MEMORANDUM
Comfort Lake-Forest Lake Watershed District

To: Board of Managers
From: Mike Kinney
Subject: Bone Lake Fish Barrier Operations and Management Plan

Date: July 5, 2016

Background/Discussion

The purpose of this agenda item is for the Board to review and accept the 2016 Bone Lake Fish Barrier Operations and Management (O&M) Plan. The plan was developed by CLFLWD and EOR staff along with input from the MNDNR and Dr. Peter Sorenson, U. of M. This O&M plan for the Bone Lake fish barrier serves as a guide to actively manage the inlet and outlet areas for carp migration while remaining sensitive to lake residents’ interest in keeping the lake below the ordinary high water (OHW) level.

Members of the Bone Lake Association have reviewed the O&M plan and do not have any further recommended changes.

Recommendation

The Board of Managers accept the 2016 Bone Lake Fish Barrier Operations and Management (O&M) Plan.

Attached: 2016 Bone Lake Fish Barrier Operations and Management Plan
Cover Images
Upper Image: Bone Lake Fish Barrier - lock detail on grate
Bottom Image: Bone Lake Fish Barrier

Document Component Specs
Text: Staples • multipurpose paper, 24 lb. text – 50% post-consumer fibers, FSC Certified.
Back Cover: Neenah Paper • Esse • Texture, Sapphire • 100 lb. cover • 30% post-consumer fibers, Green Seal® Certified
Wire Binding: Manufactured using recycled high carbon steel
Purpose

The purpose of this manual is to establish guidelines and practices for operation of the fish barriers on Bone Lake in order to provide general continuity in operations over time. Terms of fish barrier management and operation reflect the District’s consideration of several factors including fish movement, water level management in Bone Lake and Moody Lakes, public safety and administrative/maintenance costs. In the course of outlet operations, District representatives may deviate from these guidelines on the basis of judgments concerning expected hydrologic loads, fish movement, hydraulic response and other relevant factors. The District will manage the fish barriers in the best interest of affected watershed residents. However, this manual is for internal use only and does not create any right in any third party with respect to the manner in which the outlet structure is operated. By adopting this manual, the District is not assuming any duty not otherwise imposed by law and reserves all immunities and other rights and protections it is afforded under law.

Outlet Structure Description

The Bone Lake fish barriers are reinforced poured-in-place concrete structures designed to prevent carp movement to adjacent spawning habitat in wetland areas and to prevent migration from other lakes. The major components of the fish barriers include the concrete structure, half round header pipes, filter bed, stop logs, overflow grate, and a trash rack. The experimental design entails a filter bed that conveys water under normal flow conditions and then higher capacity overflow when needed. The structure also has cross members on the top with padlocks to secure the structure. See the attached design drawings showing the locations of these components.

Inspection & Maintenance

Stop Logs

The fish barrier contains stop logs to allow for a free flowing system when all of the stop logs are pulled. Each barrier has six 6-inch galvanized steel stop logs. The bottom stop log is primarily below the outlet and can remain in place at all times. With all six of the stop logs in place, all flow is forced through the drain tile system up to the 10-year event.

Based on the first three years of operation the following management plan is recommended. In all cases the top two stop logs will remain removed to allow for added flow capacity during mid to high flow event scenarios. The trash racks and overflow grates should be in-place at all times to prevent migration of adult carp.

Outlet

Stop logs should be removed whenever the surface temperature is less than 55 degrees F. This will allow for a free flowing system in the spring. Stop logs should be put in place once the Bone Lake temperature reaches at least 55 degrees and the lake is below the 908.6 (NVGD 29). The stop logs should be removed whenever the lake exceeds 908.9. The stop logs should be put back in place when the lake drops below the 908.6. For purposes of this outlet management plan the stop logs installed equates to 3 stop logs in and 3 out. Stop logs out equates to 1 stop log in and 5 out.

Inlet

Stop logs should be removed whenever the surface temperature is less than 55 degrees F. This will allow for a free flowing system in the spring. The stop logs should be put in place once the Bone Lake temperature reaches at least 55 degrees and the upstream elevation is below 909.83 (NVGD 29). The stop logs should remain in place until fall. For purposes of this inlet management plan the stop logs installed equates to 4 stop logs in and 2 out. Stop logs out equates to 1 stop log in and 5 out.
**Overflow Grates**
The aluminum overflow grates located on top of the structure are intended to provide emergency flow capacity should water levels exceed the 10-year event. At times when in operation, the aluminum grating should be inspected and cleaned frequently. For the padlocks apply one quick spray of BD660 Corrosion Free Formula 8000 Industrial Padlock Lubricant and Rust Inhibitor into both shackle holes every six months.

