Upper's Quarry, Niagara: Level 1 and Level 2 Natural Environment Technical Report and Environmental Impact Study

Revision 1.0

August 28, 2023

File 160961352

Prepared for:
Walker Aggregates Inc.

Prepared by:
Stantec Consulting Ltd.

UPPER'S QUARRY, NIAGARA: LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

This document entitled Upper's Quarry, Niagara: Level 1 and Level 2 Natural Environment Technical Report and Environmental Impact Study is intended to be read in its entirety.

Digitally signed by Geddes, Sean
Date: 2023.08.28 19:07:21 -04'00'

Prepared by ______________________________
(signature)

Sean Geddes, B.Sc. (Hons)
Senior Associate / Aquatic Biologist

Eusebi, Daniel

Digitally signed by Eusebi, Daniel
Date: 2023.08.28 20:00:59 -04'00'

Reviewed and Approved by ______________________________
(signature)

Daniel Eusebi, BES, MCIP, RPP
Senior Environmental Planner

An earlier version of this NETR was submitted to JART for review in 2022. The JART, stakeholders, and MNRF provided comments on various aspects of the NETR. Stantec has provided responses to the comments in a response matrix. A number of the responses have been incorporated into this revised NETR and are listed in this revision log below.

Revision 1 Log, August 25, 2023

In Response To	Revision Made	Section
JART comment: Evaluation of Significant Woodlands - Clarification is required regarding the evaluation of significance and proposed removal and habitat replacement of the significant woodland located on the subject property.	Updated text to clarify provincial and regional criteria and results of assessment	6.2.3
	Added basking turtle survey methodology	3.2.5
	Added basking turtle survey results	5.5
JART comments regarding Section 3.2.4 (Snake Coverboard Surveys	Added text to clarify coverboard deployment, authorizations obtained, and survey timing; and text to identify potential for snake observation during the course of other surveys within acceptable timing window	3.2.4
JART comment regarding date of survey	Updated text to read "April 4, 2017" instead of "April 19."	3.2.6.1
JART comment regarding ARU placement	Added clarification that ARUs were only deployed in mature treed habitat potentially suitable for bat roosting.	3.2.6.2
JART comment regarding incorrect reference	Updated reference to "MNRF 2014" in section 4.2.6.3. Also added MNRF 2014 to reference section.	3.2.6.3
JART comment regarding Figure 11 that should refer to Figure 12	Updated reference to refer to Figure 12.	5.10
JART comment regarding DFO authorization	Updated text to read: "Fish community monitoring, if required by DFO, will also be completed for the new channel design area. A Fisheries Act authorization will be obtained for the watercourse realignment. "	11.0
	Changed from MNDMNRF to MNRF	2.0
JART comment re: HDFA methodology reference	Added text identifying methodology reference: "The Headwater Drainage Feature Assessment (HDFA) was completed using *The Evaluation, Classification and Management of Headwater Features Guidelines* (CVC and TRCA, TRCA Approval July 2013; finalized January 2014) (the Guidelines) as a tool to examine headwater features on the Subject Property. Table 4 of the Guidelines provides approximate windows for site visits to capture observations associated with time of year."	3.2.8
	Added HDFA to abbreviations section	Abbreviations
	Added MNRF 2014 to references section.	References

In Response To	Revision Made	Section
	Added CVC and TRCA, 2014 to references section	References
	Added Henson et al. 2005 to references section	References
JART comment #15 – request for additional landscape context	Added additional landscape context per Henson et al. 2005	4.1
JART comment #16 – request for clarification on number/location of Bobolink observations	Clarified number of individual Bobolink observed at each station	5.3.2
JART comment #23 and MNRF comment #4	Amended turtle nesting area text to read: "Suitable habitat for turtle nesting is present on the road shoulders, however anthropogenic features do not qualify as significant wildlife habitat. The agricultural field is not considered preferred nesting habitat due to the high density of vegetation cover (i.e. winter wheat) during peak breeding seasons, and the likelihood for nest disturbance and loss by agricultural equipment." Amended terrestrial crayfish section to read: "Surveys were conducted across the property, including spring surveys when vegetation was low and water levels high. Although no site visits were conducted specifically to identify terrestrial crayfish burrows, qualified ecologists conducted numerous surveys in suitable areas and at suitable times, and burrows were likely to have been observed incidentally."	App B-2
JART comment #33	Added Table B-4 – wetland planning species list	App B-4
MNRF Comment #2	Added text: "A fish rescue will be undertaken prior to dewatering and channel relocation. A Licence to Collect Fish for Scientific Purposes will be obtained for the fish rescue"	12.1
SNWSO comment #25	Expanded on origin of CC assessment	3.2.1
	Revised table 5.1 heading to read "in the study area" instead of "at the subject property".	5.1.1
	Added text to FOD9c row of table 5.1: "This community is located off of the Subject Property, west of Thorold-Townline Road."	5.1.1
SNWSO comment #29	Revised breeding bird methodology to: "A total of 23 breeding bird point count stations were surveyed, as shown on Figure 5 (Appendix A). In addition, all bird species seen or heard while traversing the Subject Property were recorded. A conservative approach to determining breeding status was taken; all birds seen or heard in appropriate habitat during the breeding season were assumed to be breeding.	3.2.3
SNWSO comment #32	Revised text to: "Barn Swallow nest searches were also completed for all potentially suitable features and structures on the same survey dates as grassland breeding bird surveys. All buildings on the Subject Property with potential to have nesting Barn Swallows were searched.	3.2.3

In Response To	Revision Made	Section
SNWSO Comment #74	Included figure 4 in appendix A	Appendix A, Figure 4
SNWSO Comment #91	Updated name of Fraxinus pensylvanica to green ash	Appendix D
SNWSO Comment #118	Removed statement about widespread presence of Little Brown Myotis from Table 6.3	6.2.2
SNWSO Comment #129	Added "to mitigate potential erosion" to the sentence "…Once adequate vegetation has been established…".	12.1
SNWSO Comment #180	Removed "for various target species" from last sentence	8.5.2.1
SNWSO Comment #181	Added S.86.5. – invasive species management to mitigation section	8.6.5
SNWSO Comment #183	Modified re-fuelling bullet to "Re-fuel equipment at least 30 m away from sensitive natural features (e.g. wetlands, watercourses) and on impermeable surfaces where possible to avoid potential impacts if an accidental spill occurs."	8.6.1
SNWSO Comment #186	Added "If the wildlife fails to leave the area after a reasonable period, then MNRF and/or MECP (as appropriate) will be consulted on next steps."	8.6.2
SNWSO Comment #216	Clarified habitat suitability for common five-lined skink and gray ratsnake in table B-1	App B-1
SNWSO Comment #220	Updated eastern meadowlark targeted survey results column to clarify that although observations were made, habitat is considered absent.	App B-1
SNWSO Comment #221	Updated bobolink targeted survey results column to clarify that although observations were made, habitat is considered absent.	App B-1
SNWSO Comment #222	Updated little brown myotis targeted survey results column to clarify that although observations were made, habitat is considered absent.	App B-1
SNWSO Comment #231	Updated with list of previous studies	3.1
SNWSO Comment #231	Updated reference list with previous reports reviewed	13
	Added Section 4.6 to detail previous study results	4.6
SNWSO Comment #232	Added "including targeted searches for spoon-leaved moss *(Bryoandersonia illecebra)*, a species listed as Endangered federally and Threatened provincially".	3.2.1
SNWSO Comment #232	Added statement that no spoon-leaved moss was found in the study area.	5.1.2
SNWSO Comment #253	Added giant swallowtail to discussion of identified insect species	5.7
	Added turtle nesting survey methods section	3.2.5
	Added turtle nesting survey results section	5.5
	Added 2023 nesting surveys to field survey methods	3.2
	Minor edits for clarity on Barn Swallow status	4.4.2
	Added 2023 to list of surveys conducted	5.0

In Response To	Revision Made	Section
	Revised text to reflect Barn Swallow status	5.3
	Revised text to "The actions taken to meet ESA requirements for the removal of Barn Swallow habitat, as well as information on requirements related to their subsequent delisting, are discussed in Section 8.3."	5.3.1
	Updated text to reflect Barn swallow delisting	6.5
	Updated to reflect current status of barn swallow registration	8.3.1
	Removed section pertaining to SAR authorization for barn Swallow	8.3.2
	Added discussion of turtle nesting habitat on Upper's Lane and SWH implications	6.7
	Updated Explotech 2020 reference to 2021	multiple

Table of Contents

LIST OF TABLES

LIST OF APPENDICES

Abbreviations

ANSI	Area of Natural and Scientific Interest
ARA	*Aggregate Resources Act*
ARU	autonomous recording unit
BSC	Bird Studies Canada
CAA	*Conservation Authorities Act*
CC	coefficient of conservatism
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CVC	Credit Valley Conservation
DBH	diameter at breast height
DFO	Fisheries and Oceans Canada
ECA	environmental conservation area
EIS	Environmental Impact Study
ELC	Ecological Land Classification
EPA	environmental protection area(s)
ESA	*Endangered Species Act*

GPGGH	Growth Plan for the Greater Golden Horseshoe
HADD	harmful alteration, disruption or destruction (of fish habitat)
HDF	headwater drainage feature(s)
HDFA	Headwater drainage feature assessment
HMA	hot mix asphalt (batch plant facility)
KHA	key hydrologic area(s)
KHF	key hydrologic feature(s)
KNHF	key natural heritage feature(s)
LIO	Land Information Ontario
MBCA	*Migratory Birds Convention Act*
MECP	Ministry of Environment, Conservation and Parks
MHBC	MacNaughton Hermsen Britton Clarkson Planning Limited
MMAH	Ministry of Municipal Affairs and Housing
MNRF	Ministry of Natural Resources and Forestry
NCD	natural channel design
NETR	Natural Environment Technical Report
NHIC	Natural Heritage Information Centre
NHRM	Natural Heritage Reference Manual

NHS	natural heritage system(s)
NPCA	Niagara Peninsula Conservation Authority
OWES	Ontario Wetland Evaluation System
PPS	Provincial Policy Statement
PSW	Provincially Significant Wetland(s)
RAA	Regional Assessment Area
RfR	Request for Review (a DFO form)
SAR	species at risk
SARA	*Species at Risk Act*
SARO	Species at Risk in Ontario
SC	special concern [as defined on SARO list]
SOCC	species of conservation concern
SWH	significant wildlife habitat
TRCA	Toronto and Region Conservation Authority
YOY	Young-of-the-year

Units of Measure

%	percent
°C	degree(s) Celcius
AM	ante meridian
cm	centimetre(s)
ha	hectare(s)
km	kilometre(s)
kPa	kilopascal(s)
m	metre(s)
masl	metre(s) above sea level
mg/L	milligrams per litre
mm	millimetre(s)
mm/s	millimetre(s) per second
PM	post meridian
UTM	Universal Transverse Mercator (geographic coordinates)
µg/L	microgram(s) per litre
µS/cm	microsiemens per centimetre

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Walker Aggregates Inc. (the Proponent, Walker Aggregates) to prepare a Natural Environment Technical Report and Environmental Impact Study (NETR and EIS) in support of a licence application for proposed aggregate operations on lands referred to as Upper's Quarry located in Lots 119, 120,136 and 137 in the former Township of Stamford, City of Niagara Falls, Niagara Region. The application is for a Class 'A', Category 2 licence under the Ontario *Aggregate Resources Act* (ARA) for a quarry operation, which intends to extract aggregate from below the established groundwater table on private land. Amendments to the Official Plan for Niagara Region, the Official Plan for the City of Niagara Falls (City of Niagara Falls 2017) and the Zoning By-law for the City of Niagara Falls are also required to permit industrial extraction on lands shown as Subject Property on Figure 1, Appendix A. The purpose of this study is to determine the feasibility of the project based on potential natural heritage constraints on the property (the Subject Property) and lands within 120 metres (m) (the Study Area), which encompasses the Adjacent Lands. Should the Proponent determine to proceed with the project, this study is intended to fulfill the requirements of the NETR under the ARA as well as the requirements of an EIS for Niagara Region.

The terms of reference for the study were developed in consultation with review agencies during the pre-consultation process (Appendix B). Specifically, this NETR and EIS has been prepared to:

- Determine if any significant natural heritage features and functions are present on the Proposed Upper's Quarry Subject Property and the 120 m surrounding Study Area, in accordance with the ARA, the Niagara Region Official Plan (The Regional Municipality of Niagara 2014), the Official Plan of the City of Niagara Falls (City of Niagara Falls 2017), the Growth Plan for the Greater Golden Horseshoe (GPGGH, Government of Ontario 2019, as amended 2020), the *Provincial Policy Statement* (PPS, Government of Ontario 2020), and the *Endangered Species Act* (ESA, Government of Ontario 2007).
- Determine what, if any, impacts the proposed quarry will have on significant natural heritage features and functions identified in the Study Area and within the area of potential groundwater influence.
- Provide recommendations to be incorporated into the Site Plan, including setbacks, rehabilitation and mitigation measures for any identified significant natural heritage features or functions.
- Confirm that the Site Plan recommendations are adequate to reduce the likelihood of negative net impacts from the proposed aggregate operation after mitigation.

1.1 SITE DESCRIPTION

The Subject Property is located in Lots 119, 120,136 and 137 in the former Township of Stamford, City of Niagara Falls, Niagara Region (**Figure 1, Appendix A**) to the north and south of Upper's Lane and bounded by Thorold Townline Road to the west and Beechwood Road to the east. The Subject Property is situated outside the Urban Areas of Niagara Region and is south of the Niagara Escarpment.

Study locations referred to in this NETR are defined as follows (**Figure 1**):

Subject Property – the lands subject to the Amendment applications to permit a proposed mineral aggregate operation.

Study Area – the Subject Property plus a 120 m (Adjacent lands) area of investigation around the Subject Property, established to address ARA study requirements and the Adjacent Lands as per the PPS (Government of Ontario 2020) and the Natural Heritage Reference Manual (NHRM; MNR 2010) (see Figure 2 for a more detailed, air photo-based presentation of the Study Area).

Regional Assessment Area (RAA) – a regional study area that includes 1.5 kilometres (km) around the Subject Property. This area captures a land base representing portions of the catchments adjacent to Subject Property. It provides a regional area for a landscape-based assessment.

Additional Lands – these include parcels of land owned by Walker Aggregates adjacent to the Subject Property, primarily west of the Subject Property, that are proposed for the rehabilitation, compensation and enhancement of natural heritage features.

There are several former residential properties on the Subject Property, owned by Walker Aggregates, and an old schoolhouse on Upper’s Lane previously operated by the Bible Baptist Church. Land at the corner of Upper’s Lane and Thorold Townline Road is also leased to the Niagara Region Model Flying Club (see Existing Conditions plan, Sheet 1 of the Site Plans). A tributary to Beaverdams Creek, hereafter referred to as the existing watercourse, meanders from south to north through the centre of the Subject Property. A woodland is located along Thorold Townline Road and a conifer plantation and thicket are located along the existing watercourse in the middle of the Subject Property. Natural features on the Subject Property are described in Sections 4.0, 5.0 and 6.0 of this report.

1.2 THE NATURAL ENVIRONMENT TECHNICAL REPORT ORGANIZATION

The NETR was undertaken in accordance with the ARA and associated Standards, and with relevant federal and provincial environmental guidelines and regulations. The NETR, which documents the environmental study, will form the basis for future environmental management activities related to development of quarry operations.

The NETR is organized into the following sections:

1.0 **Introduction:** provides a description of the project and the environmental study.

2.0 **Environmental Policies and Legislation:** describes the pertinent policies and legislation.

3.0 **Methods:** describes the methods used for the studies and assessments completed for this NETR including background review and source information; field study effort, timing and protocols; natural heritage feature assessment methods and considerations.

4.0 Background Data and Agency Consultation: provides an overview of the RAA attributes and background information for wildlife, vegetation, species at risk (SAR) and designated features (wetlands, woodlands etc.). It also outlines agency consultation as it relates to the NETR.

5.0 Results of Field Investigations: provides field surveys results related to vegetation, wildlife, fish, headwater drainage and watercourse investigations.

6.0 Analysis of Significance - Natural Heritage Features Assessment: summarizes the significance of features that have been designated by the agencies and provides an analysis of the designation or an assessment of the feature significance based on the field findings and other contributing information (i.e. current agency guidance and landscape considerations).

7.0 Project Description: describes the proposed quarry development plan and introduces the Site Plans. The Site Plans for the proposed quarry provide the details of the development plan and they implement the recommendations of the NETR.

8.0 Assessment of Impacts: provides a discussion and consideration of the potential environmental impacts associated with the proposed project related to the natural heritage features and their studied attributes and conditions as well as recommendations for mitigation and permitting requirements that will minimize the impact to natural heritage features. This section also provides an introduction of the proposed natural channel design (NCD) for the realignment and restoration of the existing watercourse.

9.0 Alternate Extraction Scenario Assessment: Introduction to the Alternate Extraction Scenario Assessment in Appendix F which provides a discussion and consideration of the potential environmental impacts associated with an alternative where all road allowance roads are extracted and the resulting quarry creates one large continuous area of excavation. The key impacts and the comparison of the alternative extraction scenario to the currently proposed scenario are discussed in this section.

10.0 Rehabilitation and Enhancement: provides a conceptual plan for rehabilitation opportunities that complement the protection and mitigation recommendations in Section 8.0 and provides rehabilitation that will reduce the effect of residual net impacts and provide an enhancement opportunity at a regional landscape-level scale.

11.0 Environmental Monitoring Program: provides a monitoring plan to evaluate: the anticipated impacts, compliance with protection and mitigation initiatives during development, the performance of proposed mitigation during the operations, and the performance and success of the restored features such as the NCD and vegetation rehabilitation.

12.0 Recommendations and Conclusions: provides a summary of key findings of the EIS and proposed protection and mitigation recommendations. The conclusions offer a statement on the policy compliance of the proposal in consideration of the protection and mitigation initiatives and the overall all net residual impact of the development on Natural Heritage features.

The NETR also includes references and appendices for documentation.

1.3 ADJACENT LAND USE

The Proposed Upper's Quarry is surrounded by rural and recreational lands east of the City of Thorold and west of the urban areas of the City of Niagara Falls. Lands to the west of the proposed quarry, west of Thorold Townline Rd, are currently under agricultural production but are part of the City of Thorold urban area and, specifically, the Rolling Meadows Secondary Plan area. A woodland is located immediately west of Townline Road on a parcel of land owned by Walker Aggregates. Beechwood Golf and Country Club, rural residential uses and Beaverdams Creek Conservation Area are located to the north. East and south of the proposed quarry are lands within the urban area of Niagara Falls, currently under agricultural production but also including the existing Fernwood subdivision and Niagara Falls Golf Club.

2.0 ENVIRONMENTAL POLICIES AND LEGISLATION

This NETR has been prepared in accordance with the standards under the ARA (Ministry of Natural Resources and Forestry (MNRF), 2020). In addition to the ARA standards and requirements, this report addresses several relevant planning and policy documents, namely, the PPS (2020), provincial ESA (2007), the Niagara Region Official Plan (The Regional Municipality of Niagara 2014), the Official Plan of the City of Niagara Falls (City of Niagara Falls 2017), and the GPGGH (2020). These documents are addressed in the following sections.

2.1 AGGREGATE RESOURCES ACT

This NETR has been prepared in accordance with the Provincial Standards for a Class A Category 2 licence under the *Aggregate Resources Act* (ARA). Category 2 licences are for a quarry operation, which intends to extract aggregate from below the established groundwater table on private land. The provincial standards of the ARA require a NETR to determine whether any of the following features are present on and/or within 120 m of the Subject Property. The report must identify any of the following natural heritage features and areas that exist on the site and within 120 metres of the site:

a) significant wetlands

b) other coastal wetlands in Ecoregions SE, 6E and 7E,

c) fish habitat,

d) significant woodlands and significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River)

e) habitat of endangered species and threatened species,

f) significant wildlife habitat,

g) significant areas of natural and scientific interest,

h) Within the area of one or more provincial plan(s), any key natural heritage features not included in (a) through (g)

Where any of the above features or areas have been identified, the report must identify and evaluate any negative impacts on the natural features or areas, including their ecological functions, and identify any proposed preventative, mitigative or remedial measures. The report must also identify if the site or any of the features, included in (a) through (g), are located within a natural heritage system that has been identified by a municipality in ecoregions 6E and 7E or by the province as part of a provincial plan. Provincial plans include:

- Oak Ridges Moraine Conservation Plan
- Greenbelt Plan
- A Place to Grow: Growth Plan for the Greater Golden Horseshoe
- Niagara Escarpment Plan
- Lake Simcoe Protection Plan

The Study Area includes one or more known occurrences of the natural features listed above. Accordingly, Walker Aggregates retained Stantec to conduct the necessary field work and assessment for a NETR.

2.2 PROVINCIAL POLICY STATEMENT

This report was prepared to be consistent with Policy 2.1 of the PPS (Government of Ontario 2020) under the *Planning Act* and with the Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement 2005 Second Edition (NHRM) (Ontario Ministry of Natural Resources (MNR) 2010a). PPS Policy 2.1 addresses protection and management of natural heritage resources.

Natural heritage features relevant to the Study Area and defined in the PPS are similarly described in the ARA. The Study Area falls within Ecoregion 7E. Section 2.1.4 of the PPS (2020), states that development and site alteration shall not be permitted in the following features in Ecoregion 7E:

a) significant wetlands

b) significant coastal wetlands

Section 2.1.5 of the PPS states that development and site alteration shall not be permitted in the following features, unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions:

a) significant woodlands

b) significant valleylands

c) significant wildlife habitat

d) significant areas of natural and scientific interest

e) coastal wetlands that are not subject to policy 2.1.4(b)

Further, Sections 2.1.6 and 2.1.7 state that development and site alteration shall not be permitted in the following features, except in accordance with provincial and federal requirements:

a) habitat of endangered or threatened species

b) fish habitat

Development or site alteration may be permitted on lands adjacent to the natural heritage features listed above if it is demonstrated that there will be no negative impacts on the natural features or the ecological function for which the area was identified.

The diversity and connectivity of the natural features in an area should be maintained and enhanced, where possible, recognizing linkages between and among natural heritage, surface water and groundwater features (PPS Policy 2.1.2).

The Subject Property and/or Adjacent Lands encompass undeveloped lands, which contain natural features and areas that are listed under Section 2.1 of the PPS. Given the above, the natural heritage policies outlined in the PPS require consideration in the NETR to assess proposed development or site alteration activities on the Subject Property.

2.3 ENDANGERED SPECIES ACT

The Ontario ESA (Government of Ontario 2007) and associated Regulations that are amended from time to time, identifies wildlife species considered to be at risk in Ontario and designates them as threatened, endangered, extirpated or of special concern. Provincial SAR are identified and assessed by the Committee on the Status of Species at Risk in Ontario (COSSARO), which is a committee of wildlife experts and scientists, as well as those who provide Aboriginal traditional knowledge. COSSARO classifies species according to their degree of risk based on the best available scientific information, community knowledge and Aboriginal traditional knowledge. When COSSARO classifies a SAR, that classification applies throughout Ontario, unless otherwise noted.

The ESA protects SAR and their habitats by prohibiting anyone from killing, harming, harassing or possessing protected species (those listed as endangered or threatened), and prohibiting any damage or destruction to the habitat of protected species. All protected species are provided with general habitat protections under the ESA, which protects those areas upon which a species depends to carry out its life processes, such as reproduction, rearing, hibernation, migration or feeding.

Any activity that may impact a protected species or its habitat requires the prior issuance of a permit or other authorization from the Ministry of the Environment, Conservation and Parks (MECP). Permits may only be issued under certain circumstances, which are limited to activities required to protect human health and safety, activities that will assist in the protection or recovery of the species, activities that will result in an overall benefit to the species or activities that may provide significant social or economic benefit without jeopardizing the survival or recovery of the species in Ontario.

2.4 FISHERIES ACT

The *Fisheries Act* (most recently amended on August 28, 2019) is administered by Fisheries and Oceans Canada (DFO) and prohibits causing the death of fish and the harmful alteration, disruption or destruction (HADD) of fish habitat, unless authorized by the Minister of Fisheries, Oceans and the Canadian Coast Guard. This applies to work being conducted in or near watercourses or waterbodies that support fish and fish habitat. The fish and fish habitat protection provisions of the *Fisheries Act* apply to all fish and fish habitat in Canada (DFO 2020).

Following guidance and criteria provided on DFO's website regarding mitigation, waterbody types and codes of practice, proponents determine whether their projects in or near water will require review by DFO. In cases where impacts to fish and fish habitat cannot be avoided, proponents submit a Request for Review (RfR) form to DFO. DFO will review the project to identify the potential risks of the project to the conservation and protection of fish and fish habitat and will work with the Proponent to provide advice and guidance on how to comply with the *Fisheries Act*. If the project can avoid impacts to fish and fish habitat, project approval is not required. If impacts that cause a HADD cannot be avoided, proponents must apply for a *Fisheries Act* Authorization, and may be required to develop a habitat offsetting or compensation plan.

2.5 MIGRATORY BIRDS CONVENTION ACT

The federal *Migratory Birds Convention Act*, 1994 (MBCA) protects migratory birds and their nests (S.4). Section 6 of the Migratory Bird Regulations (C.R.C., c. 1035) prohibits the disturbance, destruction or taking of a nest, egg, or nest shelter of a migratory bird.

2.6 GROWTH PLAN FOR THE GREATER GOLDEN HORSESHOE

The GPGGH was issued under the *Places to Grow Act*, 2005. It is a framework for implementing the province's vision for building stronger and prosperous communities through the promotion of efficient infrastructure and land use patterns and through the protection of natural and cultural heritage resources. As addressed in the Ministry of Municipal Affairs and Housing (MMAH) letter of January 2021 (Appendix C), provincial policies for the natural heritage systems of the Growth Plan do not apply to the Subject Property.

2.7 CONSERVATION AUTHORITIES ACT

The Niagara Peninsula Conservation Authority's (NPCA) policies were derived from the *Conservation Authorities Act* (CAA) and Ontario Regulation (O. Reg.) *155/06* (Government of Ontario 2019b/ Government of Ontario 2013). These policies provide for the protection of natural hazards and natural heritage features within the NPCA jurisdiction (watershed), which apply to both municipal plan review and the implementation of the NPCA's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation.

The policies are intended to protect life and property from flood and erosion, ensure a sustainable water supply, protect and enhance water quality, preserve and manage natural areas and provide outdoor recreation opportunities. The NPCA uses these policies to guide development and site alteration while protecting, preserving and enhancing the natural environment.

These policies are similar to those included in the PPS and apply to the protection and preservation of natural hazards, such as floodplains, river or stream valleys and steep or eroding slopes, and natural heritage resources, such as wetlands, woodlands, wildlife habitat, threatened and endangered species, fish habitat and adjacent land areas. The NPCA's policies also include the protection of all wetlands from development and site alteration but does allow for some restricted uses (i.e. municipal infrastructure, conservation uses, hazard control structures) provided they are supported by an EIS. Compliance with such policies is required in order to obtain the necessary approvals for any development or alteration within an area regulated by the NPCA.

Generally, any development or site alteration within an area regulated by the NPCA, which includes floodplains, watercourses, steep slopes, wetlands, other natural hazards and associated allowances, requires approval of the NPCA pursuant to the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation (O. Reg. 155/06). Development or site alteration proposed within the regulated area may be permitted provided it is supported by an EIS. As determined through the pre-consultation process, ARA applications do not need permitting under the CAA.

2.8 NIAGARA REGION OFFICIAL PLAN

Natural heritage policies of the Niagara Region Official Plan (The Regional Municipality of Niagara 2014), including those relating to aggregate development, are described in Chapter 7 of the Official Plan.

Natural heritage policies in Chapter 7A emphasize the maintenance, enhancement or restoration of natural features and functions in the region, with mitigation required for negative impacts that cannot be avoided during development. Local municipalities are encouraged to adopt by-laws protecting trees and woodlands (in addition to the region's by-law, below) and to integrate natural features and vegetation into development plans. Specific policies for the protection of groundwater resources, air quality, landforms, soils, shorelines and valleylands are also included in this chapter.

Policies in Chapter 7B describe measures to identify, protect and enhance the Core NHS, including designated Core Natural Areas. Specific policies apply to development and site alteration in the Core NHS. The Core NHS consists of:

- Core Natural Areas, classified as either Environmental Protection Areas or Environmental Conservation Areas
- potential Natural Heritage Corridors connecting the Core Natural Areas
- the Greenbelt Natural Heritage and Water Resources Systems
- fish habitat.

Environmental Protection Areas (EPA) are defined in Policy 7.B.1.3 as:

Environmental Protection Areas include provincially significant wetlands; provincially significant Life Science Areas of Natural and Scientific Interest (ANSIs); and significant habitat of endangered and threatened species. In addition, within the Greenbelt Natural Heritage System, Environmental Protection Areas also include wetlands; significant valleylands; significant woodlands; significant wildlife habitat; habitat of species of concern; publicly owned conservation lands; savannahs and tallgrass prairies; and alvars. Mapping of the significant habitat of endangered and threatened species is not included in the Core Natural Heritage Map although much of this habitat may be found within the Environmental Protection and Environmental Conservation areas shown on the Map. Significant habitat of endangered and threatened species will be identified through the Planning and Development review process. Where such habitat is identified development and site alteration shall be subject to the policies for Environmental Protection Areas.

The subject property is not within the Greenbelt Natural Heritage System, therefore EPAs include provincially significant wetlands; provincially significant Life Science Areas of Natural and Scientific Interest (ANSIs); and significant habitat of endangered and threatened species.

Environmental Conservation Areas (ECA) are defined in Section 7.B.1.4 as:

Environmental Conservation Areas include significant woodlands; significant wildlife habitat; significant habitat of species of concern; regionally significant Life Science ANSIs; other evaluated wetlands; significant valleylands; savannahs and tallgrass prairies; and alvars; and publicly owned conservation lands.

Significant woodlands are defined in Section 7.B.1.5 as:

To be identified as significant a woodland must meet one or more of the following criteria: a) Contain threatened or endangered species or species of concern; b) In size, be equal to or greater than: i. 2 hectares, if located within or overlapping Urban Area Boundaries; ii. 4 hectares, if located outside Urban Areas and north of the Niagara Escarpment; iii. 10 hectares, if located outside Urban Areas and south of the Escarpment; c) Contain interior woodland habitat at least 100 metres in from the woodland boundaries; d) Contain older growth forest and be 2 hectares or greater in area; e) Overlap or contain one or more of the other significant natural heritage features listed in Policies 7.B.1.3 or 7.B.1.4; or f) Abut or be crossed by a watercourse or water body and be 2 or more hectares in area.

Policy 7.B.1.31 deals specifically with mineral aggregate operations and is a key policy with respect to the application of natural heritage protection as it relates to the Proposed Uppers Quarry, Policy 7.B.1.31 states:

Where a new mineral aggregate operation or an expansion to an existing operation is proposed outside the Greenbelt Natural Heritage System within an Environmental Conservation Area, a Potential Natural Heritage Corridor or Fish Habitat or within adjacent lands as set out in Table 7-1 the Environmental Impact Study will include consideration of:

a) Whether the following will be maintained or enhanced before, during and after mineral aggregate extraction,

i) connectivity among Core Natural Areas and hydrologic features; and

ii) significant hydrologic features and functions; and

b) How significant natural heritage features and ecological functions that would be affected will be replaced, on or off site, with features and functions of equal or greater ecological value that are representative of the natural ecosystem in that particular setting or ecodistrict.

This policy allows for the removal of certain designated natural heritage features subject to the replacement of the features' form and function in the local landscape. Beaverdams Creek and its adjacent wetlands are classified as Environmental Conservation Areas in the Niagara Regional Official Plan (Schedule C). Per Policy 7.B.1.4 "*Environmental Conservation Areas include significant woodlands; SWH; significant habitat of species of concern; regionally significant Life Science ANSI's; other evaluated wetlands; significant valleylands; savannahs and tallgrass prairies; and alvars; and publicly owned conservation lands.*" Significant habitat of threatened or endangered species, while not comprehensively mapped in the region, is subject to the policies for Environmental Protection Areas. Policy 7.B.1.11 states that in areas identified as Environmental Conservation Area an EIS is required for development within 50 m of a significant natural heritage feature. Where a new mineral aggregate operation is proposed within an Environmental Conservation Area (outside the Greenbelt NHS), the EIS must include consideration of how connectivity among Core Natural Areas and hydrologic features, and significant hydrologic features and functions will be maintained or enhanced before, during and after mineral extraction.

Environmental Conservation Areas include significant woodlands; significant wildlife habitat; significant habitat of species of concern; regionally significant Life Science ANSIs; other evaluated wetlands; significant valleylands; savannahs and tallgrass prairies; and alvars; and publicly owned conservation lands.

Policy 7.B.1.5 states: "*To be identified as significant a woodland must meet one or more of the following criteria: a) Contain threatened or endangered species or species of concern; b) In size, be equal to or greater than: i. 2hectares, if located within or overlapping Urban Area Boundaries; ii. 4 hectares, if located outside Urban Areas and north of the Niagara Escarpment; iii. 10 hectares, if located outside Urban Areas and south of the Escarpment; c) Contain interior woodland habitat at least 100 metres in from the woodland boundaries; d) Contain older growth forest and be 2 hectares or greater in area; e) Overlap or contain one or more of the other significant natural heritage features listed in Policies 7.B.1.3 or 7.B.1.4; or f) Abut or be crossed by a watercourse or water body and be 2 or more hectares in area.*"

Another key policy in Chapter 7B is Policy 7.B.1.5, that describes the identification of significant woodlands (for the purpose of the Official Plan). To be identified as significant by the Niagara Region Official Plan, a woodland must meet one or more of the following criteria:

a) Contain threatened or endangered species or species of concern.

b) In size, be equal to or greater than:

   i) 2 hectares, if located within or overlapping Urban Area Boundaries.

   ii) 4 hectares, if located outside Urban Areas and north of the Niagara Escarpment.

   iii) 10 hectares, if located outside Urban Areas and south of the Escarpment.

c) Contain interior woodland habitat at least 100 metres in from the woodland boundaries.

d) Contain older growth forest and be 2 hectares or greater in area.

e) Overlap or contain one or more of the other significant natural heritage features listed in Policies 7.B.1.3 or 7.B.1.4.

f) Abut or be crossed by a watercourse or water body and be 2 or more hectares in area.

When an EIS is required, the scope and content of the EIS shall be determined in accordance with the regional EIS Guidelines (2012) by the appropriate planning authority and in consultation with NPCA (Policy 7.B.2.3). An independent peer review of the EIS may be required (Policy 7.B.2.5).

This NETR and EIS has been prepared in consideration of the Region of Niagara’s Environmental Impact Study Guidelines (2012).

2.9 NIAGARA REGIONAL TREE AND FOREST CONSERVATION BY-LAW

To help achieve the goal of 30% forest cover in Niagara Region, the Regional Tree and Forest Conservation By-law (No. 30-2008) was developed to protect all woodlands greater than one hectare (ha) in size, smaller woodlands delegated by an area municipality, and heritage or significant community trees. Tree removal on lands described in an ARA licence is exempt from the by-law, per Section 4.6 of the by-law.

2.10 OFFICIAL PLAN FOR THE CITY OF NIAGARA FALLS

Natural Heritage policies in the Official Plan for the City of Niagara Falls (2017) generally defer to the Region’s Core NHS. Landowners are encouraged to consult with the MNRF, NPCA and Region of Niagara prior to undertaking work in or adjacent to natural heritage features.

Schedule A-1 of the Official Plan depicts Heritage Features and Environmental Lands. On this figure, both Environmental Conservation Areas and Environmental Protection Areas are shown on the Subject Property and within the Study Area.

2.11 SUMMARY OF POLICY

The policies and guidelines summarized above provide the context within which the approval of the proposed mineral aggregate operation will be considered from a natural environment perspective. The corresponding opportunities and constraints established by these policies and supporting guidelines should be recognized and addressed through the development design, location and supporting documentation, including the identification of appropriate mitigation, restoration and enhancement measures to offset potential negative impacts. The intent of this NETR is to demonstrate how the proposed development complies with the applicable policies noted above.

3.0 METHODS

3.1 BACKGROUND REVIEW AND AGENCY CONSULTATION

Background data were reviewed to identify designated natural heritage areas, significant species occurrences and landscape context. The data were used to supplement and guide the field surveys completed for the Subject Property. The main documents reviewed are listed in the reference section of this report.

Information on landscape context, natural heritage features and SAR applicable to the Study Area was obtained through agency consultation and a review of background documents and online data sources including:

- MNRF’s Natural Heritage Information Centre (NHIC) online database (MNRF 2019a)
- Land Information Ontario (LIO) Natural Heritage Area Mapping tool (MNRF 2019b)
- Fisheries and Oceans Aquatic SAR Maps – Ontario Southwest Map 17 (Government of Canada 2019b)
- Atlas of the Breeding Birds of Ontario (Cadman *et al.* 2007)
- Atlas of the Mammals of Ontario (Dobbyn 1994)
- Ontario Amphibian and Reptile Atlas (Ontario Nature 2020)
- Ontario Butterfly Atlas (Toronto Entomologists’ Association 2020)
- Niagara Peninsula Conservation Authority (NPCA) Regulation Mapping (NPCA n.d.)
- Region of Niagara Official Plan (The Regional Municipality of Niagara 2014)
- *Species at Risk Act* (SARA), Schedule 1 (Government of Canada 2019c)
- Species at Risk in Ontario (SARO) List (MECP 2019)

Walker Industries previously initiated the application process for a Category 2, Class “A” Quarry License on the Subject Property. In addition to the abovementioned resources, several ecological studies that were undertaken in support of this application were reviewed:

- AECOM conducted a fisheries assessment, environmental constraints analysis and wetland assessment on the property in 2008. The results of these assessments were outlined in two memos (AECOM 2009; AECOM 2010) and one report (AECOM 2008).
- Savanta Inc. conducted an insect survey and preliminary baseline conditions assessment in 2010. The results of these assessments were presented in two reports (Savanta Inc. 2010a; Savanta Inc. 2010b).
- Stantec conducted a bee, dragonfly and butterfly study; a salamander egg mass survey; a botanical inventory; an ELC habitat assessment; a breeding bird survey; an American badger survey; a winder wildlife survey; and a snake coverboard survey in 2012. The results of these surveys are presented in eight memos (Stantec 2012a-2012h).

3.2 FIELD SURVEY METHODS

Field investigations were conducted in 2017, 2019, 2021, and 2023. Prior to these detailed studies, preliminary reviews of the Study Area were completed and consideration was given to results when developing the scope of the field studies. Field investigations in 2017 included the characterization and mapping of vegetation communities and an assessment of headwater drainage features, as well as targeted field surveys including a summer botanical inventory, amphibian call count surveys, breeding bird surveys, snake cover board surveys, bat maternity roost and acoustic surveys, and terrestrial insect surveys. Field investigations in 2019 included a spring botanical survey and update of Ecological Land Classification (ELC), grassland breeding bird surveys, Barn Swallow nest search, and bat acoustic and exit surveys. Additional headwater drainage assessments were completed in spring of 2021. A supplemental survey for turtle nesting in suitable habitat was undertaken in 2023.

A summary of the field work completed is provided in Table 3-1. Results of field investigations are described in Section 5.0.

Table 3-1: Summary of field work completed for the Upper's Quarry Study Area in 2017, 2019, 2021 and 2023

Type of Field Work	Date(s) of Field Work	Personnel
AQUATIC SURVEY		
Headwater Drainage Feature Assessment	April 4, 2017 June 22, 2017 April 9, 2021	N. Burnett, M. Faiella, L. Uskov
Fish Community Survey	June 22, 2017	N. Burnett, M. Faiella
VEGETATION SURVEY		
ELC and Summer Botanical Surveys	July 24, 2017 August 25, 2017	B. Miller
Spring Botanical Survey and ELC update	May 10, 2019	B. Miller
Regional Review of Vegetation Communities	August 09, 2017	L. Uskov
WILDLIFE SURVEYS		
Amphibian Call Count Surveys	April 13, 2017 May 15, 2017 June 7, 2017	D. Giesbrecht, M. Ellah, L. Uskov
Breeding Bird Surveys	June 12, 2017 June 22, 2017 July 5, 2017	B. Obermayer, B. Holden
Grassland Bird Surveys	June 4, 2019 June 14, 2019 June 26, 2019	J. Ball

Table 3-1: Summary of field work completed for the Upper's Quarry Study Area in 2017, 2019, 2021 and 2023

Type of Field Work	Date(s) of Field Work	Personnel
Barn Swallow Nest Search	April 20, 2019 June 26, 2019	D. Charlton, J. Ball
Snake Cover Board Surveys	March 29, 2017 April 4, 2017 May 2, 3, 4, 8, 9, 10, 11, 15, 17, 26 and 30, 2017 June 9, 14 and 22, 2017 July 5, 2017	L. Uskov, B. Holden
Bat Maternity Roost Survey	April 4, 2017 April 20, 2019 June 26, 2019	L. Uskov, D. Charlton, J. Ball
2017 Bat Acoustic Surveys	June 14, 2017 – July 4, 2017	L. Uskov
2019 Bat Acoustic Surveys	June 14, 2019 – June 27, 2019	M. Ellah
Bat Exit Surveys (Buildings)	June 25, 2019 June 27, 2019 July 8, 2019	K. Zupfer, N. Burnett, R. Wood, S. Spisani, M. Ellah
Terrestrial Insect Surveys	July 5, 2017 August 12, 2017	B. Holden
Turtle Nesting Surveys	June 21, 2023	M. Razzouk
	June 22, 2023	L. Marshall
	June 27, 2023	M. Place
	June 28, 2023	J. Randall
	June 29, 2023	B. Miller
	June 30, 2023	M. Place
Incidental Observations and Wildlife Habitat Assessment	All dates	All Staff

3.2.1 Vegetation Surveys

Vegetation communities on the Subject Property and in the Study Area were identified in 2017 using aerial photography and field-verification. A road-side survey of the RAA was also completed to confirm the NPCA ELC community mapping on August 9, 2017.

Community naming followed the Ecological Land Classification field guide for Southern Ontario (Lee *et al.*, 1998), utilizing 2008 ELC code updates where required. The Subject Property was assessed in its entirety while adjacent lands (i.e. the Study Area) were assessed using alternative site investigation methods, such as aerial photography interpretation, edge assessments, and background data from adjacent development (where applicable). ELC was completed to the finest level of resolution (vegetation type) where feasible. Provincial significance of vegetation communities was based on the rankings assigned by the NHIC (NHIC 2020).

Botanical surveys were completed in July and August 2017 and May 2019, including targeted searches for spoon-leaved moss *(Bryoandersonia illecebra)*, a species listed as Endangered federally and Threatened provincially. Nomenclature largely follows Newmaster *et al.* (1998), with updates taken from published volumes of the Flora of North America Editorial Committee (1993+). Additional sources include Michigan Flora Online (Reznicek *et al.*, 2011) and Brouillet *et al.* (2010+). English colloquial names generally follow Newmaster *et al.* (1998). Provincial significance of vegetation communities was based on the draft rankings assigned by the Natural Heritage Information Centre (Bakowsky, 1996). The provincial status of all plant species is based on Newmaster *et al*. (1998), with updates from the NHIC database (NHIC, 2020).

Identification of potentially sensitive native plant species was based on their assigned Coefficient of Conservatism (C*C*) value, as determined by Oldham, Bakowsky & Sutherland (1995). This C*C* value, ranging from 0 (low) to 10 (high), is based on a species' tolerance to disturbance and fidelity to a specific natural habitat. Species with a C*C* value of 8, 9 or 10 generally exhibit a high degree of fidelity to a narrow range of habitat parameters and are considered habitat sensitive species and are usually typical of high-quality plant communities.Survey dates, times, weather conditions, and surveyors for 2017 and 2019 field investigations are provided below in Table 3-2.

Table 3-2: Vegetation Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	July 24, 2017 10:00 – 14:00	25	2	10	None / rain	B. Miller
2	August 9, 2017 10:00 – 14:00	25	2	50	None / rain	L. Uskov
3	August 25, 2017 10:00 – 14:00	24	2	40	None / rain	B. Miller
4	May 10, 2019 10:00 – 14:00	17	3	75	None / rain	B. Miller

3.2.2 Amphibian Call Count Surveys

Amphibian call count surveys were conducted in 2017 followed the Marsh Monitoring Program protocol (Bird Studies Canada). A total of nine (9) stations were surveyed, as shown on Figure 4 (Appendix A).

Surveys were completed on evenings that had minimum temperatures of 5°C in April, 10°C in May, and 17°C in June, between half an hour after sunset and midnight. Each survey station consisted of a 100 m radius semicircle with the surveyors listening for three minutes for all calling toads and frogs. Call levels were described using values of 1, 2, or 3. Level 1 indicates that individuals could be counted, and calls were not simultaneous. Level 2 denotes that calls are distinguishable but with some simultaneous calling. Level 3 indicates a full chorus where calls are continuous and overlapping. Toads and frogs calling from outside of the survey station were also noted on the field sheets.

Survey dates, times, weather conditions, and surveyors are provided below in Table 3-3.

Table 3-3: Amphibian Call Count Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	April 13, 2017 20:31 – 22:30	9	0	80	None / none	D. Giesbrecht M. Ellah
2	May 15, 2017 20:57 – 22:36	15	1	0	None / none	L. Uskov D. Giesbrecht
3	June 7, 2017 21:32 – 22:33	18	1	10	None / none	L. Uskov D. Giesbrecht

3.2.3 Breeding Bird Surveys

In 2017, breeding bird surveys were completed in all habitats following established protocols such as the Atlas of the Breeding Birds of Ontario and the North American Breeding Bird Survey (Cadman *et al.*, 2007, Government of Canada 2018). A total of 23 breeding bird point count stations were surveyed, as shown on Figure 5 (Appendix A). In addition, all bird species seen or heard while traversing the Subject Property were recorded. A conservative approach to determining breeding status was taken; all birds seen or heard in appropriate habitat during the breeding season were assumed to be breeding.

In 2019, additional breeding bird surveys were completed to target grassland bird species based on methods described in "Survey Methodology under the *Endangered Species Act*, 2007: *Dolichonyx oryzivorus* (Bobolink)" (MNRF 2011). Surveys were conducted between sunrise and 9:30 am in suitable grassland habitat patches using point counts located approximately 250 m apart.

Barn Swallow nest searches were also completed for all potentially suitable features and structures on the same survey dates as grassland breeding bird surveys. All buildings on the Subject Property with potential to have nesting Barn Swallows were searched. Survey dates, times, weather conditions, and surveyors are provided below in Table 3-4.

Table 3-4: Breeding Bird Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	June 12, 2017 5:37 – 10:05	23-30	2-3	50	None / none	B. Obermayer

Table 3-4: Breeding Bird Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
2	June 22, 2017 5:41 – 10:00	18-23	1-3	20-90	None / none	B. Holden
3	July 5, 2017 5:25 – 10:07	18-25	2	10	None / none	B. Holden
4	June 4, 2019 7:03 – 9:25	10	1	50	None / none	J. Ball
5	June 14, 2019 6:47 – 8:03	10	3	90	None / rain	J. Ball
6	June 26, 2019 7:29 – 8:57	15	1	80	None / rain	J. Ball

3.2.4 Snake Coverboard Surveys

Methods for snake coverboard surveys were developed in consultation with the Guelph district MNRF through a Wildlife Scientific Collector's Authorization issued by MNRF and WACC. Recommendations made in email response to the request were incorporated into the methods as outlined below.

Twenty-three (23) coverboard stations were established within various habitat types including marshes, swamps, deciduous forests, plantations and agricultural fields (Figure 5, Appendix A). At each station, two coverboards (one tin and one wood) were placed for a total of 46 boards. Each board was numbered and geo-referenced with a GPS to facilitate data recording.

Though Coverboards were set out on March 29th, no survey was completed; the boards were set and left to blend with emerging vegetation until April 4th (survey 1 in Table 3.5). A total of sixteen (16) surveys were conducted between April 4 and July 5, 2017.

Consecutive days were targeted but weather was the determining factor. Every effort was made to conduct surveys on sunny days with light winds and air temperatures over 12ºC, although this wasn't always possible.

Survey dates, times, weather conditions, and surveyors are provided below in Table 3-5.

Snakes and snake sign may also be observed during the course of other surveys conducted during appropriate weather and timeframes, such as ELC, breeding bird surveys, and fish habitat surveys that occur along riparian edges. It is Stantec's experience that these surveys, conducted at different times of the year and times of day, are instrumental in identifying the presence of various snake species and in combination with the noted artificial cover surveys offer a reliable assessment of snake habitat and activity on site.

Table 3-5: Snake Coverboard Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	April 4, 2017 9:00 – 12:00	14	4	100	Rain / rain	L. Uskov
2	May 2, 2017 8:49 – 11:27	8	3	100	None / none	L. Uskov
3	May 3, 2017 9:28 – 12:01	14	1-2	15	None / none	L. Uskov
4	May 4, 2017 9:41 – 11:56	11	2	100	Rain / rain	L. Uskov
5	May 8, 2017 11:16 – 12:56	12	2	25	None / none	L. Uskov
6	May 9, 2017 10:36 – 12:15	12	1	20	None / none	L. Uskov
7	May 10, 2017 9:41 – 11:18	9	1	50	None / none	L. Uskov
8	May 11, 2017 9:16 – 10:58	9	2	90	None / none	L. Uskov
9	May 15, 2017 9:57 – 11:31	12	2	0	None / none	L. Uskov
10	May 17, 2017 10:59 – 12:28	25	4	50	None / none	L. Uskov
11	May 26, 2017 10:04 – 11:35	14	1	100	Rain / rain	L. Uskov
12	May 30, 2017 10:14 – 11:46	19	1-2	40	None / rain	L. Uskov
13	June 9, 2017 10:45 – 12:33	24	1-2	15	None / none	L. Uskov
14	June 14, 2017 13:51 – 17:05	23	2	0	None / none	L. Uskov
15	June 22, 2017 9:52 – 11:30	22	2	50	None / none	B. Holden
16	July 5, 2017 10:05 – 11:45	23	2	10	None / none	B. Holden

3.2.5 Turtle Surveys

3.2.5.1 Turtle Basking Surveys

Basking turtle surveys were conducted to determine the presence or absence of turtles within existing habitat in the Study Area. Surveys followed guidance from *The Survey Protocol for Blanding's Turtle* (*Emydoidea blandingii) in Ontario* (OMNRF 2015). Five basking surveys were conducted between April 4 and May 30 to capture the period when turtles were most likely to be observed basking after ice cover receded and before water temperatures became too warm (OMNRF 2015). Surveys were conducted between 8 am and 5 pm when air temperatures were greater than 5°C. Survey dates, times, weather conditions, and surveyors are provided below in Table 3.6.

Table 3-6: Basking Turtle Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	April 4, 2017 10:30 – 15:30	14	6	100	Trace / Rain	L. Uskov
2	May 3, 2017 09:28 – 15:58	14	2	15	None / None	L. Uskov
3	May 9, 2017 10:36 – 13:50	12	1	20	None / None	L. Uskov
4	May 17, 2017 11:06 – 13:29	25	5	25 – 50	None / None	L. Uskov
5	May 30, 2017 10:04 – 14:37	19	2	25	None / Rain	L. Uskov

3.2.5.2 Turtle Nesting Surveys

Nesting turtle surveys were conducted to determine the presence or absence of suitable nesting habitat within the Study Area. Surveys followed guidance from *Blanding's Turtle Nest and Nesting Survey Guidelines* (MNRF 2016). Six surveys were completed on suitable nights during the nesting season. Surveys occurred between 6:00 pm and 10:00 pm during warm (> 14 degrees Celsius) nights. Survey dates, times, weather conditions, and surveyors are provided below in Table 3-7.

Table 3-7: Survey effort for 2023 Supplemental Turtle Nesting Surveys

Survey	Date/Time	Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	Surveyor
1	June 21, 2023 18:00 – 22:00	27	4	25	None/None	M. Razzouk
2	June 22, 2023 17:32 – 20:28	24	3	100	None/None	L. Marshall
3	June 27, 2023 17:20 – 20:32	21	3	100	Light Rain/ Yes	M. Place
4	June 28, 2023 18:05 – 21:12	26	3	100	None/None	J. Randall
5	June 29, 2023 17:30 – 20:00	26	1	0	None/None	B. Miller
6	June 30, 2023 17:20 – 20:12	28	2	100	None/None	M. Place

3.2.6 Bat Surveys

3.2.6.1 Bat Maternity Roost Suitability Survey

ELC was used to document potential maternity roost habitat within the Study Area. Based on criteria in the Survey Protocol for Species at Risk Bats Within Treed Habitats (MNRF 2017), all hedgerow, treed thicket and forest communities within the Study Area were considered potential bat maternity roost habitat (ELC codes: CUH, FOD, WOD and TH). A survey was completed on April 4, 2017 to identify potentially suitable roost trees. All trees within the proposed vegetation clearing zone (grading limit) with a diameter at breast height (DBH) of 10 cm or greater were assessed.

The following were recorded for each assessed tree:

- geographic coordinates (UTM)
- dbh
- height/crown class (dominant, co-dominant, intermediate, and suppressed)
- presence of cavity, loose bark, crack or knot hole
- decay class (1 – 6)

Roost tree suitability was determined using guidance from MNRF's Survey Protocol for Species at Risk Bats within Treed Habitats: Little Brown Myotis, Northern Myotis & Tri-coloured Bat, April 2017 (MNRF 2017). Snag trees suitable for Little Brown Myotis and Northern Myotis were those in an early state of decay with loose bark, or at least one cavity, crack, knot or leaf cluster. Roost trees suitable for Tri-coloured Bat were any Oak tree over 10 cm DBH, and any Sugar Maple tree over 25 cm DBH or Sugar Maple tree over 10 cm DBH that also include a dead/dying leaf cluster. Per MNRF guidance (2017), there is no minimum threshold for number of maternity roost trees per hectare for an ELC ecosite to be considered suitable maternity roost habitat for SAR bats.

Buildings on the Subject Property were surveyed for their potential to provide bat roosting habitat in April and June 2019. Surveyors looked for buildings with loose siding or shingles, or gaps providing access to an attic or building rafters. Where access or a view into the attic was permitted, surveyors looked for bats and bat droppings.

Survey dates, times, weather conditions, and surveyors are provided below in Table 3.6. The results of the suitability surveys were used to determine where acoustic monitoring and exit surveys for bats were conducted, as described in Sections 5.6.2 and 5.6.3.

Table 3-8: Bat Maternity Roost Suitability Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	April 4, 2017 12:30 – 15:30	14	4	100	Rain / rain	L. Uskov
2	April 20, 2019 11:00 – 13:00	10	2	100	None / rain	D. Charlton
3	June 26, 2019 7:29 – 8:57	15	1	80	None / rain	J. Ball

3.2.6.2 Bat Acoustic Surveys

In 2017, 13 autonomous recording units (ARUs) were deployed in treed habitat and at buildings on the Subject Property between June 14 and July 4. ARUs were only placed in mature forest habitat, as the primary purpose of the survey was to detect bats in potentially suitable roosting habitat. In 2019, seven additional ARUs were deployed in treed habitat between June 14 and June 27. Where possible, calls were identified, to species or a group of similar species using Kaleidoscope Pro software (Wildlife Acoustics) and were quality-reviewed by an experienced ecologist. Locations of ARUs are shown on Figure 7 (Appendix A).

3.2.6.3 Bat Exit Surveys

Bat exit surveys were completed at buildings on the Subject Property that were classified as potential bat habitat. Bat exit surveys took place in accordance with *Surveying for the presence of Little Brown Myotis and Northern Myotis* (MNRF, 2014).

Surveys consisted of observers watching three potential bat roost buildings looking for signs of bats exiting or entering, using binoculars and flashlights, and a handheld acoustic monitoring device to record bat calls for species identification. Surveys started 30 minutes before dusk and finished 60 minutes after dusk.

Where possible, recorded calls were identified to species or a group of similar species using Kaleidoscope Pro software (Wildlife Acoustics) and quality-reviewed by an experienced ecologist. The locations where observers were standing during bat exit surveys are shown on Figure 7 (Appendix A). Survey dates, times, weather conditions, and surveyors are provided below in Table 3-9.

Table 3-9: Bat Exit Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	June 25, 2019 21:15 – 22:26	21	1	0	None / rain	S. Spisani, N. Burnett, R. Wood, M. Ellah
2	June 27, 2019 21:00 – 22:13	24	1	0	None / none	K. Zupfer, R. Wood, C. Simmons, T. Zbieranowski
3	July 8, 2019 20:45 – 22:15	22	0	10	None / none	K. Zupfer, N. Burnett

3.2.7 Terrestrial Insect Surveys

Two surveys were completed in 2017, one in July and one in August, for damselflies, dragonflies and butterflies. Surveys were conducted under low wind conditions (0-2 on the Beaufort scale), on warm days (>15°C), and when the sun is overhead (approximately 10:00 am to 4:00 pm). Species were identified at a distance using binoculars where possible, or in the hand where required, captured using an aerial net.

Surveys were completed by walking through major habitats within the Subject Property. Emphasis was placed on areas where these insects were likely to concentrate such as woodland edges, meadows, nectar plants, wetland or open water or habitat containing butterfly larval host plants.

Survey dates, times, weather conditions, and surveyors are provided below in Table 3-10.

Table 3-10: Terrestrial Insect Survey Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	July 5, 2017 8:00 – 13:00	20-25	2	10	None / none	B. Holden
2	August 12, 2017 10:00 – 16:00	20-24	1-2	30-40	None / rain	B. Holden

3.2.8 Headwater Drainage Feature Assessment

The Headwater Drainage Feature Assessment (HDFA) was completed using *The Evaluation, Classification and Management of Headwater Features Guidelines* (CVC and TRCA, TRCA Approval July 2013; finalized January 2014) (the Guidelines) as a tool to examine headwater features on the Subject Property. Table 4 of the Guidelines provides approximate windows for site visits to capture observations associated with time of year.

Potential locations of headwater drainage features (HDF) on the Subject Property were determined in a desktop exercise using aerial photography, drainage layers from agencies including MNRF and NPCA, topographic mapping, and geology and physiography information. Field verification was then undertaken. Verification included completing site visits consistent with the timing recommended by the HDF guidelines. The locations of assessed HDF are shown on Figure 8 (Appendix A). Survey dates, times, weather conditions, and surveyors are provided below in Table 3-11. All identified HDF were noted to be dry, or only possessing limited amounts of standing water during the second site visit, therefore a third visit was not required.

Table 3-11: Headwater Drainage Feature Assessment Dates, Times and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	April 4, 2017 8:00 – 14:00	12	3	70	None / rain	L. Uskov and M. Faiella
2	June 22, 2017 10:00 – 16:00	22	2	50	None / none	N. Burnett and M. Faiella
1	April 9, 2021 10:20 – 13:45	19	NA	50	None/none	M. Faiella

3.2.9 Surveys of the Existing Watercourse (Tributary to Beaverdams Creek)

The segment of the existing watercourse within the Study Area was assessed for fish presence and fish habitat availability. Single pass backpack electrofishing techniques were used and water quality data were collected using a YSI Sonde multiprobe. Locations of fish and water quality data collection are shown on Figure 8. Fish habitat data included descriptions of substrate composition, in-stream cover availability, riparian vegetation, and an assessment of critical habitat for fish (i.e. spawning, nursery, and staging areas).

Survey date, time, weather conditions, and surveyors are provided below in Table 3-12.

Table 3-12: Existing Watercourse Assessment Dates, Times, and Weather Conditions

Survey	Date/Time	Weather				Surveyors
		Temp. (°C)	Wind (Beaufort Scale)	Cloud (%)	PPT / PPT last 24 hours	
1	June 22, 2017 9:30 – 12:00	19	2	50	None / none	N. Burnett and M. Faiella

3.3 METHODS FOR ANALYSIS OF SIGNIFICANCE AND SENSITIVITY

Biological field data were evaluated to determine the significance of natural heritage features. Status rankings for plants, vegetation communities and wildlife are based on the number of occurrences in Ontario, as noted in Section 3.3.6. Provincial significance of vegetation communities is based on the rankings assigned by the NHIC (MNRF 2021). Identification of potentially sensitive plant species was based on the coefficient of conservatism' as described in Section 3.2.1

The potential significance of the natural heritage features and associated ecological functions was evaluated in accordance with the following provincial and municipal guideline documents:

- NHRM for Natural Heritage Policies of the Provincial Policy Statement (MNRF 2010) to determine Provincially Significant natural heritage features and associated ecological functions.
- SWH Criteria Schedules for Ecoregion 7E (MNRF 2015) to determine the significance of identified wildlife habitat features and functions.
- The Niagara Region Official Plan (The Regional Municipality of Niagara 2014) and the Official Plan of the City of Niagara Falls (2017) to review natural heritage systems, and ESA in accordance with associated Official Plan policies.

3.3.6 Significant Woodland Assessment

The ARA and PPS (2020) and GPGGH (2019) identify significant woodlands as protected natural heritage features. The PPS (2020) defines a significant woodland as, "*an area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history*".

To assist in the evaluation of woodland significance, the NHRM (MNR 2010) states the following: "the Province recommends that planning authorities develop and apply a set of evaluation criteria based on the factors and characteristics outlined in the following section." The NHRM also provides detailed guidance on the determination of Significant Woodlands. All woodlands in the Study Area were assessed using criteria for woodland significance from the Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, and Policy 7.B.1.5 of the Region of Niagara Official Plan. Methods of assessment are described below.

3.3.6.1 Provincial Assessment Criteria

Guidelines for determining significance of woodlands are presented in Section 7.0 of the NHRM (MNR 2010). The NHRM provides guidance with respect to the following woodland characteristics that indicate provincial significance:

- Woodland size
- Ecological functions including interior habitat, proximity, linkages, water protection and diversity
- Woodlands that provide uncommon features
- Woodland economic and social values

The primary factor in determining woodland significance following the NHRM method is woodland size relative to woodland cover in the surrounding landscape. For example, where woodland cover is 15-30% of land cover in a given area, woodlands 20 ha in size or larger, or woodlands containing 2 ha or more of interior habitat, are considered significant. Additional natural heritage criteria such as ecological functions, uncommon characteristics and social or economic values are recommended for consideration in the NHRM, however for each of these criteria the entire woodland must also meet a minimum area threshold. The minimum area threshold for ecological functions, uncommon characteristics and social or economic values may be lower than the primary size threshold for significance.

The NHRM criteria for determining woodland significance are provided in summary in Table 3-13, below, and in detail in Table B-3, Appendix B.

Table 3-13: Criteria for Woodland Significance per Ontario Natural Heritage Reference Manual Section 7.0 (Derived from NHRM Table 7-2)

1.	**Woodland size** Where woodland cover is 15-30% of land cover in a given area, woodlands 20 ha in size or larger, or woodlands containing 2 ha or more of interior habitat, should be considered significant. Woodland cover is 25% in the City of Niagara Falls, 19% in the Town of Thorold, and 18% in the NPCA regulatory area (NPCA 2010), therefore in these jurisdictions 20 ha is the minimum size for determining significance. For criteria 2-4, a lower minimum area threshold may be appropriate. The NHRM suggests that a minimum area threshold of 4 ha could be appropriate in planning areas with 15-30% woodland cover.
2.	**Ecological function** a) Woodland Interior: woodlands of a size and shape that create habitat more than 100 metres from the edge often provide habitat for species whose success depends on larger sizes and reduced disturbance; referred to as interior species. b) Proximity to Other Woodlands or Other Habitats: woodlands should be considered significant if a portion of it is located within a specified distance (e.g. 30 m) of a significant natural feature (e.g. significant wetland) likely receiving ecological benefit from the woodland, **and the entire woodland meets the minimum area threshold**. c) Linkages: woodlands should be considered significant if they are located within a defined natural heritage system or provide a connecting link between two other significant features (e.g. significant wetland) **and the entire woodland meets the minimum area thresholds**. d) Water protection: woodlands should be considered significant if they are located within a sensitive or threatened watershed or a specified distance of a sensitive groundwater discharge, sensitive recharge, sensitive headwater area, watercourse or fish habitat **and meet minimum area thresholds**. e) Woodland diversity - woodlands should be considered significant if they have a naturally occurring composition of native forest species that have declined significantly south and east of the Canadian Shield, or have a high native diversity through a combination of composition and terrain **and meets the minimum area thresholds**.
c.	**Uncommon characteristics** Woodlands should be considered significant if they have: a unique species composition; a vegetation community with a provincial ranking of S1, S2 or S3; habitat of a rare, uncommon or restricted woodland plant species; or, characteristics of older woodlands **and meet minimum area thresholds**.
d.	**Economic and social values** Woodlands that have high economic or social values through particular site characteristics or deliberate management, **and meet minimum area thresholds**.

3.3.6.2 Regional Assessment Criteria

The Region of Niagara Official Plan Policy 7.B.1.5 provides six criteria by which woodland significance can be assessed. As per the policy, to be identified as significant a woodland must meet one or more of the criteria shown in Table 3-14.

Table 3-14: Criteria for Woodland Significance per Policy 7.B.1.5 of the Region of Niagara Official Plan

a.	Contain threatened or endangered species or species of concern;
b.	In size, be equal to or greater than: 2 hectares, if located within or overlapping Urban Area Boundaries; 4 hectares, if located outside Urban Areas and north of the Niagara Escarpment; 10 hectares, if located outside Urban Areas and south of the Escarpment;
c.	Contain interior woodland habitat at least 100 metres in from the woodland boundaries;
d.	Contain older growth forest and be 2 hectares or greater in area;
e.	Overlap or contain one or more of the other significant natural heritage features listed in Policies 7.B.1.3 or 7.B.1.4; or
f.	Abut or be crossed by a watercourse or water body and be 2 or more hectares in area.

3.3.7 Significant Wetland Assessment

Wetlands were identified from the LIO database, Region of Niagara ELC database, confirmatory windshield surveys, and targeted field investigations in the Study Area. The wetland assessment included wetlands within the Subject Property, the Study Area (adjacent land area) and the RAA. Thirteen (13) wetland units or complexes were considered in the assessment. Wetlands within the Study Area were described using the ELC descriptions. The delineation of wetland boundaries on the Subject Property were based on the method described in the Ontario Wetland Evaluation System (OWES) manual for southern Ontario. It should be noted that OWES wetland boundary and ELC community delineations use different methods and therefore do not always result in similar boundaries. The assessors completing the NETR evaluation were aware of these differences. The wetland boundaries on the Subject Property were determined using ELC boundaries and OWES methods, in this case, they were observed to be the same. Wetlands in the RAA were mapped, and their wetland type and designation area were described in the assessment.

Quarry developments are associated with dewatering activities to allow for aggregate removal at depth. A drawdown cone is most often realized beyond the Subject Property or the Study Area, which can influence the groundwater conditions at a distance from the quarry. Wetlands have the potential to be entirely or seasonally dependent on the interaction with the groundwater conditions, unless they are supported solely by surface runoff. As such, they must be considered in a regional context and in consideration of the extended effects on groundwater. The potential for interaction between surface water receptors such as wetlands and the groundwater is related to the underlying geology of the area and the movement of groundwater within the regional geological units and surface overburden. The study of geology, groundwater and surface water is provided in the Proposed Upper's Quarry Level 2 Water Study Report (Level 2 Water Study Report; WSP 2021). That WSP study forms the basis for the understanding and assessment of potential impacts to wetlands beyond the development footprint. As part of the wetland impact assessment, there was extensive dialogue with the project hydrologist and hydrogeologist to understand regional conditions, and the interaction of surface and subsurface water regimes with water dependent natural heritage features.

3.3.8 Significant Wildlife Habitat Assessment

Wildlife habitat is defined in the PPS (2020) as, "*areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual or life cycle; and areas which are important to migratory or non-migratory species.*" SWH means the feature is significant, "*in regard to other* [natural heritage] *features and areas in policy 2.1, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system*".

The potential for natural heritage features to provide SWH was evaluated in accordance with the following provincial and municipal guideline documents:

- NHRM (MNR 2010) to determine Provincially Significant natural heritage features and associated ecological functions.
- Significant Wildlife Habitat: Technical Guide (MNRF 2000) to determine the significance of identified wildlife habitat features and functions.
- Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E (MNRF 2015) to determine the updated significance criteria of identified habitat features and functions.

The SWH Ecoregion 7E Criteria (MNRF 2015) groups wildlife habitat into four categories:

1. seasonal concentration areas of animals
2. rare vegetation communities or specialized habitat for wildlife
3. habitat for species of conservation concern
4. animal movement corridors

An assessment of SWH in the Study Area was undertaken through a combination of field assessments and air photo interpretation with reference to the MNRF evaluation criteria for Ecoregion 7E.

3.3.9 Species and Risk and Species of Conservation Concern

For the purpose of this assessment, SAR are species listed as threatened or endangered on the Species at Risk in Ontario (SARO) list. Only species listed as threatened or endangered and their habitats are provided protection under this Act.

Species of conservation concern (SOCC) in this report are species that are listed as threatened or endangered on Schedule 1 of the federal *Species at Risk Act* (SARA; 2007) but are not on the SARO list, listed as special concern on SARO list, or are provincially rare (with a provincial S-rank of S1 to S3). Provincial sub-national ranks (S-ranks) are used by the NHIC to set protection priorities for rare species and vegetation communities and are based on the number of factors such as abundance, distribution, population trends and threats in Ontario. Provincial ranks are not legal designations. Provincial S-ranks are defined as follows:

S1: Critically imperiled; usually fewer than 5 occurrences
S2: Imperiled; usually fewer than 20 occurrences

S3: Vulnerable; usually fewer than 100 occurrences
S4: Apparently secure
S5: Secure
S?: Unranked, or, if following a ranking, rank uncertain (e.g. S3?).

3.3.10 Headwater Drainage Feature Management Determination

The HDF within the Subject Property were assessed using *The Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (CVC and TRCA, TRCA Approval July 2013; finalized January 2014, hereafter referred to as the guidelines). The guidelines, as outlined in the document, can generally be applied to any drainage feature that is:

- part of the drainage network (i.e. drainage channels that are identified from aerial photography, and/or drainage lines resulting from ArcHydro analysis); or
- a groundwater seepage area or spring; or
- a connected headwater wetland (a surface outlet connects to downstream); and
- not a mapped or known perennially flowing stream.

The guidelines were developed to provide direction to practitioners for features that are not clearly covered by existing policy and legislation as are important eco-hydrological features (e.g. perennial streams and Provincially Significant Wetlands (PSW)), but which may contribute to overall watershed health.

The guidelines employ a multiple survey approach to headwater drainage feature assessments (HDFA) to capture seasonal variability in hydroperiod, and to identify other potential ecological functions of these features on the landscape. The need for additional surveys and the timing of each visit is dictated by the results of the previous survey, as follows:

Site Visit 1 is conducted during a window of approximately 2 weeks, immediately after the snow pack has dissipated and the frost has melted in the ground. The melting of frost contributes to the hydroperiod of these features. The survey window is typically during late March or early April but is subject to variation depending on the weather in any given year. During the first site visit, all drainage lines generated using ArcHydro, aerial photography interpretation or contour interpretation must be examined. Both the flow condition and feature type during this site visit determine if the HDF requires further investigation or, if it is a feature exhibiting limited functions. If the feature is dry or only standing water is observed, or if there is no defined feature present, it is likely that the feature would be considered as "limited functions" and no additional data are required; therefore, no further field visits are required. If the feature exhibits functions beyond the "limited functions" criteria, such as a defined flow path and active flow, further data collection is then required to define those functions more fully.

Site Visit 2 is conducted for features that were determined to possess functions beyond "limited" during Site Visit 1. The second visit is conducted after the freshet has ended when the melt/thaw related interflow has ceased and, preferably, after a few days with no precipitation. This visit should be timed to occur before spring plant growth is very far advanced to allow unobstructed examination of features and is typically from late April through mid-May. During this site visit, flow condition and fish presence are assessed. If flow or standing water is persisting during Site Visit 2, this is documented, and the upstream limit of fish presence is determined. While visual observations can offer confirmation of presence, electrofishing is typically employed to confidently determine fish presence or absence. Electrofishing commences at the furthest upstream presence of water, which may be in the form of standing isolated pools or the upstream extent of flowing water. Once fish are captured, there is no need to sample any further downstream as the upstream extent of fish passage has been identified. If the feature is dry during Site Visit 2, or, as is often the case, it has been removed by cultivation, a third site visit is not required. If water is present, Site Visit 3 can be scheduled to obtain further data.

Site Visit 3 is conducted if water was present in the feature during Site Visit 2. The timing of the third visit is from July to mid-September, preferably after several days without a significant (i.e. flow generating) amount of rain. During this site visit, flow condition and fish presence are assessed. The primary purpose is to determine where the upstream limits of flow, permanent aquatic habitat (which would include standing water upstream from where flow ceases) and fish utilization occur. The presence of flow during this visit automatically results in classification as an “important” feature, so fish presence has no effect on management recommendations. Where isolated standing pools exist, sampling should be conducted, as described for Site Visit 2 (above), to determine the upstream limit of year-round fish utilization.

The data and observations collected from site visits are used to inform a series of classifications of the feature in relation to its function with respect to hydrology, riparian character, fish and fish habitat, and terrestrial habitat. These classifications are then used to navigate a flow chart that determines the most appropriate management approach for the feature. Management approaches can range from protection in situ to no management requirements (i.e. removal is possible), with interim management approaches that include replication of form and function or replication of function alone.

4.0 BACKGROUND DATA COLLECTION AND AGENCY CONSULTATION

4.1 LANDSCAPE CONTEXT

The Study Area is located in Ecoregion 7E (Crins *et al.* 2009) and within the Niagara section of the Deciduous Forest Region (Rowe 1972). The Niagara Section is dominated by sugar maple and American beech, mixed with basswood, red maple, red oak, white oak, and bur oak. The bulk of Canada's black walnuts, sycamores, swamp white oaks, and shagbark hickories are found in this forest region. Other associated species include butternut and bitternut hickories, rock elm, silver maple, and blue beech. Coniferous species are generally limited to scattered white pine, eastern hemlock, eastern red cedar, and, more rarely, black spruce, tamarack, and eastern white cedar. The vast majority of lands within this Ecodistrict (7E-5) are privately owned, with only about 0.26% of total area protected federally or provincially, and 0.84% owned by Conservation Authority (Henson et al. 2005). In addition, "Big Picture" Cores represent approximately 5.20% and corridors approximately 9.55% of the Ecodistrict (Henson et al. 2005).

4.2 GEOLOGY AND GROUNDWATER

Existing geology and groundwater conditions are presented in detail in the Level 2 Water Study Report (WSP 2021).

The Study Area is located within the Haldimand Clay Plain physiographic region on the Niagara Peninsula (Chapman and Putnam 2007). This region is characterized by low permeability soils (glaciolacustrine silts and clays) and relatively flat topography (Ontario Geological Survey 2010). The Subject Property is underlain by calcareous bedrock. The property generally slopes to the north, with elevations ranging from 185 metres above sea level (masl) near the west end of Upper's Lane to 177 masl along the northernmost reach of the existing watercourse. Groundwater elevations range from ±184.5 masl in the western portion of the Subject Property to ±176.0 masl in the northern portion of the Subject Property during spring conditions, with an observed decrease on the order of 1 to 2 m during fall conditions (WSP 2021). Along the western property boundary, bedrock is approximately between 4-8 m below the existing ground surface. The WSP report describes a regional aquitard subsurface matrix consisting of heavy clays that define the groundwater interaction with surface features and the hydraulic conductivity of the subsurface formations which represent the ability and rate of groundwater to move vertically and horizontally. The aquitard restricts the rate and degree to which groundwater interacts with surface features. Groundwater conditions are further discussed in Sections 8.1 (Wetlands) and 8.4 (Fish Habitat).

4.3 SURFACE WATER

The Subject Property is bisected by the existing watercourse, a tributary to Beaverdams Creek, which flows from south to north, crossing under Upper's Lane via a concrete box culvert. The existing watercourse is a warmwater system with seasonal low flow barriers beginning 150 m upstream of Upper's Lane. Discontinuous flow with isolated pools continues southward to the boundary of the Subject Property. The existing watercourse has remained relatively stable during the period of record (1976 to 2010) with no significant changes in creek planform observed (Stantec 2018).

Several small drainage features convey flows to the existing watercourse within the Subject Property. These features, described as headwater features, are evident as shallow drainage draws and some flow from off-site into the Subject Property through culverts under Thorold Townline Road. These features are further discussed in Section 5.9 Headwater Drainage Feature Assessment.

4.4 DESIGNATED NATURAL FEATURES AND SPECIES AT RISK

4.4.1 Designated Natural Features

Designated natural features are tracked by the NHIC and include Environmentally Sensitive Areas, ANSIs, PPSWs, Significant Ecological Areas, and other designated wetlands.

4.4.1.1 Subject Property and Study Area

There is one designated wetland present in the Study Area: Beaverdams Creek Wetland Complex (Figure 3, Appendix A). The Region of Niagara Official Plan Schedule C, reviewed on January 29, 2019, indicated that the Beaverdams Creek Wetland Complex is designated as an Environmental Conservation Area in the Core NHS (Region of Niagara 2014). The City of Niagara Falls designates the same wetland complex as an Environmental Protection Area, while HDF for this wetland are designated as an Environmental Conservation Area. The MNRF assessed the Beaverdams Creek Wetland Complex in 2009 and determined that the feature did not meet the provincial criteria for significance (MNR 2009a).

Fish habitat is found in the existing watercourse, which bisects the Subject Property and the Study Area. The existing watercourse is an intermittent tributary of Beaverdams Creek, which is located to the north of the Subject Property.

Two woodlands in the Study Area are mapped as Deer Winter Congregation Areas by MNRF. This category of SWH is further discussed in Section 6.7 Significant Wildlife Habitat.

4.4.1.2 Regional Assessment Area

One PSW, the Thompson Creek Wetland Complex, is located within the RAA, approximately 1 km south of the Subject Property. Three (3) other designated wetlands are present in the RAA as shown on Figure 1 and Figure 11 (Appendix A):

- Beaverdams Creek Wetland Complex
- Welland Canal South Turn Basin Wetland Complex (north; MNR 2009b)
- Shriners Creek Wetland Complex (northeast).

Woodlands mapped as Deer Winter Congregation Areas by MNRF are also present in the RAA, as shown on Figure 3 (Appendix A).

Fish habitat in the RAA includes the existing watercourse on the Subject Property and Beaverdams Creek, which is located to the north of the Subject Property. Beaverdams Creek is categorized as warmwater thermal regime for fish habitat (Figure 3, Appendix A). The existing watercourse is a warmwater tributary of Beaverdams Creek.

4.4.2 Species at Risk and Species of Conservation Concern

SAR and SOCC occurrences were obtained from the NHIC (MNRF 2019) and other online databases. These sources were used to determine if there were any significant floral or faunal species with potential to occur in the Study Area. Correspondence with the MNRF dated June 1, 2017 (Appendix C) noted the potential for the following SAR or SOCC in the Study Area:

- Snapping Turtle (*Chelydra serpentina*) – special concern
- White Wood Aster (*Eurybia divaricata*) – threatened
- Tri-colored Bat (*Perimyotis subflavus*) – endangered
- Little Brown Myotis (*Myotis lucifigus*) – endangered
- Northern Myotis (*Myotis septentrionalis*) – endangered
- Bobolink (*Dolichonyx oryzivorus*) – threatened
- Eastern Meadowlark (*Sturnella magna*) – threatened
- Barn Swallow (*Hirundo rustica*) – threatened

A review of wildlife atlas records, background data sources and consultation with MNRF identified 48 SAR (17 plants, 1 invertebrate, 4 amphibians, 5 reptiles, 17 birds and 4 mammals) and 19 SOCC (5 plants, 1 invertebrate, 4 reptiles, 8 birds and 1 mammal) with ranges that overlap the Subject Property. Range maps provided in the various wildlife atlases are relatively coarse in nature and do not provide precise locations or information on concentrations/densities of records. The NHIC database and MNRF correspondence provides more precise mapping than the atlases (1 km x 1 km squares) and is a better indicator of occurrence of significant species.

SAR and SOCC identified during records review were assessed for potential to occur in the Study Area based on the following factors:

- records of the species in the region from background sources listed above in the previous 30 years, or
- range overlap with the Study Area; and,
- the presence of suitable habitat in the Study Area.

Habitat assessments were conducted in the field to identify suitable habitat for these species. SAR and SOCC with suitable habitat and at least one recent record and/or an overlapping range in the Study Area were considered to have a reasonable probability of occurring. Results of the SAR screening for threatened and endangered species are provided in Table B-1, Appendix B. Screening for SOCC is described under Significant Wildlife Habitat, Sections 6.7 and provided in Table B-2, Appendix B.

It should be noted that barn swallow, previously listed as Threatened by SARO, was de-listed in January 2023.

4.5 AGENCY AND STAKEHOLDER CONSULTATION

The MNRF was contacted on March 22, 2017 to obtain information on SAR, SOCC and Designated Natural Areas on or near the Subject Property. A response was received on June 1, 2017. Additional consultation with MNRF, Niagara Region, the City of Niagara Falls and the NPCA was undertaken by Walker Aggregates and MacNaughton Hermsen Britton Clarkson Planning Limited (MHBC) on October 17, 2019. At that time, City of Niagara Falls staff noted that data used to support the natural environment technical report must be gathered within the previous five years. Email correspondence between MNRF and MHBC regarding deer wintering habitat in the Study Area occurred in October 2019. Agency correspondence documents are provided in Appendix C.

Representatives from the Haudenosaunee Development Institute (HDI) Environmental Division and Mississaugas of the Credit First Nation (MCFN) participated in field investigations in 2019.

4.6 PREVIOUS STUDY RESULTS

4.6.1 Invertebrate Studies

Savanta identified 5 locally rare insects (lance-tipped darner *[Aeshna constricta]*, northern spreadwing *[Lestes disjuntus]*, slender spreadwing *[Lestes rectangularis]*, white admiral *[Limenitis arthemis arthemis]*, and painted lady *[Vanessa cardui]*) and one Special Concern species (monarch) during invertebrate surveys conducted on the Subject Property in 2010 (Savanta 2010a).

Stantec conducted targeted invertebrate surveys on the Subject Property in August 2012 (Stantec 2012a), with emphasis on potential habitat for bumble bees. In total, 4 species of bumble bee, 10 dragonflies, and 17 butterflies were recorded. No species of conservation concern or SAR were observed.

4.6.2 Snake coverboards

Snake coverboard surveys conducted on the Subject Property by Stantec in 2012 identified 8 individuals of a single snake species, common gartersnake *(Thamnophis sirtalis)*, with observations at 6 coverboard stations across the site (Stantec 2012f).

4.6.3 Amphibian Studies

Stantec conducted a search for suitable salamander breeding habitat in which to conduct egg mass surveys in March 2012 (Stantec 2012b). No suitable breeding habitat was identified on the Subject Property.

Savanta conducted amphibian calling surveys on the Subject Property at 16 sites in 2009 and 2010 (Savanta 2010b). A total of 5 species were heard calling, with large numbers of individuals calling at 2 sites and few or none at the remaining 14.

4.6.4 Vegetation Studies

Stantec (Stantec 2012c); AECOM (AECOM 2008); and Savanta (Savanta 2010) conducted botanical inventories during several seasons and over three years on the Subject Property. In total, 265 vascular plants were identified during all field surveys, 63% being native and 37% being exotic. Three provincially sensitive species (honey locust *[Gleditsia triacanthos]* [S2], northern pin oak *[Quercus ellipsoidallis]* [S3], and Arctic sweet grass *[Anthoxanthum articum]* [S2]) were recorded. Twelve species considered rare in the Niagara Region were also recorded (Oldham 2010):

- Daisy fleabane (Erigeron strigosus)
- Great lobelia (Lobelia siphilitica)
- Common coontail (Ceratophyllum demersum)
- Purple vetch (Vicia americana) – observed only by Aecom
- Brookweed (Samolus valerandi ssp. parviflorus)
- Balsam poplar (Populus balsamifera ssp balsamifera)
- Finely-nerved sedge (Carex leptonervia)
- Larger straw sedge (Carex normalis)
- Necklace sedge (Carex projecta)
- Common three-square (Schoenoplectus pungens var. pungens)
- Crataegus coccinea and C. pruinosa

4.6.5 Breeding Birds

Stantec conducted breeding bird surveys in June 2012 (Stantec 2012e). In total, 62 bird species were observed, 61 of which were considered likely to be breeding in the project area. All species observed were ranked S5 or S4, and one species (barn swallow) was listed as threatened federally and provincially at the time of writing, but has since been downlisted to special concern by COSEWIC and delisted by COSSARO.

Savanta observed 55 bird species during a 2010 survey (Savanta 2010b). Bobolink, designated as threatened by COSEWIC and COSSARO, was the only SAR or SOCC recorded.

4.6.6 Winter Wildlife

Stantec conducted winter wildlife surveys on the Subject Property in January and February 2012 (Stantec 2012g). Coyote *(Canis latrans)* tracks were observed on site during the survey. Red-tailed hawk *(Buteo jamaicensis)* was observed at several locations. All other wildlife was widespread and common (blue jay *[Cyanocitta cristata]*, grey squirrel *[Sciurus carolinensis]*, American kestrel *[Falco sparverius]*, mouse *[Mus* ssp.], American tree sparrow *[Spizelloides arborea]* and American goldfinch *[Spinus tristis]*). No dens or nests were observed. Minimal sign of white-tailed deer *(Odocoileus virginianus)* was observed on site, suggesting the area is not frequently used by overwintering deer.

4.6.7 American Badger

Stantec conducted an American badger *(Taxidea taxus)* survey for the property in July 2012 (Stantec 2012h). No sign of American badger was detected, and habitat was considered marginally suitable due to a lack of preferred features.

5.0 RESULTS OF FIELD INVESTIGATIONS

Results of the field investigations completed in the Study Area in 2017, 2019, 2021, and 2023 are summarized below. Complete species lists are provided in Appendix D.

5.1 VEGETATION SURVEYS

5.1.1 Ecological Land Classification

Natural vegetation communities within the Study Area are shown on Figure 9 (Appendix A) and are described below in Table 5-1.

Table 5-1: Ecological Land Classification (ELC) Vegetation Types in the Study Area

ELC Type	Community Description
Forest (FO)	
Deciduous Forest (FOD)	
FOD9a Fresh-Moist Oak – Hickory Deciduous Forest	Red oak was the most abundant species in this mid-age to mature forest, followed by green ash and shagbark hickory. The sub-canopy contained shagbark hickory with American basswood, ironwood, and American beech. Combined, these layers formed a relatively thick canopy (>60%). The understory was moderately dense and composed mainly of red oak and green ash saplings, while species such as asters, tall goldenrod, enchanter's nightshade and herb Robert predominated in the ground layer. Soils were deep silty clay loam with mottles within the upper layers, indicating a moisture regime of 4 (Colville 2020).
FOD9b Fresh-Moist Oak – Hickory Deciduous Forest	Green ash and red oak were the most abundant canopy species in this mid-age forest, while the subcanopy contained sugar maple, ironwood, American elm and blue beech. Saplings dominated the understory, consisting mainly of shagbark hickory and green ash. Alleghany blackberry, calico aster, and enchanter's nightshade made up the ground layer. Like the previous community, soils were deep silty clay loam with mottles within the upper layers, indicating a moisture regime of 4 (Colville 2020).
FOD9c Fresh-Moist Oak – Hickory Deciduous Forest	This community is located off of the Subject property, west of Thorold-Townline Road. Shagbark hickory, red oak, and green ash were the most abundant canopy species in this mature forest and formed a tall (>25 m) and dense canopy. American basswood and shagbark hickory made up a sparse sub-canopy layer. The moderately thick understory consisted almost entirely of blue beech, while white panicled aster, Alleghany blackberry, and woody regeneration formed the ground layer. Mottles were observed at 50 cm in silty clay soil, indicating a moisture regime of 5; several scattered vernal pool locations were located and were dry at the time of the survey. The forest is disturbed by actively used paintball structures throughout. A common reed graminoid mineral meadow marsh (MAM2-12) inclusion was located in the eastern portion of this community, bordering the edge; composed primarily of common reed grass.

Table 5-1: Ecological Land Classification (ELC) Vegetation Types in the Study Area

ELC Type	Community Description
Cultural (CU)	
Cultural Plantation (CUP)	
CUP3-2 White Pine Coniferous Plantation Type	This young plantation was generally a low-diversity community, consisting of young canopies of white pine, with a sparse European buckthorn understory and an equally sparse ground layer made up of thyme-leaved speedwell and calico aster.
CUP1 Deciduous Plantation Type	A green ash-hybrid maple deciduous plantation adjacent to the white pine plantation.
HR	A hedgerow of honey locust trees was present along the rear property line of the Baptist church and school property.
Cultural Meadow (CUM)	
CUM1-1 Dry-Moist Old Field Meadow	Several old field meadow community types were observed on the Subject Property. These typically consisted of dense herbaceous layers up to 1 metre in height composed primarily of Canada goldenrod, common ragweed, and white panicled aster. Other commonly occurring species included wild carrot, common milkweed, awnless brome, and tall fescue, among others. Lower growing species typically included bird's foot trefoil, scarlet strawberry, and tufted vetch.
Cultural Thicket (CUT)	
CUT1-4a Gray Dogwood Deciduous Shrub Thicket Type	Gray dogwood dominated the canopies of these communities, growing at approximately 1 to 2 metres in height. A moderately thick layer of early goldenrod and timothy grass comprised the next stratum, followed by a sparser layer of creeping bentgrass and aster species. The lowest ground layer consisted of cool season grasses and path rush.
CUT1-4b Dry - Fresh Deciduous Shrub Thicket Ecosite - Hawthorn - Gray Dogwood	Dominated by both gray dogwood and hawthorn species, shrub cover was approximately 1 to 2 metres in height. Similar to community CUT1-4a, a layer of goldenrods and timothy grass composed the ground layer.
Swamp	
Thicket Swamp (SWT)	
SWT2-9 Gray Dogwood Mineral Thicket Swamp Type	Gray dogwood comprised the moderately dense canopy of this thicket swamp, with taller forbs such as white panicled aster and elecampane overtopping a lower layer of meadow fescue and fox sedge in the herbaceous layers.
Marsh (MA)	
Meadow Marsh (MAM)	
MAM2-10/CUM1-1 Mixed Forb Mineral Meadow Marsh/Dry - Fresh Old Field Meadow Complex	Purple loosestrife and flat-topped bushy goldenrod formed a moderately dense layer at approximately 50 to 100cm in height, while redtop and white panicled aster formed an equally dense layer beneath. The lowest stratum, growing at a height of approximately 20cm, was a relatively thin layer composed mainly of smaller forget-me-not. A second observation of this community type occurred where it formed a complex with CUM1-1. Its composition was similar to that described above, with the addition of Canada goldenrod in the upper layer, and rice cut grass and Canada thistle in the lower layer. A

Table 5-1: Ecological Land Classification (ELC) Vegetation Types in the Study Area

ELC Type	Community Description
	common reed graminoid mineral meadow marsh (MAM2-12) inclusion composed primarily of common reed grass occurred along the western portion of this community.
Shallow Marsh (MAS)	
MAS2-1/MAM2-10 Cattail Mineral Shallow Marsh/Mixed Forb Mineral Meadow Marsh Complex	This shallow marsh community consisted of a relatively thin canopy layer of narrow-leaved cattail overtopping and forming a complex with lower-growing herbaceous layers made up primarily of forbs. These are described in further detail under the MAM2-10 community type above. A common reed graminoid mineral meadow marsh (MAM2-12) inclusion composed primarily of common reed grass occurred within this community. This community was present along Beaverdams Creek upstream of Upper's Lane and forms the core of the Beaverdams Creek Wetland Complex.

5.1.1.1 Regional Assessment Area

Land cover in the RAA is predominantly agricultural land, recreational/conservation land and residential or commercial developments. Vegetation communities in the RAA were mapped by the NPCA to the ELC Community Series level. To the extent possible, these designations were verified through road-side surveys. Woodland areas in the RAA are shown on Figure 1 (Appendix A).

Natural vegetation communities to the north of the Study Area consist of small (<1 ha) patches of deciduous woodland, swamp, thicket, and marsh associated with Beaverdams Creek or Shriners Creek and their tributaries. A deciduous woodland (5 ha) is located southeast of the Study Area, a swamp (3 ha) is along the north boundary of the Fernwood subdivision, and a mixed woodland and thicket community of approximately 7 ha is south of the Study Area, near the intersection of Lundy's Lane and Thorold Townline Road. A deciduous woodland of approximately 14 ha in size, described as ecosite FOD9 (Fresh-Moist Oak – Hickory Deciduous Forest), is directly west of the proposed quarry and overlaps with the Study Area.

Woodland cover is 25% in the City of Niagara Falls, 19% in the Town of Thorold, and 18% in the NPCA regulatory area (NPCA 2010).

5.1.2 Botanical Inventory

The following is a floristic summary for the Study Area using data collected in 2017 and 2019. A detailed vascular plant list with the scientific plant names and species' status, is provided in Appendix D. The provincial status of flora and plant communities is based on the updated list of Ontario plant communities produced by the NHIC (2016).

A total of 175 species of vascular plants were recorded. This total includes taxa identified to species, subspecies (ssp.) and variation (var.) levels. One hundred and five (105) of the 175-recorded species are native to Ontario, while 70 are exotic species not native to Ontario.

Ninety (90) of native species present have a provincial rank of S5, 10 native species have a provincial rank of S4, and one (1) native species has a provincial rank of S1-S3: Honey locust (*Gleditsia triacanthos*) (S2) is a rare species in Niagara Region, but is often encountered as a horticultural planting. It is known to escape to, and persist in, natural areas. Due to the linear form (hedgerow) and monoculture planting, these observations are not considered natural occurrences. In addition to Honey locust, three species considered rare or uncommon to the Niagara Region (Oldham 2010) were confirmed on the Subject Property during field investigations:

- Daisy fleabane (*Erigeron strigosus*)
- Common three-square (*Schoenoplectus pungens var. pungens)*
- Foxglove Beardtongue (*Penstemon digitalis*)

One sensitive plant species, Pin Oak (*Quercus palustris*) with a coefficient of conservatism (CC) value of 9 was observed. In Niagara Region, Pin Oak is considered "*Native, present and not rare*" (MNR 1996). No plant SAR, including spoon-leaved moss, were observed in the Study Area.

5.2 AMPHIBIAN CALL COUNT SURVEYS

In 2017, nine amphibian calling stations were surveyed within the Subject Property as shown on Figure 3 (Appendix A). Locations of amphibian stations were selected to survey amphibians along the Beaverdams Creek Wetland Complex, the woodlot features east of Thorold Townline Road and along the existing watercourse in the northern portion of the Subject Property. Species and calling activity levels are provided in Table 5-2.

Table 5-2: Amphibian calling activity levels at the Upper's Quarry Subject Property in 2017

STATION	MONTH	SPECIES*							
		AMTO	BULL	CHFR	GRTR	GRFR	NLFR	SPPE	WOFR
1	April								
	May								
	June								
2	April								
	May								
	June								
3	April								
	May								
	June					1-1			
4a (facing north)	April						1-1		
	May								
	June					1-1			

Table 5-2: Amphibian calling activity levels at the Upper's Quarry Subject Property in 2017

STATION	MONTH	SPECIES*							
		AMTO	BULL	CHFR	GRTR	GRFR	NLFR	SPPE	WOFR
4b (facing south)	April	1-1					1-1		
	May	1-1							
	June					1-3			
5	April	1-1							
	May								1-1
	June								
6	April	1-1							
	May								
	June								
7	April								
	May								
	June								
8	April	1-1							
	May	1-2							
	June								
9	April	1-2							
	May	1-1							
	June								

* Notes:
AMTO = American Toad
BULL = Bullfrog
CHFR = Chorus Frog
GRTR = Gray Tree Frog
GRFR = Green Frog
NLFR = Northern Leopard Frog
SPPE = Spring Peeper
WOFR = Wood Frog

Small numbers of four species of calling amphibians were recorded within the Subject Property: American Toad (*Anaxyrus americanus*), Green Frog (*Lithobates clamitans*), Northern Leopard Frog (*Lithobates pipiens*) and Wood Frog (*Lithobates sylvaticus*). Most calls were heard at station 4a and 4b (facing north and south of the survey location), which is associated with the crossing of the existing watercourse at Upper's Lane (Figure 3, Appendix A).

There were no calling amphibians at three of the sites: 1, 2, and 7, while low amphibian calls (only heard on one survey date) were recorded from sites 3 and 6. Overall, there was a low diversity and abundance of amphibians within the Subject Property.

5.3 BREEDING BIRD SURVEYS

During 2017 breeding bird surveys, 43 species of birds were observed, most of which are likely to be breeding within the Subject Property. All species observed are ranked S5 (Secure; common and widespread), S4 (Apparently secure; uncommon but not rare), or SNA (Status Not Applicable). Birds that were observed during surveys but are not expected to be breeding within the Subject Property were: Turkey Vulture, Red-tailed Hawk, Ring-billed Gull, Herring Gull, and Great Blue Heron, all of which were observed flying over the Study Area and/or foraging.

During 2019 grassland breeding bird surveys, 25 species of birds were observed, most of which are likely to be breeding within the Subject Property. All species observed are ranked S5 (Secure; common and widespread), S4 (Apparently secure; uncommon but not rare), or SNA (Status Not Applicable). Birds observed during grassland surveys that are not expected to be breeding within the Subject Property were Turkey Vulture, Ring-billed Gull, Great Blue Heron, Double-crested Cormorant and Canada Goose, all of which were observed flying over the Study Area. These species were not observed to be breeding on the Subject Property.

A complete list of birds observed during both the 2017 and 2019 surveys is provided in Appendix D.

Two SAR, Bobolink and Eastern Meadowlark, were observed within the Subject Property during breeding bird surveys in 2017. These two species are provincially and federally designated as threatened and receive habitat protection under the ESA. Barn swallow, a species that was listed as Threatened during the time of surveys but was delisted in 2023, was also observed in 2017 and 2019.

5.3.1 Barn Swallow

Barn Swallows were recorded flying overhead or singing at nine locations on the Subject Property during 2017 breeding bird surveys, while at a tenth location (the residence along Beechwood Road) Barn Swallows were observed flying in and out of a small shed. In June 2019, 16 active Barn Swallow nests were confirmed in this structure. An additional Barn Swallow nest was observed on the old schoolhouse along Upper's Lane outside the nesting season so activity could not be confirmed.

The actions taken to meet ESA requirements for the removal of Barn Swallow habitat, as well as information on requirements related to their subsequent delisting, are discussed in Section 8.3.

5.3.2 Bobolink

Perennial grassland or meadow habitat on the Subject Property is limited to small patches (less than 1 ha in size) of agricultural or residential areas recently left fallow and a wet meadow community along Beaverdams Creek of approximately 3 ha (200 m by 150 m) in size. All patches are smaller than the minimum area requirement to support breeding habitat as noted in the Bobolink General Habitat Description (MECP 2019).

In 2017, agricultural fields on the Subject Property surrounding the perennial grassland patches were planted with winter wheat. Although Bobolink will nest in winter wheat, the provincial recovery strategy recommends excluding annual row crops such as winter wheat from habitat regulation (McCracken *et al.* 2013). In total, 11 Bobolink were observed at 7 of the 23 point count locations with a combination of grassland habitat and winter wheat:BBS-1 (1 individual), BBS-2 (3 individuals), BBS-3 (2 individuals), BBS-7 (1 individual), BBS-9 (1 individual), BBS-10 (1 individual) and BBS-13 (3 individuals), as shown on Figure 4, Appendix A.

In 2019, agricultural fields on the Subject Property were planted with soy. At the time of the first survey visit (June 4, 2019) many fields had been only recently tilled due to the late and wet spring. Evidence of recent tilling was observed in all grassland patches during 2019 habitat assessments and breeding bird surveys. All suitable habitat patches on the Subject Property, coinciding with the seven (7) point count observations from 2017, were surveyed in 2019, however no Bobolink were observed.

The change in grassland bird observations from 2017 to 2019 can be attributed to the rotation of crops (winter wheat to soy) and small size of grassland patches which, individually and when surrounded by tilled fields, are too small to support breeding Bobolink. Based on this assessment, Bobolink and its habitat are considered absent from the Study Area. General mitigation measures to avoid harm to breeding grassland birds are provided in Section 8.6.4.

5.3.3 Eastern Meadowlark

A single Eastern Meadowlark was observed at one of 23 point count locations in 2017 (BBS-14, Figure 4, Appendix A). Although the observation was made in suitable meadow habitat (MAM2-10/CUM1-1), the individual was only observed on the latest of three survey dates (July 5, 2017) near the end of the core breeding season. The timing of the observation suggests the individual may have moved into the area after a nest failure, or that it was a transient male looking for territory outside the core breeding season. Furthermore, the moist meadow condition and linear form of the habitat patch (maximum width 50 m) along Beaverdams Creek make this habitat of lower quality for Eastern Meadowlark. All suitable habitat patches on the Subject Property, including the location where Eastern Meadowlark was observed in 2017, were surveyed in 2019, however no Eastern Meadowlark was observed.

Based on the single, late season observation in 2017 and low quality habitat, Eastern Meadowlark and its habitat are considered absent from the Study Area.

5.4 SNAKE COVERBOARD SURVEYS

One individual snake was observed during the coverboard surveys. An Eastern Gartersnake (*Thamnophis sirtalis*), was observed on the June 14, 2017 survey under board number 20 at 14:21 and was approximately 40 cm in length. Eastern Gartersnake is ranked S5 (Secure) in Ontario.

5.5 TURTLE SURVEYS

5.5.1 Turtle Basking Surveys

No turtles were observed during the five basking turtle surveys in 2017. Turtles were not observed on site during the course of any survey.

5.5.2 Turtle Nesting Surveys

Turtle nesting evidence was observed on June 27, 28, 29 and 30, 2023. Evidence included disturbed areas of gravel and a predated nest on the road shoulders of Upper's Lane. Although positive identification of the predated nest was difficult due to its disturbed condition, it is assessed as a likely midland painted turtle nest. A single small area of soil scratching on the edge of a farm field south-west of the existing watercourse at Upper's Lane was observed, and may have been caused by a turtle or a foraging mammal.

5.6 BAT SURVEYS

5.6.1 Bat Maternity Roost Survey

In 2017, suitable bat maternity roost habitat was identified in the woodlot east of Thorold Townline Road. The woodlot contained at least seven trees with suitable characteristics for potential bat maternity roosts. According to MNRF guidance (MNRF 2017), there is no minimum threshold for number of maternity roost trees per hectare for an ELC ecosite to be considered suitable maternity roost habitat for SAR bats. Accordingly, 2 ha of suitable maternity roost habitat is located within one treed feature on the Subject Property. Details of the potential bat maternity roost trees are provided below in Table 5-3 and shown on Figure 6 (Appendix A).

ESA authorization requirements for the removal of SAR bat habitat is discussed in Section 8.3.

Table 5-3: Potential Bat Maternity Roost Trees within the Subject Property, 2017

Tree Number	Tree Species	Number of Cavities	DBH (cm)	Tree Height (m)	Cavity Height (m)	Bat Maternity Roost Characteristics
1	Oak sp.	1	55	18	14	• One of the tallest trees in community • Exhibits cavities/crevices • Largest DBH in community • Cavity/crevice is high up in tree (>10m) • Within highest density of cavity trees • Early stages of decay
2	Ash sp.	1	28	14	8	• Exhibits cavities/crevices • Cavity/crevice is high up in three (>10m) • Within highest density of cavity trees • Early stages of decay

Table 5-3: Potential Bat Maternity Roost Trees within the Subject Property, 2017

Tree Number	Tree Species	Number of Cavities	DBH (cm)	Tree Height (m)	Cavity Height (m)	Bat Maternity Roost Characteristics
3	Ash sp.	1	35	14	10	• One of the tallest trees in community • Exhibits cavities/crevices • Cavity/crevice is high up in tree (>10m) • Within highest density of cavity trees • Early stages of decay
4	Basswood	1	60	16	10	• One of the tallest trees in community • Exhibits cavities/crevices • Largest DBH in community • Cavity/crevice is high up in tree (>10m) • Within highest density of cavity trees • Early stages of decay
5	Ash sp.	1	45	14	8	• One of the tallest trees in community • Exhibits cavities/crevices • Largest DBH in community • Within highest density of cavity trees • Early stages of decay
6	Ash sp.	1	35	14	5	• Exhibits cavities/crevices • Within highest density of cavity trees • Early stages of decay
7	Ash sp.	1	40	14	5	• Exhibits cavities/crevices • Within highest density of cavity trees • Early stages of decay

5.6.2 Bat Acoustic Surveys

In 2017, five species of bats were recorded: Hoary Bat (*Lasiurus cinereus*), Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), Eastern Red Bat (*Lasiurus borealis*) and Little Brown Myotis (*Myotis lucifugus*) across 11 stations on the Subject Property (Table 5-4). Data could not be obtained from two of 13 stations due to equipment malfunction. These species are all listed as S5 (Secure) in Ontario, except for Little Brown Myotis which is listed as S4 (Apparently Secure) and is an Endangered Species in Ontario. Little Brown Myotis call frequencies were recorded from bat movement across the Subject Property at six survey locations: SM4-F, SM4-G, SM4-K, SM4-L, SM4-O and SM4-I (Figure 7, Appendix A).

The same five (5) species were recorded in 2019 at six (6) stations on the Subject Property. Data was not obtained from one acoustic recording unit in the woodland along Thorold Townline Road (SM4-P) as the unit was stolen after deployment. Acoustic recordings at buildings were limited in scope as these were augmented with visual exit surveys. Bat acoustic recording results are detailed in Table 5-4.

Table 5-4: Species at Risk Bat Acoustic Monitoring Results (# of calls) 2017 and 2019

Location	Little Brown Myotis	Hoary Bat	Big Brown Bat	Silver-haired Bat	Eastern Red Bat
2017					
Thorold Townline Woodland 88 detector nights	54	72	1,196	1,451	383
Existing Watercourse Plantation 44 detector nights	2	21	662	406	13
Upper's Lane Schoolhouse and Church 22 detector nights	3	57	421	319	24
Beechwood Rd Barn and Shed 44 detector nights	3	43	116	211	8
2019					
Thorold Townline Woodland 22 detector nights	36	82	2,955	122	108
Existing Watercourse Plantation 11 detector nights	9	71	370	30	8
Upper's Lane Schoolhouse and Church 2 detector nights	1	21	18	3	6
Beechwood Rd Barn and Shed 4 detector nights	0	78	49	37	2

5.6.3 Bat Exit Surveys

Bats were not observed entering or exiting any of the buildings on Subject Property. Bats that were observed during bat exit surveys were flying overhead, potentially foraging in the area. No SAR bats were recorded using the handheld bat detectors during the bat exit surveys at buildings. Bat species recorded were: Hoary Bat (*Lasiurus cinereus*), Big Brown Bat (*Eptesicus fuscus*) and Silver-haired Bat (*Lasionycteris noctivagans*), all ranked S4 (Apparently Secure) and S5 (Secure) in Ontario.

5.6.4 Little Brown Myotis

The Little Brown Myotis is a widespread species that lives in a variety of habitats where water is found. This species requires an abundance of insects as its sole food source, and prefers to hunt low over water, although it also forages among trees (between 3-6 m), as well as over lawns, streets and built-up areas. This species roosts in natural cavities (under loose bark and crevices), as well as in buildings (including attics, behind shutters, siding or shingles, and under bridges) (Eder 2002; van Zyll de Jong 1985). Maternity colonies are commonly located in buildings and are less likely to occur in natural sites. Factors determining ideal maternity colony sites include microclimatic requirements, where temperature conditions favour the growth of young (van Zyll de Jong 1985). This bat migrates to hibernation sites (caves/mines) in August and hibernation begins in September. Females and males leave hibernacula in April and May, respectively, and migrate back to nursery and summer roost habitat.

Until recently, Little Brown Myotis was the most common bat species in Ontario. While they are now less common, they remain widespread in southern Ontario The overwhelming threat to the persistence and recovery of Little Brown Myotis in Ontario is the fungal disease White-nose Syndrome. White-nose syndrome (WNS) is a fungal pathogen that grows in humid cold environments. It affects bats that overwinter in caves or mines by disrupting their hibernation cycle. The resulting reduction in population size lead to the listing of certain bats as species at risk such as Little Brown Myotis and other SAR bats in Ontario. In Stantec’s experience, most sites where acoustic surveys are undertaken confirm the presence of Little Brown Myotis. Results of the field investigation show relatively low activity of Little Brown Myotis (on average, one to two recorded calls on some detectors in specific locations. Based on the habitat assessment and the results of the field investigation, maternity roost habitat for Little Brown Myotis is considered to be not present on site. This conclusion is based on the assessment of significance provided in Section 6.5.

5.7 TERRESTRIAL INSECT SURVEYS

In 2017, twenty-four (24) butterfly and sixteen (16) dragonfly species were observed within the Subject Property over the two survey dates however, minimal natural habitat was observed. Most species observed were ranked S5 (very common and secure in Ontario) or S4 (common and apparently secure in Ontario). One butterfly species, giant swallowtail *(Papilio cresphontes)*, is listed as S3, and monarch (*Danaus plexippus)*, is ranked S2N (imperiled in Ontario) and is listed as special concern federally and provincially.

5.8 INCIDENTAL WILDLIFE OBSERVATIONS

During the 2017 field investigations, incidental wildlife observations included: White-tailed Deer (*Odocoileus virginianus*), Coyote (*Canis latrans*), Eastern Cottontail (*Sylvilagus floridanus*), Black Saddlebags (*Tramea lacerata*), Eastern Forktail (*Ischnura verticalis*) and Powdered Darner (*Argia moesta*). All species observed incidentally are ranked S5 (very common and secure in Ontario) or S4 (common and apparently secure in Ontario).

During the 2019 field investigations, incidental wildlife observations included: Eastern Wood-pewee (*Contopus virens*), Northern Green Frog (*Lithobates clamitans*), and American Toad (*Anaxyrus americanus*). Northern Green Frog and American Toad are both listed as S5 (Secure) in Ontario. Eastern Wood-pewee is listed as S4B (Apparently Secure) and is a special concern species. It was recorded in the woodland along Thorold Townline Road on June 14, 2019, when bat acoustic monitors were deployed but not on June 25, 2019, when monitors were collected.

5.9 HEADWATER DRAINAGE FEATURE ASSESSMENTS

The Subject Property is predominantly agricultural lands with the existing watercourse traversing the property from south to north. The existing watercourse is intermittent. A number of HDF contribute seasonal flows to the existing watercourse and are primarily draws or swales found in the ploughed and planted agricultural fields.

Observations recorded during the two site visits are summarized in Table 5-5. Using the HDF guidelines (TRCA/CVC 2014), a preliminary management recommendation was determined for each feature. Headwater features with colour coding demonstrating the appropriate management recommendations for participating lands are depicted on the reach mapping shown on Figure 8 (Appendix A). The location of headwater features is shown on Figure 8 (Appendix A).

Table 5-5: Management Recommendations for Headwater Drainage Features Present in Upper's Quarry

Drainage Feature	Step 1		Step 2	Step 3	Step 4	Management
	Hydrology	Modifiers	Riparian	Fish Habitat	Terrestrial Habitat	
1	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
2	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
3	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
4	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
5	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
6	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
7	Contributing	N/A	Valued	Contributing	Limited	Mitigation
8	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
9	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
10	Contributing	Planted Field	Limited	Contributing	Limited	Mitigation
11	Contributing	Swale within planted field	Limited	Contributing	Limited	Mitigation
12	Contributing	N/A	Valued	Contributing	Contributing	Mitigation
13	Contributing	N/A	Valued	Contributing	Limited	Mitigation
14	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
15	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
16	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
17	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
18	Limited	Planted Field	Limited	Contributing	Limited	No Management Required

Table 5-5: Management Recommendations for Headwater Drainage Features Present in Upper's Quarry

Drainage Feature	Step 1		Step 2	Step 3	Step 4	Management
	Hydrology	Modifiers	Riparian	Fish Habitat	Terrestrial Habitat	
19	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
20	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
21	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
22	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
23	Limited	Planted Field	Limited	Contributing	Limited	No Management Required
24	Limited	Altered drainage path	Valued	Contributing	Contributing	Mitigation
25	Limited	Vegetated swale	Important	Contributing	Valued / Important	Protection

The assessment of headwater features using the headwater guidelines may result in recommendations of No Management Required, Mitigation, Conservation or Protection. The assessment of headwater features resulted in a management recommendation of "Mitigation" for 13 of the headwater features examined. Guidelines for mitigation from TRCA/CVC (2014) are as follows:

- Replicate or enhance functions through enhanced lot level conveyance measures, such as well-vegetated swales (herbaceous, shrub and tree material) to mimic online wet vegetation pockets, or replicate through constructed wetland features connected to downstream.
- Replicate on-site flow and outlet flows at the top end of system to maintain feature functions with vegetated swales, bioswales, etc. If catchment drainage has been previously removed due to diversion of stormwater flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage).
- Replicate functions by lot level conveyance measures (e.g. vegetated swales) connected to the natural heritage system, as feasible and/or Low Impact Development (LID) stormwater options (refer to Conservation Authority Water Management Guidelines for details).

Eleven of the mapped features that were examined were identified as "No Management Required". These are typically features with no or minimal flow, cropped land or no riparian vegetation, no fish habitat and no amphibian habitat. No mitigating actions are required for these features and they may be removed from the landscape.

Drainage Feature 25 obtained a management recommendation of Protection based on the presence of wetland and the recording of American toad at amphibian station 9. This feature is largely located off of the Subject Property and does not receive any contributing drainage from the Subject Property. A small portion of the feature continues onto the Subject Property and connects with HDF 7.

The Guidelines (TRCA/CVC 2014,) which have been adopted for the assessment of headwater features provide recommendations for residential subdivision development projects and, as a result, reference 'lot level conveyance'. The general premise of the three mitigation recommendations, above, is that the contribution of surface flow be replicated to receptor features. Given that the project is not a residential development, some aspects of the suggested mitigation such as bioswales and roof top collection may not directly apply to a quarry operating where land excavation will be required. The general recommended premise of maintaining contribution to features is applicable to the quarry development and is usually associated with maintaining the flow contribution to main aquatic receiver, which is in this case the existing watercourse, and ultimately Beaverdams Creek.

5.10 FISH AND AQUATIC HABITAT – EXISTING WATERCOURSE

Background information from previous studies was reviewed to characterize the aquatic habitat conditions of the existing watercourse. Early fish community surveys of the watercourse were conducted by AECOM on May 27, 2010 using a backpack electrofisher. During those 2010 surveys, low water conditions at the time restricted the electrofishing survey to isolated pools within the existing watercourse. Young-of-the-year (YOY) Northern Pike were captured throughout the tributary indicating that habitat conditions are favourable for spawning of this species throughout the length of the channel. Pumpkinseed and Brown Bullhead were captured in the pool at the Upper's Lane crossing and these species are likely reproducing and over-wintering in association with the habitat provided by the pool associated with the existing culvert.

Stantec biologists examined the Subject Property on numerous occasions in 2017. During a site visit on March 29, 2017, Northern Pike were observed in two locations exhibiting potential spawning behavior, including splashing and swirling in vegetated shallows downstream of Upper's Lane, and in an area approximately 350 m upstream or south of Upper's Lane (see Figure 12, Appendix A).

Electrofishing was conducted by Stantec on June 22, 2017 at four locations (Figure 8, Appendix A) where adequate water persisted to allow for viable sampling. At the time of assessment, water clarity was clear with a water temperature of 17.0°C, pH of 7.52, conductivity 894 µS/cm, and dissolved oxygen of 3.11 mg/L. Stream velocity was slow and stream stage was at low flow. In-stream cover was 80%, provided by thick aquatic vegetation and overhanding woody debris. Banks were well vegetated and bank erosion was not observed. Soft substrates were dominant (silt, clay, muck, detritus) on the stream bed, which is likely an effect from surrounding agricultural field runoff. Mean channel wet width was 1.2 m and mean bankfull width was 6.5 m. Morphology was predominantly flat (90%) with some pools (10%). The riparian zone was characterized as 90% open canopy and 10% partly closed canopy and was comprised of shrubs, terrestrial grasses and emergent aquatic vegetation. Only Yellow Perch and Pumpkinseed were captured at 3 of the 4 stations. Habitat assessments and incidental observations recorded during several other visits for various other faunal surveys were consistent with those of AECOM in 2010; the existing watercourse provides seasonal habitat during spring freshet along its length and allows for Northern Pike to access potential spawning habitat for a brief period. As freshet wanes and conditions become intermittent, the most viable locations of refuge habitat appear to be associated with the large culvert pools at Upper's Lane. Yearly spawning success and recruitment to the Northern Pike population is expected to vary from year to year in accordance with spring melt conditions (i.e. snowpack volume and spring rain runoff), and persistent hydroperiod would be largely linked to frequency and volume of spring rain.

Flows in the existing watercourse are primarily generated from surface run-off contributions in the catchment. Groundwater contributions have been noted in the creek at the northern limit of the Study Area, however these are relatively minor. WSP (2021) noted that the upper aquitard is thinner in the reach of the existing watercourse north of Upper's Lane, and groundwater discharge in this area was conservatively estimated to be equivalent 0.1 L/s.

Spring freshet typically creates conditions that allow for movement of Northern Pike into potential spawning areas. However, as flows recede and conditions become intermittent, habitat conditions are generally too poor to support various life stages of fish. As the system dries up, refuge pool habitat becomes limiting except for the deep pool associated with the Upper's Lane culvert. The seasonal nature and lack of sustained flow, absence of adequate refuge pool habitat and inability to support perennial conditions favourable to fish all reduce the habitat quality of the tributary to a low rating.

Only Northern Pike were confirmed to exhibit spawning behaviour in the existing watercourse, and YOY Pike were captured in 2010. The other three species captured during 2010 and 2017 surveys, Yellow Perch, Pumpkinseed and Brown Bullhead, were caught primarily in the deeper pool areas associated with the Upper's Lane culvert crossing, and shallower pools downstream of the crossing, between Upper's Lane and Beaverdams Creek. No YOY of these species were captured.

In summary, the channel of the existing watercourse is a shallow, vegetation-choked system that exhibits intermittent conditions with seasonal changes to summer dry periods. During spring freshet, there is sufficient flow to allow Northern Pike to move to upstream reaches and spawn in the flooded vegetation. Other species, such as Pumpkinseed, Brown Bullhead and Yellow Perch can also move through reaches during higher flows, but as flows recede and the system approaches becoming intermittent, these species, in addition to pike, will take refuge in deeper pools, particularly those associated with the Upper's Lane culvert crossing.

6.0 ANALYSIS OF SIGNIFICANCE – NATURAL HERITAGE FEATURES ASSESSMENT

6.1 WETLANDS

No PSWs are present within the Study Area. One PSW is located within the RAA: Thompson Creek Wetland Complex, approximately 1 km south of the Subject Property (see Figure 1 and 11, Appendix A).

6.1.1 Other Designated Wetlands

Wetlands designated as part of the Beaverdams Creek Wetland Complex are present on the Subject Property and surrounding lands. This complex was evaluated by MNRF in 2009 and determined not to meet the criteria for provincial significance (MNR 2009a). The complex includes:

- marsh wetlands along the existing watercourse
- marsh wetlands in the riparian zones of Beaverdams Creek found to the north of the Subject Property
- marsh wetlands in an area just west of the existing watercourse south of the Subject Property
- an isolated swamp forest community at 5584 Beechwood Road, east of the Subject Property. This feature is outside the Study Area but within the RAA (see Figure 11, Appendix A).

The wetlands in the RAA are illustrated on Figure 11. Wetlands W1 to W6 are wetland units within the Beaverdams Creek wetland complex.

Given the heavy clay soils and relative flat topography it is likely that woodlands within the RAA will include small areas of swamp communities and localized vernal pooling that are too small to be mapped as discrete wetland communities.

The vegetation characteristics (ELC) of wetlands in the Study Area are described in Table 6-1 and shown on Figure 9 (Appendix A). Marsh wetland types are dominant with a small area of thicket swamp occurring toward the north of the Subject Property. The wetland communities on the Subject Property are primarily associated with the riparian zone of the existing watercourse. This linear wetland feature along the existing watercourse covers an area of approximately 6.6 ha on the Subject Property and an additional 2.7 ha to the north and south of the Subject Property within the 120 m Study Area.

Table 6-1 provides a list of all the wetlands assessed as part of this NETR found on the Subject Property, adjacent lands (120 m around the Subject Property) forming the Study Area and in the RAA. The table includes the wetland number, name and location, provincial wetland status and wetland ELC type. Wetland locations are illustrated on Figures 11 and 12 in Appendix A. The wetland impacts are assessed in Section 8.1.

Table 6-1: Wetlands in the Vicinity of the Proposed Upper's Quarry

Wetland No.	Name and Location	Size (Ha)	Status and Designation	Type and ELC
SUBJECT PROPERTY WETLANDS				
W1a	Beaverdams Creek Wetland Complex. Located along the existing watercourse	6.64	Evaluated – Non-PSW	Riverine type wetland MAS2-1/MAM2-10 *Subject to proposed realignment of the existing watercourse as quarry operations progress to Phase 2*
W2a	Beaverdams Creek Wetland Complex. Located southwest corner of Subject Property	0.18	Evaluated – Non-PSW	Isolated Wetland MAM2-10 *Subject to the proposed realignment of the existing watercourse as quarry operations progress to Phase 2*
W3	Unnamed wetland Located in the 2 ha Townline woodland	0.22	Evaluated – Non-PSW	Isolated Wetland MAM2-10 Mixed Forb Mineral Meadow Marsh and CUM 1-1 Fresh
WETLANDS IN STUDY AREA ADJACENT LANDS (120 m)				
W1b	Beaverdams Creek Wetland Complex. Located upstream of the Subject Property, along the existing watercourse	2.59	Evaluated – Non-PSW	Riverine type wetland MAS2-1/MAM2-10
W1c	Beaverdams Creek Wetland Complex. Located downstream of Subject Property along the existing watercourse	0.11	Evaluated – Non-PSW	Riverine type wetland MAS2-1/MAM2-10
W2b	Beaverdams Creek Wetland Complex. Small portion of wetland off site, part of wetland W2a	0.23	Evaluated – Non-PSW	Isolated Wetland MAM2-2 SWT2-2
W4	Beaverdams Creek Wetland Complex. Located north and east of the Subject Property along Beaverdams Creek. Straddles 120m area of investigation.	7.57	Evaluated – Non-PSW	Riverine type wetland MAM2-10/CUM1-1 Mixed Forb Mineral Meadow Marsh/Dry - Complex

Table 6-1: Wetlands in the Vicinity of the Proposed Upper’s Quarry

Wetland No.	Name and Location	Size (Ha)	Status and Designation	Type and ELC
WETLANDS IN REGIONAL ASSESSMENT AREA (1.5 km)				
W5	Beaverdams Creek Wetland Complex. Located to the east of the proposed quarry. Also known as the 5584 Beechwood wetland feature in the hydrological assessment report. Subject to direct monitoring activity as a representative wetland in the impact zone.	2.78	Evaluated – Non-PSW	Palustrine Wetland SWD2-2 Green Ash Mineral Deciduous Swamp SWD3-2 Silver Maple Mineral Deciduous Swamp
W6	Beaverdams Creek Wetland Complex. Located southeast of the proposed quarry. Two small parcels south of Lundy’s Lane and CN railway.	1.33	Evaluated – Non-PSW	Palustrine Wetland SWT2-2 Willow Mineral Thicket Swamp
W7	Shriners Creek Wetland Complex. Located northeast of the proposed quarry.	33.24	Evaluated – Non-PSW	Palustrine and Riverine MAS2-1/MAM2-10 Cattail Mineral Shallow Marsh/Mixed Forb Mineral Meadow Marsh Complex SWT2-2 Willow Mineral Thicket Swamp SWD2-2 Green Ash Mineral Deciduous Swamp
W8	Welland Canal Turn Basin Wetland Complex. Located northwest of the proposed quarry	24.27	Evaluated – Non-PSW	Palustrine Wetland
W9	Welland Canal South Turn Basin Wetland Complex. Located northwest of the proposed quarry on the north side of the Beaverdams Creek Reservoir.	2.2	Evaluated – Non-PSW	Riverine Wetland
W10	Thompson Creek Wetland Complex Provincially Significant	7.22	PSW - Evaluated	Palustrine Wetland

6.2 SIGNIFICANT WOODLANDS

As described in Section 3.3, woodlands in the Study Area were evaluated for significance based on criteria provided in the Region of Niagara Official Plan Policy 7.B.1.5, and Section 7.0 of the provincial NHRM.

6.2.1 Assessment Based on Provincial Criteria

The primary factor in determining woodland significance following the NHRM method is woodland size relative to woodland cover in the surrounding landscape, which sets the minimum thresholds for total size and area of interior habitat. For a woodland to be considered significant under any of the remaining natural heritage criteria (ecological functions, uncommon characteristics and social or economic values) the entire woodland must also meet a minimum area threshold, which may be lower than the primary size threshold. For example, the NHRM notes that where complete ecological information is not available for a feature, a lower threshold may be appropriate. Comprehensive ecological data are available for natural heritage features in the Study Area, therefore a reduced area threshold is not required. Nevertheless, as a conservative approach, a minimum threshold size of 4 ha for woodlands which meet at least one other ecological criterion has been used in this assessment.

The woodland on the Subject Property is slightly less than 2 ha, therefore this woodland does not meet the minimum size threshold for significance of 20 ha based on provincial criteria for size alone, or for size and ecological characteristics. The woodland west of Thorold Townline Road is 14 ha and does not meet the criteria for significance based on size alone (20 ha). However, given the presence of ecological characteristics or functions within this feature (e.g. significant wildlife habitat for deer winter congregation area, identification as part of the regional NHS), the lower area threshold of 4 ha applies, and this off-site larger woodland is assessed as Significant Woodland.

The NHRM provincial criteria assessment is provided in Table 6-2 for the Subject Property woodland and the woodland west of the Subject Property which straddles the Study Area.

Table 6-2: Assessment of Woodland Significance per Ontario Natural Heritage Reference Manual Criteria

Provincially Significant Woodlands Criteria		Interpretation Based on Field Data	
		Thorold Townline Woodland on the Subject Property	**Woodland West of Thorold Townline Road**
1.	**Woodland size** <u>Where woodland cover is 15-30% of land cover in a given area, woodlands 20 ha in size or larger should be considered significant.</u> Woodland cover is 25% in the City of Niagara Falls, 19% in the Town of Thorold, and 18% in the NPCA) regulatory area (NPCA 2010), thus woodlands 20 ha in size or larger in	**NO.** The woodland on the Subject Property is 2 ha. This size is below the minimum size threshold for significance of 20 ha independent of other characteristics, and below the conservative minimum size threshold for significance of 4 ha when paired with at least one	**NO.** The woodland west of Thorold Townline Road is 14 ha. This size is below the minimum size threshold for significance of 20 ha independent of other characteristics, however it exceeds the conservative minimum size threshold for significance of 4 ha when paired

Table 6-2: Assessment of Woodland Significance per Ontario Natural Heritage Reference Manual Criteria

Provincially Significant Woodlands Criteria		Interpretation Based on Field Data	
		Thorold Townline Woodland on the Subject Property	**Woodland West of Thorold Townline Road**
	the planning area should be considered significant. For criteria 2 through 4, below, a conservative lower minimum area threshold has been used. The NHRM suggests that a minimum area threshold of 4 ha could be appropriate in planning areas with 15-30% woodland cover.	ecological characteristic or function.	with at least one ecological characteristic or function.
2.	**Ecological functions**		
a.	Woodland Interior Woodlands of a size and shape that create habitat more than 100 m from the edge often provide habitat for species whose success depends on larger sizes and reduced disturbance; referred to as interior species. Where woodland cover is 15-30% of land cover in a given area, woodlands containing 2 ha or more of interior habitat should be considered significant.	**NO.** The woodland on the Subject Property has no interior habitat.	**NO.** The woodland west of Thorold Townline Road has approximately 1 ha of interior habitat.
b.	Proximity to Other Woodlands or Other Habitats Woodlands should be considered significant if a portion of it is located within a specified distance (e.g. 30 m) of a significant natural feature (e.g. significant wetland) likely receiving ecological benefit from the woodland, **and the entire woodland meets the minimum area threshold**.	**NO.** The woodland is not proximate (30m) to any other woodland or habitats.	**NO.** The woodland is not proximate (30m) to any other woodland or habitats.
c.	Linkages Woodlands should be considered significant if they are located within a defined natural heritage system (NHS) or provide a connecting link between two other significant features (e.g. significant wetland) **and the entire woodland meets the minimum area threshold**.	**NO.** This woodland is an isolated feature which does not provide a direct link between significant features. Although part of the City of Niagara Falls NHS, it does not meet the minimum 4 ha area threshold.	**YES.** Although relatively isolated, this woodland is part of the Niagara Region NHS and meets the minimum 4 ha area threshold.

Table 6-2: Assessment of Woodland Significance per Ontario Natural Heritage Reference Manual Criteria

Provincially Significant Woodlands Criteria		Interpretation Based on Field Data	
		Thorold Townline Woodland on the Subject Property	**Woodland West of Thorold Townline Road**
d.	Water protection Woodlands should be considered significant if they are located within a sensitive or threatened watershed or a specified distance of a sensitive groundwater discharge, sensitive recharge, sensitive headwater area, watercourse or fish habitat **and meet minimum area threshold**.	**NO.** The wetland feature bisecting the woodland does not meet the definition of a watercourse per the *Conservation Authorities Act* and is not a sensitive headwater area (see Section 6.8).	**NO.** The woodland is not located within a sensitive groundwater discharge or recharge area.
e.	<u>Woodland diversity</u> Woodlands should be considered significant if they have a naturally occurring composition of native forest species that have declined significantly south and east of the Canadian Shield, or have a high native diversity through a combination of composition and terrain **and meets the minimum area threshold**.	**NO.** Tree species within the woodland (e.g. Red Oak, Shagbark Hickory), while characteristic of the Carolinian Forest Region and therefore not widespread in Ontario, have not declined significantly south or east of the Canadian Shield.	**NO.** Tree species within the woodland have not declined significantly south or east of the Canadian Shield.
3.	Uncommon features Woodlands should be considered significant if they have: a unique species composition; a vegetation community with a provincial ranking of S1, S2 or S3; habitat of a rare, uncommon or restricted woodland plant species; or, characteristics of older woodlands **and meet minimum area thresholds**.	**NO.** This woodland does not have a unique species composition, characteristics of older woodlands, support a rare vegetation community or provide habitat for rare, uncommon or restricted woodland plant species.	**NO.** This woodland does not have a unique species composition, characteristics of older woodlands, support a rare vegetation community or provide habitat for rare, uncommon or restricted woodland plant species.
4.	Economic and social values Woodlands that have high economic or social values through particular site characteristics or deliberate management, **and meet minimum area thresholds**.	**NO.** The small size of this woodland limits any economic value, and its isolation and lack of public access reduce its social value. Evidence of litter and trampling suggest the woodland is suffering from degradation.	**NO.** The woodland does not have a documented history of providing economic benefit and is unlikely to be exploited for future timber production. Evidence of degradation is present in this feature, particularly near the paintball facility.

6.2.2 Assessment Based on Regional Criteria

Region of Niagara Official Plan Policy 7.B.1.5 provides six criteria by which the woodland located along Thorold Townline Road was assessed. Following this policy, we completed an assessment of significance for the woodland. To be identified as significant by the Niagara Region Official Plan a woodland must meet one or more of the criteria shown in Table 6-3.

Table 6-3: Assessment of Woodland Significance per Region of Niagara Official Plan Policy 7.B.1.5

Niagara Region Significant Woodlands Criteria		Interpretation Based on Field Data
a.	Contain threatened or endangered species or species of concern;	**YES.** Echolocation calls of Little Brown Myotis were detected in the woodland. Habitat replacement is proposed in the Study Area.
b.	In size, be equal to or greater than: 2 hectares, if located within or overlapping Urban Area Boundaries; 4 hectares, if located outside Urban Areas and north of the Niagara Escarpment; ***10 hectares, if located outside Urban Areas and south of the Niagara Escarpment;***	**NO.** The woodland is located outside Urban Area and south of the Escarpment, therefore it does not meet the 10 ha size criterion.
c.	Contain interior woodland habitat at least 100 metres in from the woodland boundaries;	**NO.** At its widest point, the woodland measures 185 m. Therefore, no point within the woodland is at least 100 m from the woodland boundaries.
d.	Contain older growth forest and be 2 hectares or greater in area;	**NO.** The woodland does not contain characteristics of an older growth forest.
e.	Overlap or contain one or more of the other significant natural heritage features listed in Policies 7.B.1.3 or 7.B.1.4; or	**YES.** The woodland contains Significant Wildlife Habitat for Bat Maternity Colony and Deer Winter Congregation Area. Habitat replacement on the Subject Property and adjacent lands is proposed.
f.	Abut or be crossed by a watercourse or water body and be 2 or more hectares in area.	**NO.** The wetland feature bisecting the woodland does not meet the definition of a watercourse per the *Conservation Authorities Act*.

Based on the application of regional assessment criteria, the woodland on the Subject Property along Thorold Townline Road would be considered a Significant Woodland from a policy perspective and would become a regional Environmental Conservation Area, per Policy 7.B.1.4 of the Region of Niagara Official Plan.

The woodland west of Thorold Townline Road, off the Subject Property, but just overlapping with the Study Area is also Significant Woodland following the regional assessment criteria as it is greater than 2 ha and located within the Urban Area. Other woodlands within the RAA that meet size or other regional assessment criteria would also be considered significant, for example the large, wooded areas and deer winter congregation areas shown on Figure 3 (Appendix A).

6.2.3 Summary of Significance

Using the Provincial assessment criteria found in the NHRM, the woodland is not provincially significant as addressed in section 6.2.1.

The woodland criteria found in the Region's OP suggests that the woodland would be assessed as significant as discussed in section 6.2.2.

Section 6.2.3 indicates that these criteria were used to determine that the woodland on the property meets the criteria of significance of the upper tier municipality but not significant in consideration of the NHRM provincial criteria.

In summary, the woodland has been evaluated and noted to offer certain natural environment habitat features as detailed in the EIS. In its current state, the isolated nature of the woodland from similar natural habitats is likely to limit the quality of available habitat and features. Section 8.2 details the proposal to remove the existing woodland and replace it with a like feature that is contiguous with larger existing woodlands is anticipated to not only preserve, but improve, the function and quality of woodland habitat in the immediate area. This scenario offers both considerations to maximizing the local quarry design elements by focusing the impacted area while offering a net gain to the long-term landscape ecology of the Region. The remedial measure supports and incorporates the attributes which the woodland has been identified to exhibit.

6.3 SIGNIFICANT VALLEYLANDS

There are no significant valleylands on, or within 120 m of, the Subject Property.

6.4 AREAS OF NATURAL AND SCIENTIFIC INTEREST

There are no ANSIs on, or within 120 m of, the Subject Property.

6.5 SPECIES AT RISK (THREATENED OR ENDANGERED SPECIES)

As described in Section 4.4.2, 48 SAR and/or their habitat were identified as potentially present in the Study Area based on a review of background documents and databases. Habitat assessments and targeted wildlife surveys were completed in 2017 and 2019 to confirm the presence of SAR or SAR habitat in the Study Area. An assessment of habitat presence and use for all 48 species is provided in Table B-1, Appendix B.

Three SAR were documented on the Subject Property during the 2017 field investigations: Little Brown Myotis (Endangered), Bobolink (threatened), and Eastern Meadowlark (threatened). One additional species, Barn Swallow, was listed as Threatened at the time of surveys but has since been delisted. Little Brown Myotis and Barn Swallow were also documented on the Subject Property during the 2019 field investigations:

The Niagara OP policy speaks to the protection of various features based on several criteria including the presence of habitat for endangered and threatened species (as described in Section 2.8).

The PPS states Section 2.1

2.1.7 Development and site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements.

As discussed in Sections 5.3.2 and 5.3.3, Bobolink and Eastern Meadowlark and their grassland habitat are considered absent from the Subject Property.

Habitat for Barn Swallow was confirmed on the Subject Property, as described in Section 5.3.1. A registration under the ESA through the Barn Swallow exemption in Section 23.5 of O. Reg 242/08 was obtained in 2022. This exemption permits the removal of Barn Swallow nesting structures, provided specific mitigation (e.g. removal outside nesting season), compensation measures (e.g. construction of replacement nesting structures), and subsequent monitoring efforts are implemented. The buildings identified as Barn Swallow habitat were removed and a compensation structure were installed in accordance with the registration.

Barn Swallow were delisted from SARO effective January 25, 2023, and all ESA protections afforded to the species and their habitat are no longer applicable as of this date. Correspondence from MECP obtained on May 29, 2023 included the following direction regarding existing registrations:

> *"Beginning January 25, 2023, registrants are not required to comply with:*
>
> - A one-time condition imposed by the conditional exemption for Barn Swallow in Ontario Regulation 830/21 (Exemptions – Species Subject to Species Conservation Charges) if the condition must be complied with on or after January 25, 2023.
> - A one-time condition imposed by a conditional exemption in Ontario Regulation 242/08 (General) if the condition must be complied with on or after January 25, 2023, but only to the extent that the condition applies to Barn Swallow.
> - The application of an ongoing condition imposed by the conditional exemption for Barn Swallow in O. Reg. 830/21 if the condition must be complied with on or after January 25, 2023.
> - The application of an ongoing condition imposed by a conditional exemption in O. Reg. 242/08 but only to the extent that the condition applies to Barn Swallow and must be complied with on or after January 25, 2023.
>
> *All requirements in permits and conditions imposed by conditional exemptions that were required to be complied with on or before January 24, 2023, including those that relate to Barn Swallow, remain in effect. Such requirements and conditions may include taking mitigation measures, developing a management plan, creating or modifying habitat, or paying a species conservation charge. These requirements and conditions may also include ongoing obligations to the extent that they applied on or before January 24, 2023."* (Email correspondence: Myschowoda, Clarissa May 29, 2023).

Per MECP direction outlined in the above correspondence, monitoring efforts as prescribed by the conditions of the registration will not be undertaken following the January 25, 2023 cutoff date. However, the structure will not be removed and will remain in place for the use of wildlife. As Barn Swallow habitat has been addressed through the mechanisms described, it has not been carried forward as a protected natural heritage feature under the PPS.

Based on the results of the analysis of bat ARU recordings, a detailed review of the site conditions, and MECP's approach to SAR bats, the natural heritage features on the Subject Property are not considered habitat for Little Brown Myotis. The habitat identification approach taken by MECP (and previously taken by the MNRF) applies to hibernacula and maternity roosts, as outlined in MNRF's Survey Protocol for Species at Risk Bats within Treed Habitats: Little Brown Myotis, Northern Myotis & Tri-coloured Bat, April 2017 (MNRF 2017). Suitable hibernacula habitat includes underground caves or abandoned mines, which do not occur on the Subject Property. Maternity roost refers to habitat used by female bats to give birth and raise their young. Females gather together in a maternity roost, consisting of a few individuals to hundreds. An individual female will often occupy a few roosts, rotating every 2-3 days throughout the maternity season (i.e. June and July). While a roost may not be occupied every night, evidence of bats using a roost on several occasions throughout the maternity season is a good indicator of the presence of a maternity colony.

In 2017, a small number of Little Brown Myotis calls were recorded on the ARUs in the Thorold Townline Woodland. The average number of calls was 0.6 calls per detector night, for a total of 54 calls. On most nights, four or fewer calls were detected, which suggests that a bat is simply passing through the area. The majority of the Little Brown Myotis calls (43 calls or 80%) were detected on a single night (June 15, 2017), which suggests a very short-term occupation of the woodland and not the habitual occupation associated with a maternity colony. In 2019, an average of 1.6 Little Brown Myotis calls per detector night (total of 36 calls) were detected in the Thorold Townline Woodland. Similar to 2017, most nights in 2019 had 4 or fewer Little Brown Myotis calls, with the majority (29 calls or 80%) occurring in a short period from June 17 to 19. This provides a second year of results that fail to suggest the presences of a maternity colony. Furthermore, there were very few Little Brown Myotis calls in 2017 or 2019 (5 calls or 6%) recorded within 30min of dusk, which is the period when bats would be leaving the roost. If a maternity roost were present within the woodland, a much larger number of bats calls would be expected at dusk as the bats left the roost.

ARUs in the existing watercourse plantations detected a low number of Little Brown Myotis calls; 0.05 calls per detector night (total of 2 calls) in 2017 and 0.8 calls per detector night (total of 9 calls). No more than 4 bats were detected in any one night, which suggests bats are simply passing through the area a maternity roost is not present. Likewise, very few bats (zero to three Little Brown Myotis calls per year) were detected at the two buildings within the Subject Property, which provides evidence that these buildings do not support roosts.

The woodlands and buildings on the subject property are not considered habitat of endangered or threatened bat species.

6.6 FISH HABITAT

The existing watercourse is considered fish habitat in the Study Area and supports warmwater fish species. This watercourse exhibits intermittent flow, however fish migrate to pool areas along the watercourse during periods of low flow, prior to no flow periods when these pools become isolated fish refuges. Pike spawning habitat is present in the existing watercourse system on the Subject Property.

The existing watercourse is primarily supported by flow generated through surface runoff, with minor contribution from groundwater where the overburden is shallow at the northern limit of the Study Area.

Beyond the Subject Property and within the RAA, Beaverdams Creek and Shriners Creek are also identified as fish habitat. Both features are noted to be warmwater systems supporting tolerant warm water fish species (NPCA 2011). These creeks are considered to be primarily surface water driven systems with limited input from groundwater given the presence of an overburden aquitard throughout the Region as detailed in the Level 2 Water Study Report (WSP 2021).

6.7 SIGNIFICANT WILDLIFE HABITAT

Significant Wildlife habitat includes habitat for species listed as special concern under the ESA or ranked provincially rare (S1-S3) and the four categories of *SWH*. The *Significant Wildlife Habitat Criteria Schedules for Ecoregion 7 E* (MNRF 2015) provide descriptions of wildlife habitats and guidance on criteria for determining the presence of candidate and confirmed wildlife habitats. Table B-2, Appendix B provides a detailed assessment using the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 7 E* criteria. Presence or absence of candidate habitats in the Study Area is discussed below.

Seasonal Concentration Areas are sites where large numbers of a species gather together at one time of the year, or where several species congregate. Only the best examples of these concentration areas are typically designated as SWH. Review of the NHIC and LIO databases noted the presence of deer winter congregation areas within the RAA. The potential for seasonal concentration areas to occur in the Study Area is assessed in Table B-2, Appendix B. A Deer Winter Congregation Area is identified on the Subject Property and 120 m Study Area in the woodlands along both sides of Thorold Townline Road, as mapped by MNRF. Typically, woodlots greater than 50 ha are considered SWH for deer winter congregation. Smaller conifer plantations may also be used.

