSCD) for the Cordry Lake Dam using available data and observed conditions. Burke 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 federal, 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 assistance from a qualified professional in determining the need for permits.

EXECUTIVE SUMMARY

Cordry Lake Dam is located approximately 5 miles south of the Town of Nineveh, in Brown County, Indiana in Section 17, Township 10N, Range 4E on the Nineveh USGS Quadrangle map. The lake was formed by the construction of an earthen embankment across Saddle Creek. The dam is owned by the Cordry-Sweetwater Conservancy District (CSCD) and is currently classified as significant hazard.

The embankment is approximately 120 feet high and 1,500 feet long, with a 24-foot-wide crest. The approximately 169-acre lake collects runoff from an approximately 1.1 square mile watershed. The principal spillway is a shallow drop-inlet concrete spillway with a 36-inch reinforced concrete pipe located near the right abutment with a reinforced concrete chute at the outlet. The auxiliary spillway is approximately 68 feet wide at the downstream end and is located at the right end of the dam at the same alignment as the principal spillway. The auxiliary spillway crest is approximately 2 feet vertically above the principal spillway and outlets into the same reinforced concrete chute outlet as the principal spillway. The current spillway system has the capacity to pass runoff from the 100% Probable Maximum Precipitation (PMP) event without overtopping the dam, which meets or exceeds the capacity required by the Indiana Department of Natural Resources (IDNR). However, the condition of the spillway outlet raises concerns about stability under such high-flow conditions. There is no apparent lake drawdown capability.

The dam was originally designed by Hugh K. Dargitz, Greenwood Engineering Company in the early 1950s and was conditionally approved by the State of Indiana Flood Control and Water Resources Commission (predecessor to IDNR) in September 1952 and then revised plans by Fraps and Associates, Inc. (Fraps) received approval from the Commission in May 1960 (D-863). Another revised application was approved in October 1969 (D-863, revision 1). The dam was constructed in stages between 1952 and 1971 by C.R. Morris Construction Company. Dam files include the design plans, design survey, and as-built drawings.

Christopher B. Burke Engineering, LLC (Burke) performed a visual dam safety inspection of Cordry Lake Dam on October 24, 2023. The inspection was performed by Jeffrey D. Fox, P.E., Aaron J. Fricke, P.E., and Joshua L. Erwood, P.E. who have experience in dam safety. Nick Johann of CSCD was present for portions of the inspection to discuss recent changes, maintenance, and repair items. The overall condition of the dam is considered to be "**Conditionally Poor**" based on IDNR rating criteria. This rating reflects the structural condition and uncertainties related to the concrete chute spillway. **The risk of Type 1 component failure and Type 2 uncontrolled breach failure dam failure are considered to be low to medium**. Maintenance and repairs are needed to achieve a "Satisfactory" overall conditions rating.

The component ratings, overall conditions rating, and recommendations to achieve a "Satisfactory" rating are summarized in the table on the next page.

Component	Rating	Recommendations	Schedule	Importance
Upstream Slope	Acceptable	• Spray/Remove grass, weeds, and leafy debris in riprap. Prevent spraying embankment grassed areas above riprap. • Remove trees and brush within 25 feet of the left abutment and near middle in accordance with the Indiana Dam Safety Inspection Manual • Fill and seed divots, ruts, and bare areas along the slope; vary mowing patterns to reduce likelihood of additional rutting • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; grassed portion of upstream slope	• Ongoing • Within 2 years • Within 1 year • Ongoing	• Low • Medium • Low • Low
Crest	Acceptable	• Monitor cracks in asphalt pavement and seal as needed	• Ongoing	• Low
Downstream Slope	Acceptable	• Remove trees and brush within 25 feet of the left abutment, right abutment, and toe of slope of the main embankment as well as the toe of slope of the tie-back section in accordance with the Indiana Dam Safety Inspection Manual • Monitor hummocky slope areas for changes • Fill and seed divots and bare areas along the slope; vary mowing patterns to reduce likelihood of additional surficial issues • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; entire downstream slope • Repair/Replace broken bench drain cleanouts. Install a marker post at each cleanout along the benches and at each outlet along the groins for easy identification	• Within 2 years • Ongoing • Within 1 year • Ongoing • Within 1 year	• Medium • Low • Low • Low • Medium
Seepage	Acceptable	• Monitor wet areas observed left of concrete chute spillway; install flags or similar around perimeter of wet areas in support of monitoring effort and notify engineer of observed changes	• Ongoing	• Medium
Principal Spillway	Acceptable	• Monitor deteriorated concrete inlet monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes • Monitor trash rack condition monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes	• Ongoing • Ongoing	• High • Medium
Auxiliary Spillway	Deficient	• Remove trees and brush within 25 feet of the right inlet section and outlet walls in accordance with the Indiana Dam Safety Inspection Manual • Spray/Remove vegetation growing through the cracks of the concrete chute • Monitor the concrete condition of the spillway chute and erosion of the downstream channel monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes	• Within 2 years • Ongoing • Ongoing	• Medium • Low • High
Maintenance and Repairs	Acceptable	• Prepare construction plans and technical specifications for the replacement of the spillway • Develop an Incident and Emergency Action Plan (IEAP) with dam failure flood inundation map • Develop lake drawdown plan	• Within 1 year • Within 2 years • Within 1 year	• High • Medium • Low
Overall Conditions	**Conditionally Poor**	• **See above**	• **N/A**	• **N/A**

Notes:
1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

1.0 BACKGROUND

1.1 PROJECT LOCATION

Cordry Lake Dam is an earthen embankment across Saddle Creek creating a lake utilized for recreational purposes. The dam is located approximately 5 miles south of the Town of Nineveh, in Brown County, Indiana. It is located in Section 17, Township 10N, Range 4E of the Public Land Survey System (PLSS) as shown on the Nineveh United States Geological Survey (USGS) Quadrangle Map. The dam is owned by the Cordry-Sweetwater Conservancy District (CSCD) and currently classified as significant hazard by the Indiana Department of Natural Resources (IDNR).

1.2 FILE REVIEW

Unless otherwise noted, information presented in this report is from the visual inspection, information obtained from the IDNR files for the dam, Burke's in-house file from previous work on the dam, and aerial photography, topographic information, and maps publicly available through the Indiana Spatial Data Portal and IndianaMap. An extensive review of IDNR's file was not considered necessary for this inspection due to Burke's previous research of the file and recent involvement with the dam. Primary sources of information include:

- Calculations, correspondence and permits prepared by IDNR from 1952 through 2017
- Dam construction and dam safety inspection reports prepared by IDNR from 1955 through 2010
- Cordry Lake Dam Phase 1 Inspection Report, prepared by Clyde E. Williams & Associates, Inc. for the United States Army Corps of Engineers (USACE) – Louisville District (1978)
- Ninevah 2022 7.5-minute USGS quadrangle map
- Dam safety inspection reports prepared by Burke from 2012 through 2021
- "Wabash Valley Seismic Zone". Central United States Earthquake Consortium. Accessed 4 December 2023 <http://www.cusec.org/earthquake-information/wabash-valley-seismic-zone>.
- "1811-1812 New Madrid, Missouri Earthquakes". United States Geological Survey. Accessed 4 December 2023 <https://www.usgs.gov/natural-hazards/earthquake-hazards/science>.
- "Search Earthquake Archives". United States Geological Survey. Accessed 4 December 2023. <http://earthquake.usgs.gov/earthquakes/search/>.
- Gray, Walter E. and John C. Steinmetz. "Map of Indiana Showing Known Faults and Historic Earthquake Epicenters having Magnitude 3.0 and Larger". Indiana Geological Survey. Miscellaneous Map 84, revised 2015.
- "2018 National Seismic Hazard Model for the Conterminous United States, Peak Horizontal Acceleration with a 2% Probability of Exceedance in 50 Years". United States Geological Survey. Accessed 4 December 2023. <https://www.sciencebase.gov/catalog/item/5d5597d0e4b01d82ce8e3ff1>.

1.3 HISTORY OF THE DAM

Based on the Phase 1 report, the dam was first designed in the early 1950's by Hugh K. Dargitz, Greenwood Engineering Company, for land developer Howard Prince of Prince's Lake Building Company. Conditional approval from the State of Indiana Flood Control and Water Resources Commission (predecessor to IDNR) was made in September 1952, after construction had begun, provided that evidence be submitted to the Commission showing that the work was built in accordance with the plans and specifications.

In 1957, Sweetwater Lakes, Inc. was formed and assumed ownership of the dam. Shortly thereafter, a seepage area at the right abutment was excavated and backfilled with clay. However, this work did not fix the problem and work was stopped.

In June 1959, the CSCD was established to complete the dam. Fraps and Associates, Inc. (Fraps) prepared revised plans and received approval from the Commission in May 1960, under Docket No. D-863, for construction of the dam and a common auxiliary spillway with Sweetwater Lake Dam. Work appears to have resumed in 1962, raising the dam and addressing the seepage at the right abutment. The grout repair used at the abutment was deemed ineffective and construction was again delayed until 1966 when another effort to stop the seepage was made. In 1967, a trench was cut in the right abutment and a layer of sandstone was discovered. This was believed to be the cause of the ongoing seepage. A blanket of clay was laid on the upstream slope and the trench was tied into the core of the dam and filled with bentonite slurry. This repair effort appeared to have significantly reduced the seepage.

In October 1969, a revised application for construction was approved by the Commission, under Docket No. D-863 (revised 1), for the construction of a principal and auxiliary spillway. C.R. Morris Construction Company completed the embankment work later that year and the spillway system by 1971.

Between 2007 and 2010, there were several repairs to the dam. The 36-inch diameter bituminous-coated corrugated metal pipe (CMP) principal spillway outlet was replaced with a 36-inch diameter reinforced concrete pipe (RCP). In addition, several sections of the concrete chute at the downstream end of the pipe were removed and replaced. The lake siphon, located approximately 200 feet east of the auxiliary spillway, was taken out of service by filling it with grout and capping. Cordry Lake Dam no longer has drawdown capabilities. Lastly, a large slide that had occurred on the left side of the downstream slope was repaired.

