Embro Dam
Class Environmental Assessment

Public Information Centre #2

Upper Thames River Conservation Authority
Embro Community Centre
May 10th, 2016 7:00 p.m. to 9:00 p.m.

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CONSERVATION AUTHORITY

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PROFESSIONAL ENGINEERS

Class Environmental Assessment Process and Problem Statement

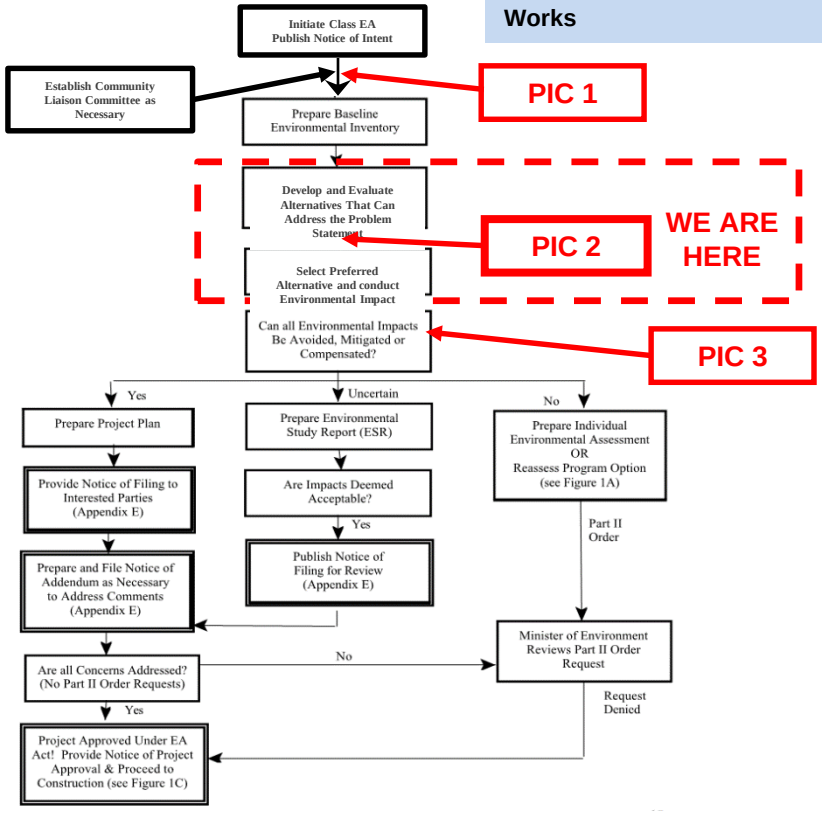
Problem Statement

Significant concerns related to the structural integrity and hydraulic capacity of the Embro Dam have been identified through recent engineering assessments.

- ***Acres International. July, 2007****. Dam Safety Assessment Report for Embro Dam: Identified issues with insufficient spillway capacity, insufficient freeboard, embankment stability and conveyance of flood flows through the emergency spillway*
- ***Naylor Engineering Associates. September 2008****. Geotechnical Investigation Embro Dam Embankment Stability Assessment: The dam does not meet current standards and is not considered stable under existing conditions.*

A Class Environmental Assessment has been initiated to evaluate a range of alternatives to address the identified issues in consideration of the environmental, social, economic, and technical aspects of the dam.

Class EA Process for Conservation Ontario Class Environmental Assessment for Remedial Flood and Erosion Control Works



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Criteria and Evaluation

Information Highlights

Technical/Engineering	Natural Environment
Flooding Impacts/Enhancement Geomorphology/Sediment Transport Protection of Infrastructure Constructability Approvability	Aquatic Habitat Impacts/Enhancement Terrestrial Habitat Impacts/Enhancement Wildlife and SAR Impacts/Enhancement Groundwater Impacts/Enhancement Water Quality Impacts/Enhancement
Social/Cultural	**Economic**
Impact to Private Property Impact to Public Safety Impact to Cultural/Heritage Features Recreational Impacts/Enhancement	Construction Costs Maintenance/Future Costs Availability of Funding

Primary Areas of Site Characterization

Environmental	Technical	Social
Water Quality	Hydraulics and Hydrology	Cultural Heritage
Flow Characteristics	Geomorphology	Archaeology
Vegetation and Wildlife	Sediment	First nations
Aquatic Biology	Structural	