Rare Vegetation Communities or Specialized Habitats for Wildlife are defined as separate components of SWH. Rare habitats are habitats with vegetation communities that are considered rare (S1-S3) in the province. These habitats are generally at risk and may support wildlife species that are considered significant. Specialized habitats are microhabitats that are critical to some wildlife species. Candidate rare or specialized habitats are discussed in Table B-2, Appendix B. Turtle nesting was observed along the Upper's Lane road shoulders during the 2023 turtle survey. However, road shoulders are not considered SWH due to their low potential for success and high potential for disturbance (MNRF 2015).

Ecoregion criteria related to SWH for turtles includes both Seasonal Concentration Areas of Animals - Turtle Wintering Areas and Specialized Habitat for Wildlife – Turtle Nesting Areas. Turtle Wintering Areas habitat criteria (Ecoregion 7 E Schedule Criteria (2015)) are noted to be:

- wintering areas are in the same general area as their core habitat – the unnamed tributary could potentially exhibit these characteristics.
- Water has to be deep enough not to freeze and have soft mud substrates – there are no areas deep enough on the Subject Property or Adjacent Lands with potential deep waterbodies with the exception of the pool associated with the Upper's Lane culvert on the unnamed tributary; however, this area was subject to basking surveys as per the Ecoregion Criteria in the spring as noted above, April and May, and no turtles were observed suggesting the pool is not an turtle winter area.
- Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen – with the exception of the above noted pool there are no permanent water bodies that would meet this criterion on the Subject Property or on Adjacent Lands

Based on the assessment of these criteria, SWH for Turtle Wintering Areas does not occur in the Study Area, namely on the Subject Property or on the Adjacent Lands.

Concerning turtle nesting, considering the survey results and location of the observed nests within the road allowance, it is concluded that Significant Wildlife Habitat related to turtles is not recorded on the Subject Property. Potential nesting sites on Adjacent Lands, beyond the licenced area, would not be compromised as they remain outside the operations area of the quarry.

No rare vegetation communities or specialized habitats for wildlife were identified in the Study Area.

Habitat for Species of Conservation Concern includes four types of species: those that are rare, those whose populations are significantly declining, those that have been identified as being at risk to certain common activities, and those with relatively large populations in Ontario compared to the remainder of the globe. Candidate habitats for species of conservation concern are discussed in Table B-2, Appendix B.

Habitat for special concern and rare wildlife (S1-S3 ranked species, including provincially designated special concern species) that were identified during the background review with potential to occur in the Study Area is provided in Table B-2, Appendix B. Habitat for the following species was identified in the Study Area:

- Monarch (special concern) in meadow communities on the Subject Property
- Eastern Wood-Pewee (special concern) is assumed to be breeding off the Subject Property but within the 120 m Study Area in the woodland (FOD9c) west of Thorold Townline Road

Animal movement corridors are distinct passageways or defined natural features that are used by wildlife to move between habitats, usually in response to seasonal requirements. Movement corridors are identified once the following seasonal concentration areas or specialized habitats are confirmed as SWH: amphibian breeding habitat and deer wintering habitat. No animal movement corridors were confirmed on the Subject Property, however deer may move west across Thorold Townline Road between the woodland on the Subject Property and nearby woodland features. Candidate animal movement corridors are discussed in Table B-2, Appendix B.

6.8 SUMMARY OF SIGNIFICANT NATURAL HERITAGE FEATURES

This section provides a summary of natural heritage features within the Study Area. Features were assessed using criteria in the *NHRM (*MNR 2010) and the SWH Criteria Schedules for Ecoregion 7E (MNRF 2015). Consideration for the natural heritage designations of the Niagara Region Official Plan (The Regional Municipality of Niagara 2014) and Official Plan for the City of Niagara Falls (City of Niagara Falls 2017), which implement similar policies. Table 6-4 provides a summary of the natural heritage features on, or within 120 m of, the Subject Property. These features are also shown on Figure 12 (Appendix A).

Table 6-4: Natural Heritage Features Associated with the Subject Property and Study Area

Natural Heritage Features	Present within Subject Property	Present within Study Area (120 m adjacent lands of Subject Property)
Significant wetlands, including unevaluated wetlands	N	N
Other designated wetlands	Y	Y
Significant woodlands	N	Y
Significant valleylands	N	N
Areas of Natural and Scientific Interest	N	N
Habitat of endangered and threatened species	N	N
Fish habitat	Y	Y
Significant Wildlife Habitat		
Seasonal concentration areas	Y	Y
Rare vegetation communities or specialized habitats	N	N
Habitats of species of conservation concern	Y	Y
Animal movement corridors	N	N

7.0 PROJECT DESCRIPTION

The Ministry of Northern Development, Mines, Natural Resources and Forestry, Niagara Region and the City of Niagara Falls identify the Subject Property as being within a good quality reserve of aggregates which is suitable for a wide variety of construction needs.

The total area proposed to be licensed is approximately 103.6 ha, and the total proposed extraction area is approximately 89 ha. Overburden on the majority of the site generally ranges in depth from 5 to 10 m below ground surface, with exceptions of the existing watercourse corridor and a wetland pocket near Thorold Townline Road. Once the overburden is stripped, excavation will proceed to a maximum depth below water table of approximately 28 m in the northeast corner to 39 m in the southwest corner corresponding to the geologic base of the Gasport member dolostone of the Lockport Group. The proposed quarry will be developed below the natural groundwater table and, in order to maintain dry working conditions, the quarry will be dewatered. The finished quarry floor will range from ±184.5 masl in the western portion to ±176 masl in the northern portion of the site. In total, approximately 60 million tonnes of high-quality limestone are planned for extraction which will provide many decades of near-market aggregate reserves for the Niagara Peninsula construction industry. Based on a maximum annual tonnage limit of 1.8 million tonnes per year, the life expectancy of the quarry will be approximately 40 to 50 years.

Upper's Lane, a road currently owned by the City of Niagara Falls, and an unopened road allowance splits the property into three sinking cut excavation areas. Access to the Site will occur at the location of the Upper's Lane / Thorold Townline Road intersection.

The existing watercourse intermittently flows north through the central portion of the property from its headwater on the north slope of the Niagara Falls Moraine. Rock extraction is planned where the existing watercourse is currently located, therefore, the development of the quarry makes it necessary to realign the watercourse to the western boundary of the Subject Property. The realigned watercourse will receive water pumped from quarry dewatering activities. The proposed watercourse realignment employs NCD methods to provide a solution that includes long-term stability as well as enhanced fish habitat and riparian wetlands.

7.1 PROPOSED EXTRACTION SCENARIO

To accommodate the realignment of the existing watercourse and maintain the two road allowances, the proposed Operational Plan includes five (5) phases of extraction within the three extraction areas.

7.1.1 Phase 1

Phase 1 is located west of the existing watercourse meander valley in the mid and south extraction areas and includes two (2) sub-phases. Phase 1A includes the area between the existing watercourse meander valley and the proposed realigned watercourse corridor (Phase 1B).

Phase 1 includes overall site preparation (i.e. fencing around entire site, removal of existing buildings, and construction of berms/acoustic barriers) and road improvements, subject to agreement with appropriate municipal road authorities, including:

- intersection improvements at Upper's Lane and Thorold Townline Road;
- upgrades to Upper's Lane and establishment an entrance/exit off of Upper's Lane to access the North Extraction Area and the Mid-Extraction Area; and,
- establishment of a culvert crossing associated with the unopened road allowance over the watercourse realignment corridor to access the South Extraction Area.

The existing watercourse will remain open (not culverted) where it enters the site along the south perimeter of the site.

An acoustic berm at the north boundary of the Subject Property will be required to attenuate noise to sensitive receptors. The berm will be placed across the existing watercourse at the northern quarry boundary early in the site preparation phase. The watercourse will be directed through a culvert placed in the berm as it exits the property. A berm will not be required at the southern boundary where the existing watercourse enters the Subject Property.

To compensate for the additional culvert on the existing watercourse, which supports direct fish habitat, a pond will be constructed in the downstream Watercourse Realignment Transition Area within Phase 2B. Compensation ponds will be excavated to a maximum depth of 174 masl in this area and in accordance with DFO approval. No drilling or blasting will occur in this Transition Area.

Other culverts will be installed under berms as they are being constructed along the west boundary and south perimeter to provide for a continual conveyance of surface water contribution to the site and, in some cases, to the watercourse. These drainage features are ephemeral or intermittent headwater drainage features and do not provide direct fish habitat.

Initial sinking cuts in each quarry cell will be completed in Phase 1A. A portable submersible pump will be installed within the excavation and will be relocated as necessary as the extraction proceeds. Once a portable crushing / screening plant is established on the quarry floor, extraction may proceed in Phase 1A and 1B concurrently. During Phase 1, a new stream channel running along the east side of Thorold Townline Road (Phase 1B) will be built for the eventual realignment of the existing watercourse. In Phase 1B, the extraction will not be completed to the full quarry depth, but rather to an elevation of approximately 155 masl. The bedrock remaining in place will form a foundation for the proposed realigned watercourse. The proposed channel realignment is discussed in greater detail in the NCD report (Stantec 2021, Appendix E) and the Section 10.1.1 of this report.

As resource extraction is completed in Phase 1B, the extraction area in this Phase will be filled with clay overburden material onsite (from early Phase 1A) to an elevation ranging between 176 to 177 masl.
A new watercourse channel designed for fish and wildlife habitat will be constructed and vegetated with an appropriate planting plan. Culverts will be installed under Upper's Lane and the unopened road allowance. 2:1 side slopes will be established on the east side of the new watercourse channel down to the quarry floor (at 155 masl).

Once the new watercourse channel is constructed and adequate vegetation has been established and stabilized, flow from the existing watercourse will be diverted to the new channel (and in accordance with DFO authorization requirements). A water regime monitoring program (post-construction) will be developed and implemented so that wetland conditions are maintained.

As extraction progresses to the east and as area provides, additional lifts (1 to 2) will be extracted in Phase 1A to an elevation ranging between ±140 masl in the southwest corner and ±145 masl in the northeast corner.

When extraction reaches the groundwater table in Phase 1A, submersible pumps will be installed in Phase 1A (and each extraction area) for the dual purpose of (i) dewatering to maintain a dry working area and (ii) aggregate washing. As water collects on the quarry floor, it will be pumped from the sump to either a man-made pond where it is either used for aggregate washing or to a sediment forebay before being discharged to the watercourse. During heavy rainfall events (25 mm or more), the sump pump will be deactivated as necessary to prevent flooding along the watercourse downstream of the site. The discharge locations into the watercourse will move with the quarry face until the final quarry depth is reached in each extraction area. At this point, a permanent sump will be established in each extraction area. The discharge location of water will be adjusted during the life of the quarry to accommodate the need of water dependent natural heritage features, namely fish habitat and riparian wetland, existing and constructed.

7.1.2 Phase 2

Phase 2 is located within the north extraction area north of Upper's Lane and includes two (2) sub-phases. Phase 2A includes the area west of the existing watercourse meander valley, except the corridor for the realigned watercourse (Phase 2B). Once processing has been shifted to Phase 2A, a hot mix asphalt (HMA) batch plant facility will then be introduced and established on the quarry floor in Phase 1A (in the area shown on the Operational Plan). The HMA batch plant will stay in that location for the life of the quarry.

7.1.3 Phase 3

Phase 3 is located in the north extraction area and includes two (2) sub-phases. Phase 3A includes the existing watercourse meander valley and Phase 3B is the remaining area in north extraction area to the east.

Extraction in Phase 3A will not commence until the realigned watercourse is commissioned and flow within the existing watercourse is diverted, based on approval from the appropriate regulatory agencies. In the event that the construction of the realigned watercourse may require additional time, extraction in Phase 3B may proceed until approval to extract Phase 3A has been granted. Once the realigned watercourse has been commissioned and is fully supporting flows, extraction in Phase 3A and 3B may occur concurrently. If extraction in Phase 3B does commence prior to Phase 3A, then a separate sinking cut would be required with a portable submersible pump to maintain dry working conditions.

Phase 3 will be extracted in up to three (3) lifts to a depth of ranging between ±147 masl and ±148 in the northeast corner.

7.1.4 Phase 4

Phase 4 is located in the mid extraction area south of Upper's Lane and east of Phase 1A. Extraction will not proceed until Phase 3 extraction is complete, and it is anticipated that the realigned watercourse will be commissioned well before Phase 4 extraction proceeds.

Phase 4 will be extracted in up to three (3) lifts to a depth ranging between ±142 and ±147 masl.

7.1.5 Phase 5

Phase 5 includes the remaining lands located in the south extraction area south of the unopened road allowance and east of Phase 1A and 1B. Extraction will not proceed until Phase 4 extraction is complete.

Phase 5 will be extracted in up to three (3) lifts to a depth ranging between ±140 and ±143 in the southwest corner.

A Final Phase will include removal of all remaining resource within the extraction limit near the entrance (e.g. ramp) and any other resource remaining in the extraction area will be removed as part of final rehabilitation. Any remaining structures will be removed, all remaining backfilling will be completed during this Phase and final rehabilitation will be completed. Following completion of extraction, the Subject Property will be rehabilitated to recreational water bodies with enhanced natural features and habitat.

7.2 ALTERNATE EXTRACTION SCENARIO

An Alternate Extraction Scenario was considered, where the Upper's Lane and unopened road allowances between the three quarry extraction areas are included in the limit of extraction, which would result in one contiguous quarry excavation. This potential scenario was modeled and given the limited difference in the overall quarry size the results indicate that there is no substantial difference in impacts if the additional bedrock resource within the road allowances is removed (see Appendix F).

8.0 ASSESSMENT OF IMPACTS

The potential impacts to natural features that might reasonably be expected to occur as a result of the proposed aggregate operation are identified and discussed in this section. Both direct and indirect impacts associated with the Project are considered and appropriate mitigation measures recommended. An assessment of overall net environmental impacts is also provided based on the implementation of appropriate mitigation, restoration and enhancement measures to improve the overall integrity of the natural system in the area. Where direct impacts to SAR or fish habitat are expected to occur, an approach to authorization under the federal *Fisheries Act* or provincial *Endangered Species Act* is described.

The application is for below water table extraction. This section should be read in conjunction with the Site Plan (MHBC 2021) and the Level 2 Water Study Report (WSP 2021) as part of the aggregate extraction application. The Site Plan provides specific details regarding the existing conditions, extraction limits, phasing of extraction, progressive rehabilitation plan and cross sections (e.g. pre- and post-licencing contours, drainage, etc.). The Rehabilitation Plan is also shown on Figure 13 (Appendix A) of this report.

The majority of the potential impacts to the various features are consistent under both the proposed extraction scenario and the alternate extraction scenario, particularly for wetlands, woodlands, significant habitat of Threatened and Endangered Species and significant wildlife habitat. The impact assessment for fish habitat and the associated proposed NCD differs slightly for each, particularly related to the use of culverts on the realigned channel. The Alternate Extraction Scenario Assessment in Section 9.0 focuses on and addresses impacts to fish habitat and associated NCD implications.

8.1 WETLANDS

8.1.1 Potential Impacts

There are no PSWs on the Subject Property or the Study Area (within 120) m of the proposed licence area. Other evaluated wetlands are present on the Subject Property and in the RAA, and one PSW in the southernmost portion of the RAA.

The proposed quarry will alter surface flow and temporarily alter water table levels, which may affect some of the non-provincially significant wetland areas on-site. The following sections describe the potential impacts to individual wetland areas from the proposed quarry. Indirect impacts and the water balance budget were determined using data from the Level 2 Water Study Report (WSP 2021).

In areas where quarry rock is found below the water table and quarrying involves activities such as blasting of rock, gathering of rock for crushing and removal of the rock using trucks and frontend loaders, the operations must be completed in a dry quarry environment. As the depth of the quarry progresses below the water table, pumps are used to draw down the water table and maintain a dry condition to allow for the safe excavation and removal of aggregate. The drawdown of the water table often extends beyond the quarry perimeter and is called the drawdown or underdraining cone. In some cases, this underdraining has the potential to affect aquatic features such as creeks (fish habitat) and wetland communities. Understanding the geology below the wetlands and the water regime of the potentially affected wetlands is essential in determining the potential impacts to these features. Details of the assessment related to geology and water regime (hydrology and hydrogeology) are provided in the Level 2 Water Study Report (WSP 2021). Key findings from the Hydrogeological Report are used in this section to help evaluate potential impacts to the features.

Wetlands within 1,500 m of the quarry (RAA) are described in the following wetland characterization table. This RAA represents a conservative distance for potential impacts to wetlands that are within the zone of potential groundwater influence from dewatering activities associated with quarry operations. The wetland units are divided into discrete wetland groupings that differ in their water regime characteristics or their potential to be affected based on their location relative to the open quarry site (i.e. on or off the property, and upstream and downstream of quarry). These groupings are illustrated on Figure 11 (Appendix A) and described with a corresponding wetland number in Table 8.1.

Table 8-1: Wetland Characterization Summary

Wetland No.*	Name and Location	Type and ELC	Water Regime and Assessment
SUBJECT PROPERTY WETLANDS			
W1a	Beaverdams Creek Wetland Complex Located <u>on</u> the Subject Property along the existing watercourse. Centrally located and traversing length of the Subject Property, flowing south to north. Approx. 6.64 Ha	**Riverine type wetland** **MAS2-1/MAM2-10** Cattail Mineral Shallow Marsh/Mixed Forb Mineral Meadow Marsh Complex Riverine wetland with no significant groundwater inputs due to thick aquitard. Exception: one section of the existing watercourse on the northern reach of the channel with shallow to bedrock conditions allowing groundwater connection to channel and wetlands (see Figure 11, Appendix A for location). ***Subject to proposed realignment of the existing watercourse as quarry operations progress to Phase 2***	Generally, not groundwater connected due to thick aquitard. The exception is one section at north boundary of Subject Property with shallow to bedrock conditions allowing groundwater connection to watercourse and wetlands (see Figure 11 for location). Groundwater discharge to this area is very low compared to watercourse flow. Wetland is primarily dependent on incident precipitation, surface run off, and flow through from upstream watercourse catchment. Watercourse and wetland will be recipient of dewatering discharge water at various locations along watercourse as extraction progresses. The discharge will increase flow to riverine wetland from discharge to downstream locations. Catchment area progressively diminished from advancing quarry operations above discharge point is 91 ha. Unaffected catchment that supports riverine wetland from upstream sources is 442 ha.

Table 8-1: Wetland Characterization Summary

Wetland No.*	Name and Location	Type and ELC	Water Regime and Assessment
			This riverine wetland has an abundance of flow through water that would be available to offset any loss associated with catchment run-off loss during progressive stages of operation on the Subject Property. The discharge water will provide a steady input of water to wetlands downstream of the discharge. Post realignment, the new watercourse and created wetlands will be supported by flow from unaffected upstream areas and will convey base flow downstream to support Beaverdams Creek and associated downstream wetlands.
W2a	Beaverdams Creek Wetland Complex Located <u>on</u> the Subject Property in the southwest corner. Connected to W2b off site portion to the south. Approx. 0.18 ha	**Isolated Wetland** MAM2-10 Mixed Forb Mineral Meadow Marsh Complex Small Remnant wetland unit. ***Subject to proposed realignment of the existing watercourse as quarry operations progress to stage 2.***	Not groundwater connected due to thick aquitard. Wetland is dependent on incident precipitation and surface run off. Will be removed and replaced once channel relocation and wetland enhancement is completed as part of the realignment of the existing watercourse, required to be in place prior to Phase 2.
W3	Unnamed wetland Feature Located in the Townline woodland on Subject Property. Includes portions of headwater #11 that dries up mid-summer that is not considered a protected headwater feature. Approx. 0.22 ha	MAM2-10 Mixed Forb Mineral Meadow Marsh and CUM 1-1 Fresh Old Field Meadow This small wetland is considered a small inclusion in the woodland feature. The feature includes a mix of both marsh habitat and old upland meadow habitat suggesting limited wetness.	The feature is mixed lowland and upland feature and as such not considered a prominent wetland feature on the Subject Property. It is not large or wet enough to provide a notable discharge of water to the headwater feature #11. This condition is supported by the assessment of headwater features conducted for the property. The mixed wetland/upland feature would be removed as part of the woodland removal. As a conservative measure this area of wetland should be considered as part of the overall replacement of wetlands in the realigned riparian corridor of the existing watercourse.

Table 8-1: Wetland Characterization Summary

Wetland No.*	Name and Location	Type and ELC	Water Regime and Assessment
STUDY AREA - ADJACENT LAND WETLANDS (120m RADIUS)			
W1b	Beaverdams Creek Wetland Complex Located upstream of the Subject Property, along the existing watercourse. Flows north into property. Approx. 2.59 ha	Riverine type wetland MAS2-1/MAM2-10 Cattail Mineral Shallow Marsh/Mixed Forb Mineral Meadow Marsh Complex	Wetland is dependent on incident precipitation surface run off, and flow through from upstream watercourse catchment. Associated with large unaffected catchment (442 ha) that provides water to off-Site wetlands and the riverine wetlands on the Subject Property.
W1c	Beaverdams Creek Wetland Complex Located downstream of Subject Property along the existing watercourse - small section of wetland. Approx. 0.11 Ha	Riverine type wetland MAS2-1/MAM2-10 Cattail Mineral Shallow Marsh/Mixed Forb Mineral Meadow Marsh Complex	Wetland is dependent on incident precipitation surface run off, and flow through from upstream watercourse catchment. The discharge water will provide a steady input of water to wetlands downstream of the discharge. Post realignment the small wetland parcel would return to predevelopment condition with flow through input from the new watercourse alignment.
W2b	Beaverdams Creek Wetland Complex Small portion of wetland off site, part of wetland W2a Approx. 0.23 Ha	**Isolated Wetland** ELC MAM2-2 Reed-canary Grass Mineral Meadow Marsh SWT2-2 Willow Mineral Thicket Swamp Small Remnant wetland unit	Not groundwater connected due to thick aquitard. Wetland is dependent on incident precipitation and surface run off. No changes to available water.
W4	Beaver Dams Creek Wetland Complex Located north and east of the Subject Property along Beavers Dam Creek. Straddles the northwest corner of the 120m area of investigation. This long, linear wetland is for the most part continuous along Beavers Dam creek with a small break in the feature just north of the Subject Property. Length covers 7.57 Ha	Riverine type wetland MAM2-10/CUM1-1 Mixed Forb Mineral Meadow Marsh/Dry - Complex	Wetland is dependent on incident precipitation surface run off, and flow through from upstream watercourse catchment. Not groundwater connected due to thick aquitard. The wetland is outside the Subject Property and straddles the Study Area boundary. A small portion of the wetland's catchment occurs on the Subject Property. Surface waters from a headwater feature drain toward portions of the wetland during periods of heavy precipitation or freshet. The feature is not considered to be influenced by the quarry activity as

Table 8-1: Wetland Characterization Summary

Wetland No.*	Name and Location	Type and ELC	Water Regime and Assessment
			the catchment contribution area in the quarry area is limited relative to the catchment and flow through from Beaverdams Creek. There are also no potential underdrain concerns associated with drawdown as it is not considered to be groundwater dependent based on the presence of the aquitard.
REGIONAL ASSESSMENT AREA WETLANDS (1500m RADIUS)			
W5	Beaverdams Creek Wetland Complex Located to the east of the Quarry at 5584 Beechwood Largest isolated wetland in the near vicinity of the quarry, 500 m from Quarry. Subject to direct monitoring activity as a representative wetland in the impact zone, known as the 5584 Beechwood wetland feature in the hydrological assessment report. Approx. 2.78 Ha	Palustrine Wetland SWD2-2 Green Ash Mineral Deciduous Swamp SWD3-2 Silver Maple Mineral Deciduous Swamp	Isolated from bedrock groundwater by thick clay aquitard. Wetland is dependent on incident precipitation and surface run off from catchment. Wetland is deciduous forest subject to seasonal drawdown. The wetland is not directly affected by quarry. Water well monitoring and testing has defined the water regime of the wetland. Modeling based on existing condition hydrogeological information indicates that during quarry this wetland would be subject to an annual underdraining of 5 to 11 mm of water. This underdraining is inconsequential to the wetland water regime given that 953 mm plus are provided to the feature annually. Most of the water comes from incident precipitation and area runoff. This feature will be monitored as a control and representative feature for ongoing ground and surface water impact confirmation *(subject to continued landowner access).*
W6	Beaverdams Creek Wetland Complex Located southeast of the Quarry. Two small parcels south of Lundy's lane and CN railway. Approx. Ha 1.33	Palustrine Wetland SWT2-2 Willow Mineral Thicket Swamp	These wetland features are similar to the W5, with a negligible groundwater connection due to thick aquitard, dependent on incident precipitation and surface run off from catchment. The quarry will not affect the catchment area. There is no potential effect from the quarry on this feature.

Table 8-1: Wetland Characterization Summary

Wetland No.*	Name and Location	Type and ELC	Water Regime and Assessment
W7	Shriner Creek Wetland Complex Located northeast of quarry. A portion of this wetland is within 500 of quarry. Approx. Ha 33.24	Palustrine and Riverine MAS2-1/MAM2-10 Cattail Mineral Shallow Marsh/Mixed Forb Mineral Meadow Marsh Complex SWT2-2 Willow Mineral Thicket Swamp SWD2-2 Green Ash Mineral Deciduous Swamp	This wetland feature is similar to wetland W4 but at a greater distance from the quarry than W4 and having no catchment within the quarry property. The nearest portion of this large feature is the upper most portion of this riverine feature. Given the presence of the thick aquitard that controls the connection to the groundwater and lack of any catchment influences, the quarry has no potential to affect this wetland feature.
W8	Welland Canal north Turn Basin Wetland Complex Located northwest of the quarry, primarily at a distance of 1 km or more from quarry. 24.27 Ha	Palustrine Wetland	Canal management drives wetland hydrology, the quarry has a negligible cumulative impact. Given the presence of the thick aquitard that controls the connection to the groundwater, and lack of any catchment influences, the quarry has no potential to affect this wetland feature.
W9	Welland Canal South Turn Basin Wetland Complex Located northwest of the quarry on the northside of the Beaverdams Creek Reservoir. Approx. 2.2 Ha	Riverine Wetland	Canal management drives wetland hydrology, the quarry has a negligible cumulative impact. Given the presence of the thick aquitard that controls the connection to the groundwater, and lack of any catchment influences, the quarry has no potential to affect this wetland feature.
W10	Thompson Creek Wetland Complex Provincially Significant. 7.22 Ha	Palustrine Wetland	Isolated from bedrock groundwater by thick clay aquitard. Wetland is dependent on incident precipitation and surface run off from catchment. Wetland is deciduous forest subject to seasonal drawdown. The wetland is not directly affected by quarry.

* See Figure 11 for wetland locations

The wetlands noted above are within a relatively thick overburden region, on soils with a dense clay composition and a low hydraulic conductivity. This overburden forms an aquitard which restricts the movement of groundwater. As a result, groundwater is generally not a factor in maintaining the wet conditions which support the wetlands. These regional geological conditions are discussed in detail in the Level 2 Water Study Report (WSP 2021). The following offers a detailed account of the wetland conditions and potential impacts that were summarized in Table 8.1.

Wetlands on the Subject Property

Features W1A, W2A and W3 are the wetlands that are directly affected by the quarry operations (see Figure 11, Appendix A). These wetlands will be removed during stripping of the overburden material in various phases of the quarry operations.

W2A and W3, which together total 0.4 ha, will be removed in the first phase of operations prior to completion of the existing watercourse realignment. More than half of this area (wetland W3, 0.22 ha) is a mixed upland/lowland area. These two wetland areas will be reestablished during the early period of Phase 2 when the realignment of the existing watercourse is completed. The temporary loss of this wetland area is not considered a significant negative impact based on the following:

- the area is very small (less than 0.5 ha)
- it is not connected to a larger wetland features in the quarry footprint
- it is generally isolated on the landscape
- it has been historically degraded by surrounding agricultural activities

These small remnant features provide very limited wetland function (hydrologic benefit (attenuation), habitat for fauna and flora, or diversity). The area covered by these wetlands will be replaced as part of the realignment and riparian enhancement of the existing watercourse. The new wetland areas will be part of a corridor system that will be linked to other wetlands in the Beaverdams Creek Wetland Complex and will provide a more diverse and connected habitat function compared to the existing isolated pockets.

Wetland W1A is the riparian wetland (6.6 ha) along the existing watercourse corridor, which will be removed as part of Phases 2B and 3. Prior to removal of the watercourse and associated wetlands in Phases 1B and 1C, the NCD realignment including created wetlands will be constructed on the landscape. Wetland W1A will be removed after the water has been diverted to the newly created creek bed and surrounding wetland habitats. The area of wetland replacement in the newly created riparian zone is approximately 7.8 ha, with 1.3 ha of shallow pond habitat and approximately 6.5 ha of riparian wetland zone. Additional wetland creation is proposed for the southwest corner of the quarry covering an area of approximately 3 ha (see Figure 13, Appendix A). Approximately 1 ha of wetland habitat is also proposed along portions of the final quarry lake as shown on Figure 13. In total, 11 ha of wetland will be created as part of the site rehabilitation to offset the removal of approximately 7.4 ha of wetland.

Phases of extraction will progressively remove sub-catchment areas on the Subject Property that drain to wetland W1A and the existing watercourse. The Subject Property catchments encompass approximately 14% of the total catchment from on-site land area and the upstream catchment areas that drain to the on-site wetland and watercourse. As quarrying progresses, portions of the 14% area will be removed and the associated water will be collected in the quarry excavation. This former surface water, along with groundwater entering the excavation will pumped through the dewatering system and discharged back to the watercourse, maintaining the watercourse flow and riparian wetland conditions. The W1A wetland will continue to function as a wetland feature throughout the quarry Phases.

Following Phase 1A the watercourse will be realigned and wetlands will be created within the new riparian zone (see NCD, Appendix E). The wetland function will be replaced by the realigned riparian corridor prior to rerouting the watercourse flow and removing the feature. This sequence of operations will maintain the spatial extent of the feature and riparian function of the feature. Six other sub catchments are located outside the quarry area on lands to the south and southwest, that will not be affected directly by the extraction but are associated with headwater draws (#5, 6, 7, 8, 10, 12, 19, 24, 25 - Figure 8, Appendix A) that drain through the Subject Property and excavation zone on their path to the watercourse. The off-site portion of the sub catchments represent 14% of the water contributing to the watercourse and will be directed to the main watercourse channel to maintain their contribution to the watercourse and wetland via the proposed dewatering system.

The main catchment to the existing watercourse found to the south of the Subject Property, that flows directly to the watercourse, represents 70% of the baseflow to watercourse and wetland. This large catchment area will not be affected by quarry excavation or underdraining conditions.

New wetland habitat types will also be created in the southwest corner of the Subject Property and along the lake perimeter.

The W1A riparian wetland near the northern property boundary is in an area where the overburden is shallow, allowing for some contribution of groundwater to the watercourse (Figure 11, Appendix A). The area is relatively small and the contribution to the watercourse and nearby wetland is seasonal; it primarily occurs when there is a surplus of water available to these receptors. The volume of this groundwater contribution is small in comparison to the surface water flowing through the system maintaining the overall wet conditions. The area is also downstream of the quarry water discharge point (at Upper’s Lane), and any loss to baseflow will be replaced by the discharge water (WSP 2021). Consequently, the potential effects from the quarry dewatering and associated underdraining on the watercourse and wetland hydrology are considered to be negligible.

In conclusion, considering the characteristics of the riparian wetland features and conditions that support the main wetland feature (W1A) on the property, there are no anticipated effects to wetland features or functions on site. Over the long term, the proposed watercourse realignment and creation of wetland habitat will increase the diversity and spatial area of wetlands on the Subject Property.

Wetlands Within the Study Area (W1B, W1C W2B, W4)

Wetlands W1B, W1C and W2B are outside the licence boundary but directly adjacent to the Subject Property. W2B is a small remnant wetland feature with no critical function. This wetland will maintain its wet condition given that its catchment remains intact outside the quarry and it is not groundwater dependent. W1B and W1C are wetland units along the existing watercourse and are supported by base flow along the existing watercourse. Wetland W1B found south of the property is supported by a large catchment area of 380 ha, which will be unaffected by the quarry operation. As such no impact is anticipated to this wetland, located in the upper reaches of the existing watercourse. Wetland W1C is located downstream of the quarry where upstream catchment will be removed from operations: however, the discharge water from the quarry will replenish the baseflow of the watercourse and offset any losses as described above for wetland W1A. The discharge water contribution to this wetland will be equal to or greater than the current contribution from the upstream catchment. This wetland will remain intact and continue to function as a riparian wetland along the existing watercourse.

Wetland W4 is associated with Beaverdams Creek and falls within the 120 m Study Area. A small portion of its catchment falls within the licence boundary, however most of the catchment is unaffected. Given that its large catchment is not affected and it is within an aquitard area, there are no anticipated impacts to this feature.

Other Beaverdams Creek Wetlands and Wetland Complexes in the RAA

Wetland W5 (5584 Beechwood), and wetlands W6, W7, W8, W9 and W10 (Figure10, Appendix A) are all located beyond the area where surface catchments are altered by the quarry footprint but are located in the RAA where potential underdraining effects need to be considered and assessed. Indirect groundwater related impacts to these wetlands are discussed below.

Wetlands W8 and W9 are near the Welland Canal. These wetlands are influenced by water control structures in the canal and are not expected to experience any quarry effects that would be greater than the influence already caused by the Welland Canal.

W10 is a PSW located at considerable distance from the quarry but within the under-draining zone. The only potential influence on this feature and other features such as W6 would be associated with under-draining, a groundwater influence. The anticipated effects from under-draining are assessed below with respect to wetland W5, which is the closest wetland to the quarry operations beyond the Study Area and subject to the greatest potential impact from under-draining in the RAA.

Wetland W5 - 5584 Beechwood

Wetland W5 is referred to as the 5584 Beechwood wetland in the Level 2 Water Study Report (WSP 2021).

This swamp feature is the closest wetland to the proposed quarry footprint that is not riparian (associated with the existing watercourse) or in a catchment that is partially affected by the quarry footprint. As described in the Hydrogeological Report, this wetland feature is interpreted to be an “off-line” feature with no distinguishable surface water drainage channels. As such it offers a good location to assess the effect of groundwater under-draining resulting from the dewatering and the drawdown cone. Wetland W5 (5584) was studied through monitoring wells and the modeling of water movement within the overburden and bedrock features below the wetland.

The seasonal average water levels observed during the hydrogeological studies (Level 2 Water Study Report; WSP 2021) show that a downward gradient exists between the pooled water in the wetland (when present), the shallow weathered overburden (i.e. to a depth of 3 metres below ground surface), and the underlying contact aquifer throughout the entire year. As such, the baseline data indicate that this feature does not receive groundwater discharge, but rather relies primarily on direct precipitation to maintain conditions within the wetland. Pooled surface water is typically only observed during the winter and spring months, although during wetter years (such as 2017) pooled water may persist into the early summer months. When present, the pooled water at surface is subject to a downward vertical hydraulic gradient, which percolates through the upper aquitard and infiltrates to the contact aquifer (i.e. groundwater recharge). The overall, annual specific discharge rates were 29 mm/year in 2017 and 15 mm/year in 2018 (WSP 2021). An increase in under-draining between 5 mm and 11mm per year under dewatering conditions during operations is also anticipated (WSP 2021). This indicates that there will be up to 11 mm of additional water escaping to the groundwater due to an increased rate in movement through the aquitard. The ecological implications of this is assessed below.

The total available water to the wetland averages 953 mm per year (WSP 2021). This available water includes approximately 309 mm of runoff/ groundwater recharge that is not available to the plants and vernal pools in the wetland. The remaining 644 mm is available and used by the plants through evapotranspiration. Assuming a worst-case scenario and the 11mm change in under-draining is all from the evapotranspiration component (none coming from the runoff component) the change to the available evapotranspiration water is 1.6%. Based on this analysis, 98% of the water in the wetland will remain to support the hydroperiod and functions of the wetlands. Wetland W5 is a resilient swamp deciduous wetland subject to large seasonal changes in water depth from deep ponded water in spring to drier surfaces in summer. The predicted change in the water that supports the wetland function in a dynamic swamp hydrology is not significant from an ecological perspective.

Overview of Potential Wetland Impacts

As reported in the water resource analysis (WSP 2021), the aquifer overburden in the region is comprised of thick layers of dense slowly permeable clay soils. These dense clay materials act as an upper aquitard. This aquitard, which is found generally throughout the region, restricts the movement of water from the surface down to the groundwater and from the groundwater up to the surface. As such, although there is potential for limited movement of water through the confining layer (represented as discharge or recharge) the rate of movement (hydraulic conductivity) is recognized to be very slow. The volume of water that moves through this tight layer of overburden in and out of water dependent features is very small compared to the total amount of water incoming or outgoing from rain, runoff, watercourse flow, evaporation or evapotranspiration. The predicted change from under-draining is less than 2%, which is not considered to be a negative impact on the wetland features or function.

In addition, the small volume of water that moves through the confining overburden layer occurs during seasonal periods of heavy precipitation or seasonally high (spring/fall) groundwater elevations. Under these seasonal conditions, features reliant on water are fully saturated (representing surplus water condition, more water than can be used by vegetation or retained by surface soils) and have an abundance of water from other contributing sources (i.e. rain, runoff).

Summary of Wetland Impacts

In conclusion, under current conditions, the influence of groundwater in supporting surface resources is negligible over the year. The loss of contribution to surface features (creeks and wetlands) from groundwater under-draining associated with the quarry dewatering is not anticipated to have any measurable or negative impacts to any of the features within the cone of influence in this region where the overburden aquitard controls water movement.

The wetlands on the Subject Property (W1A, W2A and W3), noted in Table 6.1, which total 7.04 ha, will be removed as the phases of quarrying advance. The Subject Property wetlands are those associated with the realignment of the existing watercourse: 6.64 ha (Wetland unit W1a) described as MAS2-1/MAM2-10 Cattail Mineral Shallow Marsh/Mixed Forb Mineral Meadow Marsh Complex and W2A and W3, which together total 0.4 ha. These spatial areas of wetland are incorporated into the design of the NCD of the existing watercourse and associated riparian wetlands, resulting in a created wetland area of 7.8 ha.

Additional enhancement in the form of newly created wetland, as discussed in Section 9.0, will provide a further increase in wetland area on the Subject Property.

8.1.2 Mitigation Measures

The overriding provincial and municipal goal (administered through the Conservation Authority Act) for wetland protection in southern Ontario is to maintain the area of wetland coverage in the province and, where possible, create additional wetlands on the landscape. In the proposed development of Upper's Quarry, wetland removal is associated with the removal of the riparian zone of the existing watercourse. As discussed, this feature will be realigned on site following a NCD. The NCD report (Stantec 2020) includes an extensive discussion of wetland features along the length of the realigned feature including wetland pockets that would facilitate the pike spawning in the marsh pools designed into the restoration effort. The total area of vernal pools and shallow marsh meadow communities in the proposed NCD is 1.3 ha. with 6.5 ha of riparian wetlands. This design meets the goal of maintaining and increasing the areal extent of wetlands in the Study Area are maintained and added to the regional landscape. The small wetland adjacent to the quarry, namely W2b (0.23 ha), which is partially dominated by invasive reed canary grass, is not subject to mitigation requirements as it is supported by off-site surface water. This area will be monitored to assess the impacts of quarry operations; however, the small area of this feature is effectively replaced by the wetland triangle shelf in the southwest corner of the rehabilitated quarry, which includes 1.18 ha of swamp thicket and marsh meadow and 1.03 ha of treed deciduous swamp that abuts the W2b wetland (Figure 13, Appendix A). This rehabilitation proposal provides mitigation in the form of compensation should the small wetland show evidence of residual impacts.

Mitigation for other wetlands along the downstream reaches of the existing watercourse involves the consistent release of dewatering discharge into the existing watercourse during operations. Post closure, with the implementation of the quarry design with a surface outlet to the realigned watercourse; the reestablishment of the ground water elevation and water flow through the NCD; the water inputs will continue to support downstream function of wetlands along the watercourse wetlands downstream of the quarry and created wetlands along the realigned watercourse.

Based on the understanding of the hydrogeology of the region, and the quantification of under-draining as reported in WSP 2021 and it ecological influence, and in consideration of the proposed watercourse realignment NCD plan, which includes replacement of wetlands prior to their removal, there will be no negative or residual impacts to the wetland features. Wetland spatial extent and wetland function will be maintained in the Study Area, and the overall amount of wetland increased in the RAA.

The wetland will be subject to a monitoring program (Section 11.0) where adaptive management initiatives will be employed as necessary.

8.2 WOODLANDS

8.2.1 Potential Impact

Development of the proposed quarry during Phases 1A and 1B will result in the removal of a 2 ha deciduous woodland along Thorold Townline Road (labelled Thorold Townline Road Woodland on Figure 12, Appendix A). This woodland meets the criteria for significance per Region of Niagara Official Plan, but is not significant per provincial criteria outlined in the NHRM.

The woodland along Thorold Townline Road is comprised of two patches of deciduous woodland (FOD9; Fresh-Moist Oak – Hickory Deciduous Forest) separated by a narrow meadow-marsh. This woodland feature is currently isolated from the nearest woodland (also FOD9) by Thorold Townline Road at a distance of 280 m. While small woodland patches can provide important ecological functions, such as habitat for wildlife or microclimate attenuation, the long-term stability of these communities can be compromised by external factors such as the introduction of non-native or invasive species, indirect physical disturbance along edges by wind, noise, dust or sunlight, or direct human disturbance. Under existing conditions. the woodland along Thorold Townline Road is subject to all these disturbance factors. Non-native species such as garlic mustard, Tatarian honeysuckle and common privet are present in the understorey and groundcover, and are all considered invasive within Ontario. Ash trees in the canopy have died, likely as a consequence of infestation by the invasive Emerald Ash Borer. The woodland's proximity to Thorold Townline Road and surrounding cultivated agricultural lands exposes this community to indirect physical disturbance, and, due to its small size, no portion of the woodland is protected from these edge effects. Human disturbance is likely infrequent, however signs of disturbance were observed during field investigations such as litter, a small fire scar and theft of ecological monitoring equipment.

Although the loss of woodland on the Subject Property would result in localized impacts to some common wildlife habitat, the removal of an isolated 2 ha patch of woodland in a landscape with approximately 18% woodland cover will have negligible effects on broad landscape level ecological processes. Proposed mitigation and compensation measures are described below.

8.2.2 Mitigation

Figure 13 (Appendix A) illustrates areas on and adjacent to the proposed licence area where compensatory planting is proposed. The total area identified for woodland and wildlife habitat compensation is 4 ha (removal area is 2 ha) and will be contiguous with an existing 14 ha woodland. Implementation of this strategy would result in an 18 ha forest tract, the largest in the RAA.

Planting will start during the appropriate growing season when the licence is issued for the proposed quarry. Proposed removal of the 2 ha woodland and construction of the realigned channel (including restoration planting) will be undertaken in Phase 1B of extraction.

The woodland and wildlife habitat compensation plan will replace the forest cover removed in the extraction area through restoration of natural forest cover on lands in the adjacent landscape that were under agricultural production at the time of the quarry application. While the reforestation is guided by established techniques and practices, the implementation and management may be modified through an adaptive management process in consultation with the MNRF. This will allow practices and management to respond to changing forest dynamics such as pest infestations, climatic conditions and restoration ecology. The goal of the woodland and wildlife habitat compensation plan is not merely to replace the features but to achieve a net gain in the ecological functions of the local and regional landscape through:

1. Increasing the total area of woodland cover in the regional landscape.
2. Improving associated landscape functions such as vegetative linkages and interior forest areas.
3. Improving forest ecological characteristics such as species diversity, age class distribution and structural diversity, while retaining native genetics through seed collection and replanting.
4. Incorporating specific wildlife habitat features for bats, deer and other wildlife, such as bat roosting structures, coniferous tree clusters for cover, browse-tolerant shrubs and mast producing trees.

- In addition existing vegetation within the setbacks (where technically feasible) and new vegetation is to be maintained.

8.3 SIGNIFICANT HABITAT OF THREATENED OR ENDANGERED SPECIES

8.3.1 Potential Impact

As outlined in Section 6.5, habitat for SAR is considered to be absent from the Subject Property. A registration under the ESA through the Barn Swallow exemption in Section 23.5 of O. Reg 242/08 was obtained in 2022, and the buildings identified as habitat were removed and a compensation structure erected on the Subject Property in accordance with the registration conditions. However, Barn Swallow was delisted on January 25, 2023, and ongoing monitoring as prescribed by the registration is no longer required per MECP direction. The compensation structure will not be removed.

8.4 FISH HABITAT

8.4.1 Potential Impacts

Direct impacts to fish habitat could potentially occur during blasting, sump discharge during quarry cut and floor dewatering, and during soil disturbance associated with local grading and establishment of sinking cuts, which if unchecked, could result in the transport of sediment from exposed soil surfaces to watercourse receivers. Direct impacts to fish habitat that will occur include the removal of headwater features that provide ephemeral contributions to the existing watercourse and realignment of the existing watercourse to a new, realigned channel along the west boundary of the Subject Property.

8.4.1.1 Blasting Impacts

A Blast Impact Analysis study was undertaken by Explotech to assess the ability of the Project to operate within the prescribed blast guideline limits as required by MECP (Explotech 2021).

Detonation of explosives in or near water can produce compressive shock waves which can potentially damage the internal organs of fish in close proximity to the blast area, and this damage can ultimately lead to death of the fish. Additionally, ground vibrations can potentially affect active spawning beds and have the ability to adversely impact various aspects of spawning, from the activity itself to reducing the viability of incubating eggs. In an effort to alleviate adverse impacts on fish populations as a result of blasting, DFO developed the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998). This publication establishes limits for water overpressure and ground vibrations which are intended to mitigate impacts on aquatic organisms while providing sufficient flexibility for blasting to proceed. Under the guidelines, water overpressures are to be limited to 100 kPa and, in the presence of active spawning beds, ground vibrations at the bed are to be limited to 13 mm/s.

The existing watercourse flows in a south to north direction through the middle of the Subject Property. The operational plan includes the proposed realignment of the existing watercourse as part of the license. The watercourse will remain in its current location during blasting in Phases 1a and 1b. The current alignment of the existing watercourse is at an approximate 27 m setback distance from the North section of Phase 1b and a 40 m setback distance from Phase 1a. Based on these separation distances and Explotech's experience on similar operations, water overpressures generated by the blasting will reside below the DFO 100 Kpa guideline limit and will have no impact on the fish populations present.

During 2017 fieldwork completed by Stantec, pike were identified in two distinct locations of the existing watercourse exhibiting typical spawning behaviour; however, pike can spawn in any locations along the watercourse where vegetation is flooded in the spring. The closest of the two identified spawning areas lies approximately 155 m from the blasting operations associated with the initial sinking cut area. The spawning time for fish species identified in the existing watercourse generally falls within the timing window from March 1 to June 30, which is also used as a mitigative timing window to guide instream works where applicable. Active spawning beds would be subject to the DFO guideline vibration limit of 13 mm/s. During spawning season, vibration monitoring will be required at the shoreline adjacent to the spawning area and watercourse on the blast side of the water body in order to confirm compliance with DFO limits for ground vibration.

8.4.1.2 Mitigation

In their report, Explotech provides guidance on maximum permissible loads per blasting delay, which is based on various separation distances from spawning areas (Table 5 of Explotech, 2021). In addition to providing these conservative load estimates, it is further recommended that a vibration monitoring program be designed to guide blasting operations throughout the duration of extraction and to identify key criteria that will allow for the timely adjustment of blast parameters in an adaptive management approach.

8.4.1.3 Headwater Drainage Features and Catchment Loss

The headwater drainage features (HDFs) on the Subject Property were assessed in accordance with accepted guidelines (TRCA/CVC 2014) and were determined to function primarily to deliver water on an ephemeral, or short-lived basis, to the existing watercourse. This function occurs primarily during and shortly after spring freshet. Depending on year-to-year variations in weather, the majority of these features dry up very early in the spring (April) and are typically cultivated over by May. None of the features on the Subject Property support direct fish habitat.

The impact associated with each of these features is associated with the removal of their corresponding individual catchment areas, as well as the removal of each feature through quarry extraction. These removals have the potential to affect the seasonal volume of water directly entering the existing watercourse and ultimately Beaverdams Creek.

8.4.1.4 Mitigation (Management Recommendations)

Using the HDF guidelines (TRCA/CVC 2014), management recommendations were derived for all HDFs that were examined during field surveys. The assessment resulted in a management recommendation of "Mitigation" for 13 of the headwater features examined. Eleven (11) of the mapped features that were examined were identified as *No Management Required* as per the TRCA guideline assessment. These are typically features with no or minimal flow, cropped land or no riparian vegetation, no fish habitat and no amphibian habitat. In summary, no mitigating actions are required for the No Management Required features and they may be removed from the landscape.

As noted above, 13 of the features were recommended for mitigation as per the TRCA/CVC guidelines. Suggested mitigation approaches provided in the guidelines tend to focus on replicating the function of the HDFs utilizing lot level conveyance measures that focus on delivering water to the main receiver. Since the catchment areas of the features on the Subject Property will be removed through extraction, there are no opportunities to create swale systems to convey water to the existing watercourse. However, there will be a requirement to pump water from the sinking cut areas and ultimately the quarry floor throughout the active life of the quarry.

During the initial phases of quarry development portable submersible pumps (sump) will be installed in the Initial Sinking Cut Areas for the purpose of dewatering to maintain a dry working area and/or aggregate washing. At this time, the existing watercourse will remain in its current location and will continue to receive seasonal inputs from HDFs that are not associated with the Initial Sinking Cut. Water will be pumped from the sumps to a pond where it is either used for aggregate washing or discharged to the existing watercourse. Sumps will be relocated as required within the extraction area during the initial lifts of the quarry. Upon the completion to the final quarry depth, permanent sumps will be established in the southwest corner of each extraction area. The proposed monitoring program includes daily discharge volume measurement and monthly sampling of the discharge for water quality analysis.

Water will be discharged from the sump area to the existing watercourse until the watercourse is realigned to the location of Phase 1B. Once the watercourse realignment has been completed, water will then be discharged from the sump locations to the realigned watercourse in Phase 1B. Pumping and discharge will occur as required, particularly during surplus water events in the spring (freshet and spring rains), but also during the other seasons following precipitation events and the accumulation of shallow groundwater intercepted by the quarry. Pumping operations are expected to deliver water to the channel more frequently and over a longer duration than current conditions which are influenced by year-to-year variations in weather and seasonal runoff volumes. In a drought year, for example, spring flows may recede more quickly and the existing watercourse may approach intermittent conditions earlier than in a wet year or one with "normal" precipitation. In a pumping scenario, discharge of spring flow surplus water can occur over a longer time period and increase the hydroperiod of the existing watercourse, Discharge of accumulated groundwater can also augment flows through summer and into the fall when under normal conditions, flows would be severely reduced resulting in intermittent or even dry watercourse conditions.

8.4.1.5 Existing Watercourse Realignment

The Operational Plan proposes extraction of resource beneath the existing watercourse corridor commencing in Phase 3. Prior to extraction taking place under the existing watercourse, a new watercourse alignment will be constructed that will extend along the west boundary of the Subject Property, adjacent to Thorold Townline Road. Construction of the new watercourse alignment will commence in Phase 1, which will provide sufficient time for construction, stabilization and establishment of plantings and vegetation prior to the new channel being commissioned and accepting the diversion of flows from the existing watercourse. The permanent diversion of flow to the new watercourse alignment will result in a HADD of fish habitat in the existing channel (i.e. destruction of existing fish habitat) and will require a DFO authorization under the *Fisheries Act*. The proposed channel realignment has been subject to pre-consultation with the DFO and the proposal has been supported through DFO's preliminary review process. The existing watercourse currently provides various habitat types. Channel habitat includes habitat elements located within the bankfull channel. The bankfull channel is typically the visible channel contained within obvious banks and marks the point where the channel flows begin spilling the banks and entering the floodplain. The runoff event that is contained in this condition is typically associated with a 1.5 to 2 year return period, but generally occurs on an annual basis. Within the bankfull channel, there are habitat features such as pools, riffles, runs and flats, which are associated with channel bed elevation and slope and are characteristics formed by the energy influence of flow at particular locations (e.g. pools are usually the result of scour). The existing watercourse channel is relatively shallow and low gradient (described as a flat), resulting in slow flow velocities when they occur, sediment deposition (known as aggradation) and corresponding establishment of heavy instream vegetation. Other than floodplain grasses, riparian habitat is minimal under existing conditions. Pool habitat, which is used by fish as a refuge during low or intermittent flow conditions, is relatively scarce and focused largely at the Upper's Lane culvert and a couple of other scattered locations.

The existing watercourse is approximately 1778 m long and has an approximate bankfull width of 4.5 m. This results in an areal extent of fish habitat in the channel of approximately 7,880.5 m^2. Within that length of existing watercourse, two major pool areas at the Upper's Lane crossing occupy approximately 577 m^2. The area of floodplain that is typically inundated under the annual flooding event and which could support spawning pike is 68,403 m^2.

8.4.1.6 Mitigation

In order to offset impacts to the fisheries resources of the existing watercourse, the proposed channel realignment design offers enhanced and more diverse habitat for fish that will exceed current conditions. The NCD realignment details are included in Appendix E.

As part of the planned operations, an acoustic berm will be required across the watercourse at the quarry's north boundary perimeter early in the site preparation phase. The watercourse will be placed in a culvert under the proposed noise berm for a length of approximately 12.6 m where the watercourse exits the Site at the north boundary. A Request for Review and subsequent Application for Authorization under the *Fisheries Act* for this undertaking will be submitted to the DFO as a distinct and separate project from the watercourse realignment given that this approval will be required early in the development of the quarry activities. The compensation will include the creation of additional pike spawning habitat near the proposed culvert that will become part of the greater watercourse realignment enhancement plan.

The new channel realignment is described in detail in the Upper's Creek Realignment Natural Channel Design Report (Natural Channel Design Report; Stantec 2021), Appendix E. The new channel will include a stable profile with good connectivity to a wide floodplain with diverse habitat features and native vegetation. Habitat features will also include floodplain wetlands and ponds designed to replicate the existing riparian wetlands that provide buffering and a source of invertebrates for fish foraging in the watercourse, while also providing opportunities to increase wetland diversity through grading and planting design. Adding channel meanders and connections to riparian wetlands and ponds will increase habitat diversity for a range of life cycle phases for aquatic organisms. Design elements will include new pike spawning habitat, as well as foraging and rearing habitat for a number of fish species. Various instream habitat features will be included, such as deep pools, instream cover (woody debris, etc.), and natural substrates, which will improve habitat diversity in comparison to the existing channel conditions.

Overall, the proposed channel design will include the following features:

Wood Debris Toe Protection and Wood Reinforced Banks

These are in- and above-water structures consisting of woody material, soil lifts, and (sometimes) sod mats placed along the outside of meander bends in pools. The purpose of these structures is to protect and roughen the stream bank, thereby disrupting helical flow patterns and reducing near bank shear stress. The two structures are similar, with the difference being the amount of wood installed in the bank, below the water. Wood debris toe protection consists entirely of wood material, whereas wood reinforced bank is a mix of native substrate and wood material (minimum 25% wood material). Above-water, soil lifts or sod mats are installed up to the bankfull elevation. Live plantings are installed on soil lifts to promote eventual root penetration and development and so that a living structure becomes established in the bank for long term stability. The structures may be constructed at a relatively steep angle, which increases pool depth. Wood debris toe protection and wood reinforced banks also provide instream cover for smaller forage fish (e.g. minnows) and young fish, wood substrate as an anchoring location and food for aquatic invertebrates (which, in turn, feed fish), and carbon inputs which enhance aquatic habitat nutrient levels.

Log Sills

Log sills are an instream structure used to provide grade control and prevent the development and migration of headcuts. They consist of two logs stacked on top of one another (slightly offset), with the top of the upper log matching the invert of the upstream channel. The logs are installed perpendicular to the direction of flow. In addition to contributing to fluvial function, log sills also provide additional cover for fish species.

Augmented Riffle

Augmented riffles are in-water structures which provide enhanced grade control and habitat diversity. These structures consist of the riffle matrix shaped into a low flow channel nested within the larger bankfull channel. The riffle substrate is sized to resist mobilization during flood conditions. The low flow channel is designed to maintain flow depths during low flows to promote fish passage and aquatic habitat. Riffles provide aeration and promote increased oxygenation which is particularly beneficial in warmwater systems that do not retain dissolved oxygen as well as cool and coldwater systems. Riffles also provide spawning habitat and are the preferred substrate of many benthic invertebrates. Benthic invertebrates are critical organisms in aquatic food webs as they break down larger organic debris and provide a food source for young and smaller fish.

Riparian Enhancements

The proposed planting plan will allow for the gradual succession of trees and shrubs in the riparian zone to provide shade and overhead cover to the stream. Riparian enhancements will also increase the terrestrial water retention period during precipitation events and reduce excessive overland nutrient input.

New Habitat Areas

Under the proposed extraction scenario with road crossings at each road allowance, 1,686 metres (not including culvert lengths) of open natural stream channel will be created. Habitat conditions within the channel will include 5,836 m^2 of habitat that will be constructed at a bankfull width of 4 m. A series of deeper pools will be constructed, adding 4,950 m^2 of pool habitat to the channel that will provide rearing, feeding and refuge functions. Overall, a total of 10,786 m^2 of habitat will be created within the bankfull limits of the new open channel.

The channel will be located within a large floodplain corridor, of which approximately 76,405 m^2 will be subject to annual inundation during the spring runoff and freshet period. This will result in an increase of 8,000 m^2 of potential spawning habitat in comparison to existing conditions, and is particularly important to pike, as they will seek out these areas for spawning habitat as they do in the existing watercourse. In addition, several riparian wetlands and offline ponded areas will be constructed adjacent to the channel and provided with a seasonal connection to the new watercourse. These habitat areas provide accessible habitat that fish may move in and out of depending on flow conditions, and serve as spawning, rearing, feeding and potential nursery habitat areas. In total, 7,586 m^2 of this type of connected habitat will be created.

In summary, the overall channel and floodplain design will create 94,777 m^2 of fish habitat that could be used on an annual basis (in-channel, annually flooded vegetation and connected wetlands).

Beyond the fish habitat just described, a series of wetland pockets and water ponding areas will be incorporated into the floodplain but not connected to the new channel. These areas may provide habitat for breeding amphibians, and there is the potential for fish to enter under flooded conditions and remain there until the next flooding event occurs to allow them to exit. Approximately 6,012 m^2 of this disconnected habitat will be constructed.

Predicted gains in physical habitat are quantifiable and expressed in square meters. In addition to the numeric gain in habitat area, there will be an increase in habitat quality due to the incorporation of more diverse habitat elements that subsequently offer more habitat opportunities than the existing channel. The benefits of increased habitat quality cannot be quantified pre-construction; however, increased habitat diversity should intuitively result in improved quality of habitat and consequently, increased fish productivity. Fish productivity can be confirmed through post construction monitoring. The riparian and floodplain enhancements will also contribute to increasing overall habitat diversity and quality for terrestrial wildlife.

The new channel will retain the same flow periodicity as the existing channel (i.e. intermittent), but the channel design is intended to result in a substantial increase in habitat quantity and quality.

8.4.1.7 Water Discharge Quality

Table 8.2 provided by WSP in their 2021 Level 2 Water Study Report details the exceedances identified as a result of the comparison of the existing watercourse surface water and groundwater baseline water quality ranges for selected parameters as provided in the table below (units µg/L).

Table 8-2: Water Discharge Quality Assessment (from the Level 2 Water Study Report, WSP 2021)

PARAMETER	PWQO	2019 PW1 PUMPING TEST DISCHARGE	BASELINE MEDIAN				
			Surface Water	Contact Aquifer	Shallow Bedrock Aquifer	Goat Island Member Bedrock	DeCew / Rochester Formation Bedrock
General Parameters							
pH (lab) (pH units)	**6.5 – 8.5**	7.59	7.98	7.90	7.64	7.52	6.68
Total Dissolved Solids		--	273	982	951	13,200	127,500
Total Suspended Solids		<2	27	--	--	--	--
Hardness		824	215	710	730	3,500	44,000
Turbidity	**(a)**	Visually clear	32	--	--	--	--
Hydrogen Sulphide (undissociated)	**0.002**	3.7	--	<0.005	0.9	0.6	1.8
Major Ions							
Chloride	**120** †	150	85	46	74	9,000	75,500
Sulphate		352	68	240	310	780	1,000
Alkalinity	**(b)**	443	125	440	420	230	99
Calcium		188	55	98	140	950	9,350
Magnesium		88	17	110	91	270	4,850
Sodium		80	53	65	47	3,600	29,500
Potassium		4.0	4.0	3.2	3.1	51	435

Parameter	PWQO	2019 PW1 Pumping Test Discharge	Baseline Median				
			Surface Water	Contact Aquifer	Shallow Bedrock Aquifer	Gasport Member Bedrock	DeCew / Rochester Formation Bedrock
Nutrients							
Nitrate		--	0.4	0.3	<0.1	<0.1	<1
Un-ionized Ammonia	**0.02**	<0.001	<0.001	--	--	--	--
Total Phosphorus	**0.03**	--	0.14	0.80	0.07	0.30	0.40
Metals *							
Aluminum	**0.075**	<0.01	0.009	0.006	<0.005	<0.005	<0.175
Boron	**0.2**	0.15	0.03	0.04	0.06	0.92	3.2
Total Chromium	**0.0089**	<0.001	<0.005	<0.005	<0.005	<0.025	<0.175
Cobalt	**0.0009**	<0.0002	0.0009	<0.0005	<0.0005	<0.0025	<0.0175
Copper	**0.005**	<0.001	0.0054	0.001	<0.001	<0.005	<0.035
Iron	**0.3**	0.73	2.15	<0.1	<0.1	<0.5	1.3
Lead	**0.025**	<0.001	0.0013	<0.0005	<0.0005	<0.0025	<0.0175
Molybdenum	**0.04**	<0.005	0.0008	0.0032	<0.0005	<0.0025	<0.0175
Nickel		<0.005	0.004	0.001	<0.001	<0.005	<0.035
Uranium	**0.005**	--	0.0008	0.0091	0.0018	0.008	<0.0015
Vanadium	**0.006**	<0.001	0.0030	0.0014	<0.0005	<0.001	<0.0175
Zinc	**0.03**	<0.01	0.010	0.011	<0.005	<0.025	<0.175

Notes: Concentrations in mg/L unless otherwise noted.
PWQO – Provincial Water Quality Objectives (MECP 1994 and updates)
Shaded values exceed the PWQO.
* Total metals concentrations shown for 2019 pumping test and baseline surface water median; dissolved metals concentrations shown for baseline groundwater median.
† Canadian Environmental Quality Guidelines long-term chloride water quality guideline for the protection of aquatic life (CEGQ, 1999)
(a) Turbidity does not have a firm objective
(b) Alkalinity should not decrease by more than 25% of the natural concentration

In particular, Boron and Uranium exceed the PWQO which required additional evaluation of the potential health risk to aquatic receptors. In order to assess the potential risks, the values identified for these two parameters, were compared to the MOECC (now MECP) Aquatic Protection Values (APVs). It is important to understand that under the MOECC O. Reg. 153/04, the Ministry has developed the APVs to protect aquatic biota exposed to contaminants from migration of contaminated groundwater to surface water. The PWQOs are numerical and narrative ambient surface water quality criteria that represent a desirable level of water quality that the Ministry strives to maintain in the surface waters of the Province. PWQOs for the protection of aquatic life are conservative values that, when met, are protective of all forms of aquatic life and all aspects of the aquatic life cycle during indefinite exposure to the water. Instead, APVs are designed to provide a scientifically defensible and reasonably conservative level of protection for most aquatic organisms from the migration of contaminated groundwater to surface water resources.

The boron APV is based on a LOEL (Lowest Observable Effect Level) 10 day study – frond production in duckweed, *Spirodela polyrrhiza* from Davis *et al.*, 2002 from Cantox Environmental Inc., 2007a while the Uranium APV is based on a LOEL, IC (inhibitory concentration) 25 for reproduction in *Ceriodaphnia dubia,* from Vizon SciTec Inc., 2004. When comparing the values of measured parameters to the Boron APV (3.55 ug/L) and Uranium APV (0.03 ug/L), these parameters are found to meet the MECP values and therefore are not considered to pose a potential risk to the aquatic receptors.

8.4.1.8 Mitigation

Although water quality parameters indicate that pumped groundwater is generally safe for discharge to the surface waters of the existing watercourse, water collected from the sump areas will be directed to a holding pond for storage prior to discharge to the existing watercourse or to an area for washing aggregate. The detention in the holding pond will provide additional treatment to allow for settling of suspended solids as well as dissipation and adjustment of other constituents such as hydrogen sulfide and alkalinity.

8.5 SIGNIFICANT WILDLIFE HABITAT

8.5.1 Potential Impact

Significant wildlife habitat are associated with the 2 ha woodland on Thorold Townline Rd, namely, deer winter congregation area. Impacts to these two categories of woodland SWH will be discussed together as they co-occur in the same woodland feature. Habitat for monarch is also present on the Subject Property where milkweed, the larval host plant, and wildflowers for nectaring are present.

Habitat for Eastern Wood-Pewee is assumed to be present in the woodland west of Thorold Townline Rd, within the Study Area but off the Subject Property. No direct impacts to this feature are anticipated as a result of the quarry development or operation. Mitigation for indirect impacts is described in Section 8.6.

8.5.1.1 Woodland SWH

Numerous small woodlands throughout the regional assessment area have been designated as deer winter congregation areas by MNRF. Typically, woodlots greater than 50 ha are considered SWH for deer winter congregation, although smaller conifer plantations may also be used (MNRF 2015). Smaller woodlands are more vulnerable to deer over-browsing which can degrade forest quality and eliminate understorey cover over time, thus reducing the function of the woodlot as a winter congregation area. The Thorold Townline Woodland is very low quality for deer wintering habitat due to its small size, isolation, proximity to a major roadway, lack of conifer or dense shrub cover and general level of human disturbance. The proposed habitat enhancement improvements will address all of these current limitations and result in a significant improvement in habitat quality. Although removal of the woodland will result in a small local loss of a potential winter congregation area for deer, the enlargement of nearby existing habitat in an area with a greater linkage potential through compensation planting will more than offset this impact.

8.5.1.2 Monarch

Monarch was observed during field investigations and suitable habitat for egg-laying and larval development (common milkweed and swamp milkweed) is present on the Subject Property. The monarch is typically found where milkweed and wildflowers (including goldenrods and asters) exist (Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2010). Caterpillars are generally dependent on milkweed, whereas adults are more generalized in their habitat preference, feeding on a variety of wildflower nectar (MECP 2014). Habitat can include abandoned farmland, along roadsides, and other open spaces where these plants grow (COSEWIC 2010). No impacts to monarch habitat are anticipated as a result of quarry development, as habitat for this species will be established within buffer areas outside the quarry and along the realigned existing watercourse. Additional mitigation measures specific to monarch and its habitat are provided below.

8.5.2 Mitigation

8.5.2.1 Mitigation Recommendations for Woodland SWH

As described in Section 8.2.2, woodland compensation planting will occur on 4 ha of land west of Thorold Townline Road and adjacent to an existing 14 ha woodland of similar species composition and structure.

The compensation area will incorporate specific wildlife habitat features for bats, deer and other wildlife, such as bat roosting structures (bat boxes or condos), coniferous tree clusters for cover, browse-tolerant shrubs and mast producing trees. Prior to the removal of the existing 2 ha woodland, tree seeds and nuts will be gathered from the woodland for direct planting in the compensation planting area for the continuity of genetic stock and so that the compensation habitat will have a similar community composition to the vegetation community removed (FOD9). Leaf litter and sods containing native understory vegetation will be transplanted to more rapidly establish a healthy forest soil microbiome. Native saplings and small shrubs may be transplanted from the woodland to the compensation planting area, where possible.

In addition, the onsite woodland and riparian habitat creation offers 4.3 ha of area that will support a variety of features that offer wildlife habitat.

8.5.2.2 Mitigation Recommendations for Monarch

Mitigation for loss of monarch habitat will be implemented through seasonal habitat protection and habitat creation, as follows:

- Vegetation clearing where milkweed plants are present will proceed when monarch larvae are absent (September 30 to April 1).
- During operation, common milkweed (*Asclepias syriaca*), swamp milkweed (*Asclepias incarnata*) and nectar producing plants will be planted within setbacks and the channel realignment area to provide habitat for monarch.
- Common milkweed and nectar producing plants will be incorporated into the rehabilitation seed mix described on the Site Plan (Sheet 3 of 4, MHBC 2020).

8.6 INDIRECT IMPACTS AND MITIGATION

Inadvertent encroachment of heavy equipment, siltation and/or spills of deleterious substances, noise, and dust migration into natural features are potential indirect impacts from aggregate operations. These impacts may alter species composition by compacting and smothering vegetation and introducing substances that could be harmful to vegetation and wildlife, such as fuel used by construction equipment. Additional disturbance may be required to facilitate spill clean-up activities.

8.6.1 Erosion and Sediment Control

The potential indirect impacts associated with the Project are primarily from site clearing and extraction activities. Most of the potential impacts are common to aggregate operations and can be managed using standard mitigation measures for erosion and sediment control. The primary principles associated with sedimentation and erosion protection measures are to:

- reduce the duration of soil exposure
- retain existing vegetation, where feasible
- encourage re-vegetation
- divert runoff away from exposed soils
- keep runoff velocities low
- trap sediment as close to the source as possible

To address these principles, mitigation measures recommended for implementation during construction are described below. Components of the ESC plan are shown on the Site Plan (MHBC 2021).

- Reduce disturbance of ground vegetation outside the extraction footprint to the extent possible to limit destabilization of soils near the work area.
- Use silt fencing and/or barriers such as sediment logs along all work zones where there is potential for sedimentation of wetlands, or inadvertent encroachment of construction vehicles into trees or natural areas.
- Control dust by using water instead of chemical suppressants in dust-sensitive areas such as the mapped natural heritage features.
- Do not permit equipment to enter natural areas beyond the barrier fencing.
- Stabilize all exposed soil areas (native seed mixes; sourced locally if possible) and revegetate through the placement of seed and mulching or seed and an erosion control blanket, promptly upon completion of construction activities.
- Re-fuel equipment at least 30 m away from sensitive natural features (e.g. wetlands, watercourses) and on impermeable surfaces where possible to avoid potential impacts if an accidental spill occurs.
- In addition to any specified requirements, extra silt fence and/or silt logs will be available on site, prior to grading operations, to provide a contingency supply in the event of an emergency.
- Monitor sediment and erosion controls regularly and properly maintain them as required. Controls are to be removed only after the soils of the construction area have been stabilized and adequately protected or until cover is re-established.

- Fence the limits of construction adjacent to natural features to be retained prior to construction and monitor during operations (along with sediment and erosion control measures) to make sure that the limits are maintained with respect to vehicular traffic and soil or equipment stockpiling.

8.6.2 Avoidance of Wildlife

The following mitigation measures are recommended to avoid impacts to wildlife during Project construction:

- Conduct a visual search of the work area before work commences each day, particularly for the period when most wildlife is active (generally April 1 to October 31). Visual inspections will locate and avoid snakes, turtles and other ground dwelling wildlife such as small mammals. Visual searches will include inspection of machinery and equipment left in the work area overnight prior to starting equipment.
- If wildlife is encountered, work at that location will stop, and the animal(s) will be permitted reasonable time to leave the work area on their own. If the wildlife fails to leave the area after a reasonable period, then MNRF and/or MECP (as appropriate) will be consulted on next steps.
- If there are repeat observations of wildlife in the active quarry (e.g. snakes), barrier fencing may be used to direct wildlife away from the active work area(s) and toward natural wetland areas outside the licence boundary. All fencing materials will be wildlife-friendly to prevent accidental entanglement.
- Any observations of SAR or SOCC will be reported to MECP and/or MNRF within 48 hours. SAR will not be handled, harassed, or moved in any way, unless they are in immediate danger.

8.6.3 Visual and Noise Impact Mitigation

In order to provide a sufficient level of visual and noise screening from roadways, adjacent natural features, and neighboring receptor homes, a combination of berms and natural vegetation screens will be put in place as follows:

- The setback zones along Thorold Townline Road and Beechwood Road will be planted with a mix of deciduous and coniferous trees and shrubs at a range of sizes to create a natural-appearing arrangement. Native plant materials that are complementary to the regional and local landscape will be used where appropriate. Buffer planting will be maintained to enhance survival and good growth rate, and managed to remain effective over time for screening purposes while allowing natural succession to occur in keeping with reforestation objectives.
- Berming for noise and visual attenuation is proposed along the quarry perimeter. The berm will be setback and screened from the road by planting. Existing vegetation within the setback zone will be retained.
- These berms, while not specifically designed to enhance natural habitat, will result in additional naturally vegetated areas and contribute to the overall habitat availability on the landscape.

8.6.4 Protection of Migratory Bird Nests

The federal MBCA provides legal protection of migratory birds and their nests in Canada (Government of Canada 1994) and is applicable to all development undertakings under federal and provincial jurisdictions. Construction timing must consider restrictions imposed by the MBCA. To avoid damaging or disturbing bird nests and contravening the MBCA, the timing of any vegetation clearing will occur outside of the primary nesting period (i.e. the period when the percent of total nesting species is greater than 10% based on Environment Canada's Nesting Calendars and the period for which due diligence mitigation measures are generally recommended).

The primary nesting period identified for the Study Area is April 5 – August 15, although nesting also infrequently occurs outside of this period (Environment Canada 2014). Vegetation removal during this core nesting period is not recommended; however, if required, a nest survey may be carried out by a qualified person in simple habitats such as an urban park, a vacant lot with few possible nest sites, a previously cleared area, or a structure (Government of Canada 2019). If a migratory bird nest is located within the work area at any time, a no-disturbance buffer will be delineated. This buffer will be maintained for the entire duration of the nest activity, which will be determined using periodic checks by the avian biologist. The radius of the buffer generally varies from 5 m – 60 m depending on the sensitivity of the nesting species. The Project will not resume within the nest buffer until the nest is confirmed to be no longer active.

8.6.5 Invasive Species Management

The Subject Property and surrounding lands contain non-native invasive plant species that may displace native species and reduce biodiversity over time. An invasive species management plan is recommended to control non-native invasive species within managed natural areas and determine if replacement plantings are appropriate. Species-specific management strategies should be developed using best available science such as the best management practices provided by the Ontario Invasive Plant Council. Some species may be too difficult to control with reasonable effort depending on the extent of infestation. The invasive species management plan should assess invasive populations and develop a plan that may be successful with reasonable effort.

9.0 ALTERNATE EXTRACTION SCENARIO ASSESSMENT

As noted earlier, Upper's Lane (between the north extraction area and the mid extraction area) and the unopened road allowance between Lots 120 and 136 (between the mid extraction area and the south extraction area) both cross the proposed quarry site, creating three separate extraction areas under the proposed extraction scenario. The assessment of impacts for the alternate design scenario is provided in Appendix F.

10.0 REHABILITATION AND ENHANCEMENT

A significant component of the proposed quarry is the progressive rehabilitation plan. The proposed rehabilitation plan has been created to comply with provincial, regional, and city environmental planning policies and embodies key goals as follows:

- Providing a net gain in biological diversity of habitat types after quarrying.
- Linking habitats within the proposed license area to regional habitats.
- Using native species in rehabilitation efforts.
- Employing novel restoration techniques for deep water limestone quarries.
- Introducing rehabilitation measures progressively throughout project phasing.

In the long term the rehabilitation and enhancement initiatives will result in increased forest cover in the Study Area and RAA, provide a higher quality watercourse and diverse riparian corridor and improve connections within the core NHS, which meets the intent of both the provincial and regional policies.

In support of these initiatives, Walker Aggregates has demonstrated experience with extensive and specialized rehabilitation, including a 52 ha afforestation program at Duntroon Quarry, a commercial vineyard and pollinator habitat and apiculture at Vineland Quarry, and habitat for SAR at various locations.

10.1.1 Natural Channel Design

The principles of NCD were used to develop the design for the realigned watercourse. As outlined in the Natural Channel Design Report (Appendix E), the proposed channel realignment has been designed to provide the following services:

- Stable pattern, dimension, and profile to convey sediment load without excessive aggradation or degradation;
- Accommodate discharge from quarry dewatering during the extraction phase;
- Incorporates a valley sized to convey the 100-year flow;
- Diverse riparian habitat with plantings appropriate for local wildlife;
- Wetland and pond features to mimic natural wetland habitat; and
- Natural channel substrate and instream habitat features that will provide fish and aquatic habitat.

The reference reach design method was used to determine the design parameters for the proposed channel realignment. A reference reach is a stable portion of watercourse that is considered suitable to help determine the dimensions, pattern, and profile of the channel to be restored. Using this method, suitable dimensions were determined for the bankfull channel and channel planform of the realigned watercourse. Instream structures were selected to increase channel stability and habitat diversity. Modeling was completed to evaluate culvert dimensions, flood elevations, and channel substrate sizing. Additional detail on the design methods for the proposed channel realignment are included in Natural Channel Design Report (Appendix E).

10.1.2 Rehabilitation

The final rehabilitation plan for the proposed quarry includes a central lake in the extraction area, a riparian corridor along the realigned watercourse, a wetland community with both swamp and marsh habitats in the southern portion of the extraction area above lake level, and upland meadow and hedgerow communities along the south, east and northern boundaries of the extraction area. Rehabilitated side slopes will be established using a cut-fill method, with non-vertical side slopes having at least a 2:1 ratio of horizontal to vertical slope. The slope will be more gradual at water's edge where near shore wetland zones are to be established. Shoreline areas will be graded to provide irregular shaped shore areas that will enhance habitat diversity and cover. Shallow shoreline areas will be created around the lake perimeter to increase wetland habitat. Habitat diversity will be further improved through the addition of brush piles, logs, stumps, and boulders along the shoreline zone both above and below the water.

The central lake will progressively fill with water once the dewatering systems in place during operation are shut down. It is expected that the lake will require several decades to fill with water. Ultimately, the lake will achieve levels that are in equilibrium with the annual influx of water and the outflow of water, as groundwater through the rock.

The riparian corridor and realigned existing watercourse, as described in NCD (Appendix E), is a 12 ha feature will provide fish habitat, pike spawning habitat, foraging and rearing habitat, pools and rifles, extensive riparian wetland and a forested floodplain that will offer shade and overhead cover to the stream. This design is described in Section 10.1.1 and details of the NCD are included in Appendix E.

The southernmost portion of the quarry will be restored to a wetland feature combining swamp thicket, meadow marsh and treed deciduous swamp. These features will be planted with a diversity of native species in a composition similar to adjacent and nearby wetland features. Species will be selected based on tolerance of shallow groundwater conditions.

Following establishment of the upland side slopes around the excavation area, on-site topsoil/overburden will be spread to a minimum thickness of 15 cm on the established slopes. Slopes will then be seeded using a native grass and forb seed mix.

Through restoration blasting, filling, NCD and extensive planting, the rehabilitation plan will provide a net gain in biological diversity of habitat types. The following sections describe the terrestrial and aquatic features that are proposed in the final rehabilitation plan.

10.1.2.1 Cliff and Talus Slopes

Limestone cliffs are the most prominent ecological features of the Niagara Escarpment. Cliffs are vertical rock faces with an abundance of ledges, cracks and small caves. Where soil is able to accumulate, grasses, ferns and woody plants such as white cedar and staghorn sumac are present. A variety of lichen species grow on the exposed rock faces. The abundance and diversity of species is dependent on aspect and available moisture; north-facing cliffs are more likely to be dominated by mosses and white cedar, whereas south-facing cliffs are characterized by abundant grasses and staghorn sumac. Available moisture is typically from rainfall, but also from seepage in isolated areas. Key wildlife habitat features are the abundance of refuges present in the form of crevices and small caves.

The north, south and west-facing quarry walls will be selectively blasted and scraped to create a more diverse rock face with ledges and cracks.

Talus is the accumulation of limestone or dolostone boulders at the foot of a cliff. Where rockfall is recent, very little soil is present and vegetative cover is limited to mixed grasses and forbs. Where significant weathering has occurred over time, talus may be entirely forested with typical upland forest species (sugar maple, hemlock, round-leaved dogwood, etc.). Drainage is rapid and rainfall is the predominant source of moisture. The key feature for wildlife is the abundance of refuges (including subterranean) in the gaps between large boulders. Because of the variety of subterranean features present and the potential for diverse microclimate conditions, talus slopes are important for snakes, invertebrates and small mammals.

Rockfall from the selective blasting process will be used to create talus slopes on the east-facing side of the quarry.

10.1.2.2 Shoreline Marsh

Shoreline marshes occur along streams and pond or lake edges where water depths are less than 2 m. As the interface between terrestrial and aquatic environments, shoreline marshes are important feeding and breeding habitat for both terrestrial and aquatic species. The nutrient-rich water is highly productive and supports a diverse ecological community. Shoreline marshes also buffer aquatic environments from sediment and nutrient pollution, as the densely growing vegetation functions to trap eroded sediment and sequester nutrients. Grading will be required to sculpt an irregular shoreline and produce a variety of slopes, both in shallow water and above water. Island and cove environments have been incorporated into the shoreline grading plan. Organic soil from local wetlands should be added to provide a seed source and medium for germination and growth of emergent vegetation. Gravel or sand beaches could be created above the high water line to provide nesting habitat for turtles. Wetland plant plugs from local wetlands can be used to introduce the desired native emergent and floating species, however typically wetland species will colonize naturally if the physical conditions are correctly established. The addition of submerged and partially submerged rocks and logs will provide basking opportunities for turtles, refuge for invertebrates and fish, and foraging sites for birds.

10.1.2.3 Swamp

Whether deciduous, mixed, coniferous or thicket, swamps are characterized by a variable flooding regime, often with areas of standing water. Soils are deep and poorly drained, and the microtopography is hummocky or pit and mound. Swamps are a significant component of Ontario's woodland and wetland complexes, providing breeding habitat for most frogs and salamanders.

Unless clay soils are imported into the quarry to create poorly drained areas, swamps are best established along the lake edges. Microtopographic contouring is essential to recreate this ecological feature as it provides a variety of wet and dry microsites for plant establishment. Several large pools capable of holding moisture year-round could be constructed to provide amphibian breeding habitat. Leaf litter and coarse woody debris should be concentrated in and around depressions and vernal pools. Plant stock should be a mix of seedlings and whips from a local seed source, planted at approximately 3 m spacing. Plant species shall be selected based on the type of swamp recommended in the final rehabilitation plan layout.

10.1.2.4 Meadow Marsh

Meadow marshes are typically low-lying pockets within a larger meadow landscape or adjacent to shoreline emergent wetlands. This community is subjected to a variable flooding regime, with soils typically drying up by mid-summer. Meadow marshes are important breeding habitat for amphibians and butterflies, notably the monarch butterfly where milkweed is present.

Meadow marsh will be established in the enhancement planting area in the southern corner of the quarry. Organic material should be added to provide a medium for plant germination and growth. A wetland meadow seed mix of regionally appropriate native species, including tall white aster, Joe-pye weed, spotted touch-me-not, rough goldenrod, meadow rue, and a wide variety of sedges, should be applied in early fall or late spring. Perching structures such as fence posts or snags should be added.

10.1.3 Woodland Compensation Planting

Compensation planting to offset the loss of 2 ha of woodland and associated wildlife habitat is described in Sections 8.2.2, 8.3.2 and 8.5.2.1. Walker Aggregates has committed to planting approximately 4 ha of lands that are currently in agricultural use and which are adjacent to an existing 14 ha woodland (see Figure 13, Appendix A) to replace the forest cover removed in the extraction area through restoration of natural forest cover on lands in the adjacent landscape. Reforestation will be based on ecological principles using native species and a range of habitat creation techniques.

The compensation woodland will also incorporate specific wildlife habitat features for bats, deer and other wildlife, such as bat roosting structures (Section 8.3.2), coniferous tree clusters for cover, browse-tolerant shrubs and mast producing trees (Section 8.5.2.1).

Onsite compensation provides 4.3 ha of woodland plantings, including upland deciduous forest, swamp deciduous forest, and swamp thickets. These compensation plantings are located in the southwest portion of the rehabilitated quarry, and along the setback adjacent to Beechwood Road. This combination of vegetation communities offers additional habitat diversity on the Subject Property.

Walker Aggregates’ most extensive previous experience with woodland compensation was undertaken at Duntroon Quarry as part of an application for expansion. The 52 ha woodland compensation program at Duntroon Quarry was initiated in 2015, with tree planting and other enhancement measures undertaken over three years from 2015 to 2017. Reforestation efforts were divided between areas of active reforestation (23 ha) and areas of natural regeneration (29 ha). Plant material from seedling to 25 mm branch class size were used. Tree species selection and placement in the field was based the topography and soils present on the Subject Property. Natural regeneration techniques included seeding of herbaceous species, tree seeding, and microtopographic contouring. The cumulative mortality incurred up to July 2019 has been 5.4%, which translates to a survival rate of 94.6%. Ecological monitoring for parameters such as canopy height and closure was initiated in 2020. Results will be made publicly available as part of the annual Adaptive Management Plan reporting.

10.1.4 Summary

The combined rehabilitation and enhancement plan for the Proposed Upper’s Quarry will provide the following ecological features and functions:

- **70 ha** lake with **1.3 ha** of shallow wetland edge to provide habitat for fish, aquatic invertebrates and a variety of bird species (waterfowl, shorebirds, wading birds, raptors, gulls and terns) during migration and breeding seasons.
- **10.7 ha** riparian corridor including natural channel to provide fish habitat, pike spawning habitat, foraging and rearing habitat, pools and rifles, extensive riparian wetland (**7.4 ha**) and a forested floodplain that will offer shade and overhead cover to the stream as well as foraging habitat for bats, nesting habitat for a variety of birds, and foraging and egg-laying habitat for monarch.
- **2.9 ha** of wetland (treed deciduous swamp, swamp thicket and meadow marsh) to increase vegetation community diversity, support wetland plant species, and provide foraging habitat bats, nesting habitat for a variety of birds, and foraging and egg-laying habitat for monarch.
- **4 ha** of deciduous woodland (swamp) and visual screens along setbacks on the Subject Property.
- **4.3 ha** of deciduous woodland adjacent to the licenced area, to increase overall forest cover and interior forest in the RAA, maintain local genetic diversity through seed collection from the existing FOD9 community on the Subject Property, and provide wildlife habitat for bats, deer and other wildlife through incorporation of features such as bat roosting structures, coniferous tree clusters for cover, browse-tolerant shrubs and mast producing trees.

11.0 ENVIRONMENTAL MONITORING PROGRAM

Compliance and performance monitoring will be undertaken during the operational phases of quarrying when environmental effects may be most likely. Monitoring is also recommended during the construction phase to ensure compliance with site controls:

- Boundaries of the extraction area should be clearly demarcated and monitored (monthly reconnaissance review) so that the limits are respected;
- Sediment control fencing around the existing watercourse will be monitored monthly during Phase 1 and 2 to check that sediment fencing is intact and in working order.
- Monitoring to be completed monthly during operations and to coincide with high-volume precipitation events. Monitoring events will be recorded and retained on file for the years of operation.
- Tree clearing will be monitored to avoid the active breeding period for bats and birds, as described in Section 8.6.4.

Performance monitoring of initiatives taken to protect the environment and undertakings to enhance habitat will be monitored through the operational phases of the quarry:

- Sediment fence will be monitored monthly to verify they are performing as intended and that there is no transport of sediment into the watercourse area and there is no evidence of scouring from dewatering activities.
- Baseflow monitoring of the existing watercourse will be in accordance with monitoring described in the Level 2 Water Study Report (WSP 2021). Quantitative water level monitoring will be complemented by ecological monitoring of fish communities every two years in the existing watercourse.
- Fish community monitoring, if required by DFO, will also be completed for the new channel design area. A Fisheries Act authorization will be obtained for the watercourse realignment.
- Barn Swallow replacement habitat will be monitored annually for a period of three years as required under the registration process of the ESA.

The rehabilitation plan includes extensive planting of riparian areas along the new watercourse realignment (riparian wetland) and proposed wetland in the southwest corner of the area as well as upland woodlands on off-site lands owned by Walker Aggregates.

Monitoring of the wetland areas including the riparian areas and southwest wetland will involve collecting data in sufficient detail to establish benchmarks for percent invasive species, average Coefficient of Wetness, average Coefficient of Conservatism and Floristic Quality Index. A water regime monitoring program will also be developed to assess the hydric conditions in a representative RAA wetland area that will be used to adapt water management efforts to confirm that wetland conditions are maintained.

Monitoring of upland replanting will involve a baseline floristic inventory and will document species composition and relative abundance (using abundance codes described by ELC; i.e. dominant, abundant, occasional, rare index).

All monitoring will be reported annually for general compliance and performance monitoring and rehabilitation monitoring reported on a five-year interval. Details of the monitoring plan will be developed in consultation with the MNRF and documented in a supplementary Upper’s Quarry Monitoring Plan.

12.0 RECOMMENDATIONS AND CONCLUSIONS

12.1 RECOMMENDATIONS

The following recommendations are made to assist in mitigating potential impacts on the natural environment features identified on Subject Property. These recommendations offer a consolidation of the mitigation provided in Section 8 of this report, as well as general mitigation and proposed monitoring initiatives for site control compliance and performance of rehabilitation (e.g. watercourse, wildlife habitat, and woodlands). These recommendations are incorporated into the Site Plan (MHBC 2021):

General

- Existing vegetation within the setbacks shall be maintained except where berms, haul roads and conveyors are required.
- New vegetation shall be maintained in accordance with Visual Note G.5 on the Operational Plan.
- Silt fencing shall be installed at the easterly limit of Phases 1A and 2A where field drainage enters the existing watercourse. Silt fencing will serve to demarcate the limit of protected area until the watercourse is diverted.
- Stockpiling of all excavated material shall be in accordance with Note H.7 on Drawing 2 of 6.
- Topsoil and overburden stockpiles shall be maintained in accordance with the Best Management Practices for the Protection, Creation and Maintenance of Bank Swallow Habitat in Ontario (MNRF 2017). Stripped overburden and topsoil for rehabilitation shall be utilized in accordance with Notes E.4, E.5 and E.6 on Site Plan 2 of 6.
- Dust control will be implemented in accordance with Air Quality Notes on the Site Plan
- Fuel storage shall be in accordance with the Notes under Section K on drawing 2 of 6.

Natural Channel Design

- The existing watercourse will remain open (not culverted) where it enters the south limit of the South Extraction Area.
- Where the watercourse exits the North Extraction Area, a culvert will be installed to maintain the watercourse while allowing an acoustic berm to be constructed. As part of final rehabilitation, the berm and culvert will be removed to allow for the watercourse to be open.
- As part of site preparation, a compensation pond will be constructed in the Watercourse Realignment Transition Area within Phase 2B, in accordance with the Natural Channel Design Report (Stantec 2021). The compensation pond will be excavated to a maximum depth of 174 masl in this area and in accordance with DFO authorization. No drilling or blasting shall occur in this Transition Area.

- As extraction is completed in Phases 1B and 2B, these areas will be filled with clay overburden material to an elevation ranging between 173 to 178 masl. In accordance with the Natural Channel Design Report (Stantec 2021), a new watercourse channel will be constructed, vegetated and designed in these areas and will include the following design elements:

  – floodplain wetlands,
  – fish habitat ponds, including new pike spawning habitat as well as foraging, spawning and rearing habitat for other fish species,
  – creek sections,
  – wood debris toe protection and wood reinforced banks,
  – log sills, and
  – augmented riffle.

- Culverts will be installed under Upper's Lane and the unopened road allowance.
- 2:1 side slopes will be established on the east side of the new watercourse channel down to the quarry floor.
- Once the realigned watercourse channel has been constructed in Phases 1B and 2B and adequate vegetation to mitigate potential erosion has been established (as confirmed by an ecologist), water from the existing watercourse will be diverted to the realigned watercourse in consultation with regulatory authorities. A fish rescue will be undertaken prior to dewatering and channel relocation. A Licence to Collect Fish for Scientific Purposes will be obtained for the fish rescue.

Woodland and Terrestrial Habitat Enhancement

- The 2.0 ha woodland situated on the east side of Thorold Townline Road will be removed during the advancement of operations in Phase 1A/1B. Tree clearing in the woodlot shall be undertaken outside of the breeding bird period and the active bat season from March 23 and August 26.
- The lands identified off-site as "Woodland Compensation Area" on the Operational Plan, an area of 4.7 ha, shall be planted in accordance with the Final Rehabilitation Plan.
-
- The lands identified on-site as Deciduous Woodland, Treed Deciduous Swamp and Swamp Thicket / Marsh Meadow on drawing 5 of 6, an area of 4.0 ha, shall be planted in accordance with the Rehabilitation Plan.
- Planting for the off-site woodland compensation will commence in the appropriate planting season following licence approval.

Significant Wildlife Habitat and Wildlife

- Vegetation clearing where milkweed plants are present will proceed when monarch larvae are absent (September 30 to April 1).
- The setbacks along Thorold Townline Road and Beechwood Road shall be planted with a mix of deciduous and coniferous trees and shrubs at a range of sizes. Native plant materials that are complementary to the regional and local landscape shall be used (see Final Rehabilitation Site Plan, drawing 5 of 6).

Woodland and Wildlife Habitat Compensation Plan

- A woodland and wildlife habitat compensation plan (see Rehabilitation Plan Table 1) shall be prepared in consultation with regulatory authorities to: (i) allow practices and management to respond to changing forest dynamics in the Woodland Compensation Areas such as pest infestations, climatic conditions (e.g. species selection) and restoration ecology; and (ii) achieve a net gain in the ecological functions of the local and regional landscape through:

  – Increasing the total area of woodland cover in the regional landscape;
  – Improving associated landscape functions such as vegetative linkages and interior forest areas;
  – Improving forest ecological characteristics such as species diversity, age class distribution and structural diversity, while retaining native genetics through seed collection and replanting. For example, prior to the removal of the existing 2 ha woodland:
    o Tree seeds and nuts will be gathered from the woodland for direct planting in the Woodland Compensation Area to promote the continuity of local genetic stock and a similar community composition to the removed vegetation community (FOD9);
    o Leaf litter and sods containing native understory vegetation will be transplanted to promote rapid establishment of a healthy forest soil microbiome;
    o Transplanting of native saplings and small shrubs from the woodland to the compensation planting area, where feasible.
  – Incorporating specific wildlife habitat features for bats, deer and other wildlife, such as bat roosting structures (bat boxes or condos), coniferous tree clusters for cover, browse-tolerant shrubs and mast producing trees;
  – Incorporating specific planting in setbacks and the watercourse realignment channel. For example, plantings that provide habitat for monarch including common milkweed (*Asclepias syriaca*), swamp milkweed (*Asclepias incarnata*) and nectar producing plants.

Fish and Fish Habitat

- Implement Blasting Notes D.3 and D.4 on the Operational Site Plan.
- Water shall be discharged from the sump area to the existing watercourse until water flow is diverted to the watercourse realignment channel. Once the watercourse realignment has been completed, water shall be discharged from the sump locations to the realigned watercourse. Pumping and discharge shall occur as required to support fish habitat.
- Water collected from the sump area shall be directed to a holding pond for storage to allow for settling of suspended solids and dissipation of other constituents such as hydrogen sulfide an alkalinity. Following this pond treatment, water will be discharged to the existing watercourse until water flow is diverted to the watercourse realignment channel. Once the watercourse realignment has been completed, water shall be discharged from the holding pond to the realigned watercourse. Pumping and discharge shall occur as required to support fish habitat

Wetlands

- Wetlands along the existing watercourse will be maintained until the watercourse has been diverted to the watercourse realignment channel.
- Once the watercourse has been diverted, the wetlands created in the watercourse realignment channel shall be maintained.

Monitoring Program

- A monitoring plan shall be prepared in consultation with regulatory authorities to assess the performance of the watercourse realignment channel and to confirm that impacts to off-site wetlands are not occurring as a result of dewatering.
- A monitoring program of compensation planting shall be prepared in consultation with regulatory authorities to confirm stable conditions have been established.
- A trigger mechanism and contingency plan, as detailed in WSP's Level 2 Water Study Report, shall be implemented upon licence approval to proactively ensure natural heritage features and their functions are maintained (i.e. fish habitat, wetland features downstream and at 5584 Beechwood Road, and woodlands) during operational and rehabilitation phases.

12.2 CONCLUSIONS

Based on the information provided in this Level 1 and 2 Natural Environment Technical Report, and the Site Plans (MHBC 2021), Stantec has concluded the following features occur in the Study Area:

- Significant natural heritage features within the Subject Property for which direct impacts are anticipated are:
  - Wetland features
  - Woodland feature
  - Habitat of endangered and threatened species
  - Fish habitat
  - Significant Wildlife Habitat (seasonal concentration areas and habitats of species of conservation concern)

Wetland features on the Subject Property are not provincially significant features but, in the case of the existing watercourse riparian wetland, offer a supporting role to the watercourse diversity. These wetlands will be recreated as part of the watercourse realignment initiative. With these new wetlands, in addition to swamp and marsh wetland in the southwest corner of the rehabilitated quarry and shoreline wetland along the western edge of the quarry lake, there will be a net gain in wetland area from 7 ha to 11 ha that will offer a greater diversity of habitats relative to existing conditions and maintain a corridor linkage across the Subject Property.

The existing 2 ha woodland along Thorold Townline Road is an isolated feature, subject to edge effects and degradation due to the presence of invasive plants and human disturbances. Although the loss of this feature would result in localized impacts to wildlife habitat, the removal of an isolated 2 ha patch of woodland in a landscape with approximately 18% woodland cover will have negligible effects on broad landscape level ecological processes. Furthermore, the proposed woodland compensation and enhancement plan will create an 18 ha contiguous woodland feature in the RAA, achieving a net gain in the woodland ecological functions of the local and regional landscape.

Fish Habitat will be relocated through the alignment of the existing watercourse, which has been subject to preliminary DFO review. The developed NCD offers an enhancement to the current fish habitat and diversity. The realigned channel will also provide greater connection to other natural features, reducing landscape fragmentation.

Significant wildlife habitat is associated with deer winter congregation area on the Subject Property, as well as habitat for Eastern Wood-Pewee outside the licence boundary. With the proposed woodland enhancement and compensation plan, increasing the existing 14 ha woodland in the Study Area to 18 ha, as well as the installation of specific wildlife habitat features, all three wildlife habitat types and their functions will be retained in the Study Area. Habitat for monarch will be increased in the Study Area through direct planting of milkweed and nectar-producing plants in the riparian corridor of the realigned creek.

The combined rehabilitation and enhancement plan for the Proposed Upper's Quarry will provide the following ecological features:

- **70 ha** lake with **1.3 ha** of shoreline wetland
- **10.7 ha** riparian corridor including natural channel and **7.4 ha** of riparian wetland
- **2.9 ha** of wetland (treed deciduous swamp, swamp thicket and meadow marsh)
- **4 ha** of deciduous woodland (swamp) and visual screens along setbacks on the Subject Property
- **4.3 ha** proposed deciduous woodland adjacent to the licenced area

This NETR/EIS was prepared to meet the assessment requirements of the ARA, the PPS, and Niagara Region Official and City of Niagara Falls Official Plan. Natural features are present in the extraction footprint and will be affected by development of the quarry.; however, in accordance with the PPS, avoidance, mitigation, rehabilitation and enhancements measures are recommended in this NETR/EIS. With these measures implemented, no negative impacts on the natural heritage features on the Subject Property and Study Area are anticipated but rather a net gain on the features and their ecological functions.

13.0 REFERENCES

AECOM. 2008. Walker aggregates environmental constraints analysis [draft report].

AECOM. August 12, 2009. Wetland complexing review for Walker Aggregates – South Niagara property [memo].

AECOM. June 16, 2010. *Fisheries Survey – Uppers Property near Thorold (Walker Aggregates)* [memo]. Memo on file at Stantec.

Bakowsky, W.D. 1996. *Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario.* Peterborough: Natural Heritage Information Centre, Ontario Ministry of Natural Resources.

Birds Canada. No date (n.d.). *Marsh Monitoring Program*. Electronic Document: https://birdscanada.org/birdmon/mmp/main.jsp. Last accessed: January 17, 2020.

Bird Studies Canada. 2008. Marsh Monitoring Program Participant's Handbook for Surveying Marsh Birds. Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. 17 pp.

Brouillet, L., F. Coursol, S.J. Meades, M. Favreau, M. Anions, P. Bélisle & P. Desmet. 2010+. *VASCAN, the Database of Vascular Plants of Canada*. Electronic Document: https://data.canadensys.net/vascan/about. Last accessed: January 17, 2020.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, A.R. Couturier. 2007. *Atlas of the Breeding Birds of Ontario, 2001-2005*. (eds) Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of natural resources, and Ontario Nature, Toronto, xxii + 706pp.

Chapman, L.G. and D.F. Putnam. 1984. *The Physiography of Southern Ontario*. Ontario: Ministry of Natural Resources.

City of Niagara Falls. 2017. *Official Plan.* Electronic Document: https://niagarafalls.ca/city-hall/planning/official-plan.aspx. Last accessed: January 16, 2020.

Colville, S. 2020. Email correspondence from Sean Colville, Colville Consulting Inc., to Dan Eusebi, Stantec, on December 9, 2020, regarding soil samples obtained at the Subject Property on December 8, 2020.

Committee on the Status of Species at Risk in Ontario [COSSARO]. 2013. COSSARO Candidate Species at Risk Evaluation for Eastern Wood-Pewee (*Contopus virens*). Electronic document: http://cossaroagency.ca/wp-content/uploads/2017/06/Final-COSSARO-Evaluation-Eastern-Wood-Pewee-_23-Sep-2013_GFM-FINAL-s.pdf

Cornell Lab of Ornithology. 2015. All About Birds [online database]. Cornell University. Retrieved on March 10, 2017 from https://www.allaboutbirds.org/

COSEWIC. 2002. COSEWIC assessment and status report on the northern map turtle *Graptemys geographica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 34 pp.

COSEWIC. 2003. COSEWIC assessment and status report on the spoon-leaved moss *Bryoandersonia illecebra* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 31 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2005. COSEWIC assessment and update status report on the Blanding's Turtle *Emydoidea blandingii* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 40 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2006a. COSEWIC assessment and status report on the cherry birch *Betula lenta* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 16 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2006b. COSEWIC assessment and update status report on the American Columbo *Frasera caroliniensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 21 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007a. COSEWIC assessment and status report on the Eastern Flowering Dogwood *Cornus florida* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 22 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007b. COSEWIC assessment and update status report on the Allegheny Mountain Dusky Salamander *Desmognathus ochrophaeus* (Great Lakes/St. Lawrence population and Carolinian population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii+32 pp. (www.sararegistry.gc.ca/status/status_e.cfm)

COSEWIC. 2007c. COSEWIC assessment and update status report on the Eastern Hog-nosed Snake *Heterodon platirhinos* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 36 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007d. COSEWIC assessment and update status report on the Five-lined Skink *Eumeces fasciatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.iv + 42 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007e. COSEWIC assessment and update status report on the Gray Ratsnake *Elaphe spiloides* (Great Lakes/St. Lawrence population and Carolinian population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 33 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007f. COSEWIC assessment and update status report on the round-leaved greenbrier (Great Lakes Plains and Atlantic population) *Smilax rotundifolia* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 32 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007g. COSEWIC assessment and update status report on the Wood Turtle *Glyptemys insculpta* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 42 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2008. COSEWIC assessment and status report on the Snapping Turtle *Chelydra serpentina* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 47 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2009. COSEWIC assessment and update status report on the Least Bittern *Ixobrychus exilis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 36 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2010a. COSEWIC assessment and status report on the Acadian Flycatcher *Empidonax virescens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. X + 38 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2010b. COSEWIC assessment and status report on the Bobolink *Dolichonyx oryzivorus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 42 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2010c. COSEWIC assessment and status report on the Cucumber Tree *Magnolia acuminata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 18 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2010d. COSEWIC assessment and status report on the Fowler's Toad *Anaxyrus fowleri* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 58 pp. (www.sararegistry.gc.ca/status/status_e.cfm)

COSEWIC. 2010e. COSEWIC assessment and status report on the Rusty-patched Bumble Bee *Bombus affinis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 34 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2010f. COSEWIC assessment and status report on the Virginia Mallow *Sida hermaphrodita* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 18 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2010g. COSEWIC assessment and status report on the Woodland Vole *Microtus pinetorum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 35 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2011a. COSEWIC assessment and status report on the Barn Swallow *Hirundo rustica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 37 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2011b. COSEWIC assessment and status report on the Eastern Meadowlark *Sturnella magna* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 40 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2011c. COSEWIC assessment and status report on the Yellow-breasted Chat auricollis subspecies *Icteria virens auricollis* and the Yellow-breasted Chat virens subspecies *Icteria virens virens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xvi + 51 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2012a. COSEWIC assessment and status report on the Eastern Musk Turtle *Sternotherus odoratus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 68 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2012b. COSEWIC assessment and status report on the Northern Dusky Salamander *Desmognathus fuscus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 56 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2013a. COSEWIC assessment and status report on the Bank Swallow *Riparia riparia* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 48 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2013b. COSEWIC assessment and status report on the Little Brown Myotis *Myotis lucifugus*, Northern Myotis *Myotis septentrionalis* and Tri-colored Bat *Perimyotis subflavus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxiv + 93 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2014a. COSEWIC assessment and status report on the Eastern Milksnake *Lampropeltis triangulum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 61 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2014b. COSEWIC assessment and status report on the Red Mulberry *Morus rubra* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 22 pp. (www.registrelepsararegistry.gc.ca/default_e.cfm).

COSEWIC. 2014c. COSEWIC assessment and status report on the Spotted Turtle *Clemmys guttata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiv + 74 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2015. COSEWIC assessment and status report on the Common Hoptree *Ptelea trifoliata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 33 pp. (http://www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2016. COSEWIC assessment and status report on the Spiny Softshell *Apalone spinifera* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 38 pp. (http://www.registrelep-sararegistry.gc.ca/default_e.cfm).

Crins, W.J., Gray, P.A., Uhlig, P.W.C. and Wester, M.C. 2009. *The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions*. MNRF Science and Information Branch, Technical Report SIB TER IMA TR-01. 87 pp.

CVC and TRCA, January 2014. *The Evaluation, Classification and Management of Headwater Features Guidelines.*

Dobbyn, J. 1994. *Atlas of the Mammals of Ontario.* Federation of Ontario Naturalists, Don Mills, Ontario. 120 pp.

Eder, D. 2002. *Mammals of Ontario*. Lone Pine Publishing, Edmonton, Alberta. 215 p.

Environment and Climate Change Canada [ECCC]. 2018. Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. ix + 172 pp.

Explotech Engineering Ltd. October 2021. Blast Impact Analysis. Upper's Quarry.

Farrar, J.L. 1995. Trees in Canada. Fitzhenry & Whiteside Limited and the Canadian Forest Service. Canada. 198 pp.

Government of Canada. 2018. *Breeding Bird Survey Overview.* Electronic Document: https://www.canada.ca/en/environment-climate-change/services/bird-surveys/landbird/north-american-breeding/overview.html. Last accessed: January 17, 2020.

Government of Canada. 2019a. *Fisheries Act (R.D.C., 1985, C. F-14).* Electronic Document: https://laws-lois.justice.gc.ca/eng/acts/F-14/. Last accessed: January 16, 2020.

Government of Canada. 2019b. *Aquatic Species at Risk Map*. Electronic Document: https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html. Last accessed: January 17, 2020.

Government of Canada. 2019c. *Species at Risk Act (S.C. 2002, C. 29), Schedule 1 (Subsections 2(1), 42(2) and 68(2), List of Wildlife Species at Risk*. Electronic Document: https://laws.justice.gc.ca/eng/acts/S-15.3/page-17.html#h-435647. Last accessed: January 17, 2020.

Government of Ontario. 2007. *Endangered Species Act, 2007, S.O. 2007, c. 6.* Electronic Document: https://www.ontario.ca/laws/statute/07e06. Last accessed: January 16, 2020.

Government of Ontario. 2013. *O. Reg. 155/06: Niagara Peninsula Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.* Electronic Document: https://www.ontario.ca/laws/regulation/060155. Last accessed: January 16, 2020.

Government of Ontario. 2019a. *A Place to Grow, Growth Plan for the Greater Golden Horseshoe.* Electronic Document: https://files.ontario.ca/mmah-greater-golden-horseshoe-place-to-grow-english-15may2019.pdf. Last accessed: January 16, 2020.

Government of Ontario. 2019b. *Conservation Authorities Act, R.S.O. 1990, c. C. 27* (last amended in 2019). Electronic Document: https://www.ontario.ca/laws/statute/90c27. Last accessed: January 16, 2020.

Government of Ontario. 2020. *Provincial Policy Statement.* Electronic Document: http://www.mah.gov.on.ca/AssetFactory.aspx?did=10463. Last accessed: February 28, 2020.

Henson, B.L., K.E. Brodribb, and J.L. Riley. 2005. Great Lakes Conservation Blueprint for Terrestrial Biodiversity: Volume 1. Nature Conservancy of Canada under Licence with the Ontario Ministry of Natural Resources.

Lee, H., W.D. Bakowsky, J.L. Riley, J. Bowles, M. Puddister, P. Ulrig and S. McMurray. 1998. *Ecological Land Classification for Southern Ontario: First Approximation and its Application.* Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch.

McCracken, J.D., R.A. Reid, R.B. Renfrew, B. Frei, J.V. Jalava, A. Cowie, and A.R. Couturier. 2013. *Recovery Strategy for the Bobolink (Dolichonyx oryzivorus) and Eastern Meadowlark (Sturnella magna) in Ontario*. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. viii + 88 pp.

MHBC. 2019. *Site Plans for Upper's Quarry.* File No. 9811V. Drawings on file at Stantec.

Ministry of the Environment, Conservation and Parks [MECP]. 2019. *Species at Risk in Ontario*. Electronic Document: https://www.ontario.ca/page/species-risk-ontario. Last accessed: January 17, 2020.

Ministry of Natural Resources [MNR]. 1996. Ecological Survey of the Niagara Escarpment Biosphere Reserve (Appendix B: Vascular Plants of the NEBR).

Ministry of Natural Resources [MNR]. 2009a. *Beaver Dams Creek Wetland Complex* [Ontario Wetland Evaluation System Evaluation Report].

Ministry of Natural Resources [MNR]. 2009b. *Welland Canal Turn Basins Wetland Complex* [Ontario Wetland Evaluation System Evaluation Report]

Ministry of Natural Resources [MNR]. 2010. *Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005*. Second Edition. Toronto: Queen's Printer for Ontario. Electronic Document: https://docs.ontario.ca/documents/3270/natural-heritage-reference-manual-for-natural.pdf . Last accessed: January 16, 2020.

Ministry of Natural Resources Guelph District [MNRF]. 2014. *Use of Buildings and Isolated Trees by Species at Risk Bats: Survey Methodology.*

Ministry of Natural Resources and Forestry [MNRF]. 2016. Blanding's Turtle Nest and Nesting Survey Guidelines. May 2016 – Version 1.

Ministry of Natural Resources and Forestry [MNRF]. 2019a. *Natural Heritage Information Centre.* Electronic Document: https://www.ontario.ca/page/natural-heritage-information-centre. Last accessed: January 17, 2020.

Ministry of Natural Resources and Forestry [MNRF]. 2019b. *Land Information Ontario*. Electronic Document: https://www.ontario.ca/page/land-information-ontario. Last accessed: January 17, 2020.

Ministry of Northern Development, Mines, Natural Resources and Forestry [formerly MNRF]. 2020. Aggregate Resources of Ontario Standards: A compilation of the four standards adopted by Ontario Regulation 244/97 under the *Aggregate Resources Act*. Available from https://files.ontario.ca/mnrf-aggregates-combined-standards-en-2020-08-27.pdf. 53 pp.

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [online database]. Version 7.1. NatureServe, Arlington, Virginia. Retrieved March 13, 2017 from (http://explorer.natureserve.org).

Newmaster, S.G., A. Lehela, Peter W.C. Uhlig, Sean McMurray and Michael J. Oldham. 1998. *Ontario Plant List*. Forest Research Information Paper No. 123, Ontario Forest Research Institute, Ontario Ministry of Natural Resources, Sault Ste. Marie, Ontario.

Niagara Peninsula Conservation Authority [NPCA]. 2010. Natural Areas Inventory 2006-2009, Volume 1. 609 pp.

Niagara Peninsula Conservation Authority [NPCA]. 2011. Beaverdams and Shriners Creek Watershed Plan, Phase One. Watershed Characterization and Preliminary Issues Identification.

Niagara Peninsula Conservation Authority [NPCA]. No date (n.d.). *NPCA Watershed Explorer*. Electronic Document: https://npca.ca/administration/geographic-information-services. Last accessed: January 17, 2020.

Ontario Geological Survey 2010. *Surficial geology of Southern Ontario*; Ontario Geological Survey, Miscellaneous Release--Data 128-REV

Oldham, M.J., W.D. Bakowsky and D.A. Sutherland. 1995. *Floristic quality assessment for southern Ontario.* OMNR, Natural Heritage Information Centre, Peterborough. 68 pp.

Ontario Nature. 2018. *Ontario Reptile and Amphibian Atlas*. Electronic Document: https://ontarionature.org/programs/citizen-science/reptile-amphibian-atlas/. Last accessed: January 17, 2020.

Reznicek, A.A., E. G. Voss, & B. S. Walters. February 2011. *Michigan Flora Online*. University of Michigan. Electronic Document: https://michiganflora.net/search.aspx. Last accessed: January 17, 2020.

Rowe, J.S. 1972. *Forest Regions of Canada*. Fisheries and Environment Canada, Canadian Forest Service, Headquarters, Ottawa. 172 p.

Savanta Inc. 2010a. Walker Niagara insect surveys, final report.

Savanta Inc. 2010b. Walker Upper's Land proposed quarry – Niagara Falls, Ontario preliminary baseline report [draft report].

Stantec Consulting Ltd. 2012a. Bumble Bee, Dragonfly and Butterfly Survey Walker Industries' Proposed Upper's Lane Quarry (memo)

Stantec Consulting Ltd. 2012b. Salamander Egg Mass Survey Walker Industries' Proposed Upper's Lane Quarry (memo)

Stantec Consulting Ltd. 2012c. Summer Botanical and ELC Walker Industries' proposed Upper's Lane quarry (memo)

Stantec Consulting Ltd. 2012d. Upper's Lane Plant List.

Stantec Consulting Ltd. 2012e. Walker Upper's Lane Quarry – Niagara Region Breeding Bird Survey 2012 (memo)

Stantec Consulting Ltd. 2012f. Walkers Quarry; Snake Coverboard Surveys 2012 (memo)

Stantec Consulting Ltd. 2012g. Walker's Quarry Property - Winter Wildlife Survey & Winter Raptor Survey (memo)

Stantec Consulting Ltd. 2012h. American Badger Habitat Assessment on Walker Upper's Lane Quarry Site – Niagara Region (memo)

Stantec Consulting Ltd. 2021. *Upper's Creek Realignment Natural Channel Design Report*. Report submitted to DFO for review.

The Regional Municipality of Niagara. 2008. *BY-LAW NO. 30-2008. A BY-LAW TO PROHIBIT OR REGULATE THE HARVESTING, DESTRUCTION, OR INJURING OF TREES IN*

WOODLANDS IN THE REGIONAL MUNICIPALITY OF NIAGARA AND TO REPEAL BY-LAW 47-2006, AS AMENDED. Electronic Document: https://www.niagararegion.ca/government/bylaws/tree/pdf/tree-by-law-niagara-region.pdf. Last accessed: January 16, 2020.

The Regional Municipality of Niagara. 2014. *Existing 2014 Consolidated Regional Official Plan*. Electronic Document: https://www.niagararegion.ca/living/icp/policy-plan.aspx. Last accessed: January 16, 2020.

van Zyll de Jong, C.G. 1985. Handbook of Canadian Mammals, vol. 2: Bats. National Museum of Natural Sciences, Canada. 212 pp.

Wright, D.G. and G.E. Hopky. 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34 p. Department of Fisheries and Oceans Canada.

WSP. 2021. Proposed Upper's Quarry Level 2 Water Study Report.

14.0 STATEMENT OF LIMITATIONS

This document entitled Upper’s Quarry, Niagara: Level 1 and Level 2 Natural Environment Technical Report and Environmental Impact Study was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Walker Aggregates Inc. (the “Client”) to support the regulatory review process for the proposed Upper’s Quarry (the “Project”). In connection therewith, this document may be reviewed and used by governmental authorities participating in the review process in the normal course of their duties. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document. The information and conclusions in the document are based on the conditions existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

APPENDIX A
Figures

Legend

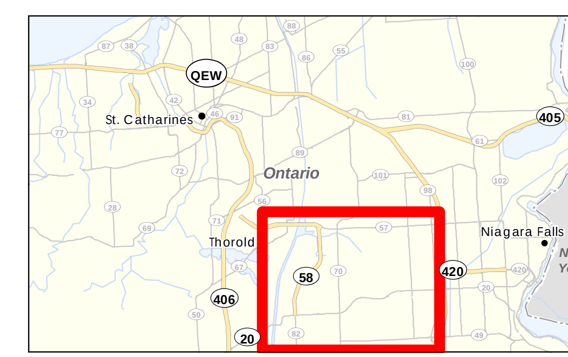
- Subject Property
- Study Area (120 m Zone of Investigation)
- Regional Assessment Area (RAA) Boundary (1,500 m)
- Flow Direction
- Additional Lands Owned by Walker
- Expressway / Highway
- Major Road
- Minor Road
- Hydro Line
- UP Unknown Pipeline
- GAS Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Evaluated (Other)
- Wooded Area

0 0.5 1 km

1:25,000 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery Date, 2018.



Project Location
Regional Municipality of Niagara

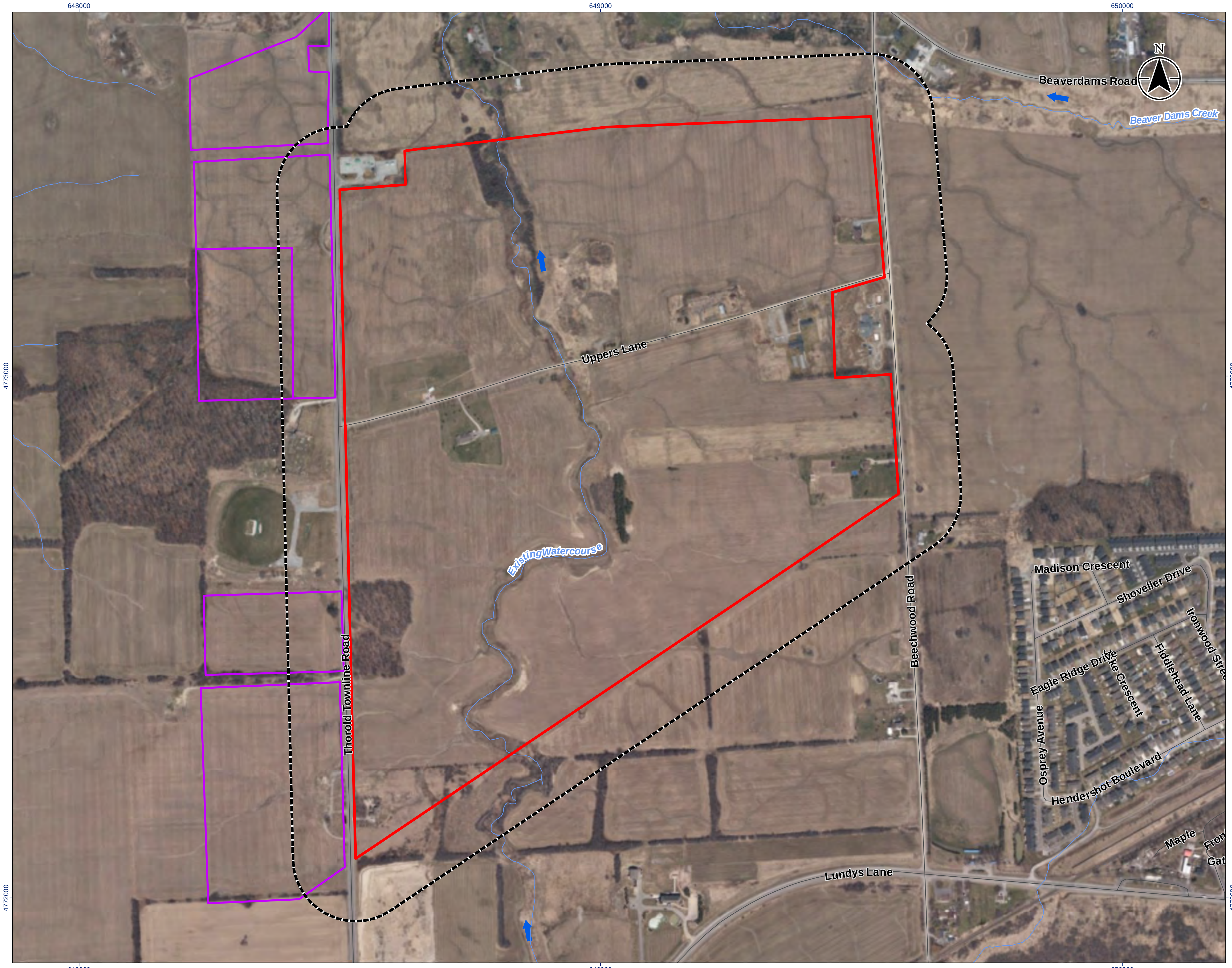
160961352 REVA
Prepared by DH on 2021-10-28

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
1

Title
Regional Context

V:\01609\active\60960948\drawing\MXD\Terrestrial\ReportFigures\NaturalEnvironment\160961352_Fig01_RegionalContext.mxd Revised: 2021-10-28 By: dharvey



Stantec

Legend

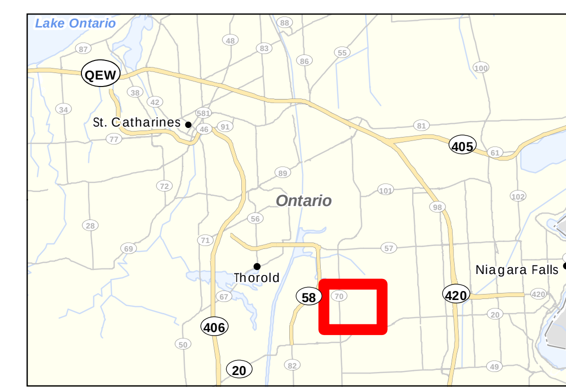
- Subject Property
- Study Area (120 m Zone of Investigation)
- Additional Lands Owned by Walker
- Flow Direction
- Watercourse

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery Date 2018.



Project Location
Regional Municipality of Niagara

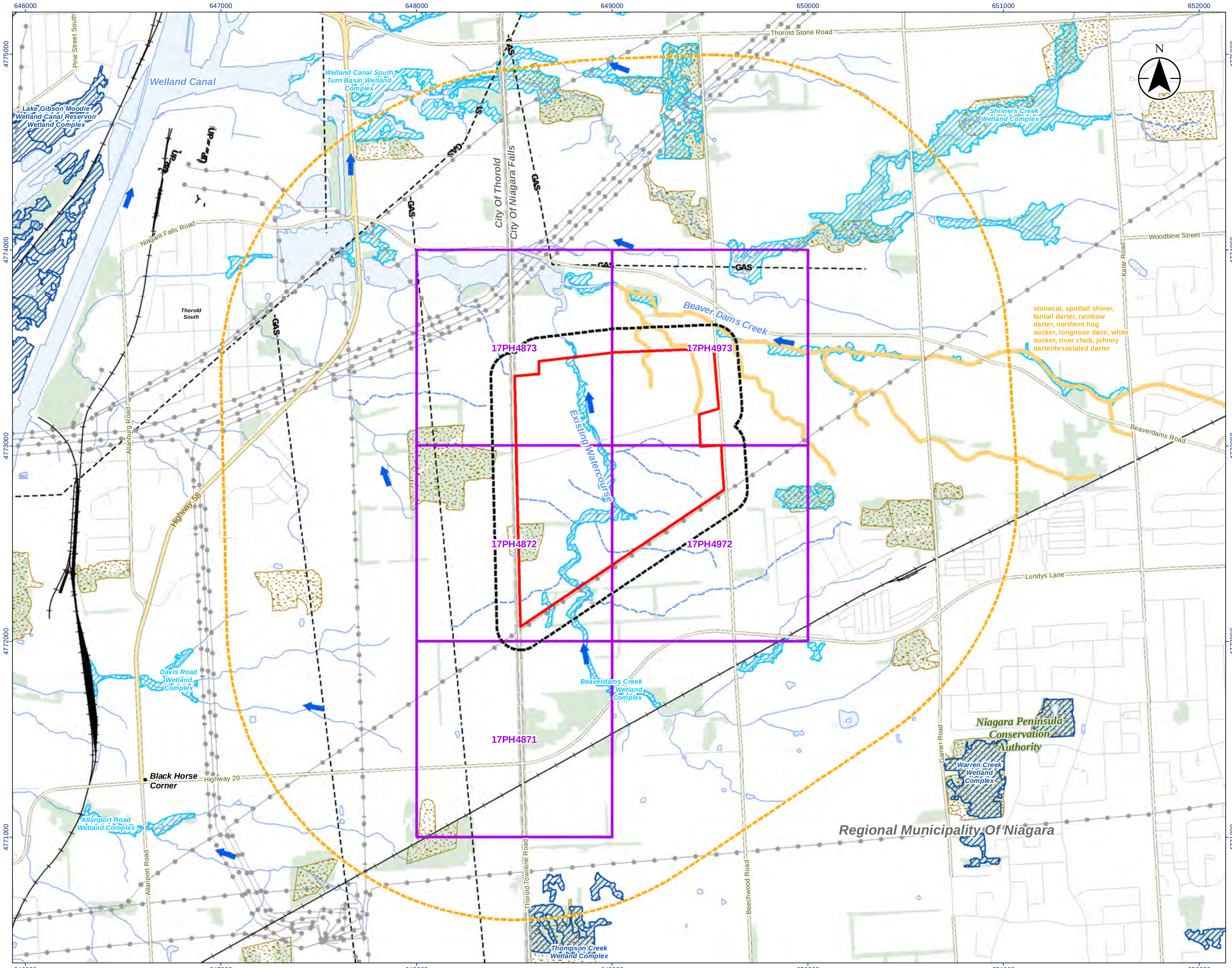
160961352 REVA
Prepared by DH on 2021-10-28
Technical Review by BC on 2019-01-31

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
2

Title
Study Area

V:\01609\active\60960948\drawing\MXD\Terrestrial\ReportFigures\NaturalEnvironment\160961352_Fig02_StudyArea.mxd Revised: 2021-10-28 By: dharvey



Stantec

N

Legend

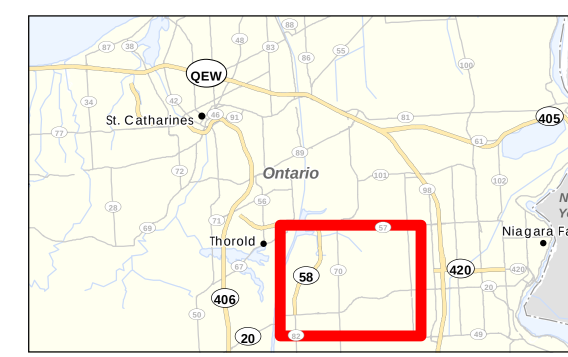
- Subject Property
- Study Area (120 m Zone of Investigation)
- Regional Assessment Area (RAA) Boundary (1,500
- Flow Direction
- Expressway / Highway
- Major Road
- Minor Road
- Hydro Line
- Unknown Pipeline
- Gas Pipeline
- Railway - Operational
- Warm Thermal Regime
- Watercourse (Intermittent)
- Watercourse (Permanent)
- Deer Wintering
- Municipal Boundary - Lower Tier
- NHIC 1 km Grid
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Evaluated (Other)
- Wooded

0 0.5 1 km

1:20,000 (At original document size of 11x17)

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, 2018.



Project Location
Regional Municipality of Niagara

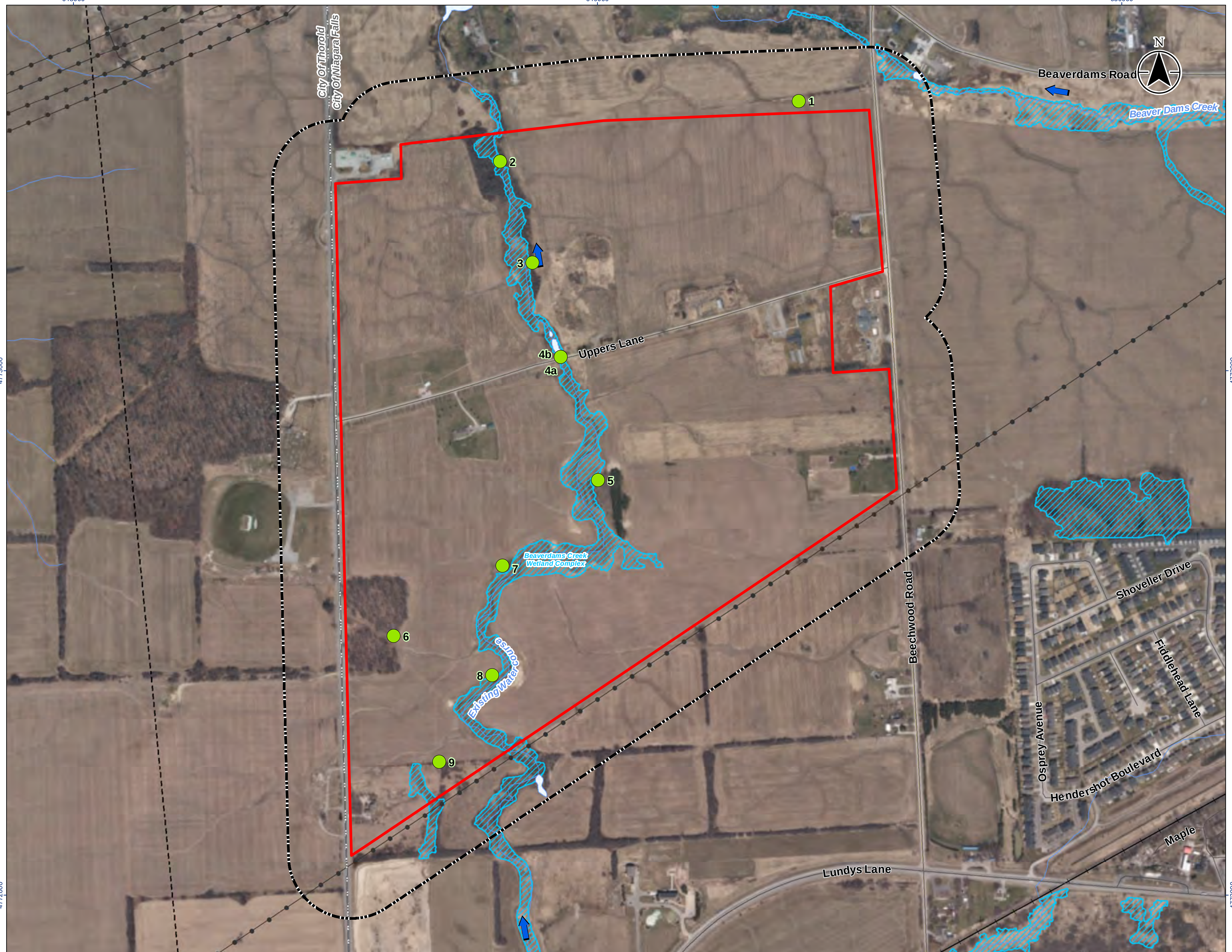
160961352 REVA
Prepared by DH on 2021-10-28

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
3

Title
Designated Natural Heritage Features

V:\01609\active\160961348\drawing\MXD\Terrestrial\ReportFigures\NaturalEnvironment\160961352_Fig03_DesignatedNaturalHeritageFeatures.mxd Revised: 2021-10-28 By: dharvey



Legend

- Subject Property
- Study Area (120 m Zone of Investigation)
- Flow Direction
- Amphibian Survey Location

Base Features

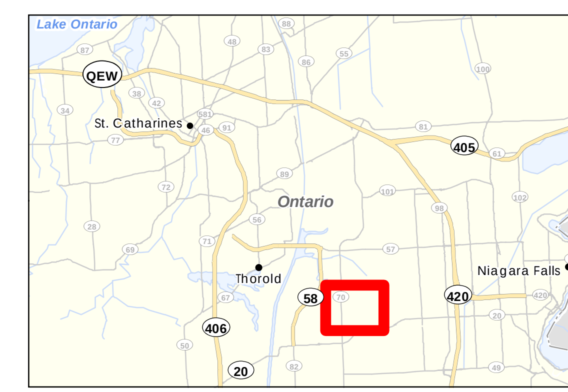
- Road
- Hydro Line
- GAS Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Waterbody
- Wetland - Evaluated (Other)

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2019. Imagery Date 2018.



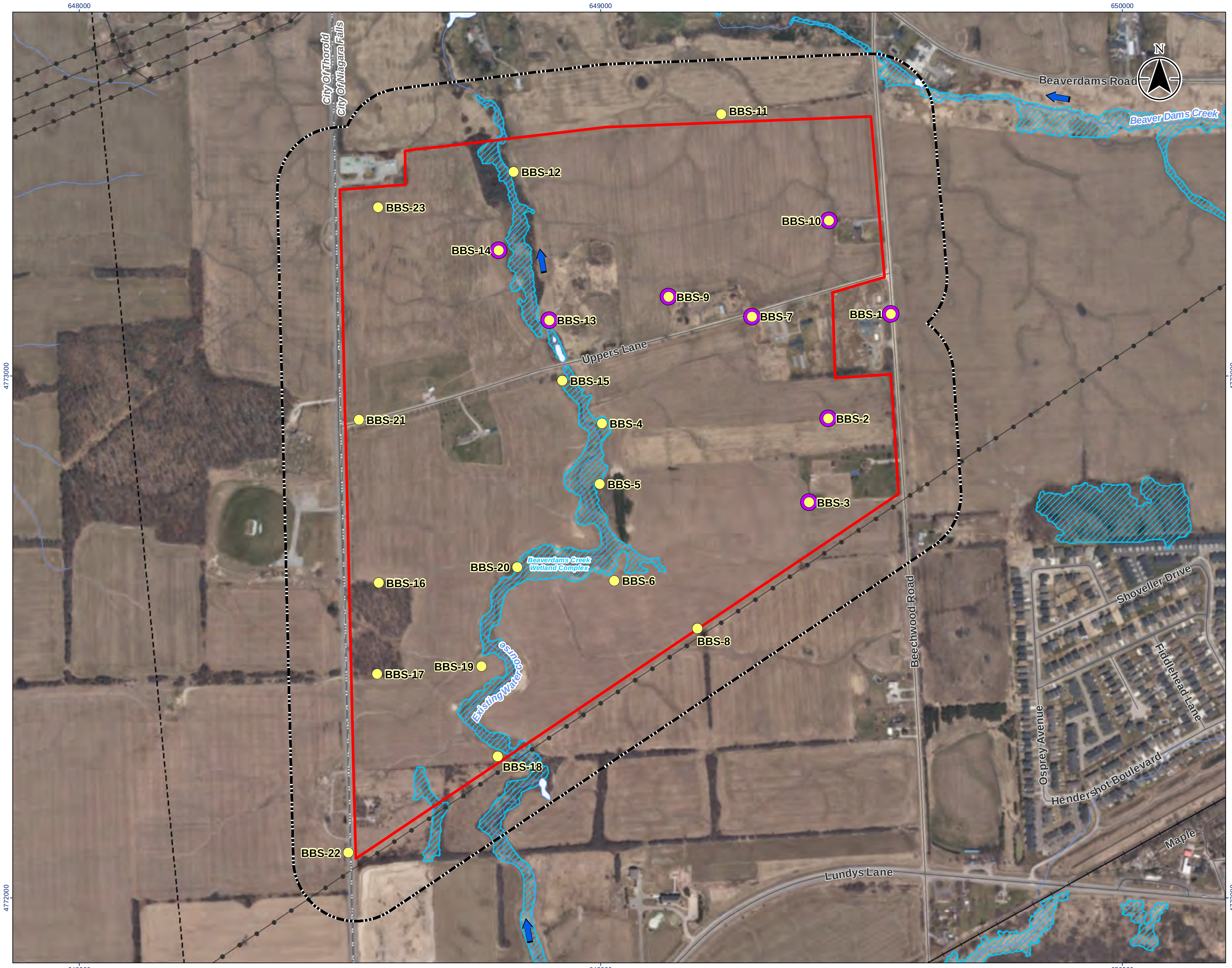
Project Location
Regional Municipality of Niagara

160961352 REVA
Prepared by CMC on 2021-10-28
Technical Review by BC on 2019-01-31

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
4

Title
Amphibian Survey Locations



Stantec

Legend

- Subject Property
- Study Area (120 m Zone of Investigation)
- Breeding Bird Survey Location (2017)
- Breeding Bird Survey Location (2019)
- Flow Direction

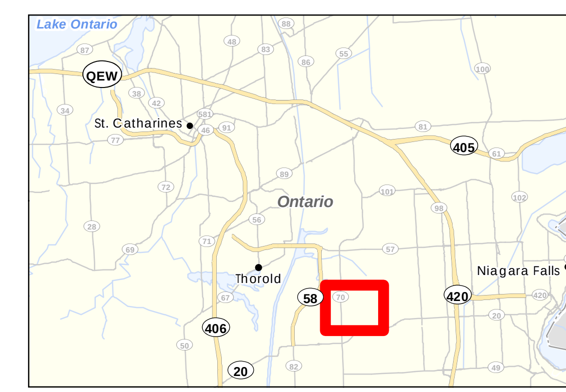
Base Features

- Road
- Hydro Line
- GAS Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Waterbody
- Wetland - Evaluated (Other)

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2019. Imagery Date 2018.



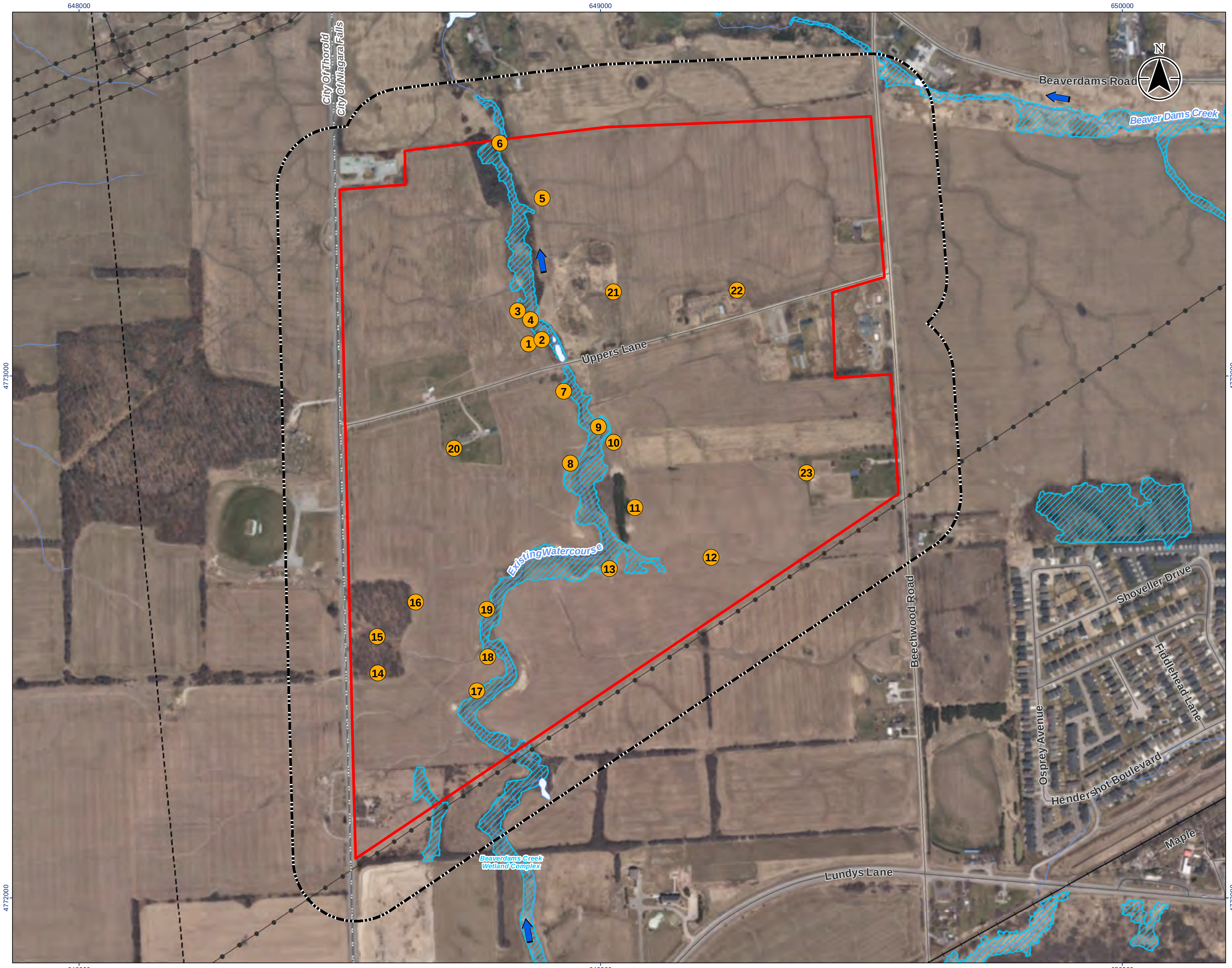
Project Location
Regional Municipality of Niagara

160961352 REVA
Prepared by CMC on 2021-10-28
Technical Review by BC on 2019-01-31

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
5

Title
Breeding bird survey stations (2017 and 2019)



Stantec

Legend

- Subject Property
- Study Area (120 m Zone of Investigation)
- Snake Coverboard Survey Location
- Flow Direction

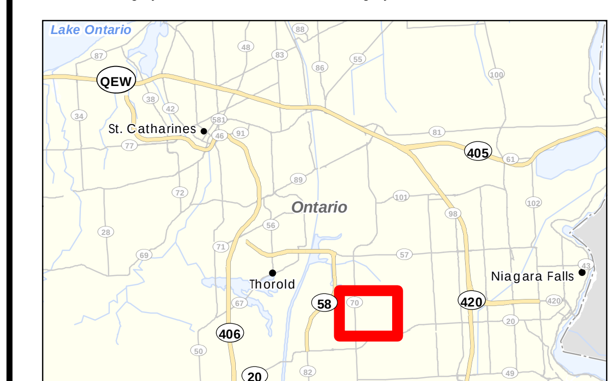
Base Features

- Road
- Hydro Line
- GAS Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Waterbody
- Wetland - Evaluated (Other)

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2019. Imagery Date 2018.



