Embro Dam
Class Environmental Assessment

Public Information Centre

UPPER THAMES RIVER
CONSERVATION AUTHORITY

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

STUDY LOCATION

FIRST NATIONS LAND ACKNOWLEDGEMENT

We acknowledge that the land on which we gather is the traditional territory of the Haudenosaunee, Lunaapeewak, and Anishinaabeg peoples who have longstanding relationships to the land, water and region of southwestern Ontario.

This territory is covered by the Upper Canada Treaties, including Treaty 29, the Huron Tract Purchase of 1833.

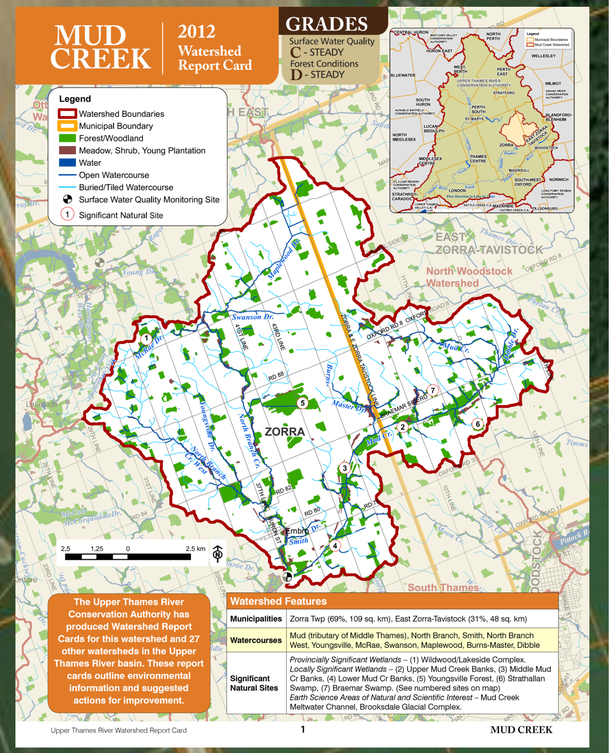
The local First Nation communities of this area include Chippewas of the Thames First Nation; Oneida Nation of the Thames; Munsee-Delaware Nation; Mississaugas of New Credit First Nation; and Six Nations of the Grand (which consists of Mohawk, Cayuga, Seneca, Onondaga, Oneida, and Tuscarora Nations). In the region, there are eleven First Nation communities and a growing Indigenous urban population.

We value the significant historical and contemporary contributions of local and regional First Nations and all of the Original peoples of Turtle Island.

Embro Dam was acquired by UTRCA in 1958 and reconstructed in 1959. The dam is located on Spring Creek, also known as Youngsville Drain, and is a tributary of North Branch Creek.

The dam controls a drainage area of 7 square kilometres of mostly agricultural lands, forming a small reservoir of approximately 0.8 ha with an estimated volume of 3,000 cubic metres.

The dam structure consists of a 100 metre long earthen embankment (4.5 metres approx. height) with a concrete bottom draw inlet with an inverted V-shaped trash-rack anchored to the top of the outlet. An emergency spillway is located on the east embankment.



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STUDY OBJECTIVES AND CLASS ENVIRONMENTAL ASSESSMENT PROCESS

Embro Dam is owned by the UTRCA; however, the Township of Zorra pays 100% of operating costs for the dam due to significant Provincial funding cuts in 1995.

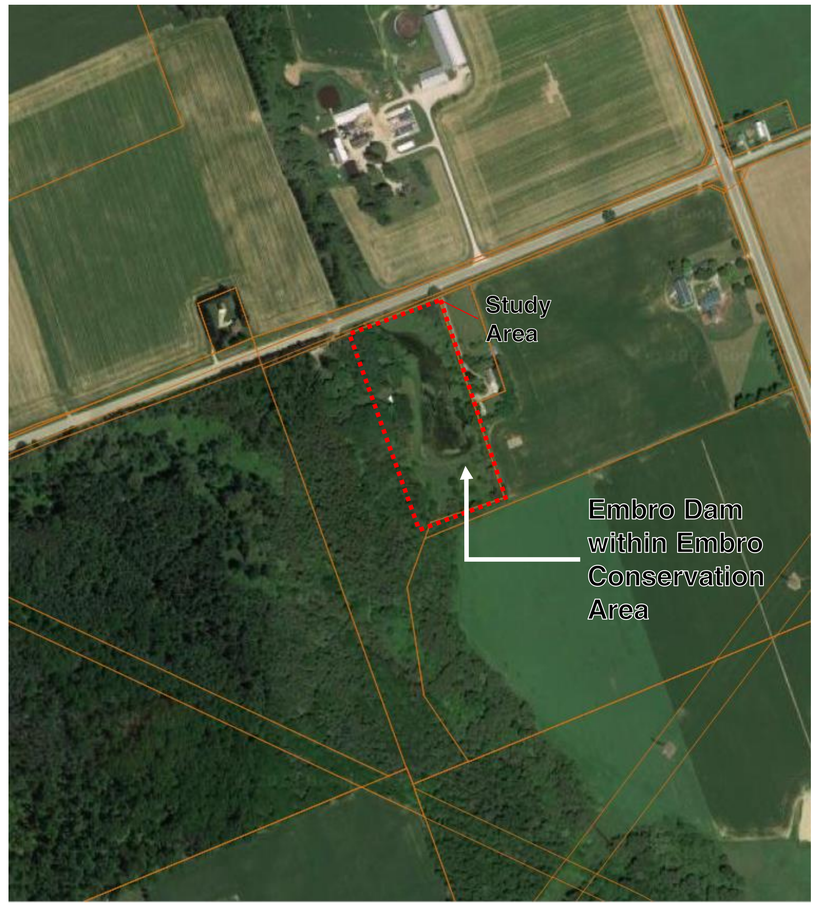
Significant concerns related to the structural integrity and hydraulic capacity of the Embro Dam have been identified through previous engineering assessments.