**Trash Rack**
The trash rack is located on the upstream face of the fish barriers and attached to the concrete structure. The trash rack is constructed of horizontal aluminum rods at two-inch spacing set in front of the concrete structure. The trash rack is intended to prevent large debris from clogging the pipe and to prevent migration of adult carp at times when the water is passing through the front of the concrete structure. The trash rack should remain in place at all times. Maintenance of the trash rack should include inspection for debris build up and clean out as needed.

**Filter Bed**
The filter bed consists of approximately 3,300 linear feet of 8-inch drain tile covered in filter rock. The surface of the rock bed should be visually inspected for debris and leaf build-up. If more than 25% of the surface of the bed is covered it should be manually raked. Synoptic flow measurements and lake levels should be taken periodically to determine if there is a long term trend of degradation of the flow capacity of the filter bed (minimum of 4 measurements per year is recommended). If flow degradation increases over time, backflow of the filter bed could be attempted. Eventually the top layer of the filter bed may need to be removed, cleaned and replaced.

**Inspection & Maintenance Summary**
The fish barriers should be regularly inspected and maintained. The table below provides recommended inspection and maintenance frequencies. This table should be used as general guidance, however more frequent inspection and maintenance may be required based on field conditions.

<table>
<thead>
<tr>
<th>Item</th>
<th>Inspection Description</th>
<th>During Operation Inspection Frequency</th>
<th>Not in Operation Inspection Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Structure</td>
<td>Visual inspection of structural concrete</td>
<td>Annually</td>
<td>Annually</td>
</tr>
<tr>
<td>Stop Logs</td>
<td>Visual inspection of stop logs</td>
<td>Annually</td>
<td>Annually</td>
</tr>
<tr>
<td>Locks</td>
<td>Lubricate</td>
<td>Semi-Annually</td>
<td>Semi-Annually</td>
</tr>
<tr>
<td>Site Landscaping</td>
<td>Check general health of vegetation</td>
<td>Semi-Annually</td>
<td>Semi-Annually</td>
</tr>
<tr>
<td>Header Pipes</td>
<td>Visually inspect inside of header pipes</td>
<td>Semi-Annually</td>
<td>Semi-Annually</td>
</tr>
<tr>
<td>Filter Bed</td>
<td>Inspect for Debris Build Up</td>
<td>Semi-Annually</td>
<td>Semi-Annually</td>
</tr>
<tr>
<td>Trash Rack</td>
<td>Check for debris</td>
<td>Weekly</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Overflow Grates</td>
<td>Check for debris</td>
<td>Daily</td>
<td>Annually</td>
</tr>
</tbody>
</table>
Operational Policy & Procedures

Operational procedures are dependent on the lake level, season and water temperature. District may pull stop logs sooner in anticipation of rain events. This may help reduce the time period that the lake spends over OHWL. Below is an overview of the operational procedures. The OHWL of Bone Lake is 909.1. The top of the concrete outlet structure is 910.5 and the top of the concrete inlet structure is 911.4 based on April 2016 survey. All elevations are in NVGD 29.

Bone Lake Outlet

Surface Temperature less than 55°F

<table>
<thead>
<tr>
<th>Lake Level*</th>
<th>Discharge Policy*</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Stop Logs Removed</td>
</tr>
</tbody>
</table>

Surface Temperature greater than 55°F

<table>
<thead>
<tr>
<th>Lake Level*</th>
<th>Discharge Policy*</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 908.9</td>
<td>Stop Logs Removed</td>
</tr>
<tr>
<td>&lt; 908.6</td>
<td>Install two additional stop logs (elevation 909.0)</td>
</tr>
</tbody>
</table>

* For purposes of this management plan the stop logs installed equates to 3 stop logs in and 3 out. Stop logs out equates to 1 stop log in and 5 out.