Project Location
Regional Municipality of Niagara

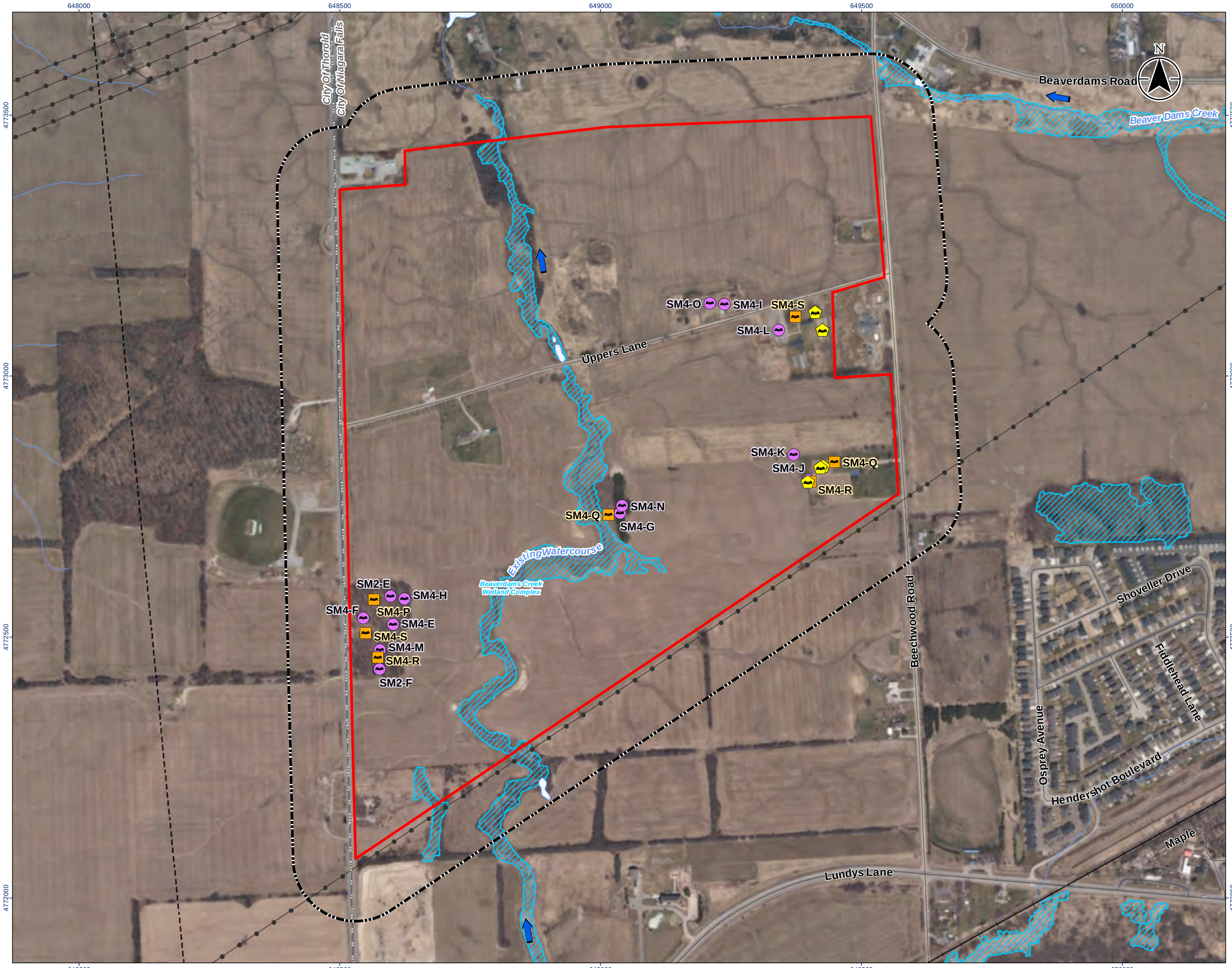
160961352 REVA
Prepared by CMC on 2021-10-28
Technical Review by BC on 2019-01-31

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
6

Title
Snake Coverboard Survey Locations

V:\01609\active\60960948\drawing\MXD\Terrestrial\ReportFigures\NaturalEnvironment\160961352_Fig06_SnakeSurvey.mxd Revised: 2021-10-28 By: dharvey



Stantec

Legend

- Subject Property
- Study Area (120 m Zone of Investigation)
- Bat Acoustic Survey Location (2017)
- Bat Acoustic Survey Location (2019)
- Bat Exit Survey Location (2019)
- Flow Direction

Base Features

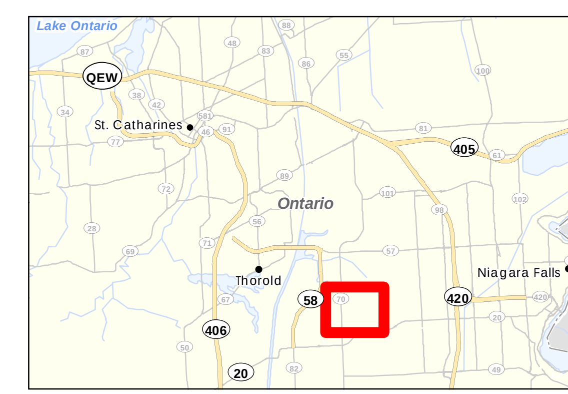
- Road
- Hydro Line
- GAS Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Waterbody
- Wetland - Evaluated (Other)

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © FIrst Base Solutions, 2019. Imagery Date 2018.



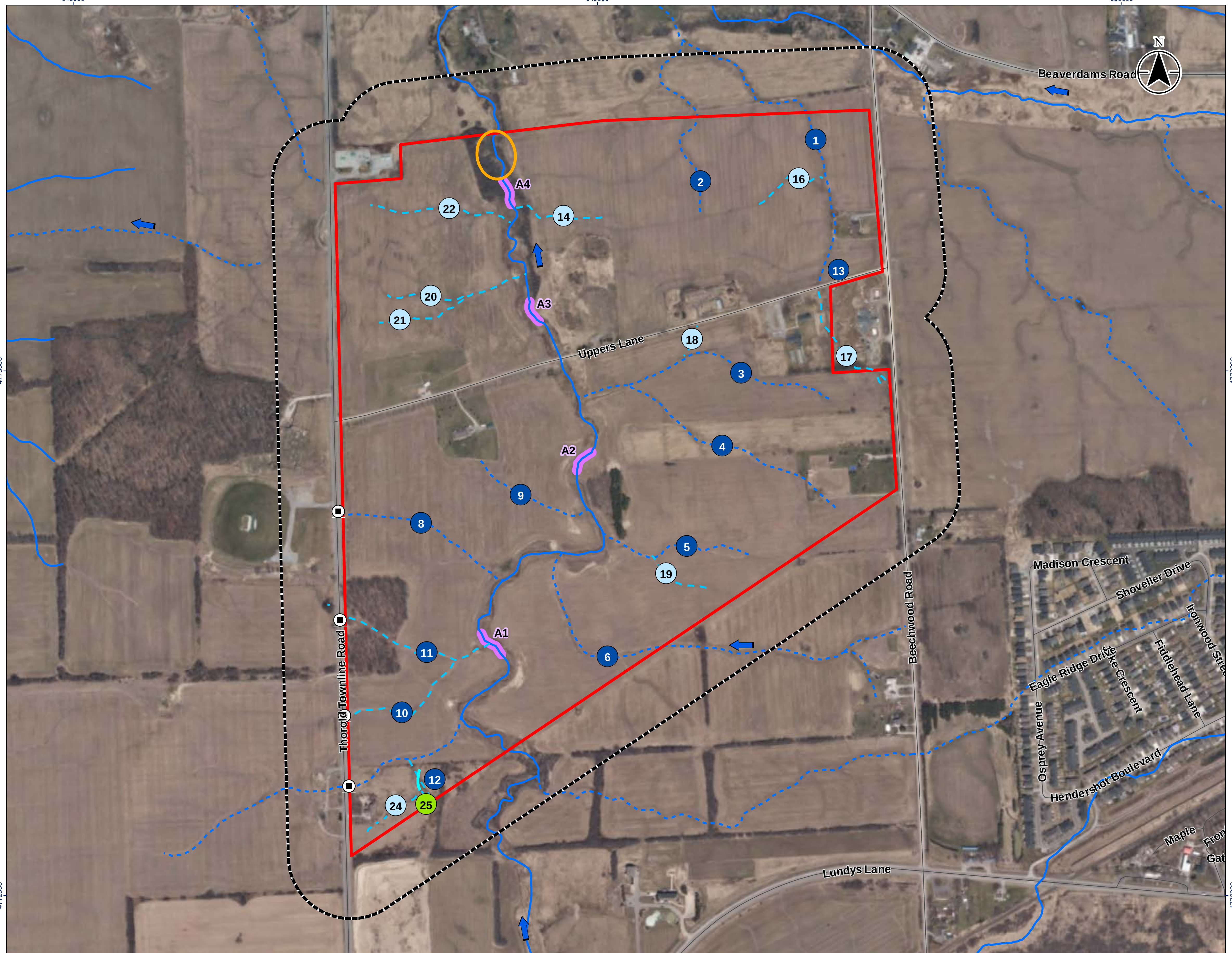
Project Location
Regional Municipality of Niagara

160961352 REVA
Prepared by CMC on 2021-10-28
Technical Review by xx on xxxx-xx-xx

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
7

Title
Bat acoustic and exit survey stations (2017 and 2019)



Stantec

Legend

- Subject Property
- Study Area (120 m Zone of Investigation)
- Flow Direction
- Culvert
- Fish Community Survey Station
- Area of Shallow Overburden and Groundwater Discharge

Headwater Assessment Feature

- Mitigation
- No Management Required
- Protection
- Watercourse, LIO/ MNRF

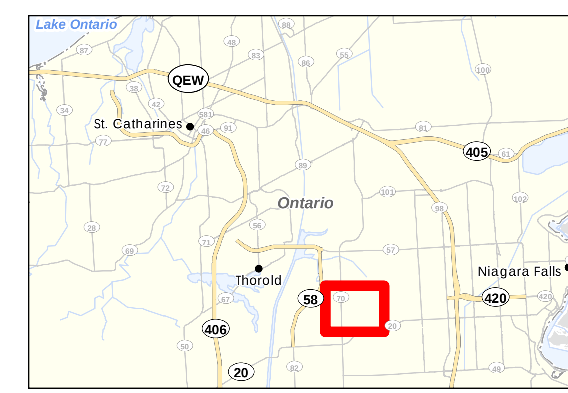
Headwater Drainage Features

- Watercourse (Intermittent) LIO/MNRF
- Watercourse (Intermittent) Stantec

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery Date 2018.



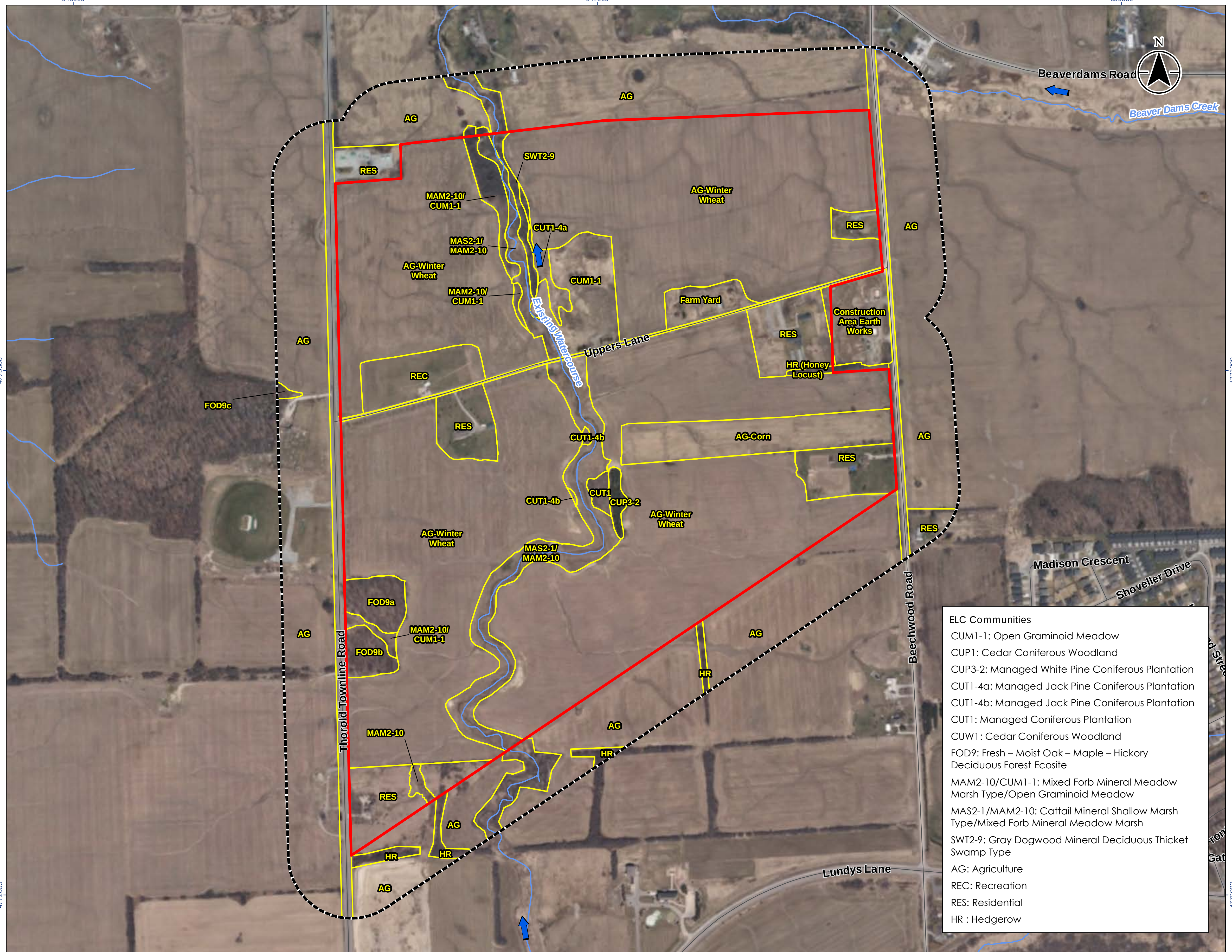
Project Location
Regional Municipality of Niagara

160961352 REVA
Prepared by DH on 2023-08-25
Technical Review by PRM on 2023-08-25

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
8

Title
Aquatic Study Locations



ELC Communities

- CUM1-1: Open Graminoid Meadow
- CUP1: Cedar Coniferous Woodland
- CUP3-2: Managed White Pine Coniferous Plantation
- CUT1-4a: Managed Jack Pine Coniferous Plantation
- CUT1-4b: Managed Jack Pine Coniferous Plantation
- CUT1: Managed Coniferous Plantation
- CUW1: Cedar Coniferous Woodland
- FOD9: Fresh – Moist Oak – Maple – Hickory Deciduous Forest Ecosite
- MAM2-10/CUM1-1: Mixed Forb Mineral Meadow Marsh Type/Open Graminoid Meadow
- MAS2-1/MAM2-10: Cattail Mineral Shallow Marsh Type/Mixed Forb Mineral Meadow Marsh
- SWT2-9: Gray Dogwood Mineral Deciduous Thicket Swamp Type
- AG: Agriculture
- REC: Recreation
- RES: Residential
- HR : Hedgerow

Stantec

Legend

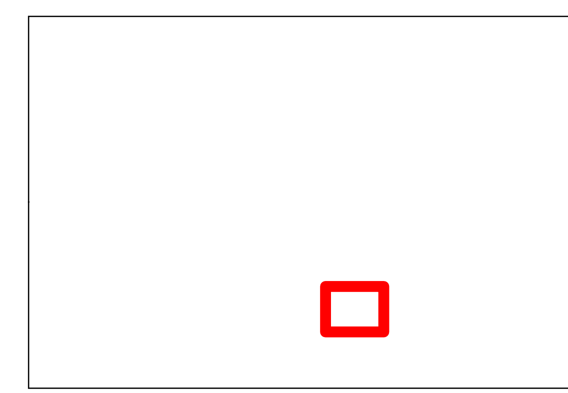
- Subject Property
- Study Area (120 m Zone of Investigation)
- Flow Direction
- Watercourse
- Ecological Land Classification

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery Date 2018.



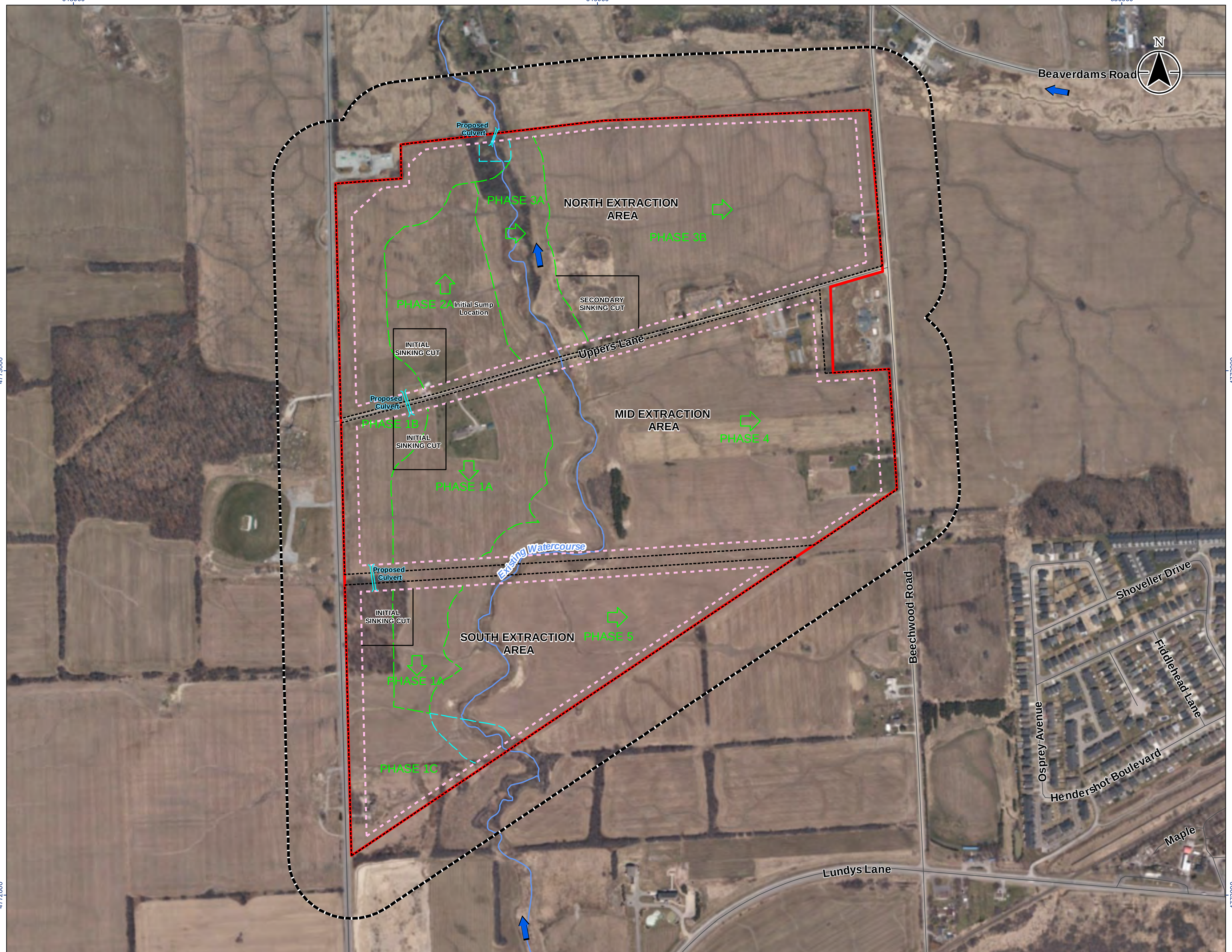
Project Location
Regional Municipality of Niagara

160961352 REVA
Prepared by CMC on 2022-04-13
Technical Review by BC on 2019-01-31

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
9

Title
Ecological Land Classification



Stantec

Legend

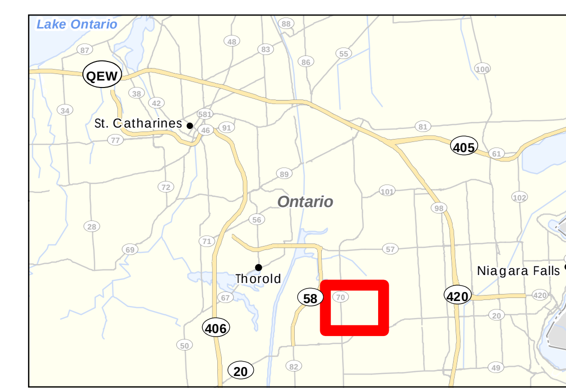
- Subject Property
- Study Area (120 m Zone of Investigation)
- Limit of Extraction
- Licence Boundary
- Flow Direction
- Watercourse

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery Date 2018.
4. Operational Site Plan provided by MHBC



Project Location
Regional Municipality of Niagara

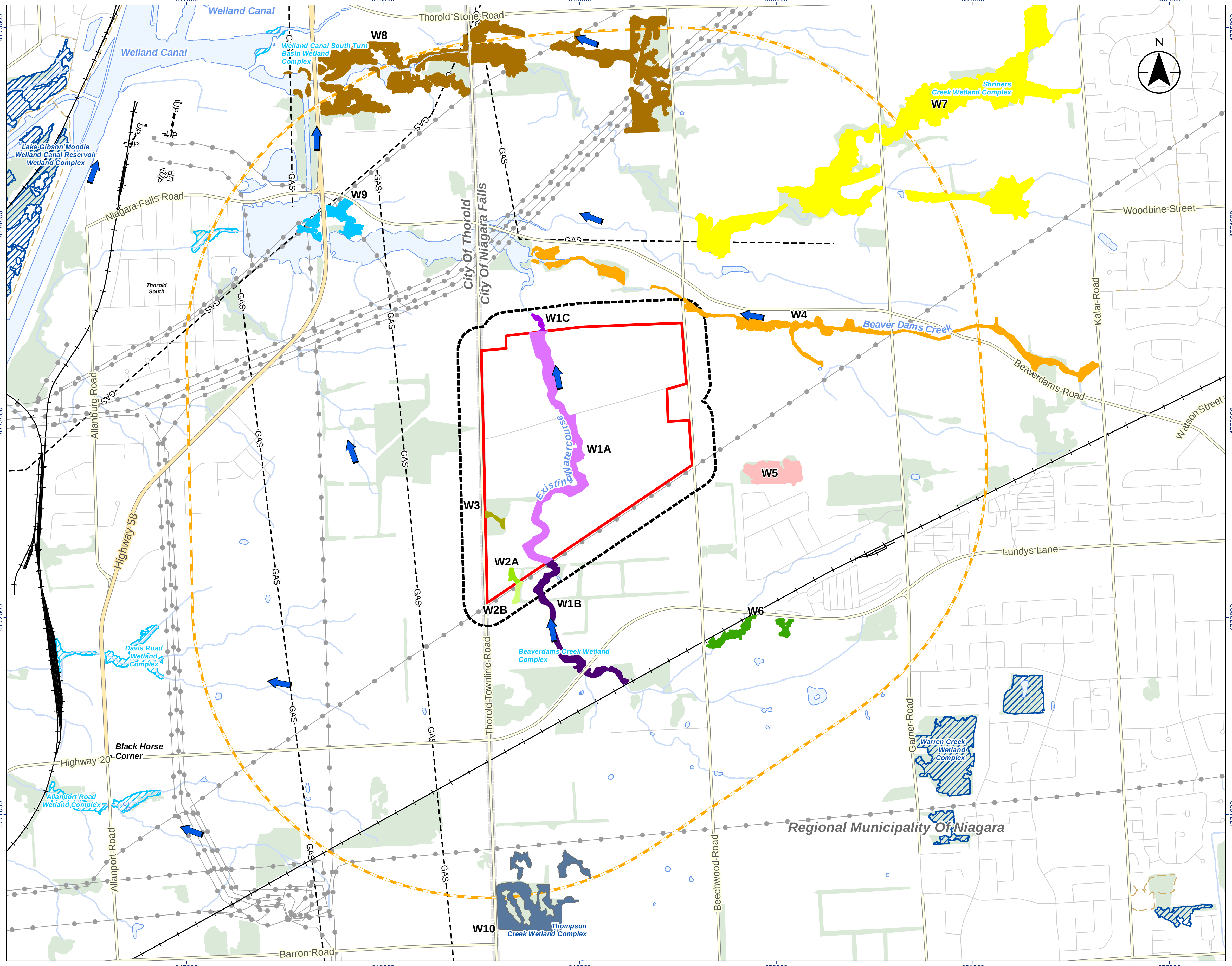
160961352 REVA
Prepared by DH on 2021-09-08
Technical Review by BC on 2019-01-31

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
10

Title
Operational Plan

V:\01609\active\60960948\drawing\MXD\Terrestrial\ReportFigures\NaturalEnvironment\160961352_Fig10_Opp_Plan_20210908.mxd Revised: 2021-09-08 By: dharvey



Stantec

Legend

- Subject Property
- Study Area (120 m Zone of Investigation)
- Regional Assessment Area (RAA) Boundary (1,500 m)
- Flow Direction
- Expressway / Highway
- Major Road
- Minor Road
- Hydro Line
- UP Unknown Pipeline
- GAS Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Waterbody
- Evaluated-Other
- Evaluated-Provincial
- Wooded Area

Beaver Dams Wetland Complex

- W1A
- W1B
- W1C
- W2A
- W2B
- W3
- W4
- W5
- W6

Shiners Creek Wetland Complex

- W7
- W8

Welland Canal South Turn Wetland Complex

- W9

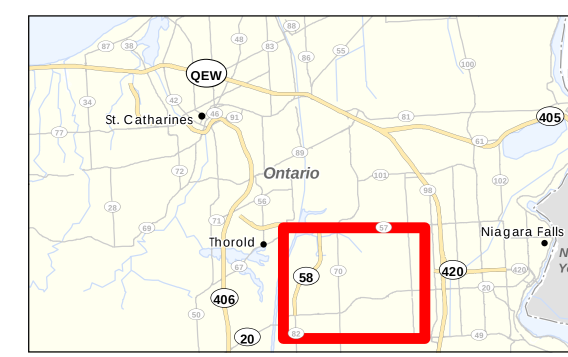
Thompson Creek Wetland Complex

- W10 (PSW)

0 0.5 1 km

1:20,000 (At original document size of 11x17)

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, 2018.



Project Location
Regional Municipality of Niagara

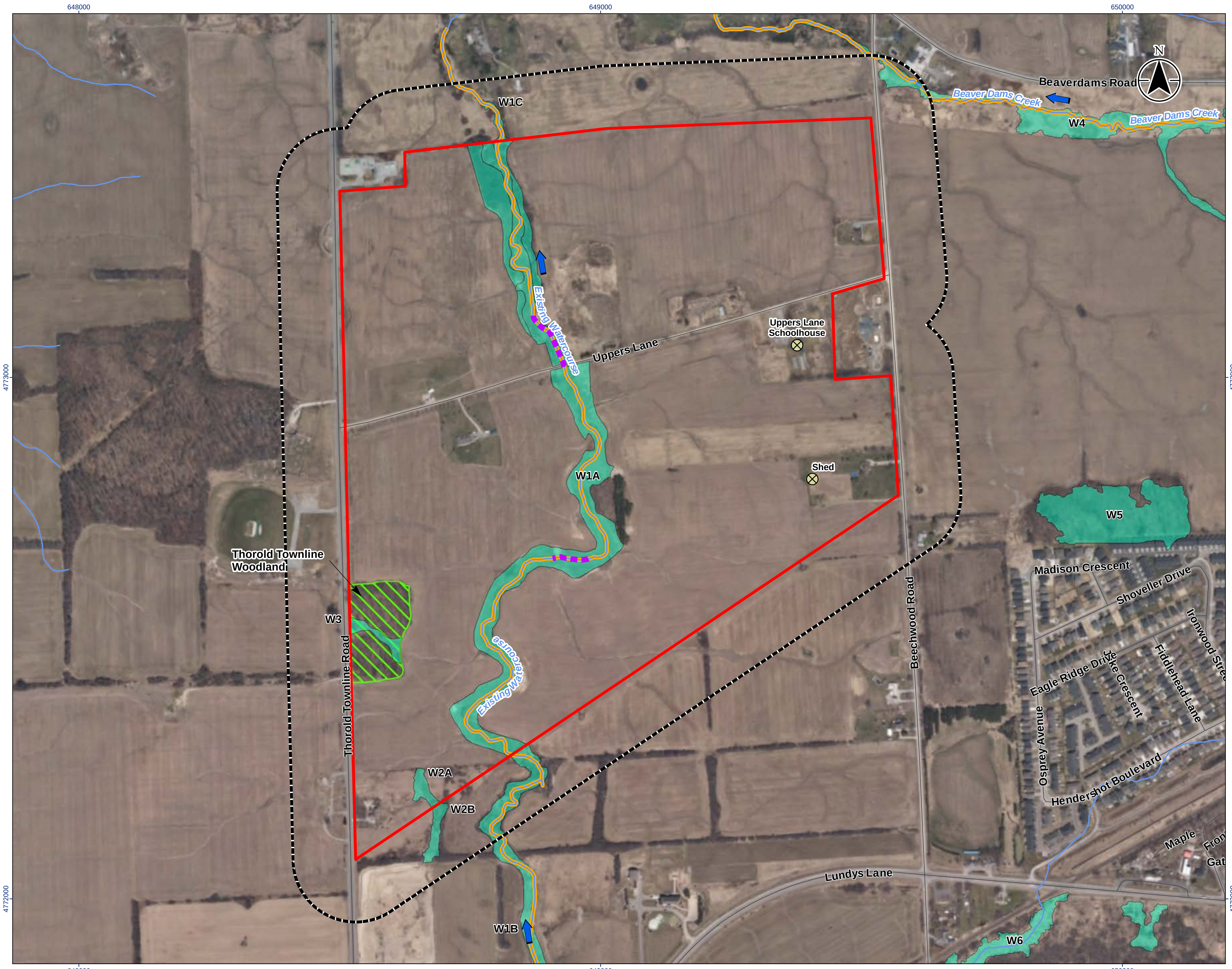
160961352 REVA
Prepared by DH on 2021-10-28

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
11

Title
Wetland Units- Near Quarry

V:\01609\active\160960848\drawing\MXD\Terrestrial\ReportFigures\NaturalEnvironment\160961352_Fig11_WetlandUnits_NearQuarry.mxd Revised: 2021-10-28 By: dharvey



Stantec

Legend

- Subject Property
- Study Area (120 m Zone of Investigation)
- Flow Direction
- Watercourse
- Fish Habitat
- Pike Spawning Habitat
- Wetland
- Significant Wildlife Habitat (Deer winter congregation area)

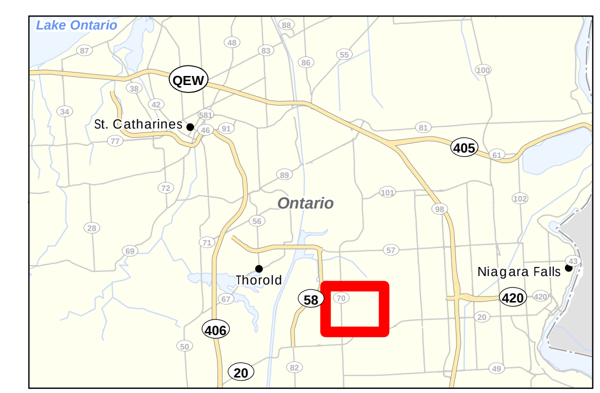
Habitat of Threatened or Endangered Species

- Barn Swallow Nesting Location

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © FIrst Base Solutions, 2018. Imagery Date 2018.



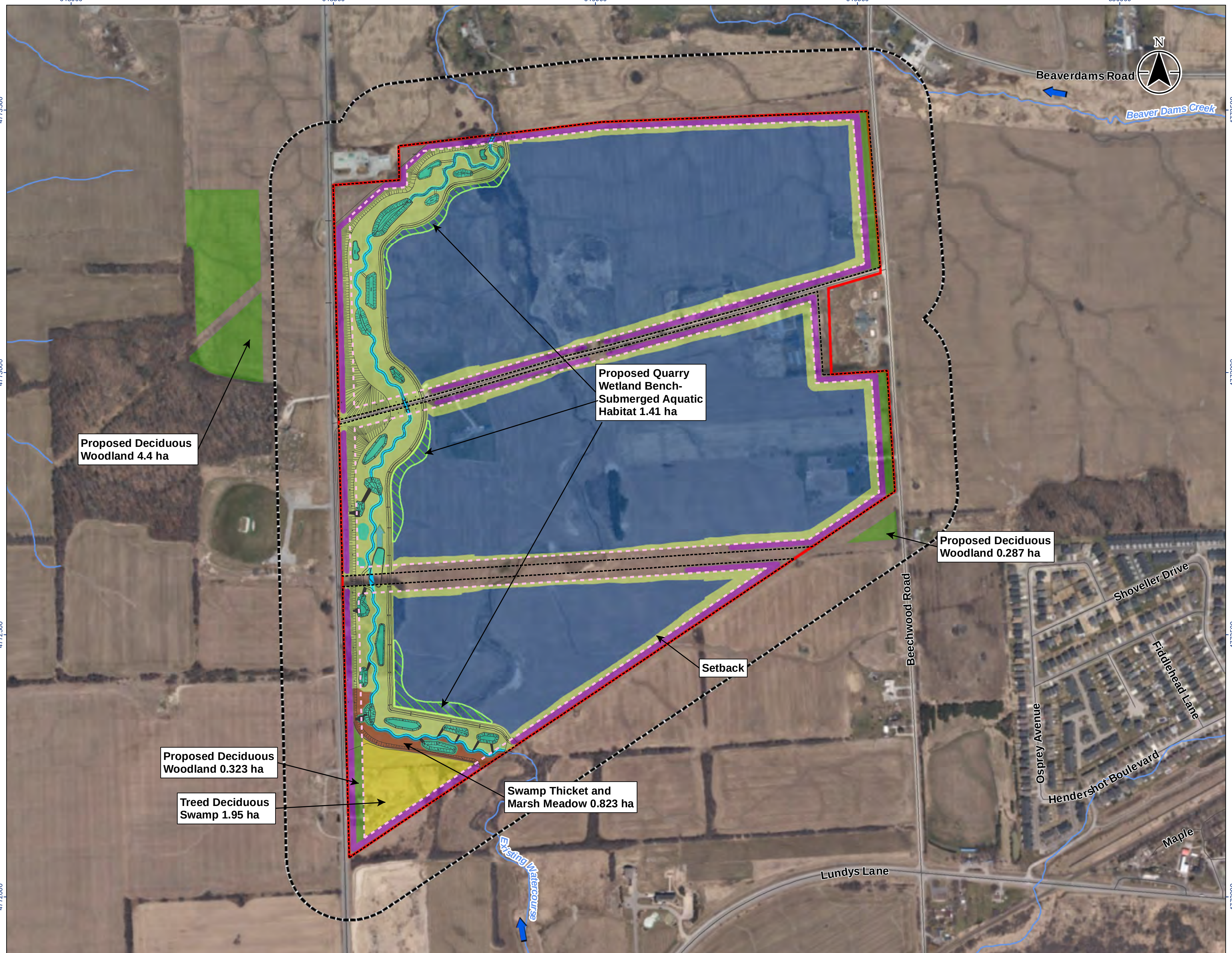
Project Location
Regional Municipality of Niagara

160961352 REVA
Prepared by DH on 2023-08-23
Technical Review by BC on 2023-08-23

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
12

Title
Natural Heritage Features



Stantec

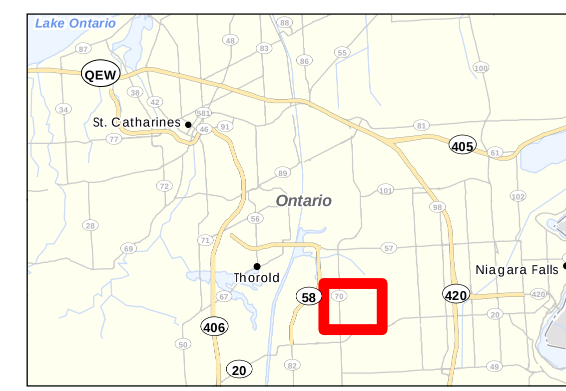
Legend

- Subject Property
- Study Area (120 m Zone of Investigation)
- Limit of Extraction
- Licence Boundary
- Flow Direction
- Watercourse
- New Channel
- Created Pond
- Planting Area
- Created Lake
- Proposed Deciduous Woodland
- Swamp Thicket and Marsh Meadow
- Treed Deciduous Swamp
- Berm
- Proposed Quarry Wetland Bench- Submerged Aquatic Habitat

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery Date 2018.



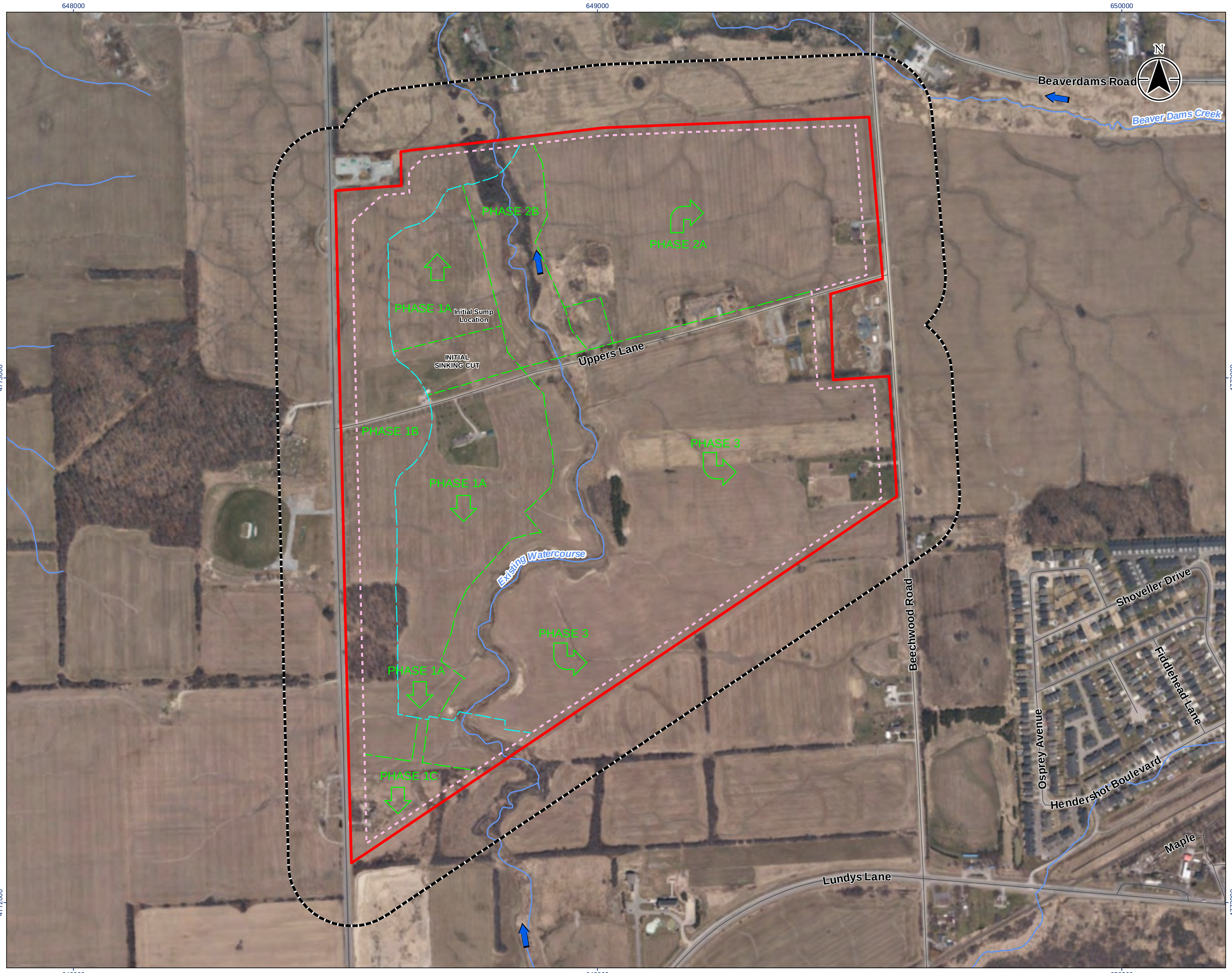
Project Location
Regional Municipality of Niagara

160961352 REVA
Prepared by DH on 2021-11-18
Technical Review by BC on 2019-01-31

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
13

Title
Rehabilitation and Enhancement

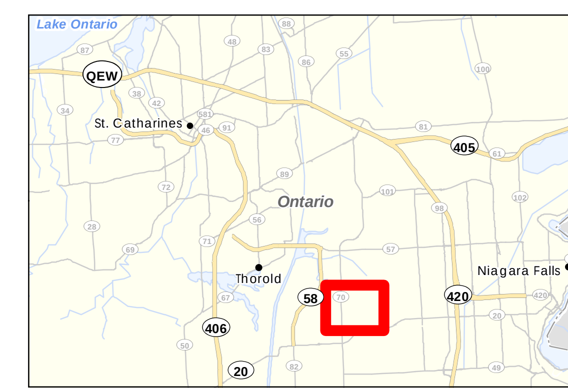


Stantec

Legend
- Subject Property
- Study Area (120 m Zone of Investigation)
- Limit of Extraction
- Flow Direction
- Watercourse

0 200 400 metres
1:7,500 (At original document size of 11x17)

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, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery Date 2018.
4. Operational Site Plan provided by MHBC



Project Location
Regional Municipality of Niagara

160961352 REVA
Prepared by DH on 2021-09-08
Technical Review by BC on 2019-01-31

Client/Project
WALKER AGGREGATES INC.
UPPERS QUARRY LEVEL 1 AND LEVEL 2 NATURAL ENVIRONMENT TECHNICAL REPORT AND ENVIRONMENTAL IMPACT STUDY

Figure No.
A1

Title
Operational Plan

APPENDIX B
Habitat Assessments

Table B-1: Habitat Potential in the Study Area for Threatened or Endangered Species

Species and COSSARO Status	Habitat Preference	Habitat Assessment in the Study Area	Results of Targeted Surveys
PLANTS			
Cherry Birch (*Betula lenta*) Endangered	The Cherry Birch is a shade intermediate species that grows on moist, well drained soils in upland deciduous and Eastern Hemlock forests (COSEWIC 2006a). Common associates are Red Oak, White Oak, Sugar Maple and Eastern Hemlock (COSEWIC 2006a).	Suitable habitat for the species is present in the Study Area. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
Spoon-leaved Moss (*Bryoandersonia illecebra*) Endangered	Found in a variety of habitat types, including cedar swamps, deciduous woodlots, pine plantations, and hawthorn-juniper scrub. Within these habitats, Spoon-leaved moss tends to grow in or at the border of low-lying areas affected seasonally by standing water (COSEWIC, 2003a).	Suitable habitat for the species is present in the Study Area in deciduous forest and pine plantation.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
American Chestnut (*Castanea dentata*) Endangered	Grows in rich mixed and deciduous forests, frequently with oak; most populations have been decimated by chestnut blight (Nixon, 1997). Typical habitat is upland deciduous forest on acid to neutral, sandy soil (COSEWIC, 2004a).	Suitable habitat is present in limited tracts along the western site boundary, and associate species (Red Oak, Sugar Maple and American Basswood) were identified. No recent records for this species were found during the background review. This species is considered unlikely to occur in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
Dwarf Hackberry (*Celtis tenuifolia*) Threatened	Dwarf Hackberry is found in a variety of habitats, including sand dunes, dry sandy habitats along lakeshores, oak savannahs, ridge tops and limestone alvars (MNRF 2016). It is shade intolerant (MNRF 2016).	**Absent.** Suitable swamp forest habitat is not present in the Study Area. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	n/a
Spotted Wintergreen (*Chimaphila maculata*) Endangered	Spotted Wintergreen is found in dry, semi-open pine-oak woodlands with sandy soil (MNRF 2016). Associated species include Red Oak, Black Oak, White Pine and American Beech (MNRF 2016).	**Absent.** Suitable swamp forest habitat is not present in the Study Area. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	n/a
Eastern Flowering Dogwood (*Cornus florida*) Endangered	Eastern Flowering Dogwood is most often found on sandy soils under tall trees in intermediate to mature deciduous forest, but is also found on floodplains, ravines, fencerows and roadsides (MNRF 2016; COSEWIC 2007a).	Suitable habitat for the species is present in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
Spoon-leaved Moss (*Bryoandersonia illecebra*) Endangered	Spoon-leaved Moss is typically found in seasonally inundated areas under trees or shrub thickets (MNRF 2016). Although it prefers soil substrates, it can be found on rocks and logs (COSEWIC 2003). It is commonly associated with another moss, Narrow-leaved Wetland Plume Moss, which is found in swamps, marshes, and wet meadows (MNRF 2016).	Suitable habitat for the species is present in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
White Wood Aster (*Eurybia divaricata*) Threatened	White Wood Aster grows in dry, open deciduous forests dominated by Sugar Maple and American Beech (MNRF 2016). It is often found with other asters along the edges of trails and prefers full or partial shade (MNRF 2016).	Suitable habitat for the species is present in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
American Columbo (*Frasera caroliniensis*) Endangered	Primarily found on dry, upland, open deciduous forest slopes, but may also be found in thickets, forest edges, pine and cedar forest, grasslands, moist woods and swamps (MNRF 2016; COSEWIC 2006b). Although it will grow on a variety of soils, it is found on rocky slopes throughout its range (COSEWIC 2006b).	Suitable habitat for the species is present in the Study Area. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
Butternut (*Juglans cinerea*) Endangered	Found in a variety of habitats throughout Southern Ontario, including woodlands and hedgerows (Farrar, 1995).	Suitable habitat for the species is present in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
American Water-willow (*Justicia americana*) Threatened	Typically grows on the shores of rivers, streams, lakes and ditches, and will occasionally grow in wetlands (MNRF 2016). It requires wet soil and frequent periods of flooding and wave-action to reduce competitive species growth (MNRF). Preferred substrates are sand, gravel and organic matter (MNRF 2016).	Suitable habitat for the species is present in the Study Area. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.

Table B-1: Habitat Potential in the Study Area for Threatened or Endangered Species

Species and COSSARO Status	Habitat Preference	Habitat Assessment in the Study Area	Results of Targeted Surveys
Cucumber Tree (*Magnolia acuminata*) Endangered	The Cucumber Tree grows in moist areas of the Carolinian forest, often on raised areas within or at the edges of swamps (COSEWIC 2010c). It is commonly associated with Red and Silver Maple swamps, swamp thickets, and moist Sugar Maple deciduous and mixed forests (COSEWIC 2010c).	**Absent.** Suitable swamp forest habitat is not present in the Study Area. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	n/a
Red Mulberry (*Morus rubra*) Endangered	Red Mulberry typically grows in moist, open forests with sandy or limestone-based loamy soils (MNRF 2016) on sites such as floodplains, river valleys, slopes of the Niagara Escarpment and swales (COSEWIC 2014b). It is a shade intermediate species (MNRF 2016).	**Absent.** Suitable habitat for the species is not present in the Study Area. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	n/a
Common Hop-tree (*Ptelea trifoliata*) Threatened	Common Hoptree is found almost exclusively along the edges of disturbance on the Lake Erie shoreline in Ontario (COSEWIC 2015). While it is still designated as Threatened under the Species at Risk Act, COSEWIC has downlisted this species as Special Concern (COSEWIC 2015).	**Absent.** Suitable habitat is not present in the Study Area.	n/a
Virginia Mallow (*Sida hermaphrodita*) Endangered	Virginia Mallow grows in sandy and rocky soils of riparian areas such as riversides and floodplains (MNRF 2016). It is also strongly associated with disturbed habitats such as roadsides and railroad beds in Ontario (MNRF 2016; COSEWIC 2010f). It prefers full sun or partial shade (MNRF 2016).	Suitable habitat for the species is present in the Study Area.	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
Round-leaved Greenbriar (*Smilax rotundifolia*) Threatened	The Round-leaved Greenbrier is found on sandy soils in open moist to wet woodlands in the Carolinian zone (MNRF 2016; COSEWIC 2007f).	Suitable habitat for the species is present in the Study Area. Forested communities on site were identified as having moisture regimes of 2-3 (dry-fresh), except one stand located outside of the site boundary which was assigned a moisture regime of 5 (moist).	**Absent.** The species was not observed during targeted field investigations in 2012, 2017 and 2019.
Deerberry (*Vaccinium stamineum*) Threatened	Deerberry is typically found near large bodies of water due their modifying effect on the local climate (MNRF 2016). It is generally found on dry sandy soils in open woods, and is commonly associated with oak and pine woodlands (MNRF 2016).	**Absent.** Suitable habitat is not present in the Study Area.	n/a
INSECTS			
Rusty-Patched Bumble Bee (*Bombus affinis*) Endangered	The Rusty-patched Bumble Bee is found in a variety of open habitats with flowers from which pollen and nectar can be collected (MNRF 2016; COSEWIC 2010e). Most recently, observations of this species have been made in oak savannah (MNRF 2016). Nests are made in underground rodent burrows (COSEWIC 2010e).	**Absent.** The Study Area is outside the modern range for this species.	n/a
AMPHIBIANS			
Alleghany Mountain Dusky Salamander (*Desmognathus ochrophaeus*) Endangered	The Allegheny Mountain Dusky Salamander is found near forested brooks, seeps, springs (COSEWIC 2007b). It is usually absent in large streams with predatory fish (COSEWIC 2007b). It broods its eggs and overwinters in springs, seeps, wet rock faces and moist upland habitats (COSEWIC 2007b).	**Absent.** Forested brooks, seeps and springs were not observed on site during previous field investigations. The unnamed tributary to Beaver Dam Creek is known to house predatory fish species and is surrounded by open habitat. This species is considered unlikely to occur in the Study Area.	n/a
Fowler's Toad (*Anaxyrus fowleri*) Endangered	The Fowler's Toad is found on the northern shore of Lake Erie on sandy beaches and shorelines, dunes, backshore wetlands, marshes and creek mouths (MNRF 2016). Eggs and tadpoles need sparsely vegetated pools with sandy substrate or rocky shoals and pools (COSEWIC 2010d).	**Absent.** The Study Area is located approximately 25 km from the Lake Erie shoreline. Suitable habitat is not present in the Study Area. This species is considered unlikely to occur in the Study Area.	n/a
Jefferson Salamander (*Ambystoma jeffersonianum*) Endangered	Adult Jefferson Salamanders are found underground in rodent burrows or under rocks and logs in moist deciduous forest (MNRF 2016). Eggs are laid on the underside of vegetation in woodland ponds, where larvae spend the first few months after hatching (MNRF 2016).	**Absent.** Suitable breeding ponds are not present in the Study Area. This species is considered unlikely to occur in the Study Area.	n/a

Table B-1: Habitat Potential in the Study Area for Threatened or Endangered Species

Species and COSSARO Status	Habitat Preference	Habitat Assessment in the Study Area	Results of Targeted Surveys
Northern Dusky Salamander (*Desmognathus fuscus*) Endangered	Adult Northern Dusky Salamanders are found in forests near groundwater streams, seeps and springs under rocks, logs or leaf litter (MNRF 2016; COSEWIC 2012b). Larvae are aquatic and live in interstitial spaces between rocks in stream beds (COSEWIC 2012). The larvae overwinter in shallow running water while adults burrow under logs, rocks or leaf litter (COSEWIC 2012b).	**Absent.** Forested brooks, seeps and springs were not observed on site during previous field investigations. The unnamed tributary to Beaver Dam Creek is known to house predatory fish species and is surrounded by open habitat. This species is considered unlikely to occur in the Study Area.	n/a
REPTILES			
Five-lined Skink (*Eumeces fasciatus*) – Carolinian Population Endangered	Carolinian populations of this species inhabit the forests around Lakes Erie, St. Clair, and Huron. They primarily inhabit clearings such as stabilized sand dunes, open forest areas, and wetlands where they find shelter, most often under plant debris, such as decomposing tree trunks; they may also use artificial structures including construction materials and wooden boardwalks (COSEWIC, 2007).	Suitable habitat for the species is present in the Study Area. There are historic (prior to 1998) records for the vicinity of the Study Area, and recent citizen records at least 20 km south-west of the Study Area.	**Absent.** The species was not observed during targeted field investigations (coverboard surveys) in 2012 and 2017.
Eastern Hog-nosed Snake (*Heterodon platirhinos*) Threatened	Eastern Hog-nosed snakes inhabit areas with loose, dry, sandy soil; open vegetation cover and proximity to a water source (COSEWIC 2007c). Common habitats include open woods, forest edges, sand dunes if they have adequate cover (COSEWIC 2007c). Their primary prey is toads (SARO 2016).	**Absent.** Suitable habitat (loose, sandy soil) is not present in the Study Area.	n/a
Gray Ratsnake (*Pantherophis spiloides*) Endangered	The Carolinian population of Gray Ratsnake is found in areas with a mixture of open and forested habitats, such as agricultural fields bordering woodlands, outcrops, and clearings (MNRF 2016; COSEWIC 2007e). They are semi-arboreal, and shelter in snags, logs, rock crevices and under rocks during the day (COSEWIC 2007). Hibernatiion occurs in communal underground hibernacula (COSEWIC 2007e).	Forested habitats on site are small and limited to discontiguous tracts on the western site boundary. Suitable patchwork habitat is absent across the majority of the site. A coverboard survey conducted in 2012 failed to detect this species, and no recent records were identified during the background review. This species isconsidered unlikely to occur in the Study Area.	**Absent.** The species was not observed during targeted field investigations (coverboard surveys) in 2012 and 2017.
Massasauga (*Sistrurus catenatus*) – Carolinian Population Endangered	The Massasauga requires semi-open habitats for cover and basking, including prairies, bogs, marshes, alvars, shorelines and open forests (MNRF 2016). Pregnant females tend to prefer dry open habitats for thermoregulation, while non-pregnant snakes favour lowland habitats for hunting (MNRF 2016). Hibernation occurs in rock crevices, root masses, burrows and sphagnum mats where the snakes are below the frost line but above the water table (MNRF 2016).	**Absent.** Wainfleet Bog is the only area where the species now occurs in the Niagara Region (Rowell 2012).	n/a
Blanding's Turtle (*Emydoidea blandingii*) Threatened	Lakes, ponds, and marshes; prefers shallow water with abundant aquatic vegetation and a soft bottom (MacCulloch, 2002).	Suitable foraging and movement habitat is present in the unnamed tributary to Beaver Dam Creek and surrounding lands. This species has recently been recorded approximately 3 km from the Study Area.	**Absent.** The species was not observed during field investigations in 2012, 2017 and 2019.
BIRDS			
Acadian Flycatcher (*Empidonax virescens*) Endangered	Typically breeds in mature deciduos forest with a dense canopy closure and ravines, or in forested swamps with maple and beech trees (MNRF 2016). This species is sensitive to disturbance and is generally found in large, undisturbed forest tracts (COSEWIC 2010a).	**Absent.** Suitable large forest tracts are not present in the Study Area.	n/a
Bank Swallow (*Riparia riparia*) Threatened	Bank Swallows excavate nests in exposed earth banks along watercourses and lakeshores, roadsides, stockpiles of soil, and the sides of sand and gravel pits (Falconer et al., 2016). Any suitable habitat may be present if stockpiles of soil are present or in areas of sand/gravel extraction.	**Absent.** Suitable exposed banks or stockpiles are not present in the Study Area.	n/a
Barn Owl (*Tyto alba*) Endangered	Favours pastures, hayfields, marshes and other grassy habitats that support mice and vole populations. Nests in barns, church steeples, silos, cavities in large trees and artificial nest boxes (Cadman et al., 2007).	**Presumed Absent.** Across Ontario there were only two confirmed nesting locations for Barn Owl in the most recent breeding bird atlas (2001-2005; Cadman et al. 2007). During this survey period one dead Barn Owl was observed in Niagara near Port Colborne. The most recent NHIC record for Barn Owl in the vicinity of the Study Area is from 1962.	n/a

Table B-1: Habitat Potential in the Study Area for Threatened or Endangered Species

Species and COSSARO Status	Habitat Preference	Habitat Assessment in the Study Area	Results of Targeted Surveys
Barn Swallow (*Hirundo rustica*) Threatened	Nest on walls or ledges of barns and other human-made structures such as bridges, culverts or other buildings; forages in open areas for flying insects (COSEWIC 2011).	Suitable habitat for the species is present in human-made structures in the Study Area.	**Present.** Barn Swallow nests were observed in two structures during targeted field investigations in 2019.
Bobolink (*Dolichonyx oryzivorus*) Threatened	Nests primarily in forage crops with a mixture of grasses and broad-leaved forbs, predominantly hayfields and pastures (COSEWIC 2010b).	Small patches of suitable habitat are present within the Study Area.. Habitat use will be determined through breeding bird surveys conducted in June 2019.	**Absent.** Bobolink was detected during grassland breeding bird surveys in 2017. However, habitat is considered absent due to the rotation of crops from suitable winter wheat in 2017 to soy in 2019, and a lack of observations during surveys conducted in 2019.
Cerulean Warbler (*Setophaga cerulea*) Endangered	The Cerulean Warbler is found in mature deciduous forest with large trees and an open understory (MNRF 2016).	**Absent.** Suitable large forest tracts are not present in the Study Area.	n/a
Chimney Swift (*Chaetura pelagica*) Threatened	Chimney Swifts primarily use chimneys for roosting and nesting, and only rarely nest in large hollow trees (Fitzgerald et al., 2014; Zanchetta et al., 2014).	Suitable habitat for the species is present in the Study Area.	**Absent.** The species was not observed during field investigations in 2012, 2017 and 2019.
Eastern Meadowlark (*Sturnella magna*) Threatened	Meadows, hayfields and pastures; also, other open habitat types including mown lawn (COSEWIC 2011b). Prefers large (~5 ha), low-lying wet grasslands with abundant litter (COSEWIC 2011b).	Small patches of suitable habitat are present within the Study Area. Habitat use will be determined through breeding bird surveys conducted in June 2019.	**Absent.** A single Eastern Meadowlark was detected during grassland breeding bird surveys in 2017. However, no further observations were made and this individual is presumed to have been transient.
Least Bittern (*Ixobrychus exilis*) Threatened	Prefers cattail marshes, but may be found in a variety of wetland habitats with stable water levels and dense vegetation interspersed with open water areas (MNRF 2016; COSEWIC 2009). Nests are built in dense vegetation near open water for foraging (MNRF 2016).	**Absent.** Suitable large marsh is not present in the Study Area.	n/a
Piping Plover (*Charadrius melodus*) Endangered	Nests on sandy beaches of the Great Lakes in Southern Ontario (MNRF 2016).	**Absent.** Great Lakes shoreline is not present in the Study Area.	n/a
Prothonotary Warbler (*Protonotaria citrea*) Endangered	Found in or near deciduous swamps with Silver Maple, ash and Yellow Birch trees where it nests in cavities low on the trunks of trees (MNRF 2016).	**Absent.** Suitable swamp forest is not present in the Study Area.	n/a
Yellow-breasted Chat (*Icteria virens*) Endangered	Prefers scrubby, early successional habitat; recorded in shrub thickets, woodland edges, hedgerows, regenerating abandoned fields and young coniferous plantations, and in hydro and rail rights-of-way (Cadman et al. 2007).	Suitable habitat for the species is present in the Study Area.	**Absent.** The species was not observed during field investigations in 2012, 2017 and 2019.

Table B-1: Habitat Potential in the Study Area for Threatened or Endangered Species

Species and COSSARO Status	Habitat Preference	Habitat Assessment in the Study Area	Results of Targeted Surveys
MAMMALS			
Small-footed Myotis (*Myotis leibii*) Endangered	Small-footed myotis hibernate in caves and abandoned mines in winter, and roost under rocks, in rock outcrops, buildings, under bridges, or in caves, mines, or hollow trees in the spring and summer (MNRF 2017).	Suitable roosting habitat is available in barns and old structures.	**Absent.** Small-footed Myotis was detected during targeted bat acoustic surveys in 2017 and 2019. However, the number and timing of recorded calls along with habitat analysis indicate that this species is not using on-site habitat for any part of it its significant life processes.
Little Brown Myotis (*Myotis lucifugus*) Endangered	Trees, buildings and bridges for roosting; trees for nesting; caves and mines for hibernation (COSEWIC 2013).	Suitable roosting habitat is available in barns and old structures. Candidate maternity roost trees were identified within suitable ELC communities.	**Absent.** Based on analysis of ARU data and knowledge of bat maternity behaviour.
Northern Myotis (*Myotis septentrionalis*) Endangered	Caves provide overwintering habitat (COSEWIC 2013). Rarely uses human-made structures for roosting (COSEWIC 2013).	Candidate maternity roost trees were identified within suitable ELC communities. Limits of clearing, if any clearing is proposed, to be determined in 2019.	**Absent.** Northern Myotis was not detected during targeted bat acoustic surveys in 2017 and 2019.
Tri-colored Bat (*Perimyotis subflavus*) Endangered	Found in a variety of habitats; caves provide overwintering habitat (COSEWIC 2013).	Candidate maternity roost trees were identified within suitable ELC communities where clearing is proposed. Limits of clearing, if any clearing is proposed, to be determined in 2019.	**Absent.** Tri-coloured Bat was not detected during targeted bat acoustic surveys in 2017 and 2019.

REFERENCES

Ontario Barn Owl Recovery Team. 2010. Recovery strategy for the Barn Owl (*Tyto alba*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 31 pp.

COSEWIC. 2000. COSEWIC assessment and update status report on the slender bush-clover *Lespedeza virginica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 9 pp.

COSEWIC. 2002. COSEWIC assessment and update status report on the spiny softshell turtle *Apalone spinifera* in Canada. Committee on the Status of Endangered Wildlife in Canada. Vii + 17 pp.

COSEWIC. 2003a. COSEWIC assessment and status report on the spoon-leaved moss *Bryoandersonia illecebra* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 31 pp.

COSEWIC. 2003b. COSEWIC assessment and status report on the willowleaf aster *Symphyotrichum praealtum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 16 pp.

COSEWIC. 2004a. COSEWIC assessment and status report on the American chestnut *Castanea dentata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 19 pp.

COSEWIC. 2004b. COSEWIC assessment and update status report on the spotted turtle *Clemmys guttata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 27 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007. COSEWIC assessment and update status report on the Five-lined Skink *Eumeces fasciatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.iv + 42 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

OSEWIC [Committee on the Status of Endangered Wildlife in Canada], 2008. COSEWIC assessment and update status report on the Eastern Foxsnake *Elaphe gloydi*, Carolinian population and Great Lakes/St. Lawrence poplation, in Canada. Committeee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 45 pp. www.sararegistry.gc.ca/status/status_e.cfm.

COSEWIC. 2010a. COSEWIC assessment and status report on the Dense Blazing Star *Liatris spicata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 23 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC [Committee on the Status of Endangered Wildlife in Canada], 2010b. COSEWIC assessment and status report on the Bobolink *Dolichonyx oryzivorus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 42 pp. www.registrelep-sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada], 2011. COSEWIC assessment and status report on the Eastern Meadowlark *Sturnella magna* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 40 pp. www.registrelep-sararegistry.gc.ca/default_e.cfm.

COSEWIC. 2013. COSEWIC Assessment and Status Report on the Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), Tri-colored Bat (*Perimyotis subflavus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario.

COSSARO, 2011. COSSARO Candidate Species at Risk Evaluation Form for Butler's Gartersnake (*Thamnophis butleri*).

Eastern Foxsnake Recovery Team, 2010. Recovery strategy for the Eastern Foxsnake (*Pantherophis gloydi*) – Carolinian and Georgian Bay populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 39 pp.

Eder, D. 2002. Mammals of Ontario. Lone Pine Publishing, Edmonton, Alberta. 215 p.

Falconer, M., K. Richardson, A. Heagy, D. Tozer, B. Stewart, J. McCracken, and R. Reid, 2016. Recovery Strategy for the Bank Swallow (*Riparia riparia*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. ix + 70 pp.

Farrar, J.L. 1995. Trees in Canada. Fitzhenry & Whiteside Limited and the Canadian Forest Service. Canada. 168 pp.

Fitzgerald, T. M., E. van Stam, J. J. Nocera, and D. S. Badzinski, 2014. Loss of nesting sites is not a primary factor limiting northern Chimney Swift populations. Population Ecology 56 (3):507-512. http://dx.doi.org/10.1007/s10144-014-0433-6

Freeman, C. C. 2009. Chimaphila, *In* Flora of North America North of Mexico (Flora of North America Editorial Committee, eds.). New York and Oxford. Vol. 8; Retrieved from the Flora of North America Online: http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=220002765

Gibbs, J. P., F. A. Reid, and S. M. Melvin. 1992. Least Bittern. In The Birds of North America, No. 17 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

Hamel, Paul B. 2000. Cerulean Warbler (Dendroica cerulea), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/511

Heagy, A., D. Badzinski, D. Bradley, M. Falconer, J. McCracken, R.A. Reid and K. Richardson, 2014. Recovery Strategy for the Barn Swallow (*Hirundo rustica*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. vii + 64 pp.

MacCulloch, R.D. 2002. The ROM Field Guide to Amphibians and Reptiles of Ontario. Royal Ontario Museum: Toronto, ON. 168 p.

McCracken, J.D., R.A. Reid, R.B. Renfrew, B. Frei, J.V. Jalava, A. Cowie, and A.R. Couturier, 2013. Recovery Strategy for the Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlark (*Sturnella magna*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. viii + 88 pp.

Ministry of Natural Resources and Forestry (MNRF). 2014a. Species account for Pink Milkwort. Available online at: https://www.ontario.ca/page/pink-milkwort.

Ministry of Natural Resources and Forestry (MNRF). 2014b. Species account for Eastern Prairie Fringed Orchid. Available online at: https://www.ontario.ca/page/eastern-prairie-fringed-orchid.

Ministry of Natural Resources and Forestry (MNRF). 2014c. Species account for Purple Twayblade. Available online at: https://www.ontario.ca/page/purple-twayblade.

Ministry of Natural Resources and Forestry (MNRF). 2016. Species account for Proud Globelet. Available online at: https://www.ontario.ca/page/proud-globelet.

Ministry of Natural Resources and Forestry (MNRF). 2017. Survey Protocol for Species at Risk Bats within Treed Habitats, Little Brown Myotis, Northern Myotis & Tri-Coloured Bat. April 2017.

Nixon, K.C. 1997. Castanea. *In* Flora of North America North of Mexico (Flora of North America Editorial Committee, eds.). New York and Oxford. Vol. 3; Retrieved from the Flora of North America Online: http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500325

Oldham and Brinker 2009. Rare Vascular Plants of Ontario. 4th Ed. Heritage Information Centre, Ontario Ministry of Natural Resources. Peterborough, Ontario. 188 pp.

Rowell, J. 2012. The Snakes of Ontario: Natural History, Distribution and Status. Self-published. 411 pp.

ROM, 2008. Species At Risk: Kentucky coffee-tree Available online: (http://www.rom.on.ca/ontario/risk.php?doc_type=fact&id=34&lang=en). Accessed February 8, 2012.

Species at Risk Public Registry – Species Profile: Colicroot. Available: http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=214

Zanchetta, C., D. C. Tozer, T. M. Fitzgerald, K. Richardson, and D. Badzinski, 2014. Tree cavity use by Chimney Swifts: implications for forestry and population recovery. Avian Conservation and Ecology 9(2): 1. http://dx.doi.org/10.5751/ACE-00677-090201

Table B-2: Wildlife Habitat Assessment for Uppers Quarry (Ecoregion 7E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
SEASONAL CONCENTRATION AREAS				
Waterfowl Stopover and Staging Area (Terrestrial and Aquatic)	Field with evidence of annual spring flooding from meltwater or runoff; aquatic habitats such as ponds, marshes, lakes, bays, and watercourses used during migration, including large marshy wetlands	ELC surveys, wildlife habitat assessments, and air photo interpretation will be used to assess features within the Study Area that may support waterfowl stopover and staging areas.	To be determined during field investigations.	**Absent**. No flooded fields were observed during spring (March – May) 2017 field investigations. No concentrations of waterfowl were observed.
Shorebird Migratory Stopover Area	Beaches and un-vegetated shorelines of lakes, rivers, and wetlands.	ELC surveys and air photo interpretation will be used to assess features within the Study Area that may support migratory shorebirds.	**Absent**. Natural unvegetated shoreline habitat was absent from the Study Area.	n/a
Raptor Wintering Area	Combination of fields and woodland (>20 ha).	ELC surveys and air photo interpretation will be used to assess features within the Study Area that may support wintering raptors.	**Absent**. Qualifying upland habitat in the Study Area was of insufficient size to support concentrations of wintering raptors.	n/a
Bat Hibernacula	Hibernacula may be found in caves, mine shafts, underground foundations and karsts.	ELC surveys, wildlife habitat assessments, and air photo interpretation will be used to assess features within the Study Area that may support bat hibernacula.	**Absent**. Crevices, caves or abandoned mines are absent from the Subject Property and Study Area.	n/a
Bat Maternity Colonies	Maternity colonies considered significant wildlife habitat are found in forested ecosites.	ELC surveys, wildlife habitat assessments, and air photo interpretation will be used to assess features within the Study Area that may support bat maternity colonies.	**Candidate.** Suitable woodland communities are present in the Study Area. Habitat use to be determined during field investigations.	**Absent.** Based on analysis of ARU data and knowledge of bat maternity behaviour.
Turtle Wintering Areas	Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate dissolved oxygen. Water has to be deep enough not to freeze and have soft mud substrate.	ELC surveys, wildlife habitat assessments and air photo interpretation will be used to assess features within the Study Area that may support areas of permanent standing water but not deep enough to freeze. Presence of 5 over-wintering Midland Painted Turtles or one or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant	To be determined during field investigations.	**Absent.** No suitable permanent, deep pools are present in the Study Area. No turtles were observed during spring field investigations.
Reptile Hibernaculum	Rock piles or slopes, stone fences, crumbling foundations	ELC surveys and wildlife habitat assessments will be used to document features that may support snake hibernacula.	To be determined during field investigations.	**Absent.** Only one snake (Eastern Gartersnake) was observed during extensive coverboard surveys in 2017.
Colonial-Nesting Bird Breeding Habitat (Bank and Cliff)	Eroding banks, sandy hills, steep slopes, rock faces or piles	ELC surveys, wildlife habitat assessments, and air photo interpretation will be used to assess features within the Study Area that may support colonial bird breeding habitat.	To be determined during field investigations.	**Absent**. No eroding features, or exposed slopes were observed during field investigations.
Colonial-Nesting Bird Breeding Habitat (Tree/Shrubs)	Dead trees in large marshes and lakes, flooded timber, and shrubs, with nests of colonially nesting heron species.	ELC surveys and wildlife habitat assessments will be used to assess features within the Study Area that may support colonial bird breeding habitat (Trees/Shrubs).	**Absent**. Large marshes and lakes are absent from the Study Area.	n/a
Colonial-Nesting Bird Breeding Habitat (Ground)	Rock islands and peninsulas in a lake or large river.	ELC surveys and air photo interpretation will be used to assess features within the Study Area that may support colonial bird breeding habitat (Ground).	**Absent**. Large lakes or rivers are absent from the Study Area.	n/a
Migratory Butterfly Stopover Areas	Meadows and forests that are a minimum of 10 ha and are located within 5km of Lake Ontario.	GIS analysis was used to measure distance from the Lake Ontario shoreline.	**Absent**. The Study Area is > 5 km from the Lake Ontario shoreline.	n/a
Landbird Migratory Stopover Areas	Woodlands of a minimum size located within 5km of Lake Ontario.	GIS analysis was used to measure distance from the Lake Ontario shoreline.	**Absent**. The Study Area is > 5 km from the Lake Ontario shoreline.	n/a

Table B-2: Wildlife Habitat Assessment for Uppers Quarry (Ecoregion 7E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
Deer Winter Congregation Areas	Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots >50ha. Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands. Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha. Woodlots with high densities of deer due to artificial feeding are not significant.	The LIO database and MNRF consultation were used to identify deer winter congregation areas. Use of the woodlot by white-tailed deer is determined by MNRF. All woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF.	**Present**. A deer wintering area was identified by MNRF overlapping the 2 ha deciduous woodland along Thorold Townline Road. Although this feature does not meet the Ecoregion 7E criteria for candidate SWH, deer management is an MNRF responsibility and features considered significant are mapped by MNRF.	n/a
RARE VEGETATION COMMUNITIES				
Sand Barren, Alvar, Cliffs and Talus Slopes	Sand barren, Alvar, Cliff and Talus ELC Community Classes, and other areas of exposed bed rock and patchy soil development, near vertical exposed bedrock and slopes of rock rubble.	ELC surveys and air photo interpretation were used to assess vegetation communities in the Study Area.	To be determined during field investigations.	**Absent**. These communities are absent from the Study Area.
Old-growth Forest	Relatively undisturbed, structurally complex; dominant trees > 100 years' old.	ELC surveys and air photo interpretation were used to assess vegetation communities in the Study Area.	To be determined during field investigations.	**Absent**. Old growth characteristics were not observed within woodlands in the Study Area.
Tallgrass Prairie and Savannah	Open canopy habitats (tree cover < 60%) dominated by prairie species.	ELC surveys and air photo interpretation were used to assess vegetation communities in the Study Area.	To be determined during field investigations.	**Absent**. Tallgrass Prairie and Savannah communities were not observed during field investigations.
Other Rare Vegetation Communities	Provincially Rare S1, S2 and S3 vegetation communities listed by the NHIC.	ELC surveys and air photo interpretation will be used to assess vegetation communities in the Study Area.	To be determined during field investigations.	**Absent**. Rare vegetation communities were not observed in the Study Area.
SPECIALIZED HABITAT FOR WILDLIFE				
Waterfowl Nesting Area	Upland habitats adjacent to wetlands (within 120m).	ELC surveys, wildlife habitat assessment, and air photo interpretation will be used to assess features within the Study Area that may support nesting waterfowl.	To be determined during field investigations.	**Absent**. Wetland communities are limited in the Study Area and no breeding waterfowl were observed during field investigations.
Bald Eagle and Osprey nesting, Foraging, and Perching Habitat	Treed communities adjacent to rivers, lakes, ponds, and other wetlands with stick nests of Bald Eagle or Osprey.	ELC surveys, air photo interpretation and wildlife habitat assessment will be used to assess features within the Study Area that may support nesting, foraging and perching habitat for large raptors.	To be determined during field investigations.	**Absent**. Open water and wetland communities are limited in the Study Area. No large trees or stick nests were observed during field investigations.
Woodland Raptor Nesting Habitat	Forested ELC communities >30 ha with 10 ha of interior habitat.	ELC surveys, wildlife habitat assessment, and GIS analysis were used to assess features within the Study Area that may support nesting habitat for woodland raptors.	**Absent**. Suitable interior forest habitat is absent from the Study Area.	n/a
Turtle Nesting Areas	Exposed soil, including sand and gravel in open sunny areas near wetlands.	ELC surveys, wildlife habitat assessment and air photo interpretation will be used to assess features within the Study Area that may support turtle nesting areas.	To be determined during field investigations.	**Absent.** Suitable habitat for turtle nesting is present on the road shoulders, however anthropogenic features do not qualify as significant wildlife habitat. The agricultural field is not considered preferred nesting habitat due to the high density of vegetation cover (i.e. winter wheat) during peak breeding seasons, and the likelihood for nest disturbance and loss by agricultural equipment.
Seeps and Springs	Any forested area with groundwater at surface within the headwaters of a stream or river system	Evidence of groundwater upwelling, including seeps and springs, was recorded during ELC surveys.	To be determined during field investigations.	**Absent.** No evidence of groundwater upwelling, seeps or springs was observed during field investigations.

Table B-2: Wildlife Habitat Assessment for Uppers Quarry (Ecoregion 7E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
Amphibian Breeding Habitat (Woodland and Wetland)	Treed uplands with vernal pools, and wetland ecosites	ELC surveys will be used to assess features within the Study Area that may support breeding amphibians.	To be determined during field investigations.	**Absent**. Suitable amphibian breeding habitat is limited in the Study Area. No salamanders were observed and few (no more than 3) individuals of a frog or toad species were heard calling during field investigations.
Woodland Area-sensitive Bird Breeding Habitat	Large mature forest stands, woodlots >30ha and >200m from the forest edge.	ELC surveys, airphoto interpretation, and GIS analysis were used to determine whether woodlots that occurred within the Study Area that were >30 ha with interior habitat present (>200 m from edge).	**Absent**. Suitable large forest stands were absent from the Study Area.	n/a
HABITAT FOR SPECIES OF CONSERVATION CONCERN				
Marsh Bird Breeding Habitat	Wetlands with shallow water and emergent aquatic vegetation.	ELC surveys and airphoto interpretation were used to identify marshes with shallow water and emergent vegetation that may support marsh breeding birds.	**Absent**. Wetland communities (marsh) in the Study Area are too small to support the required threshold of breeding marsh birds.	n/a
Open Country Bird Breeding Habitat	Large grasslands and fields (>30ha).	ELC surveys, air photo interpretation, and GIS analysis were used to identify grassland communities within the Study Area that may support area-sensitive breeding birds.	**Absent**. Non-agricultural grassland communities >30 ha are absent from the Study Area.	n/a
Shrub/Early Successional Bird Breeding Habitat	Large shrub and thicket habitats (>10ha).	ELC surveys, air photo interpretation and GIS analysis were used to identify large communities that may support shrub/early successional breeding birds.	**Absent**. Early successional communities > 10 ha are absent from Study Area.	n/a
Terrestrial Crayfish	Wet meadows and edges of shallow marshes.	ELC surveys were used to identify shallow marsh and meadow marsh communities that occurred within the Study Area; searches for crayfish chimneys will be conducted during wildlife habitat assessments.	To be determined during field investigations.	**Absent.** Surveys were conducted across the property, including spring surveys when vegetation was low and water levels high. Although no site visits were conducted specifically to identify terrestrial crayfish burrows, qualified ecologists conducted numerous surveys in suitable areas and at suitable times, and burrows were likely to have been observed incidentally.
SPECIES OF CONSERVATION CONCERN				
Broad Beech Fern (SARO Special Concern)	Broad Beech Fern grows in moist soils in deciduous forests, often with Sugar Maple and American Beech (MNRF 2016). It requires full shade (MNRF 2016).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** The species was not observed during 2012, 2017 or 2019 field investigations.
Green Dragon (SARO Special Concern)	Grows along streams in moist to wet forests dominated by maple, Green Ash and White Elm (MNRF 2016).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** The species was not observed during 2012, 2017 or 2019 field investigations.
Honey Locust (S2)	Found in moist bottomlands mixed with other deciduous trees (Farrar, 1995). Honey locust is frequently planted in Southern Ontario and occasionally escapees from cultivation are encountered (Argus et al., 1982-1987).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** The species was observed in a planted hedgerow bordering the Baptist Church during 2017 field investigations. Honey Locust is commonly used in horticultural plantings. Due to the linear form (hedgerow) and monoculture planting these observations are not considered natural occurrences.
Shumard Oak (SARO Special Concern)	Grows on moist soils close to water and swamps in deciduous forests and along fencerows (MNRF 2016).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** The species was not observed during 2012, 2017 or 2019 field investigations.

Table B-2: Wildlife Habitat Assessment for Uppers Quarry (Ecoregion 7E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
Swamp Rose-mallow (SARO Special Concern)	Restricted to shoreline marshes on lakes Erie, Ontario and St. Clair (MNRF 2016).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** The species was not observed during 2012, 2017 or 2019 field investigations.
Monarch (SARO Special Concern)	Forage and nest in open habitat (i.e., meadows, grasslands and pastures) with various milkweed species (*Asclepias* spp.) and/or wildflowers such as goldenrods (*Solidago* spp.), asters (*Aster* spp.) and yarrow (*Achillea millefolium*) (COSEWIC 2010).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Present.** Suitable habitat for Monarch is present in the Study Area in meadow communities as well as along the edges of agricultural fields and natural vegetation communities where milkweed plants were observed and nectar-producing wildflowers may be present. Monarch was observed during 2017 field investigations.
Eastern Milksnake (SARA Special Concern)	Frequently reported in and around buildings, especially old structures, however, it is found in a variety of habitats, including prairies, pastures, hayfields, rocky hillsides and a wide variety of forest types. Two important features of ideal habitat are proximity to water, and suitable locations for basking and egg-laying, nesting sites may include compost or manure piles, stumps, under boards, or in loose soil (COSEWIC 2002a).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** Some suitable habitat was observed on the Site during field surveys, however after extensive coverboard surveys in 2017 (and other field investigations in 2012 and 2019) the species was not observed.
Eastern Ribbonsnake (SARO Special Concern)	Usually found close to water and associated with wetlands that have an abundance of small fish and frogs (MNRF 2016). It hibernates in communal underground burrows (MNRF 2016).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** Suitable wetland habitat is limited in the Study Area. The species was not observed during extensive coverboard surveys in 2017 and other field investigations in 2012 and 2019.
Northern Map Turtle (SARO Special Concern)	Highly aquatic; inhabits slow moving, large rivers and lakes with soft bottoms and abundant aquatic vegetation (COSEWIC 2002). Hibernation is communal and occurs at the bottoms of lakes (MacCulloch, 2002).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	**Absent.** Suitable large large waterbodies are absent from the Study Area.	n/a
Snapping Turtle (SARO Special Concern)	Ponds, sloughs, streams, rivers, and shallow bays that are characterized by slow moving water, aquatic vegetation, and soft bottoms. Females show strong nest site fidelity and nest in sand or gravel banks at waterway edges in late May or early June (COSEWIC 2008).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** Suitable movement habitat for this species is present along the unnamed tributary to Beaver Dam Creek, however the species was not observed during 2017 or 2019 field investigations. No permanent ponds (preferred habitat) are present on the Site.
Bald Eagle (SARO Special Concern)	Almost always nests near water. Large stick nests are placed in trees located within mature woodlots. They usually prefer 250 ha of mature forest for breeding, however, along Lake Erie, where the lake provides a valuable food source, the eagles will nest in smaller woodlots or even single trees (Sandilands 2005).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	**Absent.** Suitable large trees near large waterbodies are absent from the Study Area.	n/a
Black Tern (SARO Special Concern)	Breeds in cattail marshes where it builds its floating nests in loose colonies (MNRF 2016).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	**Absent.** Suitable cattail marshes are absent from the Study Area.	n/a
Common Nighthawk (SARO Special Concern)	This species nests on the ground in open habitats with rocky or graveled substrate, and will even nest on gravel roofs in the city (Cadman et al. 2007).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** Suitable nesting habitat was not identified in the Study Area.

Table B-2: Wildlife Habitat Assessment for Uppers Quarry (Ecoregion 7E)

Wildlife Habitat Type	Criteria	Methods	Results of Desktop Habitat Assessment	Results of Field Investigations
Eastern Wood-Pewee (SARO Special Concern)	Eastern Wood-pewee is found in the mid-canopy layer of deciduous and mixed wood forests with open understories and is commonly associated with edges and clearings (MECP 2014).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent on Site, Present in Study Area.** Suitable breeding habitat for Eastern Wood-Pewee is present in the Study Area, off the Site, in the woodland west of Thorold Townline Road. This species was not detected during three rounds of breeding birds surveys on the Site in 2017 (2 point count stations). It was recorded as an incidental observation in the Thorold Townline woodland on June 14, 2019 when bat acoustic monitors were deployed but not on June 25, 2019 when monitors were collected. Breeding habitat for the species is considered absent from the Site, but is assumed to be present in the woodland west of Thorold Townline Road based on woodland size and composition.
Louisiana Waterthrush (SARO Special Concern)	Steep, forested ravines with running water but may also be found in deciduous swamps with open water (MNRF 2016). It nests under fallen logs, in root masses or in niches in stream banks (MNRF 2016).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	**Absent.** Suitable forested ravines or deciduous swamps with open water are absent from the Study Area.	n/a
Peregrine Falcon (SARO Special Concern)	The Peregrine Falcon traditionally prefers rock cliffs, particularly those adjacent to water (MECP 2017). More recently, this species has been released in various urban centres in Ontario where it successfully nests on tall buildings (Cadman et al. 2007; MECP 2017).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	**Absent.** Suitable large cliffs are absent from the Study Area.	n/a
Red-headed Woodpecker (SARO Special Concern)	Open woodlands and forest edges, and often found in disturbed areas such as cemeteries, parks and golf courses (MNRF 2016). This species shows a preference for dead or dying trees and at least a few snags or large dead limbs are necessary for its presence in more open habitats (Cadman et al. 2007).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** The species was not detected during breeding bird surveys in 2017 or during previous field investigations undertaken in 2012.
Wood Thrush (SARO Special Concern)	Deciduous and mixed forests with well-development undergrowth (MNRF 2017).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	To be determined during field investigations.	**Absent.** The species was not detected during breeding bird surveys in 2017 or during previous field investigations undertaken in 2012.
Woodland Vole (SARO Special Concern)	Mature Carolinian forest with a dense leaf litter layer (MNRF 2016), however it may also be found in sand dunes, swamps and orchards (COSEWIC 2010g). The most important factor in habitat selection is a dense herbaceous layer and friable soils with low saturation (COSEWIC 2010g).	ELC surveys, wildlife habitat assessment, botanical inventory and breeding bird surveys were used to assess features within the Study Area that may support species of conservation concern.	**Absent.** There are no records of Woodland Vole in the vicinity of the Study Area.	n/a
ANIMAL MOVEMENT CORRIDORS				
Amphibian Movement Corridor	Corridors may be found in all ecosites associated with water. Determined based on identifying significant amphibian breeding habitat (wetland).	Movement corridors should be considered when amphibian breeding habitat is confirmed as SWH from Amphibian Breeding Habitat (Wetland).	**Absent.** No SWH for amphibian breeding was identified in the Study Area.	n/a

REFERENCES

MNRF. 2015. Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E. January, 2015. 41 pp.

Layberry, R.A., P.W. Hall and J.D. Lafontaine. 1998. The butterflies of Canada. University of Toronto Press, Toronto. 280pp.

Table B3 – Criteria for Determining Significant Woodland from Table 7.2 – NHRM 2010	
CRITERIA COMMENTS	**STANDARDS**
1. WOODLAND SIZE CRITERIA	
• Size refers to the areal (spatial) extent of the woodland (irrespective of ownership). • Woodland areas are considered to be generally continuous even if intersected by narrow gaps 20 m or less in width between crown edges. • Size value is related to the scarcity of woodland in the landscape derived on a municipal basis with consideration of differences in woodland coverage among physical sub-units (e.g., watersheds, biophysical regions). • Size criteria should also account for differences in landscape-level physiography (e.g., moraines, clay plains) and community vegetation types.	Where woodlands cover: • is less than about 5% of the land cover, woodlands 2 ha in size or larger should be considered significant • is about 5–15% of the land cover, woodlands 4 ha in size or larger should be considered significant • is about 15–30% of the land cover, woodlands 20 ha in size or larger should be considered significant • is about 30–60% of the land cover, woodlands 50 ha in size or larger should be considered significant • occupies more than about 60% of the land, a minimum size is not suggested, and other factors should be considered *Note:* The size threshold should be reduced in the absence of information for the other three criteria. As a consideration in addressing the potential loss of biodiversity, the largest woodland in the planning area (or sub-unit) should be identified as significant.
2. ECOLOGICAL FUNCTIONS CRITERIA	
a. Woodland interior	
• Interior habitat more than 100 m from the edge (as measured from the limits of a continuous woodland as defined above) is important for some species. • For purposes of this criterion, a maintained public road would create an edge even if the opening was not wider than 20 m and did not create a separate woodland.	Woodlands should be considered significant if they have: • any interior habitat where woodlands cover less than about 15% of the land cover • 2 ha or more of interior habitat where woodlands cover about 15–30% of the land cover • 8 ha or more of interior habitat where woodlands cover about 30–60% of the land cover • 20 ha or more of interior habitat where woodlands cover more than about 60% of the land cover
b. Proximity to other woodlands or other habitats	
• Woodlands that overlap, abut or are close to other significant natural heritage features or areas could be considered more valuable or significant than those that are not. Patches close to each other are of greater mutual benefit and value to wildlife.	Woodlands should be considered significant if: • a portion of the woodland is located within a specified distance (e.g., 30 m) of a significant natural feature or fish habitat likely receiving ecological benefit from the woodland **and the entire woodland meets the minimum areathreshold** (e.g., 0.5–20 ha, depending on circumstance)

CRITERIA COMMENTS	STANDARDS
c. Linkages	
• Linkages are important connections providing for movement between habitats. • Woodlands that are located between other significant features or areas can be considered to perform an important linkage function as “stepping stones” for movement between habitats.	Woodlands should be considered significant if they: • are located within a defined natural heritage system or provide a connecting link between two other significant features, each of which is within a specified distance (e.g., 120 m) **and meets minimum area thresholds** (e.g., 1–20 ha, depending on circumstance)
d. Water protection	
• Source water protection is important. Natural hydrological processes should be maintained.	Woodlands should be considered significant if they: • are located within a sensitive or threatened watershed or a specified distance (e.g., 50 m or top of valley bank if greater) of a sensitive groundwater discharge, sensitive recharge, sensitive headwater area, watercourse or fish habitat **and meet minimum area thresholds** (e.g., 0.5–10 ha, depending on circumstance)
e. Woodland diversity	
• Certain woodland species have had major reductions in representation on the landscape and may need special consideration. More native diversity is more valuable than less diversity.	Woodlands should be considered significant if they have: • a naturally occurring composition of native forest species that have declined significantly south and east of the Canadian Shield **and meet minimum area thresholds** (e.g., 1–20 ha, depending on circumstance) • a high native diversity through a combination of composition and terrain (e.g., a woodland extending from hilltop to valley bottom or to opposite slopes) **and meet minimum area thresholds** (e.g., 2–20 ha, depending on circumstance)
3. UNCOMMON CHARACTERISTICS CRITERIA	
• Woodlands that are uncommon in terms of species composition, cover type, age or structure should be protected. • Older woodlands (i.e., woodlands greater than 100 years old) are particularly valuable for several reasons, including their contributions to genetic, species and ecosystem diversity.	Woodlands should be considered significant if they have: • a unique species composition or the site is represented by less than 5% overall in woodland area **and meets minimum area thresholds** (e.g., 0.5 ha, depending on circumstance) • a vegetation community with a provincial ranking of S1, S2 or S3 (as ranked by the NHIC **and meet minimum area thresholds** (e.g., 0.5 ha, depending on circumstance) • habitat (e.g., with 10 individual stems or 100 m^2 of leaf coverage) of a rare, uncommon or restricted woodland plant species **and meet minimum area thresholds** (e.g., 0.5 ha, depending on circumstance): – vascular plant species for which the NHIC’s Southern Ontario Coefficient of Conservatism is 8, 9 or 10 – tree species of restricted distribution such as sassafras or rock elm – species existing in only a limited number of sites within the planning area

CRITERIA COMMENTS	STANDARDS
	• characteristics of older woodlands or woodlands with larger tree size structure in native species **<u>and meet minimum area thresholds</u>** (e.g., 1–10 ha, depending on circumstance): – older woodlands could be defined as having 10 or more trees/ha greater than 100 years old – larger tree size structure could be defined as 10 or more trees/ha at least 50 cm in diameter, or a basal area of 8 or more m^2/ha in trees that are at least 40 cm in diameter
4. ECONOMIC AND SOCIAL FUNCTIONAL VALUES CRITERIA	
Woodlands that have high economic or social values through particular site characteristics or deliberate management should be protected.	Woodlands should be considered significant if they have: • high productivity in terms of economically valuable products together with continuous native natural attributes **<u>and meet minimum area thresholds</u>** (e.g., 2–10 ha, depending on circumstance) • a high value in special services, such as air-quality improvement or recreation at a sustainable level that is compatible with long-term retention **<u>and meet minimum area thresholds</u>** (e.g., 0.2–10 ha, depending on circumstance) • important identified appreciation, education, cultural or historical value **<u>and meet minimum area thresholds</u>** (e.g., 0.2–10 ha, depending on circumstance)

UPPERS QUARRY WETLAND PLANTING PLAN SPECIES LIST

SCIENTIFIC NAME	COMMON NAME
TREED DECIDUOUS SWAMP TREES:	
Acer rubrum	Red Maple
Acer x freemanii	Freeman's Swamp Maple
Populus deltoides	Eastern Cottonwood
Populus tremuloides	Trembling Aspen
Quercus bicolor	Swamp White Oak
Quercus macrocarpa	Bur Oak
Quercus palustris	Swamp Pin Oak
Salix amygdaloides	Peach-leaved Willow
Thuja occidentalis	Eastern White Cedar
TREED DECIDUOUS SWAMP SHRUBS:	
Cephalanthus occidentalis	Eastern Buttonbush
Cornus obliqua	Silky Dogwood
Cornus sericea	Red-osier Dogwood
Ilex verticillata	Common Winterberry
Lindera benzoin	Northern Spicebush
Ribes americanum	American Black Currant
Rubus pubescens	Dwarf Raspberry
Sambucus canadensis	Common Elderberry
Viburnum lentago	Nannyberry
Viburnum opulus var. americanum	Highbush Cranberry
TREED DECIDUOUS SWAMP HERBACEOUS SPECIES:	
Alisma triviale	Northern Water-plantain
Anemonastrum canadense	Canada Anemone
Arisaema triphyllum	Jack-in-the-pulpit
Boehmeria cylindrica	Small-spike False Nettle
Calamagrostis canadensis	Bluejoint Reedgrass
Carex bromoides	Brome-like Sedge
Carex crinita	Fringed Sedge
Carex gracillima	Graceful Sedge
Carex intumescens	Bladder Sedge
Carex lacustris	Lake Sedge
Carex lupulina	Hop Sedge
Carex retrorsa	Retrorse Sedge

SCIENTIFIC NAME	COMMON NAME
Carex stipata	Awl-fruited Sedge
Chelone glabra	White Turtlehead
Elymus virginicus	Virginia Wildrye
Glyceria striata	Fowl Mannagrass
Impatiens capensis	Spotted Jewelweed
Laportea canadensis	Canada Wood Nettle
Leersia oryzoides	Rice Cutgrass
Lilium michiganense	Michigan Lily
Lobelia cardinalis	Cardinal Flower
Lycopus uniflorus	Northern Water-horehound
Matteuccia struthiopteris	Ostrich Fern
Mentha canadensis	Canada Mint
Onoclea sensibilis	Sensitive Fern
Scirpus cyperinus	Common Woolly Bulrush
Scutellaria lateriflora	Mad-dog Skullcap
Sium suave	Common Water-parsnip
Solidago rugosa	Rough-stemmed Goldenrod
Symphyotrichum lanceolatum	Panicled Aster
SWAMP THICKET SHRUBS:	
Cephalanthus occidentalis	Eastern Buttonbush
Cornus obliqua	Silky Dogwood
Cornus racemosa	Grey Dogwood
Cornus sericea	Red-osier Dogwood
Ribes americanum	American Black Currant
Rubus idaeus ssp. strigosus	North American Red Raspberry
Salix bebbiana	Bebb's Willow
Salix discolor	Pussy Willow
Salix interior	Sandbar Willow
Salix petiolaris	Meadow Willow
Sambucus canadensis	Common Elderberry
Spiraea alba	White Meadowsweet
Viburnum dentatum var. lucidum	Smooth Arrowwood
Viburnum lentago	Nannyberry
Viburnum opulus var. americanum	Highbush Cranberry
SWAMP THICKET / MARSH HERBACEOUS SPECIES:	

SCIENTIFIC NAME	COMMON NAME
Alisma triviale	Northern Water-plantain
Anemonastrum canadense	Canada Anemone
Asclepias incarnata	Swamp Milkweed
Bidens cernua	Nodding Beggarticks
Bidens frondosa	Devil's Beggarticks
Calamagrostis canadensis	Bluejoint Reedgrass
Carex bebbii	Bebb's Sedge
Carex lacustris	Lake Sedge
Carex molesta	Troublesome Sedge
Carex retrorsa	Retrorse Sedge
Carex stricta	Tussock Sedge
Carex stipata	Awl-fruited Sedge
Carex tribuloides	Blunt Broom Sedge
Carex vulpinoidea	Fox Sedge
Elymus virginicus	Virginia Wildrye
Eupatorium perfoliatum	Common Boneset
Euthamia graminifolia	Grass-leaved Goldenrod
Eutrochium maculatum	Spotted Joe Pye Weed
Glyceria grandis	Tall Mannagrass
Helenium autumnale	Common Sneezeweed
Impatiens capensis	Spotted Jewelweed
Leersia oryzoides	Rice Cutgrass
Lobelia siphilitica	Great Blue Lobelia
Poa palustris	Fowl Bluegrass
Scirpus atrovirens	Dark-green Bulrush
Scirpus cyperinus	Common Woolly Bulrush
Scirpus pendulus	Hanging Bulrush
Symphyotrichum novae-angliae	New England Aster
Symphyotrichum puniceum	Purple-stemmed Aster
Thalictrum pubescens	Tall Meadow-rue
Verbena hastata	Blue Vervain

APPENDIX C

Agency Correspondence

Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 22, 2017
File: 160960948

Ministry of Natural Resources and Forestry Guelph District Office
Ontario Government Building
1 Stone Road W
Guelph ON, N1G 4Y2

To Whom it May Concern,

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

INTRODUCTION

Stantec Consulting Ltd. (Stantec) has been retained by Walker Industries to conduct a natural environment study for the proposed Upper's Lane Quarry (the Project) in the City of Niagara Falls (**Figure 1**). The purpose of the study is to determine the feasibility of the Project based on potential environmental constraints on the property and lands within 120 m (the Study Area) and, should the proponent determine that the project will proceed, to fulfill the requirements of the Natural Environment Level I & II study under the *Aggregate Resources Act, 1990*.

Walker Industries has previously initiated the application process for a Category 2, Class "A" Quarry License at the Site. Several ecological studies were undertaken in support of this application:

- AECOM conducted a fisheries assessment, environmental constraints analysis and wetland assessment on the property in 2008. The results of these assessments were outlined in two memos (AECOM 2009; AECOM 2010) and one report (AECOM 2008).
- Savanta Inc. conducted an insect survey and preliminary baseline conditions assessment in 2010. The results of these assessments were presented in two reports (Savanta Inc. 2010a; Savanta Inc. 2010b).
- Stantec conducted a bee, dragonfly and butterfly study; a salamander egg mass survey; a botanical inventory; an ELC habitat assessment; a breeding bird survey and a snake coverboard survey in 2011. The results of these surveys are presented in six memos (Stantec 2012a-2012f).

Although these studies provide a substantial body of data for the Study Area, the proposed 2017 assessment will include wildlife and fisheries study efforts to address the timing gap. To this end, an updated Species at Risk (SAR) and Species of Conservation Concern (SOCC) background review was conducted (**Table 1**) and a comprehensive field survey program is proposed.

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

POTENTIAL SAR AND SOCC

The SAR background review identified 68 SAR and SOCC with the potential to occur in the Niagara Region. The following resources were reviewed:

- Atlas of the Mammals of Ontario (range maps visually scanned for overlap with the Study Area) (Dobbyn 1994)
- Ontario Reptile and Amphibian Atlas (range maps visually scanned for overlap with Study Area) (Ontario Nature 2017)
- Natural Heritage Information Centre Biodiversity Explorer Database (results summary for 1 km grid squares overlapping with the Study Area) (MNRF 2017)
- Various status reports published by the COSEWIC
- The Committee on the Status of Species at Risk in Ontario (COSSARO) Species at Risk in Ontario List (MNRF 2016)
- The Ontario Breeding Bird Atlas Data Summary for the Niagara Region (Bird Studies Canada et al. 2006)
- Site data from previous studies

The 68 species were then assessed for potential to occur in the Study Area based on the following factors:

1. Recent records of the species in the Study Area from background sources listed above
2. Range overlap with the Study Area
3. The presence of suitable habitat in the Study Area.

SAR and SOCC with suitable habitat and at least one existing record and/or an overlapping range were considered to have a reasonable probability of occurring. This lead to a final list of 24 species with the potential to occur in the Study Area, including seven (7) species listed as Endangered, four (4) listed as Threatened and eight (8) listed as Special Concern under the *Endangered Species Act, 2007*. A species matrix, including habitat assessment and study targets, is included in **Table 1**.

DESIGNATED NATURAL HERITAGE AREAS

The following sources were reviewed to assess the presence of designated natural heritage areas:

- Natural Heritage Information Centre Biodiversity Explorer Database (results summary for 1 km grid squares overlapping with the Study Area) (MNRF 2017)
- Natural Heritage layers obtained from the Land Information Ontario (LIO) database
- Previous report data

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

The background review indicates the presence of the Beaver Dams Creek Wetland, a locally significant wetland, concurrent with the unnamed tributary to Beaver Dams Creek in the Study Area (**Figure 1**). MNRF assessed the Beaver Dams Creek wetland complex and another nearby wetland complex, the Welland Canal Turn Basins wetland complex, in 2009 and determined neither to be of provincial significance (MNRF 2009a; MNRF 2009b).

PROPOSED WORK PLAN

Based on the background review and consideration of applicable data from previous studies, the following work plan is proposed for the 2017 field season:

Task Description	Timeline (2017)
Terrestrial SAR and SOCC background review report	March
Natural Heritage Features and Areas background review	March
Submit WSCA application for snake coverboard survey	March
Bat maternity roost candidate habitat assessment (1 visit)	March
Put out snake coverboards at 23 pre-selected locations (Figure 2)	March
Turtle habitat/basking survey (3 visits over 3 weeks)	March - June 15
Amphibian call monitoring (3 visits)	Early April-Mid June
Check snake coverboards twice weekly from mid-April through mid-May and weekly from mid-May through mid-June	Mid-April through early June
Breeding bird surveys targeting grassland and woodland species (3 visits at least one week apart)	June - early July
ELC assessment (confirmation of previous data; 1 visit)	June - August
Insect survey (2 visits)	July - August
Spoon-leaved moss search (1-2 visits as required)	August

INFORMATION REQUEST

We respectfully request confirmation of the included findings, a review of the above work plan, and identification of any additional information you may have for the Study Area, including:

- Species/community information including occurrences of terrestrial and aquatic SAR and/or SOCC;
- Watercourse thermal regimes;
- MNRF Fish Dot data for Beaverdams Creek;
- Any additional fisheries information from MNRF files;

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

- Special habitat features;
- Construction timing windows; and
- Natural Heritage Features.

We thank you for your time and consideration in reviewing this information. Please do not hesitate to contact us with any questions or concerns regarding the content of this letter.

STANTEC CONSULTING LTD.

Lisa Uskov
Terrestrial Ecologist
Phone: 905-381-5435
Fax: 905-385-3534
lisa.uskov@stantec.com

Attachment: 1. Figure 1 – Natural Environment Regional Context Area
2. Table 1 – SAR and SOCC Assessment
3. Figure 2 – Snake Coverboard survey locations

c. David Charlton, Stantec; Kevin Kehl, Walker Aggregates

bk \\cd1220-f02\work_group\01609\active\60960948\correspondence\mnrf_ir\letter_and_attachments\60960948_mnrf_ir_20170322_fin.docx

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

REFERENCES

AECOM. 2008. Walker aggregates environmental constraints analysis [draft report].

AECOM. August 12, 2009. Wetland complexing review for Walker Aggregates – South Niagara property [memo].

AECOM. June 16, 2010. Fisheries survey – Uppers property near Thorold (Walker Aggregates) [memo].

Bird Studies Canada, Environment Canada's Canadian Wildlife Service, Ontario Nature, Ontario Field Ornithologists and Ontario Ministry of Natural Resources. 2006. Ontario Breeding Bird Atlas [Website]. Retrieved on March 12, 2017 from (http://www.birdsontario.org/atlas/index.jsp).

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, A.R. Couturier. 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. (eds) Bird Studies Canada, Environment Conada, Ontario Field Ornithologists, Ontario Ministry of natural resources, and Ontario Nature, Toronto, xxii + 706pp

Cornell Lab of Ornithology. 2015. All About Birds [online database]. Cornell University. Retrieved on March 10, 2017 from https://www.allaboutbirds.org/

COSEWIC. 2002. COSEWIC assessment and status report on the northern map turtle Graptemys geographica in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 34 pp.

COSEWIC. 2003. COSEWIC assessment and status report on the spoon-leaved moss Bryoandersonia illecebra in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 31 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2005. COSEWIC assessment and update status report on the Blanding's Turtle Emydoidea blandingii in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 40 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2006a. COSEWIC assessment and status report on the cherry birch Betula lenta in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 16 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2006b. COSEWIC assessment and update status report on the American Columbo Frasera caroliniensis in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 21 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

COSEWIC. 2007a. COSEWIC assessment and status report on the Eastern Flowering Dogwood Cornus florida in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 22 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007b. COSEWIC assessment and update status report on the Allegheny Mountain Dusky Salamander Desmognathus ochrophaeus (Great Lakes/St. Lawrence population and Carolinian population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii+32 pp. (www.sararegistry.gc.ca/status/status_e.cfm)

COSEWIC. 2007c. COSEWIC assessment and update status report on the Eastern Hog-nosed Snake Heterodon platirhinos in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 36 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007d. COSEWIC assessment and update status report on the Five-lined Skink Eumeces fasciatus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.iv + 42 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007e. COSEWIC assessment and update status report on the Gray Ratsnake Elaphe spiloides (Great Lakes/St. Lawrence population and Carolinian population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 33 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007f. COSEWIC assessment and update status report on the round-leaved greenbrier (Great Lakes Plains and Atlantic population) Smilax rotundifolia in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 32 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2007g. COSEWIC assessment and update status report on the Wood Turtle Glyptemys insculpta in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 42 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2008. COSEWIC assessment and status report on the Snapping Turtle Chelydra serpentina in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 47 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2009. COSEWIC assessment and update status report on the Least Bittern Ixobrychus exilis in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 36 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

COSEWIC. 2010a. COSEWIC assessment and status report on the Acadian Flycatcher Empidonax virescens in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. X + 38 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2010b. COSEWIC assessment and status report on the Bobolink Dolichonyx oryzivorus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 42 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2010c. COSEWIC assessment and status report on the Cucumber Tree Magnolia acuminata in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 18 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2010d. COSEWIC assessment and status report on the Fowler's Toad Anaxyrus fowleri in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 58 pp. (www.sararegistry.gc.ca/status/status_e.cfm)

COSEWIC. 2010e. COSEWIC assessment and status report on the Rusty-patched Bumble Bee Bombus affinis in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 34 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2010f. COSEWIC assessment and status report on the Virginia Mallow Sida hermaphrodita in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 18 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2010g. COSEWIC assessment and status report on the Woodland Vole Microtus pinetorum in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 35 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2011a. COSEWIC assessment and status report on the Barn Swallow Hirundo rustica in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 37 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2011b. COSEWIC assessment and status report on the Eastern Meadowlark Sturnella magna in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 40 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2011c. COSEWIC assessment and status report on the Yellow-breasted Chat auricollis subspecies Icteria virens auricollis and the Yellow-breasted Chat virens subspecies Icteria virens virens in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xvi + 51 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

COSEWIC. 2012a. COSEWIC assessment and status report on the Eastern Musk Turtle Sternotherus odoratus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 68 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2012b. COSEWIC assessment and status report on the Northern Dusky Salamander Desmognathus fuscus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 56 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2013a. COSEWIC assessment and status report on the Bank Swallow Riparia riparia in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 48 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2013b. COSEWIC assessment and status report on the Little Brown Myotis Myotis lucifugus, Northern Myotis Myotis septentrionalis and Tri-colored Bat Perimyotis subflavus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxiv + 93 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2014a. COSEWIC assessment and status report on the Eastern Milksnake Lampropeltis triangulum in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 61 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2014b. COSEWIC assessment and status report on the Red Mulberry Morus rubra in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 22 pp. (www.registrelepsararegistry.gc.ca/default_e.cfm).

COSEWIC. 2014c. COSEWIC assessment and status report on the Spotted Turtle Clemmys guttata in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiv + 74 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2015. COSEWIC assessment and status report on the Common Hoptree Ptelea trifoliata in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 33 pp. (http://www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC. 2016. COSEWIC assessment and status report on the Spiny Softshell Apalone spinifera in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 38 pp. (http://www.registrelep-sararegistry.gc.ca/default_e.cfm).

Farrar, J.L. 1995. Trees in Canada. Fitzhenry & Whiteside Limited and the Canadian Forest Service. Canada. 198 pp.

Reference: Information Request for the Proposed Upper's Lane Quarry Natural Environment Study, City of Niagara

MNRF. September 30, 2009. Beaver Dams Creek Wetland Complex [Ontario Wetland Evaluation System Evaluation Report].

MNRF. October 20, 2009. Welland Canal Turn Basins Wetland Complex [Ontario Wetland Evaluation System Evaluation Report]

MNRF. 2017. Biodiversity Explorer Database [accessed March 9, 2017].

MNRF. June 20, 2016. Species at Risk in Ontario List [database] Retreived March 9 2017 from https://www.ontario.ca/environment-and-energy/species-risk-ontario-list

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [online database]. Version 7.1. NatureServe, Arlington, Virginia. Retrieved March 13, 2017 from (http://explorer.natureserve.org).

Reznicek, A.A., E. G. Voss, & B. S. Walters. February 2011. Michigan Flora Online [online database]. University of Michigan. Retrieved on March 13, 2017 from (http://michiganflora.net/species.aspx?id=1302).

Savanta Inc. 2010a. Walker Niagara insect surveys, final report.

Savanta Inc. 2010b. Walker Upper's Land proposed quarry – Niagara Falls, Ontario preliminary baseline report [draft report].

Stantec Consulting Ltd. 2012a. Bumble Bee, Dragonfly and Butterfly Survey Walker Industries' Proposed Upper's Lane Quarry (memo)

Stantec Consulting Ltd. 2012b. Salamander Egg Mass Survey Walker Industries' Proposed Upper's Lane Quarry (memo)

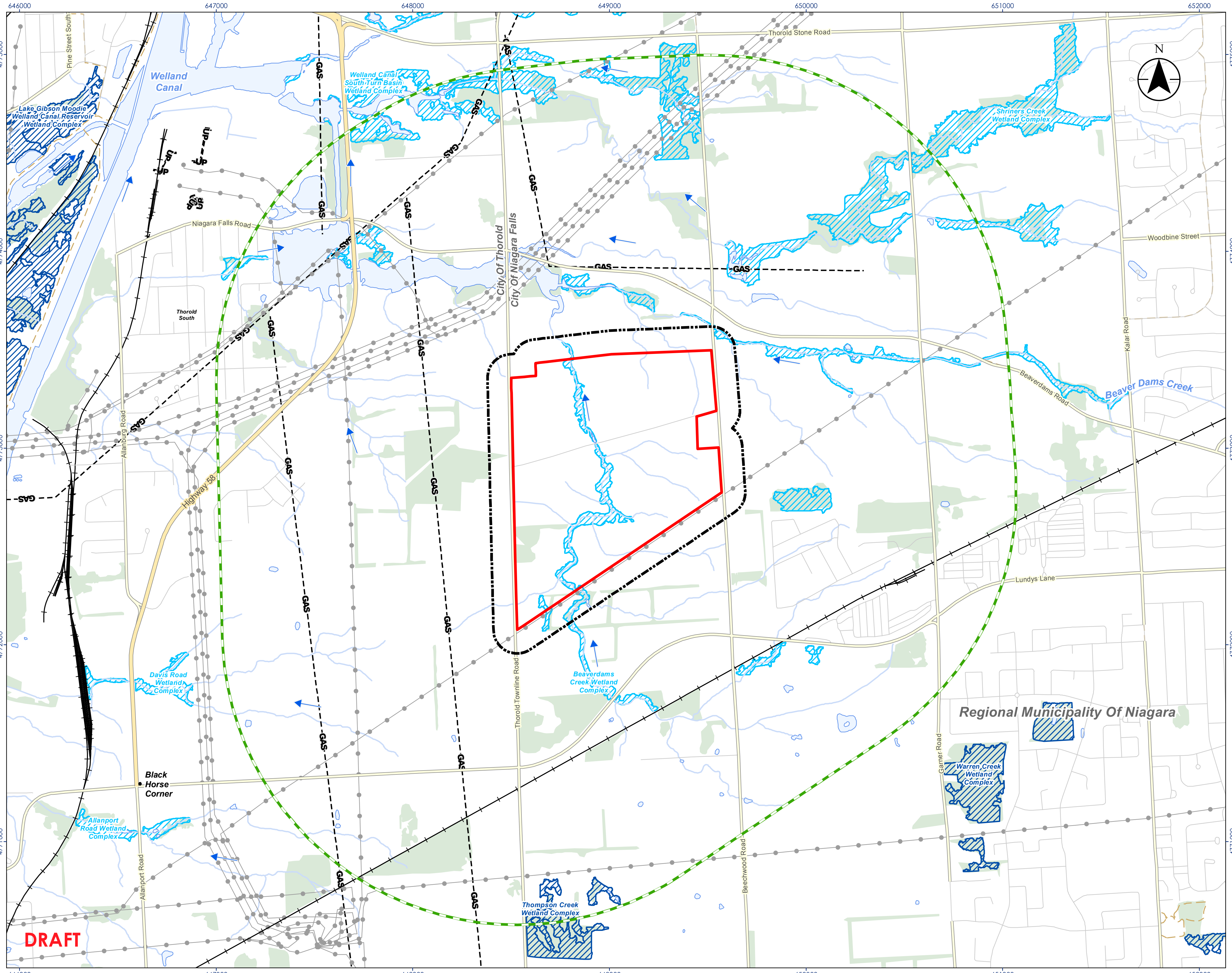
Stantec Consulting Ltd. 2012c. Summer Botanical and ELC Walker Industries' proposed Upper's Lane quarry (memo)

Stantec Consulting Ltd. 2012d. Upper's Lane Plant List.

Stantec Consulting Ltd. 2012e. Walker Upper's Lane Quarry – Niagara Region Breeding Bird Survey 2012 (memo)

Stantec Consulting Ltd. 2012f. Walkers Quarry; Snake Coverboard Surveys 2012 (memo)

ATTACHMENT 1
FIGURE 1 – NATURAL ENVIRONMENT REGIONAL CONTEXT AREA



Stantec

Legend

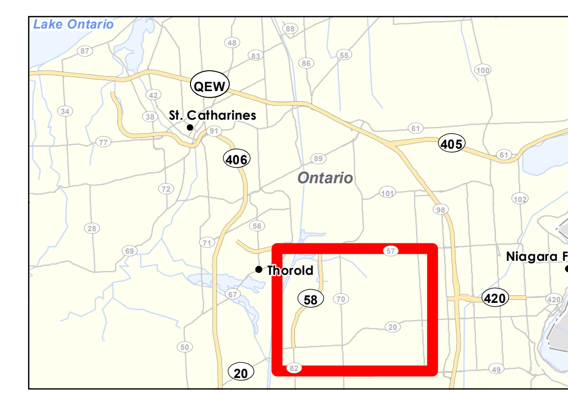
- Site
- 120 m Buffer
- Natural Environment Regional Context Area
- Flow Direction
- Expressway / Highway
- Major Road
- Minor Road
- Hydro Line
- UP Unknown Pipeline
- GAS Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Municipal Boundary - Upper Tier
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Evaluated (Other)
- Wooded Area

0 200 400 metres

1:20,000 (At original document size of 11x17)

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, 2016.



Project Location
Regional Municipality of Niagara

160960948 REVA
Prepared by MDK on 2017-03-09
Technical Review by DH on 2017-03-09
Independent Review by ABC on yyyy-mm-dd

Client/Project
WALKER INDUSTRIES HOLDINGS INC.
BEAVERDAMS CREEK RESTORATION

Figure No.
2

DRAFT

Title
Natural Environment Regional Context Area

\\cd1220-f02\work_group\01609\active\160960948\drawing\MXD\Terrestrial\ReportFigures\160960948_Fig_02_NaturalEnviroRegional_20170309.mxd Revised: 2017-03-09 By: mkraus

ATTACHMENT 2
TABLE 1 – SAR AND SOCC ASSESSMENT

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Amphibians	Allegheny Mountain Dusky Salamander	Desmognathus ochrophaeus	END	END-END (Carolinian population)	S1	Recent records less than 1 km east	MNRF 2016, Ontario Nature 2017	The Allegheny Mountain Dusky Salamander is found near forested brooks, seeps, springs (COSEWIC 2007b). It is usually absent in large streams with predatory fish (COSEWIC 2007b). It broods its eggs and overwinters in springs, seeps, wet rock faces and moist upland habitats (COSEWIC 2007b).	Forested brooks, seeps and springs were not observed on site during previous field investigations. The unnamed tributary to Beaver Dam Creek is known to house predatory fish species, and is surrounded by open habitat. This species is considered unlikely to occur in the Study Area.	No
	Fowler's Toad	Anaxyrus fowleri	END	END-END	S2	No nearby records	MNRF 2016, Ontario Nature 2017	The Fowler's Toad is found on the northern shore of Lake Erie on sandy beaches and shorelines, dunes, backshore wetlands, marshes and creek mouths (MNRF 2016). Eggs and tadpoles need sparsely vegetated pools with sandy substrate or rocky shoals and pools (COSEWIC 2010d).	The Study Area is located approximately 25 km from the Lake Erie shoreline. No suitable habitat was present during previous field investigations. This species is considered unlikely to occur in the Study Area.	No
	Jefferson Salamander	Ambystoma jeffersonianum	END	END-END	S2	No nearby records	MNRF 2016, Ontario Nature 2017	Adult Jefferson Salamanders are found underground in rodent burrows or under rocks and logs in moist deciduous forest (MNRF 2016). Eggs are laid on the underside of vegetation in woodland ponds, where larvae spend the first few months after hatching (MNRF 2016).	No suitable breeding ponds and limited deciduous forest habitats were observed on site during previous field investigations. This species is considered unlikely to occur in the Study Area.	No
	Northern Dusky Salamander	Desmognathus fuscus	END	NAR-NAR	S1	Recent and historic records less than 1 km east	MNRF 2016, Ontario Nature 2017	Adult Northern Dusky Salamanders are are found in forests near groundwater streams, seeps and springs under rocks, logs or leaf litter (MNRF 2016; COSEWIC 2012b). Larvae are aquatic and live in interstitial spaces between rocks in stream beds (COSEWIC 2012). The larvae overwinter in shallow running water while adults burrow under logs, rocks or leaf litter (COSEWIC 2012b).	Forested brooks, seeps and springs were not observed on site during previous field investigations. The unnamed tributary to Beaver Dam Creek is known to house predatory fish species, and is surrounded by open habitat. This species is considered unlikely to occur in the Study Area.	No
Birds	Acadian Flycatcher	Empidonax virescens	END	END-END	S2S3B	OBBA records for region 11 overlap	MNRF 2016, Bird Studies Canada et al. 2006	The Acadian Flycatcher typically breeds in mature deciduos forest with a dense canopy closure and ravines, or in forested swamps with maple and beech trees (MNRF 2016). This species is sensitive to disturbance and is generally found in large, undisturbed forest tracts (COSEWIC 2010a).	Deciduous forest and swamp habitats are limited and occur only on the western site boundary in small, discontiguous tracts. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Birds	Bald Eagle	Haliaeetus leucocephalus	SC	NAR-NAR	S4B,S2N	OBBA records for region 11 overlap	MNRF 2016, Bird Studies Canada et al. 2006	The Bald Eagle is found in a variety of habitats near large open water bodies such as lakes and rivers (MNRF 2016). Nests are constructed near the top of super-canopy trees, or sometimes in tall man-made structures.	The Study Area is not located in close proximity to large waterbodies, and suitable nest sites were not observed during previous field investigations. This species is considered unlikely to occur in the Study Area.	No
	Bank Swallow	**Riparia riparia**	**THR**	**THR-NS**	**S4B**	**OBBA records for region 11 overlap**	**Bird Studies Canada et al. 2006**	**The Bank Swallow breeds on a variety of sites with vertical banks, including riverbanks, bluffs, aggregate pits and stock piles of sand and soil (COSEWIC 2013a). Sand-silt substrates are preferred (COSEWIC 2013a). Nesting sites are often near open habitats used for aerial foraging (COSEWIC 2013a). Large wetlands are used as communal roosts during post-breeding, migration, and wintering periods (COSEWIC 2013a).**	**Previous field investigations did not identify suitable vertical banks for nesting. However, suitable foraging habitat such as open fields and wetlands were present, and banks could have potentially become exposed in the time since the previous study. This species could potentially occur in the Study Area.**	**Yes**
	Barn Owl	Tyto alba	END	END-END	S1	OBBA records for region 11 overlap	MNRF 2016, Bird Studies Canada et al. 2006	The Barn Owl range is extremely limited in Canada, where it is found only within 50 km of the Great Lakes (MNRF 2016). It lives year-round at its nest site, which can be constructed in old barns, abandoned buildings, tree cavities or holes in cliff faces (MNRF 2016). The Barn Owl hunts small mammals over open areas such as fields and meadows (MNRF 2016).	This species is not known to occur in the Study Area. Suitable nesting and roosting structures were not identified during previous field investigations. This species is considered unlikely to occur in the Study Area.	No
	Barn Swallow	**Hirundo rustica**	**THR**	**THR-NS**	**S4B**	**OBBA records for region 11 overlap**	**MNRF 2016, Bird Studies Canada et al. 2006; Stantec 2012e**	**The Barn Swallow commonly nests on walls or ledges of barns, bridges, culverts or other man-made structures (Cadman et al. 2007). Where suitable nesting structures occur, Barn Swallow often form small colonies, sometimes mixed with other swallow species (COSEWIC 2011a). The Barn Swallow feeds on aerial insects while foraging over a variety of open habitats such as pastures, lawns, meadows and fields (COSEWIC 2011a). It will also frequently forage in woodland clearings, over wetland habitats or open water where insect prey are abundant (Cadman et al. 2007).**	**This species was confirmed on site during 2012 field surveys (Stantec 2012e).**	**Yes**

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Birds	Black Tern	Chlidonias niger	SC	NAR-NAR	S3B		MNRF 2016	The Black Tern prefers cattail marshes for breeding, where it builds its floating nests in loose colonies (MNRF 2016). It is primarily an aerial insectivore, but will dive to feed on fish (Cornell Lab of Ornithology 2015).	Cattail marsh habitat was observed in limited, discontiguous tracts along the unnamed tributary to Beaver Dam Creek during previous field studies. These habitats are not likely large enough to support breeding colonies of Black Terns. This species is considered unlikely to occur in the Study Area.	No
	Bobolink	**Dolichonyx oryzivorus**	**THR**	**THR-NS**	**S4B**	**OBBA records for region 11 overlap**	**MNRF 2016, Bird Studies Canada et al. 2006, Savanta 2010**	**The Bobolink is generally referred to as a "grassland species". It nests primarily in forage crops with a mixture of grasses and broad-leaved forbs, predominantly hayfields and pastures. Preferred ground cover species include grasses such as Timothy and Kentucky bluegrass and forbs such as clover and dandelion (COSEWIC 2010b). Bobolink is an area-sensitive species, with reported lower reproductive success in small habitat fragments (COSEWIC 2010b).**	**Bobolink was confirmed on site during 2010 field surveys (Savanta 2010).**	**Yes**
	Cerulean Warbler	Dendroica cerulea	THR	END-END	S3B	OBBA records for region 11 overlap	MNRF 2016, Bird Studies Canada et al. 2006	The Cerulean Warbler is found in mature deciduous forest with large trees and an open understory (MNRF 2016).	Previous field investigations observed deciduous forest in small, limited tracts on the western site boundary. Forest communities were documented as middle-aged with well-developed understories, and were therefor unsuitable for this species. Cerulean Warbler is considered unlikely to occur in the Study Area.	No
	Chimney Swift	Chaetura pelagica	THR	THR-THR	S4B, S4N	OBBA records for region 11 overlap	Bird Studies Canada et al. 2006	Chimney Swift use chimneys for roosting and breeding, and less commonly, nest in large hollow trees (Cadman et al. 2007).	Suitable nesting sites for Chimney Swift were not observed on site during previous field investigations. This species is considered unlikely to occur in the Study Area.	No
	Common Nighthawk	**Chordeiles minor**	**SC**	**THR-THR**	**S4B**	**OBBA records for region 11 overlap**	**Bird Studies Canada et al. 2006**	**The Common Nighthawk is an aerial insectivore and forages at dawn and dusk. This species nests on the ground in open habitats with rocky or graveled substrate, and will even nest on gravel roofs in the city (Cadman et al. 2007). The regeneration or succession of forest clearings and the destruction of grassland habitats appear to play a major role in this species' decline along with the non-selective spraying for mosquitoes (Cadman et al. 2007).**	**Previous field investigations did not identify suitable nesting habitat for this species. There is potential for some suitable gravel nesting substrate to have been uncovered since the last surveys. This species is considered unlikely to occur in the Study Area, but further assessment to determine new habitat potential are recommended.**	**Yes**

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Birds	**Eastern Meadowlark**	**Sturnella magna**	**THR**	**THR-NS**	**S4B**	**On site**	**MNRF 2016, Bird Studies Canada et al. 2006; Savanta 2010**	**The Eastern Meadowlark is typically found in fields, meadows, golf courses, pastures, alfalfa fields, roadsides and other open areas (MNRF 2016). Older sites with moderately tall grass, a substantial litter layer, low forb and shrub cover and dense grass are preferred (COSEWIC 2011b). Larger patch sizes (>5 ha) are also generally preferred (COSEWIC 2011b).**	**Eastern Meadowlark was confirmed during 2010 field surveys (Savanta 2010).**	**Yes**
	Eastern Wood-pewee	**Contopus virens**	**SC**	**SC-NS**	**S4B**	**On site**	**Bird Studies Canada et al. 2006; Stantec 2012e**	**The Eastern Wood-peewee is found in the mid-canopy layer of deciduous and mixedwood forests with open understories, and is commonly associated with edges and clearings (MNRF 2016).**	**One signing male was confirmed on site in suitable habitat during 2012 field investigations (Stantec 2012e).**	**Yes**
	Least Bittern	Ixobrychus exilis	THR	THR-THR	S4B	OBBA records for region 11 overlap	MNRF 2016, Bird Studies Canada et al. 2006	The Least Bittern prefers cattail marshes, but may be found in a variety of wetland habitats with stable water levels and dense vegetation interspersed with open water areas (MNRF 2016; COSEWIC 2009). Nests are built in dense vegetation near open water for foraging (MNRF 2016).	Cattail marsh habitat was observed in limited, discontiguous tracts along the unnamed tributary to Beaver Dam Creek during previous field studies. Open water for foraging was also limited to the main Beaver Dam Creek tributary. This species is considered unlikely to occur in the Study Area.	No
	Louisiana Waterthrush	Seiurus motacilla	SC	SC-SC	S3B		MNRF 2016	The Louisiana Waterthrust prefers steep, forested ravines with running water but may also be found in deciduous swamps with open water (MNRF 2016). It nests under fallen logs, in root masses or in niches in stream banks (MNRF 2016).	Forested ravines and deciduous swamps were absent from the site during previous field surveys. This species is considered unlikely to occur in the Study Area.	No
	Peregrine Falcon	falco peregrinus	SC	SC-SC	S3B	OBBA records for region 11 overlap	MNRF 2016, Bird Studies Canada et al. 2006	The Peregrine Falcon traditionally prefers rock cliffs, particularly those adjacent to water (MNRF 2016). More recently, this species has been released in various urban centres in Ontario where it successfully nests on tall buildings (Cadman et al. 2007; MNRF 2016).	Rock cliffs adjacent to water were absent from the site during previous field studies. This species is considered unlikely to occur in the Study Area.	No
	Piping Plover	Charadrius melodus	END	END-END	S1B		MNRF 2016	The Piping Plover nests on sandy beaches of the Great Lakes in Southern Ontario (MNRF 2016).	The Study Area is located more than 15 km from the nearest Great Lake (Lake Ontario). This species is considered unlikely to occur in the Study Area.	No
Birds	Prothonotary Warbler	Protonotaria citrea	END	END-END	S1		MNRF 2016	The Prothonotary Warbler is found in or near deciduous swamps with Silver Maple, ash and Yellow Birch trees where it nests in cavities low on the trunks of trees (MNRF 2016).	Deciduous swamps were absent from the site during previous field investigations. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
	Red-headed Woodpecker	Melanerpes erythrocephalus	SC	THR-THR	S4B	OBBA records for region 11 overlap	Bird Studies Canada et al. 2006	The Red-headed Woodpecker prefers open woodlands and forest edges, and is often found in disturbed areas such as cemeteries, parks and golf courses (MNRF 2016). This species shows a preference for dead or dying trees and at least a few snags or large dead limbs are necessary for its presence in more open habitats (Cadman et al. 2007).	Suitable habitat is potentially present on site. This species has the potential to occur in the Study Area.	Yes
	Wood Thrush	Hylocichla mustelina	SC	THR-NS	S4B	OBBA records for region 11 overlap	Bird Studies Canada et al. 2006	The Wood Thrush is found in deciduous and mixed forests with a developed understory and tall trees (MNRF 2016). While it prefers large forest tracts, it will utilize smaller forest fragments (MNRF 2016). Nests are constructed in shrubs or saplings, typically Sugar Maple or American Beech (MNRF 2016).	Suitable oak forests were identified on site during previous field investigations. This species has the potential to occur in the Study Area.	Yes
	Yellow-breasted Chat	Icteria virens	END	END-END	S2B	OBBA records for region 11 overlap	MNRF 2016, Bird Studies Canada et al. 2006	The Yellow-breasted Chat requires dense, low shrubby vegetation and is usually associated with early successional shrub thickets (MNRF 2016; COSEWIC 2011c). It is typically found in abandoned agricultural fields, hydro lines, Right-of-ways, wetlands and pond edges (COSEWIC 2011c).	Suitable shrub-dominated habitats were identified on site during previous field investigations. This species has the potential to occur in the Study Area.	Yes
Invertebrates	Monarch	Danaus plexippus	SC	SC-SC	S4B, S2N	On site	Savanta 2010	Adult Monarchs feed on nectar from wildflowers in a variety of habitats, while larvae are confined to meadows and open areas with Milkweed plants (MNRF 2016).	Species was confirmed on site during the 2010 insect survey (Savanta 2010).	Yes
	Rusty-patched Bumblee Bee	Bombus affinis	END	END-END	S1		MNRF 2016	The Rusty-patched Bumble Bee is found in a variety of open habitats with flowers from which pollen and nectar can be collected (MNRF 2016; COSEWIC 2010e). Most recently, observations of this species have been made in oak savannah (MNRF 2016). Nests are made in underground rodent burrows (COSEWIC 2010e).	Suitable habitat is potentially present in the Study Area. This species has the potential to occur in the Study Area.	Yes

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Mammals	**Eastern Small-footed Myotis**	**Myotis leibii**	**END**	**Not listed**	**S2S3**	**General range overlap**	**Dobbyn 1994**	**The Eastern Small-footed Myotis roosts in a variety of habitats, including hollow trees, under rocks or in rock outcrops, in buildings, caves, mines and under bridges (MNRF 2016). Different roosting sites may be selected each day (MNRF 2016). Hibernation occurs in abandoned mines and caves (MNRF 2016).**	**Suitable habitat is limited but potentially present in the Study Area. This species has the potential to occur in the Study Area.**	**Yes**
	Little Brown Myotis	**Myotis lucifugus**	**END**	**END-END**	**S4**	**General range overlap**	**Dobbyn 1994**	**The Little Brown Myotis roosts in tree cavities and abandoned buildings, and often forms roosting colonies in barns, attics and abandoned buildings (MNRF 2016; COSEWIC 2013b). They have been found in a wide variety of deciduous and coniferous tree stands (COSEWIC 2013b). Hibernation typically occurs in caves and mines (MNRF 2016).**	**Suitable habitat is limited but potentially present in the Study Area. This species has the potential to occur in the Study Area.**	**Yes**
	Northern Myotis	**Myotis septentrionalis**	**END**	**END-END**	**S3?**	**General range overlap**	**Dobbyn 1994**	**The Northern Myotis roosts in colonies in tree cavities (COSEWIC 2013b) in a wide variety of deciduous and coniferous forest stands. Little is known about the effect of tree density on maternity roost selection for this species, but bats tend to avoid large open areas (COSEWIC 2013b). Small forest gaps, such as over streams or ponds, are used for foraging (COSEWIC 2013b).**	**Suitable habitat is limited but potentially present in the Study Area. This species has the potential to occur in the Study Area.**	**Yes**
	Tri-coloured Bat	Perimyotis subflavus	END	END-END	S3?	General range overlap	Dobbyn 1994	The Tri-coloured Bat roosts in colonies in tree cavities (COSEWIC 2013b) in a wide variety of deciduous and coniferous forest stands. Little is known about the effect of stand composition on maternity roost selection for this species, but it is strongly associated with forest watercourses and streamside vegetation (COSEWIC 2013b).	Forested watercourses were absent from the site during previous field investigations. This species is considered unlikly to occur in the Study Area.	No
	Woodland Vole	**Microtus pinetorum**	**SC**	**SC-SC**	**S3?**	**No recent records**	**MNRF 2016**	**The Woodland Vole is primarily found in mature Carolinian forest with a dense leaf litter layer (MNRF 2016), however it may also be found in sand dunes, swamps and orchards (COSEWIC 2010g). The most important factor in habitat selection is a dense herbaceous layer and friable soils with low saturation (COSEWIC 2010g).**	**Forest communities and swamps were present in limited tracts during previous field surveys. These habitats may be suitable for the Woodland Vole. No recent records for this species were found during the background review. This species is potentially present in the Study Area.**	**Yes**

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Plants	American Chestnut	Castanea dentata	END	END-END	S2	No recent records	MNRF 2016	The American Chestnut prefers dry upland deciduous forest with sandy, acidic to neutral soils and is often associated with Red Oak, Black Cherry, Sugar Maple and American Beech (MNRF 2016). It is only found in the Carolinian zone within Ontario (MNRF 2016).	American Chestnut was not identified during previous site investigations. Suitable habitat was present in limited tracts along the western site boundary, and associate species (Red Oak, Sugar Maple and American Basswood) were identified. No recent records for this species were found during the background review. This species is considered unlikely to occur in the Study Area.	No
	American Columbo	Frasera caroliniensis	END	END-END	S2	No recent records	MNRF 2016	The American Columbo is primarily found on dry, upland, open deciduous forest slopes, but may also be found in thickets, forest edges, pine and cedar forest, grasslands, moist woods and swamps (MNRF 2016; COSEWIC 2006b). Although it will grow on a variety of soils, it is found on rocky slopes throughout its range (COSEWIC 2006b).	This species was not identified on site during previous field surveys, however suitable habitat is present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	American Water-willow	Justicia americana	THR	THR-THR	S1	No recent records	MNRF 2016	The American Water-willow typically grows on the shores of rivers, streams, lakes and ditches, and will ocassionally grow in wetlands (MNRF 2016). It requires wet soil and frequent periods of flooding and wave-action to reduce competitive species growth (MNRF). Preferred substrates are sand, gravel and organic matter (MNRF 2016).	This species was not identified on site during previous field surveys, however suitable habitat is present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Arctic Sweet Grass	Anthoxanthum arcticum	Not listed	Not listed	S2	On site	Stantec 2012d	Arctic Sweet Grass prefers wet lowland sites, especially tundra marshes. Often grows in association with sphagnum mosses (NatureServe 2015).	Species was confirmed on site during the 2012 botanical inventory (Stantec 2012d).	No
	Broad Beech Fern	Phegopteris hexagonoptera	SC	SC-SC	S3	No recent records	MNRF 2016	Broad Beech Fern grows in moist soils in deciduous forests, often with Sugar Maple and American Beech (MNRF 2016). It requires full shade (MNRF 2016).	This species was not identified on site during previous field surveys, and suitable habitat was not present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Plants	Butternut	Juglans cinerea	END	END-END	S3?	No recent records	MNRF 2016	The Butternut is a medium-sized tree that is commonly found in a variety of habitats including woodlands and hedgerows (COSEWIC 2003). Butternut is intolerant of shade and occurs singly or in small groups with a variety of associates (Farrar 1995).	This species was not identified on site during previous field surveys, however suitable habitat is present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Cherry Birch	Betula lenta	END	END-END	S1	No recent records	MNRF 2016	The Cherry Birch is a shade intermediate species that grows on moist, well drained soils in upland deciduous and Eastern Hemlock forests (COSEWIC 2006a). Common associates are Red Oak, White Oak, Sugar Maple and Eastern Hemlock (COSEWIC 2006a).	This species was not identified on site during previous field surveys, however suitable habitat is present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Areae.	No
	Common Hoptree	Ptelea trifoliata	THR	SC-THR	S3	No recent records	MNRF 2016	Common Hoptree is found almost exclusively along the edges of disturbance on the Lake Erie shoreline in Ontario (COSEWIC 2015). While it is still designated as Threatened under the Species at Risk Act, COSEWIC has downlisted this species as Special Concern (COSEWIC 2015).	The Study Area is located approximately 25 km from the Lake Erie shoreline. This species is considered unlikely to occur in the Study Area.	No
	Cucumber Tree	Magnolia acuminata	END	END-END	S2	No recent records	MNRF 2016	The Cucumber Tree grows in moist areas of the Carolinian forest, often on raised areas within or at the edges of swamps (COSEWIC 2010c). It is commonly associated with Red and Silver Maple swamps, swamp thickets, and moist Sugar Maple deciduous and mixed forests (COSEWIC 2010c).	This species was not identified on site during previous field surveys, and suitable habitat was not present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Deerberry	Vaccinium stamineum	THR	THR-THR	S1	No recent records	MNRF 2016	Deerberry is typically found near large bodies of water due their modifying effect on the local climate (MNRF 2016). It is generally found on dry sandy soils in open woods, and is commonly associated with oak and pine woodlands (MNRF 2016).	This species was not identified on site during previous field surveys, and suitable habitat was not present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Dwarf Hackberry	Celtis tenuifolia	THR	THR-THR	S2	No recent records	MNRF 2016	Dwarf Hackberry is found in a variety of habitats, including sand dunes, dry sandy habitats along lakeshores, oak savannahs, ridge tops and limestone alvars (MNRF 2016). It is shade intolerant (MNRF 2016).	This species was not identified on site during previous field surveys, and suitable habitat was not present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Plants	Eastern Flowering Dogwood	Cornus florida	END	END-END	S2?	No recent records	MNRF 2016	Eastern Flowering Dogwood is most often found on sandy soils under tall trees in intermediate to mature deciduous forest, but is also found on floodplains, ravines, fencerows and roadsides (MNRF 2016; COSEWIC 2007a).	This species was not identified on site during previous field surveys, however suitable habitat is present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Green Dragon	Arisaema dracontium	SC	SC-SC	S3	No recent records	MNRF 2016	Green Dragon grows along streams in moist to wet forests dominated by maple, Green Ash and White Elm (MNRF 2016).	This species was not identified on site during previous field surveys, and suitable habitat was not present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Honey Locust	Gleditsia triacanthos	Not listed	Not listed	S2	On site	Savanta 2010, Stantec 2012d	Honey Locust is found on river banks, floodplains, abandoned fields, roadsides, and shorelines (Reznicek et al. 2011).	Species was confirmed on site during multiple survey years (Savanta 2010; Stantec 2012d).	No
	Pin Oak	Quercus palustris	Not listed	Not listed	S3	On site	AECOM 2008, Stantec 2012d	Pin Oak is frequently found on wet sites such as lowland forests and the edges of wet meadows and prairies, although it can be successful if planted on upland sites (Reznicek et al. 2011).	More than 20 specimens were confirmed in and near the FOD2-2 woodlot and CUM community in the western site boundary (AECOM 2008; Stantec 2012d).	No
	Red Mulberry	Morus rubra	END	END-END	S2	No recent records	MNRF 2016	Red Mulberry typically grows in moist, open forests with sandy or limestone-based loamy soils (MNRF 2016) on sites such as floodplains, river valleys, slopes of the Niagara Escarpment and swales (COSEWIC 2014b). It is a shade intermediate species (MNRF 2016).	This species was not identified on site during previous field surveys, and suitable habitat was not present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Round-leaved Greenbrier	Smilax rotundifolia	THR	THR-THR	S2	No recent records	MNRF 2016	The Round-leaved Greenbrier is found on sandy soils in open moist to wet woodlands in the Carolinian zone (MNRF 2016; COSEWIC 2007f).	This species was not identified on site during previous field surveys. Forested communities on site were identified as having moisture regimes of 2-3 (dry-fresh), except one stand located outside of the site boundary which was assigned a moisture regime of 5 (moist). No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Plants	Shumard Oak	Quercus shumardii	SC	SC-SC	S3	No recent records	MNRF 2016	The Shumard Oak grows on moist soils close to water and swamps in deciduous forests and along fencerows (MNRF 2016).	This species was not identified on site during previous field surveys, and suitable habitat was not present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Spoon-leaved Moss	**Bryoandersonia illecebra**	**END**	**END-END**	**S1**	**No nearby records**	**MNRF 2016**	**Spoon-leaved Moss is typically found in seasonally inundated areas under trees or shrub thickets (MNRF 2016). Although it prefers soil substrates, it can be found on rocks and logs (COSEWIC 2003). It is commonly associated with another moss, Narrow-leaved Wetland Plume Moss, which is found in swamps, marshes, and wet meadows (MNRF 2016).**	**This species was not identified on site during previous field surveys, although surveys did not target moss species. Suitable habitat is present. No recent records for this species were identified during the background review, although occurences may be underdocumented. This species has the potential to occur in the Study Area.**	**Yes**
	Spotted Wintergreen	Chimaphila maculata	END	END-END	S1	No recent records	MNRF 2016	Spotted Wintergreen is found in dry, semi-open pine-oak woodlands with sandy soil (MNRF 2016). Associated species include Red Oak, Black Oak, White Pine and American Beech (MNRF 2016).	This species was not identified on site during previous field surveys. The soil profile for forested communities on site identified a silty-clay parent material, which is unsuitable for Spotted Wintergreen. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	Swamp Rose-mallow	Hibiscus moscheutos	SC	SC-SC	S3	No recent records	MNRF 2016	Swamp-Rose Mallow is restricted to shoreline marshed on lakes Erie, Ontario and St. Clair (MNRF 2016).	The Study Area is located approximately 25 km from the Lake Erie shoreline. This species is considered unlikely to occur in the Study Area.	No
	Virginia Mallow	Sida hermaphrodita	END	END-END	S1	No recent records	MNRF 2016	Virginia Mallow grows in sandy and rocky soils of riparian areas such as riversides and floodplains (MNRF 2016). It is also strongly associated with disturbed habitats such as roadsides and railroad beds in Ontario (MNRF 2016; COSEWIC 2010f). It prefers full sun or partial shade (MNRF 2016).	This species was not identified on site during previous field surveys, however suitable habitat is present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No
	White Wood Aster	Eurybia divaricata	THR	THR-THR	S2	No recent records	MNRF 2016	White Wood Aster grows in dry, open deciduous forests dominated by Sugar Maple and American Beech (MNRF 2016). It is often found with other asters along the edges of trails, and prefers full or partial shade (MNRF 2016).	This species was not identified on site during previous field surveys, and suitable habitat was not present. No recent records for this species were identified during the background review. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Reptiles	**Blanding's Turtle**	**Emydoidea blandingii**	**THR**	**THR-THR**	**S3**	**Historic and Recent record 3 km SE**	**MNRF 2016, Ontario Nature 2017**	**The Blanding's Turtle prefers shallow water in heavily vegetated, large wetlands and lakes (MNRF 2016). However, in Ontario it also commonly uses clear watered habitats such as streams, rivers and ponds (COSEWIC 2005). Nests occur in a variety of loose substrates such as sand, gravel and cobblestone (COSEWIC 2005). Blanding's Turtles can often be found hundreds of metres from the nearest aquatic habitat during the active season, as they search for mates or nest sites (MNRF 2016). Overwintering sites are permanent pools approximately 1 m in depth (COSEWIC 2005).**	**The features of the unnamed tributary to Beaver Dam Creek were potentially suitable for active season use for Blanding's Turtles during previous field surveys. This species has recently been recorded approximately 3 km from the Study Area. This species has the potential to occur in the Study Area.**	**Yes**
	Common Five-lined Skink (Carolinian population)	**Plestiodon fasciatus**	**END**	**END-END**	**S2**	**Recent record overlap**	**MNRF 2016, Ontario Nature 2017**	**The Common Five-lined Skink is eastern Canada's only lizard (Ontario Nature 2017). This species' habitat varies, and includes rocky outcrops, sand dunes, open deciduous forests, and early successional habitats with low to moderate canopy cover (COSEWIC 2007d). The skink is typically found under rocks, woody debris and other forms of cover (COSEWIC 2007d).**	**Due to the varied nature of habitats preferred by this species, marginally suitable habitat is considered present in the Study Area. Recent records for this species overlap the Study Area. This species has the potential to occur in the Study Area.**	**Yes**
	Eastern Hog-nosed Snake	Heterodon platirhinos	THR	THR-THR	S3	Historic record 2 km south	Ontario Nature 2017	Eastern Hog-nosed snakes inhabit areas with loose, dry, sandy soil; open vegetation cover and proximity to a water source (COSEWIC 2007c). Common habitats include open woods, forest edges, sand dunes if they have adequate cover (COSEWIC 2007c). Their primary prey is toads (SARO 2016).	Some marginally suitable habitat was observed in the vicinity of the unnamed tributary to Beaver Dam Creek during previous field surveys. A coverboard survey conducted in 2012 failed to detect this species, and no recent records were identified during the background review. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Reptiles	**Eastern Milksnake**	**Lampropeltis triangulum**	**NAR**	**SC-SC**	**S3**	**Historic and recent records overlap**	**Ontario Nature 2017**	**The Eastern milksnake can be found in a variety of habitats, but prefer open areas such as pastures, meadows, prairies, rock outcrops, right-of-ways, and agricultural land (COSEWIC 2014a). They commonly hunt around old buildings and barns, where rodent populations are high (COSEWIC 2014a). At the landscape scale, Milksnakes are most abundant in areas of Ontario with high overall forest cover (COSEWIC 2014a). While COSSARO delisted this species in 2016, it is still designated as Special Concern by COSEWIC and the SARA.**	**Some suitable habitat was observed on site during previous field surveys. Recent records for this species overlap the Study Area, although a coverboard survey conducted in 2012 failed to result in a confirmation. This species has the potential to occur in the Study Area.**	**Yes**
	Eastern Musk Turtle	Sternotherus odoratus	THR	SC-SC	S3	No nearby records	MNRF 2016, Ontario Nature 2017	The Eastern Musk Turtle, also known as Stinkpot, is a small, aquatic freshwater turtle. It is found scattered across southern Ontario (COSEWIC 2012a). The Eastern Musk Turtle require aquatic habitats of soft substrate and shallow water with little to no current (COSEWIC 2012a). Nesting occurs in areas close to the water with direct exposure to sunlight. This species is highly aquatic, and rarely leaves the water (COSEWIC 2012a).	The unnamed tributary to Beaver Dam Creek and surrounding wetlands were not suitable for Eastern Musk Turtle due to their small size and intermittent flow. No recent records in the site vicinity were returned during the background review. This species is considered unlikely to occur in the Study Area.	No
	Eastern Ribbonsnake	**Thamnophis sauritus**	**SC**	**SC-SC**	**S3**	**Historic records overlap, recent records 3 km SE**	**MNRF 2016, Ontario Nature 2017**	**The eastern ribbon snake is usually found close to water and is particularly characteristic of wetlands that have an abundance of small fish and frogs (MNRF 2016). It hibernates in communal underground burrows over winter (MNRF 2016).**	**Some suitable habitat was observed on site during previous field surveys. Recent records for this species occur approximatley 3 km south-east of the Study Area, although a coverboard survey conducted in 2012 failed to result in a confirmation. This species has the potential to occur in the Study Area.**	**Yes**
	Gray Ratsnake (Carolinian population)	Pantherophis spiloides	END	END-END	S3	No nearby records	MNRF 2016, Ontario Nature 2017	The Carolinian population of Gray Ratsnake is found in areas with a mixture of open and forested habitats, such as agricultural fields bordering woodlands, outcrops, and clearings (MNRF 2016; COSEWIC 2007e). They are semi-arboreal, and shelter in snags, logs, rock crevices and under rocks during the day (COSEWIC 2007). Hibernatiion occurs in communal underground hibernacula (COSEWIC 2007e).	Forested habitats on site are small and limited to discontiguous tracts on the western site boundary. Suitable patchwork habitat is absent across the majority of the site. A coverboard survey conducted in 2012 failed to detect this species, and no recent records were identified during the background review. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Reptiles	Massasauga (Carolinian population)	Sistrurus catenatus	END	END-END	S3	No nearby records	MNRF 2016, Ontario Nature 2017	The Massasauga requires semi-open habitats for cover and basking, including prairies, bogs, marshes, alvars, shorelines and open forests (MNRF 2016). Pregnant females tend to prefer dry open habitats for thermoregulation, while non-pregnant snakes favour lowland habitats for hunting (MNRF 2016). Hibernation occurs in rock crevices, root masses, burrows and sphagnum mats where the snakes are below the frost line but above the water table (MNRF 2016).	Some marginally suitable habitat was observed in the vicinity of the unnamed tributary to Beaver Dam Creek during previous field surveys. A coverboard survey conducted in 2012 failed to detect this species, and no recent records were identified during the background review. This species is considered unlikely to be present in the Study Area	No
	Northern Map Turtle	Graptemys geographica	SC	SC-SC	S3	Recent records 3 km SE	MNRF 2016, Ontario Nature 2017	The Northern Map Turtle inhabits rivers and lakes with suitable basking sites such as deadheads, rocks and emergent vegetation (MNRF 2016; COSEWIC 2002). It requires high-quality water with abundant mollusc populations, which are the preferred prey source (MNRF 2016). The map turtle overwinters in slow-moving, deep sections of river (COSEWIC 2002).	The unnamed tributary to Beaver Dam Creek was not suitable for Northern Map Turtle due to its small size and absence of molluscs or basking features with high visibility. There are recent records for this species approximately 3 km south-east of the site. This species is considered unlikely to occur in the Study Area.	No
	Snapping Turtle	**Chelydra serpentina**	**SC**	**SC-SC**	**S3**	**Recent and historic records overlap**	**MNRF 2016, Ontario Nature 2017**	**The Snapping Turtle inhabits ponds, sloughs, streams, rivers, and shallow bays that are characterized by slow moving water, aquatic vegetation, and soft bottoms (COSEWIC 2008). It prefers to stay in shallow water, where it buries itself into mud and leaf litter and has easy access to the surface for air (MNRF 2016). Females nest in sand or gravel, frequently using manmade surfaces such as road shoulders and aggregate pits, in May and early June (MNRF 2016; COSEWIC 2008).**	**Potentially suitable active season habitat for this species was present along the unnamed tributary to Beaver Dam Creek. The background review returned recent records overlapping the Study Area. This species has the potential to occur in the Study Area.**	**Yes**

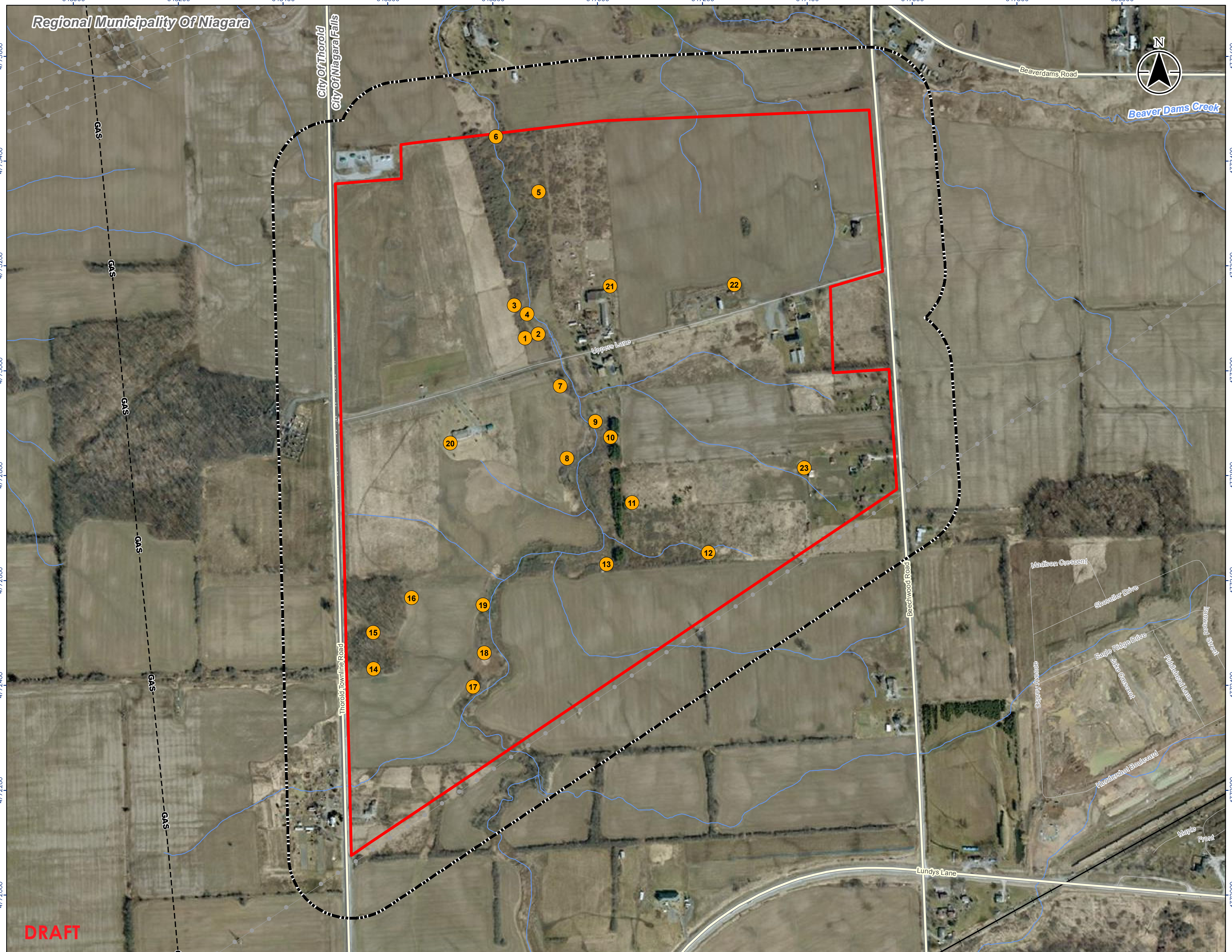
Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Reptiles	Spiny Softshell	Apalone spinifera spinifera	THR	THR-THR	S3	Unk	MNRF 2016, Ontario Nature 2017	The Spiny Softshell is usually found in rivers and lakes, but ocassionally inhabits smaller waterbodies such as streams and roadside ditches (MNRF 2016). The primary habitat requriement is access to open terrestrial sand or gravel sites for nesting, soft mud substrate for burrowing, basking sites and an abundance of crayfish and other prey items (MNRF 2016; COSEWIC 2016). The Spiny Softshell rarely travels far from aquatic habitats (COSEWIC 2016).	The unnamed tributary to Beaver Dam Creek was not suitable for Spiny Softshell due to its small size, intermittent flow and lack of suitable nesting, basking, burrowing sites. No recent records in the site vicinity were returned during the background review. This species is considered unlikely to occur in the Study Area.	No
	Spotted Turtle	Clemmys guttata	END	END-END	S3	General range overlap	Ontario Nature 2017	The Spotted Turtle is semi-aquatic (MNRF 2016) and prefers unpolluted wetlands with shallow, slow-moving water and abundant vegetation, including bogs, fens, marshes and swamps (COSEWIC 2014c). Some important habitat requirements are soft substrates, sphagnum mosses, hydrophilic shrubs, floating vegetation mats or tussocks, sedges and cattails (COSEWIC 2014c). Nesting sites are generally vegetated areas with a high level of direct sunlight and nearby trees, including open areas under cover of sphagnum, lichen, grass, sedge or leaf litter, trail edges and agricultural field edges (COSEWIC 2014). Overwintering occurs in a variety of wetland habitats under up to 100 cm of water (COSEWIC 2014c).	The unnamed tributary to Beaver Dam Creek and surrounding wetlands were not suitable for Spotted Turtle due to their small size and unsuitable vegetation structure. No recent records in the site vicinity were returned during the background review. This species is considered unlikely to occur in the Study Area.	No

Table 1: Species at Risk and Species of Conservation Concern for the Niagara Region

Group	Common Name	Scientific Name	COSSARO	COSEWIC-SARA	S-Rank	Available Records	Record Source	Habitat Characteristics	Habitat Suitability and Potential To Occur on Site Based on Previous Studies	Study Target
Reptiles	Wood Turtle	Glyptemys insculpta	END	THR-THR	S2	General range overlap	Ontario Nature 2017	Wood Turtle are semiaquatic species, associated with clear, meandering streams and rivers with moderate current and sand or gravel substrate (MNRF 2016; COSEWIC 2007g). Terrestrial habitat includes forests, fields, meadows, bogs and riparian areas with sufficient vegetation cover and foraging opportunity (COSEWIC 2007g). Nesting habitat consists of sand or gravel-sand beaches or stream banks, but Wood Turtle are also known to nest within anthropogenic sits such as gravel pits and roadsides (COSEWIC 2007g). Overwintering occurs at the bottom of streams or rivers (MNRF 2016).	The unnamed tributary to Beaver Dam Creek was not suitable for Wood Turtles due to its small size, intermittent flow, musck substrate and lack of current. No recent records in the site vicinity were returned during the background review. This species is considered unlikely to occur in the Study Area.	No

ATTACHMENT 3
FIGURE 2 – SNAKE COVERBOARD SURVEY LOCATIONS



Stantec

Legend

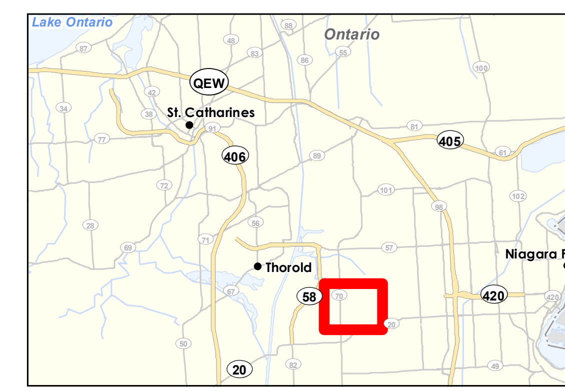
- Site
- 120 m Buffer
- Snake Coverboard Survey Location
- Major Road
- Minor Road
- Hydro Line
- Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Municipal Boundary - Upper Tier
- Waterbody

0 200 400 metres

1:7,500 (At original document size of 11x17)

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, 2016.
3. Orthoimagery © First Base Solutions, 2016. Imagery Date 2010.



