Fish Barrier at Don Williams Lake

Don Williams Recreational Area

Ogden, IA

Corn Belt Engineering

Our Team

Brian Cummings, Project Manager

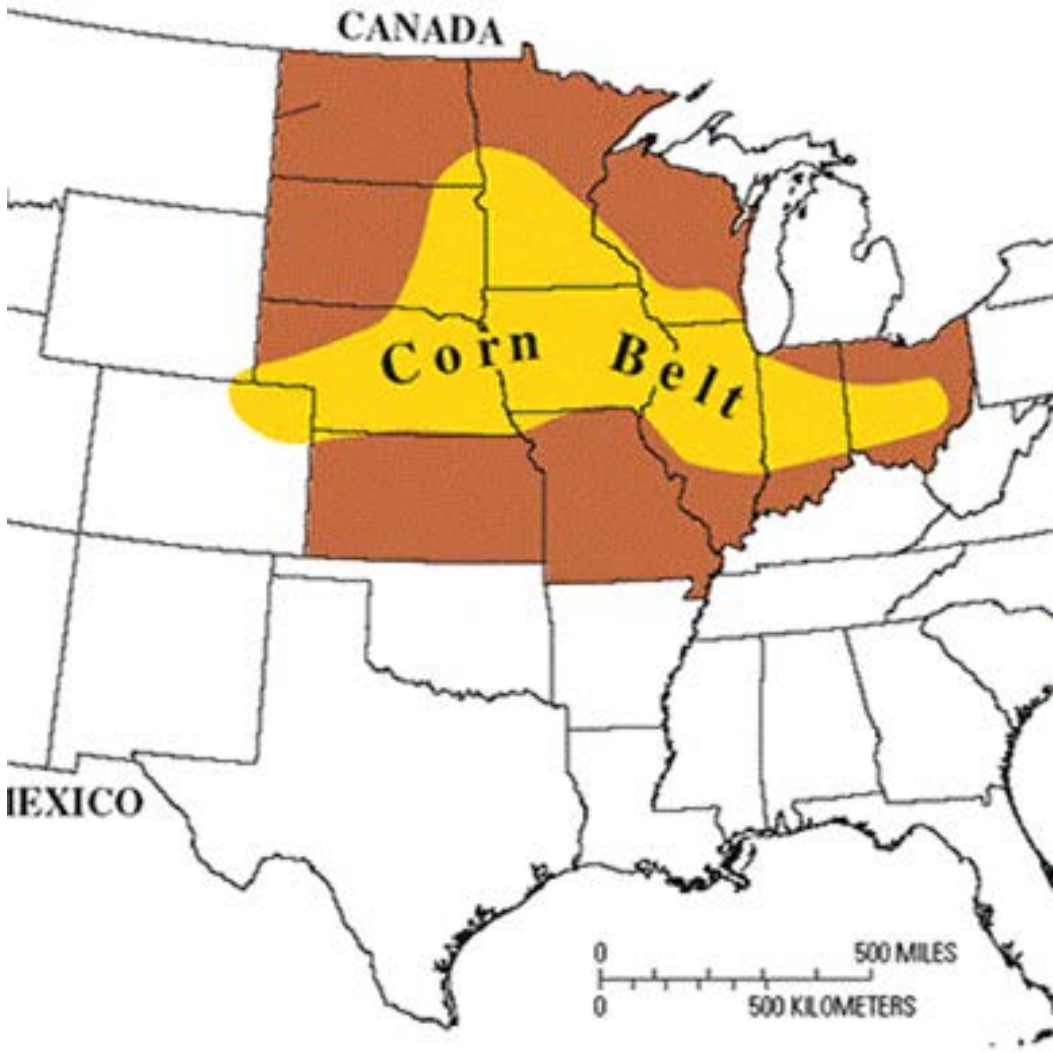
Primary Barrier and Walkway Design, Structural Analysis

