

## **Appendix C      Environmental Inventory / Existing Conditions**



# **Fullarton Dam Environmental Assessment Natural Heritage Baseline Existing Conditions Report**

March 16, 2023

Prepared for:  
UTRCA

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## Limitations and Sign-off

The conclusions in the Report titled Fullarton Dam Environmental Assessment - Natural Heritage Baseline Existing Conditions Report are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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# 1 Introduction

Stantec Consulting Ltd was retained by the Upper Thames Region Conservation Authority (UTRCA) to conduct an Environmental Assessment (EA) for the Fullarton Dam and reservoir at the Fullarton Conservation Area (the Project). The Fullarton Conservation Area (the Project Location) is in the Municipality of West Perth, Fullarton, Ontario.

The EA is being conducted to support long-term planning for the Fullarton Dam. As part of the initial phases of the EA, this report was prepared to provide a baseline characterization of natural heritage conditions for the Project Location plus Adjacent Lands within 120 m, collectively known as the Study Area.

The natural heritage baseline existing conditions assessment was completed through a review of background natural heritage data from technical reports, online databases, provincial wildlife atlases, and species at risk mapping sources. A site visit was also conducted to provide a reconnaissance-level confirmation of site context for the Project.

Background information, including designated natural heritage features, rare species, Species at Risk (SAR) and their habitats, fish communities and fish habitat within the Study Area was collected and reviewed to characterize the baseline conditions. The assessment of baseline conditions will then inform the development and evaluation of alternatives in the EA. Additionally, the assessment identifies data gaps that may need to be addressed as part of the EA or as part of a future design.

The alternative solutions to be developed and evaluated as part of the EA are anticipated to include options related to maintaining the dam or removing all or a portion of the dam combined with restoring the unnamed watercourse at the project site. The EA will evaluate the impacts and opportunities of alternatives, including the impacts of maintenance versus removal with respect to ecology and overall project costs, habitat considerations for the unnamed watercourse and the reservoir (e.g. snapping turtles), fish passage, and use of the conservation area by local residents. Other considerations, such as physical conditions and historical significance (e.g. archaeology) will also inform the evaluation of alternatives.

Under the Lakes and Rivers Improvement Act (2017), any contemplated dam reconstruction or modification requires an EA of the dam and surrounding areas. The EA will evaluate opportunities, impacts, and mitigation measures related to alternative solutions evaluated.

This report provides a summary of the natural heritage baseline existing conditions for the Study Area.

## 1.1 Background

Fullarton Conservation Area is a 34-hectare area used recreationally for hiking, fishing, canoeing, and picnicking. There are trails in the Fullarton Conservation Area that allow for day trips through the wetland and around the pond or through a mixed deciduous and pine wood forest. Two baseball diamonds are located on the northwest portion of the Fullarton Conservation Area and they are part of the Fullarton Centennial Park that opened on June 25, 1966.



An unnamed watercourse runs through the Fullarton Conservation Area and provides potential coldwater habitat (UTRCA 2017a). The dam blocks fish passage to upstream reaches of the unnamed watercourse.

The Fullarton Dam is an earth dam that was installed on the unnamed watercourse in the 1950s to create a recreational lake/reservoir. This reservoir has an area of approximately 2.5 hectares. The earth dam structure is 110 m long with a crest width of approximately 6 m. There is 2.5 m of head between the reservoir and the downstream unnamed watercourse under low flow conditions. Dam maintenance is the responsibility of the Municipality of West Perth.

## 1.2 Baseline Data Sources

The natural heritage baseline characterization is based on a site assessment conducted by Stantec on January 11, 2023, project discussions with the UTRCA and Municipality of West Perth, and multiple background data sources available for the site. Table 1 summarizes the background data available and reviewed as part of this baseline existing conditions report.

**Table 1 Baseline Characterization Data Sources**

Data Type	Source
Field Data	Stantec Field Visit (2023)
UTRCA Data, Reports, Online Data and Provincial Wildlife Atlas's	<ul style="list-style-type: none"> <li>• Fullarton Dam and Conservation Area, Existing Environmental Conditions Report (UTRCA 2017a)</li> <li>• 2017 Watershed Report Card – Fullarton (UTRCA 2017b)</li> <li>• 2022 Watershed Report Card – Fullarton (UTRCA 2022)</li> <li>• The Natural Heritage Information Centre (NHIC) (MNRF 2023a)</li> <li>• Land Information Ontario (LIO) (MNRF 2023b)</li> <li>• Fisheries and Oceans Canada (DFO) Aquatic Species at Risk Map (DFO 2023)</li> <li>• Ontario Reptile and Amphibian Atlas (ORAA) (Ontario Nature 2019)</li> <li>• Species at Risk in Ontario (SARO) List (MECP 2023)</li> <li>• Ontario Breeding Bird Atlas (OBBA) (Cadman et al. 2007)</li> <li>• Ontario Butterfly Atlas (OBA) (Toronto Entomologists' Association 2023a)</li> <li>• Ontario Moth Atlas (OMA) (Toronto Entomologists' Association 2023b)</li> <li>• eBird Online Database (eBird 2023)</li> <li>• iNaturalist Online Observations (iNaturalist 2023)</li> </ul>

## 2 Field Observations

A site meeting was held with representatives from UTRCA, the Municipality of West Perth and Stantec on January 11, 2023. A brief site tour of the reservoir and a reach of the unnamed watercourse upstream of the reservoir was undertaken as part of the meeting. Following the meeting, Stantec staff walked a portion of the unnamed watercourse downstream of the reservoir.

The reservoir is established by the earth dam that is largely manicured. The reservoir level is controlled by discharge through a rectangular concrete drop-inlet structure covered by a trash rack on the upstream



side of the dam that outlet through an 800 mm diameter concrete outlet pipe into the channel downstream of the dam.

Upstream of the reservoir, natural channel conditions in the unnamed watercourse include a wetted width of 1 to 1.5m within a bankfull width of 3 to 4 m. The overall flow pattern was a flat with pools and riffles also occurring, and substrates were primarily silt with scattered gravel and cobble patches. The surrounding riparian zone consisted of wetland roughly coincident with the meander belt as a corridor through mixed forest.

Downstream of the reservoir, the creek exhibits riffle-pool morphology with changing wetted width and bankfull dimensions depending on the location between the reservoir and the North Thames River. Flow morphology is influenced by local topography associated with the slope down to the floodplain of the North Thames River, and flattens out as the channel enters the floodplain and eventually is influenced by the water levels of the North Thames River.

Except for crossings by Perth Road 163 and 163a Road, the unnamed watercourse and the reservoir are within a corridor of well-established natural vegetation with minimal encroachment or disturbance.

A photo log of representative morphology and habitat conditions is provided in the Appendix B of the Baseline Geomorphic Characterization Report (Stantec 2023) prepared under separate cover.

## **3 Existing Conditions**

The UTRCA (2017a) Existing Environmental Conditions draft report for the Fullarton Conservation Area provided the majority of the background data for this assessment and was comprehensive in its documentation of natural heritage features and ecology in the Project Location. The majority of the data collected and findings in the UTRCA (2017a) study are sufficient to assess impacts in the EA. Details of flora and fauna species lists known to occur in the Study Area can be found in the UTRCA (2017a) report. The following sections provide a summary of the natural heritage features and functions studied by the UTRCA with supplemental information obtained through other background data sources.

