Township of Clearview
26/27 Sideroad, Township of Clearview
Proposed Improvements
Environmental Impact Study

R.J. Burnside & Associates Limited
292 Speedvale Avenue West Unit 20
Guelph ON   N1H 1C4 CANADA

October 2018
300034587.0000

26/27 Sideroad, Township of Clearview Proposed Improvements Environmental Impact Study
October 2018

Distribution List

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2	Yes	Yes	Niagara Escarpment Commission
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Record of Revisions and Addendums

Revision	Date	Description
0	August 25, 2014	Initial Submission to Niagara Escarpment Commission
1	June 30, 2015	EIS Addendum report – NEC and NVCA
2	October 18, 2018	EIS Submission to NEC

R.J. Burnside & Associates Limited

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Senior Ecology Review

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Disclaimer

1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) was retained by the Township of Clearview (Clearview) to conduct an Environmental Impact Study (EIS) for the required road improvements to 26/27 Sideroad to address public safety issues and existing environmental impacts.

The proposal is to reconstruct 26/27 Sideroad from the Osprey-Clearview Townline to Concession 10, within the existing Township right-of-way (Figure 1.1). The proposed road improvements include improving the vertical alignment, replacing road-crossing culverts, improving and widening the road base and resurfacing the road.
26/27 Sideroad, in its current condition, has deficient drainage features which create erosion and sedimentation issues that have had a negative impact on adjacent key natural heritage features and key hydrologic features, including the adjacent coldwater fishery and wetland features.

The existing Township right-of-way is approximately 20 m wide, with a total approximate length of 2.73 km for a total area of 5.46 ha.

For the purpose of the EIS, the Study Area includes:

- The existing road surface which is approximately 1.36 ha;
- The proposed road Improvement Area (IA) (2.37 ha);
- Adjacent lands which is defined as 120 m beyond the IA; and,
- The area of the disturbance to the grading limits includes approximately 2.93 ha, for a total area of 5.3 ha.

The IA is located within the Niagara Escarpment Planning Area and contains a number of features designated under this plan (Niagara Escarpment Commission, 2017) (Figure 1.2). This EIS should be read in conjunction with the Planning Report, prepared by Skelton Brumwell & Associates Ltd. which addresses:

- The policies of the Provincial Policy Statement;
- The policies and development criteria of the Niagara Escarpment Plan;
- The policies of the County of Simcoe and the Township of Clearview Official Plans; and,
- The requirements of the Nottawasaga Valley and Grey Sauble Conservation Authorities.

As part of the EIS the following have been completed:

- A review of applicable environmental policies and regulations affecting the subject lands;
- A review of existing secondary source data to identify any known natural features;

- Consultation with the various agencies to identify additional features and to confirm field study methodologies;
- Field studies and an inventory of natural features in order to confirm the presence, significance and sensitivity of any key hydrologic feature and key natural heritage features;
- A description of the proposed development;
- Identification of key hydrologic and key natural heritage features on or within 120 m of the Improvement Area (IA);
- Assessment of potential impacts resulting from the proposed development; and,
- Recommendation of mitigating measures to avoid or minimize impacts.

Based on the review of the applicable environmental policies and regulations affecting the subject lands, the following key hydrologic and key natural heritage features were assessed to determine if they exist on or within 120 m of the Improvement Area:

- Significant wetlands (Figure 1.3);
- Habitat of endangered and threatened species;
- Fish habitat;
- Areas of Natural and Scientific Interest (ANSI) which include Provincial and Regional Life and Earth Science ANSIs (Figure 1.4);
- Significant valleylands;
- Significant woodlands;
- Significant wildlife habitat;
- Habitat of special concern species;
- Non-evaluated wetlands;
- Permanent or intermittent streams;
- Lakes; and,
- Seepage areas / springs.

As a result of our investigation and proposed mitigation measures, the Improvement Area for 26/27 Sideroad results in the removal of approximately 1.2 ha of natural heritage and key hydrologic features within the existing right-of-way, in order to address the existing public safety issues and environmental deficiencies of the existing road.

As part of the design, all efforts have been made to minimize the impact on the area while addressing the growing and anticipated traffic demands for the road and mitigating the existing negative impact on the adjacent environment. The proposed Road Improvements have been designed to the Township of Clearview's minimum design standards to a design speed of 70 km/hour with the anticipated posted speed of 60 km/hour. The road will initially have a gravel surface but will be paved in the future as vehicle volumes increase, however, truck traffic will be restricted.

The design also includes measures that will significantly improve the water quality of the stream and fish habitat. These measures include:

- Improved stormwater conveyance that will considerably reduce erosion of the road base and sedimentation in the adjacent watercourses;
- Culvert replacements to improve fish passage; and,
- A short distance of channel realignment to increase the current separation distance between the road and the watercourse.

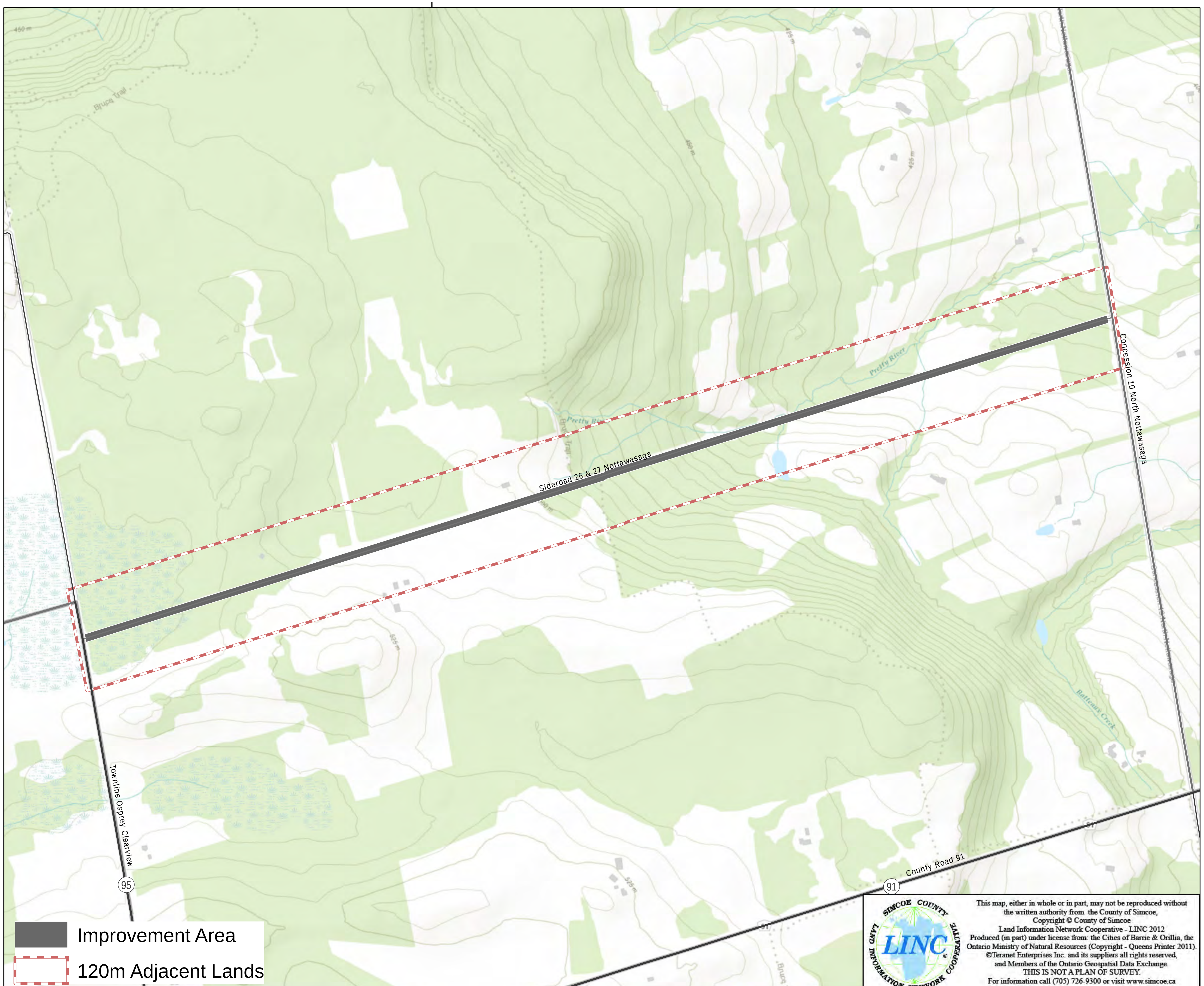
The Department of Fisheries and Oceans (DFO) has reviewed the proposed work and concluded that, with the mitigation measures proposed, the application does not result in serious harm to fish. A Letter of Advice (LOA), issued by DFO on June 19, 2017. Therefore, no further approval under the *Fisheries Act* is required.

With the mitigation measures proposed, all key natural heritage features and key hydrologic features in the 120 m adjacent lands to the IA will be protected from impacts. Examples of the mitigation measures include:

- Sedimentation and erosion control measures;
- Stormwater management controls;
- Wildlife crossings and exclusion fencing;
- Reducing the design speed from 80 km to 60 km; and,
- Restricting tree clearing from May 1 to September 30.

From a regional scale, the surrounding area contains extensive environmental features and includes over 700 ha of contiguous key natural heritage features and key hydrologic features. The removal of 2.93 ha of natural heritage features is a minor impact and will not affect the functions of the retained features as wildlife corridors.

This EIS presents the results of natural heritage investigations; analysis of the natural heritage features found and their ecological functions; and proposed mitigation and compensation to address the environmental impacts of the proposal. The Planning Report sets out how the EIS findings and recommendations satisfy the various natural heritage policy requirements.



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TOWNSHIP OF CLEARVIEW

Figure Title

CORRIDOR LOCATION

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

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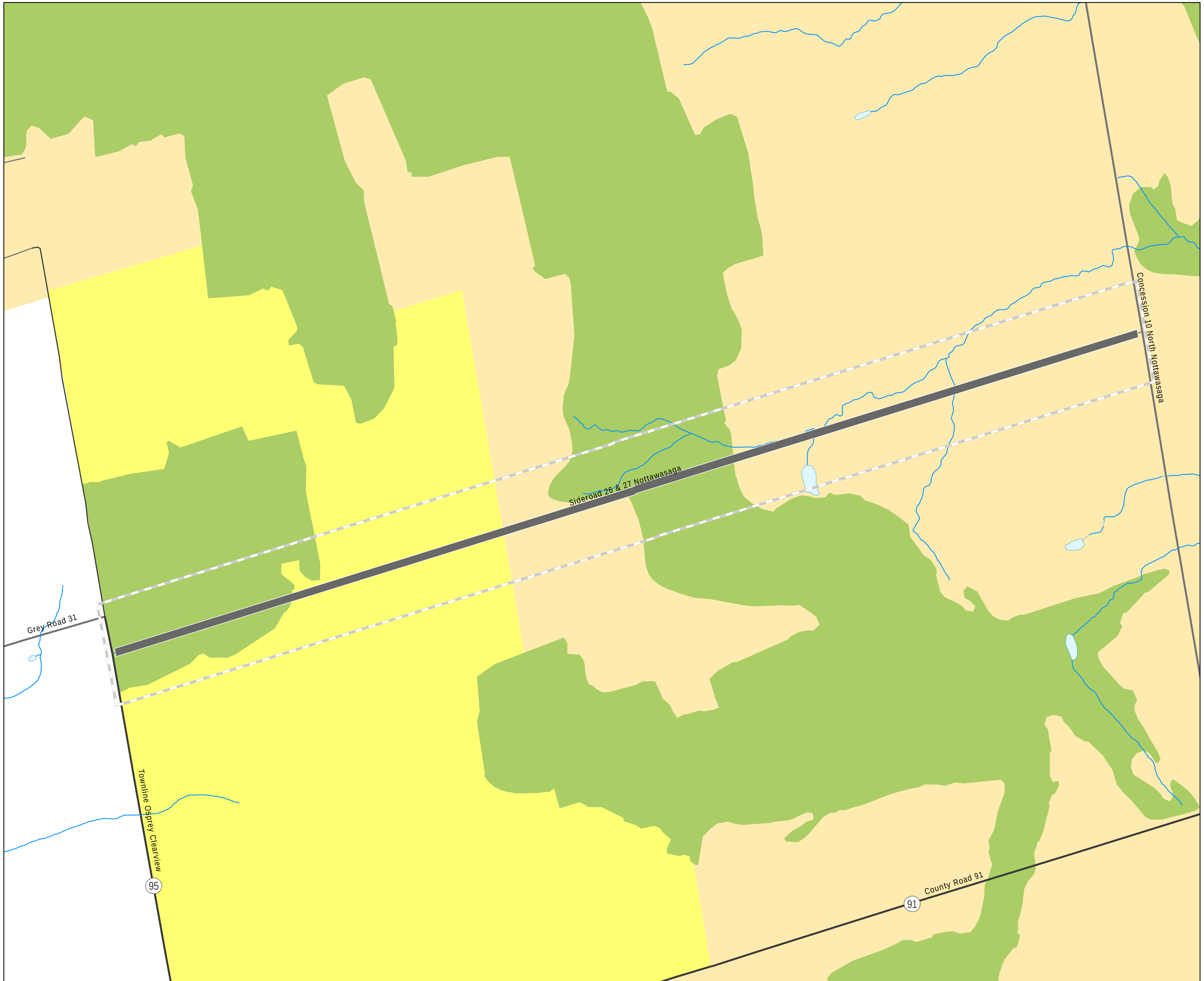

120m Adjacent Lands

Improvement Area

Niagara Escarpment Plan Designations

Escarpment Natural Area

Escarpment Protection Area

Escarpment Recreation Area

Escarpment Rural Area

Mineral Resource Extraction Area

Urban Area

Waterbody (OHN)

Lake; Pond; River Segment of Width

Watercourse (OHN)

Watercourse: Permanent

Watercourse: Intermittent

Sources:

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3. Niagara Escarpment Commission

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TOWNSHIP OF CLEARVIEW

Figure Title

NEP DESIGNATED AREAS

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

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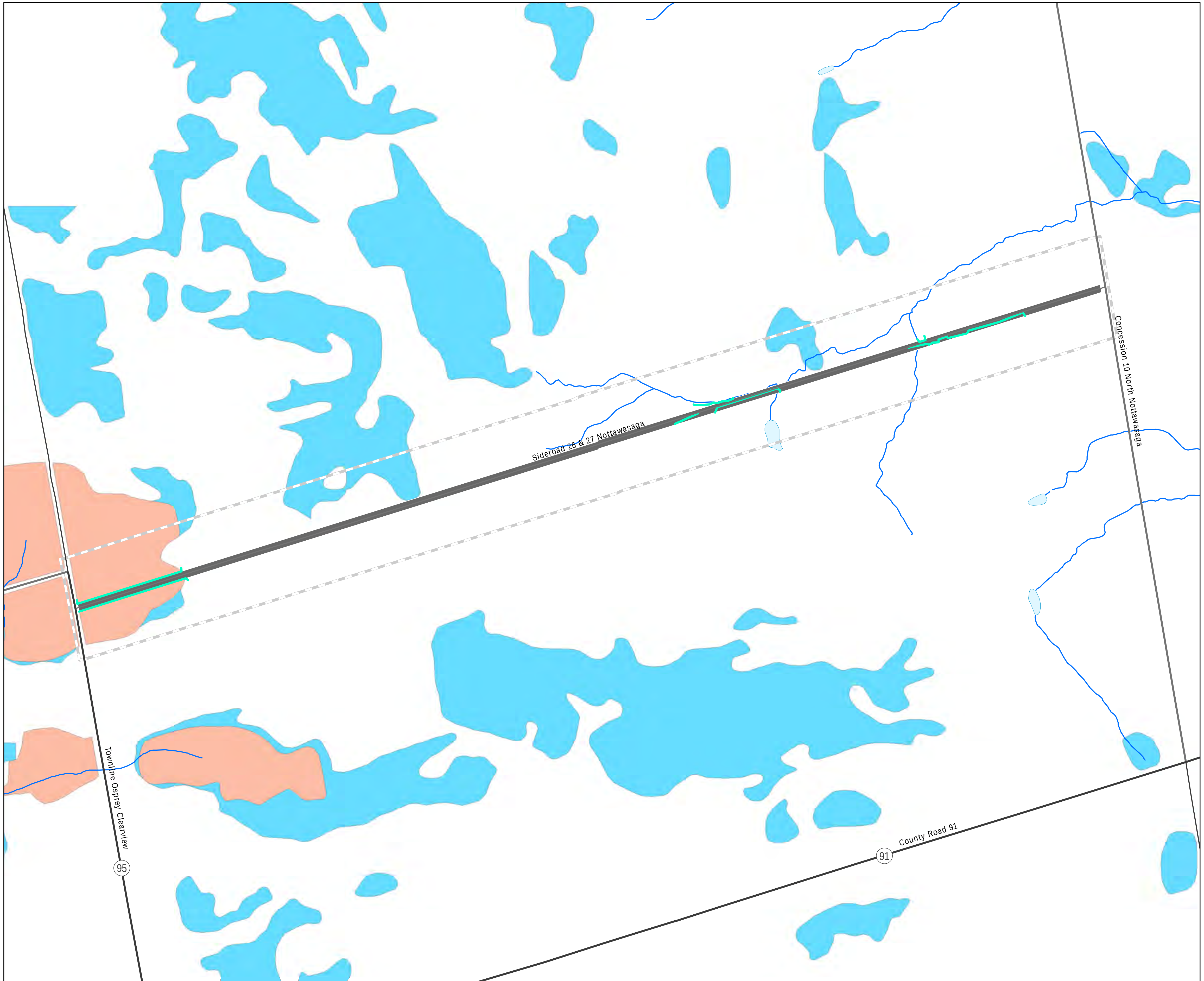

Wetland Limit

Watercourse (OHN)

Watercourse: Permanent

Watercourse: Intermittent

Waterbody (OHN)

Lake, Pond, River Segment of Width

MNRF Wetland Mapping

Provincially Significant Wetland

Wetland (Other)

Improvement Area

120m Adjacent Lands

Sources:

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TOWNSHIP OF CLEARVIEW

Figure Title

MNRF WETLAND MAPPING

CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

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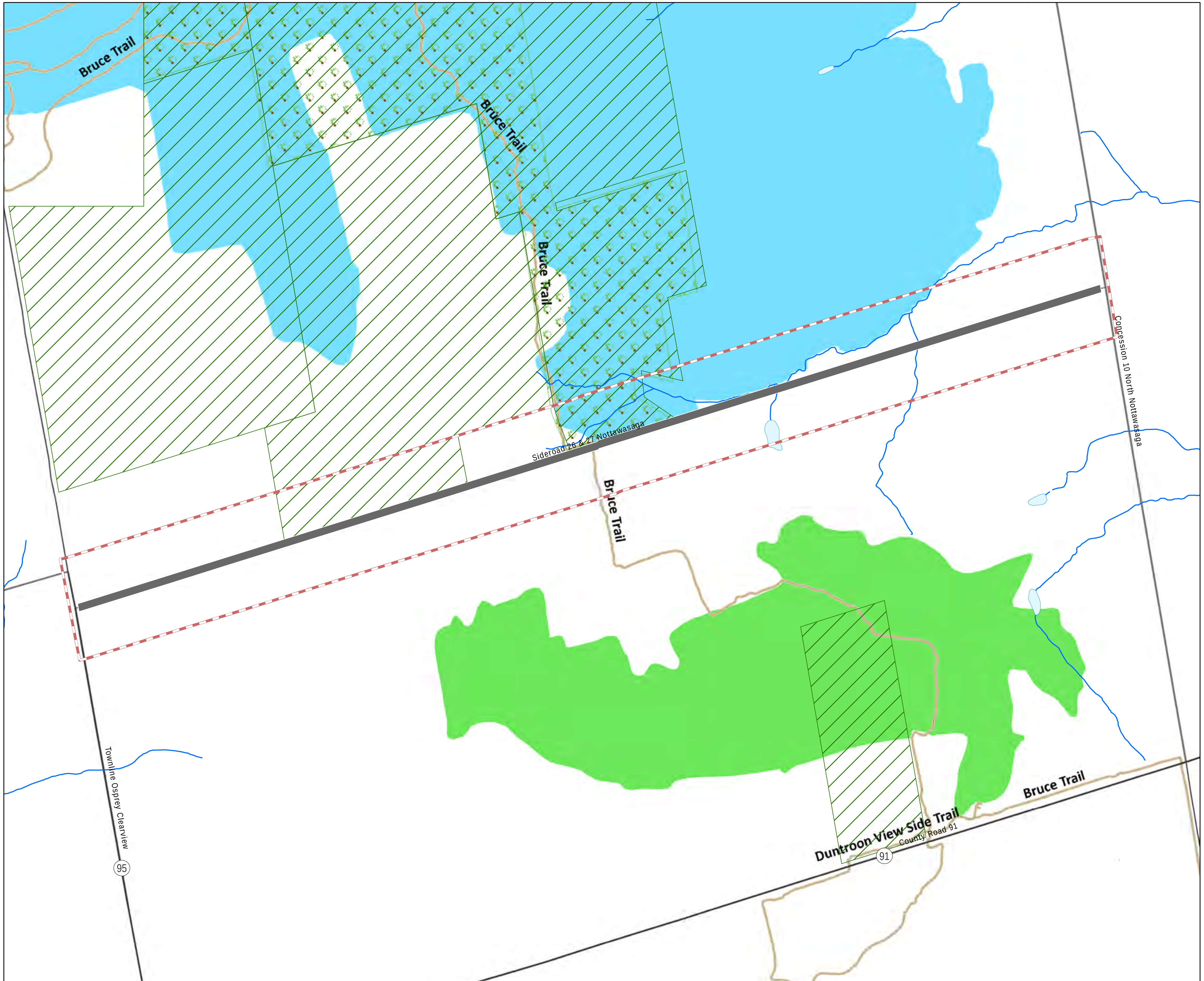

120m Adjacent Lands
Improvement Area
Lake, Pond, River Segment of Width
Watercourse: Permanent
Watercourse: Intermittent
Niagara Escarpment Parks and Open Space System
Nottawasaga Lookout Provincial Park
Bruce Trail

ANSI (Area of Natural and Scientific Interest)

Provincial ANSI
Regional ANSI

Sources:

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TOWNSHIP OF CLEARVIEW

Figure Title

ANSI, PARKS AND TRAILS

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS EIS

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2.0 Background

The following documents were reviewed to assess the environmental constraints to, and opportunities for, development of a year-round roadway within the existing Township Right-of-Way (ROW) which makes up the IA for this project:

- The Natural Heritage Information Centre (NHIC) database to identify records of rare wildlife species on, and in the vicinity of, the corridor;
- Nottawasaga Valley Conservation Authority (NVCA) Regulation 151/06 Mapping (Figure 2,1);
- Grey Sauble Conservation Authority (GSCA) Regulation 172/06 Mapping (Figure 2.1);
- NRVIS data to identify provincially significant wetlands, valleylands, Areas of Natural and Scientific Interest (ANSIs), watercourses;
- The County of Simcoe Online Mapping (2014);
- The Ontario Breeding Bird Atlas for records of birds breeding in the area (2005);
- NVCA 2013 Blue Mountain Subwatershed Health Check;
- Grey Sauble Conservation Authority (GSCA) 2013 Watershed Report Card; and,
- 2011 Assessment Report for the Grey Sauble Source Protection Area.

2.1 Results of Background Data Review

The results of the background data review are presented in Table 2.1. The corridor is located in Ecoregion 6E-4 and based on the review, the following features may be present within 120 m of the subject lands:

- Habitat of Endangered and Threatened Species;
- Significant Woodlands;
- Significant Wildlife Habitat, including:
  - Seasonal Concentration Areas of Animals;
  - Rare Vegetation Communities or Specialized Habitat for Wildlife; and,
  - Habitat for Species of Conservation Concern (not including Endangered or Threatened Species).
- Evaluated and Unevaluated Wetlands;
- Provincial Life and Earth Science ANSIs;
- A Provincial Nature Reserve and Park; and,
- Fish Habitat.

Table 2.1: Potential Natural Heritage Features within Vicinity of Subject Lands

Feature	Existing Records	Data Source
Features of Provincial Significance		
Habitat of Endangered and Threatened Species	Potentially present due to records for: • Butternut • Eastern Massasauga Bats: • Little Brown Myotis • Eastern Small-footed Myotis • Tri-coloured Bat	NHIC
Significant Wetlands (Ecoregions 5E, 6E, 7E)	Rob Roy Provincially Significant Wetland Complex	NHIC, GSCA
Significant Woodlands (Ecoregions 6E and 7E)	NEP protected areas	Aerial Photography, Simcoe County mapping
Significant Wildlife Habitat	• Rare Vegetation Communities • Specialized Habitat for Wildlife • Habitat for area-sensitive species • Forests providing a high diversity of habitats • Amphibian woodland breeding ponds • Seeps and springs	OBBA, NHIC
	Habitats for Species of Conservation Concern (not including Endangered or Threatened Species) Woodland Areas-Sensitive Bird Breeding Habitat Potentially present due to records of: • Wood Thrush • Ovenbird • Red-eyed Vireo • Blue-headed Vireo	OBBA, NHIC

Feature	Existing Records	Data Source
Significant Wildlife Habitat	• Louisiana Waterthrush • Eastern Wood-Pewee • Great Crested Flycatcher • Veery • Canada Warbler • Scarlet Tanager • Rose-Breasted Grosbeak Open County Bird Breeding Habitat Potentially present due to records of: • Bobolink • Eastern Meadowlark • Western Meadowlark • Barn Swallow Special Concern and Rare Wildlife Potentially present due to records of: • Milksnake (down listed during EIS review process) • Snapping Turtle	
Significant Areas of Natural and Scientific Interest	Regionally Significant Earth Science (Nottawasaga Lookout ES) and Life Science (Nottawasaga Lookout) ANSIs.	NHIC, NEP
Fish Habitat	Tributary of the Pretty River	GSCA and NVCA

Feature	Existing Records	Data Source
Features of Other Significance		
Unevaluated Wetlands	Several Unevaluated Wetlands North and South of corridor	County of Simcoe Mapping
Other Greenland/ NH areas	Escarpment Rural, Natural, and Protected Areas	Clearview Township Official Plan
Parks	Nottawasaga Lookout Provincial Nature Reserve and Nottawasaga Lookout Escarpment Access Park	NEP, Ontario Parks

END= Endangered
THR= Threatened
SC= Special Concern
SRank= Species ranked S1-S3 are considered to be rare in the province. Species ranked S4-S5 are considered to be common and secure.

120m Adjacent Lands

Improvement Area

Watercourse

Waterbody (OHN)

Lake, Pond, River Segment of Width

NVCA Regulated Area

GSCA Regulated Area

Sources:

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3. Grey Sauble Conservation.
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TOWNSHIP OF CLEARVIEW

Figure Title

NVCA AND GSCA REGULATED AREAS

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

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3.0 Fieldwork Methodology

3.1 Field Studies and Natural Resources Inventory

Field investigations were conducted between 2014 to 2018, according to the schedule listed in Table 3.1. The purpose of field investigation was to confirm whether the features and ecological functions identified in the background data review are, in fact, present in the IA and whether any additional natural heritage features or functions may exist.

Wetland boundary mapping for unevaluated wetlands was completed using a detailed methodology in the field, with David Featherstone Watershed Ecologist from NVCA.

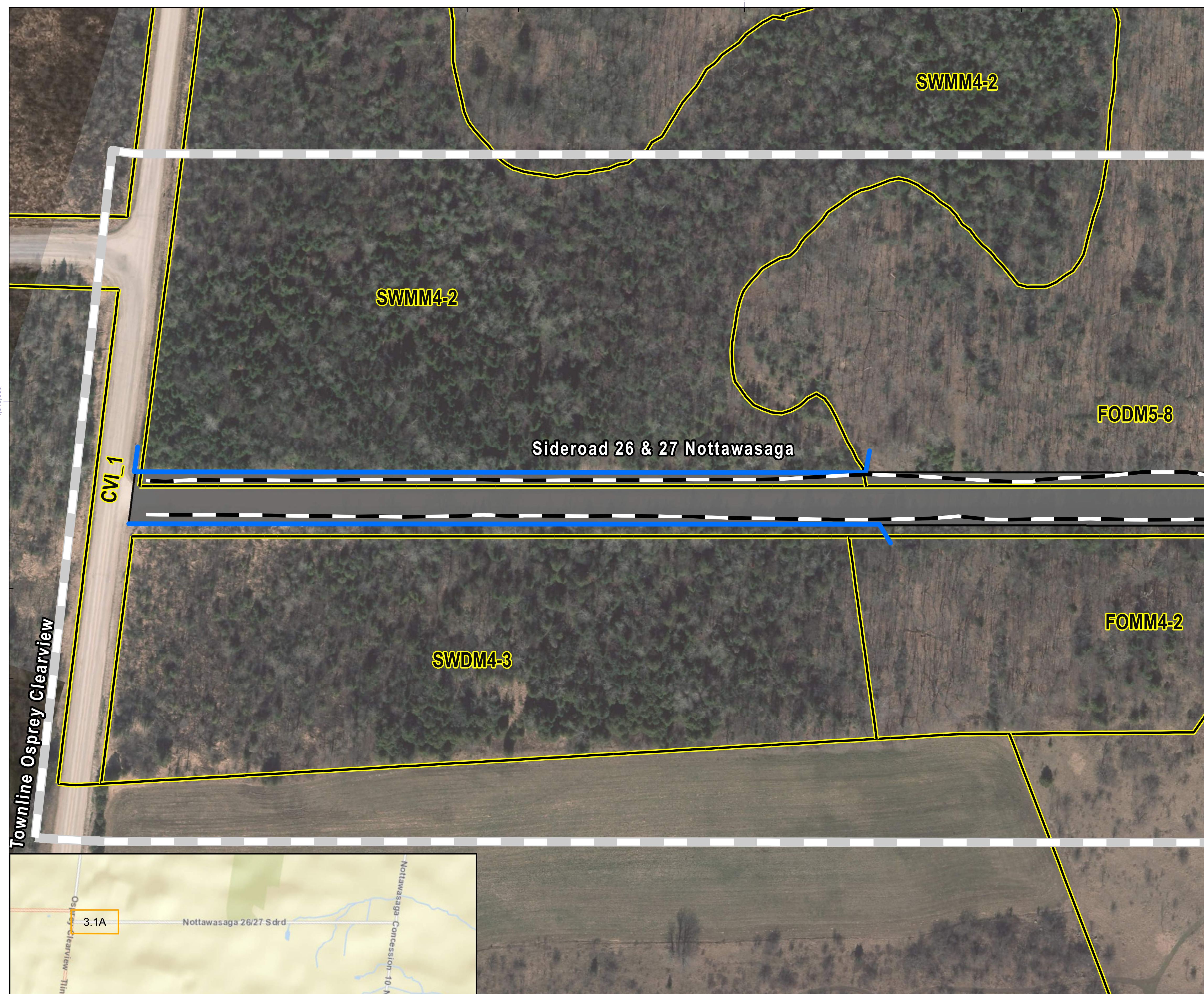
3.2 Hydrogeology Methodology

Nested streambed piezometers, designated as shallow (S) and deep (D), were installed at two locations in Tributary A, designated upstream (U/S) and downstream (D/S) of the confluence with Tributary C and at one location in Tributary C. Due to property access restrictions, the locations of the nested streambed piezometers were limited to accessible areas within the IA. The Tributary A locations were selected to obtain information near the upstream extent of the watercourse within the IA, while the downstream location was selected to be downstream of the confluence with Tributary C to allow for data comparison between the piezometer nests and to characterize the influences from the contribution of Tributary C. In general, the deep piezometers were installed by a manual post driver to depths where an impediment/resistance was encountered (i.e., impassable boulder). Shallow piezometers were generally installed approximately 0.6 m beneath the respective creek bed to ensure that the piezometer screens were established within consolidated material. Installation details are provided in Appendix A.