Trent Wilson

Horizontal Member Fasteners and Lower Barrier Design

David Millmeyer

Watershed Hydrology, AutoCAD



Fish Barrier Project at Don Williams Lake Spillway

Issues at Don Williams Lake

Alternative Solutions and Selection of Alternative

Final Barrier and Walkway Design

Social Impact

Questions

Issues at the Don Williams Lake

5,217 Fish Stocked in 2017

2,609 Estimated Lost Over Spillway

$4,170 Lost to Fish Migration in 2017

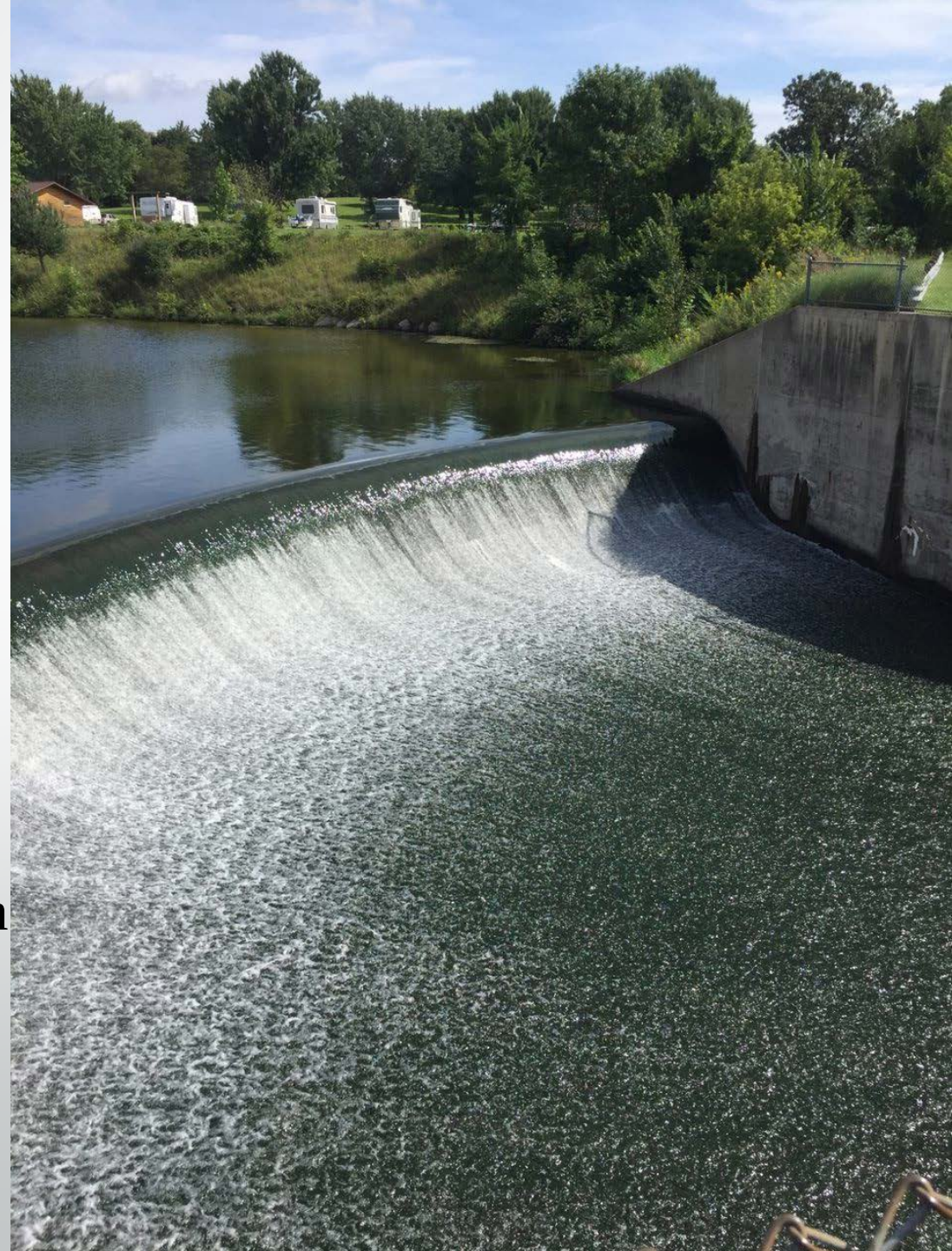
Constraints and Challenges