Bone Lake Inlet

Surface Temperature less than 55°F

<table>
<thead>
<tr>
<th>Lake Level</th>
<th>Discharge Policy*</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Stop Logs Removed</td>
</tr>
</tbody>
</table>

Surface Temperature greater than 55°F

<table>
<thead>
<tr>
<th>Wetland Level</th>
<th>Discharge Policy*</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 909.9</td>
<td>Install three additional stop logs (elevation 909.9) and leave in place until late fall</td>
</tr>
</tbody>
</table>

* For purposes of this management plan the stop logs installed equates to 4 stop logs in and 2 out. Stop logs out equates to 1 stop log in and 5 out.
Reference Outlet Culvert Drawing dated 5/16/2016*

*Elevations are in NVGD 29
Outlet Structure Record Drawings dated 1/21/2013*
*Elevations are in NAV 88
BONE LAKE OUTLET STRUCTURE

(SEE STRUCTURAL PLANS FOR CONCRETE STRUCTURE DETAILS)

1. BONE LAKE OUTLET STRUCTURE

(SEE STRUCTURAL PLANS FOR CONCRETE STRUCTURE DETAILS)
**BONE LAKE INLET PIPING LAYOUT**

(See structural plans for concrete structure details)

**BONE LAKE INLET STRUCTURE**

(See structural plans for concrete structure details)

---

**DRAIN FIELD CROSS SECTION**

**BONE LAKE INLET**

**COMFORT LAKE FOREST LAKE**

**WATERSHED DISTRICT**

220 N. LAKE STREET

FOREST LAKE, MN 55025

**BONE LAKE**

**FISH BARRIERS**

WASHINGTON & CHICAGO CO., MINN.
5' METAL OR 2"x2" WOOD FENCE POST

GEOTEXTILE

BACKFILL

6' MAXIMUM

1.5' MIN.

6" MIN. TRENCH

DIRECTION OF FLOW

NOTE: - SILT FENCE SHALL CONFORM TO MNDOT 3886.
- FENCING SHALL BE PLACED ALONG CONTOURS OR AS DIRECTED BY ENGINEER.

GEOTEXTILE TO SPAN TRENCH. LEADING EDGE TO BE BELOW GROUND, MINIMUM OF 2"

HARD SURFACE PUBLIC ROAD

12" - 2" WASHED ROCK

50' MIN

8" MIN

50' MIN

15' MIN

1" - 2" WASHED ROCK

12" TO 24"

27" TO 33"

36" TO 48"

54" AND UP

8 TO 12 CY CL. 2

14 TO 20 CY CL. 3

23 TO 38 CY CL. 3

62 CY AND UP CL. 4

(ONE CUBIC YARD IS APPROXIMATELY 2,800 LBS.)

RIPRAP REQUIREMENTS

PIPE SIZE

12"-18" 3/4"/" 6/3/6

18"45" 1/4"/" 12" 1/2"

12" 1/2"/" 6/3/6

18" 1/4"/" 12" 1/2"

1/2" MORTAR ON SLAB JOINTS INSTALL AT 45° FROM TOP OR BOTTOM OF PIPE.

Geotextile Filter Type III Fabric or Equal

FILTER BLANKET (MNDOT 3601.2B1)

FILTER BLANKET (MNDOT 3601.2B1)

GEOTEXTILE FILTER TYPE III FABRIC OR EQUAL

2" 12" 24"

12" 24"

15" 30"

5D 2' 2'

5D 2' 2'

TIE LAST 3 PIPE JOINTS. USE 2 TIE BOLT FASTENERS PER JOINT.

INSTALL AT 60° FROM TOP OR BOTTOM OF PIPE.

2 STRIPS BITUMASTIC SEAL ON SLAB JOINTS

PRECAST

COVER TYPE II SLAB

GEOMETILE TO SPAN TRENCH. LEADING EDGE TO BE BELOW GROUND, MINIMUM OF 2"

FLOATING SILT CURTAIN

NOTE: NO WOOD SHALL BE USED FOR ADJUSTING CASTING. CEMENT MORTAR ONLY.

CAST IRON MANHOLE FRAME & COVER AS PER SPECIFICATIONS.

STEPS SHALL BE CAST IRON, ALUMINUM OR STEEL REINFORCED PLASTIC. LOCATION AS SHOWN.