### **3.1 Natural Heritage Features**

Three natural heritage features were documented in the background data review including the North Thames River, a Mixed Wader Nesting Colony and the Fullarton Moraine (MNR 2023a).

Within the Study Area, the North Thames River flows through the Fullarton Corridor watershed (UTRCA 2017b, UTRCA 2022). The watershed is known to support 48 species of fish, and 13 species of freshwater mussels (UTRCA 2017b, UTRCA 2022). Natural vegetation cover represents only 12.2% of the land in the watershed. The North Thames River (as a tributary to the Thames River) is a priority Canadian watershed and the watershed is benefitting from conservation efforts but more is needed to improve natural habitat in the watershed (UTRCA 2017b, UTRCA 2022).

The Mixed Wader Nesting Colony is assumed to be associated with a wetland called the Motherwell Blue Heron Swamp which is located in the Fullarton Corridor watershed (UTRCA 2017b, UTRCA 2022).



Colonial bird nesting was not documented in the UTRCA (2017a) study and is assumed to be absent from the Study Area.

The Fullarton Moraine (glacial till deposit) is an Earth Science Areas of Natural and Scientific Interest (ANSI) and is present within the entire Study Area (MNR 2023a).

## **3.2 Terrestrial Ecology**

### **3.2.1 Vegetation**

The UTRCA completed ecological land classification (ELC) of the Fullarton Conservation Area and identified five vegetation communities (cultural woodland, coniferous plantations, shallow marsh and cultural meadow (2017c). Three-season botanical surveys documented a diverse plant community of 228 species, of which 36% are non-native. White water buttercup (*Ranunculus trichophyllus*) is abundant and the dominant aquatic plant in the reservoir. One rare plant, the Shining-branch Hawthorn (*Crataegus magniflora*), is known to occur in the geographical area, however, rare or SAR plants were not documented during UTRCA botanical surveys.

### **3.2.2 Birds**

Forty-three (43) bird species were documented in the Project Location as incidental wildlife observations during the UTRCA (2017a) study, including two species listed as Special Concern under the *Endangered Species Act* (ESA), the Bald Eagle (*Haliaeetus leucocephalus*) and Barn Swallow (*Hirundo rustica*) (UTRCA 2017a). Nesting was not observed for either species in the Fullarton Conservation Area.

Common waterfowl species including Canada Goose (*Branta canadensis*) and Mallard (*Anas platyrhynchos*) were documented in the reservoir occasionally, and were observed to be feeding, resting, breeding and rearing young. None of the documented birds exclusively rely on ponds or wetlands as these species also utilize streams, rivers and wetlands (UTRCA 2017a). Canada Geese were also noted during the January 11, 2023 site meeting.

Six other bird SAR are known to occur in the geographical area, including Bobolink (*Dolichonyx oryzivorus*), Canada Warbler (*Cardellina canadensis*), Eastern Meadowlark (*Sturnella magna*), Eastern Wood-Pewee (*Contopus virens*), Least Bittern (*Ixobrychus exilis*) (Cadman 2007), and Wood Thrush (*Hylocichla mustelina*) (Cadman 2007, UTRCA 2022), however, only one species of SAR bird could potentially be impacted by the proposed dam decommissioning: the Least Bittern.

The Least Bittern is listed as Threatened under the ESA. Threatened species receive individual and habitat protection under the *Act*. The Least Bittern nests in dense vegetation above marsh water, hidden amongst cattails and often near open water, which is used for foraging (MECP 2022). The reservoir and associated marsh wetland habitat may provide suitable conditions for the Least Bittern. Surveys targeting marsh breeding birds were not undertaken in the UTRCA (2017a) study.

The documented bird community confirmed the wetland habitat associated with the reservoir provides Significant Wildlife Habitat (SWH): *Marsh Breeding Bird Habitat* (MNR 2015) signified by the documentation of nesting Green Heron (*Butorides virescens*) by UTRCA (2017a).



### 3.2.3 Herptiles

Six species of herptiles (reptiles and amphibians) were documented as incidental wildlife observations in the Project Location (UTRCA 2017a), including Snapping Turtle (*Chelydra serpentina*) which was observed in the reservoir (iNaturalist 2023, UTRCA 2017a). The Snapping Turtle is listed as Special Concern under the *Endangered Species Act* (ESA). The observed herptile community confirmed the reservoir provides three types of SWH (MNR 2015) for herptiles including:

- *Amphibian Breeding Habitat (Wetlands)* signified by American Bullfrog (*Lithobates catesbeianus*) and Red-spotted Newt (*Notophthalmus viridescens viridescens*) were documented in the reservoir and;
- *Turtle Wintering Area and Special Concern and Rare Wildlife Species* signified by Snapping Turtle documentation in the reservoir.

### 3.2.4 Mammals

Five species of mammal were documented in the Project Location by the UTRCA (UTRCA 2017a). All are common species in Ontario. American Mink (*Neovison vison*) is also documented to occur in the reservoir (iNaturalist 2023). Four bat SAR occur in the geographical area including Eastern Small-footed Bat (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tricoloured Bat (*Perimyotis subflavus*). These bats will use large trees with cavities, cracks, peeling bark, open canopy and other features for maternity roosting. Tree assessment for bat maternity roost suitability was not completed by the UTRCA (2017a).

### 3.2.5 Insects

Seven species of butterfly were documented in the Project Location by the UTRCA (2017a), of which one is listed as Special Concern under the ESA: the Monarch (*Danaus plexippus*). No other rare or SAR insects were documented in the background data review.

## 3.3 Aquatic Ecology

The unnamed watercourse has a permanent flow regime (MNR 2023b). Fish community sampling completed by the UTRCA (2017a) documented a diverse fish community in the unnamed watercourse, especially downstream from the Fullarton Dam reservoir.

Fish sampling upstream of the dam documented nine species of fish including Mottled Sculpin (*Cottus bairdii*). Mottled Sculpin are indicators of coldwater with preferred water temperature of 13-18 °C (Eakins 2023) indicating the unnamed watercourse provides coolwater / coldwater conditions (UTRCA 2017a). Seven species of fish were documented in the reservoir, all of which are tolerant of warm water and pond habitat. Thirty-four species of fish were collected downstream of the reservoir including various trophic levels from baitfish to predators including Northern Pike (*Esox lucius*).

Mottled Sculpin were also collected downstream from the reservoir (UTRCA 2017a), however, the reservoir creates a warming effect to the unnamed watercourse resulting in higher average water temperatures and greater water temperature fluctuation downstream from the Fullarton Dam when



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compared to upstream of the dam (UTRCA 2017a). The presence of Mottled Sculpin downstream of the dam suggests that there are groundwater upwellings in the unnamed watercourse downstream of the dam that provide coldwater microhabitat for the species.