Environmental

Information Highlights

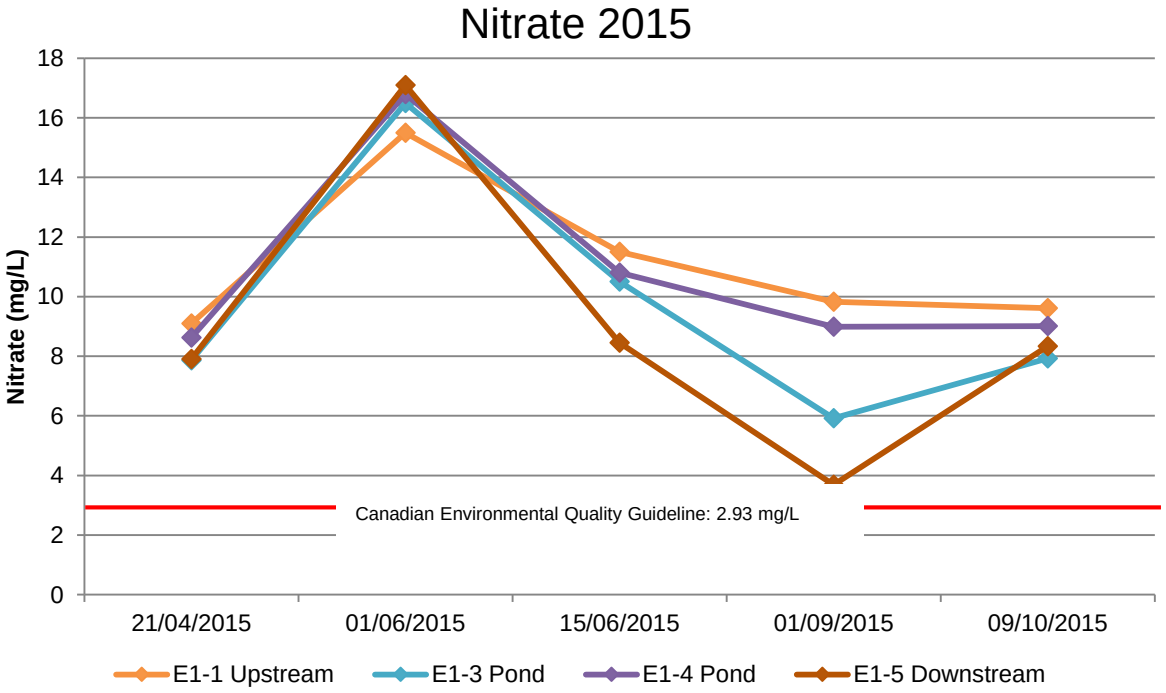
Water Quality

- 4 sampling locations (1 upstream of pond, 2 in pond, 1 downstream of pond), 5 samples were collected at each site

- Results (2015):
  - Lows levels of contaminants,
    - except Nitrate (i.e., above the Canadian Environmental Quality Guideline (CEQG), historically and currently, but similar to the rest of the Middle Thames River watershed)
  - Similar results to the historic data with E. coli

Environmental

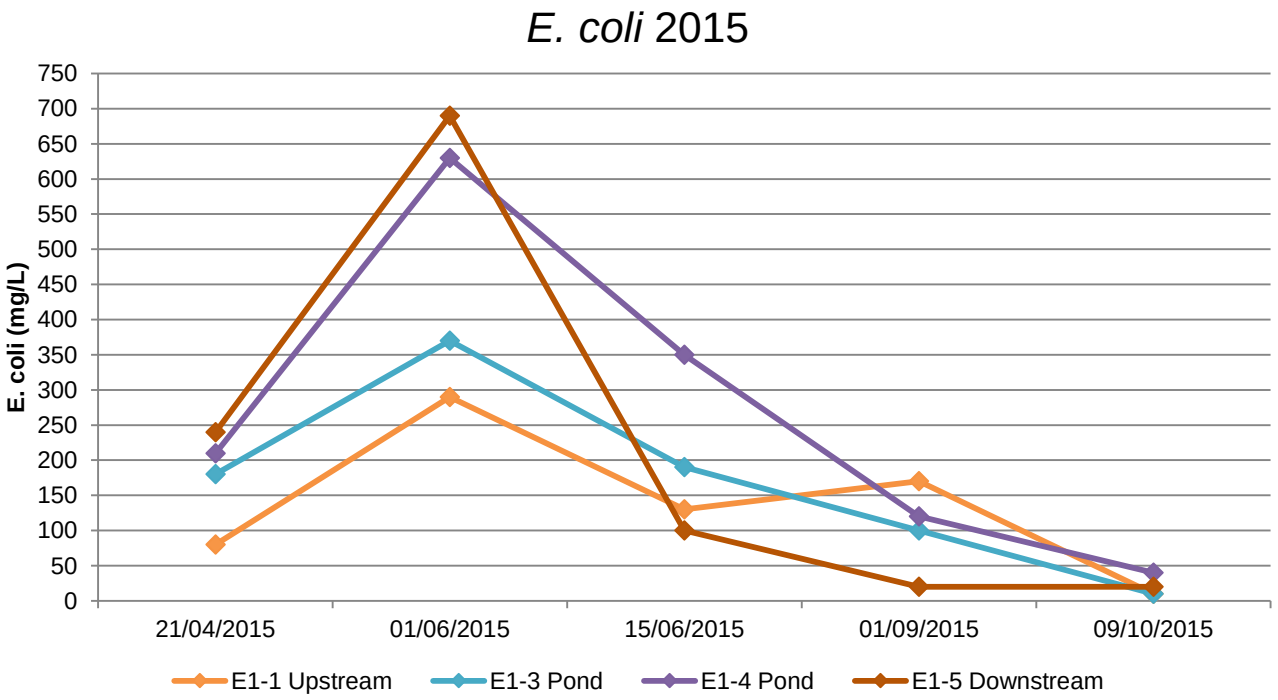
Information Highlights



- Nitrate concentration is above MOE CEQG standard
- Concentration varies seasonally