- ***Acres International. July 2007***. *Dam Safety Assessment Report for Embro Dam. : Upstream and downstream embankment slopes do not meet stability acceptance criteria. Though determined to represent a VERY LOW incremental hazard potential due to small economic, social, and environmental consequences in the event of dam failure, including no loss of life, the discharge capacity of the structure (outlet pipe plus emergency spillway) is inadequate to pass the "inflow design flood" without overtopping the dam structure itself.*

- ***Naylor Engineering Associates. September 2008***. *Geotechnical Investigation Embro Dam Embankment Stability Assessment : The existing dam does not meet current standards and is not considered stable under existing conditions*

UTRCA initiated an Ontario Conservation Class Environmental Assessment Study to review the identified concerns regarding Embro Dam. Findings are used to identify alternatives that would address the concerns (structural integrity and hydraulic capacity of Embro Dam) and to evaluate these with consideration of technical, environmental, social, and economic aspects of the dam and setting.

The study was initiated in 2015 and paused in 2017. In 2022, a cultural heritage assessment and updates to several study components were completed. Updated information will be used, along with public input, to evaluate alternatives.



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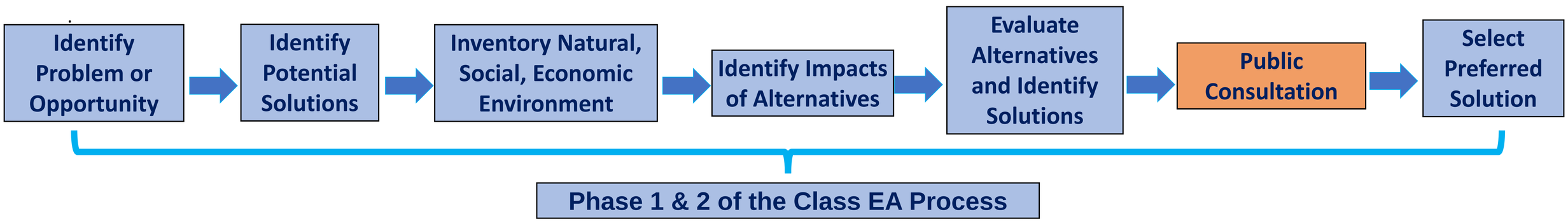


SITE CHARACTERIZATION

Civil Engineering (Dam Structure and Hazard Assessment)

A characterization of the current dam structure was undertaken, including an update of the Dam Hazard Classification, to understand risks to downstream persons and property.

The dam has an impounded volume of 30,000 m^3 and consists of a 100m long earth embankment. Spillway does not have the current capacity for inflow design flood (50-year, 8-day spring snowmelt). 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.

An updated Hazard Classification was completed for the Embro Dam in 2015: **Threat levels for Life Safety, Property Losses, Environmental Losses, and Cultural-Built Heritage were considered LOW.**

Geotechnical Engineering and Hydrogeology

Geotechnical engineering and hydrogeology considers the stability of the dam embankments and the flow of groundwater through and around the dam (seepage). Characterization of the current dam stability and seepage is critical in developing potential alternatives for the dam, as well as understanding the risks and impacts of various alternatives.

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. Geotechnical stability assessments have been previously completed and led to the initiation of this study. The existing dam does not meet dam safety guidelines and stability criteria and is not considered stable under existing conditions. No new data collection was completed in 2022

Sediment Quality

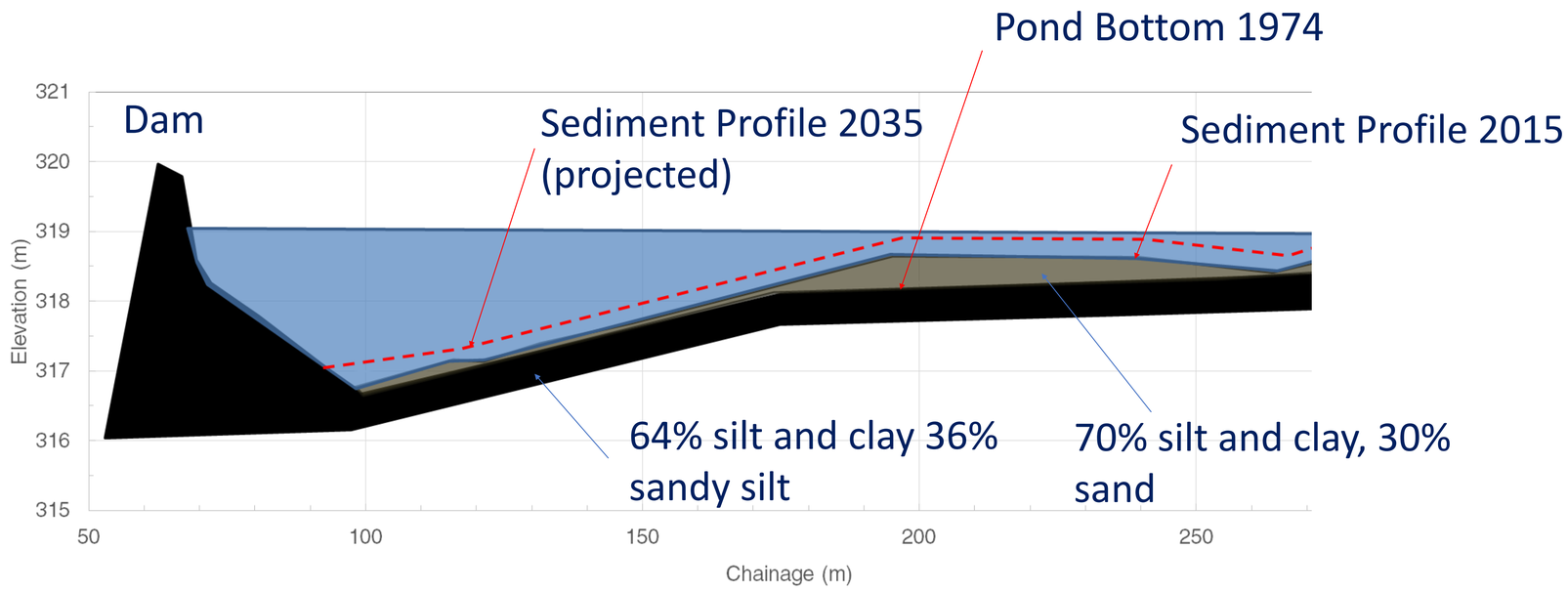
Characterization of the sediment quality in the reservoir involves the collection of sediment samples and analysis at a laboratory to identify a range of constituents of interest (i.e., metals, nutrients, pesticides, hazardous materials).

