Improving Outcomes For Stream Alteration Projects

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- Evolving stream science has changed perspectives on stream management.
- DEQ is developing expertise and tools to promote improved outcomes for projects that alter stream channels.
- Focus is on maintaining and restoring stream channel stability, as well as other stream functions.
- Goal is to preserve the many benefits rivers and streams provide to the public.

Why are Rivers and Streams important? Economic, Social and Environmental Benefits

Man versus Nature

"Change the River"

Permission from Luther Aadland

Benefits of a Stable Stream Channel

Why is channel stability important?

Ecological

- Stable stream channel = best habitat for native species
- Supports the healthiest stream ecosystem

Economical

- Slowest rate of change + ability to handle its flood flows and transport its sediment load =
- Reduces the likelihood of aggradation, excessive erosion, and damage to infrastructure (roads, culverts, utility lines).

Changing Perspectives on Stream Management

- DEQ has been working in cooperation with DNR Fish Division on ways to improve outcomes for stream alteration projects
- Focus has been on channel stability and stream function
- Using Natural Channel Design concepts such as bankfull, as well as the Stream Function Pyramid

What is Natural Channel Design?

- Restoring the natural stability and the associated physical and biological function of a stream to a self sustaining condition.
- The stream channel can accommodate expected flows and sediment load without aggrading or degrading
- It does not mean putting it back to a "PRISTINE CONDITION"!

Ecological Benefits of Using Natural Channel Design

1. <u>Floodplain Connectivity</u>
   - Riparian plant community succession and development
   - Large woody structure recruitment
   - Nutrient removal
   - Groundwater recharge
   - Hydrology to support riparian wetlands

Ecological Benefits of Using Natural Channel Design

2. Channel Stability
   - More likely to maintain habitat features such as back-eddies, riffles and pools
   - These habitat features benefit macroinvertebrates and fish
3. Natural Hydraulic Regime
   - Created or maintained by natural channel configurations or in-stream structures
   - Facilitates passage of fish and other aquatic organisms

Economic Benefits of Using Natural Channel Design

1. Reduced Maintenance
   - Proper sediment transport in drains = less maintenance
2. Reduced Project Costs
   - Avoiding overdesign = lower construction costs
3. Reduced Risk to Infrastructure
   - Natural channel configurations or in-stream structures can prevent stream bed incision, aggradation and bank *erosion* *used within correct context*
   - This protects bridge footings, buried utilities and streamside buildings

Economic Benefits of Using Natural Channel Design

4. <u>Reduced Risk of Catastrophic Failure</u>
   - Culverts and bridges that span bankfull are much less likely to wash out during high flow events
   - Protects public investment

5. <u>Increased Flood Storage Capacity</u>
   By reconnecting stream to floodplain
   Attenuate peak flows and reduce flood risk to downstream riparian property owners

Improving Outcomes for Stream Alteration Projects

- **Minor Project and General Permit Categories**
  - Inclusion of best management practices
- **Bankfull Training**
  - Promoting better design and installation of road-stream crossings
- **Natural Channel Design Checklist for Michigan**
  - Better communication tools for proposed stream alteration projects
- **Stream Mitigation and Monitoring**
  - Ensuring successful replacement of lost stream functions

Minor Project and General Permit Categories

- Tiered permitting system
  - Created in 2011
  - Permitting categories for projects expected to have minor impacts
- Category criteria include BMPs
  - Clearly communicates criteria that will help to minimize impacts
- Incentivizes reduced impacts
  - Expedited review timeline
  - Reduced fees

Examples of MP/GP Category Criteria that Minimize Stream Impacts and Promote Stream Stability

Large and Small Culvert Categories

- Sets forward criteria that incorporates Natural Channel Design concepts such as:
  - Spanning the bankfull width
  - Maintaining natural slope of stream bed
  - Aligning the culvert with the existing channel meander pattern
  - Burying the culvert invert to allow for sediment transport and a natural substrate in the bottom of the culvert