From June to September 2015 and June to July 2016, continuous water temperature data was collected in the unnamed watercourse by the UTRCA (2017a) upstream and downstream of the Fullarton Dam. The data show that the unnamed watercourse water temperature upstream of the dam is consistently cooler than downstream. In 2015, water temperature in the unnamed watercourse upstream of the dam was up to 2.3°C cooler than downstream. And in 2016, water temperature was 4 to 7°C cooler upstream than downstream of the dam.

Benthic sampling was completed by the UTRCA (2017a) in the unnamed watercourse upstream and downstream of Fullarton Dam. The benthic community was analyzed with a Family Biotic Index (FBI) which provided an indication of water quality in the unnamed watercourse at the sampling locations. In both sampling locations and for each sampling event (five sample events from 1998 through 2016), the FBI indicated water quality was “Fairly Poor” in the unnamed watercourse.

The Northern Sunfish (*Lepomis peltastes*) is known to occur in the unnamed watercourse and the Fullarton Dam reservoir (UTRCA 2017a, DFO 2022, iNaturalist 2023), and is listed as Special Concern under the *Species at Risk Act* (SARA) and the ESA. Within the Study Area the North Thames River is known to support five aquatic SAR and critical habitat for two of those species (DFO 2022) (Table 2). Habitat and individual protection is given to Threatened aquatic species listed under the SARA and the ESA.



**Table 2 Aquatic Species at Risk Known to Occur in the Study Area**

Common Name	Scientific Name	Animal Group	SARA Status	ESA Status
Black Redhorse*	Moxostoma duquesnei	Fish	Threatened	Threatened
Northern Sunfish	Lepomis peltastes	Fish	Special Concern	Special Concern
Silver Shiner*	Notropis photogenis	Fish	Threatened	Threatened
Rainbow	Villosa iris	Mussel	Special Concern	Special Concern
Wavy-rayed Lampmussel	Lampsilis fasciola	Mussel	Special Concern	Threatened

Notes

\* Indicates critical habitat under the SARA and ESA

SARA: *Species at Risk Act*

ESA: *Endangered Species Act*

Critical habitat for the Silver Shiner under the SARA (DFO 2022b) is defined as “the entire bankfull channel width, the meander belt width, and the riparian vegetation within it and associated 30 m of riparian vegetation extending from the meander belt width”, whereas the ESA (MECP 2017) categorizes general habitat for Silver Shiner into Categories 1 (in-channel), 2 (nearshore habitats), and 3 (floodplains and riparian areas). Following these habitat descriptions, it is estimated that the critical habitat for the Silver Shiner include all riparian area of the North Thames River beginning approximately 230 m downstream from the Fullarton Dam.

## 4 Recommendations

The existing background data and in particular, the existing conditions report prepared by UTRCA (2017a) provide a considerable amount of natural heritage information to support the EA process. The following studies are recommended to supplement the existing information for the EA, particularly for analyzing alternatives and subsequent development of a preferred design:

- Two breeding bird surveys (one in each May and June) with focus on the reservoir/wetland. Include call playback for marsh breeding birds with a focus on Least Bittern
- Vegetation community types will be confirmed while onsite during the breeding bird surveys. If vegetation communities have changed, the ELC will be updated.
- One survey (in August) to document aquatic plant community in the reservoir as recommended in the UTRCA (2017a) study.
- Identification of the proximity of Silver Shiner critical habitat in the North Thames River riparian area to determine if dam decommissioning activity would occur within critical habitat for the species.



## **5 Conclusion**

Stantec conducted a natural heritage baseline existing conditions assessment of the Fullarton Conservation Area Study Area in the Municipality of West Perth, Ontario. This baseline assessment was conducted as part of the initial phases of an EA to support long-term planning for the Fullarton Dam. In subsequent phases, the EA is expected to develop and evaluate alternative options related to the future of the dam and management of the unnamed watercourse catchment area through the Conservation Area.

The baseline assessment was developed based on multi-discipline site visits and a review of background data, technical reports and online databases available for the Study Area. The assessment identifies the known natural heritage features, flora and fauna communities, significant wildlife habitat and rare species / species at risk occurrences and habitat at the Fullarton Conservation Area. Some additional field surveys and SAR habitat mapping are identified to supplement the previous UTRCA (2017a) work and provide additional information for the evaluation of alternatives in the EA and to support future management recommendations.



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UTRCA [Upper Thames River Conservation Authority]. 2022. Fullarton 2022 Watershed Report Card.



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**Reference: Fullarton Dam EA – Natural Heritage Baseline Existing Conditions Report Addendum**

### **Introduction**

Stantec Consulting Ltd was retained by the Upper Thames River Conservation Authority (UTRCA) to conduct an Environmental Assessment (EA) for the Fullarton Dam and reservoir at the Fullarton Conservation Area (the Project). The Fullarton Conservation Area (the Project Location) is in the Municipality of West Perth, located approximately 1.5 kilometers south of the village of Fullarton, Ontario.

As part of the EA, a Natural Heritage Baseline Existing Conditions assessment was completed through a review of background natural heritage data from technical reports, online databases, provincial wildlife atlases, and species at risk (SAR) mapping sources. A site visit was also conducted to provide a reconnaissance-level confirmation of site context for the Project. The assessment of baseline conditions was completed to inform the development and evaluation of alternatives in the EA. Also, as part of the EA, a Data Gap Analysis (DGA) was conducted to identify gaps in existing data that may need to be addressed as part of the EA or as part of a future design. Additional surveys were recommended to obtain additional or confirmatory data that would provide additional information for the evaluation of alternatives in the EA and to support future management recommendations, as follows:

- Two breeding bird surveys with a focus on the reservoir/wetland, with surveys to include call playback for marsh breeding birds with a focus on Least Bittern (threatened in Ontario)
- Vegetation community types to be confirmed, and if vegetation communities have changed, the ELC would be updated.

This Addendum memo documents the results of the additional recommended field studies undertaken since the completion of the Natural Heritage Baseline Existing Conditions Report (Stantec 2023) in March 2023.

**Reference: Fullarton Dam EA – Natural Heritage Baseline Existing Conditions Report Addendum**

## **Additional Studies**

As part of the DGA, ecological land classification (ELC) confirmation, breeding bird surveys and targeted surveys for Least Bittern were completed on June 22 and July 5, 2023, by Kayla Ellis of Stantec.

## **ELC Confirmation**

Previously in 2015, the UTRCA completed ELC of the Fullarton Conservation Area as part of an assessment for an Existing Environmental Conditions report prepared in 2016. The ELC assessment identified five vegetation communities (cultural woodland, coniferous plantations, shallow marsh, shallow aquatic, and cultural meadow; UTRCA 2016). Field survey data for impact assessments are typically considered out of date after 5 years. As the UTRCA ELC data is now eight years old, the ELC communities were reviewed in 2023 to determine if any changes had occurred since 2015.

The 2023 results demonstrated that the previous ELC analysis remains valid. However, it should be noted that an inclusion of Reed-canary Grass Graminoid Mineral Meadow Marsh Type (MAM2-2) is located within the cultural woodland that was identified on Figure 1 of UTRCA's findings report (2016). The perimeter of the MAM2-2 community aligns with the Ecologically Important Meadow layer on Figure 2 of UTRCA's findings report (2016). This community has been highlighted as an inclusion on **Figure 1, Appendix A**.