An understanding of the sediment quality at the site is critical for understanding the potential impacts of proposed alternatives for the dam, particularly related to the costs associated with removal and disposal. In addition, upstream pollutant sources may be identified.

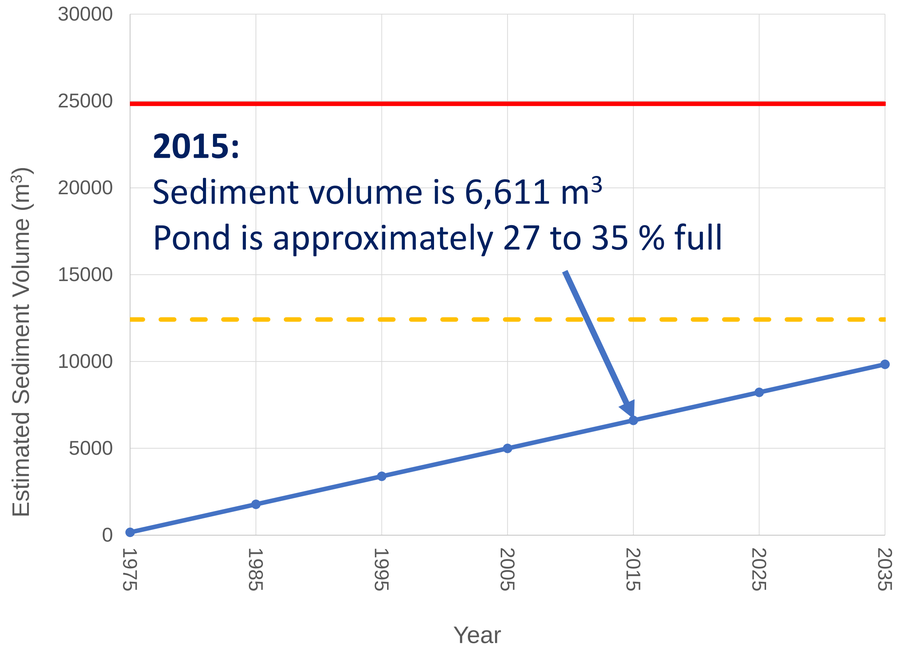
Sediment testing at the reservoir was completed in 2015. Results showed that a single tested parameter (cyanide) showed elevated concentrations as compared to Ministry of Environment standard tables. No further sediment testing was completed in 2022.

Sediment Information Highlights

Sediment Profile



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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SITE CHARACTERIZATION (CONTINUED)

Aquatic Biology

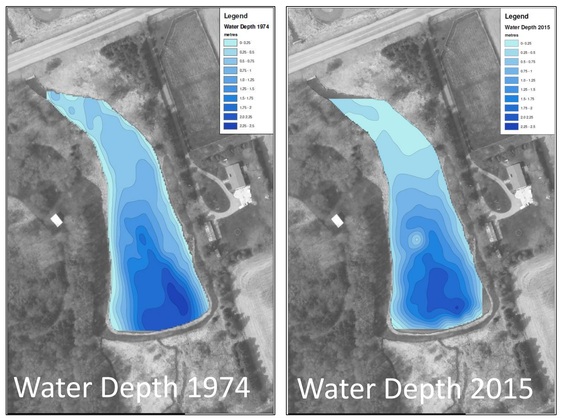
A characterization of aquatic life in the pond, as well as upstream and downstream of the pond was completed in 2015; this included an inventory of fish and benthic macroinvertebrates (bugs). Understanding the aquatic biology is critical to characterize the current impacts of the pond and dam, and potential impacts and opportunities for proposed alternatives.

Aquatic biology surveys completed in 2015 recorded 8 species of fish upstream of the pond, and 21 species downstream. Results from benthic invertebrate surveys rated the Youngsville Drain, upstream and downstream of Embro pond as having “fairly poor” water quality. No new aquatic biology data collection was completed in 2022.

Youngsville Drain was a key donor site for Brook Trout in 2010 for the Upper Thames Region CA brook trout stocking program. Fish stocking was conducted due to the estimated 70-80 percent population decline of Brook Trout in Southern Ontario and the sensitivity of the species. Due to its healthy brook trout population, the Youngsville Drain is critical to the conservation of Brook Trout for the Upper Thames watershed.

Brook Trout

Image Source: Mandrak and Crossman, 1992



Topographic and Bathymetric Survey of Pond

A topographic survey and bathymetric survey of the pond was completed, using GPS and total station, to establish physical constraints on potential alternatives for the dam and pond, as well as to develop concept designs. Survey was completed in 2015; no new survey data collection was completed in 2022.

