

A photograph of a dam spillway. The spillway is a wide, sloping concrete structure with visible erosion and cracks. A corrugated metal culvert pipe is visible on the left side, discharging water into a stream. The background shows a wooded area with bare trees, suggesting a late autumn or winter setting. The text is overlaid in yellow on the image.

Inspection, Operation and Maintenance Plans

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Presentation will cover:

- What is an Inspection, Operation and Maintenance Plan (IOM)?
- Why are IOMs required?
- How to write an IOM.
- The approval process.
- IOM upkeep.

What is an Inspection, Operation and Maintenance Plan (IOM)?



An IOM is a document describing:

- Who is responsible for the dam;
- A dam's components ;
- When a dam is to be inspected;
- How a dam is to be inspected;
- How the dam is to be operated; and
- How the various components are to be maintained.

An IOM includes documentation of operation and maintenance activities.

Why is an IOM required for a dam?



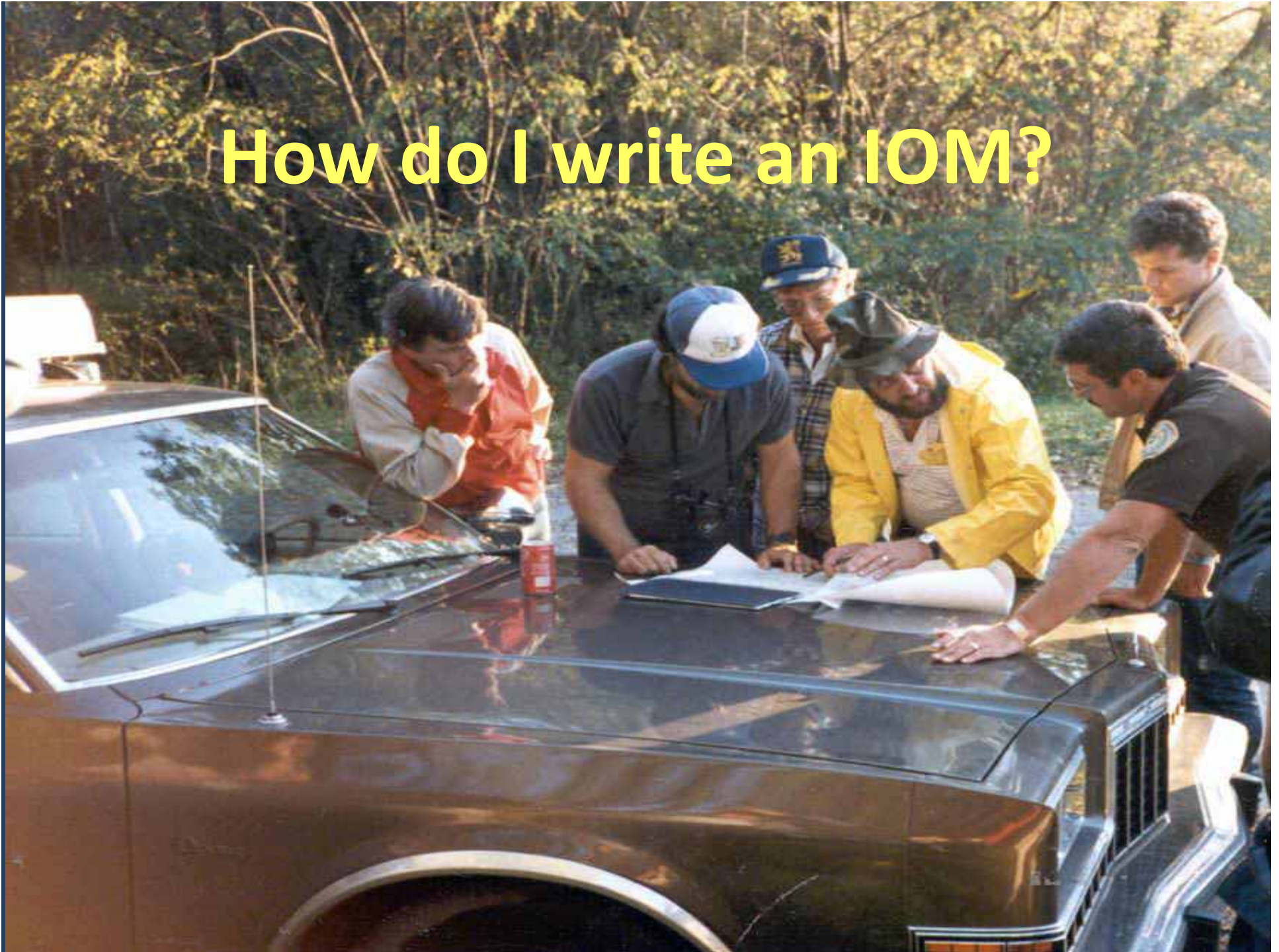
Under Chapter NR 333, Wisconsin Administrative Code, *Dam Design and Construction*, owners of large dams are required to develop an Inspection, Operation and Maintenance Plan for each dam they own.