Following installation on April 28, 2016, the piezometers were developed using a WaTerra inertial pump to remove fine sediments on the inside of the piezometer screen and allow for optimal open area within the screen. PVC pipes were installed into the substrate as temperature monitoring locations U/S Mainstem D/S Mainstem, Tributary C and in the roadside channel designated Tributary B (Figure 2 in Appendix A). Automatic Water Level recorders (AWLR's) were installed in the piezometers and PVC pipes to record water levels and groundwater and surface water temperature on a continuous basis. Rising head hydraulic conductivity tests (K tests) were undertaken in all piezometers.

3.3 Vegetation

Vegetation communities were classified according to the *Ecological Land Classification (ELC) for Southern Ontario: First Approximation and Its Application* (Lee, H., et. al., 1998), (Figure 3.1). The vegetation communities were sampled using a plotless method for the purpose of determining the general composition and structure of the vegetation. Plant species status was reviewed for Canada (Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2006), Ontario (Committee on the Status of Species at Risk in Ontario (OSSARO 2006). Vascular plant nomenclature follows Newmaster et al. (1998), with a few exceptions (Appendix B).



Grading Limit
Wetland Limit
120m Adjacent Lands
Improvement Area

Vegetation Communities*

(AG) Agriculture
(CVI_1) Transportation
(CVR_4) Rural Property
(FODM4-2) Dry - Fresh White Ash - Hardwood Deciduous Forest
(FODM5-8) Dry - Fresh Sugar Maple - White Ash Deciduous Forest
(FOMM4-2) Dry - Fresh White Cedar - Poplar Mixed Forest
(MASM1-1) Cattail Mineral Shallow Marsh
(SWDM4-3) White Birch - Poplar Mineral Deciduous Swamp
(SWDM4-5) Poplar Mineral Deciduous Swamp
(SWMM4-2) Black Ash - Conifer Mineral Mixed Swamp
(TAGM1) Medium Mineral Coniferous Plantation (Red Pine)
(TAGM5) Medium Mineral Fencerow
(THDM2-10) Apple Deciduous Shrub Thicket
(THDM4-1) Native Deciduous Regeneration Thicket
(WODM4-1) Dry - Fresh Hawthorn - Apple Deciduous Woodland
(MAMM1-2) Cattail Graminoid Mineral Meadow Marsh
(WODM4-3) Sugar Maple Deciduous Woodland

Sources:

1. Imagery: County of Simcoe

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CLEARVIEW TOWNSHIP

Figure Title

VEGETATION COMMUNITIES

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

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Grading Limit

Improvement Area

120m Adjacent Lands

Vegetation Communities*

(AG) Agriculture
(CVI_1) Transportation
(CVR_4) Rural Property
(FODM4-2) Dry - Fresh White Ash - Hardwood Deciduous Forest
(FODM5-8) Dry - Fresh Sugar Maple - White Ash Deciduous Forest
(FOMM4-2) Dry - Fresh White Cedar - Poplar Mixed Forest
(MASM1-1) Cattail Mineral Shallow Marsh
(SWDM4-3) White Birch - Poplar Mineral Deciduous Swamp
(SWDM4-5) Poplar Mineral Deciduous Swamp
(SWMM4-2) Black Ash - Conifer Mineral Mixed Swamp
(TAGM1) Medium Mineral Coniferous Plantation (Red Pine)
(TAGM5) Medium Mineral Fencerow
(THDM2-10) Apple Deciduous Shrub Thicket
(THDM4-1) Native Deciduous Regeneration Thicket
(WODM4-1) Dry - Fresh Hawthorn - Apple Deciduous Woodland
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CLEARVIEW TOWNSHIP

Figure Title

VEGETATION COMMUNITIES

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

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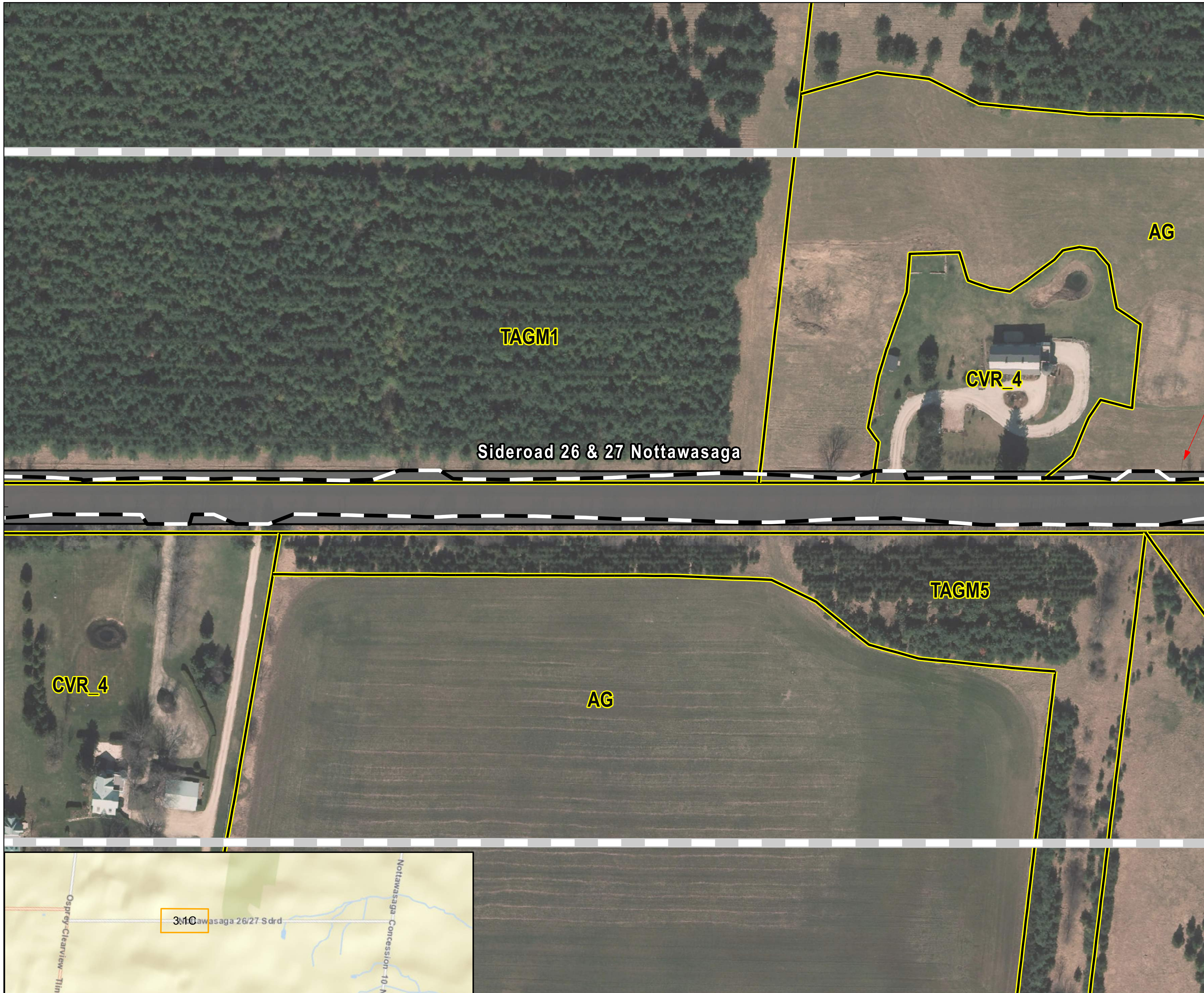

Grading Limit
Improvement Area
120m Adjacent Lands

Vegetation Communities*

(AG) Agriculture
(CVI_1) Transportation
(CVR_4) Rural Property
(FODM4-2) Dry - Fresh White Ash - Hardwood Deciduous Forest
(FODM5-8) Dry - Fresh Sugar Maple - White Ash Deciduous Forest
(FOMM4-2) Dry - Fresh White Cedar - Poplar Mixed Forest
(MASM1-1) Cattail Mineral Shallow Marsh
(SWDM4-3) White Birch - Poplar Mineral Deciduous Swamp
(SWDM4-5) Poplar Mineral Deciduous Swamp
(SWMM4-2) Black Ash - Conifer Mineral Mixed Swamp
(TAGM1) Medium Mineral Coniferous Plantation (Red Pine)
(TAGM5) Medium Mineral Fencerow
(THDM2-10) Apple Deciduous Shrub Thicket
(THDM4-1) Native Deciduous Regeneration Thicket
(WODM4-1) Dry - Fresh Hawthorn - Apple Deciduous Woodland
(MAMM1-2) Cattail Graminoid Mineral Meadow Marsh
(WODM4-3) Sugar Maple Deciduous Woodland

Sources:

1. Imagery: County of Simcoe

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Projection: Transverse Mercator	
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Rotation: 342.62	Scale Factor: 0.99960

N
Grid North

0 50 100 150 200 250
Metres

BURNSIDE

Client

CLEARVIEW TOWNSHIP

Figure Title

VEGETATION COMMUNITIES

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

Drawn	Checked	Date	Figure No.
HN	NS	2018/10/18	3.1C
Scale		Project No.	
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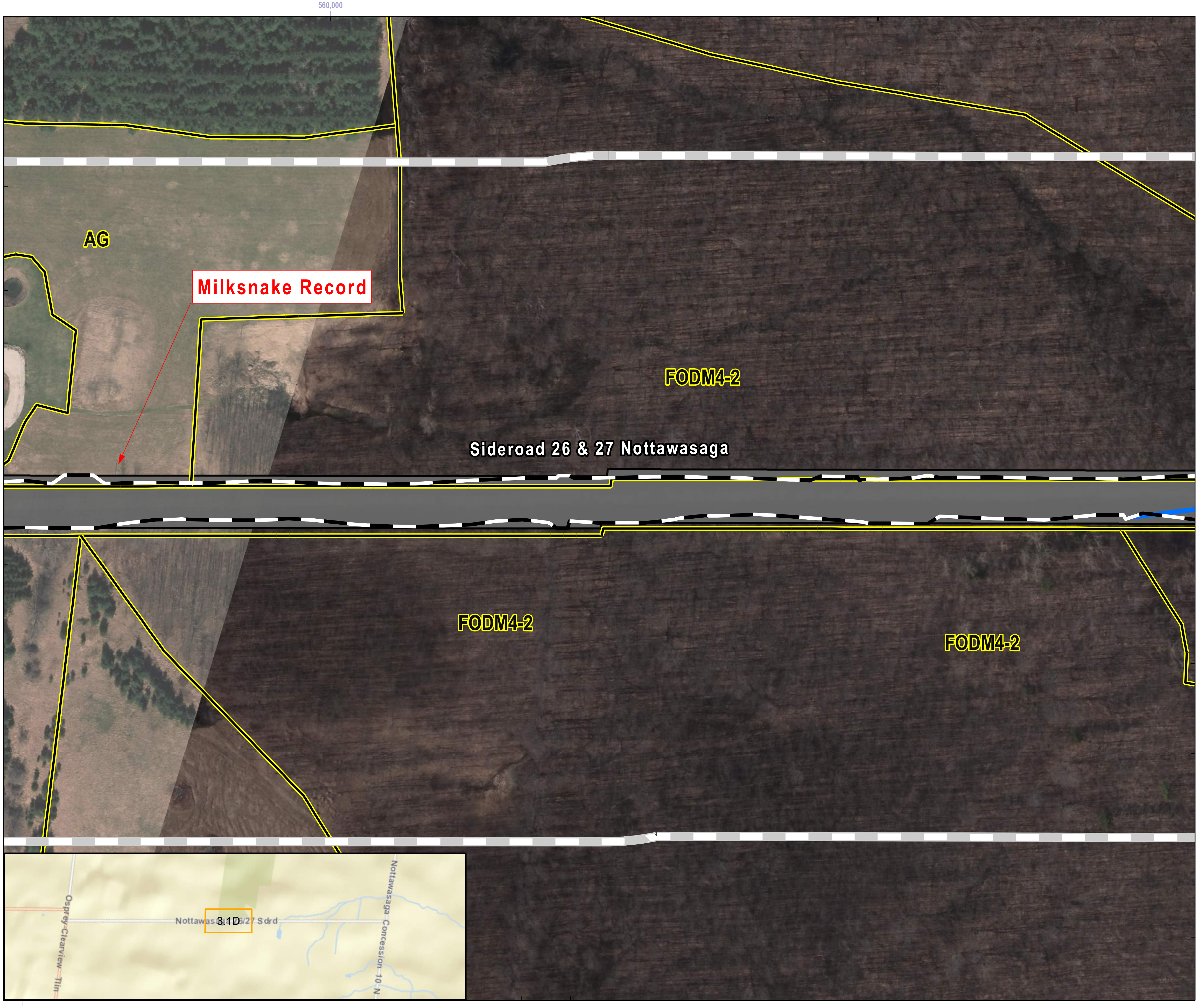

Grading Limit
Wetland Limit
120m Adjacent Lands
Improvement Area

Vegetation Communities*

(AG) Agriculture
(CVI_1) Transportation
(CVR_4) Rural Property
(FODM4-2) Dry - Fresh White Ash - Hardwood Deciduous Forest
(FODM5-8) Dry - Fresh Sugar Maple - White Ash Deciduous Forest
(FOMM4-2) Dry - Fresh White Cedar - Poplar Mixed Forest
(MASM1-1) Cattail Mineral Shallow Marsh
(SWDM4-3) White Birch - Poplar Mineral Deciduous Swamp
(SWDM4-5) Poplar Mineral Deciduous Swamp
(SWMM4-2) Black Ash - Conifer Mineral Mixed Swamp
(TAGM1) Medium Mineral Coniferous Plantation (Red Pine)
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(WODM4-1) Dry - Fresh Hawthorn - Apple Deciduous Woodland
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Rotation: 342.62	Scale Factor: 0.99960

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CLEARVIEW TOWNSHIP

Figure Title

VEGETATION COMMUNITIES

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

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Grading Limit
Wetland Limit
120m Adjacent Lands
Improvement Area

Vegetation Communities*

(AG) Agriculture
(CVI_1) Transportation
(CVR_4) Rural Property
(FODM4-2) Dry - Fresh White Ash - Hardwood Deciduous Forest
(FODM5-8) Dry - Fresh Sugar Maple - White Ash Deciduous Forest
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(SWDM4-5) Poplar Mineral Deciduous Swamp
(SWMM4-2) Black Ash - Conifer Mineral Mixed Swamp
(TAGM1) Medium Mineral Coniferous Plantation (Red Pine)
(TAGM5) Medium Mineral Fencerow
(THDM2-10) Apple Deciduous Shrub Thicket
(THDM4-1) Native Deciduous Regeneration Thicket
(WODM4-1) Dry - Fresh Hawthorn - Apple Deciduous Woodland
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Grid North

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BURNSIDE

Client

CLEARVIEW TOWNSHIP

Figure Title

VEGETATION COMMUNITIES

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

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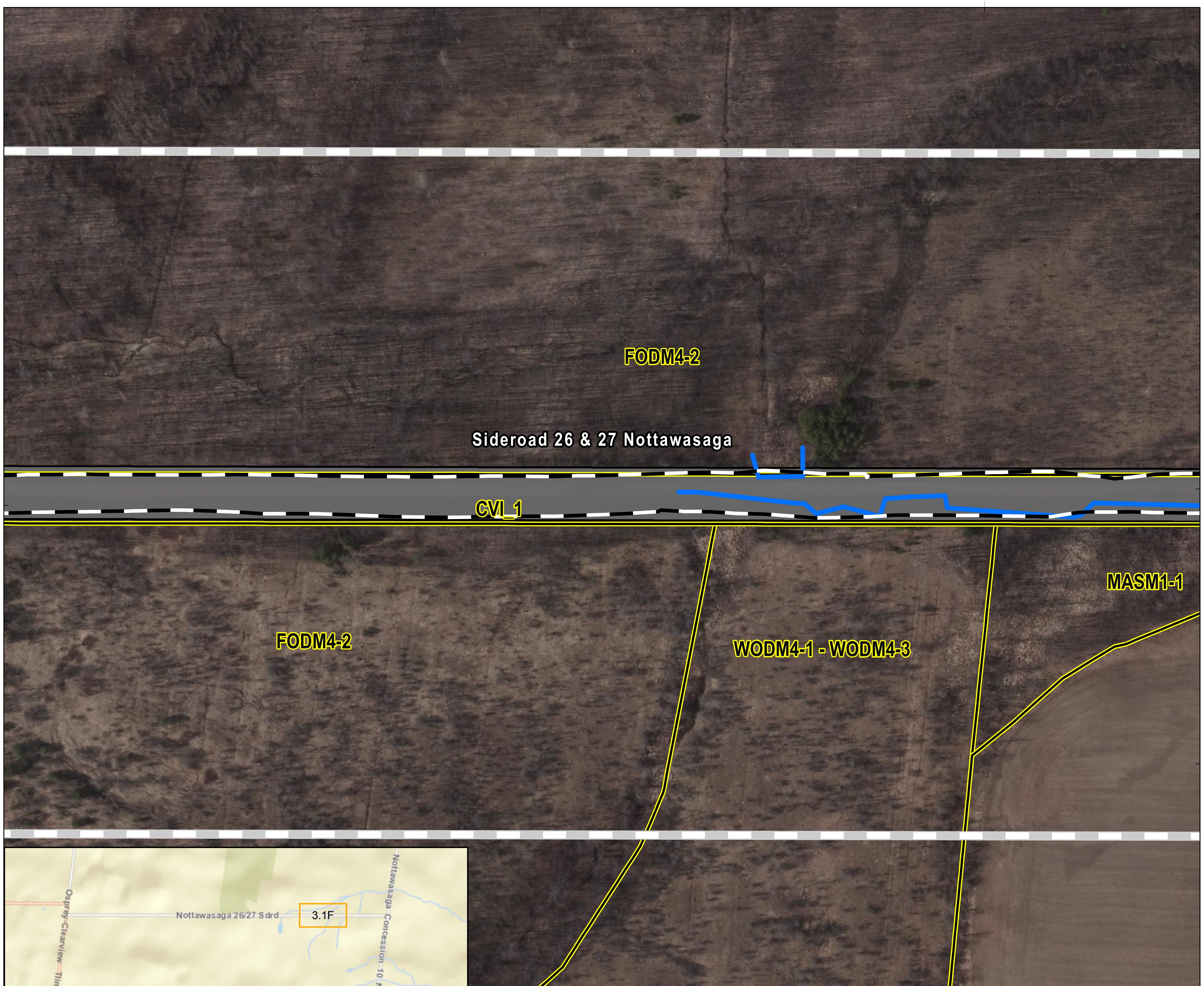

Grading Limit
Wetland Limit
120m Adjacent Lands
Improvement Area

Vegetation Communities*

(AG) Agriculture
(CVI_1) Transportation
(CVR_4) Rural Property
(FODM4-2) Dry - Fresh White Ash - Hardwood Deciduous Forest
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Central Meridian: 81°0'0.00"W	
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Rotation: 342.62	Scale Factor: 0.99960

N
Grid North

0 50 100 150 200 250
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BURNSIDE

Client

CLEARVIEW TOWNSHIP

Figure Title

VEGETATION COMMUNITIES

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

Drawn	Checked	Date	Figure No.
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Grading Limit
Wetland Limit
120m Adjacent Lands
Improvement Area

Vegetation Communities*

(AG) Agriculture
(CVI_1) Transportation
(CVR_4) Rural Property
(FODM4-2) Dry - Fresh White Ash - Hardwood Deciduous Forest
(FODM5-8) Dry - Fresh Sugar Maple - White Ash Deciduous Forest
(FOMM4-2) Dry - Fresh White Cedar - Poplar Mixed Forest
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Sources:

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Rotation: 342.62	Scale Factor: 0.99960

N

Grid North

0 50 100 150 200 250

Metres

BURNSIDE

Client

CLEARVIEW TOWNSHIP

Figure Title

VEGETATION COMMUNITIES

CLEARVIEW SIDEROAD 26/27
IMPROVEMENTS EIS

Drawn	Checked	Date	Figure No.
HN	NS	2018/10/18	3.1G
Scale		Project No.	
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3.4 Avifauna

In June 2014, WILD Canada Ecological Consulting was contracted by Burnside to undertake breeding bird surveys within the IA and 120m adjacent lands for the 2014 breeding bird season. Two separate surveys were conducted, on June 30, 2014 and July 10, 2014, to best ascertain the bird species on territory and/or potentially using the area for breeding/nesting purposes (Appendix C). Additional bird surveys have not been completed since 2014, with the exception of Whip-poor-will surveys, for the IA as there were no changes to the habitat or survey methodology. It was therefore concluded that the original Breeding Bird data was accurate in its characterization of the existing habitats within the IA and study area. The dates of the survey, although late in the breeding bird season, documented a full suite of migratory and resident birds expected to be found within the IA and 120 m adjacent lands. This data is also considered current as it was collected within 5 years of submission of the EIS document.

3.4.1 Point Count Methodology

Breeding bird surveys are conducted in order to characterize baseline habitat conditions, including potential Species at Risk (SAR) habitat, for a particular study area.

Breeding bird surveys are completed following the general principles outlined in the *Ontario Breeding Bird Atlas (OBBA) Guide for Participants* (Federation of Ontario Naturalists, 2001), and/or the *Forest Bird Monitoring Program (FBMP) Survey Instructions and Codes* (Environment Canada, 2015), tailored to the needs of each project. The entire IA and accessible 120m adjacent lands were surveyed for breeding birds in order to ensure that all species of birds that may be breeding or utilizing the IA were recorded. The surveys were conducted by documenting habitat use at pre-determined 5 to 10 minute point counts throughout the entire IA, capturing all habitat types present.

Timing:

- For southern Ontario, surveys are conducted between May 24th and July 10th, which falls within the peak breeding window for the majority of bird species (see OBBA Guide, Figure 2, for division between southern and northern Ontario);
- Two surveys are completed at least 10 days apart; and,
- Surveys are conducted anytime between dawn and 5 hours after dawn (i.e., 5:00 a.m. – 10:00 a.m.).

Weather:

- Counts should be undertaken in favourable weather for surveying birds: good visibility, no precipitation and little or no wind. Counts should not be done if it is raining, there is thick fog, or if winds are greater than 19 km per hour (i.e., >3 on the

Beaufort scale, which is enough to constantly move leaves or small twigs and to extend a light flag).

- If the weather does not meet these guidelines, or if during the survey conditions cease to meet these guidelines, the survey should be cancelled and rescheduled.

The surveys were conducted using "Point Counts" at 11 locations (Figure 3.2) in the IA and were undertaken according to Ontario Breeding Bird Atlas protocols, as set out in the *Ontario Breeding Bird Atlas (OBBA) Guide for Participants (BSC 2006)*. Surveys began no earlier than 30 minutes prior to sunrise (dawn) and ended no later than 10:00 a.m. They were conducted within appropriate weather conditions; temperature of 10ºC or greater, wind no greater than 3 on the Beaufort scale, no heavy fog or current precipitation. Five-minute point counts were conducted at stations located approximately 250 m apart.

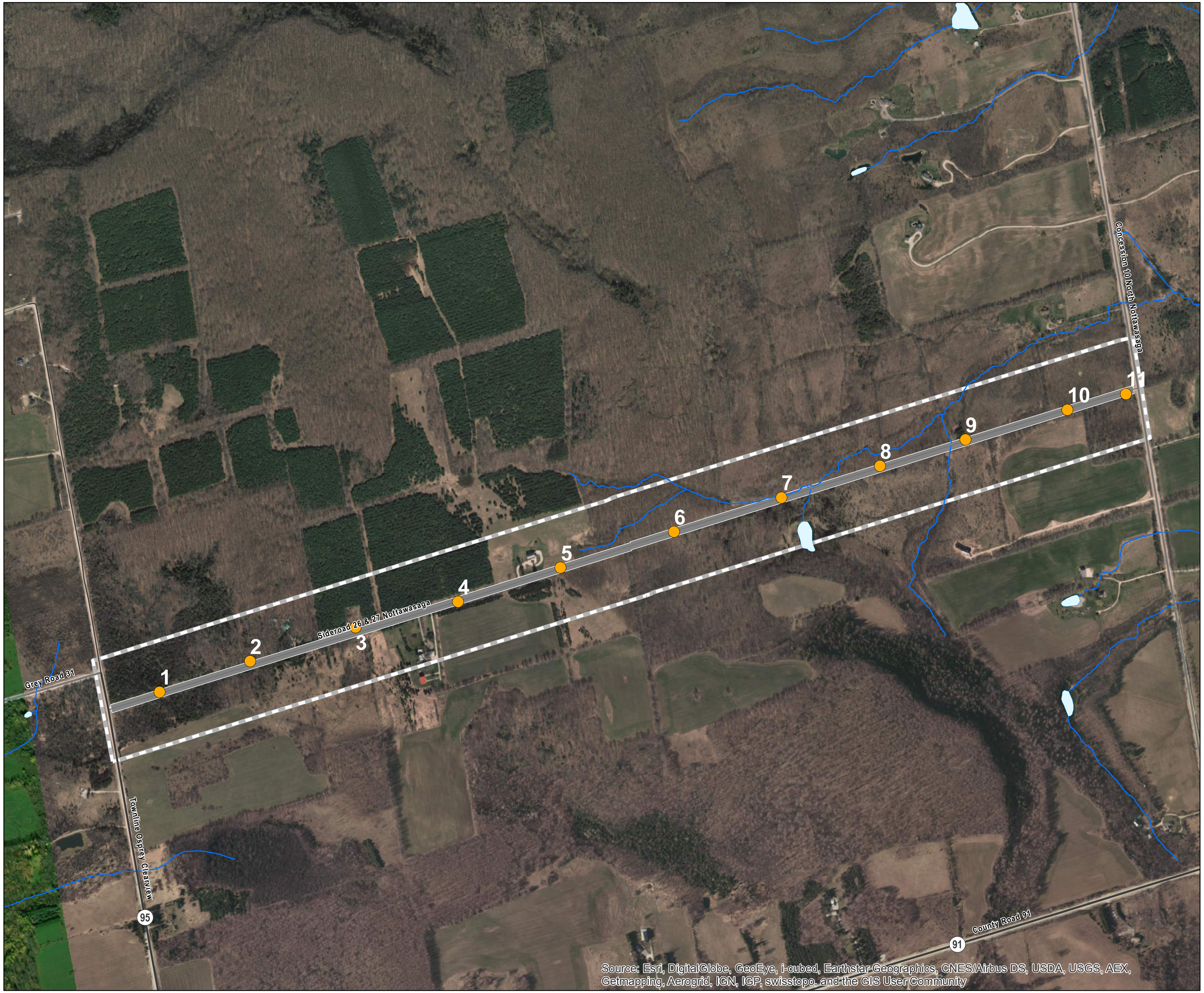
The first survey was conducted on June 30, 2014 with the follow-up survey being conducted on July 10. As there were no property access permissions granted for the land on either side of the IA, the counts were conducted from a safe location near the centre of the roadway.

For most of this portion, the tree canopy extends over all or most of the roadway. This encapsulates the surveyor within the woodland habitats and lets the birds to freely move throughout the point count station, allowing for accurate results, even from a roadway.

3.4.2 Whip-Poor Will Surveys

In 2018, there were only two windows during which to conduct EWPW surveys, due to the timing of the full moons. These windows were May 21-29 (preferred), with May 30-6 as alternate), and June 20-28 (preferred), with June 29-July 6 as alternate. Due to the timing of the awarding of this contract, and the weather, the first survey was conducted on May 30, only one day after the prime conditions at full moon. The second survey was completed on June 26, within the preferred period of the week preceding and including the full moon.

Surveys were conducted according to the "Guidelines for Conducting Eastern Whip-poor-will Roadside Surveys in Ontario, 12 May 2014" (MNRF – Natural Heritage Information Centre, and Bird Studies Canada), which prescribes appropriate timing, spacing, moon and weather conditions for completing surveys. 8 individual point count stations were spaced evenly, 400m apart, along Sideroad 26/27. Most point count sites were located adjacent to habitat, ranging from mature hardwood forest to semi-open meadow/thicket, to wetland/wet meadow, which should be quite suitable to EWPW for nesting or foraging (Appendix C).