Function During Design Flood Event

Retain Smaller-Sized Fish

Narrow Crest

Water Must Be Drawn Down for Construction



Alternative Solutions

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1. Fence-Type Barrier with Lower Spillway Barrier

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2. Rotating Drum Screens

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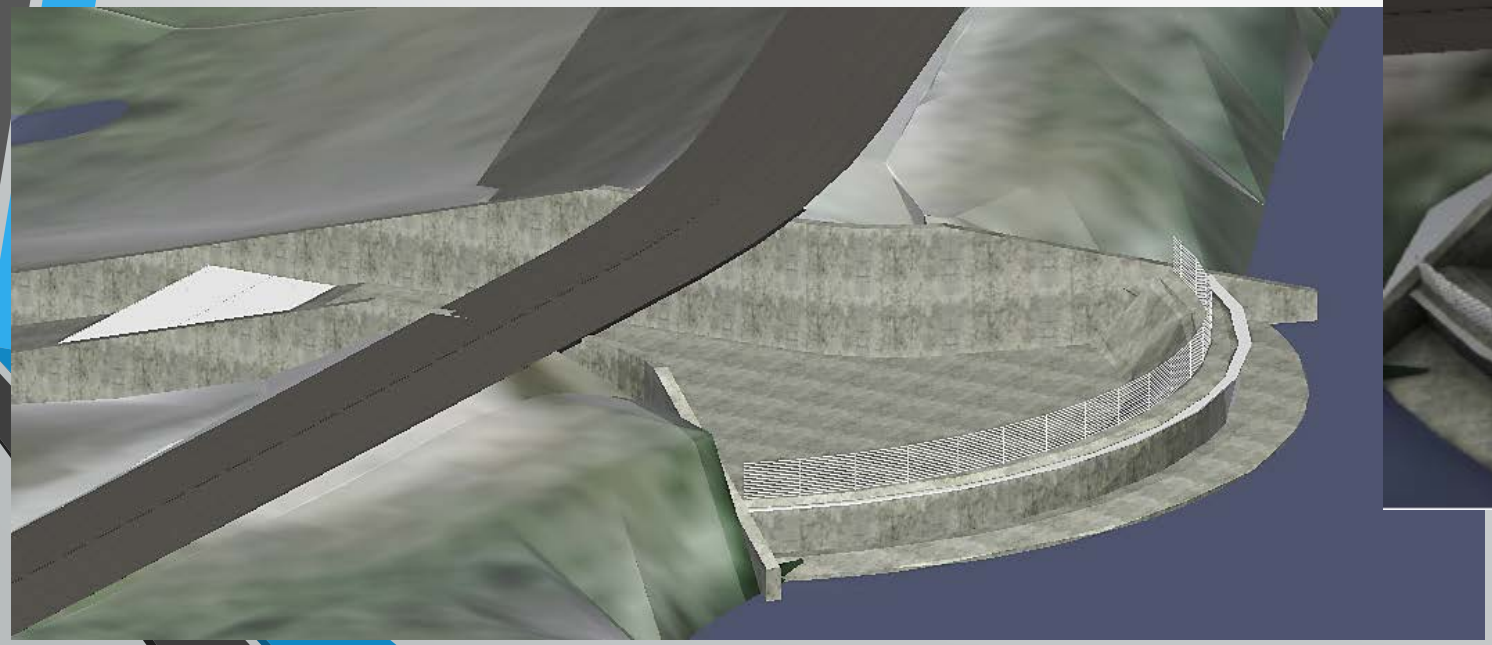
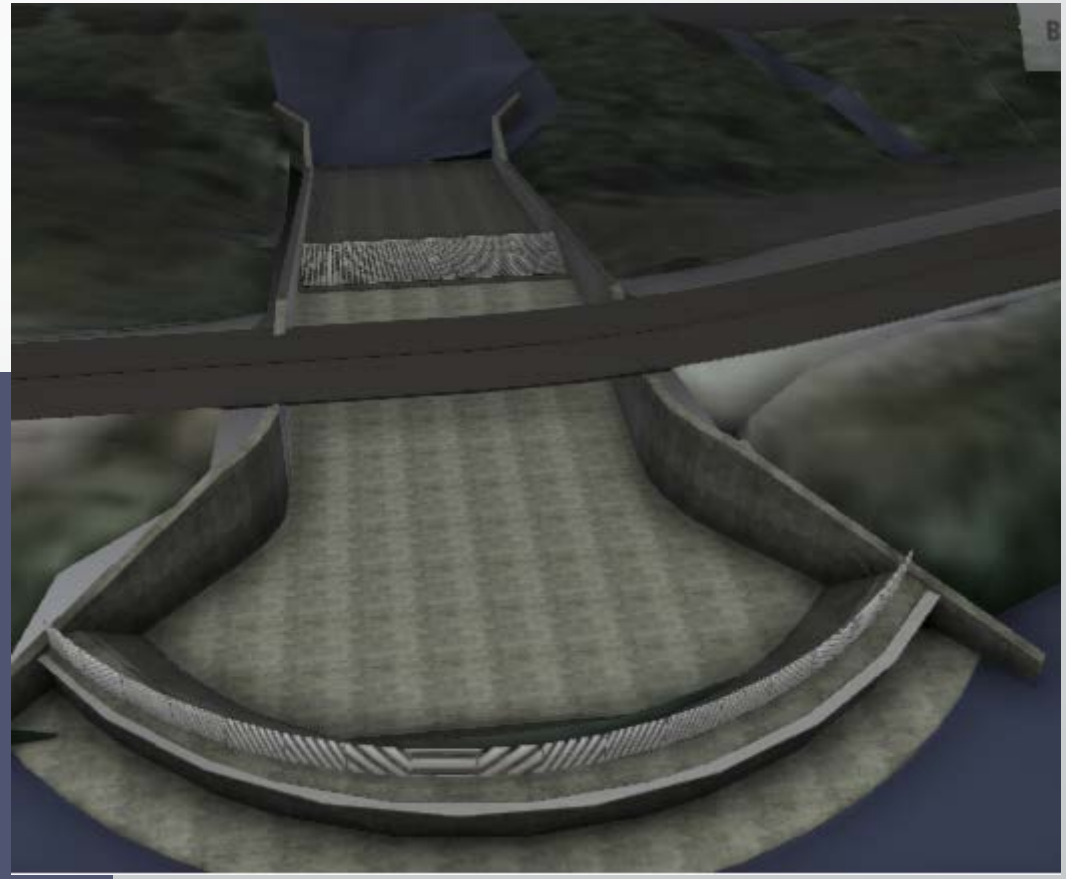
3. Electric Strip Barrier