In November 2019, Burke performed a structural evaluation of the spillway chute. The evaluation included a visual inspection of the concrete surfaces, soundings using hammer and chain dragging methods, and a coring program to better understand the condition of the concrete and extent of any subgrade settlement. Overall, the spillway was considered to be in poor to fair condition with recommendations for repair or replacement of the structure. A brief report summarizing the inspection findings and recommendations was completed in August 2020.

In June 2021, Burke was retained to complete preliminary engineering for spillway improvements. The intent of this initial phase was to gather the necessary data needed to evaluate potential solutions for spillway replacement based on technical and economic feasibility. Although several spillway alternatives were considered as part of this preliminary study, the most desirable alternative to CSCD included constructing a new riser structure with outlet pipe and baffled chute at the location of the existing spillway. The study was completed in March 2022.

Subsequently, Burke was retained to develop final design drawings and submit permit applications for reconstruction of the spillway. The work is currently in progress and anticipated to be completed by Spring 2024.

1.4 PREVIOUS INSPECTIONS

In accordance with Indiana Code 14-27-7.5-10, significant hazard dams will be inspected at least once every three years by IDNR. Cordry Lake Dam was inspected by IDNR routinely from 1955 through 2010. In 2012, CSCD elected to retain Burke to begin completing biennial inspections of the dam. Burke has inspected the dam from 2012 through 2021. **Table 1** below is a summary of the inspection ratings from 2012 to 2021.

Table 1: Previous Inspection Ratings (2012 - 2021)

Component	Condition Ratings Per Inspection					
	2012	2013	2015	2017	2019	2021
Upstream Slope	Good	Good	Good	Good	Acceptable	Acceptable
Crest	Good	Good	Good	Good	Acceptable	Acceptable
Downstream Slope	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Seepage	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Principal Spillway	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Auxiliary Spillway	Acceptable	Acceptable	Acceptable	Acceptable	Deficient	Deficient
Maintenance and Repairs	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Overall Conditions	**Fair**	**Fair**	**Fair**	**Fair**	**Conditionally Poor**	**Conditionally Poor**

Notes:
1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

1.5 HISTORICAL EVENTS

No major historical rainfall events were noted in IDNR's file. No gages or other instruments have been used to record peak water levels or discharges at the site. Based on discussions with CSCD, the auxiliary spillway has only engaged once since 1993. In 2008, the depth of flow through the auxiliary spillway was approximately 2 feet.

1.6 EMERGENCY PREPAREDNESS

Cordry Lake Dam is classified by IDNR as a significant hazard structure. There is no record of an Incident and Emergency Action Plan (IEAP) for this dam. Access to the site is from local paved roads. The dam has good dry weather access. Access from the northwest may be limited during activation of the auxiliary spillway. The CSCD is staffed with employees and volunteers. Between these individuals and residents living in the surrounding houses, a fair amount of security is present at the dam. There are no mechanical components needed for the operation of the spillways, so no auxiliary power is necessary.

1.7 HYDROLOGY

According to the Phase 1 report, Cordry Lake Dam has a surface area of approximately 169 acres at normal pool, at an elevation of 850.0 feet mean sea level (MSL), with a corresponding storage volume of 6,300 acre-feet. The contributing watershed is 1.07 square miles (685 acres), comprised primarily of steeply sloping forested land and low density seasonal and permanent residential development near the shores of the lake.

The lake is located in a relatively narrow and steep valley. The maximum pool elevation at the top of the dam is 859.0 feet MSL, resulting in a surface area of about 207 acres and a storage volume of 7,960 acre-feet. The principal and auxiliary spillways are located at elevations 850.0 feet MSL, and approximately 852.0 feet MSL, respectively.

According to the Phase 1 report, IDNR files contain elevation-area-storage curves for the lake. A report submitted to IDNR by Franklin Engineering Co. states that the spillway was designed to pass a "Maximum

Probable Storm" of 29.5 inches in 12 hours. The inflow of this storm was approximately 6,300 cubic feet per second (cfs) resulting in a maximum water surface elevation of 856.5 MSL. The rating curve was developed based on field measurements of the spillway dimensions. The combined spillway capacity was calculated to be roughly 8,750 cfs at the top of the dam elevation of 859.0 MSL. This methodology does not currently meet the requirements outlined in IDNR's *General Guidelines for New Dams and Improvements to Existing Dams in Indiana.*

Dams classified as significant hazard by IDNR are required to safely pass the rainfall runoff from the 50% 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. Due to the size and steep topography of the Cordry Lake Dam watershed, the 6-hour PMP event produces a higher peak flow rate than the 12-hour event utilized in the previous analysis, making the 6-hour event the appropriate design storm based on IDNR requirements.

1.8 GEOLOGIC, SEISMIC AND GEOTECHNICAL CONSIDERATIONS

According to the Phase I report, "Cordry Lake Dam is located in northeast Brown County on the east side of the Norman Upland physiographic unit. The Norman Upland is a narrow upland formed on Borden (Lower Mississippian) sandstones, siltstones, and shale. Most of the region is between 500 and 1000 feet in elevation in rugged terrain. Bedrock under the dam is Borden shale, underlying a thin layer of gravelly material. A core trench 130 feet wide was excavated down to shale at the center of the dam. A key trench 20 feet wide and about 10 feet deep, with side slopes 1V on 1.5H was cut into the shale of the center of the core trench."

According to the Federal Emergency Management Agency (FEMA), the dam is within the limits of an area where seismic design category (SDC) "B" is applicable. This category is the second lowest risk and is described as an area that "could experience shaking of moderate intensity." The USGS has determined that the 50-year two-percent probability of exceedance peak ground acceleration near Cordry Lake Dam is approximately 0.14g, where "g" is standard gravity.

Although the perceived seismic risk is low, the dam is in an area that could be impacted by earthquakes from the Wabash Valley Seismic Zone in southwest Indiana and southeast Illinois and the New Madrid Seismic Zone centered in southeast Missouri, according to information from the Central United States Earthquake Consortium and the USGS. Three earthquakes of magnitude 7.3 or greater occurred near New Madrid, Missouri in 1811 and 1812 which were undoubtedly felt in central Indiana. Indiana Geological Survey (IGS) records indicate that the closest earthquakes to the dam that occurred in Indiana with magnitude 3.0 or greater were:

- Magnitude 4.9 near Columbus in Bartholomew County on August 15, 1891
- Magnitude 3.2 near Shelbyville in Shelby County on May 8, 1906
- Magnitude 3.8 near Shelbyville in Shelby County on September 12, 2004

Several other earthquakes have occurred in Indiana and Illinois, many since the dam was constructed. A magnitude 3.8 occurred September 12, 2004, near Shelbyville, Indiana about 24 miles northeast of Cordry Lake Dam. The most notable is a magnitude 5.2 that occurred on April 18, 2008, near Mount Carmel, Illinois about 105 miles southwest of Cordry Lake Dam. Most recently, a magnitude 3.8 earthquake occurred northeast of Montezuma, Indiana on June 17, 2021 about 75 miles northwest of Cordry Lake Dam. All earthquakes noted were reported to the USGS as felt in Brown County. There has been no documented damage to Cordry Lake Dam because of earthquakes.

ATLAS Technical Consultants LLC (ATLAS) completed a geotechnical engineering investigation in April 2023 to characterize and evaluate the geotechnical aspects of the existing earthen dam and to determine if modifications to the existing dam embankment appear to be required so that the dam will meet the structural requirements outlined in the document "General Guidelines for New Dams and Improvements to Existing

Dams in Indiana" 2001 edition, prepared by IDNR Division of Water and based on general guidelines described in the document "General Design and Construction Considerations for Earth and Rock-Fill Dams" dated July 30, 2004 (USACE, Engineering and Design Manual EM 1110-2-2300). The evaluation consisted of a site reconnaissance, an exploratory test drilling and sampling program, and laboratory testing of soil samples obtained from the test borings.

The subsurface conditions were investigated by drilling thirteen test borings along the crest of the existing embankment to depths ranging from 26.1 feet to 136.5 feet below the existing ground surface. The test borings generally encountered asphalt pavement at the existing ground surface with a thickness of approximately 3 inches to 4 inches. Below the surficial materials, the test borings typically encountered earthen embankment fill materials that consist of cohesive silty clay, clay and clayey silt with varying amounts of sand, gravel and weathered shale and/or sandstone fragments to depths ranging from approximately 13 feet to 116 feet below the existing ground surface. Based upon the results of the test borings, it appears that the earthen embankment fill materials are generally suitable for the retention of Cordry Lake and generally consist of relatively low permeability cohesive soil materials.

Underlying the embankment fill materials, the test borings typically encountered medium stiff to very stiff silty clay (CL) and clay (CH) that contains varying amounts of sand, gravel and weathered shale and/or sandstone to depths of about 13 feet to 127 feet below the existing ground surface. Underlying these soils, the test borings typically encountered very stiff to hard clay (CH) and silty clay (CL) to depths of approximately 29.1 feet to 132.0 feet below the existing ground surface. These soils appeared to consist of completely weathered shale, siltstone and/or sandstone and retained the appearance of completely weathered bedrock, although these "intermediate geomaterials" likely behave as soil for the analyses of the earthen embankment. Layers of very loose to dense clayey sand (SC) and/or silty sand (SM) were encountered at depths of approximately 26 feet to 43.5 feet below the existing ground surface in the "western" section of the dam, west of the natural knob or high-ground where the lower height portion of the dam and the spillway structures are located.

Slope stability analyses were performed, and factors of safety calculated for four loading cases: long-term steady-state seepage at normal pool, long-term steady-state seepage at maximum pool (dam crest), seismic loading, and rapid drawdown. The cases were evaluated at four cross-sections: two through the "western" section dam embankment and two through the "eastern" main embankment section. The calculated factors of safety for all cases meet or exceed the minimum required factors of safety outlined by IDNR and USACE.