PRECAST REINFORCED CONCRETE MANHOLE SECTIONS PER ASTM C479.

FILL OPENING BETWEEN PIPE & MH WALL WITH CEMENT MORTAR. INSIDE SURFACE SHALL BE FINISHED SMOOTH.

ALL MORTAR SHALL CONFORM TO ASTM C270 AND MEET THE REQUIREMENTS OF MNDOT 2506.2B.

GRADE AROUND CASTING TO MATCH TOP OF THE CASTING

NOTE: SILT FENCE SHALL CONFORM TO MNDOT 3886.

- FENCING SHALL BE PLACED ALONG CONTOURS OR AS DIRECTED BY ENGINEER.

CASTING R-1733

RINGE (MIN. 1/2"

MAX. OF DMS & VMENTS)

1/2" MORTAR ON

SLAB JOINTS INSTALL AT 45° FROM TOP OR BOTTOM OF PIPE.

CAST IRON MANHOLE FRAME & COVER AS PER SPECIFICATIONS.

PRECAST REINFORCED CONCRETE MANHOLE SECTIONS PER ASTM C479.

FILL OPENING BETWEEN PIPE & MH WALL WITH CEMENT MORTAR. INSIDE SURFACE SHALL BE FINISHED SMOOTH.

ALL MORTAR SHALL CONFORM TO ASTM C270 AND MEET THE REQUIREMENTS OF MNDOT 2506.2B.
EROSION CONTROL NOTES:

1. THE CONTRACTOR SHALL PROVIDE THE NECESSARY EROSION CONTROL AS OUTLINED IN THE STORMWATER POLLUTION PREVENTION PLAN. THE PROJECT DISTURBS LESS THAN 1 ACRE OF LAND, THEREFORE A NPDES CONSTRUCTION ACTIVITY PERMIT IS NOT REQUIRED.

2. THE CONTRACTOR SHALL HAVE A COPY OF THE PROJECT STORMWATER POLLUTION PREVENTION PLAN AND THE REQUIRED INSPECTION FORMS ON SITE AT ALL TIMES DURING CONSTRUCTION ACTIVITY.

3. THE CONTRACTOR SHALL INSTALL CONSTRUCTION ENTRANCES, SILT CURTAIN AND SILT FENCE AT LOCATIONS INDICATED ON THE PLANS PRIOR TO BEGINNING ANY OTHER CONSTRUCTION ACTIVITIES AND MAINTAIN SUCH INSTALLATIONS UNTIL FINAL STABILIZATION IS COMPLETED.

4. DURING THE CONSTRUCTION PROCESS THE CONTRACTOR SHALL REMOVE ALL SEDIMENT AND DEBRIS THAT IS TRACKED ONTO OR ACCUMULATED ON ADJACENT PAVEMENTS ON A DAILY BASIS.

5. THE CONTRACTOR SHALL REMOVE ALL TEMPORARY EROSION CONTROL DEVICES AFTER FINAL STABILIZATION OF THE SITE IS COMPLETE.
**EROSION CONTROL NOTES:**

1. THE CONTRACTOR SHALL PROVIDE THE NECESSARY EROSION CONTROL AS OUTLINED IN THE STORMWATER POLLUTION PREVENTION PLAN. THE PROJECT DISTURBS LESS THAN 1 ACRE OF LAND, THEREFORE A NPDES CONSTRUCTION ACTIVITY PERMIT IS NOT REQUIRED.

2. THE CONTRACTOR SHALL HAVE A COPY OF THE PROJECT STORMWATER POLLUTION PREVENTION PLAN AND THE REQUIRED INSPECTION FORMS ON SITE AT ALL TIMES DURING CONSTRUCTION ACTIVITY.

3. THE CONTRACTOR SHALL INSTALL CONSTRUCTION ENTRANCES, SILT CURTAIN AND SILT FENCE AT LOCATIONS INDICATED ON THE PLANS PRIOR TO BEGINNING ANY OTHER CONSTRUCTION ACTIVITIES AND MAINTAIN SUCH INSTALLATIONS UNTIL FINAL STABILIZATION IS COMPLETED.

4. DURING THE CONSTRUCTION PROCESS THE CONTRACTOR SHALL REMOVE ALL SEDIMENT AND DEBRIS THAT IS TRACKED ONTO OR ACCUMULATED ON ADJACENT PAVEMENTS ON A DAILY BASIS.

