# INSPECTION, OPERATION AND MAINTENANCE PLAN

_____ **DAM**
(FORMAL NAME)

_____ **DAM**
(LOCAL NAME)

_____
(LOCATION INCLUDING STREET AND STREAM SYSTEM)

_____ _____
DNR FIELD FILE NUMBER DAM KEY SEQUENCE NUMBER (DNR)

**COUNTY:** _____

**OWNER:** _____

**TELEPHONE:** _____

**CELL**: _____

**OPERATOR:** _____
*(if applicable)*

**TELEPHONE:** _____

**CELL**: _____

**OWNER MAILING ADDRESS:** _____

_____

_____

Plan prepared by: _____
Name Title Company

_____ _____
Signature Date

***Note**: If the IOM is prepared by the owner then his/her information should be used to complete the "Plan prepared by" section of the cover page and elsewhere in the plan as needed.*

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# I. INTRODUCTION AND DEFINITION OF GENERAL RESPONSIBILITIES

## A. Introduction

This document describes a plan of inspection, operation and maintenance for the _____ Dam. This plan should be periodically reviewed and modified to reflect operational and structural changes. The inspection and maintenance forms and other applicable figures are designed for easy revision.

This plan was prepared for (owner/dam) _____, by _____. This plan was prepared to conform to Dam Design and Construction Standards – "Hydraulic Design and Safety Requirements (3) Safety Measures Requirements", Chapter NR 333.07(3), Wisconsin Administrative Code.

## B. Purpose and Intent

The purpose of the Inspection, Operations and Maintenance (IOM) plan is to provide the owner/operator of _____Dam and other officials with the following:

- Basic Guidelines which assist the operator/officials to:
  - Perform routine/recommended safety inspections;
  - Properly document the inspections;
  - Define and document normal operation procedures;
  - Define operational procedures during extreme events; and
  - Properly document maintenance requirements and activities.
- Guidelines and checklist items for routine inspections; and
- A series of alterable and reproducible master forms which will assist in documenting inspections.

Inspection, operation and maintenance procedures are needed to ensure the overall integrity of the dam and the public's safety. The operator can only reasonably maintain the dam in working order through active inspection. The following sections should be used to guide routine inspection, operation, maintenance, and emergency actions.

## C. Description

The _____ Dam is located on the _____ _____ River/Creek/Lake. The dam is accessed via _____

_____. A map showing the location of _____ _____ Dam and access roads can be found in Appendix ___. As-built plans for _____ Dam can be found in Appendix ____.

Type of dam: _____

Location of dam: _____

Height of dam: _____

Max Storage: _____

Number of gates: _____

Type of gates: _____

Primary Use of dam: _____

Downstream land use: _____

Downstream zoning in place: No ___ Yes ___

Type of zoning: 100-Year Floodplain ___ Dam Failure ___

Ordinance Adoption Date _____ DNR Approval Date _____

Upstream land use: _____

Hazard Rating: Low ___ Significant ___ High ___

*[Include any other information considered necessary to adequately describe the dam.]*

**D. Key Personnel and Their Responsibilities**

_____ is the Owner of _____ _____ Dam. It is the Owner's responsibility to operate, inspect and maintain the dam. The Owner may have an operator who manages the dam on a day-to-day basis, but the owner is ultimately responsible and liable for any damages should the dam not be operated correctly or fail. _____ is the Operator of _____ _____ Dam.

Only _____ as the _____ Dam Owner/Operator may operate the dam. The operator shall notify adjacent upstream and downstream dam operators about changes to the timing of gate openings and resulting

pool levels and flows. High water levels in the impoundment may require the operator to change the operation of the gates or the level of the pool.

_____ as owner/operator of _____ Dam is responsible for routine daily, monthly and annual inspections, for routine maintenance (e. g. mowing or burrowing animal removal) and other preventative maintenance (e. g. painting or seal repair) of the dam as well as operation of the dam during normal or low flows and especially during periods of high flows or flooding. _____ is also responsible for day by day monitoring when high or low flow conditions exist. More thorough inspections are required after high river flow conditions or other emergency conditions have subsided.

