

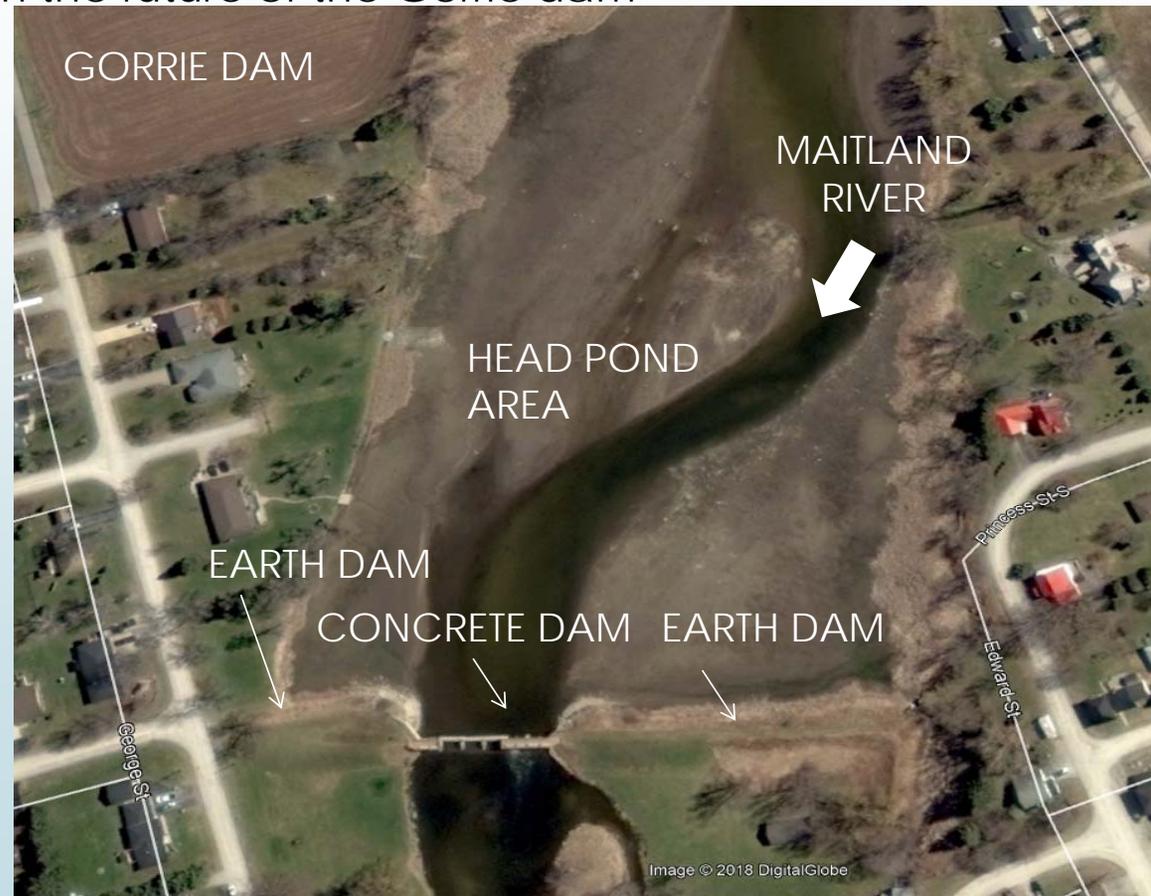
MVCA GORRIE DAM FUTURE PLANS STUDY



Maitland Valley Conservation Authority
19 December 2018 Board Meeting
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Purpose of Presentation

To summarize the key findings of a report prepared which identifies the studies and costs for preparing plans on the future of the Gorrie dam



The Study Scope of Work

1. Collect and review of background information on the dam and head pond.
2. Meet with the MVCA and conduct a site visit.
3. Contact the local MNRF district and regional offices to obtain any additional background information and to confirm LRIA requirements.
4. Review MVCA/Conservation Authority Class EA requirements.
5. Identify goals, objectives, general scope of work for key studies.
6. Prepare concept plan and range of cost for each alternative under consideration.
7. Prepare a draft and final report.