5. THE CONTRACTOR SHALL REMOVE ALL TEMPORARY EROSION CONTROL DEVICES AFTER FINAL STABILIZATION OF THE SITE IS COMPLETE.
CONSTRUCTION NOTES:
1. MAXIMUM DITCH/SIDE SLOPES SHALL NOT EXCEED 3:1 WITHIN THE RIGHT OF WAY.
2. PAVEMENT RESTORATION SHALL INCLUDE 8 INCHES OF CLASS 5 COMPACTED TO 100% STANDARD PROCTOR DENSITY, 2 1/2 INCHES OF MVN35035B AND 1.5 INCHES OF LVWE45030B
3. INSTALL MANHOLE STRUCTURES 1 & 2 FLUSH WITH THE SURROUNDING GRADE.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL REQUIRED WORK PERMITS/TEMPORARY CONSTRUCTION EASEMENTS.
5. CONTRACTOR SHALL PREPARE AND SUBMIT PLANS FOR ANY REQUIRED DEWATERING FOR REVIEW AND APPROVAL PRIOR TO STARTING ANY DEWATERING ACTIVITIES.
6. SEE SHEET 18 FOR APPROVED INLET TRAFFIC CONTROL DETOUR PLAN.
2.765 SF of 1.5 inch rock bed, 3.5 feet thick
55 ea. - 8" HDPE perforated pipe, 30 feet long, 16" on center

55ea. - 8" HDPE perforated pipe, 30 feet long, 16" on center

2.765 SF of 1.5 inch rock bed 3.5 FEET THICK

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

CONSTRUCTION NOTES:
1. MAXIMUM DITCH/SIDE SLOPES SHALL NOT EXCEED 3:1 WITHIN THE RIGHT OF WAY.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL REQUIRED WORK PERMITS/TEMPORARY CONSTRUCTION EASEMENTS.
3. CONTRACTOR SHALL SUBMIT TEMPORARY TRAFFIC CONTROL WORK ZONE SAFETY PLAN FOR REVIEW AND APPROVAL PRIOR TO STARTING CONSTRUCTION ACTIVITIES.
4. CONTRACTOR SHALL PREPARE AND SUBMIT PLANS FOR ANY REQUIRED DEWATERING FOR REVIEW AND APPROVAL PRIOR TO STARTING ANY DEWATERING ACTIVITIES.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.

EXISTING PIPE INV=907.91

OHW=909.1
CLASS 2
RIP RAP

REMOVE & RESET
LAST SECTION OF
36" RCPA AS
NEEDED FOR OUTLET
CONTROL STRUCTURE
CONSTRUCTION

BITUMINOUS EDGE

LOFTON AVENUE CL

WL AUGUST 2011 EL=908.86

FINISHED TOP OF AGGREGATE BED TO MATCH EXISTING LAKE BOTTOM ELEVATION AND PROFILE.
STORMWATER POLLUTION PREVENTION PLAN

PROJECT DESCRIPTION
The project purpose is to construct fish barriers to prevent migration of rough fish to and from Bone Lake in the Comfort Lake Forest Lake Watershed District (CLFLWD). The project consists of drain tile piping with rock cover, header piping to carry water to the new outlet and inlet structures, rip rap shoreline, replacement of a 36 inch cmp culvert under 238th Street, stabilization, and landscape restoration. This project does not require an NPDES stormwater permit.

RECEIVING WATERS
Stormwater from this project will flow into Bone Lake and an unnamed wetland west of Loften Avenue through a culvert from Bone Lake. This project neither increases nor decreases impervious surface and does not require additional stormwater treatment.

SPECIAL OR IMPAIRED WATERS (APPENDIX A)
No special or impaired waters exist with one mile of any project discharge points. Appendix A requirements do not apply to this project.

RESPONSIBLE PARTIES:
Comfort Lake Forest Lake Watershed District (Owner), and the Contractor (Site Operator), are responsible for the implementation of the SWPPP. The Contractor is responsible for installations, inspections, maintenance and repairs of all erosion prevention and sediment control BMP's before, during, and after active construction. The CLFLWD is responsible for the long-term operation and maintenance of all permanent stormwater management systems. The contractor is liable until final stabilization of all disturbed areas has been achieved, all BMP's have been removed.