## **Breeding Birds**

In 2015, UTRCA also undertook breeding bird surveys, recording 43 species in the Fullarton Conservation Area. As the 2015 data were now 8 years old, update surveys were undertaken in 2023. Breeding bird surveys were conducted on June 22 and July 5, 2023, using a wandering transect approach consisting of traversing the area on foot and recording all species of birds that were heard or seen. All species recorded during the surveys are secure (S5) or apparently secure (S4) in Ontario. The complete list of bird species, with their respective status and scientific names, is provided in **Appendix B**.

## **Least Bittern Surveys**

Of the 43 species of birds recorded by UTRCA in 2015, two species of Special Concern were noted. A review of background data in 2023 revealed that six bird SAR are known to occur in the geographical area of Fullarton; however, only one, the Least Bittern (*Ixobrychus exilis*), could potentially be impacted by any future dam and/or headpond alterations.

**Reference: Fullarton Dam EA – Natural Heritage Baseline Existing Conditions Report Addendum**

The Least Bittern is listed as Threatened under the provincial *Endangered Species Act* (ESA). Threatened species receive individual and habitat protection under the *Act*. The Least Bittern nests in dense vegetation above marsh water, hidden amongst cattails and often near open water, which is used for foraging (MECP 2022).

Least Bittern surveys were conducted on June 22 and July 5, 2023, using methods described in the National Least Bittern Survey Protocol (Jobin et al. 2011). Surveys were conducted at two stations around the reservoir (**Figure 1, Appendix A**) to target potentially suitable breeding habitat. According to the protocol, surveys are conducted early May to mid-July, during morning hours from 30 minutes before sunrise to 10:00 AM with a 10-day period between visits. Surveys cannot be conducted in adverse weather conditions (rain, fog, >30°C, strong winds). During the survey a 13-minute call broadcast is played per station and all Least Bittern and other priority marsh birds detected are recorded.

A summary of 2023 Least Bittern survey dates, times and weather is provided in **Table 1**.

**Table 1: Least Bittern Survey Dates, Times, and Weather Conditions**

Date	Time	Temp. (°C)	Wind (Beaufort)	Cloud (%)	Precipitation
June 22, 2023	7:42-8:28	16	1	20	None
July 5, 2023	7:15-7:53	20	1	35	None

No Least Bittern or other priority marsh birds were detected during either of the 2023 surveys.

### **Incidental Observations**

Observations of wildlife (birds, reptiles, mammals, amphibians, and insects) and signs of wildlife were recorded during all Stantec site visits, including species that were detected by sight and sound, dens, nests, burrows, browse, tracks, and scat.

Incidental observations included one mammal, one amphibian, two reptiles and 32 birds. All species recorded are secure (S5) or apparently secure (S4) in Ontario. The complete list of wildlife species and their status and scientific name is provided in **Appendix B**.

Two species of conservation concern (SOCC) were observed during site visits. This includes Midland Painted Turtle (*Chrysemys picta marginata*) which is federally listed as Special Concern and Snapping Turtle (*Chelydra serpentina*) which is listed both federally and provincially as Special Concern.

**Reference: Fullarton Dam EA – Natural Heritage Baseline Existing Conditions Report Addendum**

## **Conclusions**

Stantec conducted ELC confirmation and targeted surveys for Least Bittern as a part of a natural heritage baseline existing conditions assessment of the Fullarton Conservation Area Study Area in the Municipality of West Perth, Ontario. This was conducted as part of the DGA in the initial phase of an EA to determine long-term planning for the Fullarton Dam.

The results of the 2023 ELC confirmed that little had changed from work completed in 2015. An inclusion inclusion of Reed-canary Grass Graminoid Mineral Meadow Marsh Type (MAM2-2) was added to the updated 2023 mapping but aligns with an Ecologically Important Meadow polygon identified in 2015 by UTRCA. Breeding bird surveys did not reveal any additional SAR, and no Least Bittern were detected during targeted surveys for that species.

The information contained in this Addendum is intended to supplement that of the Natural Heritage Baseline Existing Conditions Report (Stantec 2023) and inform the analysis of alternative options being considered in the Fullarton Dam EA process.

Closing,

**STANTEC CONSULTING LTD.**

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Attachments: Appendix A: Figure 1 - Ecological Land Classification and Survey Location  
Appendix B: Wildlife List 2023

**Reference: Fullarton Dam EA – Natural Heritage Baseline Existing Conditions Report Addendum**

## **References**

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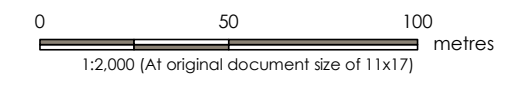
**Reference:** Fullarton Dam EA – Natural Heritage Baseline Existing Conditions Report Addendum

**Appendix A:            Figure 1 - Ecological Land Classification  
and Survey Locations**



Legend

- Fullarton Dam Property Boundary
- Least Bittern Survey Station
- ELC Inclusion
- Ecological Land Classification Boundary
- CUM** - Cultural Meadow
- CUP3** - Coniferous Plantation
- CUW** - Cultural Woodland
- MAM2-2** - Reed-canary Grass Graminoid Mineral Meadow Marsh Type
- MAS** - Shallow Marsh
- SA** - Shallow Water



Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2023.
3. Orthoimagery © Firstbase Solutions 2023.



Project Location: 160901056 REVA  
 County of Perth Prepared by PRM on 2025-01-21  
 Technical Review by KE on 2025-01-21

Client/Project: UPPER THAMES RIVER CONSERVATION AUTHORITY  
 FULLARTON DAM REHABILITATION

Figure No. **1**  
 Title: **Ecological Land Classification and Survey Locations**

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November 3, 2023  
Heather Amirault  
Page B

**Reference:** Fullarton Dam EA – Natural Heritage Baseline Existing Conditions Report Addendum

## **Appendix B: Wildlife List 2023**

**Incidental Wildlife List  
Fullarton Conservation Area**

<b>Species Type</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>Ontario Status</b>	<b>Global Status</b>	<b>SARO</b>	<b>SARA</b>	<b>COSEWIC</b>
Amphibians	Northern Green Frog	<i>Lithobates clamitans</i>	S5	G5			
	Snapping Turtle	<i>Chelydra serpentina</i>	S4	G5	SC	SC	SC
	Midland Painted Turtle	<i>Chrysemys picta marginata</i>	S4	G5T5		SC	SC
Reptiles	Snapping Turtle	<i>Chelydra serpentina</i>	S4	G5	SC	SC	SC
	Midland Painted Turtle	<i>Chrysemys picta marginata</i>	S4	G5T5		SC	SC
Birds	Wood Duck	<i>Aix sponsa</i>	S5B, S3N	G5			
	Mallard	<i>Anas platyrhynchos</i>	S5	G5			
	Killdeer	<i>Charadrius vociferus</i>	S4B	G5			
	Great Blue Heron	<i>Ardea herodias</i>	S4	G5			
	Green Heron	<i>Butorides virescens</i>	S4B	G5			
	Belted Kingfisher	<i>Megaceryle alcyon</i>	S5B, S4N	G5			
	Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	S5	G5			
	Downy Woodpecker	<i>Dryobates pubescens</i>	S5	G5			
	Alder Flycatcher	<i>Empidonax alnorum</i>	S5B	G5			
	Eastern Phoebe	<i>Sayornis phoebe</i>	S5B	G5			
	Eastern Kingbird	<i>Tyrannus tyrannus</i>	S4B	G5			
	Red-eyed Vireo	<i>Vireo olivaceus</i>	S5B	G5			