Seepage analyses were performed at the same cross-sections to determine the potential for soil piping and the estimated seepage flow rate. The results of the analyses indicate that the maximum hydraulic exit gradients occurred near the downstream toe of slope. The estimated exit gradient values are below the recommended maximum, which is based on a factor of safety of 2.0. Thus, it no special measures to reduce seepage were recommended.

1.9 DAM AND LAKE CHARACTERISTICS

Cordry Lake Dam is an earthfill embankment approximately 120 feet high and 1,500 feet long, with a 24-foot-wide crest. The main embankment section runs about 1,000 feet in a northeast to southwest direction before turning to the northwest for approximately 500 feet in what will be referred to as the tie-back section. The upstream slope of the dam is approximately 3(H):1(V) and is armored with riprap approximately 4 feet above normal pool. The slope is covered with grass from the top of riprap to the paved crest of the embankment. Cordry Drive is located along the crest and is approximately 24 feet in width. The downstream slope is approximately 2.6(H):1(V) on the upper level of the embankment. The embankment flattens to approximately 2.9(H):1(V) below the top section. Each section has a 10-foot-wide bench that contains an underdrain system to facilitate drainage. The bench underdrains outlet to riprap ditches located along the groin on both sides of the embankment.

The principal spillway consists of a shallow 3-sided concrete drop inlet being 6-foot by 6-foot with a 36-inch diameter RCP outlet pipe located near the right abutment. The concrete pipe outlets onto a reinforced concrete chute which discharges into a natural rock lined channel near the right abutment. The auxiliary spillway is approximately 68 feet wide at the crest with 20(H):1(V) side slopes and is also located near the right abutment, in line with the principal spillway. The auxiliary spillway crest consists of the paved road which is approximately 2 feet vertically above the principal spillway and outlets onto the same reinforced concrete chute outlet as the principal spillway. The reinforced concrete chute tapers from 68 feet wide at the top to approximately 42 feet at the principal spillway outlet and down to 10 feet at the bottom where four baffle blocks are located and utilized for energy dissipation prior to discharging into channel. There is no lake drawdown facility present.

The following descriptions and summary of pertinent information regarding the dam, lake, and spillway system were compiled from the sources listed in Section 1.2 and by field investigation or calculations by Burke.

DAM HEIGHT	120 feet +/-
CREST LENGTH	1,500 feet +/-
CREST WIDTH	24 feet +/-
U/S SLOPE	3(H):1(V) +/-
D/S SLOPE	Upper - 2.6(H):1(V) +/-; Lower 2.9(H):1(V) +/-
LAKE NORMAL POOL	850.0 feet (MSL)
LAKE AREA	169 acres (normal pool), 207 acres (top of dam)
STORAGE VOLUME	6,300 acre-ft (normal pool) 7,960 acre-ft (top of dam)
PRINCIPAL SPILLWAY CREST	850.0 feet (MSL)
AUXILIARY SPILLWAY CREST	852.0 feet (MSL)
DAM CREST	859.0 feet (MSL)

1.10 DRAWDOWN SYSTEM

The dam does not have permanent drawdown capability.

1.11 DOWNSTREAM FEATURES

The downstream toe of the dam, near the receiving stream, is a flat valley that is marshy and overgrown with vegetation. The stream is relatively shallow and flows eastward through a densely forested valley. The valley is approximately 300 to 400 feet wide with steep forested slopes. The stream eventually flows through an undeveloped area to its confluence with Mud Creek approximately 3 miles downstream.

2.0 OBSERVED CONDITIONS

Burke personnel performed a visual dam safety inspection of the Cordry Lake Dam on October 24, 2023. The inspection was performed by Jeffrey D. Fox, P.E., Aaron J. Fricke, P.E., and Joshua L. Erwood, P.E. who have experience in dam safety. The weather conditions during the inspection were partly cloudy with a temperature of approximately 77 degrees Fahrenheit. The principal spillway was not engaged on the day of the inspection being approximately 4 inches below the normal pool. For purposes of reference, the left and right sides of the dam are based on a view looking downstream. Thus, right is generally coincidental with west and left is

coincidental with east. 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**. A copy of the 2021 IDNR Inspection Report Form is provided in **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 a USGS quadrangle map, aerial photograph, and inspection summary map.

2.1 UPSTREAM SLOPE

The upstream slope is armored with an adequate cover of riprap from approximately 3 feet below normal pool to 4 feet above normal pool. Leafy debris was sporadically located near normal pool level along the riprap. Grass and weeds growing within the riprap appeared to have been sprayed resulting in the grass color above the riprap to have changed. Grass appeared to be dead along the far right tie-back section for about 150 feet. Above the riprap, the slope has mostly adequate grass cover that extends to the asphalt crest. Slope measurements were taken at the riprap, the flat grassed area above the riprip, and at the top of slope to be approximately 2.4:1, 6.5:1, and 2.5:1 (H:V) respectively. Minor sporadic rutting and divots were observed along the entire length near the crest, likely due to mowing equipment. A minor surficial mowing rut extends along the entire embankment at the grassed slope transition area at the upper portion of slope. The guardrail equipment opening near the embankment bend was bare with several ruts up to 8-inches deep. The tie-back section slope appears to be slightly irregular with steep areas between the spillway and right-side embankment bend. New riprap appeared to be added in this area. The tie-back section slope was measured by inspection rod and tape to be slightly steeper near the curve with a 2:1 (H:V) slope. A shallow burrow was observed near the top of the right-side embankment bend. Two utility poles are located on the right-side tie-back section. A fuel tank, boat dock, bird house and bird feeder also encroach on the right abutment. A few trees and landscaped garden bed areas are within 25 feet of the left abutment off property. The upstream slope was considered "**Acceptable**" based on IDNR rating criteria.

2.2 CREST

Cordry Drive is an asphalt road along the crest with guardrail on both the upstream and downstream sides. At the embankment curve, the roadway transitions to Center Lake Road along the tie-back section. The asphalt pavement surface exhibited longitudinal cracks and transverse cracks spaced approximately every 20 feet. The observed cracks appeared to have been sealed, are consistent with the age of the asphalt, and do not appear to be indicative of embankment instability. There is a utility pole on the downstream side at the right-side bend. The road appeared to have been constructed with a low point near the center of the dam. The crest width was measured by tape to be approximately 20 feet. The crest was considered "**Acceptable**" according to IDNR rating criteria.

2.3 DOWNSTREAM SLOPE

The downstream slope was observed to have adequate grass cover at an appropriate height. Trees and brush were observed in the groins and within 25 feet of the right abutment, left abutment, and along the toe of slope. The tie-back section had several areas of trees, brush, and tall grass along the toe of slope. Due to dense vegetation, the groin ditches could not be inspected thoroughly, and it was noted that some of the bench drain outlets were obstructed. The upper bench drain cleanout caps could not be removed for inspection. The lower left drain cleanout was broken and has a missing cap with about one inch of standing water observed in the drain. The slope had a hummocky appearance in some areas, particularly along the tie-back section and lower tier. A few small burrows and rodent runs were observed interspersed throughout the entire downstream slope. Several small surficial divots were found sporadically. The most notable surficial hole measured to be 6-inches in diameter and 8-inches deep near the middle upper bench. Another divot on the upper tier near the middle measured to be 5-inches in diameter and 8-inches deep. A minor bare area was found at the left side of the

upper bench. Several encroachments were found along the top of the slope including bird houses, a utility pole, and road signage. Slope measurements were taken with an inspection rod and tape along each embankment tier ranging from 3:1 to 4:1 (H:V). The downstream slope was considered "**Acceptable**" according to IDNR rating criteria.

2.4 SEEPAGE

A large wet area was observed at the downstream toe of the tie-back section, approximately 150 feet left of the spillway. This area has been noted in previous inspection reports. The area was measured to be approximately 42 feet long and 20 feet wide. In addition, there is a second smaller wet area located about 300 feet left of the spillway that is approximately 40 feet by 15 feet. Previous discussions with CSCD assumed a damaged water line which runs through the embankment may have contributed to the wet areas. However, the water line has since been fixed and likely not a factor in these areas being wet. Seepage was considered "**Acceptable**" according to IDNR rating criteria.

2.5 PRINCIPAL SPILLWAY

The visible portions of the concrete drop inlet structure had cracking and spalling throughout. Vegetation is growing within some of the inlet structure cracks. In addition, some rebar is exposed. The metal trash rack was observed to be weathered with loose, rusted bolts. The interior of the outlet pipe could not be inspected thoroughly but appeared to have slight variations in alignment and profile. Previously observed discharge from the pipe infiltrating a large crack in the center of the concrete chute could not be observed at the time of inspection due to the lack of flow. For the purpose of this report, the concrete chute is considered a component of the auxiliary spillway and is discussed in further detail in the following section. Note that at the time of the inspection, design plans for reconstruction of the spillway system are under development. The principal spillway was considered "**Acceptable**" according to IDNR rating criteria.

2.6 AUXILIARY SPILLWAY

The asphalt road serves as the crest of the auxiliary spillway. Trees and brush encroach the right upstream side of the spillway. Also, on the right upstream side of the spillway inlet is a boat ramp comprised of articulated concrete mating that extends into the lake. Encroaching the left side of the upstream inlet section is a boat dock, fuel tank mounted on a concrete pad, and utility pole. Metal guardrail and concrete bollards observed on the downstream side of the crest would likely obstruct flow but to an unknown extent. The spillway crest roadway surface exhibits several patched areas with some concrete pop-outs along the curb on the downstream side. Vegetation is growing within some of the cracks between concrete curb and roadway surface. Visible portions of the downstream concrete chute had varying degrees of cracking and spalling throughout the chute floor and walls as well as on the baffle blocks. Some cracks did appear to be sealed but some had vegetation growing through. Spalling was observed to be more significant near the downstream end of the chute. There appeared to be an area near the upper left side of the chute showing signs of delamination. The natural channel downstream of the concrete chute is eroding and may impact the structural integrity of the concrete chute if it propagates. Less than one gallon per minute of seepage appeared to be flowing beneath the concrete chute potentially undermining the structure since the lake level was below normal pool. It should be noted that an existing water line runs directly below the concrete chute. The 6-inch clay underdrain for the concrete chute appears to no longer be operational. Brush was observed to be encroaching over the chute walls, particularly towards the downstream end. Note that at the time of the inspection, design plans for reconstruction of the spillway system are under development. The auxiliary spillway was considered "**Deficient**" according to IDNR rating criteria.