The _____ Dam *does/does not* have an "Early Warning System Device". The operator from _____ has been trained to identify potentially dangerous flow conditions. Potential flood conditions at the _____ Dam are characterized by the following:

- Extended periods of greater than average precipitation or combined melting periods with greater than average precipitation;
- Rapidly increasing headwater levels (greater than 2" increase per hour) or other water level issues specific to the dam; or
- Other site specific conditions such as ice jams, etc.

The operator for the _____ Dam has been trained to identify other conditions indicating a possible emergency situation and the potential for dam failure. These include, but are not limited to:

- Serious rain events with the water level above the dam rising quickly;
- Slumping or sloughing of the dam's embankment;
- Excessive erosion on the embankment below the spillway or at the abutments;
- Excessive seepage or cloudy seepage through the abutments or the embankments;
- Settlement or cracking in the embankment;
- Piping or boils in the embankment or immediately downstream;
- Noticeable movement of any portion of the outlet structure;
- Vandalism activity in the vicinity of the dam; or
- Ice build-up at the dam inlet.

During an emergency, the dam operator will follow the procedures outlined in the _____ _____ Dam Emergency Action Plan as approved by the DNR on _____.

*[If the dam has an Early Warning System, briefly describe the system, the owner/operator's responsibilities and the response procedure. This description will replace the above text. ]*

Staff Contact Information

| Name/Title | Telephone Numbers | | |
|---|---|---|---|
| | Office | Home | Cell |
| | | | |
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| | | | |

## II. INSPECTION

*[Briefly describe the general surveillance provisions for the dam including the frequency of observations and inspections and the location of all records. Examples of routine inspections can be found in the IOM Guide. At minimum, use of the text below is recommended.]*

### A. Inspections

Routine inspections are a necessary part of owning and operating a dam since early detection of gradual changes can reduce maintenance and repair costs. Routine inspections provide a way to monitor a dam's performance and identify changed conditions at the dam. All routine inspections shall be performed by properly trained persons. Records of completed inspections will be kept on file at the _____.

Examples of routine inspections include:

- Daily /Weekly
  - River flow observations

  - Precipitation records
  - Water level readings
  - Gate operation
  - Seepage monitoring (if present)
- Monthly
  - Operating equipment
  - Safety equipment
  - Performance and superficial structure
- Yearly or post flooding
  - Structural
  - Operating and safety equipment

Listed below are the categories of routine inspections and documentation that shall be conducted by the dam owner/operator:

- _____
- _____
- _____
- _____
- _____
- _____

Periodic detailed inspections of large dams are required under Chapter 31.19 (2)(ag) *Regulation of Dams and Bridges Affecting Navigable Waters*, Wis. Stats. At a frequency determined by the dam's hazard rating as well as after any emergency. All of these required inspections must be performed by a professional engineer licensed in Wisconsin. Copies of these inspections will be submitted to the assigned DNR Water Management Engineer for concurrence.

The following detailed inspections shall be conducted by _____: [*Must be a professional engineer licensed in Wisconsin with dam experience.]:*

- Department of Natural Resources required owner inspections under ch. 31.19 (2)(ag), Stats.
- After all emergencies as per the Emergency Action Plan.

If anything unusual is noted during a post-flood self-inspection, contact should be made

with the owner's consultant and the Department Water Management Engineer for the county in which the dam is located.

**B. Inspection Equipment**

*[Briefly describe the equipment to be used when doing an inspection of the dam. At minimum, use of the text below is recommended.]*

The Dam Owner/Operator and qualified persons should/shall be adequately equipped for inspection. The following are recommended inspection related equipment items:

- Camera with flash.
- Ruler with graduations large enough to be identified on photos
- Knives for prying cracks and removing materials
- Copy of site map to note locations of problems and changing conditions.
- Life jacket
- Radio
- Crack gauges
- Inspection forms
- Other tools or equipment specifically needed to inspect dam

C. Inspection Procedures

*[Briefly describe the procedure to be used when doing an inspection of the dam. An example of an inspection procedure can be found in Appendix __.]*

**III. OPERATIONAL PROCEDURES**

**A. General Surveillance Provisions**

*[Briefly describe the general surveillance provisions for the dam including the frequency of observations, operation levels and flows and the location of all records. At minimum, use of the text below is recommended.]*

Dams are part of a dynamic system composed of the river, the dam and precipitation. In order to operate a dam correctly, a dam owner/operator needs to monitor flow conditions and precipitation rates. Under certain conditions some dam owners will need to notify downstream dams of changes in operation.