<b>Species Type</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>Ontario Status</b>	<b>Global Status</b>	<b>SARO</b>	<b>SARA</b>	<b>COSEWIC</b>
Birds cont.	Blue Jay	<i>Cyanocitta cristata</i>	S5	G5			
	American Crow	<i>Corvus brachyrhynchos</i>	S5	G5			
	Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	S4B	G5			
	Black-capped Chickadee	<i>Poecile atricapillus</i>	S5	G5			
	House Wren	<i>Troglodytes aedon</i>	S5B	G5			
	American Robin	<i>Turdus migratorius</i>	S5	G5			
	Gray Catbird	<i>Dumetella carolinensis</i>	S5B,S3N	G5			
	Cedar Waxwing	<i>Bombycilla cedrorum</i>	S5	G5			
	American Goldfinch	<i>Spinus tristis</i>	S5	G5			
	Chipping Sparrow	<i>Spizella passerina</i>	S5B,S3N	G5			
	Song Sparrow	<i>Melospiza melodia</i>	S5	G5			
	Swamp Sparrow	<i>Melospiza georgiana</i>	S5B, S4N	G5			
	Baltimore Oriole	<i>Icterus galbula</i>	S4B	G5			
	Red-winged Blackbird	<i>Agelaius phoeniceus</i>	S5	G5			
	Common Grackle	<i>Quiscalus quiscula</i>	S5	G5			
	Common Yellowthroat	<i>Geothlypis trichas</i>	S5B,S3N	G5			
	Yellow Warbler	<i>Setophaga petechia</i>	S5B	G5			
	Pine Warbler	<i>Setophaga pinus</i>	S5B,S3N	G5			
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	S5B	G5				
Indigo Bunting	<i>Passerina cyanea</i>	S5B	G5				
Mammals	Muskrat	<i>Ondatra zibethicus</i>	S5	G5			



## Explanation of Status and Acronymns

COSSARO: Committee on the Status of Species at Risk in Ontario

COSEWIC: Committee on the Status of Endangered Wildlife in Canada

S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)

S4: Apparently Secure—Uncommon but not rare

S5: Secure—Common, widespread, and abundant in the province

S#S#: Range Rank—A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species

S#B- Breeding status rank

S#N- Non Breeding status rank

G5: Very common globally; demonstrably secure

SC: Special Concern

All rankings for birds refer to breeding birds unless the ranking is followed by N



## **Appendix D      Dam Safety Report – Gap Analysis**





**Fullarton Dam Facilities - Dam  
Safety Review – Gap Analysis**

March 21, 2023

Prepared for:

Upper Thames River Conservation  
Authority

Prepared by:

Stantec Consulting Ltd.  
200-325 25 Street SE  
Calgary, AB T2A 7H8

File: 160901056



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# FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

Introduction  
March 21, 2023

## 1.0 INTRODUCTION

The Fullarton Dam was constructed in 1955 and is located approximately 2 km south of the Town of Fullarton. Fullarton Pond was constructed for recreational purposes with the dam on the north side of the pond.

## 2.0 AVAILABLE DOCUMENTATION

Stantec performed a high-level review of the following documents and data obtained from historical and available reports, aerial photos, and figures for the Fullarton Dam:

- Dam Safety Assessment for Fullarton Dam Prepared for Upper Thames River Conservation Authority, August 2007, ACRES International Limited, (ACRES).
- Geotechnical Investigation Fullarton Embankment Stability Assessment Municipality of West Perth, Ontario for Upper Thames River Conservation Authority, February 2006, Naylor Engineering Associates Ltd., (Naylor).
- Fullarton Dam Hydrotechnical and Geotechnical Review, January 17, 2017, Upper Thames River Conservation Authority.



## FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

GAP Analysis  
March 21, 2023

### 3.0 GAP ANALYSIS

#### 3.1 GENERAL DESCRIPTION

The Fullarton Dam is an earth embankment dam approximately 110 m long 3.4 m high and with a 6 m wide crest. The dam creates a pond on the upstream side and the water level in the pond is controlled by the concrete inlet overflow structure in the middle of the pond with an outlet made of pre-cast concrete pipe on the downstream side of the dam. This allows the water to discharge into North Thames River (Naylor, 2006). There is an emergency overflow spillway located on the east end of the dam with a mouth length of 9.5 m and runs parallel to the creek (ACRES, 2007).



**Figure 3-1: Fullarton Dam and Fullarton Pond**

#### 3.2 PREVIOUS FIELD INVESTIGATIONS

There were two previous borehole campaigns at the dam. The first in 2003 by ACRES and involved two boreholes BH1 and BH2 advanced from the dam crest centerline.

During the 2005 field investigation, four (4) boreholes were drilled. BH 101 and 102 were drilled on the crest of the dam and two other boreholes BH103 and BH104 were located at the downstream toe (see Figure 3-2).



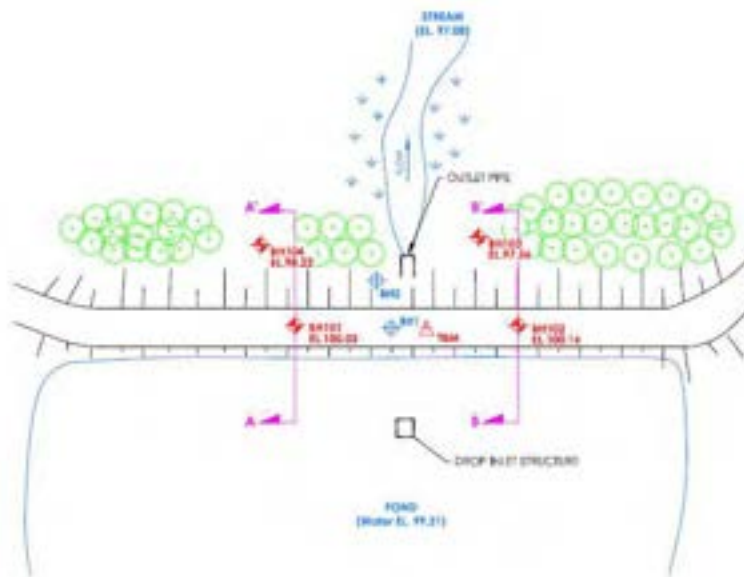


Figure 3-2: Borehole Locations (Naylor Engineering Associates, 2006)

### 3.3 DAM GEOMETRY AND MATERIAL ZONING

The Fullarton Dam is approximately 110 m long and approximately 3.4 m high (ACRES, 2007), with a width of 6 m on the crest of the dam. It is an earth fill dam with downstream and side slopes varied from 2 to 3 horizontal and 1 vertical (Naylor, 2006). The downstream portion of the dam has an outlet pipe which is covered with loose riprap. The inside diameter of the pre-cast outline pipe is 762 mm.