PROJECT SEQUENCING DATES:
Project start date: Final completion date: July 31, 2012

IMPERVIOUS SURFACE AND DISTURBED AREA:
Total disturbed Area = 25,940 S.F. Post-construction impervious Area = 1,330 S.F. Pre-construction impervious Area = 1,330 S.F. Net increase in impervious Area = 0 S.F.

MISCELLANEOUS EROSION CONTROL NOTES:
Construction shall be governed by the MnDOT spec. book, special provisions, amendments, project specifications, and detail plates. The contractor shall keep the inspection and maintenance log on site at all times during active construction. Permits and maps relating to this project SWPPP can be found in the project manual.

BMP NOTES:
1. BMP's must be adequately designed, installed, and maintained to prevent erosion and sediment from a minimum 0.5 inch rainfall.
2. Silt fence is not an acceptable catch basin inlet protection BMP.
3. Contractor shall submit a location map and narrative for rock construction entrances (or equivalent), concrete washout locations, and hazardous material storage (if proposed) to the Project Engineer prior to land disturbance.
4. Contractor shall submit location map and BMP plan for any stock piles proposed on-site (more than 24 hours) for the Project Engineer's approval.
5. Multiple street sweepings may be required at all points of entrance or exit to the site at the discretion of the Project Engineer.

TIMING OF BMP INSTALLATION:
No construction operations, including removals, that require erosion & sediment control per SWPPP can commence until the erosion control supervisor certifies the proper installation of BMP's. The Erosion Prevention and Sediment Control BMP's shall be installed as necessary to minimize erosion from disturbed surfaces and to capture sediment on site. Perimeter controls (silt fence, construction entrances, etc.) shall be installed prior to the start of construction. Contractor shall implement the necessary on site BMP's in accordance with the plan and specification requirements to prevent nuisance conditions (MN Rules 7050.2010) from any discharges. In some cases, multiple applications of BMP's may be needed to meet these requirements.

CONSTRUCTION SEQUENCING:
1. Contractor to verify that all applicable permits have been obtained.
2. Contractor shall develop a chain of command with all operators on the site to ensure the SWPPP will be implemented and stay in effect until the project is complete.
3. Contractor must plan and implement appropriate construction phasing, vegetative buffer strips, horizontal slope grading, and other construction practices that minimize erosion, so that the inspection and maintenance requirements are met. The location of areas not to be disturbed (including tree protection fencing) must be delineated (e.g. with flags, stakes, signs, silt fence, orange tree protection fence, etc.) on the project site before work begins.
4. Sediment control practices must be established on all down gradient parameters before any up gradient land disturbing activities begin. These practices shall remain in place until final stabilization is achieved.
5. Contractor to rough grade site and install utilities, then install and maintain all temporary permanent erosion control BMP's as shown on plans.
6. Contractor to achieve final stabilization prior to submission of the notice of final completion.

DEWATERING AND BASIN DRAINING:
In the event dewatering or basin draining is required, the contractor shall submit a dewatering plan to the Project Engineer for approval prior to undertaking these activities. Dewatering plan must include: BMP's to prevent sediment transport, erosion, and adverse impacts to downstream waters. If an approved TMDL, Waste Load Allocation is established for construction activities on a receiving waterbody, the contractor must implement all necessary BMPs to meet the assigned Waste Load Allocation. The dewatering plan and DNR appropriations permit will become part of the SWPPP.

POLLUTION PREVENTION MANAGEMENT MEASURES:
1. Solid waste (collected sediment, asphalt, concrete millings, construction and demolition debris) and other wastes must be properly disposed and must comply with MPCA disposal requirements.
2. Truck and construction vehicle washing is prohibited on site.
3. Concrete washout onsite prohibited. All washout materials transported off site and disposed of properly.
4. Hazardous Materials (oil, gas, paints, lubricants, etc.) must be properly stored, including secondary containment and restricted access. Storage and disposal of hazardous waste must be site compliance with MPCA regulations. Specifications of temporary on-site storage devices and locations must be submitted by the contractor for review and approval by the Project Engineer.
5. No burning of trees, brush, or other vegetative material is allowed within the project area.