Current Condition of Dam and Head Pond

In June 2017 the emergency spillway at the Gorrie Dam was exceeded damaging the earthen berm and parts of the concrete infrastructure.







The Maitland Valley Conservation Authority (MVCA) is now considering three alternatives for the site:

1. Decommissioning of the current structure
2. Repair the current structure
3. Replacement/redesign of a new structure

Brief History

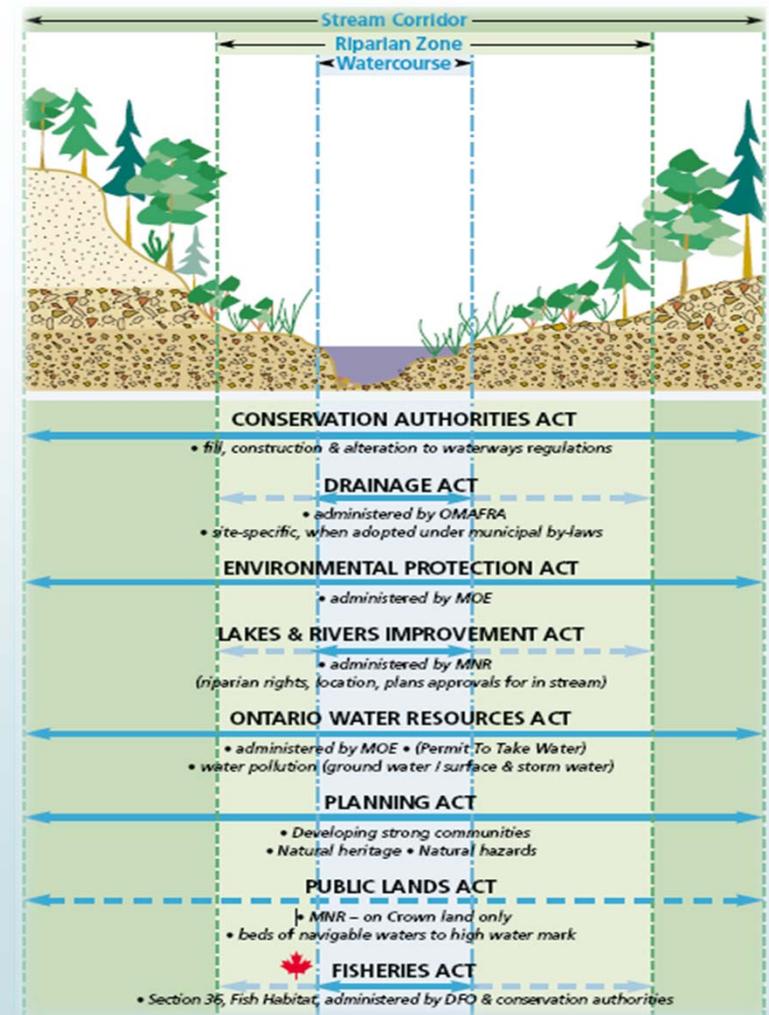
1. The original dam was constructed in 1856, reconstructed in 1867 and rebuilt in 1929.
2. MVCA purchased the mill and dam in 1963.
3. The dam was repaired in 1970.
4. In May 1974 the dam and earth berm were damaged by flood waters.
5. In 1976 and 1977 structural and geotechnical engineers reports were prepared.
6. The engineers report concluded that the existing earth fill dikes and concrete spillway structures have not been constructed with acceptable suitable soils.
7. MNR's engineer concurred with the assessment and stated in their report that: failure of the existing dam was bound to eventually occur again.
8. MVCA decided to undertake bare minimum approach to the repairs with support of MNR in 1979. Estimated cost was \$75,000.
9. Repairs halted in July 1979 due to the engineer identifying serious engineering deficiencies with respect to the southeast wingwall. Revised costs for repair was \$205,000.
10. In 1980-1988 water seepage problems were encountered on south side of earthen berm. In 2016 and 2017 an increase in seepage was noted.
11. In June 2017 the dam was once again overtopped by flood water.

The dam also failed earlier in 1974



Lakes and Rivers Improvement Act (LRIA).