Project Location
Regional Municipality of Niagara

160960948 REVA
Prepared by MDK on 2017-03-22
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
WALKER INDUSTRIES HOLDINGS INC.
BEAVERDAMS CREEK RESTORATION

Figure No.
1

DRAFT

Title
Site and Adjacent Lands
Snake Coverboard Survey

Ministry of Natural Resources and Forestry

Box 5000
4890 Victoria Ave. N.
Vineland Station, Ontario
L0R 2E0

Tel: (905) 562-4147
Fax: (905) 562-1154

Ministère des Richesses naturelles et des Forêts

C.P. 5000
4890 avenue Victoria Nord
Vineland Station, Ontario
LOR 2EO

Tél : 905-562-4147
Téléc.: 905-562-1154

June 1, 2017

Lisa Uskov
Terrestrial Ecologist
Stantec
200-835 Paramount Drive Stoney Creek ON L8J 0B4
Phone: (905) 381-5435
Lisa.Uskov@stantec.com

Dear Lisa,

Thank you for your inquiry regarding the presence of species at risk and other natural heritage features within the vicinity of the proposed Upper's Lane Quarry in the City of Niagara Falls, Ontario.

Digital mapping for some natural heritage features is available from Land Information Ontario (LIO). MNRF recommends contacting LIO to obtain relevant feature mapping. Datasets of potential interest (and the corresponding LIO dataset) include – wetlands ('Wetland' dataset), ANSI ('ANSI dataset), wooded areas ('Wooded Areas'), wintering areas ('Wintering Areas'), and fish spawning areas ('Spawning Areas').

WETLANDS

The Ministry notes that the Beaverdams Creek Wetland Complex is located within the identified lands.

Digital mapping of wetlands can be obtained from Land Information Ontario (LIO). The Warehouse Dataset Name is 'Wetlands' within LIO. LIO manages key provincial datasets, and is responsible for housing most of the Ministry's digital natural heritage and resource data. The LIO Warehouse also includes spatial data from a variety of other sources and agencies, including federal ministries and conservation authorities. The LIO website provides instructions on how to request/obtain data, and a full listing of all data in the Warehouse. The link to the LIO website is as follows: http://www.mnr.gov.on.ca/en/Business/LIO/index.html. LIO staff can also be contacted at lio@ontario.ca or at (705) 755-1878 for assistance.

ANSI

The Ministry notes that no ANSI's are currently identified within or directly adjacent to the identified lands.

Digital mapping of Areas of Natural and Scientific Interest can be obtained from Land Information Ontario (LIO). The Warehouse Dataset Name is 'ANSI' within LIO. LIO manages key provincial datasets, and is responsible for housing most of the Ministry's digital natural heritage and resource data. The LIO Warehouse also includes spatial data from a variety of other sources and agencies, including federal ministries and conservation authorities. The LIO website provides instructions on how to request/obtain data, and a full listing of all data in the Warehouse. The link to the LIO website is as follows: http://www.mnr.gov.on.ca/en/Business/LIO/index.html. LIO staff can also be contacted at lio@ontario.ca or at (705) 755-1878 for assistance

FISHERIES INFORMATION

The timing restrictions for work in or nearby water for the watershed of Beaverdams Creek and its tributaries are March 1st to July 1st (Dates represent when work should be avoided). The Ministry recommends that you adhere to the timing restrictions for work in or nearby water. Please note that certain activities may also require a Scientific Fish Collectors Permit. If you require more detailed fisheries information, contact David Denyes at david.denyes@ontario.ca.

SPECIES AT RISK

The Ministry notes the following species at risk have been documented on or within the general vicinity of the subject property:

- Snapping Turtle *(Chelydra serpentina)*- Special Concern
- Round-leaved Greenbrier *(Smilax rotundifolia)*- Threatened
- White Wood Aster *(Eurybia divaricate)* - Threatened

The Ministry notes that there may be habitat for SAR bats in the wooded area. If the works propose to alter the wooded area then MNRF will require additional information to assess the status of bats on the property.

- Tri-colored Bat (Perimyotis subflavus)- Endangered
- Little Brown Myotis (Myotis lucifigus)- Endangered
- Northern Myotis (Myotis Septentrionalis)- Endangered

Bobolink *(Dolichonyx oryzivorus),* Eastern Meadowlark *(Sturnella magna)* and Barn *Swallow (Hirundo rustica)* are frequently observed within the Niagara Region and these threatened birds may exist on the subject property if suitable habitat is available.

Please note that because the province has not been surveyed comprehensively for the presence of species at risk (SAR), the absence in the NHIC database of an EO in a particular geographic area does not indicate the absence of the species in that area. Consequently, the presence of an EO is useful to flag the presence of the species in the area, but is not an appropriate tool to determine whether a species is absent, or whether it should be surveyed for or not in a particular area.

Consequently, we provide the following advice with respect to determining the presence of species at risk on a property for which a land-use change or on-the-ground activity is being proposed (note that some of the following may not apply to a given type of proposed activity, or for a given study area):

I. Habitat Inventory

The District recommends undertaking a comprehensive botanical inventory of the entire area that may be subject to direct and indirect impacts from the proposed activity. The vegetation communities and aquatic habitats in the study area should be classified as per the “Ecological Land Classification (ELC) for Southern Ontario” system, to either the “Ecosite” or “Vegetation Type” level. With respect to aquatic habitats in the study area, we recommend you collect data on the physical characteristics of the waterbodies and inventory the riparian zone vegetation, so that these habitats can be classified as per the Aquatic Ecosites described in the ELC manual.

II. Potential SAR on the property

A list of species at risk that have the potential to occur in the area can be produced by cross-referencing the ecosites described during the habitat inventory with the habitat descriptions of species at risk known to occur in the county or regional municipality within which the area is located. The list of species at risk known to occur in Niagara Falls is attached. The species-specific COSEWIC status reports (www.cosewic.gc.ca) are a good source of information on species at risk habitat needs and will be helpful in determining the suitability of the property’s ecosites for a given species.

Please note that the Species at Risk in Ontario list (SARO) is a living document and is amended periodically as a result of species assessment and re-assessments conducted by the Committee on the Status of Species at Risk in Ontario (COSSARO). The SARO list can be accessed on the webpage http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/MNR_SAR_CSSR_SARO_LST_EN.html

COSSARO also maintains a list of species to be assessed in the future. It is recommended to take COSSARO's list of anticipated assessments into consideration, especially when the proposed start date of the activity is more than 6 months away, or the project will be undertaken over a period greater than 6 months. The list can be viewed by going to http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/244543.html and clicking on the link Priority List of Species to be Assessed and Classified by COSSARO.

III. SAR surveys

The District is of the opinion that each species at risk identified under Step II should be surveyed for, regardless of whether or not the species has been previously recorded in the area, or whether previous records are historical in nature. The survey report should describe how each species at risk was surveyed for, and provide a rationale for why, if any, certain species appearing on the county/ regional municipal list were not the subject of the survey. These rationales must be based on evidence demonstrating either that: suitable habitat for the species is not present on the property or; the project will not have any impacts -including indirect impacts- on the species. Some SAR surveys require an authorization under the *Endangered Species Act 2007* and/or a Scientific Collector's Permit; please contact me if you require further direction regarding these.

Guelph District additionally recommends contacting the municipal planning approval authority and the conservation authority to determine if they have any additional information or records of interest for the study area.

If your investigations reveal the presence of species at risk on the project area, or you would like further advice regarding the provisions of the Endangered Species Act, please contact the undersigned at 905-562-1196 or david.denyes@ontario.ca.

Sincerely,

David Denyes
Management Biologist

Stantec

Stantec Consulting Ltd.
70 Southgate Drive, Suite 1, Guelph ON, N1G 4P5

July 15, 2019
File: 160960948

Attention: Kevin Kehl
Project Manager
Walker Aggregates Inc.
P.O. Box 100
Thorold, ON L2V 3Y8
kkehl@walkerind.com

Dear Mr. Kehl,

Reference: Natural Environment Level I/II Study (Existing Conditions and Impact Assessment) Terms of Reference – Upper's Lane properties, City of Niagara Falls

Stantec Consulting Ltd. (Stantec) is pleased to provide this Terms of Reference (ToR) for a Natural Environment Level I/II Study in support of an Aggregate Resources Act (ARA) licence application for the Subject Property located at Upper's Lane in the City of Niagara Falls. The Subject Property is bound by Thorold Townline Rd to the west, private property to the north, Beechwood Rd to the east and a hydro corridor to the south (see **Figure 1**). Portions of the property are designated Core Natural Heritage (Environmental Conservation Area) in the Niagara Region Official Plan (Schedule C).

The purpose of the ToR is to establish the level of effort that is required to determine if significant natural features are present in the Study Area (the Subject Property plus 120-m) and, if so, whether there will be any negative impacts on these features or their functions. The proposed field studies were established using the Region of Niagara's Environmental Impact Study Guidelines (2012) and in consideration of the requirements of the ARA.

FIELD INVESTIGATIONS

Field investigations were undertaken on the Subject Property in 2017 and 2019. The following site-specific field investigations and background data review were undertaken to document the natural heritage attributes in the Study Area:

Task Description	Timeline
Terrestrial SAR and SOCC background review report	March 2017
Natural Heritage Features and Areas background review	March 2017
Aquatic habitat assessment	April and June 2017

Reference: Natural Environment Level I/II Study (Existing Conditions and Impact Assessment) Terms of Reference – Upper's Lane properties,

Task Description	**Timeline**
Bat maternity roost candidate habitat assessment (1 visit)	March 2017
Amphibian call monitoring (3 visits)	April – June 2017
Turtle habitat/basking survey (3 visits over 3 weeks)	March - June 15
Snake coverboard survey at 23 pre-selected locations. WSCA was granted by MNRF prior to undertaking this survey	April – July 2017
Bat maternity roost candidate habitat acoustic monitoring	June 2017 and 2019
Bat exit surveys at candidate structures	June 2019
Breeding bird surveys targeting grassland and woodland species (3 visits at least one week apart)	June - early July 2017 and 2019
ELC assessment (confirmation of previous data)	June – August 2017, March 2019
Targeted search for previously identified SOCC plants	June 2017, May 2019
Insect survey (Butterflies and Dragonflies)	July – August 2017
Incidental wildlife observations and documentation of wildlife evidence (all visits)	March – August 2017, March – June 2019

EVALUATION OF SIGNIFICANCE

Findings of the field investigations will be used to determine if significant natural features are present on site including:

- Significant Woodlands
- Wetlands
- Significant Wildlife Habitat
- Habitat for endangered or threatened species
- Locally uncommon and rare species

Findings will be evaluated using the relevant provincial and municipal policy documents, such as the Official Plan, EIS Guidelines (2012) and policies of the Niagara Peninsula Conservation Authority, and provincial guidance documents, such as the Natural Heritage Reference Manual, Significant Wildlife Habitat Technical Guide (MNR 2000), and the Significant Wildlife Habitat Ecoregion 6E Criterion Schedule (MNRF 2015). Minimum protection zones (setbacks) will be identified for significant natural features, if relevant, and appropriate mitigation strategies will be identified to address potential negative effects to natural features.

REPORTING

Stantec will prepare a Natural Environment Level I/II Technical Report, which will summarize the methods and findings of the field investigations, evaluation of significance, assessment of impacts and proposed mitigation. The report will include mapping of features and their associated recommended setbacks.

CLOSURE

We trust that this ToR provides a clear understanding of the Natural Environment Level I/II Study, the site investigations undertaken, and methods to evaluated natural heritage features. Feel free to contact Stantec with any comments or questions you may have regarding the ToR. We look forward to finalizing this ToR with your input.

Regards,

STANTEC CONSULTING LTD

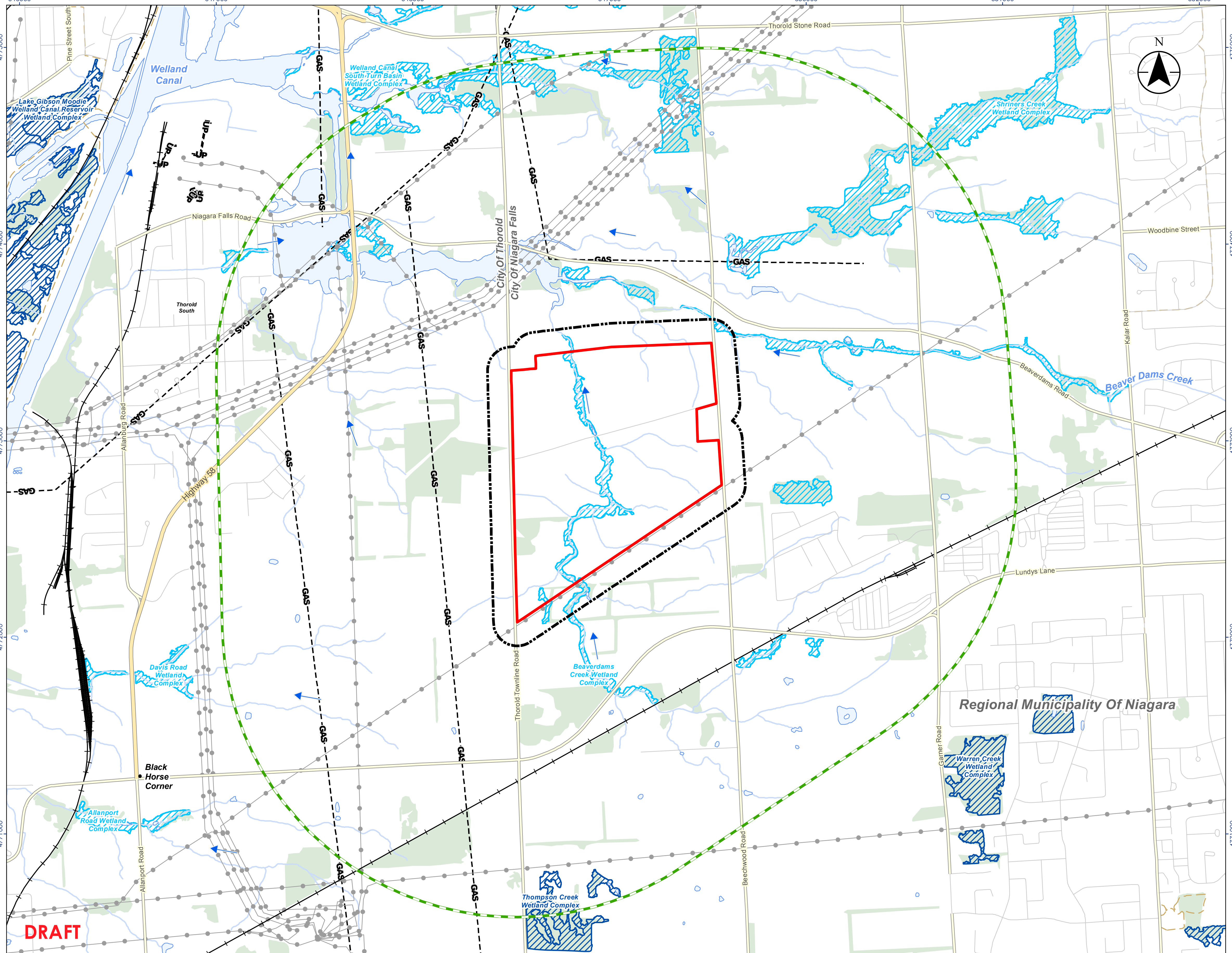
Daniel Eusebi BES, MCIP, RPPcredentials
Senior Environmental Planner
Phone: 519-780-8134
dan.eusebi@stantec.com

Melissa Cameron M.Sc., M.LA., OALA
Ecologist / Landscape Architect
Phone: 519-645-3351
Melissa.cameron@stantec.com

Attachment: Figure 1

c. Sean Geddes, Stantec (sean.geddes@stantec.com); Debra Kakaria, MHBC; David Charlton

g:\active\60960948\correspondence\2019 tor\let_160960948_tor_20190715.docx



Stantec

Legend

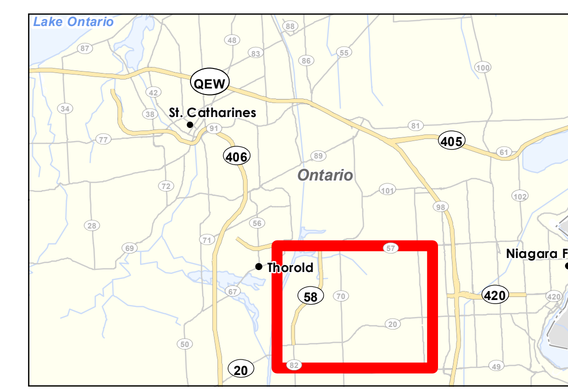
- Site
- 120 m Buffer
- Natural Environment Regional Context Area
- Flow Direction
- Expressway / Highway
- Major Road
- Minor Road
- Hydro Line
- UP Unknown Pipeline
- GAS Gas Pipeline
- Railway - Operational
- Trail
- Watercourse
- Municipal Boundary - Lower Tier
- Municipal Boundary - Upper Tier
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Evaluated (Other)
- Wooded Area

0 200 400 metres

1:20,000 (At original document size of 11x17)

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, 2016.



Project Location
Regional Municipality of Niagara

160960948 REVA
Prepared by MDK on 2017-03-09
Technical Review by DH on 2017-03-09
Independent Review by ABC on yyyy-mm-dd

Client/Project
WALKER INDUSTRIES HOLDINGS INC.
BEAVERDAMS CREEK RESTORATION

Figure No.
2

Title
Natural Environment Regional Context Area

Cameron, Melissa

From: Debra Walker <dwalker@mhbcplan.com>
Sent: Friday, October 18, 2019 3:18 PM
To: Eusebi, Daniel; Cameron, Melissa; Amirault, Heather; Geddes, Sean
Cc: Kevin Kehl (KKehl@walkerind.com)
Subject: Uppers - preliminary agency comments provided at pre-consultation meeting

Good afternoon,

Yesterday, we attended pre-consultation meetings with MNRF and then separately with the Region, City and NPCA staff.

There were a few preliminary comments noted at these meetings that I thought I would pass along and draw to your attention so they can be addressed in the EIS Report:

1. MNRF noted that the small woodlot on-site (and the large woodlot west of Thorold Townline Road) are identified as **Deer Wintering Yards** and may be considered Significant Wildlife Habitat. Please advise if Stantec has already reviewed this specifically and what the findings were.
2. MNRF was not clear on SAR review process (whether there comments would be submitted withn 45 day window) now that it is under MECP. MNRF (Melinda) suggested us letting her know who Stantec has been working with at MECP re Information Forms to date and she will coordinate with them.
3. NPCA Staff asked if **blasting impacts on habitat** was reviewed. We noted that there may be a restriction on the timing of blasting associated with fish spawning within specified areas but were not aware of any other restrictions. We noted that Stantec would review this with input from Explotech and address this in the EIS.
4. City Staff noted that there would be a **5 –year shelf life** on natural environment studies.

Deb

DEBRA WALKER (formerly KAKARIA), BES, MBA, MCIP, RPP, | Partner

Please update your contact information with updated email address: dwalker@mhbcplan.com

MHBC **Planning, Urban Design & Landscape Architecture**
7050 Weston Road, Suite 230 | Woodbridge | ON | L4L 8G7 | T 905 761 5588 x 216 | F 905 761 5589 | C 416 605 6039 | dkakaria@mhbcplan.com

Follow us: Webpage | Linkedin | Facebook | Twitter | Vimeo

From:	Debra Walker
To:	Eusebi, Daniel; Cameron, Melissa
Cc:	Kevin Kehl (KKehl@walkerind.com); Brian Zeman
Subject:	FW: Proposed Uppers Quarry - Deer Wintering Question
Date:	Thursday, October 24, 2019 4:03:21 PM
Attachments:	NHFeatures_UppersQuarry.pdf

Dan and Melissa,

Please see attached map and email below from Melinda confirming it is a Deer Wintering Area (vs. a Yard).

Deb

Debra Walker (formerly Kakaria)
dwalker@mhbcplan.com
905 761 5588 (x 216)

From: Thompson, Melinda (MNRF) [mailto:Melinda.Thompson@ontario.ca]
Sent: October-24-19 3:50 PM
To: Debra Walker
Cc: Denyes, David (MNRF)
Subject: RE: Proposed Uppers Quarry - Deer Wintering Question

Hello Debra

I can confirm that the woodlot in the south end of the property abutting Thorold Townline Road, as well as the woodlot to the west of that same road are mapped as Deer Wintering Areas as opposed to Deer Yards. Please see the attached map detailing the extent of the mapped features.

Melinda

MELINDA J. THOMPSON, B.A. Hon, M.Sc.
A\DISTRICT PLANNER | ONTARIO MINISTRY of NATURAL RESOURCES and FORESTRY | GUELPH DISTRICT OFFICE
1 Stone Road West, Guelph, Ontario, N1G 4Y2 | ☎ 519.826.6543 | melinda.thompson@ontario.ca

---

From: Debra Walker <dwalker@mhbcplan.com>
Sent: Thursday, October 24, 2019 1:44 PM
To: Thompson, Melinda (MNRF) <Melinda.Thompson@ontario.ca>
Subject: Proposed Uppers Quarry - Deer Wintering Question

Good afternoon Melinda,

At our pre-consultation meeting last week for the proposed Uppers Quarry, you had mentioned that the small woodlot on the subject lands had been flagged as a possible Deer Wintering Yard or Area.

My notes are unfortunately not clear on which it was. Stantec advises that there is a difference between these two terms and wanted to confirm whether it was identified by MNRF as a possible "Deer Wintering Yard" or a "Deer Wintering Congregation Area".

Further, if you could please provide us with the mapping that identifies whether it is a Yard or Congregation Area and a contact at MNRF that Stantec can follow up with further on what is expected for any necessary surveys / criteria relating to this matter.

Thank you,
Deb

DEBRA WALKER (formerly KAKARIA), BES, MBA, MCIP, RPP, | Partner

Please update your contact information with updated email address:
dwalker@mhbcplan.com

MHBC **Planning, Urban Design & Landscape Architecture**
7050 Weston Road, Suite 230 | Woodbridge | ON | L4L 8G7 | T 905 761 5588 x 216 | F 905 761 5589 | C 416 605 6039 | dkakaria@mhbcplan.com

Follow us: Webpage | Linkedin | Facebook | Twitter | Vimeo

Email Signature Banner Template - 2015 DRAFT 3

Pre-Consultation Meeting Form

Niagara Region &
City of Niagara Falls

Persons intending to make an application for a proposed development are required to consult with planning staff prior to submitting an application. A pre-consultation meeting will identify what is required to be submitted for a complete application and will provide the opportunity to discuss:

- The nature of the application;
- Development and planning issues;
- Fees;
- The need for information and/or reports to be submitted with the application;
- The planning approval process;
- Other matters, as determined.

Pre-Consultation Meeting Date: October 17, 2019

Site Address:	See Schedule 'A' attached (includes Upper's Lane & Road Allowance Between Township Lots 120 and 136)	**Approximate Land Area (metric):**	106.3 ha

Owner Contact Information:

Name of Owner:	Walker Aggregates Inc.	**Contact:**	Kevin Kehl, Project Manager
Phone Number:	905-680-3692	**Email:**	kkehl@walkerind.com

Agent Contact Information:

Name of Agent:	MHBC Planning	**Contact:**	Debra Walker (Kakaria)
Phone Number:	905-761-5588 x. 216	**Email:**	dkakaria@mhbcplan.com

Application Types:

X	Regional Official Plan Amendment	X	Local Official Plan Amendment	X	Zoning By-law Amendment

1. **Brief description of proposed development:**

Regional Official Plan Amendment, City of Niagara Falls Official Plan and Zoning By-law Amendments to permit the proposed below water aggregate quarry operation

2. **Existing Regional Official Plan Designations:**

Good General Agriculture and Environmental Conservation Area

Conformity with Regional Official Plan land use designations and policies? ☐ Yes ☒ No

If 'No', what is the nature of the amendment needed?

To add site specific policies to Section 13 to permit the proposed quarry operation

3. **Check All Applicable:** ☐ Brownfield ☐ Greenfield ☐ Built-up ☐ NEP ☐ Greenbelt

4. **Existing Local Official Plan Designation:**

Good General Agriculture and Environmental Protection Area

Conformity with Official Plan land use designations and policies? ☐ Yes ☒ No

If 'No', what is the nature of the amendment needed?

To add a Special Policy Area to permit the proposed quarry operation

5. **Existing Zoning:**

Agricultural (A) and Hazard Land (HL)

Conformity with existing zoning? ☐ Yes ☒ No

If 'No', what is the proposed zoning?

Extractive Industrial

6. **Is Site Plan approval required?** ☐ Yes ☒ No

7. Fees Required at time of Submission of the Application:

Application	City of Niagara Falls	Niagara Region	Niagara Peninsula Conservation Authority	Other Fees
Regional Official Plan Amendment		$111,650	$7,425	
Local Official Plan Amendment	See S.10	$9,520	$7,425	
Zoning By-law Amendment	See S. 10	$1,270	$7,425	
Plan of subdivision				
Plan of Condominium				
Consent				
Site Plan Control or Amendment				
Other	Full Cost Recovery + $16,200 Base Fee	$1830 Stormwater Management review fee (site over 5ha) Peer Reviews and Aggregate Advisor	$2205 – EIS review $1755 – Hydrogeological Review $1755 – Storm Water Management Review	
TOTAL	Full Cost Recovery + $16,200 Base Fee	$124,270 + Aggregate Advisor and Peer Reviews	$27,990	

Notes:

- Notwithstanding the fees noted above, all fees are payable based upon the rate in the fee schedule by-law in effect on the date the application is received.
- Further fees may be required at a later date as per the fee schedule by-law.
- Separate cheques shall be made payable to the appropriate agency.
- The owner/applicant shall bear the cost of peer reviews and an aggregate advisor as per the Regional Municipality of Niagara Fee By-Law in accordance with the Cost Acknowledgement Agreement
- As provided for under Section 69 of the *Planning Act* an applicant may pay the fees under protest.

8. Additional Agencies to be contacted:

[x] Hydro [x] Pipelines [ ] NEC [x] Other City of Thorold

9. Required Information and Studies to be submitted with the Application(s):

See Schedule 'B' attached

10. Additional Comments:

In addition to the comments provided below, please see other preliminary staff comments attached as Schedule 'C'.

- All studies listed in Section 9 (Schedule 'B') of this form may be peer reviewed. The Terms of Reference for a peer review is determined by the Joint Agency Review Team (JART) and paid for by the applicant. An Aggregate Advisor will be required. As per the Regional Municipality Fee By-Law the applicant/owner shall bear any and all costs associated with the peer reviews and the aggregate advisor. The applicant/owner shall be required to sign a cost acknowledgment agreement, which must be signed and submitted as part of the application.
- The City of Niagara Falls requires full cost recovery for aggregate applications with a $16,200 base fee. The owner/applicant is required to enter into a separate Cost Acknowledgement Agreement with the City of Niagara Falls.
- Some of the above mentioned studies/required information may be combined. If the required information/study as listed above is not found in a standalone report, the applicant will be required to indicate in a covering letter to the application where the information/study can be found within the application package. In addition, if a report contains information/studies on multiple topics from the table above, the qualified person writing each section shall be clearly identified within the report and this portion of the report shall be signed and dated by the qualified professional.
- A Joint Agency Review Team will be formed. The purpose of the JART is to share information and expertise among review agencies; review, analyze and comment on the completeness of the submissions; engage the public more efficiently; and, improve decision-making and efficiency associated with aggregate applications. A JART does not make recommendations on whether or not applications should be approved.
- Certain reports, such as the Natural Environment Study, Traffic Study and Land Use Studies, shall not be more than five years old when submitted, and will not be accepted unless previously agreed to by the JART. All studies shall be in accordance with current applicable regulations, policies and standards.
- To date, Terms of References for the following studies have been submitted to the Region, City and NPCA for review:
  - Transportation Impact Study
  - Natural Environmental Level I/II Study
  - Economic Impact Assessment
- Comments on the above Terms of Reference documents are included as Schedule 'D'. The JART may request additional scoping or Terms of Reference for other studies, as necessary. Generally, Terms of Reference comments are provided by the individual or agency responsible for reviewing the study. However, it is noted that the Aggregate Advisor and peer reviewers have not been retained to date. Future

scoping or Terms of Reference comments may be provided by the Aggregate Advisor or a peer reviewer when they are retained.

11. Site Visits:

- An initial site visit and additional site visits, as required, may requested. Reasonable requests for site visits will be accommodated. The owner consents to these site visits by signing this Pre-Consultation Meeting Checklist.

12. Additional Notes:

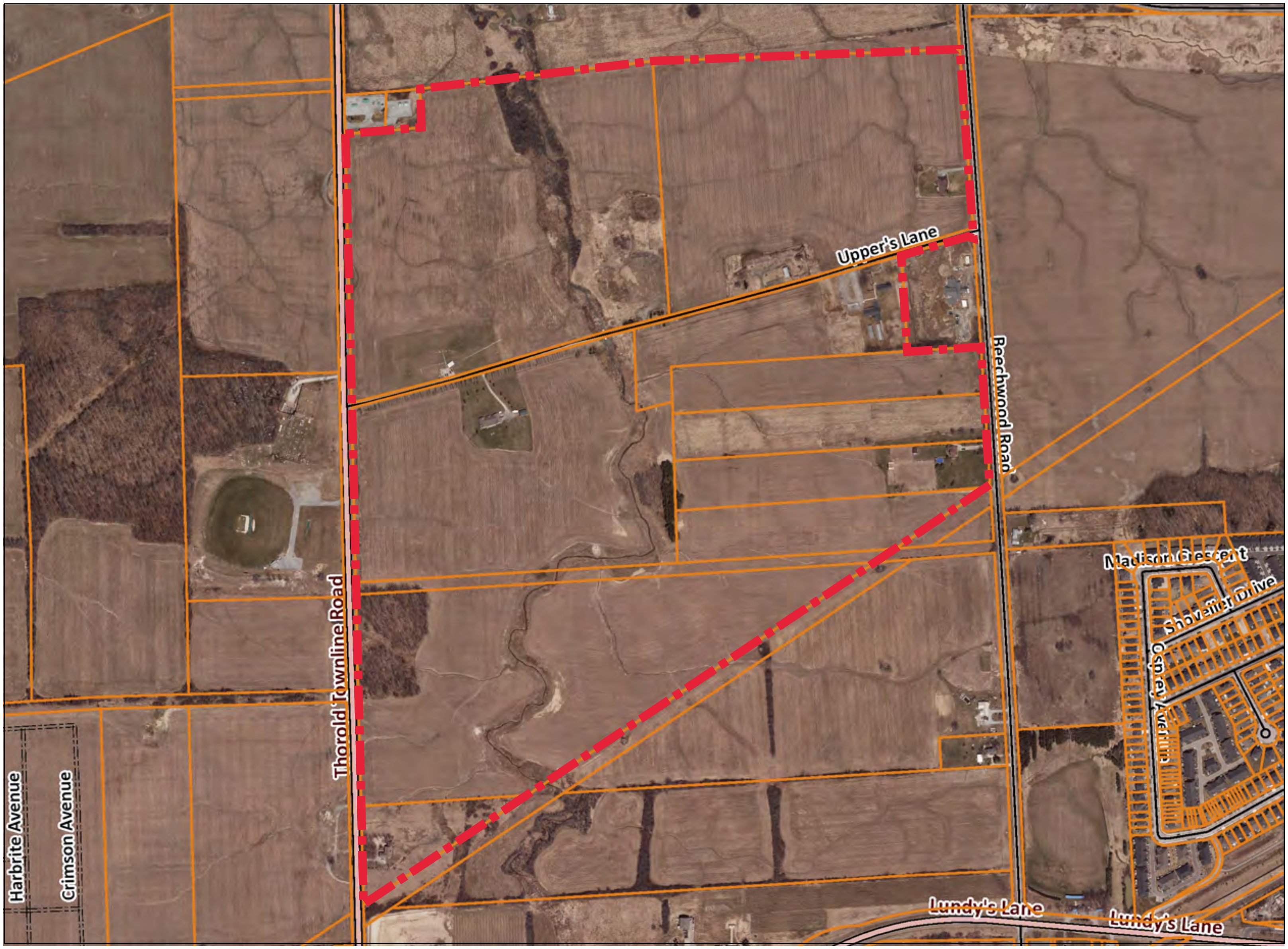
1. The purpose of this document is to identify the information required to commence processing and evaluating an application as set out in the Planning Act. This pre-consultation process is designed to proceed based on the mutual agreement of the parties as shown by the signatures below.
2. Pre-consultation does not imply or suggest any decision whatsoever on behalf of staff or the municipality to either support or refuse the application.
3. The applicant should be aware that the information provided is accurate as of the date of the pre-consultation meeting. Should an application not be submitted in the near future, and should other policies, by-laws or procedures be approved by the Province, Municipality, Region or other agencies prior to the submission of a formal application, the applicant will be subject to any new policies, by-laws or procedures that are in effect at the time of the submission of a formal application. If an application is not submitted within 1 year, it is advisable that the applicant confirm with the municipality the directives of the original pre-consultation meeting.
4. Any application submitted without the information identified in this Pre-consultation Document will be deemed incomplete and not processed. Alternately, staff may recommend refusal of the application based upon insufficient information to properly evaluate the application.
5. The applicant acknowledges that the Municipality and Region considers the application forms and all supporting materials including studies and drawings, filed with any application to be public information and to form part of the public record. With the filing of an application, the applicant consents and hereby confirms that the consent of the authors of all supporting reports have been obtained, to permit the Municipality and Region to release the application and any supporting materials either for its own use in processing the application, or at the request of a third party, without further notification to, or permission from, the applicant.
6. It is hereby understood that during the review of the application additional studies or information may be required as a result of issues arising during the processing of the application or the review of the submitted studies.
7. All plans and statistics must be submitted in metric.

Signatures:

Andrew Bryce City of Niagara Falls Planning Staff	Niagara Falls Staff (signature)	Date: Nov 20/19
Pat Busnello Niagara Region Development Services Staff	Regional Staff (signature)	Date: Nov 19/19
ERIK ACS Niagara Region Policy Planning Staff	Regional Staff (signature)	Date: Nov 19/19
Sean Norman Niagara Region JART Chair	Regional Staff (signature)	Date: Nov 19/19
Cara Lampman NPCA Staff	NPCA Staff (signature)	Date: Nov 20/19.
Agent	Agent (signature)	Date:
Owner	Owner (signature)	Date:

Niagara Region

Schedule 'A' Subject Lands



Legend

- Assessment with Owner
- Streets Labels
- Provincial
- Regional
- Municipal/Private Roads
- Unimproved Roads
- Future/Planned Roads
- Regional Roads
- Subject Lands

508.0 0 254.00 508.0 Meters

N

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. This map is not to be used for navigation.

Notes

Schedule 'B' - Required Information and Studies

Region	Niagara Falls	NPCA	Thorold	Submission Requirements	Notes	* Peer Review
Studies						
✓	✓		✓	Planning Justification Report	Specifically address 14.D.5 of ROP Please include surrounding land uses plan within 500 m of property (including buildings and structures)	
✓	✓		✓	Land Use Compatibility / Sensitive Land Use Study	Includes Land Use Compatibility / Sensitive Land Use Study, informed by applicable Provincial Guidelines (e.g., D-Series, NPC-300) and applicable Air Quality, Noise and Vibration Studies	✓
✓	✓		✓	Air Quality Assessment		✓
✓	✓		✓	Noise Study		✓
✓	✓		✓	Blasting Impact Assessment / Vibration Study		✓
✓	✓	✓	✓	Site Plans	As per Aggregate Resources Act (ARA) standards (including Existing Features, Proposed Operations, Progressive Rehabilitation, Final Rehabilitation, Cross-Sections). Landscape Plans, including fencing and screening.	
✓	✓		✓	Visual Impact Study		
✓	✓	✓	✓	Environmental Impact Study / Natural Heritage Evaluation	Will be combined with Natural Environment Level 1 and Level 2 Studies required as part of the ARA process. Include copy of Draft Natural Channel Design Report	✓

✓	✓			Hydrogeological / Hydrological / Water Resources Study / *Stormwater Management Report	Hydrogeological components of the study will include geotechnical considerations Includes an analysis of the ability of the site to support private services and a plan illustrating the location of services *See notes attached Includes on-site sedimentation and erosion control plans; drainage and grading plans	✓
✓	✓			Archaeological Assessment		
✓	✓			Cultural Heritage Assessment	Built Resources and Cultural Heritage Resources	✓
✓	✓			Agricultural Impact Assessment		
✓	✓			Transportation Impact Study / Transportation / Haul Route Study		
✓	✓		✓	Financial Impact Assessment / Economic Benefits		✓
Other Information						
✓	✓	✓		Completed Application Forms		
✓			✓	Draft Regional Official Plan Amendment		
	✓			Draft Local Official Plan Amendment		
	✓			Draft Zoning By-Law Amendment		
✓	✓		✓	Public Consultation Plan	Will include an overview of the work completed to date	
✓	✓			Summary of Well Records	Including information related to the decommissioning of on-site wells	
✓	✓	✓		Required Fees		
✓	✓			Cost Acknowledgement Agreement	Separate Cost Acknowledgment Agreements with the Region and City	

Please note that some of the above mentioned studies/required information may be combined. If the required information/study as listed above is not found in a standalone report, the applicant will be required to indicate in a covering letter to the application where the information/study can be found within the application package. In addition, if a report contains information/studies on multiple topics from the table above, the qualified person writing each section shall be clearly identified within the report and this portion of the report shall be signed and dated by the qualified professional.

* In accordance with the Memorandum of Understanding and Regional Fee By-Law, the Joint Agency Review Team will retain third party consultants to peer review certain technical studies and to provide advice and recommendations on specific topics. Please note that the “Peer Review” column above is provided for information only at this time and represents a preliminary prediction of which studies will be peer reviewed.

Schedule 'C' - Other Preliminary Comments

Based on information received to date, the following preliminary comments are provided. These comments are not intended to be comprehensive and are provided to assist the applicant in preparing the application and technical reports.

City of Niagara Falls

Planning

- Site plans should note building sizes and setbacks and dimensions of parking and aisles that are provided. In addition any proposed fencing should be noted.
- Well survey – Wells within 300m of the site should be surveyed.
- Agricultural study should look at the capability and soils of the affected agricultural areas.

Niagara Region

Stormwater Management
The Niagara Region expects the following with respect to on-site stormwater management:

- Water quality control: Normal level of protection (the receiving waterbody is a Type 2 fish habitat)
- Water quantity control: attenuate post-development flows to pre-development flow levels for all storm events (2- to 100-year) due to the development size and potential flooding impacts to Thorold Townline Road. To address the MECP's minimum erosion control requirement, i.e. detain runoff from a 25 mm rainfall-runoff for at least 24 hours.
- Preparation of Operation/Inspection/Maintenance Manual of the SWM facilities and the emergency (spill) management plan. Routine monitoring and records of outflow quality would be required.
- The on-site sedimentation and erosion control plan shall be provided.
- A SWM report which outlines the overall SWM plan for the entire development and the detailed plan/measures for each individual phase indicating how the above requirements will be achieved.

The Region notes that the above noted SWM comments may be addressed through Hydrogeological, Hydrological and/or Water Resource studies and reports.

City of Thorold

- MHBC's Figure 1 – Location Map identifies a small portion of lands on the west side of Thorold Townline Road as "Buffer" lands. Please note that Schedule A-3 of the City's Official Plan identifies a significant portion of lands west of Thorold Townline Road as an Aggregate Impact Area. The lands are designated for various uses including residential, employment – light industrial, employment – prestige industrial and environmental protection two. Policies for the Aggregate Impact Area are included in Policy B1.8.12.3 of the City's Official Plan.
- Policy B1.8.12.3 of the City of Thorold Official Plan identifies Thorold Townline Road as the aggregate haul route (option 1 on the proposed haul route options map prepared by TMIG Ltd.). The haul route identified as option 2 is not identified in the City's Official Plan.

Schedule 'D' - Terms of Reference Comments

To date, Terms of References for the following studies have been submitted to the Region, City and NPCA for review:

- Transportation Impact Study
- Natural Environmental Level I/II Study
- Economic Impact Assessment

The following comments are provided to support the applicant in completing/finalizing the studies.

Natural Heritage Evaluation

Natural Environment Level I/II Study (Existing Conditions and Impact Assessment) Terms of Reference (TOR) for the property located at Upper's Lane in the City of Niagara Falls, prepared by Stantec Consulting Ltd., dated July 15, 2019 - Overall, staff are satisfied that the studies/surveys proposed (some of which have already been completed) adequately address the natural heritage features present on the subject property.

Staff would like to clarify that the ELC Assessment proposed by Stantec Consulting Inc. is expected to include a 3-season vegetation inventory and soil assessment/classification. All ELC data sheets should be included with the Environmental Impact Study (EIS) submission. In addition, the TOR identifies that the ELC Assessment will include "confirmation of previous data". Environmental Planning staff caution that natural heritage data (i.e. vegetation inventories, ELC polygon delineations etc.) generally have a shelf life of approximately 5 years. If "previous data" includes information that is more than 5 years old, please contact Regional Environmental Planning staff to discuss.

Further, please note that the most Recent Regional EIS Guidelines are dated 2018 - the TOR identifies our 2012 EIS Guidelines. The updates contained in the 2018 version are predominately administrative in nature and are available on the Region's website.

Transportation Impact Study

- The TIS shall be undertaken in accordance with Niagara Region's *Guidelines for Transportation Impact Studies*, 2012 which stipulates:
    - Planning horizons shall include the base year (2019), short-term horizon (2024), and long-term horizon (2029);
    - A 2% compound annual growth rate shall be used to forecast future background traffic volumes in addition to incorporating traffic generated by adjacent developments currently not captured within the existing background traffic volumes;
    - The traffic analyses shall be undertaken using ideal saturation flow rates of 1,750 vehicles per hour per lane, total lost times of 4 seconds for any signalized intersections, and peak hour factors of 0.92 for all movements;

- 8-hour turning movement counts shall be collected with 7:00 a.m. to 9:00 a.m., 11:00 a.m. to 2:00 p.m., and 3:00 p.m. to 6:00 p.m. as the collection periods on a typical weekday including automobiles, heavy vehicles, and cyclists;
- Traffic volume balancing shall only be undertaken if the variance between the counts is minimal and no significant traffic generators/attractors are situated between the count locations;
- Given the geometry of several of the roadways and intersections and the acceleration characteristics of typical vehicles travelling to and from quarries, sight lines shall be reviewed at each intersection under Niagara Region's jurisdiction;
- The analysis shall include the proposed accesses to the site for operations including the need for geometric improvements, left-turn lanes, and intersection control;
- Any geometric improvements recommended shall be accompanied by a functional plan demonstrating the feasibility of implementing such a recommendation;
- Any operational improvements shall be supported by justification analyses such as, but not limited to: left-turn lane warrants, traffic control signal warrants, roundabout feasibility reviews, and demonstrated operational and/or safety benefits;
- Based on the study intersections, the Ministry of Transportation Ontario (MTO) will be a review and commenting agency on the TIS and will also have their own requirements to be placed on the TIS; and
- One of the haul routes identified falls within the City of Thorold's jurisdiction and consideration should be given for providing the opportunity to review and comment on the TIS for representatives from the City of Thorold.

Economic Impact Assessment

- It is requested that the Economic Impact Assessment includes financial and economic benefits for the City of Thorold as well as the City of Niagara Falls and the Region.

Schedule ‘E’ - Pre-consultation Meeting Attendees

Name	Organization	Email Address
Debra Walker	MHBC Planning	dwalker@mhbcplan.com
Brian Zeman	MHBC Planning	bzeman@mhbcplan.com
Kevin Kehl	Walker Industries	kkehl@walkerind.com
Erik Acs	Region of Niagara	Erik.Acs@niagararegion.ca
Sean Norman	Region of Niagara	Sean.Norman@niagararegion.ca
Pat Busnello	Region of Niagara	Pat.Busnello@niagararegion.ca
Adam Boudens	Region of Niagara	Adam.Boudens@niagararegion.ca
Cara Lampman	NPCA	clampman@npca.ca
Denise Landry	City of Thorold	Denise.Landry@thorold.ca
Andrew Bryce	City Planning and Development	abryce@niagarafalls.ca
John Grubich	City Transportation Services	jgrubich@niagarafalls.ca
Jeff Claydon	City Parks Design	jclaydon@niagarafalls.ca
Tammy Agnoletto	City Building Services	tagnoletto@niagarafalls.ca
Josiah Jordan	City Municipal Works	jjordan@niagarafalls.ca

Ministry of
Municipal Affairs
and Housing

Office of the Minister

777 Bay Street, 17th Floor
Toronto ON M7A 2J3
Tel.: 416 585-7000

Ministère des
Affaires municipales
et du Logement

Bureau du ministre

777, rue Bay, 17e étage
Toronto ON M7A 2J3
Tél. : 416 585-7000

Ontario

234-2020-5382

January 18, 2021

Ken Lucyshyn
Executive Vice President, Aggregates & Construction
Walker Industries Holdings Limited
klucyshyn@walkerind.com

Dear Ken Lucyshyn:

Thank you for your correspondence expressing your concerns about the Walker Quarry site within Niagara Region and the recent amendments to the aggregate resources policies in **A Place to Grow: Growth Plan for the Greater Golden Horseshoe** (Growth Plan).

Our government understands the important role that the aggregates industry plays in supporting job creation and economic health across Ontario. As you may know, the Ministry of Natural Resources and Forestry has recently brought forward regulatory amendments under the *Aggregate Resources Act* which will help streamline processes for businesses in the aggregate industry. The changes will ensure unnecessary administrative requirements are reduced and create opportunities for growth, while maintaining a steadfast commitment to protecting the environment and managing impacts to communities.

In response to your inquiry about your property located between Thorold Townline Road and Beechwood Road, south of Beaverdams Road in City of Niagara Falls, we have reviewed our provincial Natural Heritage System (NHS) mapping and can confirm that your lands are not included in this mapping. As such, once adopted by Niagara Region, the provincial policies for the NHS in the Growth Plan will not apply to your lands.

It should be noted that the NHS is intended to protect the region's natural heritage and biodiversity. Based on provincial mapping criteria, the lands on Upper's Lane were not and were never intended to be included in the NHS. I hope this helps to alleviate any concerns you may have had and allows you to proceed with your application process.

We recommend continuing to work with the City of Niagara Falls and Niagara Region as they complete their official plan review.

…/2

The Ministry of Municipal Affairs and Housing, along with our colleague ministries, remains committed to supporting the mineral aggregate industry and we look forward to future discussions.

Sincerely,

Steve Clark
Minister

c. Cordelia Clarke Julien, ADM Ontario Growth Secretariat
Ministry of Municipal Affairs and Housing

John Matheson
Strategy Corp
aosindero@strategycorp.com

Doug Giles
Acting Commissioner
Planning and Development Services
Niagara Region
1815 Sir Isaac Brock Way
Thorold ON L2V 4T7

APPENDIX D
Species Lists

LATIN NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS	LOCAL STATUS NIAG
PTERIDOPHYTES		**FERNS & ALLIES**								
Equisetaceae		**Horsetail Family**								
Equisetum	*arvense*	Field Horsetail	0	0		S5			G5	X
GYMNOSPERMS		**CONIFERS**								
Thuja	*occidentalis*	Eastern White Cedar	4	-3		S5			G5	X
Pinaceae		**Pine Family**								
Picea	*abies*	Norway Spruce		5	-1	SE3			G?	I
Picea	*pungens*	Colorado Spruce				SE1			G5	
Pinus	*nigra*	Austrian Pine		-5	-1	SE2			G?	
Pinus	*strobus*	Eastern White Pine	4	3		S5			G5	X
DICOTYLEDONS		**DICOTS**								
Amaranthaceae		**Amaranth Family**								
Amaranthus	*retroflexus*	Green Amaranth		2	-1	SE5			G?	I
Chenopodium	*album* var. *album*	Lamb's Quarters		1	-1	SE5			G5T5	I
Chenopodium	*glaucum* ssp. *glaucum*	Oak-leaved Goosefoot		-3	-1	SE5			G5T?	I
Anacardiaceae		**Sumac or Cashew Family**								
Rhus	*typhina*	Staghorn Sumac	1	5		S5			G5	X
Toxicodendron	*radicans var. radicans*	Eastern Poison-ivy	5	-1		S5			G5T	X
Toxicodendron	*radicans var. rydbergii*	Western Poison-ivy	0	0		S5			G5T	X
Apiaceae		**Carrot or Parsley Family**								
Cicuta	*maculata*	Spotted Water-hemlock	6	-5		S5			G5	X
Daucus	*carota*	Wild Carrot		5	-2	SE5			G?	I
Apocynaceae		**Dogbane Family**								
Apocynum	*cannabinum* var. *cannabinum*	Indian Hemp		1		S5			G5T	X
Asclepias	*incarnata* ssp. *incarnata*	Swamp Milkweed	6	-5		S5			G5T5	X
Asclepias	*syriaca*	Common Milkweed	0	5		S5			G5	X
Asteraceae		**Composite or Aster Family**								
Achillea	*millefolium*	Common Yarrow		3	-1	SE?			G5T?	I
Ambrosia	*artemisiifolia*	Common Ragweed	0	3		S5			G5	X
Ambrosia	*trifida*	Giant Ragweed	0	-1		S5			G5	X
Bidens	*vulgata*	Tall Beggar-ticks	5	-3		S5			G5	X
Carduus	*nutans* ssp. *nutans*	Musk Thistle		5	-1	SE?			G?T?	I
Centaurea	*sp.*	Knapweed		5	-1	SE5			G?	I
Cichorium	*intybus*	Chicory		5	-1	SE5			G?	I
Cirsium	*arvense*	Canada Thistle		3	-1	SE5			G?	I
Erigeron	*canadensis*	Horseweed	0	1		S5			G5	X
Erigeron	*annuus*	Annual Fleabane	0	1		S5			G5	
Erigeron	*strigosus*	Daisy Fleabane	0	1		S5			G5	R
Eupatorium	*perfoliatum*	Perfoliate Thoroughwort	2	-4		S5			G5	X

LATIN NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS	LOCAL STATUS NIAG
Euthamia	*graminifolia*	Flat-topped Bushy Goldenrod	2	-2		S5			G5	X
Inula	*helenium*	Elecampane		5	-2	SE5			G?	I
Lactuca	*serriola*	Prickly Lettuce		0	-1	SE5			G?	I
Leucanthemum	*vulgare*	Ox-eye Daisy		5	-1	SE5			G?	I
Solidago	*altissima ssp. altissima*	Tall Goldenrod	1	3		S5				X
Solidago	*juncea*	Early Goldenrod	3	5		S5			G5	X
Sonchus	*arvensis* ssp. *arvensis*	Field Sow-thistle				SE5			G?T?	I
Sonchus	*asper* ssp. *asper*	Spiny-leaved Sow-thistle		0	-1	SE5			G?T?	I
Symphyotrichum	*lanceolatum ssp. lanceolatum*	White Panicled Aster	3	-3		S5			G5T5	
Symphyotrichum	*lateriflorum var. lateriflorum*	Calico Aster	3	-2		S5			G5T5	X
Symphyotrichum	*novae-angliae*	New England Aster	2	-3		S5			G5	X
Symphyotrichum	*pilosum* var. *pilosum*	Hairy Aster	4	2		S5			G5T5	X
Taraxacum	*officinale*	Common Dandelion		3	-2	SE5			G5	I
Tragopogon	*dubius*	Doubtful Goat's-beard		5	-1	SE5			G?	I
Xanthium	*strumarium*	Tumor-curing Cocklebur	2	0		S5			G?	X
Balsaminaceae		**Touch-me-not Family**								
Impatiens	*capensis*	Spotted Touch-me-not	4	-3		S5			G5	X
Betulaceae		**Birch Family**								
Carpinus	*caroliniana* ssp. *virginiana*	Blue Beech	6	0		S5			G5T	X
Ostrya	*virginiana*	Hop Hornbeam	4	4		S5			G5	X
Boraginaceae		**Borage Family**								
Myosotis	*laxa*	Smaller Forget-me-not	6	-5		S5			G5	X
Brassicaceae		**Mustard Family**								
Alliaria	*petiolata*	Garlic Mustard		0	-3	SE5			G5	I
Caprifoliaceae		**Honeysuckle Family**								
Lonicera	*dioica*	Glaucous Honeysuckle	5	3		S5			G5	X
Celastraceae		**Staff-tree Family**								
Euonymus	*obovata*	Running Strawberry-bush	6	5		S5			G5	X
Convolvulaceae		**Morning-glory Family**								
Calystegia	*sepium* ssp. *angulatum*	Hedge Bindweed				SU			G4G5T?	
Cornaceae		**Dogwood Family**								
Cornus	*racemosa*	Gray Dogwood	2	-2		S5			G5?	X
Cornus	*stolonifera*	Red-osier Dogwood	2	-3		S5			G5	X
Dipsacaceae		**Teasel Family**								
Dipsacus	*fullonum* ssp. *sylvestris*	Wild Teasel		5	-1	SE5			G?T?	I
Euphorbiaceae		**Spurge Family**								
Acalypha	*virginica* var. *rhomboidea*	Three-seeded Mercury	0	3		S5			G5T5	X
Fabaceae		**Pea Family**								
Gleditsia	*triacanthos*	Honey Locust	3	0		S2			G5	R
Lotus	*corniculatus*	Bird's-foot Trefoil		1	-2	SE5			G?	I
Medicago	*lupulina*	Black Medick		1	-1	SE5			G?	I

LATIN NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS	LOCAL STATUS NIAG
Melilotus	*alba*	White Sweet-clover		3	-3	SE5			G?	I
Melilotus	*officinalis*	Yellow Sweet-clover		3	-1	SE5			G?	I
Robinia	*pseudo-acacia*	Black Locust		4	-3	SE5			G5	I
Trifolium	*hybridum* ssp. *elegans*	Alsike Clover		1	-1	SE5				I
Trifolium	*repens*	White Clover		2	-1	SE5			G?	I
Vicia	*cracca*	Tufted Vetch		5	-1	SE5			G?	I
Fagaceae		**Beech Family**								
Fagus	*grandifolia*	American Beech	6	3		S5			G5	X
Quercus	*palustris*	Pin Oak	9	-3		S4			G5	X
Quercus	*rubra*	Red Oak	6	3		S5			G5	X
Geraniaceae		**Geranium Family**								
Geranium	*robertianum*	Herb-robert		5	-2	SE5			G5	I
Guttiferae		**St. John's-wort Family**								
Hypericum	*perforatum*	Common St. John's-wort		5	-3	SE5			G?	I
Juglandaceae		**Walnut Family**								
Carya	*ovata* var. *ovata*	Shagbark Hickory	6	3		S5			G5	X
Lamiaceae		**Mint Family**								
Glechoma	*hederacea*	Creeping Charlie		5	-2	SE5			G?	I
Hedeoma	*pulegioides*	American Pennyroyal	6	5		S4			G5	X
Lycopus	*americanus*	Cut-leaved Water-horehound	4	-5		S5			G5	X
Lycopus	*americanus*	Cut-leaved Water-horehound	4	-5		S5			G5	X
Mentha	*arvensis* ssp. *borealis*	American Wild Mint	3	-3		S5				X
Nepeta	*cataria*	Catnip		1	-2	SE5			G?	I
Prunella	*vulgaris* ssp. *lanceolata*	Heal-all	5	5		S5			G5T?	X
Lythraceae		**Loosestrife Family**								
Lythrum	*salicaria*	Purple Loosestrife		-5	-3	SE5			G5	X
Malvaceae		**Mallow Family**								
Abutilon	*theophrasti*	Velvet-leaf		4	-1	SE5			G?	I
Oleaceae		**Olive Family**								
Fraxinus	*americana*	White Ash	4	3		S5			G5	X
Fraxinus	*pennsylvanica*	Red Ash	3	-3		S5			G5	X
Ligustrum	*vulgare*	Common Privet		1	-2	SE5			G?	I
Syringa	*vulgaris*	Common Lilac		5	-2	SE5			G?	I
Onagraceae		**Evening-primrose Family**								
Circaea	*lutetiana* ssp. *canadensis*	Yellowish Enchanter's Nightshade	3	3		S5			G5T5	X
Epilobium	*coloratum*	Purple-veined Willow-herb	3	-5		S5			G5	X
Oenothera	*biennis*	Common Evening-primrose	0	3		S5			G5	X
Oxalidaceae		**Wood Sorrel Family**								
Oxalis	*stricta*	Upright Yellow Wood-sorrel	0	3		S5			G5	
Plantaginaceae		**Plantain Family**								
Plantago	*lanceolata*	Ribgrass		0	-1	SE5			G5	I

LATIN NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS	LOCAL STATUS NIAG
Plantago	*major*	Common Plantain		-1	-1	SE5			G5	I
Polygonaceae		**Smartweed Family**								
Persicaria	*pensylvanica*	Pennsylvania Smartweed	3	-4		S5			G5	X
Persicaria	*virginiana*	Virginia Knotweed	6	0		S4			G5	X
Polygonum	*aviculare ssp. aviculare*	Prostrate Knotweed		1	-1	SE5			GNR	X
Rumex	*crispus*	Curly-leaf Dock		-1	-2	SE5			G?	I
Ranunculaceae		**Buttercup Family**								
Ranunculus	*sceleratus* var. *sceleratus*	Cursed Buttercup	2	-5		S5			G5T5	X
Rhamnaceae		**Buckthorn Family**								
Rhamnus	*cathartica*	Common Buckthorn		3	-3	SE5			G?	I
Rhamnus	*frangula*	Glossy Buckthorn		-1	-3	SE5			G?	I
Rosaceae		**Rose Family**								
Agrimonia	*gryposepala*	Tall Hairy Agrimony	2	2		S5			G5	X
Crataegus	*species*	Hawthorn species								
Crataegus	*macrosperma*	Variable Thorn	4	5		S5			G5	X
Fragaria	*virginiana* ssp. *virginiana*	Scarlet Strawberry	2	1		SU			G5T?	X
Geum	*canadense*	White Avens	3	0		S5			G5	X
Geum	*laciniatum*	Rough Avens		-3		S4			G5	X
Malus	*pumila*	Common Crabapple		5	-1	SE5			G5	I
Potentilla	*norvegica*	Rough Cinquefoil	0	0		SU			G5T?	
Potentilla	*recta*	Rough-fruited Cinquefoil		5	-2	SE5			G?	I
Potentilla	*simplex*	Old-field Cinquefoil	3	4		S5			G5	X
Prunus	*avium*	Sweet Cherry		5	-2	SE4			G?	I
Prunus	*serotina*	Black Cherry	3	3		S5			G5	X
Pyrus	*communis*	Common Pear		5	-1	SE4			G5	I
Rosa	*multiflora*	Multiflora Rose		3	-3	SE4			G?	I
Rosa	*palustris*	Marsh Rose	7	-5		S5			G5	X
Rubus	*allegheniensis*	Alleghany Blackberry	2	2		S5			G5	X
Rubus	*idaeus* ssp. *idaeus*	Red Raspberry				SE1			G5T5	X
Galium	*aparine*	Cleavers	4	3		S5			G5	X
Salicaceae		**Willow Family**								
Populus	*deltoides* ssp. *deltoides*	Eastern Cottonwood	4	-1		SU			G5T5	X
Salix	*bebbiana*	Long-beaked Willow	4	-4		S5			G5	X
Salix	*nigra*	Black Willow	6	-5		S4?			G5	X
Sapindaceae		**Maple Family**								
Acer	*negundo*	Manitoba Maple	0	-2		S5			G5	X
Acer	*platanoides*	Norway Maple		5	-3	SE5			G?	I
Acer	*saccharum*	Sugar Maple	4	3		S5			G5T?	X
Acer X	*freemanii*	Freeman's Maple								X
Penthorum	*sedoides*	Ditch Stonecrop	4	-5		S5			G5	X
Scrophulariaceae		**Figwort Family**								

Stantec

LATIN NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS	LOCAL STATUS NIAG
Linaria	*vulgaris*	Butter-and-eggs		5	-1	SE5			G?	I
Penstemon	*digitalis*	Foxglove Beard-tongue	6	1		S4S5			G5	U
Penstemon	*hirsutus*	Hairy Beard-tongue	7	5		S4			G4	X
Verbascum	*thapsus*	Common Mullein		5	-2	SE5			G?	I
Veronica	*officinalis*	Common Speedwell		5	-2	SE5			G5	I
Veronica	*serpyllifolia* ssp. *serpyllifolia*	Thyme-leaved Speedwell				SE5			G?T?	I
Solanaceae		**Nightshade Family**								
Solanum	*dulcamara*	Bitter Nightshade		0	-2	SE5			G?	I
Tiliaceae		**Linden Family**								
Tilia	*americana*	American Basswood	4	3		S5			G5	X
Ulmaceae		**Elm Family**								
Ulmus	*americana*	White Elm	3	-2		S5			G5?	X
Verbenaceae		**Vervain Family**								
Verbena	*hastata*	Blue Vervain	4	-4		S5			G5	X
Vitaceae		**Grape Family**								
Parthenocissus	*inserta*	Inserted Virginia-creeper	3	3		S5			G5	X
Vitis	*riparia*	Riverbank Grape	0	-2		S5			G5	X
MONOCOTYLEDONS		**MONOCOTS**								
Alismataceae		**Water-plantain Family**								
Alisma	*plantago-aquatica*	Common Water-plantain	3	-5		S5			G5	X
Cyperaceae		**Sedge Family**								
Carex	*species*	Sedge species								
Carex	*crinita*	Fringed Sedge	6	-4		S5			G5	X
Carex	*cristatella*	Crested Sedge	3	-4		S5			G5	X
Carex	*laxiflora*	Loose-flowered Sedge	5	0		S5			G5	X
Carex	*lupulina*	Hop Sedge	6	-5		S5			G5	X
Carex	*pensylvanica*	Pennsylvania Sedge	5	5		S5			G5	X
Carex	*tribuloides var. tribuloides*	Blunt Broom Sedge	5	-4		S4S5			G5	X
Carex	*vulpinoidea*	Fox Sedge	3	-5		S5			G5	X
Cyperus	*strigosus*	Straw-colored Umbrella Sedge	5	-3		S5			G5	X
Schoenoplectus	*pungens var. pungens*	Common Three-square	6	-5		S5			G5	R
Schoenoplectus	*tabernaemontani*	Soft-stemmed Bulrush	5	-5		S5			G5	X
Scirpus	*atrovirens*	Dark-green Bulrush	3	-5		S5			G5?	X
Iridaceae		**Iris Family**								
Iris	*versicolor*	Multi-coloured Blue-flag	5	-5		S5			G5	X
Sisyrinchium	*angustifolium*	Pointed Blue-eyed-grass	6	-2		S4			G4?	X
Juncaceae		**Rush Family**								
Juncus	*effusus* ssp. *solutus*	Soft Rush	4	-5		S5			G5T?	X
Lemnaceae		**Duckweed Family**								
Lemna	*minor*	Lesser Duckweed	2	-5		S5			G5	X
Liliaceae		**Lily Family**								

LATIN NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS	LOCAL STATUS NIAG
Asparagus	*officinalis*	Garden Asparagus		3	-1	SE5			G5?	I
Hemerocallis	*fulva*	Orange Day-lily		5	-3	SE5			G?	I
Poaceae		**Grass Family**								
Agrostis	*gigantea*	Red-top		0	-2	SE5			G4G5	I
Agrostis	*stolonifera*	Redtop		-3		S5			G5	X
Bromus	*inermis* ssp. *inermis*	Awnless Brome		5	-3	SE5			G4G5T?	I
Bromus	*secalinus*	Cheat Chess		5	-1	SE4				I
Dactylis	*glomerata*	Orchard Grass		3	-1	SE5			G?	I
Elymus	*repens*	Quack Grass		3	-3	SE5			GNR	I
Elymus	*virginicus* var. *virginicus*	Virginia Wild Rye	5	-2		S5			G5T5	X
Glyceria	*striata*	Fowl Meadow Grass	3	-5		S4S5			G5T5	X
Leersia	*oryzoides*	Rice Cut Grass	3	-5		S5			G5	X
Panicum	*capillare ssp. capillare*	Witch Grass	0	0		S5			G5	X
Panicum	*dichotomiflorum*	Fall Panicum		-2	-1	SE5			G5	X
Phalaris	*arundinacea*	Reed Canary Grass	0	-4		S5			G5	X
Phleum	*pratense ssp. pratense*	Timothy		3	-1	SE5			G?	I
Phragmites	*australis ssp. australis*	European Reed				SNR			GNR	
Poa	*compressa*	Canada Blue Grass		2		SE			GNR	I
Poa	*palustris*	Fowl Meadow Grass	5	-4		S5			G5	X
Poa	*pratensis* ssp. *pratensis*	Kentucky Bluegrass	0	1		S5			G5T5	X
Schedonorus	*pratensis*	Meadow Fescue		4	-1	SE5			G5	I
Setaria	*faberi*	Giant Foxtail		2	-1	SE4			G?	
Setaria	*faberi*	Giant Foxtail		2	-1	SE4			G?	
Setaria	*pumila ssp. pumila*	Yellow Foxtail		0	-1	SE5			G?	I
Typhaceae		**Cattail Family**								
Typha	*angustifolia*	Narrow-leaved Cattail	3	-5		S5			G5	X
Typha	*latifolia*	Broad-leaved Cattail	3	-5		S5			G5	X
Typha X	*glauca*	Glaucous Cattail	3	-5		S5			HYB	X

FLORISTIC SUMMARY & ASSESSMENT			
Species Diversity			
Total Species:		**175**	
Native Species:		**105**	60%
Exotic Species		**70**	40%
Regionally Significant Species		4	
Locally Significant Species			
S1-S3 Species		1	1%
S4 Species		10	10%
S5 Species		90	89%
Co-efficient of Conservatism and Floristic Quality Index			
Co-efficient of Conservatism (CC) (average)		**3.8**	
CC 0 to 3	*lowest sensitivity*	53	52%
CC 4 to 6	*moderate sensitivity*	45	45%
CC 7 to 8	*high sensitivity*	2	2%
CC 9 to 10	*highest sensitivity*	1	1%
Floristic Quality Index (FQI)		**38**	
Presence of Weedy & Invasive Species			
mean weediness		**-1.8**	
weediness = -1	*low potential invasiveness*	36	56%
weediness = -2	*moderate potential invasiveness*	16	25%
weediness = -3	*high potential invasiveness*	12	19%
Presence of Wetland Species			
average wetness value		**1.8**	
upland		34	20%
facultative upland		41	24%
facultative		37	22%
facultative wetland		31	18%
obligate wetland		26	15%

COMMON NAME	SCIENTIFIC NAME	ONTARIO STATUS	GLOBAL STATUS	SARO	SARA	AREA SENSITIVITY (ha)
ODONATA						
Common Speadwing	*Lestes disjunctus*	S5	G5			
Slender Spreadwing	*Lestes rectangularis*	S5	G5			
Familiar Bluet	*Enallagma civile*	S5	G5			
Eastern Forktail	*Ischnura verticalis*	S5	G5			
Lance-Tipped Darner	*Aeshna constricta*	S5	G5			
Common Green Darner	*Anax junius*	S5	G5			
Common Baskettail	*Epitheca cynosura*	S5	G5			
Eastern Pondhawk	*Erythemis simplicicollis*	S5	G5			
Dot-tailed Whiteface	*Leucorrhinia intacta*	S5	G5			
Widow Skimmer	*Libellula luctuosa*	S5	G5			
Twelve-Spotted Skimmer	*Libellula pulchella*	S5	G5			
Blue Dasher	*Pachydiplax longipennis*	S5	G5			
Wandering Glider	*Pantala flavescens*	S4	G5			
Common Whitetail	*Plathemis lydia*	S5	G5			
White-faced Meadowhawk	*Sympetrum obtrusum*	S5	G5			
Black Saddlebags	*Tramea lacerata*	S4	G5			
BUTTERFLIES						
Silver Spotted Skipper	*Epargyreus clarus*	S4	G5			
Wild Indigo Duskywing	*Erynnis baptisiae*	S4	G5			
Least Skipper	*Ancyloxypha numitor*	S5	G5			
European Skipper	*Thymelicus lineola*	SNA	G5			
Delaware Skipper	*Anatrytone logan*	S4	G5			
Dun Skipper	*Euphyes vestris*	S5	G5			
Black Swallowtail	*Papilio polyxenes*	S5	G5			
Giant Swallowtail	*Papilio cresphontes*	S3	G5			
Eastern Tiger Swallowtail	*Papilio glaucus*	S5	G5			
Cabbage White	*Pieris rapae*	SNA	G5			
Clouded Sulphur	*Colias philodice*	S5	G5			
Orange Sulphur	*Colias eurytheme*	S5	G5			
Bronze Copper	*Lycaena hyllus*	S5	G5			
Eastern Tailed Blue	*Everes comyntas*	S5	G5			

COMMON NAME	***SCIENTIFIC NAME***	**ONTARIO STATUS**	**GLOBAL STATUS**	**SARO**	**SARA**	**AREA SENSITIVITY (ha)**
Spring Azure	*Celastrina ladon*	S5	G5			
Eastern Comma	*Polygonia comma*	S5	G5			
Mourning Cloak	*Nymphalis antiopa*	S5	G5			
American Painted Lady	*Vanessa virginiensis*	S5	G5			
Red Admiral	*Vanessa atalanta*	S5	G5			
Red-spotted Purple	*Limenitis arthemis astyanax*	S5	G5T5			
Viceroy	*Limenitis archippus*	S5	G5			
Northern Pearly Eye	*Enodia anthedon*	S5	G5			
Common Ringlet	*Coenonympha tullia*	S5	G5			
Monarch	*Danaus plexippus*	S4B, S2N	G5	SC	SC	
AMPHIBIANS						
American Toad	*Anaxyrus americanus*	S5	G5			
Northern Green Frog	*Lithobates clamitans*	S5	G5			
Wood Frog	*Lithobates sylvatica*	S5	G5			
Northern Leopard Frog	*Lithobates pipiens*	S5	G5	NAR	NAR	
REPTILES						
Eastern Gartersnake	*Thamnophis sirtalis*	S5	G5			
BIRDS						
Canada Goose	*Branta canadensis*	S5	G5			
Mourning Dove	*Zenaida macroura*	S5	G5			
Killdeer	*Charadrius vociferus*	S5B, S5N	G5			
Upland Sandpiper	*Bartramia longicauda*	S4B	G5			25
Ring-billed Gull	*Larus delawarensis*	S5B,S4N	G5			
Herring Gull	*Larus argentatus*	S5B,S5N	G5			
Double-crested Cormorant	*Phalacrocorax auritus*	S5B	G5	NAR	NAR	20
Great Blue Heron	*Ardea herodias*	S5	G5			
Turkey Vulture	*Cathartes aura*	S5B	G5			
Red-tailed Hawk	*Buteo jamaicensis*	S5	G5	NAR	NAR	
Downy Woodpecker	*Dryobates pubescens*	S5	G5			
Northern Flicker	*Colaptes auratus*	S4B	G5			
Eastern Wood-Pewee	*Contopus virens*	S4B	G5	SC	SC	

COMMON NAME	SCIENTIFIC NAME	ONTARIO STATUS	GLOBAL STATUS	SARO	SARA	AREA SENSITIVITY (ha)
Willow Flycatcher	*Empidonax traillii*	S5B	G5			
Eastern Phoebe	*Sayornis phoebe*	S5B	G5			
Eastern Kingbird	*Tyrannus tyrannus*	S4B	G5			
Warbling Vireo	*Vireo gilvus*	S5B	G5			
Blue Jay	*Cyanocitta cristata*	S5	G5			
American Crow	*Corvus brachyrhynchos*	S5B	G5			
Horned Lark	*Eremophila alpestris*	S5B	G5			
Purple Martin	*Progne subis*	S4B	G5			
Tree Swallow	*Tachycineta bicolor*	S4B	G5			
Barn Swallow	*Hirundo rustica*	S4B	G5	THR	THR	
Black-capped Chickadee	*Poecile atricapillus*	S5	G5			
American Robin	*Turdus migratorius*	S5B	G5			
Gray Catbird	*Dumetella carolinensis*	S4B	G5			
Northern Mockingbird	*Mimus polyglottos*	S4	G5			
European Starling	*Sturnus vulgaris*	SNA	G5			
Cedar Waxwing	*Bombycilla cedrorum*	S5B	G5			
House Sparrow	*Passer domesticus*	SNA	G5			
House Finch	*Haemorhous mexicanus*	SNA	G5			
American Goldfinch	*Spinus tristis*	S5B	G5			
Chipping Sparrow	*Spizella passerina*	S5B	G5			
Vesper Sparrow	*Pooecetes gramineus*	S4B	G5			
Savannah Sparrow	*Passerculus sandwichensis*	S4B	G5			
Song Sparrow	*Melospiza melodia*	S5B	G5			
Swamp Sparrow	*Melospiza georgiana*	S5B	G5			
Bobolink	*Dolichonyx oryzivorus*	S4B	G5	THR	THR	10
Eastern Meadowlark	*Sturnella magna*	S4B	G5	THR	THR	
Baltimore Oriole	*Icterus galbula*	S4B	G5			
Red-winged Blackbird	*Agelaius phoeniceus*	S4	G5			
Brown-headed Cowbird	*Molothrus ater*	S4B	G5			
Common Grackle	*Quiscalus quiscula*	S5B	G5			
Common Yellowthroat	*Geothlypis trichas*	S5B	G5			
Yellow Warbler	*Setophaga petechia*	S5B	G5			

COMMON NAME	***SCIENTIFIC NAME***	**ONTARIO STATUS**	**GLOBAL STATUS**	**SARO**	**SARA**	**AREA SENSITIVITY (ha)**
Northern Cardinal	*Cardinalis cardinalis*	S5	G5			
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S4B	G5			

SUMMARY

Total Odonata:	*16*
Total Butterflies:	*24*
Total Amphibians:	***4***
Total Reptiles:	*1*
Total Birds:	*47*
Total Mammals:	*0*

SIGNIFICANT SPECIES

Global:	*0*
National:	*5*
Provincial:	*5*

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

REGION: Rare in a Site Region

S1: Critically Imperiled—Critically imperiled in the province (often 5 or fewer occurrences)

S2: Imperiled—Imperiled in the province, very few populations (often 20 or fewer),

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

SX: Presumed extirpated

SH: Possibly Extirpated (Historical)

SNR: Unranked

SU: Unrankable—Currently unrankable due to lack of information

SNA: Not applicable—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

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

?: Indicates uncertainty in the assigned rank

G1: Extremely rare globally; usually fewer than 5 occurrences in the overall range

G1G2: Extremely rare to very rare globally

G2: Very rare globally; usually between 5-10 occurrences in the overall range

G2G3: Very rare to uncommon globally

G3: Rare to uncommon globally; usually between 20-100 occurrences

G3G4: Rare to common globally

G4: Common globally; usually more than 100 occurrences in the overall range

G4G5: Common to very common globally

G5: Very common globally; demonstrably secure

GU: Status uncertain, often because of low search effort or cryptic nature of the species; more data needed.

GNR: Unranked—Global rank not yet assessed.

T: Denotes that the rank applies to a subspecies or variety

Q: Denotes that the taxonomic status of the species, subspecies, or variety is questionable.

END: Endangered

THR: Threatened

SC: Special Concern

2, 3 or NS after a COSEWIC ranking indicates the species is either on Schedule 2, Schedule 3 or No Schedule of the Species At Risk Act (SARA)

NAR: Not At Risk

IND: Indeterminant, insufficient information to assign status

DD: Data Deficient

6: Rare in Site Region 6

7: Rare in Site Region 7

Area: Minimum patch size for area-sensitive species (ha)

H- highly significant in Hamilton Region (i.e. rare) m- moderately significant in Hamilton Region (i.e. uncommon)

L1- extremely rare locally (Toronto Region)

L2- very rare locally (Toronto Region)

L3- rare to uncommon locally (Toronto Region)

HR- rare in Halton Region, highly significant

HU- uncommon in Halton Region, moderately significant

* The Pileated Woodpecker will incorporate smaller woodlots into its homerange, therefore it may not be a true area-sensitive species (Naylor et al. 1996)

LATEST STATUS UPDATE

Odonata: Jan 2018

Butterflies: Jan 2018

Bumble Bees: June 2016

Other Arthropods: May 2018

Terrestrial Molluscs: May 2018

Amphibans: Jan 2018

Reptiles: Jan 2018

Birds: August 2018

Mammals: May 2018

S and G ranks and explanations: December 2011

NOTE

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

REFERENCES

COSSARO Status

Endangered Species Act, 2007 (Bill 184). Species at Risk in Ontario List.

COSEWIC Status

COSEWIC. 2007. Canadian Species at Risk. Committee on the Status of Endangered Wildlife in Canada.

Local Status

Dwyer, Jill K. 2003. Nature Counts Project Hamilton Natural Areas Inventory 2003. Species Checklists. Hamilton Naturalists Club.

Ontario Partners in Flight. 2006. Ontario Landbird Conservation Plan: Lower Great Lakes/St. Lawrence Plain (North American Bird Conservation Region 13), Priorities, Objectives and Recommended Actions. Environment Canada and Ontario Ministry of Natural Resources. Draft, February 2006.

Region of Waterloo. 1996. Regionally Significant Breeding Birds.

TRCA. 2003. Revised Fauna Scores and Ranks, February 2003. Toronto Region Conservation Authority.

Area-sensitive information

Austen, M.J.W., M.D. Cadman, and R.D. James. 1994. Ontario birds at risk: status and conservation needs. Toronto and Port Rowan, ON: Federation of Ontario Naturalists and Long Point Bird Observatory. 165 pp.

Dunn, Erica H. and David J. Agro. 1995. Black Tern (Chlidonias niger), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/147

Herkert, J.R. 1991. An ecological study of the breeding birds of grassland habitats within Illinois. Ph.D. dissertation. University of Illinois, Urbana, IL. 112 pp.

Hejl, S.J., J.A. Holmes, and D.E. Kroodsma. 2002. Winter Wren (Troglodtyes troglodytes). In Poole, A., and F. Gill, eds. The birds of North America, No. 623. Philadelphia, PA: The Birds of North America, Inc. 31 pp.

Naylor, B. J., J. A. Baker, D. M. Hogg, J. G. McNicol and W. R. Watt. 1996. Forest Management Guidelines for the Provision of Pileated Woodpecker Habitat. Ontario Ministry of Natural Resources, Forest Management Branch, Sault Ste. Marie, Ontario. 26 pp.

Page, A.M., and M.D. Cadman. 1994. Status report on the Acadian Flycatcher Empidonax virescens in Canada. Prepared for the Committee on the Status of Endangered Wildlife in Canada. 27 pp

Robbins, C.S. 1979. Effect of forest fragmentation on bird populations. Pp. 198-212 in DeGraaf, R.M., and K.E. Evans, eds. Management of northcentral and northeastern forests for nongame birds. United States Department of Agriculture, Forest Service General Technical Report NC-51. 268 pp.

Sandilands. A. 2005. Birds of Ontario. Habitat Requirements, Limiting Factors and Status. UBC Press.

APPENDIX E

Natural Channel Design

Proposed Upper's Quarry, Natural Channel Design Report

October 20, 2021

Prepared for:

Walker Aggregates
2800 Thorold Townline Road
Niagara Falls, ON L2E 6S4

Prepared by:

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo, N2L 0A4
Tel.: (519) 579-4410
Fax: (519) 579-6733

160961352

This document entitled Proposed Upper’s Quarry, Natural Channel Design Report is intended to be read in its entirety.

Prepared by ______________________________________
(signature)

Amber Garrett, P.Eng.
Water Resources Engineer

Reviewed by ______________________________________
(signature)

Heather Amirault, P.Eng.
Senior Stream Restoration Engineer

Approved by ______________________________________
(signature)

Sean Geddes, B.Sc.
Senior Aquatic Biologist

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

This report has been prepared to support the realignment of a tributary of Beaverdams Creek (the existing watercourse), on lands owned by Walker Aggregates (Walker) and referred to herein as the "Proposed Upper's Quarry".

The proposed Upper's Quarry is 106.3 ha in area and is located within the City of Niagara Falls (City). It is bounded by Thorold Townline Road to the West and Beechwood Road to the East. The southern boundary is the hydro right-of-way (approximately 750 m south of the Upper's Lane culvert) and the northern boundary is the property boundary located on the northern limit of the Enbridge Thorold Townline Road Gate Station property (approximately 430 m north of the Upper's Lane culvert). Figure 1 illustrates the location of the proposed Upper's Quarry, and surrounding lands.

Two municipal road allowances separate the proposed quarry site into three extraction areas

I. North Extraction Area: extraction areas north of Upper's Lane;

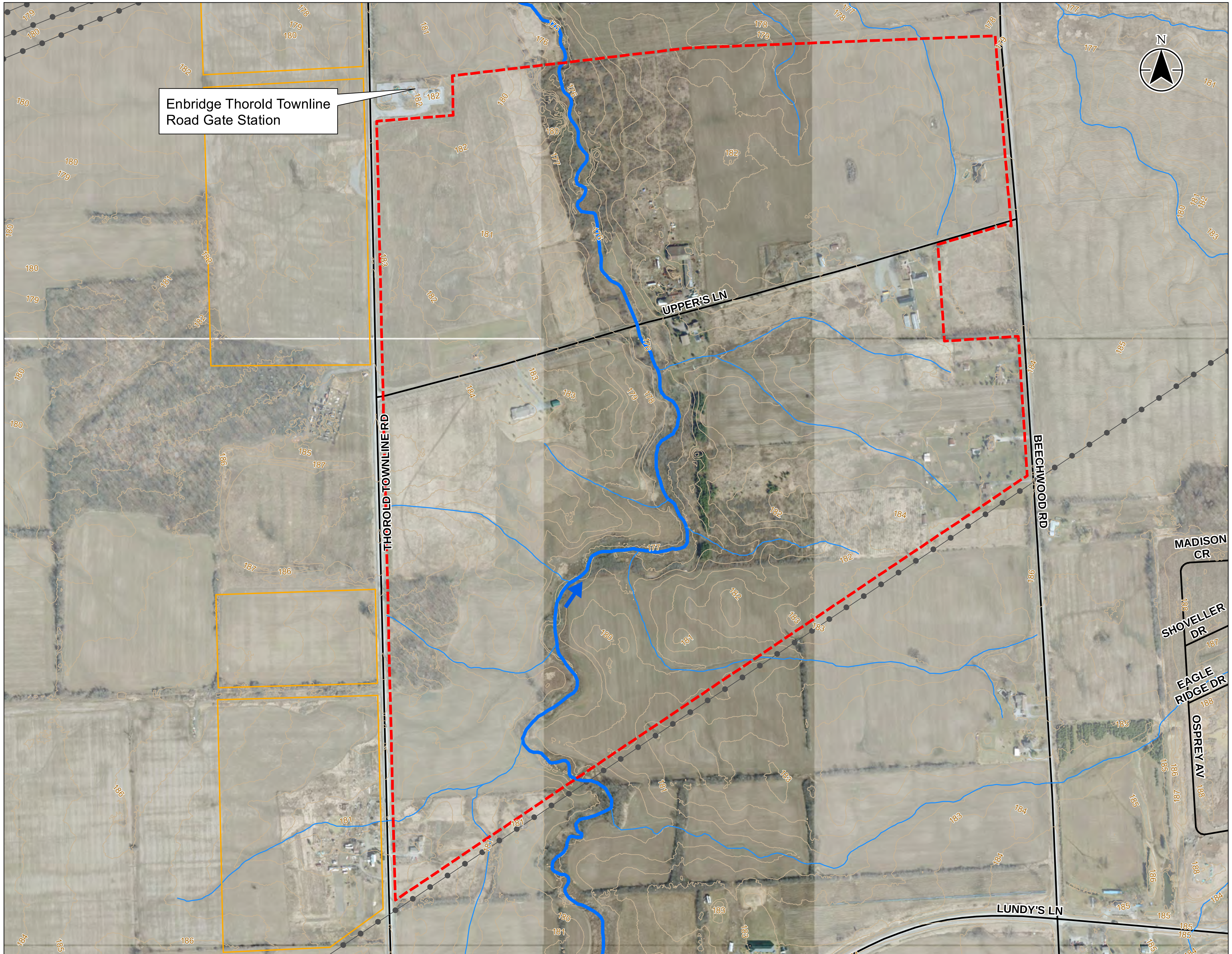
II. Mid Extraction Area: extraction area south of Upper's Lane and north of the unopened road allowance between Lots 120 and 136 in the former Township of Stamford, now in the City of Niagara Falls ("unopened road allowance"); and,

III. South Extraction Area: extraction area south of the unopened road allowance.

Under proposed conditions, extraction is planned where the existing watercourse is located; therefore, the development of the quarry makes it necessary to realign the watercourse to the western boundary. The realigned watercourse will also receive water pumped from quarry dewatering activities (see Section 4.7) and from the pit lake at the end of quarry operations. The realigned watercourse will be fully within the proposed quarry site and will contain features that enhance fish habitat.

This report documents the existing conditions of the watercourse and associated riparian corridor, the Natural Channel Design (NCD) for the realignment of the watercourse and the improvements that will be made as part of the realignment. Overall, the realigned watercourse represents a net ecological gain by increasing ecological diversity and total area of natural habitat, and by improving fish habitat compared to existing conditions.

In addition to the NCD, this report addresses the sizing of three proposed culverts required for the channel realignment. One at Upper's Lane, one at the unopened road allowance, and another at the downstream end of the realigned Creek where an acoustic attenuation berm will be constructed at the northern boundary of the proposed Upper's Quarry.



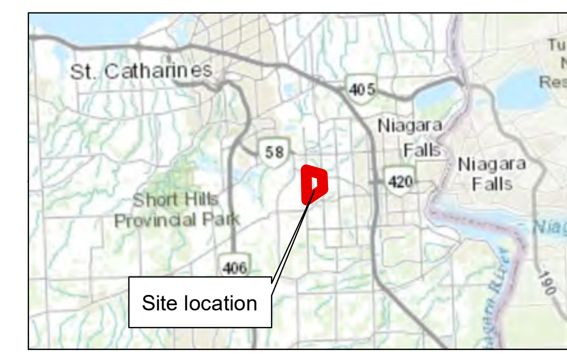
Stantec

Legend
- Site Boundary
- Contour (1m)
- Hydro Line
- Road
- Tributary
- Existing Watercourse
- Additional Lands Owned by Walker Aggregates

0 200 400 metres

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, 2017.



Project Location 160960948
Niagara Falls

Client/Project
WALKER AGGREGATES
PROPOSED UPPERS QUARRY
WATERCOURSE REALIGNMENT

Figure No.
Figure 1

Title
Site Location

2.0 PREVIOUS REPORTING

Previous studies have been completed for the proposed Upper's Quarry in support of the realignment. These studies are relied on to provide the appropriate criteria that apply to this design. The studies include:

- Meander Belt Width Determination – Upper's Creek, a Tributary to Beaverdams Creek. Stantec Consulting Ltd., 2018. (See Appendix A)
- Beaverdams and Shriners Creek Watershed Plan Phase One – Watershed Characterization and Preliminary Issues Identification. Niagara Peninsula Conservation Authority (NPCA), 2011.

3.0 EXISTING WATERCOURSE CONDITIONS

3.1 TOPOGRAPHY AND GEOLOGY

The proposed Upper's Quarry is located within the Haldimand Clay Plain physiographic region on the Niagara Peninsula. This region is characterized by low permeability soils (glaciolacustrine silts and clays) and relatively flat topography.

The property generally slopes to the north and is bisected by the existing watercourse, which flows from south to north. The existing watercourse conveys flow north to Beaverdams Creek, from lands south of the proposed quarry site. Several small drainage features convey flows to the existing watercourse within the proposed quarry site. These features are evident as shallow drainage draws and flow through culverts under Thorold Townline Road.

3.1.1 Bedrock Conditions

The proposed Upper's Quarry is underlain by calcareous bedrock. Along the western property boundary where the realignment is proposed, bedrock is approximately 4-8 m below the existing ground surface. In areas where a significant amount of cut will be required to realign the watercourse, bedrock will be encountered at elevations above the creek invert and bedrock removal will be required prior to implementing the realignment.

3.2 LAND USE

The predominant land use within the Beaverdams Creek watershed is agricultural, with occasional residential concentrations. Within the proposed quarry site, the existing watercourse flows though mainly open scrubland and cultivated terrain with small pockets of tree cover within the riparian corridor.

3.3 GEOMORPHOLOGY

3.3.1 Historic Assessment

The historic assessment of the proposed quarry site is detailed in the Meander Belt Width Determination technical memo (Stantec, 2018). Stantec's report included a review of: aerial photographs from 1976, 1983, 2002, and, 2010; detailed topographic mapping (1 m contours); and geologic (Quaternary) mapping. These materials provided insight into channel form, surrounding land use/cover, and changes that occurred during the period of record.

Riparian vegetation within the proposed quarry site has increased and matured over the period of record (1976 to 2010). The existing watercourse has remained relatively stable during the period of record with no significant changes in creek planform observed. Furthermore, the Upper's Lane culvert was present in the 1976 aerial photograph.

3.3.2 Reach Delineation

The existing watercourse was partitioned into two reaches based on field observations. Reach BDT-1 extends downstream (north) along the thalweg of the channel from the southern boundary of the proposed Upper's Quarry for approximately 1,336 m and terminates approximately 125 m downstream of Upper's Lane. Reach BDT-2 extends from the downstream limit of Reach BDT-1 for approximately 373 m and terminates at the northern boundary of the proposed Upper's Quarry. Table 1 provides a summary of reach characteristics for BDT-1 and BDT-2. Section 3.3.2.1 and 3.3.2.2 provide detailed descriptions of the reaches based on site visits completed by Stantec on September 20, 2017 and January 18, 2018. Photos are included in Appendix E.

A channel substrate sample taken on January 18, 2018 was identified as clayey silt with trace sand.

Table 1: Existing Conditions Reach Characteristics

Reach	BDT-1	BDT-2
Hydrophysiographic Region	Southern Ontario	Southern Ontario
Drainage Area, DA (km^2)	4.6	6
Sediment Transport	Predominantly silty clay washload and bedload from upstream agricultural watershed	Predominantly silty clay washload and bedload from upstream agricultural watershed
Valley Type	Very broad gentle sloping valley with low degree of channel confinement and relatively flat floor slope.	Very broad gentle sloping valley with higher degree of channel confinement and slope than BDT-1.
	VIIIc[1]	VIIIc[1]
Channel Length, L_v (m)	1336	373
Channel Slope, S_v (m/m)	0.0013	0.0026
Geology	Glaciolacustrine silt and clay	Glaciolacustrine silt and clay

[1] *According to classification by Rosgen (1996)*

3.3.2.1 Reach BDT-1

The banks and riparian corridor of Reach BDT-1 are predominantly vegetated with tall grasses. Some trees and shrubs are also present. The surrounding land use is agricultural. Creek banks and substrate are comprised of clayey silt with cattails present in pools. At the time of the site visit, there did not appear to be excessive degradation or aggradation within the channel. Banks were generally stable, with some minor erosion identified on outside bends. Reach BDT-1 exhibits a naturally sinuous planform within a broad and gently sloping valley with a low degree of channel confinement and relatively flat slope (0.13% channel slope). BDT-1 had an approximate bankfull width of 4.4 m.

3.3.2.2 Reach BDT-2

The banks and riparian corridor of Reach BDT-2 are predominantly vegetated with thick shrubs and some grasses and trees. Creek banks and substrate are comprised of clayey silt. At the time of the site visit, there did not appear to be excessive degradation or aggradation within the channel. Banks were generally stable, with some erosion on outside bends. Reach BDT-2 exhibits a naturally sinuous planform within a broad and gently sloping valley setting. There is a higher degree of channel confinement and slope in Reach BDT-2 than BDT-1. BDT-2 has a channel slope of 0.26% and an approximate bankfull width of 4.6 m. The land use surrounding both reaches is agricultural, defined by cultivated fields.

3.3.3 Meander Belt Summary

The Meander Belt Width Determination technical memo (Stantec, 2018) is presented in Appendix A. The assessment followed the TRCA Meander Belt Delineation Procedure. The results of the computational procedures are presented in Table 2 below. The final belt widths were determined to be 60 and 52 m for reach BDT-1 and BDT-2, respectively. The belt width used for the project is 60 m as the much longer reach BDT-1 is most representative of site conditions.

Table 2: Summary of Belt Width Dimensions for the Existing Watercourse

Reach	Preliminary Belt Width (m)	Bankfull Width (m)	Existing Belt Width (m)	100 Year Erosion Allowance (m)	Final Belt Width (m)
BDT-1	38	4.4	42.4	9	60
BDT-2	33	4.6	37.6	7	52

3.3.4 Erosion Threshold

Significant pumping of water to facilitate the aggregate extraction will be required. Increased flows and alterations to sediment supply associated with land use change can exacerbate erosion within receiving watercourses. In turn, this altered hydrology can lead to channel instability, degradation of aquatic habitat, and can create downstream hazards by increasing rates of bank erosion and channel migration (CVC, 2010).

Given the potential impact of the proposed pumping on existing flows, an erosion threshold analysis was performed upstream of Upper's Lane (upstream reach – BDT-1) to the downstream limit of the proposed Upper's Quarry (downstream reach BDT-2). The purpose of this investigation was to determine erosion threshold discharges for the existing watercourse. The scope of this erosion threshold analysis involved various desktop and field components, including:

- Review background information including topographic mapping, geologic mapping, and aerial photographs;
- Perform detailed geomorphic site investigations; and

- Perform an erosion threshold analysis.

As seen in Table 3, the upstream reach is characterized by cohesive materials (i.e. silts and clay). The channel in the downstream reach is more confined and defined by non-cohesive (fine gravel and sand) bed material, specifically 50% gravel and 29% sand.

Table 3: Results of Geomorphic Site Assessment for Erosion Threshold Assessment

Bank Vegetation	Substrate	Stability
Upstream Reach (BDT-1)		
Dense shrubs and grasses with wetland vegetation (cattails and purple loostrife) and some trees.	Loose to compact clayey silt with trace sand.	Multithreaded planform, although one channel appears to be more defined, slightly u-shaped. No significant areas of erosion. This upstream section is vegetation dominant. Rooting depth of bank vegetation approx. 200 mm.
Downstream Reach (BDT-2)		
Banks are dominated by dense shrubs and grasses. Some large woody vegetation close to top of bank.	bed substrate is coarse sand with and gravel and a few large cobbles (<200 mm).	Slightly confined, single threaded, trapezoidal cross-section. No significant areas of erosion, vegetation and the coarser material maintain the channel stability. Rooting depth of bank vegetation approx. 200 mm.

Based on the results of the site assessments it was determined that the downstream reach demonstrates the highest degree of instability (i.e. more easily erodible substrate (sand and gravel) and higher degree of confinement). As a result, this reach was deemed the most geomorphically sensitive to changes in flow or sediment regime. The downstream reach was also considered representative of the reach within the downstream property due to similar level of confinement, riparian corridor, and bankfull width (determined by aerial photographs). Consequently, the critical discharge derived for this reach represents a conservative estimate of the erosion threshold within the proposed quarry site and on the downstream property.

3.3.4.1 Erosion Threshold Analysis

The purpose of the erosion threshold analysis is to determine the magnitude of discharges required to potentially entrain and transport sediment in the channel. Rather than indicating complete erosion of the channel boundary, the erosion threshold indicates a flow which may initiate motion of the channel materials. Erosion threshold analysis does not address any sediment supply characteristics which are important to consider in evaluating the potential long-term erosion, degradation, and/or aggradation of a watercourse. Erosion threshold parameters for the downstream reach are provided in Table 4 below and appended in Appendix F.

Table 4: Erosion Threshold Analysis

Parameter	Downstream Reach
Water surface slope (%)	0.26
Manning's n	0.033
Method of Analysis	Chow/Fischenich
Critical Particle Size – D_{50} (mm)	4.2
Critical Shear Stress (N/m^2)	3.60
Critical Discharge (m^3/s)	0.37
% of Bankfull Discharge	90

The critical discharge needed to entrain the median grain size in the downstream reach was estimated at 0.37 m^3/s which was based on a critical bed shear stress of 3.60 N/m^2 and represents 90% of the bankfull discharge. This was developed using the Chow and Fischenich methods for determining allowable shear stress for non-cohesive sediments. Regular dewatering pump discharge rates below 0.37 m^3/s should not have erosive impacts on the existing channel within the proposed quarry site and the channel reach downstream. It is noted that the estimated pumping rates for the quarry are well below 0.37 m^3/s.

3.3.4.2 Limitations

The estimates of erosion threshold are based on conditions observed at the time of the site investigation, and although they are intended to be conservative, are subject to change upon modification of controlling influences (i.e. sediment supply, hydrological regime, and channel morphology).

Additionally, it should be noted that impacts to the sediment supply characteristics in a watershed can impact the potential for aggradation, degradation, and/or erosion within the receiving watercourses. As such, maintaining the existing sediment supply is an important component to preserve the existing dynamic equilibrium.

3.4 AQUATIC HABITAT

The existing watercourse is classified as a warmwater intermittent watercourse. The existing watercourse was examined by AECOM biologists in 2008 and 2010. During the September 2008 visit, AECOM noted intermittent flow conditions through a largely braided channel, with a refuge pool located on the downstream (north) side of the Upper's Lane culvert. No fish were documented during the 2008 assessment. The drainage feature was reviewed again in 2010, with a visit on March 26 to evaluate the potential for habitat for Northern Pike. Flow conditions at that time were intermittent with seasonal low flow barriers beginning approximately 150 m south of Upper's Lane and isolated pools and wet stream reaches continuing south to the boundary of the property. Habitat conditions for potential usage by spawning Northern Pike were noted to be of marginal quality during that survey.

AECOM conducted a fish community survey on May 27, 2010, using a backpack electrofisher. Due to the low water conditions of the stream at the time, the electrofishing survey was conducted in the isolated pools present throughout the entire existing watercourse. Young-of-the-year (YOY) Northern Pike were captured throughout the tributary indicating that habitat conditions are favourable for spawning of this species through the length of the channel. Pumpkinseed and Brown Bullhead were captured in the pool at Upper’s Lane and are likely reproducing and over-wintering in association with the habitat provided by the pool. The number of YOY pike that would be able to migrate back to the main channel of Beaverdams Creek downstream of the proposed Upper’s Quarry is unknown and likely varies from year to year with weather conditions, hydroperiod and precipitation events to keep the channel flowing. Many of the YOY caught during the AECOM 2010 survey were found in isolated shallow pools that would become dry through the summer months. Although the pool at Upper’s Lane could potentially provide refuge habitat for northern pike the remainder of the tributary limits Pike productivity due to seasonal low flows and lack of a substantial forage fish base upon which the predatory Northern Pike relies.

Stantec biologists examined the proposed quarry site on numerous occasions in 2017. During a site visit on March 29, Northern Pike were observed in two locations exhibiting potential spawning behavior, including splashing and swirling in vegetated shallows downstream of Upper’s Lane, and in an area approximately 350 m upstream or south of Upper’s Lane. Electrofishing was conducted by Stantec on June 22, 2017 at four locations where adequate water persisted to allow for viable sampling. Only Yellow Perch and Pumpkinseed were captured at 3 of the 4 stations. Habitat assessments and incidental observations recorded during several other visits for various other faunal surveys were consistent with those of AECOM in 2008 and 2010. The existing watercourse provides seasonal habitat during spring freshet along its length and allows for Northern Pike to access potential spawning habitat for a brief period. As freshet wanes and conditions become intermittent, the most viable locations of refuge habitat appear to be associated with the large culvert pool at Upper’s Lane. Yearly spawning success and recruitment to the Northern Pike population likely varies from year to year in accordance with spring melt conditions (i.e. snowpack and spring rain runoff), and persistent hydroperiod would be largely linked to frequency and volume of spring rain.

While spring freshet typically creates conditions that allow for movement of Northern Pike into potential spawning areas, as flows recede and conditions become intermittent, habitat conditions are generally too poor to support various life stages of fish. As the system dries up, refuge pool habitat becomes limiting except for the pool associated with the Upper’s Lane culvert. The seasonal nature and lack of sustained flow, absence of adequate refuge pool habitat and inability to support perennial conditions favourable to fish reduce the habitat quality of the tributary to a low rating.

3.5 RIPARIAN CORRIDOR

The riparian vegetation associated with the existing watercourse lies predominately within the creek floodplain and is dominated by a mixture of wetland plants such as cattail, blue flag, rice cutgrass, phragmites and purple loosestrife. Other smaller patches of blue flag, spotted touch-me-not, reed-canary grass and tall white aster also occur. Overall, the riparian zone is very low profile and overhead canopy cover, which would moderate instream temperatures, is lacking. Beyond the extent of the floodplain, the land has undergone active cultivation which encroaches into the floodplain vegetation in years where dry spring conditions allow for tillage into these areas. In some areas, the corridor is narrow with limited buffer between the channel and agricultural fields.

4.0 PROPOSED WATERCOURSE CONDITIONS

The proposed realignment will relocate the watercourse to the western side of the proposed quarry site. The portion of the proposed quarry site where the watercourse realignment will occur will not be quarried to full extraction depth, however, some stone will need to be removed to achieve the required channel grading. It is anticipated that the channel will be constructed offline and flow from the existing channel will be diverted once construction of the new watercourse is complete and it has stabilized.

The proposed realignment employs Natural Channel Design (NCD) methods to provide a solution that includes long-term stability as well as aquatic habitat. NCD uses observations from natural watercourses to design a stable planform, profile, and cross-section, as well as provide substrate, and vegetation characteristics which will be sustainable and require minimal maintenance.

Sections 4.1 to 4.11 outline the watercourse design for the proposed extraction scenario, which assumes that Upper's Lane and the unopened road allowance are not included in the license and extraction area. Section 4.12 includes a discussion on the alternate extraction scenario which assumes that Upper's Lane and the unopened road allowance are included in the license and extraction area.

4.1 DESIGN GOALS AND CRITERIA

The following list outlines the design goals and criteria for the realigned portion of the watercourse:

- Design a channel alignment with stable pattern, dimension, and profile to convey sediment load without excessive aggradation or degradation;
- The new channel should accommodate discharge from quarry dewatering during the extraction phase;
- Design a valley to convey the 100-year flow;
- Create diverse riparian habitat through plantings appropriate for local wildlife;
- Create wetland and pond features to mimic natural wetland habitat; and,
- Incorporate natural channel substrate and instream habitat features that will provide fish and aquatic habitat.

A design that meets the project goals and criteria will provide a significant improvement to habitat over existing conditions. Historically the channel appears to have been dredged to improve flow conveyance for agricultural operations. This activity indicates that the channel was likely experiencing sediment aggradation – a sign of instability. A stable profile with good floodplain connectivity will eliminate the need for dredging and the associated disturbances. At present, the channel has poor riparian habitat along much of its length while the proposed channel will have a wide floodplain with diverse habitat features and native vegetation. Currently the channel is a single thread, straightened system. Adding meanders and connections to riparian wetlands and ponds will increase habitat diversity for a range of life cycle phases for aquatic organisms, including fish. A number of instream features will be included, such as deep pools, wood, and natural substrates, which will improve habitat diversity from the existing channel conditions.

4.2 BANKFULL DISCHARGE

Bankfull discharge (Q_{bkf}) is the flow which is most effective at doing the work which shapes the morphological characteristics of a natural watercourse (Dunne and Leopold, 1978). It follows that Q_{bkf} is often considered the most important parameter in a natural channel design. Establishing an accurate estimate of Q_{bkf} is paramount to the ultimate success of a natural channel design.

The existing channel, while anthropogenically altered, possessed numerous bankfull indicators throughout its length. Hydrology under proposed conditions will not be altered upstream of the proposed Upper's Quarry. Therefore, the bankfull area and discharge of the existing channel can be directly applied in the proposed design.

Multiple cross-sections were surveyed during the site visit in September 2017. Bankfull indicators at each cross-section were identified in the field and the bankfull area was calculated using the cross-section dimensions. Bankfull area (A_{bkf}) of the surveyed cross-sections ranged from 0.88 m^2 to 1.42 m^2 with an average of 1.11 m^2. Bankfull discharge (Q_{bkf}), considering a Manning's roughness coefficient (n) of 0.045, ranged from 0.25 m^3/s to 0.66 m^3/s with an average of 0.41 m^3/s. The average values of A_{bkf} (1.11 m^2) and Q_{bkf} (0.41 m^3/s) were adopted for design.

4.3 REFERENCE REACH SURVEY AND DIMENSIONLESS RATIOS

A reference reach is a stable portion of watercourse that is considered suitable to help determine the dimensions, pattern, and profile of the channel to be restored. A reference reach is suitable if:

1) the reference reach possesses similar geology, valley type, and slope as the restoration reach; and,

2) the reference reach is a stable system that exhibits equilibrium or quasi-equilibrium morphological conditions.

Ideally, reference reaches, or reference conditions are found within the restoration reach boundaries; however, reference reaches upstream or downstream of the restoration reach or from other watersheds can be used, provided they satisfy 1) and 2) above.

If a suitable reference reach is found, its morphological characteristics and dimensions are determined via geomorphic survey and subsequent analysis. These characteristics are converted to dimensionless ratios, which are then used to determine planform, profile, and cross-sectional geometry of the restoration reach. Ideally, the reference reach is completely unaltered, stable, and similar enough to the restoration reach to allow for the direct application of the dimensionless ratios to the restoration reach design. Unfortunately, these ideal conditions are uncommon in southern Ontario, given the prevalence of watercourse alteration in both urban and rural settings. Therefore, the dimensionless ratios are often refined based on geomorphic rules-of-thumb and practical experience, prior to application to the restoration design.

There were no completely unaltered and stable reference reaches within or upstream or downstream of the design reaches. Therefore, the channel design adopted ratios from two partial reference reaches. The two partial reference reaches were Credit River Tributary West 8B (Credit River Tributary) in Brampton, Ontario, and Indian Creek in Milton, Ontario. Table 5 summarizes the characteristics of the partial reference reaches. These partial reference reaches were considered appropriate for use in this design because their characteristics (Table 3) are similar to those of the design reaches (Table 1).

Table 5: Characteristics of Reference Reaches

Reach	Credit River Tributary West 8B	Indian Creek
Climatic Region	Southern Ontario	Southern Ontario
Drainage Area, DA (ha)	310	3480
Sediment Transport	partially urbanized catchment with occasional stormwater management controls; alluvial system with low/moderate washload and bed material load	partially urbanized catchment with occasional stormwater management controls; alluvial system with low/moderate washload and bed material load
Valley Type	VIIIb – moderately confined valley; steep side slopes; gentle/moderate valley floor slope	VIIIb – moderately confined valley; steep side slopes; gentle/moderate valley floor slope
Valley Slope, S_v (m/m)	0.0085	0.0032
Valley Slope, S_v (%)	0.85%	0.32%
Geology	semi-alluvial till	semi-alluvial till w/ bedrock

Table 6 summarizes dimensionless ratios for each of the partial reference reaches. Table 4 also summarizes the dimensionless ratios adopted for design. The ratios adopted for design were refined from partial reference reach ratios using geomorphic rules of thumb and practical experience in natural channel design. All dimensionless ratios are for the bankfull cross-section.

Table 6: Dimensionless Ratios for Reference Reaches and Design

		Partial Reference Reaches		Adopted for Design	
		Credit River Trib. West 8B	Indian Creek	Realigned Watercourse	Notes
Riffle Cross-Section	Riffle Width/Riffle Depth, W_{bkf}/D_{bkf}	17	24	14	Ratio reduced to maintain channel definition given low flows in reach
	Max. Riffle Depth/ Mean Riffle Depth, D_{max}/D_{mean}	1.9	1.9	1.8	Ratio within range of reference
Pool Cross-Section	Pool Area/Riffle Area, A_{pool}/A_{bkf}	1.5	2.1	2.2	Pool area increased for energy dissipation, low flow refuge habitat for fish
	Max. Pool Depth/Mean Riffle Depth, $D_{max,pool}/D_{mean}$	3.1	2.9	3	$D_{max,\ pool}$ for energy dissipation, low flow refuge habitat for fish
	Pool Width/Riffle Width, W_{pool}/W_{bkf}	0.88	1.11	1.05	Ratio within range of reference
Planform	Radius of Curvature/Riffle Width, R_c/W_{bkf}	1.8 – 2.6	5.9 – 8.1	2.5 – 4.1	Ratio of 2.5 – 3 generally encourages stability in meandering systems
	Riffle Length/Riffle Width, L_{riffle}/W_{bkf}	1.4 – 1.8	0.82 – 0.97	1.5 – 1.9	Ratio of 1.5 – 3 generally encourages stability in meandering systems
	Pool Length/Riffle Width, L_{pool}/W_{bkf}	3.4 – 4.8	2.4 – 3.6	3.2-3.7	Ratio within range of reference
	Pool-to-Pool Spacing/Riffle Width, $L_{pool-pool}/W_{bkf}$	4.1 – 4.7	3.3 – 4.5	4.7 – 5.6	Pool to pool spacing increased due to lower slope in design channel

4.4 DESIGN MORPHOLOGY

The design planform, profile, and cross-section dimensions were determined using Q_{bkf} (calculated in Section 4.2) and the dimensionless ratios (specified in Section 4.3). The design dimensions are summarized in Table 7. Design planform, profile, and cross-sections are illustrated in the Design Drawings (Appendix B). The slope of the realigned channel is 0.18 -0.19%.

Table 7: Summary of Morphological Parameters Used in Relocation Design

Parameter	Realigned Watercourse
Bankfull Riffle Cross-Section	
Area, A_{bkf} (m^2)	1.11
Discharge, Q_{bkf} (m^3/s)	0.41
Width-to-Depth Ratio (m/m)	14
Width, W (m)	4
Mean Depth, d (m)	0.29
Maximum Depth, d_{max} (m)	0.5
% Low Flow Channel	30
Bankfull Pool Cross-Section	
Area, A_{bkf} (m^2)	1.7
Width, W (m)	4.3
Maximum Depth, d_{max} (m)	0.8
Point Bar Slope	15:01
Planform Morphology	
Linear Wavelength (m)	26.0 – 32.0
Radius of Curvature, R_c (m)	10.0 – 16.4
Riffle Length, L_R (m)	6.0 – 7.6
Pool Length, L_P (m)	12.8 – 14.8
Pool-Pool Spacing (m)	18.8 – 22.4
Channel Length (m)	1,788
Sinuosity	1.2

4.5 HYDRAULIC ANALYSIS

Bankfull and flood stage hydraulics under proposed conditions were modelled using HEC-RAS software in 2-D. The bankfull event was calculated using Manning's equation as per Section 4.2 above, and the 100-year and Regional events at the upstream end of the proposed Upper's Quarry were calculated by AECOM in 2009. A Manning's roughness coefficient (n) of 0.045 was used for the channel indicating a meandering, slightly vegetated, earthen channel and 0.1 was used for the floodplain indicating a vegetated floodplain with overland flow. The bankfull, 100-year, and regional flow rates were modelled at nine (9) cross-sections.

Table 8, Table 9, and Table 10 summarize the results of the HEC-RAS hydraulic modelling for the bankfull, 100-year, and Regional storm events (respectively) for proposed conditions. Cross-section locations and full tabular results and plots from the HEC-RAS model are provided in Appendix D.

Table 8: Results of HEC-RAS Hydraulic Modelling for Bankfull Event (0.41 m^3/s)

HEC-RAS XS ID	Water Surface (masl)	Shear Stress (N/m^2)	Location
XS1	177.65	8.45	Riffle
XS2	177.29	4.59	Riffle
XS3	177.11	5.29	Riffle
XS4	176.76	3.83	Downstream end of unopened road culvert
XS5	176.63	6.88	Riffle
XS6	176.41	5.70	Riffle
XS7	176.14	5.01	Downstream end of Upper's Lane culvert
XS8	175.98	5.91	Riffle
XS9	175.74	7.39	Riffle
XS10	175.45	6.96	Riffle

Table 9: Results of HEC-RAS Hydraulic Modelling for 100-Year Return Period (9.3 m^3/s)

HEC-RAS XS ID	Water Surface (masl)	Sheer Stress (N/m^2)	Location
XS1	178.23	11.12	Riffle
XS2	178.13	11.06	Riffle
XS3	178.10	3.18	Riffle
XS4	177.36	12.82	Downstream end of unopened road culvert
XS5	177.28	9.78	Riffle
XS6	177.25	4.74	Riffle
XS7	176.71	84.89	Downstream end of Upper's Lane culvert
XS8	176.53	15.91	Riffle
XS9	176.48	7.39	Riffle
XS10	176.44	2.04	Riffle

Table 10: Results of HEC-RAS Hydraulic Modelling for the Regional Flood (29.3 m^3/s)

HEC-RAS XS ID	Water Surface (masl)	Sheer Stress (N/m^2)	Location
XS1	178.71	21.74	Riffle
XS2	178.51	37.72	Riffle
XS3	178.44	40.20	Riffle
XS4	177.52	10.43	Downstream end of unopened road culvert
XS5	177.47	7.03	Riffle
XS6	177.45	3.95	Riffle
XS7	176.84	78.52	Downstream end of Upper's Lane culvert
XS8	176.73	9.66	Riffle
XS9	176.70	5.22	Riffle
XS10	176.68	1.75	Riffle

A valley berm on the east side of the proposed new valley alignment has been designed to contain the 100-year flow. The results from the 100-year event show that proposed conditions flood elevations were contained within the designed floodplain; however, the valley berm will overtop into the quarry upstream of the unopened road allowance for approximately 100 m in the Regional flood. The shear stresses are highest at the downstream end of the culverts and on the side of the valley berm facing into the quarry. To ensure there is no scour or erosion in these areas, culvert substrate and berm protection has been sized based on these velocities and shear stresses.

4.5.1 Culvert Sizing

Three new culverts are proposed as part of the channel realignment. The culverts are located at Upper's Lane, at the unopened road allowance, and at the acoustic attenuation berm at the downstream limit. The culverts were sized using the HEC-RAS software. Culvert parameters such as inverts, cross-sectional dimensions, and lengths were used in the model to determine water surface elevations and flow velocities.

The final proposed culvert dimensions are presented in Table 11. The final engineering of the culverts will be designed by others. The proposed culverts were modelled embedded by 0.5 m to allow for the maximum depth of cover while still accommodating the bankfull cross-section. The proposed culvert dimensions were sized so that the headwater depth in the 100-year event is contained within the floodplain and provide greater than 0.3 m of freeboard. The proposed culverts were included in the hydraulic modelling of the channel that was summarized in Tables 8 and 9.

Table 11: Summary of Culvert Parameters

Culvert	Culvert Type	Length (m)	Span (m)	Rise (m)	Upstream Invert (mASL)	Downstream Invert (mASL)
Upper's Lane	CMP Arch	33.5	4.88	2.03	175.29	175.20
Unopened Road Allowance	CMP Arch	43.6	4.88	2.03	175.95	175.85
Acoustic Attenuation Berm	CMP Arch	12.6	4.88	2.03	174.12	174.10

4.6 BEDROCK CONDITONS

The approximate elevation of the bedrock on the proposed quarry site is shown on the profiles in the design drawings (C-200 to C-210). There are several areas where bedrock excavation will be required to construct the channel realignment. Areas where bedrock may be encountered include the online pond at station 0+300 and within the floodplain, channel, and ponds between station 0+375 and the downstream end of the channel. Bedrock excavation up to 7 m may be required.

4.7 SUBSTRATE AND PARTICLE STABILITY ANALYSIS

In addition to conveying water, watercourses also transport sediment. Each watercourse has a unique sediment carrying capacity which is a function of slope and discharge. If a given watercourse has its upstream sediment supply decreased or eliminated (due to, for example, an upstream impoundment), it will meet its sediment carrying capacity by eroding material from the riverbed and banks. This process typically continues until the particles remaining in the bed and banks are too large to be mobilized. At this point, the watercourse bed and banks cannot be eroded, and the channel has become a "threshold channel" in response to the lack of upstream sediment sources (USDA and NRCS, 2007).

The realigned watercourse has been designed as a threshold channel because the sediment transport regime consists primarily of suspended silts and clays from upstream agricultural drainage features. There is limited supply of coarse bedload material. The fine suspended load is typically conveyed through the watercourse during flow events, making the threshold channel approach appropriate for this application.

Therefore, riffle substrate was sized such that riffles would hold grade under high flows. The method for determining riffle substrate material size was as follows:

- Median particle diameter ("50% finer than", referred to as the D_{50} particle diameter) was sized to be stable under the maximum shear stresses (across all riffles) calculated for bankfull flows;
- "84% finer than" particle diameter, referred to as the D_{84} particle diameter, was sized to be stable under the maximum shear stress (across all riffles) calculated for 100-year return period flows;

Based on this sizing method, 50% of the substrate particles may be mobile under the bankfull event and 84% of the substrate under the 100-year event. The shear stresses for the bankfull and 100-year events were obtained from HEC-RAS modelling results (refer to Section 4.5). The maximum shear stress within a riffle cross-section for the bankfull (XS1) and 100-year (XS8) events were chosen to size the riffle substrate to be conservative. The design shear stress was calculated by multiplying the shear stress from HEC-RAS by a safety factor of 1.2. Stable particle size analysis was performed using six different methods with the most conservative method being adopted as the stable particle size. Particle sizing and stability calculations and results can be found in Appendix C. The design particle size distribution of riffle substrate is summarized in Table 12 and provided on Drawing C-700.

Table 12: Riffle Substrate Gradation

Gradation	Particle Diameter, D (mm)
D_{100}	100
D_{84}	80
D_{50}	50
D_{36}	25
D_{16}	5

Pool substrate will consist of native / fill material. Smooth transitions between pool and riffle substrates are to be achieved by gradually transitioning the riffle substrate and native material.

The shear stresses within the culverts, and directly upstream and downstream of the culverts in the 100-year event are higher than the average channel shear stress in the proposed riffles. To promote the stability of the substrate surrounding the culverts during the 100-year event, culvert substrate was sized using the same method as the riffle substrate above. The resulting stable culvert substrate is shown in Table 13. Culvert substrate will be placed within the culvert as well as in the riffles at the upstream and downstream ends of the culverts.

Table 13: Culvert Substrate Gradation

Percent of mix (%)	Substrate
80	WB-350 (OPSS.PROV 1005)
20	Riffle Substrate (see Table 12)

The valley berm along the eastern edge of the floodplain will overtop in the Regional Flood. To prevent scour and erosion of the berm, rock protection was sized to withstand the maximum velocity of the water as it flows down the slope to the pit lake. The valley berm rock protection was sized based on Section 3.3.1 of the Ontario Ministry of Transportation (MTO) Highway Drainage Design Standards (MTO, 2008). The maximum velocity along the berm of 2.11 m/s corresponds with a nominal stone size of 200 mm and maximum stone size of 300mm. Table 14 below shows the stable gradation. Valley berm rock protection will be placed for 100 m upstream of the unopened road allowance from the crest of the valley berm and down the east side of the berm to the elevation of the pit lake.

Table 14: Valley Berm Rock Protection

Percent of mix (%)	Substrate
100	R-50 Rip-Rap (OPSS.MUNI 1004)

4.8 EROSION THRESHOLD ANALYSIS

As mentioned in Section 1.0, dewatering of the quarry will take place throughout the life of the quarry operation. The dewatering flows will be discharged into the existing watercourse while it is still in place, and then into the new channel once the watercourse has been realigned. To determine the potential impacts of the dewatering flows an erosion threshold analysis was completed for existing conditions (see Section 3.3.4). The proposed channel substrate has been sized as described in Section 4.7 above and the channel should remain stable under the flow conditions proposed for dewatering.

4.9 IN-STREAM STRUCTURES AND BANK TREATMENTS

Three types of in-stream structures have been included in the realignment design to enhance the vertical and lateral stability of the channel, while increasing the diversity of hydraulics and aquatic habitat. Locations and details of in-stream structures are illustrated on Drawings C-200 to C-210 and C-501 to C-502. Each structure will fulfill specific design functions that are related to controlling flow direction, maintaining pool depth or channel dimensions, dissipating flow energy, enhancing aquatic habitat, or combinations thereof.

4.9.1 Wood Debris Toe Protection and Wood Reinforced Banks

Wood Debris Toe Protection and Wood Reinforced Banks are in- and above-water structures consisting of woody material, soil lifts, and (sometimes) sod mats placed along the outside of meander bends in pools. The purpose of these structures is to protect and roughen the stream bank, thereby disrupting helical flow patterns and reducing nearbank shear stress. The two structures are similar, with the difference being the amount of wood installed in the bank, below the water. Wood Debris Toe Protection consists entirely of wood material, whereas Wood Reinforced Bank is a mix of native substrate and wood material (minimum 25% wood material). Above-water, soil lifts or sod mats are installed up to the bankfull elevation. Live plantings are installed on soil lifts to promote eventual root penetration and development and to help a living structure becomes established in the bank for long term stability. The structures may be constructed at a relatively steep angle, which maximizes pool depth. Wood Debris Toe Protection and Wood Reinforced Banks also provide instream cover for smaller forage base and young fish, wood substrate as an anchoring location and food for aquatic invertebrates (which, in turn, feed fish), and carbon inputs which enhance aquatic habitat nutrient levels.

4.9.2 Log Sills

Log Sills are an instream structure used to provide grade control and prevent the development and migration of headcuts. They consist of two logs stacked on top of one another (slightly offset), with the top of the upper log matching the invert of the upstream channel. The logs are installed perpendicular to the direction of flow.

Log Sills were placed at some riffles and at the upstream and downstream end of online pools to hold grade and were also placed at the downstream end of the project to protect it from possible changing conditions downstream. A detail of a Log Sill is provided on Drawing C-501.

4.9.3 Augmented Riffle

Augmented Riffles are in-water structures which provide enhanced grade control and habitat diversity. These structures consist of the riffle matrix shaped into a low flow channel nested within the larger bankfull channel. The riffle substrate is sized to resist mobilization during flood conditions as discussed in Section 4.6. The low flow channel is designed to maintain flow depths during low flows to promote fish passage and aquatic habitat. Riffles also provide aeration and promote increased oxygenation which is particularly beneficial in warmwater systems that do not retain dissolved oxygen as well as cool and coldwater systems. Riffles also provide spawning habitat and are the preferred substrate of many benthic invertebrates, which also break down larger organic debris and provide a food source for young and smaller fish.

4.10 PLANTING PLAN

A proposed planting plan has been submitted with this report with planting zones and species lists provided on Drawings L-460 to L-462 and planting details on Drawings L-500 and L-501.

The livestake planting zone (streambank) will focus on bank stability and providing a vegetated habitat through the use of live stakes adjacent to the creek. Over the long-term, shading will be provided to the water by the canopy of the water tolerant livestake species such as dogwoods and willows. Areas adjacent to the channel are to be seeded with a valleyland seed mix that is predominantly a mix of Fox Sedge, Virginia Wild Rye and Fowl Bluegrass.

The riparian planting zone (floodplain) will use shrubs and smaller tree species and will be planted in the valley within the stream corridor. The planting design is intended to allow for the gradual successional spread of trees and shrubs within the corridor, while maintaining the hydraulic capacity of the channel, and providing habitat. The riparian planting zone is to be seeded with the same valleyland seed mix as the livestake planting zone. There is approximately 61,630 m^2 of riparian planting area proposed.

The upland planting zone (outside of the floodplain) will include larger tree species that will provide habitat enhancement within the stream corridor. The planting design is intended to allow for the gradual successional spread of trees and shrubs within the stream corridor. The upland planting zone will be seeded with a tableland grass mixture that is predominantly Canada Wild Rye, Switch Grass, and bluestem varieties. There is approximately 50,490 m^2 of upland planting area proposed.

All plant species selected are native to the region.

4.11 AQUATIC AND RIPARIAN HABITAT FEATURES

Riparian ponds and wetland features have been integrated into the floodplain to diversify the habitat provided in the proposed design. The offline wetland features range in depth from approximately 0.3 m to 3.0 m. Incorporating a variety of depths in the design will allow for a greater diversity of flora and fauna. Shallower areas will produce emergent vegetation which will help create habitat for amphibians, benthic invertebrates and spawning habitat for pike. The deeper areas will develop submergent aquatic vegetation and can provide overwintering habitat for fish and turtles. Additional habitat structures such as basking logs, turtle nesting areas, brush piles, and raptor poles, have also been provided in the design and are illustrated on Drawing C-502. The planting plan described in Section 4.10 is intended to diversify riparian habitat as much as possible.

4.12 ALTERNATE EXTRACTION SCENARIO

Subject to agreement with the City of Niagara Falls, Walker proposes to extract:

i. Upper's Lane, between the North Extraction Area and the Mid Extraction Area; and

ii. the unopened road allowance between Lots 120 and 136, between the Mid Extraction Area and the South Extraction Area (see Figure X).

Walker owns all of the lands north and south of Upper's Lane and the unopened road allowance between Thorold Townline Road and Beechwood Road, with exception of the Bible Baptist Church property which has secured access from Beechwood Road. Subject to an agreement with the City, Walker proposes to extract this portion of Upper's Lane and the unopened road allowance to maximize access to the aggregate resource and to create a more integrated operation and rehabilitation plan.

Should Agreement with the City be reached, the extraction area will be expanded, and the channel design would be adapted to accommodate this alternative pit configuration. In this scenario, the unopened road allowance culvert would no longer be required. The current location of Upper's Lane would become an access ramp to the proposed quarry site allowing for a shorter culvert at this location since the road would be lowered. Hydraulics under this alternate extraction scenario are not significantly different than the proposed scenario. Flood levels will not increase offsite. Internally to the proposed quarry site, the spill point of the Regional flood event over the valley berm will shift from upstream of the unopened road allowance to upstream of the Upper's Lane access ramp.

The alternate extraction scenario does not require the culvert and road embankment at the unopened road allowance and would require a shorter culvert at the Upper's Lane access ramp which will expand the area available for habitat improvements. This scenario will allow for an increase in channel length, an increase in the area of riparian planting, as well as an increase in the area of aquatic and riparian habitat features.

5.0 CONSTRUCTION

5.1 REQUIRED PLANS

Experience has shown that a qualified contractor is often the best equipped to determine phasing and methods of completing instream work to protect aquatic ecosystems while completing the work efficiently. Therefore, prior to construction, the contractor (in consultation with the design engineer or owner's representative), is required to prepare the following plans to meet the requirements outlined in this report and in the Design Drawings (Appendix B):

1) Construction Phasing Plan

2) Water Management Plan

3) Erosion and Sediment Control Plan

4) Fish Salvage Plan

The plans must be approved by the design engineer, Walker Aggregates, and appropriate regulatory agencies prior to commencement of construction. The components of the four plans listed above are presented in the Design Drawings and the contractor's plans must be accompanied by marked-up planform drawing(s) and details as necessary to illustrate the components of the various plans.

