Indiana Dam Safety Laws & Regulations

The Indiana Department of Natural Resource (IDNR) currently regulates over 1,000 dams throughout the State.

49 of the 50 States currently regulate dams (Alabama currently has no dam safety legislation or formal dam safety program).

Regulations vary from State to State.
Indiana Dam Safety Laws & Regulations

Dams meeting ANY ONE of the following criteria are regulated by the IDNR:

- The Drainage Area above the Dam is greater than one (1) square mile;
- The dam embankment is greater than 20-feet high; or
- The dam impounds more than 100 acre-feet of water.
IC 14-27-7.5-16
Request to have structure declared high hazard; notice

Sec. 16. (a) A property owner, the owner’s representative, or an individual who resides downstream from a structure:

(1) over which the department does not have jurisdiction under this chapter; and

(2) that the property owner, the owner’s representative, or the individual believes would cause a loss of life or damage to the person’s home, industrial or commercial building, public utility, major highway, or railroad if the structure fails; may request in writing that the department declare the structure a high hazard structure.

(b) If the department receives a request under subsection (a), the department shall:

(1) investigate the structure and the area downstream from the structure;

(2) notify the owner of the structure that the structure is being investigated;

(3) review written statements and technical documentation from any interested party; and

(4) after considering the available information, determine whether or not the structure is a high hazard structure.

(c) The department shall issue a written notice of the department's determination under subsection (b) to:

(1) the individual who requested the determination; and

(2) the owner of the structure that is the subject of the request.

(d) Either:

(1) the individual who requested a determination; or

(2) the owner of the structure that is the subject of the request;

may request an administrative review under IC 4-21.5-3-6 within thirty (30) days after receipt of the written determination.

(e) If the department determines that a structure is a high hazard structure under subsection (b), the provisions of this chapter concerning high hazard structures apply to the structure.
Dam Hazard Classification System

- **Per Indiana Law**, hazard classification refers to a rating assigned to a structure by the IDNR, based on the best *available* information, regarding potential consequences resulting from the uncontrolled release of its contents due to a failure or wrongful operation of the structure.
  - (hazard classification is not a reflection of the condition of the structure)
- Indiana follows national professional practice of using three (3) hazard classifications
  - High
  - Significant
  - Low
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 roads.
**Significant Hazard**

A structure the failure of which may damage isolated homes, and highways, or cause the temporary interruption of public services.
Low Hazard
A structure the failure of which may damage farm buildings, agricultural land, or local roads.
Indiana Dam Hazard Classification Breakdowns

24% High Hazard
28% Significant Hazard
48% Low Hazard
Koontz Lake Dam
Koontz Lake Dam

LFA selected in 2007 to design repair for lake level control structure at a small dam.

Estimated Budget for planning, design, and construction - $350,000

LFA asked to attend Dam Safety inspection that was to be conducted by the IDNR
Koontz Lake Dam

Constructed in 1849 by Samuel Koontz

High Hazard Classification

Drainage Area = 6.27 mi² (4,014 Acres)

Lake at Normal Pool = 330 Acres

S.R. 23 Runs along the crest of the dam
Anatomy of a Dam Failure
The most common causes of dam failures:

- **Overtopping**: Water spilling over the top of the dam can cause failure.
- **Structural Failures**: Caused by instability of materials used in dam construction.
- **Seepage Path**: Water moves through the dam and can cause failure.
- **Cracking**: Caused by movement in the dam, such as due to natural settling.
- **Percolation**: Caused by seepage of water from the dam, which may lead to internal erosion or foundation failure.
- **Breach**: A relatively small failure that has the dam in place, may collapse.
- **Erosion**: Loss of material from the dam, which may lead to failure.
What do we do now?

Conduct a Field Survey to gather topographic information

Conduct a hydrologic/hydraulic (h/h) analysis of the existing spillway system

Perform a geotechnical (soils) investigation and analysis

Perform an alternative analysis to determine design approach
Geotechnical Analysis
Hydrologic / Hydraulic Analysis

What is the inflow (cubic feet per second) coming into the Lake?