2.7 MAINTENANCE AND REPAIRS

Cordry Lake Dam was considered to be maintained in "**Acceptable**" condition according to IDNR rating criteria. Although CSCD regularly monitors the dam components, repairs and improvements are needed including clearing trees and brush from the left abutment, right abutment, and toe of slope, repairing ruts observed along the upstream slope, and supplementing the riprap at the left end of the upstream slope. Regular maintenance activities should include mowing, clearing trees and brush, monitoring the downstream toe for seepage and changes in seepage in the observed wet areas in the tie-back section left of the spillway chute, and removing trash and debris from the principal spillway inlet. It is important to note that the dam is not equipped with a drawdown valve or another means of lowering the lake level for maintenance or emergency situations. Continued maintenance should be completed as discussed in Section 4.0.

2.8 OVERALL CONDITION

The overall condition of the Cordry Lake Dam was considered "**Conditionally Poor**" according to IDNR rating criteria. Based on IDNR guidelines, the potential overall condition ratings include, from worst to best, Unsatisfactory, Poor, Conditionally Poor, Fair, and Satisfactory. A "Conditionally Poor" dam is one that "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". This overall condition rating is primarily the result of the structural condition and uncertainties related to the concrete chute spillway. A summary of inspection observations is provided in **Table 2**. Locations of observations are shown on **Exhibit 3**. Refer to **Appendix 3** for typical photographs.

Table 2: Inspection Observations Summary

Observation Number	Category	Component	Location	Observation
1	Surficial	Upstream Slope	Right	Bare and rutted area near equipment entrance with 8" depth
2	Note	Upstream Slope	Right	2:1 slope measurement near curve
3	Surficial	Upstream Slope	Right	Shallow burrow
4	Encroachment	Upstream Slope	Right	Bird house on slope
5	Encroachment	Upstream Slope	Right	Fuel tank, dock, telephone pole, and bird feeder on slope
6	Surficial	Upstream Slope	Right	Grass cover appears to be dead
7	Vegetation	Upstream Slope	Left	Trees and garden beds within 25ft of dam
8	Note	Upstream Slope	Left	2.4:1 slope measurement
9	Note	Upstream Slope	Left	6.5:1 slope measurement near area above riprap
10	Note	Upstream Slope	Left	2.5:1 riprap slope measurement
11	Surficial	Upstream Slope	Shoreline	Riprap appears new and slope is hummocky
12	Vegetation	Upstream Slope	Entire Component	Vegetation color change near riprap extending 6ft up the slope. Possible result from spraying riprap.
13	Slope	Upstream Slope	Entire Component	Slightly hummocky in some areas
14	Surficial	Upstream Slope	Entire Component	Sporadic divots and minor ruts
15	Surficial	Upstream Slope	Entire Component	Minor mowing rut in upper slope
16	Encroachment	Upstream Slope	Entire Component	Leafy debris along shoreline
17	Note	Crest	Left	20ft wide crest measurement

Observation Number	Category	Component	Location	Observation
18	Surficial	Crest	Entire Component	Typical pavement maze, transverse, and longitudinal cracking every 20ft mostly patched
19	Note	Downstream Slope	Right	3:1 slope measurement
20	Surficial	Downstream Slope	Right	Upper slope area contains rocky soil with sparse grass. Soil is not ideal for grass growth.
21	Encroachment	Downstream Slope	Right	Bird house on slope
22	Surficial	Downstream Slope	Right	Divot hole
23	Surficial	Downstream Slope	Right	Divot area 8" deep by 6ft long and 2ft wide
24	Drainage	Downstream Slope	Right	Upper right bench drain clean out could not open
25	Surficial	Downstream Slope	Right	Minor rodent run
26	Encroachment	Downstream Slope	Right	Bird house near top
27	Note	Downstream Slope	Right	Keep off the dam sign
28	Encroachment	Downstream Slope	Right	Bird house on slope near top
29	Note	Downstream Slope	Right	Dam signage
30	Surficial	Downstream Slope	Right	6" deep burrow
31	Note	Downstream Slope	Right	Water valve at abutment
32	Note	Downstream Slope	Right	Dam signage
33	Surficial	Downstream Slope	Right	Few burrows in area
34	Note	Downstream Slope	Right	Keep off spillway sign
35	Encroachment	Downstream Slope	Right	Utility pole, bird house, and signage on slope
36	Vegetation	Downstream Slope	Right	Trees, brush, and tall grass on and within 25ft of slope. Wetland area noted.
37	Note	Downstream Slope	Right	Edge of tree line noted
38	Vegetation	Downstream Slope	Right	Trees and tall grass within 25ft
39	Vegetation	Downstream Slope	Right	Trees and brush at toe
40	Vegetation	Downstream Slope	Right	Trees and brush within 25ft
41	Vegetation	Downstream Slope	Right	Trees and brush at toe and within 25ft
42	Slope	Downstream Slope	Middle	Lower tier slightly hummocky
43	Note	Downstream Slope	Middle	Lower tier slope 4:1 measured
44	Drainage	Downstream Slope	Middle	Lower tier right drain clean out
45	Note	Downstream Slope	Middle	4:1 slope measurement
46	Surficial	Downstream Slope	Middle	Hole 6" diameter and 8" deep
47	Drainage	Downstream Slope	Middle	Upper bench left clean out could not open
48	Drainage	Downstream Slope	Middle	Lower left drain cleanout broken and missing cap with 1" of standing water in drain
49	Note	Downstream Slope	Middle	3:1 slope measurement
50	Surficial	Downstream Slope	Middle	Upper tier 8" divot with 5" diameter
51	Surficial	Downstream Slope	Left	Sporadic burrows along middle tier and lower bench interface
52	Drainage	Downstream Slope	Left	Lower left tier bench drain outlet blocked
53	Surficial	Downstream Slope	Left	Bare area at interface with upper bench
54	Drainage	Downstream Slope	Left	Upper left bench drain outlet
55	Note	Downstream Slope	Left	Keep off dam sign near top
56	Encroachment	Downstream Slope	Left	Bird house on slope near top
57	Vegetation	Downstream Slope	Entire Component	Could not inspect groin ditch and toe due to trees and brush within 25ft of dam
58	Drainage	Seepage	Right	Wet area at toe of tie-back section

Observation Number	Category	Component	Location	Observation
59	Structural	Principal Spillway	Inlet	Trash rack rusty with 14" by 16" openings. Concrete deteriorating with cracks, pop outs, spalls, and exposed rebar.
60	Note	Principal Spillway	Right	Roadside drive culvert outlet
61	Structural	Principal Spillway	Outlet	Appears to be seepage under spillway structure less than a gallon per minute of flow
62	Encroachment	Auxiliary Spillway	Inlet	Bollards obstructing inlet
63	Structural	Auxiliary Spillway	Inlet	Concrete cracks
64	Vegetation	Auxiliary Spillway	Inlet	Trees and brush on right side of spillway
65	Encroachment	Auxiliary Spillway	Inlet	Bollards and cable obstruct inlet section
66	Note	Auxiliary Spillway	Right	Boat ramp and signage
67	Structural	Auxiliary Spillway	Control Section	Cracking in asphalt pavement some patches
68	Encroachment	Auxiliary Spillway	Outlet	Bollards and guardrails obstructing outlet
69	Structural	Auxiliary Spillway	Outlet	Concrete cracking and deterioration throughout. Some vegetation growing in cracks.
70	Encroachment	Auxiliary Spillway	Outlet	Bollards and Guard railing obstruct downstream of control section

3.0 RISK OF DAM FAILURE

Burke utilized the results of the dam inspection to evaluate the potential for failure of Cordry Lake 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 release from the lake
- Type 2 – uncontrolled breach failure of a structure that results in a significant release from the lake

Refer to **Appendix 5** for more details of types of failure and definitions of risk levels. Burke evaluated the risk for both types of failures.

3.1 RISK OF DAM COMPONENT FAILURE (TYPE 1)

Burke evaluated the risk for Type 1 component failure at Cordry Lake Dam after the inspection was completed by considering possible failure of each dam component. The components that were evaluated include the upstream embankment slope, downstream embankment slope, embankment crest, spillway system, and dam abutments. After considering the dam's current condition and the potential maximum loadings, Burke has estimated the risk of failure for each component as shown below. The estimated risk levels are based on Burke's visual observations during the inspection and do not necessarily account for uncertainties in critical analysis parameters which could impact the risk level.

Component	Risk Level
Upstream slope	Low
Downstream slope	Low
Embankment crest	Low
Principal spillway	Low
Auxiliary spillway	Medium
Dam abutments	Low

3.2 RISK OF UNCONTROLLED BREACH FAILURE (TYPE 2)

Burke evaluated the potential for uncontrolled breach failure at Cordry Lake Dam after the inspection was completed by considering possible failure modes. Embankment dams such as Cordry Lake Dam generally have three potential modes of uncontrolled breach failure: 1) hydraulic failure, 2) seepage failure, and 3) structural 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. Refer to Appendix 5 for more information about failure modes and risk factors. **At the present time, Cordry Lake Dam appears to have a low to medium risk for uncontrolled breach failure**. Structural factors are summarized below.