Breeding Bird Survey Stations

Waterbody (OHN)

Lake, Pond, River Segment of Width

Watercourse (OHN)

Watercourse: Permanent

Watercourse: Intermittent

120m Adjacent Lands

Improvement Area

SIMCOE COUNTY LINC LAND INFORMATION NETWORK COOPERATIVE

Sources:

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N

Grid North

0 100 200 300 400 500 600 700 800

Metres

BURNSIDE

Client

TOWNSHIP OF CLEARVIEW

Figure Title

BREEDING BIRD SURVEY STATIONS

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

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Scale		Project No.	
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3.5 Amphibian Call Count Surveys

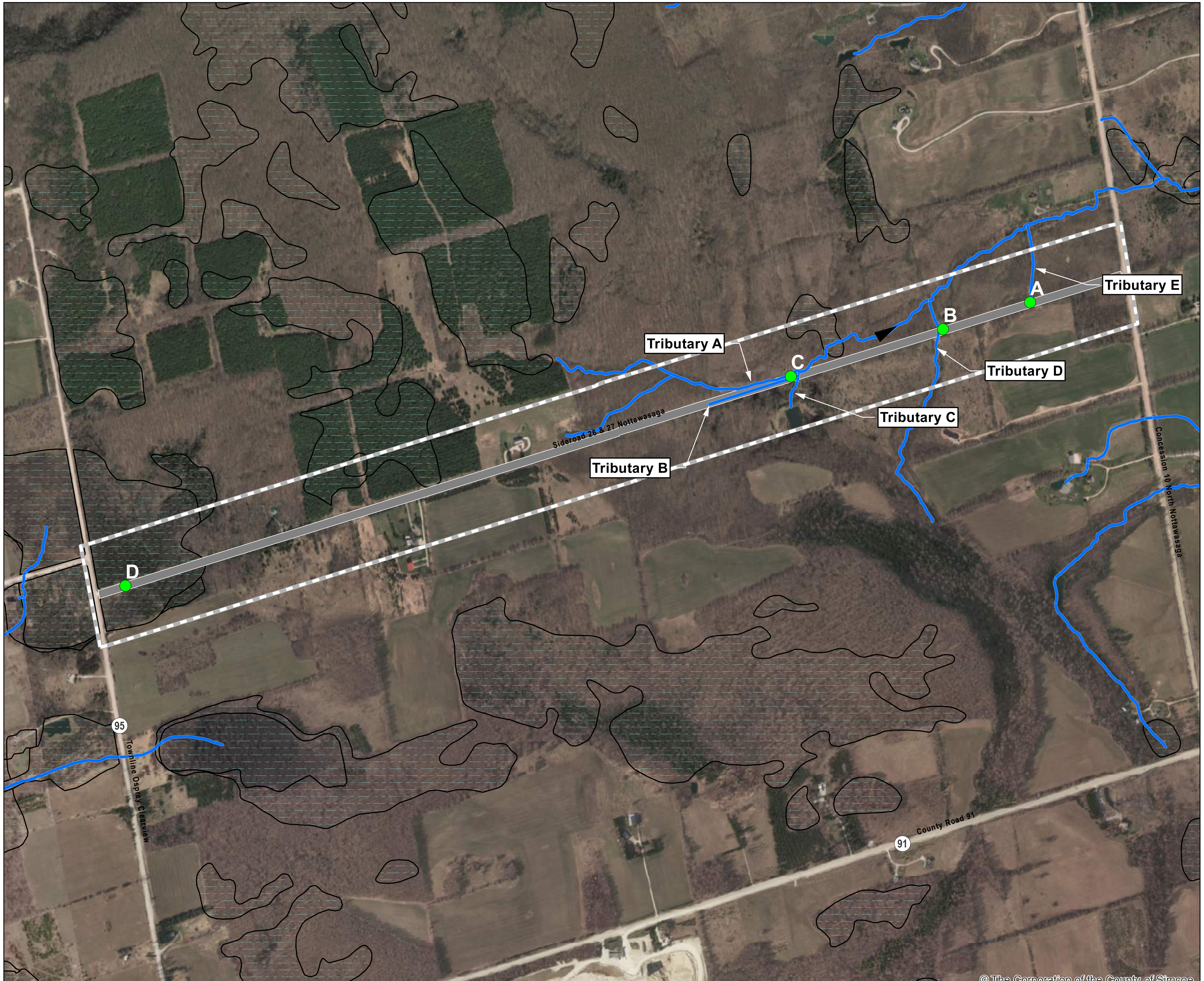
Burnside staff conducted amphibian call surveys over the course of two site visits, in the spring and early summer of 2014 (May 30, and June 25), to document frog and toad species present within and adjacent to the right-of-way for Clearview Sideroad 26/27. Additional surveys were completed in 2015 (April 27 and May 21) and 2016 (May 1, May 23 and June 24) to confirm the presence and estimate the abundance of early breeding frog species (e.g., western chorus frog) within and adjacent to the IA. Survey protocols were based on the Marsh Monitoring Program Participant's Handbook for Surveying Amphibians (Bird Studies Canada, 2008). Four survey stations, established in the 2014 surveys based on available aquatic feature mapping and prior knowledge of existing conditions, were also used for the 2015 surveys (Figure 3.3).

3.6 Fisheries and Fish Habitat Assessment Methodology

3.6.1 Aquatic Habitat

As previously mentioned, there are headwater tributaries of the Pretty River that intersect and flow within the corridor. The reaches that fall within the IA for the 26/27 Sideroad were initially assessed by Burnside aquatic ecology staff during a site visit on May 22, 2014. The initial aquatic assessment included one watercourse reach flowing parallel to the road base, along the northern limit of the IA (Tributary A - Site 2) and four road crossings (Tributaries B to E - Sites 1, 3, 4, and 5 respectively). Flows from these reaches converge downstream, prior to crossing Clearview Line 10, and are eventually conveyed to the main stem of the Pretty River downgradient. The aquatic habitat assessment was completed using modules of the Ontario Stream Assessment Protocol (TRCA 2010) and selected sites are shown in Figure 3.4.

Additional fish habitat assessments were carried out in the spring and fall of 2015 to 2017, and the spring of 2018. The fish habitat assessments for Brook trout (*Salvelinus fontinalis*) included Young of the Year (YOY) emergence / presence (spring), spawning surveys (fall), electrofishing, temperature monitoring and observation of groundwater inputs. These additional surveys were conducted to support DFO permitting and approvals, future detailed design and mitigation efforts during construction.



- Amphibian Survey Stations
- Improvement Area
- 120m Adjacent Lands
- Watercourse
- Flow Direction
- Wetland

Sources:

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N

Grid North

0 100 200 300 400 500 600 700 800

Metres

BURNSIDE

Client

TOWNSHIP OF CLEARVIEW

Figure Title

AMPHIBIAN SURVEY STATIONS

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

Drawn	Checked	Date	Figure No.
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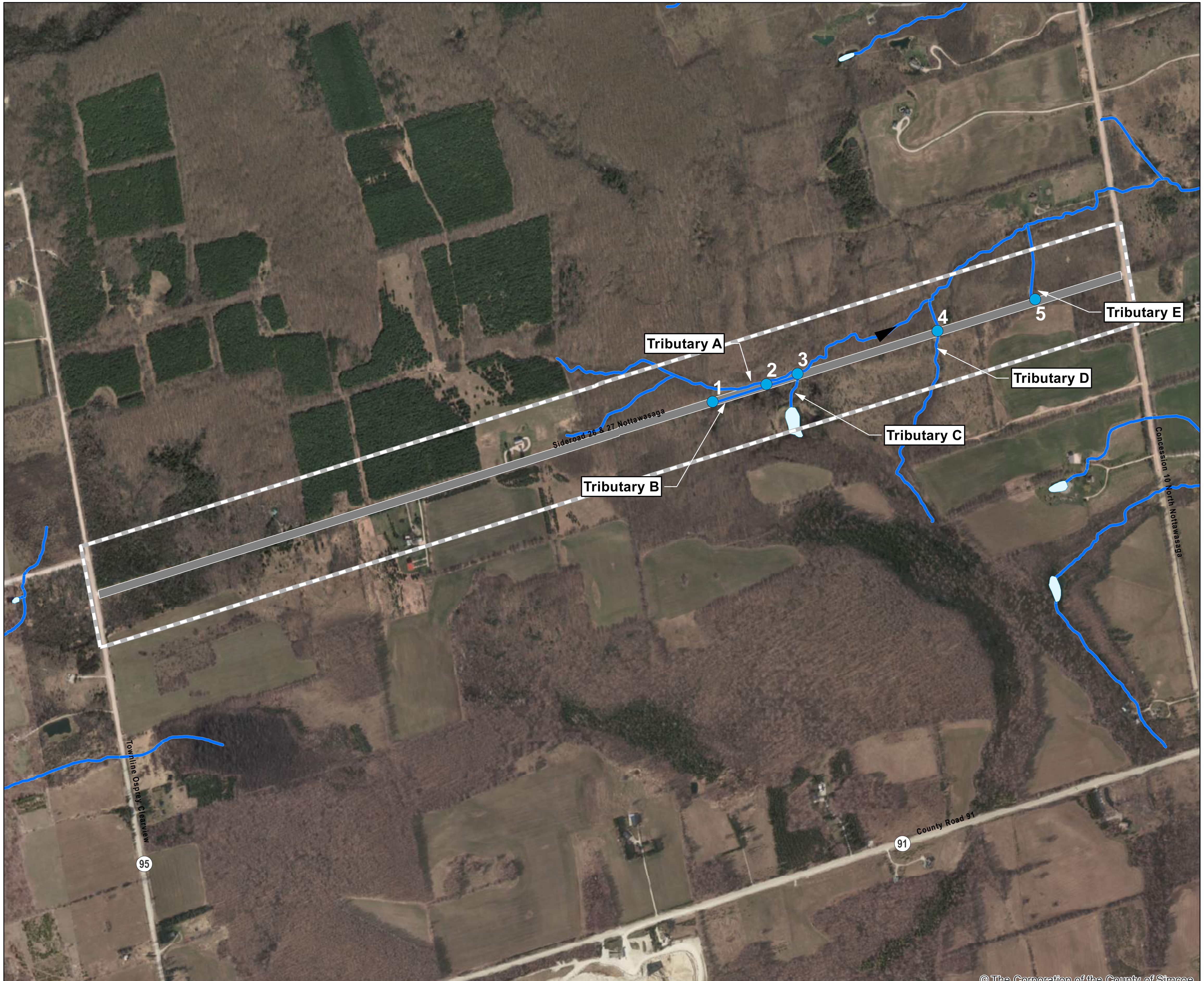

Aquatic Assessment Sites
Improvement Area
120m Adjacent Lands
Watercourse
Flow Direction

Waterbody (OHN)

Lake, Pond, River Segment of Width

Sources:

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Rotation: 0	Scale Factor: 0.99960

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Grid North

0 100 200 300 400 500 600 700 800

Metres

BURNSIDE

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TOWNSHIP OF CLEARVIEW

Figure Title

AQUATIC ASSESSMENT SITES

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

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Scale		Project No.	
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3.6.2 Young of the Year Emergence

Visual observations for YOY Brook trout were conducted in the spring, from March to May from 2015 to 2018. Observation surveys were dependent on suitable timing and conditions based on weather and flow conditions. YOY surveys consist of observation with good polarized glasses in calm, low current areas with darker fine-grained substrates. YOY Brook trout can get pushed by flow into these areas, depending on emergence and location of previous spawning sites. Typically, YOY prefer the calmer “backwater” areas to conserve energy and seek refuge on sun exposed sides of the channel. These areas are carefully observed for evidence of YOY and individuals are enumerated by walking upstream.

3.6.3 Brook trout Spawning

Brook trout Spawning surveys were conducted in Tributaries A, B, C and D, between late October and early December 2015/2017. Burnside staff carried out visual searches for “redds” and individual fish exhibiting behavior typically associated with spawning activity within the limits of the IA due to approved access. Surveys were timed to coincide with what was deemed to be the active spawning period for Brook trout, based on local conditions. In southern and eastern Canada, Brook trout typically spawn between late September and November; however, spawning activity has been noted as late as the beginning of December (Scott & Crossman, 1973). Ricker (1932) documented peak Brook trout spawning activity in the Mad River, a nearby tributary of the Nottawasaga River, in mid-November.

3.6.4 Backpack Electrofishing

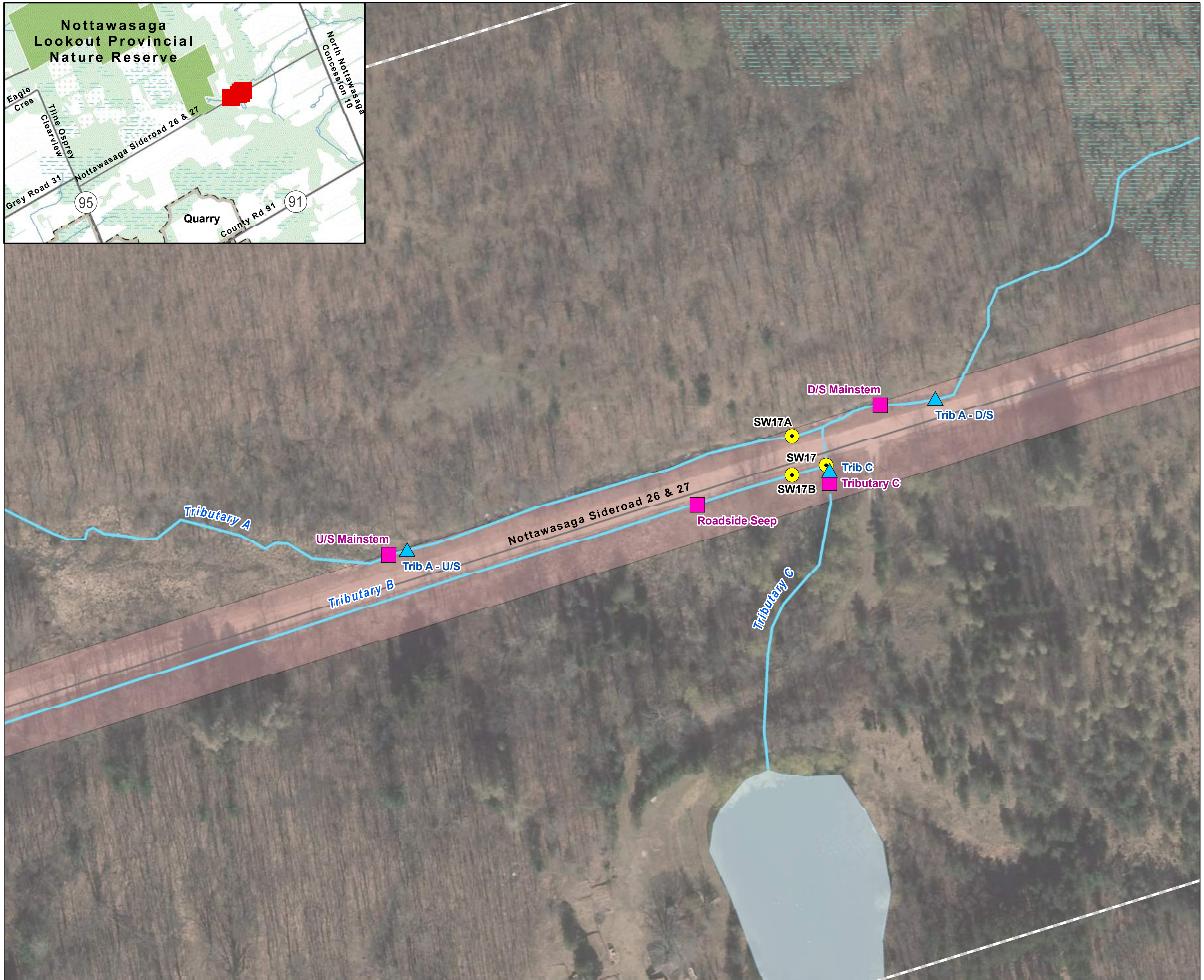
Backpack electrofishing is a sampling technique for small, wadeable streams. A backpack electrofisher consists of a portable electrofishing unit and a power source attached to a pack frame. It is equipped with a hand held, button-operated anode pole and a cathode plate which is left trailing in the water. The operator wears the pack unit and uses the button switch to activate the anode in order to stun fish while wading in stream. One or more assistants wading next to the operator use dip nets to capture the stunned fish. The assistant also adjusts the electrofisher settings for the operator and monitors the electrical output. Sampling is normally conducted while moving upstream so that fish are not disturbed, prior to being sampled, by disturbances to the stream bed and material moving downstream with the flow.

Fish community sampling was conducted using a backpack electrofisher (Smith Root Model LR24) on July 21, 2016, to help determine whether Tributaries A, B, C, and D, within the IA, are occupied by fish. Tributary A was sampled intermittently to focus on small pools and undercuts that provide high quality cover for Brook trout. Tributary E was not sampled due to insufficient water depth to conduct electrofishing. All results are presented in Section 4.8 below.

3.7 Surface Water and Groundwater Monitoring

Monitoring of stream temperature, air temperature, groundwater gradients and groundwater temperature was conducted by Burnside from April 2016 to May 2018. Stream temperature monitoring in Tributary A was undertaken at two locations upstream and downstream of the confluence with Tributary C. Stream temperatures were also monitored in Tributary B at one midstream location within the IA and in Tributary C, approximately 10 m upstream of the confluence with Tributary A (Figure 3.5).

Nested streambed piezometers and temperature monitoring stations were installed in Tributary A (upstream and downstream of the confluence with Tributary C, respectively) and in Tributary C on April 28, 2016. Shallow (S) and deep (D) streambed piezometers were installed at two locations in Tributary A, upstream (U/S) and downstream (D/S) of the confluence with Tributary C, and one location in Tributary C. Automatic Water Level Recorders (AWLR/Van Essen Diver Loggers) were used to collect groundwater elevations and water temperature at the above noted locations.



Legend

- Approximate Nested Streambed Piezometer Location
- Approximate Temperature Logger Location
- Approximate Surface Water Monitoring Location (WSP)
- Local Road
- Wetland
- Waterbody: Permanent
- Stream: Permanent
- Stream: Intermittent
- Improvement Area
- 120m Adjacent Lands

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Datum: North American 1983	
Coord. System: NAD 1983 UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Rotation: 0	Scale Factor: 0.99960

N

Grid North

0 10 20 30 40 50 60 70 80

Meters

BURNSIDE

Client

TOWNSHIP OF CLEARVIEW

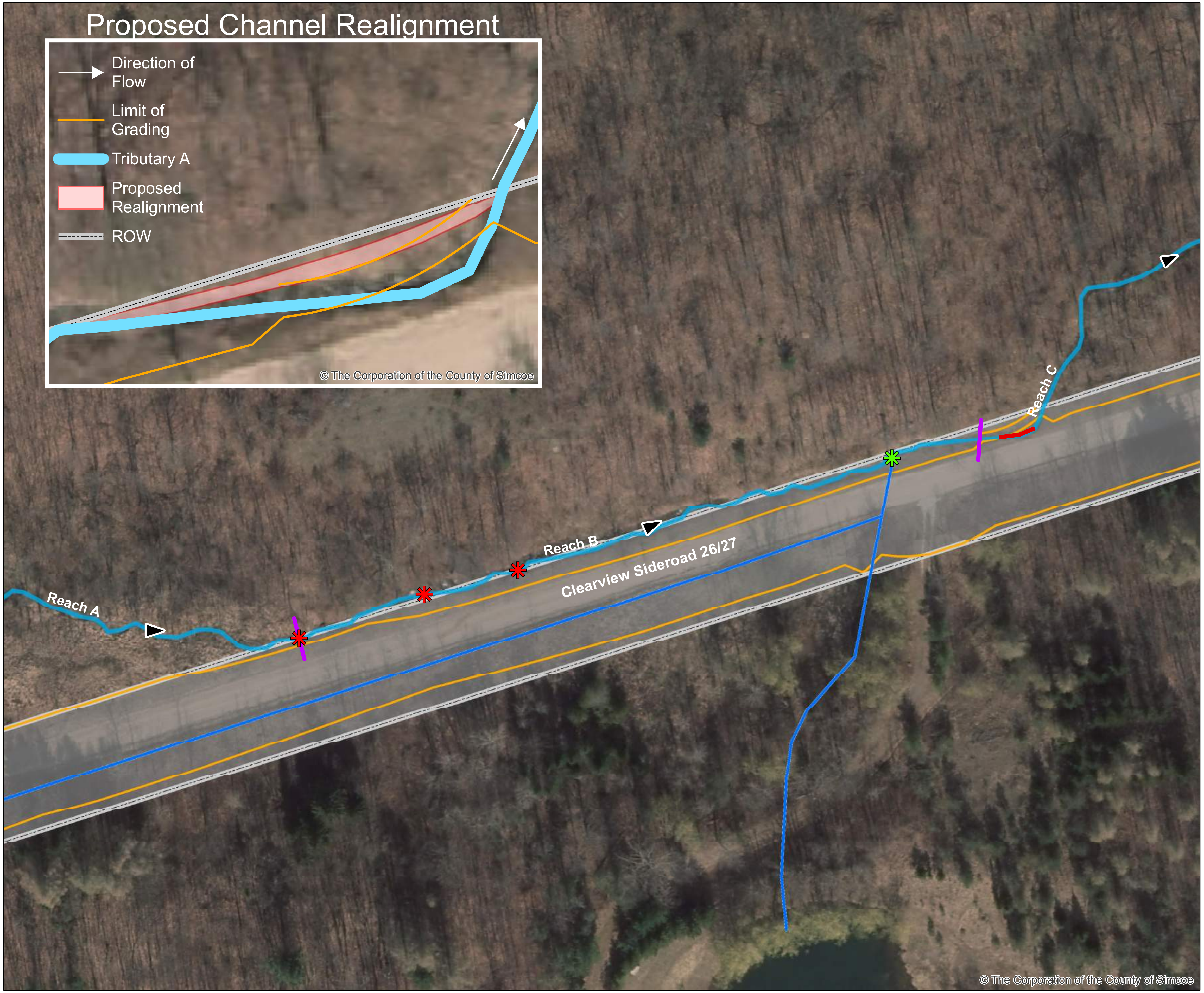
Figure Title

SURFACE AND GROUNDWATER MONITORING STATIONS

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

Drawn	Checked	Date	Figure No.
CD	DH	2018/10/18	3.5
Scale		Project No.	
H 1:1,000		300034587	

File Path: \\Elmo\gis\Project\300\034587 (Clearview SR 26-27 EIS)\2018\034587_2018_EIS_StreamAssessment_MonitoringPlan.mxd Print Date: 2018/10/18 Time: 09:19 AM



- Permanent Barrier
- Seasonal Barrier
- Reach Break
- Proposed Realignment
- Tributary A
- Watercourse
- Limit of Grading
- Legal ROW
- Improvement Area
- Flow Direction

Sources:

1. Ministry of Natural Resources and Forestry, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Disclaimer:

R.J. Burnside & Associates Limited and the above mentioned sources and agencies are not responsible for the accuracy of the spatial, temporal, or other aspects of the data represented on this map. It is recommended that users confirm the accuracy of the information represented.

This map is the product of a Geographic Information System (GIS). As such, the data represented on this map may be subject to updates and future reproductions may not be identical.

Datum: North American 1983	
Coord. System: NAD 1983 UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Rotation: 0	Scale Factor: 0.99960

N

Grid North

0 15 30 45 60

Metres

BURNSIDE

Client

TOWNSHIP OF CLEARVIEW

Figure Title

TRIBUTARY A AND PROPOSED REALIGNMENT

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

Drawn	Checked	Date	Figure No.
HN	CP	2018/10/18	3.6
Scale		Project No.	
H 1:750		300034587	

File Path: \\Elm\gis\Project\300\034587 (Clearview SR 26-27 EIS)\2018\034587_Aquatics for DFO_Legal.mxd Print Date: 2018/10/18 Time: 01:51 PM

Table 3.1: Field Study Methodology

Field Study	Methodology	Staff Involved	Date(s)	Time of Day	Weather Conditions		
					Precipitation/ Cloud Cover[1]	Temperature (°C)	Wind (Beaufort Wind Scale)[2]
2014							
Ecological Land Classification	Ecological Land Classification for Southern Ontario (Lee et. al., 1998)	Nicholle Smith, Senior Terrestrial Ecologist; Deanna DeForest, Environmental Scientist	June 13 and 16 2014	08:00 – 17:00	No precipitation Cloud very high and thin	20°C on arrival 27°C on departure	0 – 1
Wetland Identification	Field verification of wetland boundary	Nicholle Smith, Senior Terrestrial Ecologist	June 13, 2014	09:00 – 10:00	No precipitation Cloud very high and thin	20°C on arrival 27°C on departure	0 - 1
Search for potential wildlife habitats	Meandering survey throughout corridor. Search for features such as: • reptile hibernacula • amphibian breeding ponds • old barns, structures, uncapped chimneys, foundations	Nicholle Smith, Senior Terrestrial Ecologist	June 13 and 16 2014	08:00 – 17:00	No precipitation Clear skies, no cloud cover	20°C on arrival 27°C on departure	0 - 1
Incidental flora and fauna observations	Visual observations of animals, tracks or scat; compilation of a plant inventory	Nicholle Smith, Senior Terrestrial Ecologist	June 13 and 16 2014	08:00 – 17:00	No precipitation Cloud very high and thin	20°C on arrival 27°C on departure	0 - 1
Wetland/ Woodland Delineation	GRCA field verified, surveyed using handheld GPS	Nicholle Smith, Senior Terrestrial Ecologist	June 13 and 16 2014	08:00 – 17:00	No precipitation Cloud very high and thin	20°C on arrival 27°C on departure	0 - 1
Breeding Bird Survey	Entire corridor surveyed. Area specific searches were also conducted in potentially significant habitats.	Scott Martin, Wild Canada Ecological Consulting	June 30, 2014 July 10, 2014	05:22 – 08:07 05:48 – 07:48	No precipitation 30% cloud cover --	18°C --	2 --
Wildlife Inventory	Incidental observations during all site visits.	All field staff	All site visits	-	-	-	-
Aquatic Habitat Assessment	Survey of all aquatic habitat features within the corridor	Jeremy Prahl, Aquatic Ecologist	May 22, 2014	09:00 – 14:00	No precipitation 30-60% cloud cover	10°C on arrival 13°C on departure	0 - 1
Amphibian Call Survey #1	Point count surveys completed according to the Marsh Monitoring Protocol (Bird Studies Canada 2008)	Jeremy Prahl, Aquatic Ecologist	May 30, 2014	21:30 – 22:30	No precipitation Clear skies, no cloud cover	21°C on arrival 20°C on departure	0 - 1
Amphibian Call Survey #2	Point count surveys completed according to the Marsh Monitoring Protocol.	Jeremy Prahl, Aquatic Ecologist	June 25, 2014	21:30 – 22:30	No precipitation; light rain in the afternoon and early evening 50% cloud cover, clearing	15°C on arrival 14°C on departure	1 - 2

Field Study	Methodology	Staff Involved	Date(s)	Time of Day	Weather Conditions		
					Precipitation/ Cloud Cover[1]	Temperature (°C)	Wind (Beaufort Wind Scale)[2]
2015							
Brook trout survey	Visual searches for young of the year Brook trout.	Jeremy Prahl, Aquatic Ecologist	May 5, 2015	13:00 – 15:30	0	10°C	1
Brook trout survey and fish habitat assessment	Visual searches for young of the year Brook trout. Components of the Ontario Stream Assessment Protocol (OSAP).	Jeremy Prahl and Chris Pfohl, Aquatic Ecologists	May 12, 2015	13:30 – 18:00	2/5	16°C	1
2016							
Terrestrial Ecology – ELC, Wetlands, Plants	ELC field data collection as per Lee 1998 OWES wetland boundary delineation Opportunistic plant survey	Nicholle Smith, Terrestrial Ecologist	April 14, 2016	09:00 – 16:00	none	10°C on arrival 18°C on departure	1-2
Data Logger Installation	Installation of piezometers and data loggers for groundwater conditions	Devin Soeting, Env. Tech.	April 28, 2016	10:30 – 16:00	none	7°C	1
Data Logger Download	Download data loggers for groundwater conditions	Devin Soeting, Env. Tech.	May 24, 2016	10:30 – 12:15	none	19°C	1
Terrestrial Ecology – ELC, Wetlands, Plants	ELC field data collection as per Lee 1998 OWES wetland boundary delineation Opportunistic plant survey	Nicholle Smith, Terrestrial Ecologist Peter DeCarvalho, EIT/Ecologist Tammy Wheeldon, Ecology technician	June 24, 2016	09:30 – 17:45	none	16°C on arrival 23°C on departure	1-2
Terrestrial Ecology – ELC, Wetlands, Plants	Constraints analysis	Nicholle Smith, Terrestrial Ecologist	July 15, 2016	10:30 – 14:00	none	20°C on arrival 23°C on departure	0-1
Terrestrial Ecology – ELC, Wetlands, Plants	ELC field data collection as per Lee 1998 OWES wetland boundary delineation Opportunistic plant survey	Nicholle Smith, Terrestrial Ecologist Peter DeCarvalho, EIT/Ecologist	July 27, 2016	09:30 – 17:30	none	27°C on arrival 28°C on departure	0-1
Data Logger Download	Download data loggers for groundwater conditions	Devin Soeting, Env. Tech.	July 29, 2016	10:00 – 14:15	none	23°C	1
Wetland delineation with NVCA	OWES wetland boundary delineation	Nicholle Smith, Terrestrial Ecologist David Featherstone, NVCA	August 3, 2016	13:00 – 16:30	none	25°C on arrival 30°C on departure	0-1
Terrestrial Ecology – ELC, Wetlands, Plants	ELC field data collection as per Lee 1998 OWES wetland boundary delineation Opportunistic plant survey	Nicholle Smith, Terrestrial Ecologist Peter DeCarvalho, EIT/Ecologist	August 15, 2016	09:30 – 18:30	none	27°C on arrival 29°C on departure	0-1

Field Study	Methodology	Staff Involved	Date(s)	Time of Day	Weather Conditions		
					Precipitation/ Cloud Cover[1]	Temperature (°C)	Wind (Beaufort Wind Scale)[2]
Terrestrial Ecology – ELC, Wetlands, Plants	ELC field data collection as per Lee 1998 OWES wetland boundary delineation Opportunistic plant survey	Nicholle Smith, Terrestrial Ecologist	August 19, 2016	10:30 – 18:30	Very light	25°C on arrival 31°C on departure	0-1
Terrestrial Ecology – ELC, Wetlands, Plants	ELC field data collection as per Lee 1998 OWES wetland boundary delineation Opportunistic plant survey	Nicholle Smith, Terrestrial Ecologist	August 26, 2016	10:00 – 18:00	none	18°C on arrival 26°C on departure	1-2
Butternut Health Assessment	Butternut trees encountered were assessed according to the MNRF Butternut Health Assessment protocol.	Kevin Butt, ISA Certified Arborist	June 25, 2016	9:30 – 16:30	n/a	n/a	n/a
Tree Inventory and Assessment	Inventory of trees with DBH of 10 cm or greater with potential to be impacted by developments.	Kevin Butt, ISA Certified Arborist	August 3, 4, 10, 11, 15, and 18, 2018	9:30 – 16:30	n/a	n/a	n/a
Brook trout Survey	Visual searches for young of the year Brook trout.	Jeremy Prahl, Chris Pfohl, Aquatic Ecologists, and Devin Soeting, Env. Tech.	April 28, 2016	9:00 – 14:00	2	4°C	0-1
Brook trout Survey	Visual searches for young of the year Brook trout.	Chris Pfohl, Aquatic Ecologist, and Devin Soeting, Env. Tech.	May 24, 2016	10:00 – 13:00	0	18°C	1
Brook trout Survey	Visual searches for adult and young of the year Brook trout.	Chris Pfohl, Ecologist	June 9, 2016	11:00 – 14:30	0	13°C	1
Brook trout Electrofishing Survey Data Logger Download	Electrofishing, young of the year observations Download data loggers for Groundwater conditions	Jeremy Prahl, Chris Pfohl, Aquatic Ecologists, Christopher Wren, Sr. Fisheries and Water Quality Specialist, and Devin Soeting, Env. Tech.	July 21, 2016	10:00 – 16:00	1	28°C	5
Data Logger Download, Groundwater Sampling	Download data loggers for Groundwater conditions	Chris Pfohl, Aquatic Ecologist, and Devin Soeting, Env. Tech	July 28, 2016	08:30 – 14:30	2	25°C	2
Brook trout Spawning Survey Data Logger Download	Visual searches for Brook trout spawning Download data loggers for Groundwater conditions	Chris Pfohl, Aquatic Ecologist and Devin Soeting, Env. Tech	October 31, 2016	10:00 – 13:00	2	4°C	1
Brook trout Spawning Survey	Visual searches for Brook trout spawning	Chris Pfohl, Aquatic Ecologist and Devin Soeting, Env. Tech	December 1, 2016	10:00 – 13:00	5	4°C	5

Field Study	Methodology	Staff Involved	Date(s)	Time of Day	Weather Conditions: Precipitation/ Cloud Cover[1]	Weather Conditions: Temperature (°C)	Weather Conditions: Wind (Beaufort Wind Scale)[2]
Data Logger Download	Download data loggers for Groundwater conditions; Data logger removal for winter						
2017							
Brook trout survey Data Logger Download	Visual searches for young of the year Brook trout. Download data loggers for Groundwater conditions; Data logger re-installation	Chris Pfohl, Aquatic Ecologist and Devin Soeting, Env. Tech	March 8, 2017	10:00 – 15:30	1	4°C	6
Brook trout survey Data Logger Download	Visual searches for young of the year Brook trout. Download data loggers for Groundwater conditions	Chris Pfohl, Aquatic Ecologist and Devin Soeting, Env. Tech	May 11, 2017	10:00 – 12:30	2	12°C	2
Brook trout survey Data Logger Download	Visual searches for Brook trout spawning Download data loggers for Groundwater conditions	Chris Pfohl, Aquatic Ecologist and Devin Soeting, Env. Tech	November 7, 2017	10:15 – 13:00	2	6°C	2-3
2018							
Brook trout survey Data Logger Download and removal	Visual searches for young of the year Brook trout. Download data loggers for Groundwater conditions	Chris Pfohl, Aquatic Ecologist and Devin Soeting, Env. Tech	May 2, 2018	10:00 – 15:30	5	22°C	2

[1]NAAMP/ Beaufort Sky Codes
0 = clear (no cloud cover)
1 = partly cloudy (scattered or broken) or variable
2 = cloudy or overcast
3 = sandstorm, dust storm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

[2]Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

4.0 Site Characterization

4.1 Soils

The IA is underlain by dolostone above the top of the Escarpment, at the western end. This is the cap rock of the Escarpment. The section of the IA located below the top of the Escarpment (at the eastern end) is underlain by much older shales and limestone, which is present throughout the 120 m adjacent lands and is characteristic of the Niagara Escarpment, while overburden is characterized by surficial deposits of organic soils and loam.

