Boardman Dam Removal & Ecosystem Restoration Project

[ The Project ]

Purpose:
The Boardman Dam Removal is the second phase of the Boardman River Ecosystem Restoration Project. The objectives of the Boardman River Ecosystem Restoration Project include reconnecting and restoring tributary habitat, allowing unimpeded movement of wood, nutrients and sediment materials through the river system, negating thermal disruption, and restoring natural balance between coldwater and coolwater species.

Project Partners:
Grand Traverse County
City of Traverse City
Grand Traverse Band of Ottawa and Chippewa Indians
Grand Traverse County Road Commission
Traverse City Light and Power Department
Michigan Hydro Relicensing Coalition
US Fish and Wildlife Service
Michigan Department of Natural Resources
Michigan Department of Environmental Quality
Grand Traverse Conservation District
Conservation Resource Alliance
Watershed Center Grand Traverse Bay
Charter Township of Garfield
US Army Corps of Engineers

Timeline:
Key project milestones and tentative dates are as follows:

- March 2016: Cass Road Bridge construction begins
- June 2016: Dam Removal Project released for bidding
- Sept 2016: Contractor selection and award of contract
- Oct 2016: Begin channel and floodplain excavation in upper impoundment and from Boardman Dam to Sabin Pond
- June-Sept 2017: Drawdown impoundment, remove dam and channel and floodplain restoration activities
- Aug 2017: Remove powerhouse and reconstruct Cass Road
- Aug-Sept 2017: Habitat restoration, seeding and planting
- Post Project: Monitoring, invasive species management, habitat restoration and recreation management

Boardman Dam Removal Estimate: $8.4 Million
Funded through Great Lakes Restoration Initiative (GLRI) and other grants/partner funds.
**Boardman Dam Removal & Ecosystem Restoration Project**

[Fisheries and Wildlife]

- Improve and increase fisheries and river associated wildlife habitat on the Boardman River
- Restore 1.9 miles of riverine and riparian habitat and reconnect 12.4 miles of high quality river habitat.

**Dam Effects**

**UPSTREAM IMPACTS**
- Reduced: Natural function, water quality, oxygen, turbid flow circulation, available habitat, river's ability to adjust horizontally & vertically (reduced resilience to change)
- Increased: Pollutant accumulation, stratification, temperatures, algae blooms
- Loss of: Natural transport processes of sediments, nutrients & debris self-sustaining nature

**DOWNSTREAM IMPACTS**
- Reduced: Water quality & riverbed elevation
- Altered: Flow regime & temperatures
- Stabilized: Sediment, nutrients & debris (habitat building blocks)

**Removal Benefits**

- Transport of sediments, debris & nutrients
- Naturally turbid flows
- Spawning habitat
- Fish & other aquatic organism passage
- Natural temperature regime

**Terrestrial Wildlife Corridor**
• Planting plan for restoration project will include seeding, live-stakes and plantings within the restored floodplain.

• Sediment storage areas and steep upland slopes will be seeded and stabilized to prevent erosion.

• Native seed bank in upland areas will be allowed to vegetate.

• Monitoring and adaptive management will prevent establishment of invasive species and ensure success of seeding and planting.
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Wetlands and Habitat

[ Invasive Species Control ]
- Mullin
- Phragmites
- Bull Thistle
- Active Removal
- Thistle after spraying

[ Installation of Large Woody Habitat ]
- Natural Large Woody Habitat

[ Installation of Habitat Structures ]
- Project
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[ Water Quality and Sediment Management ]

[ Restoration Plan and Sediment Storage Areas ]

Legend
- Roads
- River Alignment
- Restored River Floodplain
- Existing Wetlands
- Spoils Areas

<table>
<thead>
<tr>
<th>Restoration Area</th>
<th>Anticipated Sediment Volume (Cubic Yards)</th>
<th>Adjacent Disposal Volume (Cubic Yards)</th>
<th>Adjacent Disposal Areas</th>
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</thead>
<tbody>
<tr>
<td>Boardman Dam to Sabin Pond</td>
<td>20,707</td>
<td>48,426</td>
<td>8, 9, 10</td>
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<tr>
<td>Lower Impoundment</td>
<td>91,843</td>
<td>106,740</td>
<td>5, 6, 7</td>
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<td>Lower Delta</td>
<td>57,739</td>
<td>148,011</td>
<td>4</td>
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<td>Upper Delta</td>
<td>60,191</td>
<td>39,253</td>
<td>1, 2, 3</td>
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<tr>
<td>Upper Impoundment</td>
<td>55,585</td>
<td>39,253</td>
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</tr>
<tr>
<td>Total</td>
<td>286,065</td>
<td>342,430</td>
<td></td>
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</tbody>
</table>

Fill Area 1
Fill Area 2
Fill Area 3
Fill Area 4
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Fill Area 8
Fill Area 9
Fill Area 10

Cross Section 1
Cross Section 2

[ Example of Sediment Storage Sections ]

[ Channel and Floodplain Characteristics ]
Water quality impacts associated with dam removal include, restoring coldwater habitat, and restoring natural transport of sediments, wood and nutrients.