Environmental

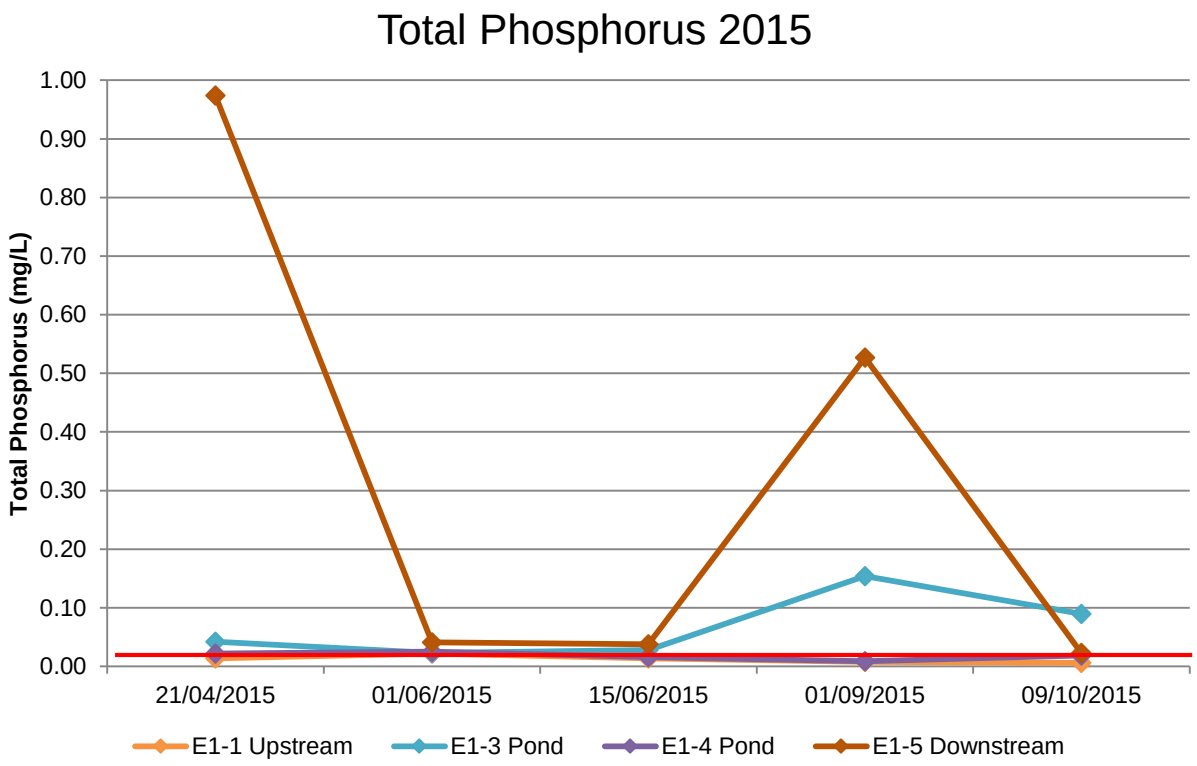
Information Highlights



- E. Coli levels increase downstream of dam in summer
- E.Coli levels are generally higher in pond than upstream or downstream

Environmental

Information Highlights



- Total Phosphorus is highest downstream of dam
- Levels are higher than Provincial objectives in and downstream of pond