An IOM is recommended for all dams.

An IOM can assist in:

- Maintaining structural integrity;
- Maintaining operational status;
- Protecting upstream/downstream lives and property;
- Protecting dam owner's investment; and
- Reducing liability.

How do I write an IOM?



Ch. NR 333.07(3)(a), Wisconsin Administrative Code does not specify what must be in an IOM.

Each IOM should be tailored to:

- Site specific conditions; and
- Requirements of the dam owner/operator.

More complex organizational structures will require additional language and customization.

An IOM plan is essentially:

- A description of the dam;
- A description of key personnel and their responsibilities;
- A list of routine and detailed inspections;
- A description of how the dam is operated; and
- A description of routine maintenance.

To assist owners in writing an IOM for their dam, DNR Dam Safety has produced a guidebook and a template IOM.

A GUIDE TO WRITING INSPECTION, OPERATION AND MAINTENANCE PLANS

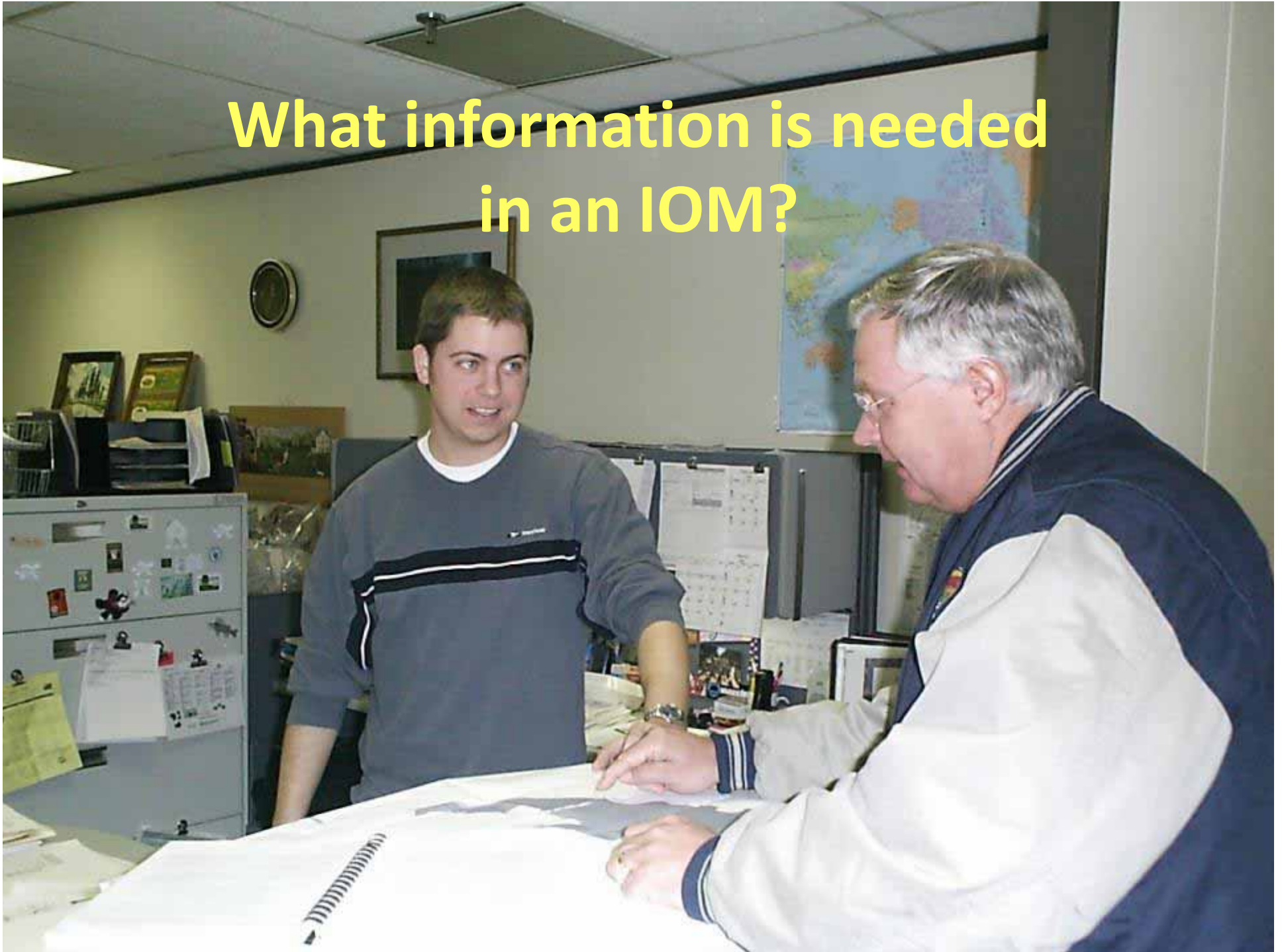


Prepared by the Wisconsin Department of
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Dam Safety/Floodplain Management



**What information is needed
in an IOM?**



IOMs consist of five sections:

1. General responsibilities

- Dam description
- Key personnel and responsibilities

2. Inspections

- Routine
- Detailed

3. Operations

- Equipment
- Coordination of flows

4. Maintenance

- Routine
- Maintenance vs repair

5. Record Keeping

General Responsibilities

Dam Description should include information such as:

- Location map/contact information;
- Type of dam/gates; and
- Hazard rating/surrounding land use.