The west end of the IA includes Otonabee Loam soils which area light grey, calcareous, loam tills with good drainage on smooth to moderately steep sloping terrain. The surface stoniness is moderate to very stony Organic type soil is located at the western end of the IA, near the Rob Roy Swamp. Below the brow of the Escarpment soil's transition to Dundonald sandy loam and outwash sand underlain by grey calcareous loam or sandy loam till to depths of 1 m or less. The drainage of these soils is good and they occur on smooth to gently sloping terrain. The surface materials are generally stone free (Hoffman, D.W., et al. 1962).

A detailed analysis of the geotechnical conditions associated with the road are presented in the Peto MacCallum Ltd. Geotechnical Investigation, Proposed Reconstruction of Sideroad 26/27 Nottawasaga, from Osprey-Clearview Townline to Concession Road 10 North (March 2015).

4.2 Hydrology and Drainage

The IA is bisected by the surface watersheds of the Beaver River (to the west) and the Pretty River (to the east). Watercourses located within these regions flow in different overall directions, depending on which watershed they are found. As previously discussed, a tributary of the Pretty River is located within the IA and flows in an east to northeasterly direction across the corridor, eventually discharging into Georgian Bay.

Interpretation of the local and regional topography indicates that overland runoff is generally anticipated to flow in an easterly direction within the Pretty River watershed. In areas around the existing wetlands and watercourses, local drainage is anticipated to flow towards these surface water features. Within the IA, no watercourses are located within the Upper Beaver River watershed. However, overland runoff in this watershed would generally flow west, towards the headwaters of the Beaver River.

Areas of known and potential karst formations are also noted as being within the general vicinity of the IA and larger Study Area (within 120 m of IA) (Brunton et al, 2008). Karst formations and topography are characterized by underground drainage systems, through the dissolution of carbonate rocks, and are most commonly observed in limestone and dolomite-based geologic units. As shown in the NVCA 2013 Blue Mountain Watersheds Health Check (NVCA 2013), the entire region of the corridor is classified as having a highly vulnerable aquifer and large portions of the corridor are considered to be a significant groundwater resource area, which is likely directly related to the sensitivity of the local hydrologic and drainage environment.

4.3 Hydrogeology

Water level and temperature data have been collected, beginning on April 28, 2016, at a number of locations along Clearview Sideroad 26/27 (Appendix D). Nested streambed piezometers and stream temperature monitoring stations were installed in Tributary A and Tributary C. A stream temperature monitoring station was installed in Tributary B, located in the roadside ditch.

Monitoring Location Details

Shallow (S) and deep (D) streambed piezometers were installed at two locations in Tributary A, upstream (U/S) and downstream (D/S) and one location in Tributary C. Installation details are provided in Appendix D (Appendix A of report).

There appears to be a low incidence of groundwater/surface water interaction in the portions of Tributary A/Tributary C that were investigated. Groundwater gradient between the shallow and deep piezometers at Tributary A-U/S and Tributary C are downwards. At Tributary A-D/S gradients are downwards between the shallow and deep piezometers, however water levels in the shallow piezometers are higher than surface water levels between May and November 2017 and suggest there is potential for shallow groundwater to enter the tributary.

The water level and temperature data indicate that the portion of Tributary A that was monitored is an area with downwards (or recharge) water level gradients.

4.3.1 Summary of Hydrogeological Findings

Based on the information presented above (and presented in more detail in Appendix A), Burnside offers the following conclusions:

Downward gradients were measured between the shallow and deep piezometer at the locations monitored in Tributary A and Tributary C.

Water levels exhibit a typical seasonal pattern with highest levels occurring in the spring and lowest levels in the summer.

Groundwater temperatures are lowest in the deep piezometers at each location, with temperatures being lowest at Tributary A-U/S and highest in Tributary C.

The greatest range in groundwater temperatures between locations is seen in the summer (6°C), with a much lower range in spring and fall (~1°C).

The portions of Tributary A, Tributary B and Tributary C in the study area are not considered to represent significant groundwater discharge areas.

Road improvements will not have any significant negative impact on surface water or groundwater temperatures.

4.4 Vegetation Communities

The IA included a variety of human influenced, or cultural communities, as well as forested and wetland features. Burnside staff conducted a site investigation on June 13 and 17, 2014 to characterize vegetation communities within the corridor. Additional surveys were conducted throughout the summer of 2016 (Table 4.1) to further refine vegetation community classification and delineate unevaluated wetland features, in coordination with NVCA ecology staff. Based on Lee et. al, 1998 (and community descriptions from the updated ELC codes found in Ecological Land Classification System for Southern Ontario Ecosystem Table 2008), 12 vegetation community types and 3 anthropogenic communities are present within, or proximal to, the IA. All the communities identified are considered to be relatively common in Ontario. A summary of these units is shown on Figure 3.1.

White Birch-Poplar Mineral Deciduous Swamp (SWDM 4-3)*

This community is located at the southeast corner of the intersection of the Osprey Clearview Townline and the 26/27 Sideroad and is part of the Rob Roy PSW. Tree cover within the community is estimated at about 40 to 50%. It is dominated by European White Birch (*Betula pendula*), with White Elm (*Ulmus Americana*), Ash species (*Fraxus species*), Willow species (*Salix* species) and Red Osier Dogwood (*Cornus sericea*). Due to the patchy nature of the canopy, there is extensive groundcover throughout this community, dominated by sedge species (*Carex sp*). Ground conditions were saturated, where observed, with some small areas of standing water present.

4.4.1 Black Ash-Conifer Mineral Mixed Swamp (SWMM 4--2)*

This community is located at the western end of the IA and is part of the PSW. The species in this community differ in that the canopy cover is denser, at approximately 50 to 60% and is dominated by Black Ash (*Fraxinus nigra*) and Trembling Aspen (*Populus tremuloides*), with occasional White Elm and Black Spruce (*Picea mariana*) in the canopy and White Cedar (*Thuja occidentallis*) and Black Spruce dominating in the sub-canopy with Black Ash and White Elm. The understory of Black Ash and White Cedar also includes Red Maple (*Acer rubrum*). Groundcover consists of Sensitive Fern (*Onoclea sensiblis*) and Ostrich Fern (*Matteuccia struthiopteris*) and dominated by sedge species. Small pockets of open water are found within this community.

4.4.2 Dry-Fresh White Cedar – Poplar Mixed Forest Type (FOMM 4-2)*

This community is located to the east of the previous community and at a small increase in elevation with a slight slope. Balsam Poplar (*Populus balsamifera*) is dominant in the canopy, with Eastern White Cedar. The sub-canopy consists predominantly of Eastern White Cedar, with Ash species and Sugar maple (*Acer saccharum*). Sugar maple was observed to be dominant in the understory, with Eastern *White* Cedar and occasional Black Spruce. Ground cover was minimal (approximately 15 to 20%) with moss species, Blue Cohosh (*Caulophyllum thalictroides*), Canada Mayflower (*Maianthemum canadense*), Trillium (Trillium grandiflorum) species observed. Canopy cover is approximately 60 to 70%, with less cover in the subcanopy and understory.

4.4.3 Dry – Fresh Sugar Maple – White Ash Deciduous Forest (FODM 5-8)*

This community surrounds the Rob Roy PSW at the west end of the corridor. Dominant species in the canopy of this community include Sugar Maple, White Ash and Green Ash. Canopy cover is greater than 60% in the canopy and about 25% in the subcanopy layer. The groundcover layer is dominated by Canada mayflower, Red trillium and European stinging nettle. This large community is located on both the north and south sides of the road extending for a significant distance to the north of the corridor.

4.4.4 Apple Deciduous Shrub Thicket Type (THDM – 2-10)*

This community has been culturally influenced in the past by previous agricultural practices, resulting in the establishment of a mixed thicket containing a variety of anthropogenic and native species of trees and shrubs. Apple, Hawthorn species and Eastern White Cedar dominate the sub-canopy which is the defining vegetative layer in this community at 25% cover. The canopy is sparse (ten percent cover) and is dominated by Sugar maple, White Ash and Eastern White Cedar. Hawthorn and Eastern White Cedar are the predominant species within the understory and Grass and Vetch species are the most predominant species in the ground cover layer.

4.4.5 Medium Mineral Coniferous Plantation (TAGM 1)*

This community includes an extensive plantation on the north side of the road. This community a mix of Red Pine (*Pinus resinosa*) with scattered Sugar maple in the canopy with little to no subcanopy or understory. Groundcover includes Grass species in greater abundance at the community edge (road) and sparse coverage within the community.

4.4.6 Medium Mineral Fencerow (TAGM 5)*

This anthropogenic community extends along the road across from the plantation. The fencerow is dominated by a mixture of different species, including apple, hawthorn species, Manitoba maple and White ash. Groundcover in this anthropogenic community is limited to Goldenrod (*Solidago* sp.) and Grass species.

4.4.7 Dry-Fresh White Ash – Hardwood Deciduous Forest (FODM 4-2)*

This slope forest appears to be young to mid aged, with a few large open crowned trees, which would indicate that this community was previously part of more open agricultural areas. Canopy cover is consistent and approximately 70 to 75%. The understory is dominated by the same species as the canopy, with White Ash as the dominant species. The shrub and sapling layer includes Red Raspberry (*Rubus idaeus*), Red-osier Dogwood and Alternate Leaved Dogwood. Groundcover is dominated by Virginia Waterleaf (*Hydrophyllum virginianum*) and Grass species.

On the north side of the road, this community extends for the majority of the slope and along the watercourse. Movement of surface water across the roadway has resulted in the deposition of significant amounts of sediment in both the watercourse and in sections of the forest. Canopy cover on the north side of the road is patchier than that found on the south side. Groundcover is more diverse and includes a mixture of upland deciduous forest plants and riparian species, including aster, goldenrod, wood ferns, grass species and enchanter’s nightshade, mixed with spotted jewelweed, sensitive fern and sedge and rush species.

4.4.8 Poplar Mineral Deciduous Swamp / Cattail – Horsetail Gramminoid Meadow Marsh (SWDM 4-5/MAMM 1-2/10)*

This community forms a complex on the south side of the road where a considerable amount of groundwater discharge is occurring. There is a large ponded area on the tableland, surrounded by Cattail Meadow Marsh (Narrow-leaved Cattail). The slope community is dominated by treed cover, including Trembling Aspen (*Populus trembuloides*) and Balsam Poplar (*Populus balsamea*). The plateau adjacent to the road includes a Meadow Marsh dominated by both Narrow-leaved Cattail (*Typha angustifolia*) and Water Horsetail (*Equisetum palustris*). There is significant evidence of groundwater input to the wetland features continual flow, shallow water conditions and iron precipitate (orange) staining. This water flows into the ditch and across the road where it discharges into the cold-water stream discussed in Section 5.4. The flow of water across the road surface is causing considerable erosion and transfer of sediment into the watercourse and plant communities on the north side of the road.

4.4.9 Dry – Fresh Hawthorn / Apple-Sugar Maple Deciduous Woodland (WODM 4-1/3)*

This woodland community is documented on the south side of the road between blocks of the Ash slope forest (FODM 4-2). The sub-canopy, which is the dominant woody layer in this community, is characterized by a cultural mix of hawthorn, apple and Sugar maple along the more naturalized edges. The canopy which is patchy includes both Sugar maple and White Ash. The shrub layer includes a mix of species (dogwood, willow, Tartarian honeysuckle, European buckthorn and currant species) and the groundcover is dominated by grass species and some old field associations.

4.4.10 Cattail Mineral Shallow Marsh (MASM 1-1)*

This community runs parallel to the road on the south side, in an area where groundwater is continually seeping from the slope. The edges include Basswood (*Tillia Americana*), Eastern White Cedar and Green Ash. The central part of the community is dominated by Narrow-leaved Cattail with Spotted Touch-me-not (*Impatiens capensis*), and Water Horsetail. Water is conveyed to the north side of the road through a culvert at this location.

4.4.11 Transportation (CVL-1)

This community is located within the road right-of-way. This community consists of open area between the road base and the adjacent wooded areas. Groundcover is quite dense, at about 80 to 90%, and dominated by grass and sedge species, with Vetch (*Vincca* sp.), Wild Strawberry (*Fragaria vulgaris*), Red–osier Dogwood, Buttercup (*Ranunculus hispidus*), Ostrich Fern, and Sensitive Fern.

4.4.12 Rural Property (CVR_4)

This includes the rural residences and some of the farmsteads that are located along the corridor.

4.5 Avifauna

A total of 47 bird species were recorded during the June 30 and July 10, 2014 surveys (see Appendix C). Seventeen species were confirmed to be on breeding territory, either through observation of fledged young or a mating pair, other appropriate signs of breeding evidence, or through the registration of territorial song on at least two days, a week or more apart, at the same place.

Two species recorded during these surveys are considered to be Species At Risk (SAR) in Ontario under the Endangered Species Act 2007 (ESA). These are the Wood Thrush (*Hylocichla mustelina)* Special Concern, recorded at survey station #6 and #7, and Eastern Wood-Pewee (*Contopus virens)* Special Concern, identified at stations #3 and #6. One SAR, Wood Thrush, was confirmed to be on breeding territory within a point count circle. This was recorded at station #6, within the 50 to 100 m circle from the count location (Figure 3.2).

4.5.1 Eastern Whip-poor-will Survey Results

The first Whip-poor Will (EWPW) survey was completed on May 30, 2018. Eight stations, 400 m apart, were surveyed during a full moon phase with appropriate weather conditions. The 400 m separation put the survey points in what should have been good locations based on roadside habitat. The sky was marginally cloudy during the survey period and the moon had just risen, providing excellent conditions. No EWPW were documented at any of the eight roadside point count locations (Appendix C).

While cloud cover was generally between 25-50%, the moon was visible for all but 3 points between both surveys. The temperature was 25 °C during the May 30 survey and 17 °C during the June 26 survey. There was no precipitation during either survey, and the wind was within acceptable limits, ranging between 1-3 on the Beaufort scale.

On both survey dates, to ensure that surveying was being conducted during appropriate moon/time/weather conditions, I visited an EWPW monitoring control site in Wasaga Beach, immediately prior to conducting the surveys along Sideroad 26/27. On both dates, EWPW were recorded calling at the control site.

No EWPW were recorded during the surveys on Sideroad 26/27. The surveys were conducted fully according to protocol – during preferred moon/sky conditions, temperatures, wind conditions, and at the proper times. While it was demonstrated, through the use of a control site, that the conditions on the survey dates were optimal for recording singing EWPW, and although much of the habitat bordering Sideroad 26/27 would seem suitable for EWPW, no EWPW were recorded along the surveyed portion of Clearview Sideroad 26/27 during these 2018 breeding season surveys. From these findings, it can be concluded that there are no EWPW actively breeding along the surveyed portion of Clearview Sideroad 26/27 in 2018.

4.6 Mammals

The proposed development does not include a measurable disturbance to any of the potential mammal habitat features or functions that exist within the IA, further minimizing the potential for effects to mammals at that time.

Due to declining species numbers, as a result of both White-nosed Syndrome and loss of habitat, a number of bat species have been listed as endangered in the province. To address the new species rankings, and the lack of bat species and habitat data available in Ontario, the MNRF published new habitat survey protocol for these species in 2007. Skelton Brumwell & Associates Inc. was retained by the Township to survey potential bat habitat and the results of these studies are presented under separate cover (2018).

Incidental mammalian wildlife observations, compiled for the IA, include raccoon (*Procyon lotor*) and eastern cottontail (*Sylvilagus floridanus*), however the following mammals are also expected given the habitats present: eastern grey squirrel (*Sciurus carolinensis)*, eastern chipmunk (*Tamias minimus*), white-tailed deer (*Odocoileus virginianus*), striped skunk (*Mephitis mephitis*) and other common species of mammals. None of these species are considered at risk either federally or provincially and are generally widespread and secure in Ontario.

4.7 Amphibians

Amphibian call survey results are summarized in Table 4.1 below. The following species were observed (heard calling and/or seen) within the IA and 120 m adjacent lands, over the course of the 7 site visits:

- American Toad (*Bufo americanus*);
- Gray Treefrog (*Hyla versicolor*);
- Green Frog (*Rana clamitans*);
- Western Chorus Frog (*Pseudacris triseriata*);
- Wood Frog (*Rana sylvatica*);
- Northern Leopard Frog (*Rana pipiens*); and,
- Spring Peeper (*Pseudacris crucifer*).

All encountered species are ranked S5 (Ministry of Natural Resources and Forestry subnational rankings) and are considered secure, common and widespread across the province.

According to the Significant Wildlife Habitat Ecoregion Criteria for Ecoregion 6E (MNRF, 2017), it is unlikely that the IA is considered significant for breeding amphibians as the amphibian study did not confirm the presence of a highly diverse, rare, or numerous breeding populations of frog species.

Table 4.1: Summary of Amphibian Call Survey Results for Surveys Completed from 2014 to 2016

Date	Survey No.	Station ID	Species Observed (Common and Scientific Names)	Call Level Code[1]	Abundance Count[2]	Notes
Year 1 –2014						
May 30	1	A	Spring Peeper (*Pseudacris crucifer*) Gray Treefrog (*Hyla versicolor*)	2 2	3 3	Low background water noise disturbance; calls well removed from IA (> 50 m)
		B	Spring Peeper (*Pseudacris crucifer*) Gray Treefrog (*Hyla versicolor*)	3 2	TMTC 5	Calls well removed from IA (> 50 m)
		C	(none)	n/a	n/a	Moderate background water noise disturbance.
		D	Spring Peeper (*Pseudacris crucifer*) Gray Treefrog (*Hyla versicolor*) Green Frog (*Rana clamitans*)	3 1 1	TMTC 2 1	Calls from all three species also heard calling from within PSW, west of Osprey Clearview Townline
June 25	2	A	(none)	n/a	n/a	Low background water noise
		B	(none)	n/a	n/a	
		C	(none)	n/a	n/a	Moderate background water noise disturbance; One (1) American Toad (*Bufo americanus*) observed
		D	(none)	n/a	n/a	

Date	Survey No.	Station ID	Species Observed (Common and Scientific Names)	Call Level Code[1]	Abundance Count[2]	Notes
Year 2 - 2015						
April 27	1	A	Spring Peeper (*Pseudacris crucifer*)	2	3	Low background water noise disturbance; calls well removed from IA (> 50 m)
		B	Spring Peeper (*Pseudacris crucifer*)	3	TMTC	Some calls well removed from IA (> 50 m)
		C	(none)	n/a	n/a	Moderate background water noise disturbance
		D	Spring Peeper (*Pseudacris crucifer*) Western Chorus Frog (*Pseudacris triseriata*) Wood Frog (*Rana sylvatica)*	3 2 1	TMTC 6 2	Calls from all three species also heard calling from within PSW, west of Osprey Clearview Townline
May 21	2	A	(none)	n/a	n/a	
		B	(none)	n/a	n/a	
		C	(none)	n/a	n/a	Moderate background water noise disturbance
		D	Spring Peeper (*Pseudacris crucifer*)	3	TMTC	
Year 3 - 2016						
May 1	1	A	(none)	n/a	n/a	
		B	Spring Peeper (*Pseudacris crucifer*)	1	1	
		C	(none)	n/a	n/a	
		D	Spring Peeper (*Pseudacris crucifer*) Western Chorus Frog (*Pseudacris triseriata*) Wood Frog (*Rana sylvatica)*	3 2 2	TMTC 6 4	

Date	Survey No.	Station ID	Species Observed (Common and Scientific Names)	Call Level Code[1]	Abundance Count[2]	Notes
May 23	2	A	(none)	n/a	n/a	
		B	Spring Peeper (*Pseudacris crucifer*)	1	2	Spring peeper calls heard >50 m north of IA
		C	(none)	n/a	n/a	
		D	Spring Peeper (*Pseudacris crucifer*) American Toad (*Bufo americanus*)	3 2	TMTC 3	
June 24	3	A	(none)	n/a	n/a	
		B	American Bullfrog (*Lithobates catesbeiana)* Gray Treefrog (*Hyla versicolor*) Green Frog (*Rana clamitans*)	1 1 1	1 2 1	American Bullfrog heard >50 m north of IA
		C	(none)	n/a	n/a	
		D	Green Frog (*Rana clamitans*)	1	1	

[1] 1 = individuals can be counted, calls not simultaneous; 2 = calls distinguishable, some simultaneous calling; and 3 = full chorus, calls continuous and overlapping.
[2] TMTC = too many to count
Note: One (1) Northern Leopard Frog (*Rana pipiens*) and one (1) Green Frog (*Rana clamitans*) were seen at Station C, during the aquatic assessment on May 22, 2014.

4.8 Fisheries and Fish Habitat Results

4.8.1 Aquatic Habitat Assessment – Tributaries A, B, C, D, and E

An initial aquatic habitat assessment, generally following OSAP protocols, was completed at each watercourse crossing of SR26/27 in the spring of 2014. A summary of existing aquatic conditions at each site is provided in Table 4.2 below. Figure 3.4 shows the locations of the watercourses within the IA and 120 m adjacent lands.

Table 4.2: Summary of Existing Aquatic Habitat Conditions 2014

	Site 1 (Tributary B)	Site 2 (Tributary A)	Site 3 (Tributary C)	Site 4 (Tributary D)	Site 5 (Tributary E)
Date	May 22, 2014	May 22, 2014	May 22, 2014	May 22, 2014	May 22, 2014
Time	10:00	10:30	11:30	12:00	12:30
Weather Conditions	sun/cloud	sun/cloud	sun/cloud	sun/cloud	sun/cloud
Air Temperature	10°C	11°C	13°C	13°C	12°C
Water Clarity	clear	clear	clear	clear	clear
Water Colour	colourless	colourless	colourless	colourless	colourless
Thermal Regime	cool/coldwater	cool/coldwater	cool/coldwater	cool/coldwater	cool/coldwater
System	Pretty River	Pretty River	Pretty River	Pretty River	Pretty River
Reach Description	road crossing	parallel to road, within IA	road crossing	road crossing	road crossing
Upstream Morphology	riffle, run; flow from roadside trench	riffle, run, pool, stepped bed	riffle, run, flow from roadside trench	braided channel, wetland	run, flow from roadside trench
Downtream Morphology	riffle		riffle, run	riffle, run	riffle, run, pool, stepped bed
In-stream cover	overhanging vegetation	undercut banks, overhanging vegetation	undercut banks, overhanging vegetation, woody debris	aquatic vegetation	undercut banks, woody debris, overhanging vegetation
Bank Stability	0% stable 20% vulnerable 80% eroding	80% stable 10% vulnerable 10% eroding	60% stable 20% vulnerable 20% eroding	70% stable 30% vulnerable 0% eroding	30% stable 60% vulnerable 10% eroding
Substrates	sand. gravel, organics	sand, gravel, cobble	sand, gravel	sand, silt, organics	sand, silt, organics

	Site 1 (Tributary B)	Site 2 (Tributary A)	Site 3 (Tributary C)	Site 4 (Tributary D)	Site 5 (Tributary E)
In-stream Aquatic Vegetation	sparse	moderate, along banks	moderate, along banks	moderate to dense	sparse
Riparian Vegetation	deciduous/coniferous trees, herbs, grasses	shrubs, grasses	deciduous trees, shrubs, grasses	shrubs, herbs, grasses	deciduous trees, shrubs, herbs, grasses
Canopy Cover	40%	10%	40%	0%	70%
Wetted Width (m)	0.2 - 0.4	0.5 - 1.0	0.3 - 0.7	0.5 - 1.0 (downstream)	0.3 - 1.0
Bank Full Width (m)	0.5 - 1.0	0.5 - 1.5	0.5 - 1.0	1.0 - 1.5 (downstream)	1.0 - 2.0
Depth at Thalweg (cm)	5 - 10	10 - 45	5 - 15	5 - 10	10 - 30
Barriers to Fish Passage	seasonal perched culvert outlet at CSP Tributary C	vertical bedrock ledges (0.4 to >1.0 m)	seasonal perched culvert outlet at CSP Tributary C	none	perched culvert outlet
Culvert Type	CSP	n/a	CSP	CSP	CSP

Two high-gradient headwater tributaries contribute flow to Tributary A, immediately adjacent to the existing road. Based on available watercourse mapping, Tributary B (Aquatic Assessment Site 1) is a first order stream, whereas Tributary C (Aquatic Assessment Site 3) is a second order stream. Flows are conveyed beneath Sideroad 26/27 through shallow embedded corrugated steel pipes (CSPs; 500 mm in diameter) measuring 16.9 m and 14.7 m in length, respectively. Both culverts are partially obstructed with accumulated sand and gravel, providing very limited conveyance. Stormwater and groundwater-sourced surface water routinely collects and is conveyed along the south side, and across the surface, of the existing gravel road.

Upstream (south) of Sideroad 26/27, Tributary B appears to be fed primarily by numerous groundwater seeps originating on the northeast-facing slope of the Niagara Escarpment. They are relatively small headwater features, with poorly defined channels, and are strongly associated with the groundwater fed wetland pockets established on low to moderately sloped terrain. Over the course of the Study period (2014-2018), the flow path of Tributary B varied significantly. In the spring of 2016, the flow path previously identified in 2014 was completely abandoned and dry. Surface flow is currently directed to Tributary C, via the ditch on the south side of Sideroad 26/27.

Tributary C originates from a man-made pond developed on higher ground that has a high perimeter containment berm around the northern section. The water source to the pond is comprised of many surface water channels that are fed by groundwater springs at high elevations up the Escarpment and by surface water. The pond has a surface draw overflow outlet and vertical piping system that prevents overtopping of the berm. The discharge from the pond flows into the channel that is called Tributary C, and discharges to Tributary A on the North side of the corridor. The surface draw outlet system maintains flow in Tributary C but also effects the temperature of the water discharging from Tributary C to Tributary A.

In the few areas of Tributaries B and C where a defined channel exists, substrates are dominated by organics with sparse pockets of sand and gravel. During periods of high flow, wetted widths generally do not exceed 0.7 m and depths are less than 0.2 m. Based on 2012 aerial photography available through the County of Simcoe's online Interactive Map application (www.simcoe.ca/dpt/it/gis), Tributary C flows through an online pond located approximately 60 m south of the IA.