Structural factors	Risk Level	Failure Mode
Trees within 25 feet of D/S abutments and toe	Low	Seepage
Rodent burrows	Low	Seepage
Ruts on upstream slope	Low	Hydraulic
Deteriorated concrete principal spillway inlet	Low	Structural
Rusted trash rack hardware	Low	Structural
Deteriorated concrete chute spillway	Medium	Hydraulic/Structural
Lack of drawdown capability	Low	Hydraulic

Natural and human risk factors were also considered. Severe storms present a low risk to Cordry Lake Dam. Earthquakes present a low risk but cannot be ignored due to the dam's proximity to the Wabash Valley and New Madrid Seismic Zones. **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	Low	Hydraulic
Earthquakes	Low	Structural

Human factors	Risk Level	Failure Mode
Vandalism	Low	Structural
Terrorism	Low	Structural

Operating factors	Risk Level	Failure Mode
Maintenance Practices	Low	Hydraulic/Structural
Access	Low	Hydraulic/Structural

4.0 RECOMMENDATIONS

This section presents Burke's recommendations for action based on the findings of the dam safety inspection, Burke's assessment of the risk of dam failure at Cordry Lake Dam, and Burke's assessment of the priority for repairs of each observed deficiency. The recommendations are summarized by dam feature, such as the upstream slope, crest, etc. Based on inspection findings, Cordry Lake Dam requires monitoring, maintenance, and repairs to achieve IDNR's "Satisfactory" rating. A summary of the 2023 inspection ratings and recommendations are provided in **Table 3**. **Table 4** is a summary of inspection ratings from 2013-2023.

Table 3: Inspection Ratings and Recommendations

Component	Rating	Recommendations	Schedule	Importance
Upstream Slope	Acceptable	• Spray/Remove grass, weeds, and leafy debris in riprap. Prevent spraying embankment grassed areas above riprap. • Remove trees and brush within 25 feet of the left abutment and near middle in accordance with the Indiana Dam Safety Inspection Manual • Fill and seed divots, ruts, and bare areas along the slope; vary mowing patterns to reduce likelihood of additional rutting • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; grassed portion of upstream slope	• Ongoing • Within 2 years • Within 1 year • Ongoing	• Low • Medium • Low • Low
Crest	Acceptable	• Monitor cracks in asphalt pavement and seal as needed	• Ongoing	• Low
Downstream Slope	Acceptable	• Remove trees and brush within 25 feet of the left abutment, right abutment, and toe of slope of the main embankment as well as the toe of slope of the tie-back section in accordance with the Indiana Dam Safety Inspection Manual • Monitor hummocky slope areas for changes • Fill and seed divots and bare areas along the slope; vary mowing patterns to reduce likelihood of additional surficial issues • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; entire downstream slope • Repair/Replace broken bench drain cleanouts. Install a marker post at each cleanout along the benches and at each outlet along the groins for easy identification	• Within 2 years • Ongoing • Within 1 year • Ongoing • Within 1 year	• Medium • Low • Low • Low • Medium
Seepage	Acceptable	• Monitor wet areas observed left of concrete chute spillway; install flags or similar around perimeter of wet areas in support of monitoring effort and notify engineer of observed changes	• Ongoing	• Medium
Principal Spillway	Acceptable	• Monitor deteriorated concrete inlet monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes • Monitor trash rack condition monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes	• Ongoing • Ongoing	• High • Medium
Auxiliary Spillway	Deficient	• Remove trees and brush within 25 feet of the right inlet section and outlet walls in accordance with the Indiana Dam Safety Inspection Manual • Spray/Remove vegetation growing through the cracks of the concrete chute • Monitor the concrete condition of the spillway chute and erosion of the downstream channel monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes	• Within 2 years • Ongoing • Ongoing	• Medium • Low • High
Maintenance and Repairs	Acceptable	• Prepare construction plans and technical specifications for the replacement of the spillway • Develop an Incident and Emergency Action Plan (IEAP) with dam failure flood inundation map • Develop lake drawdown plan	• Within 1 year • Within 2 years • Within 1 year	• High • Medium • Low
Overall Conditions	**Conditionally Poor**	• **See above**	• **N/A**	• **N/A**

Notes:
1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

Table 4: Previous Inspection Ratings (2013 - 2023)

Component	Condition Ratings Per Inspection					
	2013	2015	2017	2019	2021	2023
Upstream Slope	Good	Good	Good	Acceptable	Acceptable	Acceptable
Crest	Good	Good	Good	Acceptable	Acceptable	Acceptable
Downstream Slope	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Seepage	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Principal Spillway	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Auxiliary Spillway	Acceptable	Acceptable	Acceptable	Deficient	Deficient	Deficient
Maintenance and Repairs	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Overall Conditions	**Fair**	**Fair**	**Fair**	**Conditionally Poor**	**Conditionally Poor**	**Conditionally Poor**

Notes:

1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

EXHIBITS

Sources of Data:
1. 2022 USGS 7.5 Minute Quadrangle (Nineveh)

Christopher B. Burke Engineering, LLC
PNC Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT: Cordry Lake Dam 2023 Dam Safety Inspection		PROJECT NO. 23-0291	APPROX. SCALE 1"=1,500'
TITLE: USGS Quadrangle Map			DATE: 02/2024
			EXHIBIT 1

Sources of Data:
1. Aerial Photography: 2021 Brown County, IndianaMap Framework Data (indianamap.org)

Christopher B. Burke Engineering, LLC
PNC Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
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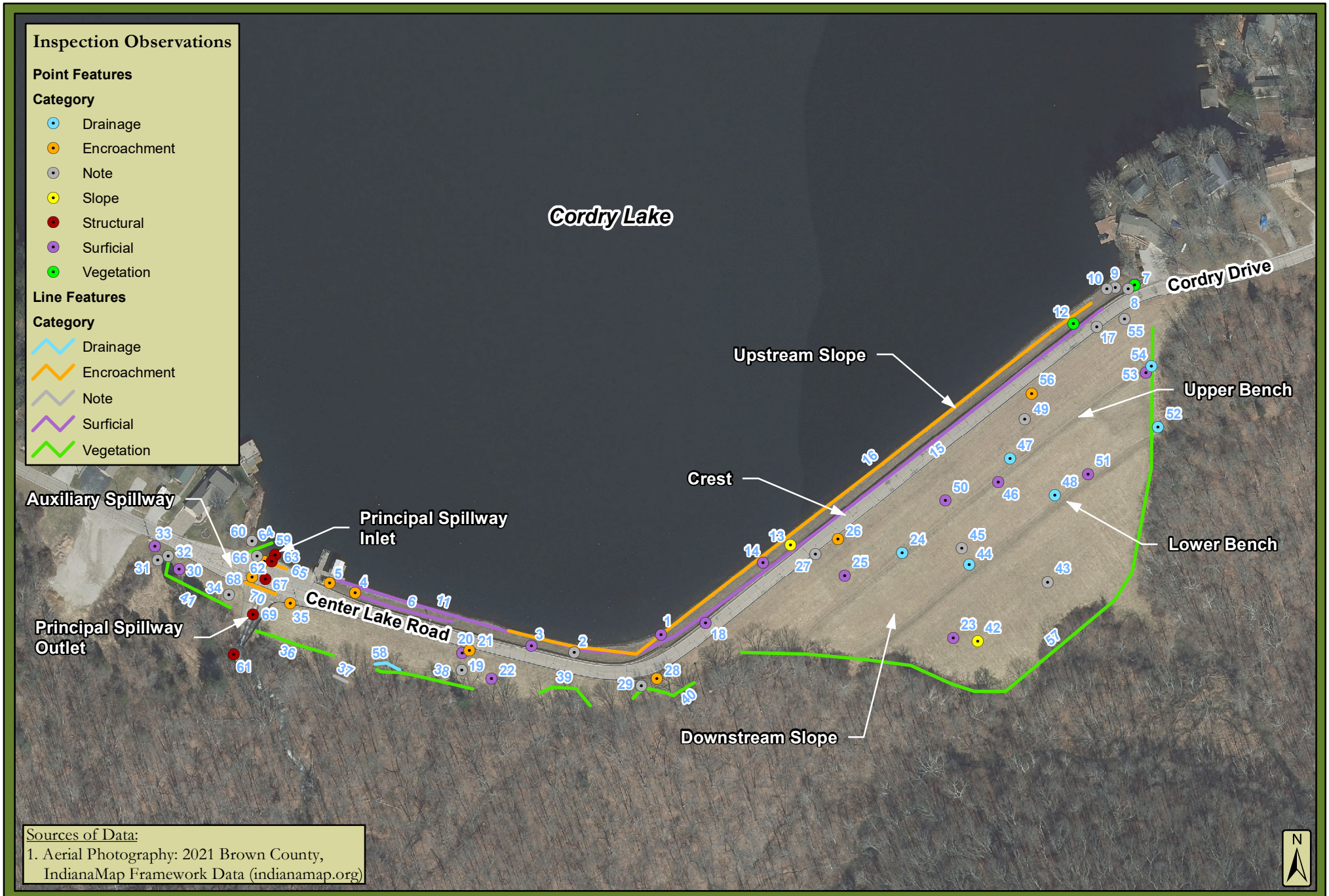
PROJECT: Cordry Lake Dam 2023 Dam Safety Inspection		PROJECT NO. 23-0291	APPROX. SCALE 1"=2,000'
TITLE: Aerial Photograph			DATE: 02/2024
			EXHIBIT 2



Christopher B. Burke Engineering, LLC
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115 West Washington Street
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(t) 317.266.8000 (f) 317.632.3306

PROJECT: Cordry Lake Dam 2023 Dam Safety Inspection		PROJECT NO. 23-0291	APPROX. SCALE 1 "=200 '
TITLE: Inspection Summary			DATE: 02/2024
			EXHIBIT 3

APPENDIX 1: **IDNR DAM INSPECTION REPORT FORM (OCTOBER 24, 2023)**

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./Aaron J. Fricke, P.E./Joshua L. Erwood, P.E.	PE11100632/PE11100305/PE12100846
Business Address 115 West Washington Street, Suite 1368 South, 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
Cordry Lake Dam	Nineveh	10 / 24 / 23

State Dam ID	Permit (if unapproved see pg. 6)	County	Sec.	T.	R.	Last Inspection
7-1	D-863	Brown	17	10 N	4 E	07 / 13 / 21

Owners Name	Owner's Phone
Cordry-Sweetwater Conservancy District	(317) 933-9858

Address/Zip Code 8377 Cordry Drive, Nineveh, IN 46164

Contact's Name	Contact's Phone (day) 317 - 933 - 2893 (evening) 317 - 412 - 7052	Spillway Width Top Bot. 68 ft.	Ft. FBD.
Nick Johann			7

Hazard	Drainage Area	Surface Area	Height	Crest Length	Crest Width	Inlet Below Crest	Slope: Up / Down
Significant	1.07 MI^2	169 AC	120 FT	1500 FT	24 FT	9 FT	3:1 / 3:1 +/-

FIELD CONDITIONS OBSERVED

Water Level - Below Dam Crest 9.3 +/- Ft.