Design of Fence-Type Barrier with Lower Spillway Barrier and Security Fence

Hydraulic Analysis

Structural Analysis





Flood Elevation for 100-Year Event

Hydraulic Analysis

Assumptions:

Total Blockage at 100-Year Event

Size Upright Members to Withstand Design Event with Total Blockage For an 8' fence Section

Size Horizontal Members to Fail Under Moderate Blockage

Flowrate =	$Q := 6700 \frac{ft^3}{s}$
Length of Spillway =	$L := 125.5\ ft$
Height of water =	$y := 5.45\ ft$
Area of fence =	$A_f := y \cdot 8\ ft$
Area of spillway =	$A_s := L \cdot y = 683.975\ ft^2$
velocity of water =	$v := \frac{Q}{A_s} = 9.796 \frac{ft}{s}$
specific weight water	$\gamma_w := 62.43 \frac{lbf}{ft^3}$

$$Vy := \frac{\left(\frac{Q}{L \cdot y}\right)^2}{2} = 47.978 \frac{ft^2}{s^2}$$

Force of water on fence

$$F_{x\_water} := \frac{\gamma_w \cdot Vy \cdot A_f}{g} = 4.059\ kip$$

Primary Walkway and Barrier Design

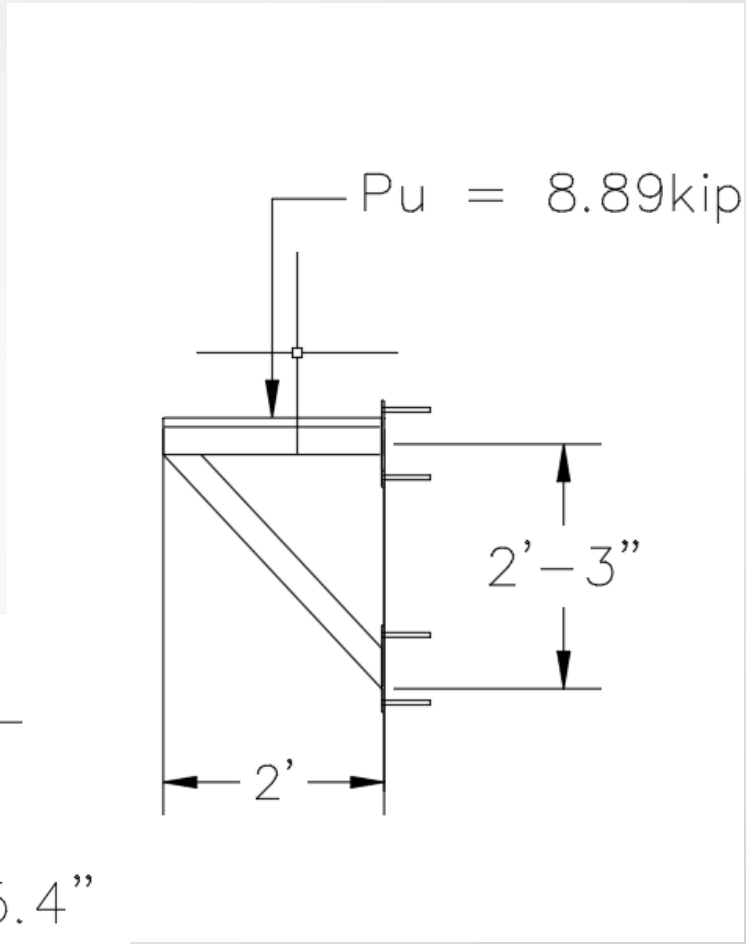
Structural Analysis

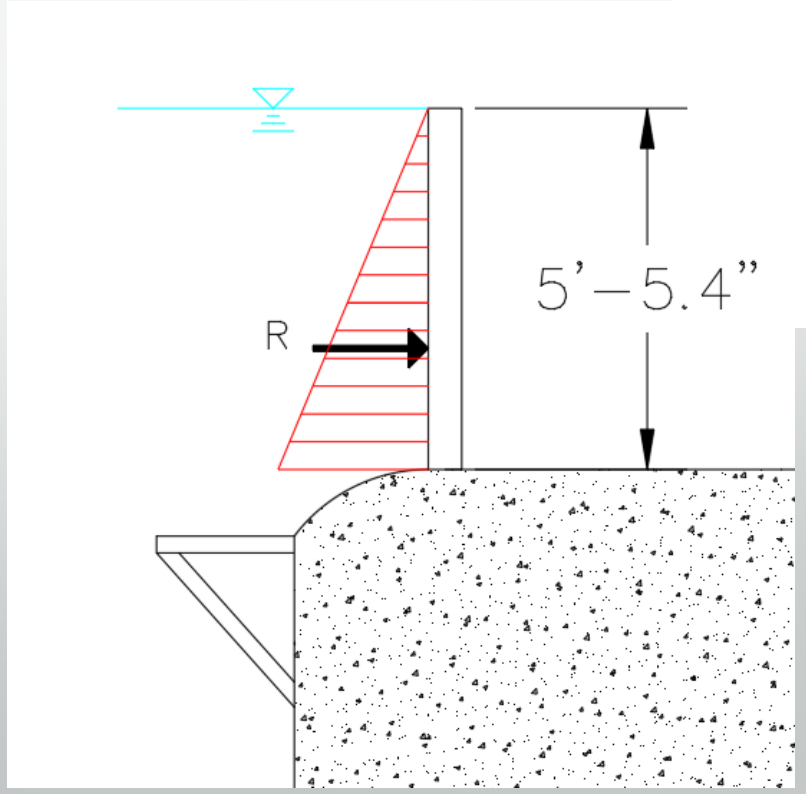
Load and Resistance Factor Design (LRFD)