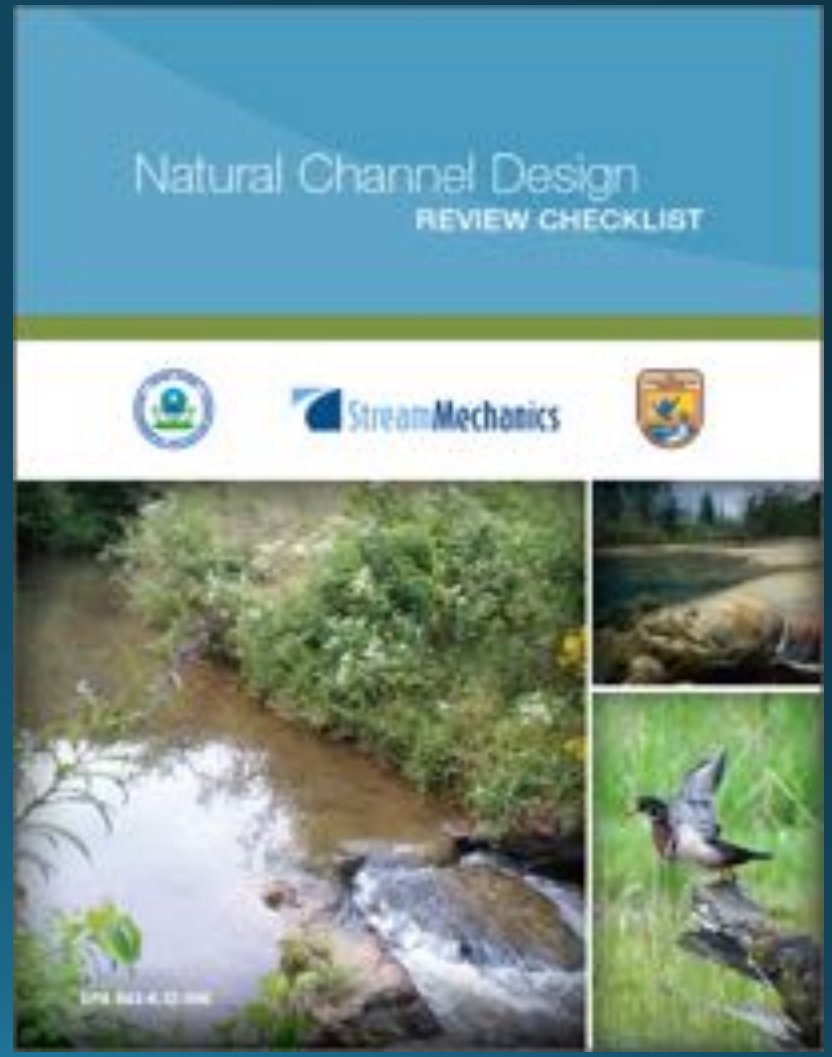
Bankfull Trainings

- Since 2011 over 175 people from various local, state, and federal agencies across the state have attended these trainings
- Goals are to promote better design and installation of road-stream crossings
  - To protect channel stability and stream function

- Discussions at a variety of field sites include:
  - Identification of bankfull using field indicators;
  - Impacts of road stream crossings on channel stability and fish passage;
  - Alternative culvert designs that minimize resource impacts and reduce maintenance costs

Michigan's Natural Channel Design Review Checklist

- Intended to assist staff with reviewing permit applications for projects that include alterations to the dimension, pattern, or profile of a stream channel or in-stream structures.
- Michigan's Checklist is based on the "Natural Channel Design Review Checklist" developed for the EPA.
- DEQ is currently working with one of the lead authors of the original EPA document to finalize the Michigan version.