CONTACT INFORMATION
AGENCY: MPCA
STATE DUTY OFFICER: TWIN CITIES METRO AREA
PROJECT CONSULTANT: GREG ORLOFF
SWPPP DESIGNER: GREG ORLOFF
EROSION CONTROL SUPERVISOR: MINI NELSON

RECORD DRAWING
COPYRIGHT:
COMMERS & OLIVER RESOURCES, INC.
3305 M HALE AVENUE NORTH
OAKSAS, MN 55120
651-773-8446
WWW.COMORS.COM

COMFORT LAKE FOREST LAKE WATERSHED DISTRICT
220 NORTH LAKE STREET
FOREST LAKE, MN 55025
BONE LAKE WASHINGTON & CHISAGO CO. , MN
BONE LAKE SWPPP

SWPPP REQUIREMENTS - LOCATION IN CONSTRUCTION DOCUMENTS

<table>
<thead>
<tr>
<th>AGENCY</th>
<th>PERMIT</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPCA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATE DUTY OFFICER</td>
<td>TWIN CITIES METRO AREA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROJECT CONSULTANT</td>
<td>GREG ORLOFF</td>
<td>651-203-2020</td>
<td></td>
</tr>
<tr>
<td>SWPPP DESIGNER</td>
<td>GREG ORLOFF</td>
<td>651-203-2020</td>
<td></td>
</tr>
<tr>
<td>EROSION CONTROL SUPERVISOR</td>
<td>MINI NELSON</td>
<td>651-203-2020</td>
<td></td>
</tr>
</tbody>
</table>

CONTACT INFORMATION:
AGENCY: MPCA
STATE DUTY OFFICER: TWIN CITIES METRO AREA
PROJECT CONSULTANT: GREG ORLOFF
SWPPP DESIGNER: GREG ORLOFF
EROSION CONTROL SUPERVISOR: MINI NELSON

RECORD DRAWING
COPYRIGHT:
COMMERS & OLIVER RESOURCES, INC.
3305 M HALE AVENUE NORTH
OAKSAS, MN 55120
651-773-8446
WWW.COMORS.COM

COMFORT LAKE FOREST LAKE WATERSHED DISTRICT
220 NORTH LAKE STREET
FOREST LAKE, MN 55025
BONE LAKE WASHINGTON & CHISAGO CO. , MN
BONE LAKE SWPPP

SWPPP REQUIREMENTS - LOCATION IN CONSTRUCTION DOCUMENTS

<table>
<thead>
<tr>
<th>AGENCY</th>
<th>PERMIT</th>
<th>NAME</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPCA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATE DUTY OFFICER</td>
<td>TWIN CITIES METRO AREA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROJECT CONSULTANT</td>
<td>GREG ORLOFF</td>
<td>651-203-2020</td>
<td></td>
</tr>
<tr>
<td>SWPPP DESIGNER</td>
<td>GREG ORLOFF</td>
<td>651-203-2020</td>
<td></td>
</tr>
<tr>
<td>EROSION CONTROL SUPERVISOR</td>
<td>MINI NELSON</td>
<td>651-203-2020</td>
<td></td>
</tr>
</tbody>
</table>
NOTES:
1. THE CONTRACTOR SHALL PROTECT ALL EXISTING TREES, SHRUBS, BUSHES AND OTHER VEGETATION OUTSIDE THE CONSTRUCTION LIMITS AS ESTABLISHED BY THE SILT FENCE.
2. PROVIDE A MINIMUM OF 5 INCHES OF TOPSOIL, MNDOT 3877.
3. SEED MIXTURE SHALL BE MN STATE SEED MIX 35-241.
4. ALL SEEDED AREAS SHALL BE COVERED WITH EROSION CONTROL BLANKET, MNDOT TYPE 1.
NOTES:

1. THE CONTRACTOR SHALL PROTECT ALL EXISTING TREES, SHRUBS, BUSHES AND OTHER VEGETATION OUTSIDE THE CONSTRUCTION LIMITS AS ESTABLISHED BY THE SILT FENCE.

2. PROVIDE A MINIMUM OF 5 INCHES OF TOPSOIL, MNDOT 3877.

3. SEED MIXTURE SHALL BE MN STATE SEED MIX 35-221.

4. ALL SEEDED AREAS SHALL BE COVERED WITH EROSION CONTROL BLANKET, MNDOT TYPE 1.