Ground Moisture Condition: Dry ☒ Wet ☐ Snowcover ☐ Other ___

DRAWDOWN STRUCTURE

☐ Yes ☒ None

Comment ___

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/leaves/fuel tank/dock

Comments:

(A-9) A few small animal burrows were observed in grassed portion of slope.
(A-10) Trees and woody vegetation within 25ft of left abutment and in middle above riprap
(A-11) Minor rutting was observed along the entire length near the crest; larger mower ruts near middle equipment entrance; grass and weeds were growing in riprap slope protection; fuel tank and boat dock on right abutment

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) Transverse and longitudinal cracks were observed throughout the crest and appeared to have been sealed

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.

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 Hummocky/bench drains
Comments:

(C-10) Trees and brush were observed within 25 feet of left and right abutments and toe
(C-11) Several small animal burrows throughout the slope and small divots
(C-12) Slope appeared hummocky, particularly along "tie-back" section of embankment and middle tier
(C-12) Some of the bench drain outlets were obstructed and cleanouts broken

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-5) Wet areas observed 150' and 300' left of concrete chute spillway measuring 42'x20' and 40'x15', respectively

E PRINCIPAL SPILLWAY

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

DESCRIPTION: Reinforced concrete drop inlet structure and a 36-inch diameter reinforced concrete pipe

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 deterioration was observed on the shallow drop inlet, including cracking, spalling, and exposed rebar
(E-7) Metal trash rack was slightly weathered with loose and rusted bolts
Note: Pipe discharge previously observed infiltrating a large crack in the chute spillway was unable to be seen at the time of the inspection

F AUXILIARY SPILLWAY

GOOD	☐
ACCEPTABLE	☐
DEFICIENT	☒
POOR	☐

DESCRIPTION: 68' Wide open channel with 20(H):1(V) side slopes; asphalt crest and tapered concrete chute

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) Trees, brush, docks, fuel tank, utility pole, guardrail and bollards would likely obstruct flow
(F-9) Chute spillway has varying degrees of deterioration. Erosion at downstream end of chute may impact structural integrity if propagates. Less than one gallon per minute of flow undermining the structure.

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:

The dam appears to receive regular maintenance but improvements are needed. See comments for individual components. Spillway repairs are needed.

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 Cordry Lake Dam STATE DAM I.D. 7-1 DATE 10 / 24 / 23

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

MAINTENANCE-MINOR REPAIR-MONITORING

☐ (1) Provide Additional Erosion Protection: _____

☐ (2) Mow: _____

☒ (3) Clear Trees and/or Brush From: Upstream slope left abutment; downstream slope right and left abutments, and toe.

☒ (4) Initiate Rodent Control Program and Properly Backfill Existing Holes: Upstream and downstream slope

☒ (5) Repair: Broken bench drain cleanouts; Principal spillway concrete inlet and trash rack; rutting on upstream slope

☐ (6) Provide Surface Drainage For: _____

☒ (7) Monitor: Asphalt cracking on embankment crest; wet areas on downstream slope; hummocky downstream slope

☒ (8) Other: Monitor condition of concrete chute and erosion downstream of chute spillway in natural channel

☒ (9) Other: remove leaf debris and vegetation in riprap along upstream slope

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: Note, spillway rehabilitation design is currently in progress

☐ (15) Set up a Monitoring Program: _____

☐ (16) Refer to Unapproved Status of Dam: _____

☒ (17) Develop an Emergency Action Plan: _____

☒ (18) Other: Develop a lake drawdown plan

☐ (19) Other: _____

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

See attached table of recommendations.

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 _____ Date 2/29/2024

Reviewed By Nicholas B. Strawn _____ Date 2/12/24

Owner/Owner's Representative

Component	Rating	Recommendations	Schedule	Importance
Upstream Slope	Acceptable	• Spray/Remove grass, weeds, and leafy debris in riprap. Prevent spraying embankment grassed areas above riprap. • Remove trees and brush within 25 feet of the left abutment and near middle in accordance with the Indiana Dam Safety Inspection Manual • Fill and seed divots, ruts, and bare areas along the slope; vary mowing patterns to reduce likelihood of additional rutting • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; grassed portion of upstream slope	• Ongoing • Within 2 years • Within 1 year • Ongoing	• Low • Medium • Low • Low
Crest	Acceptable	• Monitor cracks in asphalt pavement and seal as needed	• Ongoing	• Low
Downstream Slope	Acceptable	• Remove trees and brush within 25 feet of the left abutment, right abutment, and toe of slope of the main embankment as well as the toe of slope of the tie-back section in accordance with the Indiana Dam Safety Inspection Manual • Monitor hummocky slope areas for changes • Fill and seed divots and bare areas along the slope; vary mowing patterns to reduce likelihood of additional surficial issues • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; entire downstream slope • Repair/Replace broken bench drain cleanouts. Install a marker post at each cleanout along the benches and at each outlet along the groins for easy identification	• Within 2 years • Ongoing • Within 1 year • Ongoing • Within 1 year	• Medium • Low • Low • Low • Medium
Seepage	Acceptable	• Monitor wet areas observed left of concrete chute spillway; install flags or similar around perimeter of wet areas in support of monitoring effort and notify engineer of observed changes	• Ongoing	• Medium
Principal Spillway	Acceptable	• Monitor deteriorated concrete inlet monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes • Monitor trash rack condition monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes	• Ongoing • Ongoing	• High • Medium
Auxiliary Spillway	Deficient	• Remove trees and brush within 25 feet of the right inlet section and outlet walls in accordance with the Indiana Dam Safety Inspection Manual • Spray/Remove vegetation growing through the cracks of the concrete chute • Monitor the concrete condition of the spillway chute and erosion of the downstream channel monthly and after significant rainfall events while new structure is being designed and notify engineer of observed changes	• Within 2 years • Ongoing • Ongoing	• Medium • Low • High
Maintenance and Repairs	Acceptable	• Prepare construction plans and technical specifications for the replacement of the spillway • Develop an Incident and Emergency Action Plan (IEAP) with dam failure flood inundation map • Develop lake drawdown plan	• Within 1 year • Within 2 years • Within 1 year	• High • Medium • Low
Overall Conditions	**Conditionally Poor**	• **See above**	• **N/A**	• **N/A**

Notes:
1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

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:

There are no rating changes.

PREVIOUS RECOMMENDATIONS FOR MAINTENANCE, REPAIRS, AND UPGRADES:

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

Items that have been performed include the following:
- Retained geotechnical engineer to evaluate embankment slope stability and seepage condition
- Ongoing design plan development to rehabilitate the spillway structure
- Remove yard debris from upstream slope
- Supplement riprap in bare areas

Items that have not been performed include the following:
- Tree removal at downstream toe and abutments
- Add riprap to left groin
- Develop Incident and Emergency Action Plan (IEAP)
- Remove vegetation growing in concrete chute spillway

Supporting Documentation

Photographs ☒ Attachments ☒ Calculations ☐ Drawings ☐ Other ☐

Comments:

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: 2/29/2024

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,

APPENDIX 2: **PREVIOUS IDNR DAM INSPECTION REPORT FORM (JULY 13, 2021)**

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./Aaron J. Fricke, P.E./Joshua L. Erwood, E.I.	PE11100632/PE11100305
Business Address 115 West Washington Street, Suite 1368 South, 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
Cordry Lake Dam	Nineveh	07 / 13 / 21

State Dam ID	Permit (if unapproved see pg. 6)	County	Sec.	T.		R.		Last Inspection
7-1	D-863	Brown	17	10	N	4	E	07 / 10 / 19

Owners Name	Owner's Phone
Cordry-Sweetwater Conservancy District	(317) 933-9858

Address/Zip Code: 8377 Cordry Drive, Nineveh, IN 46164

Contact's Name	Contact's Phone	Spillway Width	Ft. FBD.
Josh Bryant	(day) 317 - 306 - 8395 (evening) ___ - ___ - ___	Top Bot. 68	7

Hazard	Drainage Area	Surface Area	Height	Crest Length	Crest Width	Inlet Below Crest	Slope: Up / Down
Significant	1.07 MI^2	169 AC	120 FT	1500 FT	24 FT	9 FT	3:1 / 3:1 +/-

FIELD CONDITIONS OBSERVED

Water Level - Below Dam Crest 8.8 +/- Ft.

Ground Moisture Condition: Dry ☐ Wet ☒ Snowcover ☐ Other ___

DRAWDOWN STRUCTURE

☐ Yes ☒ None

Comment ___

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/Vegetation in Riprap

Comments:

(A-2) 12ft gap in riprap with yard debris pile
(A-9) A few small animal burrows were observed in grassed portion of slope.
(A-10) Trees and woody vegetation within 25ft of left abutment and in middle above riprap
(A-11) Minor rutting was observed along the entire length near the crest; grass and weeds were growing in riprap slope protection

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 Rodent burrow

Comments:

(B-4) Transverse and longitudinal cracks were observed throughout the crest and appeared to have been sealed
(B-11) Rodent burrow found on upstream side guardrail post near middle

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.