5.2 CONSTRUCTION ADMINISTRATION

A qualified professional, with experience in stream restoration and construction administration, will perform construction administration throughout the construction process to verify that channel features are constructed in a manner consistent with the channel design drawings. The qualified professional will also monitor erosion and sediment controls on a weekly basis and after any significant rainfall event and will recommend any necessary corrective measures to the contractor.

Following the completion of channel works, a construction monitoring report will be prepared describing the general sequence of construction, outstanding corrective actions necessary to adhere to the design drawings, and any deviations to the design and the reasons for the deviation. A photographic record will be appended to the report to illustrate the various stages of construction.

6.0 POST-CONSTRUCTION

A stream restoration project requires 3 – 5 years to fully vegetate and stabilize following completion of construction and installation of plantings. During this initial growth phase, the stream is vulnerable to minor erosion. Left unmitigated, these instances of minor erosion can escalate into costly reach-scale failures in the constructed watercourse. Therefore, to reduce risk and promote long-term success of the project, it is recommended that a post-construction monitoring (PCM) program be completed following construction of this natural channel design.

The post-construction monitoring program will last for a minimum of 3 years, which includes the typical contract warranty periods in stream restoration projects. The 3-year PCM program will begin the year following completion of construction.

The PCM program will consist of channel stability, vegetation, and aquatic biology components. The items which are included with each of these three components are detailed in Sections 6.1, 6.2, and 6.3 and are summarized in Table 15. An annual report documenting the findings of the PCM program, along with any recommended rehabilitative actions, will be completed at the end of each calendar year. The report will be submitted to the Client for review and to applicable permitting agencies.

Table 15: Summary of Post-Construction Monitoring Requirements

Component	Specialist Required	Monitoring Frequency	Details
Channel Stability	Fluvial Geomorphologist	twice per year	Profile, pattern, dimensions characterized through geomorphic survey; substrate characteristics quantified using Wolman Pebble Count at riffles
Vegetation	Biologist	twice per year in year 1, once per year in year 2 and 3	Tree/shrub count to determine survival and species percentages; invasive species noted; deficient, dead, or decaying plants identified for replacement
Aquatic Habitat	Fisheries Biologist	once per year	Qualitative assessment of habitat; fish sampling using appropriate methods

6.1 CHANNEL STABILITY MONITORING

Prior to the commencement of the 3-year PCM program, a Year 0 (baseline) survey must be performed immediately following construction. The Year 0 survey will consist of a longitudinal profile and permanent riffle and pool cross-sections. Channel stability surveys from years 1, 2, and 3 will be compared to the Year 0 survey.

Geomorphic monitoring includes the collection of profile, pattern, and dimension data using a total station or survey- grade GPS. Bed substrate material data will also be collected. These items are detailed below.

Profile: A longitudinal profile will be surveyed, consisting of thalweg elevations and water surface elevations. Success should be determined based on whether the channel features remain generally within design ranges, without demonstrating excessive aggradation, degradation or profile adjustment over the monitoring period.

Pattern: Top of bank features will be surveyed to characterize the planform characteristics of the site. Success will be determined based on whether the pattern features remain generally within design ranges, without demonstrating excessive adjustment from the design parameters over the monitoring period.

Dimension: Cross-sectional geometry will be surveyed at the permanent cross-sections established during the Year 0 survey. Success will be measured based on whether the channel features generally remain within design ranges for various morphological characteristics (e.g., cross-sectional area, bankfull width, bankfull mean depth, bankfull max depth, flood-prone width, width-to-depth ratio, and entrenchment ratio).

Bed Material: Reach-wide pebble counts and pebble counts in the riffle cross-sections using the modified Wolman Pebble Count procedure (Rosgen, 1996) will be completed to characterize bed material. Note that, pebble count particle size is not expected to remain the same before and after restoration. Pebble counts will be used to check that bed particle size remains within design tolerances over the monitoring period.

6.2 VEGETATION MONITORING

Riparian and upland vegetation establishment should be assessed by a qualified biologist with experience in post-construction monitoring. Monitoring should occur in the first spring and fall following completion of construction, followed by a single fall visit in the remaining monitoring years.

A tree/shrub count should be conducted to determine survival and species percentages. If one or more species is not thriving, recommendations will be made for replacements.

Invasive species should be noted with recommendations for control as appropriate.

Deficient, dead, or dying plant material should be replaced by the contractor based on recommendations made in each annual monitoring report.

6.3 AQUATIC HABITAT MONITORING

The purpose of the aquatic habitat monitoring is to evaluate if aquatic habitat features are in good condition and are being used by aquatic organisms. Aquatic habitat monitoring should be completed in support of the project objectives. It is anticipated that the details of the monitoring plan will be developed in consultation with DFO staff that are reviewing the proposed realignment and design elements. Aquatic habitat monitoring should be performed by a qualified professional and may include:

Overall Habitat Assessment: A qualitative evaluation of the aquatic habitat features in the project reach should be conducted at each monitoring visit. The evaluation should include sketch maps and qualitative evaluation of habitat quality and quantity, in reference to designed and as-recorded conditions.

Fish: Fish surveys should be performed using, but not limited to, single path electrofishing, netting, trapping, and/or video recording. Locations, species, and quantities of fish will be noted and analyzed to evaluate habitat usage by fish.

7.0 SUMMARY

The realignment of an existing watercourse, tributary to Beaverdams Creek is required as part of the proposed Upper's Quarry. The proposed watercourse realignment includes 1788 m of channel and incorporates online ponds and offline wetland features within the floodplain.

The proposed design employs Natural Channel Design (NCD) principles. The restoration design includes a meandering riffle-pool system for the bankfull channel which contains adequate floodplain connectivity for flows greater than bankfull, reducing shear stresses and decreasing the risk of channel erosion. In-stream structures, including wood debris toe protection, wood reinforced bank stabilization, and augmented riffles will enhance aquatic habitat while also increasing stability of the channel design. The channel design will offer a greater diversity of habitat types (pool, riffle, floodplain, wetland, refuge areas, etc.) that will provide niches to be exploited by the existing fish species and are intended to attract other fish species into the new channel habitat areas. Pool habitat will be increased both in depth and number of locations so that the availability of refuge habitat for overwintering and withstanding intermittent flow conditions will be increased. Riparian ponds and wetland habitat features will be included in the floodplain for habitat diversity. Additionally, brush piles, raptor poles, and log tangles are proposed, which will benefit the local wildlife populations and promote greater ecological diversity along the stream corridor.

A native species planting plan will stabilize the stream banks and encourage a vegetated floodplain, providing valuable flood flow roughness and riparian habitat. The riparian corridor being established for the relocated channel will include significant improvements over the existing system. It will be wider and more diverse that the current corridor and the planting of only native species will enable the system to resist the incursion of invasive species. Overall, the corridor will provide better aquatic and terrestrial habitat for a wider range of native species.

While operating, the quarry will be pumping water into the existing and proposed channel. An erosion threshold assessment was carried out to determine what level of pumping the existing and proposed channel can safely handle without erosion damage. The anticipated levels of pumping by the quarry operation are below the values that could cause erosion and degrade the channels.

In summary, the proposed design provides a natural, sustainable solution that will improve aquatic habitat within the realigned watercourse. While some adjustment of the channel is anticipated as the design settles into equilibrium with the existing hydrologic and sediment transport regimes, this is a natural process which will encourage stability in the long term.

8.0 REFERENCES

CVC, 2010. Fluvial Geomorphic Guidelines – Fact Sheet II: Instream Erosion and Geomorphological Considerations in Stormwater Management.

Dunne, T. and Leopold, L.B., 1978. Water in Environmental Planning. W.H. Freeman, 818 pp.

Niagara Peninsula Conservation Authority (NPCA), 2011. Beaverdams and Shriners Creek Watershed Plan Phase One – Watershed Characterization and Preliminary Issues Identification.

Ontario Ministry of Transportation (MTO), 2008. Highway Drainage Design Standards.

Ontario Provincial Standard Specification (OPSS), 2013. Material Specification for Aggregates – Miscellaneous. OPSS.MUNI 1004, Metric. 18 pp.

Rosgen, D.L., 1996. Applied River Morphology, 2nd Edition. Wildland Hydrology, Pagosa Springs, CO.

Stantec Consulting Ltd., 2018. Meander Belt Width Determination – Upper's Creek, a Tributary to Beaverdams Creek. (Nov 2018)

United States Department of Agriculture (USDA) and Natural Resources Conservation Service (NRCS), 2007. "Chapter 8: Threshold Channel Design." Part 654, Stream Restoration Design, National Engineering Handbook. 50 pp.

9.0 STATEMENT OF LIMITATIONS

This document entitled Proposed Upper's Quarry, Natural Channel Design Report was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Walker Aggregates Inc. (the "Client") to support the regulatory review process for the proposed Upper's Quarry (the "Project"). In connection therewith, this document may be reviewed and used by governmental authorities participating in the review process in the normal course of its duties. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document. The information and conclusions in the document are based on the conditions existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

APPENDIX A

Meander Belt Delineation

Stantec

Technical Memo

To:	Kevin Kehl, Walker Aggregates Inc.	From:	Scott Cowan, Heather Amirault Waterloo, ON
File:	160960948	Date:	November 20, 2018

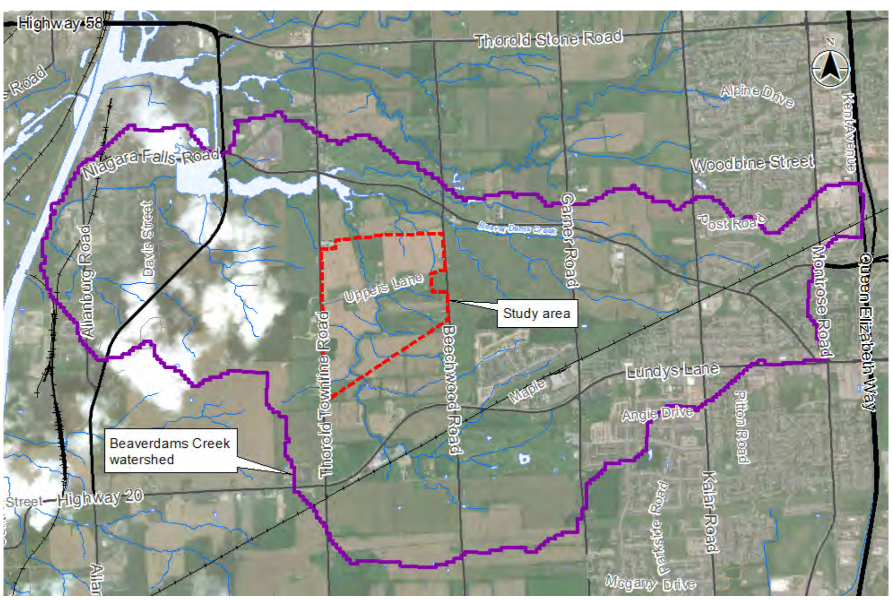
Reference: Meander Belt Width Determination, Uppers Creek, A Tributary to Beaverdams Creek

1.0 INTRODUCTION

Stantec Consulting Ltd. was retained by Walker Aggregates Inc. to conduct a meander belt assessment of Uppers Creek ('the Creek'), a tributary of Beaverdams Creek, within a proposed Walker Aggregates development property (the Study Area). The results of this assessment will support the development of aggregate extraction by delineating the limits of the existing creek's meander belt. Additionally, the results of this assessment will support the investigation of channel realignment alternatives within the Study Area.

The Study Area is located within the City of Niagara Falls and is bounded by Thorold Townline Road to the West and Beechwood Road to the East. The Southern boundary is the hydro right-of-way (approximately 750 m south of the Upper's Lane culvert) and the northern border is the property boundary located on the northern limit of the Enbridge Thorold Townline Road Gate Station property (approximately 430 m North of the Uppers Lane culvert). The limits of the Study Area are presented on Figure 1 below.

Figure 1 - Limits of Study Area



1.1 SCOPE OF WORK

The scope of this meander belt assessment involved various desktop and field components. The goal of these components was to determine a meander belt width for the creek within the Study Area. The tasks completed for this study included:

i. review background information including topographic mapping, geologic mapping, and aerial photographs;

ii. reach delineation and field observations; and

iii. meander belt width delineation.

2.0 BACKGROUND REVIEW

2.1 GEOLOGY

Surficial and bedrock geology maps published by the Ontario Geological Service (OGS) indicated the predominant physiographic region within the Study Area is the Haldimand Clay Plain which extends from the Niagara Escarpment to Lake Erie (Chapman and Putnam, 1984). The Haldimand Clay Plain was historically submerged by post-glacial Lake Warren (NPCA, 2011). As a result, surficial geology within the Study Area is characterized by glaciolacustrine silt and clay deposits. Bedrock within the Study Area consists of limestone and dolomite from the Lockport formation. The Lockport formation represents an extended period of clear water carbonate shelf deposition in the Niagara Region during the Middle and Lower Silurian geologic period (NPCA, 2011).

2.2 BEAVERDAMS CREEK WATERSHED

The Beaverdams Creek watershed extends across the municipalities of the City of Thorold, Niagara Falls, and St. Catharines. The Beaverdams Creek watershed lies above the Niagara Escarpment which rises to an elevation of approximately 180 masl (NPCA, 2011). The topography within the watershed is relatively flat with gentle undulating topography that defines the general alignment of Beaverdams Creek. Downstream of the Study Area, Beaverdams Creek discharges into the Welland Canal which ultimately discharges into Lake Ontario. The watershed draining to the Study Area has an area of approximately 6.0 km^2. Within the Study Area, a few small rills and ephemeral drainage features contribute flow to the watercourse during and immediately after precipitation events. Field assessment confirmed that geomorphic processes are not ongoing within these features, and as result, processes leading to meander development are not the same as in larger watercourses. Subsequently, meander belt delineation is not required for these small features.

2.3 HISTORICAL ANALYSIS

A sequence of aerial photographs (1976, 1983, 2002, 2010), detailed topographic mapping (1 m contours), and geologic (Quaternary) mapping were reviewed to gain insight into channel form, surrounding land use/cover, and to identify any changes that have occurred during the period of record. The predominant land use within the watershed is agricultural with some residential. Within the Study Area, the watercourse traverses mainly open scrubland or pastured/cultivated terrain with small pockets of tree cover within the riparian corridor. Riparian vegetation within the Study Area has increased and matured over the period of record (1976 to 2010). The creek has remained relatively stable during the period of record with no significant changes in creek planform observed. Furthermore, the Uppers Lane crossing has been present since the earliest aerial photograph (1976).

3.0 REACH DELINEATION AND FIELD OBSERVATIONS

3.1 REACH DELINEATION

Reaches are lengths of channel that have physical constraints (e.g. geology, slope, discharge, vegetation, sediment input) that remain nearly constant along their length and subsequently exhibit similar physical geomorphic characteristics (e.g. channel form, sinuosity, physical dimensions). Subsequently, the controlling and modifying influence of channel form in a reach are similar (Parish, 2004). This partitioning guides desktop and field analyses in that it considers the influence of localized channel patterns and processes.

Based on the information available, the creek within the vicinity of the proposed development was partitioned into two reaches. Reach BDT-1 extends downstream (north) along the thalweg of the channel from the southern boundary of the study area for approximately 1,336 m and terminates approximately 125 m downstream of Uppers Lane. Reach BDT-2 extends from the downstream limit of Reach BDT-1 for approximately 373 m and terminates at the downstream limit of the study boundary.

3.2 FIELD OBSERVATIONS

Existing site conditions were observed during a site visit completed by Stantec on September 20, 2017. The banks and riparian corridor of Reach BDT-1 are predominantly vegetated with tall grasses. Some trees and shrubs are also present. The surrounding land use is agricultural. Creek banks and substrate are comprised of silty clay with cattails present in pools. There did not appear to be excessive degradation or aggradation within the channel. Banks are generally stable, with some minor erosion identified on outside bends. Reach BDT-1 exhibits a naturally sinuous planform within a very broad and gently sloping valley with a low degree of channel confinement and relatively flat slope. A typical photograph of Reach BDT-1 is provided in Figure 2 below.

Figure 2 – Photographs of Reach BDT-1 and BDT-2

Reach BDT-1 looking upstream. Tall grasses with some shrubs on the banks and overbank.

Reach BDT-2 Looking downstream. Dense shrubs on the banks and overbank.

The banks and riparian corridor of Reach BDT-2 are predominantly vegetated with thick shrubs and some grasses and trees. Creek banks and substrate are comprised of silty clay. There did not appear to be excessive degradation or aggradation within the channel. Banks are generally stable, with some erosion on outside bends. Reach BDT-2 exhibits a naturally sinuous planform within a broad and gently sloping valley setting. There is a higher degree of channel confinement and slope in Reach BDT-2 than BDT-1. A typical photograph of Reach BDT-2 is provided in Figure 2 above. The land use surrounding both reaches is agricultural, defined by cultivated terrain. Reach break locations are presented in Figure 3 (attached).

The physical attributes of the channels within each reach are summarized in Table 1 below. There were differences in slope observed along the watercourse, which were considered when delineating reaches.

Table 1 - Summary of Existing Conditions along Beaverdams Creek

Reach	**BDT-1 (Upstream Reach)**	**BDT-2 (Downstream Reach)**
Length (m)	1,336	373
Valley form	Unconfined	Partially confined
Channel slope (m/m)	0.0013	0.0026
Drainage Area (km^2)	5.8	6.0
Bankfull Width (m)	4.4	4.6
Riparian vegetation	Tall grasses with some shrubs and trees	Dense shrubs with some tall grasses and trees

4.0 MEANDER BELT WIDTH DETERMINATION

The meander belt is a term used to quantify the lateral extent of a river's occupation of its floodplain (TRCA, 2004). Meander belts are inherently variable and their extent is dependent on a number of controlling factors. These include, among other things, hydrology, stormwater flows, bank erosion rates, slope, and the degree of channel confinement by the valley walls.

The technique used in this assessment follows the procedure outlined in the TRCA Meander Belt Delineation Procedure. The specific methodology applicable to the Study Area was the method that assumed no change in hydrologic regime (Procedure 2). This scenario is considered appropriate given that the area upstream of the Study Area is not intended for development in the near future. The steps involved in this procedure include:

1. historic channel mapping;
2. delineation of meander axis;
3. quantification of the Preliminary Belt Width;
4. quantification of the Existing Belt Width;
5. quantification of the 100-year migration distance; and
6. quantification of the Final Meander Belt Width.

4.1 HISTORIC CHANNEL MAPPING

To evaluate historic creek planform movement, channel mapping was conducted from a series of historic aerial photographs. Four series of aerial photographs were used as the basis for channel mapping. Summary details of the aerial photographs are provided in Table 2 below.

Table 2 - List of Available Aerial Photographs

Year	Source	Notes
1976	National Air Photo Library	Black and white. Medium-quality image. Watercourse discernable
1983	National Air Photo Library	Black and white. Medium-quality image. Watercourse discernable
2002	First Base Solutions	Colour. Good quality image
2010	First Base Solutions	Colour. Good quality image

Channel mapping was conducted by digitizing the centerline of the creek on-screen using ArcGIS. The centerline was digitized using visual assessment and geomorphic judgement. Mapping proceeded in reverse chronological order, starting with 2010. In locations where it was determined that no changes had occurred between mapping periods, the digitized linework was left unmodified. This methodology avoids the generation of spurious changes by maintaining consistent linework where no changes in channel morphology are identified. The results of the historic channel mapping are presented in Figure 3 (attached).

4.2 DELINEATION OF MEANDER AXIS

The meander axis, used to describe the general down-valley orientation of the meander pattern, delineates the centerline of the meander belt. The meander axis defines the trend of the valley, and thus the trend or orientation of the meander belt within that valley. The delineation of the meander axis along the creek was fairly straightforward owing to the well-defined meander pattern.

4.3 PRELIMINARY BELT WIDTH

A preliminary meander belt width was delineated for each tributary by following protocols outlined in TRCA (2004). First, a meander belt axis was identified that follows the watercourses general down valley trend. After defining the meander belt axis, parallel lines that are tangential to the outermost meanders are used to define the limits of the preliminary belt width. As a result, the preliminary meander belt is centered around the meander axis. The perpendicular distance between these limits represents the preliminary meander belt. The preliminary belt widths for BDT-1 and BDT-2 are 38 and 33 m, respectively.

4.4 EXISTING BELT WIDTH

The width of the channel was incorporated into the meander belt width by adding the channel bankfull width into the preliminary belt width. The resulting sum yields the existing belt width. In addition to encompassing the entire active channel, the existing belt width includes fluvial features that indicated former or present channel occupation within its valley. The existing belt width for BDT-1 and BDT-2 are 42.4 and 37.6 m, respectively.

4.5 BANK EROSION RATE

The meander belt delineation is augmented by incorporating the 100-year bank erosion rate into the calculation, thus adding an additional and appropriate margin of safety. Bank erosion was measured for the two reaches using historical aerial photographs. The 100-year erosion rate was estimated by multiplying the annual rate of bank recession, based on the available imagery, by 100. The annual recession rates for BDT-1 and BDT-2 are 0.09 and 0.07 m/yr, respectively.

4.6 FINAL MEANDER BELT WIDTH

The results of the computational procedures are presented in Table 3 below. The final belt widths were determined to be 60 and 52 m for reach BDT-1 and BDT-2, respectively.

Table 3- Summary of Belt Width Dimensions in Uppers Creek

Reach	Preliminary Belt Width (m)	Bankfull Width (m)	Existing Belt Width (m)	100 Year Erosion Allowance (m)	Final Belt Width (m)
BDT-1	38	4.4	42.4	9	60
BDT-2	33	4.6	37.6	7	52

As a single meander belt value is required to define the meander belt allowance for channel realignment, the more conservative (larger) meander belt width is selected as it provides sufficient width for all the natural channel processes to occur. As a result, the final meander belt to be used when investigating creek realignment alternatives within the Study Area is 60 m.

5.0 SUMMARY

The purpose of this assessment was to define a meander belt width for Uppers Creek, a tributary to Beaverdams Creek which bisects an aggregate development property owned by Walker Aggregates Inc. The results of this assessment support aggregate extraction by defining a meander belt that provides adequate width to address the migration hazard associated with the watercourse in its current location. Additionally, this meander belt assessment is required as part of the analysis to support channel realignment if Walker intends to pursue this option. Based on the background review, field reconnaissance, and historic channel mapping the meander belt width for Uppers Creek located within the Study Area ranges from 52 m to 60 m. However, to be conservative, a meander belt of 60 m will be used when investigating creek realignment alternatives. Please note that additional assessment (e.g. hydraulic analysis, geotechnical investigation, ecological assessment, and hydrogeological investigation) would be required to determine the ultimate valley width required to complete channel realignment within the Study Area.

Reference: **Meander Belt Width Determination, Uppers Creek, A Tributary to Beaverdams Creek**

5.1 REFERENCES

Chapman, L.J., and Putnam, D.F., 1984. *The Physiography of Southern Ontario; Ontario Geological Survey, Special Volume 2*, 270p. Accompanied by Map P.2715 (coloured), scale 1:600,000.

Niagara Peninsula Conservation Authority (NPCA), 2011. *Beaverdams and Shriners Creek Watershed Plan Phase One – Watershed Characterization and Preliminary Issues Identification*, 108p

Toronto and Region Conservation Authority (TRCA), 2004. *Belt Width Delineation Procedures.* Prepared by PARISH Geomorphic Ltd.

All of which is respectfully submitted,

STANTEC CONSULTING LTD.

PROFESSIONAL GEOSCIENTIST
SCOTT J. E. COWAN
PRACTISING MEMBER
2751
Dec 4, 2018
ONTARIO

Scott Cowan P.Geo, CTech.
Fluvial Geomorphologist

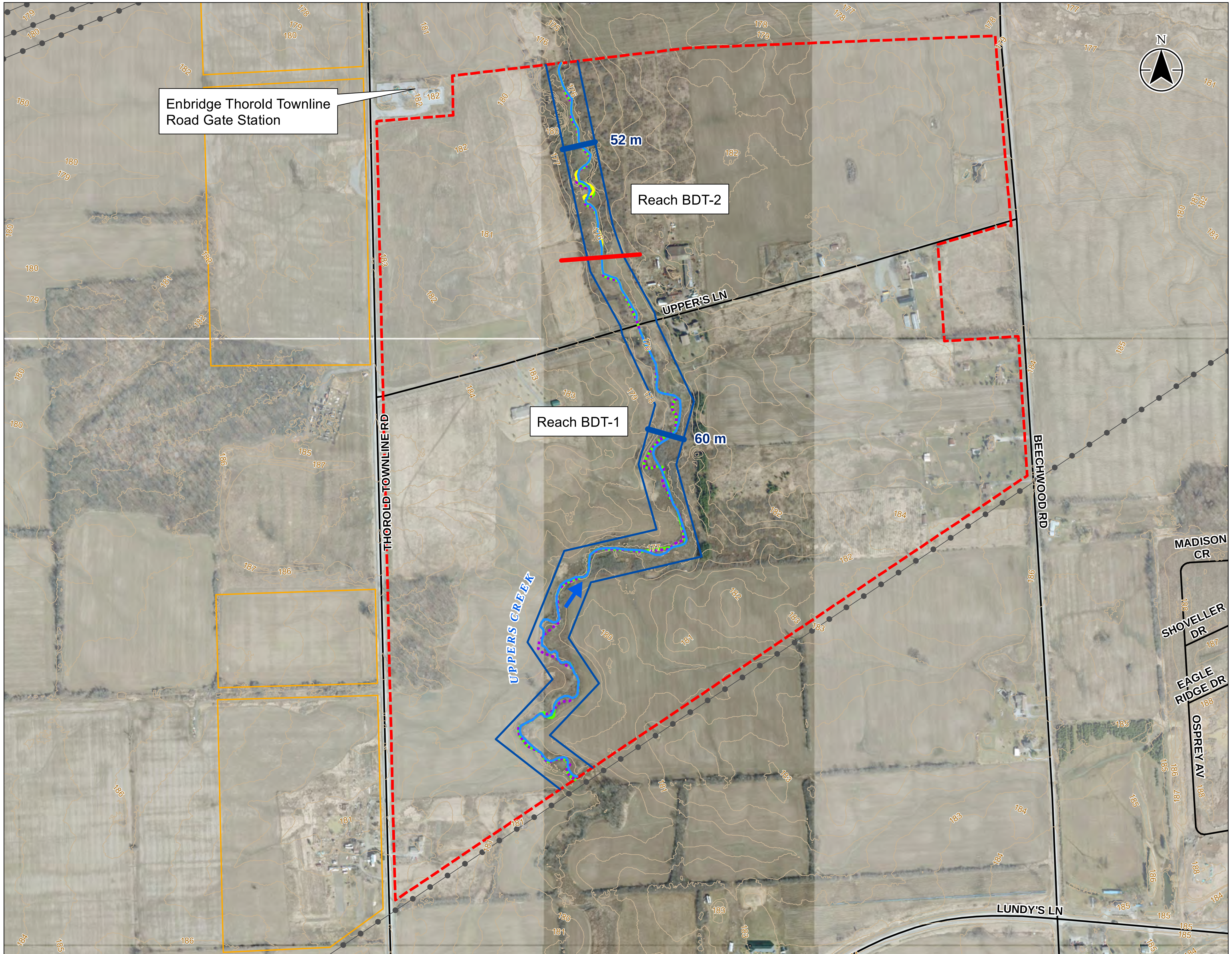
Phone: (519) 585 7306
Fax: (519) 579-6733
Scott.Cowan@stantec.com

Heather Amirault P.Eng.
Stream Restoration Engineer

Phone: (519) 585-7453
Fax: (519) 579-6733
heather.amirault@stantec.com

Attachment: Figure 3, Uppers Creek Tributary – Historic Channel Mapping

c. Sean Geddes, Stantec Consulting Ltd.



Stantec

Legend

- Site Boundary
- Contour (1m)
- Hydro Line
- Road
- Meander Belt Width
- 2010 Channel Centreline
- 2002 Channel Centreline
- 1983 Channel Centreline
- 1976 Channel Centreline
- Reach Break
- Additional Lands Owned by WAI

0 200 400 metres

1:6,500 (At original document size of 11x17)

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, 2017.

Project Location
Niagara Falls

160960948

Client/Project
WALKER AGGREGATES INC.
MEANDER BELT ASSESSMENT

Figure No.
Figure 3

Title
Uppers Creek Tributary - Historic Channel Mapping

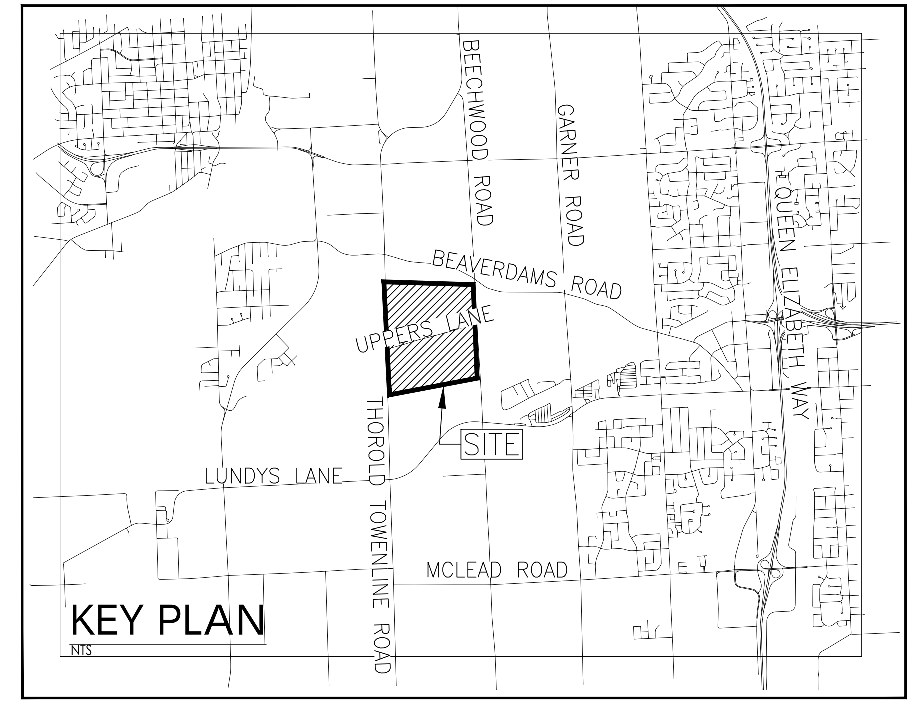
APPENDIX B

Design Drawings

Stantec

WALKER AGGREGATES

NIAGARA FALLS, ON



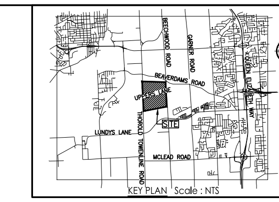
UPPERS QUARRY WATERCOURSE REALIGNMENT

NOT FOR CONSTRUCTION

ISSUED FOR: PERMITTING
2021.11.18
PROJECT NUMBER: 160960948

INDEX

SHEET NO.	DESCRIPTION
C-010	SITE PLAN
C-200	PLAN AND PROFILE - 0+000 TO 0+175
C-201	PLAN AND PROFILE - 0+175 TO 0+330
C-202	PLAN AND PROFILE - 0+330 TO 0+500
C-203	PLAN AND PROFILE - 0+500 TO 0+700
C-204	PLAN AND PROFILE - 0+700 TO 0+875
C-205	PLAN AND PROFILE - 0+875 TO 1+025
C-206	PLAN AND PROFILE - 1+025O 1+175
C-207	PLAN AND PROFILE - 1+160 TO 1+325
C-208	PLAN AND PROFILE - 1+300 TO 1+425
C-209	PLAN AND PROFILE - 1+425 TO 1+600
C-210	PLAN AND PROFILE - 1+600 TO END
C-220	GRADING PLAN - 0+000 TO END - ACCESS ROAD
C-500	GENERAL NOTES
C-501	TYPICAL DETAILS
C-502	TYPICAL DETAILS
C-503	TYPICAL DETAILS
C-600	SEDIMENT AND EROSION CONTROL PLAN SOUTH
C-601	SEDIMENT AND EROSION CONTROL PLAN CENTRAL
C-602	SEDIMENT AND EROSION CONTROL PLAN NORTH
C-700	TYPICAL CROSS-SECTIONS
C-701	CROSS-SECTION A-A, B-B, C-C AND D-D
C-702	CROSS-SECTIONS E-E AND F-F
C-703	CROSS-SECTIONS G-G AND H-H
C-704	CROSS-SECTIONS I-I AND J-J
C-705	CROSS-SECTIONS K-K AND L-L
C-706	CROSS-SECTION M-M, N-N AND O-O
L-460	RESTORATION PLANTING PLAN - SOUTH
L-461	RESTORATION PLANING PLAN - CENTRAL
L-462	RESTORATION PLANTING PLAN - NORTH
L-500	LANDSCAPE DETAILS - GENERAL PLANTING
L-501	LANDSCAPE TYPICAL SECTIONS



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-010SP.dwg	RJB	HA	HA	21.09.01
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

SITE PLAN

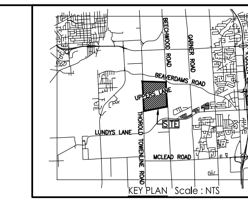
Project No. 160960948

Scale 1:2500 0 25 75 125m

Revision 7 Sheet 1 of 32

Drawing No. **C-010**

ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

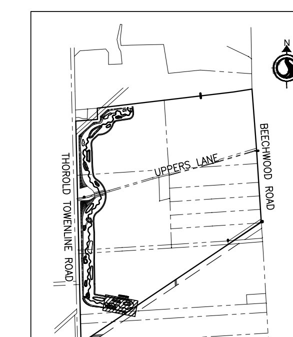
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



SITE LOCATION Scale : NTS

		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-200ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE 0+000 TO 0+175

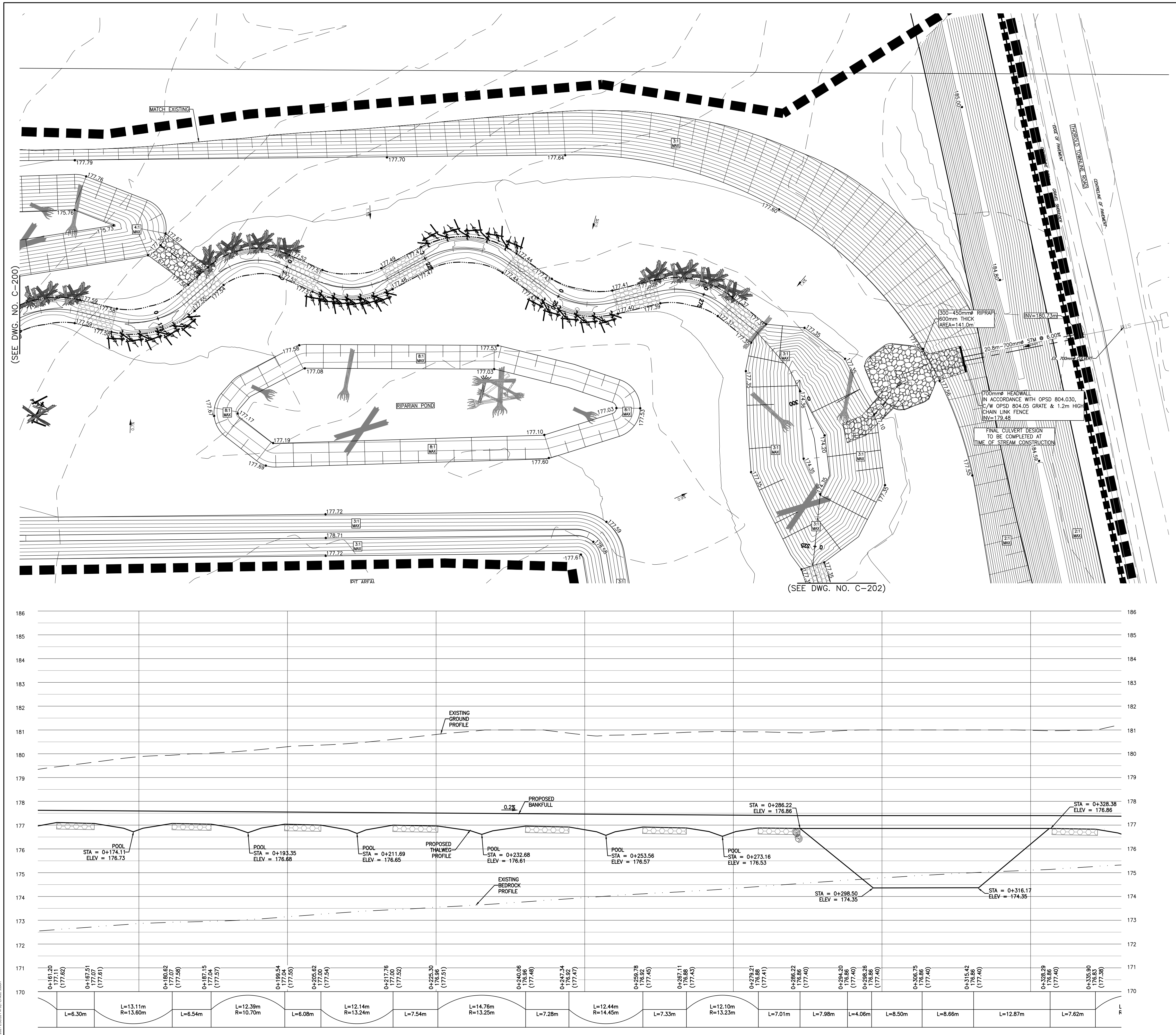
Project No. 160960948

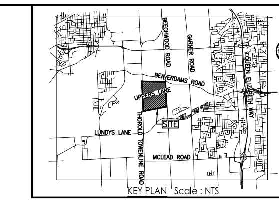
Scale 1:300H 1:75V

Revision 7

Sheet 2 of 32

Drawing No. **C-200**





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

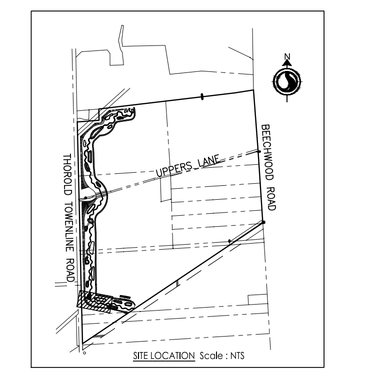
Legend

- 0+125.45 — STATION
- 377.60 — THALWEG ELEVATION
- (338.10) — BANKFULL ELEVATION
- L=18.6 — CENTRE LINE LENGTH
- R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

- PROPERTY LINE / PROPERTY BOUNDARY
- EXISTING CONTOUR / PROPOSED CONTOUR
- AUGMENTED RIFFLE (SEE DETAILS)
- CULVERT SUBSTRATE (SEE DETAILS)
- WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
- LIMIT OF GRADING
- REINFORCED BANK PROTECTION (SEE DETAILS)
- ROOTWADS (SEE DETAILS)
- COVER LOG (SEE DETAILS)
- LOG SILL (SEE DETAILS)
- COVER LOGS (SEE DETAILS)
- BRUSH PILE (SEE DETAILS)
- LOG TANGLE (SEE DETAILS)
- SNAG TREE (SEE DETAILS)
- LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-200ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
0+175 TO 0+330

Project No. 160960948

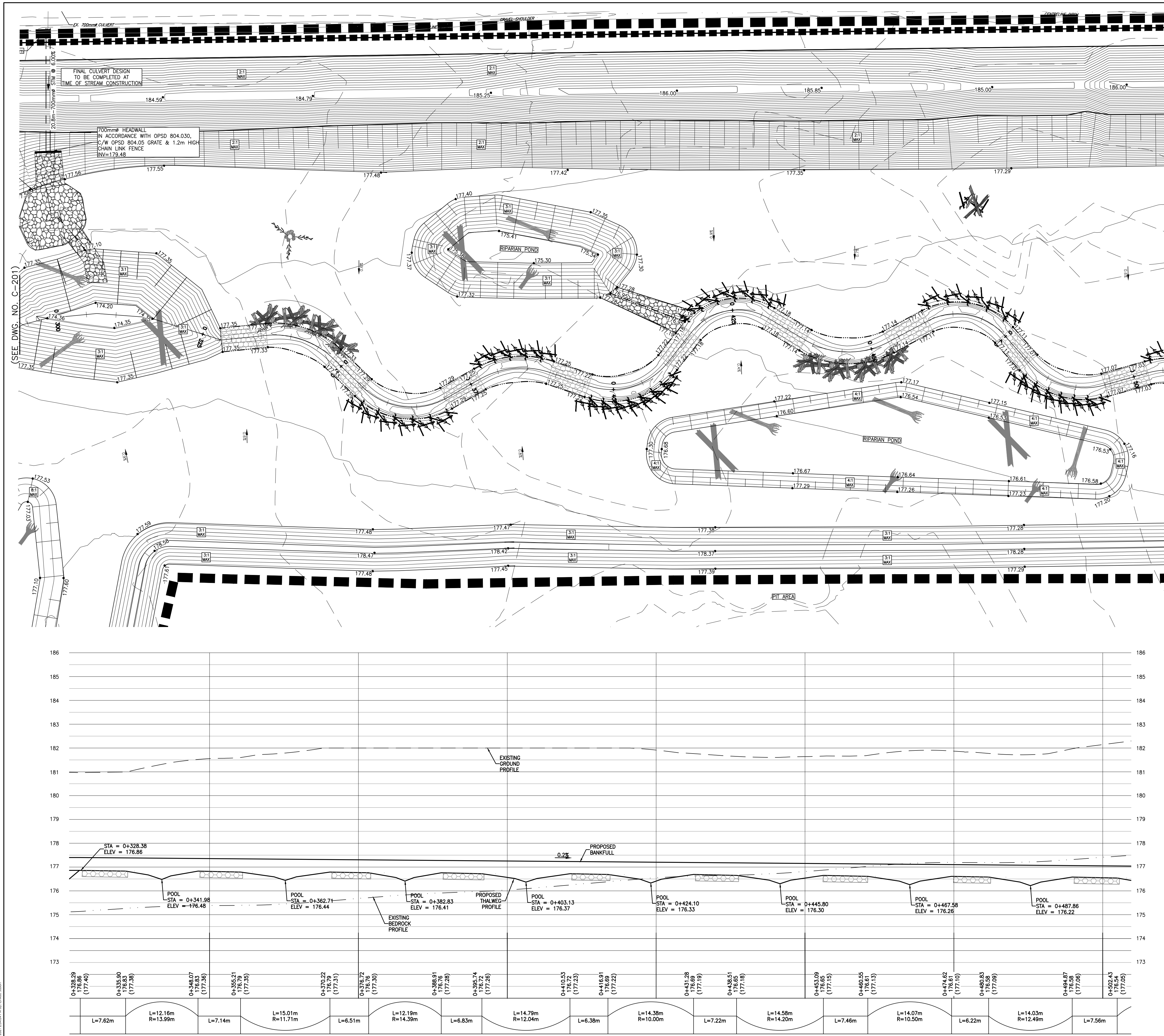
Scale 1:300H 1:75V

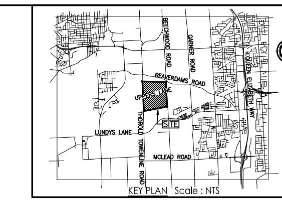
Revision 7

Sheet 3 of 32

Drawing No. **C-201**

ORIGINAL SHEET - ARCH D





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

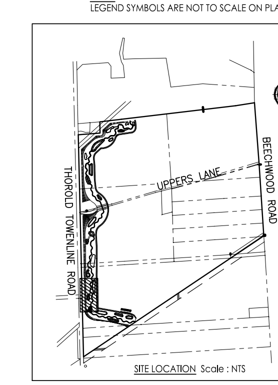
1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE
PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
ROOTWADS (SEE DETAILS)
REINFORCED BANK PROTECTION (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-200ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

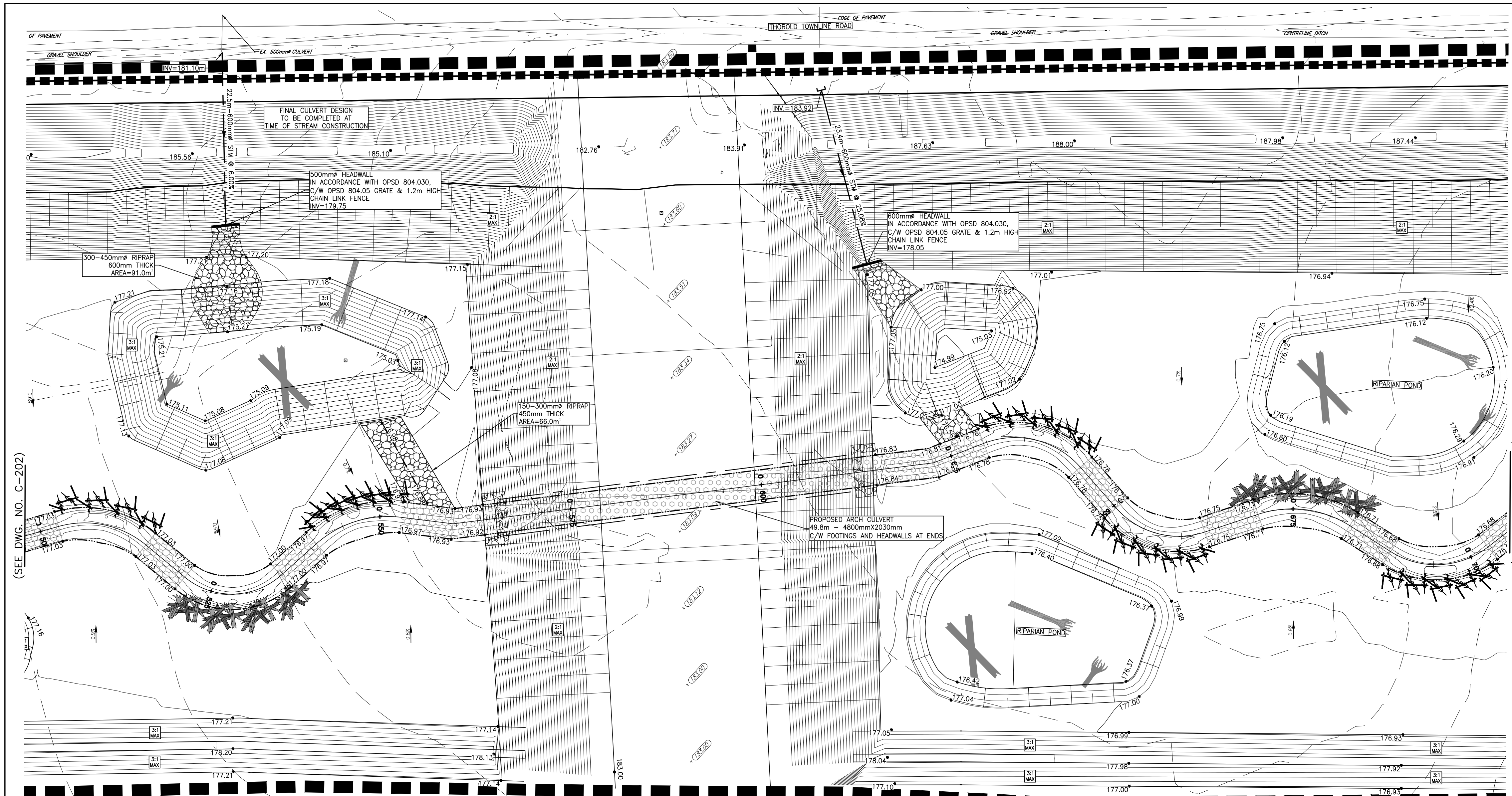
UPPERS QUARRY
WATERCOURSE REALIGNMENT

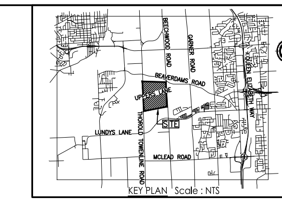
Niagara Falls, ON

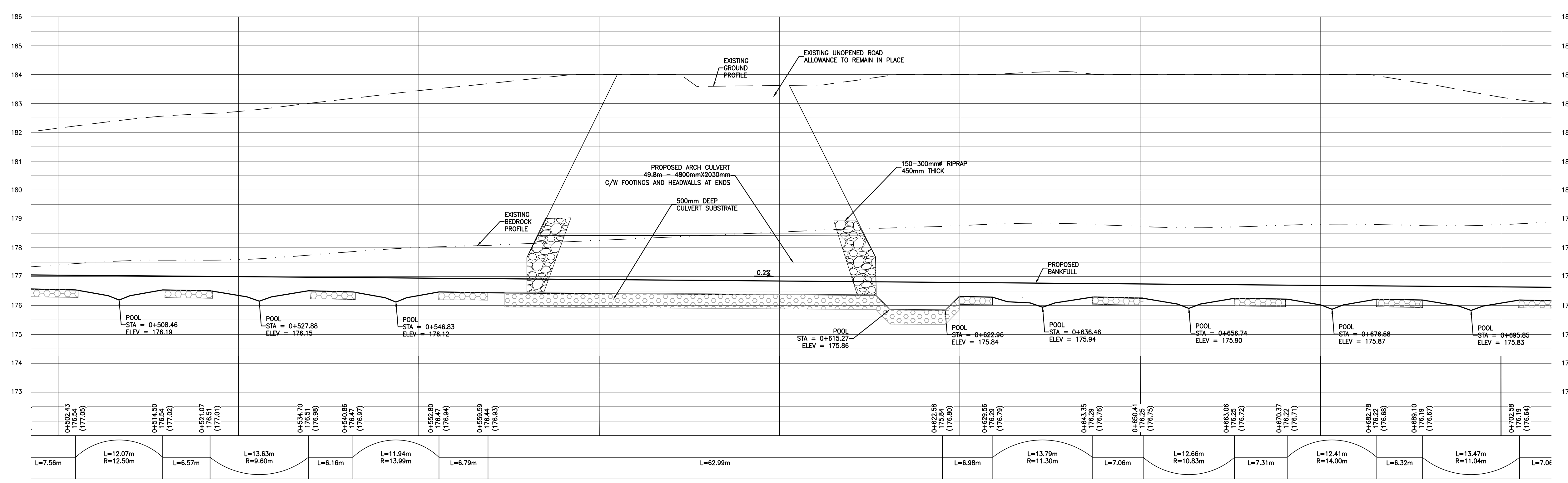
Title

PLAN AND PROFILE
0+330 TO 0+500

Project No. 160960948
Scale 1:300H 1:75V
Revision 7
Sheet 4 of 32
Drawing No. **C-202**







Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Copyright Reserved

Notes

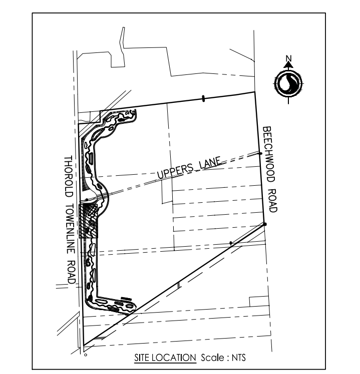
1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE
PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
ROOTWADS (SEE DETAILS)
REINFORCED BANK PROTECTION (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-200ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

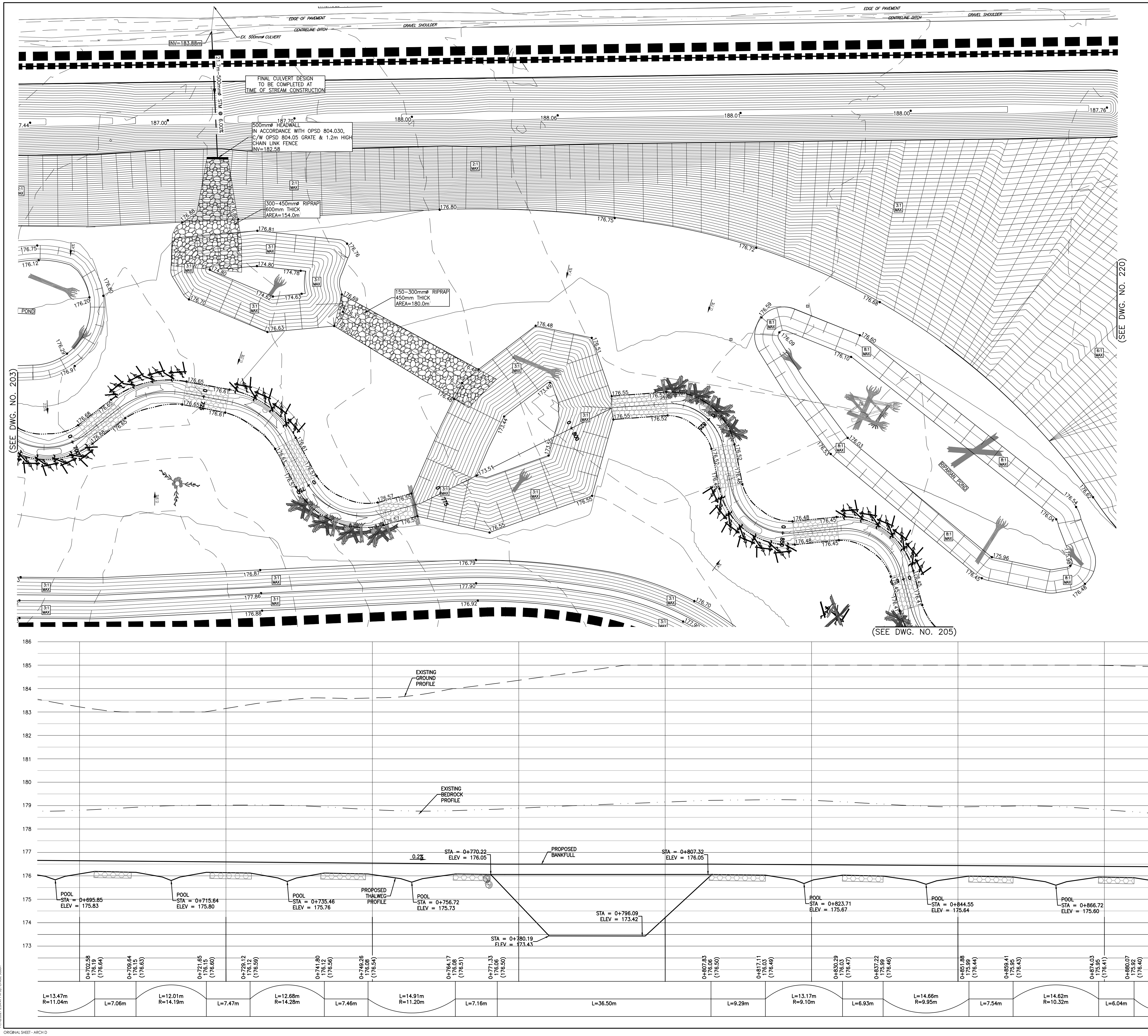
Niagara Falls, ON

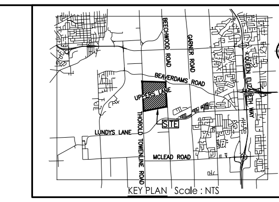
Title

PLAN AND PROFILE
0+500 TO 0+700

Project No. 160960948
Scale 1:300H 1:75V
Revision 7
Sheet 5 of 32
Drawing No. **C-203**

ORIGINAL SHEET - ARCH D





KEY PLAN Scale : NTS

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

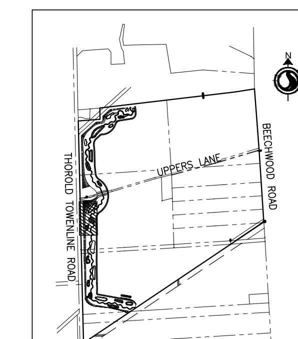
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



SITE LOCATION Scale : NTS

		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-200ST.dwg — RJB (Dwn.) — HA (Chkd.) — HA (Dsgn.) — 21.11.18 (YYYY.MM.DD)

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
0+700 TO 0+875

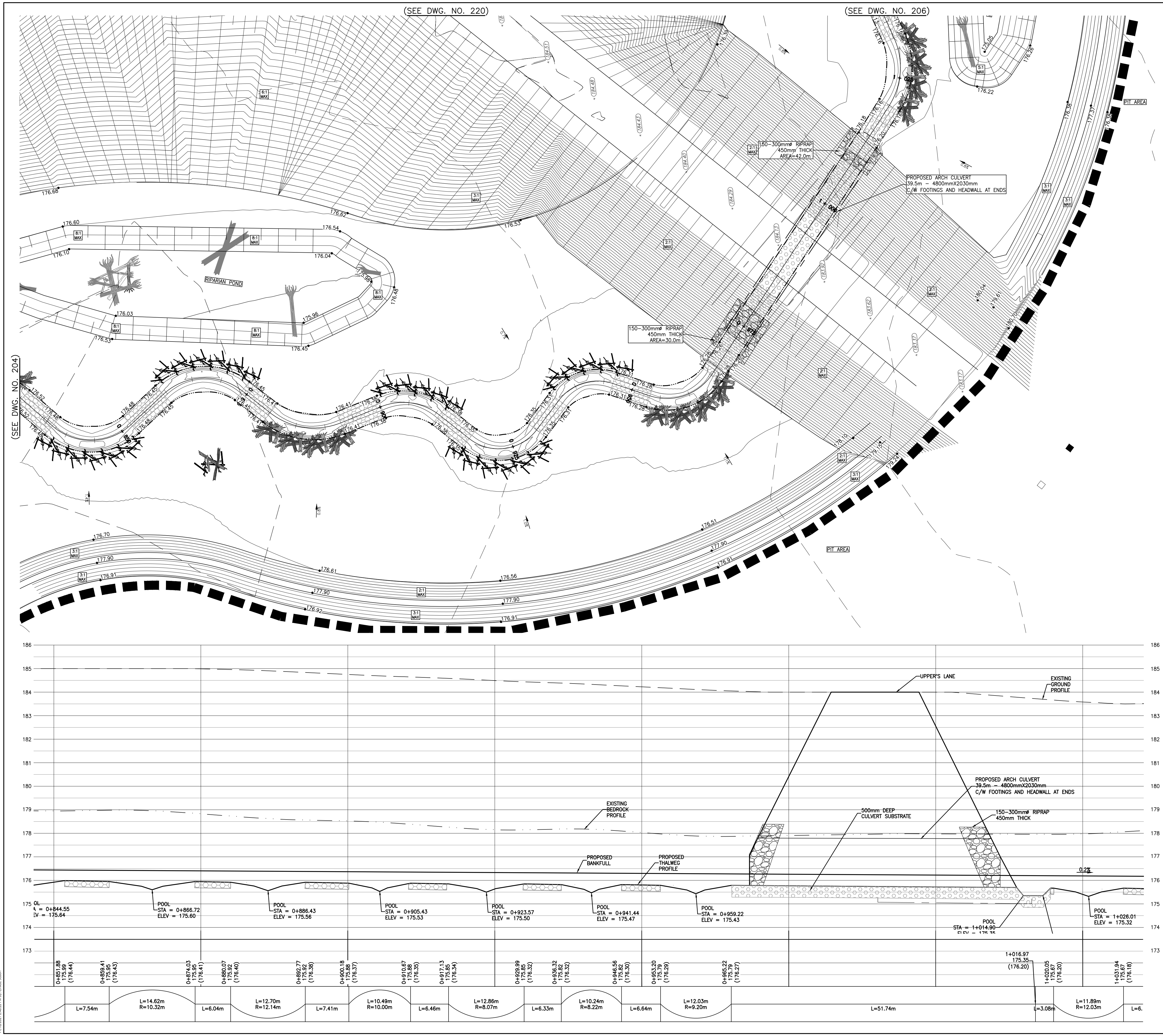
Project No. 160960948

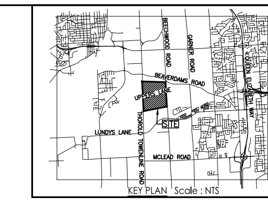
Scale 1:300H 1:75V

Revision 7

Sheet 6 of 32

Drawing No. **C-204**





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

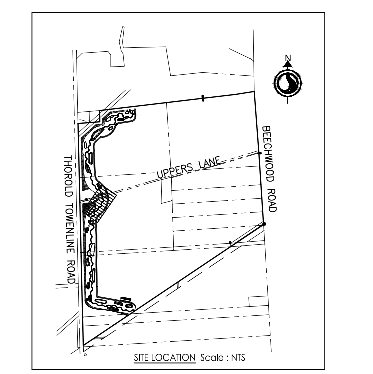
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

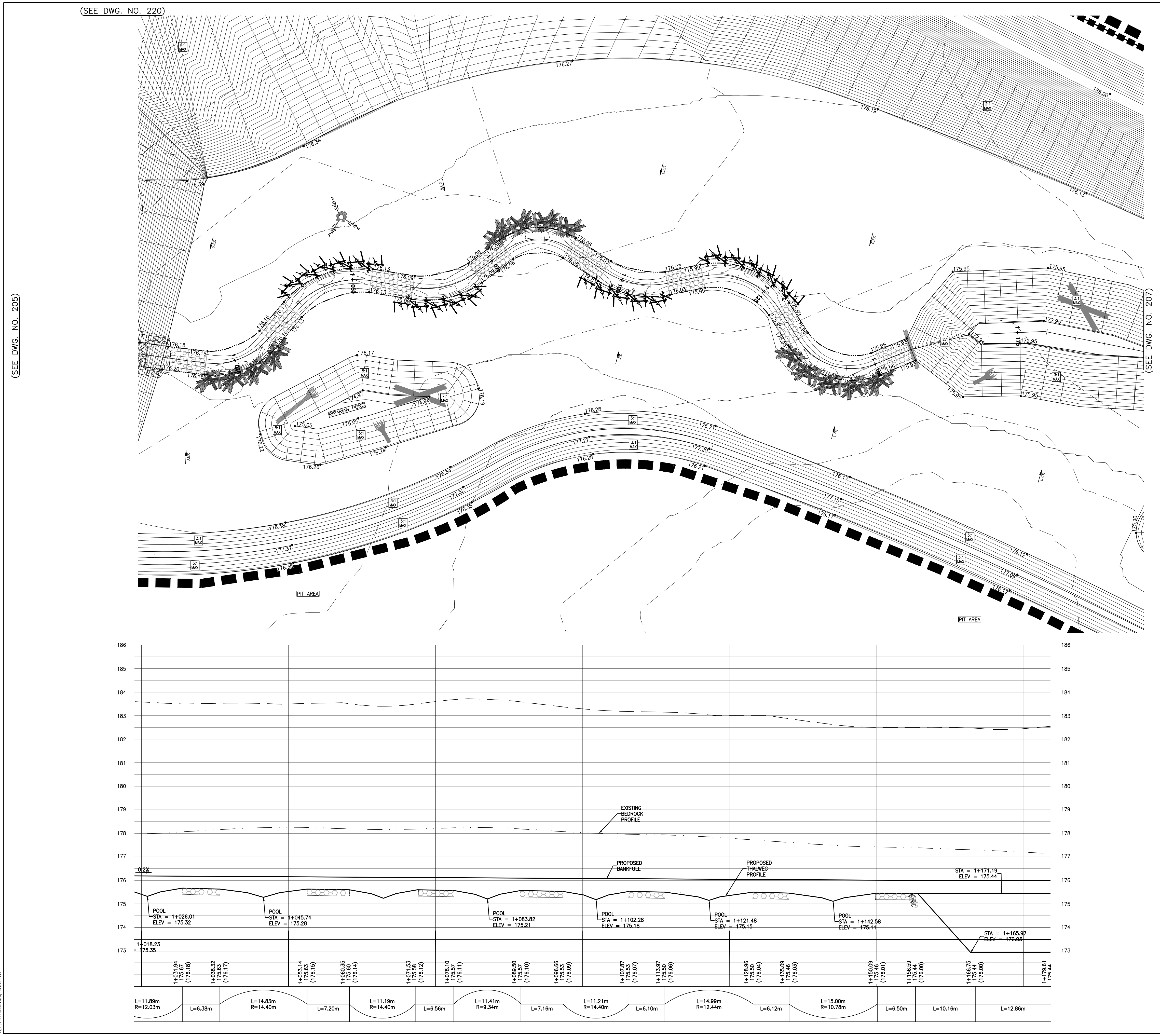
PLAN AND PROFILE
0+875 TO 1+025

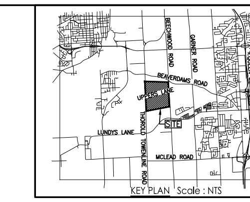
Project No. 160960948

Scale 1:300H 1:75V

Revision 7 | Sheet 7 of 32 | Drawing No. C-205

ORIGINAL SHEET - ARCH D





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

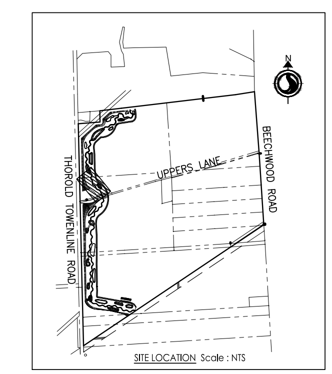
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

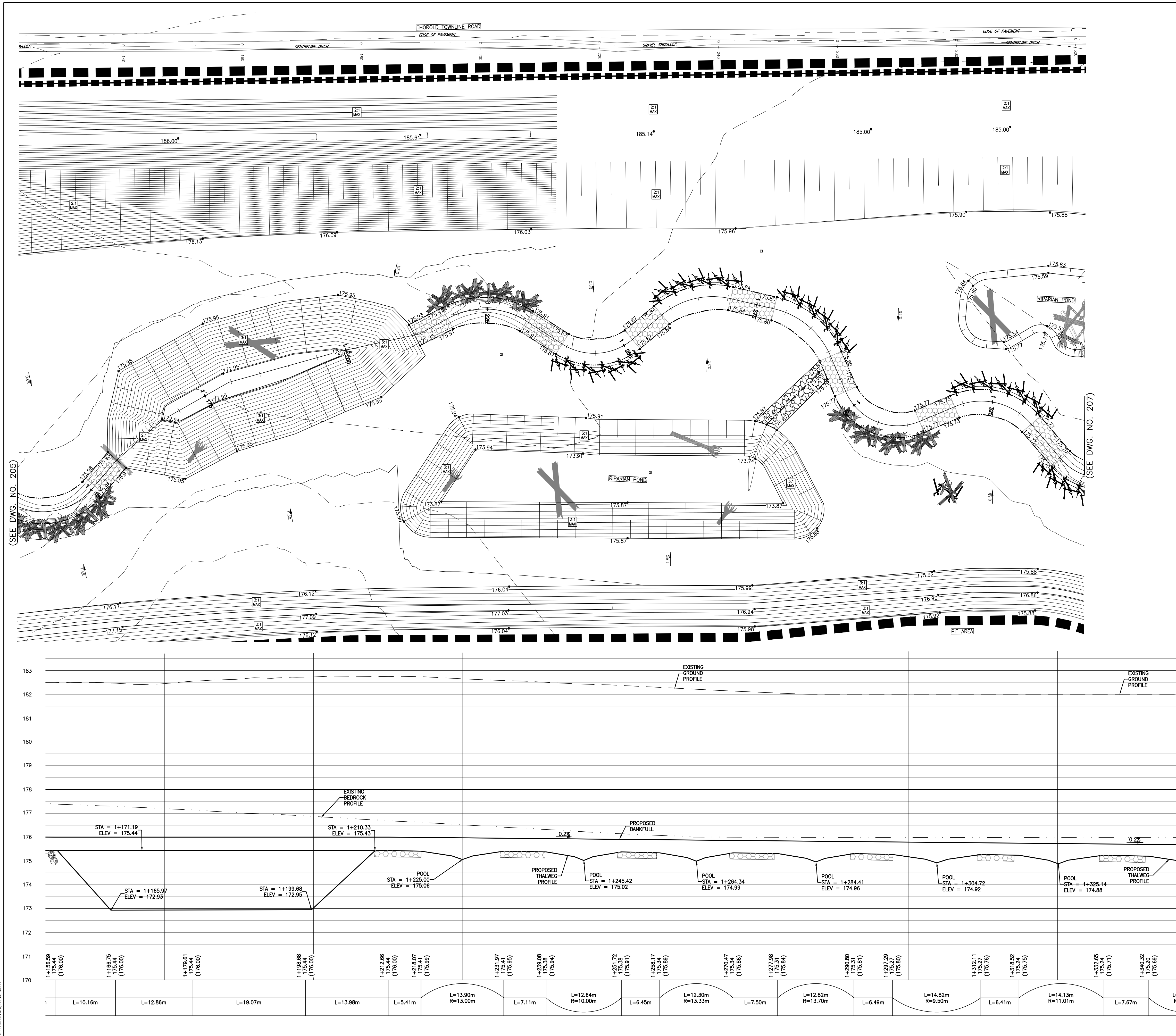
Title

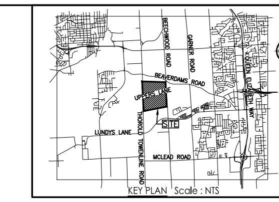
PLAN AND PROFILE
1+025 TO 1+175

Project No. 160960948
Scale 1:300H 1:75V

Revision 7 | Sheet 8 of 32 | Drawing No. **C-206**

ORIGINAL SHEET - ARCH D





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

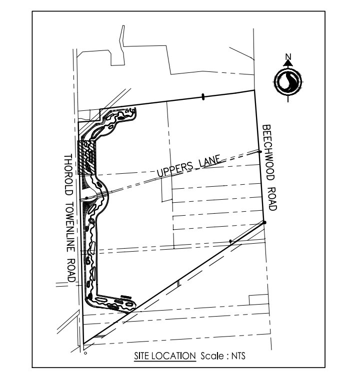
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

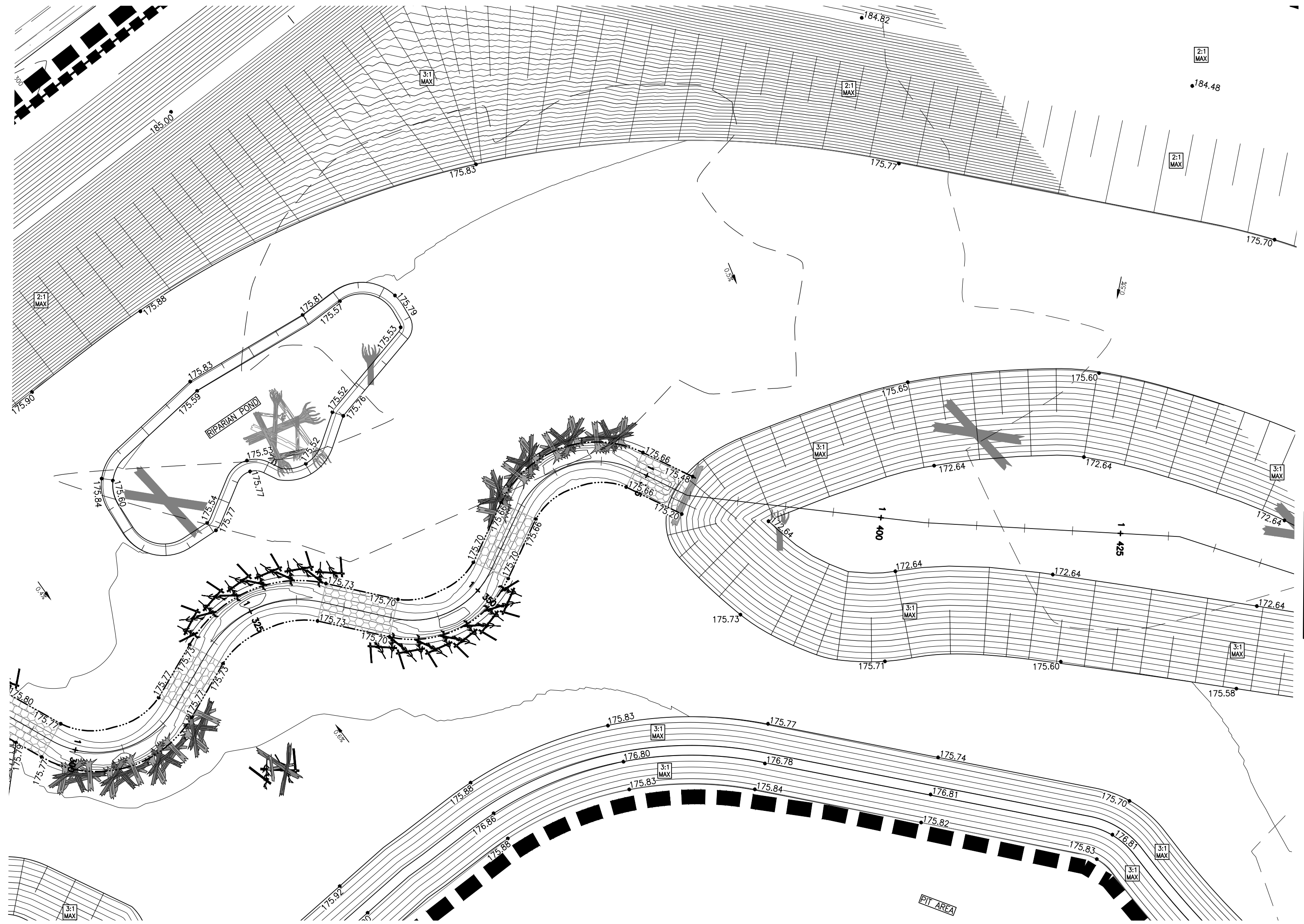
Niagara Falls, ON

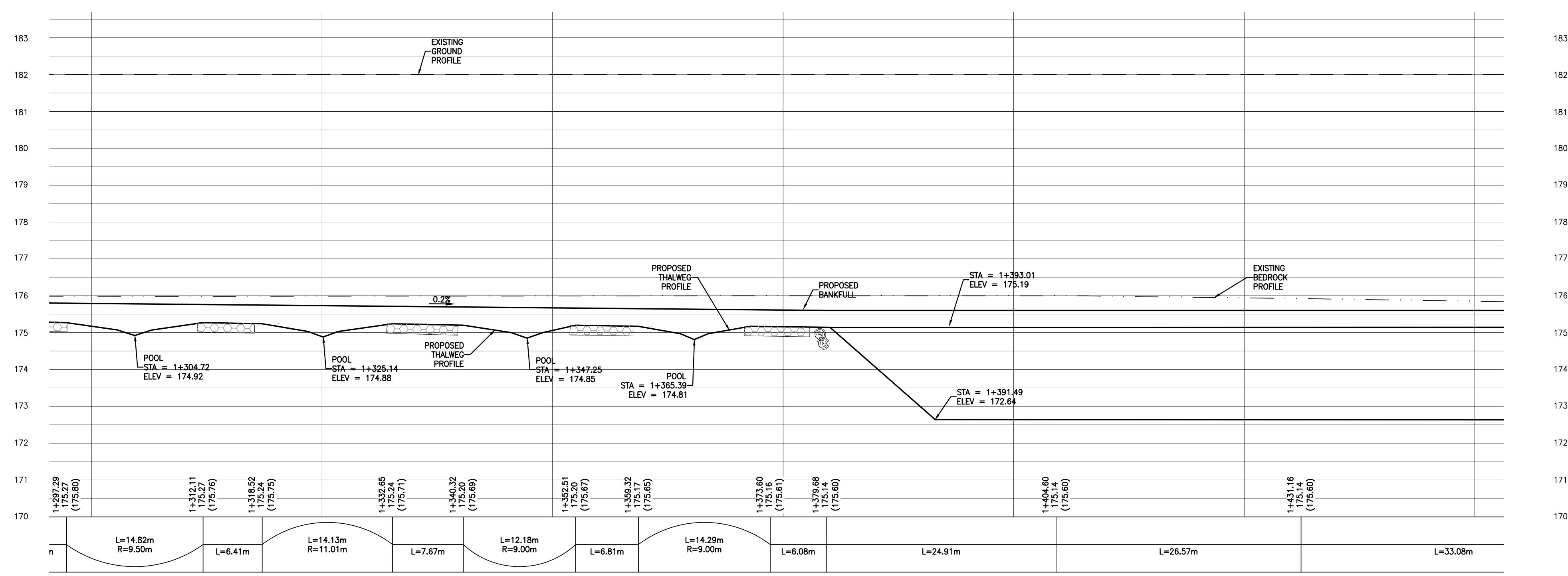
Title

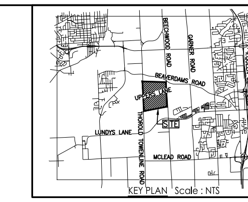
PLAN AND PROFILE
1+160 TO 1+325

Project No. 160960948
Scale 1:300H 1:75V
Revision 7
Sheet 9 of 32
Drawing No. C-207

ORIGINAL SHEET - ARCH D







Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

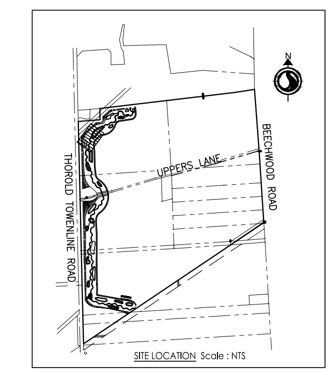
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
1+300 TO 1+425

Project No. 160960948

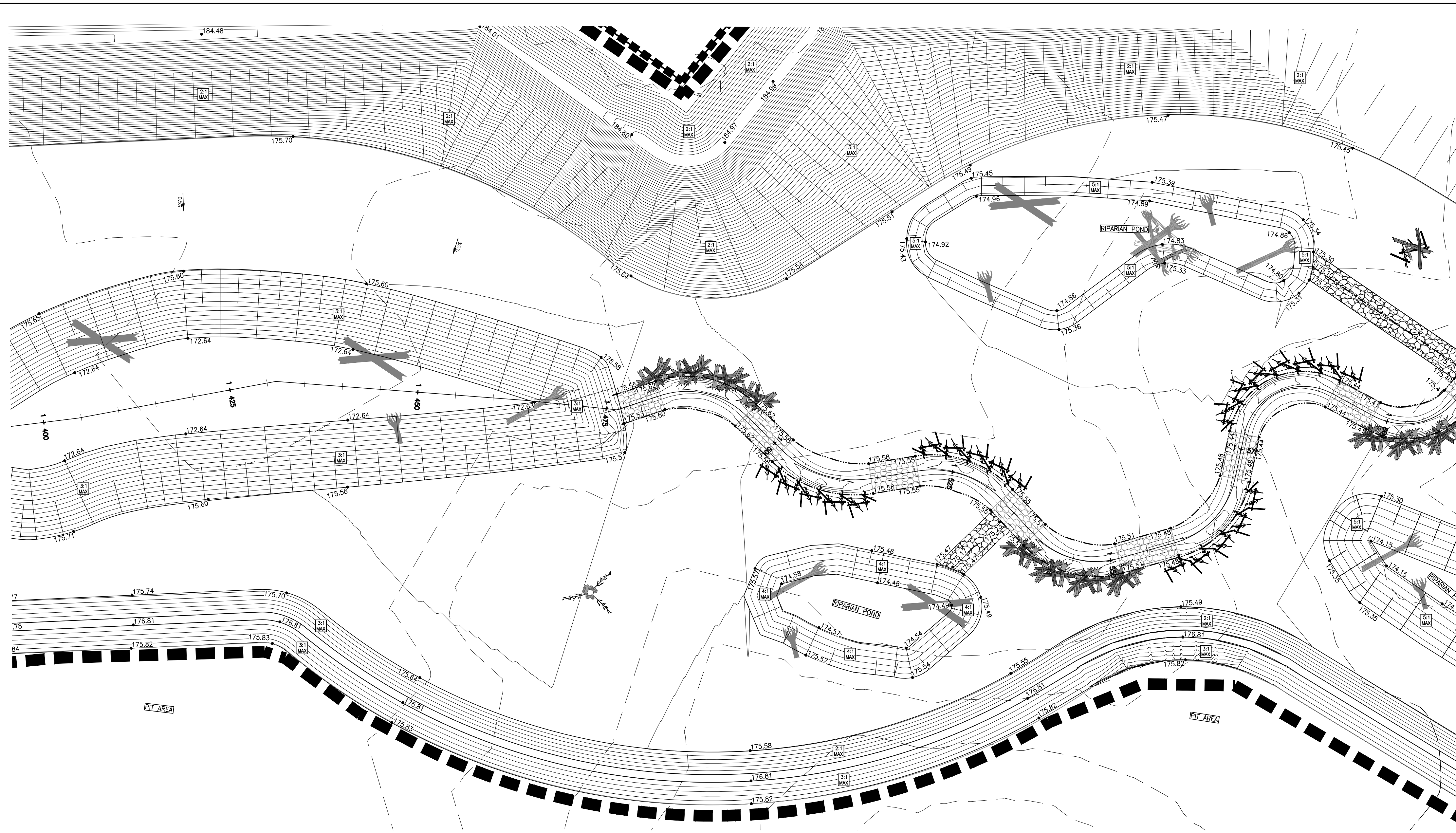
Scale 1:300H 1:75V (0, 3, 9, 15m; 0, 0.75, 2.25, 3.75m)

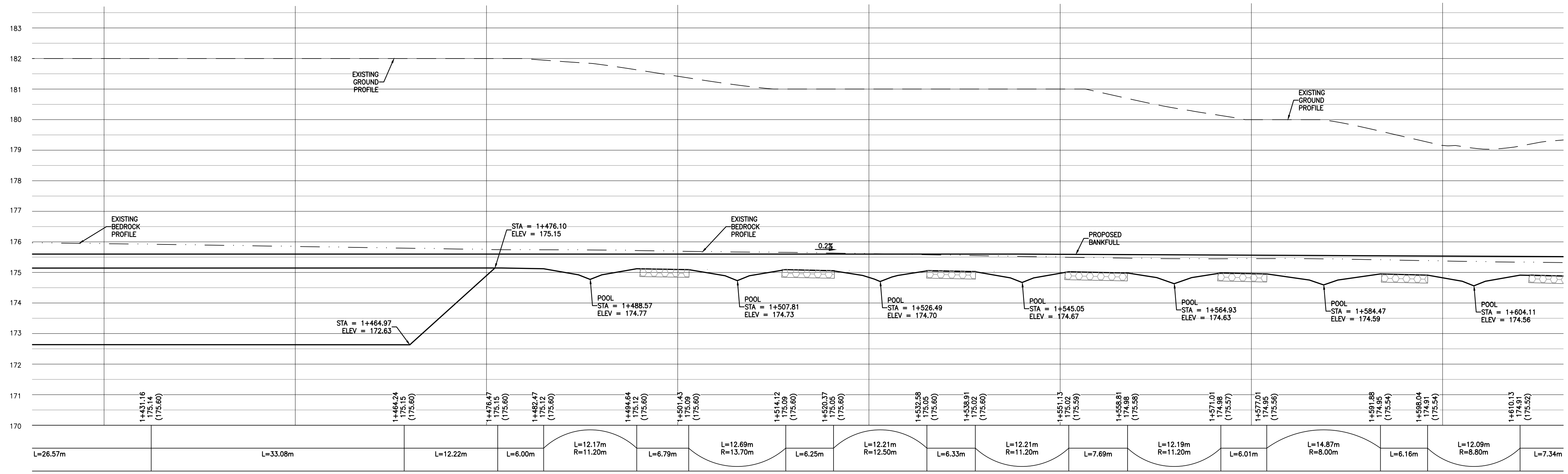
Revision 7

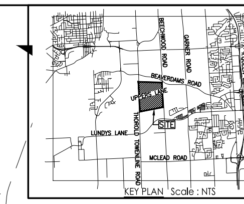
Sheet 10 of 32

Drawing No. **C-208**

ORIGINAL SHEET - ARCH D







Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

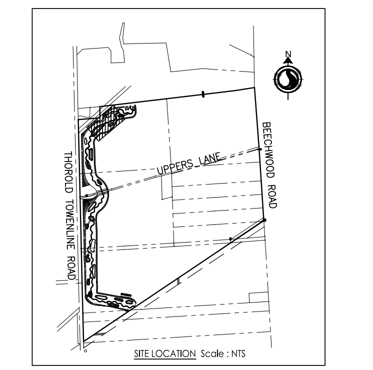
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE / PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

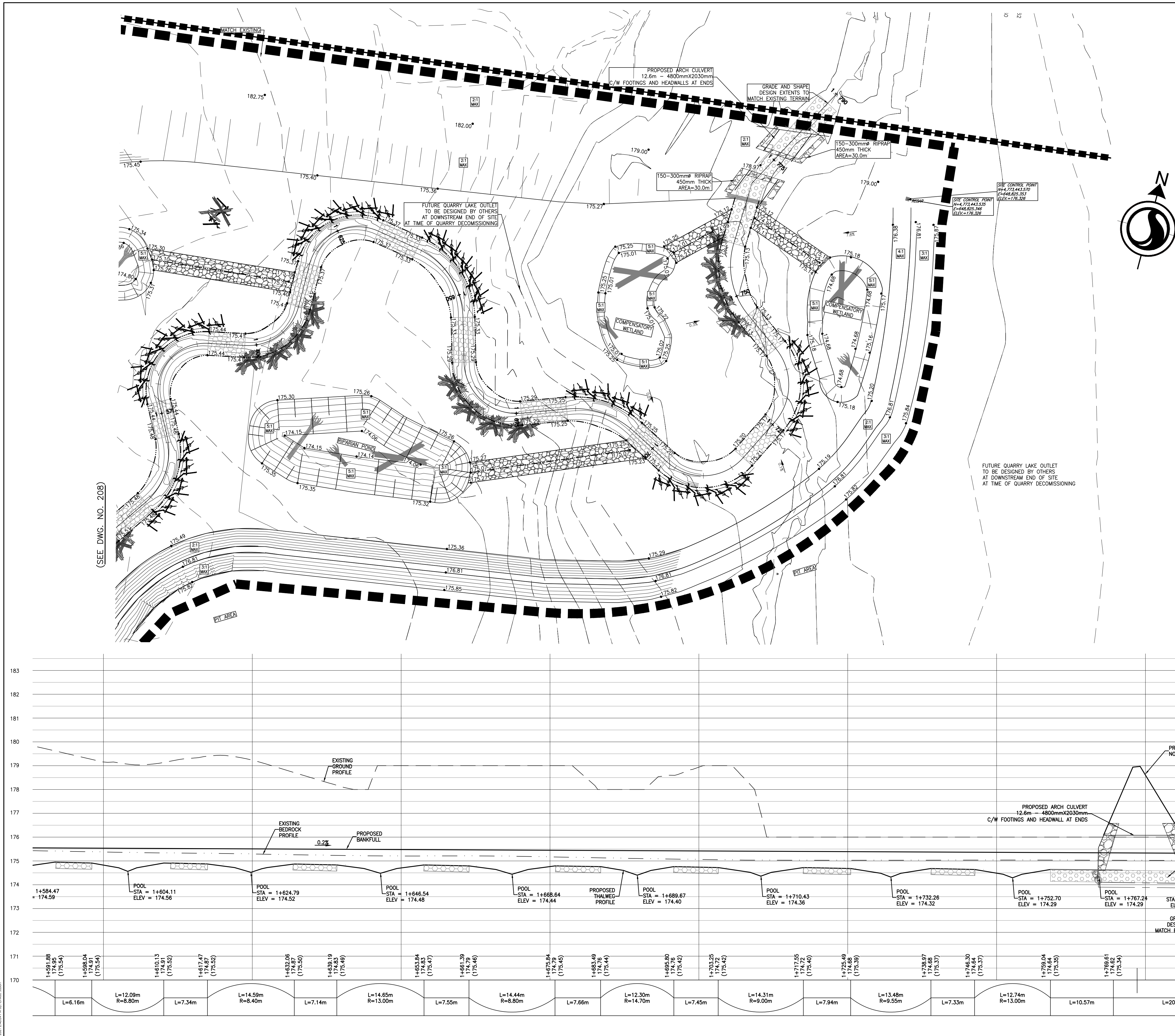
Title

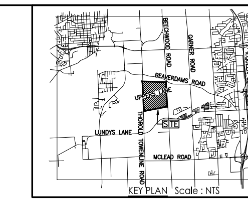
PLAN AND PROFILE
1+425 TO 1+600

Project No.	Scale
160960948	1:300H 1:75V

Revision	Sheet	Drawing No.
7	11 of 32	C-209

ORIGINAL SHEET - ARCH D





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

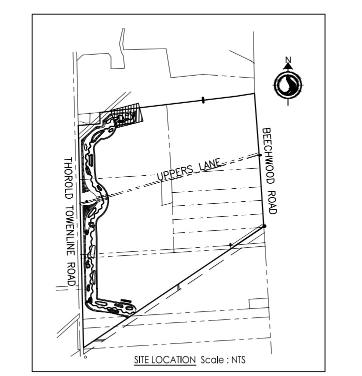
1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE
PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



Revision		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-205ST.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
1+600 TO END

Project No. 160960948

Scale 1:300H 1:75V

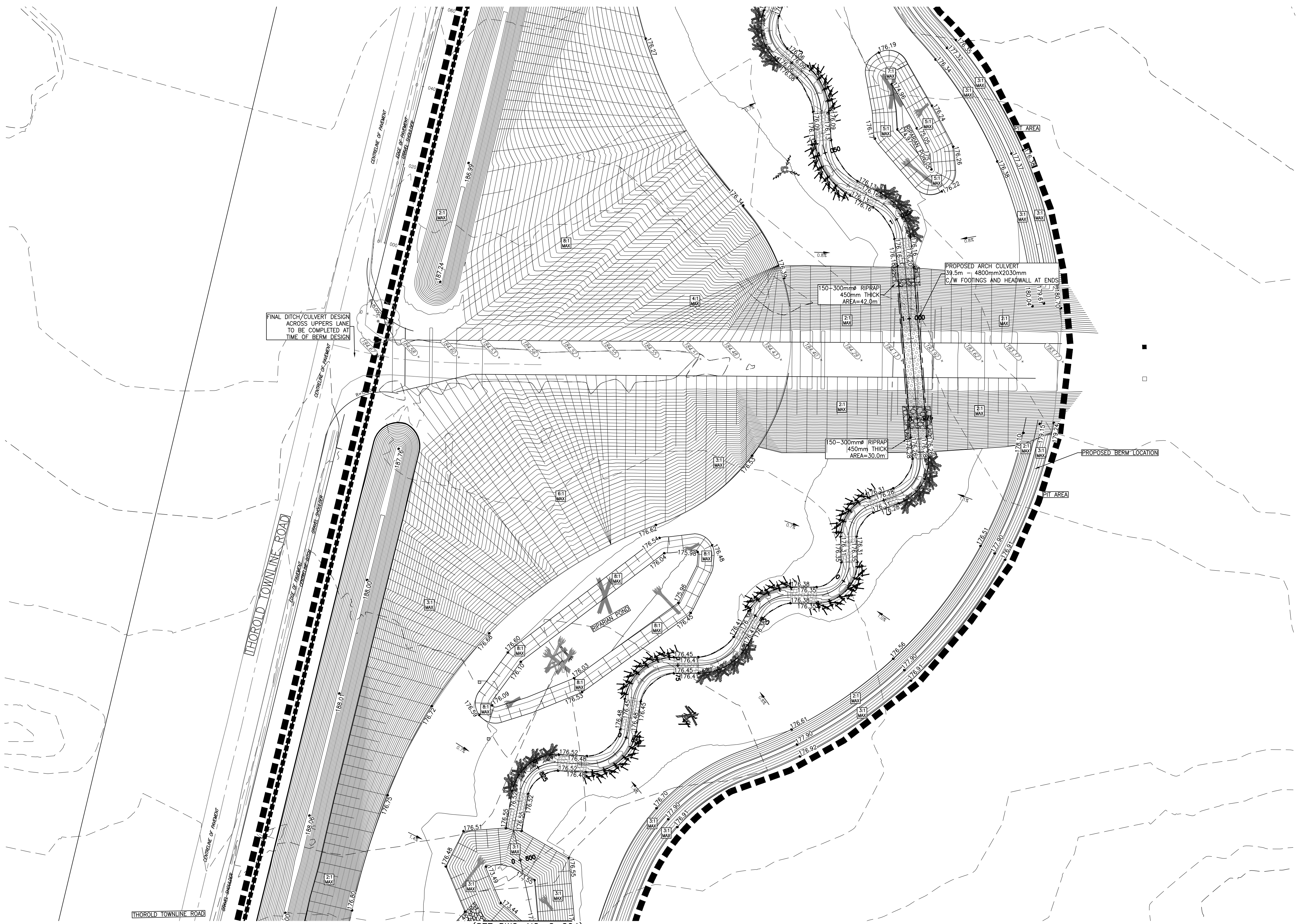
Revision 7

Sheet 12 of 32

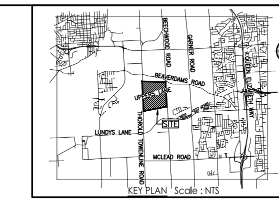
Drawing No. **C-210**

ORIGINAL SHEET - ARCH D

(SEE DWG. NO. C-207)



(SEE DWG. NO. C-204)



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

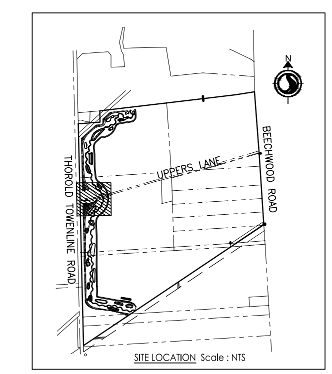
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
ROOTWADS (SEE DETAILS)
REINFORCED BANK PROTECTION (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



SITE LOCATION Scale : NTS

		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-220ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

GRADING PLAN
0+000 TO END
ALONG UPPER'S LANE

Project No. 160960948

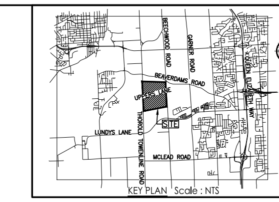
Scale 1:500 (0 5 15 25m)

Revision 7

Sheet 13 of 32

Drawing No. **C-220**

ORIGINAL SHEET - ARCH D



GENERAL NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE PLAN AND PROFILE DRAWINGS (C-200 TO C-210) PREPARED BY STANTEC CONSULTING.
2. THESE PLANS FOR CONSTRUCTION ONLY WHEN APPROVED BY WALKER AGGREGATES INC. AND SEALED BY THE ENGINEER.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS, GRADES, AND EXISTING CONDITIONS, OBTAIN ALL UTILITY LOCATES, OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK AND REPORT ANY DISCREPANCIES TO THE ENGINEER.
4. ANY PROPOSED CHANGES SHALL BE APPROVED BY THE CONTRACT ADMINISTRATOR AND WALKER AGGREGATES INC.
5. ALL UNDERGROUND SERVICING TO BE INSPECTED BY STANTEC CONSULTING LTD. AND CERTIFIED FOR WALKER AGGREGATES INC. CONTRACTOR SHALL COORDINATE WITH STANTEC AND SHALL CONTACT SAME AT LEAST 48 HOURS PRIOR TO INSTALLATION OF SERVICES.
6. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION), ONTARIO TRAFFIC MANUAL (OTM) BOOK 7 (LATEST EDITION).
7. ALL TRAFFIC MANAGEMENT, HAUL ROUTES, ROAD CLOSURES PLANS SHALL BE APPROVED BY THE CITY OF THOROLD AND/OR THE CITY OF NIAGARA FALLS AND A COPY MAINTAINED ON SITE AT ALL TIMES.
8. EMERGENCY SERVICE VEHICLES CAN ENTER THE SITE AT ANY ACCESS (EXISTING OR PROPOSED)
9. IF, FOR UNFORESEEN REASONS, THE CONTRACTOR AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE CONTRACT ADMINISTRATOR AND WALKER AGGREGATES INC., PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT CONTRACTORS' RISK.
10. ALL WORK WITHIN OR ADJACENT TO UTILITY RIGHT OF WAYS OR EASEMENTS MUST BE COORDINATED WITH AND APPROVED BY THE UTILITY. NO WORK SHALL PROCEED WITHOUT WRITTEN APPROVAL.

NOTES FOR WORKING NEAR WATER

1. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER.
2. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE WILL BE CONDUCTED A MINIMUM OF 30 METRES FROM ANY AQUATIC RESOURCES TO AVOID POTENTIAL IMPACTS. IN THE EVENT THAT AN ACCIDENTAL SPILL OCCURS. IF A GAS PUMP IS USED FOR FLOW DIVERSION AND IT IS NOT POSSIBLE TO ACHIEVE THE 30 M DISTANCE FROM AQUATIC RESOURCES, A CONTAINMENT SYSTEM SHOULD BE IMPLEMENTED TO PREVENT ACCIDENTAL SPILLS OR LEAKS FROM ENTERING THE CREEK.
3. ALL DEWATERING/UNWATERING SHALL BE LOCATED AT LEAST 30 METRES FROM THE WATERCOURSE TO A FILTER BAG OR SPLASH PAD. NO DEWATERING SHALL BE SENT DIRECTLY TO ANY WATERCOURSE. THESE CONTROL MEASURES SHALL BE MONITORED FOR EFFECTIVENESS AND MAINTAINED OR REVISED TO MEET THE OBJECTIVE OF PREVENTING SEDIMENT FROM ENTERING THE WATERCOURSE.
4. ALL DISTURBED AREAS WILL BE STABILIZED AND RESTORED WITH NON-INVASIVE SPECIES IMMEDIATELY UPON COMPLETION OF GRADING WORK. ALL SEEDING AND PLANTING SHALL BE COMPLETED BEFORE OCTOBER OF THE CONSTRUCTION YEAR. FINAL SURFACE RESTORATION SHALL BE INITIATED AS SOON AS BACKFILLING AND GRADING ACTIVITIES HAVE BEEN COMPLETED.
5. DISTURBANCE AREAS WITHIN THE STREAM SHOULD BE LIMITED TO AN AREA THAT CAN BE COMPLETED AND STABILIZED WITHIN ONE WORKING DAY.
6. ALL NEAR-WATER WORK WILL BE CONDUCTED WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS. IN-WATER WORKS SHALL NOT BE PERMITTED. THE CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE TO ENSURE THAT WORKS ARE CONDUCTED DURING FAVORABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE CONTRACTOR SHALL IMPLEMENT A CONTINGENCY PLAN THAT HAS BEEN PRE-APPROVED BY THE CONTRACT ADMINISTRATOR AND WALKER AGGREGATES INC. THE CONTINGENCY PLAN SHALL INCLUDE REMOVAL OF ALL ITEMS FROM THE REGIONAL STORM FLOODPLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR A SPILL (E.G., FUEL TANKS, UNFIXED EQUIPMENT, ETC.).
7. SITE ACCESS AND STAGING WILL MINIMIZE DISTURBANCE TO ALL WATERCOURSES AND THE NATURAL AREA.
8. CONTRACTOR SHALL PROVIDE PERMITTING AGENCIES WITH 48 HOURS ADVANCE NOTICE PRIOR TO CONSTRUCTION START.

STREAM CONSTRUCTION

FOLLOWING RECEIPT OF ALL REQUIRED PERMITS, IN-WATER WORK MAY TAKE PLACE BETWEEN JULY 1ST AND MARCH 15TH. NO IN-WATER WORK SHALL TAKE PLACE WITHOUT NOTIFYING THE CONTRACT ADMINISTRATOR AND THE PERMITTING AGENCIES.

1. WORKS TO BE COMPLETED DURING LOW FLOW CONDITIONS.
2. EXISTING FLOWS WILL BE MAINTAINED DOWNSTREAM OF THE DE-WATERED WORK AREA.
3. WATER INTAKES OR OUTLET PIPES TO BE SCREENED TO PREVENT ENTRAINMENT OR IMPINGEMENT OF FISH. FLOW DISSIPATERS, FILTER BAGS OR OTHER APPROPRIATE MEASURES WILL BE USED AT ANY PUMP DISCHARGE LOCATION TO PREVENT EROSION AND THE DEPOSITION OF DELETERIOUS SUBSTANCES INTO THE WATERCOURSE.
4. SILT OR DEBRIS THAT HAS ACCUMULATED AROUND THE TEMPORARY COFFERDAMS WILL BE REMOVED PRIOR TO THEIR WITHDRAWAL.
5. ALL EXPOSED SOIL AREAS WILL BE STABILIZED AND RE-VEGETATED AS SET OUT IN THE PLANTING PLAN.
6. ALL MATERIAL USED IN THE CONSTRUCTION OF THE NEW STREAM WILL BE NATIVE MATERIAL OR WILL BE WASHED PRIOR TO ARRIVAL ON SITE TO PREVENT THE INTRODUCTION OF DELETERIOUS SUBSTANCES TO THE WATERCOURSE.
7. EXCESS TRAPPED SEDIMENTS AND CONTROLS ARE TO BE REMOVED ONLY AFTER THE SOILS OF THE CONSTRUCTION AREA HAVE BEEN STABILIZED AND ADEQUATELY RE-VEGETATED IMPLEMENT EROSION AND SEDIMENT CONTROL PLAN TO PROTECT EXISTING WATERCOURSE FROM CONSTRUCTION TRAFFIC AND AROUND STAGING AREA(S).

SEQUENCE:
1. INSTALL COFFER DAMS TO ISOLATE WORK AREA, PUMP STREAM FLOWS AROUND WORK AREA ACCORDING TO PERMIT TO TAKE WATER CONDITIONS.
2. IMPLEMENT FISH RESCUE PLAN IN ISOLATED WORK AREA.
3. DE-WATER WORK AREA BY PUMPING.
4. REMOVE TREES / OTHER VEGETATION. APPROPRIATE SPECIES OF TREE CANOPIES, LOGS AND BRUSH TO BE STOCKPILED ON SITE FOR USE IN STRUCTURES
5. COMMENCE CONSTRUCTION OF PROPOSED STREAM
6. A QUALIFIED ENGINEER OR FLUVIAL GEOMORPHOLOGIST OR REPRESENTATIVE THEREOF SHALL BE PRESENT DURING THE CONSTRUCTION OF THE STREAM WORKS.
7. COMPLETED AREAS OF STREAM CONSTRUCTION SHALL BE STABILIZED WITH EROSION CONTROL MATTING AND SEEDED ACCORDING TO THE APPROVED PLANTING PLAN AS WORK PROCEEDS.

MONITORING

SITE MONITORING WILL BE CARRIED OUT AT VARIOUS MILESTONES BY THE OWNER'S REPRESENTATIVE. (NUMBERED BELOW):
1. ONCE ALL EROSION AND SEDIMENT CONTROL MEASURES INSTALLED;
2. DURING INSTALLATION OF DIVERSION PUMPING;
3. DURING ANY FISH RESCUE;
4. DURING INSTALLATION OF SUBSTRATE AND IN-STREAM FEATURES OF THE PROPOSED STREAM; AND
5. PRIOR TO EROSION AND SEDIMENT CONTROL MEASURE REMOVAL.

EROSION CONTROL NOTES

1. THE EROSION AND SEDIMENT CONTROL PLAN MUST BE SUBMITTED TO THE CONSULTANT AND WALKER AGGREGATES INC. FOR APPROVAL AT LEAST SEVEN (7) DAYS PRIOR TO THE PLANNED START OF CONSTRUCTION. CONSTRUCTION MAY NOT COMMENCE UNTIL THE EROSION AND SEDIMENT CONTROL PLAN HAS BEEN APPROVED BY THE CONSULTANT AND WALKER AGGREGATES INC.
2. ALL SILT FENCING TO BE INSTALLED PRIOR TO COMMENCEMENT OF ANY AREA GRADING, EXCAVATION OR DEMOLITION.
3. EROSION CONTROL FENCE TO BE PLACED AROUND THE BASE OF ALL STOCKPILES. ALL STOCKPILES TO BE KEPT A MINIMUM OF 2.5 M FROM ALL PROPERTY LINES.
4. EROSION PROTECTION TO BE PROVIDED AROUND ALL STORM AND SANITARY MANHOLES AND/OR CATCHBASINS.
5. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE WORKS PROGRESSES. THE CONTRACTOR TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRUCTURES.
6. EROSION AND SEDIMENT CONTROLS WILL BE MONITORED ON A DAILY BASIS, AFTER PRECIPITATION AND RAIN EVENTS, AND ANY NECESSARY REPAIRS WILL BE COMPLETED WITHIN 48 HOURS. SHOULD THE CONTROLS NOT SERVE THEIR INTENDED PURPOSE THEY WILL BE CORRECTED OR REPLACED.
7. SEDIMENTS TO BE REMOVED WHEN ACCUMULATIONS REACH A MAXIMUM OF ONE THIRD (1/3) THE HEIGHT OF THE SILT FENCE. THE CONTRACTOR SHALL REMOVE AND DISPOSE OFF-SITE ACCUMULATED SEDIMENT FROM ALL BARRIERS TO THE LEVEL OF EXISTING GRADE, IN A MANNER THAT AVOIDS SEDIMENT ESCAPE TO THE DOWNSTREAM SIDE OF DEVICE. ALL BARRIERS SHALL REMAIN IN PLACE UNTIL AFTER THE SURROUNDING GROUND HAS BEEN RESTORED.
8. ALL EROSION CONTROL STRUCTURES TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN RE-STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
9. NO ALTERNATIVE METHODS OF EROSION CONTROL PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY THE CONTRACT ADMINISTRATOR.
10. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING SEDIMENTS FROM THE MUNICIPAL ROAD AND SIDEWALKS AT THE END OF EACH WORK DAY.
11. MUD MATS TO BE PROVIDED ON SITE AT ALL LOCATIONS WHERE CONSTRUCTION VEHICLES EXIT THE SITE. CONTRACTOR TO ENSURE ALL VEHICLES LEAVE THE SITE VIA THE MUD MAT AND THAT THE MAT IS MAINTAINED IN A MANNER TO MAXIMIZE ITS EFFECTIVENESS AT ALL TIMES.
12. STANTEC CONSULTING LTD. TO MONITOR THE SITE DEVELOPMENT TO ENSURE ALL EROSION CONTROLS ARE INSTALLED AND MAINTAINED TO PROJECT REQUIREMENTS. CONTRACTOR TO COMPLY WITH THE ENGINEER'S INSTRUCTIONS TO INSTALL, MODIFY, OR MAINTAIN EROSION CONTROL WORKS.

NOTE: IN ADDITION TO BEING RESPONSIBLE FOR ENSURING THAT THE PRESCRIBED MEASURES ARE INSTITUTED AND FUNCTIONING AS INTENDED, THE CONTRACTOR IS ALSO RESPONSIBLE FOR IMPLEMENTING ANY INTERIM OR EMERGENCY MEASURES AS NECESSARY, TO ENSURE THAT NO SEDIMENT IS DISCHARGED TO THE WATERCOURSE. THE FOLLOWING EXTRA EQUIPMENT/MATERIALS ARE TO BE KEPT ON SITE AS A CONTINGENCY, IN CASE THE PROPOSED CONTROL MEASURES ARE BREACHED:

1. SILT FENCE
2. FILTER CLOTH
3. FILTER BAGS (AT LEAST 1 PER INSTALLED BAG)
4. PUMPS (AT LEAST 1 PER INSTALLED PUMP)
5. CLEAN RIP-RAP (FREE OF FINES) FOR ROCK CHECK DAMS
6. SAND BAGS AND CLEAN GRAVEL (FREE OF FINES)
7. ANY ADDITIONAL MATERIAL DEEMED NECESSARY TO REPAIR/REMEDIATE PROPOSED MEASURES, OR TO ADEQUATELY DEAL WITH UNEXPECTED HIGH FLOWS.

EROSION AND SEDIMENT CONTROL PLAN:

1. THE EXACT CONFIGURATION OF THE EROSION AND SEDIMENT CONTROL PLAN WILL BE DEPENDENT ON THE CONTRACTOR'S CONSTRUCTION PHASING. THE PREPARATION OF THE EROSION AND SEDIMENT CONTROL PLAN IS THE RESPONSIBILITY OF THE CONTRACTOR.
2. THE EROSION AND SEDIMENT CONTROL PLAN WILL INCORPORATE THE FOLLOWING PRINCIPLES AS THEY APPLY TO THE SITE AND CONSTRUCTION PHASING PLAN:
   - THE EROSION AND SEDIMENT CONTROL PLAN SHALL ADHERE TO ANY AND ALL PERMIT REQUIREMENTS FROM MUNICIPAL, PROVINCIAL, AND/OR FEDERAL AGENCIES.
   - EROSION AND SEDIMENT CONTROLS WILL BE IMPLEMENTED PRIOR TO AND DURING THE CONSTRUCTION PHASES.
   - EROSION CONTROL (THE PREVENTION OF EROSION OF SOIL FROM THE LANDSCAPE) FROM DISTURBED SURFACES SHALL BE ACHIEVED THROUGH THE USE OF PRUDENT CONSTRUCTION PHASING AND EROSION CONTROL MEASURES (E.G., COIR FIBER MATTING) WHERE NECESSARY.
   - SEDIMENT CONTROL (THE TRAPPING OF SEDIMENT BEING CARRIED BY RUNOFF) SHALL BE ACHIEVED USING APPROPRIATELY INSTALLED SEDIMENT CONTROL MEASURES (E.G., TEMPORARY SILT FENCE, SEDIMENT TRAPS, TURBIDITY CURTAIN) AS NECESSARY. AREAS TO BE PROTECTED INCLUDE: STAGING AREAS, TREE CLEARING AND GRUBBING AREAS, TREE PRESERVATION AREAS, AREAS DELINEATED ON THE FIGURE, AND ALL OTHER WORK AREAS.
   - SITE ACCESS AND STAGING WILL MINIMIZE DISTURBANCE TO ALL WATERCOURSES AND NATURAL AREAS.
   - MATERIALS REMOVED OR STOCKPILED DURING CONSTRUCTION (E.G., EXCAVATED SOIL, BACKFILL MATERIAL) MUST BE DEPOSITED, STORED, AND CONTAINED IN A MANNER TO ENSURE SEDIMENT DOES NOT ENTER A WATER BODY AND WILL BE APPROPRIATELY STORED, AS APPROVED BY THE CONSULTANT AND BY WALKER AGGREGATES INC. AREAS CONTAINING EXPOSED SOILS OR STOCKPILED MATERIALS WILL BE ISOLATED USING APPROPRIATE SEDIMENT CONTROL DEVICES TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
   - ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER.
   - THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THESE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, ALTERNATIVE MEASURES SHALL BE IMPLEMENTED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS, AND THE CONTRACTOR SHALL CONTACT THE PERMITTING AGENCIES ENFORCEMENT OFFICER IMMEDIATELY. ANY REQUIRED UPGRADES OR AMENDMENTS ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE OWNER WILL SUPPLY THE SERVICES OF AN ENVIRONMENTAL INSPECTOR TO REGULARLY INSPECT AND MONITOR THE PROGRESS AND STATUS OF ENVIRONMENTAL CONTROLS, AND WHO SHALL HAVE THE FULL AUTHORITY OF THE OWNER TO ACT ON ITS BEHALF. THE PRESENCE OF THE ENVIRONMENTAL INSPECTOR SHALL NOT, IN ANY WAY, RELIEVE THE CONTRACTOR OF ITS CONTRACTUAL OBLIGATIONS WITH RESPECT TO ENVIRONMENTAL PROTECTION.
   - NO EXCESS EARTH OR GRANULAR MATERIALS SHALL BE LEFT IN AREAS WHERE IT WILL BE SUBJECT TO EROSION INTO THE CREEK CHANNEL.
   - ALL DISTURBED AREAS WILL BE STABILIZED IMMEDIATELY UPON COMPLETION OF GRADING WORK. STABILIZATION WILL CONSIST OF REVEGETATION AS PER THE PLANTING PLAN ON FIGURE L-460 TO L-462.

WATER MANAGEMENT PLAN:

1. THE CONTRACTOR SHALL SUBMIT A WATER MANAGEMENT PLAN TO THE CONSULTANT AND WALKER AGGREGATES INC. FOR APPROVAL AT LEAST SEVEN (7) DAYS PRIOR TO THE PLANNED START OF CONSTRUCTION. CONSTRUCTION ACTIVITIES MAY NOT COMMENCE UNTIL THE WATER MANAGEMENT PLAN HAS BEEN APPROVED BY THE CONSULTANT AND BY WALKER AGGREGATES INC.
2. THE WATER MANAGEMENT PLAN SHALL SPECIFY BEST MANAGEMENT PRACTICES WITH RESPECT TO WORKING IN THE WET, AS THEY APPLY TO THE SITE AND CONSTRUCTION PHASING PLAN. THE WATER MANAGEMENT PLAN SHALL ALSO SPECIFY ANY OTHER DRAINAGE STRATEGIES WHICH MINIMIZE THE IMPACTS OF WORKING IN THE WET.
3. CONSTRUCTION DEWATERING BETWEEN 50,000 L/D AND 400,000 L/D REQUIRES A EASR REGISTRATION FROM THE ONTARIO MINISTRY OF CONSERVATION AND PARKS WEBSITE. CONSTRUCTION DEWATERING GREATER THAN 400,000 L/D REQUIRES A PERMIT FROM THE MECP. PERMIT CONDITIONS MUST BE OBSERVED

HIGH FLOW CONTINGENCY PLAN:

1. THE CONTRACTOR SHALL SUBMIT A HIGH FLOW CONTINGENCY PLAN TO THE CONSULTANT AND WALKER AGGREGATES INC. FOR APPROVAL AT LEAST SEVEN (7) DAYS PRIOR TO THE PLANNED START OF CONSTRUCTION. CONSTRUCTION ACTIVITIES MAY NOT COMMENCE UNTIL THE HIGH FLOW CONTINGENCY PLAN HAS BEEN APPROVED BY THE CONSULTANT AND BY WALKER AGGREGATES INC.
2. THE HIGH-FLOW CONTINGENCY PLAN SHALL OUTLINE THE ACTIONS WHICH SHALL BE TAKEN IF AN UNEXPECTED STORM ARISES AND THE RESULTING HIGH FLOWS CAUSE CONSTRUCTION TO CEASE, FOR REASONS OF SAFETY OR DAMAGE TO THE BANK STABILIZATION CONSTRUCTION. ACTIONS SHALL INCLUDE, BUT ARE NOT LIMITED TO, THE REMOVAL OF ALL ITEMS FROM THE 100 YEAR FLOODPLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR REPRESENT A POTENTIAL SPILL HAZARD (E.G., FUEL TANKS, UNFIXED EQUIPMENT, ETC.)

FISH SALVAGE PLAN

1. THE CONTRACTOR SHALL SUBMIT A FISH SALVAGE PLAN TO THE OWNER AND CONSULTANT FOR APPROVAL AT LEAST SEVEN (7) DAYS PRIOR TO THE PLANNED START OF CONSTRUCTION. CONSTRUCTION ACTIVITIES MAY NOT COMMENCE UNTIL THE FISH SALVAGE PLAN HAS BEEN APPROVED BY THE OWNER AND THE CONSULTANT.
2. THE CONTRACTOR SHALL ACQUIRE A SPECIAL COLLECTION PERMIT FOR A FISH SALVAGE OPERATION FROM THE MINISTRY OF THE NATURAL RESOURCES AND FORESTRY
3. THE CONTRACTOR SHALL NOTIFY THE OWNER AND THE CONSULTANT AT LEAST TWO (2) DAYS PRIOR TO ANY FISH REMOVAL ACTIVITIES.
4. FISH REMOVAL WILL TAKE PLACE PRIOR TO ANY CONSTRUCTION ACTIVITIES.
5. FISH REMOVAL SHALL PROCEED AS FOLLOWS:
   - A BARRIER NET SHALL BE PLACED UPSTREAM AND DOWNSTREAM OF THE WORK AREA TO PREVENT THE ENTRY OF FISH INTO THE WORK AREA.
   - A QUALIFIED FISHERIES BIOLOGIST SHALL BE RETAINED BY THE CONTRACTOR TO REMOVE ANY FISH FROM THE WORK AREA USING A SEINE NET (PROCEEDING IN A DOWNSTREAM DIRECTION) AND/OR BACKPACK ELECTROFISHING PROCEDURE. ANY CAPTURED FISH SHOULD BE RELEASED IMMEDIATELY UPSTREAM OF THE WORK AREA IN AN AREA WITH AT LEAST 0.15 M DEPTH OF WATER. IF NO SUCH AREA IS AVAILABLE UPSTREAM, THE FISH SHALL BE RELEASED DOWNSTREAM IN AT LEAST 0.15 M OF WATER.
   - A RECORD OF THE FISH REMOVAL OPERATION SHALL BE PROVIDED TO THE OWNER AND THE CONSULTANT.
   - IF WATER OVER-TOPS THE NET (OR BARRIER) AT ANY POINT DURING CONSTRUCTION, THEN THE FISH REMOVAL MUST BE REPEATED PRIOR TO RESUMING CONSTRUCTION.

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

	Revision	By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-500DT.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

GENERAL NOTES

Project No. 160960948

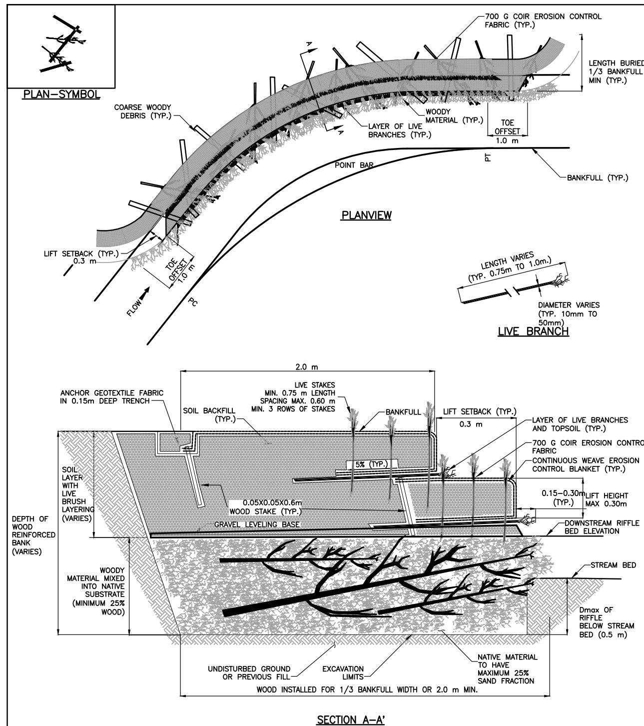
Scale

Revision 7

Sheet 14 of 32

Drawing No. C-500

ORIGINAL SHEET - ARCH D

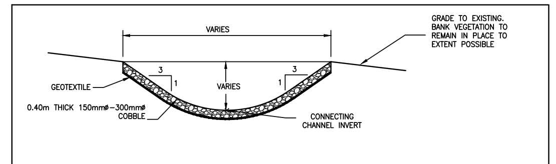


NOTES:

1. WOODY MATERIAL SHALL CONSIST OF SMALL LOGS, ROOTWADS, MEDIUM TO SMALL LIMBS, BRANCHES, AND/OR BUSHES. ALL MATERIALS ARE TO BE APPROVED BY THE ENGINEER.
2. NO WOODY MATERIAL SHALL BE PLACED PARALLEL TO THE FLOW OF WATER, UNLESS DIRECTED BY THE ENGINEER. WOODY MATERIAL SHALL BE PLACED IN A CROSSING PATTERN OR WEAVE.
4. THE WOODY MATERIAL IS TO BE MIXED INTO NATIVE SUBSTRATE, AT A DENSITY OF AT LEAST 25% WOOD.
5. INVASIVE SPECIES SHALL NOT BE USED IN THE WOODY MATERIAL.
6. THE WOODY MATERIAL/NATIVE MATERIAL MIX SHALL BE COMPACTED WITH THE EXCAVATOR BUCKET IN ORDER TO REDUCE THE PRESENCE OF VOIDS IN THE WOOD MATERIAL/NATIVE SUBSTRATE LAYER
7. THE HORIZONTAL LOCATIONS OF ALL WOOD REINFORCED BANKS ARE LOCATED ON THE PLAN AND PROFILE SHEETS. NO LOCATIONS OF WOOD REINFORCED BANKS SHALL VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM THE ENGINEER.
8. GRAVEL LEVELING BASE (GRANULAR 'B') OVER NON-WOVEN FILTER FABRIC MAY BE INSTALLED ABOVE THE HIGHEST ELEVATION OF THE WOODY DEBRIS BEFORE THE SOIL LIFTS ARE INSTALLED.
9. THE SOIL BACKFILL USED FOR LIFTS AND TOPSOIL USED FOR LAYERING WITH THE LIVE BRANCHES SHALL BE FREE OF ANY LARGE ROOTS OR WOODY DEBRIS AND SHALL GENERALLY BE FREE FROM ANY GRAVEL OR COBBLE MATERIAL.
10. SOIL BACKFILL SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM; YET, NOT SUCH THAT THE UNDERLYING BRUSH IS DISPLACED OR DAMAGED.
11. THE TOP OF THE BACKFILL FOR THE FIRST LIFT SHALL BE SLOPED AT APPROXIMATELY 5% AWAY FROM THE STREAM.
12. PLACE A LAYER OF TOPSOIL AND LIVE BRANCHES ON TOP OF EACH SOIL LIFT SUCH THAT APPROXIMATELY 0.15 to 0.30 m OF EACH LIVE BRANCH WILL BE EXPOSED AND THE REMAINDER (0.60 TO 1.20m) OF EACH LIVE BRANCH WILL BE COVERED BY THE NEXT SOIL LIFT.
13. LIVE BRANCHES SHALL BE OF THE SPECIES SPECIFIED FOR LIVE STAKES OR APPROVED BY THE ENGINEER.
14. PLACE A LAYER OF 2.0 m WIDE COIR 700 EROSION CONTROL BLANKET, OR EQUIVALENT, ON TOP OF THE TOPSOIL AND LIVE BRANCHES SUCH THAT 0.75 m OF THE BLANKET WILL BE BURIED BELOW THE NEXT SOIL LIFT. ALLOW THE REMAINING 1.25 m OF BLANKET TO HANG OVER THE PRECEDING SOIL LIFT OR COIR FIBER LOGS.
15. PLACE A SECOND LAYER OF 2.0 m WIDE NON-WOVEN COIR MATTING OVER THE EROSION CONTROL BLANKET TO THE SAME LIMITS.
16. SOIL CAN BE COMPACTED BY STACKING A PIECE OF SAWN LUMBER BOARD EDGEWAYS UP TO THE LIFT HEIGHT SPECIFIED AND SECURING WITH WOODEN STAKES TO PROVIDE A RIGID BACKSTOP FOR COMPACTING SOIL LIFT.
17. PLACE SOIL BACKFILL UP TO THE LIFT HEIGHT SPECIFIED OF NO GREATER THAN 0.30m BEING CAREFUL NOT TO PUSH/PULL OR TEAR THE FABRIC PREVIOUSLY PLACED.
18. THE TOP OF THE SOIL BACKFILL SHALL BE FLAT WITHIN THE LIFT SETBACK DISTANCE SPECIFIED IN THE DETAIL. BEYOND THE LIFT SETBACK DISTANCE, THE SOIL BACKFILL SHALL BE SLOPED AT AN APPROXIMATE 5% SLOPE AWAY FROM THE STREAM.
19. TOP DRESS THE SOIL LIFT WITH TOPSOIL FROM THE FACE OF THE SOIL LIFT BACK INTO THE FLOODPLAIN AT LEAST 1.2 m.
20. REMOVE THE SAWN LUMBER AND WOODEN STAKES FROM THE FACE OF THE SOIL LIFT AND WRAP THE FACE AND TOP OF THE SOIL LIFT USING THE WOVEN AND NON-WOVEN COIR MATTING HANGING OVER THE PREVIOUS LIFT/COIR FIBER LIFTS.
21. THE EROSION CONTROL FABRIC SHALL BE PULLED AS TIGHT AS POSSIBLE WITHOUT TEARING OR EXCESSIVELY DISTORTING THE FABRIC.
22. SECURE THE EROSION CONTROL AND NON-WOVEN MATTING IN PLACE BY STAKING THE END OF THE EROSION CONTROL FABRIC WITH WOOD STAKES ON 0.5 m CENTERS.
23. BEGIN CONSTRUCTION OF THE NEXT SOIL LIFT BY REPEATING THE PREVIOUS NOTES STARTING WITH NOTE 11.
24. THE OVERALL SLOPE CREATED BY THE LIVE BRUSH LAYERING SHALL MATCH THE PROPOSED CROSS SECTION SHAPE FOR THE OUTER BANK OF THE THE TYPICAL POOL CROSS-SECTION FOR EACH REACH.
25. THE COIR BLANKETS AND GEOTEXTILE FABRIC USED FOR THE UPPER MOST SOIL LIFT WILL BE SECURED WITHIN A 0.15 m DEEP TRENCH AS SHOWN IN DETAIL.
26. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR ELEVATIONS SHALL BE WITHIN 0.03 m OF THE GRADES AND ELEVATIONS INDICATED OR APPROVED BY THE ENGINEER.
27. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
28. SOD MAT WRAPPED IN COIR MATTING MAY BE USED INSTEAD OF THE SOIL LIFTS ABOVE THE WOOD REINFORCED BANK IF IT IS AVAILABLE AND APPROVED BY THE ENGINEER.
29. THE LOWER BANK STABILIZATION IS CRITICAL TO THE DESIGN INTENT OF THIS PROJECT. VARIANCE FROM WOOD REINFORCED BANK WILL ONLY BE CONSIDERED AT THE DISCRETION OF THE ENGINEER.

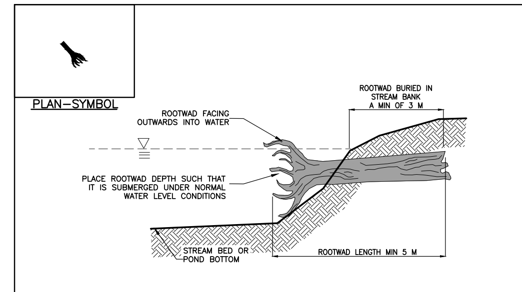
DETAIL – WOOD REINFORCED BANK

NOT TO SCALE



CONNECTING CHANNEL DETAIL

N.T.S

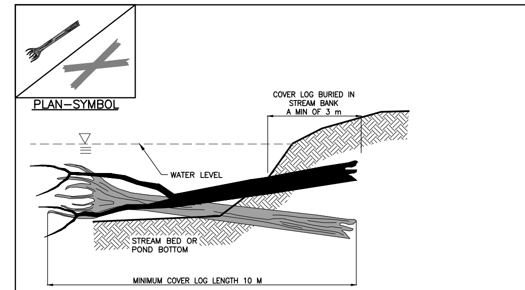


NOTES:

1. THE ROOTWARDS SHALL BE SOUND AND NOT ROTTED OR SOFT.
2. ROOTWAD DIMENSIONS SHALL BE: MINIMUM 5 m LENGTH, MINIMUM 0.2 m DIAMETER.
3. ROOTWADS SHALL BE BURIED IN THE CHANNEL/POND BANKS A MINIMUM OF 3 m.
5. THE PLACEMENT OF THE ROOT WAD SHALL BE IN THE GENERAL LOCATIONS SHOWN AND EACH LOCATION SHALL BE OPTIMIZED IN THE FIELD TO MAXIMIZE HABITAT POTENTIAL.
6. ROOTWADS SHALL BE PLACED AT AN ELEVATION WHERE THEY WILL REMAIN LARGELY SUBMERGED UNDER NORMAL FLOW CONDITIONS.
7. PRESERVE SUFFICIENT ROOT MASS ON ROOTWAD TO PROVIDE HABITAT COMPLEXITY. EXCESSIVE ROOT MASS MAY BE TRIMMED.
8. SOIL BACKFILL OVER THE BURIED PORTION OF THE ROOTWAD SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM. BOULDERS MAY BE USED TO ANCHOR THE WOOD AT THE BANK.
9. ANCHOR BOULDERS WILL BE INCLUDED AT THE DISCRETION OF THE ENGINEER AND MUST BE BURIED AND NOT EXPOSED AT THE GROUND SURFACE.
10. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

DETAIL – ROOTWAD

N.T.S

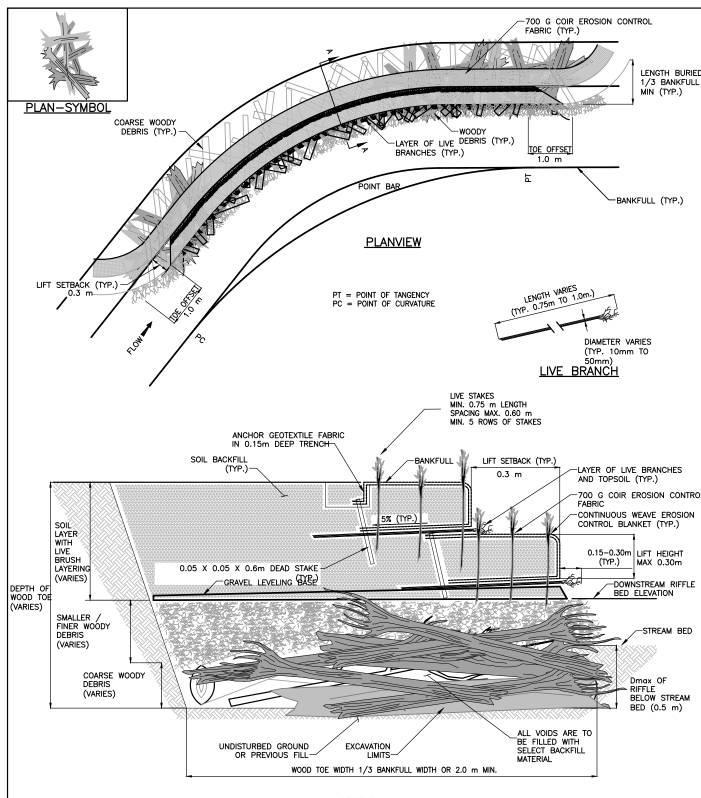


NOTES:

1. THE COVER LOGS SHALL BE SOUND AND NOT ROTTED OR SOFT.
2. COVER LOG DIMENSIONS SHALL BE: MINIMUM 10m LENGTH, MINIMUM 0.2m DIAMETER. LARGER LOGS SHALL BE SELECTED FOR LARGER CHANNELS AT THE ENGINEERS DISCRETION.
3. COVER LOGS SHALL BE BURIED IN THE CHANNEL/POND BANKS A MINIMUM OF 3m.
4. THE PLACEMENT OF THE COVER LOGS SHALL BE IN THE GENERAL LOCATIONS SHOWN AND EACH LOCATION SHALL BE OPTIMIZED IN THE FIELD TO MAXIMIZE HABITAT POTENTIAL.
5. COVER LOGS SHALL BE PLACED AT AN ELEVATION WHERE THEY WILL REMAIN LARGELY SUBMERGED UNDER NORMAL FLOW CONDITIONS.
6. COVER LOGS MAY HAVE ROOTWADS ATTACHED.
7. COVER LOGS MAY HAVE SOME LARGE BRANCHES (TRIMMED) ATTACHED.
8. SOIL BACKFILL OVER THE BURIED PORTION OF THE COVER LOG SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM. BOULDERS MAY BE USED TO ANCHOR THE WOOD AT THE BANK.
9. ANCHOR BOULDERS WILL BE INCLUDED AT THE DISCRETION OF THE ENGINEER AND MUST BE BURIED AND NOT EXPOSED AT THE GROUND SURFACE.
10. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

DETAIL – COVER LOGS

N.T.S

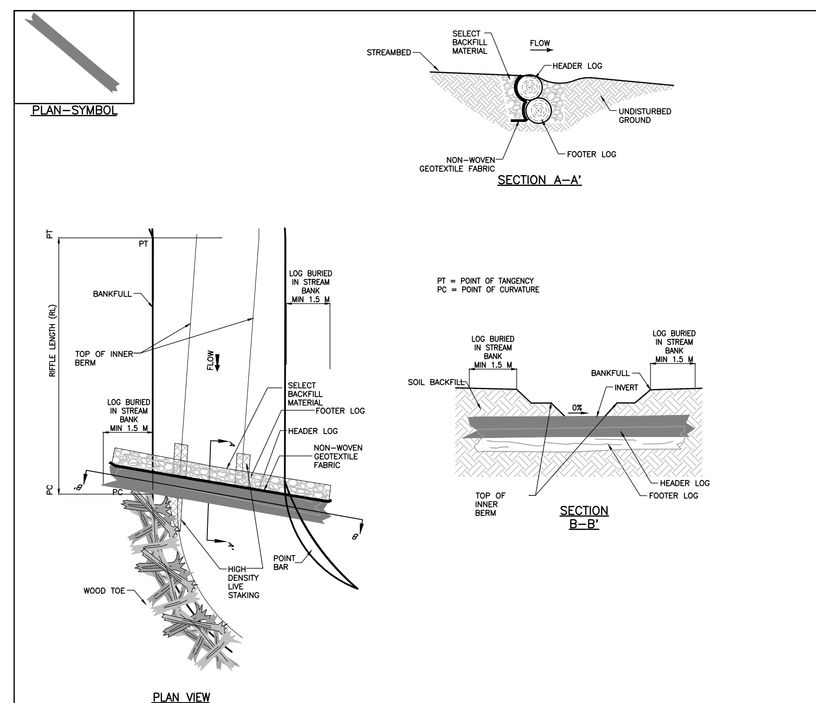


NOTES:

1. COARSE WOODY DEBRIS SHALL CONSIST OF LOGS, ROOTWADS, AND LARGE BRANCHES NOT SUITABLE FOR CONSTRUCTION OF LOG STRUCTURES. ALL MATERIALS ARE TO BE APPROVED BY THE ENGINEER.
2. COARSE WOODY DEBRIS SHALL BE CONSTRUCTED WITH THE LARGEST MATERIAL PLACED FIRST. NO LOGS SHALL BE PLACED PARALLEL TO THE FLOW OF WATER, UNLESS DIRECTED BY THE ENGINEER. LOGS SHALL BE PLACED IN A CROSSING PATTERN OR WEAVE SUCH THAT EACH LOG IS ANCHORED BY ANOTHER LOG.
3. SMALL/FINE WOODY DEBRIS SHALL CONSIST OF MEDIUM TO SMALL LIMBS, BRANCHES, BUSHES, AND/OR LOGS. INVASIVE SPECIES SHALL NOT BE USED.
4. SMALL/FINE WOODY DEBRIS SHALL BE PLACED ABOVE THE COARSE WOODY DEBRIS WITH THE LARGEST MATERIAL BEING PLACED FIRST AND THE SMALLEST MATERIAL PLACED LAST.
5. ALL WOODY DEBRIS SHALL BE COMPACTED WITH THE EXCAVATOR BUCKET IN ORDER TO REDUCE THE PRESENCE OF VOIDS IN THE SMALL/FINE WOODY DEBRIS LAYER.
6. THE HORIZONTAL LOCATIONS OF ALL WOODY DEBRIS ARE LOCATED ON THE PLAN AND PROFILE SHEETS. NO LOCATIONS OF WOODY DEBRIS SHALL VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM THE ENGINEER.
7. GRAVEL LEVELING BASE (GRANULAR 'B') OVER NON-WOVEN FILTER FABRIC MAY BE INSTALLED ABOVE THE HIGHEST ELEVATION OF THE WOODY DEBRIS BEFORE THE SOIL LIFTS ARE INSTALLED.
8. THE SOIL BACKFILL USED FOR LIFTS AND TOPSOIL USED FOR LAYERING WITH THE LIVE BRANCHES SHALL BE FREE OF ANY LARGE ROOTS OR WOODY DEBRIS AND SHALL GENERALLY BE FREE FROM ANY GRAVEL OR COBBLE MATERIAL.
9. SOIL BACKFILL SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM; YET, NOT SUCH THAT THE UNDERLYING BRUSH IS DISPLACED OR DAMAGED.
10. THE TOP OF THE BACKFILL FOR THE FIRST LIFT SHALL BE SLOPED AT APPROXIMATELY 5% AWAY FROM THE STREAM.
11. PLACE A LAYER OF TOPSOIL AND LIVE BRANCHES ON TOP OF EACH SOIL LIFT SUCH THAT APPROXIMATELY 0.15 TO 0.30 m OF EACH LIVE BRANCH WILL BE EXPOSED AND THE REMAINDER (0.60 TO 1.20M) OF EACH LIVE BRANCH WILL BE COVERED BY THE NEXT SOIL LIFT.
12. LIVE BRANCHES SHALL BE OF THE SPECIES SPECIFIED FOR LIVE STAKES OR APPROVED BY THE ENGINEER.
13. PLACE A LAYER OF 2.0 m WIDE COIR 700 EROSION CONTROL BLANKET, OR EQUIVALENT, ON TOP OF THE TOPSOIL AND LIVE BRANCHES SUCH THAT 0.75 m OF THE BLANKET WILL BE BURIED BELOW THE NEXT SOIL LIFT. ALLOW THE REMAINING 1.25 m OF BLANKET TO HANG OVER THE PRECEDING SOIL LIFT OR COIR FIBER LOGS.
14. PLACE A SECOND LAYER OF 2.0 m WIDE NON-WOVEN COIR MATTING OVER THE EROSION CONTROL BLANKET TO THE SAME LIMITS.
15. SOIL CAN BE COMPACTED BY STACKING A PIECE OF SAWN LUMBER BOARD EDGEWAYS UP TO THE LIFT HEIGHT SPECIFIED AND SECURING WITH WOODEN STAKES TO PROVIDE A RIGID BACKSTOP FOR COMPACTING SOIL LIFT.
16. PLACE SOIL BACKFILL UP TO THE LIFT HEIGHT SPECIFIED OF NO GREATER THAN 0.30M BEING CAREFUL NOT TO PUSH/PULL OR TEAR THE FABRIC PREVIOUSLY PLACED.
17. THE TOP OF THE SOIL BACKFILL SHALL BE FLAT WITHIN THE LIFT SETBACK DISTANCE SPECIFIED IN THE DETAIL. BEYOND THE LIFT SETBACK DISTANCE, THE SOIL BACKFILL SHALL BE SLOPED AT AN APPROXIMATE 5% SLOPE AWAY FROM THE STREAM.
18. TOP DRESS THE SOIL LIFT WITH TOPSOIL FROM THE FACE OF THE SOIL LIFT BACK INTO THE FLOODPLAIN AT LEAST 1.2 m.
19. REMOVE THE SAWN LUMBER AND WOODEN STAKES FROM THE FACE OF THE SOIL LIFT AND WRAP THE FACE AND TOP OF THE SOIL LIFT USING THE WOVEN AND NON-WOVEN COIR MATTING HANGING OVER THE PREVIOUS LIFT/COIR FIBER LIFTS.
20. THE EROSION CONTROL FABRIC SHALL BE PULLED AS TIGHT AS POSSIBLE WITHOUT TEARING OR EXCESSIVELY DISTORTING THE FABRIC.
21. SECURE THE EROSION CONTROL AND NON-WOVEN MATTING IN PLACE BY STAKING THE END OF THE EROSION CONTROL FABRIC WITH DEAD STAKES ON 0.5 m CENTERS.
22. BEGIN CONSTRUCTION OF THE NEXT SOIL LIFT BY REPEATING THE PREVIOUS NOTES STARTING WITH NOTE 11.
23. THE OVERALL SLOPE CREATED BY THE LIVE BRUSH LAYERING SHALL MATCH THE PROPOSED CROSS SECTION SHAPE FOR THE OUTER BANK OF THE THE TYPICAL POOL CROSS-SECTION FOR EACH REACH.
24. THE COIR BLANKETS AND GEOTEXTILE FABRIC USED FOR THE UPPER MOST SOIL LIFT WILL BE SECURED WITHIN A 0.15 m DEEP TRENCH AS SHOWN IN DETAIL.
25. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR ELEVATIONS SHALL BE WITHIN 0.03 m OF THE GRADES AND ELEVATIONS INDICATED OR APPROVED BY THE ENGINEER.
26. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
27. SOD MAT WRAPPED IN COIR MATTING MAY BE USED INSTEAD OF THE SOIL LIFTS ABOVE THE WOOD TOE IF IT IS AVAILABLE AND APPROVED BY THE ENGINEER.
28. THE LOWER BANK STABILIZATION IS CRITICAL TO THE DESIGN INTENT OF THIS PROJECT. VARIANCE FROM WOOD TOE BANK STABILIZATION WILL ONLY BE CONSIDERED AT THE DISCRETION OF THE ENGINEER.

DETAIL – WOOD DEBRIS TOE PROTECTION

N.T.S



NOTE:

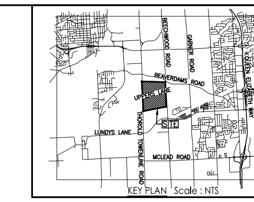
1. SOME LOG SILLS MAY BE INSTALLED AT THE PC IF INDICATED ON THE PLAN AND PROFILE SHEET. LOG SILLS LOCATED AT THE PC SHALL BE INSTALLED WITH SIMILAR PROCEDURE, EXCEPT THE LOGS SHALL HAVE A 1% VERTICAL SLOPE TOWARD THE INSIDE OF THE BEND. THE LOG SILL LOCATIONS SHALL BE AS SHOWN ON THE PLAN AND PROFILE

NOTES:

1. LOGS SHALL HAVE MINIMUM DIAMETER OF 0.3 m
2. LOGS SHALL HAVE A MINIMUM LENGTH OF THE REACH BANKFULL WIDTH PLUS 3 m.
3. IT IS PREFERRED THAT THE HEADER LOG USED FOR THIS STRUCTURE BE SLIGHTLY BOWED OR CURVED.
4. IF A BOWED LOG IS USED FOR THE HEADER LOG, POSITION THE LOG SUCH THAT THE LOWEST POINT IS AT THE CENTERLINE OF THE CHANNEL AS SHOWN IN THE DETAIL.
5. LIMBS OF ALL LOGS SHALL BE TRIMMED FLUSH.
6. FOOTER LOGS ARE LOGS PLACED TO PROVIDE A FOUNDATION AND SCOUR PROTECTION FOR THE HEADER LOGS.
7. THE HEADER LOG SHALL BE UNDERLAIN BY A FOOTER LOG UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
8. HEADER LOGS ARE THE UPPER MOST LOGS USED IN EACH STRUCTURE. THE HEADER LOG FOR THIS STRUCTURE IS ONLY VISIBLE BETWEEN THE INNER BERMS.
9. HEADER LOG SHALL BE OFFSET SLIGHTLY DOWNSTREAM OF THE FOOTING LOG.
10. SET INVERT TO MATCH STREAM BED ELEVATION AS PER THE DESIGN PROFILE.
11. THE VERTICAL SLOPE OF EACH LOG SHALL BE 0% AND AT NOT EXCEED 1% UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
12. ALL GAPS/VOIDS LARGER THAN 2.5cm BETWEEN THE HEADER AND FOOTER LOGS SHALL BE CHINKED WITH LIMBS AND/OR BRUSH ON THE UPSTREAM SIDE PRIOR TO PLACEMENT OF THE GEOTEXTILE.
13. ON THE UPSTREAM SIDE OF THE LOGS NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED AS SHOWN IN THE GEOTEXTILE PLACEMENT DETAIL ALONG THE ENTIRE LENGTH OF THE LOG.
14. BACKFILL STRUCTURE WITH SELECT BACKFILL MATERIAL AS SHOWN AND DEFINED IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL.
15. NAIL NON-WOVEN GEOTEXTILE TO EDGE OF HEADER LOG AND BACKFILL AS SHOWN IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL.
16. SELECT BACKFILL AND SOIL BACKFILL MATERIAL SHALL BE COMPACTED SUCH THAT FUTURE SETTLEMENT OF THE MATERIAL IS KEPT TO A MINIMUM.
17. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 3 CM OF THE GRADES AND ELEVATIONS INDICATED.
18. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
19. SEE WOOD DEBRIS TOE DETAIL.