The _____ Dam is checked *[as appropriate for the dam*

*hourly/daily/weekly/monthly]* to ensure the dam's pool level is at required or customary levels for summer vs. winter and that minimum flow levels are being met. The dam's levels and flows are also checked in response to precipitation. The required pool levels for the _____ Dam are:

Maximum _____ (Winter/Summer)

Minimum _____ (Winter/Summer)

Normal _____ (Winter/Summer)

and are based on the water level gage located _____.

The required minimum flow rate (25% of the natural low flow) for the _____Dam is _____ for summer and _____ for winter.

The _____ Dam is routinely observed each month and inspected once a year. Thorough inspections also occur after high flow conditions have subsided. Flow conditions are monitored weekly and day by day when high flow conditions exist. Routine and required preventive maintenance is performed by the _____. Site inspection, operation and flow monitoring records are kept on file at the _____.

**1. Gate Operation**

*If applicable, briefly describe the type and number of gates on the dam and operation procedures during normal, low and high flows.*

**2. Upstream Dam** _____

*Briefly describe any upstream dam(s) including type, gauges used, name of the owner and operator and all contact information. If there are no dams upstream then include a statement noting there is no upstream dam.*

**3. Downstream Dam** _____

*Briefly describe any downstream dam(s) including type, gauges used, name of the owner and operator and all contact information. If there are no dams downstream then include a statement noting there is no downstream dam.*

**4. Early Warning System _____ Dam**

*If the dam has an Early Warning System, briefly describe the warning system and the method for controlling flow. State who is responsible for initiating and maintaining communication during an emergency and after an emergency. Consider referencing the Emergency Action Plan. If there is no early warning system then include a statement noting there is no early warning system for the dam.*

**B. Response during Periods of Darkness**

*Briefly describe how the dam is illuminated during the night including where lights if any are located, off site light sources and portable light sources. Include the contact information for any portable light sources not owned by the dam owner/operator.*

**C. Identification of Emergency**

*Briefly describe the flood warning system used by the dam owner/operator including level and type of monitoring. Describe flood conditions. At minimum, the description of flood conditions should include consideration of the following factors:*

- *Initial Water Elevation and Gate Operation*
- *Previous Weather History (days and weeks) which includes past rainfall*
- *Predicted Weather*
- *Upstream and Downstream Dam Operation Procedures*

**D. Emergency Repair Supplies and Resources**

*Briefly describe what supplies, equipment and other resources the dam owner/operator has on-site and off-site to respond to an emergency including location and contact information for off-site materials. Identify who is responsible for and involved in assisting in or coordinating repairs. This should include the EAP Coordinator if different from the owner/operator and possibly the engineering firm who designed/constructed the dam.*

**E. Coordination of Flows**

*The flow of water between dams must be coordinated to reduce the risk of damage to the dams as well as nearby structures and property. If applicable, briefly describe how flows are regulated between any upstream or downstream dams including how lake/pool levels are maintained and the location/type of any gauges or other measuring devices. Describe how the owner/operator regulates flows under low, normal and high water flow conditions.*

### F. Winter Drawdown

*Ice formation during the winter months can damage gates, spillways, flashboards and any other component of a dam in direct contact with the ice formation. Spring thaws can produce ice jam conditions. If applicable, briefly describe how the dam will be prepared for winter ice conditions and spring thaws including how the pool will be lowered and how the drawdown will be coordinated with any upstream or downstream dams and affected property owners. Include a description of any inspections that will be conducted.*

### G. Mechanical Equipment and Vehicles

*If applicable, briefly describe any mechanical equipment or vehicles used to operate or maintain the dam. Any Operation and Maintenance manuals for vehicles and systems on dams such as electrically operated gates, motors, weirs, drains, filters or seals should be listed and the manuals including any diagrams should be included as an appendix to the dam's IOM.*

## IV. MAINTENANCE

Maintenance should be performed regularly. Routine, annual, and post storm inspection results will dictate how often and to what degree maintenance is required. A record should be kept of all maintenance activities. A maintenance log for _____ Dam can be found in Appendix ___.