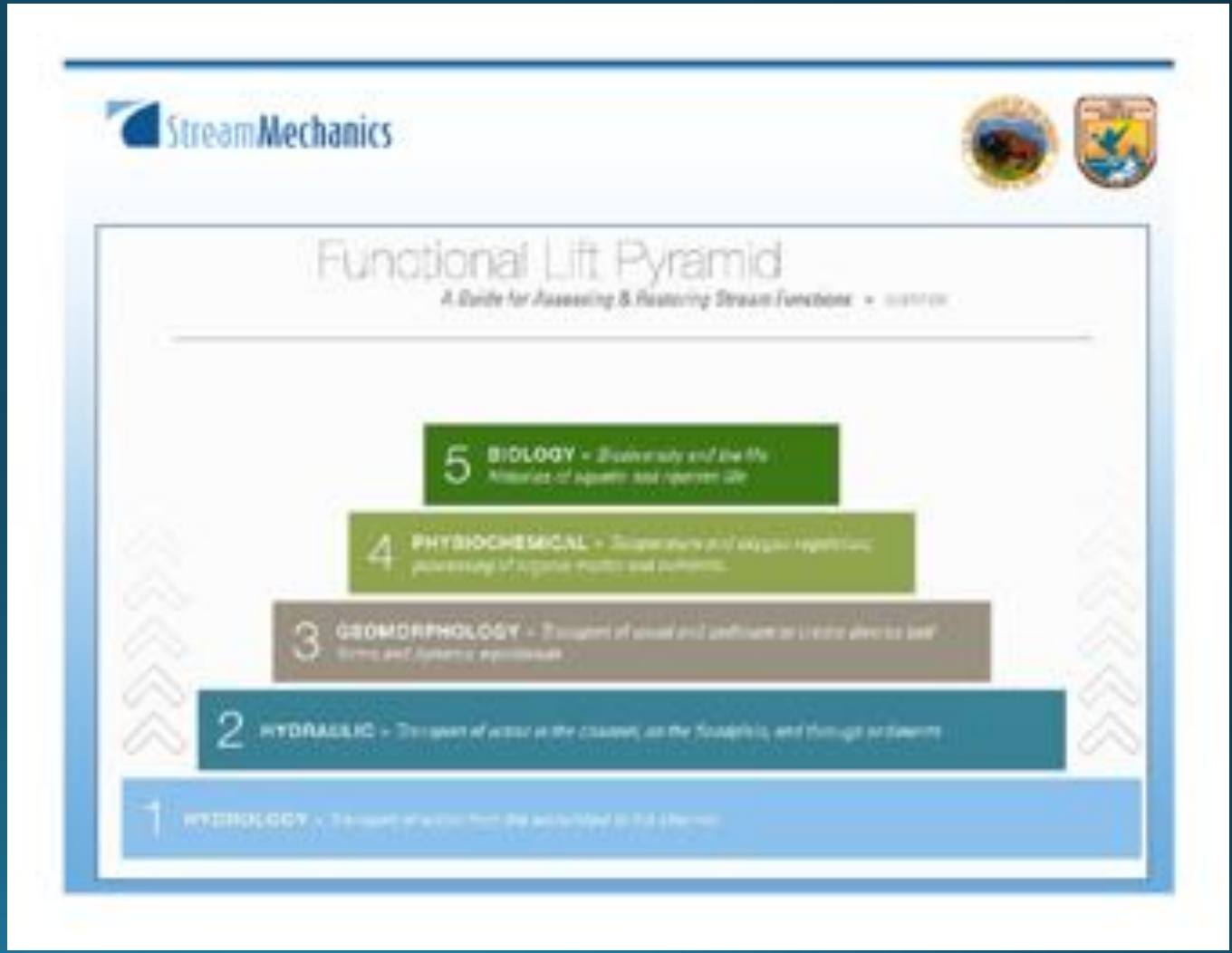


Stream Mitigation
Evaluating Impacts, Replacing Functions

- Goal is to evaluate impacts to aquatic function and quantify the functions that need to be replaced
- DEQ's basis for stream functional assessment is a 2012 EPA document "A Function-Based Framework for Stream Assessment & Restoration Projects"
- In 2015, all DEQ 404 program staff attended a training course on this assessment framework provided by the lead author, Will Harman.

Stream Mitigation
Evaluating Impacts, Replacing Functions

- Framework lays out a hierarchy of functions provided by streams
- Includes parameters and measurement techniques that can be used to measure stream function
- DEQ is using this framework to evaluate impacts for larger stream alteration projects



Parameters and Measurement Methods to Evaluate Stream Function

1. Floodplain Connectivity
   - Can the stream easily access its floodplain to dissipate energy, deposit sediment, and provide refuge for fish during higher flows?
   - Bank Height Ratio and Entrenchment Ratio
2. Bedform Diversity
   - Does the stream bed have a stable configuration of riffles and pools to dissipate energy and provide habitat variability for fish?
   - Pool to Pool Spacing, Depth Variability
3. Bank Migration/Lateral Stability
   - Are the channel banks stable or are they exhibiting signs of excessive erosion?
   - Bank Erosion Hazard Index and Near Bank Stress (BEHI/NBS)

Parameters and Measurement Methods to Evaluate Stream Function

4. Large Woody Structure
   - Is there an adequate amount of large wood within the channel to provide habitat complexity for fish and macroinvertebrates and to aid in channel stability?
   - Reference Reach Comparison or LWD Index
5. Riparian Buffer
   - Is the width and quality of the riparian buffer such that it contributes to channel stability and allows for possible future lateral channel adjustments?
   - Width along with metrics for vegetation quality

Moving Forward

- MP/GPs: Continue to improve and develop categories to incentivize use of BMPs to minimize stream impacts
- Bankfull Trainings: Continue to offer training to promote the correct application of our recommended BMPs
- Updates to the Part 301 Administrative Rules will improve permitting consistency for stream alteration projects
- Finalize Michigan's NCD Review Checklist and develop additional tools and resources to assist in the planning and permitting of stream alteration projects
- Continue to work with DNR Fish Division to promote techniques for stream management that preserve and improve channel stability and stream functions.

Questions?
Comments?

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