DETAIL – LOG SILL

N.T.S



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
	Revision	By	Appd	YYYY.MM.DD

File Name: 160960948_C-500DT.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

Title

TYPICAL DETAILS

Project No. 160960948

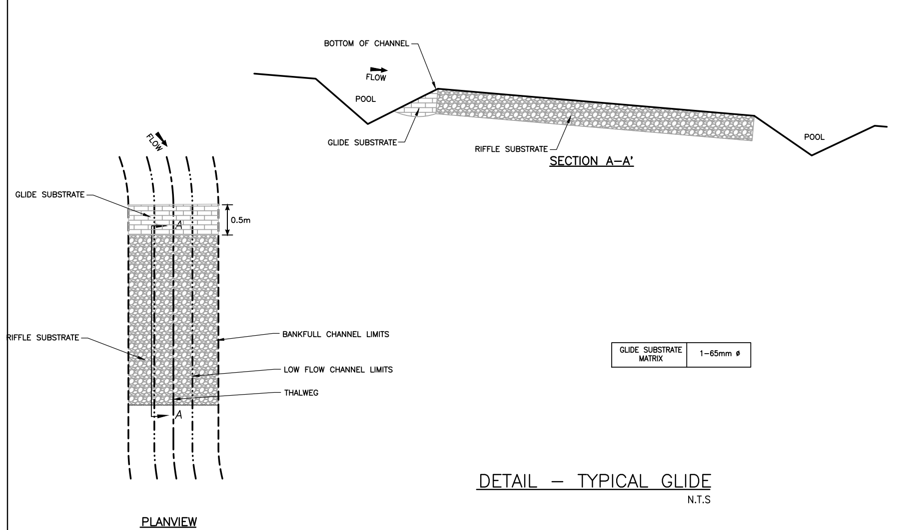
Scale

Revision 7

Sheet 15 of 32

Drawing No. C-501

ORIGINAL SHEET - ARCH D

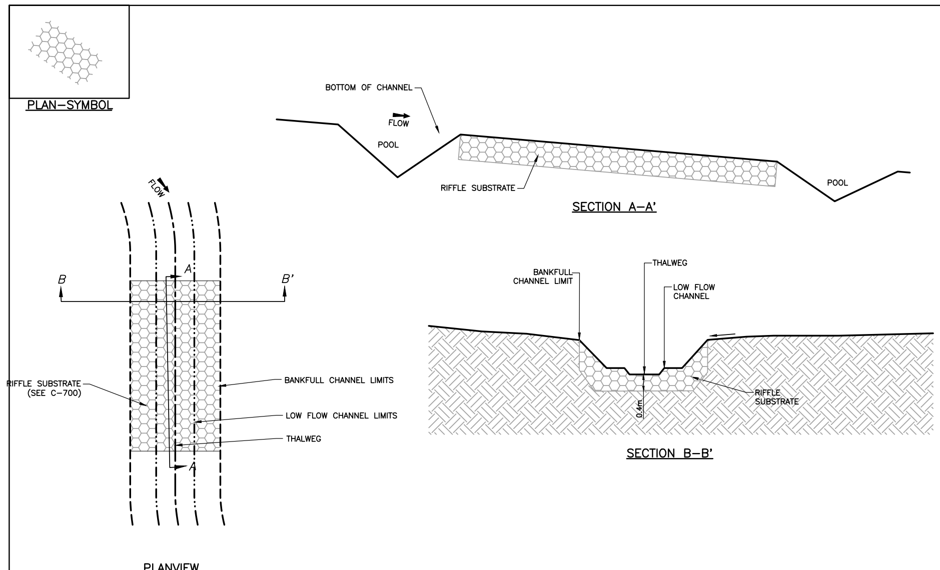


GLIDE SUBSTRATE MATRIX	1-65mm ⌀

NOTES:

1. GLIDE SUBSTRATE MATERIAL IS AS SPECIFIED ON THIS PAGE.
2. GLIDE MATERIAL IS TO BE PLACED UPSTREAM OF EACH RIFFLE TO THE DIMENSIONS SPECIFIED.
3. INVERTS ARE TO BE SET AT THE ELEVATION SHOWN ON THE PLAN AND PROFILE SHEETS. NO ELEVATIONS OF THE GLIDE MAY VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM THE ENGINEER.
4. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.03m OF THE GRADES AND ELEVATIONS INDICATED.
5. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

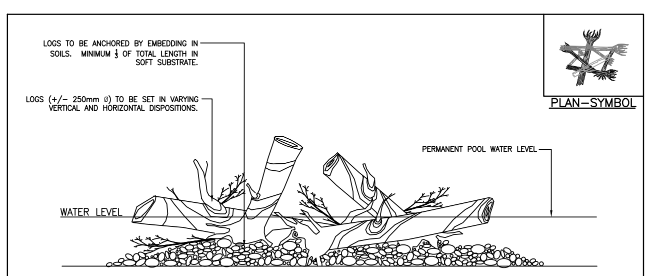
DETAIL – TYPICAL GLIDE
N.T.S



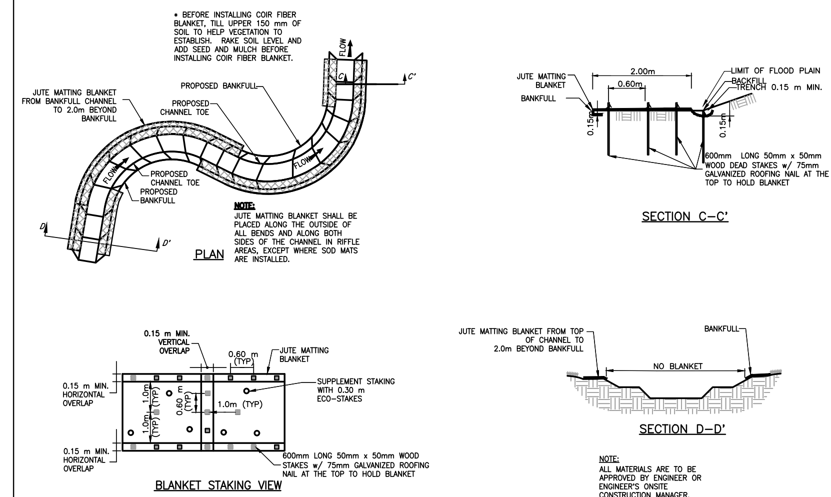
NOTES:

1. AUGMENTED RIFFLE SUBSTRATE MATERIAL IS AS SPECIFIED ON C-700.
2. INVERTS ARE TO BE SET AT THE ELEVATION SHOWN ON THE PLAN AND PROFILE SHEETS. NO ELEVATIONS OF THE AUGMENTED RIFFLE MAY VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM THE ENGINEER.
3. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.03m OF THE GRADES AND ELEVATIONS INDICATED.
4. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

DETAIL – AUGMENTED RIFFLE
N.T.S



LOG TANGLES DETAIL
N.T.S.



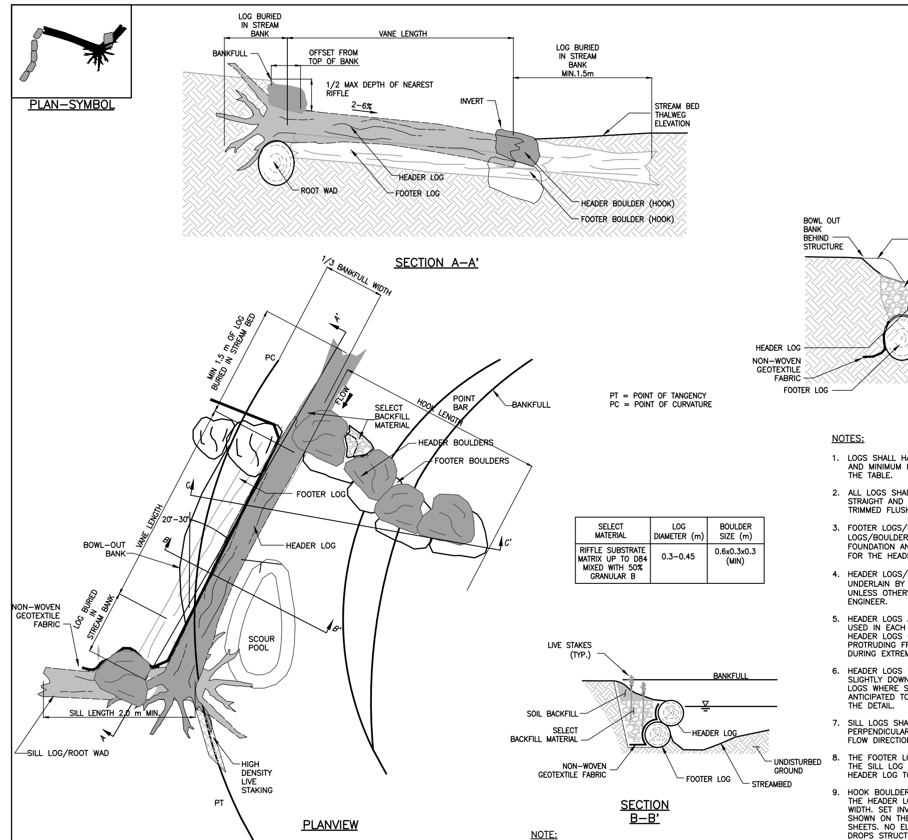
NOTE:
JUTE MATTING BLANKET SHALL BE PLACED ALONG THE OUTSIDE OF ALL BENDS AND ALONG BOTH SIDES OF THE CHANNEL IN RIFFLE AREAS, EXCEPT WHERE SOD MATS ARE INSTALLED.

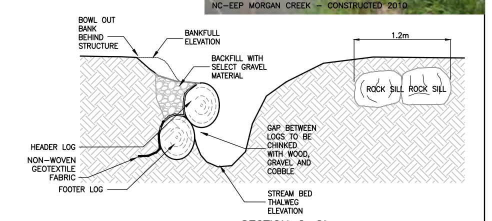
NOTE:
ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.

NOTE:

SECURE BLANKET BY STAKING AND OVERLAPPING AT THE SEAMS WITH A SHINGLE-TYPE METHOD. ADDITIONAL STAKING SHALL BE APPLIED AT NO ADDITIONAL COST IF THE BLANKET SEPARATES FROM THE SOIL MORE THAN 0.05m UNDER A REASONABLE PULL.

DETAIL – TYPICAL EROSION CONTROL BLANKET
N.T.S





PT = POINT OF TANGENCY
PC = POINT OF CURVATURE

SELECT MATERIAL	LOG DIAMETER (m)	BOULDER SIZE (m)
RIFFLE SUBSTRATE MATRIX UP TO D84 MIXED WITH 50% GRANULAR B	0.3-0.45	0.6x0.3x0.3 (MIN)

SECTION B-B'

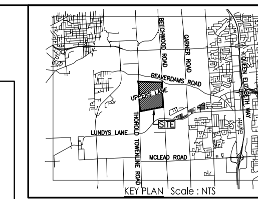
NOTE:

THE DEPARTURE ANGLE SHOWN ABOVE IS DEPICTED IN SUCH A WAY TO EMPHASIZE DETAIL. ACTUAL DEPARTURE ANGLE AND STRUCTURE LOCATION SHALL BE AS SHOWN ON THE PLAN AND PROFILE SHEETS.

DETAIL – LOG J-HOOK / WITH ROOTWAD
N.T.S

NOTES:

1. LOGS SHALL HAVE MINIMUM DIAMETER AND MINIMUM LENGTH AS SHOWN IN THE TABLE.
2. ALL LOGS SHALL BE RELATIVELY STRAIGHT AND LIMBS SHALL BE TRIMMED FLUSH.
3. FOOTER LOGS/BOULDERS ARE LOGS/BOULDERS PLACED TO PROVIDE A FOUNDATION AND SCOUR PROTECTION FOR THE HEADER LOGS/BOULDERS.
4. HEADER LOGS/BOULDERS SHALL BE UNDERLAIN BY FOOTER LOGS/BOULDERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
5. HEADER LOGS ARE THE TOP MOST LOGS USED IN EACH LOG STRUCTURE. ALL HEADER LOGS CAN BE SEEN PROTRUDING FROM THE WATER SURFACE DURING EXTREMELY LOW FLOWS.
6. HEADER LOGS SHALL BE OFFSET SLIGHTLY DOWNSTREAM OF THE FOOTING LOGS WHERE SCOUR POOLS ARE ANTICIPATED TO FORM AS SHOWN IN THE DETAIL.
7. SILL LOGS SHALL BE PLACED PERPENDICULAR TO THE BANKFULL FLOW DIRECTION.
8. THE FOOTER LOGS SHALL EXTEND FROM THE SILL LOG TO THE END OF THE HEADER LOG TOWARD THE BANK.
9. HOOK BOULDERS SHALL EXTEND FROM THE HEADER LOG TO BEYOND BANKFULL WIDTH. SET INVERTS AT ELEVATION SHOWN ON THE PLAN AND PROFILE SHEETS. NO ELEVATIONS OF THE LOG DROPS STRUCTURE MAY VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTIONS FROM THE ENGINEER
10. HEADER LOG SHALL TIE INTO THE STREAM BANK AT A MAXIMUM ELEVATION OF 1/4 DMAX (MEASURED AT THE NEXT DOWNSTREAM RIFFLE) BELOW BANKFULL ELEVATION AND A MINIMUM ELEVATION OF 1/2 DMAX (MEASURED AT THE NEXT DOWNSTREAM RIFFLE) BELOW BANKFULL ELEVATION UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
11. CUTTING OF THE SILL LOG ROOTWAD MAY BE REQUIRED TO PREVENT THE ROOTWAD FROM PROTRUDING ABOVE THE BANKFULL ELEVATION.
12. ALL GAPS/VOIDS LARGER THAN 25mm BETWEEN THE HEADER AND FOOTING LOGS SHALL BE CHINKED WITH LIMBS AND/OR BRUSH ON THE UPSTREAM SIDE PRIOR TO PLACEMENT OF THE GEOTEXTILE.
13. ALL GAPS/VOIDS LARGER THAN 25mm BETWEEN THE HEADER AND FOOTING BOULDERS SHALL BE CHINKED WITH GRAVEL AND COBBLES.
14. ON THE UPSTREAM SIDE OF THE LOGS AND/OR BOULDERS NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED AS SHOWN IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL FOR THE ENTIRE LENGTH OF THE LOG AND BOULDER HOOK.
15. BACKFILL STRUCTURE WITH SELECT BACKFILL MATERIAL AS SHOWN AND DEFINED IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL.
16. SELECT BACKFILL AND SOIL BACKFILL MATERIAL SHALL BE COMPACTED SUCH THAT FUTURE SETTLEMENT OF THE MATERIAL IS KEPT TO A MINIMUM.
17. NAIL NON-WOVEN GEOTEXTILE TO EDGE OF HEADER LOG AND BACKFILL AS SHOWN IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL.
18. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.03m OF THE GRADES AND ELEVATIONS INDICATED.
19. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
20. SEE THE PLANTING TABLE FOR DETAILS ON HIGH DENSITY LIVE STAKING.
21. NO LIVE STAKES SHALL BE INSTALLED ON THE UPSTREAM SIDE OF THE LOG VANE AT OR BELOW THE TIE-IN ELEVATION OF THE HEADER LOG WITH THE STREAM BANK UNLESS OTHERWISE DIRECTED BY THE ENGINEER.



KEY PLAN Scale : NTS

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-500DT.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

Title

TYPICAL DETAILS

Project No. 160960948

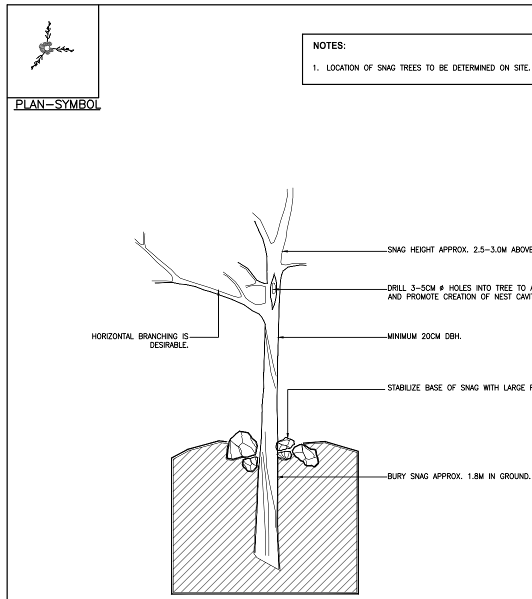
Scale

Revision 7

Sheet 16 of 32

Drawing No. C-502

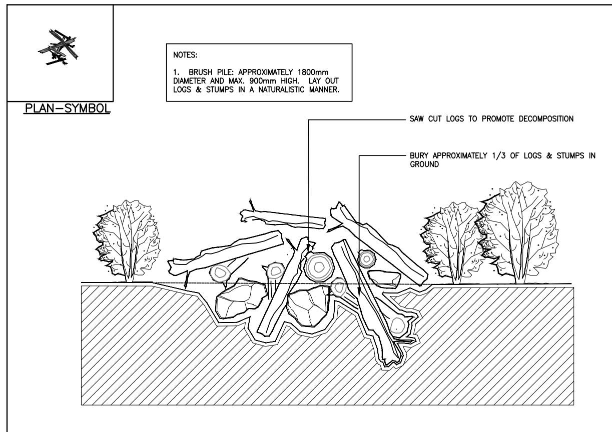
ORIGINAL SHEET - ARCH D



NOTES:

1. LOCATION OF SNAG TREES TO BE DETERMINED ON SITE.

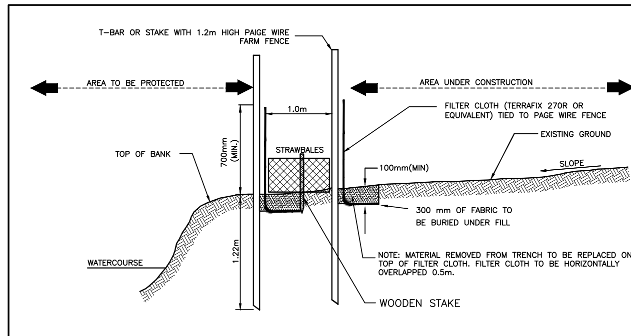
SNAG TREE DETAIL
N.T.S.



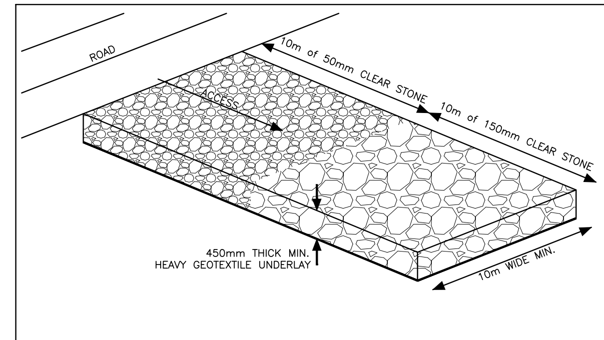
NOTES:

1. BRUSH PILE: APPROXIMATELY 1800mm DIAMETER AND MAX. 900mm HIGH. LAY OUT LOGS & STUMPS IN A NATURALISTIC MANNER.

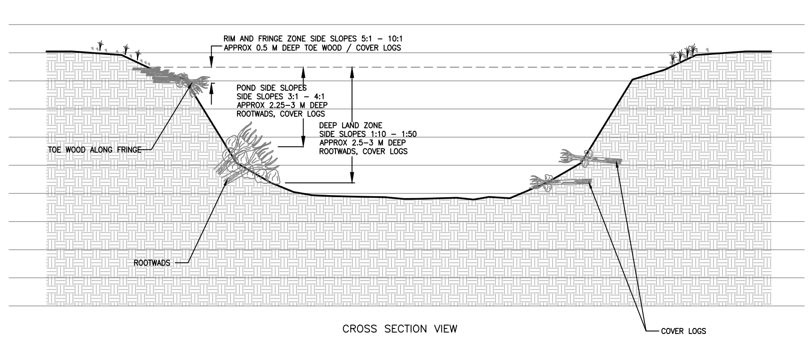
BRUSH PILE DETAIL
N.T.S.



REINFORCED DOUBLE ROW OF SILT FENCE
NTS



CONSTRUCTION ENTRANCE DETAIL
NOT TO SCALE



NOTES:

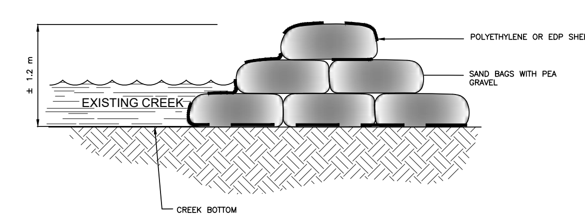
DETAIL INTENDED AS A GUIDE FOR A TYPICAL POND CROSS-SECTION. EACH POND IS UNIQUE IN SIZE, DEPTH AND SHAPE. THE TYPES OF HABITAT STRUCTURES ARE THE SAME FOR EACH POND AND INSTALLED THE SAME. THE POND STRUCTURES HAVE FLEXIBILITY FOR INTERPRETATION, THESE ARE LOW RISK STRUCTURES FOR FAILURE, THEY ARE MEANT TO INCREASE THE BIO-DIVERSITY OF THE POND AND PROVIDE COVER FOR AQUATIC HABITAT. STRUCTURE PLACEMENT AND QUANTITY SHALL BE ADVISED BY QUALIFIED PROFESSIONAL.

MIX LAYERS OF TOPSOIL ON TOP OF COARSE WOODY DEBRIS. WOODY DEBRIS TO BE INSTALLED IN THE RIM/FRINGE AREA OF THE PONDS. SEE TOE WOOD DETAIL FOR INSTALLATION STRUCTURES.

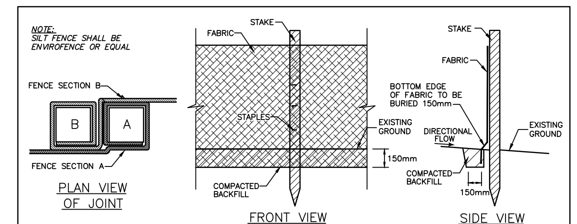
COVER LOGS TO BE INSTALLED IN POND SIDE SLOPE AREA, DEEP LAND ZONE AND DEEP WATER ZONE. LOGS CAN BE ANY RANGE IN SIZE TO FIT THE LIMIT OF AVAILABLE WOOD ON SITE. BOULDERS SHALL BE LARGE ENOUGH TO HOLD WOOD IN PLACE AS ANCHORS TO THE LOGS. LOGS SHALL BE BURIED INTO BANK OF PONDS A MIN 2-3m PER DETAILS. COVER LOGS TO BE INSTALLED AT RANDOM IN THE DIFFERENT ZONES FOR MAXIMUM HABITAT. CONTRACTOR SHALL BE ADVISED ON PLACEMENT AND QUANTITY BY QUALIFIED PROFESSIONAL.

ROOTWADS INSTALLED IN THE DEEP LAND ZONE AND DEEP WATER ZONE SHALL BE INSTALLED WITH ROOT FAN FACING OUTWARDS. ROOTWADS SHALL BE EXPOSED AT THE BANK SURFACE OF THE POND FOR HABITAT FUNCTION WITH LOG OF THE ROOTWAD BURIED INTO THE SURFACE OF THE GROUND. LARGE BOULDERS SHALL BE USED TO ANCHOR ROOTWADS DOWN. ROOTWADS TO BE INSTALLED AT RANDOM. CONTRACTOR SHALL BE ADVISED ON PLACEMENT AND QUANTITY BY QUALIFIED PROFESSIONAL.

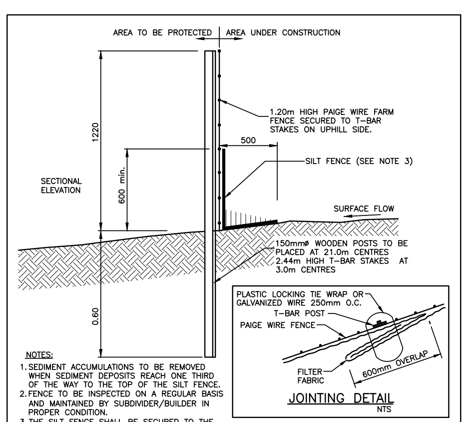
DETAIL - TYPICAL RIPARIAN WETLAND (TYP.)
N.T.S



COFFER DAM WITH IMPERMEABLE LINER
N.T.S



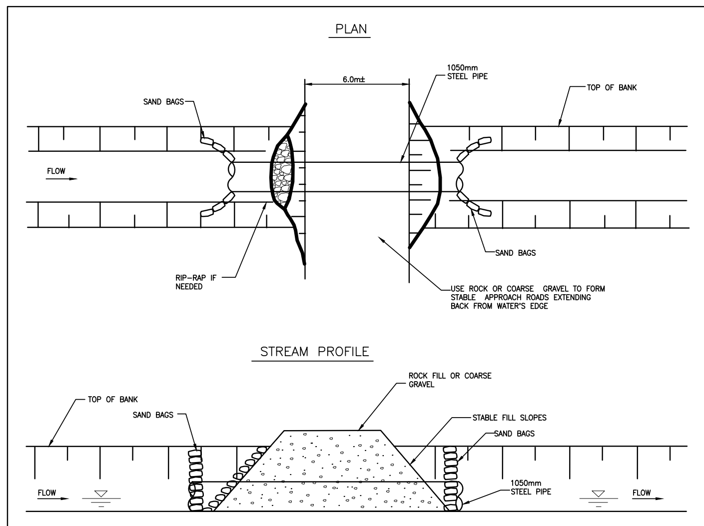
SILT FENCE DETAILS
NTS



NOTES:

1. SEDIMENT ACCUMULATIONS TO BE REMOVED WHEN SEDIMENT DEPOSITS REACH ONE THIRD OF THE WAY TO THE TOP OF THE SILT FENCE.
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION.
3. THE SILT FENCE SHALL BE SECURED TO THE PAIGE WIRE FENCE WITH GALVANIZED WIRE. (SEE JOINTING DETAIL)

HEAVY DUTY SILT FENCE DETAIL
NTS



TEMPORARY VEHICLE CROSSING

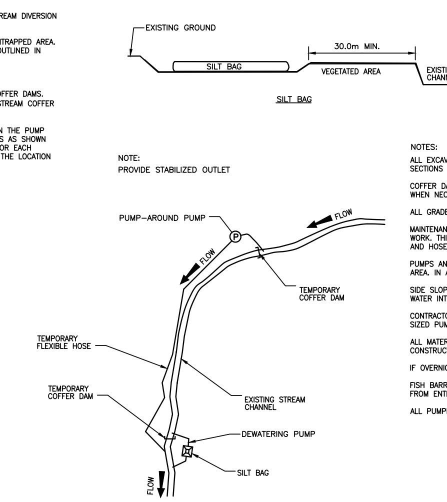
THERE WILL BE NO FORDING OF A FLOWING STREAM DURING CONSTRUCTION. TEMPORARY VEHICLE CROSSING WILL BE INSTALLED AS NECESSARY. THE FOLLOWING SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES WILL BE FOLLOWED AT ALL TEMPORARY BRIDGES:

1. INSTALL THE CROSSING IN A MANNER THAT WILL MINIMIZE SEDIMENT ENTERING THE WATER. FILL FOR THE TEMPORARY ROAD IS TO BE COARSE GRANULAR OR ROCK FILL MATERIAL.
2. THE ROAD APPROACH LEADING TO THE TEMPORARY CROSSING MUST BE RAISED AND STABLE. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO KEEP SEDIMENT ON LAND (E.G. CHECK DAMS, FILTER CLOTH, ANGULAR RIP RAP, SEED AND MULCH, SEDIMENT TRAPS, ETC.).
3. WHILE THE TEMPORARY CROSSING IN USE, ANY BUILD-UP OF MUD ON THE ROAD SURFACE OR APPROACHES THAT IS AFFECTING WATER QUALITY IS TO BE SCRAPED OFF AND DISPOSED OF IN AN APPROVED LOCATION.
4. WHEN THE TEMPORARY CROSSING IS NO LONGER REQUIRED, IT IS TO BE REMOVED AS QUICKLY AS POSSIBLE. REMOVAL SHALL NOT OCCUR OUTSIDE CONSTRUCTION WINDOWS AS IDENTIFIED ON THE WORK PERMIT WITHOUT PRIOR WRITTEN APPROVAL FROM DFO. SURPLUS GRAVEL IS TO BE REMOVED FROM THE CROSSING AREA AND DISPOSED OF IN A LOCATION APPROVED BY THE CLIENT AND DFO. THE CREEK BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL PER PLANTING PLAN AND DETAIL C-501-2 (TYPICAL MATTING DETAIL).
5. ALTERNATE METHODS OF CROSSING MAY BE CONSIDERED WITH PRIOR APPROVAL FROM THE ENGINEER.

TEMPORARY VEHICLE CROSSING PLAN
N.T.S

SEQUENCE OF CONSTRUCTION FOR TYPICAL WORK AREA

1. INSTALL SILT BAGS AS REQUIRED.
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM COFFER DAM AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION OR AS OUTLINED IN THE APPROVED WATER MANAGEMENT PLAN
4. PLACE DOWNSTREAM COFFER DAM AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA. AREA TO BE DEWATERED SHALL BE EQUAL TO ONE DAY'S WORK OR AS OUTLINED IN THE APPROVED WATER MANAGEMENT PLAN.
5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF COFFER DAMS. REMOVE COFFER DAMS, PUMPS, AND TEMPORARY FLEXIBLE HOSE. (DOWNSTREAM COFFER DAMS FIRST).
7. ALL GRADING AND STABILIZATION MUST BE COMPLETED IN ONE DAY WITHIN THE PUMP AROUND AREAS BETWEEN THE COFFER DAMS. THE COFFER DAM LOCATIONS AS SHOWN ON THIS SHEET ONLY SHOW THE UPPER AND LOWER EXTENT OF WORK FOR EACH STREAM SEGMENT. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE COFFER DAM(S) FOR EACH DAY'S WORK.
8. REMOVE SILT BAGS AND STABILIZE BASE AREA.
9. STABILIZE DISTURBED AREA WITH SEED AND MULCH.



NOTES:

ALL EXCAVATION SHALL BE PERFORMED IN ONLY DRY OR ISOLATED SECTIONS OF CHANNEL.

COFFER DAMS ARE TO BE USED TO ISOLATE WORK FROM STREAM FLOW WHEN NECESSARY.

ALL GRADED AREAS SHALL BE STABILIZED WITHIN 24 HOURS.

MAINTENANCE OF STREAM FLOW OPERATIONS SHALL BE INCIDENTAL TO THE WORK. THIS INCLUDES POLYETHYLENE SHEETING, DIVERSION PIPES, PUMPS AND HOSES.

PUMPS AND HOSES SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. IN ACCORDANCE WITH THE PERMIT TO TAKE WATER

SIDE SLOPES OF RESTORED CHANNEL SHALL BE MATTED PRIOR TO TURNING WATER INTO CHANNEL. SEE TYPICAL MATTING LOCATION DETAIL.

CONTRACTOR IS RESPONSIBLE FOR DETERMINING & ACQUIRING THE PROPER SIZED PUMP.

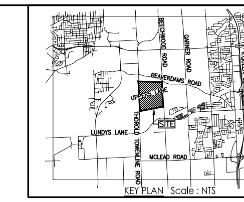
ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.

IF OVERNIGHT PUMPING IS REQUIRED NOISE BY-LAWS MUST BE OBSERVED.

FISH BARRIER NETS MUST BE ERECTED AND MAINTAINED TO PREVENT FISH FROM ENTERING THE WORKING AREA OF THE CHANNEL

ALL PUMPING TO CONFORM TO MOE PTTW

PUMP AROUND OPERATION
N.T.S



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

	Revision	By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-500DT.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

TYPICAL DETAILS

Project No.
160960948

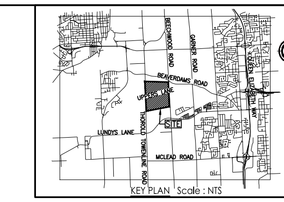
Scale

Revision 7
Sheet 17 of 32

Drawing No.
C-503

11/18/2021 3:01:42 PM By: Childs, Jason

ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

JUTE MATTING

STRAW MATTING

RIP-RAP ROCK PROTECTION
(R-50 PER OPSS.MINU 1004)

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-600EC.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

SEDIMENT AND EROSION
CONTROL PLAN
SOUTH

Project No.
160960948

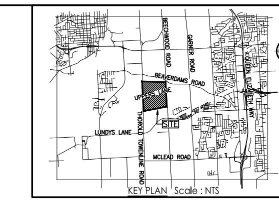
Scale
1:750
0 7.5 22.5 37.5m

Revision 7

Sheet 18 of 32

Drawing No.
C-600

ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

JUTE MATTING

STRAW MATTING

	Revision	By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-600EC.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

Title

SEDIMENT AND EROSION
CONTROL PLAN
CENTRAL

Project No. 160960948

Scale 1:750 0 7.5 22.5 37.5m

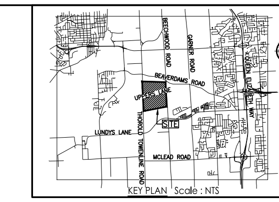
Revision 5

Sheet 19 of 32

Drawing No. **C-601**

ORIGINAL SHEET - ARCH D

(SEE DWG. NO. C-601)



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

JUTE MATTING

STRAW MATTING

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-600EC.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

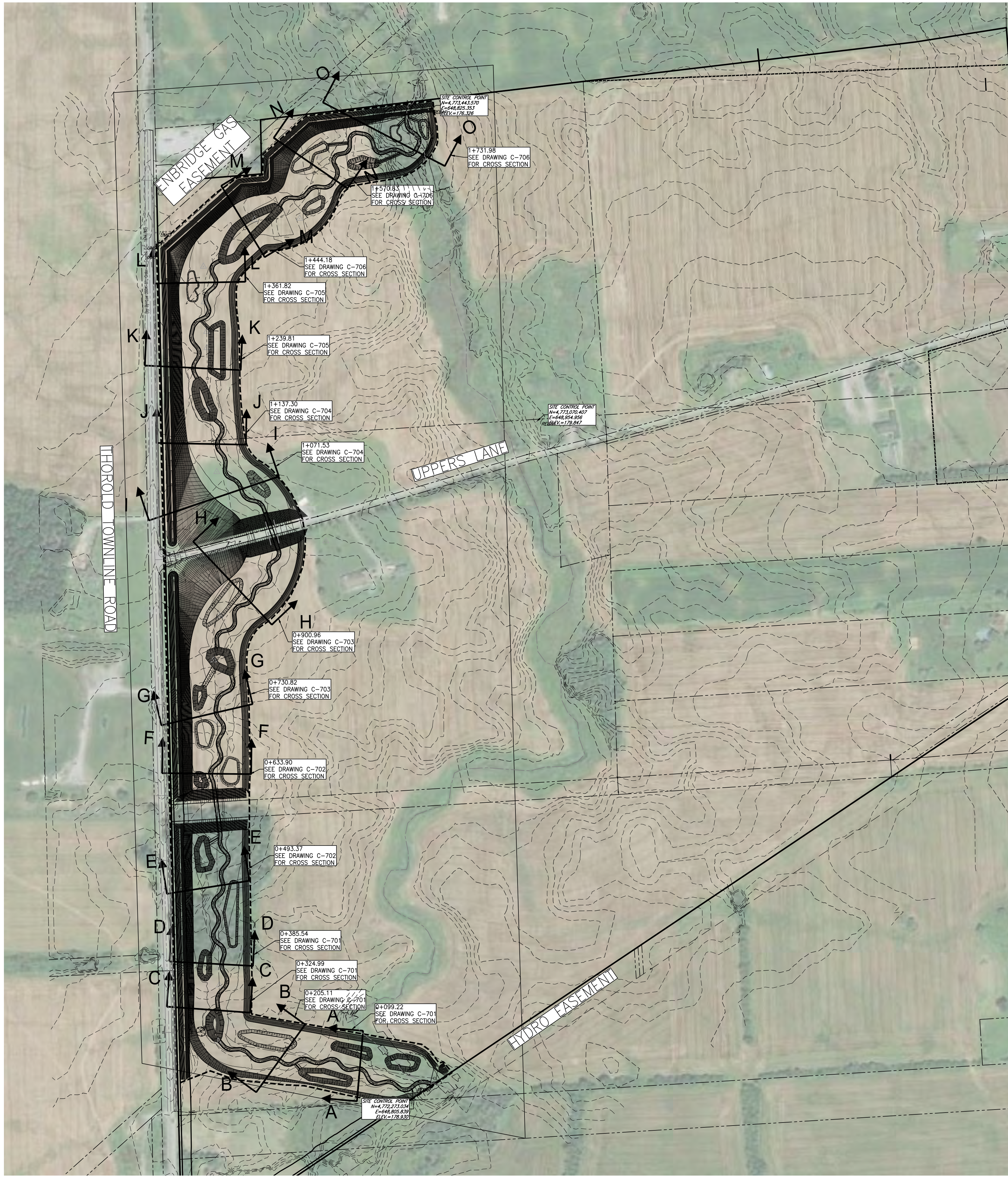
Title

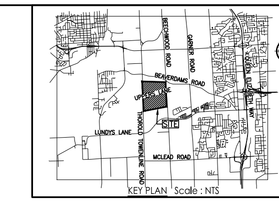
SEDIMENT AND EROSION
CONTROL PLAN
NORTH

Project No.	Scale
160960948	1:750 0 7.5 22.5 37.5m

Revision	Sheet	Drawing No.
7	20 of 32	C-602

ORIGINAL SHEET - ARCH D





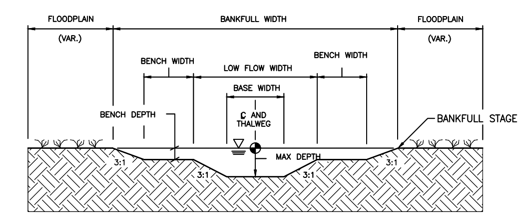
Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

DIMENSION	LENGTH (m)
BANKFULL WIDTH	4.00
BASE WIDTH	0.60
MAXIMUM DEPTH	0.50
BENCH DEPTH	0.20
LOW FLOW WIDTH	2.40
BENCH WIDTH	0.20

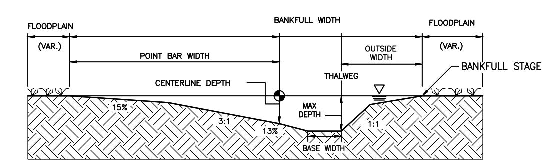


NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED
– RIFFLE BANKS TO BE STABLISED WITH COIR MATTING PER DETAIL.

TYPICAL SECTION – RIFFLE
N.T.S

MIRROR ABOUT CENTERLINE FOR POOL LEFT

DIMENSION	LENGTH (m)
BANKFULL WIDTH	4.30
POINT BAR WIDTH	2.20
MAX DEPTH (THALWEG)	0.85
BASE WIDTH	0.20
CENTERLINE DEPTH	0.44
OUTSIDE WIDTH	0.75



THALWEG (DEEPEST POINT IN A CROSS SECTION) IS LOCATED OUTSIDE 1/3 OF BANKFULL CHANNEL.

NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED
– OUTSIDE OF THE MEANDER BEND WILL BE TREATED WITH WOODY DEBRIS TOE PROTECTION

TYPICAL SECTION – POOL RIGHT
N.T.S

RIFFLE SUBSTRATE	
MATRIX GRADATION	DIAMETER (mm)
D_{16}	5
D_{35}	25
D_{50}	50
D_{84}	80
D_{100}	100

THE RIFFLE SUBSTRATE MATRIX SHALL BE PREPARED BY MIXING OR PLACING IN LAYERS SUCH THAT THE SMALLER MATERIAL FILLS THE VOIDS BETWEEN THE LARGER MATERIAL. RIFFLE SUBSTRATE SHALL BE PLACED 0.20m THICK AT RIFFLES.

TABLE 2	
GLIDE MATRIX	WELL GRADED SAND & GRAVEL 1–65mmø

THE GLIDE MATRIX SHALL BE PLACED IN A 0.20m DEEP LAYER AT EACH GLIDE TO PROVIDE SPAWNING HABITAT.

CULVERT SUBSTRATE	
PERCENT OF MIX (%)	MIX
80	WB350, OPSS.PROV 1005
20	RIFFLE SUBSTRATE

VALLEY BERM ROCK PROTECTION	
PERCENT OF MIX (%)	MIX
100	R–50 RIP–RAP OPSS.MINI 1005

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

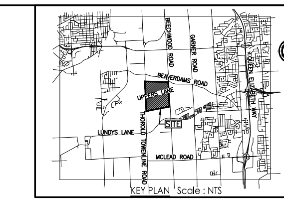
Title

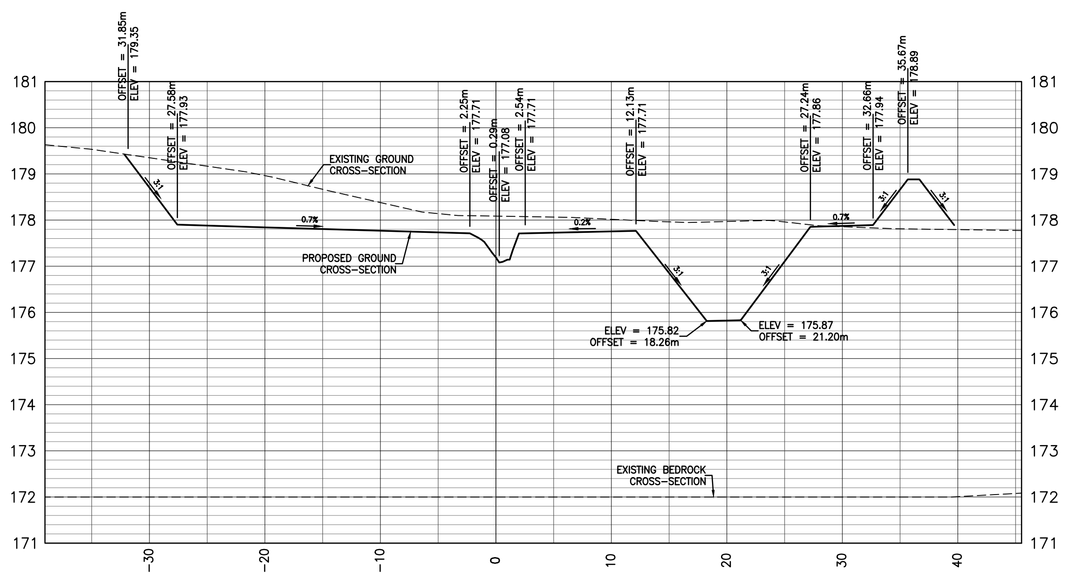
TYPICAL CROSS SECTIONS

Project No.	Scale
160960948	1:2500 (0, 25, 75, 125m)

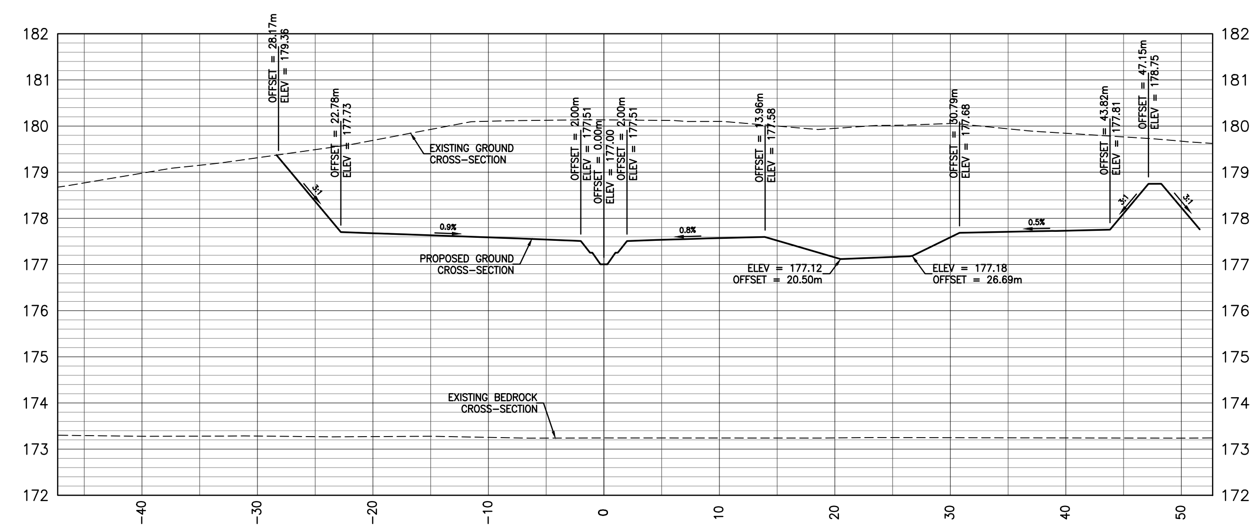
Revision	Sheet	Drawing No.
7	21 of 32	C-700

ORIGINAL SHEET - ARCH D



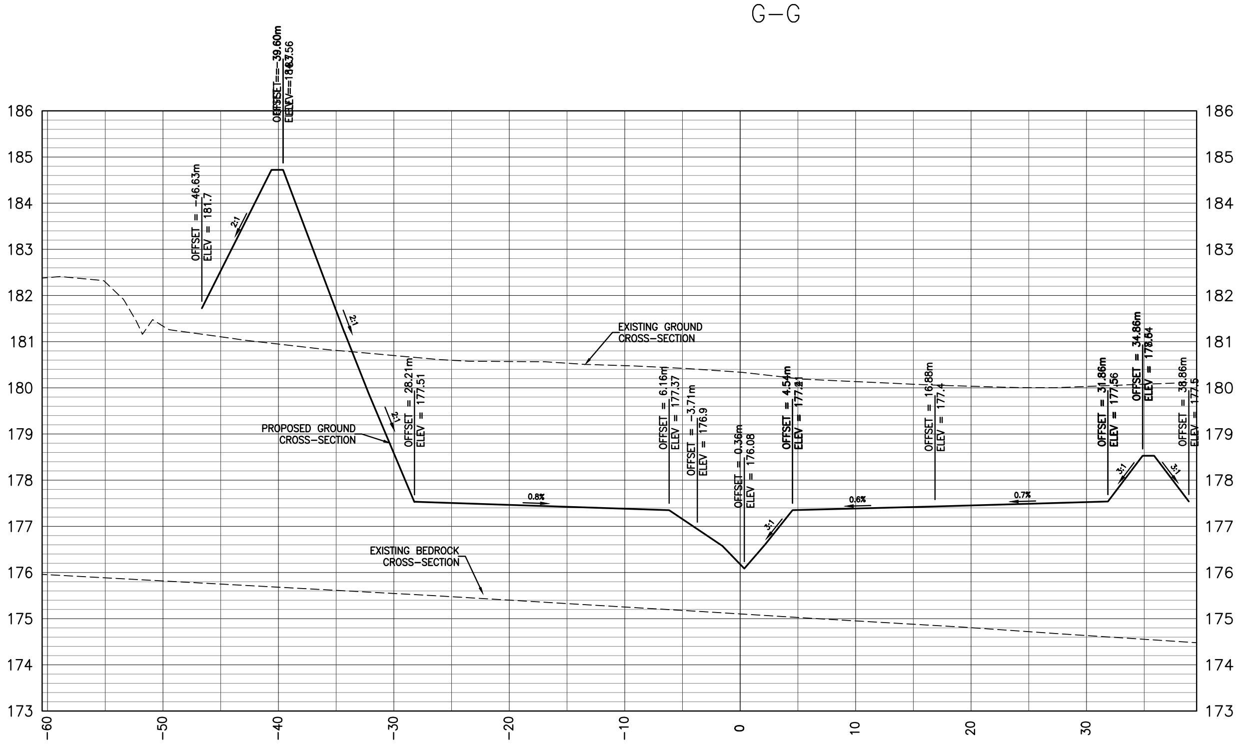


STA 0+099.22
A–A

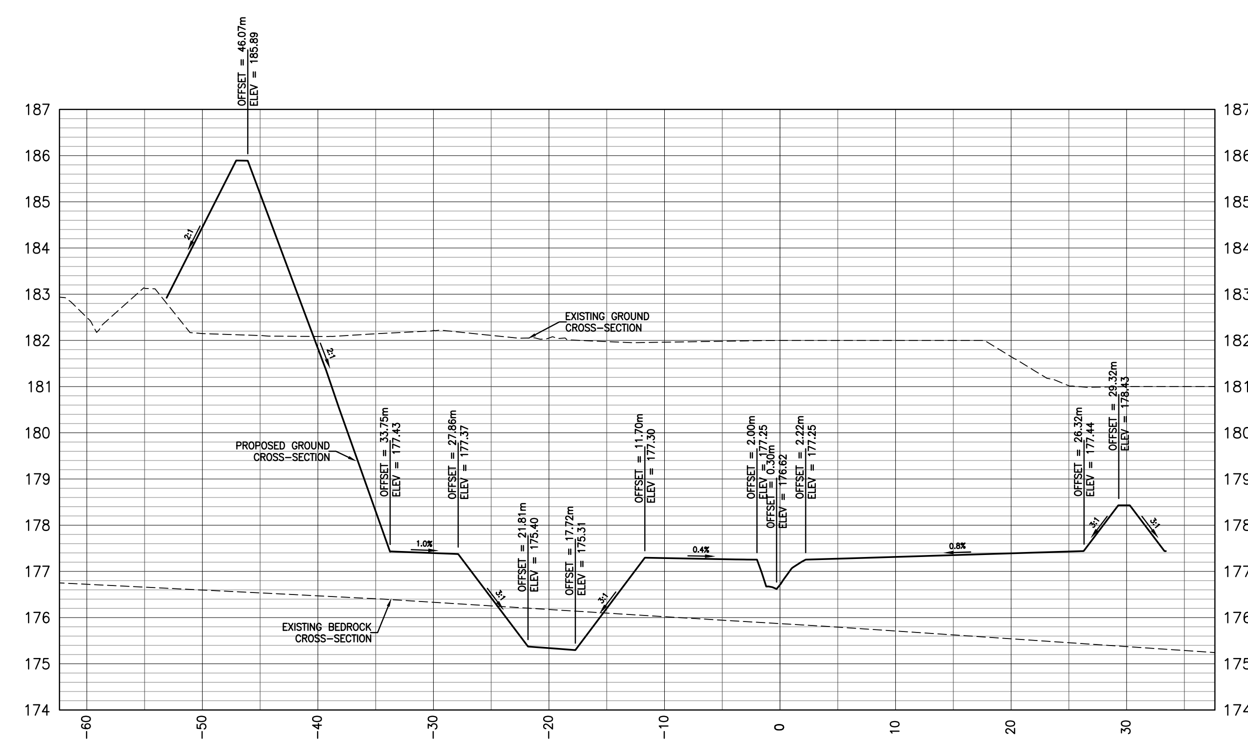


STA 0+205.11
B–B

G–G



STA 0+324.99
C–C



STA 0+385.54
D–D

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

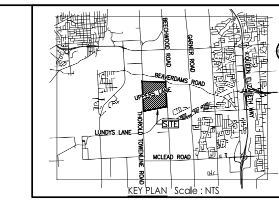
Title

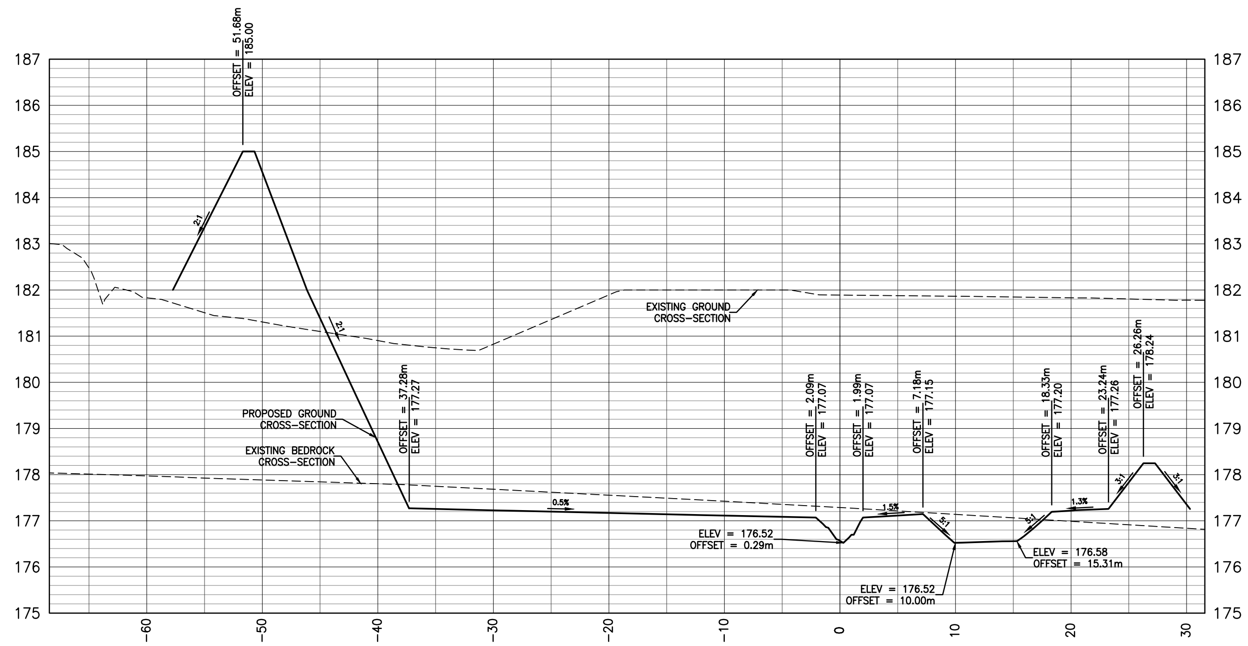
CROSS- SECTIONS
A-A, B-B, C-C, AND D-D

Project No.	Scale
160960948	1:300H 1:75V

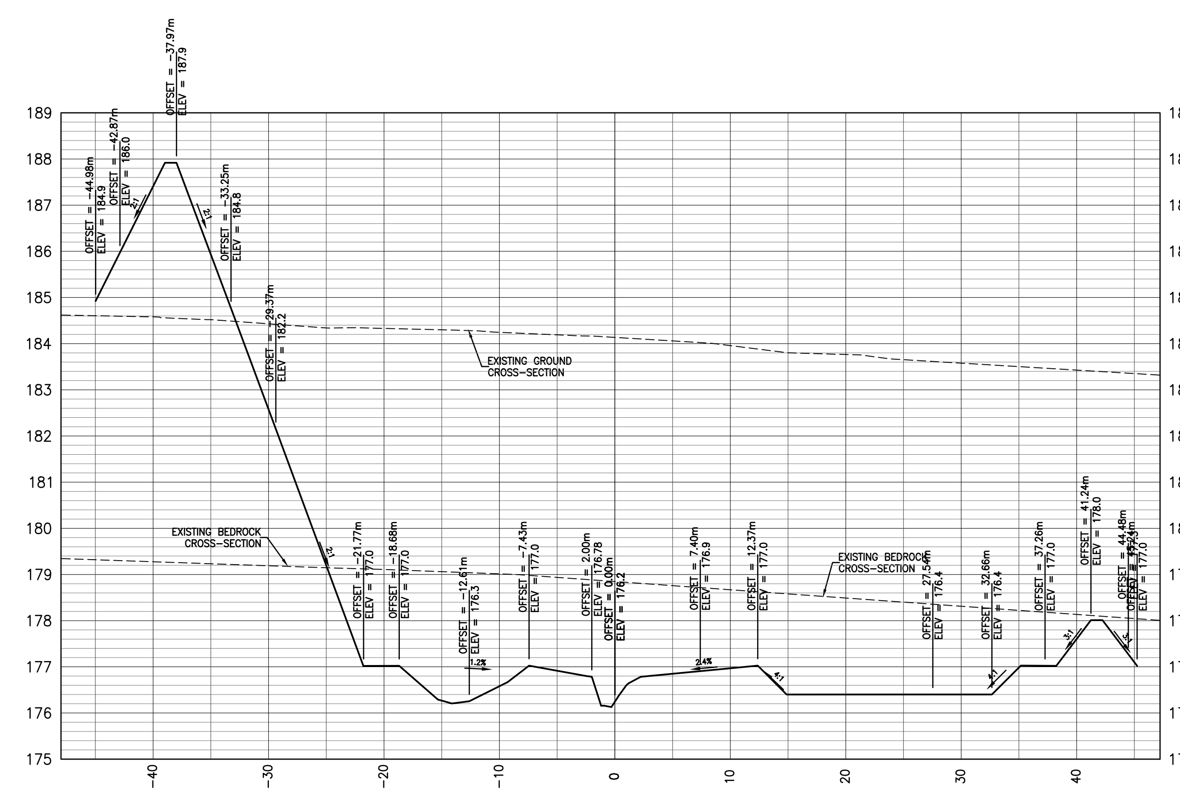
Revision	Sheet	Drawing No.
5	22 of 32	C-701

ORIGINAL SHEET - ARCH D





STA 0+493.37
E–E



STA 0+633.93
F–F

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

	Revision	By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-700CS.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

Title

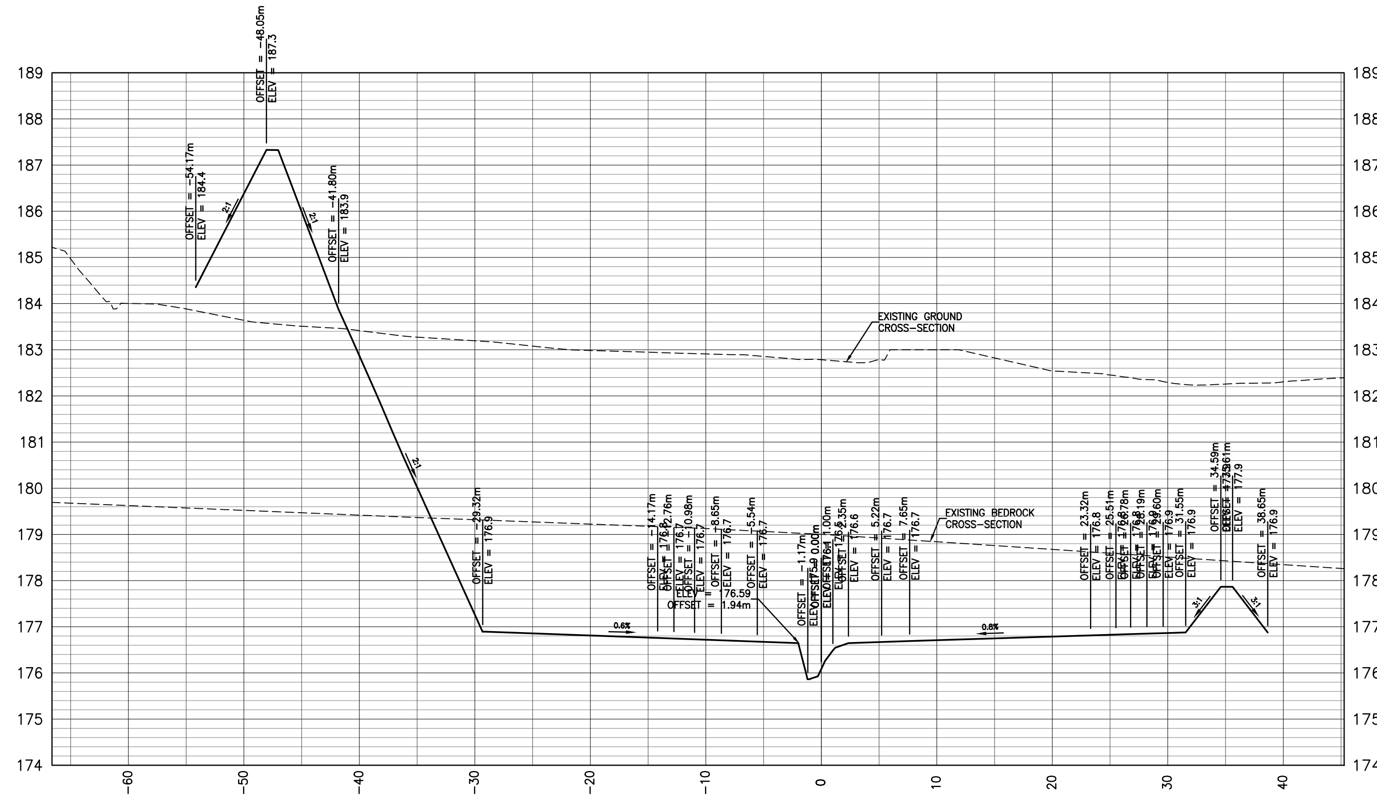
CROSS SECTIONS
E-E AND F-F

Project No.
160960948

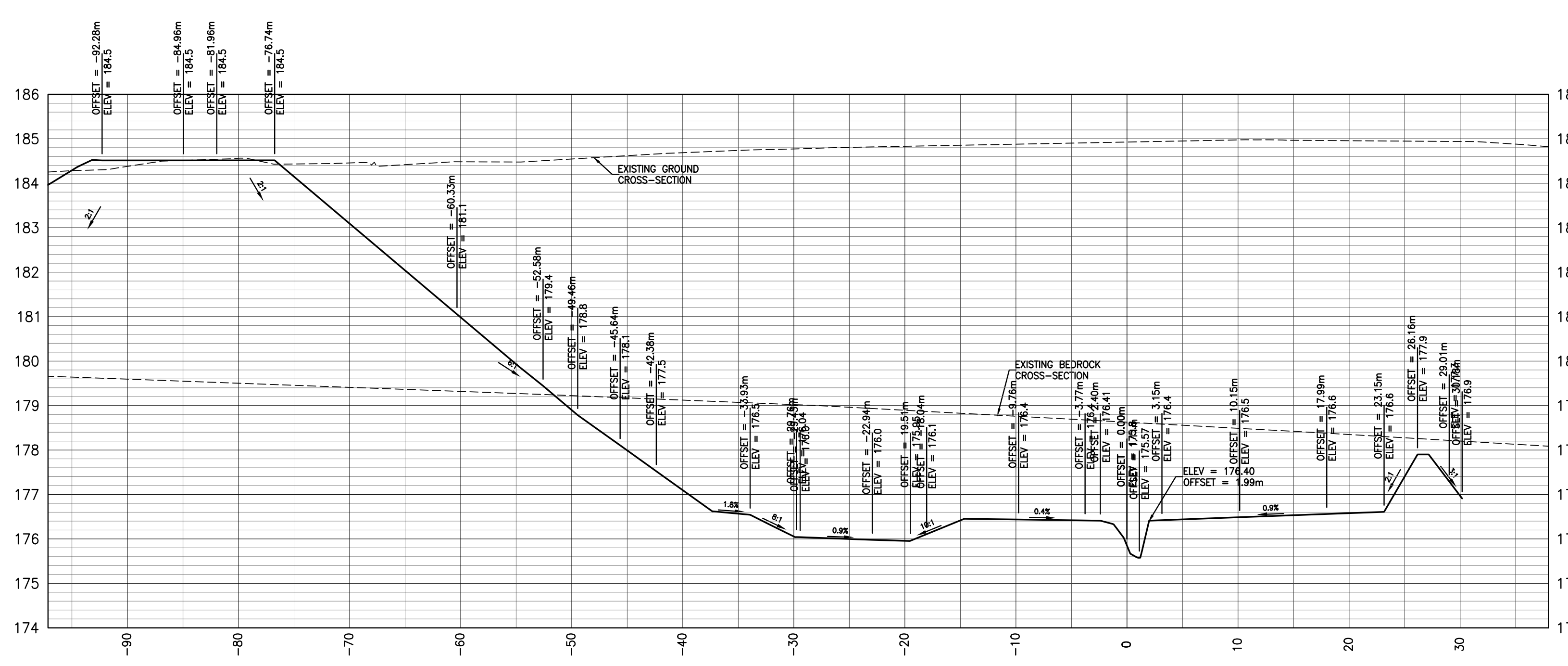
Scale
1:300H 1:75V

Revision 7
Sheet 23 of 32
Drawing No.
C-702

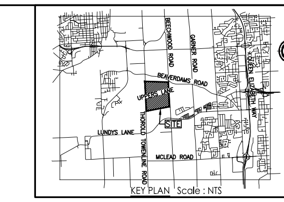
ORIGINAL SHEET - ARCH D



STA 0+716.32
G–G



STA 0+886.30
H–H



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

CROSS SECTION
G-G AND H-H

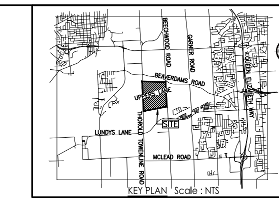
Project No. 160960948

Scale 1:300H 1:75V

Revision 7

Sheet 24 of 32

Drawing No. C-703

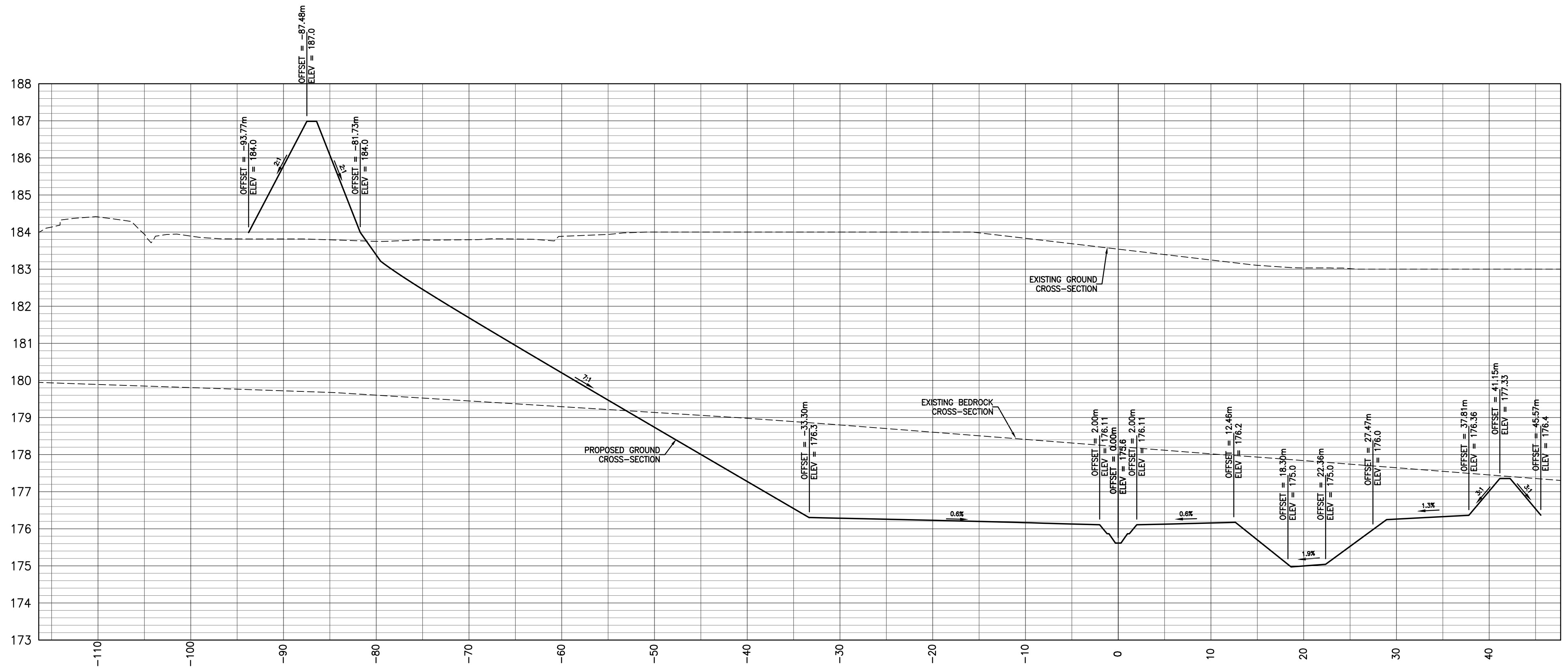


Stantec

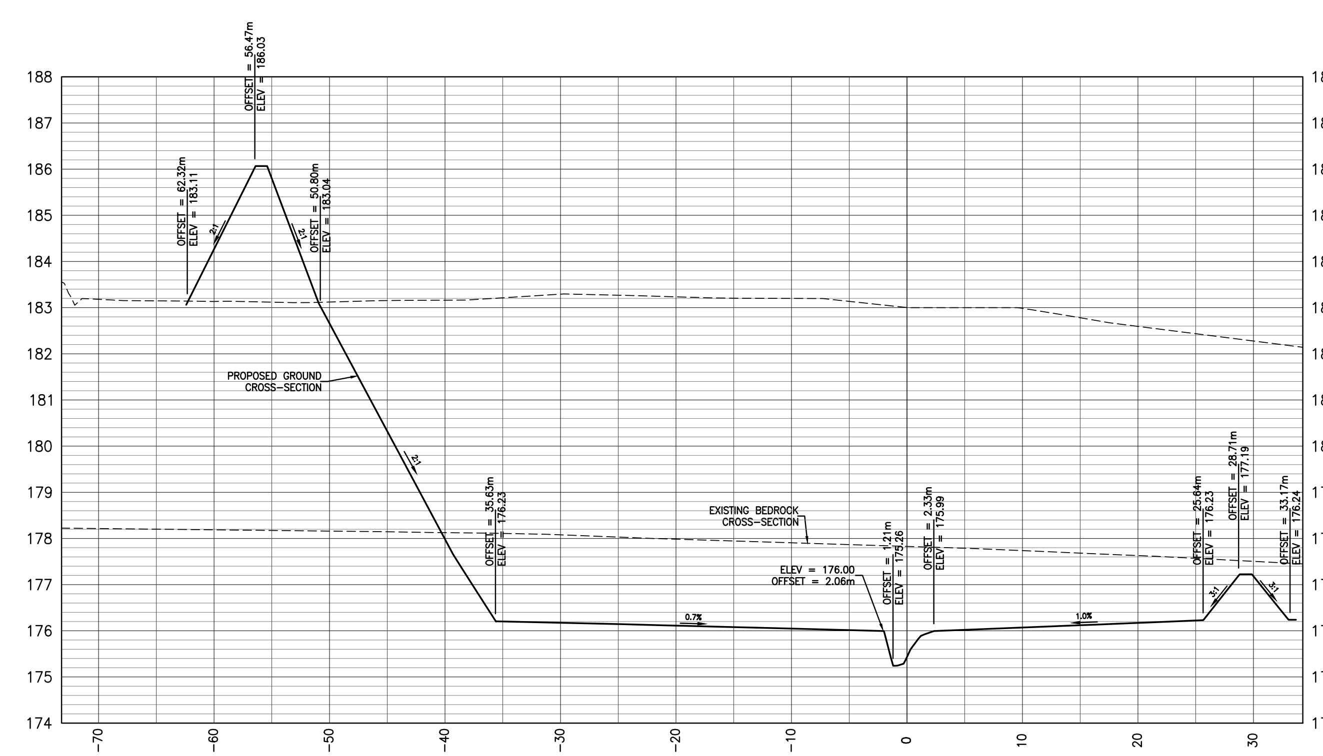
Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.



STA 1+056.99
I–I



STA 1+122.65
J–J

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

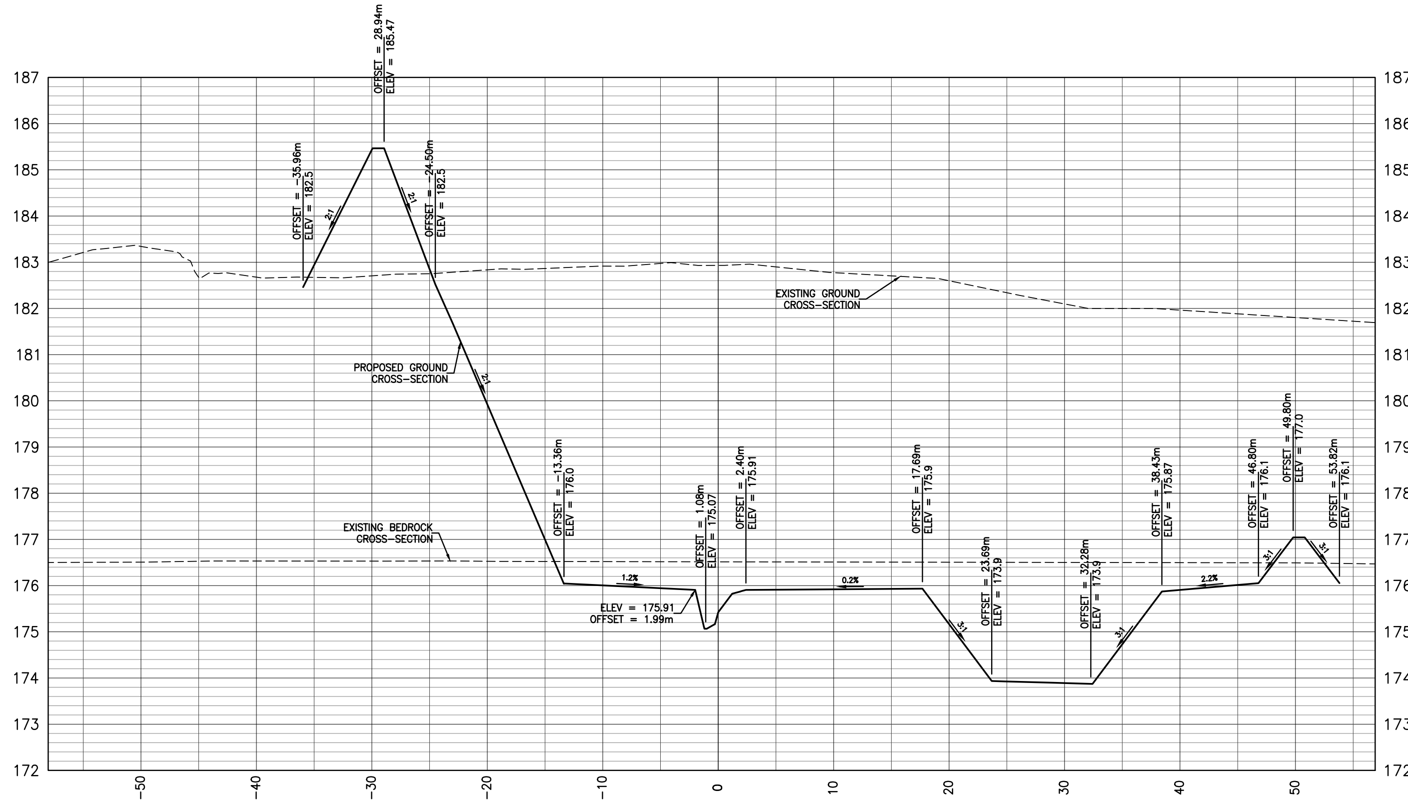
CROSS-SECTIONS
I-I AND J-J

Project No. 160960948

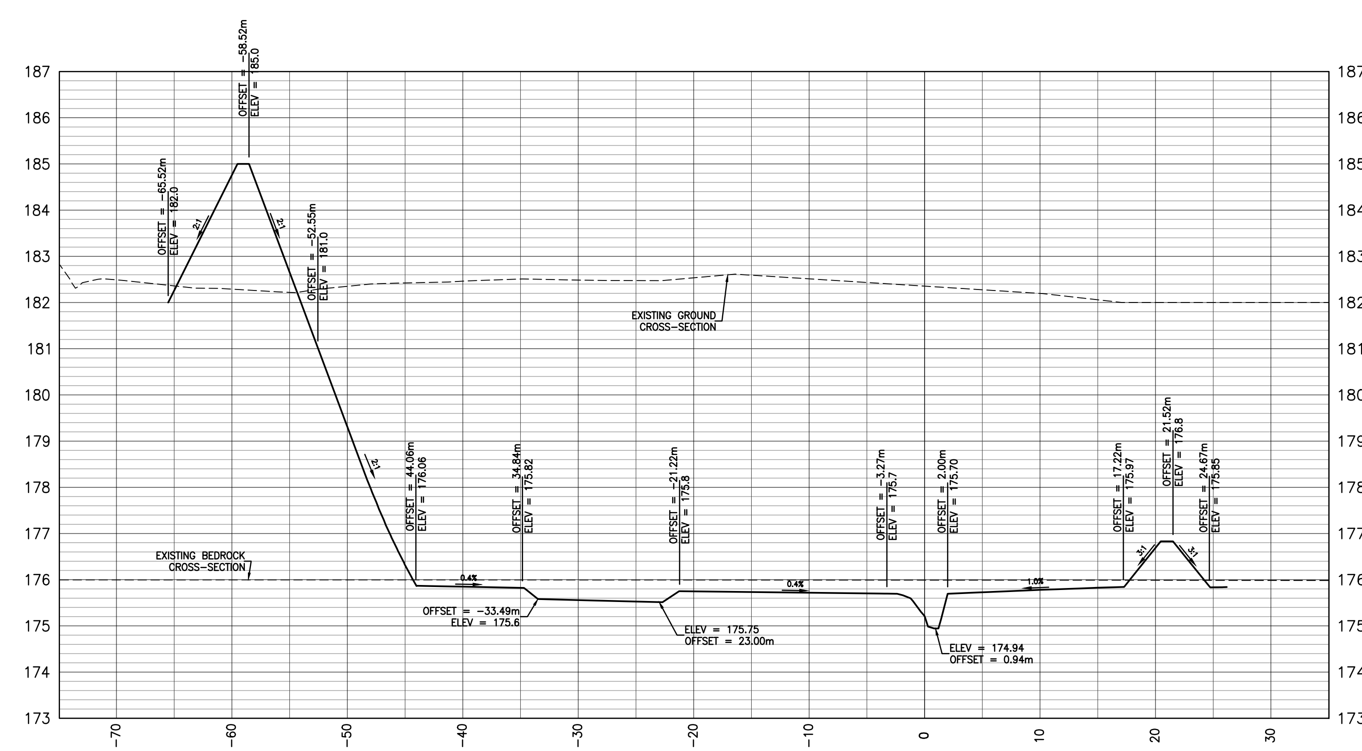
Scale 1:300H 1:75V

Revision 7 | Sheet 25 of 32 | Drawing No. **C-704**

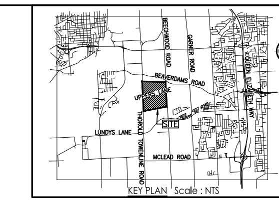
ORIGINAL SHEET - ARCH D



STA 1+225.21
K-K



STA 1+347.28
L-L



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

CROSS-SECTION
K-K AND L-L

Project No. 160960948

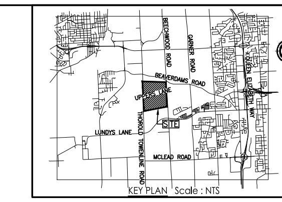
Scale 1:300H 0 3 9 15m
1:75V 0 0.75 2.25 3.75m

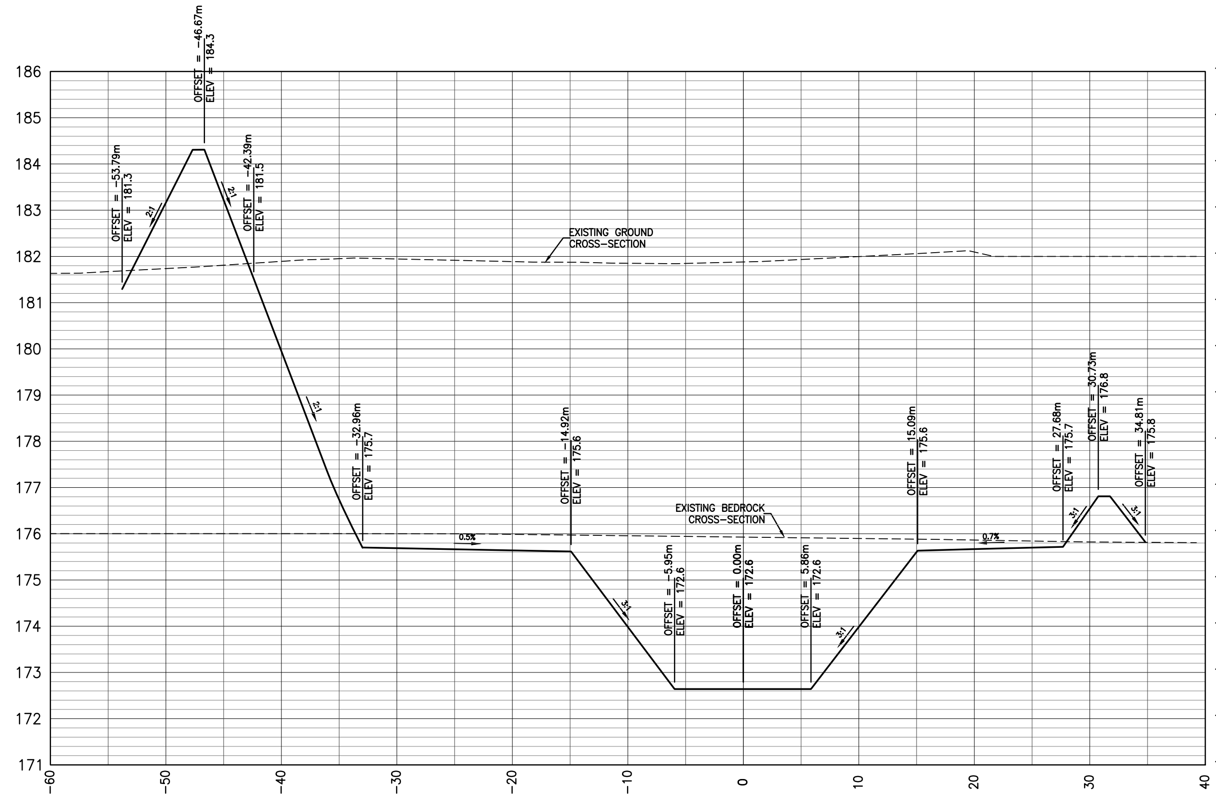
Revision 7

Sheet 26 of 32

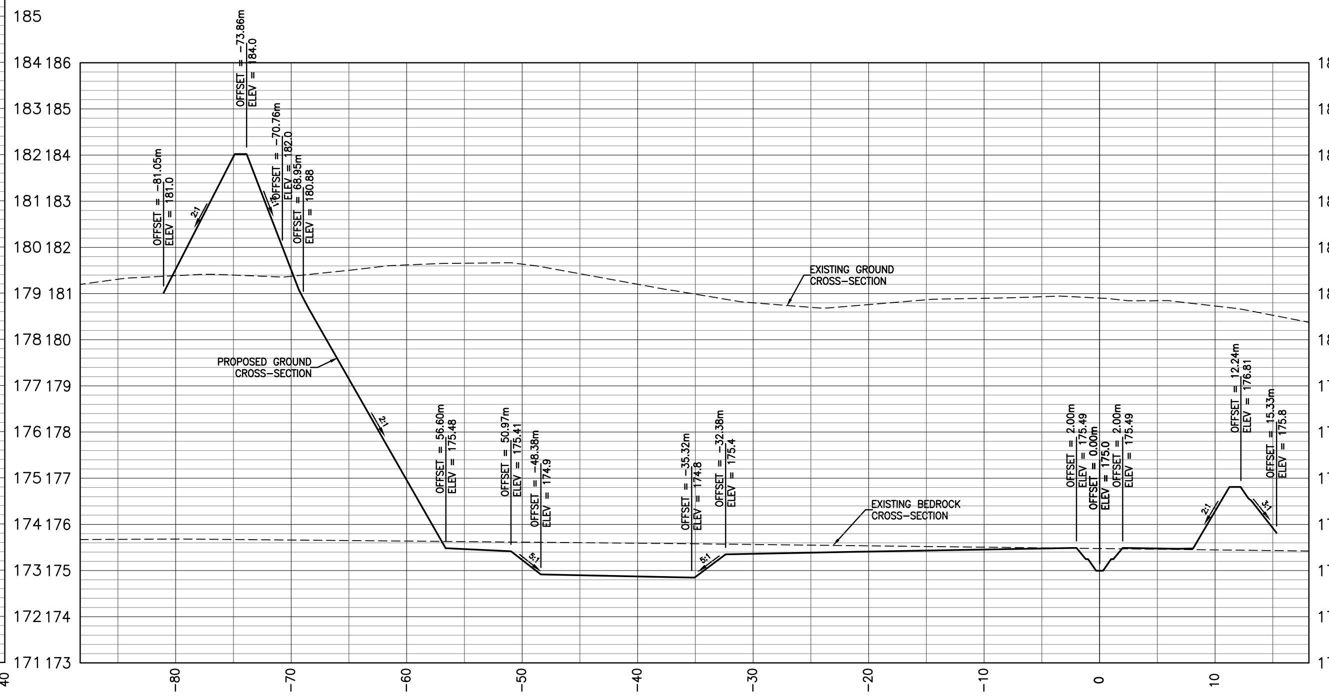
Drawing No. C-705

ORIGINAL SHEET - ARCH D

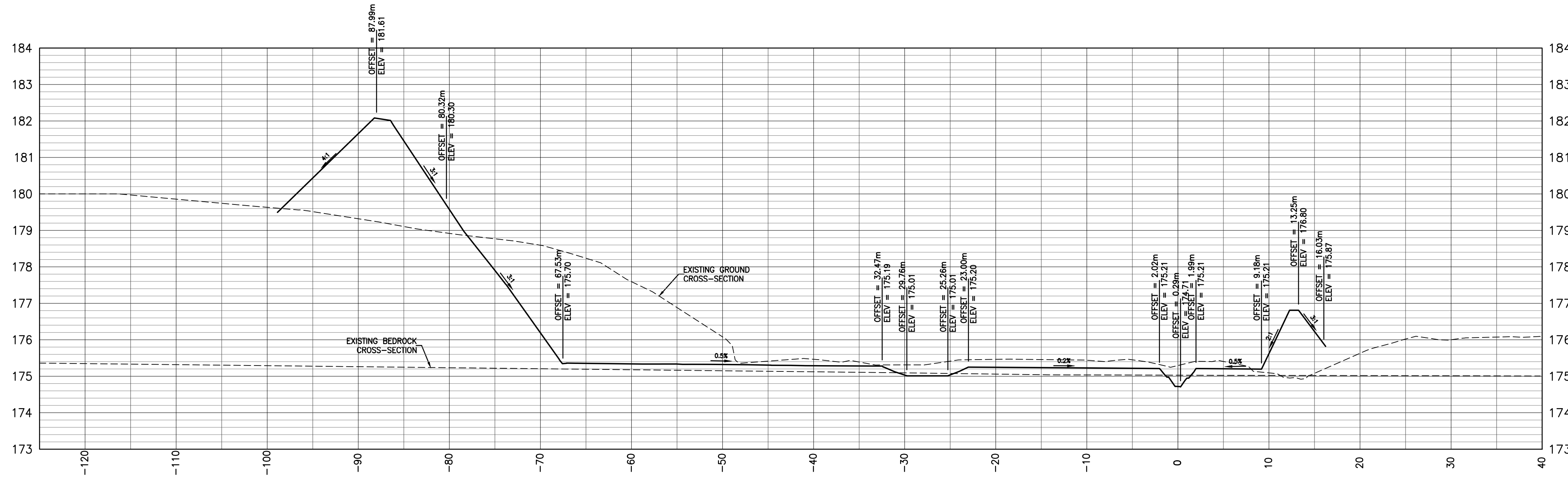




STA 1+429.62
M–M



STA 1+556.21
N–N



STA 1+717.29
O–O

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

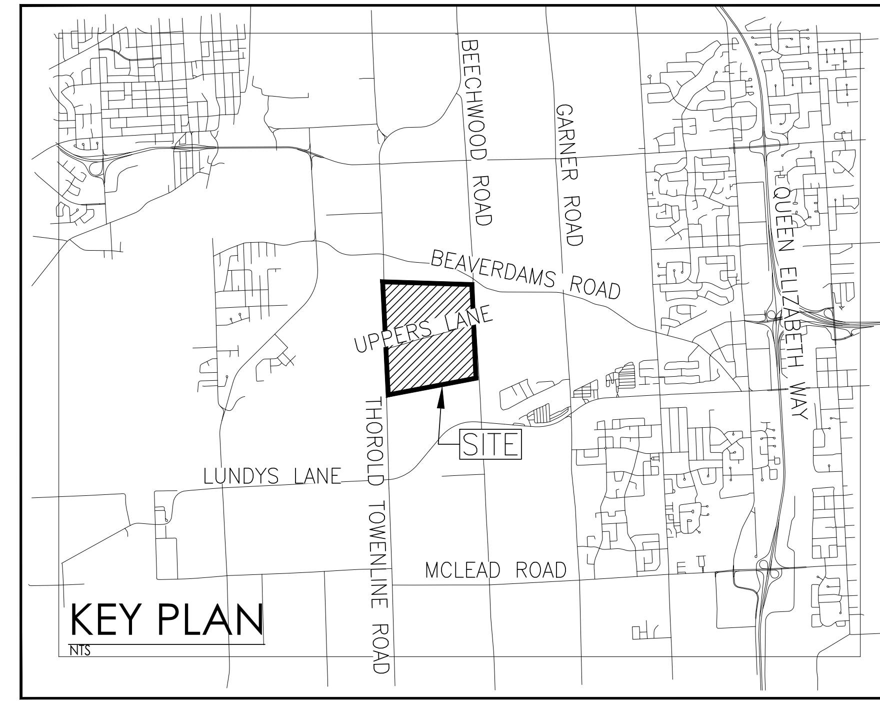
Title

CROSS-SECTIONS
M-M, N-N AND O-O

Project No. 160960948
Scale 1:300H 1:75V
Revision 7
Sheet 27 of 32
Drawing No. **C-706**

ORIGINAL SHEET - ARCH D

Stantec



WALKER AGGREGATES

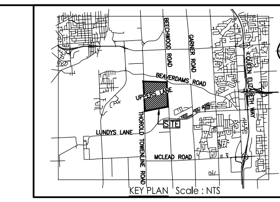
NIAGARA FALLS, ON

UPPERS QUARRY WATERCOURSE REALIGNMENT

NOT FOR CONSTRUCTION

ISSUED FOR: PERMITTING
2021.11.18
PROJECT NUMBER: 160960948

INDEX



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Revision		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-010SP.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.09.01

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

SITE PLAN

Project No. 160960948

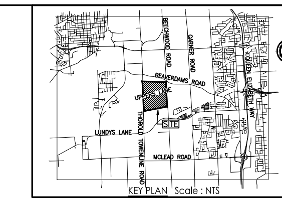
Scale 1:2500

Revision 7

Sheet 1 of 32

Drawing No. **C-010**

ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

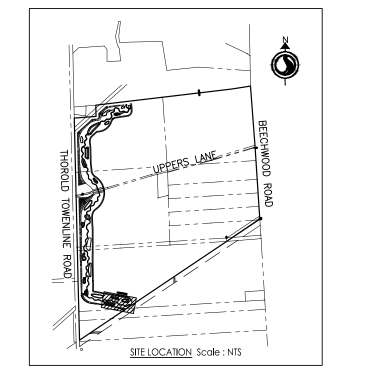
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-200ST.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

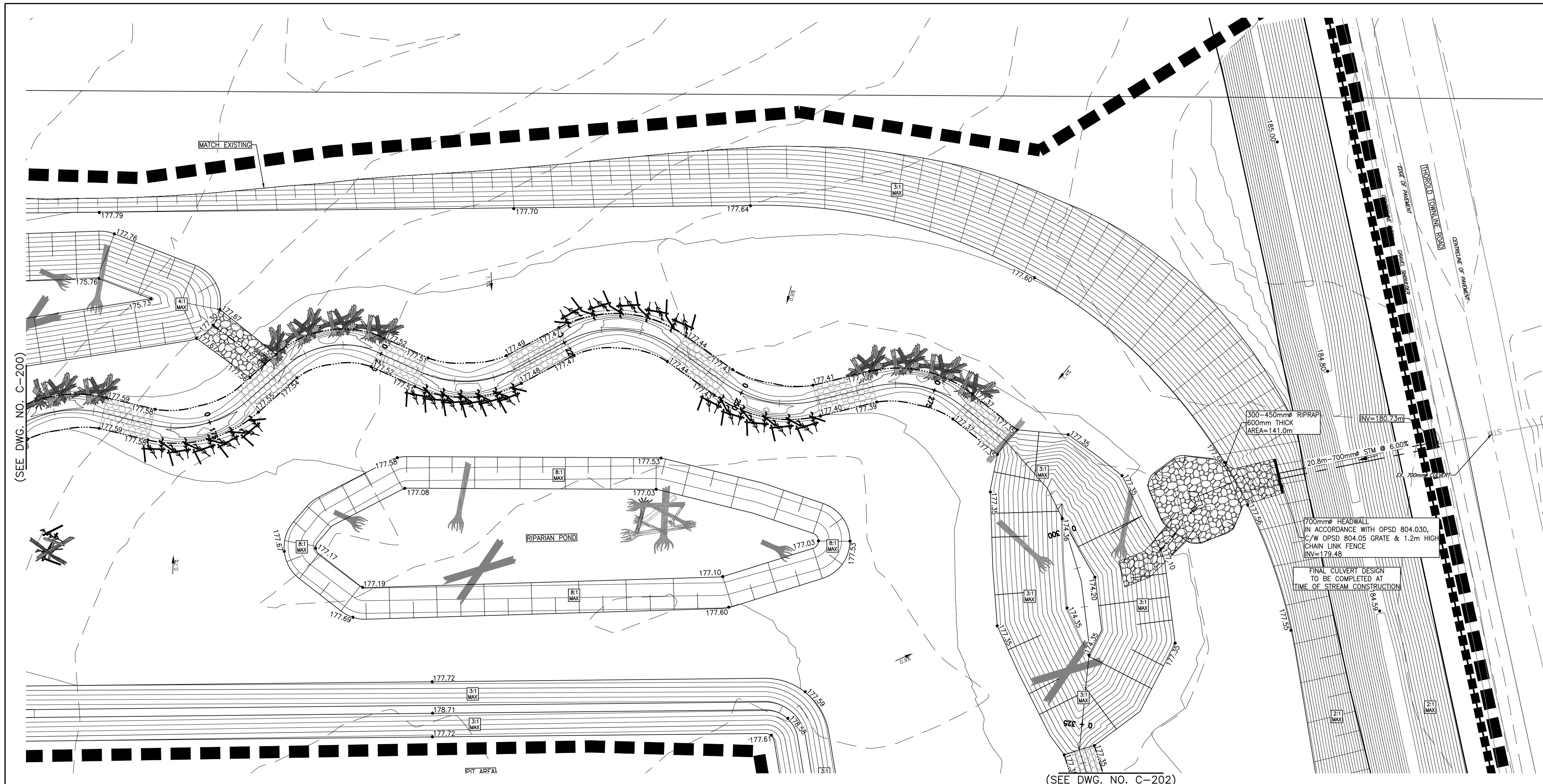
Niagara Falls, ON

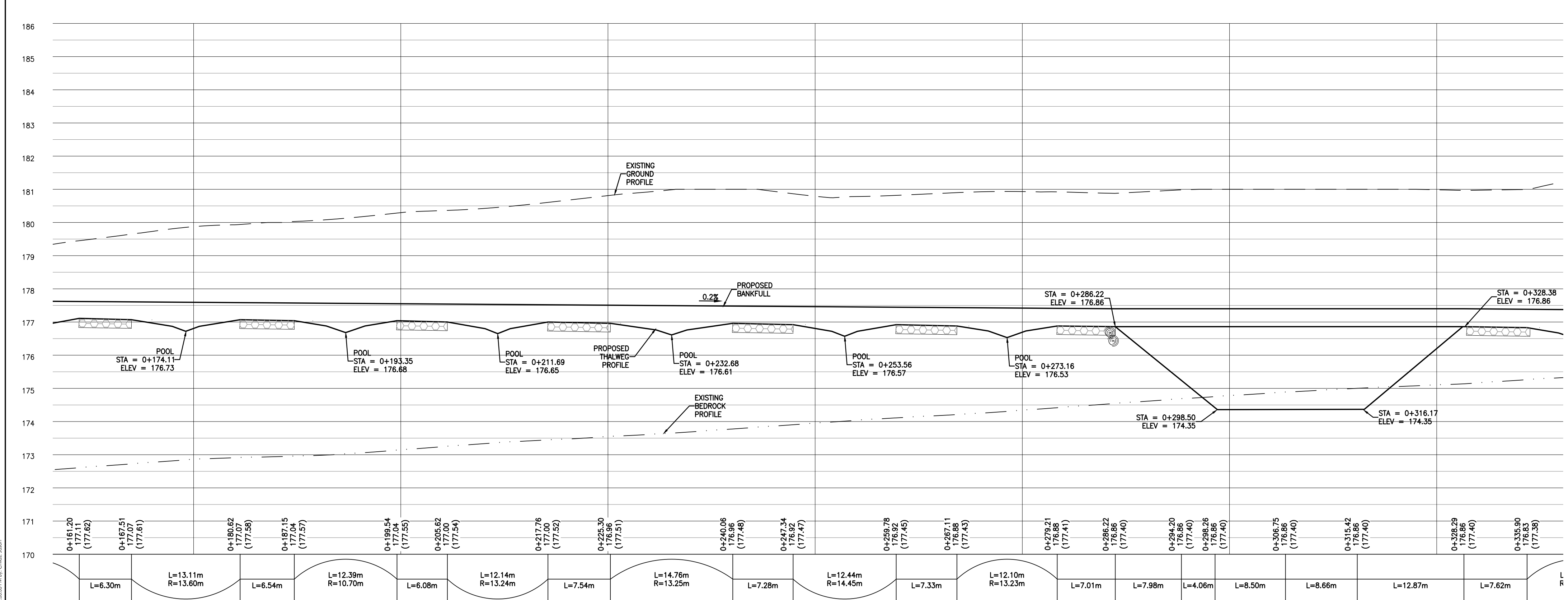
Title

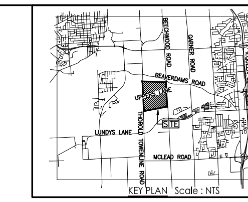
PLAN AND PROFILE
0+000 TO 0+175

Project No. 160960948
Scale 1:300H 1:75V
Revision 7
Sheet 2 of 32
Drawing No. **C-200**

ORIGINAL SHEET - ARCH D







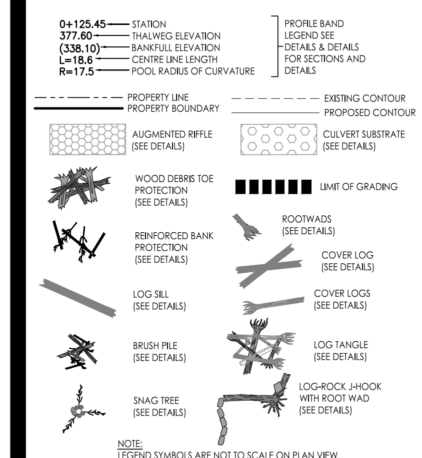
Stantec

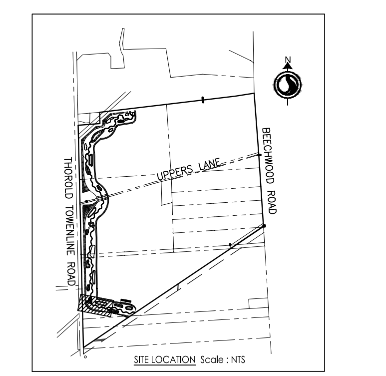
Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend





7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-200ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
0+175 TO 0+330

Project No. 160960948

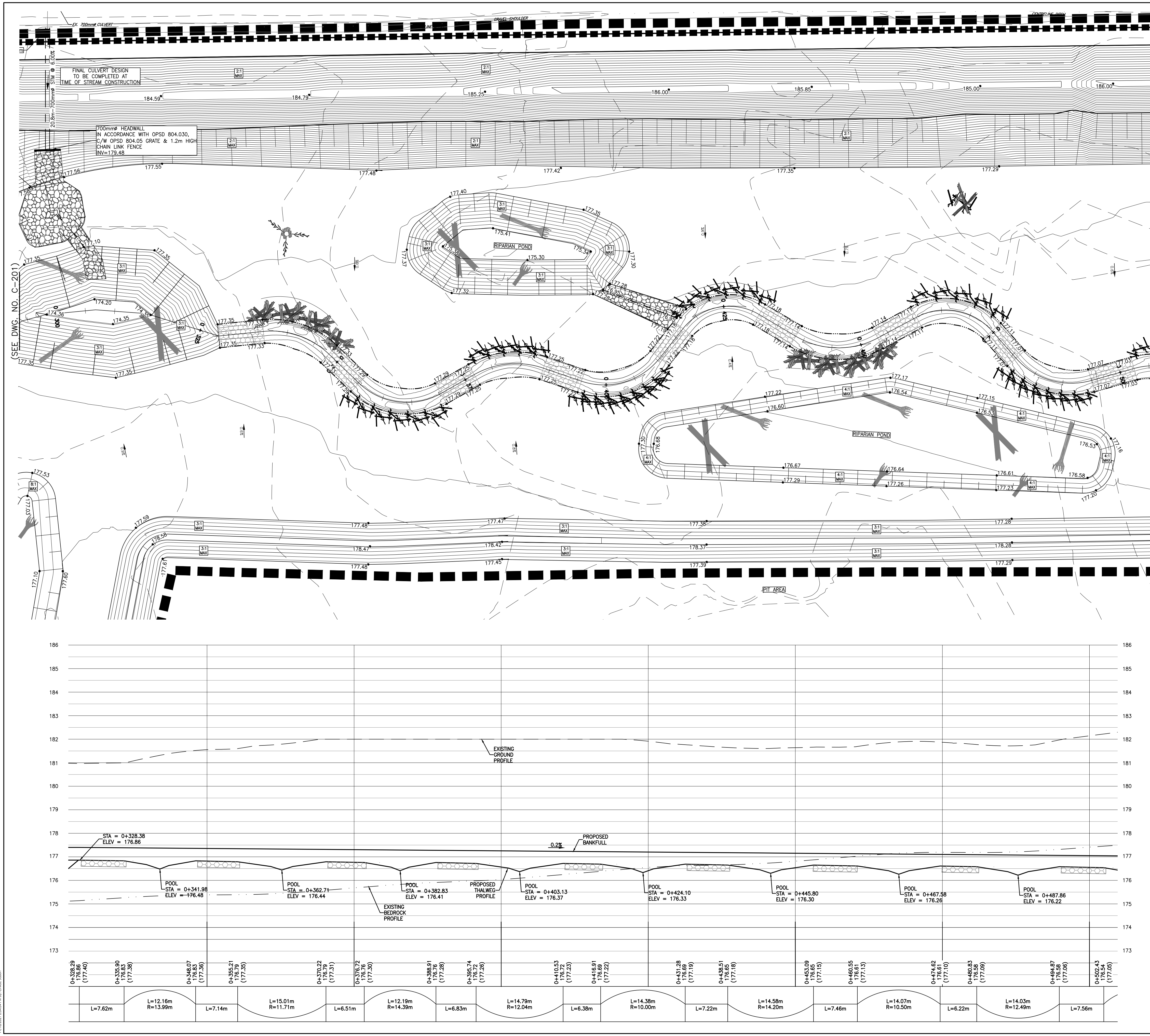
Scale 1:300H 1:75V

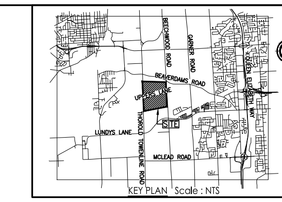
Revision 7

Sheet 3 of 32

Drawing No. **C-201**

ORIGINAL SHEET - ARCH D





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

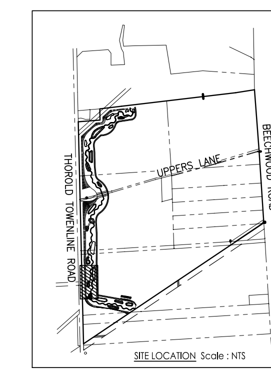
1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE
PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-200ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
0+330 TO 0+500

Project No. 160960948

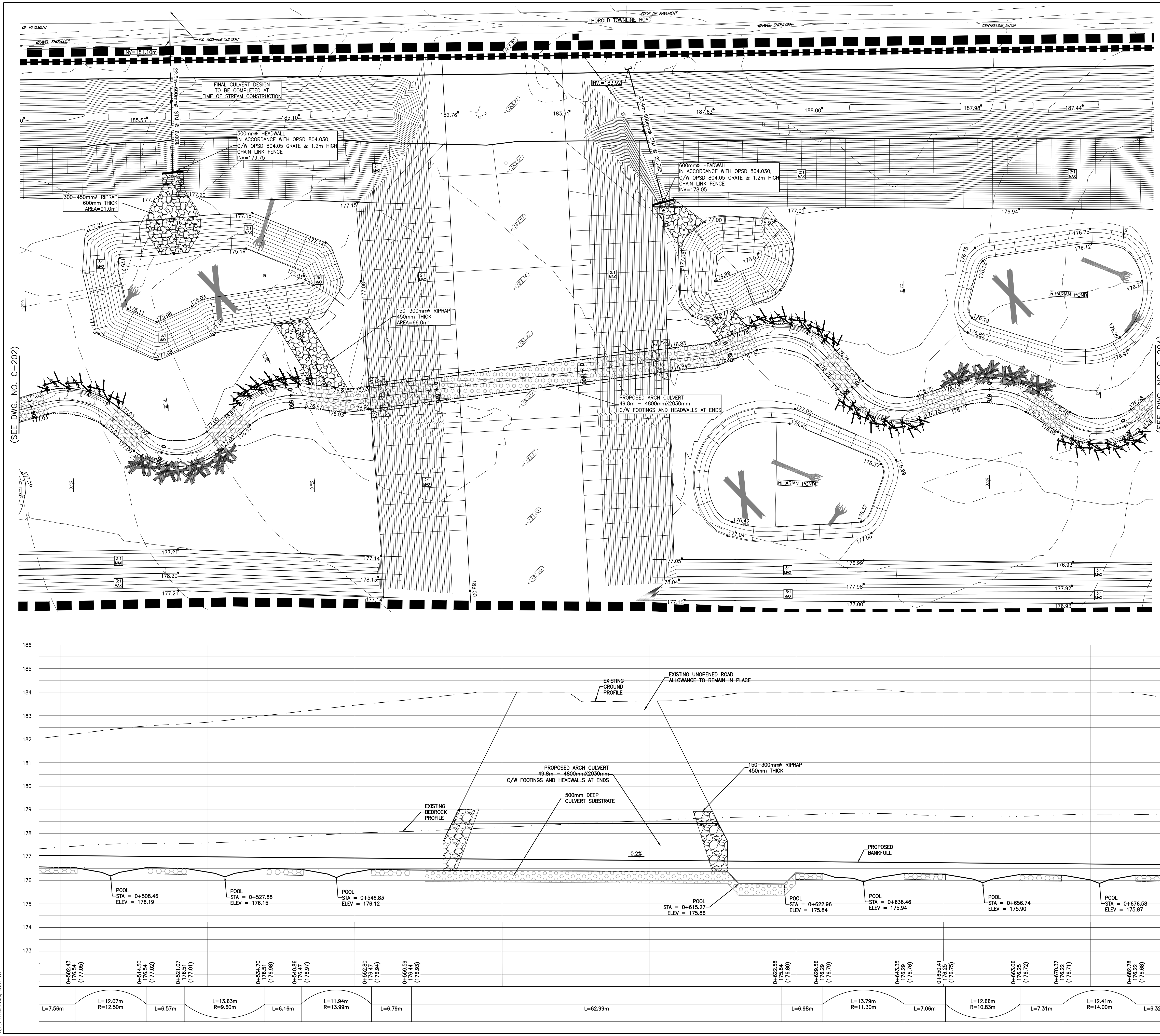
Scale 1:300H 1:75V

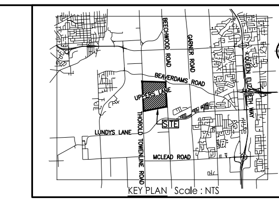
Revision 7

Sheet 4 of 32

Drawing No. **C-202**

ORIGINAL SHEET - ARCH D





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING G-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend

0+125.45 — STATION; 377.60 — THALWEG ELEVATION; (338.10) — BANKFULL ELEVATION; L=18.6 — CENTRE LINE LENGTH; R=17.5 — POOL RADIUS OF CURVATURE — PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE / PROPERTY BOUNDARY — EXISTING CONTOUR / PROPOSED CONTOUR

AUGMENTED RIFFLE (SEE DETAILS) — CULVERT SUBSTRATE (SEE DETAILS)

WOOD DEBRIS TOE PROTECTION (SEE DETAILS) — LIMIT OF GRADING

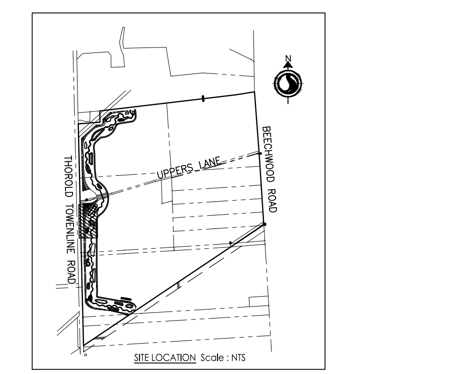
REINFORCED BANK PROTECTION (SEE DETAILS) — ROOTWADS (SEE DETAILS) — COVER LOG (SEE DETAILS)

LOG SILL (SEE DETAILS) — COVER LOGS (SEE DETAILS)

BRUSH PILE (SEE DETAILS) — LOG TANGLE (SEE DETAILS)

SNAG TREE (SEE DETAILS) — LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE: LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
	Revision	By	Appd	YYYY.MM.DD

File Name: 160960948_C-200ST.dwg — RJB (Dwn.) — HA (Chkd.) — HA (Dsgn.) — 21.11.18 (YYYY.MM.DD)

Permit-Seal

LICENSED PROFESSIONAL ENGINEER — NOVEMBER 18, 2021 — H.E. AMRAULT — 100116290 — PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

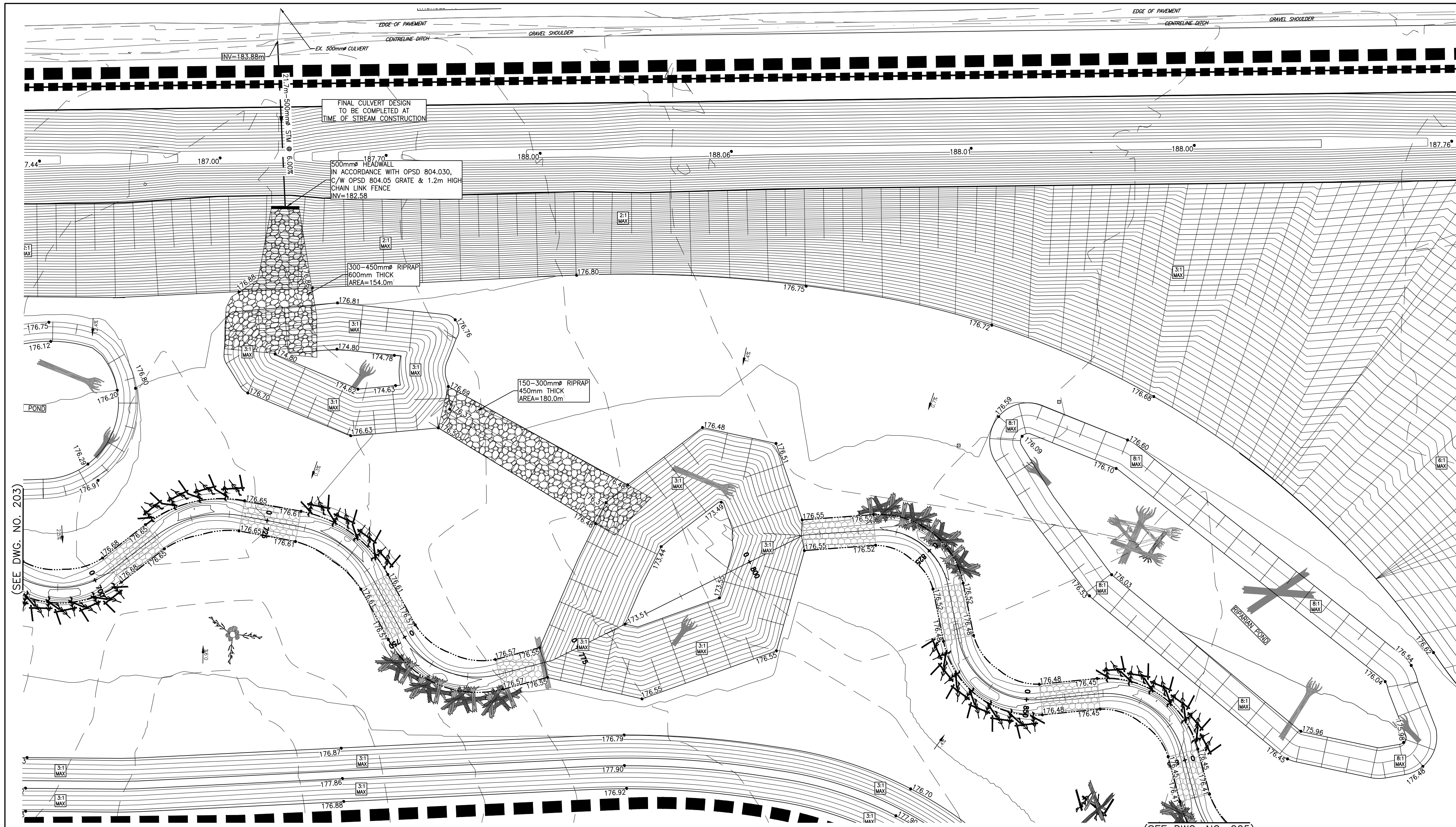
Title

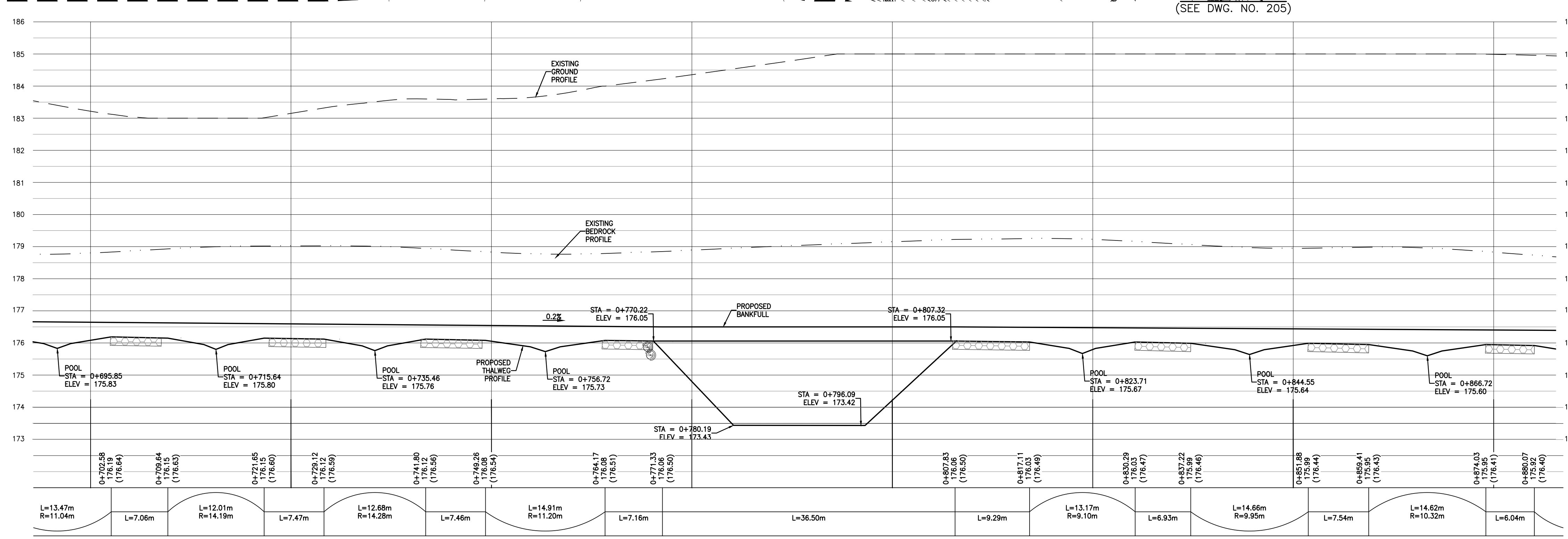
PLAN AND PROFILE
0+500 TO 0+700

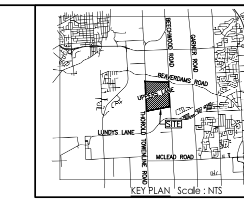
Project No. 160960948 — Scale 1:300H 1:75V

Revision 7 — Sheet 5 of 32 — Drawing No. **C-203**

ORIGINAL SHEET - ARCH D







Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

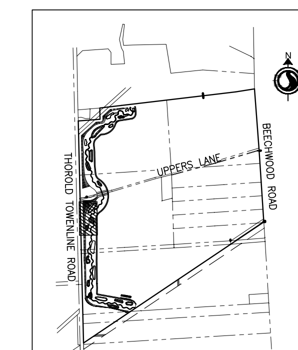
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-200ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
0+700 TO 0+875

Project No. 160960948

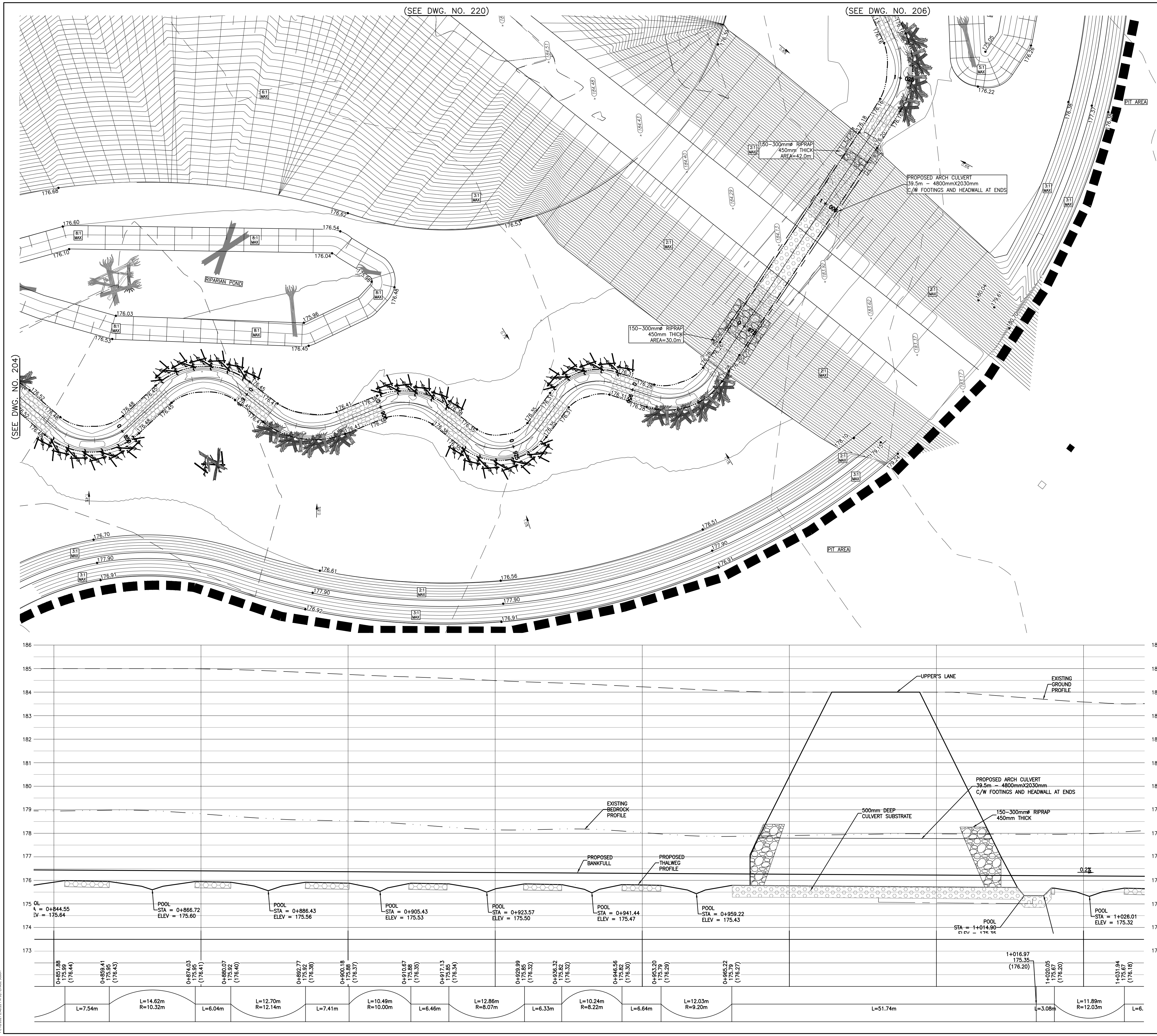
Scale 1:300H 1:75V

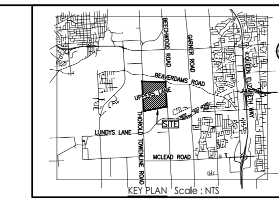
Revision 7

Sheet 6 of 32

Drawing No. **C-204**

ORIGINAL SHEET - ARCH D





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

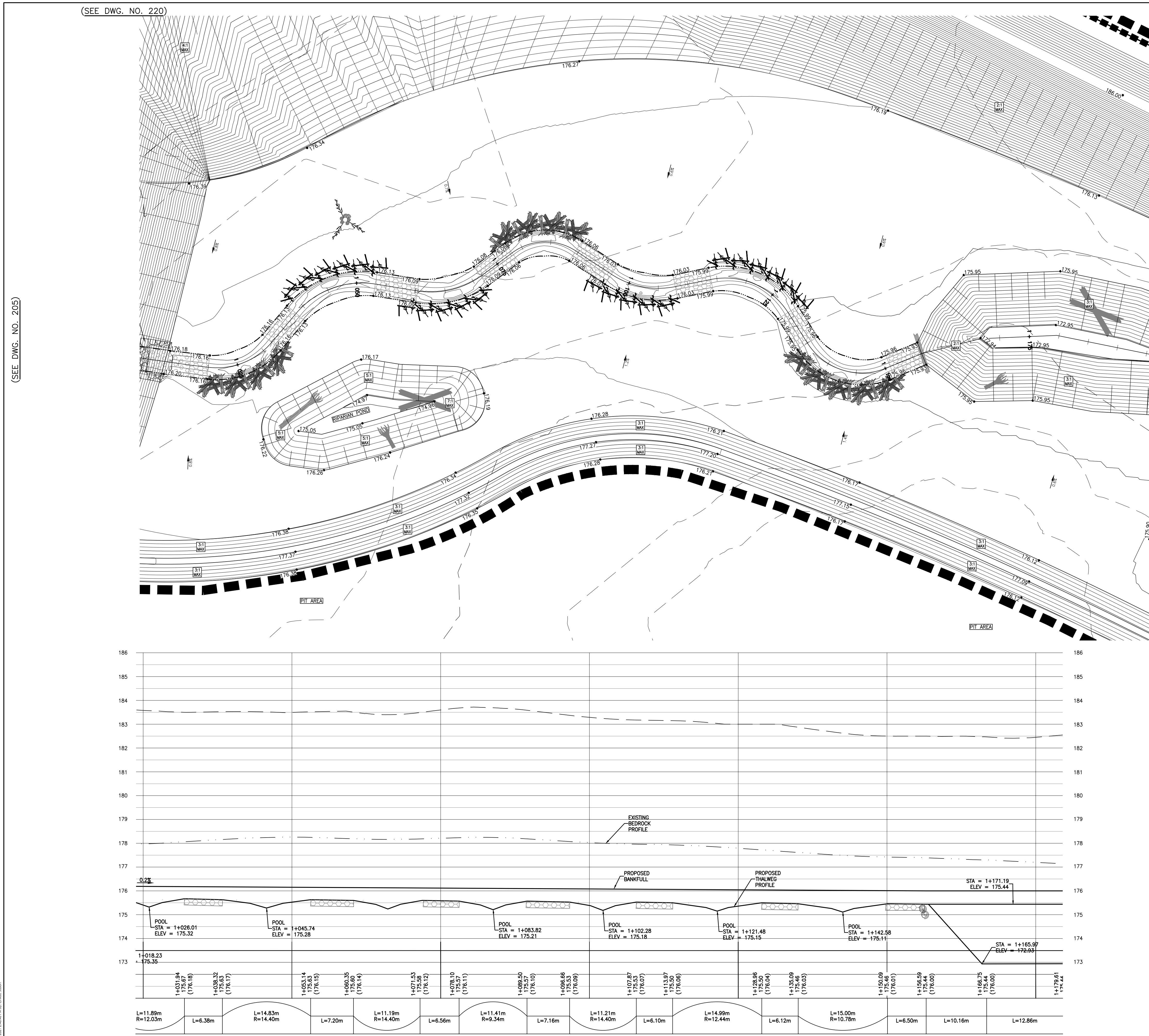
PLAN AND PROFILE
0+875 TO 1+025

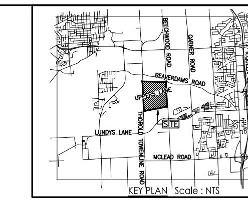
Project No. 160960948

Scale 1:300H 1:75V

Revision 7 | Sheet 7 of 32 | Drawing No. **C-205**

ORIGINAL SHEET - ARCH D





Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

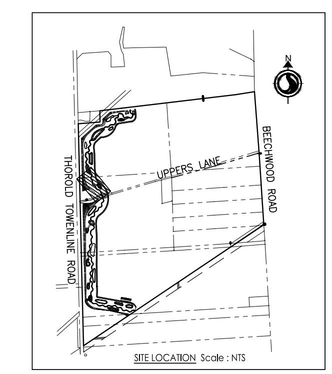
1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE
PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



Revision		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-205ST.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

Title

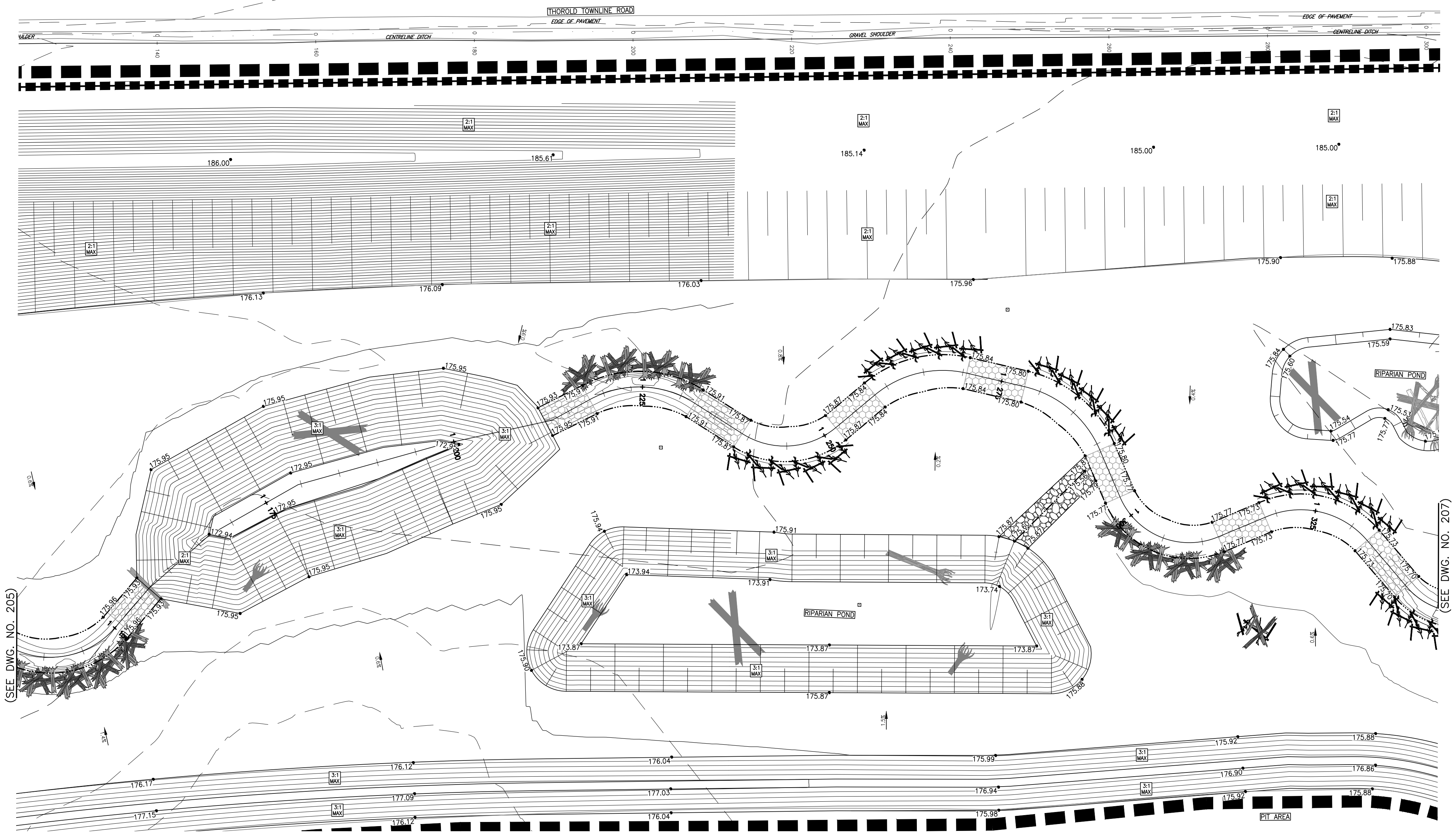
PLAN AND PROFILE
1+025 TO 1+175

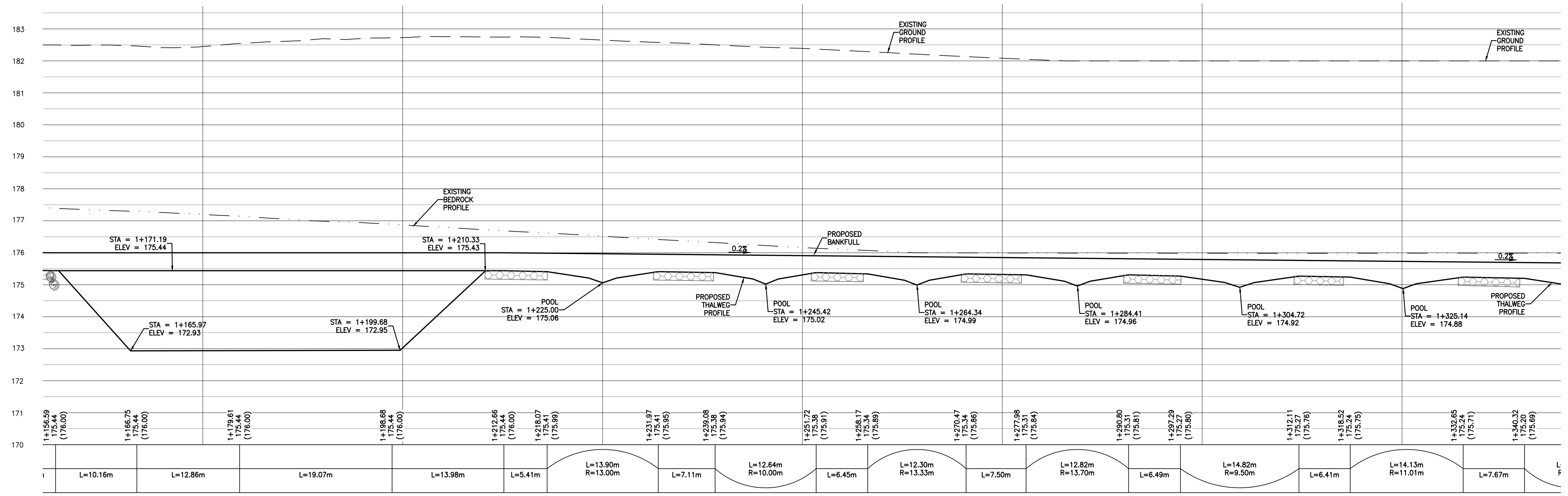
Project No. 160960948

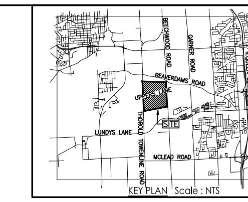
Scale 1:300H 1:75V

Revision 7 Sheet 8 of 32 Drawing No. **C-206**

ORIGINAL SHEET - ARCH D







Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Copyright Reserved

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

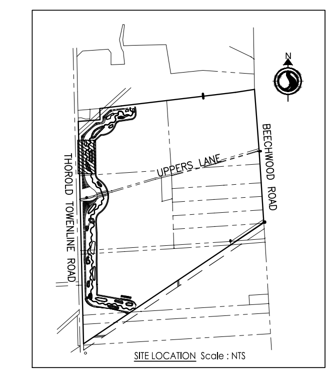
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
1+160 TO 1+325

Project No. 160960948

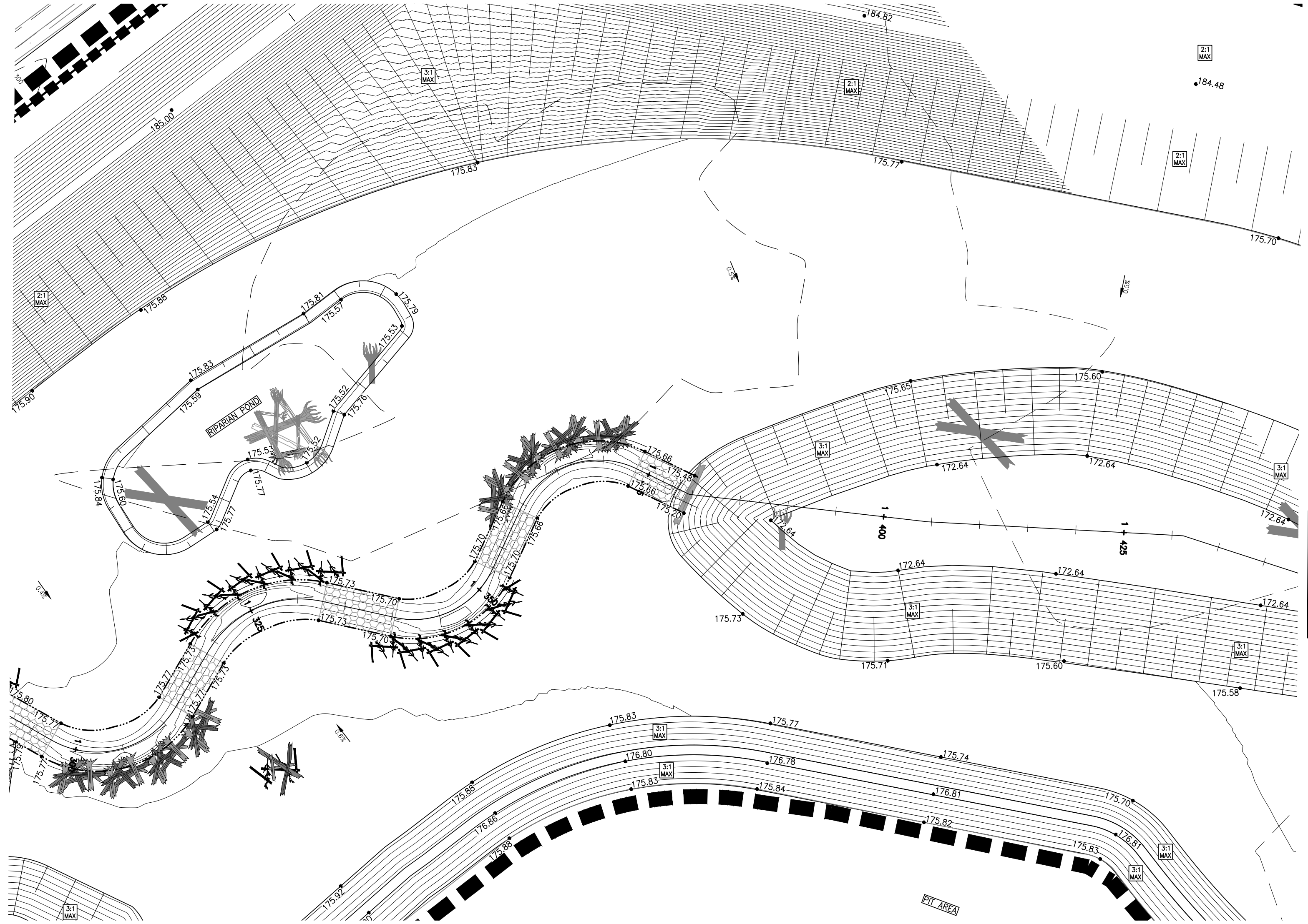
Scale 1:300H 1:75V

Revision 7

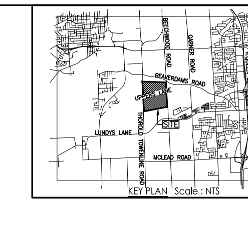
Sheet 9 of 32

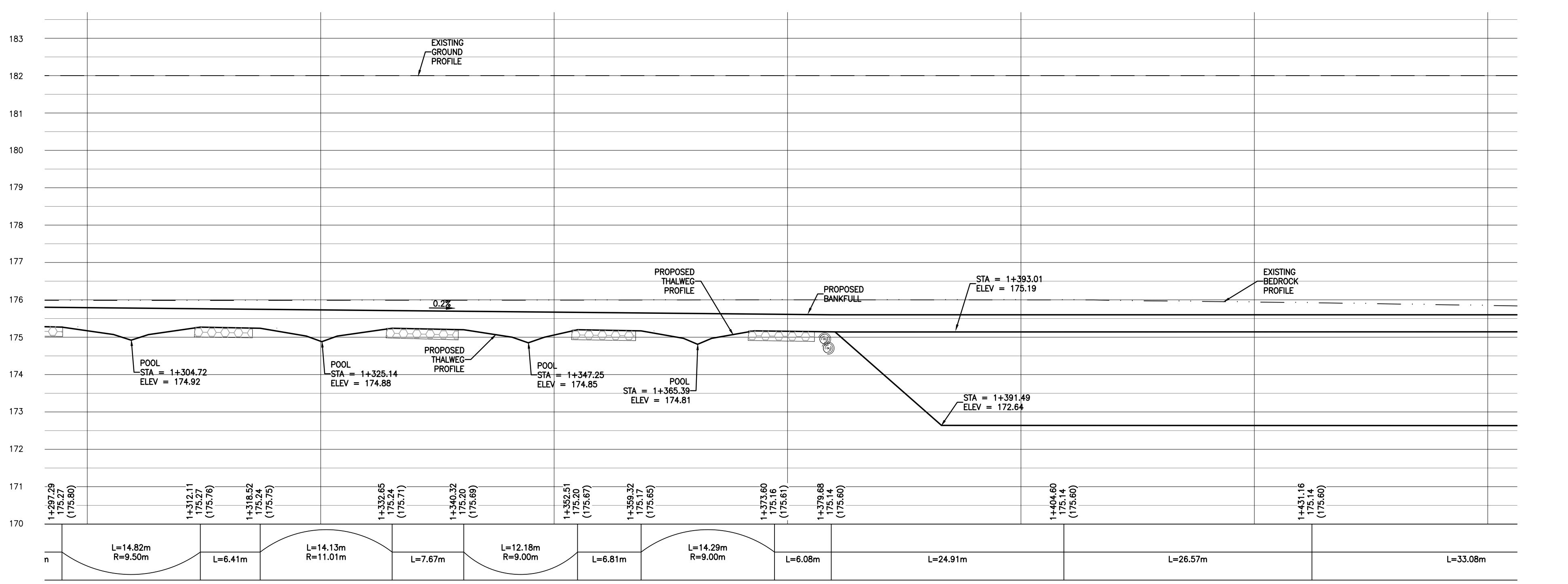
Drawing No. C-207

(SEE DWG. NO. 206)



(SEE DWG. NO. 208)





ORIGINAL SHEET - ARCH D

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

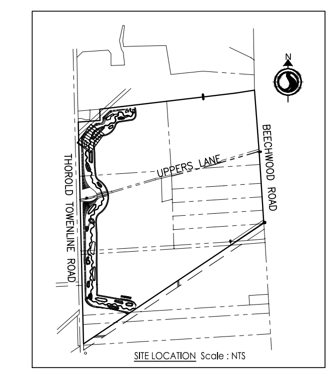
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
ROOTWADS (SEE DETAILS)
REINFORCED BANK PROTECTION (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-205ST.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
1+300 TO 1+425

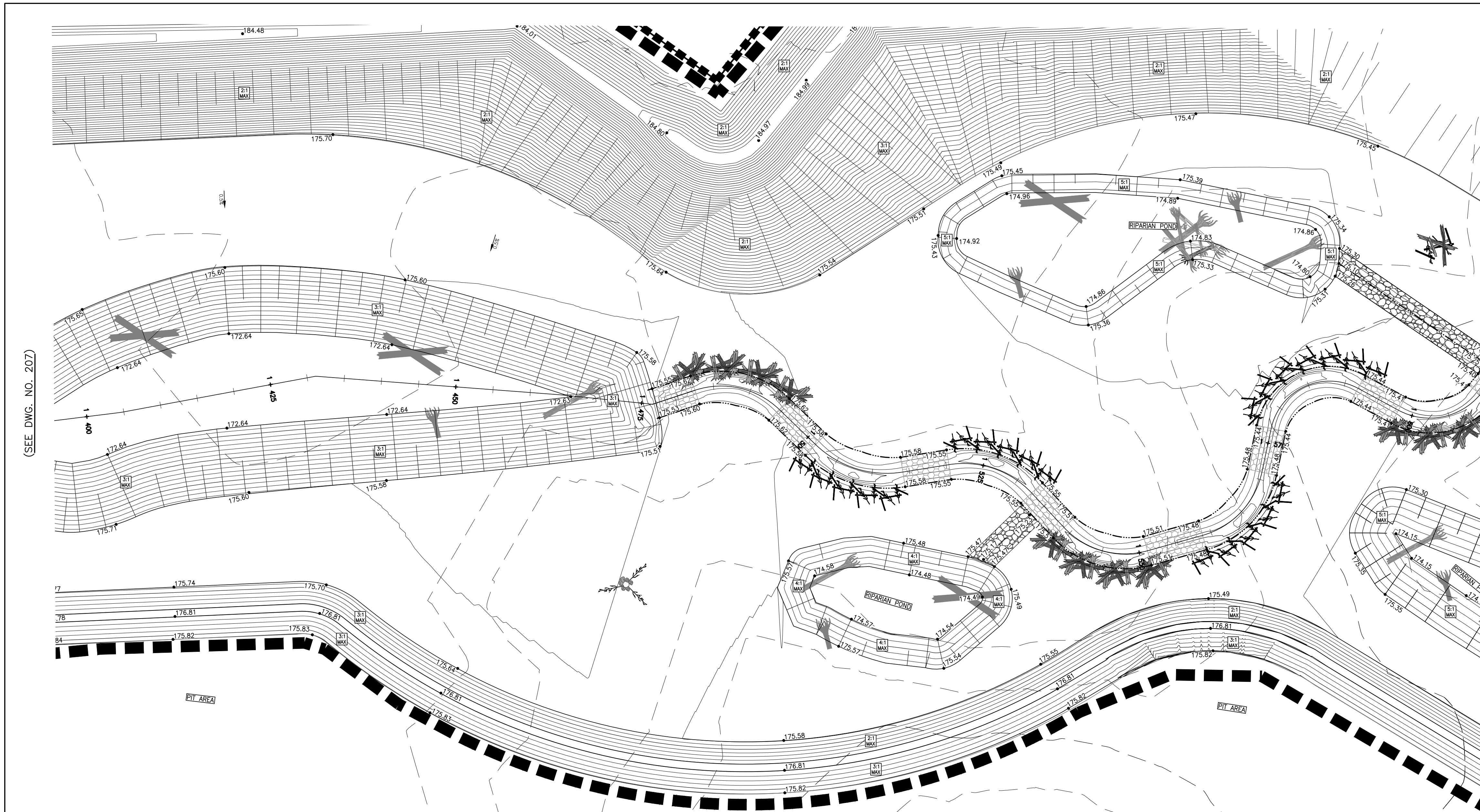
Project No. 160960948

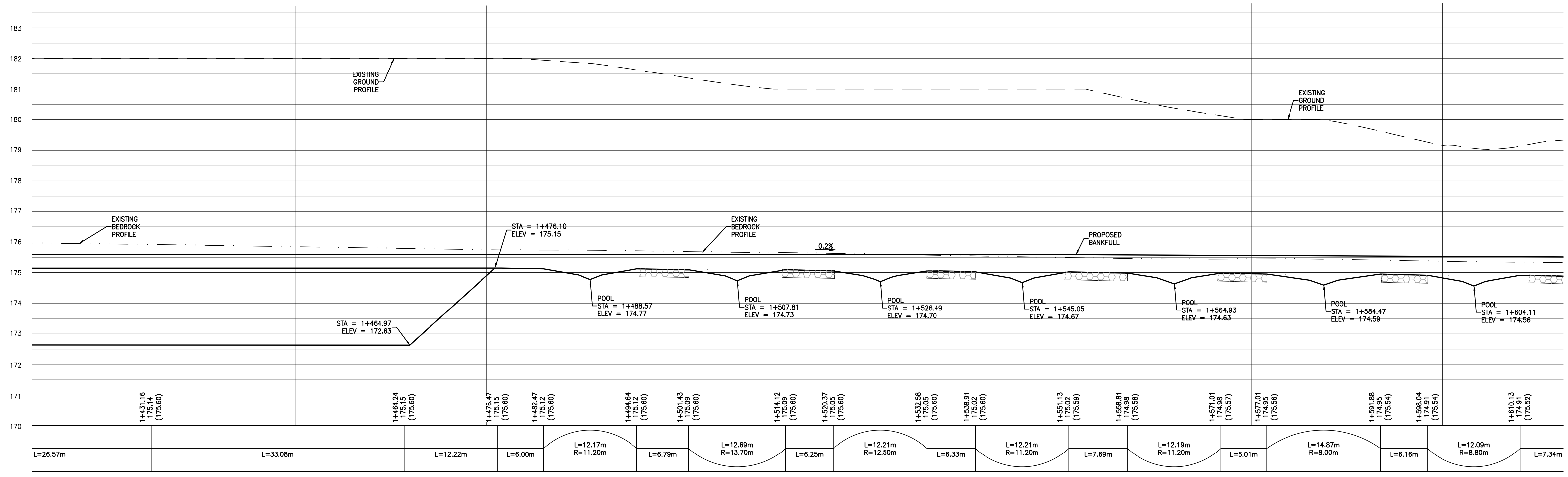
Scale 1:300H 1:75V

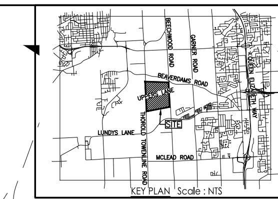
Revision 7

Sheet 10 of 32

Drawing No. **C-208**







Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

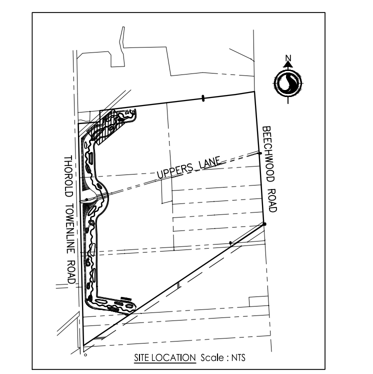
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
ROOTWADS (SEE DETAILS)
REINFORCED BANK PROTECTION (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE 1+425 TO 1+600

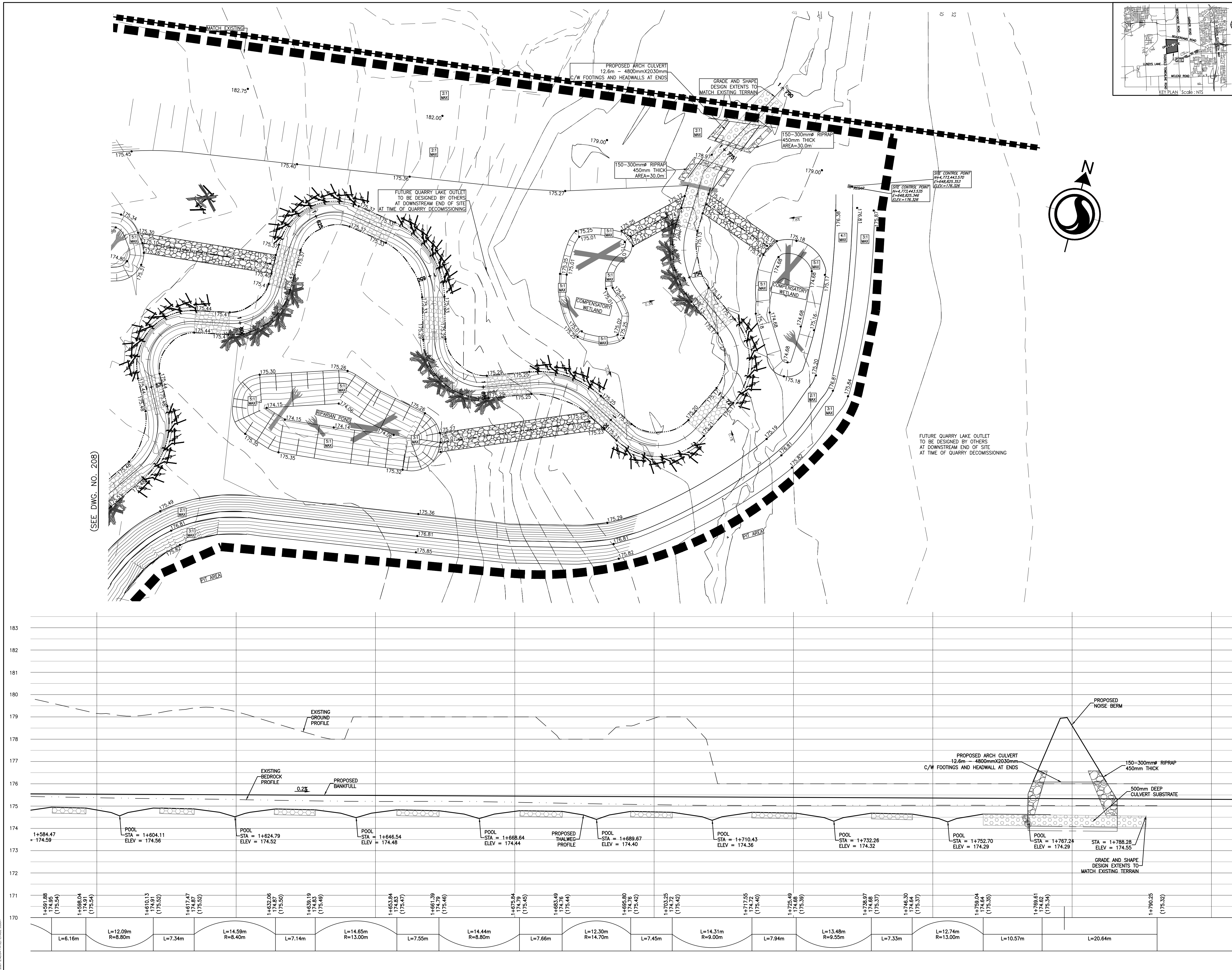
Project No. 160960948

Scale 1:300H 1:75V

Revision 7

Sheet 11 of 32

Drawing No. C-209



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

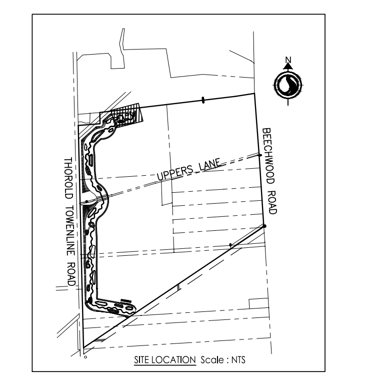
1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE
PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
REINFORCED BANK PROTECTION (SEE DETAILS)
ROOTWADS (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-205ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

PLAN AND PROFILE
1+600 TO END

Project No. 160960948

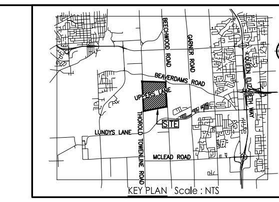
Scale 1:300H 1:75V

Revision 7

Sheet 12 of 32

Drawing No. **C-210**

ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

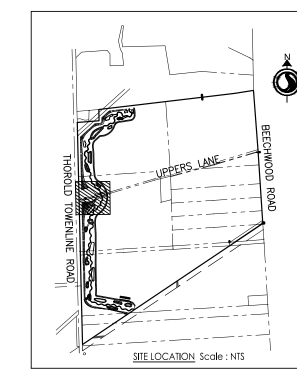
Legend

0+125.45 — STATION
377.60 — THALWEG ELEVATION
(338.10) — BANKFULL ELEVATION
L=18.6 — CENTRE LINE LENGTH
R=17.5 — POOL RADIUS OF CURVATURE

PROFILE BAND LEGEND SEE DETAILS & DETAILS FOR SECTIONS AND DETAILS

PROPERTY LINE
PROPERTY BOUNDARY
EXISTING CONTOUR
PROPOSED CONTOUR
AUGMENTED RIFFLE (SEE DETAILS)
CULVERT SUBSTRATE (SEE DETAILS)
WOOD DEBRIS TOE PROTECTION (SEE DETAILS)
LIMIT OF GRADING
ROOTWADS (SEE DETAILS)
REINFORCED BANK PROTECTION (SEE DETAILS)
COVER LOG (SEE DETAILS)
LOG SILL (SEE DETAILS)
COVER LOGS (SEE DETAILS)
BRUSH PILE (SEE DETAILS)
LOG TANGLE (SEE DETAILS)
SNAG TREE (SEE DETAILS)
LOG-ROCK J-HOOK WITH ROOT WAD (SEE DETAILS)

NOTE:
LEGEND SYMBOLS ARE NOT TO SCALE ON PLAN VIEW.