Information on dams including hazard ratings, height, field files numbers, key sequence numbers can be obtained from the Department Dam Safety database at:
<http://dnr.wi.gov/topic/Dams/damSearch.html>.

General Responsibilities

Key personnel and responsibilities should include:

- All owners'/operators' names and contact information;
- Name/contact information of professional engineer used for detailed inspections; and
- Brief description of responsibilities during operation at normal, high and low flows, routine/preventative maintenance and routine/detailed inspections.

For many dams, the owner may be the only personnel.

Inspections

- Inspections are a necessary part of owning and operating a dam since early detection of gradual changes can minimize problems and reduce maintenance costs.
- Routine inspections provide a way to monitor a dam's performance and are an opportunity to note any vandalism which may have occurred.
- Detailed inspections provide an opportunity to have the dam be closely reviewed by a licensed professional engineer.

Inspections

Inspections section should include:

- List inspections and schedule;
- Who is responsible for inspections;
- Where needed documentation maintained;
- List of required equipment; and
- Description of inspection process.

Detailed inspections must be conducted by a professional engineer licensed in Wisconsin.

Inspections

Examples

Routine

- Daily/Weekly
 - River flow observations
 - Precipitation records
 - Water level readings
 - Gate operation
 - Seepage monitoring (if present)
- Monthly
 - Operating/safety equipment
 - Performance and superficial structure
- Annual or after a flooding event
 - Structural
 - Operating/safety equipment