Tributaries D and E are located east of Tributary A, and are characterized as indirect fish habitat that provide a source of water flow to Tributary A. Based on the conditions observed within both Tributaries D and E, they are considered to be marginal fish habitat due to instream vegetation (cattails) and organic substrates, with limited water depth.

4.8.2 Detailed Aquatic Habitat Assessment – Tributary A

The upstream section of Tributary A (Reach 1) consists of a channel with multiple flow paths, within a wetland community (Figure 3.6). Further downstream, the channel becomes confined, as the vegetated strip along the north side of the existing road and the adjacent woodland area form defined banks. Reach 2, which extends from Sta. 6+019 to Sta. 6+159, consists of a series of step-pool features (including natural barriers >1 m) interspersed with short riffles and runs. Reach 3 extends downstream from Sta. 6+159 and consists of an extended riffle feature on lower-gradient terrain. The channel turns sharply away from the IA at Sta. 6+165, and continues northeastward, beyond the Study Area. The average gradient over the full length of Tributary A (within the limits of the Study Area, defined above) is approximately 8-9%, gradually becoming less steep near the downstream end (approximately 4-5%).

Throughout the channelized section of Tributary A (i.e., Reaches 2 and 3), substrates are dominated by gravel, cobble and boulder, with deposits of sand and organics in areas of low velocity. Extensive sand and gravel washout from the Sideroad 26/27, impacting Tributary A, has been observed on several occasions. Upon close inspection, the dimpled, sub-angular gravel predominant in the stream bed appears to match the material found on the surface of road. This suggests that a significant portion of the smaller coarse material covering the stream bed is not derived from the native parent material, but rather from the municipal road, which is routinely re-surfaced with gravel.

At the time of the spring 2015 site visit, the wetted widths of Reaches 2 and 3 ranged from 0.6 m to 0.9 m and the maximum depth of pool features ranged from 0.18 m to 0.60 m. Bankfull width ranged from 1.5 m to 3.2 m. In Reach 3, the channel has vertical (undercut) banks and the bankfull width is similar to the wetted width (1.0 to 1.5 m). A grassed area, approximately 1.5 m to 3 m wide, buffers the road from the channel of Tributary A; however, road washout has eroded this buffer in two areas. Reach 2 is well shaded by deciduous trees and shrubs, mainly associated with the woodland along the north bank. Overhead cover in Reach 3 is more open, with some overhanging grasses and shrubs providing shade during the growing season.

As mentioned above, a minor channel realignment (22 m) of Tributary A will be required to accommodate the road reconstruction. The anticipated area of impact is located within the downstream section of Reach 2 and Reach 3. Due to gradual bends in the channel, the actual watercourse feature in the area of impact is approximately 22 m in length, measured along the center line of the channel.

Detailed fish habitat information was collected along transects oriented perpendicular to flow, located at 2.0 m intervals along the IA, to document fish habitat features. The corresponding data is presented in Table 4.3 below.

Table 4.3 Overview of fish habitat in Reaches 2 and 3 of Tributary A, between Station 6+146.5 and Station 6+165 (proposed realignment), May 12, 2015

Transect No.	Station No.	Morphology	Wetted Width (m)	Max. Depth (m)	Substrate Composition (%)[1]							Cover Type Present[2]						
					C/S	Sa	Gr	Co	Bo	Br	Or	WM	Su	AV	Tu	OHG	OHS	UB
1	6+163	Riffle	0.8	0.09	Tr	10	20	60	0	0	10	N	Y	N	Y	Y	Y	N
2	6+161	Riffle	0.9	0.11	Tr	5	50	40	0	0	Tr	N	Y	N	Y	Y	Y	Y
3	6+159	Riffle	0.6	0.10	Tr	10	60	30	0	0	Tr	N	Y	N	Y	Y	N	Y
4	6+157	Riffle	0.9	0.11	Tr	10	70	20	0	0	Tr	N	Y	N	Y	Y	Y	Y
5	6+155	Pool	1.0	0.18	Tr	40	50	10	0	0	Tr	N	Y	N	Y	Y	N	Y
6	6+153	Riffle	1.0	0.09	Tr	40	50	0	0	0	10	N	N	Y	Y	Y	Y	N
7	6+151	Riffle	1.2	0.13	Tr	70	20	5	0	0	5	N	N	N	Y	Y	Y	Y
8	6+149	Pool	0.9	0.18	Tr	60	20	10	0	0	10	N	N	N	Y	Y	N	N
9	6+147	Riffle	1.0	0.07	Tr	5	10	5	80	0	Tr	N	Y	Y	Y	Y	N	N

1 C/S = Clay/Silt; Sa = Sand; Gr = Gravel; Co = Cobble; Bo = Boulder; Br = Bedrock; Or = Organics; and Tr = Trace
2 WM = Woody Material; Su = Substrates; AV = Aquatic Vegetation; Tu = Turbidity; OHG = Overhanging Grasses; OHS = Overhanging Shrubs and Trees; and UB = Undercut Bank

Further east along the road alignment, there are two additional watercourse crossings that contribute flow to Tributary A, north of the Study Area. Tributary D is a first-order stream conveyed beneath Sideroad 26/27 via an existing CSP (Site 4). Within the IA, the channel is dominated by organics, silt and sand substrates with dense aquatic/wetland vegetation upstream. No fish were observed at this site during our field investigations, but access from downstream areas may be possible.

Tributary E is a spring-fed first-order stream located mainly in the south ditch. It is conveyed beneath Sideroad 26/27 through a partially obstructed CSP with a perched outlet. This culvert is a permanent barrier to fish movement. The upstream channel is dominated by organic substrates and very little flow was noted.

It should be noted that a barrier to fish movement was observed at Site 5 (Tributary D), where the outlet of the existing corrugated steel pipe (CSP) culvert is perched. A seasonal barrier to fish movement exists in Tributary B and C at the CSP culvert that conveys flow to Tributary A. This CSP culvert can be perched due to seasonal water levels depending on flow. Additionally, there are numerous natural barriers (0.4 to 1.0 m in height) to upstream fish movement observed within Reach 2 in all flow conditions on Tributary A.

4.8.3 Brook trout Spawning and Young of Year Observations

Juvenile and/or small adult Brook trout (*Salvelinus fontinalis*) were documented in Reaches 2, and 3 of Tributary A throughout the study period (2014 to 2018) and YOY were observed in small, low velocity pockets of water along the margins of Tributary A each year except 2016. Based on the observation of limited numbers of YOY Brook trout observed, spawning does occur within the section of watercourse along the north side of Sideroad 26/27 although it is expected to be limited due to available depth and suitable groundwater input (i.e., a critical habitat feature to support Brook trout spawning). No observation of adult Brook trout engaging in spawning activities (building nests or redds) were observed despite numerous site visits during suitable time periods for known Brook trout spawning in southern Ontario.

No other species were observed in Tributary A and no fish were observed in Tributaries B, C, D or E. The existing culverts are in very poor condition and are likely acting as barriers to upstream fish passage during periods of low flow. Furthermore, the shallow, poorly defined, and organic substrate-dominated channels typical of the watercourses on the south side of Sideroad 26/27 do not provide high quality habitat for coldwater fish species. These headwater areas do however provide indirect / contributing fish habitat benefitting known occupied reaches, downstream.

Further details on the methodology and results of the additional surveys can be found in the DFO Request for Review Support Document in Appendix D.

4.8.4 Backpack Electrofishing

Fish community sampling was conducted using a backpack electrofisher (Smith Root Model LR24) on July 21, 2016, to help determine whether Tributaries A, B, C, and D, within the IA, are occupied by fish. Tributary A was sampled intermittently (based on available depth) to focus on small pools and undercuts that provide high quality cover for Brook trout. Tributary E was not sampled due to insufficient water depth to conduct electrofishing. All results are presented in Table 4.4 below.

Table 4.4: Summary of fish community sampling by electrofishing in Tributaries A, B, C, D and E (July 21, 2016).

	Tributary A	Tributary B	Tributary C	Tributary D	Tributary E
Electrofishing Effort (seconds)	437	41	35	65	0
Species Observed	Brook trout	N/A	N/A	N/A	N/A
Number of fish caught/released	6	0	0	0	N/A
Size range (total length in mm)	105-180	N/A	N/A	N/A	N/A
Number of fish observed/escaped	7	N/A	N/A	N/A	N/A

Based on the above noted results, Tributary A supports a Brook trout population that is confined to Tributary A due to the existing conditions. Tributary B, C, D, and E provide a source of waterflow and allochthonous input to Tributary A as indirect fish habitat, based on the electrofishing results provided above.

4.9 Surface and Groundwater Monitoring

4.9.1 Surface Water Monitoring

Surface and Groundwater Monitoring was conducted by Burnside from April 2016 to May 2018. Surface water temperature monitoring in Tributary A was conducted in two locations upstream and downstream within the IA. Surface water temperatures were also monitored in Tributary B at one midstream location within the IA and in Tributary C, approximately 10 m upstream of the confluence at Tributary A. HOBO Water Temp Pro V2 data loggers were used to collect surface water temperatures at each of the locations described above.

Surface water temperatures were recorded during the afternoon of May 22, 2015, from Tributaries A and C, using a waterproof quick-read digital thermometer. Surface water temperatures in Tributary A, upstream and downstream of the confluence of Tributary C, were 9.4°C and 10.5°C, respectively. Surface water temperature in Tributary C was 11.1°C while water temperatures in the eroded south ditch of the existing road were

14.4°C, on average. Following an extended period of hot weather in July 2016, the water temperature in Tributary A (upstream of Tributary C) was measured at 16°C, while the air temperature was 27°C.Surface water temperature measurements obtained from Tributary A were not sufficiently refined to allow for the confirmation of suspected groundwater upwelling sites, based on thermal gradient.

As mentioned, watercourse temperatures were recorded using Hobo Water Temp Pro V2 data loggers in Tributary A (two locations - upstream and downstream of the confluence with Tributary C), Tributary B (one location), and Tributary C (one location) during periods in 2016, and throughout the duration of the 2017 to 2018 monitoring. For the purposes of this study, three mean temperature categories (cold, <19°C; cool, 19–<22°C; and warm, ≥22°C) and three temperature fluctuation categories (stable, <5°C; moderate, 5–<10°C; and elevated, ≥10°C) were used to classify the recorded temperatures.

The recorded temperatures indicated that the Tributary C watercourse is considered to be cool to warm in nature, as temperatures were recorded above 22°C in the summers of 2016 and 2017 respectively and fluctuates at an elevated level. The median temperature recorded at this location throughout the 2017-2018 monitoring period was 8.21°C. This result is not unexpected as the source of the Tributary C watercourse is a private pond, located south of Sideroad 26/27. The data recorded within Tributary B indicated that the watercourse is classified as cold to cool and fluctuates at an elevated level. The highest temperature recorded at this location was 21.3°C in the summer or 2016, while the lowest temperature was less than 1°C and was recorded in the winter of 2017. The median temperature recorded within this watercourse throughout the 2017-2018 monitoring period was 5.7°C.

The recorded temperatures indicated that the Tributary A upstream monitoring location is considered to be cold and fluctuates at an elevated level. The highest temperatures were observed in August 2016 (above 18°C), while the lowest was observed in April of 2018 (less than 1°C). The median temperature observed throughout the 2017-2018 monitoring period at the Tributary A upstream monitoring location was 7.15°C. The temperature data from the Tributary A downstream location indicated that the watercourse at that location is considered to vary between cold to cool and fluctuates at an elevated level. Cool temperatures were recorded in the summer of 2016 (intermittently above 19°C), while cold temperatures were recorded throughout the 2017-2018 monitoring. The variation in thermal classifications between the upstream and downstream locations is attributed to the thermal contribution of Tributary B and C (both considered to be seasonally warmer than the Tributary A upstream location).

4.9.2 Groundwater Monitoring

Nested streambed piezometers and temperature monitoring stations were installed in Tributary A (upstream and downstream) and Tributary C on April 28, 2016 to monitor groundwater conditions. Shallow (S) and deep (D) streambed piezometers were installed at two locations in Tributary A, upstream (U/S) and downstream (D/S) and one location in Tributary C. Automatic Water Level Recorders (AWLR/Van Essen Diver Loggers) were outfitted within each piezometer and were used to collect pressure and temperature data in the above noted locations. Installation details are provided in Appendix A (Appendix A of report). Development of the monitoring procedures following installation on April 28, 2016 are discussed in detail in the technical memorandum found in Appendix A.

Based on the results of the surface and groundwater temperature monitoring, Tributary A is classified as a coldwater stream due to consistent temperatures below 18°C. Due to the results of the electrofishing and observation of Brook trout (adult and YOY), it is also confirmed that Tributary A supports coldwater fish species (Brook trout). Tributary B and C also have surface water temperatures that support being classified as cool/coldwater, although no fish species were observed in these watercourses based on electrofishing and numerous observations. Tributary D and E were not monitored for surface or groundwater temperature, although both support water quality and flow in Tributary A downstream.

See Results and Conclusions from Sections 4.3 above under Hydrogeology. The locations of surface and groundwater monitoring stations are provided on Figure 3.5.

5.0 Key Natural Heritage and Hydraulic Features

5.1 Habitat of Endangered and Threatened Species

The background data review indicated the potential presence of the following species in the general vicinity of the corridor (OBBA 2001-2005, Natural Heritage Information Centre (NHIC) 2013 and 2017):

- Eastern Massasauga (*Sistrurus catenatus*), THR;
- Barn Swallow (*Hirundo rustica*), THR;
- Bobolink (*Dolichonyx oryzivorus*), THR;
- Butternut (*Jugulans cinerea*), END;
- Little Brown Myotis (*Myotis lucifugus*);
- Northern Myotis (*Myotis septentrionalis);* and,
- Eastern Small-footed Bat (*Myotis leibii*).

Four of these seven species were observed in the IA, or within 120 m of the subject lands, during field data collection completed in 2014 through 2018. Additional SAR observations are included in the Bat Survey report (Skelton Brumwell, 2018) incorporating field observations from 2016 through 2018.

Butternut trees were found in three locations, within the IA and 120 m adjacent lands, as part of this project. One specimen was documented within the IA on the north side of the road, at the west end, approximately 440 m from the Townline intersection. The other two specimens were documented outside of the IA on the north side of the road, within the Bruce Trail designated area.

A Butternut health assessment was completed for these specimens according to MNRF guidelines. The specimen located within the IA was assessed to be “not retainable,” while the other two specimens include one non-retainable and one healthy. The specimen located within the IA will be removed during site preparation activities. However, removal of a non-retainable specimen is permitted in accordance with the ESA.

No evidence of Eastern Massasauga presence (i.e., direct observations of individuals, basking sites, hibernacula or suitable habitat conditions) was observed. As such, it was concluded that this species is not present in, or within, 120 m of the IA and no further investigation or assessment is required.

Habitat for both Barn Swallow and Bobolink may be present within the agricultural lands, located within 120 m of the IA but outside of the actual IA. Evidence for either of these two species was not documented during the breeding bird surveys. As such, it was concluded that these species are not present on or within 120 m of the IA and no further investigation or assessment is required.

Bat habitat and acoustic monitoring was conducted in suitable treed, within the IA and adjacent 120 m lands, as part of the additional fieldwork component in 2016, 2017 and 2018. This work was completed by Skelton Brumwell and is presented under separate cover.

5.2 Significant Woodlands

As stated in the Natural Heritage Reference Manual (MNR, 2010), Significant Woodlands are identified at the municipal level. Referencing both the County of Simcoe and the Township of Clearview Official Plans, significant woodlands are mapped in accordance with the Natural Heritage Reference Manual.

The Township of Clearview, considers the woodlands within the IA and adjacent 120 m lands to be significant. For the purposes of this study, the woodlands are considered significant within the IA and the proposed road improvements result in the removal of 0.86 ha of significant woodlands.

5.3 Significant Wildlife Habitat

According to the Significant Wildlife Habitat Guidelines for Ecoregion 6E (MNRF 2017) there are four types of Significant Wildlife Habitat (SWH), as follows:

- Habitats of Seasonal Concentrations of Animals;
- Rare Vegetation Communities/ Specialized Habitats;
- Habitats of Species of Conservation Concern; and,
- Animal Movement Corridors.

SWH must be identified at the local planning level (i.e., municipality) because conditions and feature vary widely between municipalities and what is important and unique in one area may be common and secure in another. The Township of Clearview and the County of Simcoe has not specifically identified criteria for defining SWH; however, Section 3.33 (Clearview) and 3.7 (Simcoe) of their respective Official Plans indicates that known wildlife habitat is generally encompassed within the Environmental and Hazard (Clearview)Lands and Greenlands System (Simcoe).

As such, this assessment will use broad habitat descriptions from the Significant Wildlife Habitat Technical Guide (SWHTG) and the SWHTG Ecoregion 6E Criterion Schedule (MNRF 2017) as well as Burnside ecology staff’s professional judgment to determine whether any habitats may be potentially present within the Study Area.

A discussion of each type of wildlife habitat is presented in the following sections.

5.3.1 Habitats of Seasonal Concentrations of Animals

These are habitats for species that congregate at certain times of the year, typically during migration, breeding or hibernation periods. The background data review identified one type of seasonal habitat potentially present on, or within 120 m, of the IA: Colonially Nesting Bird Breeding Habitat. During the field investigations two additional habitat types were also identified: Snake Hibernaculum and Turtle Wintering Areas.

Colonial Nesting Bird Sites

No records of colonial nesting species were identified in the vicinity of the IA, or the adjacent 120 m lands through OBBA records. No other colonially nesting bird species were observed during breeding bird surveys conducted during the spring 2014 season. Furthermore, site investigations did not identify any large stick nests or other remnants of other colonial nesting sites.

As such, this type of habitat is not present and will not be assessed further in this report.

Snake Hibernaculum

No rock or debris piles were observed throughout the corridor that could provide potential snake hibernacula. The IA does not contain any features that provide the specific requirements for hibernating species of snakes. An Eastern Milksnake was identified during field investigations conducted for ELC, crossing the road between the upland deciduous forest and rural development located at the highest elevation point along the IA.

This species is no longer listed as Threatened under the ESA and impacts to its habitat features are not anticipated within the IA or 120m adjacent lands.

Turtle Wintering Areas

Turtle wintering areas were not identified within the wetland habitat features located within the IA, or 120 m adjacent lands. These wetlands, while containing areas of open water, do not have suitable habitat for turtles.

There are therefore no turtle wintering areas, nor any other component of turtle habitat, present within the IA and this type of habitat features will not be assessed further in this report.

5.3.2 Rare Vegetation Communities/Specialized Habitats for Wildlife

There are no rare vegetation communities present within the IA. Background data review indicated two uncommon vegetation communities are located within, or in close proximity to the IA, but they both include talus slopes, which are not found within the IA or 120 m adjacent lands. All of the communities described in Section 4.4 are common in southern Ontario. No significantly old or uniquely diverse habitats are present.

While the background data review did not identify records of any Specialized Habitats, breeding amphibians, a snake and area sensitive species of birds were observed during field investigations.

The proposed development will not result in negative effects to any of these ecological features. Amphibian breeding is limited to anuran species that do not require woodland vernal pools. No specialized habitat for snakes or turtles was found. Large blocks of forested and thicket habitat are available for breeding birds on both the north and south sides of the road corridor and the corridor itself is already significantly disturbed with clearing for the existing road and drainage features. The proposed development will not result in a long term measurable effect to these habitat features, or the species of birds for which they provide breeding habitat.

Indirect effects associated with traffic and potential road mortality exist for most of the wildlife species located within the road corridor and adjacent lands. Mitigation measures to address this potential are discussed in Section 7.0 and include options to install ecopassages and wildlife fencing, where feasible.

5.3.3 Habitat for Species of Conservation Concern

The background records review did not identify any habitat for Species of Conservation Concern within the IA. During the field investigation it was determined that areas of amphibian concentrations and area sensitive breeding bird habitat were present within the IA.

These habitat types are discussed below.

Woodland Area-Sensitive Bird Breeding Habitat

These are habitats for species that require large tracts of habitat, away from edges, in order to carry out important life functions, such as breeding. Records from the OBBA (Square Numbers 17NK51 and 17NK61) identified a number of woodland area-sensitive species which have been recorded in the vicinity of the subject lands (i.e., within 10 km), including:

- Eastern Wood Pewee (*Contopus virens*);
- Great-crested Flycatcher (*Myiarchus crinitus*);
- Blue-headed Vireo (*Vireo solitaries*);
- Warbling Vireo (*Vireo gilvus*);
- Red-eyed Vireo (*Vireo olivaceus*);
- Veery (*Catharus fuscescens*);
- Wood Thrush (*Hylocichla mustelina*);
- Ovenbird (*Seiurus aurocapillus*);
- Louisiana Waterthrush (*Parkesia motacilla*);
- Canada Warbler (*Cardellina Canadensis)*;
- Scarlet Tanager (*Piranga olivacea*); and,
- Rose-breasted Grosbeak (*Pheucticus ludovicianus*).

The large contiguous tracts of forest that are present on both sides of the IA provide interior forest habitat. A number of area-sensitive species were documented during breeding bird surveys, in the forested communities throughout the IA. The Significant Wildlife Habitat Technical Guide (MNR, 2000) (SWHTG) states that the minimum forest habitat for area-sensitive species is at least 100 m from any edge habitat. Edges can have adverse effects on forest-interior habitat. Some of the forested areas are currently intersected by open areas (agricultural) and thicket communities. Tree removals throughout the corridor will account for removal of 0.86 ha of woodlands and the creation of a new forest edge. However, any clearing activities are not expected to have a measurable effect on the function of the forested communities in the regional area, based on the vast amount of contiguous forested habitat both within the 120 m adjacent lands and north and south of the IA. Tree loss associated with the clearing required to conduct the road improvements accounts for a small percentage of forest area and is not likely to result in a measurable loss of area sensitive, forest interior habitat features or functions. The clearing activities will be limited to the exiting edge habitat, which is currently influenced by wind, light, invasive species and predators. Clearing activities will be scheduled outside of the active breeding bird window to both prevent and minimize potential disruption of nest migratory species.

Open Country Bird Breeding Habitat

Records from the OBBA (Square Number 17NK51 and 17NK6) identified four grassland area-sensitive species, which have been recorded in the IA or 120 m adjacent lands (i.e., within 10 km), including:

- Bobolink (*Pheucticus ludovicianus*);
- Eastern Meadowlark (*Sturnella magna*);
- Western Meadowlark (*Sturnella neglecta*); and,
- Barn Swallow (*Hirundo rustica*).

Upon further investigation of the IA, it was determined that grassland habitat is present. These habitat features include fallow agricultural lands, located on both the north and south sides of the IA. These communities are buffered from the IA by either forested, wetland or fencerow communities and are not expected to be affected by the proposed development. There is no grassland habitat within the IA itself. Therefore, no direct effects to grassland habitat are associated with the proposed road improvement activities. In addition, indirect effects will be mitigated by both strict vegetation clearing timing windows in habitats adjacent to grassland habitat and the maintenance of buffers between the project works and clearing activities.

Shrub / Early Successional Bird Breeding Habitat

Regenerating thicket habitat is present within both the IA and 120 m adjacent lands in the form of Apple-Hawthorn communities. Naturally occurring shrub thicket was not documented within the IA. These habitat units are not located within IA, as they exist on inactive farmland beyond the limited of the proposed development. In many cases, a naturally occurring buffer of native species of trees is located between the thicket and the road. No species removal is anticipated within the thicket communities as part of the site preparation activities for the proposed road improvements.

Special Concern and Rare Wildlife Species

This habitat type includes areas suitable for species that are not listed as Endangered or Threatened provincially but may have a federal designation, may be listed as Special Concern in the province or may be provincially rare, based on their S-rank[1]. Through a review of aerial photography, the NHIC and OBBA on-line databases, the species listed in Table 5.1 were identified as being potentially present in the vicinity of the IA.

As summarized in Table 5.1, wetlands, watercourses, slope forests, forest interior, grassland and thicket habitats are present within the IA. However, detailed surveys did not confirm the presence of significant habitat for any of the species listed above, within the area affected by the proposed road improvements.

Potential direct and indirect impacts to these species are assessed in Section 7.0.

Seeps and Springs

Seepage areas, springs, and small intermittent streams provide habitat for numerous uncommon species. In winter, Wild Turkey (*Meleagris gallopavo*) and White-tailed Deer (*Odocoileus virginianus*) also forage in these areas because of the lack of snow on the ground. Often these areas support a high diversity of plant species.

Areas of groundwater input were documented during both the vegetation and aquatic habitat surveys for this project. The seepage areas observed were not discreet features located within forested habitats, but were found within larger open marsh type areas. Seep locations were noted on the east facing escarpment slopes, including the road bed. They provide a supporting function in the maintenance of the wetland features that flank the IA in the eastern half of the IA, however, it is assumed that they do not provide significant habitat for wild turkey in winter as no evidence of significant turkey habitat use was documented within the IA.

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1 Species with S-rank S1-S3 are considered to be rare in the province, while S4-S5 are considered to be relatively common and secure.

Table 5.1: Species of Concern Potentially Present on or Within 120 m of the Subject Lands

Common Name	Scientific Name	Srank1	Federal Sara Status2	Federal Sara Schedule3	Provincial Esa Status4	Habitat Description5	Habitat Present on Site?	Species Observed?
Birds								
Canada Warbler	*Seiurus motacilla*		THR	THR	SC	Range of deciduous and coniferous trees, usually wet forest types, all with a well-developed, dense shrub layer. Dense shrub and understory vegetation helps conceal Canada Warbler nests that are usually located on or near the ground on mossy logs or roots, along stream banks or on hummocks. It winters in South America. In its wintering range in South America, the Canada Warbler prefers the dense shrub understoreys of mature cloud and rain forests, second-growth forests, as well as coffee plantations and farm field edges.	Yes. Suitable habitat may be present within the woodlands and thickets, adjacent wetland.	No. Not identified during breeding bird survey.
Louisiana Waterthrush	*Parkesia motacilla*				SC	A southern species usually found in steep, forested ravines with fast-flowing streams. Although it prefers running water, especially clear, coldwater streams, it also less frequently inhabits heavily wooded, deciduous swamps having large pools of open water. It nests among the roots of fallen trees, in niches of stream banks, and in or under mossy logs. In Canada, the Louisiana Waterthrush breeds only in southern Ontario, along the Niagara Escarpment, in woodlands along Lake Erie and scattered locations elsewhere. It probably nests sporadically in southwestern Quebec, but breeding there has never been confirmed.	Yes. Suitable habitat may be present within the slope forests, woodlands, adjacent wetland and watercourse.	No. Not identified during breeding bird survey.

Common Name	Scientific Name	Srank1	Federal Sara Status2	Federal Sara Schedule3	Provincial Esa Status4	Habitat Description5	Habitat Present on Site?	Species Observed?
Reptiles								
Eastern Milksnake	*Lampropeltis triangulum*	S3	SC	SC	SC	Generalist species inhabiting a wide variety of habitats, from open woodlands, bogs, swamps, and woods edges, to marshes, lakeshores, old fields, pastures, farmyards, and suburban parks and gardens. They often occur in or near farm outbuildings, barns and sheds, and are attracted to piles of rocks, logs, firewood, or building materials, or any place that offers shelter to the snakes and their rodent food. Often uses communal nest sites.	Yes. Suitable habitat may be present within the cultural habitats, woodlands, adjacent wetland (MAS); potential hibernation habitat may be present.	Yes. Crossing roadway at the highest elevation point of the corridor.
Snapping Turtle	*Chelydra serpentine*	S3	SC	SC	SC	Common habitats are shallow ponds or streams. Some may inhabit brackish environments, such as estuaries. Snapping turtles are omnivores, consuming both plant and animal matter, and are important aquatic scavengers; but they are also active hunters that prey on anything they can swallow, including many invertebrates, fish, frogs, reptiles (including snakes and smaller turtles), unwary birds, and small mammals. Females travel over land to find sandy soil in which to lay their eggs, often some distance from the water. Designated in the Canadian part of its range as "Special Concern" due to its life history being sensitive to disruption by anthropogenic activity.	No. No bodies of open water or suitable habitat were documented in the corridor.	No. Species specific surveys were not completed and there were no opportunistic sightings during the surveys on site.

Common Name	Scientific Name	Srank1	Federal Sara Status2	Federal Sara Schedule3	Provincial Esa Status4	Habitat Description5	Habitat Present on Site?	Species Observed?
Flora								
Hart's-tongue fern	*Asplemiun scolopendrium var. americanum*	S3	SC	SC	SC	It usually grows in rocky areas, particularly on limestone rock outcrops in maple-beech forest. Established plants can grow in exposed, rocky crevices and outcrops, but moist, mossy areas seem to be essential for spore germination and early plant development.	Potentially. This habitat type may be present within the study area, however was not documented during the vegetation surveys.	No. This species was not documented during field surveys, including detailed SAR plant surveys completed in 2016 in conjunction with both the ELC and tree inventory surveys.
Eastern Small-footed Bat	*Myotis leibii*	S2S3	n/a	Not assessed	END	will roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees. These bats often change their roosting locations every day. At night, they hunt for insects to eat, including beetles, mosquitos, moths, and flies. In the winter, these bats hibernate, most often in caves and abandoned mines and will return to the same spot each year.	Confirmed	Refer to separate report from Skelton Brumwell & Associates Inc.
Little Brown Myotis	*Myotis lucifugus*	S4	Not listed	END	END	Roost in trees and buildings. They often select attics, abandoned buildings and barns for summer colonies where they can raise their young. Little brown bats hibernate from October or November to March or April, most often in caves or abandoned mines that are humid and remain above freezing.	Confirmed	Refer to separate report from Skelton Brumwell & Associates Inc.
Northern Myotis	*Myotis septentrionalis*	S3	Not listed	END	END	The northern long-eared bat is found throughout forested areas in southern Ontario	Potentially. This habitat type is present within the study area however this species was not identified during bat surveys.	Refer to separate report from Skelton Brumwell & Associates Inc.