Provincial Water Quality Objective 0.03mg/L

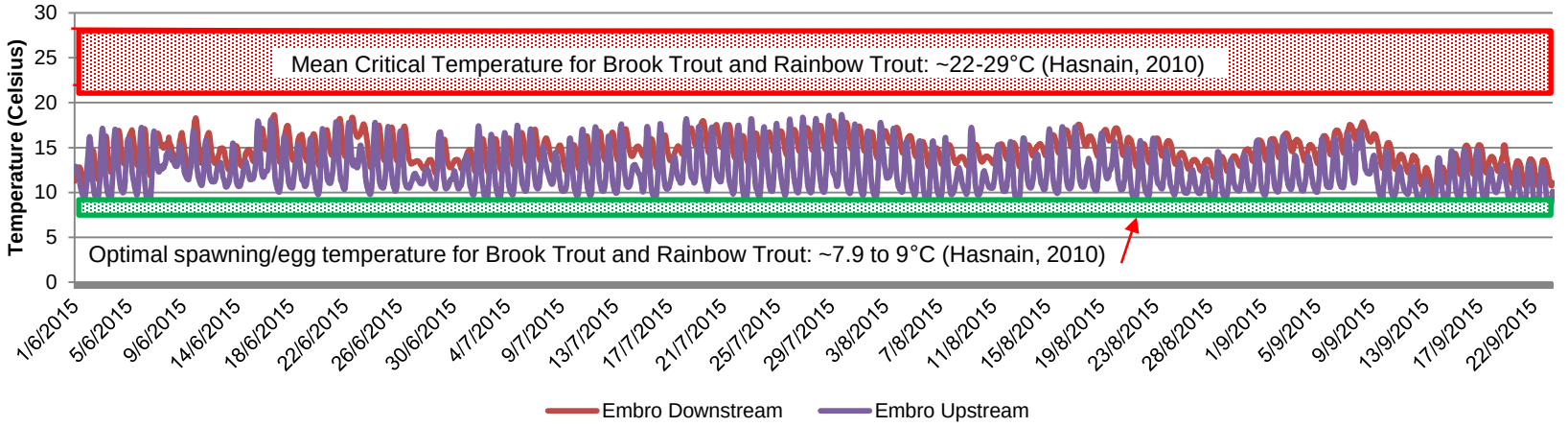
Environmental

Information Highlights

Water Temperature

- Continuous temperature measurements taken from June to September 2015
  - Water often warmer downstream than upstream of the pond:

    Least temp. difference: 0.0^0C
    Average temp. difference: 2.5^0C
    Maximum peak difference: 7.0^0C
  - Temperatures are higher than optimal for Brook/Rainbow Trout spawning



Reference: Hasnain, Sarah, et. Al. 2010. Key Ecological Temperature Metrics for Canadian Freshwater Fishes. Prepared for the Ontario Ministry of Natural Resources.

Environmental

Information Highlights

Flow Characteristics

- Flow downstream of the pond contributes between 3.5 – 6.5% of the total flow downstream of Thamesford
- Flow contribution to Mud Creek (downstream) could not be estimated (no monitoring stations)
- Flow rates downstream of the dam are resilient to drought
- Groundwater input to the increases baseflow from upstream to downstream of the dam by 8%

Environmental

Information Highlights

Vegetation and Wildlife

- No Species at Risk or of Special Concern were found
  - No records of Species at Risk within a 2 km radius
  - No wetlands within 120 m
- Wooded areas of the Conservation Area are part of the Oxford Natural Heritage System
- Inventory Findings:
  - 198 plant species, 31% of species found are non-native
  - 40 species of birds, mostly common forest birds
  - Barn Swallow (Threatened) was seen but not found nesting in study area
  - Snapping Turtles (Special Concern) spotted in the reservoir

Environmental

Information Highlights

Aquatic Biology

- Classified as Shallow Aquatic (i.e., < 2 m depth)
- Very few wetland emergent plants (due to steep side slopes and consistent water levels)
- Duckweed and algae float on pond surface
- Four rooted aquatic species identified
- Vegetation does not provide good cover for fish species that are adapted to ponds

Environmental

Information Highlights

Fisheries Resources

- Electrofishing conducted in 2015 (April, July, October and November)

Brook Trout

Image Source: Mandrak and Crossman, 1992

<u>Upstream of Dam (8 species recorded):</u>

- Brook Trout in large numbers
- Habitat suitable for cold water species

<u>Downstream of Dam (21 species recorded):</u>

- Brook Trout
- Cold water species
- Permanent and seasonally present warm water species

Environmental

Information Highlights

Benthic Resources

- Sampling was conducted in the spring and fall of 2015
- Sample records with the calculated Family Biotic Index (FBI) are shown below:
  - Water quality indicators upstream/downstream of pond are FAIRLY POOR

Water quality ranges for FBI values

FBI Value	Water Quality
< 4.25	Excellent
4.25 – 5.00	Good
5.00 – 5.75	Fair
5.75 – 6.50	Fairly Poor
6.50 – 7.25	Poor
> 7.25	Very Poor

Comparison for FBI values for Embro CA, Mud Creek and UTRCA watersheds

Benthic Sample Location	Spring 2015 FBI	Fall 2015 FBI	Average FBI	Water Quality
Youngsville Drain upstream of Embro Pond	5.82	6.06	5.94	Fairly poor
Youngsville Drain downstream of Embro Dam	5.84	6.37	6.12	Fairly poor
Mud Creek watershed 2012	N/A	N/A	6.20	Fairly poor
UTRCA watershed 2015	N/A	N/A	5.68	Fair
Provincial Guideline (target only)	N/A	N/A	< 5.00	Good