7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-220ST.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

GRADING PLAN
0+000 TO END
ALONG UPPER'S LANE

Project No. 160960948

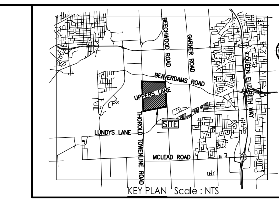
Scale 1:500 0 5 15 25m

Revision 7

Sheet 13 of 32

Drawing No. C-220

ORIGINAL SHEET - ARCH D



KEY PLAN Scale : NTS

GENERAL NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE PLAN AND PROFILE DRAWINGS (C–200 TO C–210) PREPARED BY STANTEC CONSULTING.
2. THESE PLANS FOR CONSTRUCTION ONLY WHEN APPROVED BY WALKER AGGREGATES INC. AND SEALED BY THE ENGINEER.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS, GRADES, AND EXISTING CONDITIONS, OBTAIN ALL UTILITY LOCATES, OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK AND REPORT ANY DISCREPANCIES TO THE ENGINEER.
4. ANY PROPOSED CHANGES SHALL BE APPROVED BY THE CONTRACT ADMINISTRATOR AND WALKER AGGREGATES INC.
5. ALL UNDERGROUND SERVICING TO BE INSPECTED BY STANTEC CONSULTING LTD. AND CERTIFIED FOR WALKER AGGREGATES INC. CONTRACTOR SHALL COORDINATE WITH STANTEC AND SHALL CONTACT SAME AT LEAST 48 HOURS PRIOR TO INSTALLATION OF SERVICES.
6. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION), ONTARIO TRAFFIC MANUAL (OTM) BOOK 7 (LATEST EDITION).
7. ALL TRAFFIC MANAGEMENT, HAUL ROUTES, ROAD CLOSURES PLANS SHALL BE APPROVED BY THE CITY OF THOROLD AND/OR THE CITY OF NIAGARA FALLS AND A COPY MAINTAINED ON SITE AT ALL TIMES.
8. EMERGENCY SERVICE VEHICLES CAN ENTER THE SITE AT ANY ACCESS (EXISTING OR PROPOSED)
9. IF, FOR UNFORESEEN REASONS, THE CONTRACTOR AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE CONTRACT ADMINISTRATOR AND WALKER AGGREGATES INC., PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT CONTRACTORS' RISK.
10. ALL WORK WITHIN OR ADJACENT TO UTILITY RIGHT OF WAYS OR EASEMENTS MUST BE COORDINATED WITH AND APPROVED BY THE UTILITY. NO WORK SHALL PROCEED WITHOUT WRITTEN APPROVAL.

NOTES FOR WORKING NEAR WATER

1. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER.
2. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE WILL BE CONDUCTED A MINIMUM OF 30 METRES FROM ANY AQUATIC RESOURCES TO AVOID POTENTIAL IMPACTS, IN THE EVENT THAT AN ACCIDENTAL SPILL OCCURS. IF A GAS PUMP IS USED FOR FLOW DIVERSION AND IT IS NOT POSSIBLE TO ACHIEVE THE 30 M DISTANCE FROM AQUATIC RESOURCES, A CONTAINMENT SYSTEM SHOULD BE IMPLEMENTED TO PREVENT ACCIDENTAL SPILLS OR LEAKS FROM ENTERING THE CREEK.
3. ALL DEWATERING/UNWATERING SHALL BE LOCATED AT LEAST 30 METRES FROM THE WATERCOURSE TO A FILTER BAG OR SPLASH PAD. NO DEWATERING SHALL BE SENT DIRECTLY TO ANY WATERCOURSE. THESE CONTROL MEASURES SHALL BE MONITORED FOR EFFECTIVENESS AND MAINTAINED OR REVISED TO MEET THE OBJECTIVE OF PREVENTING SEDIMENT FROM ENTERING THE WATERCOURSE.
4. ALL DISTURBED AREAS WILL BE STABILIZED AND RESTORED WITH NON–INVASIVE SPECIES IMMEDIATELY UPON COMPLETION OF GRADING WORK. ALL SEEDING AND PLANTING SHALL BE COMPLETED BEFORE OCTOBER OF THE CONSTRUCTION YEAR. FINAL SURFACE RESTORATION SHALL BE INITIATED AS SOON AS BACKFILLING AND GRADING ACTIVITIES HAVE BEEN COMPLETED.
5. DISTURBANCE AREAS WITHIN THE STREAM SHOULD BE LIMITED TO AN AREA THAT CAN BE COMPLETED AND STABILIZED WITHIN ONE WORKING DAY.
6. ALL NEAR–WATER WORK WILL BE CONDUCTED WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS. IN–WATER WORKS SHALL NOT BE PERMITTED. THE CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE TO ENSURE THAT WORKS ARE CONDUCTED DURING FAVORABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE CONTRACTOR SHALL IMPLEMENT A CONTINGENCY PLAN THAT HAS BEEN PRE–APPROVED BY THE CONTRACT ADMINISTRATOR AND WALKER AGGREGATES INC. THE CONTINGENCY PLAN SHALL INCLUDE REMOVAL OF ALL ITEMS FROM THE REGIONAL STORM FLOODPLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR A SPILL (E.G., FUEL TANKS, UNFIXED EQUIPMENT, ETC.).
7. SITE ACCESS AND STAGING WILL MINIMIZE DISTURBANCE TO ALL WATERCOURSES AND THE NATURAL AREA.
8. CONTRACTOR SHALL PROVIDE PERMITTING AGENCIES WITH 48 HOURS ADVANCE NOTICE PRIOR TO CONSTRUCTION START.

STREAM CONSTRUCTION

FOLLOWING RECEIPT OF ALL REQUIRED PERMITS, IN–WATER WORK MAY TAKE PLACE BETWEEN JULY 1ST AND MARCH 15TH. NO IN–WATER WORK SHALL TAKE PLACE WITHOUT NOTIFYING THE CONTRACT ADMINISTRATOR AND THE PERMITTING AGENCIES.

1. WORKS TO BE COMPLETED DURING LOW FLOW CONDITIONS.
2. EXISTING FLOWS WILL BE MAINTAINED DOWNSTREAM OF THE DE–WATERED WORK AREA.
3. WATER INTAKES OR OUTLET PIPES TO BE SCREENED TO PREVENT ENTRAINMENT OR IMPINGEMENT OF FISH. FLOW DISSIPATERS, FILTER BAGS OR OTHER APPROPRIATE MEASURES WILL BE USED AT ANY PUMP DISCHARGE LOCATION TO PREVENT EROSION AND THE DEPOSITION OF DELETERIOUS SUBSTANCES INTO THE WATERCOURSE.
4. SILT OR DEBRIS THAT HAS ACCUMULATED AROUND THE TEMPORARY COFFERDAMS WILL BE REMOVED PRIOR TO THEIR WITHDRAWAL.
5. ALL EXPOSED SOIL AREAS WILL BE STABILIZED AND RE–VEGETATED AS SET OUT IN THE PLANTING PLAN.
6. ALL MATERIAL USED IN THE CONSTRUCTION OF THE NEW STREAM WILL BE NATIVE MATERIAL OR WILL BE WASHED PRIOR TO ARRIVAL ON SITE TO PREVENT THE INTRODUCTION OF DELETERIOUS SUBSTANCES TO THE WATERCOURSE.
7. EXCESS TRAPPED SEDIMENTS AND CONTROLS ARE TO BE REMOVED ONLY AFTER THE SOILS OF THE CONSTRUCTION AREA HAVE BEEN STABILIZED AND ADEQUATELY RE–VEGETATED IMPLEMENT EROSION AND SEDIMENT CONTROL PLAN TO PROTECT EXISTING WATERCOURSE FROM CONSTRUCTION TRAFFIC AND AROUND STAGING AREA(S).

SEQUENCE:
1. INSTALL COFFER DAMS TO ISOLATE WORK AREA, PUMP STREAM FLOWS AROUND WORK AREA ACCORDING TO PERMIT TO TAKE WATER CONDITIONS.
2. IMPLEMENT FISH RESCUE PLAN IN ISOLATED WORK AREA.
3. DE–WATER WORK AREA BY PUMPING.
4. REMOVE TREES / OTHER VEGETATION. APPROPRIATE SPECIES OF TREE CANOPIES, LOGS AND BRUSH TO BE STOCKPILED ON SITE FOR USE IN STRUCTURES
5. COMMENCE CONSTRUCTION OF PROPOSED STREAM
6. A QUALIFIED ENGINEER OR FLUVIAL GEOMORPHOLOGIST OR REPRESENTATIVE THEREOF SHALL BE PRESENT DURING THE CONSTRUCTION OF THE STREAM WORKS.
7. COMPLETED AREAS OF STREAM CONSTRUCTION SHALL BE STABILIZED WITH EROSION CONTROL MATTING AND SEEDED ACCORDING TO THE APPROVED PLANTING PLAN AS WORK PROCEEDS.

MONITORING

SITE MONITORING WILL BE CARRIED OUT AT VARIOUS MILESTONES BY THE OWNER'S REPRESENTATIVE. (NUMBERED BELOW):
1. ONCE ALL EROSION AND SEDIMENT CONTROL MEASURES INSTALLED;
2. DURING INSTALLATION OF DIVERSION PUMPING;
3. DURING ANY FISH RESCUE;
4. DURING INSTALLATION OF SUBSTRATE AND IN–STREAM FEATURES OF THE PROPOSED STREAM; AND
5. PRIOR TO EROSION AND SEDIMENT CONTROL MEASURE REMOVAL.

EROSION CONTROL NOTES

1. THE EROSION AND SEDIMENT CONTROL PLAN MUST BE SUBMITTED TO THE CONSULTANT AND WALKER AGGREGATES INC. FOR APPROVAL AT LEAST SEVEN (7) DAYS PRIOR TO THE PLANNED START OF CONSTRUCTION. CONSTRUCTION MAY NOT COMMENCE UNTIL THE EROSION AND SEDIMENT CONTROL PLAN HAS BEEN APPROVED BY THE CONSULTANT AND WALKER AGGREGATES INC.
2. ALL SILT FENCING TO BE INSTALLED PRIOR TO COMMENCEMENT OF ANY AREA GRADING, EXCAVATION OR DEMOLITION.
3. EROSION CONTROL FENCE TO BE PLACED AROUND THE BASE OF ALL STOCKPILES. ALL STOCKPILES TO BE KEPT A MINIMUM OF 2.5 M FROM ALL PROPERTY LINES.
4. EROSION PROTECTION TO BE PROVIDED AROUND ALL STORM AND SANITARY MANHOLES AND/OR CATCHBASINS.
5. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE WORKS PROGRESSES. THE CONTRACTOR TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRUCTURES.
6. EROSION AND SEDIMENT CONTROLS WILL BE MONITORED ON A DAILY BASIS, AFTER PRECIPITATION AND RAIN EVENTS, AND ANY NECESSARY REPAIRS WILL BE COMPLETED WITHIN 48 HOURS. SHOULD THE CONTROLS NOT SERVE THEIR INTENDED PURPOSE THEY WILL BE CORRECTED OR REPLACED.
7. SEDIMENTS TO BE REMOVED WHEN ACCUMULATIONS REACH A MAXIMUM OF ONE THIRD (1/3) THE HEIGHT OF THE SILT FENCE. THE CONTRACTOR SHALL REMOVE AND DISPOSE OFF–SITE ACCUMULATED SEDIMENT FROM ALL BARRIERS TO THE LEVEL OF EXISTING GRADE, IN A MANNER THAT AVOIDS SEDIMENT ESCAPE TO THE DOWNSTREAM SIDE OF DEVICE. ALL BARRIERS SHALL REMAIN IN PLACE UNTIL AFTER THE SURROUNDING GROUND HAS BEEN RESTORED.
8. ALL EROSION CONTROL STRUCTURES TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN RE–STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
9. NO ALTERNATIVE METHODS OF EROSION CONTROL PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY THE CONTRACT ADMINISTRATOR.
10. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING SEDIMENTS FROM THE MUNICIPAL ROAD AND SIDEWALKS AT THE END OF EACH WORK DAY.
11. MUD MATS TO BE PROVIDED ON SITE AT ALL LOCATIONS WHERE CONSTRUCTION VEHICLES EXIT THE SITE. CONTRACTOR TO ENSURE ALL VEHICLES LEAVE THE SITE VIA THE MUD MAT AND THAT THE MAT IS MAINTAINED IN A MANNER TO MAXIMIZE ITS EFFECTIVENESS AT ALL TIMES.
12. STANTEC CONSULTING LTD. TO MONITOR THE SITE DEVELOPMENT TO ENSURE ALL EROSION CONTROLS ARE INSTALLED AND MAINTAINED TO PROJECT REQUIREMENTS. CONTRACTOR TO COMPLY WITH THE ENGINEER'S INSTRUCTIONS TO INSTALL, MODIFY, OR MAINTAIN EROSION CONTROL WORKS.

NOTE: IN ADDITION TO BEING RESPONSIBLE FOR ENSURING THAT THE PRESCRIBED MEASURES ARE INSTITUTED AND FUNCTIONING AS INTENDED, THE CONTRACTOR IS ALSO RESPONSIBLE FOR IMPLEMENTING ANY INTERIM OR EMERGENCY MEASURES AS NECESSARY, TO ENSURE THAT NO SEDIMENT IS DISCHARGED TO THE WATERCOURSE. THE FOLLOWING EXTRA EQUIPMENT/MATERIALS ARE TO BE KEPT ON SITE AS A CONTINGENCY, IN CASE THE PROPOSED CONTROL MEASURES ARE BREACHED:

1. SILT FENCE
2. FILTER CLOTH
3. FILTER BAGS (AT LEAST 1 PER INSTALLED BAG)
4. PUMPS (AT LEAST 1 PER INSTALLED PUMP)
5. CLEAN RIP–RAP (FREE OF FINES) FOR ROCK CHECK DAMS
6. SAND BAGS AND CLEAN GRAVEL (FREE OF FINES)
7. ANY ADDITIONAL MATERIAL DEEMED NECESSARY TO REPAIR/REMEDIATE PROPOSED MEASURES, OR TO ADEQUATELY DEAL WITH UNEXPECTED HIGH FLOWS.

EROSION AND SEDIMENT CONTROL PLAN:

1. THE EXACT CONFIGURATION OF THE EROSION AND SEDIMENT CONTROL PLAN WILL BE DEPENDENT ON THE CONTRACTOR'S CONSTRUCTION PHASING. THE PREPARATION OF THE EROSION AND SEDIMENT CONTROL PLAN IS THE RESPONSIBILITY OF THE CONTRACTOR.
2. THE EROSION AND SEDIMENT CONTROL PLAN WILL INCORPORATE THE FOLLOWING PRINCIPLES AS THEY APPLY TO THE SITE AND CONSTRUCTION PHASING PLAN:
   - THE EROSION AND SEDIMENT CONTROL PLAN SHALL ADHERE TO ANY AND ALL PERMIT REQUIREMENTS FROM MUNICIPAL, PROVINCIAL, AND/OR FEDERAL AGENCIES.
   - EROSION AND SEDIMENT CONTROLS WILL BE IMPLEMENTED PRIOR TO AND DURING THE CONSTRUCTION PHASES.
   - EROSION CONTROL (THE PREVENTION OF EROSION OF SOIL FROM THE LANDSCAPE) FROM DISTURBED SURFACES SHALL BE ACHIEVED THROUGH THE USE OF PRUDENT CONSTRUCTION PHASING AND EROSION CONTROL MEASURES (E.G., COIR FIBER MATTING) WHERE NECESSARY.
   - SEDIMENT CONTROL (THE TRAPPING OF SEDIMENT BEING CARRIED BY RUNOFF) SHALL BE ACHIEVED USING APPROPRIATELY INSTALLED SEDIMENT CONTROL MEASURES (E.G., TEMPORARY SILT FENCE, SEDIMENT TRAPS, TURBIDITY CURTAIN) AS NECESSARY. AREAS TO BE PROTECTED INCLUDE: STAGING AREAS, TREE CLEARING AND GRUBBING AREAS, TREE PRESERVATION AREAS, AREAS DELINEATED ON THE FIGURE, AND ALL OTHER WORK AREAS.
   - SITE ACCESS AND STAGING WILL MINIMIZE DISTURBANCE TO ALL WATERCOURSES AND NATURAL AREAS.
   - MATERIALS REMOVED OR STOCKPILED DURING CONSTRUCTION (E.G., EXCAVATED SOIL, BACKFILL MATERIAL) MUST BE DEPOSITED, STORED, AND CONTAINED IN A MANNER TO ENSURE SEDIMENT DOES NOT ENTER A WATER BODY AND WILL BE APPROPRIATELY STORED, AS APPROVED BY THE CONSULTANT AND BY WALKER AGGREGATES INC. AREAS CONTAINING EXPOSED SOILS OR STOCKPILED MATERIALS WILL BE ISOLATED USING APPROPRIATE SEDIMENT CONTROL DEVICES TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
   - ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER.
   - THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THESE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, ALTERNATIVE MEASURES SHALL BE IMPLEMENTED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS, AND THE CONTRACTOR SHALL CONTACT THE PERMITTING AGENCIES ENFORCEMENT OFFICER IMMEDIATELY. ANY REQUIRED UPGRADES OR AMENDMENTS ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE OWNER WILL SUPPLY THE SERVICES OF AN ENVIRONMENTAL INSPECTOR TO REGULARLY INSPECT AND MONITOR THE PROGRESS AND STATUS OF ENVIRONMENTAL CONTROLS, AND WHO SHALL HAVE THE FULL AUTHORITY OF THE OWNER TO ACT ON ITS BEHALF. THE PRESENCE OF THE ENVIRONMENTAL INSPECTOR SHALL NOT, IN ANY WAY, RELIEVE THE CONTRACTOR OF ITS CONTRACTUAL OBLIGATIONS WITH RESPECT TO ENVIRONMENTAL PROTECTION.
   - NO EXCESS EARTH OR GRANULAR MATERIALS SHALL BE LEFT IN AREAS WHERE IT WILL BE SUBJECT TO EROSION INTO THE CREEK CHANNEL.
   - ALL DISTURBED AREAS WILL BE STABILIZED IMMEDIATELY UPON COMPLETION OF GRADING WORK. STABILIZATION WILL CONSIST OF REVEGETATION AS PER THE PLANTING PLAN ON FIGURE L–460 TO L–462.

WATER MANAGEMENT PLAN:

1. THE CONTRACTOR SHALL SUBMIT A WATER MANAGEMENT PLAN TO THE CONSULTANT AND WALKER AGGREGATES INC. FOR APPROVAL AT LEAST SEVEN (7) DAYS PRIOR TO THE PLANNED START OF CONSTRUCTION. CONSTRUCTION ACTIVITIES MAY NOT COMMENCE UNTIL THE WATER MANAGEMENT PLAN HAS BEEN APPROVED BY THE CONSULTANT AND BY WALKER AGGREGATES INC.
2. THE WATER MANAGEMENT PLAN SHALL SPECIFY BEST MANAGEMENT PRACTICES WITH RESPECT TO WORKING IN THE WET, AS THEY APPLY TO THE SITE AND CONSTRUCTION PHASING PLAN. THE WATER MANAGEMENT PLAN SHALL ALSO SPECIFY ANY OTHER DRAINAGE STRATEGIES WHICH MINIMIZE THE IMPACTS OF WORKING IN THE WET.
3. CONSTRUCTION DEWATERING BETWEEN 50,000 L/D AND 400,000 L/D REQUIRES A EASR REGISTRATION FROM THE ONTARIO MINISTRY OF CONSERVATION AND PARKS WEBSITE. CONSTRUCTION DEWATERING GREATER THAN 400,000 L/D REQUIRES A PERMIT FROM THE MECP. PERMIT CONDITIONS MUST BE OBSERVED

HIGH FLOW CONTINGENCY PLAN:

1. THE CONTRACTOR SHALL SUBMIT A HIGH FLOW CONTINGENCY PLAN TO THE CONSULTANT AND WALKER AGGREGATES INC. FOR APPROVAL AT LEAST SEVEN (7) DAYS PRIOR TO THE PLANNED START OF CONSTRUCTION. CONSTRUCTION ACTIVITIES MAY NOT COMMENCE UNTIL THE HIGH FLOW CONTINGENCY PLAN HAS BEEN APPROVED BY THE CONSULTANT AND BY WALKER AGGREGATES INC.
2. THE HIGH–FLOW CONTINGENCY PLAN SHALL OUTLINE THE ACTIONS WHICH SHALL BE TAKEN IF AN UNEXPECTED STORM ARISES AND THE RESULTING HIGH FLOWS CAUSE CONSTRUCTION TO CEASE, FOR REASONS OF SAFETY OR DAMAGE TO THE BANK STABILIZATION CONSTRUCTION. ACTIONS SHALL INCLUDE, BUT ARE NOT LIMITED TO, THE REMOVAL OF ALL ITEMS FROM THE 100 YEAR FLOODPLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR REPRESENT A POTENTIAL SPILL HAZARD (E.G., FUEL TANKS, UNFIXED EQUIPMENT, ETC.)

FISH SALVAGE PLAN

1. THE CONTRACTOR SHALL SUBMIT A FISH SALVAGE PLAN TO THE OWNER AND CONSULTANT FOR APPROVAL AT LEAST SEVEN (7) DAYS PRIOR TO THE PLANNED START OF CONSTRUCTION. CONSTRUCTION ACTIVITIES MAY NOT COMMENCE UNTIL THE FISH SALVAGE PLAN HAS BEEN APPROVED BY THE OWNER AND THE CONSULTANT.
2. THE CONTRACTOR SHALL ACQUIRE A SPECIAL COLLECTION PERMIT FOR A FISH SALVAGE OPERATION FROM THE MINISTRY OF THE NATURAL RESOURCES AND FORESTRY
3. THE CONTRACTOR SHALL NOTIFY THE OWNER AND THE CONSULTANT AT LEAST TWO (2) DAYS PRIOR TO ANY FISH REMOVAL ACTIVITIES.
4. FISH REMOVAL WILL TAKE PLACE PRIOR TO ANY CONSTRUCTION ACTIVITIES.
5. FISH REMOVAL SHALL PROCEED AS FOLLOWS:
   - A BARRIER NET SHALL BE PLACED UPSTREAM AND DOWNSTREAM OF THE WORK AREA TO PREVENT THE ENTRY OF FISH INTO THE WORK AREA.
   - A QUALIFIED FISHERIES BIOLOGIST SHALL BE RETAINED BY THE CONTRACTOR TO REMOVE ANY FISH FROM THE WORK AREA USING A SEINE NET (PROCEEDING IN A DOWNSTREAM DIRECTION) AND/OR BACKPACK ELECTROFISHING PROCEDURE. ANY CAPTURED FISH SHOULD BE RELEASED IMMEDIATELY UPSTREAM OF THE WORK AREA IN AN AREA WITH AT LEAST 0.15 M DEPTH OF WATER. IF NO SUCH AREA IS AVAILABLE UPSTREAM, THE FISH SHALL BE RELEASED DOWNSTREAM IN AT LEAST 0.15 M OF WATER.
   - A RECORD OF THE FISH REMOVAL OPERATION SHALL BE PROVIDED TO THE OWNER AND THE CONSULTANT.
   - IF WATER OVER–TOPS THE NET (OR BARRIER) AT ANY POINT DURING CONSTRUCTION, THEN THE FISH REMOVAL MUST BE REPEATED PRIOR TO RESUMING CONSTRUCTION.

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
	Revision	By	Appd	YYYY.MM.DD

File Name: 160960948_C-500DT.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

Title

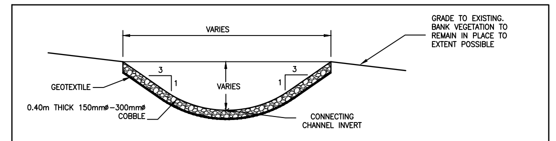
GENERAL NOTES

Project No. 160960948

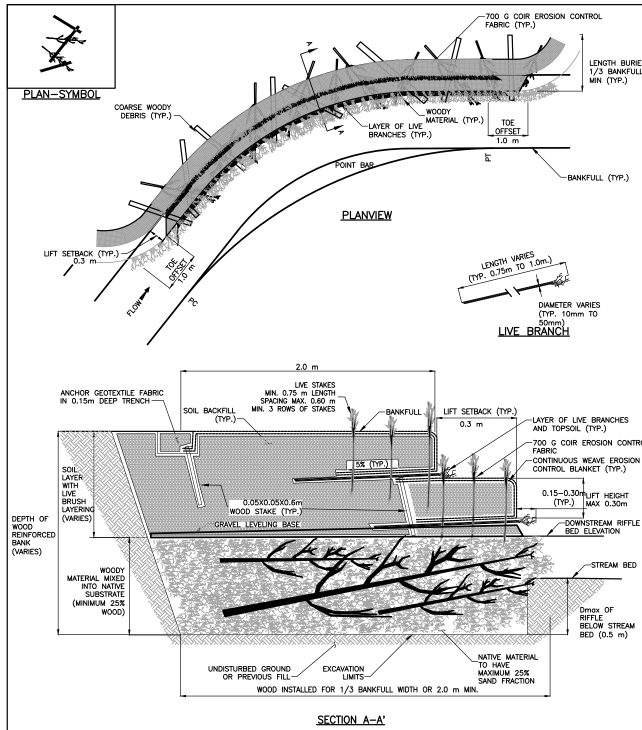
Scale

Revision 7 Sheet 14 of 32 Drawing No. C-500

ORIGINAL SHEET - ARCH D



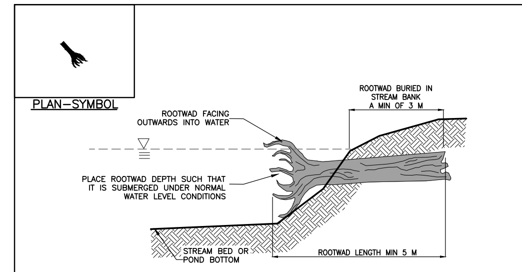
CONNECTING CHANNEL DETAIL
N.T.S



NOTES:

1. WOODY MATERIAL SHALL CONSIST OF SMALL LOGS, ROOTWADS, MEDIUM TO SMALL LIMBS, BRANCHES, AND/OR BUSHES. ALL MATERIALS SHALL BE AS APPROVED BY THE ENGINEER.
2. NO WOODY MATERIAL SHALL BE PLACED PARALLEL TO THE FLOW OF WATER, UNLESS DIRECTED BY THE ENGINEER. WOODY MATERIAL SHALL BE PLACED IN A CROSSING PATTERN OR WEAVE.
3. THE WOODY MATERIAL IS TO BE MIXED INTO NATIVE SUBSTRATE, AT A DENSITY OF AT LEAST 25% WOOD.
4. INVASIVE SPECIES SHALL NOT BE USED IN THE WOODY MATERIAL.
6. THE WOODY MATERIAL/NATIVE MATERIAL MIX SHALL BE COMPACTED WITH THE EXCAVATOR BUCKET IN ORDER TO REDUCE THE PRESENCE OF VOIDS IN THE WOODY MATERIAL/NATIVE SUBSTRATE LAYER.
7. THE HORIZONTAL LOCATIONS OF ALL WOOD REINFORCED BANKS ARE LOCATED ON THE PLAN AND PROFILE SHEETS. NO LOCATIONS OF WOOD REINFORCED BANKS SHALL VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM THE ENGINEER.
8. GRAVEL LEVELING BASE (GRANULAR 'B') OVER NON-WOVEN FILTER FABRIC MAY BE INSTALLED ABOVE THE HIGHEST ELEVATION OF THE WOODY DEBRIS BEFORE THE SOIL LIFTS ARE INSTALLED.
9. THE SOIL BACKFILL USED FOR LIFTS AND TOPSOIL USED FOR LAYERING WITH THE LIVE BRANCHES SHALL BE FREE OF ANY LARGE ROOTS OR WOODY DEBRIS AND SHALL GENERALLY BE FREE FROM ANY GRAVEL OR COBBLE MATERIAL.
10. SOIL BACKFILL SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM; YET, NOT SUCH THAT THE UNDERLYING BRUSH IS DISPLACED OR DAMAGED.
11. THE TOP OF THE BACKFILL FOR THE FIRST LIFT SHALL BE SLOPED AT APPROXIMATELY 5% AWAY FROM THE STREAM.
12. PLACE A LAYER OF TOPSOIL AND LIVE BRANCHES ON TOP OF EACH SOIL LIFT SUCH THAT APPROXIMATELY 0.15 to 0.30 m OF EACH LIVE BRANCH WILL BE EXPOSED AND THE REMAINDER (0.60 TO 1.20m) OF EACH LIVE BRANCH WILL BE COVERED BY THE NEXT SOIL LIFT.
13. LIVE BRANCHES SHALL BE OF THE SPECIES SPECIFIED FOR LIVE STAKES OR APPROVED BY THE ENGINEER.
14. PLACE A LAYER OF 2.0 m WIDE COIR 700 EROSION CONTROL BLANKET, OR EQUIVALENT, ON TOP OF THE TOPSOIL AND LIVE BRANCHES SUCH THAT 0.75 m OF THE BLANKET WILL BE BURIED BELOW THE NEXT SOIL LIFT. ALLOW THE REMAINING 1.25 m OF BLANKET TO HANG OVER THE PRECEDING SOIL LIFT OR COIR FIBER LOGS.
15. PLACE A SECOND LAYER OF 2.0 m WIDE NON-WOVEN COIR MATTING OVER THE EROSION CONTROL BLANKET TO THE SAME LIMITS.
16. SOIL CAN BE COMPACTED BY STACKING A PIECE OF SAWN LUMBER BOARD EDGEWAYS UP TO THE LIFT HEIGHT SPECIFIED AND SECURING WITH WOODEN STAKES TO PROVIDE A RIGID BACKSTOP FOR COMPACTING SOIL LIFT.
17. PLACE SOIL BACKFILL UP TO THE LIFT HEIGHT SPECIFIED OF NO GREATER THAN 0.30m BEING CAREFUL NOT TO PUSH/PULL OR TEAR THE FABRIC PREVIOUSLY PLACED.
18. THE TOP OF THE SOIL BACKFILL SHALL BE FLAT WITHIN THE LIFT SETBACK DISTANCE SPECIFIED IN THE DETAIL. BEYOND THE LIFT SETBACK DISTANCE, THE SOIL BACKFILL SHALL BE SLOPED AT AN APPROXIMATE 5% SLOPE AWAY FROM THE STREAM.
19. TOP DRESS THE SOIL LIFT WITH TOPSOIL FROM THE FACE OF THE SOIL LIFT BACK INTO THE FLOODPLAIN AT LEAST 1.2 m.
20. REMOVE THE SAWN LUMBER AND WOODEN STAKES FROM THE FACE OF THE SOIL LIFT AND WRAP THE FACE AND TOP OF THE SOIL LIFT USING THE WOVEN AND NON-WOVEN COIR MATTING HANGING OVER THE PREVIOUS LIFT/COIR FIBER LIFTS.
21. THE EROSION CONTROL FABRIC SHALL BE PULLED AS TIGHT AS POSSIBLE WITHOUT TEARING OR EXCESSIVELY DISTORTING THE FABRIC.
22. SECURE THE EROSION CONTROL AND NON-WOVEN MATTING IN PLACE BY STAKING THE END OF THE EROSION CONTROL FABRIC WITH WOOD STAKES ON 0.5 m CENTERS.
23. BEGIN CONSTRUCTION OF THE NEXT SOIL LIFT BY REPEATING THE PREVIOUS NOTES STARTING WITH NOTE 11.
24. THE OVERALL SLOPE CREATED BY THE LIVE BRUSH LAYERING SHALL MATCH THE PROPOSED CROSS SECTION SHAPE FOR THE OUTER BANK OF THE TYPICAL POOL CROSS-SECTION FOR EACH REACH.
25. THE COIR BLANKETS AND GEOTEXTILE FABRIC USED FOR THE UPPER MOST SOIL LIFT WILL BE SECURED WITHIN A 0.15 m DEEP TRENCH AS SHOWN IN DETAIL.
26. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR ELEVATIONS SHALL BE WITHIN 0.03 m OF THE GRADES AND ELEVATIONS INDICATED OR APPROVED BY THE ENGINEER.
27. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
28. SOD MAT WRAPPED IN COIR MATTING MAY BE USED INSTEAD OF THE SOIL LIFTS ABOVE THE WOOD REINFORCED BANK IF IT IS AVAILABLE AND APPROVED BY THE ENGINEER.
29. THE LOWER BANK STABILIZATION IS CRITICAL TO THE DESIGN INTENT OF THIS PROJECT. VARIANCE FROM WOOD REINFORCED BANK WILL ONLY BE CONSIDERED AT THE DISCRETION OF THE ENGINEER.

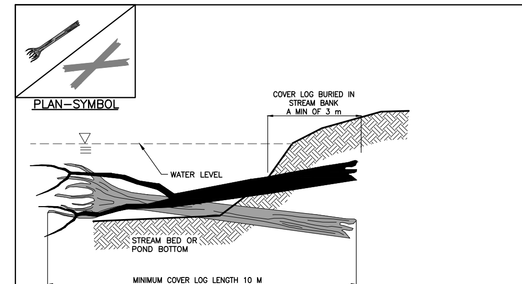
DETAIL – WOOD REINFORCED BANK
NOT TO SCALE



NOTES:

1. THE ROOTWARDS SHALL BE SOUND AND NOT ROTTED OR SOFT.
2. ROOTWAD DIMENSIONS SHALL BE: MINIMUM 5 m LENGTH, MINIMUM 0.2 m DIAMETER.
3. ROOTWADS SHALL BE BURIED IN THE CHANNEL/POND BANKS A MINIMUM OF 3 m.
5. THE PLACEMENT OF THE ROOT WAD SHALL BE IN THE GENERAL LOCATIONS SHOWN AND EACH LOCATION SHALL BE OPTIMIZED IN THE FIELD TO MAXIMIZE HABITAT POTENTIAL.
6. ROOTWADS SHALL BE PLACED AT AN ELEVATION WHERE THEY WILL REMAIN LARGELY SUBMERGED UNDER NORMAL FLOW CONDITIONS.
7. PRESERVE SUFFICIENT ROOT MASS ON ROOTWAD TO PROVIDE HABITAT COMPLEXITY. EXCESSIVE ROOT MASS MAY BE TRIMMED.
8. SOIL BACKFILL OVER THE BURIED PORTION OF THE ROOTWAD SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM. BOULDERS MAY BE USED TO ANCHOR THE WOOD AT THE BANK.
9. ANCHOR BOULDERS WILL BE INCLUDED AT THE DISCRETION OF THE ENGINEER AND MUST BE BURIED AND NOT EXPOSED AT THE GROUND SURFACE.
10. RE–DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN–STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

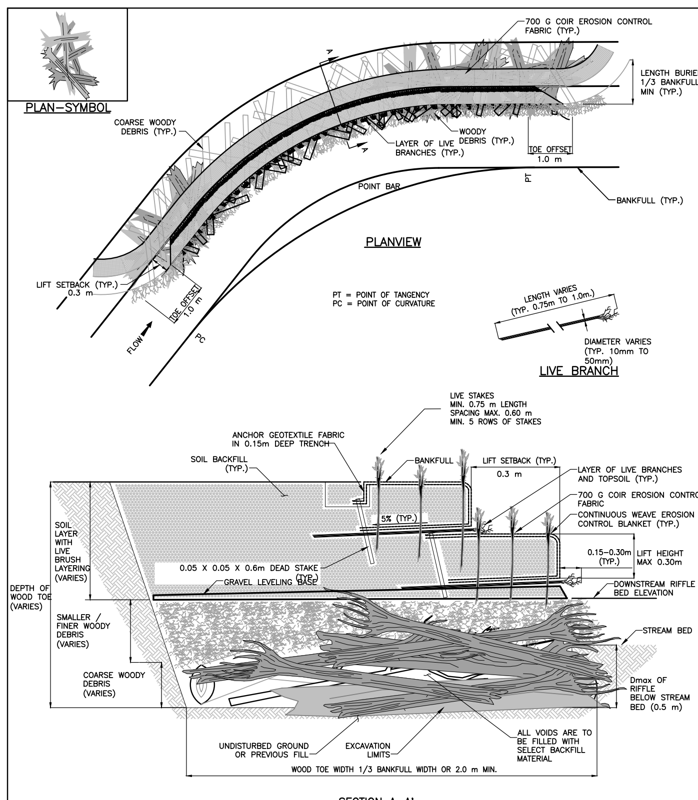
DETAIL – ROOTWAD
N.T.S



NOTES:

1. THE COVER LOGS SHALL BE SOUND AND NOT ROTTED OR SOFT.
2. COVER LOG DIMENSIONS SHALL BE: MINIMUM 10m LENGTH, MINIMUM 0.2m DIAMETER. LARGER LOGS SHALL BE SELECTED FOR LARGER CHANNELS AT THE ENGINEERS DISCRETION.
3. COVER LOGS SHALL BE BURIED IN THE CHANNEL/POND BANKS A MINIMUM OF 3m.
4. THE PLACEMENT OF THE COVER LOGS SHALL BE IN THE GENERAL LOCATIONS SHOWN AND EACH LOCATION SHALL BE OPTIMIZED IN THE FIELD TO MAXIMIZE HABITAT POTENTIAL.
5. COVER LOGS SHALL BE PLACED AT AN ELEVATION WHERE THEY WILL REMAIN LARGELY SUBMERGED UNDER NORMAL FLOW CONDITIONS.
6. COVER LOGS MAY HAVE ROOTWADS ATTACHED.
7. COVER LOGS MAY HAVE SOME LARGE BRANCHES (TRIMMED) ATTACHED.
8. SOIL BACKFILL OVER THE BURIED PORTION OF THE COVER LOG SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM. BOULDERS MAY BE USED TO ANCHOR THE WOOD AT THE BANK.
9. ANCHOR BOULDERS WILL BE INCLUDED AT THE DISCRETION OF THE ENGINEER AND MUST BE BURIED AND NOT EXPOSED AT THE GROUND SURFACE.
10. RE–DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN–STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

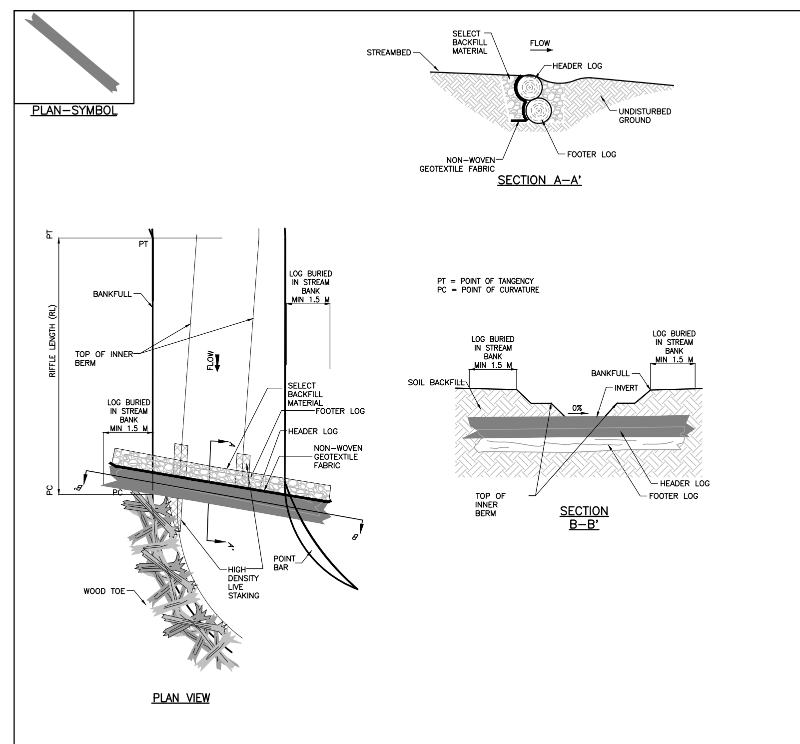
DETAIL – COVER LOGS
N.T.S



NOTES:

1. COARSE WOODY DEBRIS SHALL CONSIST OF LOGS, ROOTWADS, AND LARGE BRANCHES NOT SUITABLE FOR CONSTRUCTION OF LOG STRUCTURES. ALL MATERIALS ARE TO BE APPROVED BY THE ENGINEER.
2. COARSE WOODY DEBRIS SHALL BE CONSTRUCTED WITH THE LARGEST MATERIAL PLACED FIRST. NO LOGS SHALL BE PLACED PARALLEL TO THE FLOW OF WATER, UNLESS DIRECTED BY THE ENGINEER. LOGS SHALL BE PLACED IN A CROSSING PATTERN OR WEAVE SUCH THAT EACH LOG IS ANCHORED BY ANOTHER LOG.
3. SMALL/FINE WOODY DEBRIS SHALL CONSIST OF MEDIUM TO SMALL LIMBS, BRANCHES, BUSHES, AND/OR LOGS. INVASIVE SPECIES SHALL NOT BE USED.
4. SMALL/FINE WOODY DEBRIS SHALL BE PLACED ABOVE THE COARSE WOODY DEBRIS WITH THE LARGEST MATERIAL BEING PLACED FIRST AND THE SMALLEST MATERIAL PLACED LAST.
5. ALL WOODY DEBRIS SHALL BE COMPACTED WITH THE EXCAVATOR BUCKET IN ORDER TO REDUCE THE PRESENCE OF VOIDS IN THE SMALL/FINE WOODY DEBRIS LAYER.
6. THE HORIZONTAL LOCATIONS OF ALL WOODY DEBRIS ARE LOCATED ON THE PLAN AND PROFILE SHEETS. NO LOCATIONS OF WOODY DEBRIS SHALL VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM THE ENGINEER.
7. GRAVEL LEVELING BASE (GRANULAR 'B') OVER NON-WOVEN FILTER FABRIC MAY BE INSTALLED ABOVE THE HIGHEST ELEVATION OF THE WOODY DEBRIS BEFORE THE SOIL LIFTS ARE INSTALLED.
8. THE SOIL BACKFILL USED FOR LIFTS AND TOPSOIL USED FOR LAYERING WITH THE LIVE BRANCHES SHALL BE FREE OF ANY LARGE ROOTS OR WOODY DEBRIS AND SHALL GENERALLY BE FREE FROM ANY GRAVEL OR COBBLE MATERIAL.
9. SOIL BACKFILL SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM; YET, NOT SUCH THAT THE UNDERLYING BRUSH IS DISPLACED OR DAMAGED.
10. THE TOP OF THE BACKFILL FOR THE FIRST LIFT SHALL BE SLOPED AT APPROXIMATELY 5% AWAY FROM THE STREAM.
11. PLACE A LAYER OF TOPSOIL AND LIVE BRANCHES ON TOP OF EACH SOIL LIFT SUCH THAT APPROXIMATELY 0.15 to 0.30 m OF EACH LIVE BRANCH WILL BE EXPOSED AND THE REMAINDER (0.60 TO 1.20m) OF EACH LIVE BRANCH WILL BE COVERED BY THE NEXT SOIL LIFT.
12. LIVE BRANCHES SHALL BE OF THE SPECIES SPECIFIED FOR LIVE STAKES OR APPROVED BY THE ENGINEER.
13. PLACE A LAYER OF 2.0 m WIDE COIR 700 EROSION CONTROL BLANKET, OR EQUIVALENT, ON TOP OF THE TOPSOIL AND LIVE BRANCHES SUCH THAT 0.75 m OF THE BLANKET WILL BE BURIED BELOW THE NEXT SOIL LIFT. ALLOW THE REMAINING 1.25 m OF BLANKET TO HANG OVER THE PRECEDING SOIL LIFT OR COIR FIBER LOGS.
14. PLACE A SECOND LAYER OF 2.0 m WIDE NON-WOVEN COIR MATTING OVER THE EROSION CONTROL BLANKET TO THE SAME LIMITS.
15. SOIL CAN BE COMPACTED BY STACKING A PIECE OF SAWN LUMBER BOARD EDGEWAYS UP TO THE LIFT HEIGHT SPECIFIED AND SECURING WITH WOODEN STAKES TO PROVIDE A RIGID BACKSTOP FOR COMPACTING SOIL LIFT.
16. PLACE SOIL BACKFILL UP TO THE LIFT HEIGHT SPECIFIED OF NO GREATER THAN 0.30M BEING CAREFUL NOT TO PUSH/PULL OR TEAR THE FABRIC PREVIOUSLY PLACED.
17. THE TOP OF THE SOIL BACKFILL SHALL BE FLAT WITHIN THE LIFT SETBACK DISTANCE SPECIFIED IN THE DETAIL. BEYOND THE LIFT SETBACK DISTANCE, THE SOIL BACKFILL SHALL BE SLOPED AT AN APPROXIMATE 5% SLOPE AWAY FROM THE STREAM.
18. TOP DRESS THE SOIL LIFT WITH TOPSOIL FROM THE FACE OF THE SOIL LIFT BACK INTO THE FLOODPLAIN AT LEAST 1.2 m.
19. REMOVE THE SAWN LUMBER AND WOODEN STAKES FROM THE FACE OF THE SOIL LIFT AND WRAP THE FACE AND TOP OF THE SOIL LIFT USING THE WOVEN AND NON-WOVEN COIR MATTING HANGING OVER THE PREVIOUS LIFT/COIR FIBER LIFTS.
20. THE EROSION CONTROL FABRIC SHALL BE PULLED AS TIGHT AS POSSIBLE WITHOUT TEARING OR EXCESSIVELY DISTORTING THE FABRIC.
21. SECURE THE EROSION CONTROL AND NON-WOVEN MATTING IN PLACE BY STAKING THE END OF THE EROSION CONTROL FABRIC WITH WOOD STAKES ON 0.5 m CENTERS.
22. BEGIN CONSTRUCTION OF THE NEXT SOIL LIFT BY REPEATING THE PREVIOUS NOTES STARTING WITH NOTE 11.
23. THE OVERALL SLOPE CREATED BY THE LIVE BRUSH LAYERING SHALL MATCH THE PROPOSED CROSS SECTION SHAPE FOR THE OUTER BANK OF THE TYPICAL POOL CROSS-SECTION FOR EACH REACH.
24. THE COIR BLANKETS AND GEOTEXTILE FABRIC USED FOR THE UPPER MOST SOIL LIFT WILL BE SECURED WITHIN A 0.15 m DEEP TRENCH AS SHOWN IN DETAIL.
25. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR ELEVATIONS SHALL BE WITHIN 0.03 m OF THE GRADES AND ELEVATIONS INDICATED OR APPROVED BY THE ENGINEER.
26. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
27. SOD MAT WRAPPED IN COIR MATTING MAY BE USED INSTEAD OF THE SOIL LIFTS ABOVE THE WOOD TOE IF IT IS AVAILABLE AND APPROVED BY THE ENGINEER.
28. THE LOWER BANK STABILIZATION IS CRITICAL TO THE DESIGN INTENT OF THIS PROJECT. VARIANCE FROM WOOD TOE BANK STABILIZATION WILL ONLY BE CONSIDERED AT THE DISCRETION OF THE ENGINEER.

DETAIL – WOOD DEBRIS TOE PROTECTION
N.T.S



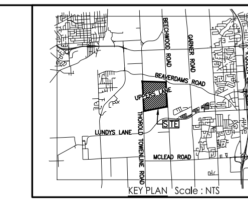
NOTE:

1. SOME LOG SILLS MAY BE INSTALLED AT THE PC IF INDICATED ON THE PLAN AND PROFILE SHEET. LOG SILLS LOCATED AT THE PC SHALL BE INSTALLED WITH SIMILAR PROCEDURE, EXCEPT THE LOGS SHALL HAVE A 1% VERTICAL SLOPE TOWARD THE INSIDE OF THE BEND. THE LOG SILL LOCATIONS SHALL BE AS SHOWN ON THE PLAN AND PROFILE

NOTES:

1. LOGS SHALL HAVE MINIMUM DIAMETER OF 0.3 m
2. LOGS SHALL HAVE A MINIMUM LENGTH OF THE REACH BANKFULL WIDTH PLUS 3 m.
3. IT IS PREFERRED THAT THE HEADER LOG USED FOR THIS STRUCTURE BE SLIGHTLY BOWED OR CURVED.
4. IF A BOWED LOG IS USED FOR THE HEADER LOG, POSITION THE LOG SUCH THAT THE LOWEST POINT IS AT THE CENTERLINE OF THE CHANNEL AS SHOWN IN THE DETAIL.
5. LIMBS OF ALL LOGS SHALL BE TRIMMED FLUSH.
6. FOOTER LOGS ARE LOGS PLACED TO PROVIDE A FOUNDATION AND SCOUR PROTECTION FOR THE HEADER LOGS.
7. THE HEADER LOG SHALL BE UNDERLAIN BY A FOOTER LOG UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
8. HEADER LOGS ARE THE UPPER MOST LOGS USED IN EACH STRUCTURE. THE HEADER LOG FOR THIS STRUCTURE IS ONLY VISIBLE BETWEEN THE INNER BERMS.
9. HEADER LOG SHALL BE OFFSET SLIGHTLY DOWNSTREAM OF THE FOOTING LOG.
10. SET INVERT TO MATCH STREAM BED ELEVATION AS PER THE DESIGN PROFILE.
11. THE VERTICAL SLOPE OF EACH LOG SHALL BE 0% AND AT NOT EXCEED 1% UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
12. ALL GAPS/VOIDS LARGER THAN 2.5cm BETWEEN THE HEADER AND FOOTER LOGS SHALL BE CHINKED WITH LIMBS AND/OR BRUSH ON THE UPSTREAM SIDE PRIOR TO PLACEMENT OF THE GEOTEXTILE.
13. ON THE UPSTREAM SIDE OF THE LOGS NON–WOVEN GEOTEXTILE FABRIC SHALL BE PLACED AS SHOWN IN THE GEOTEXTILE PLACEMENT DETAIL ALONG THE ENTIRE LENGTH OF THE LOG.
14. BACKFILL STRUCTURE WITH SELECT BACKFILL MATERIAL AS SHOWN AND DEFINED IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL.
15. NAIL NON–WOVEN GEOTEXTILE TO EDGE OF HEADER LOG AND BACKFILL AS SHOWN IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL.
16. SELECT BACKFILL AND SOIL BACKFILL MATERIAL SHALL BE COMPACTED SUCH THAT FUTURE SETTLEMENT OF THE MATERIAL IS KEPT TO A MINIMUM.
17. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS–SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 3 CM OF THE GRADES AND ELEVATIONS INDICATED.
18. RE–DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN–STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
19. SEE WOOD DEBRIS TOE DETAIL.

DETAIL – LOG SILL
N.T.S



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-500DT.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

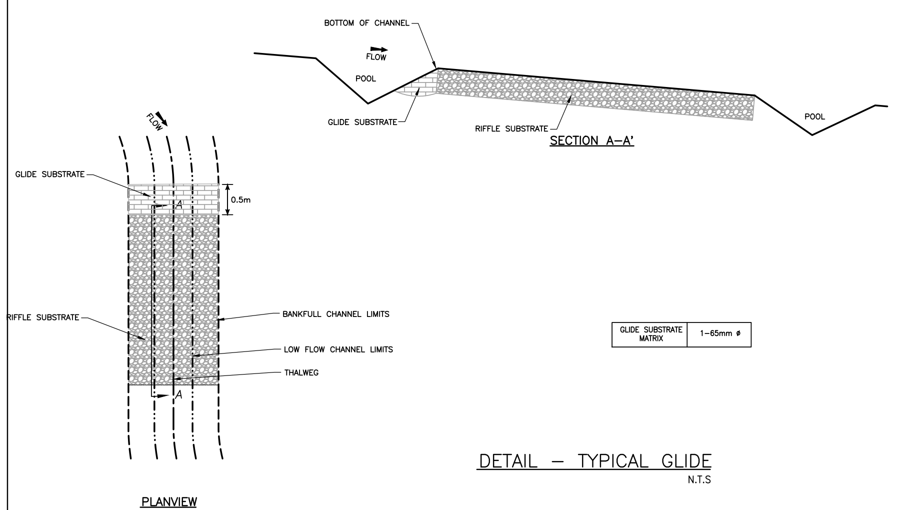
Title

TYPICAL DETAILS

Project No.	Scale
160960948	

Revision	Sheet	Drawing No.
7	15 of 32	C-501

ORIGINAL SHEET - ARCH D



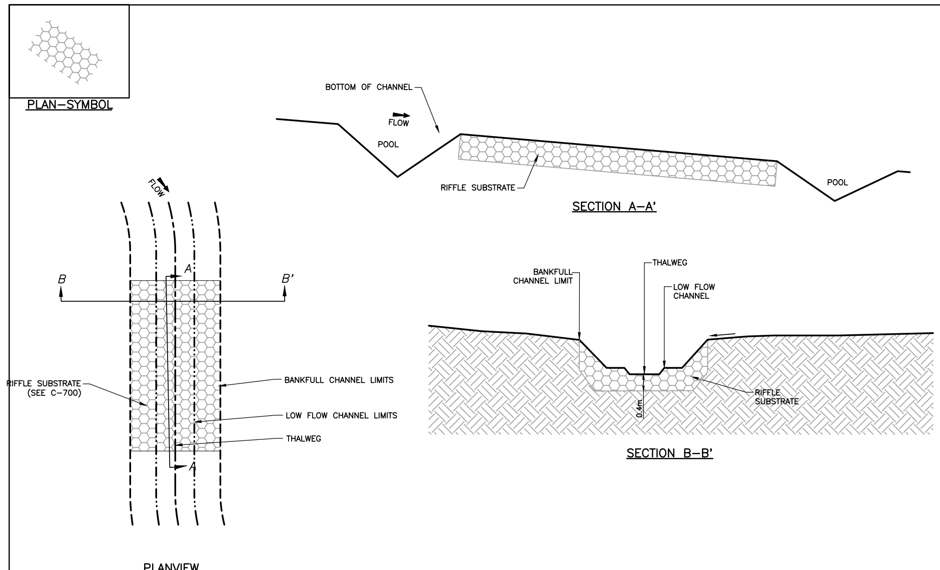
GLIDE SUBSTRATE MATRIX	1-65mm ø

DETAIL – TYPICAL GLIDE

N.T.S

NOTES:

1. GLIDE SUBSTRATE MATERIAL IS AS SPECIFIED ON THIS PAGE.
2. GLIDE MATERIAL IS TO BE PLACED UPSTREAM OF EACH RIFFLE TO THE DIMENSIONS SPECIFIED.
3. INVERTS ARE TO BE SET AT THE ELEVATION SHOWN ON THE PLAN AND PROFILE SHEETS. NO ELEVATIONS OF THE GLIDE MAY VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM THE ENGINEER.
4. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.03m OF THE GRADES AND ELEVATIONS INDICATED.
5. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

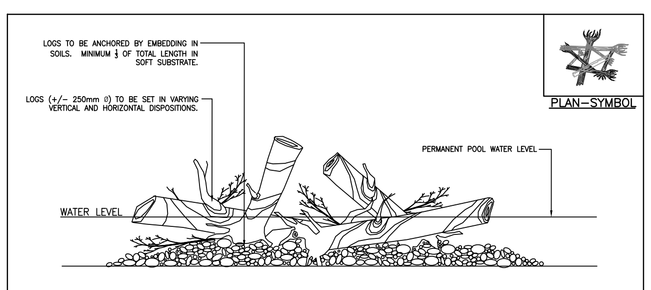


DETAIL – AUGMENTED RIFFLE

N.T.S

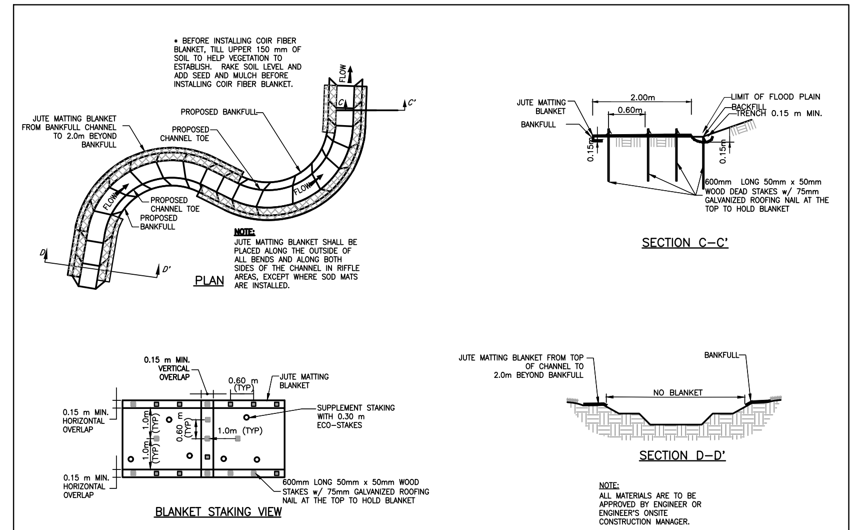
NOTES:

1. AUGMENTED RIFFLE SUBSTRATE MATERIAL IS AS SPECIFIED ON C-700.
2. INVERTS ARE TO BE SET AT THE ELEVATION SHOWN ON THE PLAN AND PROFILE SHEETS. NO ELEVATIONS OF THE AUGMENTED RIFFLE MAY VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM THE ENGINEER.
3. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.03m OF THE GRADES AND ELEVATIONS INDICATED.
4. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.



LOG TANGLES DETAIL

N.T.S.

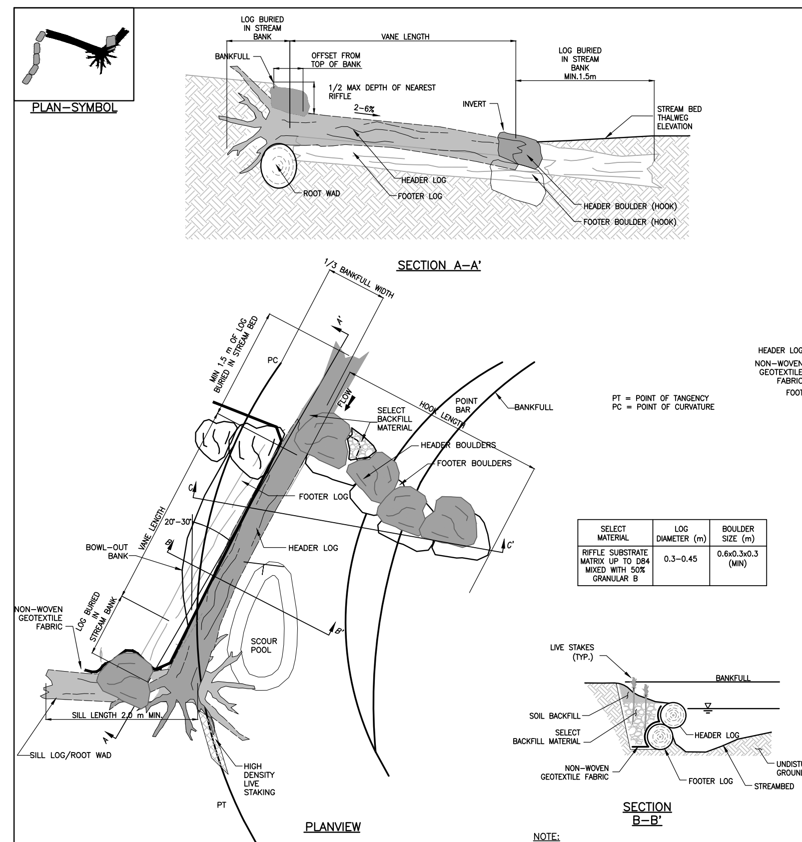


NOTE:
ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.

NOTE:
SECURE BLANKET BY STAKING AND OVERLAPPING AT THE SEAMS WITH A SHINGLE-TYPE METHOD. ADDITIONAL STAKING SHALL BE APPLIED AT NO ADDITIONAL COST IF THE BLANKET SEPARATES FROM THE SOIL MORE THAN 0.05m UNDER A REASONABLE PULL.

DETAIL – TYPICAL EROSION CONTROL BLANKET

N.T.S



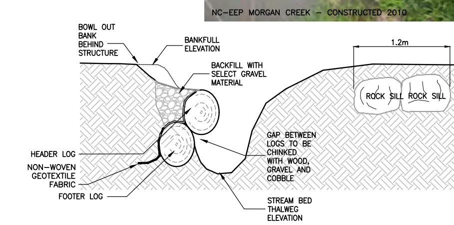
PT = POINT OF TANGENCY
PC = POINT OF CURVATURE

SELECT MATERIAL	LOG DIAMETER (m)	BOULDER SIZE (m)
RIFFLE SUBSTRATE MATRIX UP TO D84 MIXED WITH 50% GRANULAR B	0.3–0.45	0.6x0.3x0.3 (MIN)

NOTE:
THE DEPARTURE ANGLE SHOWN ABOVE IS DEPICTED IN SUCH A WAY TO EMPHASIZE DETAIL. ACTUAL DEPARTURE ANGLE AND STRUCTURE LOCATION SHALL BE AS SHOWN ON THE PLAN AND PROFILE SHEETS.

DETAIL – LOG J-HOOK / WITH ROOTWAD

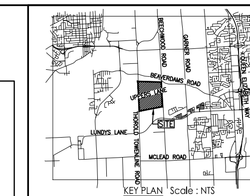
N.T.S



SECTION C-C'

NOTES:

1. LOGS SHALL HAVE MINIMUM DIAMETER AND MINIMUM LENGTH AS SHOWN IN THE TABLE.
2. ALL LOGS SHALL BE RELATIVELY STRAIGHT AND LIMBS SHALL BE TRIMMED FLUSH.
3. FOOTER LOGS/BOULDERS ARE LOGS/BOULDERS PLACED TO PROVIDE A FOUNDATION AND SCOUR PROTECTION FOR THE HEADER LOGS/BOULDERS.
4. HEADER LOGS/BOULDERS SHALL BE UNDERLAIN BY FOOTER LOGS/BOULDERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
5. HEADER LOGS ARE THE TOP MOST LOGS USED IN EACH LOG STRUCTURE. ALL HEADER LOGS CAN BE SEEN PROTRUDING FROM THE WATER SURFACE DURING EXTREMELY LOW FLOWS.
6. HEADER LOGS SHALL BE OFFSET SLIGHTLY DOWNSTREAM OF THE FOOTING LOGS WHERE SCOUR POOLS ARE ANTICIPATED TO FORM AS SHOWN IN THE DETAIL.
7. SILL LOGS SHALL BE PLACED PERPENDICULAR TO THE BANKFULL FLOW DIRECTION.
8. THE FOOTER LOGS SHALL EXTEND FROM THE SILL LOG TO THE END OF THE HEADER LOG TOWARD THE BANK.
9. HOOK BOULDERS SHALL EXTEND FROM THE HEADER LOG TO BEYOND BANKFULL WIDTH. SET INVERTS AT ELEVATION SHOWN ON THE PLAN AND PROFILE SHEETS. NO ELEVATIONS OF THE LOG DROPS STRUCTURE MAY VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTIONS FROM THE ENGINEER
10. HEADER LOG SHALL TIE INTO THE STREAM BANK AT A MAXIMUM ELEVATION OF 1/4 DMAX (MEASURED AT THE NEXT DOWNSTREAM RIFFLE) BELOW BANKFULL ELEVATION AND A MINIMUM ELEVATION OF 1/2 DMAX (MEASURED AT THE NEXT DOWNSTREAM RIFFLE) BELOW BANKFULL ELEVATION UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
11. CUTTING OF THE SILL LOG ROOTWAD MAY BE REQUIRED TO PREVENT THE ROOTWAD FROM PROTRUDING ABOVE THE BANKFULL ELEVATION.
12. ALL GAPS/VOIDS LARGER THAN 25mm BETWEEN THE HEADER AND FOOTING LOGS SHALL BE CHINKED WITH LIMBS AND/OR BRUSH ON THE UPSTREAM SIDE PRIOR TO PLACEMENT OF THE GEOTEXTILE.
13. ALL GAPS/VOIDS LARGER THAN 25mm BETWEEN THE HEADER AND FOOTING BOULDERS SHALL BE CHINKED WITH GRAVEL AND COBBLES.
14. ON THE UPSTREAM SIDE OF THE LOGS AND/OR BOULDERS NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED AS SHOWN IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL FOR THE ENTIRE LENGTH OF THE LOG AND BOULDER HOOK.
15. BACKFILL STRUCTURE WITH SELECT BACKFILL MATERIAL AS SHOWN AND DEFINED IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL.
16. SELECT BACKFILL AND SOIL BACKFILL MATERIAL SHALL BE COMPACTED SUCH THAT FUTURE SETTLEMENT OF THE MATERIAL IS KEPT TO A MINIMUM.
17. NAIL NON-WOVEN GEOTEXTILE TO EDGE OF HEADER LOG AND BACKFILL AS SHOWN IN THE GEOTEXTILE PLACEMENT AND SELECT BACKFILL DETAIL.
18. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.03m OF THE GRADES AND ELEVATIONS INDICATED.
19. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
20. SEE THE PLANTING TABLE FOR DETAILS ON HIGH DENSITY LIVE STAKING.
21. NO LIVE STAKES SHALL BE INSTALLED ON THE UPSTREAM SIDE OF THE LOG VANE AT OR BELOW THE TIE-IN ELEVATION OF THE HEADER LOG WITH THE STREAM BANK UNLESS OTHERWISE DIRECTED BY THE ENGINEER.



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

	Revision	By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-500DT.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

Title

TYPICAL DETAILS

Project No. 160960948

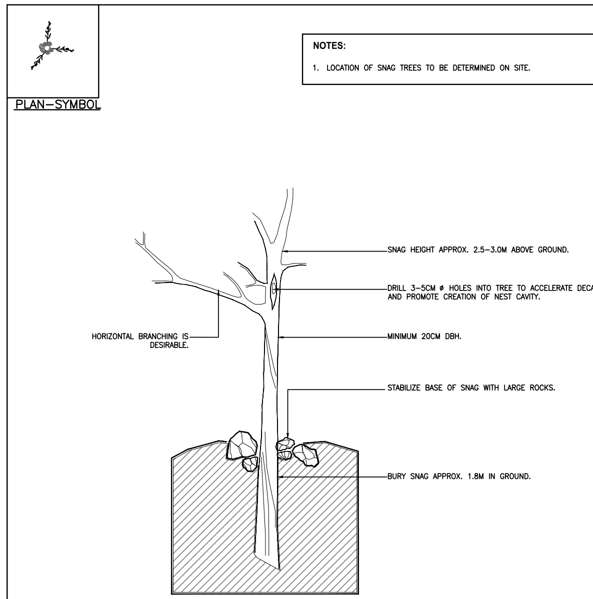
Scale

Revision 7

Sheet 16 of 32

Drawing No. **C-502**

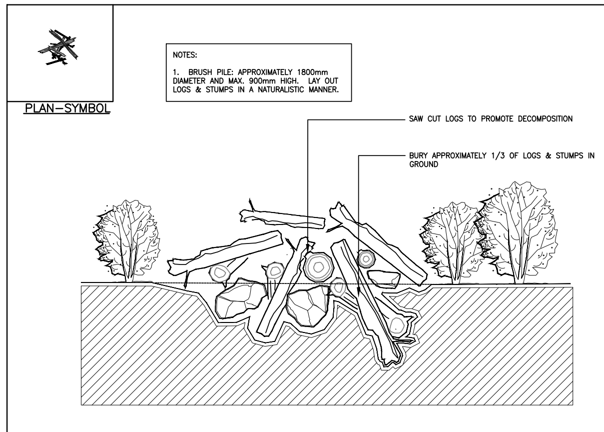
ORIGINAL SHEET - ARCH D



NOTES:

1. LOCATION OF SNAG TREES TO BE DETERMINED ON SITE.

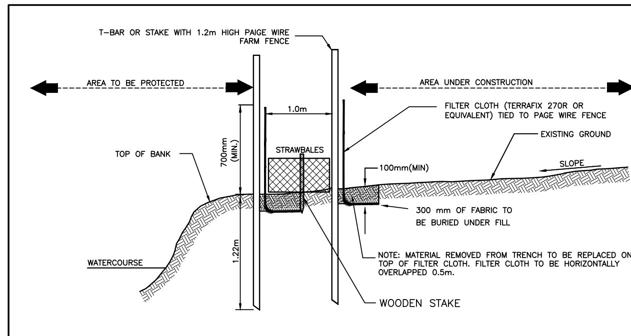
SNAG TREE DETAIL
N.T.S.



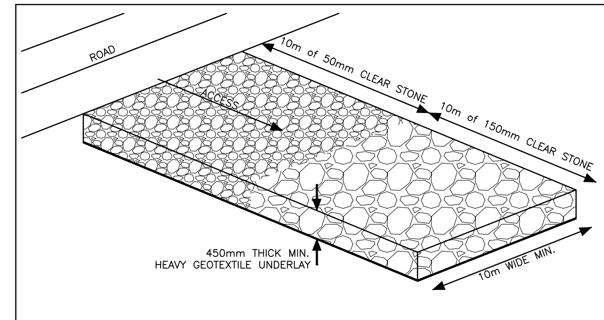
NOTES:

1. BRUSH PILE: APPROXIMATELY 1800mm DIAMETER AND MAX. 900mm HIGH. LAY OUT LOGS & STUMPS IN A NATURALISTIC MANNER.

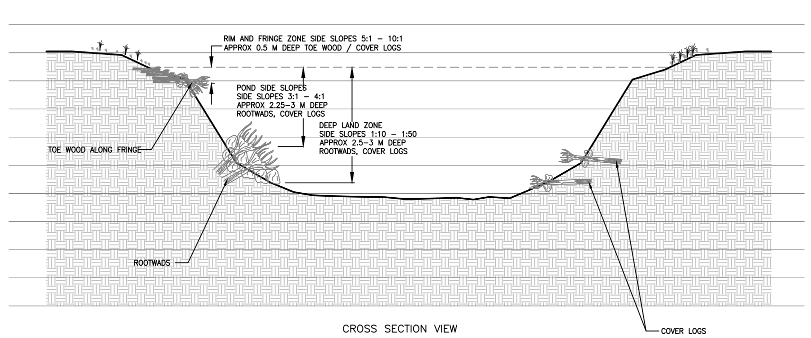
BRUSH PILE DETAIL
N.T.S.



REINFORCED DOUBLE ROW OF SILT FENCE
NTS



CONSTRUCTION ENTRANCE DETAIL
NOT TO SCALE



NOTES:

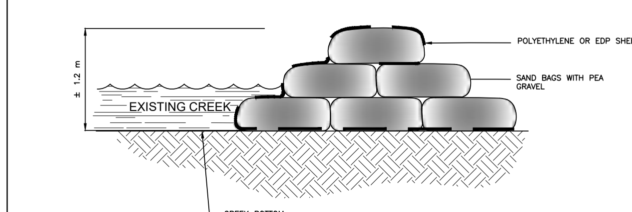
DETAIL INTENDED AS A GUIDE FOR A TYPICAL POND CROSS–SECTION. EACH POND IS UNIQUE IN SIZE, DEPTH AND SHAPE. THE TYPES OF HABITAT STRUCTURES ARE THE SAME FOR EACH POND AND INSTALLED THE SAME. THE POND STRUCTURES HAVE FLEXIBILITY FOR INTERPRETATION, THESE ARE LOW RISK STRUCTURES FOR FAILURE, THEY ARE MEANT TO INCREASE THE BIO–DIVERSITY OF THE POND AND PROVIDE COVER FOR AQUATIC HABITAT. STRUCTURE PLACEMENT AND QUANTITY SHALL BE ADVISED BY QUALIFIED PROFESSIONAL.

MIX LAYERS OF TOPSOIL ON TOP OF COARSE WOODY DEBRIS. WOODY DEBRIS TO BE INSTALLED IN THE RIM/FRINGE AREA OF THE PONDS. SEE TOE WOOD DETAIL FOR INSTALLATION STRUCTURES.

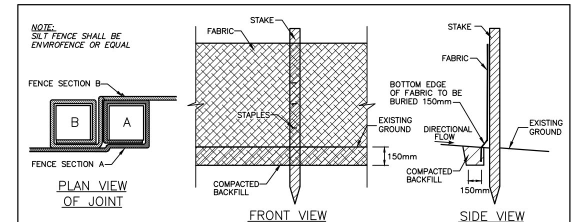
COVER LOGS TO BE INSTALLED IN POND SIDE SLOPE AREA, DEEP LAND ZONE AND DEEP WATER ZONE. LOGS CAN BE ANY RANGE IN SIZE TO FIT THE LIMIT OF AVAILABLE WOOD ON SITE. BOULDERS SHALL BE LARGE ENOUGH TO HOLD WOOD IN PLACE AS ANCHORS TO THE LOGS. LOGS SHALL BE BURIED INTO BANK OF PONDS A MIN 2–3m PER DETAILS. COVER LOGS TO BE INSTALLED AT RANDOM IN THE DIFFERENT ZONES FOR MAXIMUM HABITAT. CONTRACTOR SHALL BE ADVISED ON PLACEMENT AND QUANTITY BY QUALIFIED PROFESSIONAL.

ROOTWADS INSTALLED IN THE DEEP LAND ZONE AND DEEP WATER ZONE SHALL BE INSTALLED WITH ROOT FAN FACING OUTWARDS. ROOTWADS SHALL BE EXPOSED AT THE BANK SURFACE OF THE POND FOR HABITAT FUNCTION WITH LOG OF THE ROOTWAD BURIED INTO THE SURFACE OF THE GROUND. LARGE BOULDERS SHALL BE USED TO ANCHOR ROOTWADS DOWN. ROOTWADS TO BE INSTALLED AT RANDOM. CONTRACTOR SHALL BE ADVISED ON PLACEMENT AND QUANTITY BY QUALIFIED PROFESSIONAL.

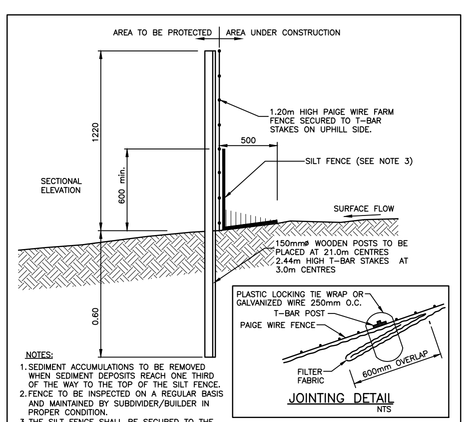
DETAIL – TYPICAL RIPARIAN WETLAND (TYP.)
N.T.S



COFFER DAM WITH IMPERMEABLE LINER
N.T.S



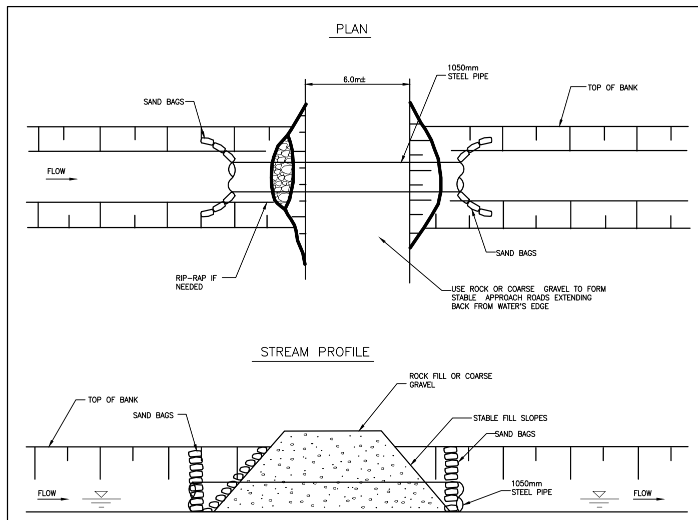
SILT FENCE DETAILS
NTS



NOTES:

1. SEDIMENT ACCUMULATIONS TO BE REMOVED WHEN SEDIMENT DEPOSITS REACH ONE THIRD OF THE WAY TO THE TOP OF THE SILT FENCE.
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION.
3. THE SILT FENCE SHALL BE SECURED TO THE PAIGE WIRE FENCE WITH GALVANIZED WIRE. (SEE JOINTING DETAIL)

HEAVY DUTY SILT FENCE DETAIL
NTS



TEMPORARY VEHICLE CROSSING

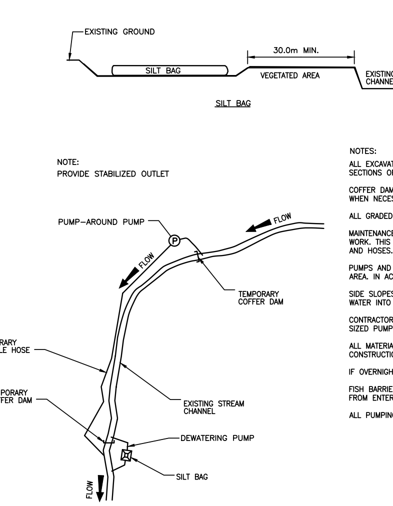
THERE WILL BE NO FORDING OF A FLOWING STREAM DURING CONSTRUCTION. TEMPORARY VEHICLE CROSSING WILL BE INSTALLED AS NECESSARY. THE FOLLOWING SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES WILL BE FOLLOWED AT ALL TEMPORARY BRIDGES:

1. INSTALL THE CROSSING IN A MANNER THAT WILL MINIMIZE SEDIMENT ENTERING THE WATER. FILL FOR THE TEMPORARY ROAD IS TO BE COARSE GRANULAR OR ROCK FILL MATERIAL.
2. THE ROAD APPROACH LEADING TO THE TEMPORARY CROSSING MUST BE RAISED AND STABLE. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO KEEP SEDIMENT ON LAND (E.G. CHECK DAMS, FILTER CLOTH, ANGULAR RIP RAP, SEED AND MULCH, SEDIMENT TRAPS, ETC.).
3. WHILE THE TEMPORARY CROSSING IN USE, ANY BUILD–UP OF MUD ON THE ROAD SURFACE OR APPROACHES THAT IS AFFECTING WATER QUALITY IS TO BE SCRAPED OFF AND DISPOSED OF IN AN APPROVED LOCATION.
4. WHEN THE TEMPORARY CROSSING IS NO LONGER REQUIRED, IT IS TO BE REMOVED AS QUICKLY AS POSSIBLE. REMOVAL SHALL NOT OCCUR OUTSIDE CONSTRUCTION WINDOWS AS IDENTIFIED ON THE WORK PERMIT WITHOUT PRIOR WRITTEN APPROVAL FROM DFO. SURPLUS GRAVEL IS TO BE REMOVED FROM THE CROSSING AREA AND DISPOSED OF IN A LOCATION APPROVED BY THE CLIENT AND DFO. THE CREEK BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL PER PLANTING PLAN AND DETAIL C–501–2 (TYPICAL MATTING DETAIL).
5. ALTERNATE METHODS OF CROSSING MAY BE CONSIDERED WITH PRIOR APPROVAL FROM THE ENGINEER.

TEMPORARY VEHICLE CROSSING PLAN
N.T.S

SEQUENCE OF CONSTRUCTION FOR TYPICAL WORK AREA

1. INSTALL SILT BAGS AS REQUIRED.
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM COFFER DAM AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION OR AS OUTLINED IN THE APPROVED WATER MANAGEMENT PLAN
4. PLACE DOWNSTREAM COFFER DAM AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA. AREA TO BE DEWATERED SHALL BE EQUAL TO ONE DAY'S WORK OR AS OUTLINED IN THE APPROVED WATER MANAGEMENT PLAN.
5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF COFFER DAMS. REMOVE COFFER DAMS, PUMPS, AND TEMPORARY FLEXIBLE HOSE. (DOWNSTREAM COFFER DAMS FIRST).
7. ALL GRADING AND STABILIZATION MUST BE COMPLETED IN ONE DAY WITHIN THE PUMP AROUND AREAS BETWEEN THE COFFER DAMS. THE COFFER DAM LOCATIONS AS SHOWN ON THIS SHEET ONLY SHOW THE UPPER AND LOWER EXTENT OF WORK FOR EACH STREAM SEGMENT. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE COFFER DAM(S) FOR EACH DAY'S WORK.
8. REMOVE SILT BAGS AND STABILIZE BASE AREA.
9. STABILIZE DISTURBED AREA WITH SEED AND MULCH.



NOTES:

ALL EXCAVATION SHALL BE PERFORMED IN ONLY DRY OR ISOLATED SECTIONS OF CHANNEL.

COFFER DAMS ARE TO BE USED TO ISOLATE WORK FROM STREAM FLOW WHEN NECESSARY.

ALL GRADED AREAS SHALL BE STABILIZED WITHIN 24 HOURS.

MAINTENANCE OF STREAM FLOW OPERATIONS SHALL BE INCIDENTAL TO THE WORK. THIS INCLUDES POLYETHYLENE SHEETING, DIVERSION PIPES, PUMPS AND HOSES.

PUMPS AND HOSES SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. IN ACCORDANCE WITH THE PERMIT TO TAKE WATER

SIDE SLOPES OF RESTORED CHANNEL SHALL BE MATTED PRIOR TO TURNING WATER INTO CHANNEL. SEE TYPICAL MATTING LOCATION DETAIL.

CONTRACTOR IS RESPONSIBLE FOR DETERMINING & ACQUIRING THE PROPER SIZED PUMP.

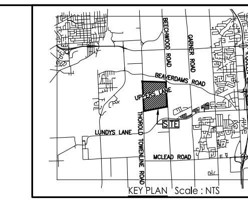
ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.

IF OVERNIGHT PUMPING IS REQUIRED NOISE BY–LAWS MUST BE OBSERVED.

FISH BARRIER NETS MUST BE ERECTED AND MAINTAINED TO PREVENT FISH FROM ENTERING THE WORKING AREA OF THE CHANNEL

ALL PUMPING TO CONFORM TO MOE PTTW

PUMP AROUND OPERATION
N.T.S



KEY PLAN Scale : NTS

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-500DT.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

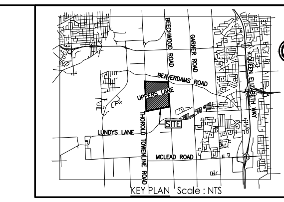
Title

TYPICAL DETAILS

Project No.	Scale
160960948	

Revision	Sheet	Drawing No.
7	17 of 32	C-503

ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

JUTE MATTING

STRAW MATTING

RIP-RAP ROCK PROTECTION
(R-50 PER OPSS.MUNI 1004)

Revision		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-600EC.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMIRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

SEDIMENT AND EROSION
CONTROL PLAN
SOUTH

Project No. 160960948

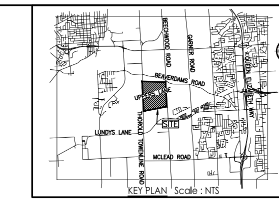
Scale 1:750 0 7.5 22.5 37.5m

Revision 7

Sheet 18 of 32

Drawing No. **C-600**

ORIGINAL SHEET - ARCH D



N

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

JUTE MATTING

STRAW MATTING

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-600EC.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

SEDIMENT AND EROSION
CONTROL PLAN
CENTRAL

Project No.
160960948

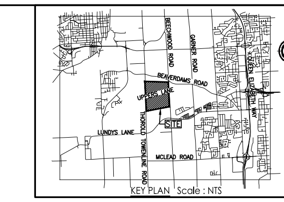
Scale
1:750
0 7.5 22.5 37.5m

Revision 5

Sheet 19 of 32

Drawing No.
C-601

ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

JUTE MATTING

STRAW MATTING

		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-600EC.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

SEDIMENT AND EROSION
CONTROL PLAN
NORTH

Project No. 160960948

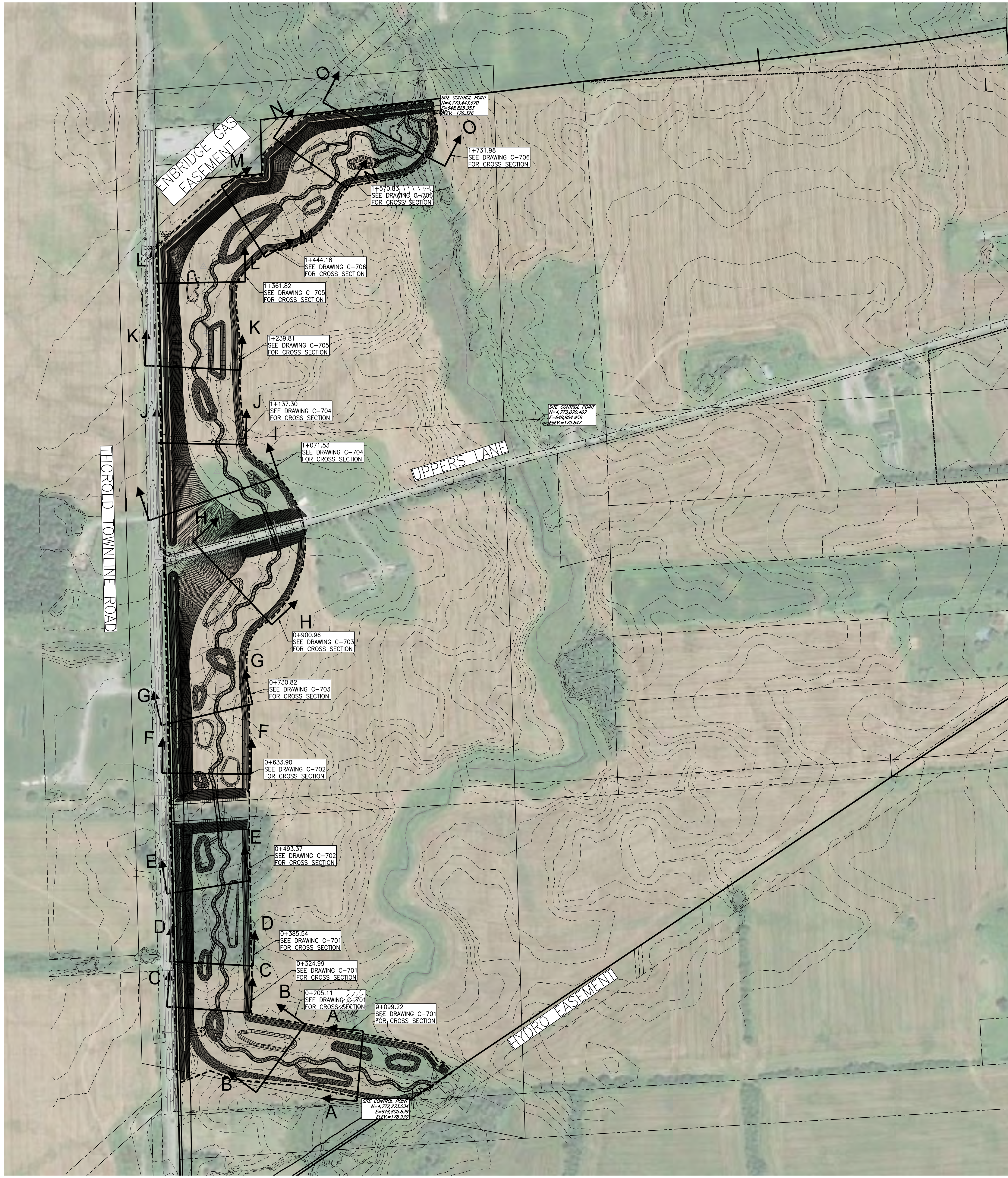
Scale 1:750 0 7.5 22.5 37.5m

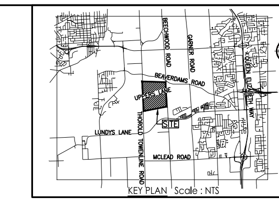
Revision 7

Sheet 20 of 32

Drawing No. C-602

ORIGINAL SHEET - ARCH D





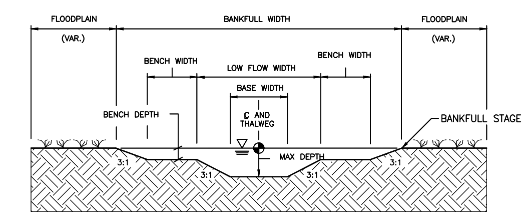
Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

DIMENSION	LENGTH (m)
BANKFULL WIDTH	4.00
BASE WIDTH	0.60
MAXIMUM DEPTH	0.50
BENCH DEPTH	0.20
LOW FLOW WIDTH	2.40
BENCH WIDTH	0.20



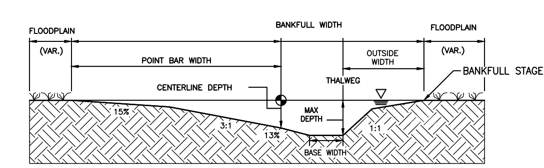
NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED
– RIFFLE BANKS TO BE STABLISED WITH COIR MATTING PER DETAIL.

TYPICAL SECTION – RIFFLE

N.T.S

MIRROR ABOUT CENTERLINE FOR POOL LEFT

DIMENSION	LENGTH (m)
BANKFULL WIDTH	4.30
POINT BAR WIDTH	2.20
MAX DEPTH (THALWEG)	0.85
BASE WIDTH	0.20
CENTERLINE DEPTH	0.44
OUTSIDE WIDTH	0.75



THALWEG (DEEPEST POINT IN A CROSS SECTION) IS LOCATED OUTSIDE 1/3 OF BANKFULL CHANNEL.

NOTES: – ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
– ⊕ – GRADE POINT IS THE CENTERLINE OF THE STREAM
– ALL SHARP CORNERS SHOULD BE ROUNDED
– OUTSIDE OF THE MEANDER BEND WILL BE TREATED WITH WOODY DEBRIS TOE PROTECTION

TYPICAL SECTION – POOL RIGHT

N.T.S

RIFFLE SUBSTRATE	
MATRIX GRADATION	DIAMETER (mm)
D_{16}	5
D_{35}	25
D_{50}	50
D_{84}	80
D_{100}	100

THE RIFFLE SUBSTRATE MATRIX SHALL BE PREPARED BY MIXING OR PLACING IN LAYERS SUCH THAT THE SMALLER MATERIAL FILLS THE VOIDS BETWEEN THE LARGER MATERIAL. RIFFLE SUBSTRATE SHALL BE PLACED 0.20m THICK AT RIFFLES.

TABLE 2	
GLIDE MATRIX	WELL GRADED SAND & GRAVEL 1–65mmø

THE GLIDE MATRIX SHALL BE PLACED IN A 0.20m DEEP LAYER AT EACH GLIDE TO PROVIDE SPAWNING HABITAT.

CULVERT SUBSTRATE	
PERCENT OF MIX (%)	MIX
80	WB350, OPSS.PROV 1005
20	RIFFLE SUBSTRATE

VALLEY BERM ROCK PROTECTION	
PERCENT OF MIX (%)	MIX
100	R-50 RIP-RAP OPSS.MINI 1005

Revision		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-700CS.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

TYPICAL CROSS SECTIONS

Project No. 160960948

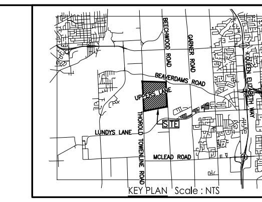
Scale 1:2500

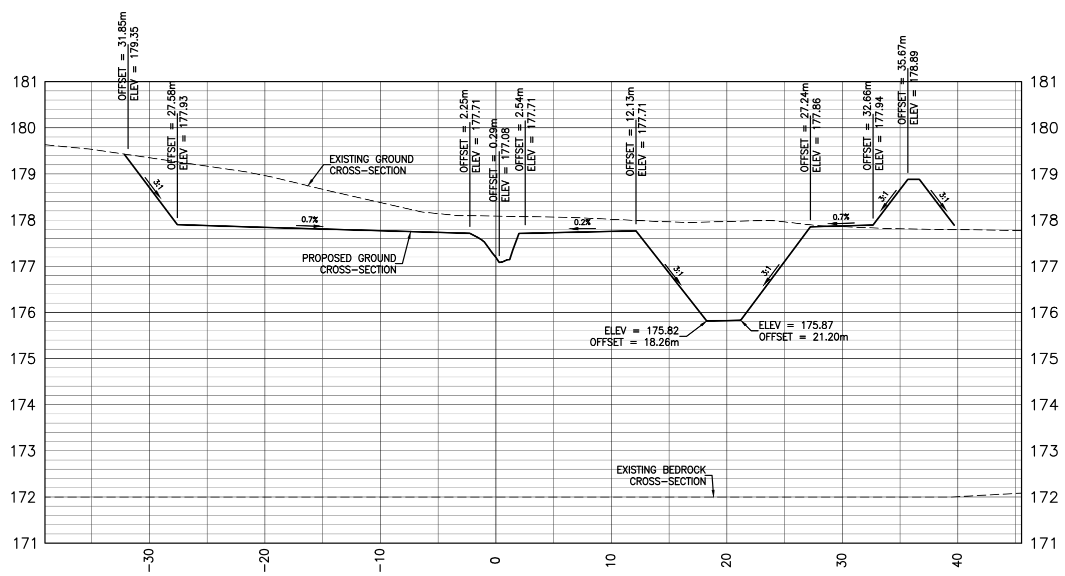
Revision 7

Sheet 21 of 32

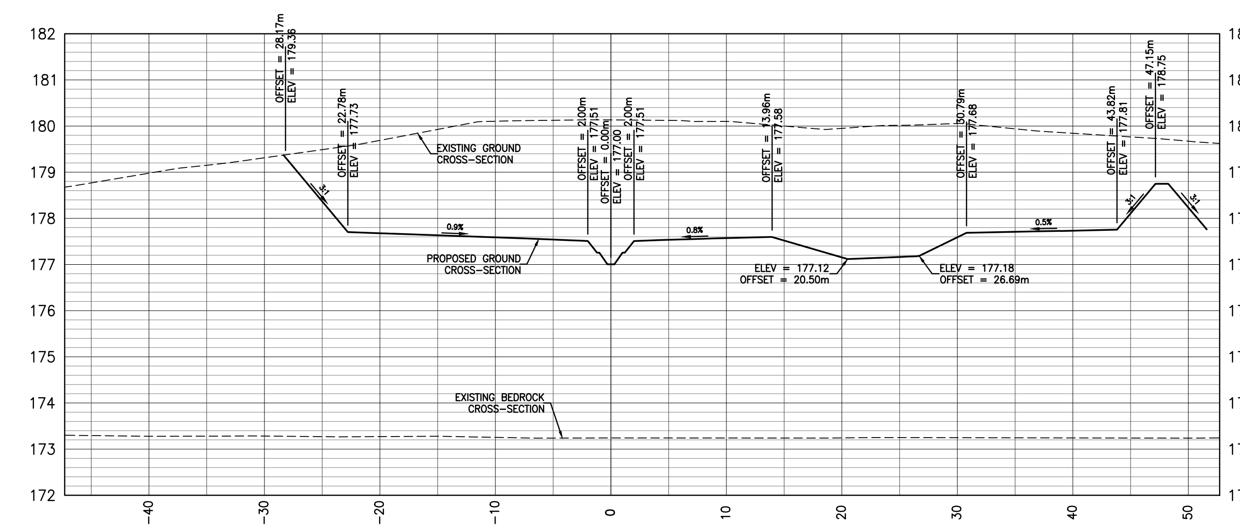
Drawing No. C-700

ORIGINAL SHEET - ARCH D



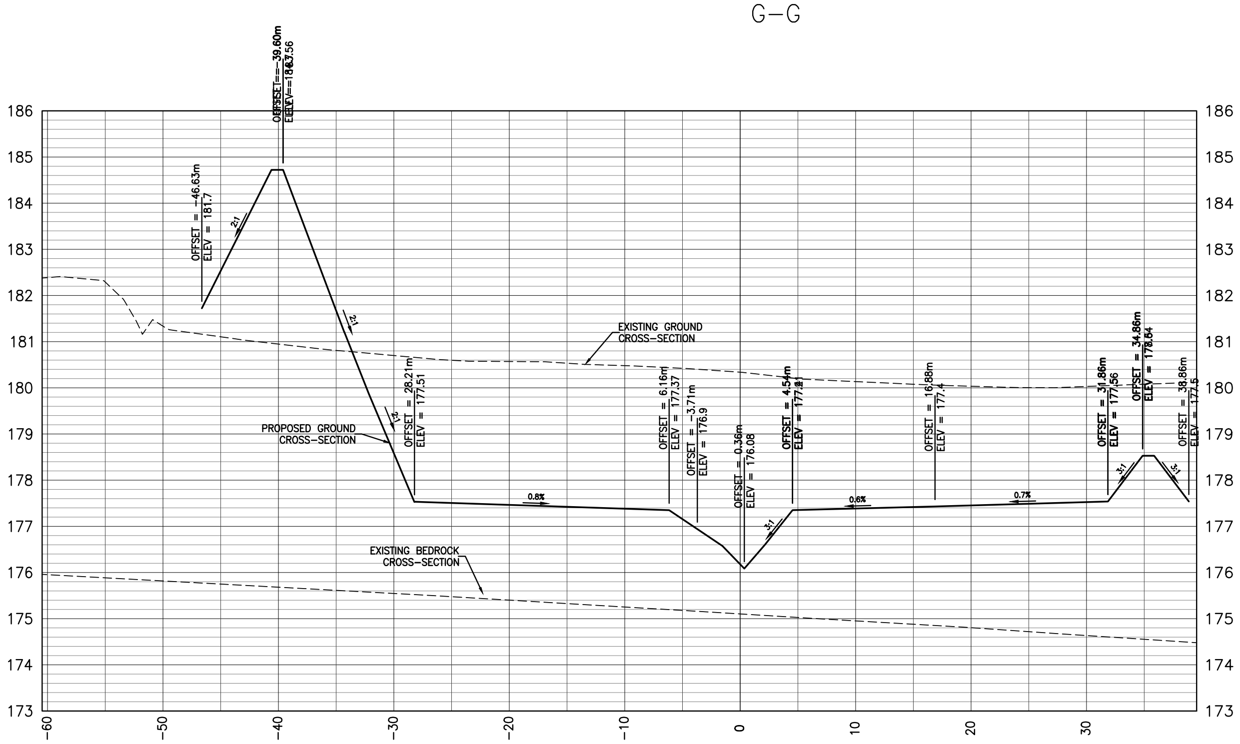


STA 0+099.22
A–A

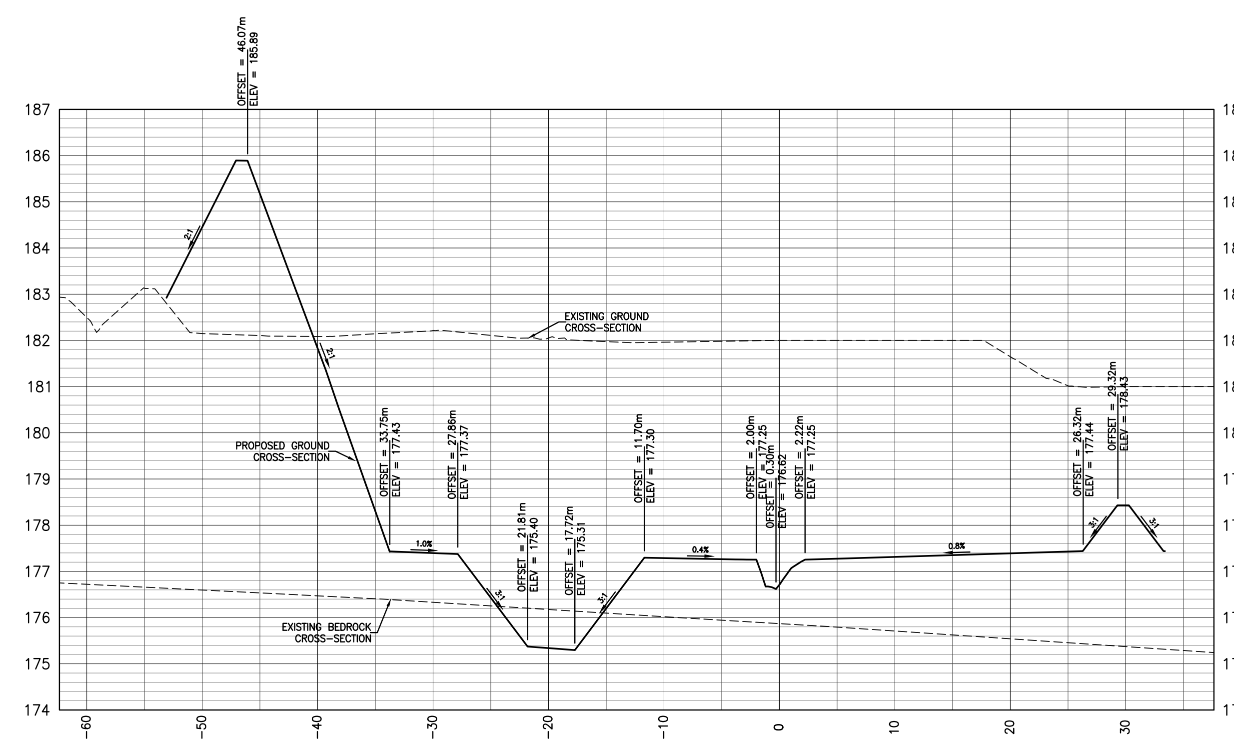


STA 0+205.11
B–B

G–G



STA 0+324.99
C–C



STA 0+385.54
D–D

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

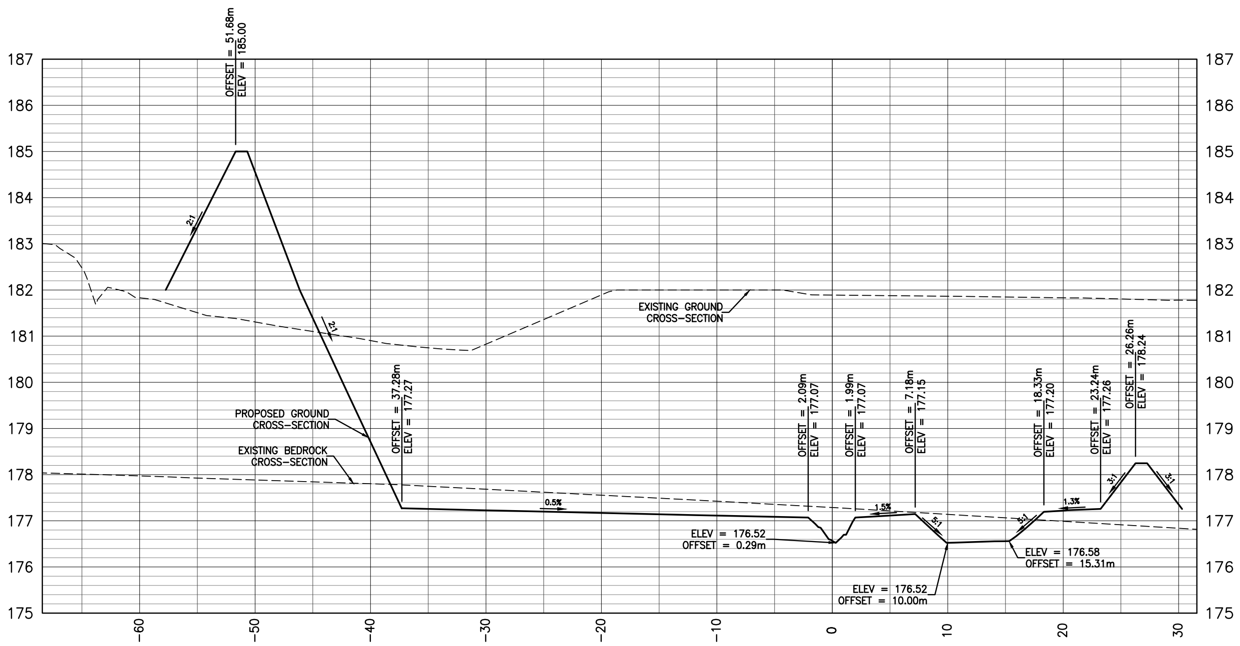
Title

CROSS- SECTIONS
A-A, B-B, C-C, AND D-D

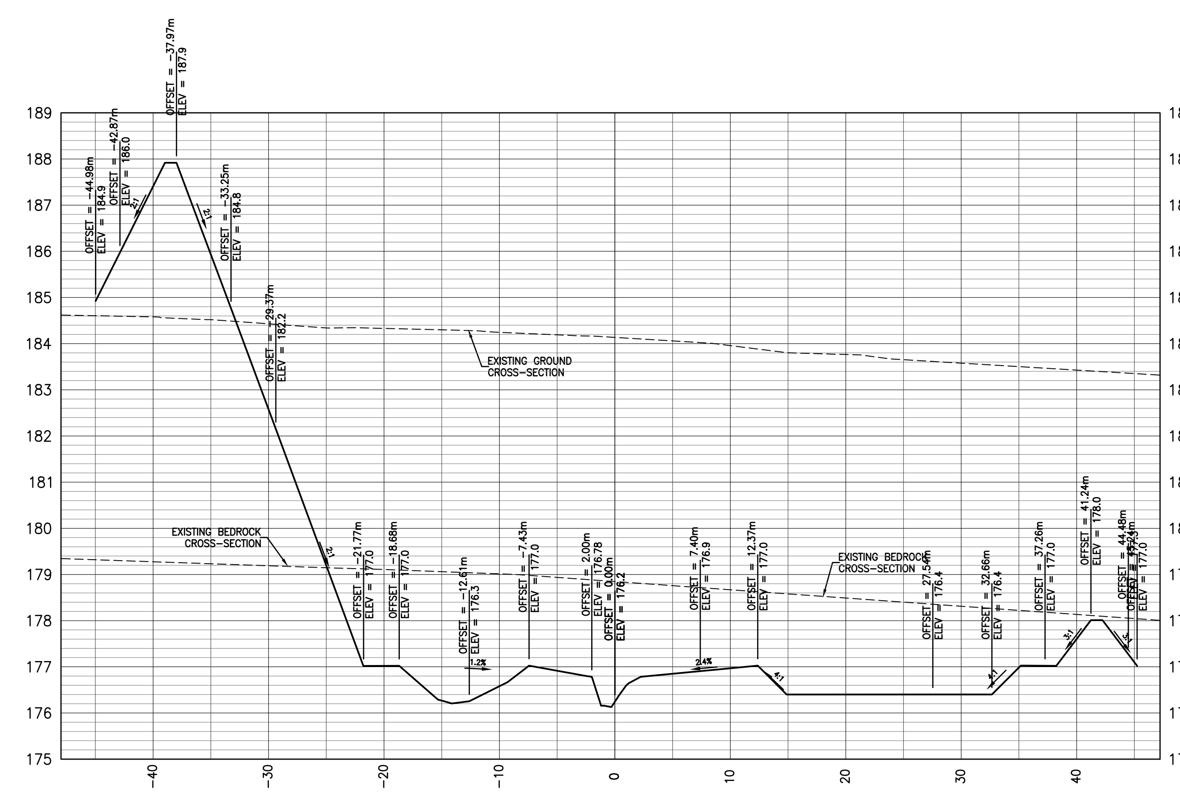
Project No. 160960948
Scale 1:300H 1:75V

Revision 5
Sheet 22 of 32
Drawing No. C-701

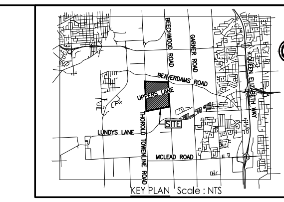
ORIGINAL SHEET - ARCH D



STA 0+493.37
E–E



STA 0+633.93
F–F



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

Revision		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name: 160960948_C-700CS.dwg	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
	RJB	HA	HA	21.11.18

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

CROSS SECTIONS
E-E AND F-F

Project No. 160960948

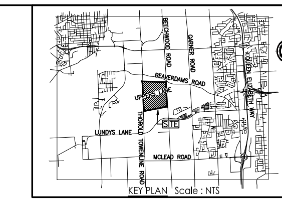
Scale 1:300H 1:75V

Revision 7

Sheet 23 of 32

Drawing No. **C-702**

ORIGINAL SHEET - ARCH D

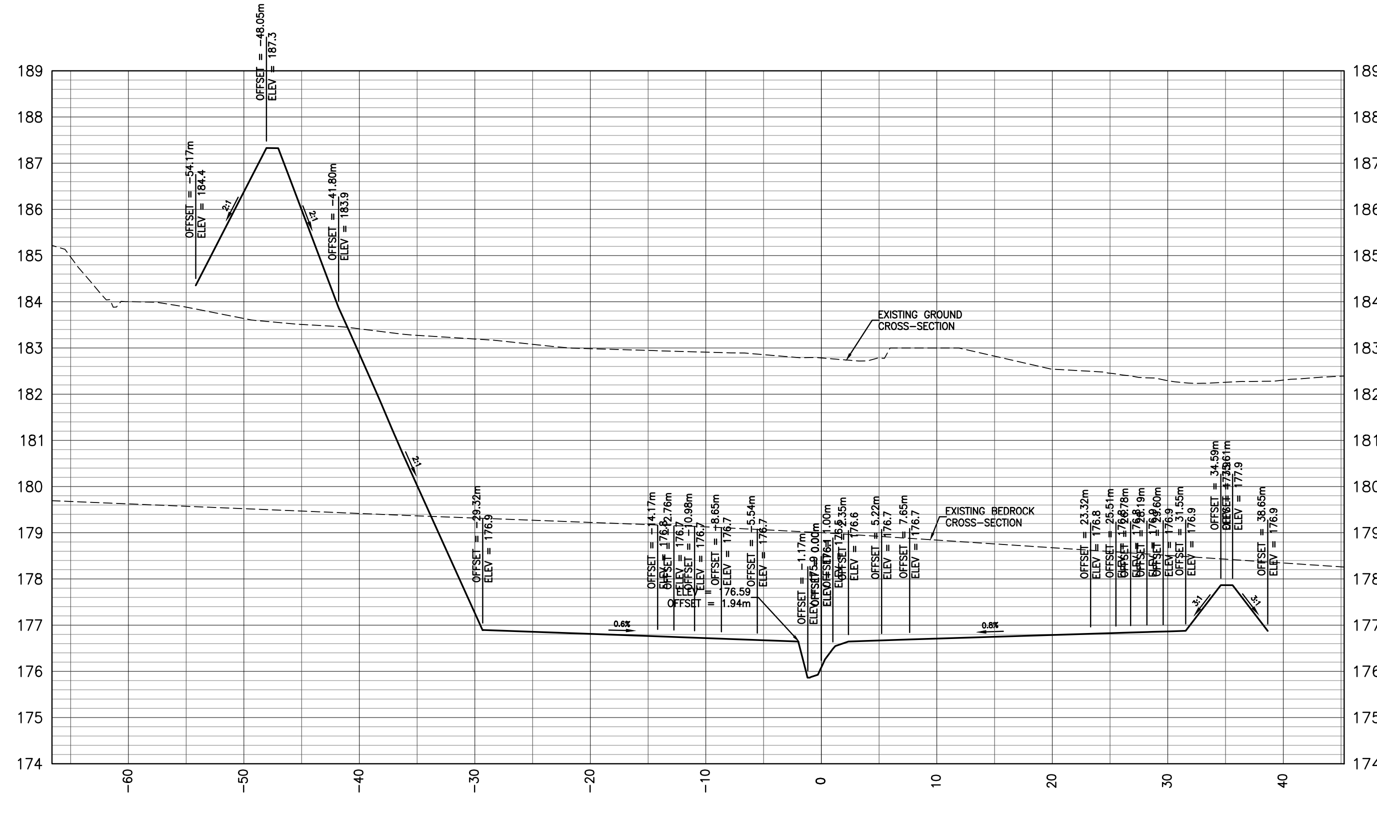


Stantec

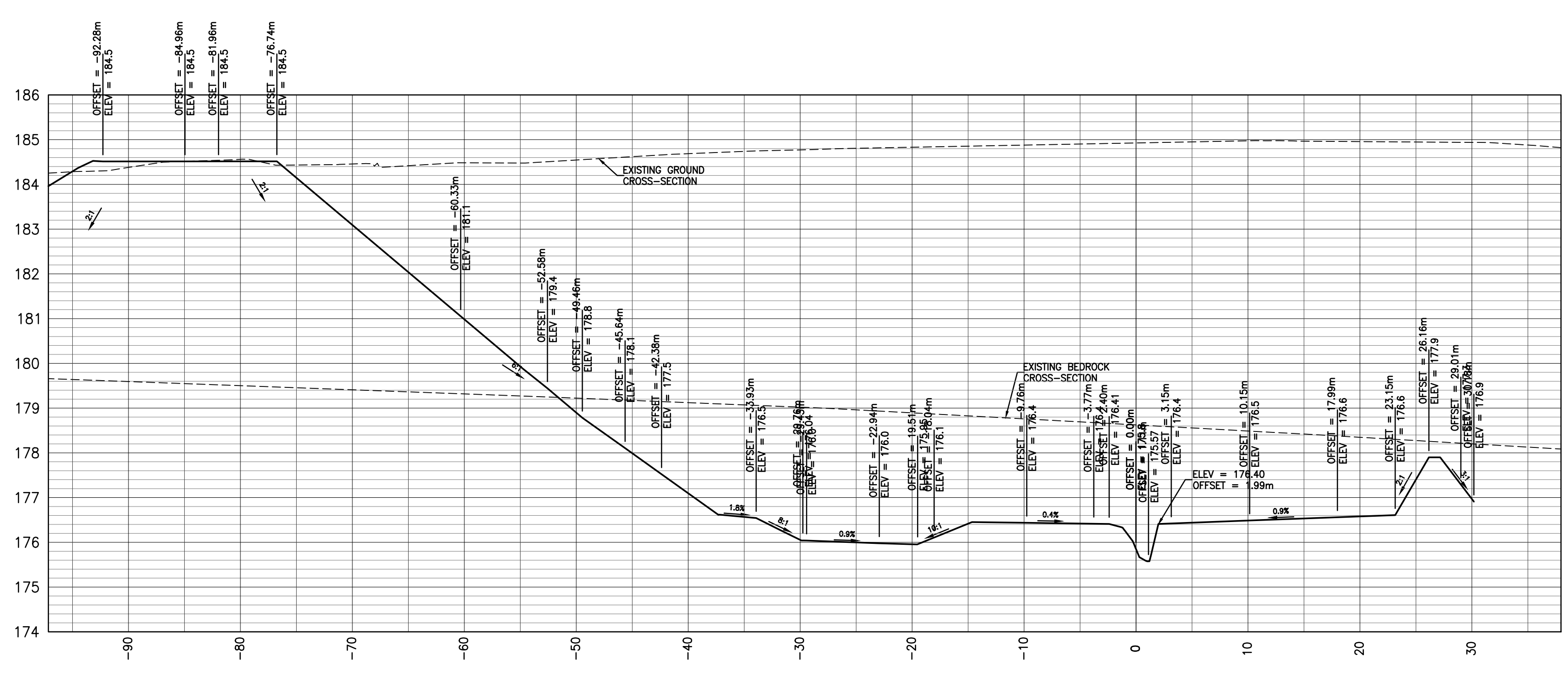
Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.



STA 0+716.32
G-G



STA 0+886.30
H-H

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

CROSS SECTION
G-G AND H-H

Project No. 160960948

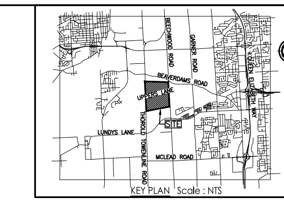
Scale 1:300H 1:75V

Revision 7

Sheet 24 of 32

Drawing No. **C-703**

ORIGINAL SHEET - ARCH D

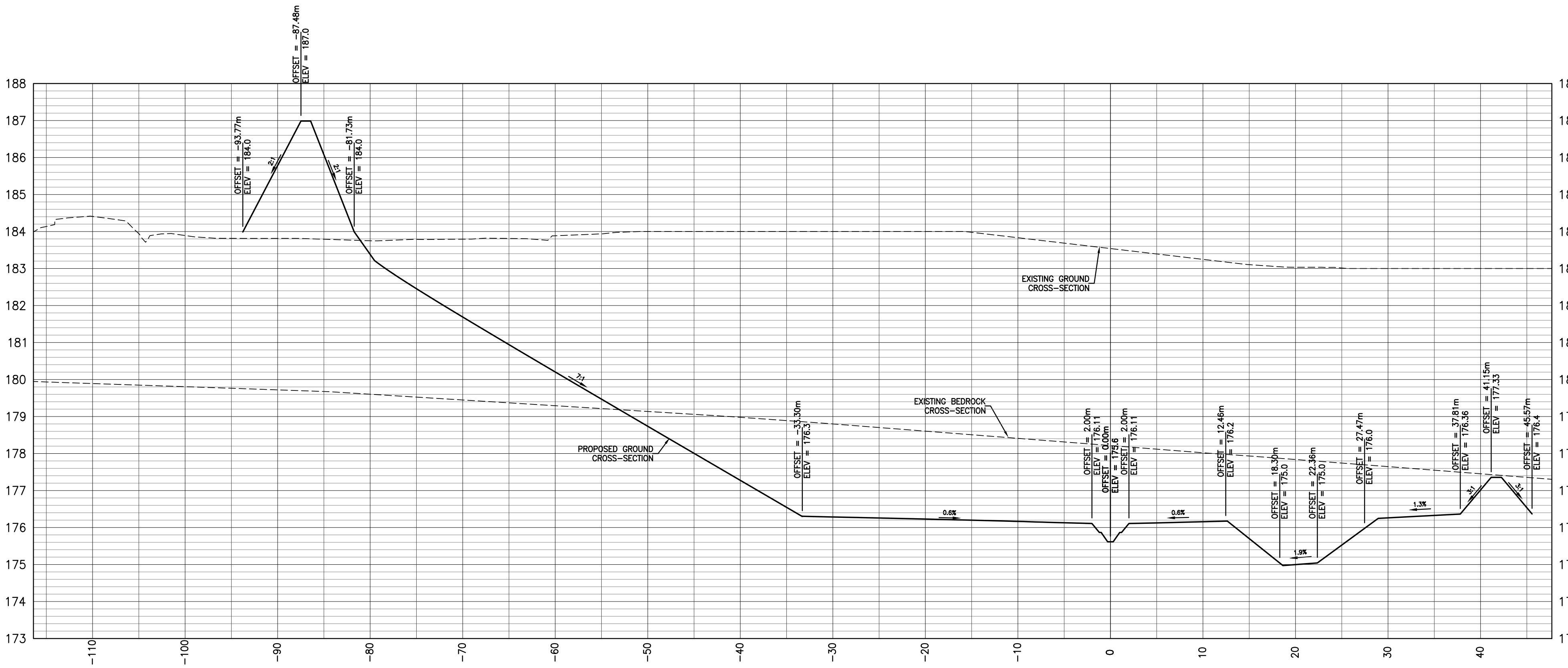


Stantec

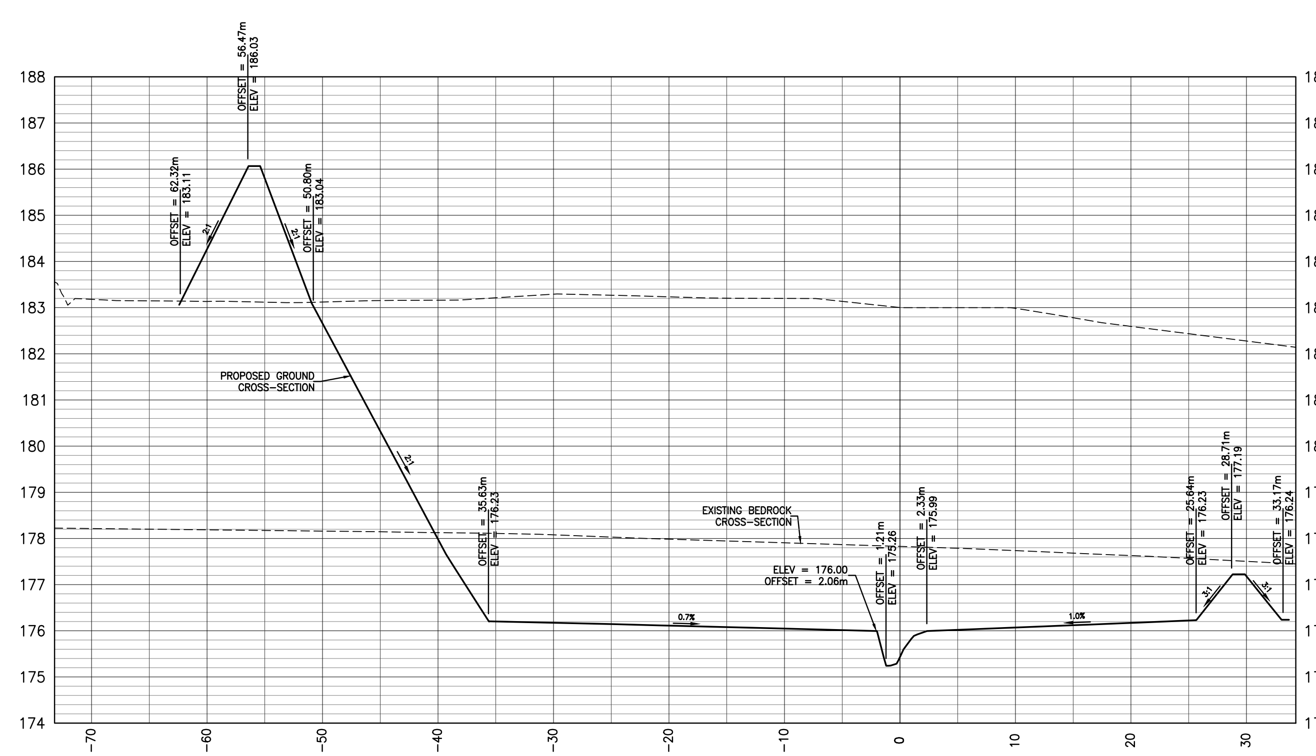
Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.



STA 1+056.99
I–I



STA 1+122.65
J–J

Revision		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

File Name:	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD
160960948_C-700CS.dwg	RJB	HA	HA	21.11.18

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

CROSS-SECTIONS
I-I AND J-J

Project No. 160960948

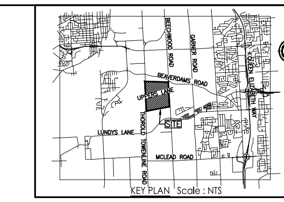
Scale 1:300H 1:75V (0, 3, 9, 15m / 0, 0.75, 2.25, 3.75m)

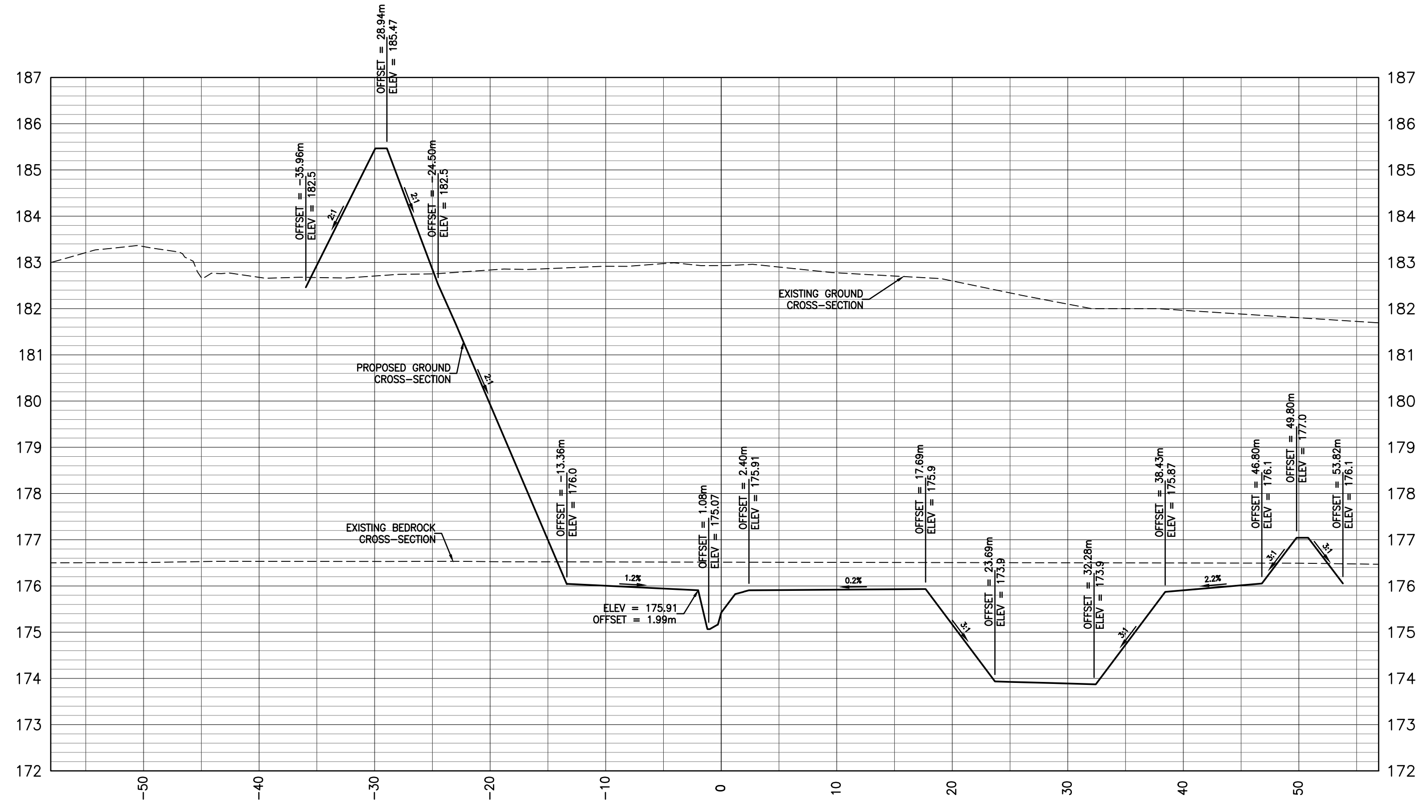
Revision 7

Sheet 25 of 32

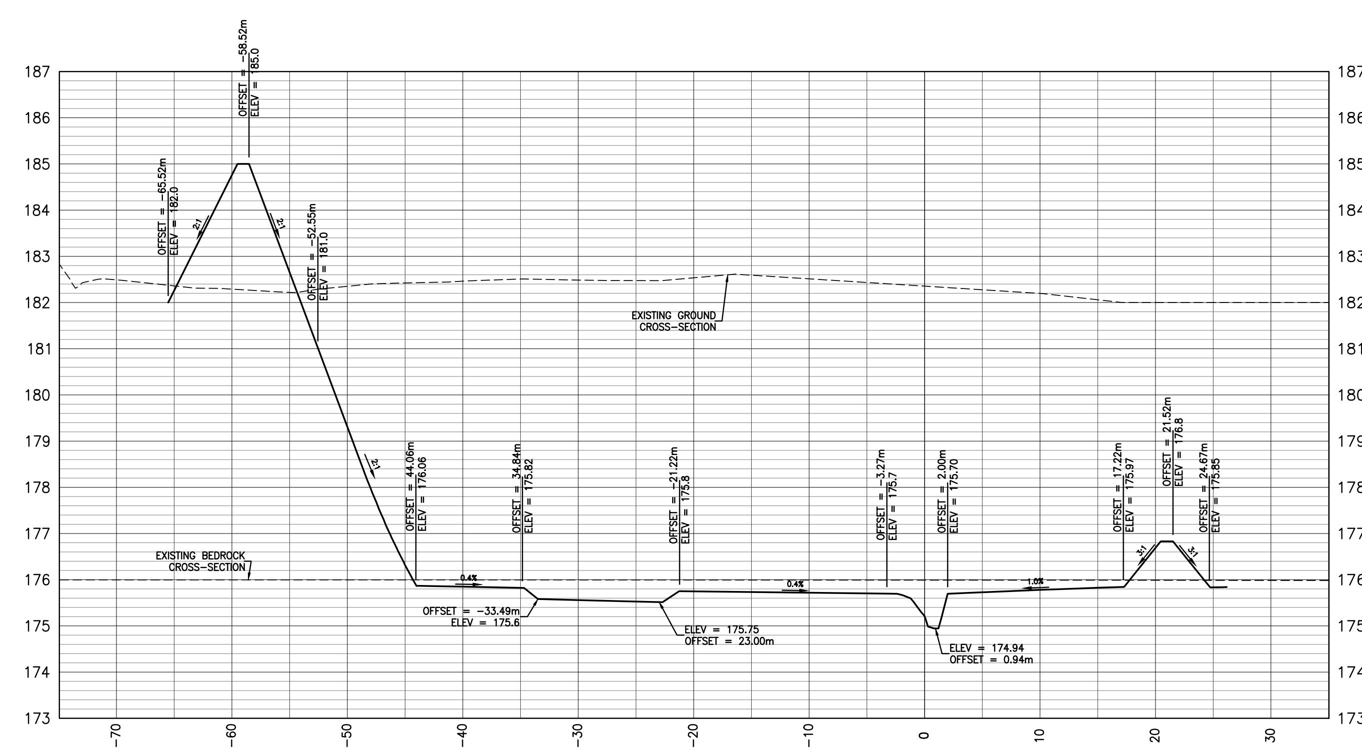
Drawing No. **C-704**

ORIGINAL SHEET - ARCH D





STA 1+225.21
K–K



STA 1+347.28
L–L

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18
Revision		By	Appd	YYYY.MM.DD

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

LICENSED PROFESSIONAL ENGINEER
NOVEMBER 18, 2021
H.E. AMRAULT
100116290
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title

CROSS-SECTION
K-K AND L-L

Project No. 160960948

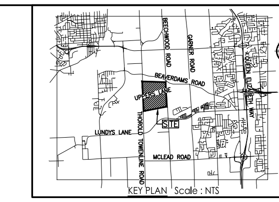
Scale 1:300H 1:75V

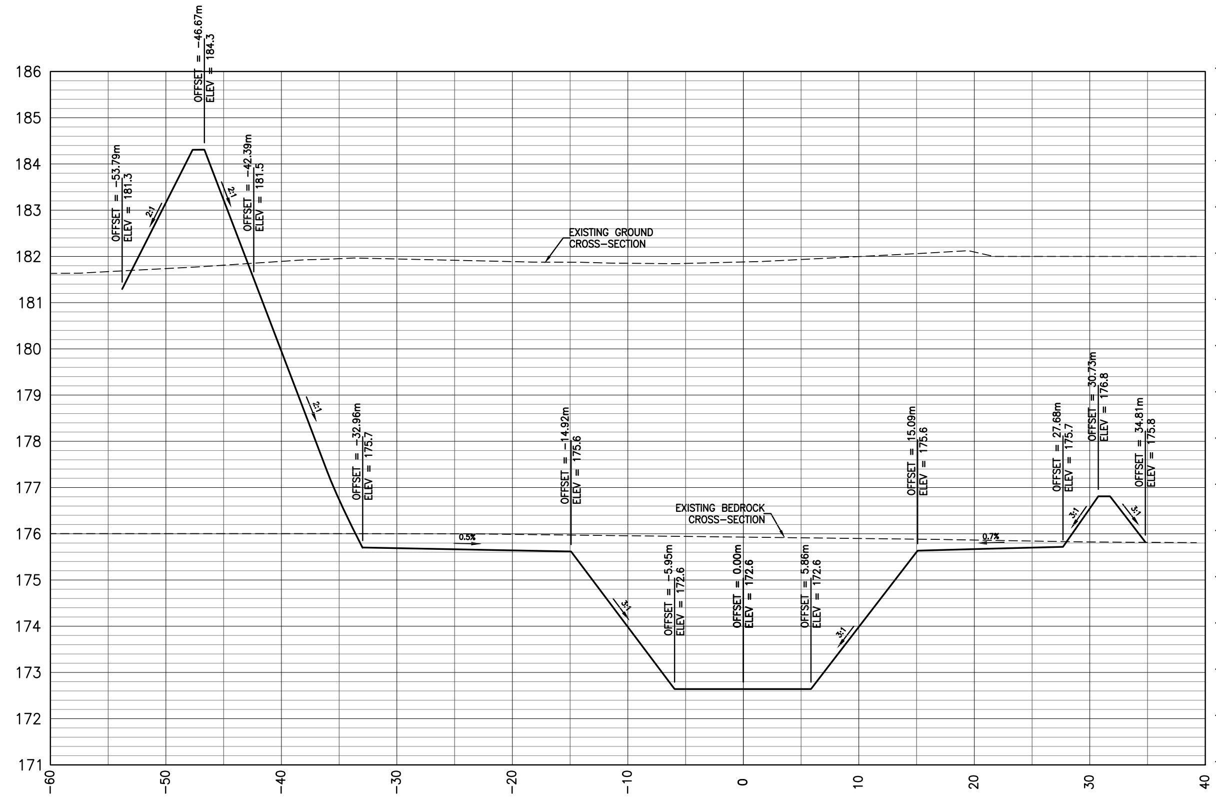
Revision 7

Sheet 26 of 32

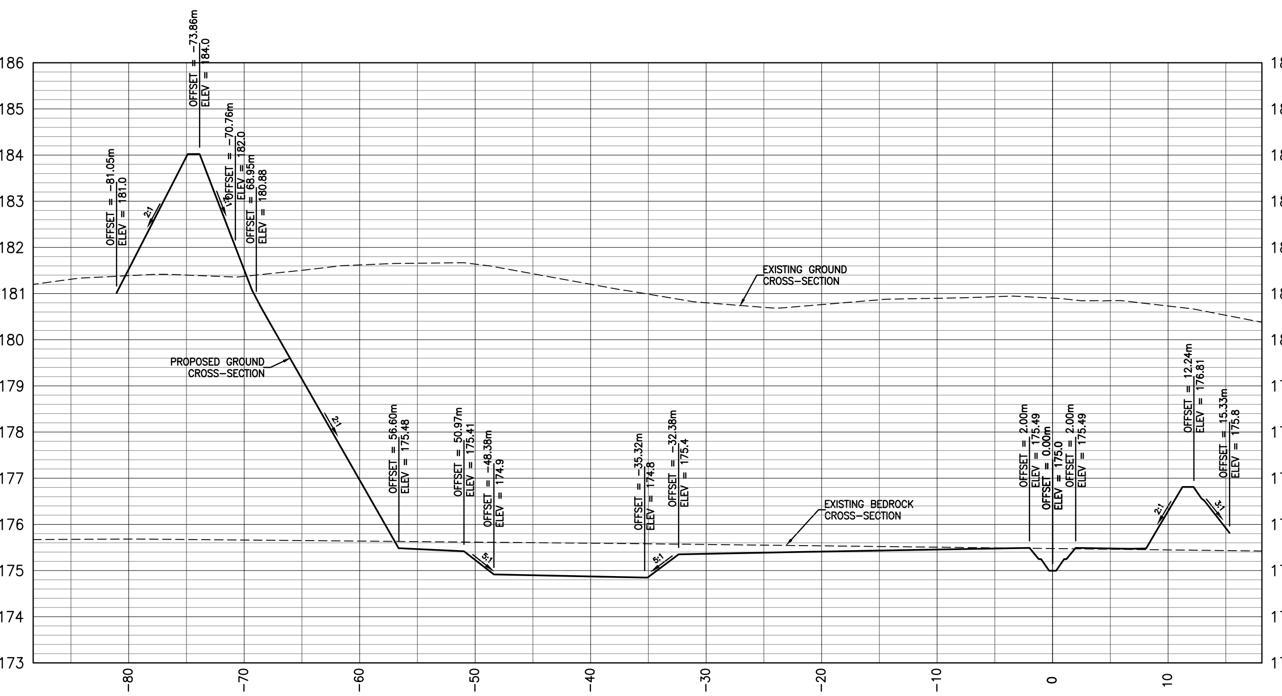
Drawing No. C-705

ORIGINAL SHEET - ARCH D

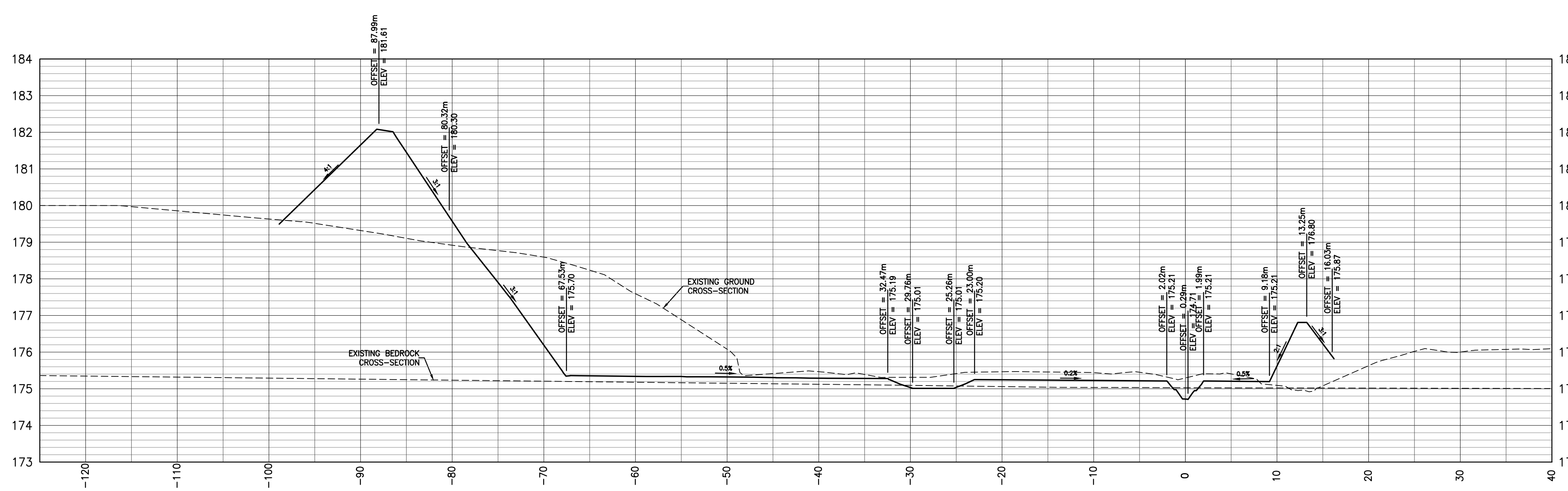




STA 1+429.62
M–M



STA 1+556.21
N–N



STA 1+717.29
O–O

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) SITE BENCH MARKS - SEE DRAWING 0-010 FOR LOCATION AND ELEVATION
2. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 18, 2018. ADDITIONAL TOPOGRAPHICAL SURVEYS COMPLETED BY RENISHAW (CANADA) LIMITED FEBRUARY 2018.
3. CONTOURS OUTSIDE OF THE SURVEYED AREA, FROM LIDAR INFORMATION FROM RENISHAW (CANADA) LIMITED.