Steel Walkway Structural Analysis

Analysis of Steel Fish Barrier Posts During 100-Year Storm Event

Design Standards/References
AISC Steel Construction Manual



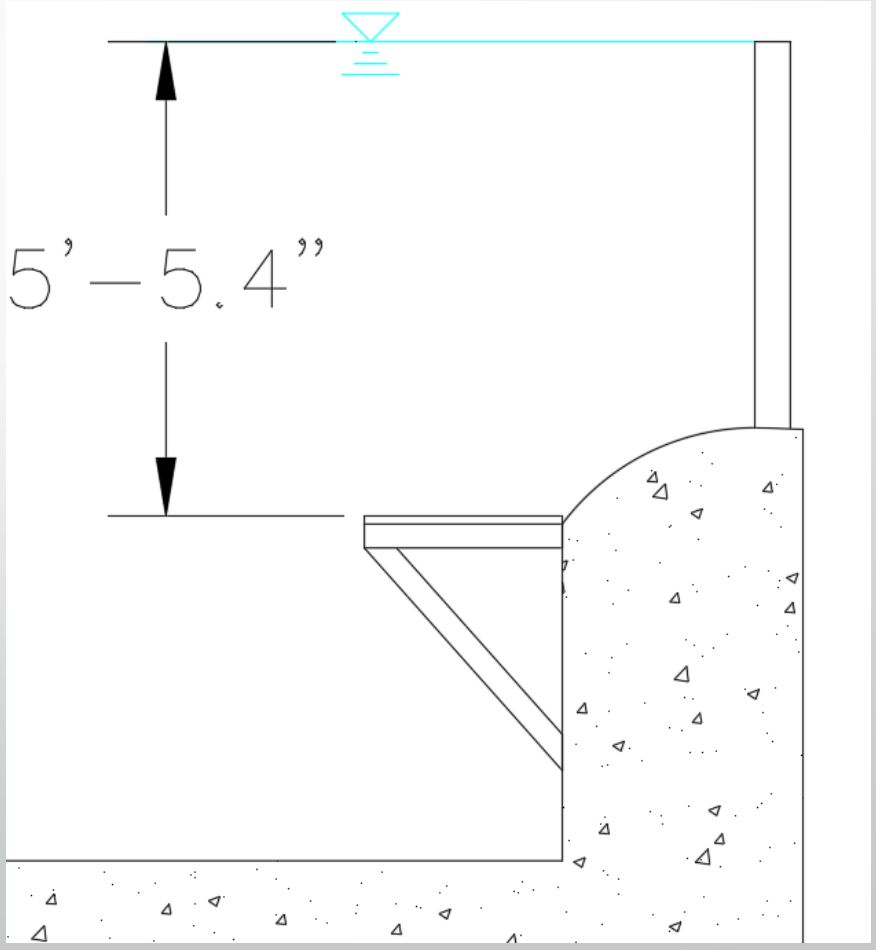


Structural Analysis for the Walkway

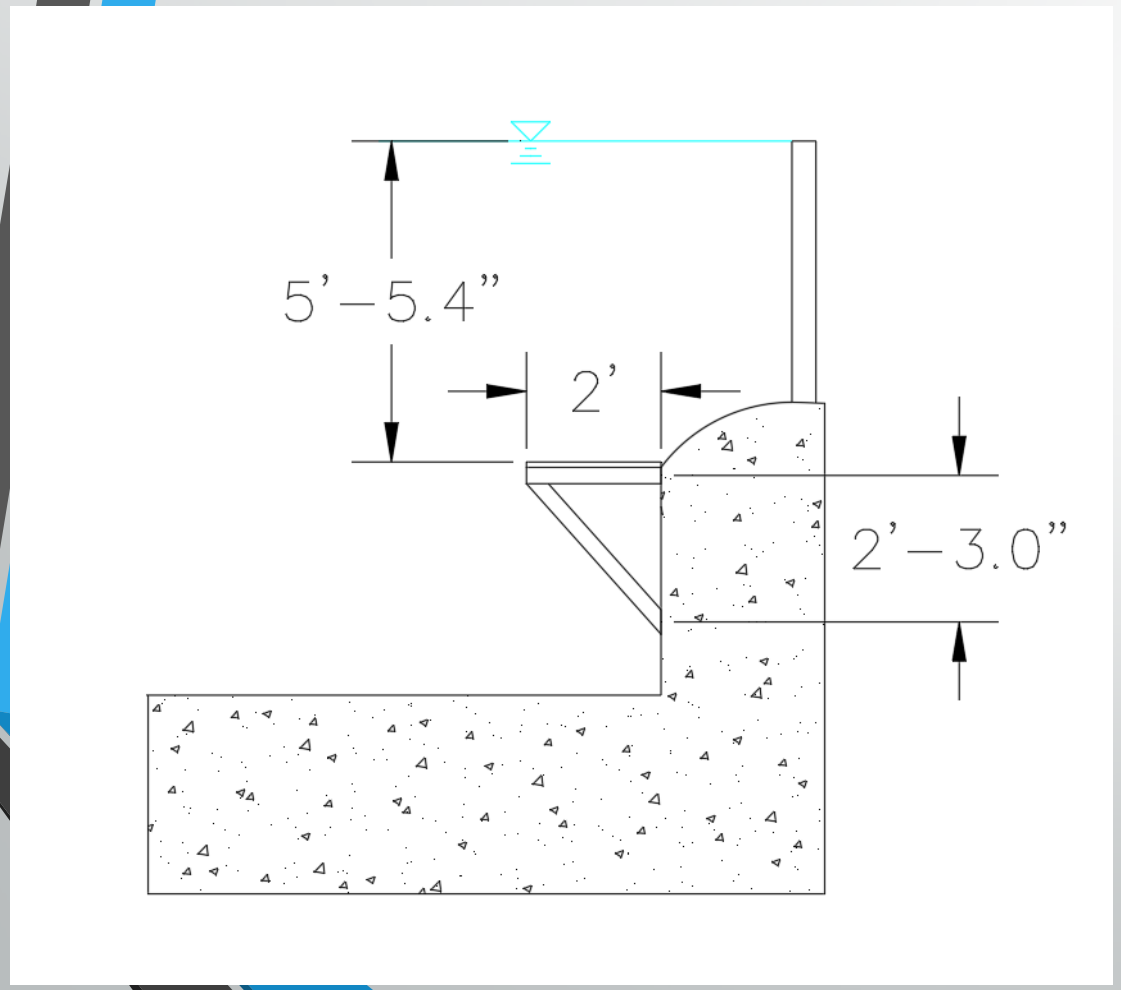
Two Load Cases

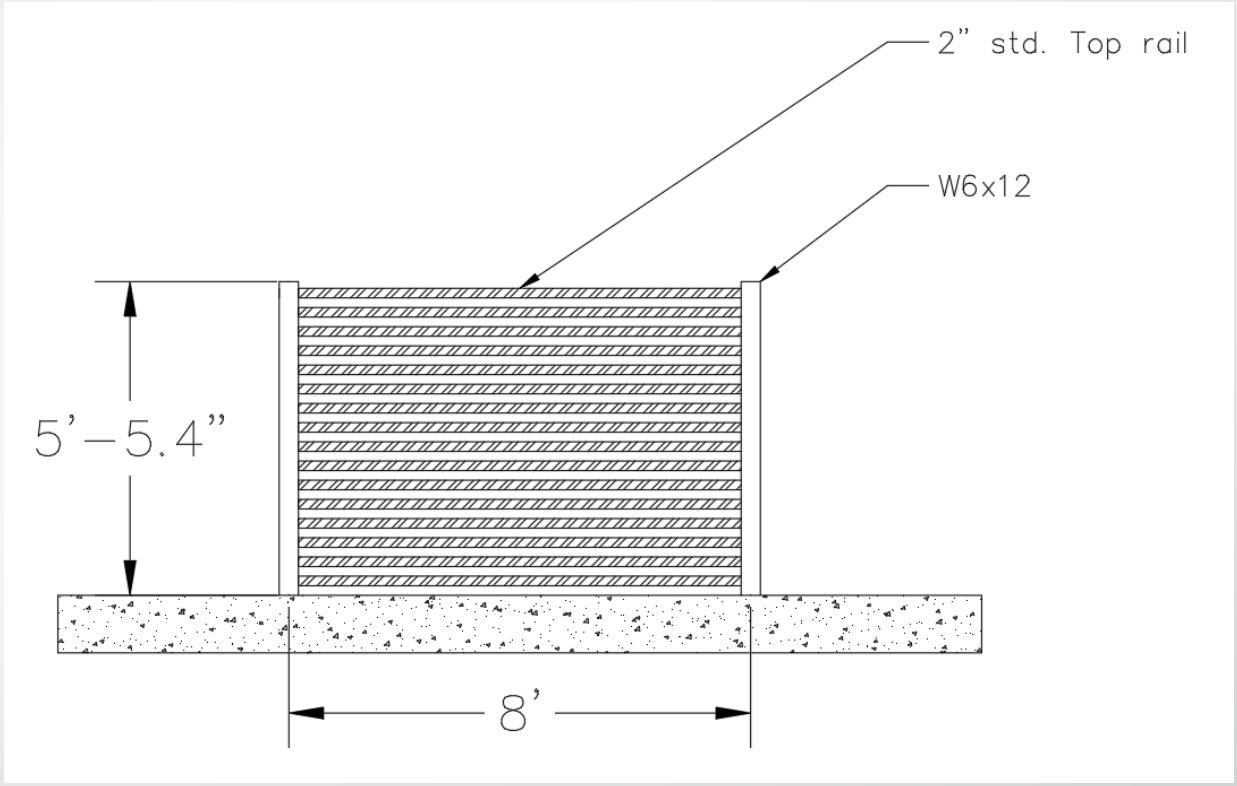
1. Weight of structure plus weight of 4 workers or debris on the walkway when the flow over the spill way is minimal