The dam fill was determined in boreholes 101 and 102 (Naylor, 2006) and was determined as homogenous fill, mainly silt with some clay and trace to some gravel. Shear strength of clay material was determined by pocket penetrometer and was in the range 100 to 200 kPa, indicating stiff clay consistency. **Based on boreholes**, the dam fill appears to be uniform zone, there is no zonation within the dam, except upstream rip rap layer. There is no drain to control the piezometric level within the dam, and there is no erosion protection layer on the downstream slope.

**Gaps:**

There is no toe drain in the dam to control piezometric levels

### 3.4 FOUNDATION CONDITIONS

There is no design or as-built document available which provide information regarding foundation preparation or dam construction of the Fullarton Dam (ACRES, 2007). Based on the borehole logs, it is assumed that the loose materials and organics were removed prior to constructing the dam (ACRES, 2007). It is believed that the ground surface consists of clay, silt, sand, and gravel meaning it is under the



## FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

GAP Analysis

March 21, 2023

dam and reservoir (ACRES, 2007). It is unknown the depth at which the bedrock is encountered (ACRES, 2007).

During 2005 field investigation, it was found that there was a layer of peat under the dam foundation (BH102) and some pockets of peat were found within the dam fill (BH101) (Naylor, 2006).

### Gaps:

Stantec identifies the following gaps.

1. As-built conditions and foundation preparation procedure are unknown.
2. There are pockets of weak organics layer (peat) that apparently was not removed during construction, the extent of the peat is unknown.
3. The peat strength needs to be better defined using CPT investigation.
4. Limited knowledge of foundation conditions from the borehole data which is not adequate for complete assessment.

## 3.5 DAM CLASSIFICATION

The incremental hazard potential (IHP) of the dam was reported (UTCRA, 2017) to be VERY LOW, as no incremental economic, social, and environmental losses are to be expected in flooding conditions. As well, no potential incremental loss of life is reported to be expected under flooding conditions (UTCRA, 2017). The IHP was assessed in accordance with the 1999 Ontario Dam Safety Guidelines (Draft), which are outdated now. These guidelines were revised in 2011 and are known as Technical Bulletins issued by Ministry of Natural Resources (MNR), 2011 (under LRIA, 2011). Under new MNR guidelines, there is no Very Low class anymore. The new dam classification system was developed called Dam Hazard Potential Classification (HPC). HPC varies from Low to Very High and the criteria of classification has been changed since. The dam classification has to be reviewed again in accordance with latest MNR guidelines. 2011 standards.

### Gaps:

Previous dam classification VERY LOW is outdated and needs to be reviewed in accordance with latest 2011 MNR guidelines and update as needed.

## 3.6 SLOPE STABILITY ASSESSMENT

Slope stability analyses were performed originally by Acres in 2004 and finalized in 2007. These analyses were reviewed by Naylor (2006) and UTSRA (2017). The following table presents the results as per all loadings conditions as required by MNR, 2011.



## FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

GAP Analysis  
March 21, 2023

**Table 3-1: Factor of Safety Comparison**

Loading Conditions	Minimum Factor of Safety	Slope	Reported Factor of Safety*	Reported Loading Conditions*
End of construction before reservoir filling	1.3	Upstream and downstream	Not applicable	
Long-term (steady state seepage, normal reservoir level)	1.5	Upstream and downstream	1.3 to 1.4	Steady state seepage with maximum storage pool
IDF loading condition	1.3	Upstream and downstream	1.3 to 1.4	
Full or partial rapid drawdown	1.2 to 1.3	Upstream	1.5 to 1.7	
Pseudo-static	Greater than 1.0	Upstream and Downstream	1.3 to 1.4	Pseudo-static horizontal seismic load – downstream and upstream
Post earthquake	1.1		Not evaluated	

\*(Naylor Engineering Associates, 2006)

According to the 2007 DSR, the dam does not meet the stability criteria, especially for long term normal conditions. The soil properties selected by ACRES did not consider undrained conditions, in addition peat layer was not considered in the model. Lower factors of safety are anticipated, if more conservative soil strength are used.

### Gaps:

Additional slope stability loading conditions should be considered, including post-earthquake.

Cone Penetration Test (CPT) field investigation is recommended to determine undrained soil strengths and apply those to the stability model.

Undrained soil properties for clay and peat should be defined based on the CPT data

## 3.7 DAM SAFETY MANAGEMENT SYSTEM

Currently, there is no documentation on the Dam Safety Management System (DSMS), and Operation, Maintenance and Surveillance (OMS) manuals. Stantec recommended preparation of an OMS manual including an instrumentation monitoring plan and procedures to monitor dam performance and manage risk in accordance with CDA guidelines, as this dam is free for the public to access the structure. The annual Dam Safety Inspections DSIs should be considered as part of the future DSMS.



## FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

GAP Analysis

March 21, 2023

There is an Emergency Preparedness Plan and Response Plan (EPRP) developed by UTRCA, giving them the responsibility to follow the correct procedures based on the emergency. The current EPRP is generic and does not contain key details, such as trigger levels, thresholds, key contacts, etc.

Dam Safety Reviews (DSR) and annual Dam Safety Inspections (DSI) are also part of DSMS, there is no record of recent DSIs. The last DSR was performed in 2007 in accordance with old 1999 ODSG. It is recommended that the DSR should be repeated in accordance with latest dam safety guidelines of CDA and MNRF.

As mentioned before the HPC should also be reviewed and updated based on latest MNRF guidelines and frequency of DSRs and DSIs should be determined based on the new updated dam classification.

### Gaps:

Stantec indicates the following gaps and recommendation.

1. Update Dam Hazard Potential Classification and design frequency of DSRs and DSIs in accordance with updated classification.
2. OMS manuals and DSMS systems have not been developed. Develop a detailed EPRP for the Fullarton Dam with all the necessary details.
3. Perform annual DSIs.
4. Perform new DSR in accordance with new 2011 MNR standards.

## 3.8 INSTRUMENTATION AND MONITORING

In November of 2003, two boreholes were drilled, one on the centerline of the dam and one on the downstream slope. A standpipe piezometer was installed in the borehole drilled on the centerline of the dam.

During the 2005 field program piezometers and monitoring wells were installed into the drilled boreholes. Six monitoring wells and two pumping wells were installed during this program (Naylor, 2006). These piezometers were not found during 2022 site visit.

### Gaps:

1. Stantec indicates the following gaps.
2. Piezometers were not found at site.
3. Instrumentation monitoring program is not provided.



## FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

Gap Analysis Summary and Recommendations

March 21, 2023

### 4.0 GAP ANALYSIS SUMMARY AND RECOMMENDATIONS

The following table summarizes gaps identified for both the Fullarton Dam, as well as recommendations on how to address the gaps.