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 Hummocky/Rut

Comments:

(C-10) Trees and brush were observed within 25 feet of left abutment and toe
(C-11) A few small animal burrows throughout the slope
(C-12) Slope appeared hummocky, particularly along "tie-back" section of embankment
(C-12) Rut 30ft long and 1ft wide on right-side bend upper section

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:

(D-5) Wet areas observed 150' and 300' left of concrete chute spillway measuring 33'x20' and 40'x15', respectively

E PRINCIPAL SPILLWAY

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

DESCRIPTION: Reinforced concrete drop inlet structure and a 36-inch diameter reinforced concrete pipe

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) Concrete deterioration was observed on the shallow drop inlet, including cracking, spalling, and exposed rebar
(E-7) Metal trash rack was slightly weathered with loose and rusted bolts
Note: Pipe discharge previously observed infiltrating a large crack in the chute spillway was unable to be seen at the time of the inspection

F AUXILIARY SPILLWAY

GOOD	☐
ACCEPTABLE	☐
DEFICIENT	☒
POOR	☐

DESCRIPTION: 68' Wide open channel with 20(H):1(V) side slopes; asphalt crest and tapered concrete chute

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) Trees, brush, docks, fuel tank, utility pole, guardrail and bollards would likely obstruct flow
(F-9) Chute spillway has varying degrees of deterioration. Erosion at downstream end of chute may impact structural integrity if propagates

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 Additional Investigations/Analyses

Comments:

The dam appears to receive regular maintenance but improvements are needed. See comments for individual components. Spillway repairs and embankment stability analyses are needed.

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 Cordry Lake Dam STATE DAM I.D. 7-1 DATE 07 / 13 / 21

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

MAINTENANCE-MINOR REPAIR-MONITORING

☒ (1) Provide Additional Erosion Protection: Add riprap to upstream slope at left abutment
☐ (2) Mow: _____
☒ (3) Clear Trees and/or Brush From: Upstream slope middle and left abutment; downstream slope right and left abutments, and toe.
☒ (4) Initiate Rodent Control Program and Properly Backfill Existing Holes: Upstream and downstream slope
☒ (5) Repair: Principal spillway concrete inlet and trash rack; rutting on upstream and downstream slopes
☐ (6) Provide Surface Drainage For: _____
☒ (7) Monitor: Asphalt cracking on embankment crest; wet areas on downstream slope; hummocky downstream slope
☒ (8) Other: Monitor condition of concrete chute and erosion downstream of chute spillway in natural channel
☒ (9) Other: Remove yard debris from upstream slope; debris and vegetation in riprap along upstream slope

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: Note, spillway alternative evaluation is currently in progress
☐ (15) Set up a Monitoring Program: _____
☐ (16) Refer to Unapproved Status of Dam: _____
☒ (17) Develop an Emergency Action Plan: _____
☒ (18) Other: Perform a video inspection of the principal spillway outlet pipe
☐ (19) Other: _____

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

See attached table of recommendations.

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 _____ Date 10/22/2021

Reviewed By _____ Date 10/22/2021
Owner/Owner's Representative

Component	Rating	Recommendations	Schedule	Importance
Upstream Slope	Acceptable	• Remove yard debris pile near left abutment and install riprap where missing to ensure uniform shoreline protection • Spray/Remove grass, weeds, and woody debris in riprap • Remove trees and brush within 25 feet of the left abutment and near middle in accordance with the Indiana Dam Safety Inspection Manual • Fill and seed rutted areas along the slope; vary mowing patterns to reduce likelihood of additional rutting • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; grassed portion of upstream slope	• 2 years • 2 years • 2 years • 2 years • Ongoing	• Low • Low • Medium • Low • Low
Crest	Acceptable	• Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; grassed portion of upstream along guardrail posts • Monitor cracks in asphalt pavement	• Ongoing • Ongoing	• Low • Low
Downstream Slope	Acceptable	• Remove trees and brush within 25 feet of the left abutment, right abutment, and toe of slope in accordance with the Indiana Dam Safety Inspection Manual • Monitor hummocky slope areas for changes • Fill and seed rut at right-side bend; vary mowing patterns to reduce likelihood of additional rutting • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; entire downstream slope	• 2 years • Ongoing • 2 years • Ongoing	• Medium • Low • Low • Low
Seepage	Acceptable	• Monitor wet areas observed left of concrete chute spillway; install flags or similar around perimeter of wet areas in support of monitoring effort and notify engineer of significant changes	• Immediately/ Ongoing	• Medium
Principal Spillway	Acceptable	• Repair/Replace deteriorated concrete inlet • Repair/Replace loose, rusted bolts for trash rack	• 2-4 years • 2-4 years	• Medium • Low
Auxiliary Spillway	Deficient	• Remove trees and brush within 25 feet of the right inlet section and outlet walls in accordance with the Indiana Dam Safety Inspection Manual • Spray/Remove vegetation growing through the cracks of the concrete chute • Monitor the concrete condition of the spillway chute and erosion of the downstream channel monthly and after significant rainfall events and notify engineer of significant changes	• 2 years • Ongoing • Immediately/ Ongoing	• Medium • Low • High
Maintenance and Repairs	Acceptable	• Prepare construction plans and technical specifications for the replacement of the spillway • Retain a geotechnical engineer to perform an investigation to evaluate dam stability • Develop an Incident and Emergency Action Plan (IEAP) with dam failure flood inundation map • Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years • Develop reservoir drawdown plan	• 2 years • 2 years • 2 years • 2 years • 2 years	• High • Medium • Medium • Low • Low
Overall Conditions	**Conditionally Poor**	• **See above**	• **N/A**	• **N/A**

Notes:

1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

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:

There are no rating changes.

PREVIOUS RECOMMENDATIONS FOR MAINTENANCE, REPAIRS, AND UPGRADES:

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

Items that have been performed include the following:
- Retained structural engineer to evaluate the concrete deterioration throughout the spillway chute
- Performed spillway capacity analysis in accordance with IDNR requirements

Items that have not been performed include the following:
- Tree removal at downstream toe and abutments
- Add riprap to left groin
- Develop inundation mapping
- Remove vegetation growing in concrete chute spillway

Supporting Documentation

Photographs ☒ Attachments ☒ Calculations ❒ Drawings ❒ Other ❒

Comments:

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: 10/22/2021

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,

APPENDIX 3: **INSPECTION PHOTOGRAPHS (OCTOBER 24, 2023)**

Top: Upstream slope from right side; note some dead grass above riprap. Note utility pole on tie-back section top of slope.

Bottom: Upstream slope; note ruts at equipment entrance

Top: Upstream slope from right side; note minor rutting at top of slope near crest

Bottom: Upstream slope from left side; note some leafy debris along shoreline

Top: Upstream slope from left side; note trees on left abutment

Bottom: Upstream slope at left abutment; note garden beds and landscaping on abutment

Top: Embankment crest from right side bend; note cracking patchwork (typ.)

Bottom: Embankment crest from left abutment; note cracking particularly along edges (some cracks previously sealed)

Top: Downstream slope at left abutment; note tall grass, brush, and trees within 25 feet

Bottom: Downstream slope on left side; note adequate grass cover and generally uniform slope. Note brush and trees within 25 feet of toe.

Top: Downstream slope on upper tier looking right

Bottom: Downstream slope lower left bench drain (typ.) cleanout broken; some standing water in drain

Top: Downstream slope; note small animal burrow (typ.) in upper portion of slope

Bottom: Downstream slope on upper tier looking left; note although visually difficult to see, the entire slope was observed to be slightly hummocky

Top: Downstream slope at "tie-back" section; note 40ft by 15ft wet area observed near toe with tall grass

Bottom: Downstream slope at "tie-back" section; note rutting in 42ft by 20ft wet area observed near toe with tall grass

Top: Principal spillway inlet; note concrete deterioration on left side and rusted trash rack hardware

Bottom: Principal spillway inlet; note concrete deterioration cracking and spalling

Top: Principal spillway outlet; note exterior of spillway pipe appeared in good condition

Bottom: Principal spillway outlet; note interior of pipe could not be thoroughly inspected

Top: Auxiliary spillway inlet; note dock, utility pole and fuel tank on the left upstream side

Bottom: Auxiliary spillway inlet; note trees and brush encroaching by signs. Note articulated concrete block mat extends into lake for boat ramp access. Note bollards on upstream side of road.

Top: Auxiliary spillway crest; note roadway surface with guardrail bollards at the downstream edge.