- There are several Acts Which Apply to the Protection and Management of Stream Corridors
- Dams in Ontario are regulated by the province under the Lakes and Rivers Improvement Act (LRIA).
- LRIA provides the Ministry of Natural Resources and Forestry (MNRF) with the legislative authority to govern the design, construction, operation, maintenance and safety of dams in Ontario.



Class Environmental Assessments (Class EAs)

The Ontario Environmental Assessment Act sets out a planning and decision-making process so that potential environmental effects are considered before a project begins.

1. Class Environmental Assessments (Class EAs) apply to routine projects that have predictable and manageable environmental effects.
2. Works at the Gorrie Dam may follow a Class EA process.
3. Two possible Terms of Reference may be used for a Class EA processes including:
 - Conservation Authorities Class EA, and
 - MNRF -Resource Stewardship and Facility Development (RSFD) Class EA.

Which Class EA Process To Use?

The Conservation Authorities Class EA tends to focus on matters related to remediating flooding and erosion problems. The Gorrie dam is not designed as a flood control facility.

Therefore, the Conservation Authorities Class EA Terms of Reference may not be considered one which is entirely suitable for works associated with the decommissioning, restoration and or replacement of a dam and its head pond.

Often the MNRF RSFD Class EA is considered a more suitable process to follow when working around dams. While it is similar in concept to the Conservation Authority Class EA, it tends to better fit the greater concerns and interests of proponents, stakeholders and public.

Studies

To assist with the decision-making process, comply with regulatory requirements for dam safety and address possible environmental effects of the works, several studies must be completed.

The key studies focus on assessing the risks associated with the existing dam and its ability to hold back water and safely convey large flow events.

These studies are typically completed as part of a Dam Safety Review (DSR) which is reviewed by the MNRF under the regulatory requirements of the LRIA.

DSR typically requires the following studies:

- Geotechnical
- Structural, and
- Hydrotechnical (watershed hydrology, and river and dam hydraulics)

Existing and Required Studies

Review of existing information, including a 1974 engineers report, suggests that the dam likely does not meet today's dam safety standards. This would likely still be the case even if the failed section was repaired.

This conclusion would have to be confirmed and defined for MNRF review in terms of the Hazard Potential Classification (HPC) and the Inflow Design Flood (IDF). This requires Hydrotechnical Study.

Should the dam be confirmed not to meet current standards, the repair to the dam will likely be significant and approach the cost for constructing an entirely new dam.

Hazard Potential Classification (HPC)

The HPC assigned to a dam is a measure of the greatest incremental losses that could result from the uncontrolled release of water or stored contents behind a dam due to the failure of the dam or its appurtenances based on the worst-case but realistic failure condition (MNR, 2011).

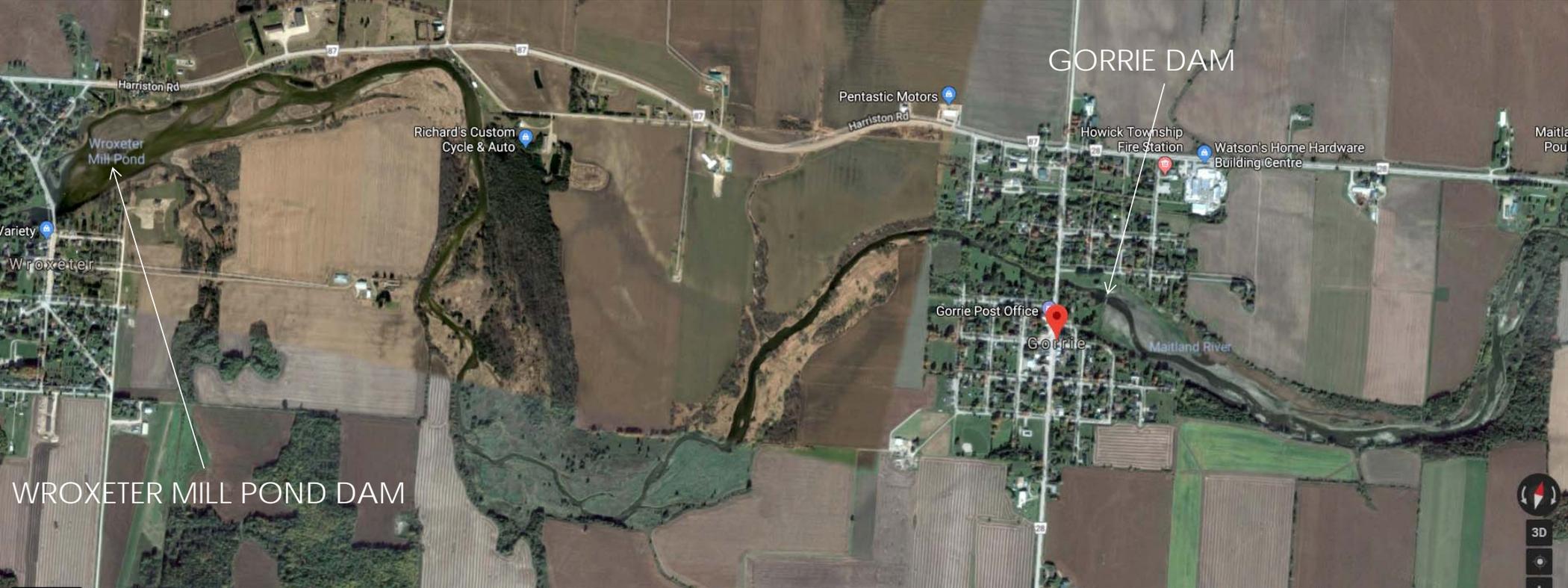
HPC are defined as Low, moderate, High, and Very High.