The dam forms a reservoir of approximately 0.5 ha (length of ~ 190 m) with an estimated volume of 30,000 m^3. The dam has a height of approximately 4.5 m and freeboard of 1.1 m. Bathymetric surveys of Embro Pond showed that approximately 27-35% of the available pond volume has filled with sediment. The pond will continue to retain sediment transported from upstream drainage areas and require periodic dredging to maintain functional and aesthetic qualities.

Water Quality

Water quality sampling at the site involves collection of water samples during dry weather and wet weather conditions, at locations upstream and downstream of the dam, as well as within the pond. This provides insight to the impact of the current dam and pond on the watercourse, specifically on the ability of the watercourse to support aquatic life.

Water quality samples from 2015 showed the watercourse was within the range typically found in the Thames River watershed. The least, average, and maximum temperature differences from upstream to downstream were plus 0°C, 2.5°C, and 7.0°C respectively. No new water quality data collection was completed in 2022.

SITE CHARACTERIZATION (CONTINUED)

Hydrology

Hydrologic characterization of the site includes monitoring and rating of river flows upstream and downstream of the dam. An understanding of the site hydrology is required to inform the operational parameters so that potential alternatives can be generated, and to inform numerous other technical disciplines such as aquatic biology, water quality, and fluvial geomorphology.

Upstream drainage area to the Embro dam is 7 km^2. Based on monitoring undertaken in 2011, 2012, and 2015, Youngsville Drain contributes 3.5%, 12.4%, and 6.4% respectively, of the total flow measured downstream of Thamesford. It is predicted that Youngsville Drain has a high resiliency to drought/ low flow conditions due to geological and hydrogeological conditions.

Terrestrial Biology

The terrestrial biology of the site includes the range of vegetative and wildlife species that inhabit the site, as well as connectivity to adjacent natural areas and the significance of species found on site (i.e., Species at Risk, Endangered Species).

Understanding of the terrestrial biology of the site is required to establish and characterize the impacts of alternatives for the dam, and to recommend restoration and enhancement strategies for the site.

Terrestrial biology surveys were completed in 2015 and indicated that there are no sensitive plants, plant communities, birds or wildlife that would be threatened from changes to the environment in Embro Conservation Area. Results from a survey completed in 2022 indicated confirmed or candidate Species at Risk (SAR) see next board (Terrestrial Ecology – SAR Screening)

Social

The Embro Dam and pond are located within the Embro Conservation Area. The dam was built in the late 1950's and the Embro Conservation Area officially opened on October 26, 1959. Currently the Embro Conservation area (11.7 ha) is used for passive recreation and includes hiking trails, cross country skiing trails and picnic areas.

In July 2015, a "Memorial Tree Sign" was unveiled within the Embro CA. In a program run through the Township of Zorra, memorial trees purchased through UTRCA may be planted within the Conservation Area. About six memorial trees have been planted in the Embro CA in previous years.

SITE CHARACTERIZATION UPDATES

Fluvial Geomorphology

Fluvial geomorphology aims to understand the processes and functions of rivers and creeks, and their role in transporting sediment and providing habitat for aquatic life.

An understanding of the natural watercourse function around the pond is important to characterize impacts of potential alternatives, as well as the current impact of the pond and dam on river processes.

The geomorphic characterization was completed in 2016. A second visit was completed in November 2022 to revise and update existing conditions

Results of the 2022 investigation show that the channel downstream of Embro Dam is degrading, with increased width and depth when compared to the initial assessment.

Upstream of the road, the channel was reclassified as aggrading, with large deposits of fine sediment observed due to the backwater conditions created by the dam.

2015

Downstream of Dam

Looking Upstream from pond at Rd 84

Looking Upstream from Rd 84

2022

Looking Upstream from pond at Rd 84

Looking Upstream from Rd 84

Terrestrial Ecology – SAR Screening

A Species at Risk (SAR) Screening was completed using the information collected in 2015, as well as a reconnaissance level site visit completed in 2022, to assess the availability of SAR habitat within the study area.

Species listed as either Threatened (THR) or Endangered (END), as well as their habitat, are protected under the *Endangered Species Act (ESA)*. Species listed as Special Concern (SC) are not protected under the ESA; however, are protected under the Provincial Policy Statement and considered Species of Conservation Concern (SOCC) and Significant Wildlife Habitat (SWH).

Confirmed SAR: Barn Swallow (Hirundo rustica) (THR) was observed foraging

Candidate SAR: SAR Bats (END) Cavity trees were observed within the treed vegetation communities and may provide suitable habitat.

Confirmed SOCC: Snapping Turtle (Chelydra serpentina) (SC) was observed within the pond. Eastern Wood-Pewee (*Contopus virens*) (SC) was observed during breeding bird surveys completed in 2015, and Monarch (*Danaus plexippus*) was observed in 2015 within the study area.

ARCHAEOLOGICAL AND CULTURAL ASSESSMENTS

TMHC has completed a **Stage 1 Archaeological Assessment** and a **Cultural Heritage Assessment** for the site. Findings of the studies include the following:

Archaeological Assessment

A Stage 1 Archaeological Assessment was conducted in order to determine the archaeological potential of the study area; this includes identification of previously known archaeological sites, if any, and to provide recommendations for further assessment if necessary.

There was no prior archaeological assessments within 50m of the study area. There was no prior identified archaeological sites within 1 km of the study area. Archeological potential was assessed using soils, hydrology, and landform considerations.

The existing condition of the study site has a reduced archaeological potential due to sloped lands greater than 20 degrees, permanently wet lands, and extensive land alterations. In terms of archaeological potential, the Embro Dam study area is characterized by 2.09 ha (66.8% of study area) of archaeological potential and 1.05 ha (33.2% of study area) of land identified as areas of no archaeological potential.