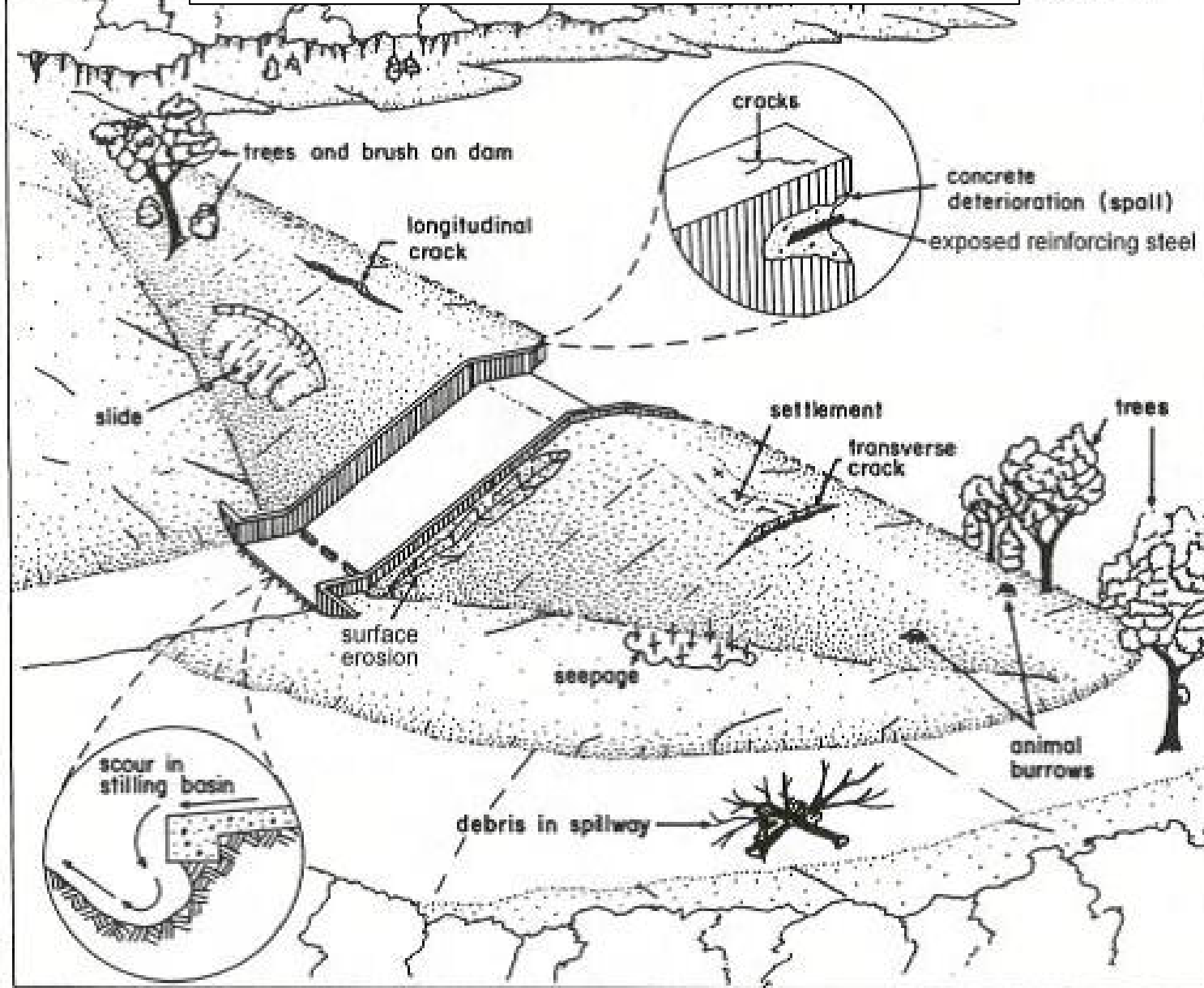
Detailed

- DNR required inspections [Ch. 31.19 (2)(ag) large dams]
- After emergencies as per the Emergency Action Plan

Detailed inspections must be conducted by a professional engineer licensed in Wisconsin.

Dam inspection schedules can be found in the Dam Safety Database at: <http://dnr.wi.gov/topic/Dams/damSearch.html>

Typical Deficiencies



Examples of Inspections Forms

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
-

Sample Dam Inspection Checklist

NAME OF DAM INSPECTION CHECKLIST
DNR FIELD FILE NUMBER

OWNER: _____

OWNER'S REPRESENTATIVE: _____

DATE: _____

WEATHER/SITE CONDITIONS: _____

INSPECTOR(S): _____

OTHERS: _____

CHECK ITEM AS INSEPECTED <input checked="" type="checkbox"/>	NOTE CONDITIONS AND OBSERVATIONS	NOTE ACTIONS REQUIRED
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___ 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: _____