Inflow Design Flood (IDF).

The IDF is defined as the flood flow above which any incremental increase in water surface elevation downstream due to failure or mis-operation of the dam is no longer considered to present additional downstream threat to loss of life, property damage, or adverse environmental impacts.

For example, if the dam is defined as having a “Low” HPC the minimum acceptable IDF is a flow event somewhere between Regional Flood and half of the Probable Maximum Flood (PMF).

Flood Risk Area



Other Studies

The level of study to assess the condition of the existing dam may not be too significant.

Other studies will be required to assist in the decision making process. These studies are typically completed as part of the Class EA process. These studies will examine the net negative impacts associated with the following:

- Natural Environmental Considerations
- Land Use, Resource Management Considerations
- Social, Cultural and Economic Considerations
- Aboriginal Communities Considerations

How Much Study is Required?

Should the preference or decision be made to rebuild or construct a new dam, then a detailed level of study would be required to ensure the works meet current regulations and environmental standards.

If dam removal is the preferred course of action, then less study would be required. This in part is due to the most significant concerns associated with possible dam failure have already occurred. Even with the dam in its current breached state, some study is required, as the remaining dam, as defined by the LRIA, still presents a risk to public safety and a hazard to private and public property.

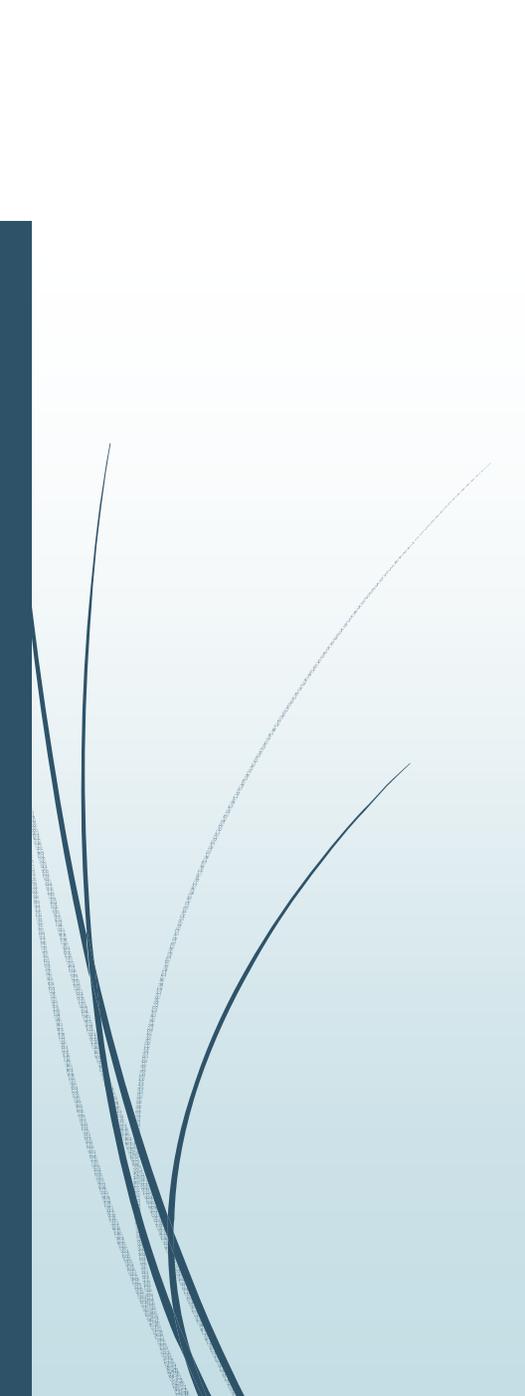
Currently, the most contentious issues at the Gorrie dam appear to be associated with the social, cultural and economic considerations associated with the dam.