**Table 4-1: Identified Gaps**

<b>Gap</b>	<b>Recommendations</b>
HPC Classification	<ul style="list-style-type: none"><li>- Update dam Hazard Potential Classification in accordance with 2011 MNR guidelines.</li></ul>
Dam Safety Review/Inspection	<ul style="list-style-type: none"><li>- Carry out DSR in accordance with new 2011 MNR.</li><li>- Carry out DSI every 1 to 2 years.</li></ul>
Design and as-built documentation	<ul style="list-style-type: none"><li>- Perform CPT investigation program to define foundation conditions including peat delineation and definition of new undrained strength properties for clay and foundation.</li><li>- Define design criteria based on the dams' classification using most recent (2011) MNR guidelines.</li><li>- Perform additional slope stability analyses based on soil parameters obtained from CPT investigation and in accordance with 2011 MNR guidelines.</li><li>- Re-evaluate emergency spillway capacity and freeboard based on new IDF criteria selected based on updated HPC.</li></ul>
DSMS and OMS manual	<ul style="list-style-type: none"><li>- Develop Operation, Maintenance and Surveillance plan to address potential failure modes. The surveillance program should define future DSIs, DSRs and an instrumentation monitoring program.</li></ul>
EPRP	<ul style="list-style-type: none"><li>- Develop a detailed EPRP to mitigate potential dam failure. The level of effort should correspond to the dam's classification.</li></ul>



## FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

References  
March 21, 2023

### 5.0 REFERENCES

ACRES International Limited (2007). *Dam Safety Assessment Report for Fullarton Dam*. Prepared for Upper Thames River Conservation Authority

Naylor Engineering Associates Ltd. (2006). *Geotechnical Investigation Fullarton Dam Embankment Stability Assessment Municipality of West Perth, Ontario*. Prepared for Upper Thames River Conservation Authority

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Upper Thames River Conservation and Authority (2017). *Appendix A – Fullarton Dam Hydrotechnical and Geotechnical Review*. January 17, 2017



## **Appendix E      Cultural Heritage Report**





**CULTURAL HERITAGE REPORT:  
EXISTING CONDITIONS AND  
PRELIMINARY IMPACT  
ASSESSMENT—FULLARTON DAM  
REHABILITATION**

FINAL REPORT

November 2024

Prepared for:  
Upper Thames River Conservation Authority  
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Prepared by:  
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Project Number:  
160901056

## Limitations and Sign-off

The conclusions in the Report titled Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment—Fullarton Dam Rehabilitation are Stantec’s professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient’s own risk.

Stantec has assumed all information received from Upper Thames River Conservation Authority (the “Client”) and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec’s contract with the Client. While the Report may be provided to applicable authorities having jurisdiction and others for whom the Client is responsible, Stantec does not warrant the services to any third party. The report may not be relied upon by any other party without the express written consent of Stantec, which may be withheld at Stantec’s discretion.

Prepared by:  Digitally signed by Smith, Frank  
Date: 2024.11.06 16:08:44 -05'00'

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Frank Smith, MA, CAHP

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Printed Name

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Lashia Jones, MA, CAHP

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Approved by:  Digitally signed by Rivard, Meaghan  
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Signature

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Meaghan Rivard, MA, CAHP

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Printed Name



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# FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

Introduction  
March 21, 2023

## 1.0 INTRODUCTION

The Fullarton Dam was constructed in 1955 and is located approximately 2 km south of the Town of Fullarton. Fullarton Pond was constructed for recreational purposes with the dam on the north side of the pond.

## 2.0 AVAILABLE DOCUMENTATION

Stantec performed a high-level review of the following documents and data obtained from historical and available reports, aerial photos, and figures for the Fullarton Dam:

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GAP Analysis  
March 21, 2023

## 3.0 GAP ANALYSIS

### 3.1 GENERAL DESCRIPTION

The Fullarton Dam is an earth embankment dam approximately 110 m long 3.4 m high and with a 6 m wide crest. The dam creates a pond on the upstream side and the water level in the pond is controlled by the concrete inlet overflow structure in the middle of the pond with an outlet made of pre-cast concrete pipe on the downstream side of the dam. This allows the water to discharge into North Thames River (Naylor, 2006). There is an emergency overflow spillway located on the east end of the dam with a mouth length of 9.5 m and runs parallel to the creek (ACRES, 2007).



**Figure 3-1: Fullarton Dam and Fullarton Pond**

### 3.2 PREVIOUS FIELD INVESTIGATIONS

There were two previous borehole campaigns at the dam. The first in 2003 by ACRES and involved two boreholes BH1 and BH2 advanced from the dam crest centerline.

During the 2005 field investigation, four (4) boreholes were drilled. BH 101 and 102 were drilled on the crest of the dam and two other boreholes BH103 and BH104 were located at the downstream toe (see Figure 3-2).



## FULLARTON DAM FACILITIES - DAM SAFETY REVIEW – GAP ANALYSIS

GAP Analysis  
March 21, 2023

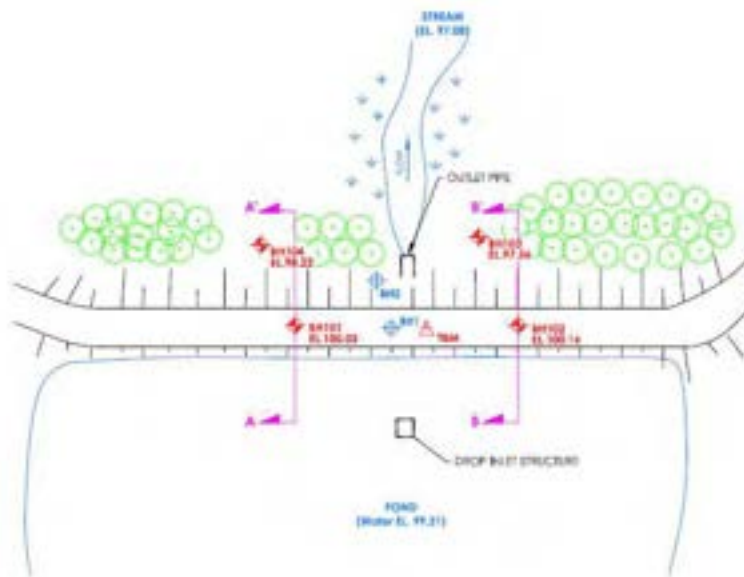


Figure 3-2: Borehole Locations (Naylor Engineering Associates, 2006)

### 3.3 DAM GEOMETRY AND MATERIAL ZONING

The Fullarton Dam is approximately 110 m long and approximately 3.4 m high (ACRES, 2007), with a width of 6 m on the crest of the dam. It is an earth fill dam with downstream and side slopes varied from 2 to 3 horizontal and 1 vertical (Naylor, 2006). The downstream portion of the dam has an outlet pipe which is covered with loose riprap. The inside diameter of the pre-cast outline pipe is 762 mm.

The dam fill was determined in boreholes 101 and 102 (Naylor, 2006) and was determined as homogenous fill, mainly silt with some clay and trace to some gravel. Shear strength of clay material was determined by pocket penetrometer and was in the range 100 to 200 kPa, indicating stiff clay consistency. **Based on boreholes**, the dam fill appears to be uniform zone, there is no zonation within the dam, except upstream rip rap layer. There is no drain to control the piezometric level within the dam, and there is no erosion protection layer on the downstream slope.