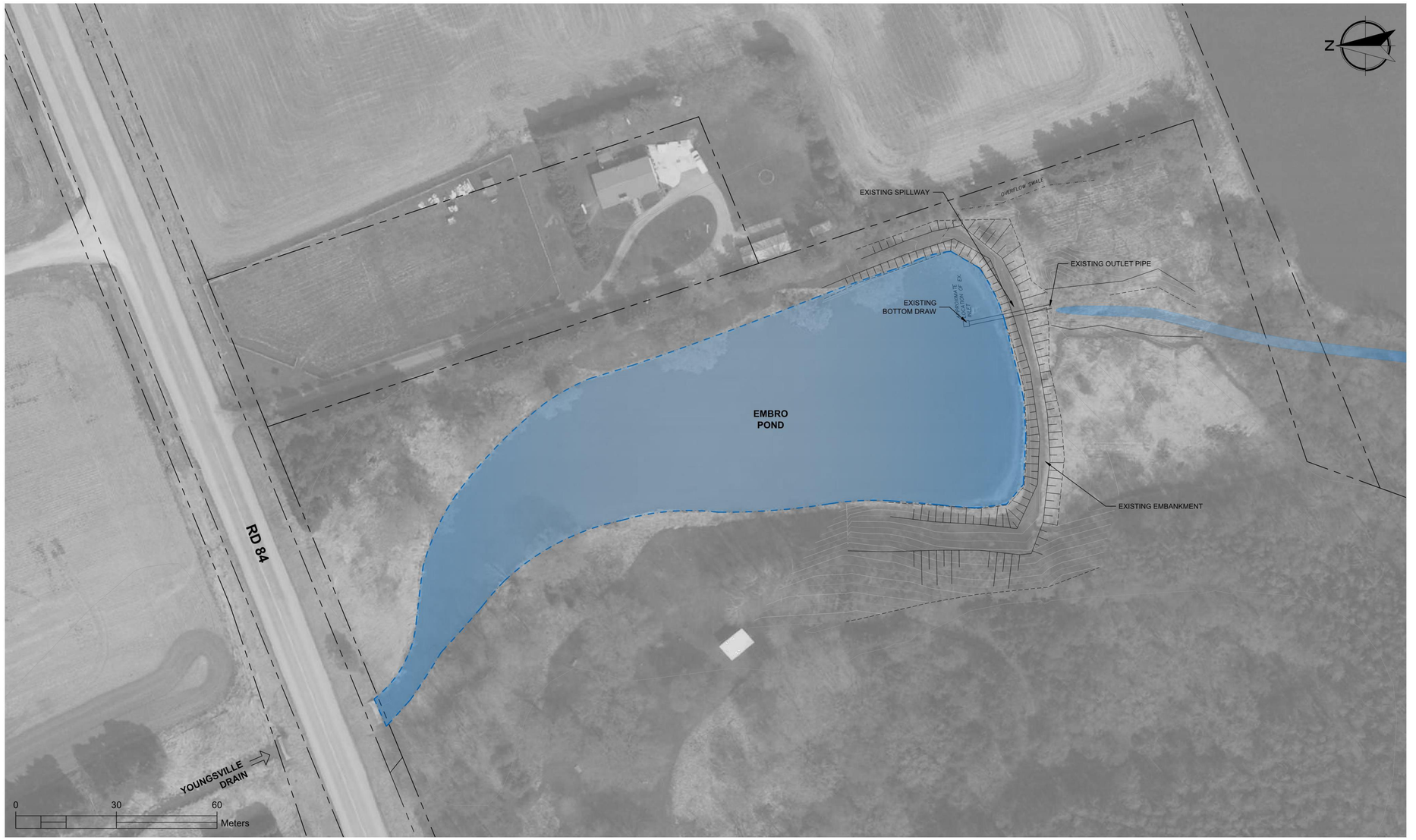
Cultural Heritage Assessment

As a result of public consultation in 2016, a Cultural Heritage Assessment was completed for the Embro Dam and pond.

A review of historical documents shows a pond and grist mill had existed in the area, these features have since been removed and are not visible on current site. The pond and dam at the study site had been constructed in the late 1950's to serve as a water supply and to serve as a recreational area within the newly established Embro Pond Conservation Area. Due to the recent construction of the Embro Dam and pond, and the lack of historic structures, cultural or visual significance, the Embro Dam was found to not meet the O.Reg 9/06 Cr and therefore is not considered a landmark.