Since dams hold back water under pressure, repairs often need to done differently than at other types of structures. Most items can be repaired by the Dam Owner/Operator. Larger repair items may need to be completed by qualified contractors. Large repairs may also require the submittal of plans and specifications to the Department for approval prior to starting any work. Generally, questionable repair items should be inspected by a qualified engineer and if required, repaired by contractors. All proposed repairs must be presented to the regional DNR water regulation engineer for a determination if any formal approval is required.

### A. Maintenance Frequency

The _____ Dam is a _____ type dam and is constructed of _____ _____.

Periodic maintenance and item replacement are expected and preventative maintenance activities will increase with time. Maintenance should be routinely performed. Some items require more frequent attention than others. Routine maintenance should include activities such as mowing, tree removal, filling rodent holes, replacing boards, greasing motors, patching concrete and fixing cables and chains. Waterproof filler materials can be removed from construction joints by flood waters, differential settling of the structure or freeze/thaw action. Waterproof filler materials should be maintained as outlined by the contractors or product suppliers' specifications.

**B. Budget Considerations**

*As dams age maintenance costs will increase. Briefly describe how funding will be allocated for future maintenance costs as well as emergency situations.*

# APPENDIX A Location Map

*Insert Location Map for dam.*

# APPENDIX B As-Built Plans

*Insert As-Built Plans for dam if available.*

APPENDIX C Inspections

*Below are an example of inspection procedures and a dam inspection checklist that can be used to conduct routine dam inspections for most dams in Wisconsin.*

*The Sample Dam Inspection Checklist is very detailed to try and cover all types of dams and appurtenant works. It can be edited to include only those parts relevant to the dam in question. Any style of checklist is appropriate if it covers all the components of the dam, allows for documentation of observations and requires action to be taken on any deficiencies.*

*A checklist for inspections required under ss. 31.19 (2)(ag) can also be found at: http://dnr.wi.gov/topic/Dams/documents/DamInspectionChecklist102011.pdf.*

**Sample Inspection Procedures**

- Work in methodical pattern (all upstream faces end to end, then crest end to end, then all downstream faces end to end, e. g). Use same pattern each time.
- Fill in checklist as you go.
- Survey periodically to determine settlement or movement.
- Photograph apparent deficiencies from several different locations and at a distance as well as close up.
- Measure cracks and holes periodically.
- Measure seepage volumes periodically.
- Operate gates regularly.
- Inspect concrete for new cracks, holes, spalling, etc.
- Inspect earthen sections for holes, slumps, slides, cracks, vegetation.
- Inspect gates, gate chains, cables, stop logs, electrical operation, ice damage.
- Inspect toe and other drains for clogs, flow, etc.
- Inspect signs/fencing.
- Inspect safety equipment.
- Other

APPENDIX C Inspections

**Sample Dam Inspection Checklist**

NAME OF DAM INSPECTION CHECKLIST
DNR FIELD FILE NUMBER

OWNER: _____

OWNER'S REPRESENTATIVE: _____

_____

_____

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DATE: _____

WEATHER/SITE CONDITIONS: _____

INSPECTOR(S): _____

OTHERS: _____

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| CHECK ITEM AS INSEPCTED √ | NOTE CONDITIONS AND OBSERVATIONS | NOTE ACTIONS REQUIRED |
|---|---|---|

___ Benchmark
- Check for disturbance/vandalism
- Condition: _____

___ Headwater Gage
- Condition: _____
- Reading: _____

___ Timber Weir
- Condition: _____
- Action: _____

___ Security Fence and Locked Gate and Gate Valve Locks
- Check for damage/vandalism
- Condition: _____
- Action: _____

___ Walkway and Railing
- Check for broken welds or other damage.
- Condition: _____
- Action: _____

___ Signage
- Condition and Visibility: _____
- Action: _____

___ Gate Valve __ inch
- Exercise Gate (fully open/close – return to desired position), check for smooth operation and seal.
- Condition: _____
- Action: _____

___ Sluice Gate __ inch
- Exercise Gate (fully open/close), check for smooth operation and seal.
- Condition: _____
- Action: _____

APPENDIX C Inspections

| CHECK ITEM AS INSEPCTED √ | NOTE CONDITIONS AND OBSERVATIONS | NOTE ACTIONS REQUIRED |
|---|---|---|

___ Trash Rack
- Check for debris and remove if necessary
- Check for broken connections at anchor chains. Repair as required.
- Condition: _____
- Action: _____