Technical

Information Highlights

Groundwater

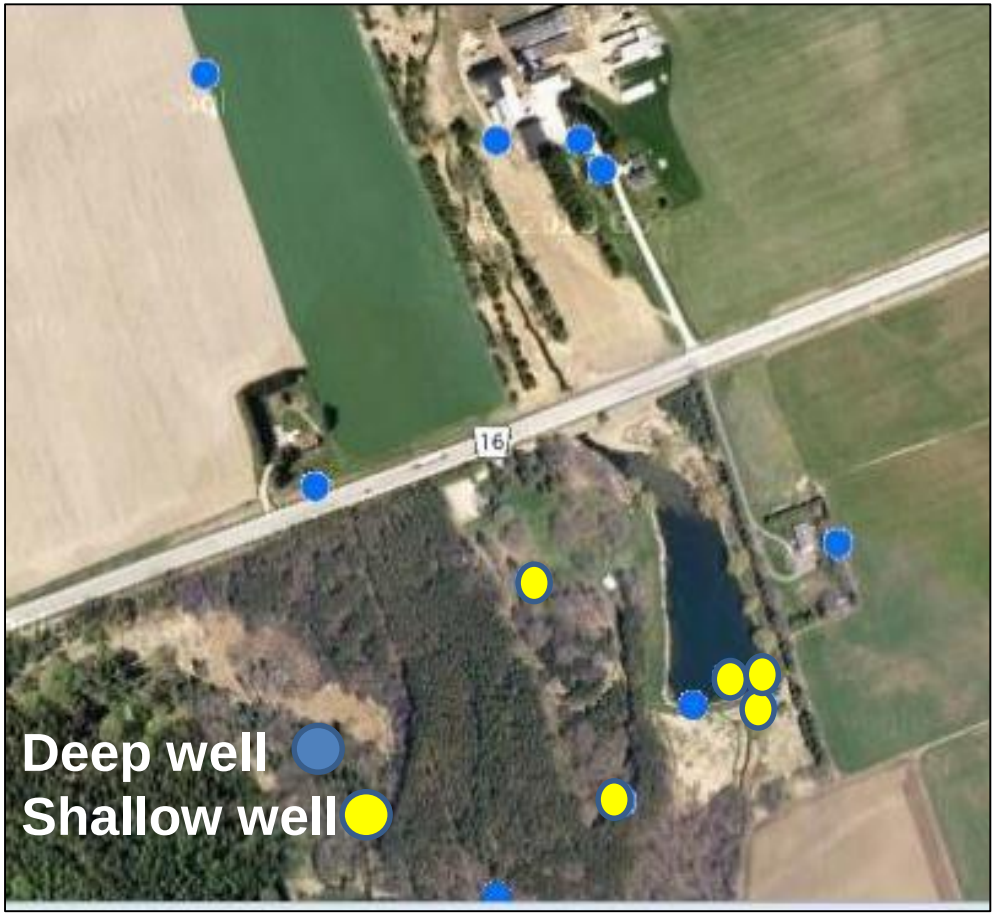
- Soil is characterized as fill overlying silt and clay deposits, and native glacial till
- Groundwater generally occurs in the fill above the glacial till
- Groundwater flow gradient is towards the south side of the pond; a possible seepage zone is located on the south side of the dam
- Water level in the fill is ~ 0.4 m below the pond water level

Technical

Information Highlights

Well Information

- Approximately 13 wells exist in the vicinity of Embro Pond
- Installation dates range from 1959 to 2008
- Well depths range from 3.8 to 50.3 m
- Water depths range from 2 to 49 m below the top of well



Technical

Information Highlights

Geomorphology

- Air photo analysis:
  - 1955: creek is sinuous, no pond
  - 1972: pond is constructed, channel realignment
  - 1989-2010: minor planform changes in creek
- Three reaches have been delineated

Reach 1 (Downstream of dam):

- Relatively straight, slight meander
- Cross sections: symmetrical and trapezoidal and confined
- Bed morphology: riffles/runs with shallow pools
- Bed material: cobbles and gravel
- Riparian vegetation: dense grasses and herbaceous plants with some shrubs

Technical

Information Highlights

Geomorphology

Reach 2 (Backwater area (85 m long)):

- Straight channel with poorly developed bed forms
- Cross section: generally trapezoidal
- Bed material: silt and sand, some gravel
- Riparian vegetation: well vegetated with grasses and herbaceous plants

Reach 3:

- Riparian vegetation: grasses, herbaceous plants, and cedar trees
- Cross section: generally uniform in shape
- Bed morphology: riffles/runs with shallow pools
- Bed material: fine sand and silt with some large boulders/cobbles and gravel on riffles