2. Weight of structure and water at 100-yr flood elevation



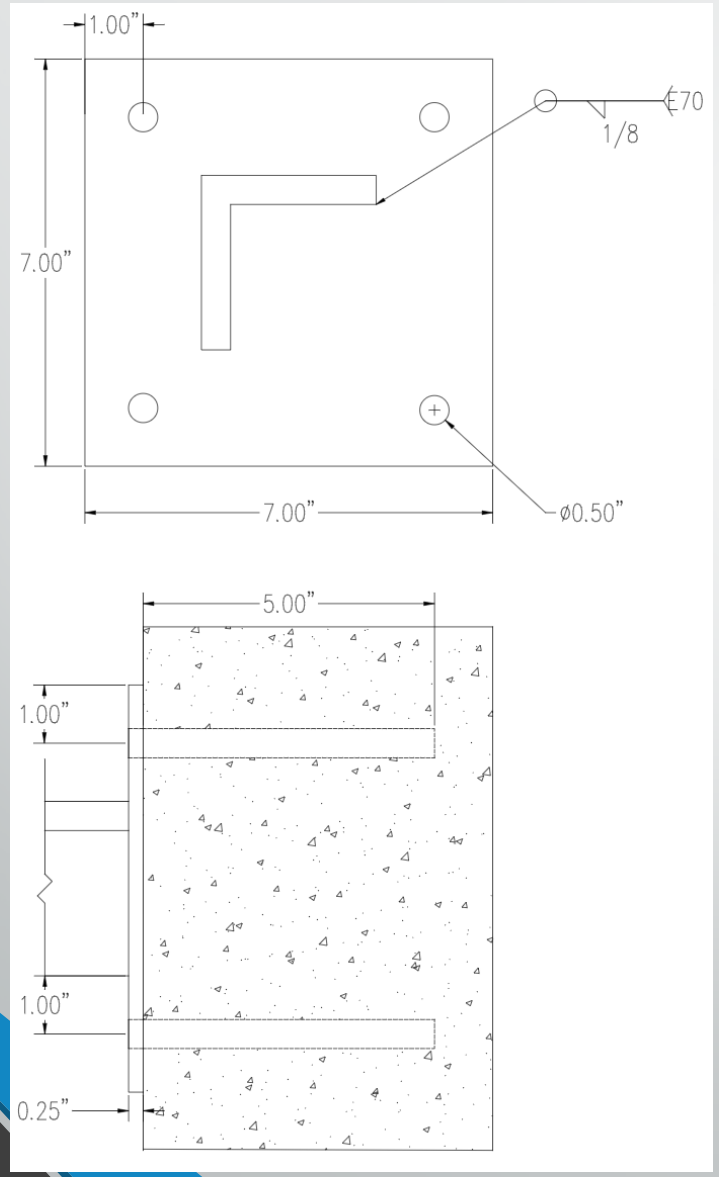
Primary Barrier and Walkway Design



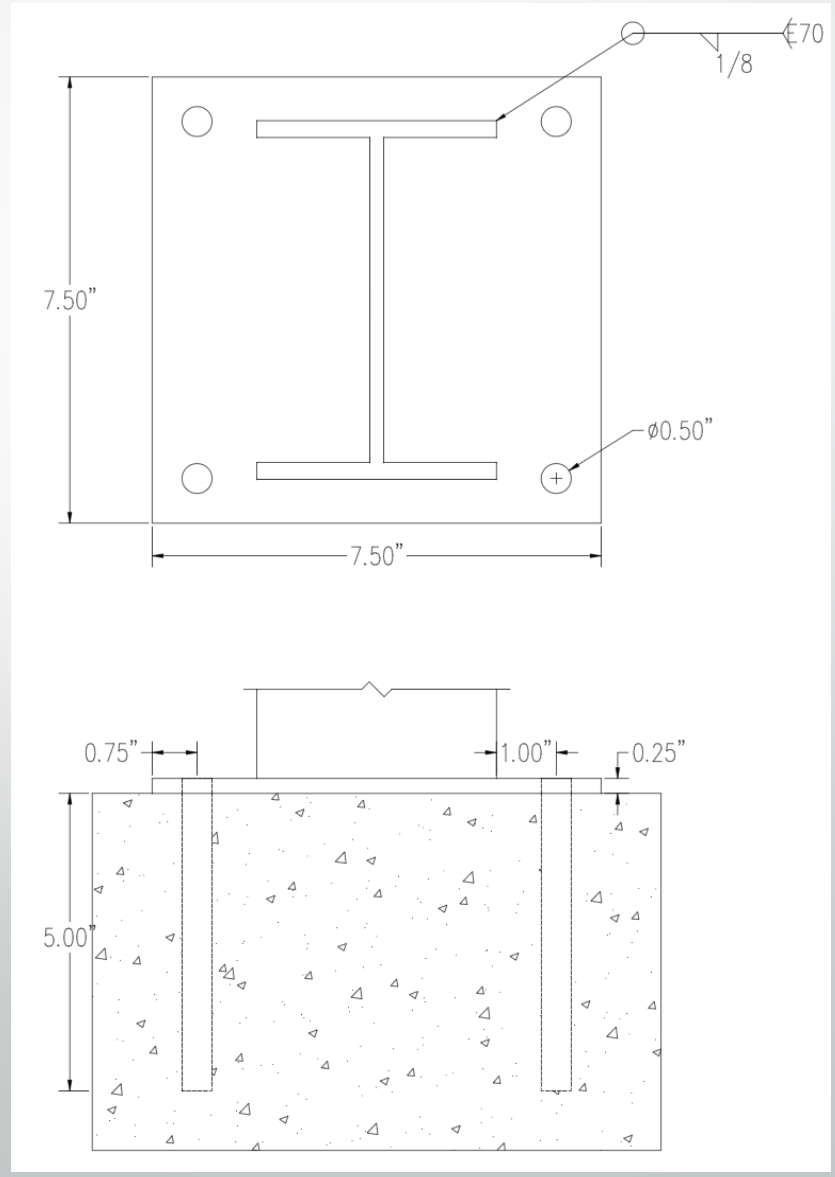


Design of Baseplates and Connections

Walkway Baseplate



Barrier Baseplate



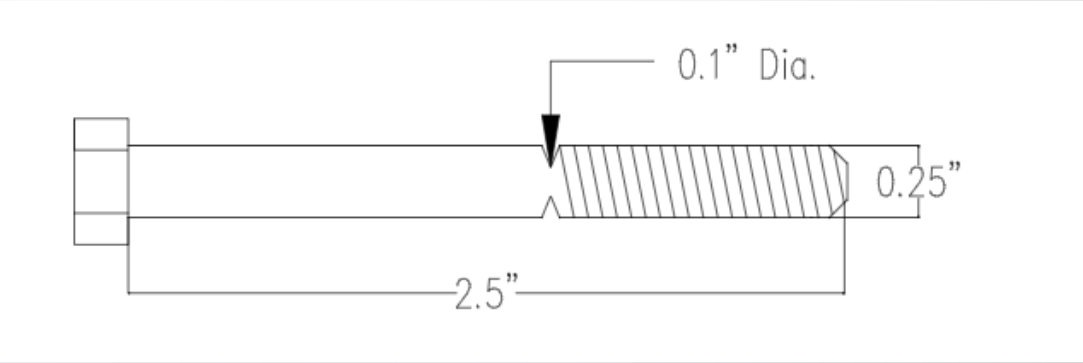