Table 1: Gorrie Dam Cost Estimate for Studies and Implementation of Options

STUDIES	Relative Priority	REMOVAL			REPAIR			REPLACE		
		Scope of Work	Cost		Scope of Work	Cost		Scope of Work	Cost	
			Low	High		Low	High		Low	High
LRIA - Dam Safety - Plans and Specifications Approval										
Geotechnical Investigations	Must do as part of a Dam Safety Review	Limited Work Required. May need to know the soil characteristics for offsite disposal	\$ -	\$ 10,000	Earthen dam soil properties, dam seepage, slope stability etc. Existing data suggests poor soils for earth dam and foundation soils.	\$ 15,000	\$ 25,000	Soil in earthen dam, foundation soils for structures several locations, dam seepage, slope stability	\$ 15,000	\$ 30,000
Dam Structural Assessments	Must do as part of a Dam Safety Review	Limited Work Required. May need to know dam structural design and materials for demolition purposes and offsite disposal.	\$ -	\$ 5,000	Integrity of existing structure, expected remaining life span, sluiceway, spillway, operational controls. Need to assess alternatives for an additional structure etc. Excludes detail design.	\$ 15,000	\$ 30,000	Limited Work Required for demolition of the existing structure. Need to assess alternatives for a new dam, sluiceway, spillway, operational controls etc. Excludes detail design.	\$ 5,000	\$ 15,000
Dam Operations, Review Records, Historical and Future Requirements	Must do as part of a Dam Safety Review	Limited or Not Required	\$ -	\$ 5,000	Historical use(s), past failures, accidents need to be assessed	\$ 5,000	\$ 10,000	Historical use(s), past failures, accidents need to be assessed for design of new dam	\$ 5,000	\$ 15,000
Watershed Hydrology	Must do as part of a Dam Safety Review	Limited assessment may be required. Primarily required to determine the HPC for the dam and for water and flood risk management during period of dam removal.	\$ 10,000	\$ 15,000	Detailed assessment required. Flood hazard flows including return period events, regulatory flood, historical flood, maximum probable flood, inflow design flood. For environmental considerations base flows, minimum environmental flow, bankfull flow	\$ 20,000	\$ 30,000	Detailed assessment required. Flood hazard flows including return period events, regulatory flood, historical flood, maximum probable flood, inflow design flood. For environmental considerations base flows, minimum environmental flow, bankfull flow	\$ 20,000	\$ 30,000
River and Dam Hydraulics	Must do as part of a Dam Safety Review	Limited assessment may be required. Primarily required to determine DF and HPC for the dam and for water and flood risk management during period of dam removal.	\$ 10,000	\$ 15,000	Water levels and flood risks required for return period events, regulatory flood, historical flood, maximum probable flood, inflow design flood. Dam break analysis shown separately. Operational review of existing flow control structures including sluiceways, spillways, water taking. Determine the DF and HPC. Requires prior completion of Watershed Hydrology Study.	\$ 20,000	\$ 30,000	Water levels and flood risks required for return period events, regulatory flood, historical flood, maximum probable flood, inflow design flood. Dam break analysis shown separately. Operational review of proposed flow control structures including sluiceways, spillways, water taking. Determine the DF and HPC. Requires prior completion of Watershed Hydrology Study.	\$ 20,000	\$ 30,000
Dam Break Analysis and Hazard Potential Classification	Must do as part of a Dam Safety Review	Dam break analysis likely not required or at most a qualitative assessment. HPC required.	\$ -	\$ 5,000	Detailed hydraulic analysis for various flood events. Must include cascade dam failure analyses due to dam in Wrooster. Requires prior completion of River and Dam Hydraulics Study.	\$ 10,000	\$ 15,000	Detailed hydraulic analysis for various flood events. Must include cascade dam failure analyses due to dam in Wrooster. Requires prior completion of River and Dam Hydraulics Study.	\$ 10,000	\$ 15,000