[1]S-Ranks (provincial)

Provincial (or Subnational) ranks are used by the Natural Heritage Information Centre (NHIC) to set protection priorities for rare species and natural communities. These ranks are not legal designations. Provincial ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Ontario.
(Provincial Status from MNR Biodiversity Explorer September 2012)

S1 Critically Imperiled - Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2 Imperiled - Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3 Vulnerable - Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

[2]SARA (Species at Risk Act) Status and Schedule

The Act establishes Schedule 1, as the official list of wildlife species at risk. It classifies those species as being Extirpated, Endangered, Threatened, or a Special Concern. Once listed, the measures to protect and recover a listed wildlife species are implemented.
http://www.sararegistry.gc.ca/sar/listing/listing_e.cfm
EXT Extinct - A wildlife species that no longer exists.
EXP Extirpated - A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
END Endangered - A wildlife species that is facing imminent extirpation or extinction.
THR Threatened - A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC Special Concern - A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

[3]**Schedule 1:** is the official list of species that are classified as extirpated, endangered, threatened, and of special concern.
Schedule 2: species listed in Schedule 2 are species that had been designated as endangered or threatened, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.
Schedule 3: species listed in Schedule 3 are species that had been designated as special concern, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.

The Act establishes Schedule 1 as the official list of wildlife species at risk. However, please note that while Schedule 1 lists species that are extirpated, endangered, threatened and of special concern, the prohibitions do not apply to species of special concern.

Species that were designated at risk by COSEWIC prior to October 1999 (Schedule 2 & 3) must be reassessed using revised criteria before they can be considered for addition to Schedule 1 of SARA. After they have been assessed, the Governor in Council may on the recommendation of the Minister, decide on whether or not they should be added to the List of Wildlife Species at Risk.

[4]OMNR (Ontario Ministry of Natural Resources)

(Provincial status from MNR January 13, 2012)
The provincial review process is implemented by the MNR's Committee on the Status of Species at Risk in Ontario (COSSARO).

EXT Extinct - A species that no longer exists anywhere.
EXP Extirpated - A species that no longer exists in the wild in Ontario but still occurs elsewhere.
END Endangered - A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's Endangered Species Act (ESA) (END-R designations are no longer relevant as species are covered under new ESA April 2009)
THR Threatened - A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC Special Concern (formerly Vulnerable) - A species with characteristics that make it sensitive to human activities or natural events.
NAR Not at Risk - A species that has been evaluated and found to be not at risk.
DD Data Deficient (formerly Indeterminate) - A species for which there is insufficient information for a provincial status recommendation.

[5]Source: Ontario Ministry of Natural Resources. 2000. Significant Wildlife Habitat Technical Guide & Appendices; Harding, J. H. 2007. Amphibians and Reptiles of the Great Lakes Region. The University of Michigan Press.

5.3.4 Animal Movement Corridors

The natural areas of the Niagara Escarpment located on both sides of 26/27 Sideroad provide a large scale, landscape level movement corridor for wildlife both within the IA, 120 m adjacent lands and the regional areas. Existing barriers to movement are focused around the existing road network, the residential development, agricultural lands and aggregate extraction activities within the local area. Improvements to the existing road and surface drainage conditions will not result in a measurable negative effect to wildlife movement across the roadway. In addition, the improvements to sightlines may decrease the potential of road mortality, as road visibility is improved.

During clearing and construction activities, installation of wildlife fencing should be included in locations where wetland features are located to minimized potential road mortality and direct wildlife to areas of safer passage. Detailed design plans will include both the exact locations and extent of the recommended fencing and timing constraints for installation and removal.

5.4 Fish and Fish Habitat

In summary, Brook trout spawning activity was documented in the Study Area (Tributary A) by Burnside staff as a result of the 2015 to 2018 spawning survey work, based on limited observations of “young of the year” (YOY). Given the surface water conditions observed during the spawning survey period (late October to early December), candidate Brook trout spawning microhabitat within the Study Area was very limited. The site does appear to marginally contribute to the spawning success of the local Brook trout population, under these conditions based on limited evidence of YOY.

Based on the confirmed presence of fish and fish habitat, as it is defined in the *Fisheries Act,* it is Burnside’s opinion that the proposed improvements to the 26/27 Sideroad could affect fish and fish habitat. The fish species (Brook trout) which inhabit Tributary A are considered to be part of, or support, a Recreational Fishery as defined in the *Fisheries Act*. The proposed mitigation measures to avoid serious harm to fish and fish habitat are described in Section 7.0.

As discussed above, with the use of proper mitigation techniques described in Section 7.0, any potential impact to the aquatic environment will be minimized or negated completely. Potential for improvements to the system through Natural Channel Design and water quality improvements (turbidity) have been included in the DFO Request for Review application submitted in September 2016 (Appendix D). This minor loss of fish habitat (less than 5 m^2) has been reviewed by DFO and approved under a Letter of Advice (LOA) issued by DFO on June 19, 2017 (Appendix D).

5.5 Provincially Significant Wetland

The Rob Roy Swamp, which is located adjacent to the road at the intersection of 26/27 and Townline, is a PSW wetland complex comprised of 17 individual wetland units, representing a total area of 408 ha. The individual wetland complexes range in size from 0.5 ha to 239.9 ha. The majority of the wetland units are less than 10 ha in size. The largest of the wetlands (239.9 ha) occupies the central position within the complex, which is located outside of our study area. Based on the Ontario Wetland Evaluation System (1990), the following represents the key wetland features, functions, and values for the wetland complex:

- Overall large size of the complex (>400 ha);
- High diversity of vegetative communities (>40 species);
- Potential economic resources (timber, baitfish, furbearers);
- Flood attenuation of surface water;
- Short term water quality improvement;
- Potential for ground water recharge; and,
- Nesting colony of a provincially significant colonial waterbirds.

This wetland is located at the intersection of Townline and 26/27, where the existing road footprint is somewhat wider and on level grade (Appendix E). The existing road right-of-way is maintained through brushing, which has limited the spread of wetland plants adjacent to the road, however the delineated wetland boundary, which was redefined and surveyed in 2016, is located within the IA. There are no discernable ditches in this location and surface water is conveyed through sheet flow and shallow swales. The proposed road improvements will maintain the existing water balance to the wetland features. Direct impacts to the PSW include the removal of 663 m^2 of herbaceous (dominant) wetland edge vegetation.

The existing right-of-way in this location is occupied by a year-round accessible gravel road, which bisects the wetland unit. There is currently no surface water connection from one side of the travelled roadway to the other.

As an enhancement measure it is proposed that two culverts be installed along with exclusion fencing for amphibians. The culverts will allow for surface water movement and this will also facilitate safe passage of observed frog species. Numerous green frogs (*Lithobates clamitans*) have been observed incidentally on the travelled road within this area. Exclusionary fencing and culverts will provide mitigation and enhancement measures for the PSW. Exclusionary fencing should be installed, in accordance with the specifications set out in Appendix E, which include permanent fencing with low maintenance requirements at the edge of the road shoulder, focusing in wetland areas.

Sediment fencing should be placed along the limit of the IA prior to any grading or earth works. Fencing should be maintained in place and regularly monitored for the duration of construction and until such time as lands are re-vegetated and stabilized using habitat specific native seed mixes and individual planting, where appropriate. All stockpiles, equipment and work areas should be maintained outside of the fenced area.

A more detailed erosion and sediment control plan is included in the detailed drawing set. The proposed road improvements will maintain the existing water balance to the wetland features. Indirect effects will be discussed in Section 7.0.

5.6 Unevaluated wetlands

A number of small wetland features were identified throughout the IA and 120 m adjacent lands, flanking to the watercourse and in areas where groundwater discharge occurs. The boundaries of these features were refined and surveyed in 2016, with the assistance of David Featherstone, NVCA to ensure accurate delineation (Figure 3.1 and Appendix E). A full evaluation of these wetlands was not completed due to their small size. The total direct impacts to these small wetland features located in the roadside ditches in the IA includes removal of 0.18 ha of both woody and herbaceous wetland vegetation associated with both cattail marsh and willow-dogwood thicket swamp communities.

The water balance to these features will be maintained as part of the proposed road improvements and stormwater management plan (Appendix E). The existing ditches will be improved to allow for appropriate conveyance of flows during peak periods, which will minimize both erosion and transfer of materials into wetland and aquatic features. It is therefore expected that direct effects will result in an overall benefit to existing conditions within the wetland features.

5.7 Regional Earth Science ANSI

The Nottawasaga Lookout Earth Science and Life Science ANSI is located on the north side of 26/27 within the provincial park, as shown on . No alterations to the terrain or physiography of this feature will be made, thus, no impacts are anticipated.

No further assessment of this feature is required.

5.8 Summary of Natural Heritage Features

The following features have been confirmed present in the IA, or in the 120 m adjacent lands, and could potentially directly or indirectly impacted by the proposed development:

- Significant Wetlands;
- Unevaluated wetlands;
- Fish Habitat;
- Significant Woodlands;
- Habitat for Species of Concern;

- Species at Risk
- Habitat for Area Sensitive species;
- migratory birds; and,
- Significant Wildlife Habitat.

Section 7.0 of this report will identify potential impacts to each of these features, as well as mitigation measures to minimize impacts.

6.0 Development Concept

6.1 Proposal

The Township of Clearview proposes to reconstruct the 26/27 Sideroad, between the 10th Concession of Clearview and the Clearview / Grey Highlands Townline, which is also the boundary road between Simcoe and Grey Counties. The IA includes 5.40 ha of area, with the existing roadway occupying 1.36 ha within the IA. The proposed improvements to the road will include 1.21 ha of encroachment into natural features and other land uses to the south and 1.16 ha to the north, resulting in an overall impact of 2.37 ha of lands that need to be prepared for construction activities.

The existing road is a gravel surface of deficient width as well as inadequate roadside drainage and structural base to meet the current needs for vehicles and public safety. The westerly portion of the road serves a number of local residents and agricultural properties and is maintained year around. The easterly portion of the road serves vacant properties and is open for the majority of the year, but is closed to vehicular traffic in the winter months due to operational constraints on this section of the road.

Similar to most roads within the Township of Clearview and rural Ontario, the migration of traffic onto secondary roads continues to grow as drivers look for alternative routes to shorten travel distance and time, to access properties that continually develop, to access local land base features and/or experiences, to avoid traffic congestion and in some cases for the adventure of trying a new route. As the overall volume of traffic increases in the area and on these roads, the need for road maintenance increases as does the municipality's obligation to meet its own standards and accepted Provincial standards for road maintenance. It is noted that similar to other roads, the volume of traffic on 26/27 Sideroad continues to grow and the use of the road and the associated maintenance required continues to evolve.

As traffic volumes increase certain deficiencies, such as road width and structural base, cannot be addressed by maintenance of the road infrastructure and reconstruction is necessary to bring the road to an acceptable standard. Reconstruction of road assets is a typical response to increased use and traffic across all road jurisdictions to mitigate the cost of maintenance and have the road meet the jurisdiction's road standards.

The Township of Clearview intends to reconstruct the 26/27 Sideroad to meet the Township's minimum road standards, which will include two 3.5 m travel lanes with 1.0 m shoulders constructed on an adequate granular base and to design speed of 70 km/hr with an anticipated posted speed of 60 km/hr. Road side drainage and water crossings will be included while mitigating the impact on the adjacent lands and environment, which has been addressed in detail in this EIS. The proposed work will be completed within the existing road right of way. The road will initially be reconstructed to a granular surface but as traffic increases, it is anticipated that the road will be paved in the future (Detailed Design Drawings are found in Appendix E).

Aside from the ever increasing traffic on 26/27 Sideroad and the ongoing evolution of the use of this road by the travelling public and the resulting need for this proposed reconstruction project. The Township of Clearview as a party to an agreement between Walker Industries and the County of Simcoe agreed that this road would be reconstructed. This was part of an overall plan for the reconstruction of County Road 91 from the 10th Concession to County Road 124, the reconstruction of the 10th Concession from County Road 91 to 30/31 Sideroad and the closure of a section of County Road 91, more or less on the frontage of the Walker Quarry Expansion. The pending closure of a portion of the existing County Road 91 required an adequate alternative route for local traffic, which is 26/27 Sideroad and created a further need for the proposed reconstruction project. Part of this agreement was a significant financial commitment by Walker Industries, the County of Simcoe and the Township of Clearview towards the proposed road improvement projects. The Township of Clearview is obligated by this agreement to reconstruct 26/27 Sideroad.

6.2 Stormwater Management

At present, 26/27 Sideroad road is gravel surface with drainage in most locations provided by inadequate ditches on both sides of the road draining to either the Rob Roy Wetland Complex to the west or to the local tributaries of the Pretty River, which eventually drains into Georgian Bay. The local topography slopes generally from the south-west to the north-east and has many steep sections. Large external areas, the steepness and erodible surface of the road, coupled with insufficient ditch and culvert sizing, has led to existing erosion issues in numerous locations. The majority of the road surface is characterized by washboarding and/or rilling. As a result, re-grading of the road and the addition of more gravel is a frequent maintenance requirement. The eroded material is washed into the downstream tributaries of the Pretty River. Based on the mass of granular material required to restore the road after each significant rainfall event, the level of erosion of the road surface results in significant quantities of material being washed into the downstream system per event (the Stormwater Management Report is found in Appendix F).

Potential paving of the road surface and proposed drainage improvements should dramatically reduce the erosion and resultant total suspended solids (TSS) loading to the downstream tributaries. Proposed improvements also include potential future paving of the road surface.

Proposed improvements to the road will include reduced slopes on steep sections of the road, adequately sized culvert crossings, appropriately sized ditches on both sides of the road and erosion protection within steep sections of the ditches and downstream of culvert crossings. Proposed improvements also potentially include paving of the road surface in the future.

6.2.1 Surface Water Quality Control

The MOE Stormwater Management Planning and Design Manual (SWMPDM) (2003) is the current provincial standard for stormwater quality control in Ontario. It provides a prescriptive approach for mitigating the negative effects of development based on the assumption that increased impervious cover within a catchment results in a proportional increase in pollutant loading, in particular TSS loading, to the downstream receiver. Under this assumption the manual prescribes minimum sizes for various stormwater management (SWM) practices, to mitigate the impairment of downstream water quality resulting from the increased TSS loading. However, the proposed paving of 26/27 Sideroad does not increase TSS loading to the downstream receiver, it actually reduces it due to the minimization of washout. Therefore, it can be readily demonstrated that the proposed reconstruction will reduce TSS loading to the downstream receiver.

Notwithstanding the proposed reduction in TSS loading to the downstream receiver, the vast majority of the IA will also be treated with a proposed Low Impact Development stormwater management treatment drain, designed to achieve enhanced level quality control of stormwater.

The proposed overall stormwater management strategy incorporates two main types of low impact development (LID) stormwater management practices, in a treatment train approach, to achieve enhanced quality control. The first method is a bioretention LID concept adapted to a rural road cross-section. The second is the use of enhanced grassed swales. Both methods receive good reviews in the CVC/TRCA LID Stormwater Management Planning and Design Guide for achieving quality control and water balance benefits. Refer to Appendix F – Schematic Summary of Mitigation for the locations of the bioretention and enhanced grassed swale quality control measures.

According to the CVC/TRCA LID Stormwater Management Planning and Design Guide, "Performance results from both laboratory and field studies indicate that bioretention systems have the potential to be one of the most effective BMPs for pollutant removal (TRCA, 2009). Bioretention provides effective removal for many pollutants as a result of sedimentation, filtering, soil adsorption, microbial processes and plant uptake."

Based on the CVC TRCA LID Stormwater Management Planning and Design Guide, "Median pollutant mass removal rates of swales from available performance studies are 76% for total suspended solids, 55% for total phosphorus, and 50% for total nitrogen (Deletic and Fletcher, 2006)." Furthermore, "Enhanced grass swales are well suited for conveying and treating runoff from highways and other roads because they are a linear practice and easily incorporated into road rights-of-way."

The incorporation of the proposed enhanced quality control design is suggested as an effective means to mitigate stormwater quality impacts downstream. It employs LID methods that have been demonstrated to be effective at removing pollutants from stormwater runoff.

6.2.2 Stormwater Conveyance

Existing culverts are proposed to be replaced with culverts of equal or greater size (Appendix A). The existing culverts are typically undersized, resulting in frequent overtopping of the road and high stream velocities, and scouring immediately downstream of the culvert. Proposed replacement culverts will generally be placed in the same location as existing and sized to pass the 25 year storm event without overtopping the road, in accordance with the Ministry of Transportation (MTO) directive B-100. Plunge pools are proposed at the downstream end of proposed cross culverts to reduce scour (Appendix I).

6.2.3 Quantity Control

The MOE SWMPDM (2003) provides the quantity control criteria that apply to the proposed road reconstruction to ensure that the road reconstruction does not result in increased flooding downstream. The manual states that stormwater peak flows should not exceed existing peak flow rates for the 2 through 100 year events. Quantity control measures are not anticipated for the road reconstruction, as the potential paved area is sufficiently small and the external areas sufficiently large that the additional paving would not be expected to have a significant impact on stormwater peak flows downstream of the road.

7.0 Potential Impacts and Proposed Mitigation

The proposed road improvements have the potential to impact the following features:

- The Rob Roy PSW Complex;
- Significant Woodlands;
- Unevaluated wetlands;
- Fish habitat;
- Migratory birds;
- SAR; and,
- Significant Wildlife Habitat.

Potential impacts can be categorized as direct (within the footprint of the development) or indirect (adjacent to the development but may be affected by changes to surface water flow and quality, transfer of sediments, noise, light, and air quality).

Potential impacts include:

- Direct:
  - Loss of species or habitat;
  - Killing of migratory birds or destruction of their nests during land clearing;
  - Loss of wetland area in the Rob Roy PSW Complex and unevaluated wetlands;
  - Road mortality associated with increased road speed; and,
  - Serious harm to fish and fish habitat.
- Indirect:
  - Construction impacts, including erosion/sedimentation and unintentional encroachment to: wetlands, habitat for amphibian breeding, habitat for special concern and rare species;
  - Changes to surface and ground water hydrology, which could adversely alter upland and wetland habitat conditions; and,
  - Temporary changes to noise, light and air quality.

A detailed discussion of potential impacts and proposed mitigation is provided below.

7.1 Rob Roy Wetland (PSW) Complex and Unevaluated Wetlands

7.1.1 Direct Impacts and Mitigation

Potential Impacts

Direct impacts to the PSW include the removal of 663 m^2 of herbaceous (dominant) wetland edge vegetation. It has been determined that the appropriate measures include minimization of potential effects with the use of best management practices, wildlife exclusion fencing and Erosion and Sediment Control (ESC) plans.

Sediment fencing should be placed along the buffer line prior to any grading or earth works. Fencing should be maintained in place and regularly monitored for the duration of construction until such time as lands are re-vegetated and stabilized using habitat specific native seed mixes and individual planting, where appropriate. All stockpiles, equipment and work areas should be maintained outside of the fenced area. No direct compensation efforts within the GSCA have been identified to date for this project.

A more comprehensive erosion and sediment control plan has been included in the detailed drawing set.

7.1.2 Indirect Impacts and Mitigation

Potential Impacts

Features associated with the designated area could potentially be impacted indirectly during construction from erosion/sedimentation and encroachment beyond the approved development area, or if there is a change in the water balance for this feature.

Recommended Mitigation

An appropriate buffer within the road right-of-way should be applied to the boundary of the wetland. The adjacent land is disturbed to the edge of the wetland. Trees, shrubs and herbaceous vegetation have thus become tolerant of edge effects and a wider buffer is not required. Limiting development to land outside of the buffer will sufficiently protect the roots of edge trees and shrubs will minimize impacts to wildlife habitat associated with the wetlands.

Sediment fencing should be placed along the buffer line prior to any grading or earth works. Fencing should be maintained in place and regularly monitored for the duration of construction until such time as lands are re-vegetated and stabilized. All stockpiles, equipment and work areas should be maintained outside of the fenced area, as discussed above.

A more comprehensive erosion and sediment control plan should be developed during the detailed design phase.

7.2 Significant Woodlands

7.2.1 Direct Impacts and Mitigation

Potential Impacts

The proposed IA results in the removal of 0.86 ha of Significant Woodland. Additional brushing activities needed during road reconstruction may remove and alter the transitional edges of these features, but this area is already affected by roadside brushing and ditch dredging. The Tree Survey Report (Burnside 2017) addresses tree loss in detail and should be consulted in conjunction with this report.

Recommended Mitigation

Clearing of trees and brushing activities during site preparation and construction should be targeted to only those species required for removal to minimize potential impacts. Clearing should be completed outside of the breeding bird season (May 1 to September 1), as discussed in Section 7.4.2 below. Buffer and exclusion areas should be established through the use of wildlife and exclusion fencing to prevent equipment refuelling and laydown and trampling of vegetation, and to exclude wildlife species from construction and stockpile areas. See detailed design drawings for the location of the fencing.

7.2.2 Indirect Impacts and Mitigation

Potential Impacts

Changes to surface water movement, light conditions, air quality and noise levels during construction and from potential increased traffic levels, may have indirect effects on SW within the IA and 120 m adjacent lands. Existing conditions along the roadway result in significant levels of soil erosion and deposition in the natural communities, causing in unstable slopes and banks in some areas and unnatural soil conditions in others. Existing deposition rates will decrease with the proposed road improvements which produce an over improvement of habitat conditions and potentially in a net positive benefit.

Recommended Mitigation

The intent of the proposed improvements to the existing road is to both improve conditions for human use of the transportation corridor (safety),and prevent any additional damage to the natural environment. Road sight lines will be improved, which will minimize the potential for road mortality of wildlife species. In addition to improved sight lines, wildlife eco fencing hase been designed surround all of the wetland features in the IA which is very effective for both reptiles and amphibians and for small mammals. Eco passages have also been designed to accommodate dry passage of small wildlife in selected locations as should in Appendix E.

Drainage features have been designed to result in minimal encroachment into the natural vegetation communities, to provide adequate flow transfer and minimize the potential for sedimentation. Culverts that are currently not functioning, or are situated in the wrong location, will be corrected and improved to both convey water and allow for some animal movement. The intent of this project is to improve the road function as well as both maintaining the functions of the surrounding natural areas and prevent further negative impacts from occurring. The surface water management plan for the IA focusses on maintaining the water balance and improving groundwater conveyance to the wetland features within the IA, especially below the brow of the Escarpment where most of the unevaluated wetlands have been mapped.

While traffic movement through the improved road corridor is likely to increase, trucks will continue to be excluded from the corridor. Improved sightlines and surface will increase visibility with the anticipated effect of reducing road mortality of wildlife, when combined with the recommended eco passages and wildlife (eco) fencing. Additional signage for larger mammals (White-tailed deer) movement will also alert motorists of the potential hazards.

In addition, improvement of the road surface will result in a significant reduction in the transfer of sediment to the wetland features and coldwater fish habitat located in the watercourse adjacent to the road. Dust deposition on the vegetation in the roadside communities should be reduced to an immeasurable level as well.

The existing noise levels associated with the road have not been studied and while traffic numbers may increase, the level of noise may decrease with the proposed surface conditions therefore increasing the duration of noise but decreasing both the magnitude and extent.

7.3 Fish and Fish Habitat

7.3.1 Direct Impacts and Mitigation

A section of watercourse (Tributary A) adjacent to Sideroad 26/27 is proposed to be realigned away from the proposed road alignment. A potential impact to fish habitat may occur in this reach. Fish will be captured and released downstream of the affected area during construction activities.

Various elements of the proposed road improvements have the capacity to impact fish habitat including:

- Loss of natural cover and inputs due to installation of new culverts, which are generally longer and/or larger than existing culverts. However, the longer culverts will provide additional man-made cover which is known to be used by salmonids in small tributary streams. The impacts of the proposed culvert extensions are quantified in Table 7.1, below.
- Changes to external energy /nutrient inputs (food supply, nutrient concentrations) and loss of shade, resulting from southward expansion of road base and re-location of the roadside drainage ditch, currently providing year-round baseflow to downstream fish habitat.
- Relatively minor loss (<5 m^2) of aquatic habitat due to realignment of a short (22 m) section of Tributary A to 18.5 m.

- Erosion, sedimentation and loss of natural cover as a result of the construction process.

Table 7.1: Summary of Anticipated Areas of Impact to Fish Habitat Resulting from Proposed Culvert Extensions

Culvert Location (Proposed)	Plan & Profile Sheet No.	Tributary	Existing Culvert Length (m)	Proposed Culvert Length (m)	Average Bankfull Width of Watercourse (m)	Area of Impact (m^2)
Sta. 5+945	C005 A005	B	12.3	16.9	0.6	10.1
Sta. 6+125	C006 A006	C	15.3	28.0	0.6	16.8
Sta. 6+510	C007 A007	D	9.5	24.0	1.3	31.2
Sta. 6+765	C007 A007	E	9.5	16.7	0.6	10.0

7.3.2 Mitigation Measures

The following mitigation measures will be implemented to minimize or avoid impacts to fish and fish habitat during construction of the channel and culvert replacement:

- All in-water construction to take place between July 1st and September 30th of any given year (or as otherwise directed by the MNRF);
- All in-water work to be performed in dry, dewatered conditions;
- Flow will be maintained from upstream to downstream of the work area at all times;
- Stabilization works should follow the natural contour and profile of the watercourse, using natural channel design techniques (riverstone and plantings);
- Any stockpiled materials will be stored and stabilized away from the watercourse;
- Vehicle and equipment re-fueling and maintenance will be conducted a minimum of 30 m away from the water;
- Any part of equipment entering the water should be free of fluid leaks and cleaned/degreased to prevent deleterious substances from entering the water;
- Only clean material free of fine particulates should be placed in the water;
- General erosion control notes will be part of the engineering drawings, to be provided to the contractor;
- Sediment and erosion control measures should be implemented prior to work and maintained during the work phase, to prevent the entry of sediment into the water;
- All sediment and erosion control measures should be inspected daily to ensure they are functioning properly, and upgraded or maintained as required;

- If the sediment and erosion controls are not functioning properly, no further work should occur until the sediment and/or erosion control problem is addressed;
- Sediment and erosion control measures should be left in place until all disturbed areas in the construction area are stabilized;
- All disturbed areas should be stabilized and re-vegetated as soon as possible following construction to preconstruction conditions or better; and,
- All erosion and sediment controls should be removed once the site is deemed stable. Any accumulated silt or sediment will be removed with care once the site is stabilized.

7.3.3 Anticipated Improvements to Fish Habitat

Road Improvements Adjacent to Subject Watercourses

The proposed road improvements will result in a more effective stormwater conveyance, significantly reducing erosion of the road base and sedimentation in adjacent watercourses. Stormwater quality control measures are also expected to reduce the concentration of pollutants and sediment in stormwater conveyed off the road surface (refer to Section 6.2.2 for more details) (Appendix G).

Culvert Replacements

The new box culvert design for Tributaries C and D will incorporate a low flow channel, with a defined bed and banks formed with natural riverstone substrates. The box culvert will be embedded to a depth of 0.6 m and will tie into the existing channel invert. Fish passage will be improved at these crossings by including a low flow channel, potentially allowing for periodic access to upstream reaches on the south side of the IA (Appendix A).

All of the existing culverts are heavily impacted by accumulated sand and gravel. As such, replacement CSP culverts will generally offer improved conveyance and fish passage. Groundwater inputs will be more efficiently directed across Sideroad 26/27 and into the receiving watercourse, reducing the potential for surface warming in the roadside ditch.

Channel Realignment (Tributary A)

Currently, road run-off is resulting in significant sediment load and coarse material input to Tributary A during spring melt and large rain events. Erosion and sedimentation issues in Reach 2 and 3 will be addressed by providing some separation between the road and the watercourse through the channel realignment. Benefits to the natural geomorphic function of the tributary are also anticipated (Appendix D).

7.3.4 Summary of Net Impact to Fish and Fish Habitat

Despite best efforts to minimize grading limits associated with the road widening, the proposed channel realignment in Tributary A will be required to achieve the minimum municipal road standard. The proposed realignment will impact approximately 22 m^2 of existing coldwater habitat. The realigned channel is expected to be slightly straighter than the existing condition (approximately 18.5 m in length), resulting in a minor loss of overall habitat in Reach 3 of Tributary A (less than 5 m^2). Permanent changes to shade, food supply, nutrient concentrations and structural cover are unavoidable at the watercourse crossings and within the footprint of the road expansion, on the south side of Sideroad 26/27.

Given the proposed design elements and mitigation measures specifically intended to maintain and/or enhance fish habitat features and functions and/or water quality, we anticipate that net impacts to fish and fish habitat can be minimized or negated completely and therefore will not significantly alter the natural ecological function or productivity of the subject watercourses.

As discussed above, with the use of proper mitigation techniques described in Section 7.0, any potential impact to the aquatic environment will be minimized or negated completely. Potential for improvements to the system through Natural Channel Design and water quality improvements (turbidity) have been included in the DFO Request for Review application submitted in September 2016 (Appendix G). This minor loss of fish habitat (less than 5 m^2) has been reviewed by DFO and approved under a Letter of Advice (LOA) issued by DFO on June 19, 2017 (Appendix G).

7.4 Indirect Impacts Associated with Changes to Surface and Ground Water Hydrology to Wetland Features

Potential Impacts

Changes to surface water features, runoff, and infiltration on the subject lands have the potential to alter hydrology in the woodlands, wetlands, and watercourses. This could negatively affect the functions of the woodlands, wetlands, and watercourses including the types of species and habitats they support.

Recommended Mitigation

The proposed replacement culverts will be designed to reduce velocities through the culvert, scour at the outlet and frequency of overtopping of the road by flood waters.

7.4.1 Significant Wildlife Habitat: Amphibian Breeding Habitat

7.4.1.1 Direct Impacts and Mitigation

Potential Impacts

Temporary impacts to amphibian habitat are anticipated in culvert replacement areas. As these areas will be cleared of vegetation during construction, there is a potential for erosion and sedimentation impacts to the surrounding environments.

Recommended Mitigation

Appropriate sediment and erosion control measures will be employed throughout the construction process to minimize potential impacts to adjacent habitat.

The water balance to downstream environments will be maintained throughout the construction process, while maintaining up-gradient wetland/habitat features. A monitoring and inspection program, facilitated by a qualified Environmental Inspector, will be employed to ensure any potential impacts are mitigated and that mitigation measures are being properly employed and are functioning effectively.