___ Log Booms
- Check for debris accumulation and remove if necessary
- Check for broken welds, severe rust or other deterioration. Repair as required.
- Condition: _____
- Action: _____

___ Concrete Drop Inlet and Headwall
- Check concrete surfaces for cracks and spalls. Note location and crack widths on sketch.
- Concrete deterioration may be patched through maintenance procedures.
- Extreme deterioration should be examined by an engineer.
- Severe cracking or rapid changes require immediate notification to State Dam Safety Engineer.
- Condition: _____
- Action: _____

___ Concrete pipe ___ inch diameter
- Check for blockage and remove if necessary.
- Check for improper alignment.
- Check for cracks, spalling or other deterioration.
- Check pipe for joint deterioration.
- Condition: _____
- Action: _____

___ Upstream Riprap
- Elevation/location/extent of riprap_____
- Condition: _____
- Action: _____

___ Downstream Riprap
- High flow can cause underwater erosion (scour). Check for stream erosion and for scour hole at outlet of pipe. Use probe to check depth of scour hole.
- Condition: _____
- Action: _____

___ Earth Embankment
- Check vegetative cover. The embankment should have a suitable cover of grass with no woody vegetation such as brush, shrubs and trees. Mow regularly to maintain a 6-inch grass stand.
- Check for animal burrows. Remove animals and backfill holes with soil.
- Check for surface erosion on grassed slopes and at riprap flumes which intercept roadway drainage.
- Replace riprap as required and topsoil and re-seed eroded areas as required.
- Check for slumps (slides or sloughs). Slow or sudden movement of earth embankment is an indication of instability and requires immediate response. Contact State Dam Safety Engineer for advice.
- Check for settlement of embankment. Settlement may be uniform or at isolated depressions. Settlement indicates loss of material or compression of material either within the dam

| CHECK ITEM AS INSEPCTED √ | NOTE CONDITIONS AND OBSERVATIONS | NOTE ACTIONS REQUIRED |
|---|---|---|

embankment or the foundation. Settlement should be documented and evaluated by an engineer.

- Check for seepage on the downstream slope. If present, monitor for presence of soil particles. If soil is moving, a piping condition (internal erosion) may exist and requires immediate contact with the State Dam Safety Engineer.
- Condition: _____
- Action: _____

___ Boat Ramp

- Check for ruts, potholes and other damage to gravel surface.
- When boat ramp is maintained/graded the crest should not be lowered. The crest should be preferably maintained at elevation _____ and at a minimum of _____ to prevent overtopping. Elevations should be checked during the engineering inspections.
- Condition: _____
- Action: _____

___ Emergency Spillway

- Check for evidence of flow through emergency spillway, note location of highwater marks at crest, inlet of culverts and outlets of culverts.
- Check for displaced riprap and erosion.
- Check for woody vegetation such as brush, shrubs and trees within riprap or at edges of riprap. Remove as required.
- Check for animal burrows. Remove animals and backfill holes with soil.
- Check condition of ___ inch corrugated metal culvert pipes.
- Check for ruts, potholes and other damage to gravel surface of road over culverts.
- Condition: _____
- Action: _____

# APPENDIX D Operations

*The forms found in Appendix D and E are examples of operation and maintenance logs. Any style of log is appropriate if it covers all the needed observations or maintenance activity, allows for documentation of observations and requires action to be taken on any deficiencies.*

Daily/Weekly Operations Observations Log _____ Dam

| Date | Time | Inspector | Water Level | Gate Operation | Precipitation | Observations |
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| Monthly Equipment Observations Log _____ Dam | | | | |
|---|---|---|---|---|
| Date | Time | Inspector | Equipment | Comments |
| Mower | | | | |
| Truck | | | | |
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| Maintenance Log _____ Dam | | | | |
|---|---|---|---|---|
| Activity | Date | Person | Action Taken | Comments |
| Mowing | | | | |
| Floating Debris Removal | | | | |
| Trees/Woody Vegetation Removal | | | | |
| Rodent Removal/Hole Repair | | | | |
| Gate Stem Lubrication | | | | |
| Motor Lubrication | | | | |
| Cable/Chain Repair | | | | |
| Concrete Patching | | | | |
| Rip Rap Replacement | | | | |
| Painting | | | | |
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