Technical

Information Highlights

Sediment Characteristics

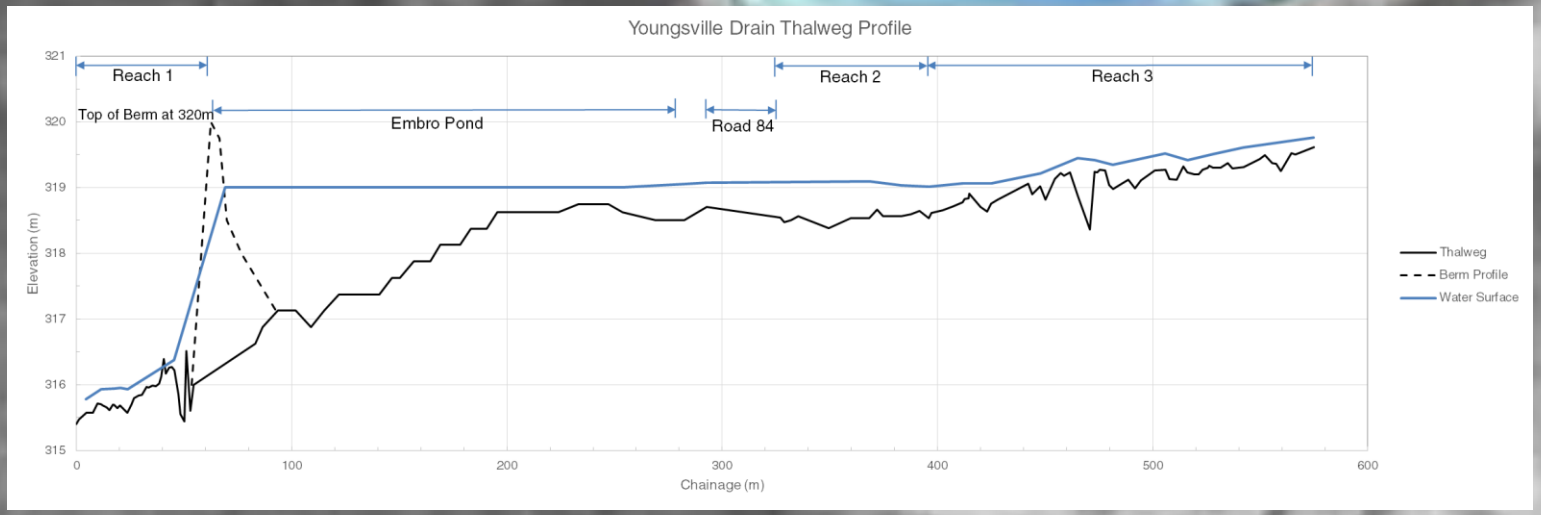
Sediment testing was conducted in 2015 to investigate parameters including:

- metals and inorganics
- volatile organic compounds
- petroleum hydrocarbons
- conductivity
- pH
- grain size analysis

Sediment test results were compared to Ministry of the Environment (MOE) Table 2 and 3 Standard, O. Reg. 153/04

- One parameter is outside of the MOE limit: Cyanide (weak acid dissociable)
- Cyanide concentration was 0.092ug/g vs the MOE limit of 0.051ug/g
- Options for sediment: beneficial reuse (requires further investigation) or landfilling

Water Depth 2015



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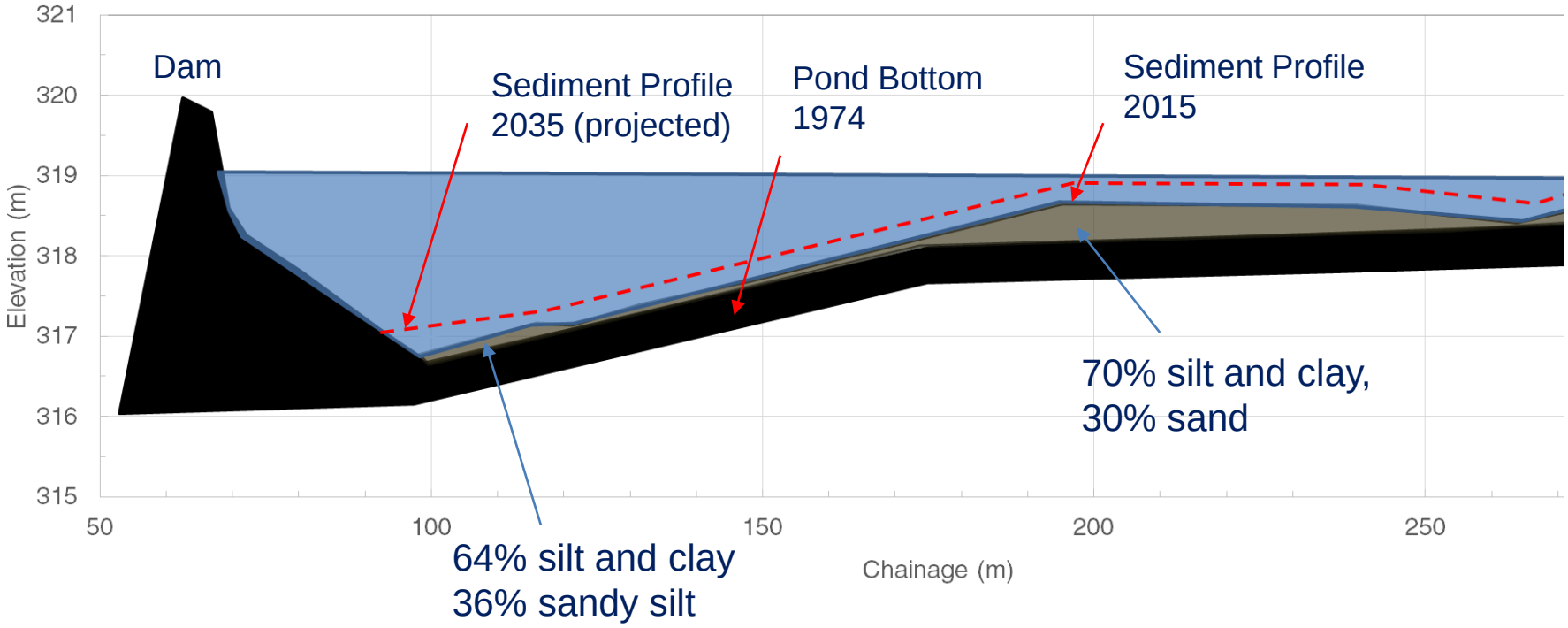
Technical