LRIA - Location Approval										
New Dam Location Study	Only Required if a new dam location is under consideration	Not Required	\$ -	\$ -	Not Required	\$ -	\$ -	LRIA requires a separate study to obtain approvals for the location of a new dam. Follows MNRF R6FD - Class EA	\$ 47,000	\$ 110,000
Class EA/Environmental Studies										
Fluvial Geomorphology Study	Good to complete the Class EA process	Limited Work Required. May need to know impacts to downstream and upstream channel stability due to changes in hydrology and sediment transport.	\$ -	\$ 5,000	Limited Work Required. Need to assess impacts existing and additional flow control structure will have to channel stability. Need to know impacts to downstream and upstream channel stability due to changes in hydrology and sediment transport.	\$ 5,000	\$ 10,000	Completed as part of New Dam Location Study		
Aquatic Resources and Fish Habitat Study	Good to complete the Class EA process	Conservation of fish habitat and fish migration and passage. Federal Fisheries Act	\$ -	\$ 5,000	Conservation of fish habitat and fish migration and passage. Federal Fisheries Act. Update migratory fish passage procedures for additional flow control structure.	\$ 5,000	\$ 10,000	Completed as part of New Dam Location Study		
Water Quality Study	Good to complete the Class EA process	All water quality criteria, as established by the Ministry of the Environment for the protection of fish and other aquatic life should be met in a lake or river at the location of a dam both during and after construction. Limited or Not Required	\$ -	\$ -	All water quality criteria, as established by the Ministry of the Environment for the protection of fish and other aquatic life should be met in a lake or river at the location of a dam both during and after construction.	\$ -	\$ 5,000	Completed as part of New Dam Location Study		
Head Pond Bathymetry, Sediment Quantity and Quality Study	Good to complete the Class EA process	Limited Work Required. May need to know sediment load, quantity and quality that remains to be flushed over time.	\$ 5,000	\$ 10,000	May need to know what potential sediment load will be captured by the head pond long term operational purposes.	\$ 10,000	\$ 15,000	Completed as part of New Dam Location Study		
Wildlife Habitat	Good to complete the Class EA process	Howick Official Plan identifies valley lands and Part of Natural Heritage system for its wildlife habitat. Considerations required for the protection of wildlife that depends on lakes, rivers, and adjoining wetlands. Special consideration required for valuable, threatened or endangered species.	\$ -	\$ 5,000	Howick Official Plan identifies valley lands and Part of Natural Heritage system for its wildlife habitat. Considerations required for the protection of wildlife that depends on lakes, rivers, and adjoining wetlands. Special consideration required for valuable, threatened or endangered species.	\$ -	\$ 5,000	Completed as part of New Dam Location Study		
Natural Heritage Wetlands Study	Good to complete the Class EA process	The Howick Official Plan has identified no provincially significant wetlands or wetlands of local significance at the Gorrie dam pond. It does recognize that there are natural features including wetlands that border the head pond. Assess impacts to boarder wetlands.	\$ -	\$ 5,000	The Howick Official Plan has identified no provincially significant wetlands or wetlands of local significance at the Gorrie dam pond. It does recognize that there are natural features including wetlands that border the head pond. Assess impacts to boarder wetlands.	\$ 5,000	\$ 10,000	Completed as part of New Dam Location Study		