All efforts will be made to minimize the operation of equipment in and around the watercourse and ditch(s), as well as proceed in a continuous fashion to minimize the duration of such work. No equipment refueling will occur near the watercourse, culvert, or ditch areas and all stationary equipment will be equipped with drip pans to prevent/contain oil spills. Weather forecasts will also be monitored, and construction will be scheduled during anticipated periods of low flow.

Ecopassage culverts will be installed to allow for passage of amphibian species between wetland habitat features, in conjunction with wildlife fencing which will prevent species from entering the roadway in the most sensitive habitat areas of the corridor. Additional signage to make drivers aware of the potential for wildlife road mortality will both increase awareness and aid in the prevention of road mortality.

7.4.2 Migratory Birds and Area Sensitive Birds

The *Migratory Bird Convention Act* prohibits the killing or harming of migratory birds. Several migratory species were observed during field investigations. Potential impacts to these species are assessed in Section 7.0 of this report. 7.0 of this report.

7.4.2.1 Direct Impacts and Mitigation: Land Clearing

Potential Impacts

Migratory birds, or their nests, may be harmed during land clearing and grading. This is in contravention of the *Migratory Birds Convention Act*.

Recommended Mitigation

Land clearing should be completed outside of the breeding bird season (May 1 to July 31). If this is not possible, a qualified avian ecologist should survey the corridor prior to clearing to confirm that no active nests of migratory birds are present. Pre-construction nest surveys should be completed by a qualified avian ecologist within two days prior to initiation of construction activities. If active nests are found, they should be flagged with an appropriate buffer and avoided until the nests are no longer active.

7.4.3 Endangered and Threatened Species

7.4.3.1 Direct Impacts and Mitigation

Potential Impacts

Direct impacts to Threatened or Endangered species have not been identified through the processes of this project. No direct species loss or removals will occur as a result of the proposed development.

Indirect Impacts

Endangered and Threatened species associated with the IA and the 120 m surrounding lands, including bats species, may be indirectly affected by vegetation and site preparation activities. These activities will be limited to the IA and will not extend into the surrounding lands.

The proposed road improvements impact potential habitat of at risk bat species. An initial study of potential bat habitat impacts has been prepared and is available under separate cover (Skelton Brumwell 2018).

Mitigation

As is recommended in Section 7.4.2.1 above, land clearing should be scheduled to occur outside of the active seasons for bat maternity roosting. Potential affects to bat species and habitat will be addressed in a separate report. Appendix F contains information regarding bat findings to date. This report will be submitted for review by the MNRF and that process will determine if there are negative impacts to bat habitat, and what, if any, permitting is required under the Endangered Species Act. That process will also determine what, if any, mitigation or offsetting is required. Confirmation of either a lack of impact to species at risk bat habitat or the issuance or authorization of the works under the Endangered Species Act is an appropriate condition of the NEC Development Permit.

7.4.4 Significant Wildlife Habitat: Habitat for Species of Conservation Concern; and Wildlife Movement Corridors

7.4.4.1 Direct Impacts and Mitigation

Potential Impacts

Direct impacts to Species of Conservation Concern are limited to the removal of habitat features, including brushing and tree removal. These activities are limited to the IA, in areas that have already been disturbed and are habituated to edge effects. Area sensitive birds and species designated as Special Concern were not documented immediately adjacent to the road, in areas where clearing may occur.

Mitigation

As is recommended in Section 7.4.2.1 above, land clearing should be scheduled to occur outside of the breeding bird and breeding amphibian seasons, which overlap.

7.4.4.2 Indirect Impacts and Mitigation

Potential Impacts

Indirect impacts to significant wildlife habitat are the same as those discussed in Section 5.3, including changes to surface water quantity and quality, changes to noise levels, light conditions and air quality and increased potential for road mortality.

Increased traffic levels on the road may result in the potential for increases in road mortality for small species of wildlife. However, improvements to sight lines on the road will increase the visibility and balance the hazard of additional traffic.

Mitigation

The intent of the proposed improvements to the existing road is to both improve conditions for human use of the transportation corridor and prevent any additional damage to the natural environment that the existing conditions are causing. Road sight lines will be improved, which will minimize the potential for road mortality of wildlife species. Drainage features will be designed to result in minimal encroachment into the natural vegetation communities, provide adequate flow transfer and minimize the potential for sedimentation. Culverts that are currently not functioning, or are situated in the wrong location, will be corrected and improved to both convey water and allow for some animal movement. The intent of this project is to improve the road function, as well as both maintaining the functions of the surrounding natural areas and prevent further negative impacts from occurring.

All site preparation and construction activities should occur outside of breeding seasons and periods of movement between significant habitat features, which includes spring breeding ponds for amphibians and upland habitats, fall movements to hibernation sites and winter movements of large mammals between feeding and yarding areas. Construction equipment should not be allowed to idle when not in use, and appropriate baffles and muffling systems should be employed to minimize noise. Exclusion fencing to keep wildlife out of areas to be impacted is also an effective way to minimize potential impacts to species. Employee education and signage will help to minimize potential species interactions.

In addition, the exclusion of street lighting from the corridor, the minimization of dust and sediment transfer and the low road speed of 60 km/hr will limit the potential for indirect edge effects to the wildlife habitat in the corridor. Tree mitigation of replacement or enhancement plantings, where feasible, will further reduce the extent of edge effects.

8.0 Compliance with Applicable Policies

Policy compliance is discussed in a separate planning report, prepared by Skelton Brumwell and Associates Inc. (2018) and will not be addressed as part of the EIS.

9.0 Conclusions

The proposed road improvements to 26/27 Sideroad in the Township of Clearview, between Townline and 10th Concession are intended to both improve the safety and conditions of the road for local residents and minimize the damage that the existing stormwater management features are causing to the road surface, ditches and culverts, and to the watercourse, wetlands and forests through significant amounts of sediment deposition.

The corridor can be described as including a mixture of natural heritage features, much of which is protected under the NEP and local planning policies, rural and agricultural development and passive parkland. Included in this area is a PSW, two ANSIs, NEP protected forested features, significant wildlife habitat, SAR and fish habitat.

The most significant natural features in the corridor include the Rob Roy PSW Complex, coldwater fish habitat, habitat for endangered species of bats and NEP Natural Areas. It is recognized that the IA and adjacent lands include a number of significant natural heritage and hydrologic features and functions. The ecological studies completed as part of the EIS have helped to inform the design of the road improvements, including such mitigation factors as reduced speed, improved surface water and stormwater quality, ecopassage design in sensitive habitat areas and a minimal footprint area within the IA. The design of the necessary 26/27 Sideroad improvements has been developed to minimize the potential footprint within the IA, while still meeting the safety requirements of the Township of Clearview. Low impact design, improvements to water quality, maintenance of hydrology and improvements to fish and herpetofaunal habitat have been included and have resulted in an overall benefit to vegetation communities, wildlife and wildlife habitat within the road corridor and IA. The NVCA is in agreement with rehabilitation offsetting at a separate location in their watershed in order to appropriately compensate for minor impacts to unevaluated wetlands.

The proposal will include an immediate effect, both indirect and direct, on the features and functions of the IA and the 120 m adjacent to the IA. The extent of the impacts is significantly reduced based on the minimal footprint of the road improvements, which results in a net effect of approximately 2.37 ha of natural forested and wetland habitat loss, combined with some areas of anthropogenic land use and culturally influenced vegetation communities. The duration of the effects will be both short and long-term, but the mitigation and compensation has been designed to result in an overall improvement to water quality, aquatic habitat features and functions and wetland habitats. Therefore, it is Burnside's opinion that the proposed development is environmentally and ecologically sound and that the potential impacts are acceptable, on the basis of recommended mitigation and compensation measures.

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Appendix A

Appendix A

Hydrogeological Report

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Technical Memorandum

Date:	August 7, 2018	**Project No.:**	300034587.0000
Project Name:	Clearview Sideroad 26/27 Improvements Streambed Piezometer Monitoring		
Client Name:	Township of Clearview		
Submitted To:	Mr. Andy Hims		
Submitted By:	David Hopkins		
Reviewed By:	Dwight Smikle		

1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) has been retained by the Township of Clearview ("Clearview") to conduct an Environmental Impact Study ("EIS") for proposed improvements to 26/27 Sideroad in order to facilitate the year-round use of this road between Townine Osprey Clearview (Grey County Road 31) and 10th Concession, shown on Figure 1.

The eastern section of the road is not maintained (ploughed) during the winter season and typically is impassable during that period. There are three residences located along the western section of the road which is maintained during the winter months to facilitate vehicle access.

The road currently consists of a gravel surface with a narrow base which is not maintained throughout the winter months between the last residence on the western half of the road and 10th Concession. Road conditions vary between a passable road (with caution) and a one lane, heavily rutted surface. Surface runoff water is inadequately conveyed through ditches that are either failing due to flow velocities or through surficial sheet flow across the road surface, causing granular washout after road surface grading into the adjacent forested and aquatic habitats.

Topography in this area is very undulating with a mix of upland forest communities, fields and valleys, which required assessment in the field to accurately characterize the baseline conditions of the road corridor. The extent of the corridor is included within various levels of Niagara Escarpment Plan Protected Areas (Natural Area, Protection Area, Rural Area and Parks and Open Space), which has triggered the requirement for preparation of an Environmental Impact Study (EIS). In addition to the NEC planning designations in the corridor, a portion of the road corridor also includes provincial Areas of Natural and Scientific Interest

(ANSI), Provincially Significant Wetland (PSW), Watercourses, regulated Provincial Park and Bruce Trail.

R.J. Burnside & Associates Limited (Burnside) has been collecting ground water and surface water level and water temperature data at a number of locations along Clearview Sideroad 26/27 (Figure 1). On April 28, 2016, nested streambed piezometers and/or temperature monitoring stations were installed in Tributary A, Tributary C and a see (Tributary B) located in a roadside ditch adjacent to Tributary C (Figure 2).

As part of the proposed road-improved works there is a 20 m reach of Tributary A within this monitored area that will require realignment to the north.

2.0 Monitoring Location Details

Tributary A is a natural year-round stream is sustained by groundwater discharge out of the Amabel Formation and/or Manitoulin Formation bedrock scarps at locations higher up on the Escarpment to the west, as well as by surface runoff. Tributary B has intermittent flow, the source of which is groundwater discharge from the rock higher up on the Escarpment and by surface water runoff. Tributary C has year-round flow, the source of which is a surface-draw outlet pipe system that discharges down through the perimeter berm to maintain the water level in the man-made pond located on the property south of 26/27 Sideroad. The pond collects discharge from several groundwater springs emanating from the bedrock at higher elevations, as well as surface water runoff.

Nested streambed piezometers, designated as shallow (S) and deep (D) were installed at two locations in Tributary A, designated upstream (U/S) and downstream (D/S), and at one location in Tributary C. Installation details are provided in Appendix A. Following installation on April 28, 2016, the piezometers were developed using a WaTerra inertial pump in order to remove fine sediments on the inside of the piezometer screen and allow for optimal open area within the screen. PVC pipes were installed into the substrate at temperature monitoring locations U/S Mainstem D/S Mainstem, Tributary C and in the roadside seep Tributary B (Figure 2). Automatic Water Level recorders (AWLR's) were installed in the piezometers and PVC pipes to record water levels and groundwater and surface water temperature on a continuous basis (Figure 2). Rising head hydraulic conductivity tests (K tests) were undertaken in all piezometers.

3.0 Results

The results of in situ hydraulic conductivity testing are found in Appendix A and are summarized in Table 1.

Table 1: Results of K Testing

Piezometer Location	K (m/s)
Trib A-U/S shallow	6.5×10^{-7}
Trib A-U/S deep	2.3×10^{-5}
Trib A-D/S shallow	8.1×10^{-6}
Trib A-D/S deep	9.8×10^{-6}
Trib C shallow	5.8×10^{-9}
Trib C deep	1.5×10^{-9}

3.1 Water Levels

Automatic Water Level Recorders (AWLR's) were installed in the piezometers on April 28, 2016. Water levels were recorded at 15-minute intervals until the AWLR's were removed for the winter on October 31, 2016. The AWLR's were re-installed on March 8, 2017. The AWLR's were left in place through the winter of 2017/2018. The Hydrographs in Appendix C show the data from April 28, 2016 to May 2, 2018. Manual water levels were collected on 11 occasions during this period in order to confirm the data recorded on the AWLRs. A 63 mm rainfall event on June 17, 2017 resulted in a rapid water level rise in all of the streambed piezometers as well as in the surface water levels.

3.1.1 Tributary A – Upstream (U/S)

Water levels at this location (Figure C-1, Appendix C) were within a 0.2 m range with deep ground water levels being lower than shallow ground water levels. Water levels in both the shallow and deep piezometers respond to individual precipitation events with the most significant rise in water levels about 0.18 m in response to 3 days of significant rainfall around May 2, 2017. Ground water levels in the deep and shallow piezometers and surface water levels in Tributary A exhibit a normal seasonal trend, with highest levels occurring in the spring following the snowmelt. Water levels progressively decline through the summer and early fall, followed by a rise in levels to May 2018.

Ground water levels in the deep piezometer typically are lower than shallow ground water levels, indicating a downwards, or recharge vertical gradient. The water levels in both the shallow and deep piezometer typically are about 20 cm below that of the surface water level, suggesting that there is only a limited connection between groundwater and surface water at this location.

Water levels recorded in the deep piezometer rose 0.16 m on July 29, 2016 following a data download event, and remained above the shallow piezometer water levels for about 30 days. A thorough review of the data did not provide a suitable explanation for the sudden change in water levels. As a result, ground water level data for this location through this period is not considered representative and is treated with caution.

3.1.2 Tributary A – Downstream (D/S)

Water levels at this location (Figure C-2, Appendix C) show a similar seasonal pattern to the upstream location with highest levels occurring in the spring followed by a decline to the end of the summer. Ground water levels in the shallow piezometer and in the surface water show a response to individual precipitation events, with a more subdued response observed in the deep piezometer. Water levels and water level responses in both piezometers and the tributary (surface water) are similar suggesting that there is no confining layer between the base of the tributary and the deep piezometer. Water levels in the shallow piezometer are slightly above the surface water from about June 18, 2017 to November 2, 2017 suggesting that some groundwater discharge may be occurring.

3.1.3 Tributary C

The hydrographs for Tributary C are shown on Figure C-3 in Appendix C. Ground water levels in the piezometers and the surface water levels in the tributary show a normal seasonal pattern with higher levels in the spring followed by a progressive decline to the end of summer. Water levels in the shallow piezometer are similar to surface water levels and respond to individual precipitation events with the highest water levels in the spring.

The ground water level in the deep piezometer showed a very slow recovery for several months following the initial development of the monitor, reflective of low hydraulic conductivity soil below the channel. Ground water levels in the monitor remain 0.1 to 0.2 m below the shallow piezometer water levels. Water levels in the deep piezometer show a limited seasonal variation, with no immediate response to individual precipitation events. Water levels in the deep piezometer exhibit a subdued seasonal pattern, with highest levels in the spring.

It is noted that Tributary C is the outlet channel from the man-made pond's surface draw-overflow control piping system, and may not exhibit the typical characteristics of a natural stream channel.

3.2 Temperature

Temperature graphs are found in Appendix C. Surface water temperatures in Tributary A, Tributary B and Tributary C are compared to air temperature on Figure C-4. The surface water temperatures exhibit a subdued reflection of the ambient air temperature both daily and seasonally. The water temperature is typically lower than the air temperature, with the exception of the winter months, and fluctuates by up to five degrees or more daily in response to variations in air temperature. Temperatures typically increase from approximately 2°C in late March to in excess of 20°C in July and August. This is followed by a progressive decrease to around 2°C by late October. Temperatures at all locations are similar in the spring and fall with the greatest range between locations (about 6°C) in July and August.

Coolest summer maximum temperatures (near 14°C) are found at the Tributary A-U/S location. This is to be expected as this is the closest location to the area where groundwater first discharges from the bedrock escarpment located at higher elevations further to the west. Temperatures increase from approximately 7°C in late April to in excess of 15 degrees C by late July, with daily fluctuations of about 5°C.

Surface water temperatures at the Tributary A-D/S location are typically a few degrees warmer than the upstream location and rise from about 6 to 7°C in April to 14 to 18°C in late August before declining to about 10°C to the end of October. Temperatures at the Tributary B monitoring location follow a similar pattern to those seen at both Tributary A stations, except the temperatures are typically 1 to 2°C warmer.

Surface water temperatures are highest at Tributary C with peak temperatures in July and August in excess of 20°C. This is to be expected as the tributary is fed from surface-draw outlet of the man-made pond located to the south of SR26/27.

Groundwater temperatures for the streambed piezometers are compared with air temperatures on Figure C-5 and are compared with surface water temperatures on Figures C-6, C-7 and C-8. Groundwater temperatures typically rise from near 5°C in April to peak summer values between 10°C and 18°C before decreasing to near 5°C in late November. Temperatures remain steady near 5°C during the winter before warming up in the spring. Groundwater temperatures at all locations are cooler than surface water temperatures from March until November when surface water temperatures drop below the groundwater temperatures through the winter period.

At the Tributary A-U/S location (Figure C-6) the deeper groundwater is slightly cooler than the shallow groundwater in the spring and summer, and is warmer than the shallow groundwater during the winter months. Peak summer temperatures are near 12°C. The deeper groundwater at this location shows less daily temperature variation than the shallow groundwater. Which responds to the thermal transfer from the surface water.

The groundwater-surface water temperature patterns at the Tributary A-D/S (Figure C-7) location are similar to those at the upstream locations, except that the groundwater temperatures are slightly warmer due to the increased distance from the groundwater discharge areas from the bedrock to the west, and the increased thermal transfer influence of the surface water on the shallow groundwater. The deep and shallow groundwater at this location exhibit very similar daily fluctuations in temperature. Groundwater temperatures at the Tributary C piezometer (Figure C-8) show a similar pattern as the Tributary A locations, except that the shallow groundwater temperatures are about 2°C higher than the deep location which is a result of thermal transfer effects from the warmer surface water at this location.

Several of the surface water temperature monitoring locations shown on Figure 2 are at locations in close proximity to continuous logger-to-web surface water monitoring stations included in the approved Duntroon Expansion Quarry's Adaptive Management Plan (AMP) surface water monitoring program, as follows:

- Tributary C (temperature logger) is just upstream from station SW17 in the AMP program.

- D/S Mainstream (temperature logger) measures temperatures upstream of SW17A in the AMP program (both locations are upstream of the confluence of Tributary A and tributary C).
- Roadside Seep (temp logger) is upstream of SW17B in the AMP program.

As can be seen in Figures C-9 to C-11, the temperature data collected as part of the AMP compares favorably with data collected as part of the Sideroad 26/27 assessment.

4.0 Vertical Gradients

The vertical hydraulic gradient within an aquifer (or between two aquifers separated by an aquitard) is calculated by dividing the difference in hydraulic head (or water level elevation) at nested piezometers by the vertical (elevation) distance between the well screen midpoints. Positive values indicate that the water level in the shallow piezometer is higher than the water level in the deep piezometer and the gradient is downwards (recharge condition). Similarly, a negative value indicates that water levels in the deep piezometer are higher and the gradient is upwards (discharge condition). Calculated vertical gradients are shown on Figures C-12 to C-14. As can be seen, values are predominantly positive indicating downwards gradients, or recharge conditions. Occasional negative values (upwards gradients) are likely related to precipitation events causing short-term changes in water levels.

5.0 Discussion

There appears to be little groundwater/surface water interaction in the portions of Tributary A/Tributary C that were investigated. Groundwater gradients between the shallow and deep piezometers at Tributary A-U/S and Tributary C are downwards. At Tributary A-D/S gradients are downwards between the shallow and deep piezometers, however water levels in the shallow piezometers are higher than surface water levels between May and November 2017 which suggests there is potential for groundwater to enter the tributary at this location.

The water level and temperature data indicate that the portion of Tributary A that was monitored is an area with downwards (or recharge) water level gradients. As such, realignment of a 20 m section of the tributary is not expected to have any significant negative impact on surface water or groundwater temperatures through that reach.

6.0 Conclusions

Based on the information presented above, Burnside offers the following conclusions:

- Downward gradients were measured between the shallow and deep piezometer at the locations monitored in Tributary A and Tributary C.
- Water levels exhibit a typical seasonal pattern with highest levels occurring in the spring and lowest levels in the summer.
- Groundwater temperatures are lowest in the deep piezometers at each location, with temperatures being lowest at Tributary A-U/S and highest in Tributary C.

  - The greatest range in groundwater temperatures between locations is seen in the summer (6°C) with a much lower range in spring and fall (~1°C).
- The portions of Tributary A, Tributary B and Tributary C in the study area are not considered to represent significant groundwater discharge areas.
- Road improvements will not have any significant negative impact on surface water or groundwater temperatures.

R.J. Burnside & Associates Limited

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Enclosure(s)	Figures
	Appendix A – Piezometer Installation Data Sheet
	Appendix B – Piezometer K-Test Data
	Appendix C – Hydrographs and Temperature Graphs

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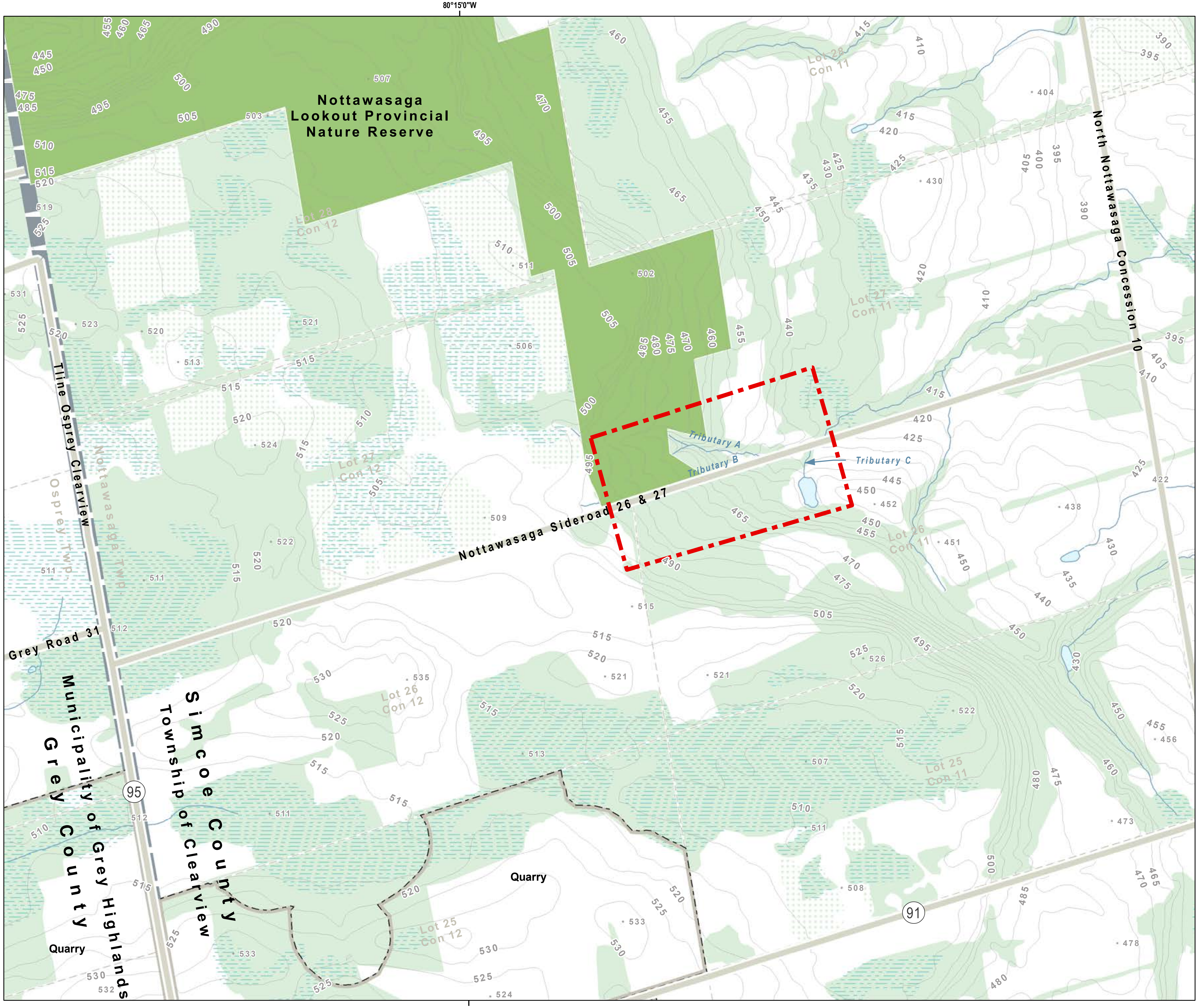
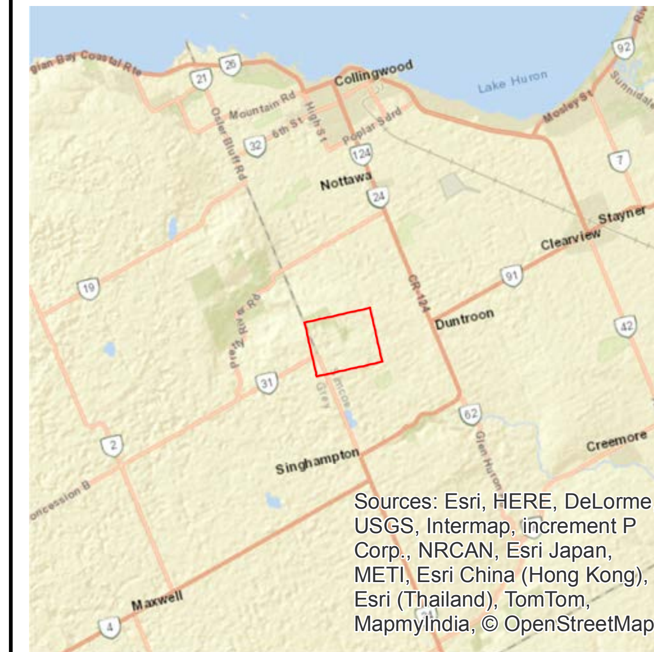
Figure s

Figu res





Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Disclaimer:

R.J. Burnside & Associates Limited and the above mentioned sources and agencies are not responsible for the accuracy of the spatial, temporal, or other aspects of the data represented on this map. It is recommended that users confirm the accuracy of the information represented.

This map is the product of a Geographic Information System (GIS). As such, the data represented on this map may be subject to updates and future reproductions may not be identical.

Datum: North American 1983	
Coord. System: NAD 1983 UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Rotation: 0	Scale Factor: 0.99960

N

Grid North

0 75 150 225 300 375 450 525 600 675 750

Meters

BURNSIDE

Client

TOWNSHIP OF CLEARVIEW

Figure Title

TRIBUTARY LOCATIONS

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

Drawn	Checked	Date	Figure No.
CD	DH	2018/07/12	1
Scale		Project No.	
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File Path: \\Elmo\gis\Project\300\034587 (Clearview SR 26-27 EIS)\034587_2018HG_StreamAssessment_LocationPlan.mxd Print Date: 2018/07/12 Time: 01:21 PM

Legend

- Approximate Nested Streambed Piezometer Location
- Approximate Temperature Logger Location
- Approximate Surface Water Monitoring Location (WSP)
- Local Road
- Wetland
- Waterbody: Permanent
- Stream: Permanent
- Stream: Intermittent

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Datum: North American 1983	
Coord. System: NAD 1983 UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Rotation: 0	Scale Factor: 0.99960

N

Grid North

0 10 20 30 40 50 60 70 80

Meters

BURNSIDE

Client

TOWNSHIP OF CLEARVIEW

Figure Title

WATER LEVEL AND TEMPERATURE MONITORING LOCATIONS

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

Drawn	Checked	Date	Figure No.
CD	DH	2018/08/07	2
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Appendix A

Piezometer Installation Data Sheet

Clearview Sideroad 26/27 Piezometer Installation
Branch of the Pretty River

Piezometer AU (Tributary A, Upstream)

Shallow

1.885 m = Total Depth -inside- from top of pipe (t.o.p.)
1.285 m = Stick-up - outside from top of pipe to creek bed
0.3 m = Screen Length - top of screen (t.o.s.) to bottom of screen (b.o.s.)
1.215 m = Water Level - inside - from top of pipe (24-May-16)
1.05 m = Water Level - outside - from top of pipe (24-May-16)

Deep

1.885 m = Total Depth -inside- from t.o.p.
0.84 m = Stick-up - outside - from t.o.p. to creek bed
0.3 m = Screen Length - t.o.s. to b.o.s.
0.835 m = Water Level -inside- from t.o.p. (24-May-16)
0.64 m = Water Level -outside- from t.o.p. (24-May-16)

Piezometer AD (Tributary A, Downstream)

Shallow

1.52 m = Total Depth -inside- from t.o.p.
0.95 m = Stick-up - outside - from t.o.p. to creek bed
0.3 m = Screen Length - t.o.s. to b.o.s.
0.885 m = Water Level -inside- from t.o.p. (24-May-16)
0.885 m = Water Level -outside- from t.o.p. (24-May-16)

Deep

1.885 m = Total Depth -inside- from top of pipe
1.06 m = Stick-up - outside - from t.o.p. to creek bed
0.3 m = Screen Length - t.o.s. to b.o.s.
0.96 m = Water Level -inside- from t.o.p. (24-May-16)
0.96 m = Water Level -outside- from t.o.p. (24-May-16)

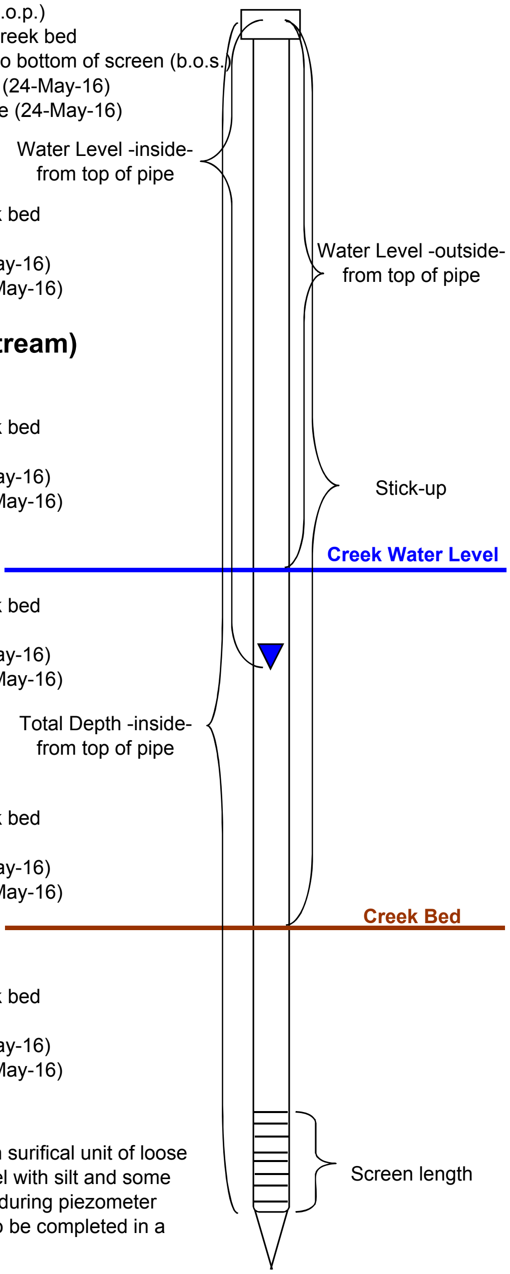
Piezometer C (Tributary C)

Shallow

1.885 m = Total Depth -inside- from t.o.p.
1.27 m = Stick-up - outside - from t.o.p. to creek bed
0.3 m = Screen Length - t.o.s. to b.o.s.
1.13 m = Water Level -inside- from t.o.p. (24-May-16)
1.13 m = Water Level -outside- from t.o.p. (24-May-16)

Deep

1.885 m = Total Depth -inside- from top of pipe
0.85 m = Stick-up - outside - from t.o.p. to creek bed
0.3 m = Screen Length - t.o.s. to b.o.s.
1.43 m = Water Level -inside- from t.o.p. (24-May-16)
0.73 m = Water Level -outside- from t.o.p. (24-May-16)



Notes:
Encountered stratigraphy generally consisted of a thin surifical unit of loose sand and gravel, followed by compact sand and gravel with silt and some cobbles and stones. Based on purge water observed during piezometer screen development, each of the screens appeared to be completed in a reddish to medium brown, relatively hard, silt unit.