Information Highlights

Sediment Profile



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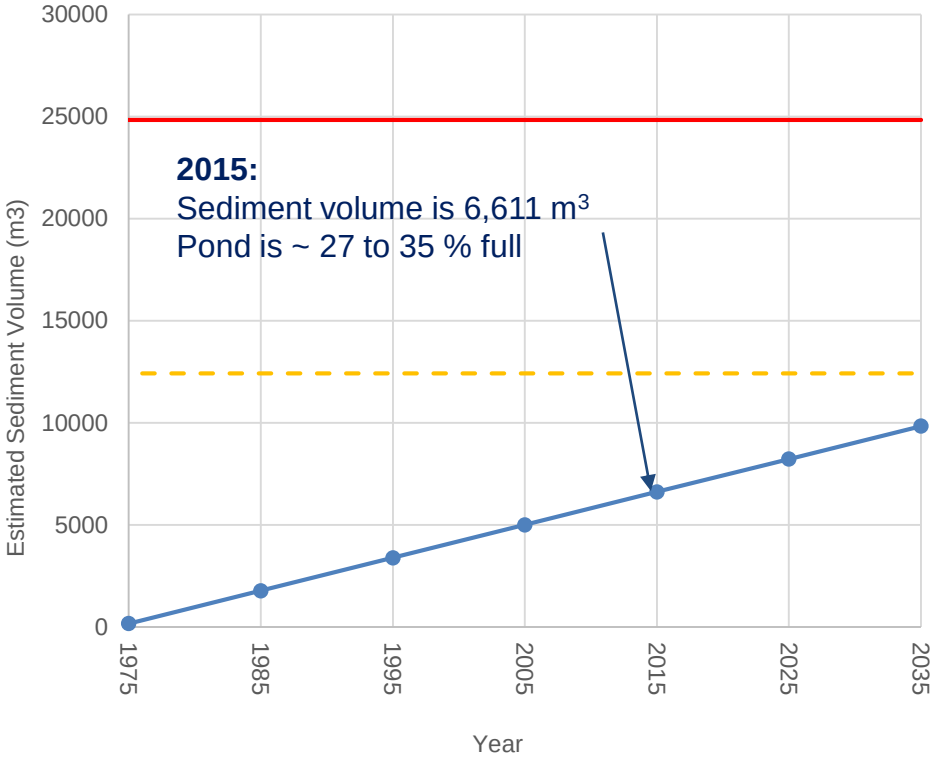
Estimated Sediment Volume (m3)

Technical

Information Highlights

Pond Capacity and Sediment Infilling Rate



100% of the Pond Volume

50% of the Pond Volume

Average sediment accumulation rate = 161 m³/year

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Technical

Information Highlights

Structural

- Dam impounded volume: 30,000 m^3 (small dam based on storage volume)
- Dam height ~4.5 m
- 100 m long earth embankment
- Inflow design flood (IDF) criteria: 50 year, 8 day spring snowmelt event

Structural Condition (2002/2003 Dam Safety Assessment)

- Spillway does not have current capacity to pass the IDF
- Insufficient freeboard
- Upstream and downstream embankment slopes do not meet slope stability acceptance criteria
- Flood flows are not adequately conveyed by the emergency spillway
- Date of last repair is unknown

Technical

Information Highlights

Updated Hazard Classification

2007: Dam hazard potential classification (DHC) for Embro Dam was completed:

- Loss of Life: VERY LOW
- Economic and Social Losses: VERY LOW
- Environmental Losses: VERY LOW

2011: the Ministry of Natural Resources and Forestry updated the DHC criteria and procedure

2015: Update to the Embro dam hazard potential classification:

- Life safety: LOW
- Property Losses: LOW
- Environmental Losses: LOW
- Cultural-Built Heritage Losses: LOW

Social

Information Highlights

Cultural Heritage

- Embro Conservation Area: 11.7 ha (28.9 acres) for passive recreation
- Includes hiking trails, cross-country skiing trails and picnic areas
- Memorial Tree Sign program run through the Township of Zorra
- The Embro Pond Association

Social

Information Highlights

Archaeology and First Nations

- Stage 1 Archaeological Assessment was completed
- No prior archaeological assessments within 50 m of the study area
- No prior identified archaeological sites within 1 km of the study area
- Archeological potential was assessed using soils, hydrology, and landform considerations

Findings: The study areas would have been attractive to both Pre-Contact and Euro-Canadian populations as a result of close proximity to water sources, well drained soils, and the diversity of local vegetation. The site was found to have archaeological potential.