"Shear" Pin Fastener

4.059 kips Total Blockage of Barrier

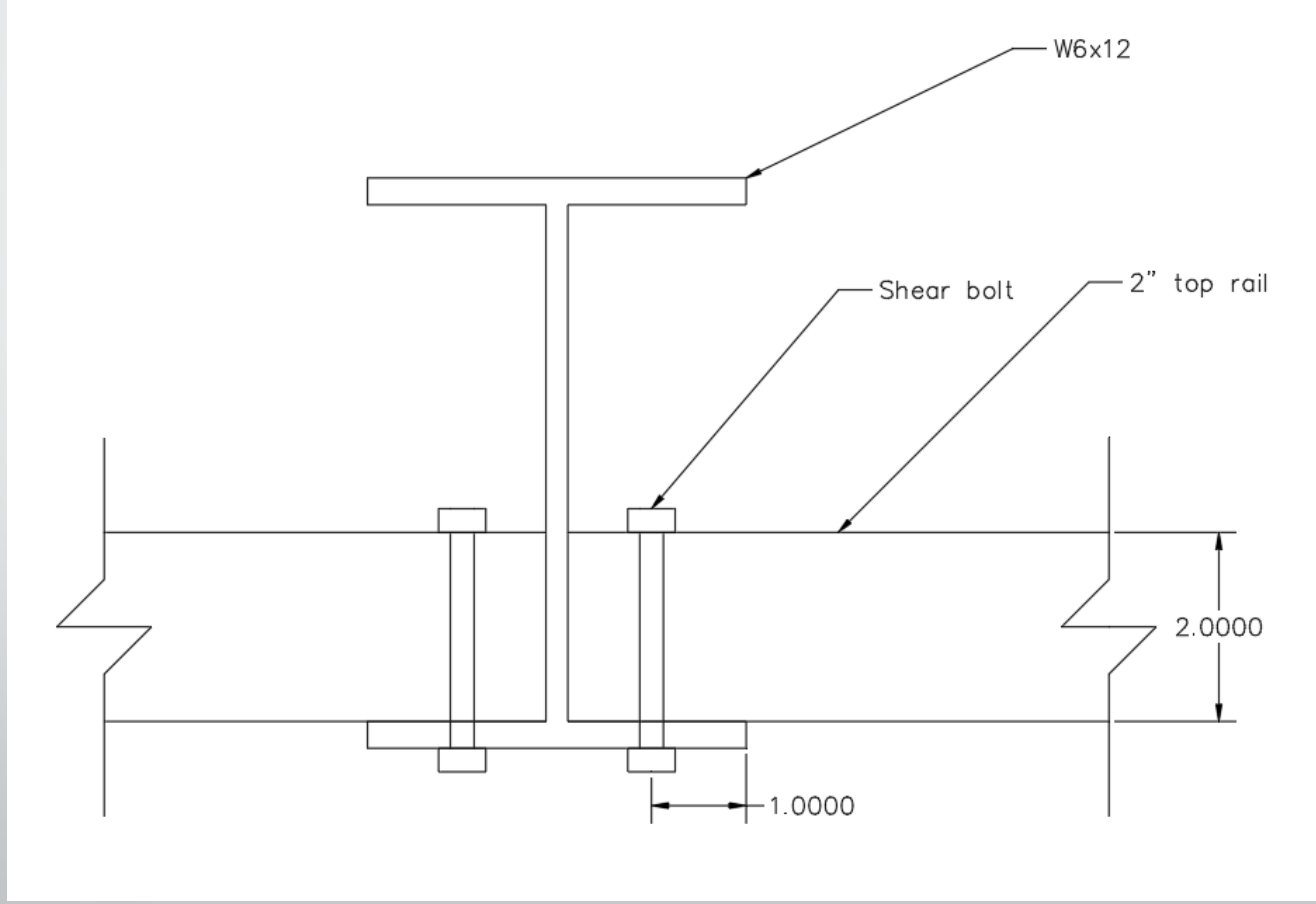
~**300** lbs Tension Per Horizontal Joint

¼ - 20 x 2.5" 18-8 S/S Hex Cap Screw Notched to 0.1" Dia.

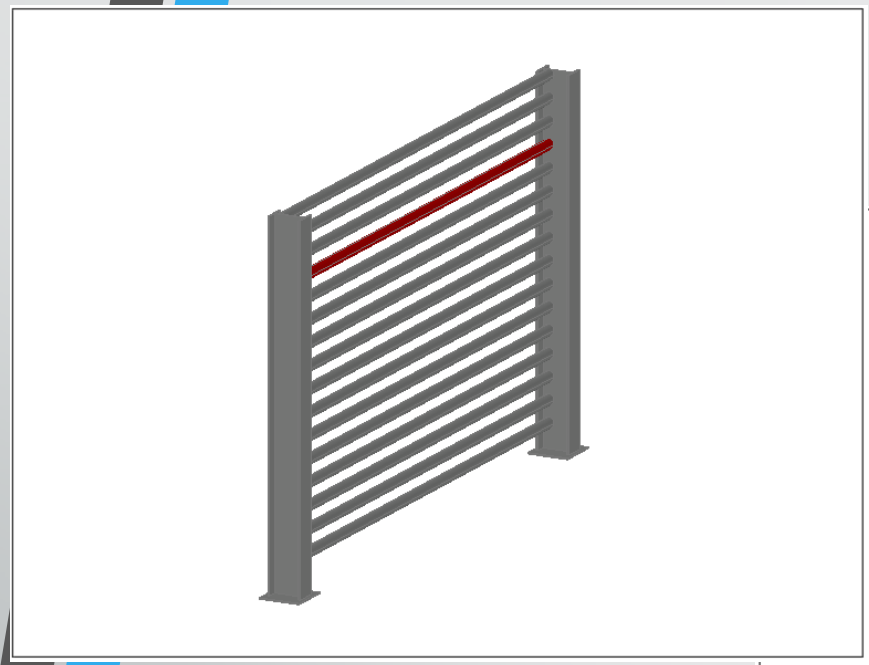
Designed to Fail in Tension Under Design Load