ALTERNATIVE #1 – DO NOTHING

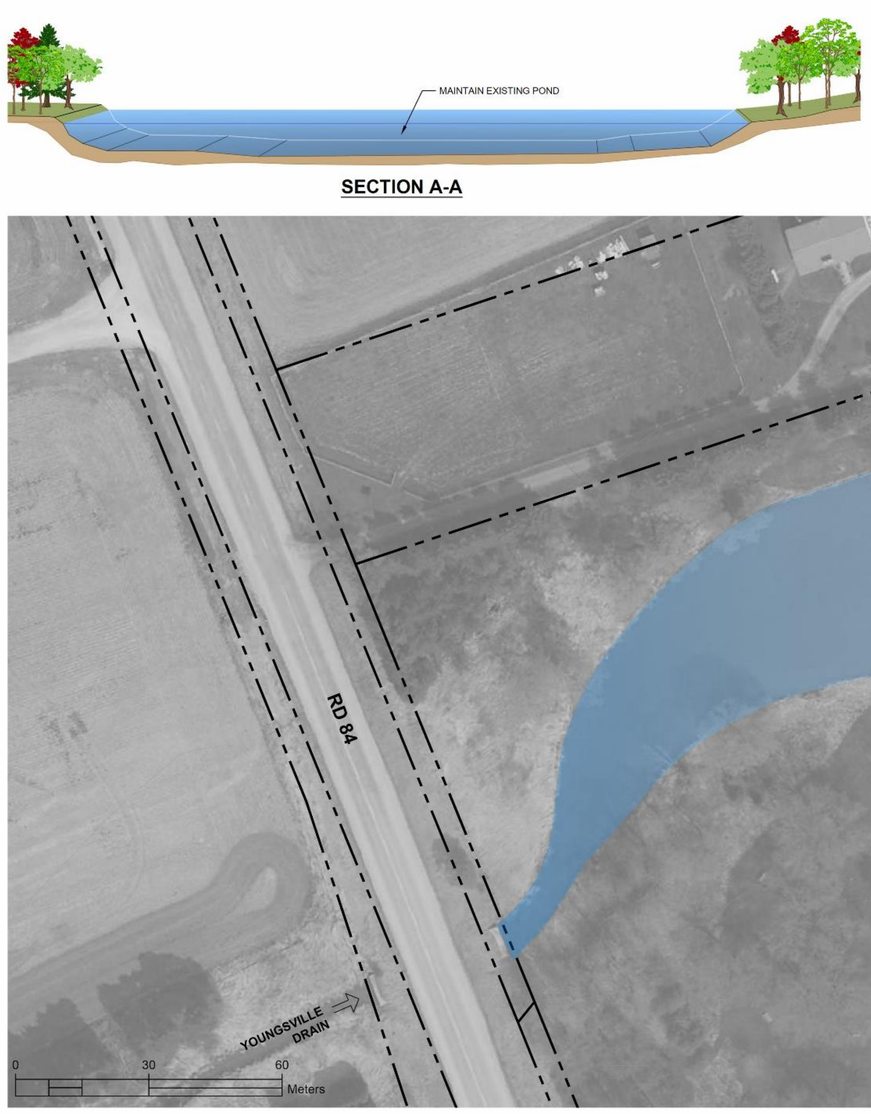
No intervention would be implemented



Advantages	Disadvantages
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 and downstream private landowner
Maintains current area uses	Requires regular monitoring
Maintains habitat functions	Imposes an impediment to upstream fish passage and causes habitat fragmentation
	Increases water temperatures seasonally
	Accumulates sediment, will fill over time
	Impedes sediment transport
	Will require future maintenance/cost
	Requires vigilance with respect to potential failure and emergency preparedness

ALTERNATIVE #2 - REPAIR/ RECONSTRUCT EXISING DAM

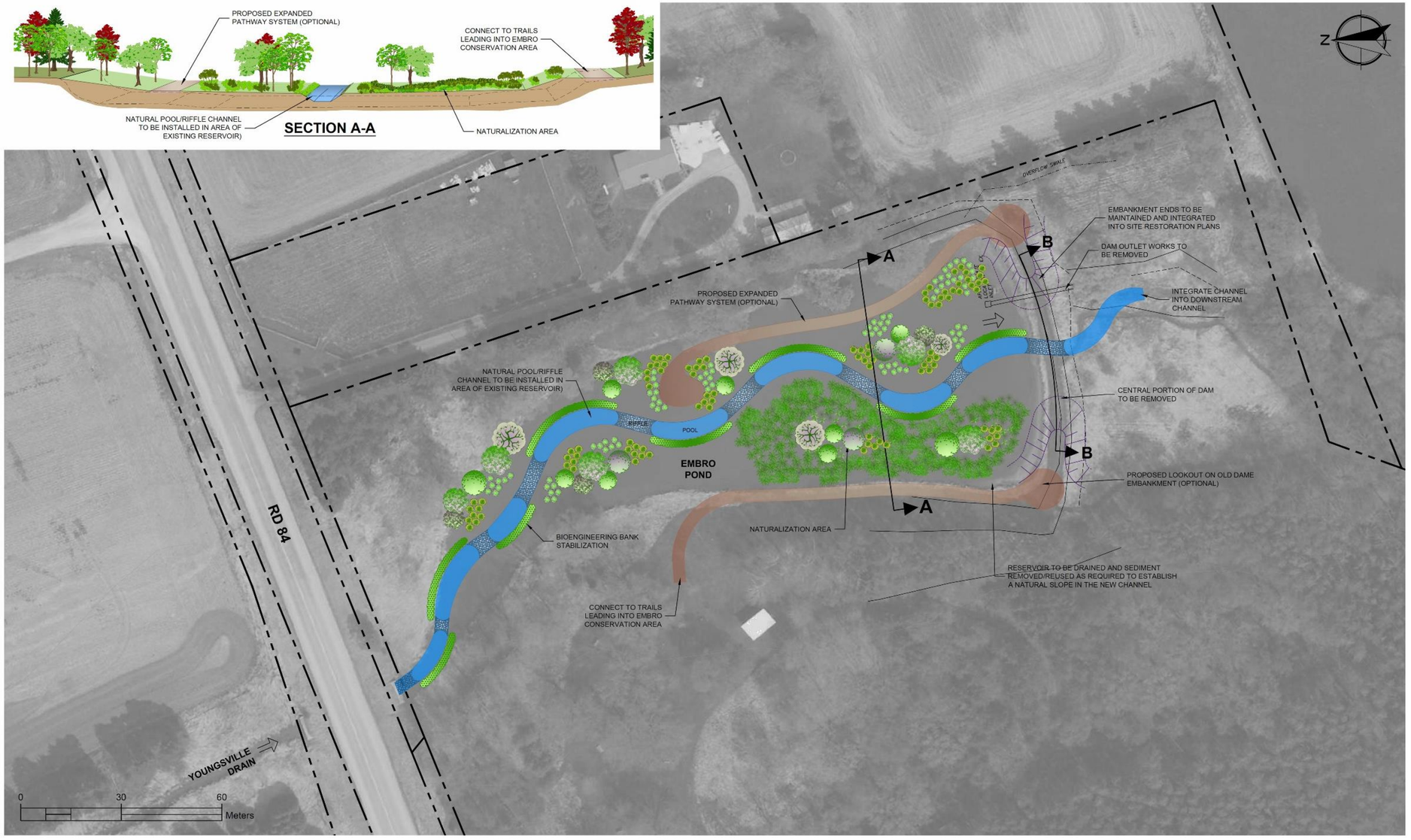
Construct Dam ‘Shell’, add rock protection, extend outlet pipe, provide emergency spillway



