Concurrent Sessions A: Design of Nature-Like Fishways for Fish Passage; Bypass Channels and Rock Ramps

Jessica Pica
Milone & MacBroom, Inc.

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Introduction to Nature-Like Fishways for Fish Passage
Bypass Channels and Rock Ramps
Jessica Pica, M.S., E.I.T.
University of Massachusetts Amherst

- Master of Science in Civil Engineering with Specialization in Fish Passage Engineering
Presentation Outline

- What is a Nature-Like Fishway?
- Identifying Critical Characteristics of Candidate Sites
- Review of Key Design Elements
- Explore Technical and Non-Technical Project Challenges
- Touch on Some Real-Life Examples
What is a Nature-Like Fishway?

- Mechanism for Fish Passage When a Dam/Barrier Must Remain
- Alternative to Conventional Fish Ladders
- Replicates a Natural Stream

- Two Primary Types
  - Bypass Channel
  - Rock Ramp
Design Variables

- Flow Velocity & Water Depth
  - Species Dependent – Swimming Speeds and Body Size Requirements
  - Design for and Consider Varying Flow Conditions
  - Use of Hydraulic Modeling as an Assessment Tool
  - Scour and Erosion
Fishway Entrance
- Located at Tailwater
- Amount and Range of Flow
- Location in Relation to Dam
- Can Fish Easily Find It?

Fishway Exit
- Located at Headwater
- Away from Dam/Spillway Overflow
Design Variables

- **Upstream Flow Control**
  - Consider Upstream Water Users
  - Upstream Flood Control Structures
  - Water Supply Reservoirs
  - Water Diversions to Other Watersheds

- **Variable River Stages**
  - Will There be Enough Water in the Fishway at Various Flows?
Design Variables

- **Vertical Rise**
  - Is the Dam Height too High for a Nature-Like Fishway?
  - Maximum Slope Considerations
  - Land Area?
  - River Length?
  - Consider Downstream Infrastructure (Bridges, Culverts, etc.)
Velocity – Depth – Slope Relationships

- Channel Gradient
- Profile Pattern
- Channel Width
- Manning Roughness
- Materials
- “In-Channel” Features
Project Challenges

- Type and Condition of Dam (Safety)
- Site Limitations
- Upstream and Downstream Issues
- Project Permitting
- Alternatives Analysis
- Social Issues
  - Historic
  - Archaeological
  - Land Use
  - Recreation
  - Aesthetics
  - Economics
Example: Peconic River – Riverhead, NY

**Challenges**
- Municipal Park
- Multiple Clients
- Financial Limitations
- Complicated Hydraulics

**Solutions**
- Rock Ramp
- Made Use of Secondary Spillway
- No Impacts to Park Layout
- Coastal America Partnership Award
- Very Successful!
Example: Tingue Dam – Seymour, CT

### Challenges
- Historic Resources
- State Highway
- High Flow Rates
- Extensive Bedrock
- Significant Height

### Solutions
- Dam Remains
- Bypass Channel
- Better Access to Bridge Abutments
- Incorporates Public Access/Park
- All Permits Issued – Construction Underway
Example: Swan Lake Dam—East Patchogue, NY

- **Challenges**
  - Recreational Park
  - Financial Limitations
  - Adjacent to Roadway
  - Awkward Entrance Hydraulics
  - Needs to Serve as Auxiliary Spillway

- **Solutions**
  - Bypass Channel
  - Aesthetic Feature in Park
  - Cost Within Financial Constraints
  - Armored to Protect Against Scour
Example: Cannondale – Wilton, CT

- **Challenges**
  - Private Land Owner
  - Residential/Suburban Setting
  - Second Dam Located Downstream

- **Solutions**
  - Bypass Channel
  - Maintains Aesthetic
  - Freshwater Fish Using Bypass
  - Low Cost Solution
Example: Heishman – Carlisle, PA

- **Challenges**
  - Flour Mill with High Cultural Resource Sensitivity
  - Aesthetic Sensitivity

- **Solutions**
  - Bypass Channel
  - Maintains Picturesque Setting
  - Innovative Step Pool Hydraulics
  - Low Head Allows Low Gradient Channel with High Success
  - Low Cost Alternative
Example: Bronx Zoo – Bronx, NY

- **Challenges**
  - Tourist Destination
  - High Visibility
  - Extensive Bedrock
  - Dam Safety Issues/Constraints

- **Solutions**
  - Integrated Bypass Channel
  - Hybrid Fishway
  - Downstream Boulder Diversion Weirs
  - Unique Aesthetic Treatment
  - Will Serve as an Educational Component
Thanks!

Contact me at:

jessicap@miloneandmacbroom.com