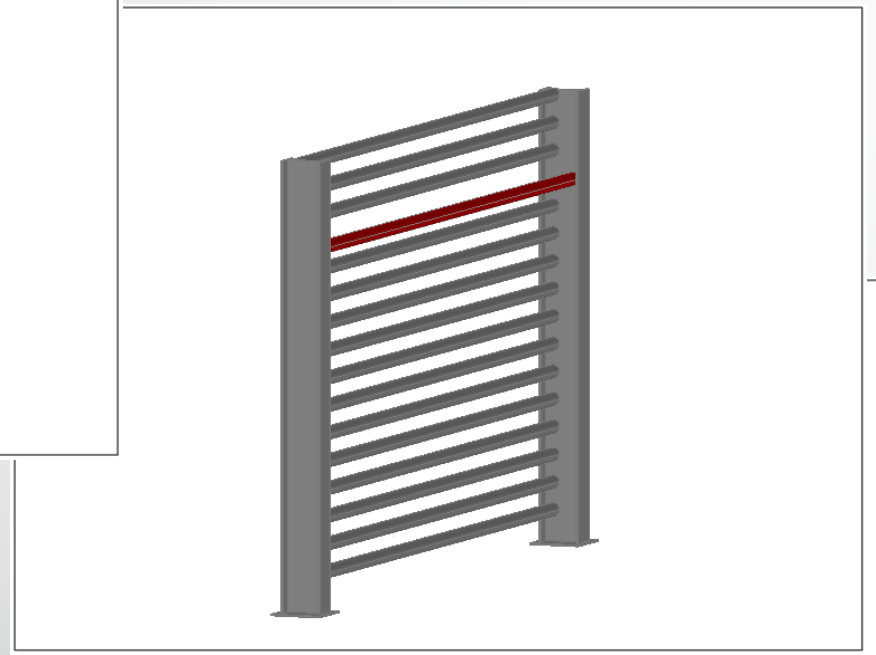


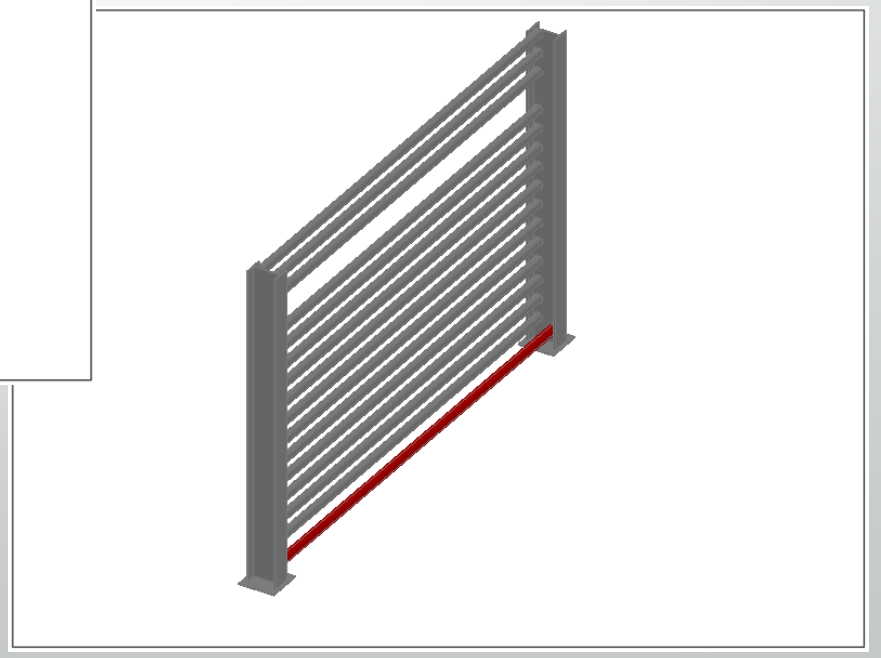
Shear Pin Connections to Uprights



Members Breaking Away





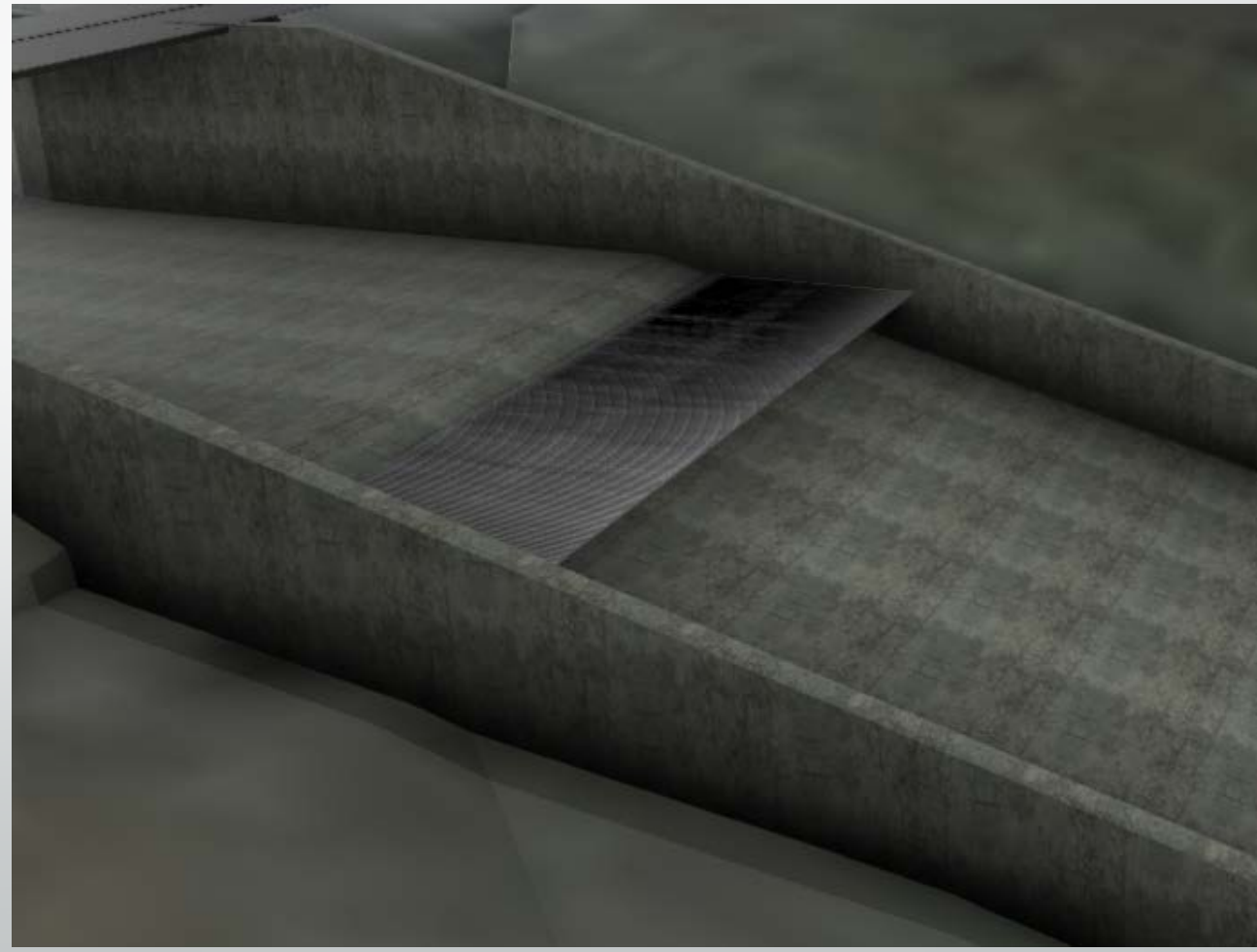


Lower Barrier Option

1" Bar Grating Barrier Spanning Width of Spillway

Supported by Spillway Structure
And L 3x3x0.5 with 5 Vertical Supports

Prevent Invasive Gizzard Shad



Cost Estimation Primary Barrier

Item	Cost
Primary Fish Barrier	$14,900
Walkway Structure	$20,600
Secondary Fish Barrier	$11,000
Security Fence	$11,000
Total Project Cost	**$75,000**

Social Impact

Retain Stocked Fish

Reestablish Desired Fish Population

Improved Overall Quality of Lake

Increased Number of Visitors

Increased Revenue

Questions?