Advantages	Disadvantages
Complies with Dam Safety Guidelines	Moderate cost
Reduces risk of flooding to downstream private landowner	Continued operation and maintenance costs
Maintains current area uses	Imposes an impediment to fish passage and causes aquatic habitat fragmentation
Maintains current aesthetic and habitat functions	Increases water temperatures seasonally
	Accumulates sediment, will fill over time
	Impedes sediment transport continuity

ALTERNATIVE #3 – REMOVE DAM AND CONSTRUCT NATURAL CHANNEL

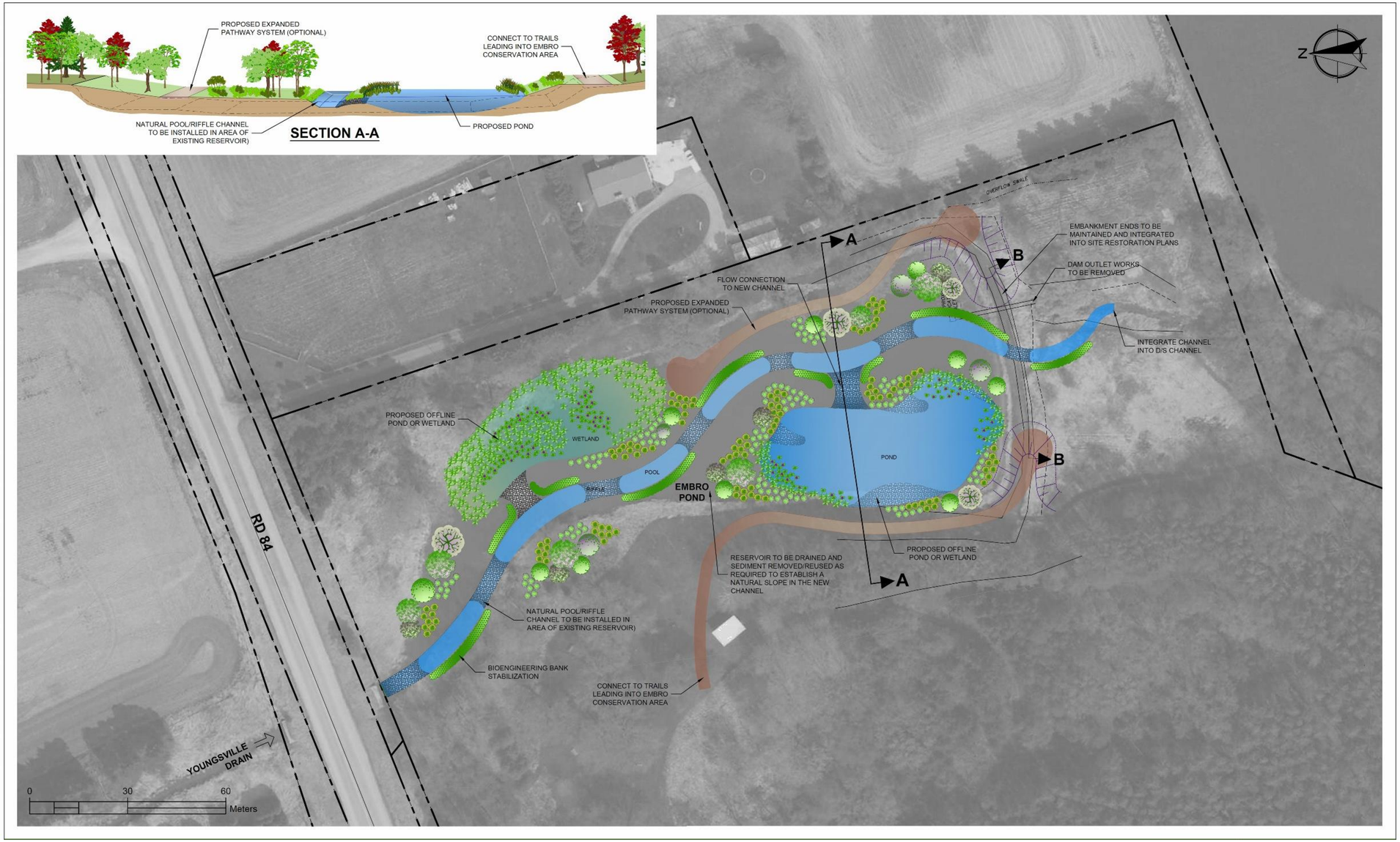
Remove Dam, construct natural channel, provide landscape restoration



Advantages	Disadvantages
Removes risk of dam failure/ flooding	Imposes restoration costs (high)
Minimizes long-term operational costs	Does not reflect existing aesthetic (open water)
Provides recreational and educational potential	Has the risk of impacting shallow wells
Restores area to naturalized conditions and provides diverse fish habitat	Removes pond habitat
Enables sediment transport continuity	
Improves creek water temperature	
Provides access to an additional 2,460 m of channel habitat for downstream fish (e.g., Brook Trout), or approximately 8 times the current fish accessible length (300m) within Youngsville Drain for downstream fish.	