Historical and Archeological Study	Good to complete the Class EA process	Should consider due to the historical uses of the area.	\$ -	\$ 5,000	Should consider due to the historical uses of the area	\$ -	\$ 5,000	Completed as part of New Dam Location Study		
Fill, Construction and Alteration of Waterways	Good to complete the Class EA process	Ontario Regulation 164/06 (Development, Interference with Wetlands and Alterations to Shorelines and Watercourse Regulation, Update regulatory flood plain with dam removal)	\$ -	\$ 5,000	Ontario Regulation 164/06 (Development, Interference with Wetlands and Alterations to Shorelines and Watercourse Regulation, Update regulatory flood plain with restored modified dam.	\$ -	\$ 5,000	Completed as part of New Dam Location Study		
Water Taking and Water Power Study	Good to complete the Class EA process	Full assessment of the impacts for temporary and or permanent water taking including power generation must be studied. Water taking subject to authorization by permit from the Ministry of the Environment (MEECC).	\$ -	\$ -	Full assessment of the impacts for temporary and or permanent water taking including power generation must be studied. Water taking subject to authorization by permit from the Ministry of the Environment (MEECC).	\$ 5,000	\$ 10,000	Completed as part of New Dam Location Study		
Navigable Waters Study	Good to complete the Class EA process	The Navigable Waters Protection Program (NWPP) approval requirements of DFO/CCG.	\$ -	\$ 5,000	The Navigable Waters Protection Program (NWPP) approval requirements of DFO/CCG.	\$ 5,000	\$ 10,000	Completed as part of New Dam Location Study		
Aboriginal Communities Consultation	Must do	Consult with Aboriginal Communities	\$ 2,000	\$ 5,000	Consult with Aboriginal Communities	\$ 2,000	\$ 5,000	Completed as part of New Dam Location Study		
Public Consultation	Must do	Managed by MVCA	\$ 5,000	\$ 10,000	Managed by MVCA + third party consultant (optional)	\$ 10,000	\$ 20,000	Managed by MVCA + third party consultant (optional)	\$ 20,000	\$ 30,000
SUBTOTALS										
Technical Studies	Essential to obtain LRIA Approvals		\$ 20,000	\$ 55,000		\$ 85,000	\$ 140,000		\$ 122,000	\$ 245,000
Environmental / Class EA Studies	Good to complete the Class EA process some mandatory tasks		\$ 12,000	\$ 60,000		\$ 47,000	\$ 110,000		\$ 20,000	\$ 30,000
All Studies			\$ 32,000	\$ 115,000		\$ 132,000	\$ 250,000		\$ 142,000	\$ 275,000
Engineering Design		Detail design, permitting and inspection. Will include design drawings, design brief, water and sediment management plan. Excludes construction inspection and contract administration	\$ 23,000	\$ 45,000		\$ 66,000	\$ 104,000		\$ 120,000	\$ 180,000
Capital Costs		Mob and Demob, Water Management, ESC, earthworks, concrete removal and disposal, channel and floodplain restoration	\$ 380,000	\$ 750,000	Mob and Demob, Water Management, ESC, existing earth dam reconstruction, additional concrete dam, site restoration, optional new fish passage facilities and footbridge	\$ 1,100,000	\$ 1,720,000		\$ 2,000,000	\$ 3,000,000
TOTAL COST			\$ 435,000	\$ 910,000		\$ 1,298,000	\$ 2,074,000		\$ 2,262,000	\$ 3,455,000

Table A: Cost Estimate of Dam Alternatives

OPTIONS	COSTS (\$1000)		
	Studies	Implementation (Engineering & Construction)	Total
Decommissioning of the current structure	32 - 115	380 – 750	435 – 910
Repair the current structure	132 - 250	1,100 - 1,720	1,300 - 2,074
Replacement/redesign of a new structure	142 - 275	2,000 - 3,000	2,260 – 3,455



This Study has not examined the “Do nothing” option. This option would have to be examined as part of the Class EA process.

The cost presented also do not represent the full life-cycle costs associated with the dam (i.e. long-term operations and maintenance).

Other cost not included are those associated with potential accidents (insurances) or a future dam failure or changes, in property values, if any (increase and / or decreases).