#### Gaps:

There is no toe drain in the dam to control piezometric levels

### 3.4 FOUNDATION CONDITIONS

There is no design or as-built document available which provide information regarding foundation preparation or dam construction of the Fullarton Dam (ACRES, 2007). Based on the borehole logs, it is assumed that the loose materials and organics were removed prior to constructing the dam (ACRES, 2007). It is believed that the ground surface consists of clay, silt, sand, and gravel meaning it is under the



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dam and reservoir (ACRES, 2007). It is unknown the depth at which the bedrock is encountered (ACRES, 2007).

During 2005 field investigation, it was found that there was a layer of peat under the dam foundation (BH102) and some pockets of peat were found within the dam fill (BH101) (Naylor, 2006).

### Gaps:

Stantec identifies the following gaps.

1. As-built conditions and foundation preparation procedure are unknown.
2. There are pockets of weak organics layer (peat) that apparently was not removed during construction, the extent of the peat is unknown.
3. The peat strength needs to be better defined using CPT investigation.
4. Limited knowledge of foundation conditions from the borehole data which is not adequate for complete assessment.

## 3.5 DAM CLASSIFICATION

The incremental hazard potential (IHP) of the dam was reported (UTCRA, 2017) to be VERY LOW, as no incremental economic, social, and environmental losses are to be expected in flooding conditions. As well, no potential incremental loss of life is reported to be expected under flooding conditions (UTCRA, 2017). The IHP was assessed in accordance with the 1999 Ontario Dam Safety Guidelines (Draft), which are outdated now. These guidelines were revised in 2011 and are known as Technical Bulletins issued by Ministry of Natural Resources (MNR), 2011 (under LRIA, 2011). Under new MNR guidelines, there is no Very Low class anymore. The new dam classification system was developed called Dam Hazard Potential Classification (HPC). HPC varies from Low to Very High and the criteria of classification has been changed since. The dam classification has to be reviewed again in accordance with latest MNR guidelines. 2011 standards.

### Gaps:

Previous dam classification VERY LOW is outdated and needs to be reviewed in accordance with latest 2011 MNR guidelines and update as needed.

## 3.6 SLOPE STABILITY ASSESSMENT

Slope stability analyses were performed originally by Acres in 2004 and finalized in 2007. These analyses were reviewed by Naylor (2006) and UTSRA (2017). The following table presents the results as per all loadings conditions as required by MNR, 2011.



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**Table 3-1: Factor of Safety Comparison**

Loading Conditions	Minimum Factor of Safety	Slope	Reported Factor of Safety*	Reported Loading Conditions*
End of construction before reservoir filling	1.3	Upstream and downstream	Not applicable	
Long-term (steady state seepage, normal reservoir level)	1.5	Upstream and downstream	1.3 to 1.4	Steady state seepage with maximum storage pool
IDF loading condition	1.3	Upstream and downstream	1.3 to 1.4	
Full or partial rapid drawdown	1.2 to 1.3	Upstream	1.5 to 1.7	
Pseudo-static	Greater than 1.0	Upstream and Downstream	1.3 to 1.4	Pseudo-static horizontal seismic load – downstream and upstream
Post earthquake	1.1		Not evaluated	

\*(Naylor Engineering Associates, 2006)

According to the 2007 DSR, the dam does not meet the stability criteria, especially for long term normal conditions. The soil properties selected by ACRES did not consider undrained conditions, in addition peat layer was not considered in the model. Lower factors of safety are anticipated, if more conservative soil strength are used.

### Gaps:

Additional slope stability loading conditions should be considered, including post-earthquake.

Cone Penetration Test (CPT) field investigation is recommended to determine undrained soil strengths and apply those to the stability model.

Undrained soil properties for clay and peat should be defined based on the CPT data

## 3.7 DAM SAFETY MANAGEMENT SYSTEM

Currently, there is no documentation on the Dam Safety Management System (DSMS), and Operation, Maintenance and Surveillance (OMS) manuals. Stantec recommended preparation of an OMS manual including an instrumentation monitoring plan and procedures to monitor dam performance and manage risk in accordance with CDA guidelines, as this dam is free for the public to access the structure. The annual Dam Safety Inspections DSIs should be considered as part of the future DSMS.



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There is an Emergency Preparedness Plan and Response Plan (EPRP) developed by UTRCA, giving them the responsibility to follow the correct procedures based on the emergency. The current EPRP is generic and does not contain key details, such as trigger levels, thresholds, key contacts, etc.

Dam Safety Reviews (DSR) and annual Dam Safety Inspections (DSI) are also part of DSMS, there is no record of recent DSIs. The last DSR was performed in 2007 in accordance with old 1999 ODSG. It is recommended that the DSR should be repeated in accordance with latest dam safety guidelines of CDA and MNRF.

As mentioned before the HPC should also be reviewed and updated based on latest MNRF guidelines and frequency of DSRs and DSIs should be determined based on the new updated dam classification.

### Gaps:

Stantec indicates the following gaps and recommendation.

1. Update Dam Hazard Potential Classification and design frequency of DSRs and DSIs in accordance with updated classification.
2. OMS manuals and DSMS systems have not been developed. Develop a detailed EPRP for the Fullarton Dam with all the necessary details.
3. Perform annual DSIs.
4. Perform new DSR in accordance with new 2011 MNR standards.

## 3.8 INSTRUMENTATION AND MONITORING

In November of 2003, two boreholes were drilled, one on the centerline of the dam and one on the downstream slope. A standpipe piezometer was installed in the borehole drilled on the centerline of the dam.

During the 2005 field program piezometers and monitoring wells were installed into the drilled boreholes. Six monitoring wells and two pumping wells were installed during this program (Naylor, 2006). These piezometers were not found during 2022 site visit.

### Gaps:

1. Stantec indicates the following gaps.
2. Piezometers were not found at site.
3. Instrumentation monitoring program is not provided.



## **4.0 GAP ANALYSIS SUMMARY AND RECOMMENDATIONS**

The following table summarizes gaps identified for both the Fullarton Dam, as well as recommendations on how to address the gaps.

**Table 4-1: Identified Gaps**

<b>Gap</b>	<b>Recommendations</b>
HPC Classification	- Update dam Hazard Potential Classification in accordance with 2011 MNR guidelines.
Dam Safety Review/Inspection	- Carry out DSR in accordance with new 2011 MNR. - Carry out DSI every 1 to 2 years.
Design and as-built documentation	- Perform CPT investigation program to define foundation conditions including peat delineation and definition of new undrained strength properties for clay and foundation. - Define design criteria based on the dams' classification using most recent (2011) MNR guidelines. - Perform additional slope stability analyses based on soil parameters obtained from CPT investigation and in accordance with 2011 MNR guidelines. - Re-evaluate emergency spillway capacity and freeboard based on new IDF criteria selected based on updated HPC.
DSMS and OMS manual	- Develop Operation, Maintenance and Surveillance plan to address potential failure modes. The surveillance program should define future DSIs, DSRs and an instrumentation monitoring program.
EPRP	- Develop a detailed EPRP to mitigate potential dam failure. The level of effort should correspond to the dam's classification.



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### 5.0 REFERENCES

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