Bottom: Auxiliary spillway crest; note guardrail and bollards at the downstream edge

Top: Auxiliary spillway concrete chute; note condition of concrete and vegetation growth in cracks

Bottom: Auxiliary spillway concrete chute; note vegetation growth intruding along wall sections

Top: Auxiliary spillway concrete chute; note condition of concrete (cracking, spalling)

Bottom: Auxiliary spillway end of concrete chute; note cracked concrete and some seepage observed flowing under the concrete structure

APPENDIX 4: **DAM INSPECTION CHECKLIST (OCTOBER 24, 2023)**

Dam Safety Inspection Checklist

Complete All Portions of This Section (Pre-inspection)
Date of Inspection: 10/24/2023
Name of Dam: CORDRY LAKE DAM File Number: 7-1
EAP: (yes, no) OM&I: (yes, no)

Review Inventory - Highlight missing information (Pre -inspection)
Owner=s Name(s): CORDRY - SWEETWATER CONSERVANCY DISTRICT
Address: 8377 CORDRY DR
City: NOBLESVILLE State: IN Zip (+4): 46164

Telephone (Home): Telephone (Work): 317-933-2859
Contact Person: NICK JOHNSON Telephone: 317-412-7052
Designed By: DARCOTT / EAPS
Constructed By: PRINCE / CR MORRIS
Year Completed: 1971 Plans Available (Yes, No) (location): IDNR FILE (SELECT)
Purpose of dam: RECREATION

Interview with Owner (at the site):
Owner/Representative present: (Yes, No) Name(s): NICK JOHNSON

Double check address, telephone #, purpose (check ->) G✓
How long have you owned dam - previous name/owner? CSCD OWNED SINCE 1959

EAP/OM&I: up-dated-(yes, no) & location: NO IEAP
Operate lake drain (times per year, accessibility): NO LAKE DRAIN

Mowing (times per year): 3 TIMES PER YR
Prior problems (wet areas, erosion, slides): YES; SEE INSPECTION REPORT

Repair or modification (what & when): NONE; SPILLWAY RECONSTRUCTION CURRENTLY UNDER DESIGN

Failure/Incident/Breach (max. pool): NONE; SEE INSPECTION REPORT

Downstream hazard status (recent changes): NO CHANGES OBSERVED

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: SOME DETAIL AVAILABLE IN IDNR FILE
Volume of fill (earth or rock) in dam: "
Foundation (earth or rock) of dam: "

Field Information (while at site)
Pool Elevation (during inspection): 4" BELOW NP Time: 2:30 (a.m. p.m.)
Site Conditions(temp., weather, ground moisture): 77°F, PARTLY CLOUDY, DRY

Inspection Party: AJ FRICHE, PE; JEFF COX, PE; JUDD ERWOOD, PE
Maximum Height: 120 FT (measured or inventory appears correct)
Normal Pool Surface Area: 169 AC (measured or inventory appears correct)

See Inspection Report for Recommended Action

Required Action

UPSTREAM SLOPE

Gradient: Horizontal: 2.4 : 1 Upper Half 0.5 : 1 Lower Half Vertical: 2.5 : 1 Riprap Section (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:

☑ Ground Cover: Type: (grass, crown vetch) Other:
Quantity: (bare, sparse, adequate, dense)
Appearance: (too tall, too short, good)
Notes: 6 Ft above Riprap section appears dead; possibly reaction from riprap spraying. Entire slope. Right side dead grass extends from riprap to crest

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

☐ None

☐ Riprap: Average Diameter: 9" Revetment
(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: Height:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes:

☐ 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: SLIGHT HUMMOCKY ALONG SLOPE

☐ 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: SHALLOW; ± 2 INCHES WIDE

☑ Ruts: ☐☐☐☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) U/S SLOPE ENTRANCE NEAR MIDDLE
Depth: Width Length: VARIABLE MOWER/OTHER ACCESS
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) SPORADIC DIRECTLY ABOVE RIPRAP

☑ Other: LEAVES / MIN. DEBRIS ALONG TOE OF U/S SLOPE ☐☐☐☐
Notes:
FUEL TANK AND BOAT DOCK/MARINA OBSTRUCTION AT RIGHT END

CREST Length: 1500 FT (EST.) Width: 20 FT (est, meas.)
EDGE OF PVMT TO EDGE OF PVMT

☑ ***VEGETATION*** [no problem]
☐ 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: ROAD SURFACE (ASPHALT) ☐☐☐☐
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: ☐ ☐ ☐ ☐

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

Elevation Difference: Length:

Notes/Causes: VARIABLE; LIKELY AS CONSTRUCTED

☑ Horizontal: ☐ ☐ ☐ ☐

Notes/Causes: NO OBSERVED ISSUES

☑ ***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: THROUGHOUT; NOT INDICITIVE OF EMBANKMENT INSTABILITY. SURFICIAL IN NATURE

☐ 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:

None Monitor Maintenance Engineer

Required Action

3:1 TIE BACK SECTION

4:1 LOWER & MIDDLE TIER

3:1 UPPER TIER

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

	Required Action: 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) AND TOE				
Notes: COULD NOT INSPECT GROIN & TOE				
☑ Brush: Quantity: (sparse, dense)	☐	☐	☐	☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) AND TOE				
Notes: COULD NOT INSPECT GROIN & TOE				
☑ Ground Cover: Type: (grass, crown vetch) Other: SPARSE W/ ROCKY SOIL UPPER PORTION OF TIE BACK SECTION	☐	☐	☐	☐
Quantity: (bare, sparse, adequate, dense)				
Appearance: (too tall, too short, good)				
Notes: BARE AREAS LEFT UPPER BENCH				
☑ ***EROSION*** [no problem, could not inspect thoroughly]				
☐ 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:				
☐ 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) LOWER TIER, MIDDLE TIER				
Notes/Causes:				
☐ Bulges ☐ Depressions ☐ Hummocky	☐	☐	☐	☐
Size: Height: Depth:				
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)				
Notes/Causes:				

Required Action: None Monitor Maintenance Engineer

Required Action

None Monitor Maintenance Engineer

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

☑ Rodent Burrows: (few, numerous) → LOWER TIER AND TOE, LOWER BENCH ☐ ☐ ☐ ☐

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

Notes: RODENT RUN, UPPER TIER, RIGHT SIDE RIGHT END, WEST OF SPILLWAY

☐ Ruts: ☐ ☐ ☐ ☐

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

Depth: Width Length:

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

☑ Other: DIVOTS AT RIGHT SIDE, LOWER TIER, 8 INCHES DEEP, 2 ft WIDE ☐ ☐ ☐ ☐

Notes: HOLE AT TOP OF MIDDLE TIER, CENTER OF EMBANKMENT LOFT LONG

LOWER BENCH, LEFT CLEANOUT BROKEN, WATER VISIBLE

LOWER BENCH, RIGHT CLEANOUT DRY, IN TACK

LOWER BENCH, LEFT OUTLET OBTRUCTED

UPPER BENCH LEFT CLEANOUT COULD NOT OPEN

UPPER BENCH RIGHT CLEANOUT COULD NOT OPEN

UPPER BENCH RIGHT OUTLET ☐ ☐ ☐ ☐

COULD NOT LOCATE

≈ 150FT LEFT

≈ 300FT LEFT

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

☑ Wet Area ☐ Flow ☐ Boil ☐ Sinkhole

Flow Rate Size:

Location: DOWNSTREAM TOE OF TIE BACK SECTION, LEFT OF SPILLWAY → 42FT x 20FT, 40FT x 15FT

☑ Aquatic Vegetation ☐ None

☐ Rust Colored Deposits ☐ None

☐ Sediment in Flow ☐ None

☐ Other:

Notes/Causes: PREVIOUSLY NOTED, SATURATED SOILS

☐ 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

PRINCIPAL SPILLWAY

Required Action: None | Monitor | Maintenance | Engineer

☑ ***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: 14" x 16" (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)_____ ☐ ☐ ☐ ☐

☐ 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:_____
Location:_____
Notes/Causes:_____

☑ Concrete
(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐
(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐
(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐
Dimensions/Location: INLET STRUCTURE DETERIORATED
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:_____

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

None Monitor Maintenance Engineer

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

Notes:

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

Required Action (None / Monitor / Maintenance / Engineer)

☑ ***OUTLET MATERIALS*** [no problem, could not inspect thoroughly] | See Emergency Spillway |

☐ Metal (loss of coating/paint, surface rust, corrosion (pitting, ~~scaling), rusted out, pipe deformation~~) ☐ ☐ ☐ ☐
Dimensions:
Location:
Notes/Causes:

☑ Concrete
(bug holes, hairline crack, efflorescence) See Emergency Spillway ☐ ☐ ☐ ☐
(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:(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: ☐ ☐ ☐ ☐

Required Action

None | Monitor | Maintenance | Engineer

OUTLET EROSION CONTROL STRUCTURE (Stilling Basins)

SEE Emergency Spillway

☐ 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:_____

Notes:_____

_____

_____

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

Flow Rate:_____ Size:_____ Number:_____

Location:_____

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)_____ ☐ ☐ ☐ ☐

☐ 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: Bollards, Guardrail, ETC

☑ ***INLET 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 & ASPHALT

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

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

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

Dimensions/Location:_____

Notes/Causes: CONCRETE DETERIORATED; ASPHALT CRACKED

(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** (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") Along Spillway (Hunt Falls
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: Along Spillway (Hunt Falls

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

☑ **OUTLET MATERIALS** [no problem, could not inspect thoroughly] — None ☐ Monitor ☐ Maint. ☐ Engineer ☐

☐ 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) SPILLWAY CHUTE DETERIORATED THROUGHOUT ☐ ☐ ☐ ☐
Dimensions/Location:
Notes/Causes: HOLLOW AREAS, VEGETATION IN JOINTS

(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: DOWNSTREAM RETENTION CHANNEL ☐ ☐ ☐ ☐
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: SEEPAGE @ 1 GPM OBSERVED AT END OF SPILLWAY CHUTE
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) SIGNIFICANT DETERIORATION — ☐ ☐ ☐ ☐
Dimensions/Location: THROUGHOUT SPILLWAY CHUTE,
Notes/Causes: SIDEWALLS, AND ON BAFFLES

(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: NUMEROUS LOCATIONS, WATER PREVIOUSLY
Notes/Causes: SEEN FLOWING INTO JOINTS

☑ Undermining: — ☐ ☐ ☐ ☐
Location:
Description: WATER OBSERVED AT SPILLWAY CHUTE OUTLET
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: NONE Size: 6" Number: 1
Location:
Notes: LIKELY RELIEF DRAIN OBSERVED TOWARDS END OF SPILLWAY CHUTE; NO LONGER APPEARS OPERATIONAL

Type: ☐ Weep Holes ☐ Relief Drains ☐ Other: — ☐ ☐ ☐ ☐
Flow Rate: Size: Number:
Location:
Notes:

Required Action — None | Monitor | Maintenance | Engineer

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

LAKE DRAIN

Required Action: None | Monitor | Maint. | Engineer

☑ ***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:

☐ 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: ☐ ☐ ☐ ☐

☐ Leakage - Flow Rate: ☐ ☐ ☐ ☐

Notes/Causes:

Required Action: 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:_____

☐ Other:_____ ☐ ☐ ☐ ☐
Notes:_____

Required Action

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.