ALTERNATIVE #4 – REMOVE DAM AND CONSTRUCT OFFLINE POND(S) OR WETLAND(S)

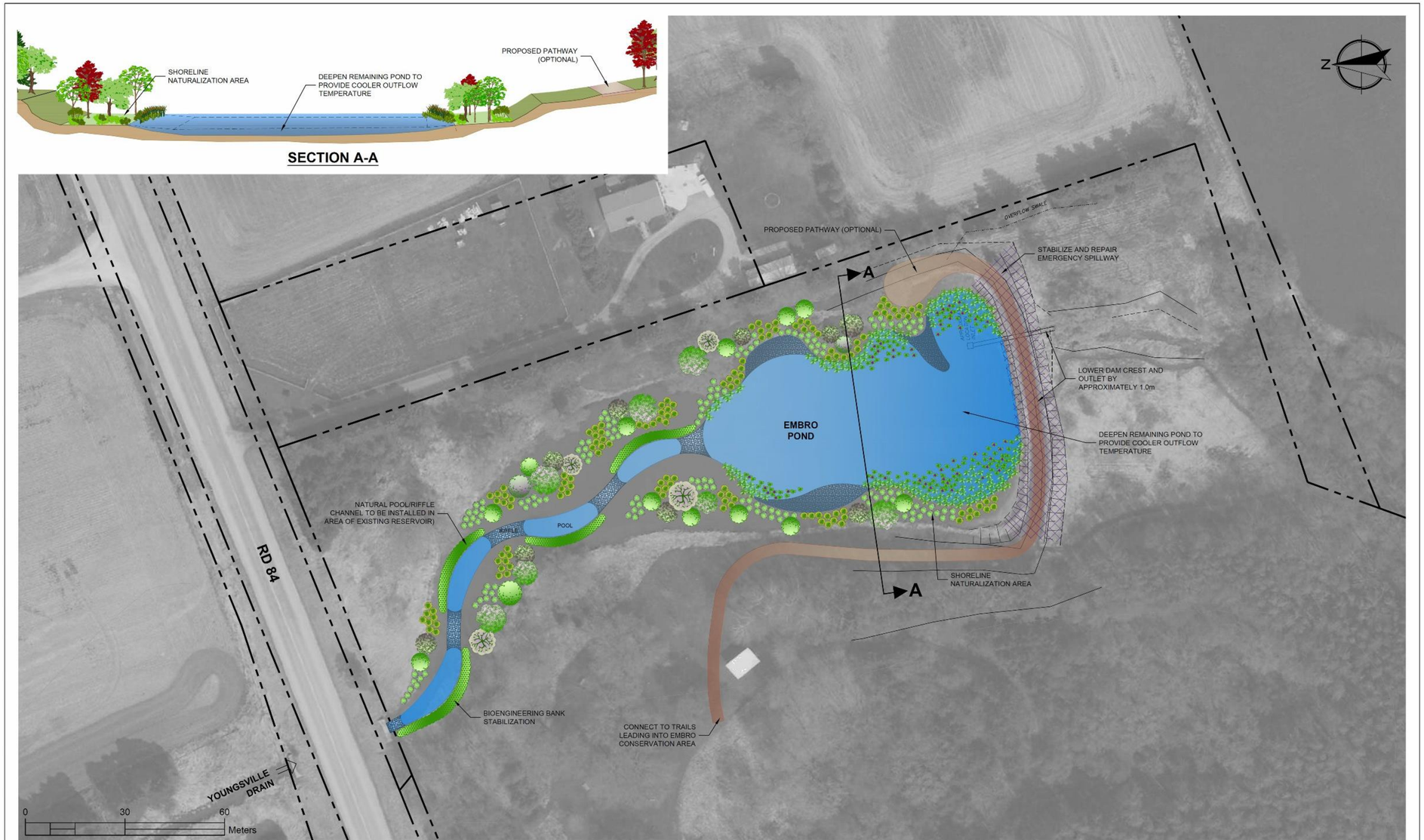
Remove Dam, construct offline pond with less surface area as existing, create natural channel, provide landscaping



Advantages	Disadvantages
Minimizes long-term operational costs	Imposes restoration costs (very high)
Removes risk of dam failure/ flooding	Reduces pond surface area (water views)
Increases diversity in area (visual) and opportunity for educational signage	
Improves creek water temperatures	
Provides open water/pond habitat and diversity of aquatic habitat	
Provides access to an additional 2,460 m of channel habitat for downstream fish (e.g., Brook Trout), or approximately 8 times the current fish accessible length (300m) within Youngsville Drain for downstream fish.	
Enables sediment transport continuity	

ALTERNATIVE #5 – LOWER DAM CREST AND OUTLET AND NATURALIZE NEW POND PERIMETER

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



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

ALTERNATIVE CRITERIA AND EVALUATION

Each option is evaluated based on its technical effectiveness, environmental impact, socio-economic impact, and cost.

This alternative evaluation system ranks the proposed alternatives from least impactful (most preferred) (1) to most impactful (least preferred)(5).

Technical/Engineering	Natural Environment
Flooding Impacts/Enhancement Protection of Infrastructure Constructability Implementability Approvability	Aquatic Habitat Impacts/Enhancement Pond Habitat Impacts/Enhancement Terrestrial Habitat Impacts/Enhancement SAR Impacts/Enhancement Geomorphology/Sediment Transport Groundwater Impacts/Enhancement Water Quality Impacts/Enhancement

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

Scan me for more info!

Next Steps and Contact Information

- **Compile and review feedback from this Public Information Centre**
- **Complete ranking of criteria for each alternative based on updated study findings and public input**
- **Complete Project File report and submit to MECP for review and approval**
- **Establish community liaison committee**
- **Complete technical studies in support of detailed design for the preferred alternative**
- **Obtain regulatory agency approvals**

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

singhs@thamesriver.on.ca

For further information please contact:

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