		By	Appd	YYYY.MM.DD
7	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	JAC	HEA	2021.11.18
6	ISSUED FOR REVIEW - DRAFT	JAC	HEA/AG	2021.09.02
5	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HEA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	HEA	2018.11.16
1	ISSUED FOR REGULATORY	RJB	HEA	2018.08.03
0	90% REVIEW	RJB	HA	2018.05.18

Revision

File Name: 160960948_C-700CS.dwg	RJB	HA	HA	21.11.18
	Dwn.	Chkd.	Dsgn.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project

WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT
Niagara Falls, ON

Title

CROSS-SECTIONS
M-M, N-N AND O-O

Project No. 160960948

Scale 1:300H 1:75V

Revision 7

Sheet 27 of 32

Drawing No. **C-706**

ORIGINAL SHEET - ARCH D

Master Planting Schedule:

UPLAND PLANTING ZONE:

TREES:

Sym.	Percent	Botanical Name	Common Name	Ht. (cm)	Root	O.C. Spacing
BP	10%	*Betula papyrifera*	Paper Birch	125	2 Gal. Pot	3 m to 7 m
CAO	5%	*Carya ovata*	Shagbark Hickory	100	2 Gal. Pot	3 m to 7 m
JN	15%	*Juglans nigra*	Black Walnut	250	15 Gal. Pot	3 m to 7 m
PT	15%	*Populus tremuloides*	Trembling Aspen	150	3 Gal. Pot	3 m to 7 m
PGA	10%	*Populus grandidentata*	Largetooth Aspen	175	10 Gal. Pot	3 m to 7 m
QA	15%	*Quercus alba*	White Oak	250	15 Gal. Pot	3 m to 7 m
QRU	15%	*Quercus rubra*	Red Oak	175	7 Gal. Pot	3 m to 7 m
SAS	5%	*Sassafras albidum*	Sassafras	100	5 Gal. Pot	3 m to 7 m
TA	10%	*Tilia americana*	Basswood	175	10 Gal. Pot	3 m to 7 m
Totals:	**100%**	**Upland Zone Planting Density Target Goal = 5 trees / 100 m²**				

SHRUBS:

Sym.	Percent	Botanical Name	Common Name	Ht. (cm)	Root	O.C. Spacing
CFO	20%	*Cornus racemosa*	Gray Dogwood	50	2 Gal. Pot	1 m to 1.5 m
DL	15%	*Diervilla lonicera*	Bush Honeysuckle	40	3 Gal. Pot	1 m to 1.5 m
PRA	15%	*Prunus americana*	American Plum	100	2 Gal. Pot	1 m to 1.5 m
RT	25%	*Rhus typhina*	Staghorn Sumac	80	3 Gal. Pot	1 m to 1.5 m
RRI	10%	*Rubus idaeus*	Red Raspberry	60	2 Gal. Pot	1 m to 1.5 m
VT	15%	*Viburnum lentago*	Nannyberry	50	3 Gal. Pot	1 m to 1.5 m
Totals:	**100%**	**Upland Zone Planting Density Target Goal = 10 shrubs / 100 m²**				

RIPARIAN PLANTING ZONE:

TREES:

Sym.	Percent	Botanical Name	Common Name	Ht. (cm)	Root	O.C. Spacing
ASN	15%	*Acer saccharum subsp. nigrum*	Black Maple	100	2 Gal. Pot	8 m to 12 m
ASM	20%	*Acer saccharinum*	Silver Maple	250	15 Gal. Pot	8 m to 12 m
PD	10%	*Populus deltoides*	Eastern Cottonwood	175	10 Gal. Pot	8 m to 12 m
QB	15%	*Quercus bicolor*	Swamp White Oak	175	10 Gal. Pot	8 m to 12 m
QMA	20%	*Quercus macrocarpa*	Bur Oak	150	5 Gal. Pot	8 m to 12 m
SAB	10%	*Salix bebbiana*	Bebb's Willow	100	2 Gal. Pot	8 m to 12 m
SAN	10%	*Salix nigra*	Black Willow	200	3 Gal. Pot	8 m to 12 m
Totals:	**100%**	**Riparian Zone Planting Density Target Goal= 1 tree / 100 m²**				

SHRUBS:

Sym.	Percent	Botanical Name	Common Name	Ht. (cm)	Root	O.C. Spacing
ARN	5%	*Aronia melanocarpa*	Black Chokeberry	60	2 Gal. Pot	1 m to 1.5 m
CEO	15%	*Cephalanthus occidentalis*	Buttonbush	60	3 Gal. Pot	1 m to 1.5 m
COR	15%	*Cornus sericea*	Red Osier Dogwood	50	2 Gal. Pot	1 m to 1.5 m
PH	15%	*Physocarpus opulifolius*	Common Ninebark	50	3 Gal. Pot	1 m to 1.5 m
SAD	15%	*Salix discolor*	Pussy Willow	60	3 Gal. Pot	1 m to 1.5 m
SAE	15%	*Salix eriocephala*	Heart-leaved Willow	60	2 Gal. Pot	1 m to 1.5 m
SAL	15%	*Salix lucida*	Shining Willow	60	2 Gal. Pot	1 m to 1.5 m
SCR	10%	*Sambucus racemosa*	Red-berried Elderberry	50	3 Gal. Pot	1 m to 1.5 m
SPL	15%	*Spiraea alba*	Meadowsweet	60	2 Gal. Pot	1 m to 1.5 m
Totals:	**120%**	**Riparian Zone Planting Density Target Goal = 15 shrubs / 100 m²**				

LIVESTAKE PLANTING ZONE:

Sym.	Percent	Botanical Name	Common Name	Ht. (cm)	Root	O.C. Spacing
COR	10%	*Cornus sericea*	Red Osier Dogwood	min. 75	Livestake	50 cm
SAD	30%	*Salix discolor*	Pussy Willow	min. 75	Livestake	50 cm
SAE	30%	*Salix exigua*	Sandbar Willow	min. 75	Livestake	50 cm
SAP	30%	*Salix petiolaris*	Slender Willow	min. 75	Livestake	50 cm
Totals:	**100%**	**Livestake Zone Planting Density Target Goal = 3-5 livestakes / 1 m²**				

SEED MIX #1
VALLEYLAND SEED MIX (RIPARIAN PLANTING ZONE)

Latin Name	Common Name	%
Carex vulpinoidea	Fox Sedge	30%
Elymus virginicus	Virginia Wild Rye	30%
Glyceria striata	Fowl Mannagrass	2%
Poa palustris	Fowl Bluegrass	30%
Juncus tenuis	Path Rush	8%

SEED MIX #2
TABLELAND GRASS MIXTURE (UPLAND PLANTING ZONE)

Latin Name	Common Name	%
Andropogon gerardii	Big Bluestem	25%
Elymus canadensis	Canada Wild Rye	20%
Panicum virgatum	Switchgrass	20%
Schizachyrium scoparium	Little Bluestem	10%
Sorghastrum nutans	Indian Grass	20%
Spartina pectinata	Prairie Cordgrass	5%

SEED MIX #3
SHORELINE SEED MIX

Latin Name	Common Name	%
Asclepias incarnata	Swamp Milkweed	2%
Aster puniceus	Purple-Stemmed Aster	2%
Acorus americanus	Sweet Flag	10%
Carex scoparia	Blunt Broom Sedge	10%
Carex vulpinoidea	Fox Sedge	25%
Eupatorium maculatum	Spotted Joe Pye Weed	1%
Elymus virginicus	Virginia Wild Rye	40%
Scirpus atrovirens	Green Bulrush	1%
Verbena hastata	Blue Vervain	9%

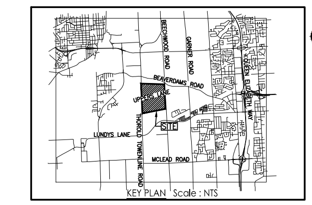
Application: Sow seed mixes at rate of 25 kg/ha with a nurse crop of Annual Oats (*Avena sativa*), seeded at a rate of 22 kg/ha.

Available From: Ontario Seed Company (OSC)
Address: 77 Wellington St. South, P.O. Box 7, Waterloo, ON N2J 3Z6 Phone: 519-886-0557 or 1-800-465-5849
Fax: 519-886-0605

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Key Map NTS.



Legend

- LIMIT OF WORK
- PROPERTY PARCEL LINE
- RIPARIAN PLANTING ZONE
- UPLAND PLANTING ZONE
- SHORELINE PLANTING ZONE
- LIVE STAKING PLANTING ZONE

		By	Appd	YYYY.MM.DD
6	ISSUED FOR PERMITTING	HE	HS	2021.11.18
5	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	TM	2018.11.16
1	ISSUED FOR REGULATORY	RJB	DG	2018.08.03
0	90% REVIEW	RJB	DG	2018.05.18

Revision/Issue

File Name: 160960948_L-460PS	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD
	RJB	DG	DG	2021.11.18

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project
WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

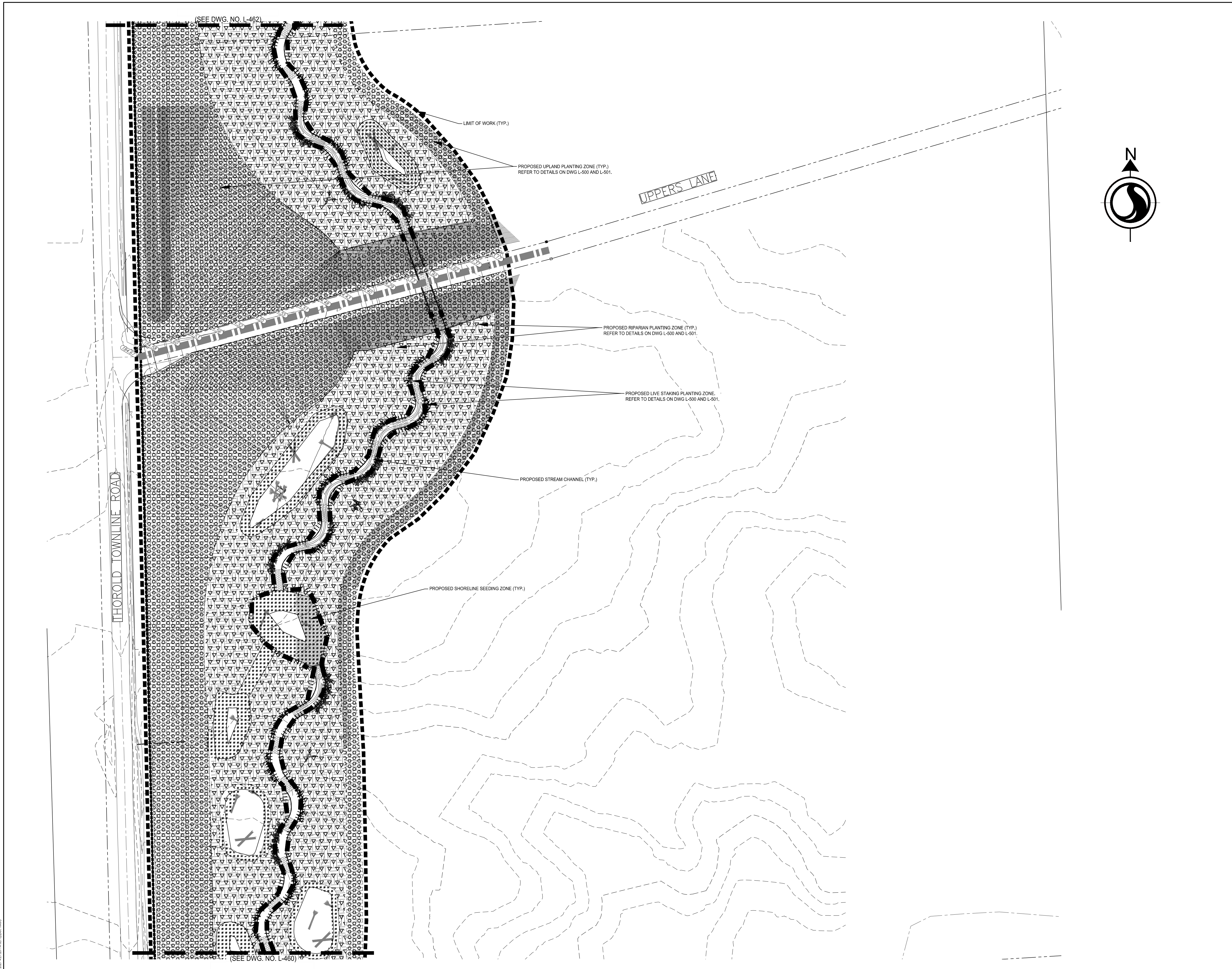
Niagara Falls, ON

Title
RESTORATION PLANTING PLAN
SOUTH

Project No. 160960948
Scale 1:750 (0 7.5 22.5 37.5m)

Revision 7
Sheet 28 of 32
Drawing No. **L-460**

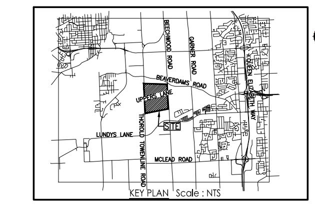
ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Key Map NTS.



Legend

- LIMIT OF WORK
- PROPERTY PARCEL LINE
- RIPARIAN PLANTING ZONE
- UPLAND PLANTING ZONE
- SHORELINE PLANTING ZONE
- LIVE STAKING PLANTING ZONE

Revision/Issue		By	Appd	YYYY.MM.DD
6	ISSUED FOR PERMITTING	HE	HS	2021.11.18
5	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	TM	2018.11.16
1	ISSUED FOR REGULATORY	RJB	DG	2018.08.03
0	90% REVIEW	RJB	DG	2018.05.18

File Name: 160960948_L-460PS	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD
	RJB	DG	DG	2021.11.18

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project
WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

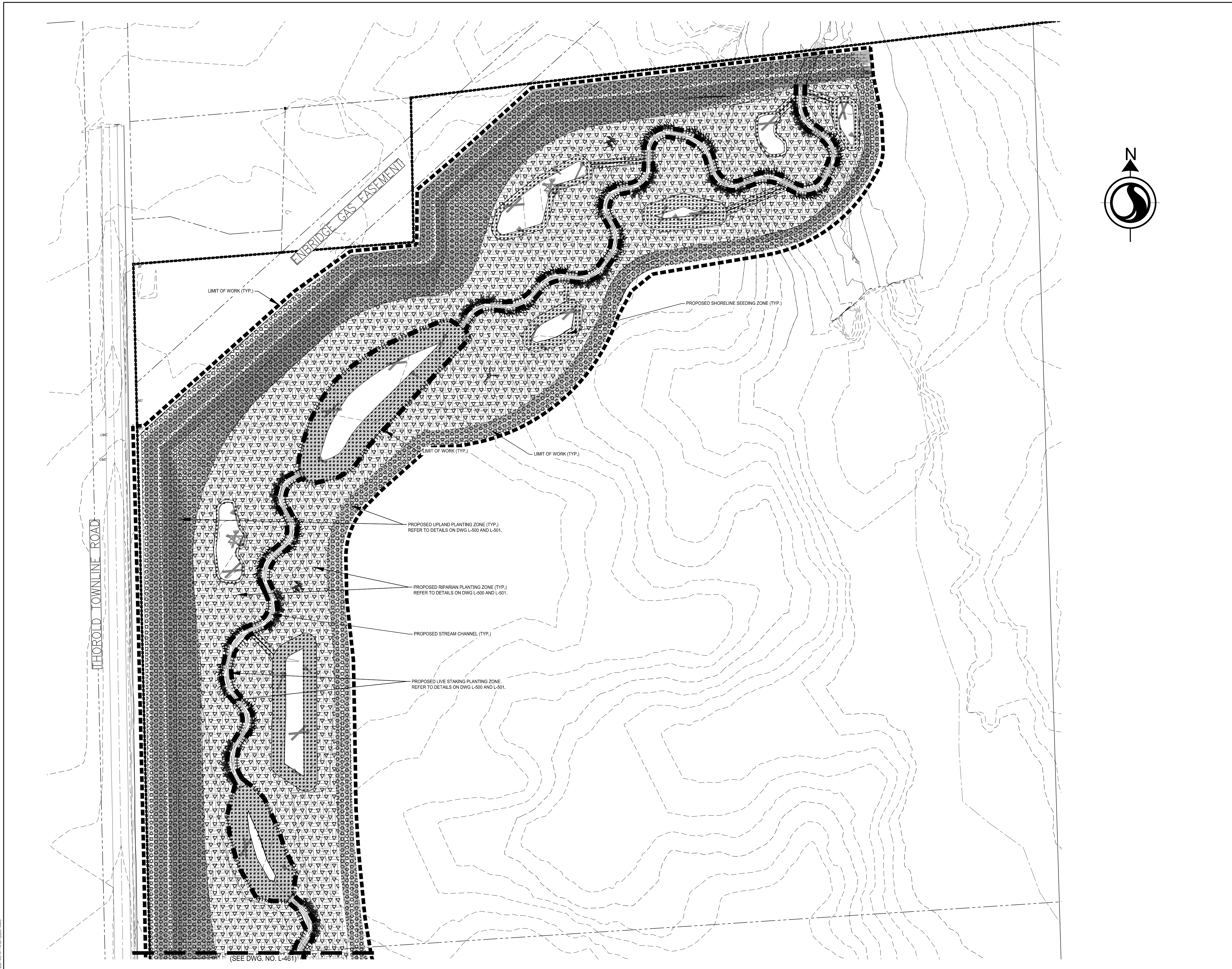
Niagara Falls, ON

Title
RESTORATION PLANTING PLAN
CENTRAL

Project No. 160960948
Scale 1:750 0 7.5 22.5 37.5m

Revision 7
Sheet 29 of 32
Drawing No. L-461

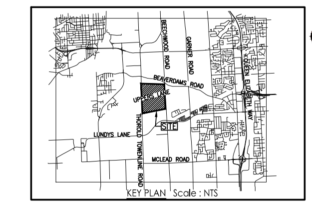
ORIGINAL SHEET - ARCH D



Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Key Map NTS.



Legend

LIMIT OF WORK
PROPERTY PARCEL LINE
RIPARIAN PLANTING ZONE
UPLAND PLANTING ZONE
SHORELINE PLANTING ZONE
LIVE STAKING PLANTING ZONE

6	ISSUED FOR PERMITTING	HE	HS	2021.11.18
5	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	TM	2018.11.16
1	ISSUED FOR REGULATORY	RJB	DG	2018.08.03
0	90% REVIEW	RJB	DG	2018.05.18
Revision/Issue		By	Appd	YYYY.MM.DD

File Name: 160960948_L-460PS	RJB	DG	DG	2021.11.18
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project
WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

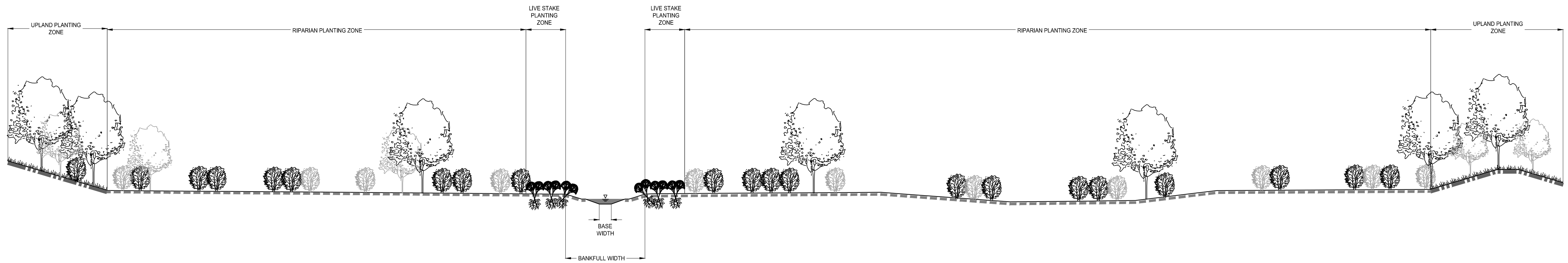
Niagara Falls, ON

Title
RESTORATION PLANTING PLAN
NORTH

Project No. 160960948
Scale 1:750 (0 7.5 22.5 37.5m)

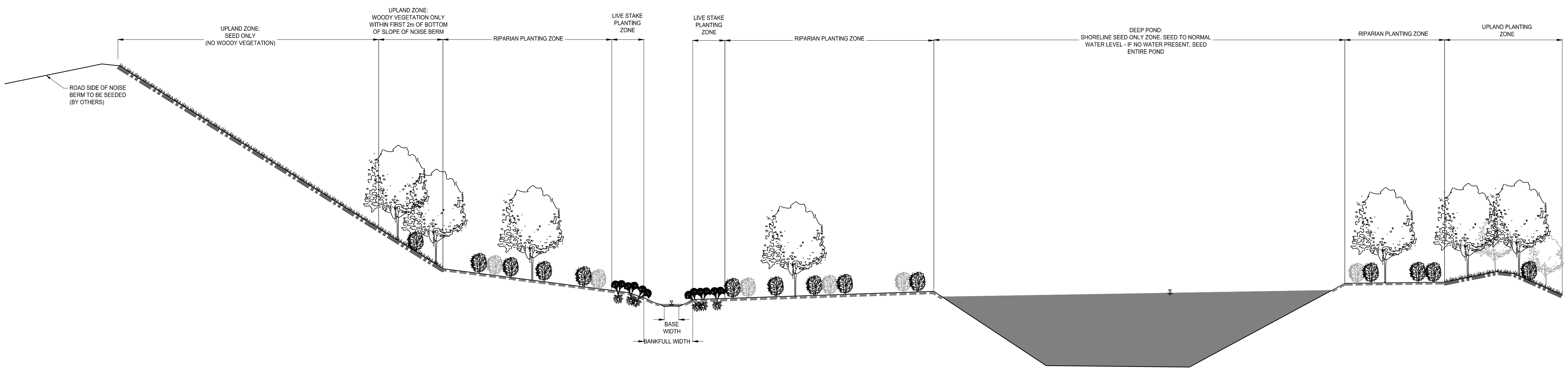
Revision 7
Sheet 30 of 32
Drawing No. **L-462**

ORIGINAL SHEET - ARCH D



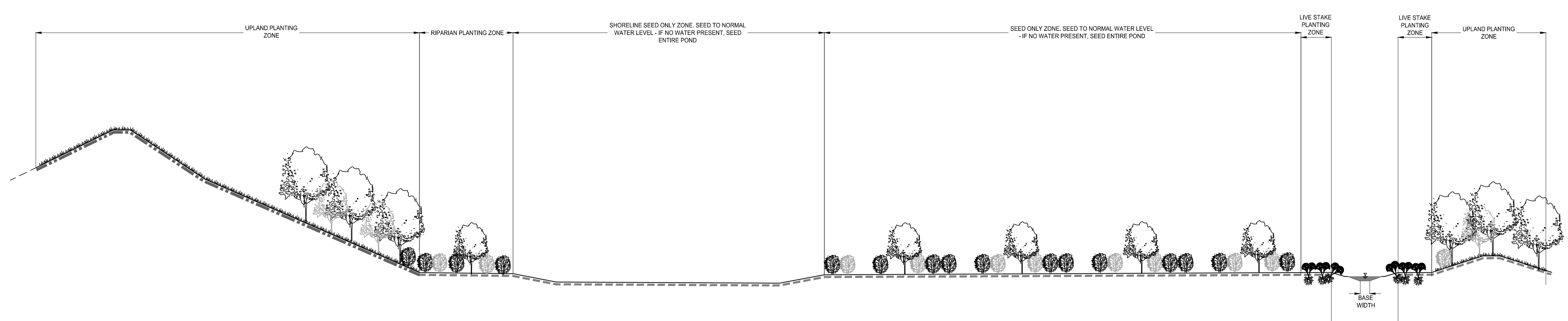
REFERENCED STATION 0+205.00

LD 1 TYPICAL CREEK CROSS SECTION
N.T.S.



REFERENCED STATION 1+012.58

LD 2 TYPICAL CREEK CROSS SECITON - DEEP POND CONDITION
N.T.S.



REFERENCED STATION 1+570.83

LD 3 TYPICAL CREEK CROSS SECTION - SHALLOW POND CONDITION
N.T.S.

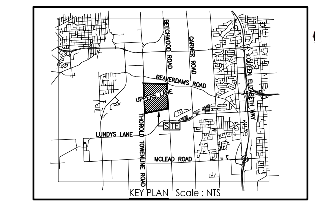
NOTE:
1. REFER TO DRAWING L-460 FOR SEED MIX SPECIFICATIONS AND PROPOSED PLANT SCHEDULE.
2. REFER TO DRAWING L-501 FOR PLANTING DETAILS

ORIGINAL SHEET - ARCH D

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Key Map NTS.



Legend

SEED MIX #1 VALLEYLAND SEED MIX

SEED MIX #2 TABLELAND GRASS MIXTURE SEED MIX

PROPOSED DECIDUOUS TREE PLANTING

PROPOSED DECIDUOUS SHRUB PLANTING

PROPOSED LIVE STAKE PLANTING

6	ISSUED FOR PERMITTING	HE	HS	2021.11.18
5	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	TM	2018.11.16
1	ISSUED FOR REGULATORY	RJB	DG	2018.08.03
0	90% REVIEW	RJB	DG	2018.05.18
Revision/Issue		By	Appd	YYYY.MM.DD

File Name: 160960948_L-DT	RJB	DG	DG	2021.11.18
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project
WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title
LANDSCAPE DETAILS
GENERAL PLANTING

Project No. 160960948
Scale N.T.S.

Revision 7
Sheet 31 of 32
Drawing No. L-500

RIPARIAN PLANTING ZONE LAYOUT:

A. NO MORE THAN 35% OF ANY SINGLE GENUS AND 20% OF ANY SINGLE SPECIES SHALL BE THROUGHOUT THE ENTIRE RIPARIAN PLANTING ZONE.

B. SHRUBS WILL BE PLANTED A MINIMUM OF 1m APART UP TO A MAXIMUM OF 1.5 m ON CENTRE.

C. SHRUBS ARE TO BE PLANTED IN GROUPINGS OF 5 TO 30 SHRUBS, WITH A MINIMUM OF 3 DIFFERENT SPECIES PER GROUPING. PLANTING TO MIMIC A NATURAL LAYOUT AND HAVE SOME GAPS BETWEEN GROUPINGS.

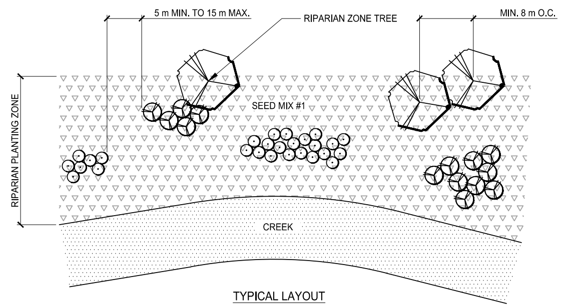
D. SHRUBS SHOULD BE PLANTED IN APPROPRIATE MOISTURE REGIMES TO PROMOTE AND SUSTAIN HEALTHY GROWTH.

E. TREES TO BE LOCATED A MINIMUM OF 5.0m FROM POINT BAR FEATURES AND AREAS WHERE FREQUNT FLOODING CAN BE EXPECTED. TREES SHOULD BE PLANTED IN A SINGULAR LAYOUT OR GROUPED TO FIVE MAXIMUM PER CLUSTER AS SPACE PERMITS.

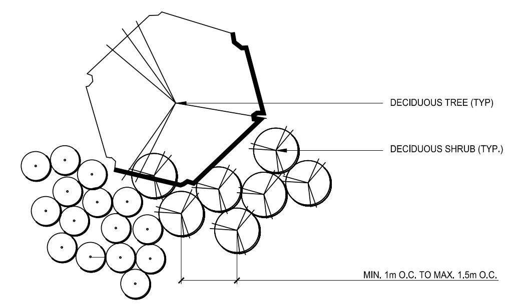
F. ALL TREES TO BE SPACED MINIMUM OF 8m ON CENTRE.

G. SEED MIX #1 - VALLEYLAND SEED MIX TO BE APPLIED THROUGHOUT THE RIPARIAN PLANTING ZONE.

H. REFER TO DRAWINGS L-460 TO L-462 FOR PROPOSED EXTENTS OF RIPARIAN PLANTING ZONES AND SPECIES REQUIREMENTS.



TYPICAL LAYOUT



SHRUB GROUPING ENLARGEMENT

LD 4 — TYPICAL RIPARIAN PLANTING ZONE LAYOUT
N.T.S.

UPLAND PLANTING ZONE LAYOUT:

A. NO MORE THAN 35% OF ANY SINGLE GENUS AND 20% OF ANY SINGLE SPECIES SHALL BE THROUGHOUT THE ENTIRE UPLAND PLANTING ZONE AT ALL SITES.

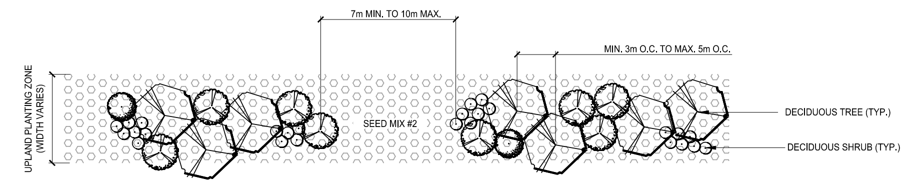
B. TREES ARE TO BE PLANTED IN GROUPINGS OF 7 TO 15 TREES PLANTED AT 3m TO 7m O.C. SPACING, WITH A MINIMUM OF 3 DIFFERENT SPECIES PER GROUPING. PLANTING TO MIMIC A NATURAL LAYOUT AND HAVE SOME GAPS BETWEEN TREES WITH VARIED SPACING THROUGHOUT.

C. TREES SHOULD BE PLANTED IN APPROPRIATE MOISTURE REGIMES TO PROMOTE AND SUSTAIN HEALTHY GROWTH.

D. ALL UPLAND AREAS TO BE SEEDED WITH MIX #2 -TABLELAND GRASS MIXTURE SEED MIX.

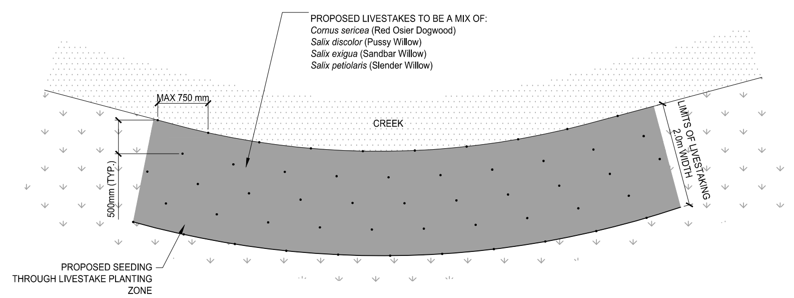
E. WHERE PLANTING IS TO OCCUR ON 2:1 SLOPED BERMS PLANTING TO BE ON FIRST 2m FROM TOE OF SLOPE TO ALLOW PLANTINGS ACCESS TO ADEQUATE MOISTURE CONDITIONS.

F. REFER TO DRAWINGS L-460 TO L-462 FOR PROPOSED EXTENTS OF UPLAND PLANTING ZONES AND SPECIES REQUIREMENTS.

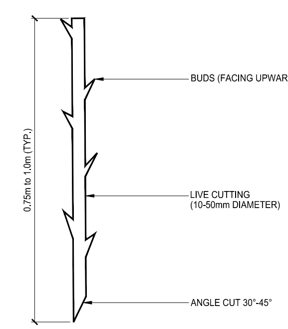


TYPICAL LAYOUT

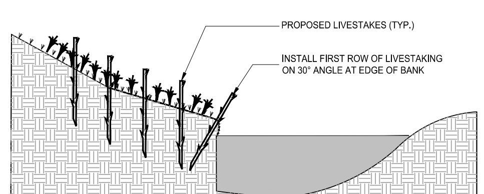
LD 5 — TYPICAL UPLAND PLANTING ZONE LAYOUT
N.T.S.



PLAN VIEW:



TYPICAL LIVESTAKE



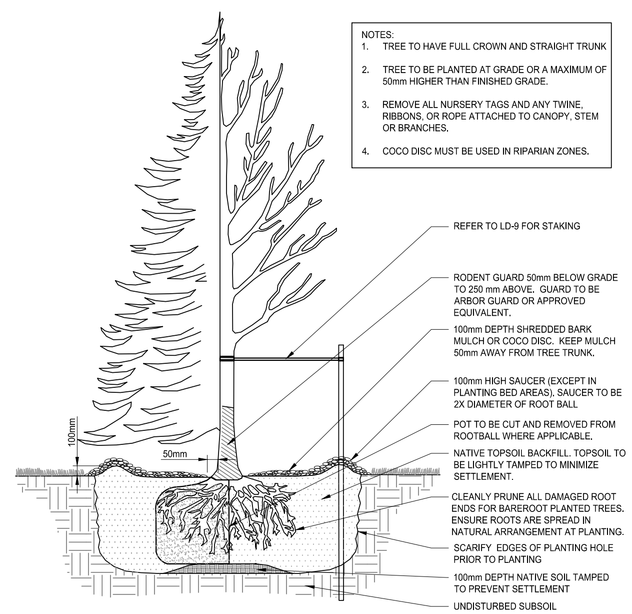
ELEVATION VIEW:

NOTES:

1. LIVE STAKING TO BE IMPLEMENTED IN THE SPRING WITH CUTTINGS DIPPED IN ROOTING HORMONE PRIOR TO PLANTING. STAKES TO BE CUT FROM DORMANT PLANTS AND PLANTED WITHIN 24 HOURS MAXIMUM.
2. LIVE STAKES MUST BE PLANTED SO THAT LEAF BUD SCARS AND/OR EMERGING BUDS ARE POINTING UP, AWAY FROM THE GROUND
3. SOAK LIVE STAKES FOR A MINIMUM OF 6 HOURS IMMEDIATELY PRIOR TO INSTALLATION
4. LIVE STAKES SHALL BE EVENLY SPACED WITH OFFSET ROWS OR DIAMOND PATTERN.
5. LIVE STAKES SHALL BE DRIVEN UNTIL APPROXIMATELY $\frac{3}{4}$ OF LIVE STAKE IS WITHIN GROUND.
6. IF STARTER HOLE IS NEEDED, MINIMIZE AIR POCKET BY LIGHTLY TAMPING SOIL AROUND STAKE.
7. TRIM OFF SPLIT, CRACKED AND DAMAGED ENDS AFTER INSTALLATION. MAKE SURE TO LEAVE AT LEAST 3 BUDS TO ENSURE GROWTH. IF AFTER TRIMMING DAMAGED ENDS, NOT ENOUGH BUDS EXIST, REPLACE STAKE.
8. STAKING MAY BE REQUIRED THROUGH MATTING, WOOD DEBRIS, ROCK OR COMPACTED SOILS. A STARTER HOLE MAY BE REQUIRED.
9. LIVE STAKES SHALL BE INSTALLED IN ALL AREAS WITH WOOD DEBRIS TOE PROTECTION AND ALONG BOTH SIDES OF RIFFLES.

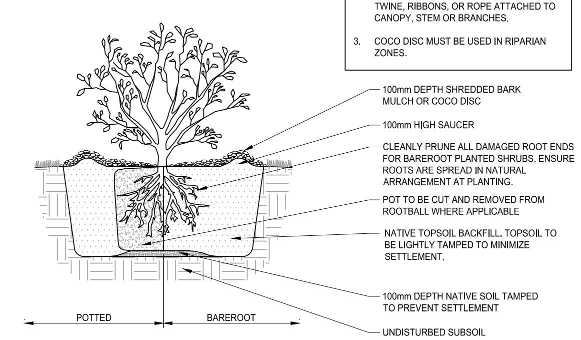
LD 6 — TYPICAL LIVESTAKE LAYOUT AND INSTALLATION
N.T.S.

NOTES:
1. TREE TO HAVE FULL CROWN AND STRAIGHT TRUNK
2. TREE TO BE PLANTED AT GRADE OR A MAXIMUM OF 50mm HIGHER THAN FINISHED GRADE.
3. REMOVE ALL NURSERY TAGS AND ANY TWINE, RIBBONS, OR ROPE ATTACHED TO CANOPY, STEM OR BRANCHES.
4. COCO DISC MUST BE USED IN RIPARIAN ZONES.



LD 7 — TYPICAL TREE PLANTING DETAIL
N.T.S.

NOTES:
1. SHRUB TO BE PLANTED AT GRADE OR A MAXIMUM OF 50mm HIGHER THAN FINISHED GRADE.
2. REMOVE ALL NURSERY TAGS AND ANY TWINE, RIBBONS, OR ROPE ATTACHED TO CANOPY, STEM OR BRANCHES.
3. COCO DISC MUST BE USED IN RIPARIAN ZONES.



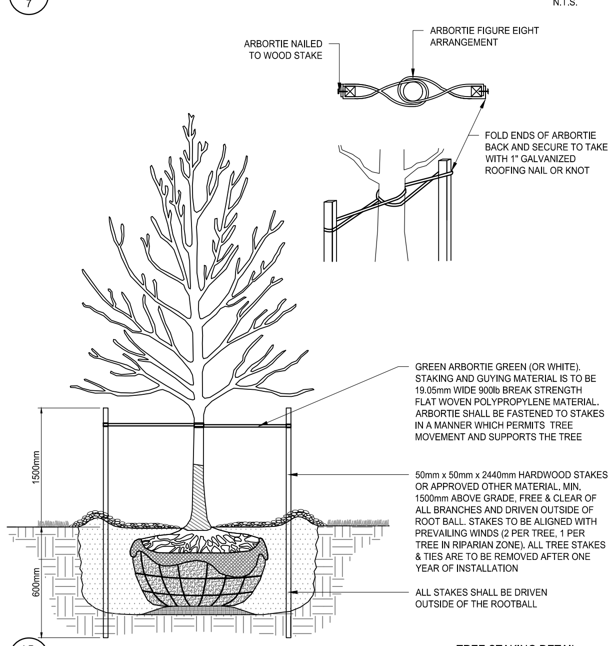
LD 8 — TYPICAL SHRUB PLANTING DETAIL
N.T.S.

PLANTING NOTES:

1. The Contractor must notify the Landscape Architect prior to the commencement of any planting. Contractor shall supply all plants and materials in quantities sufficient to complete work shown on this drawing. Any discrepancies between quantities shall be reported to the Landscape Architect for direction.
2. The Landscape Architect is to be contacted for inspection and written approval prior to plant material arriving on site. The Landscape Architect reserves the right to reject any plant materials that have not been inspected and approved.
3. All species will be native to the region and shall be sourced from local nurseries to promote and maintain the local genetic stock.
4. Plant material collected from wild sources will not be accepted. The Landscape Architect reserves the right to require that supplier invoices be submitted for inspection and approval prior to acceptance.
5. Staking (layout) of plant materials to be approved by Landscape Architect prior to installation. Drawing may be scaled for approximate layout of individual trees and planting beds.
6. Plant materials specified for this project will conform to the Canadian Nursery Landscape Association (CNLA) for size, variety, and condition as indicated on the plant schedule shown on these drawings. Any plant materials that do not conform (in the sole opinion of the Landscape Architect) will be promptly removed from the site and replaced by the Contractor at no additional cost to the Owner or project.
7. Do not make substitutions of plant materials, products or quantities without the prior written permission of the Landscape Architect.
8. Remove dead and/or damaged branches on trees or shrubs. All pruning shall be performed in accordance with standard horticultural practices and appropriate timing for each species.
9. Plants are not to be installed during extreme heat, drought, or other undesirable conditions. Thoroughly water all plants immediately after installation. Contractor not to proceed in uncertainty. Contact Landscape Architect for direction. The Contractor is required to water plant material regularly or as directed by the Landscape Architect during construction and the two year warranty period. Plants will be watered within 48 hours of a written request by the Landscape Architect. Failure to do so after the second request will result in this work being undertaken by others. The cost of this work shall be deducted from the total contract price.
10. Do not plant in drainage swales or sunken areas. Where proposed site drainage patterns conflict with proposed plantings, contact the Landscape Architect for direction.
11. All trees and shrubs are to be planted in accordance with the planting details shown on this drawing.
12. All plants are to be installed through existing ground stabilization measures (ie. coir, jute, straw matting, etc.). Existing matting to be cut in 'x' shape to permit planting.
13. Minor field adjustments to plant material locations may be necessary to respond to the locations of existing plants. Contractor to review with Landscape Architect where relocations are necessary. Contractor must receive approval from Landscape Architect prior to installation.
14. The Contractor is responsible for location of all underground services prior to excavation of any tree pits and shrub beds.
15. All plant materials will be planted in approved topsoil. No additional soils or additives will be permitted unless approved by the Landscape Architect at no additional cost to the project. Topsoil to be free from toxic material and anything that may inhibit healthy growth of plants.
16. Shredded bark mulch, or coco discs will be spread uniformly at individual plants to a minimum depth of 100mm where applicable. Do not place mulch in direct contact with trunks; allow a 50mm mulch free ring around stems. Coco discs to be used on all riparian zone plantings.
17. All wood stakes and associated ties to be removed one year after planting.
18. The Landscape Architect reserves the right to refuse acceptance of any plant material displaying poor growth habits, injury or disease. Any plant material rejected by the Landscape Architect will be promptly removed from the site and replaced with material of acceptable quality at no additional cost to the project.
19. Contractor to identify with owner and Landscape Architect any maintenance requirements necessary for warranty purposes beyond those identified in the Contract Documents.

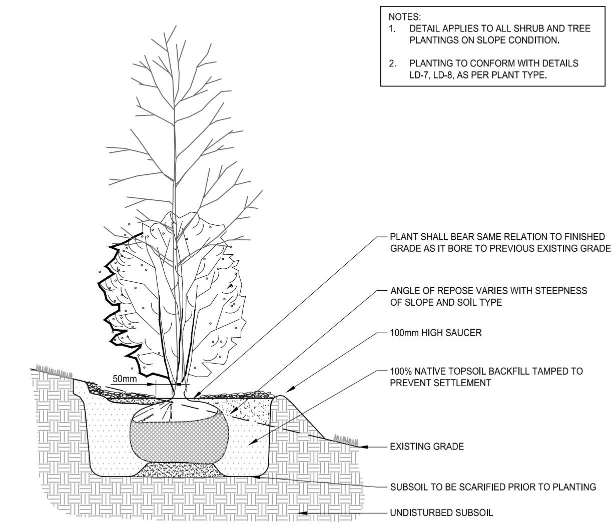
WARRANTY REQUIREMENTS:

1. All landscape works will be warranted for a period of two years following inspection and substantial completion. Plant material, which is not in a healthy growing condition two years after inspection, shall be replaced to the satisfaction of the Landscape Architect / Client.
2. The Landscape Architect reserves the right to extend contractor's warranty responsibilities for an additional year if, at the end of initial warranty period, leaf development and growth is not sufficient to ensure future survival as determined by the Landscape Architect.
3. The contractor must have a minimum of 80% of the plantings within each planting zone alive and vigorous at the end of the two year warranty period.
4. The contractor shall replace any plants necessary to meet the minimum number of healthy plants required to achieve the minimum 80% or greater success to ensure planting density target goals are met.



LD 9 — TREE STAKING DETAIL
N.T.S.

NOTES:
1. DETAIL APPLIES TO ALL SHRUB AND TREE PLANTINGS ON SLOPE CONDITION.
2. PLANTING TO CONFORM WITH DETAILS LD-7, LD-8, AS PER PLANT TYPE.



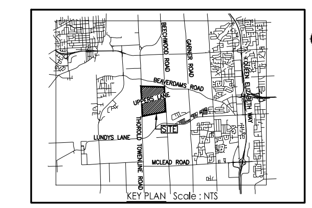
LD 10 — TYPICAL PLANTING DETAIL FOR SLOPE CONDITIONS
N.T.S.

ORIGINAL SHEET - ARCH D

Stantec

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
Tel: (519) 579-4410
www.stantec.com

Key Map NTS.



		By	Appd	YYYY.MM.DD
6	ISSUED FOR PERMITTING	HE	HS	2021.11.18
5	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.09.11
4	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.27
3	ISSUED FOR REVIEW - DRAFT	JAC	HA	2020.08.14
2	ISSUED FOR REVIEW - DRAFT	RJB	TM	2018.11.16
1	ISSUED FOR REGULATORY	RJB	DG	2018.08.03
0	90% REVIEW	RJB	DG	2018.05.18

Revision/Issue

File Name: 160960948_L-DT	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD
	RJB	DG	DG	2021.11.18

Permit-Seal

NOT FOR CONSTRUCTION

Client/Project
WALKER AGGREGATES

UPPERS QUARRY
WATERCOURSE REALIGNMENT

Niagara Falls, ON

Title
LANDSCAPE DETAILS
RESTORATION PLANTING

Project No. 160960948
Scale N.T.S.

Revision 7
Sheet 32 of 32
Drawing No. **L-501**

APPENDIX C

Design Calculations

160960948

Shear Stress/Particle Size Calculation

Walker - Bankfull Event

SECTION 1: OBSERVED SHEAR STRESS, τ_0

Method 1: Chow (1959)

Calculate Observed Shear Stress, τ_0:

$$\tau_o = \gamma R_h S$$

Specific Weight of Water, γ (N/m^3)	9790
Hydraulic Radius, R_h (m)	0.18
Bed Slope, S (m/m)	0.0019
Observed Shear Stress, τ_0 (N/m^2)	3.35

Method 2: HEC-RAS Output

a) Channel Shear Stress, $\tau_{0,channel}$ (N/m^2)	8.45
b) Total Shear Stress, $\tau_{0,total}$ (N/m^2)	

Shear Stress Selection for Analysis:

Method selected for analysis	Method 2a)
Observed Shear Stress, τ_0 (N/m^2)	8.5
Safety Factor	1.2
Observed Shear Stress, τ_0, considered in analysis	**11**

SECTION 2: CRITICAL SHEAR STRESS, τ_c

Method 1: Shields/Julien (1995)

Step 1: Calculate Dimensionless Particle Diameter, d_*, for particle d_i:

$$d_* = d_i \left[\frac{(G-1)g}{{v_m}^2}\right]^{1/3}$$ Julien (1995)

Particle Diameter, d_i (mm)	12.60
Specific Gravity of Particulate, G	2.65
Gravitational Acceleration, g (m/s^2)	9.81
Kinematic Viscosity of Water, v_m (m^2/s)	1.00E-06
Dimensionless Particle Diameter, d_*	318.85

Step 2: Calculate Critical Shields Parameter, τ_{*c}, for particle d_i:

If $d_* < 0.3$, $\tau_{*c} = 0.5 \tan\phi$

If $0.3 \le d_* < 19$, $\tau_{*c} = 0.25 {d_*}^{-0.6} \tan\phi$

If $19 \le d_* < 50$, $\tau_{*c} = 0.013 {d_*}^{0.4} \tan\phi$

If $d_* \ge 50$, $\tau_{*c} = 0.06 \tan\phi$

Julien (1995)

Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.733038286	
Critical Shields Parameter, τ_{*c}	0.054024243	

Step 3: Calculate Critical Shear Stress, τ_c, for particle d_i:

$$\tau_c = \tau_{*c}[(G-1)\gamma d_i]$$ Julien (1995)

Specific Gravity of Particulate, G	(as in Step 1)
Specific Weight of Water, γ (N/m^3)	9790
Particle Diameter, d_i (mm)	(as in Step 1)
Critical Shields Parameter, τ_{*c}	(as in Step 2)
Critical Shear Stress, τ_c (N/m^2)	11

Setting τ_0 (Section 1) = τ_c (Section 2, Method 1) yields a particle size, d_i, of: **13** mm

160960948

Shear Stress/Particle Size Calculation

Walker - Bankfull Event

Method 2: MTO DMM (1997) - Shear Stress on Bed

Step 1: Calculate Critical Shear Stress of Bed Material, $\tau_{c,bed}$

$$\tau_{cb} = 0.0642 g\, d_i$$

Equation 5.31, MTO DMM (1997)

Gravitational Acceleration, g (m/s^2)	9.81
Particle Diameter, d_i (mm)	17.47
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	11

Setting τ_0 (Section 1) = $\tau_{c,bed}$ (Section 2, Method 2) yields a particle size, d_i, of: **18** mm

Method 3: MTO DMM (1997) - Shear Stress on Side Slopes

Step 1: Calculate Observed Shear Stress of Side Slopes, $\tau_{0,ss}$

$$\tau_{os} = 0.75 \gamma R_h S = 0.75 \tau_o$$

Chow (1959)

Observed Shear Stress, τ_0 (N/m^2)	(as in Section 1)
Observed Shear Stress of Side Slopes, $\tau_{0,ss}$ (N/m2)	8.25

Step 2: Calculate Bank Tractive Force Coefficient, K_{sb}

$$K_{sb} = \left(\frac{1 - sin^2\theta}{sin^2\phi}\right)^{0.5}$$

Design Chart 2.11, MTO DMM (1997)

Side Slopes, H:1V (e.g., 3:1)	3	
Angle of Side Slopes, θ (radians)	0.34	
Angle of Side Slopes, θ (degrees)	19.5	
Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.73	
Bank Tractive Force Coefficient, K_{sb}	0.87	

Step 3: Calculate Critical Shear Stress of Side Slopes, $\tau_{0,ss}$

$$\tau_{c,ss} = K_{sb} \tau_{c,bed}$$

Equation 5.32, MTO DMM (1997)

Bank Tractive Force Coefficient, K_{sb}	(as in Step 2)
Gravitational Acceleration, g (m/s^2)	9.81
Particle Diameter, d_i (mm)	15.11
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	9.51
Critical Shear Stress of Side Slopes, $\tau_{C,ss}$ (N/m^2)	8

Setting $\tau_{0,ss}$ (Section 2, Method 3) = $\tau_{c,ss}$ (Section 2, Method 3) yields a particle size, d_i, of: **16** mm

Method 4: Smith (1978)

Step 1: Calculate Particle Diameter, di:

$$d_i = 10yS$$

Smith (1978)

Normal Flow Depth, y (m)	0.5
	0.0019
Particle Diameter, di (m)	0.0095
Particle Diameter, di (mm)	9.5

Method 4 yields a particle size, d_i, of: **10** mm

160960948

Shear Stress/Particle Size Calculation

Walker - Bankfull Event

Method 5: Leopold, Wolman, and Miller (1964) Trendline

$$d_i = 77.966\tau_c^{\,1.042}$$

Leopold et al. (1964); Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	0.23

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	0.23
Particle Size, d_i (mm)	16.85

Method 5 yields a particle size, d_i, of: **17** mm

Method 6: WARSSS Colorado Trendline (Rosgen, 2006)

$$d_i = 152.02\tau_c^{\,0.7355}$$

Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	0.23

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	0.2256768
Particle Size, d_i (mm)	50.86163937

Method 6 yields a particle size, d_i, of: **51** mm

SECTION 3: SUMMARY OF RESULTS

Method	Particle Size (mm)
Method 1: Shields/Julien (1995)	13
Method 2: MTO DMM (1997) - Shear Stress on Bed	18
Method 3: MTO DMM (1997) - Shear Stress on Side Slopes	16
Method 4: Smith (1978)	10
Method 5: Leopold, Wolman, and Miller (1964) Trendline	17
Method 6: WARSSS Colorado Trendline (Rosgen, 2006)	51

160960948

Shear Stress/Particle Size Calculation

Walker - 100-YR Event

SECTION 1: OBSERVED SHEAR STRESS, τ_0

Method 1: Chow (1959)

Calculate Observed Shear Stress, τ_0:

$$\tau_o = \gamma R_h S$$

Specific Weight of Water, γ (N/m^3)	9790
Hydraulic Radius, R_h (m)	0.59
Bed Slope, S (m/m)	0.0019
Observed Shear Stress, τ_0 (N/m^2)	10.97

Method 2: HEC-RAS Output

a) Channel Shear Stress, $\tau_{0,channel}$ (N/m^2)	15.91
b) Total Shear Stress, $\tau_{0,total}$ (N/m^2)	6.34

Shear Stress Selection for Analysis:

Method selected for analysis	Method 2a)
Observed Shear Stress, τ_0 (N/m^2)	15.91
Safety Factor	1.2
Observed Shear Stress, τ_0, considered in analysis	**19.1**

SECTION 2: CRITICAL SHEAR STRESS, τ_c

Method 1: Shields/Julien (1995)

Step 1: Calculate Dimensionless Particle Diameter, d_*, for particle d_i:

$$d_* = d_i \left[\frac{(G-1)g}{{v_m}^2}\right]^{1/3}$$

Julien (1995)

Particle Diameter, d_i (mm)	21.89
Specific Gravity of Particulate, G	2.65
Gravitational Acceleration, g (m/s^2)	9.81
Kinematic Viscosity of Water, v_m (m^2/s)	1.00E-06
Dimensionless Particle Diameter, d_*	553.64

Step 2: Calculate Critical Shields Parameter, τ_{*c}, for particle d_i:

If $d_* < 0.3$, $\tau_{*c} = 0.5\tan\phi$

If $0.3 \le d_* < 19$, $\tau_{*c} = 0.25{d_*}^{-0.6}\tan\phi$

If $19 \le d_* < 50$, $\tau_{*c} = 0.013{d_*}^{0.4}\tan\phi$

If $d_* \ge 50$, $\tau_{*c} = 0.06\tan\phi$

Julien (1995)

Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.733038286	
Critical Shields Parameter, τ_{*c}	0.054024243	

Step 3: Calculate Critical Shear Stress, τ_c, for particle d_i:

$$\tau_c = \tau_{*c}[(G-1)\gamma d_i]$$

Julien (1995)

Specific Gravity of Particulate, G	(as in Step 1)
Specific Weight of Water, γ (N/m^3)	9790
Particle Diameter, d_i (mm)	(as in Step 1)
Critical Shields Parameter, τ_{*c}	(as in Step 2)
Critical Shear Stress, τ_c (N/m^2)	19.1

Setting τ_0 (Section 1) = τ_c (Section 2, Method 1) yields a particle size, d_i, of: **22** mm

160960948
Shear Stress/Particle Size Calculation
Walker - 100-YR Event

Method 2: MTO DMM (1997) - Shear Stress on Bed

Step 1: Calculate Critical Shear Stress of Bed Material, $\tau_{c,bed}$

$\tau_{cb} = 0.0642 g\, d_i$	Equation 5.31, MTO DMM (1997)	
Gravitational Acceleration, g (m/s^2)	9.81	
Particle Diameter, d_i (mm)	30.33	
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	19.1	
Setting τ_0 (Section 1) = $\tau_{c,bed}$ (Section 2, Method 2) yields a particle size, d_i, of:	**31**	mm

Method 3: MTO DMM (1997) - Shear Stress on Side Slopes

Step 1: Calculate Observed Shear Stress of Side Slopes, $\tau_{0,ss}$

$\tau_{os} = 0.75\gamma R_h S = 0.75\tau_o$	Chow (1959)	
Observed Shear Stress, τ_0 (N/m^2)	(as in Section 1)	
Observed Shear Stress of Side Slopes, $\tau_{0,ss}$ (N/m2)	14.325	

Step 2: Calculate Bank Tractive Force Coefficient, K_{sb}

$K_{sb} = \left(\frac{1 - sin^2\theta}{sin^2\phi}\right)^{0.5}$	Design Chart 2.11, MTO DMM (1997)	
Side Slopes, H:1V (e.g., 3:1)	3	
Angle of Side Slopes, θ (radians)	0.34	
Angle of Side Slopes, θ (degrees)	19.5	
Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.73	
Bank Tractive Force Coefficient, K_{sb}	0.87	

Step 3: Calculate Critical Shear Stress of Side Slopes, $\tau_{0,ss}$

$\tau_{c,ss} = K_{sb}\tau_{c,bed}$	Equation 5.32, MTO DMM (1997)	
Bank Tractive Force Coefficient, K_{sb}	(as in Step 2)	
Gravitational Acceleration, g (m/s^2)	9.81	
Particle Diameter, d_i (mm)	26.24	
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	16.53	
Critical Shear Stress of Side Slopes, $\tau_{C,ss}$ (N/m^2)	14	
Setting $\tau_{0,ss}$ (Section 2, Method 3) = $\tau_{c,ss}$ (Section 2, Method 3) yields a particle size, d_i, of:	**27**	mm

Method 4: Smith (1978)

Step 1: Calculate Particle Diameter, di:

$d_i = 10yS$	Smith (1978)	
Normal Flow Depth, y (m)	1.16	
Bed Slope, S (m/m)	0.0019	
Particle Diameter, di (m)	0.02204	
Particle Diameter, di (mm)	22.04	
Method 4 yields a particle size, d_i, of:	**23**	mm

160960948
Shear Stress/Particle Size Calculation
Walker - 100-YR Event

Method 5: Leopold, Wolman, and Miller (1964) Trendline

$$d_i = 77.966\tau_c^{\ 1.042}$$

Leopold et al. (1964); Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	0.40

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	0.40
Particle Size, d_i (mm)	29.94

Method 5 yields a particle size, d_i, of: **30** mm

Method 6: WARSSS Colorado Trendline (Rosgen, 2006)

$$d_i = 152.02\tau_c^{\ 0.7355}$$

Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	0.40

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	0.3991136
Particle Size, d_i (mm)	77.35835458

Method 6 yields a particle size, d_i, of: **78** mm

SECTION 3: SUMMARY OF RESULTS

Method	Particle Size (mm)
Method 1: Shields/Julien (1995)	22
Method 2: MTO DMM (1997) - Shear Stress on Bed	31
Method 3: MTO DMM (1997) - Shear Stress on Side Slopes	27
Method 4: Smith (1978)	23
Method 5: Leopold, Wolman, and Miller (1964) Trendline	30
Method 6: WARSSS Colorado Trendline (Rosgen, 2006)	78

160960948

Shear Stress/Particle Size Calculation

Walker - Culvert Substrate

SECTION 1: OBSERVED SHEAR STRESS, τ_0

Method 1: Chow (1959)

Calculate Observed Shear Stress, τ_0:

$$\tau_o = \gamma R_h S$$

Specific Weight of Water, γ (N/m^3)	9790
Hydraulic Radius, R_h (m)	1.08
Bed Slope, S (m/m)	0.0019
Observed Shear Stress, τ_0 (N/m^2)	20.09

Method 2: HEC-RAS Output

a) Channel Shear Stress, $\tau_{0,channel}$ (N/m^2)	84.89
b) Total Shear Stress, $\tau_{0,total}$ (N/m^2)	

Shear Stress Selection for Analysis:

Method selected for analysis	Method 2a)
Observed Shear Stress, τ_0 (N/m^2)	84.9
Safety Factor	1.2
Observed Shear Stress, τ_0, considered in analysis	**102**

SECTION 2: CRITICAL SHEAR STRESS, τ_c

Method 1: Shields/Julien (1995)

Step 1: Calculate Dimensionless Particle Diameter, d_*, for particle d_i:

$$d_* = d_i \left[\frac{(G-1)g}{{v_m}^2}\right]^{1/3}$$ Julien (1995)

Particle Diameter, d_i (mm)	116.88
Specific Gravity of Particulate, G	2.65
Gravitational Acceleration, g (m/s^2)	9.81
Kinematic Viscosity of Water, v_m (m^2/s)	1.00E-06
Dimensionless Particle Diameter, d_*	2956.62

Step 2: Calculate Critical Shields Parameter, τ_{*c}, for particle d_i:

If $d_* < 0.3$, $\tau_{*c} = 0.5 tan\phi$

If $0.3 \le d_* < 19$, $\tau_{*c} = 0.25 {d_*}^{-0.6} tan\phi$

If $19 \le d_* < 50$, $\tau_{*c} = 0.013 {d_*}^{0.4} tan\phi$

If $d_* \ge 50$, $\tau_{*c} = 0.06 tan\phi$

Julien (1995)

Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.733038286	
Critical Shields Parameter, τ_{*c}	0.054024243	

Step 3: Calculate Critical Shear Stress, τ_c, for particle d_i:

$$\tau_c = \tau_{*c}[(G-1)\gamma d_i]$$ Julien (1995)

Specific Gravity of Particulate, G	(as in Step 1)
Specific Weight of Water, γ (N/m^3)	9790
Particle Diameter, d_i (mm)	(as in Step 1)
Critical Shields Parameter, τ_{*c}	(as in Step 2)
Critical Shear Stress, τ_c (N/m^2)	102

Setting τ_0 (Section 1) = τ_c (Section 2, Method 1) yields a particle size, d_i, of: **117** mm

160960948

Shear Stress/Particle Size Calculation

Walker - Culvert Substrate

Method 2: MTO DMM (1997) - Shear Stress on Bed

Step 1: Calculate Critical Shear Stress of Bed Material, $\tau_{c,bed}$

$\tau_{cb} = 0.0642 g\, d_i$	Equation 5.31, MTO DMM (1997)	
Gravitational Acceleration, g (m/s^2)	9.81	
Particle Diameter, d_i (mm)	161.96	
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	102	
Setting τ_0 (Section 1) = $\tau_{c,bed}$ (Section 2, Method 2) yields a particle size, d_i, of:	**162**	mm

Method 3: MTO DMM (1997) - Shear Stress on Side Slopes

Step 1: Calculate Observed Shear Stress of Side Slopes, $\tau_{0,ss}$

$\tau_{os} = 0.75\gamma R_h S = 0.75\tau_o$	Chow (1959)	
Observed Shear Stress, τ_0 (N/m^2)	(as in Section 1)	
Observed Shear Stress of Side Slopes, $\tau_{0,ss}$ (N/m2)	76.5	

Step 2: Calculate Bank Tractive Force Coefficient, K_{sb}

$K_{sb} = \left(\frac{1-\sin^2\theta}{\sin^2\phi}\right)^{0.5}$	Design Chart 2.11, MTO DMM (1997)	
Side Slopes, H:1V (e.g., 3:1)	3	
Angle of Side Slopes, θ (radians)	0.34	
Angle of Side Slopes, θ (degrees)	19.5	
Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.73	
Bank Tractive Force Coefficient, K_{sb}	0.87	

Step 3: Calculate Critical Shear Stress of Side Slopes, $\tau_{0,ss}$

$\tau_{c,ss} = K_{sb}\tau_{c,bed}$	Equation 5.32, MTO DMM (1997)	
Bank Tractive Force Coefficient, K_{sb}	(as in Step 2)	
Gravitational Acceleration, g (m/s^2)	9.81	
Particle Diameter, d_i (mm)	140.09	
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	88.23	
Critical Shear Stress of Side Slopes, $\tau_{C,ss}$ (N/m^2)	77	
Setting $\tau_{0,ss}$ (Section 2, Method 3) = $\tau_{c,ss}$ (Section 2, Method 3) yields a particle size, d_i, of:	**141**	mm

Method 4: Smith (1978)

Step 1: Calculate Particle Diameter, di:

$d_i = 10yS$	Smith (1978)	
Normal Flow Depth, y (m)	3.88	
	0.0019	
Particle Diameter, di (m)	0.07372	
Particle Diameter, di (mm)	73.72	
Method 4 yields a particle size, d_i, of:	**74**	mm

160960948
Shear Stress/Particle Size Calculation
Walker - Culvert Substrate

Method 5: Leopold, Wolman, and Miller (1964) Trendline

$$d_i = 77.966\tau_c^{\ 1.042}$$

Leopold et al. (1964); Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	2.13

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	2.13
Particle Size, d_i (mm)	171.54

Method 5 yields a particle size, d_i, of: **172** mm

Method 6: WARSSS Colorado Trendline (Rosgen, 2006)

$$d_i = 152.02\tau_c^{\ 0.7355}$$

Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	2.13

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	2.131392
Particle Size, d_i (mm)	265.2360847

Method 6 yields a particle size, d_i, of: **266** mm

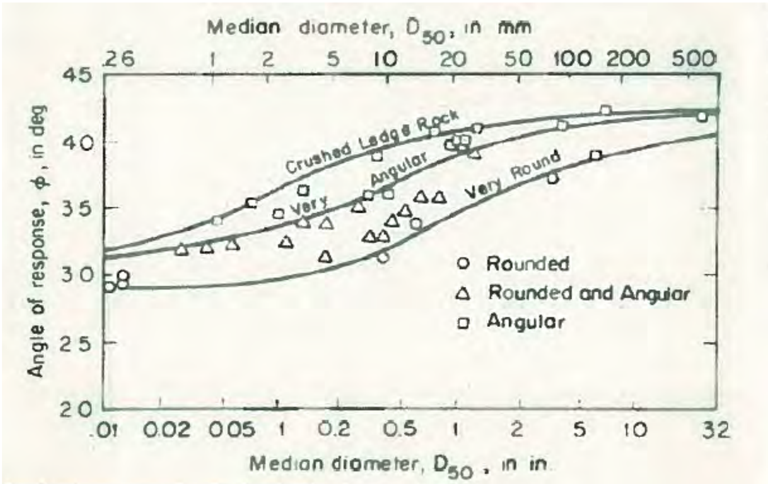
SECTION 3: SUMMARY OF RESULTS

Method	Particle Size (mm)
Method 1: Shields/Julien (1995)	117
Method 2: MTO DMM (1997) - Shear Stress on Bed	162
Method 3: MTO DMM (1997) - Shear Stress on Side Slopes	141
Method 4: Smith (1978)	74
Method 5: Leopold, Wolman, and Miller (1964) Trendline	172
Method 6: WARSSS Colorado Trendline (Rosgen, 2006)	266

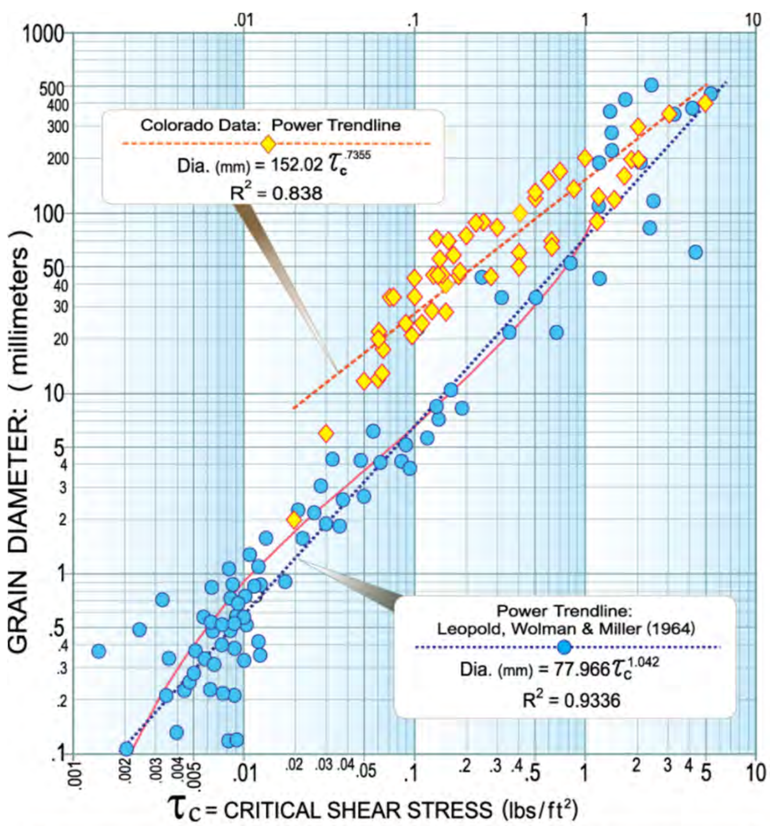
160960948

Shear Stress/Particle Size Calculation Reference Figures

<u>Section 2, Method 1: Angle of Repose for Granular Materials (Simons, 1957)</u>



<u>Section 2, Method 6: Critical Shear Stress Required to Initiate Incipient Movement of Bed Material Grains (Rosgen, 2006)</u>

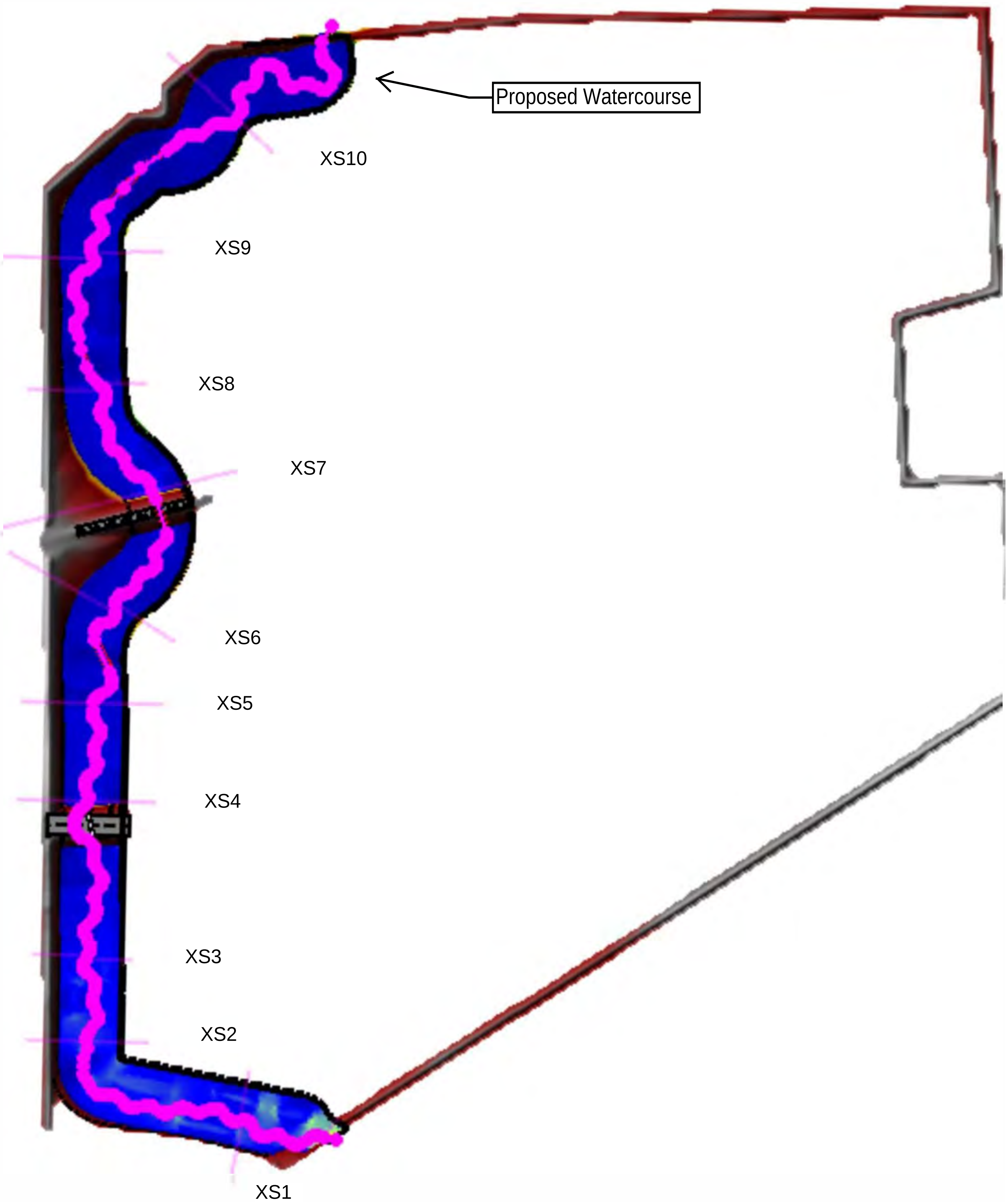


Laboratory and field data on critical shear stress required to initiate movement of grains (Leopold, Wolman, & Miller, 1964). The solid line is the Shields curve of *the threshold of motion*; transposed from the $\boldsymbol{\Theta}$ versus $\boldsymbol{R_g}$ form into the present form, in which critical shear stress is plotted as a function of grain diameter.

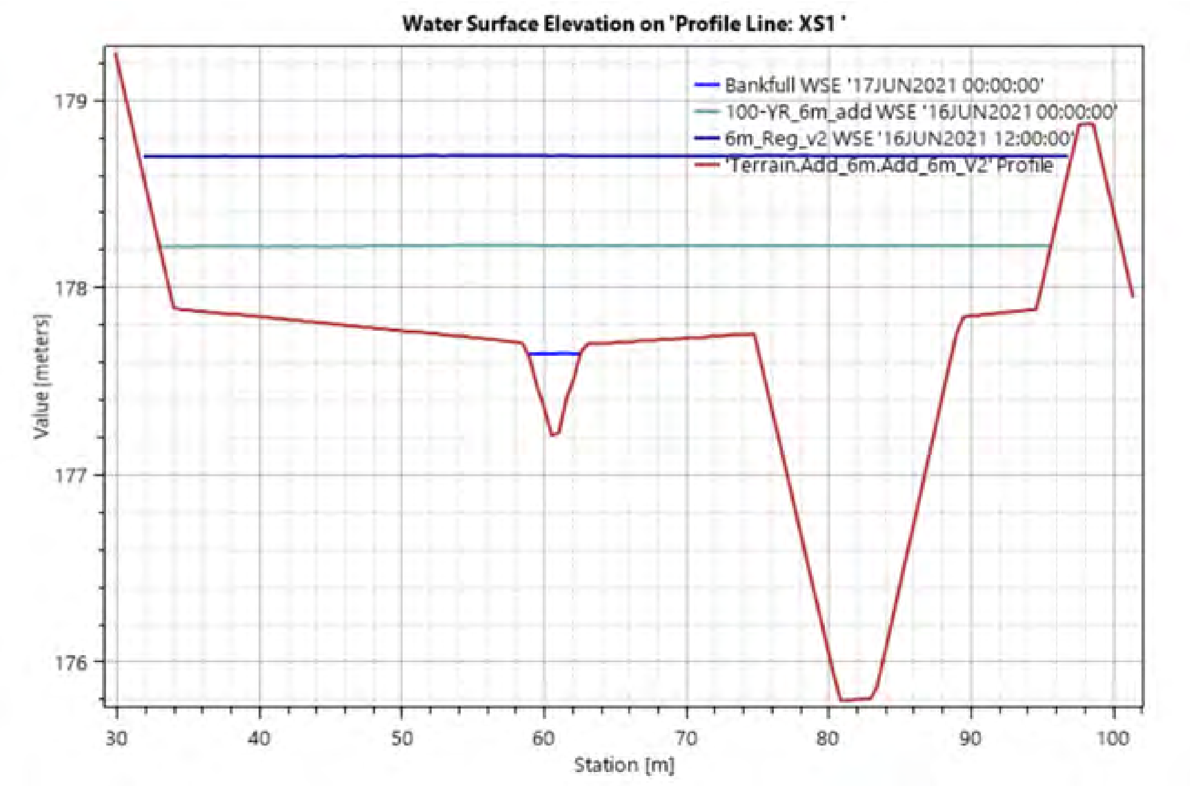
APPENDIX D

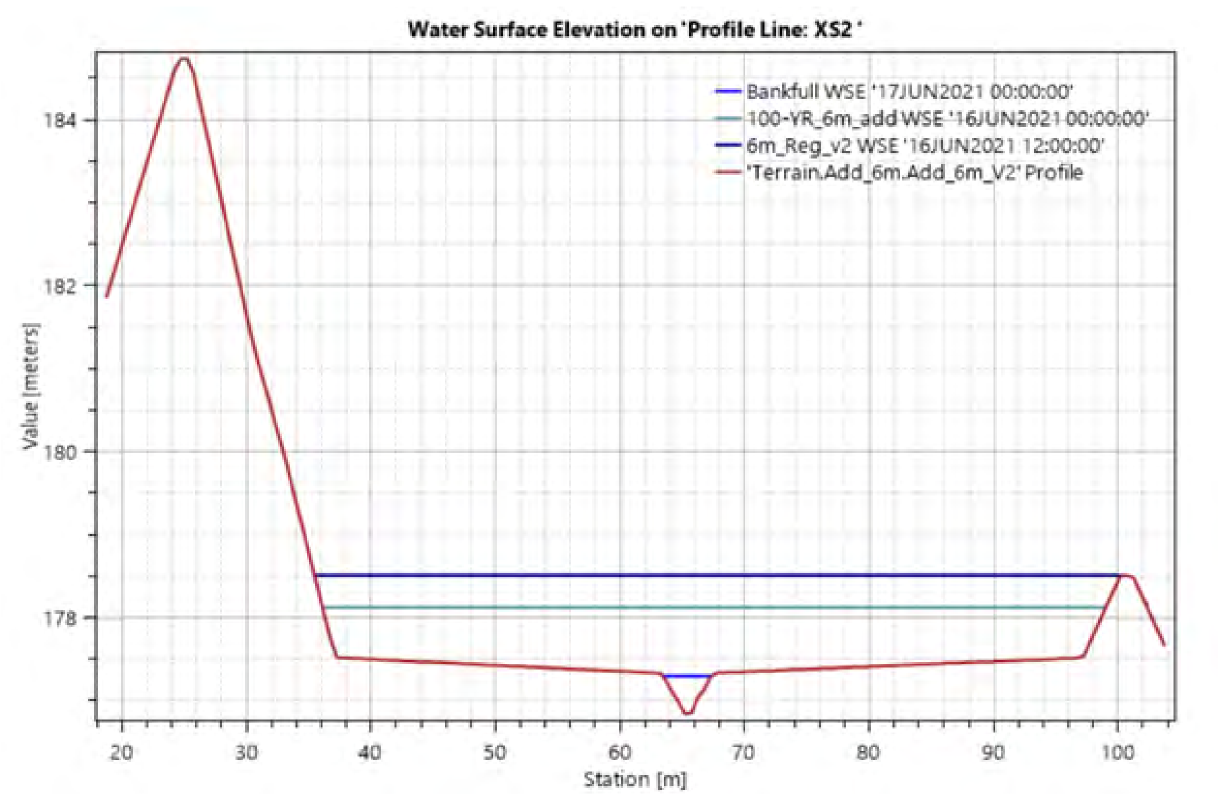
Hydraulic Modeling

Proposed Upper's Quarry - Channel Realignment - Plan View

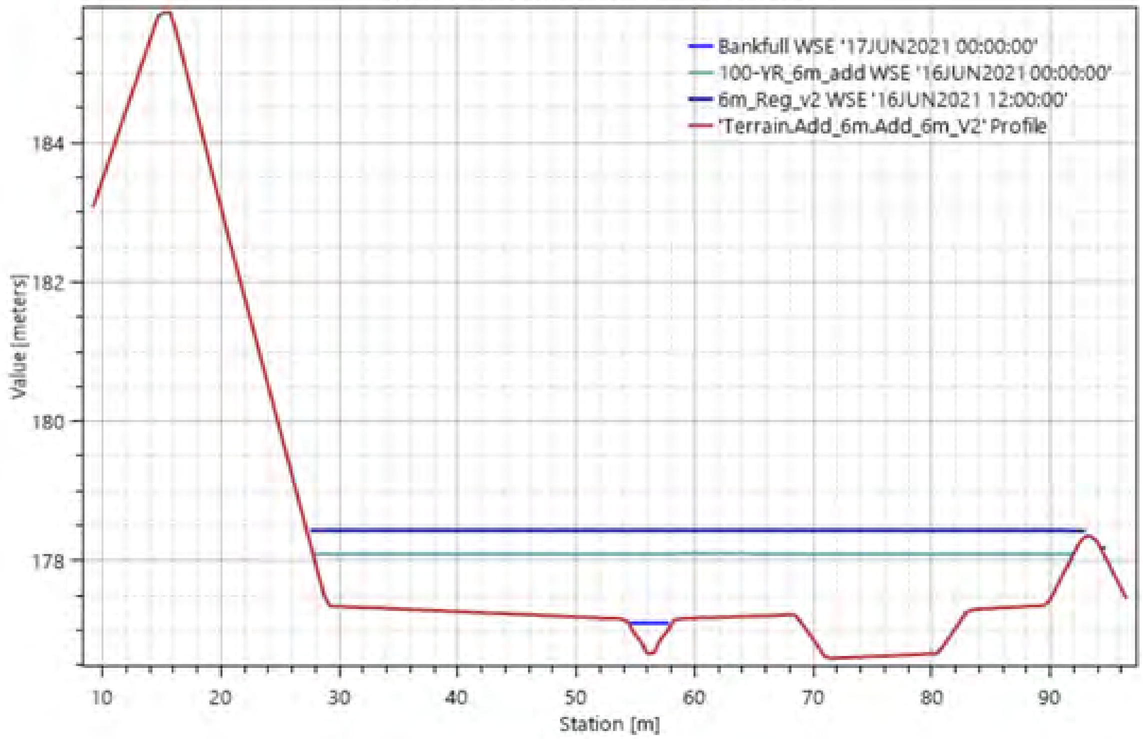


Proposed Upper's Quarry - Channel Realignment - Cross-Sections

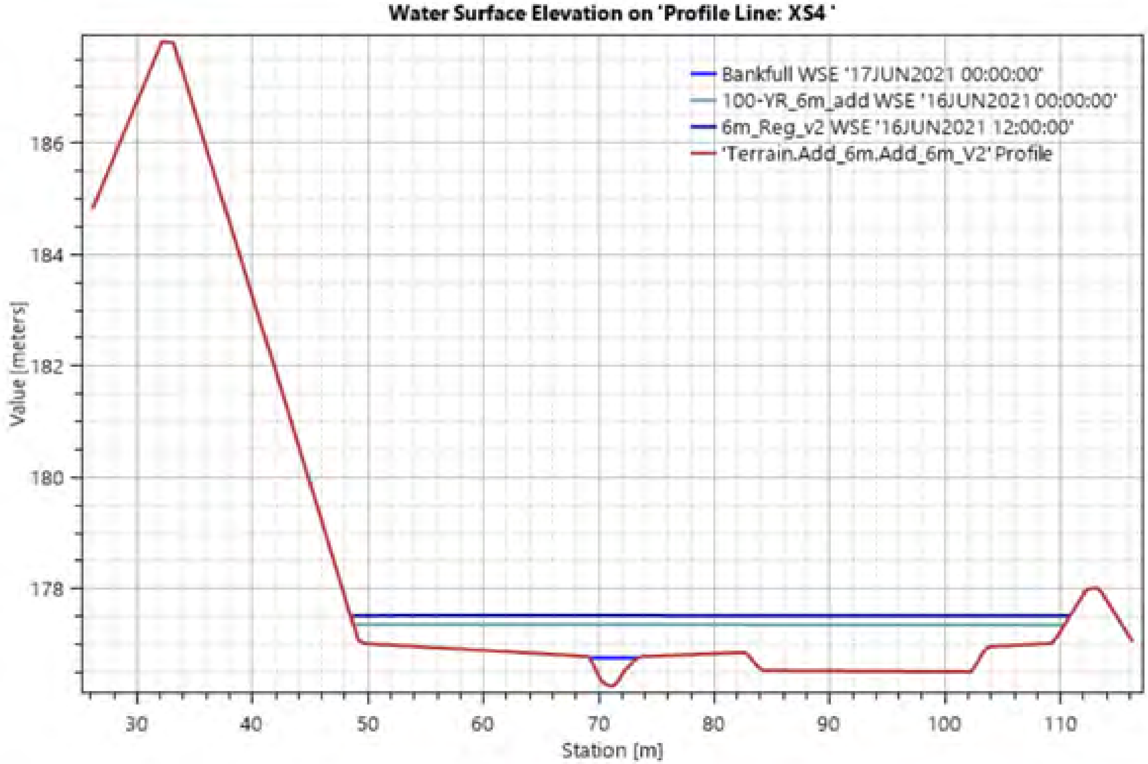


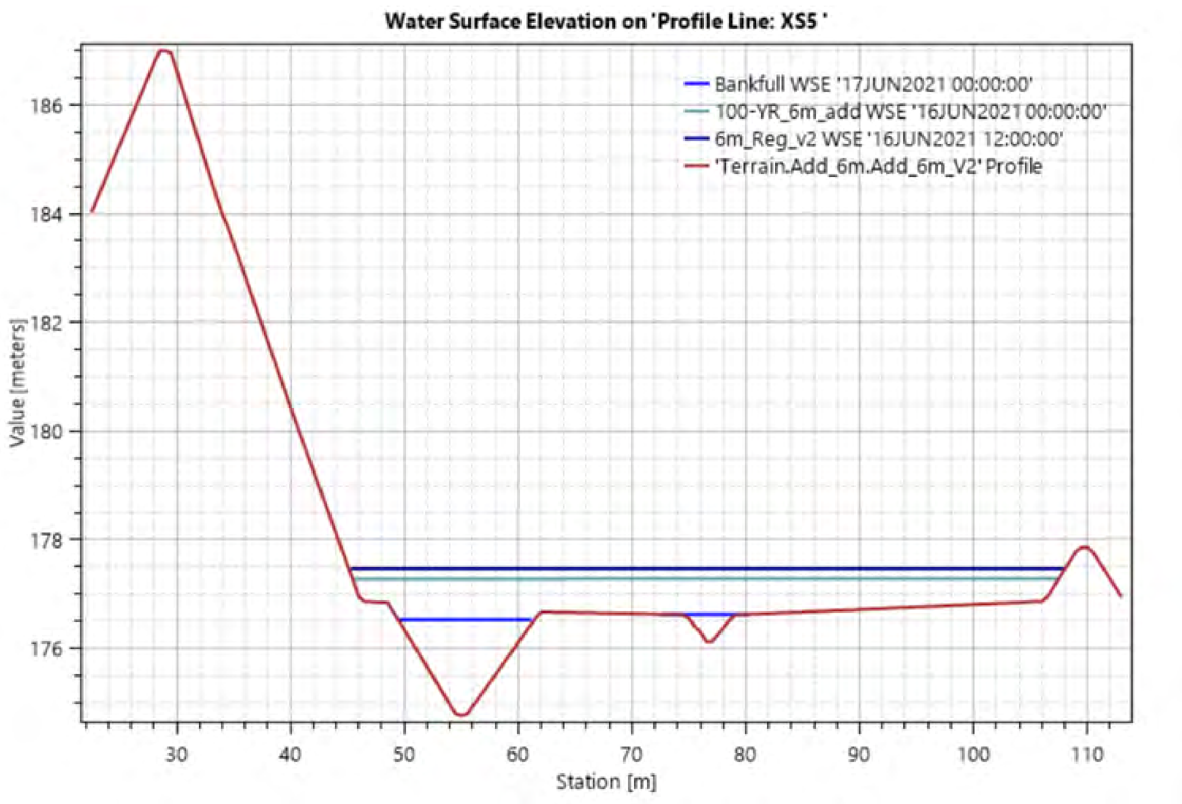


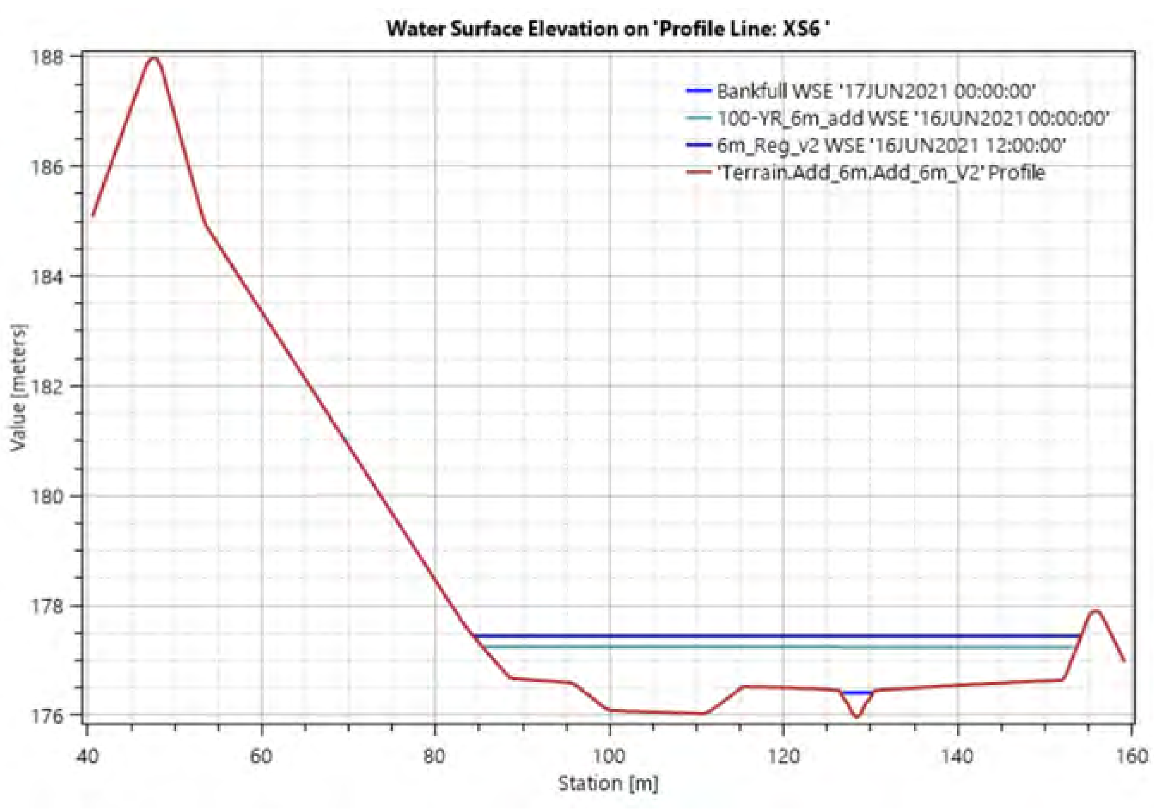
Water Surface Elevation on 'Profile Line: XS3 '

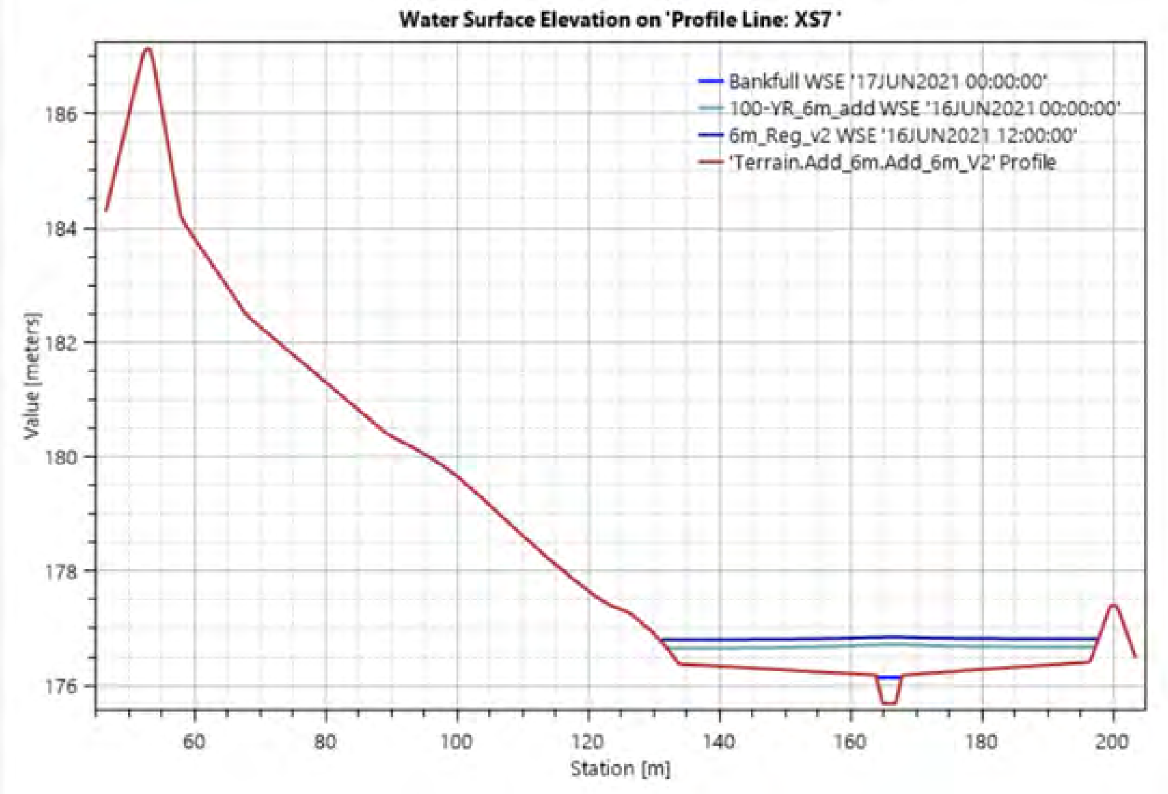


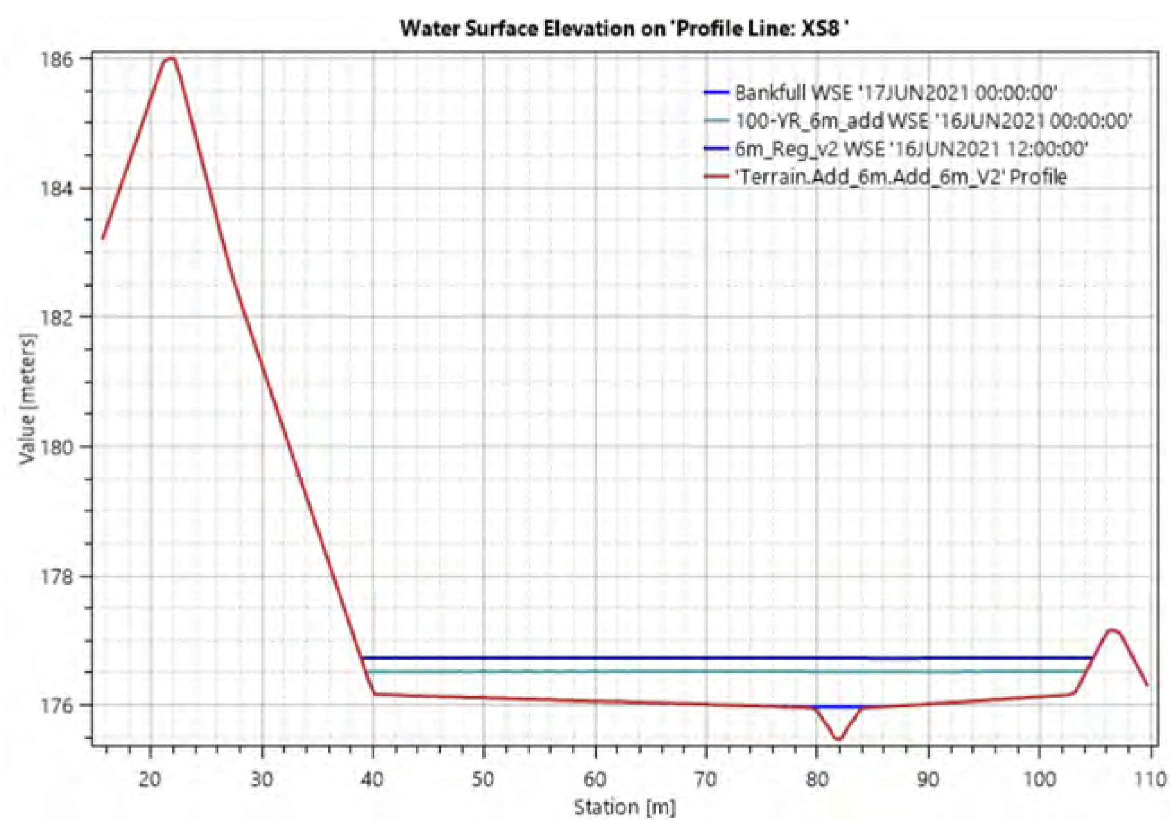
Water Surface Elevation on 'Profile Line: XS4 '

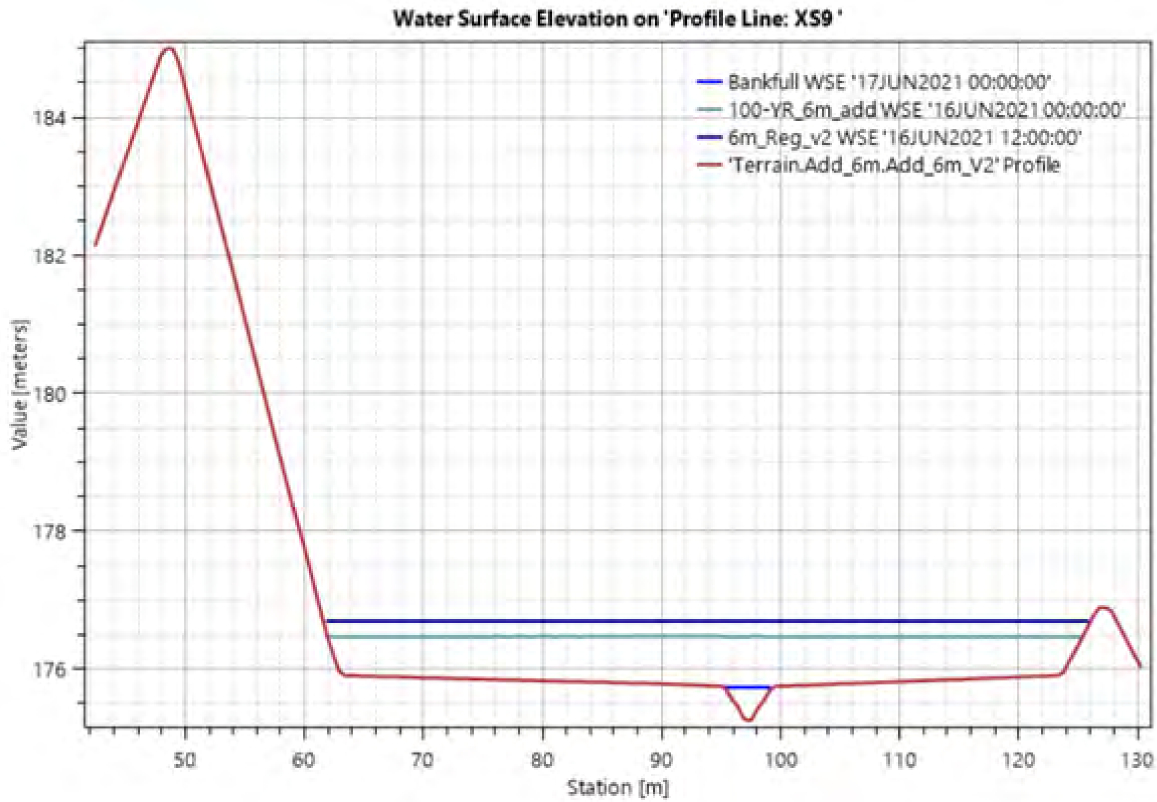


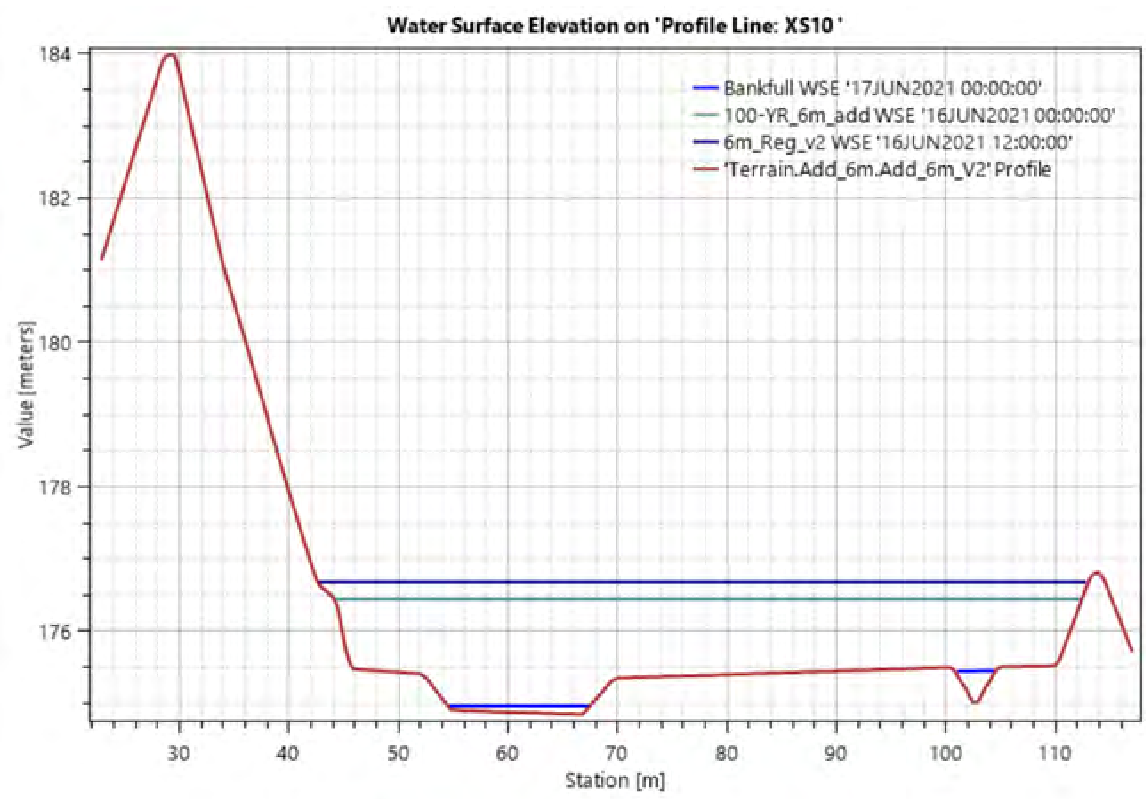

Water Surface Elevation on 'Profile Line: XS5 '
Bankfull WSE '17JUN2021 00:00:00'
100-YR_6m_add WSE '16JUN2021 00:00:00'
6m_Reg_v2 WSE '16JUN2021 12:00:00'
'Terrain.Add_6m.Add_6m_V2' Profile
Value [meters]
Station [m]
186
184
182
180
178
176
30
40
50
60
70
80
90
100
110


Water Surface Elevation on 'Profile Line: XS6 '
Bankfull WSE '17JUN2021 00:00:00'
100-YR_6m_add WSE '16JUN2021 00:00:00'
6m_Reg_v2 WSE '16JUN2021 12:00:00'
'Terrain.Add_6m.Add_6m_V2' Profile
Value [meters]
Station [m]
188
186
184
182
180
178
176
40
60
80
100
120
140
160

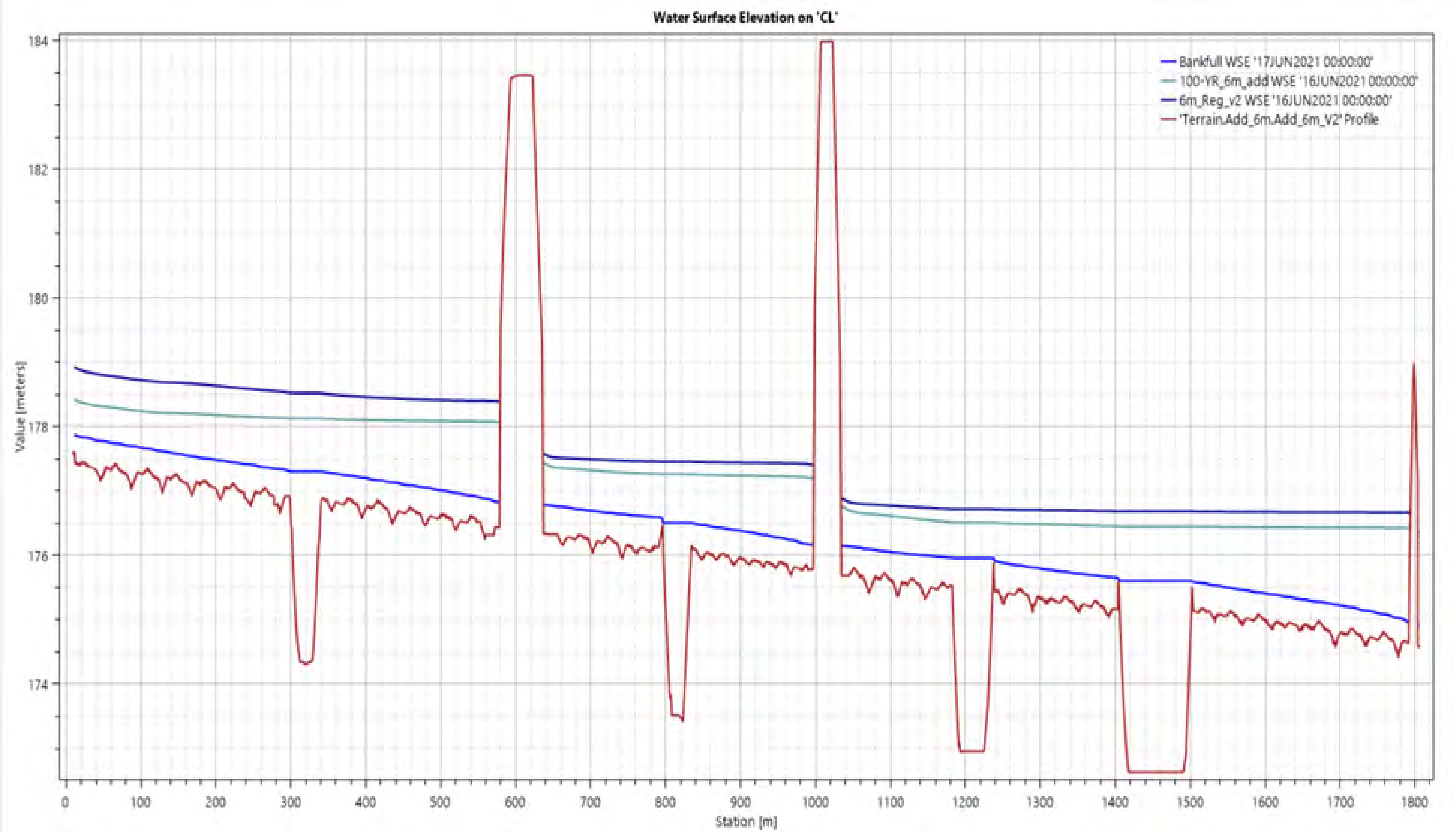

Water Surface Elevation on 'Profile Line: XS7 '
Bankfull WSE '17JUN2021 00:00:00'
100-YR_6m_add WSE '16JUN2021 00:00:00'
6m_Reg_v2 WSE '16JUN2021 12:00:00'
'Terrain.Add_6m.Add_6m_V2' Profile
Value [meters]
186
184
182
180
178
176
60
80
100
120
140
160
180
200
Station [m]


Water Surface Elevation on 'Profile Line: XS8 '
Bankfull WSE '17JUN2021 00:00:00'
100-YR_6m_add WSE '16JUN2021 00:00:00'
6m_Reg_v2 WSE '16JUN2021 12:00:00'
'Terrain.Add_6m.Add_6m_V2' Profile
Value [meters]
186
184
182
180
178
176
20
30
40
50
60
70
80
90
100
110
Station [m]


Water Surface Elevation on 'Profile Line: XS9 '
Bankfull WSE '17JUN2021 00:00:00'
100-YR_6m_add WSE '16JUN2021 00:00:00'
6m_Reg_v2 WSE '16JUN2021 12:00:00'
'Terrain.Add_6m.Add_6m_V2' Profile
Value [meters]
Station [m]
184
182
180
178
176
50
60
70
80
90
100
110
120
130


Water Surface Elevation on 'Profile Line: XS10 '
Bankfull WSE '17JUN2021 00:00:00'
100-YR_6m_add WSE '16JUN2021 00:00:00'
6m_Reg_v2 WSE '16JUN2021 12:00:00'
'Terrain.Add_6m.Add_6m_V2' Profile
Value [meters]
Station [m]
184
182
180
178
176
30
40
50
60
70
80
90
100
110

Proposed Upper's Quarry - Channel Realignment - Profile View



APPENDIX E

Photographic Inventory

Photo 1: Looking upstream at Uppers Creek. Unconfined through agricultural fields upstream of Uppers Lane (October 2017).

Photo 2: Looking upstream from upstream end of Uppers Lane culvert (October 2017).

Photo 3: Looking downstream from downstream end of Uppers Lane culvert (October 2017).

Photo 4: Looking downstream at Uppers Creek. Slightly more confined downstream of Uppers Lane Culvert (October 2017).

Appendix E: Photographic Inventory of Uppers Creek
Existing Conditions

PREPARED FOR:
Walker Aggregates Inc.

Stantec

Photo 5: Downstream section of Uppers Creek. More confined with trees closer to banks (October 2017).

Photo 6: Looking upstream from downstream section of Uppers Creek (January 2018).

Photo 7: Looking upstream at Uppers Creek. Unconfined through agricultural fields upstream of Uppers Lane (January 2018).

Photo 8: Facing southwest (upstream) approx. 400 m upstream of Uppers Lane, unconfined through fields (March 2018).

Appendix E: Photographic Inventory of Uppers Creek Existing Conditions

PREPARED FOR:
Walker Aggregates Inc.

Stantec

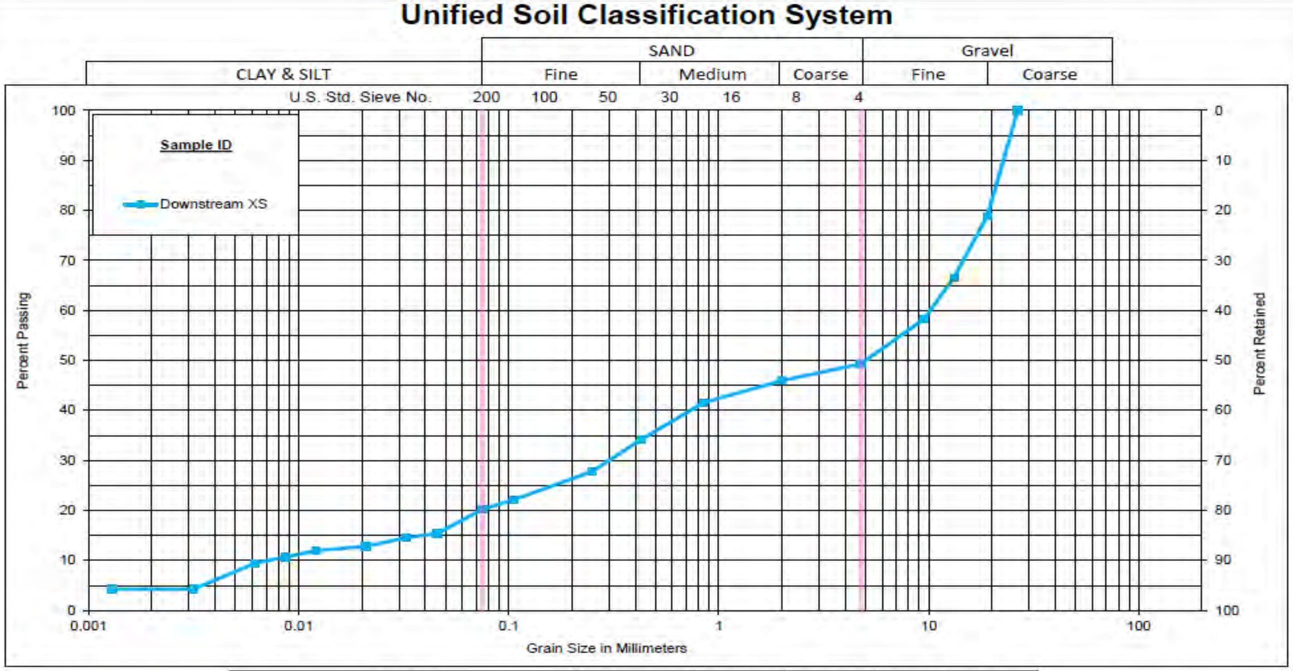
APPENDIX F

Erosion Threshold Analysis

Substrate Data

Project Number: 160960948
Sample Date: July 19, 2018

Downstream Reach	
D50	4.2
D84	21
% Gravel	51
% Sand	28.8
% Silt	16.2
% Clay	4
Total	100
Soil Classification	Fine Gravel



Sample ID	Depth (m)	% Gravel	% Sand	% Silt	% Clay
Downstream XS	N/A	51.0	28.8	16.2	4.0

Stantec

GRAIN SIZE DISTRIBUTION

Figure No. 1

Project No. 160960948.403

Chow Method

Project Number: 160960948

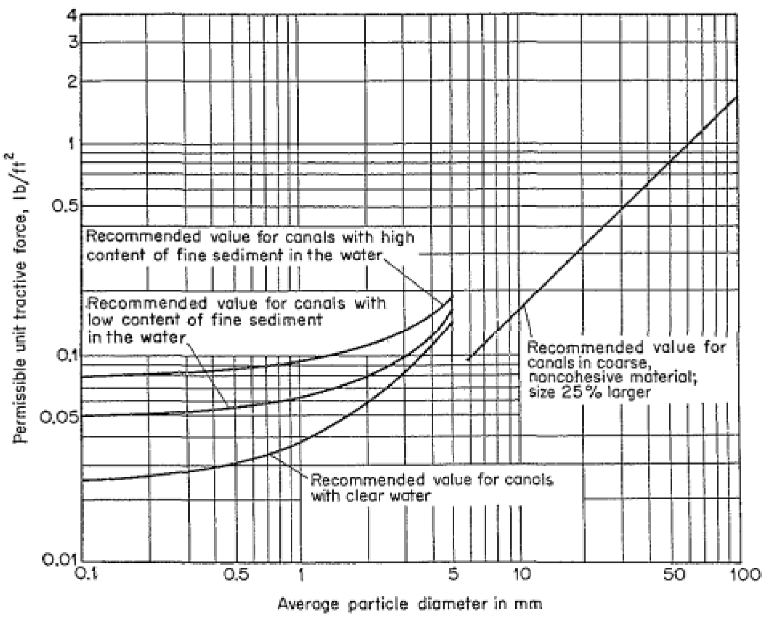


Fig. 7-10. Recommended permissible unit tractive forces for canals in noncohesive material. (*U.S. Bureau of Reclamation.*)

Table 7-3. Maximum Permissible Velocities Recommended by Fortier and Scobey and the Corresponding Unit-tractive-force Values Converted by the U.S. Bureau of Reclamation*
(For straight channels of small slope, after aging)

Material	n	Clear water		Water transporting colloidal silts	
		V, fps	τ_0, lb/ft²	V, fps	τ_0, lb/ft²
Fine sand, colloidal	0.020	1.50	0.027	2.50	0.075
Sandy loam, noncolloidal	0.020	1.75	0.037	2.50	0.075
Silt loam, noncolloidal	0.020	2.00	0.048	3.00	0.11
Alluvial silts, noncolloidal	0.020	2.00	0.048	3.50	0.15
Ordinary firm loam	0.020	2.50	0.075	3.50	0.15
Volcanic ash	0.020	2.50	0.075	3.50	0.15
Stiff clay, very colloidal	0.025	3.75	0.26	5.00	0.46
Alluvial silts, colloidal	0.025	3.75	0.26	5.00	0.46
Shales and hardpans	0.025	6.00	0.67	6.00	0.67
Fine gravel	0.020	2.50	0.075	5.00	0.32
Graded loam to cobbles when noncolloidal	0.030	3.75	0.38	5.00	0.66
Graded silts to cobbles when colloidal	0.030	4.00	0.43	5.50	0.80
Coarse gravel, noncolloidal	0.025	4.00	0.30	6.00	0.67
Cobbles and shingles	0.035	5.00	0.91	5.50	1.10

* The Fortier and Scobey values were recommended for use in 1926 by the Special Committee on Irrigation Research of the American Society of Civil Engineers.

Downstream Reach	
D50 (mm)	4.2
Figure 7-10	
Tractive Force (lb/ft^2)	0.12
Tractive Force (n/m^2)	5.7456
Table 7-3	
Soil Classification	Fine Gravel
Velocity (fps)	2.5
Velocity (m/s)	0.762
Tractive Force (lb/ft^2)	0.075
Tractive Force (n/m^2)	3.591

Fischenich Method

Project Number: 160960948

Downstream Reach	
D50	4.2
Texture	Fine Gravel
Shear (lb/ft^2)	0.075
Shear (N/m^2)	3.591
Permissible V (ft/sec)	2.5
Permissible v (m/s)	0.762

Table 2. Permissible Shear and Velocity for Selected Lining Materials[1]

Boundary Category	Boundary Type	Permissible Shear Stress (lb/sq ft)	Permissible Velocity (ft/sec)	Citation(s)
Soils	Fine colloidal sand	0.02 - 0.03	1.5	A
	Sandy loam (noncolloidal)	0.03 - 0.04	1.75	A
	Alluvial silt (noncolloidal)	0.045 - 0.05	2	A
	Silty loam (noncolloidal)	0.045 - 0.05	1.75 – 2.25	A
	Firm loam	0.075	2.5	A
	Fine gravels	0.075	2.5	A
	Stiff clay	0.26	3 – 4.5	A, F
	Alluvial silt (colloidal)	0.26	3.75	A
	Graded loam to cobbles	0.38	3.75	A
	Graded silts to cobbles	0.43	4	A
	Shales and hardpan	0.67	6	A
Gravel/Cobble	1-in.	0.33	2.5 – 5	A
	2-in.	0.67	3 – 6	A
	6-in.	2.0	4 – 7.5	A
	12-in.	4.0	5.5 – 12	A
Vegetation	Class A turf	3.7	6 – 8	E, N
	Class B turf	2.1	4 - 7	E, N
	Class C turf	1.0	3.5	E, N
	Long native grasses	1.2 – 1.7	4 – 6	G, H, L, N
	Short native and bunch grass	0.7 - 0.95	3 – 4	G, H, L, N
	Reed plantings	0.1-0.6	N/A	E, N
	Hardwood tree plantings	0.41-2.5	N/A	E, N
Temporary Degradable RECPs	Jute net	0.45	1 – 2.5	E, H, M
	Straw with net	1.5 – 1.65	1 – 3	E, H, M
	Coconut fiber with net	2.25	3 – 4	E, M
	Fiberglass roving	2.00	2.5 – 7	E, H, M
Non-Degradable RECPs	Unvegetated	3.00	5 – 7	E, G, M
	Partially established	4.0-6.0	7.5 – 15	E, G, M
	Fully vegetated	8.00	8 – 21	F, L, M
Riprap	6 – in. d_{50}	2.5	5 – 10	H
	9 – in. d_{50}	3.8	7 – 11	H
	12 – in. d_{50}	5.1	10 – 13	H
	18 – in. d_{50}	7.6	12 – 16	H
	24 – in. d_{50}	10.1	14 – 18	E
Soil Bioengineering	Wattles	0.2 – 1.0	3	C, I, J, N
	Reed fascine	0.6-1.25	5	E
	Coir roll	3 - 5	8	E, M, N
	Vegetated coir mat	4 - 8	9.5	E, M, N
	Live brush mattress (initial)	0.4 – 4.1	4	B, E, I
	Live brush mattress (grown)	3.90-8.2	12	B, C, E, I, N
	Brush layering (initial/grown)	0.4 – 6.25	12	E, I, N
	Live fascine	1.25-3.10	6 – 8	C, E, I, J
	Live willow stakes	2.10-3.10	3 – 10	E, N, O
Hard Surfacing	Gabions	10	14 – 19	D
	Concrete	12.5	>18	H

[1] Ranges of values generally reflect multiple sources of data or different testing conditions.

A. Chang, H.H. (1988).
B. Florineth. (1982)
C. Gerstgraser, C. (1998).
D. Goff, K. (1999).
E. Gray, D.H., and Sotir, R.B. (1996).
F. Julien, P.Y. (1995).
G. Kouwen, N.; Li, R. M.; and Simons, D.B., (1980).
H. Norman, J. N. (1975).
I. Schiechtl, H. M. and R. Stern. (1996).
J. Schoklitsch, A. (1937).
K. Sprague, C.J. (1999).
L. Temple, D.M. (1980).
M. TXDOT (1999)
N. Data from Author (2001)
O. USACE (1997).

Summary of Hydraulics

Project Number: 160960948

Downstream Reach	
Bottom Width	0.3
Bankfull Width	7.3
Side Slope (X:1)	8.8
Bankfull Depth	0.4
Water Surface Slope (m/m)	0.0026
Bankfull Area (m^2)	1.52
Gradation (m)	
D50	0.0042
D84	0.021
Manning's Roughness Coefficient (n)	
Strickler (n)	0.019
Limerions (n)	0.026
Cowan (n)	
n_0	0.024
n_1	0
n_2	0.003
n_3	0.001
n_4	0.005
m_5	1
Cowan's n	0.033
Critical Shear	
Critical Shear (N/m^2)	3.60

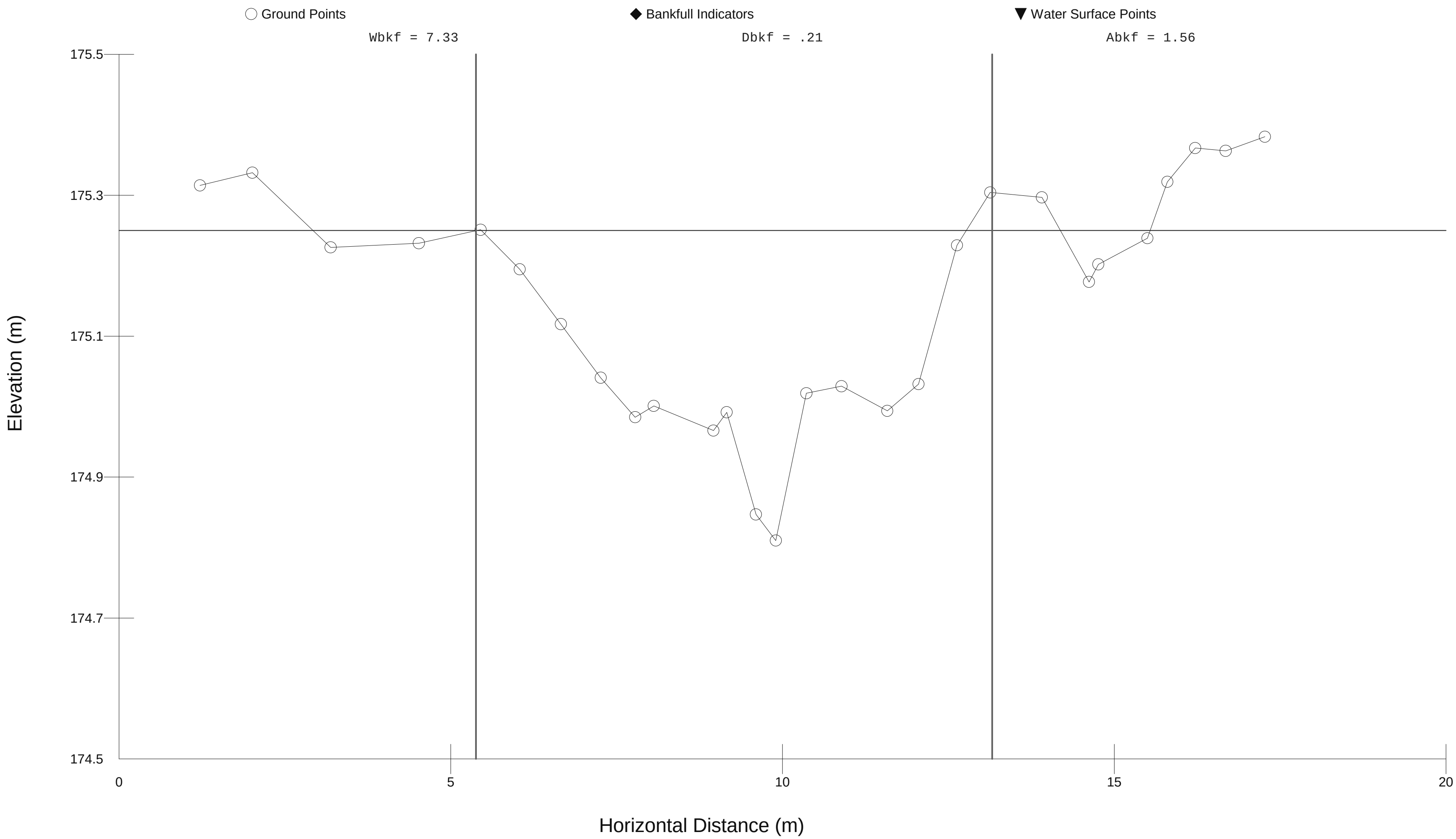
Table C.2 Modified Cowan method for determining channel roughness

Manning's $n = (n_b + n_1 + n_2 + n_3 + n_4)\, m$

Channel condition		n and m values	Description
Channel material (n_b)	Earth	0.020	Clay-based channels.
	Bed rock	0.025	Channels cut into bed rock.
	Sand–fine gravel	0.024*	Sandy creeks.
	Coarse gravel	0.026	Gravel-based creeks (otherwise use Eqn C.1).
Degree of irregularity (n_1)	Smooth	0.0	Smooth channel.
	Minor	0.001–0.005	Excavated channels in good condition.
	Moderate	0.006–0.010	Channels with considerable bed roughness and some bank erosion.
	Severe	0.011–0.020*	Natural' channels: pools and riffles, exposed tree roots, boulders, and/or irregular banks.
Variation in channel cross section (n_2)	Uniform	0.0	Near-uniform channel section.
	Gradual	0.001–0.005*	Large and small cross sections alternate occasionally (eg. typical NCD $n_2 = 0.003$).
	Severe	0.010–0.015	Large and small cross sections alternate frequently (eg. a significant pool-riffle system).
Effect of obstructions (n_3) excluding vegetation	Negligible	0.0–0.004	A few scattered obstructions (boulders, trees, logs) that occupy less than 5% of the channel.
	Minor	0.005–0.015*	Obstructions occupy 5–15% of the channel and the obstructions are generally isolated.
	Appreciable	0.020–0.030	Obstructions occupy 15–50% of the channel.
	Severe	0.040–0.050	Obstructions occupy more than 50% of the channel (eg. severe debris collection).
Amount of vegetation (n_4) Consideration should be given to the obstruction caused by vegetation relative to channel width and depth	Small	0.002–0.010	Grasses and/or weeds with the flow at least three times the height of the vegetation.
	Medium	0.010–0.025*	Grass and/or weeds with the flow one to two times the height of the vegetation; or reeds or tree seedlings growing with the flow two to three time the vegetation height; or minor bed vegetation with medium bank vegetation.
	Large	0.025–0.050	Grasses and/or weeds with flow depth equal to vegetation height; or weedy beds with thick bank vegetation; or moderate shrub growth across the bed and banks.
	Very Large	0.050–0.100	Grass and/or weeds more than twice the height of flow depth; or dense, strong reed growth; or significant shrub growth within the channel; or significant inflexible vegetation within channel.
Degree of channel meandering (m)	Minor	1.00	Channel sinuosity is 1.0 to 1.2
	Appreciable	1.15*	Channel sinuosity is 1.2 to 1.5
	Severe	1.30	Channel sinuosity is greater than 1.5 or: m = 0.57 + 0.43 (Sinuosity), but ≯ 1.30

(*) Typical NCD channel roughness n = (0.024 + 0.003 + 0.012 + 0.005 + 0.015) 1.15 = 0.068

Downstream Cross-Section



RiverMorph Stage-Discharge-Shear Summary

Project:160960948

ELEV (m)	DEPTH (m)	AREA (sq m)	WET PER (m)	WIDTH (m)	HYD RAD (m)	MEAN D (m)	SLOPE (m/m)	ROUGH [n] (m^(1/6))	R/D84	VELOCITY (mps)	U/U*	U^2/2g (m)	DISCHARGE (cms)	SHEAR (Pa)	POWER (W)	POWER/W (W/m)	FROUDE	TRANSPORT (kg/s)
174.86	0.05	0.01	0.46	0.45	0.03	0.03	0.0026	0.033	0	0.15	5.39	0	0	0.76	0.01	0.01	0.28	0
174.91	0.1	0.04	0.75	0.71	0.06	0.06	0.0026	0.033	0	0.24	6.05	0	0.01	1.53	0.07	0.03	0.31	0
174.96	0.15	0.08	1.03	0.97	0.08	0.09	0.0026	0.033	0	0.29	6.35	0	0.02	2.04	0.18	0.06	0.31	0
175.01	0.2	0.18	3.38	3.31	0.05	0.05	0.0026	0.033	0	0.21	5.87	0	0.04	1.27	0.29	0.03	0.3	0
175.06	0.25	0.4	5.11	5.02	0.08	0.08	0.0026	0.033	0	0.29	6.35	0	0.11	2.04	0.89	0.05	0.32	0
175.11	0.3	0.67	5.66	5.56	0.12	0.12	0.0026	0.033	0	0.38	6.8	0.01	0.25	3.06	1.96	0.11	0.35	0
175.16	0.35	0.96	6.22	6.11	0.15	0.16	0.0026	0.033	0	0.44	7.05	0.01	0.42	3.82	3.25	0.16	0.35	0.12
175.21	0.4	1.29	7.31	7.19	0.18	0.18	0.0026	0.033	0	0.49	7.27	0.01	0.64	4.59	4.94	0.21	0.37	0.38
175.26	0.45	1.76	11.62	11.47	0.15	0.15	0.0026	0.033	0	0.44	7.05	0.01	0.77	3.82	5.97	0.16	0.36	0.23
175.31	0.5	2.37	13.67	13.51	0.17	0.18	0.0026	0.033	0	0.47	7.2	0.01	1.12	4.33	8.73	0.2	0.36	0.54

APPENDIX F
Alternate Extraction Scenario Assessment

Alternate Extraction Scenario Assessment

Upper’s Lane (between the north extraction area and the mid extraction area) and the unopened road allowance between Lots 120 and 136 (between the mid extraction area and the south extraction area) both cross the proposed quarry site, creating three separate extraction areas under the proposed extraction scenario. The assessment of impacts for the alternate design scenario is provided in this appendix.

In the event that agreement is reached with the City of Niagara Falls, Walker Aggregates would seek to extract:

i) Upper’s Lane, between the north extraction area and the mid extraction area; and

ii) the unopened road allowance between Lots 120 and 136, between the mid extraction area and the south extraction area (see Figure A1, Appendix A).

Walker Aggregates currently owns all of the lands north and south of Upper’s Lane and the unopened road allowance between Thorold Townline Road and Beechwood Road, with exception of the Bible Baptist Church property which has secured access from Beechwood Road. The alternate extraction scenario would maximize access to the aggregate resource and to create a more integrated operation and rehabilitation plan.

The majority of the potential impacts to the various features are consistent with the proposed extraction scenario, particularly for wetlands, woodlands, significant habitat of threatened and endangered species and SWH. Impact assessments associated with those features are described in Section 8.0.

In the alternate extraction scenario, the impact assessment is slightly different for fish habitat and the associated components of the NCD, primarily related to the culverts associated with Upper’s Lane and the unopened road allowance. The extraction of these two road allowances eliminates the three separate extraction cells and results in one single extraction area, as described in Section 7.2.

With an expanded, single cell extraction area, the new channel design would be adapted to accommodate the alternate extraction scenario pit configuration. In this scenario, the unopened road allowance culvert would no longer be required. The current location of Upper’s Lane would become an access ramp to the proposed quarry site allowing for a shorter culvert at this location since the road would be lower and the depth of cover would not facilitate as extensive embankments on either side of the road. Hydraulics under this alternate extraction scenario are not significantly different than the proposed extraction scenario. Under the alternate extraction scenario, flood levels will not increase offsite.

Fish Habitat

Under the alternate extraction scenario, the culvert and road embankment is not required at the unopened road allowance. This allows for an open corridor through that area with an increase in natural channel length, associated habitat components and adjacent riparian floodplain habitat, when compared to the proposed extraction scenario.

Since Upper's Lane would be closed and the right of way subject to extraction, Upper's Lane would be reconfigured to function as an access road into the quarry. A culvert would still be required across the proposed realigned channel. The access road would be lower than the existing roadway, and the subsequent decrease in the depth of cover over the culvert would result in a corresponding decrease in the side embankments encroachment longitudinally into the corridor. A shorter culvert than the one for the proposed extraction scenario would be feasible, which would allow for a slight increase in open channel length, associated habitat features and a corresponding increase in the creation of floodplain and riparian planting areas.

New Habitat Areas

Under the alternate extraction scenario, only the Upper's Lane culvert will be required and will be shorter than that required for the Proposed Extraction Scenario, as Upper's Lane will be modified (lowered) to act as an access road/ramp into the proposed quarry area. For the Alternate Extraction Scenario, 1,760 metres (not including culvert lengths) of open natural stream channel will be created. Habitat conditions within the channel will include 6,132 m^2 of habitat that will be constructed using a 4 m bankfull width. A series of deeper pools will be constructed, adding 4,950 m^2 of pool habitat to the channel that will provide rearing, feeding and refuge functions. Overall, a total of 11,082 m^2 of habitat will be created within the bankfull limits of the new open channel.

The channel will be located within a large floodplain corridor, of which approximately 79,484 m^2 will be subject to annual inundation during the spring runoff and freshet period. This is particularly important to pike, as they will seek out these areas for spawning habitat as they do in the existing watercourse. In addition, several wetlands and offline ponded areas will be constructed adjacent to the channel but provided with a seasonal connection to the new watercourse. These habitat areas provide accessible habitat that fish may move in and out of depending on flow conditions, and serve as spawning, rearing, feeding and potential nursery habitat areas. In total, 7,586 m^2 of this type of connected habitat will be created.

In summary, the overall channel and floodplain design will create 98,152 m^2 of fish habitat that could be used on an annual basis (in-channel, annually flooded vegetation and connected wetlands).

Finally, a series of wetland pockets and water ponding areas will be incorporated but not connected to the new channel. These may provide habitat for breeding amphibians, and there is the potential for fish to enter under flooded conditions and remain there until the next flooding event occurs to allow them to exit. Approximately 5,976 m^2 of this disconnected habitat will be constructed.

Predicted gains in physical habitat are quantifiable and expressed in square metres. In addition to the numeric gain in habitat area, there will be an increase in habitat quality due to the incorporation of more diverse habitat elements that subsequently offer more habitat opportunities than the existing channel. The benefits of increased habitat quality cannot be quantified pre-construction; however, increased habitat diversity should intuitively result in improved quality of habitat and consequently, increased fish productivity. Fish productivity can be confirmed through post construction monitoring. The riparian and floodplain enhancements will also contribute to increasing overall habitat diversity and quality for terrestrial wildlife.

The new channel will retain the same flow periodicity as the existing channel (i.e. intermittent), but the channel design is intended to result in a substantial increase in habitat quantity and quality.

Natural Channel Design

The principles of NCD were used to develop the design for the realigned watercourse. As outlined in the Natural Channel Design Report (Appendix E), the proposed channel realignment has been designed to provide the following services:

- Stable pattern, dimension, and profile to convey sediment load without excessive aggradation or degradation;
- Accommodate discharge from quarry dewatering during the extraction phase;
- Incorporates a valley sized to convey the 100-year flow;
- Diverse riparian habitat with plantings appropriate for local wildlife;
- Wetland and pond features to mimic natural wetland habitat; and
- Natural channel substrate and instream habitat features that will provide fish and aquatic habitat.

The reference reach design method was used to determine the design parameters for the proposed channel realignment. A reference reach is a stable portion of watercourse that is considered suitable to help determine the dimensions, pattern, and profile of the channel to be restored. Using this method, suitable dimensions were determined for the bankfull channel and channel planform of the realigned watercourse. Instream structures were selected to increase channel stability and habitat diversity. Modeling was completed to evaluate culvert dimensions, flood elevations, and channel substrate sizing. Additional detail on the design methods for the proposed channel realignment are included in Natural Channel Design Report (Appendix E).

Summary of Potential Impacts and Mitigation

The key differences between the proposed extraction scenario and the alternate extraction scenario relate to the Upper's Lane road allowance and the unopened road allowance. Under the alternate extraction scenario, both of these road allowances would be extracted. A culvert across the realigned watercourse would not be required at the unopened road allowance location. A culvert would still be required at the Upper's Lane location, however the road would be modified by lowering and using it as an access ramp/road to the quarry operations. As a result, the crossing embankments would be lowered and a shorter culvert length could be employed. The reduction in the number of culvert crossings, coupled with the shortening of the Upper's Lane culvert results in an increased availability of corridor space to increase the length of open natural channel and a corresponding area of floodplain.