Does the existing spillway system have the capability to safely pass the design inflow ($I = O + S$)

What are the discharge characteristics of the existing spillway

If the spillway is inadequate – what do we need to do.
### Hydraulics – Stage-Discharge

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head Loss</td>
<td>1.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Discharge</td>
<td>3.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Headway</td>
<td>5.6</td>
<td>6.7</td>
</tr>
<tr>
<td>Froude</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Eddy</td>
<td>2.3</td>
<td>1.4</td>
</tr>
<tr>
<td>Roughness</td>
<td>0.6</td>
<td>0.7</td>
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<tr>
<td>Depth</td>
<td>1.2</td>
<td>1.3</td>
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<tr>
<td>Width</td>
<td>3.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Slope</td>
<td>0.8</td>
<td>0.9</td>
</tr>
</tbody>
</table>

### Equations
- **Velocity Equation:** \( v = C_d \sqrt{2gh} \)
- **Discharge Equation:** \( Q = C_d A \sqrt{2gh} \)

### Table

<table>
<thead>
<tr>
<th>Stage (ft)</th>
<th>Discharge (cfs)</th>
<th>Depth (ft)</th>
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<tbody>
<tr>
<td>1.0</td>
<td>10.0</td>
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<tr>
<td>2.0</td>
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<td>3.0</td>
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<td>4.0</td>
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<td>6.0</td>
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<td>40.0</td>
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<tr>
<td>8.0</td>
<td>45.0</td>
<td>10.0</td>
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</table>
**Model Results**

### SUMMARY OF HYDROLOGIC PARAMETERS

<table>
<thead>
<tr>
<th>BASIN</th>
<th>Area (sq. mi)</th>
<th>$T_i$ (hr)</th>
<th>SCS Lag (hr)</th>
<th>Calibrated RCN</th>
<th>Percent Importation</th>
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</thead>
<tbody>
<tr>
<td>North</td>
<td>5.293</td>
<td>2.047</td>
<td>1.50</td>
<td>66.7</td>
<td>55</td>
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<tr>
<td>Lake</td>
<td>0.96</td>
<td>0</td>
<td>0</td>
<td>98</td>
<td>98</td>
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<tr>
<td>South</td>
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<td>2.047</td>
<td>1.72</td>
<td>60.2</td>
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</table>

### SUMMARY OF RESULTS

<table>
<thead>
<tr>
<th>Duration</th>
<th>Frequency</th>
<th>Rainfall (in)</th>
<th>Runoff Distribution</th>
<th>Peak Stage (ft)</th>
<th>Outflow (cfs)</th>
<th>Inflow (cfs)</th>
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<tbody>
<tr>
<td>12 hr</td>
<td>All Season POP for 10 Square Miles</td>
<td>28.80</td>
<td>SCS Type II</td>
<td>722.41</td>
<td>6977</td>
<td>17169</td>
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<td>12 hr</td>
<td>100 Year</td>
<td>4.95</td>
<td>SCS Type II</td>
<td>715.33</td>
<td>114</td>
<td>2890</td>
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</table>

LFA
Larson Fisher Associates P.C.
Model Results
Alternative Analysis

How do we increase our spillway capacity
(I = O + S)

Address our geotechnical issues

State Highway

Environmental aspects
Labyrinth Weir
PARTNERING TEAM

- INDOT – Owner
- IDNR – Owner
- Lawson-Fisher Associates P.C. – Engineer
- Northern Indiana Construction Co., Inc. – Contractor
- Various Subcontractors & Suppliers
- Utility Companies
- Starke County
PLANNING – Design & Construction

- INDOT Criteria - Road/bridge
- IDNR Criteria - Dam/labyrinth
- Construction Inspection
  - IDNR (1 On-site Inspector)
  - INDOT (2 On-site Inspectors)
- Application for Payment Coordination
- Memorandum of Understanding Between IDNR/INDOT