66.8% of the site has archaeological potential,

- requires test pit survey before any potential construction works in area

33.2% of the site has no archaeological potential (due to disturbance, permanent water features or steep slopes)

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Social/Cultural	**Economic**
Impact to Private Property Impact to Public Safety Impact to Cultural/Heritage Features Recreational Impacts/Enhancement	Construction Costs Maintenance/Future Costs Availability of Funding

Alternatives

Information Highlights

1) Do Nothing
2) Repair Dam
3) Remove Dam and Construct a Natural Channel
4) Remove Dam and Construct Offline Pond(s) or Wetland(s)
5) Lower Dam Crest and Outlet and Naturalize New Pond and Perimeter

Opportunities and Constrains of the Alternatives

Summarizes how each of the alternatives impacts elements of the evaluation criteria

Do Nothing

No intervention would be implemented

Opportunities	Constraints
No immediate cost	Does not meet dam safety guidelines
Maintains current aesthetic	Has a risk of failure – this can impact the channel by flood, erosion and sediment
Maintains current uses	Requires regular monitoring
	Imposes an impediment to fish passage
	Increases water temperatures seasonally
	Accumulates sediment, will fill over time
	Impedes sediment transport

Repair Dam

Construct Dam 'Shell', add rock protection, extend outlet pipe, provide emergency spillway

Opportunities	Constraints
Complies with Dam Safety Guidelines	Imposes repair costs (moderate)
Maintains current aesthetic	Imposes an impediment to fish passage
Maintains current uses	Increases water temperatures seasonally
	Accumulates sediment, will fill over time
	Impedes sediment transport

Remove Dam and Construct Natural Channel

Remove Dam, construct natural channel, provide landscape restoration

Opportunities	Constraints
Restores area to pre-existing conditions	Imposes restoration costs (moderate)
Provides diverse fish habitat	Does not reflect existing aesthetic (open water)
Provides sediment transport	Has the risk of impacting shallow wells
Maintains creek temperatures	
Removes risk of dam failure	

Remove Dam and Construct Offline Pond/Wetland

Remove Dam, construct offline pond with less surface area as existing, create natural channel, provide landscaping

Opportunities	Constraints
Restores area to pre-existing conditions	Imposes restoration costs (high)
Provides aquatic habitat diversity	Reduces pond surface area (water views)
Provides sediment transport	
Maintains creek temperatures	
Removes risk of dam failure	
Partially provide water views	

Lower Dam Crest and Outlet and naturalize pond area

Lowers height of dam, provided less surface area as existing, create natural channel, provides landscape enhancements

Opportunities	Constraints
Partially maintains current aesthetic	Imposes restoration costs (high)
Reduces solar heat gain compared to existing	Reduces pond surface area (water views)
Reduces magnitude of potential impacts in the event of breach/failure	Imposes an impediment to fish passage
Provides diversity in landscape	Imposed risk to Increases in water temperatures seasonally
	Accumulates sediment, will fill over time
	Impedes sediment transport

Watershed Initiatives

Information Highlights

Initiative	Approach
2010 Water Quality Monitoring Station Added	A new water quality monitoring station was added to Mud Creek just south of Embro along Highway 6
Clean Water Program Since 2001	26 Clean Water Program (CWP) projects (fragile land retirement, septic upgrades, wellhead protection) have been completed since 2001
UTRCA Community Nature Program	Over 80 trees and 2800 native wildflowers and grasses were planted by 75 students at Embro Conservation Area
2008-2009 Mud Creek Community-based Watershed Strategy	Technical information about the state of the watershed combine with concerns and priorities of watershed residents combine to produce a list of recommended actions
2010-2011 Hardwood Forest Regeneration in Embro Conservation Area	5 ha conifer plantation at Embro Conservation Area was thinned by UTRCA to encourage the regeneration of hardwood forest. 2100 native hardwood seedlings were planted. Project funding was by Oxford County and the CWP.

Next Steps and Contact Information

Next Steps for our project team include:

- **Compile and review feedback from this Public Information Centre**
- **Final criteria and alternatives evaluation completed based on public feedback**
- **Select 'Preferred Alternative' and evaluate environmental impacts**
- **Public Information Centre #3**
- **If impacts can be mitigated, work will proceed to completion and filing of Project Plan**

To provide feedback and comments to the project team, please send all correspondence to the project email address:

embro_dam@thamesriver.on.ca

For further information please contact:

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