- Sediments deposited in the impoundments will be managed and disposed of onsite. Sediment disposal areas are targeted for upland areas that would not otherwise become wetlands.
- Where feasible, sediments will be actively removed from the proposed/historic channel and floodplains off-line. Some of the channel excavations will be in-stream.
- Temporary in-stream sediment traps will be installed within the impoundment area and downstream of the breaching operation to capture the majority of sediments mobilized by the river.
- Highly erodible banks and slopes will be stabilized with natural stabilization measures such as large wood, soil wraps, brush mattresses, seeding and plantings.
The goal of the drawdown operation design is minimizing and eliminating potential failure modes by maintaining the structural integrity of the dam until dewatering is complete.

- The primary drawdown mechanism will be bypass pumping/siphoning
- To draw down the impoundment in 20 days, the pump/siphon system would need to pass 10 cfs more than the river inflow. The siphon system has a capacity of 400 cfs. The average river flow is 270 cfs (250 cfs during summer months).
- In the event the bypass pumping/siphoning capacity is exceeded, flow would pass through the powerhouse
- The impoundment will be dewatered prior to breaching the earthen dam
- An auxiliary spillway will be constructed to temporarily divert flows while the proposed river channel is constructed through the earthen dam
- The powerhouse and intake would remain intact until the auxiliary spillway is constructed

Final design has incorporated geotechnical investigations and analyses of the dams and breaching operations.

- Failure Mode Analysis and Emergency Action Plan
- Hydraulic design of energy dissipation
- Slope stability analysis
- Seepage analysis
- Core wall evaluation

Note: Flow data from USGS river gages extrapolated to Boardman Dam.
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[ Water Management and River Flows ]

[ Floodplain Mapping ]

[ Existing / Proposed 100-year Event Flood Profile ]

• Channel geometry was designed for adequate bank full depth and width based on reference reach data and hydraulic modeling.

• Floodplain width was analyzed for sufficient flood capacity to dissipate energy during large storm events.

• The 100-year flood event has been modeled and mapped as part of the design and permitting. The proposed Boardman Dam Removal will not result in any increases in flood elevation or limits.

• The dams situated along the Boardman River were constructed as power generation structures, and were not intended to be used for flood risk management. The dams have been analyzed for their flood attenuation capabilities and were found to lack the capacity to significantly reduce peak flood flows on the Boardman River.

Note: Flow data from USGS river gages extrapolated to Boardman Dam.
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[ Cass Road Crossing ]
• Cass Road Bridge replacement is being managed by Grand Traverse County Road Commission with funding from MDOT Local Assistance Program
• Bridge designed to span entire restored floodplain bench.
• Bridge span accommodates planned trail systems identified in numerous regional studies and wildlife corridors.

[ Cass Road Maintenance of Traffic ]
• Closures planned for Summer 2016 and Summer 2017
• Summer 2016: Cass Road Bridge replacement
• Summer 2017: Boardman River Restoration and reconstruction of Cass Road at old Cass Road Bridge.

[ Timeline of Road Closures ]
SUMMER 2016
• Cass Road to close - May 2016
• Cass Road Bridge over proposed location of restored Boardman River channel to be constructed
• Cass Road to reopen - August 31, 2016

SUMMER 2017 (projected)
• Boardman Dam Removal activities resume - April/May 2017
• Boardman impoundment fully dewatered and Boardman Dam demolition begins - July - August 2017
• Cass Road to close - August 2017 (anticipated)
• Boardman Dam concrete structures fully removed and Cass Road reconstructed - August - September 2017
• Cass Road to reopen - September 2017
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[ Recreation and Access ]

[ Fishing and Paddling ]

- Increased bottomlands will provide opportunities for additional trails, both for natural education and for trail corridors.
- Restored river will provide unique paddling opportunities from the Forks all the way to downtown Traverse City.