EMBANKMENTS

Description:		Action		
		M	I	R
Item	N	P	Location on Embankment and Deficiency	
1 Vegetation:		No problem		
A. Trees Quantity (<5, sparse, dense): Diameter: Location:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Brush Quantity (sparse, dense): Location:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Ground cover Type (grass, crown vetch, other): Quantity (bare, sparse, adequate, dense): Appearance (too tall, too short, good):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Erosion		No problem	Not applicable	Could not inspect
A. Wave erosion (Beaching): Scarp: Length/ Width: Location:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Runoff Erosion (Gullies) Quantity: Length/ Width/ Depth: Location:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Instabilities		No problem	Not applicable	Could not inspect
A. Slides Transverse: Longitudinal: Scarp: Length/ Width: Crack Length/ Width:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Cracks: Transverse: Longitudinal: Length/ Width/ Depth: Location: Other:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Bulges/ Depressions Size: Height/ Depth:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Slope (Too Steep) U/S, D/S	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
N= Noted; P= Photo; M= Monitor I= Investigate; R= Repair F.F.= Field File; RT = Right; LT = Left U/S = Upstream; D/S = Downstream		Action Suggestion	1. Requires immediate action 2. Plan to do soon 3. Do when convenient	
Additional Comments:				

Be Safe! Even the most experienced dam engineer can get injured!



Operations

- 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.
- A dam operator is responsible for ensuring the dam is operated correctly during normal, high and low flows as well as during an emergency.
- Each dam has different components and is operated in a way specific to its design and location. Because each IOM is tailored to a dam's specific conditions and the requirements of the owner, agency or organization that operates the dam, the text used in this section may be brief.

Operations

Operations section should include:

- List activities involved in operating dam;
- Who is responsible for operating dam;
- Required pool levels (if applicable);
- Required flow rates; and
- Coordination of flows (if applicable).

If any equipment or system has an operation and maintenance manual, a copy of the manual including any diagrams should be included as an appendix to the IOM.

Examples of Operations Forms

Monthly Equipment Observations Log _____ Dam

Date	Time	Inspector	Equipment	Comments
Mower				
Truck				

Maintenance

- Maintenance should be performed regularly. Routine, annual, and post storm inspection results will dictate how often and to what degree maintenance is required.
- 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.
- All proposed repairs must be presented to the regional DNR water regulation engineer for a determination if any formal approval is required.

Maintenance

Maintenance section should include:

- List appropriate maintenance activities;
- Schedule for maintenance and item replacement;
- Who is responsible for maintenance; and
- Description of funding for future maintenance costs and emergency situations.

Since dams hold back water under pressure, repairs often need to be done differently than at other types of structures.

When repairs are proposed, a dam owner should seek advice from engineering consultants and contractors familiar with dam design and construction.

Maintenance

Typical maintenance tasks can include:

- mowing embankments;
- controlling livestock damage;
- controlling burrowing animal damage;
- removal of trees and woody vegetation;
- removal of floating debris from outlet works;
- clearing toe drains;
- painting and greasing of metal components;
- grouting or sealing concrete joints and cracks;
- repair and replacement of safety signs and barriers;
- controlling upstream slope erosion; and
- replacing gate seals.

Examples of Maintenance Forms

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				

Record Keeping

Record Keeping section should include:

- List of records to be kept;
- Location of records; and
- Record of updates and approvals.

It is suggested that the IOM be kept in a 3-ring binder so that additions to the document can be done easily.

Record Keeping

- The operation of a dam should include keeping accurate records of any observations, maintenance, gate operations, rainfall, pool levels, drawdowns or inspections. The records may include reports, photos or forms.
- A dam operator should annually update all forms.
- Maintenance of records is important to document historic operation of the dam and provide the background data for future inspections or proposed modifications.

IOM Approval

- Draft IOMs must be sent to the appropriate DNR Water Management Engineer (WME) for review and approval.
- Contact information for WMEs by county can be found at: *<http://dnr.wi.gov/topic/dams/regionalContacts.html>*.
- IOM should be updated to reflect changes in a dam's structure, operation or ownership.



QUESTIONS?