Clearview Sideroad 26/27 Piezometer Installation
Branch of the Pretty River

Station Name	Screen	Date	Water Level (inside)	Water Level (outside)	Difference
Piezometer AU	Deep	5/24/2016 11:40	0.835	0.64	-0.195
	Shallow	5/24/2016 11:37	1.215	1.05	-0.165
Piezometer AD	Deep	5/24/2016 11:05	0.96	0.96	0.00
	Shallow	5/24/2016 11:10	0.885	0.885	0.00
Piezometer C	Deep	5/24/2016 11:18	1.43	0.73	-0.70
	Shallow	5/24/2016 11:15	1.13	1.13	0.00

UTM Coordinates (17T)

Station Name	Easting	Northing
Piezometer AU	560468.92	4916500.00
Piezometer AD	560639.52	4916552.46
Piezometer C	560591.91	4916520.77

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Append ix B

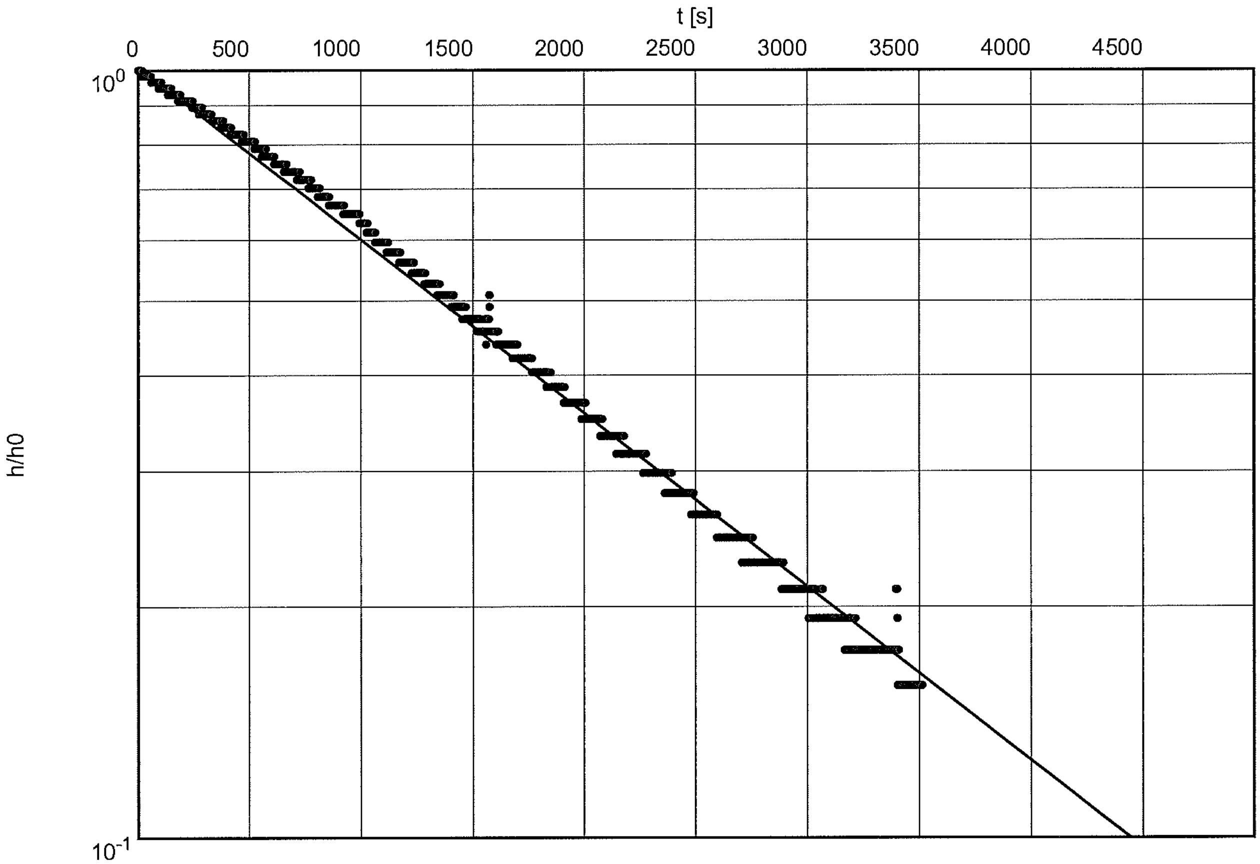
Piezometer K-Test Data

Append dix B

BURNSIDE

slug/bail test analysis HVORSLEV's method	Date: 05.08.2016	Page 1
	Project: 300034587	
	Evaluated by: S.Quinlan	

Slug Test No.	Test conducted on: 29.07.2016
Trib A U/S-SHALLOW	

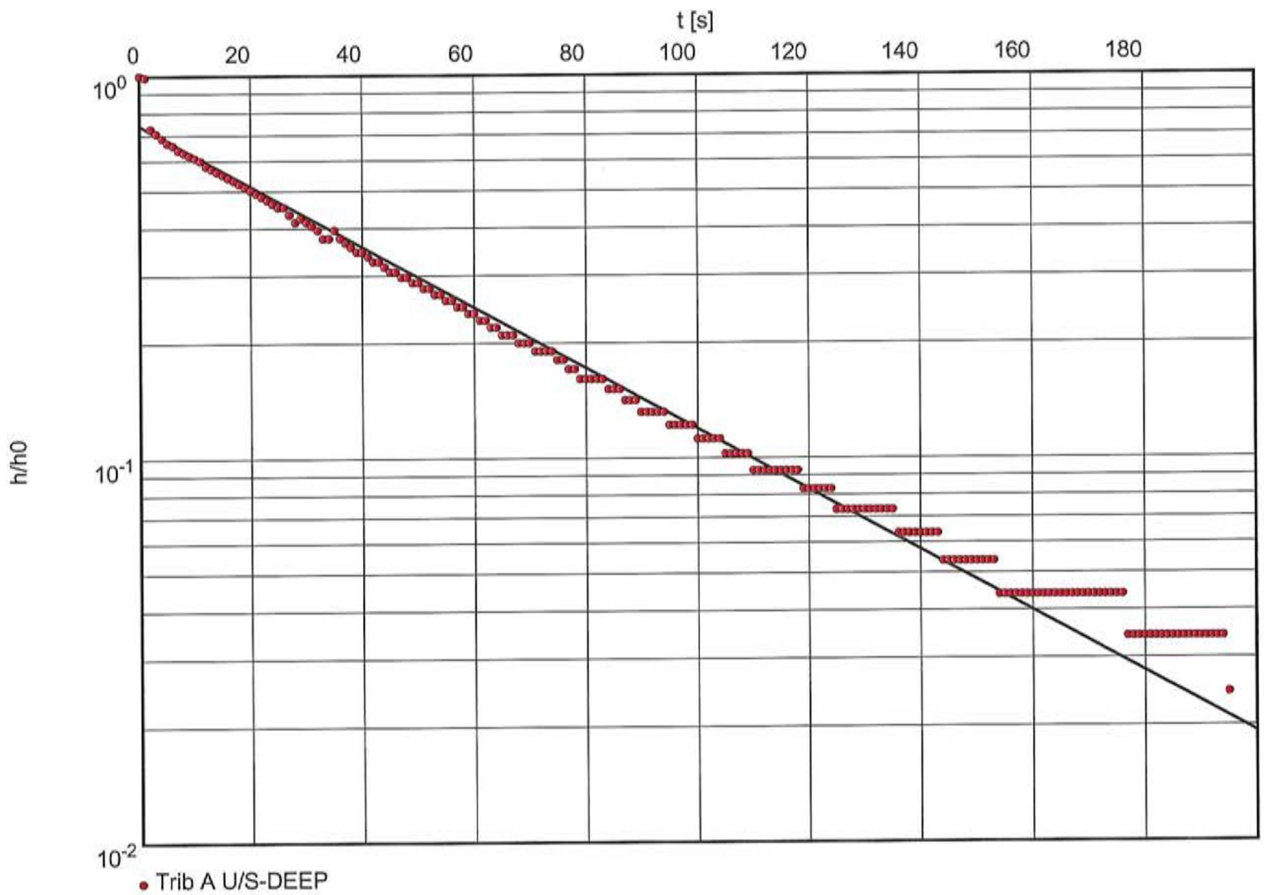


• Trib A U/S-SHALLOW

Hydraulic conductivity [m/s]: 6.54×10^{-7}

BURNSIDE	slug/bail test analysis HVORSLEV's method	Date: 05.08.2016	Page 1
		Project: 300034587	
		Evaluated by: S.Quinlan	

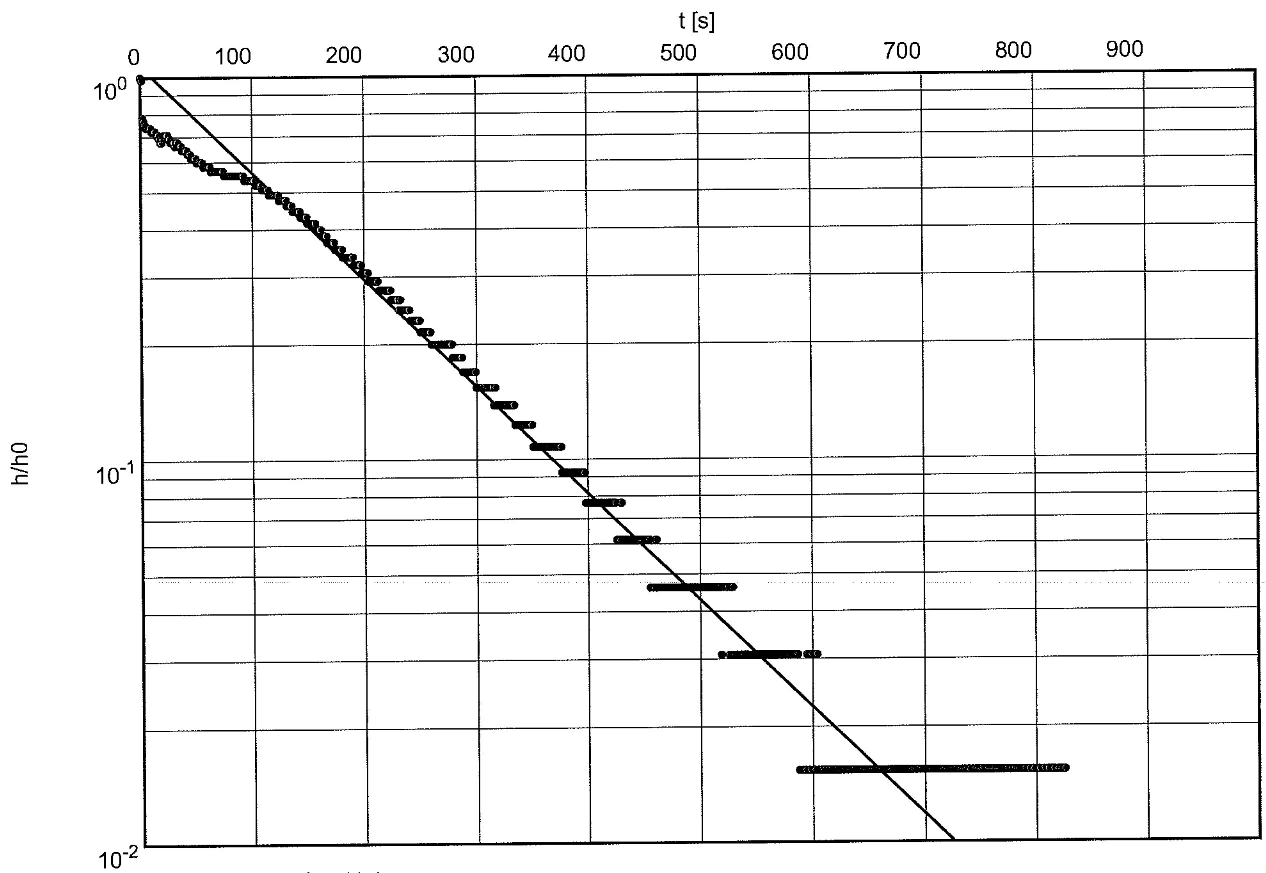
Slug Test No.	Test conducted on: 29.07.2016
Trib A U/S-Deep	



Hydraulic conductivity [m/s]: 2.29×10^{-5}

BURNSIDE	slug/bail test analysis HVORSLEV's method	Date: 05.08.2016	Page 1
		Project: 300034587	
		Evaluated by: S.Quinlan	

Slug Test No.	Test conducted on: 29.07.2016
Trib A D/S-Shallow	

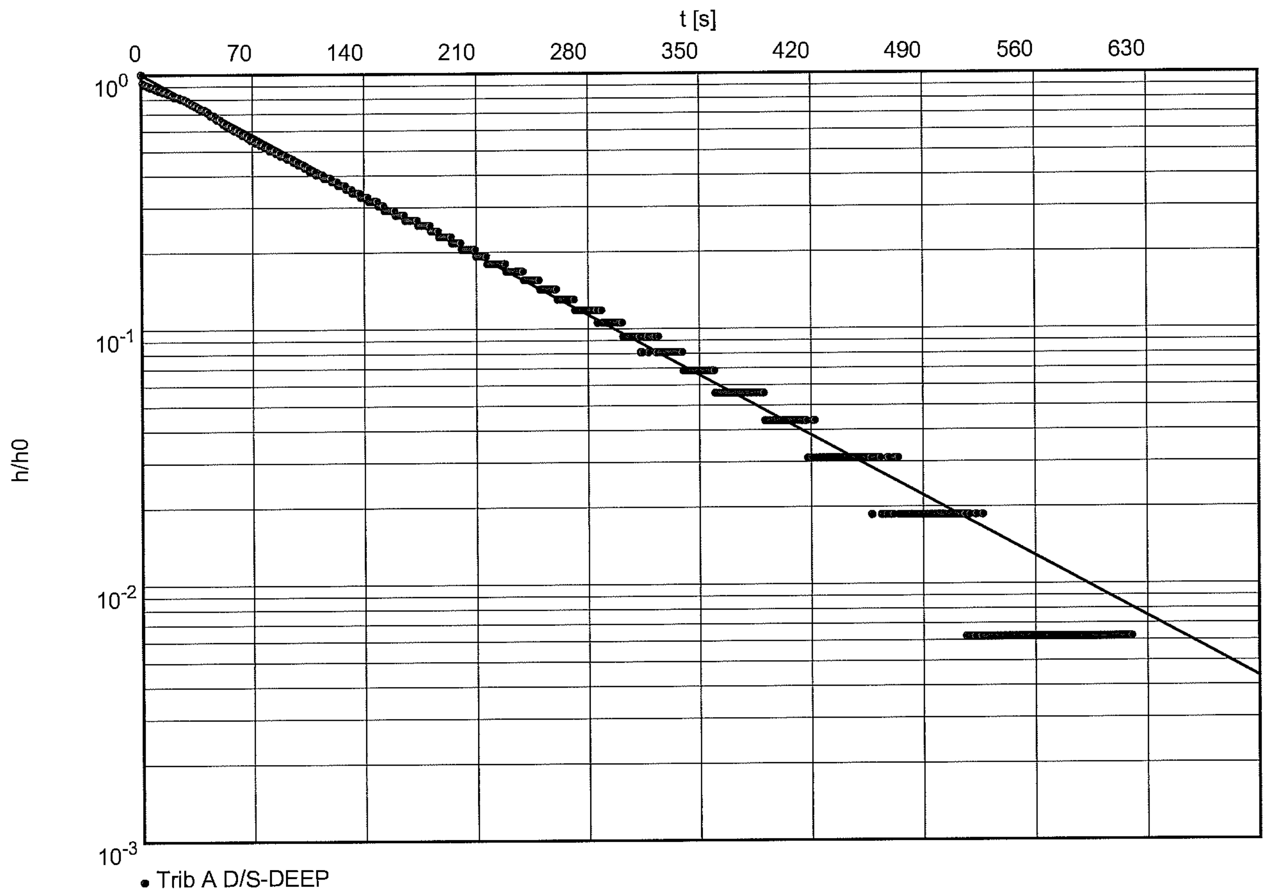


• Trib A D/S-SHALLOW

Hydraulic conductivity [m/s]: 8.09×10^{-6}

BURNSIDE	slug/bail test analysis HVORSLEV's method	Date: 05.08.2016 — Page 1 Project: 300034587 Evaluated by: S.Quinlan

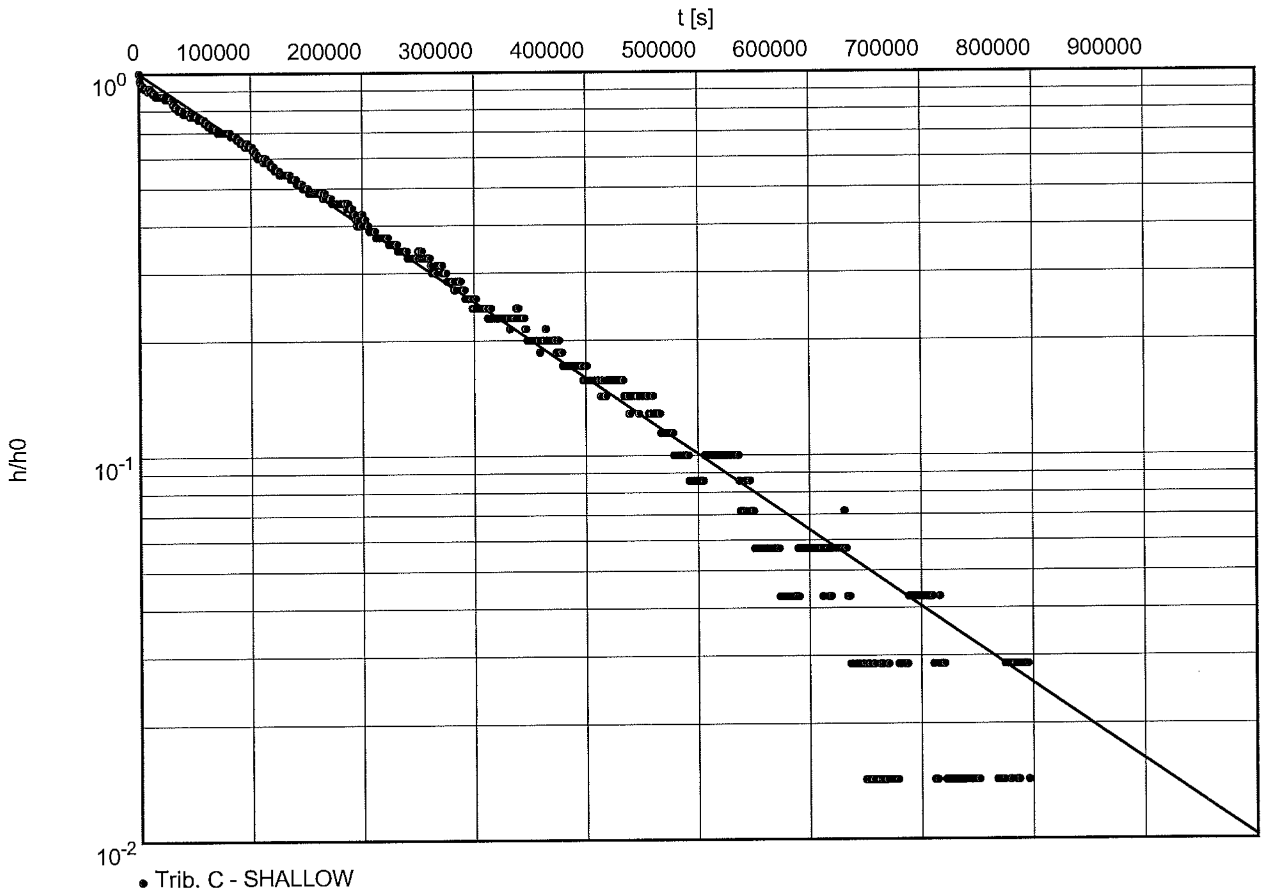
Slug Test No.	Test conducted on: 30.07.2016
Trib A D/S-Deep	



Hydraulic conductivity [m/s]: 9.77×10^{-6}

BURNSIDE	slug/bail test analysis HVORSLEV's method	Date: 05.08.2016	Page 1
		Project: 300034587	
		Evaluated by: S.Quinlan	

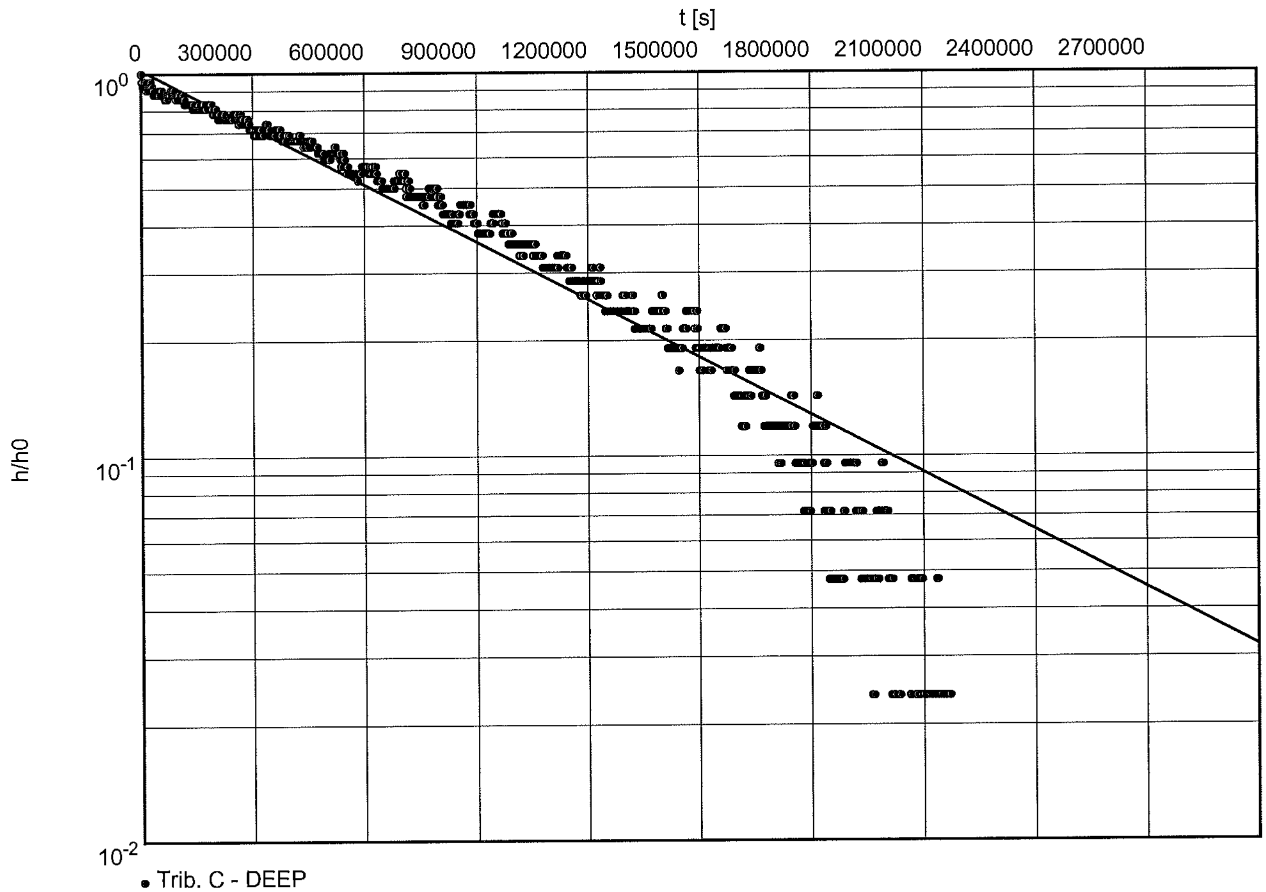
Slug Test No.	Test conducted on: 24.05.2016
Trib C Shallow	



Hydraulic conductivity [m/s]: 5.76×10^{-9}

BURNSIDE	slug/bail test analysis HVORSLEV's method	Date: 05.08.2016	Page 1
		Project: 300034587	
		Evaluated by: S.Quinlan	

Slug Test No.	Test conducted on: 24.05.2016
Trib C Deep	



Hydraulic conductivity [m/s]: 1.45×10^{-9}

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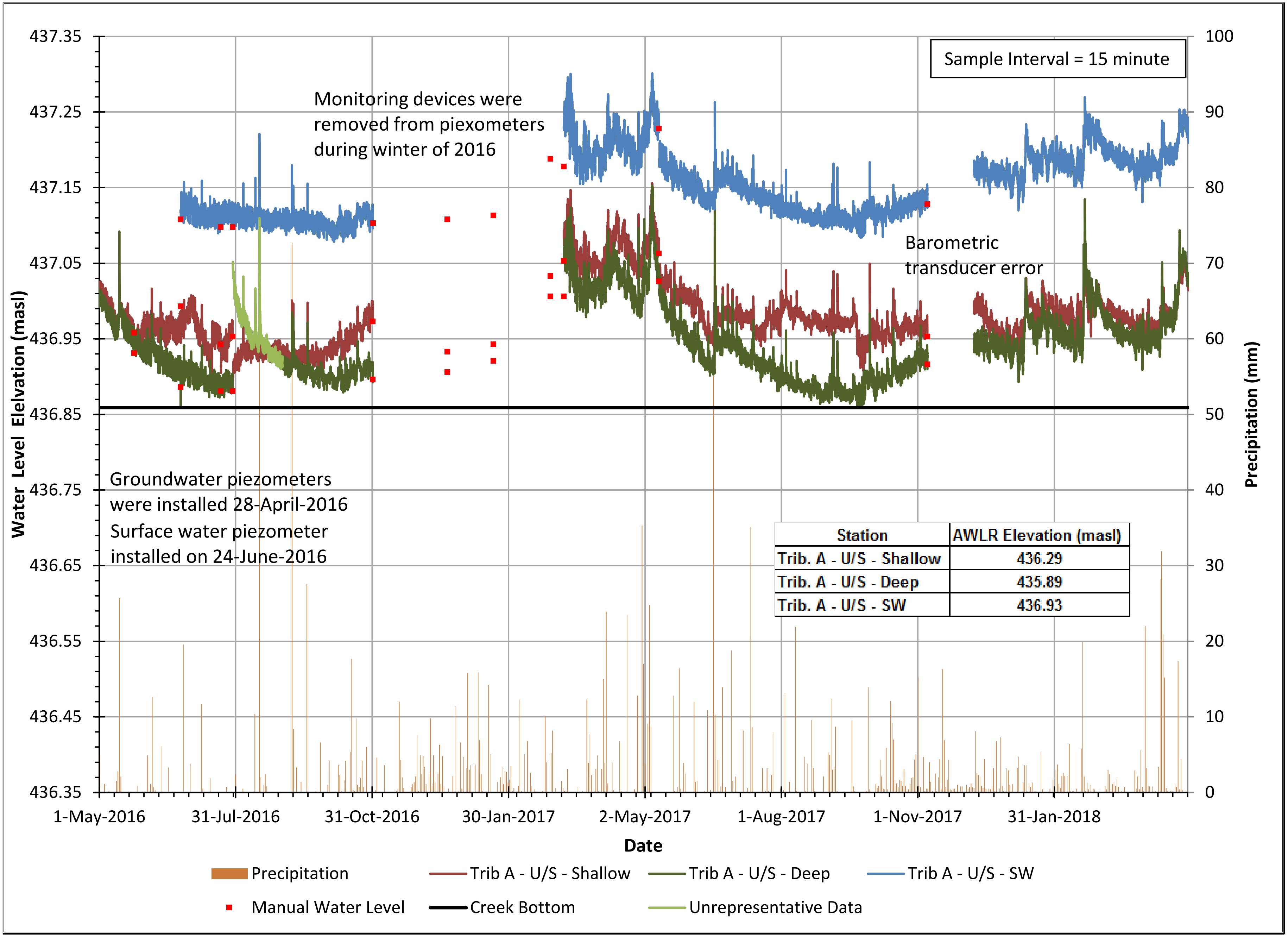
Append ix C

Hydrog raphs

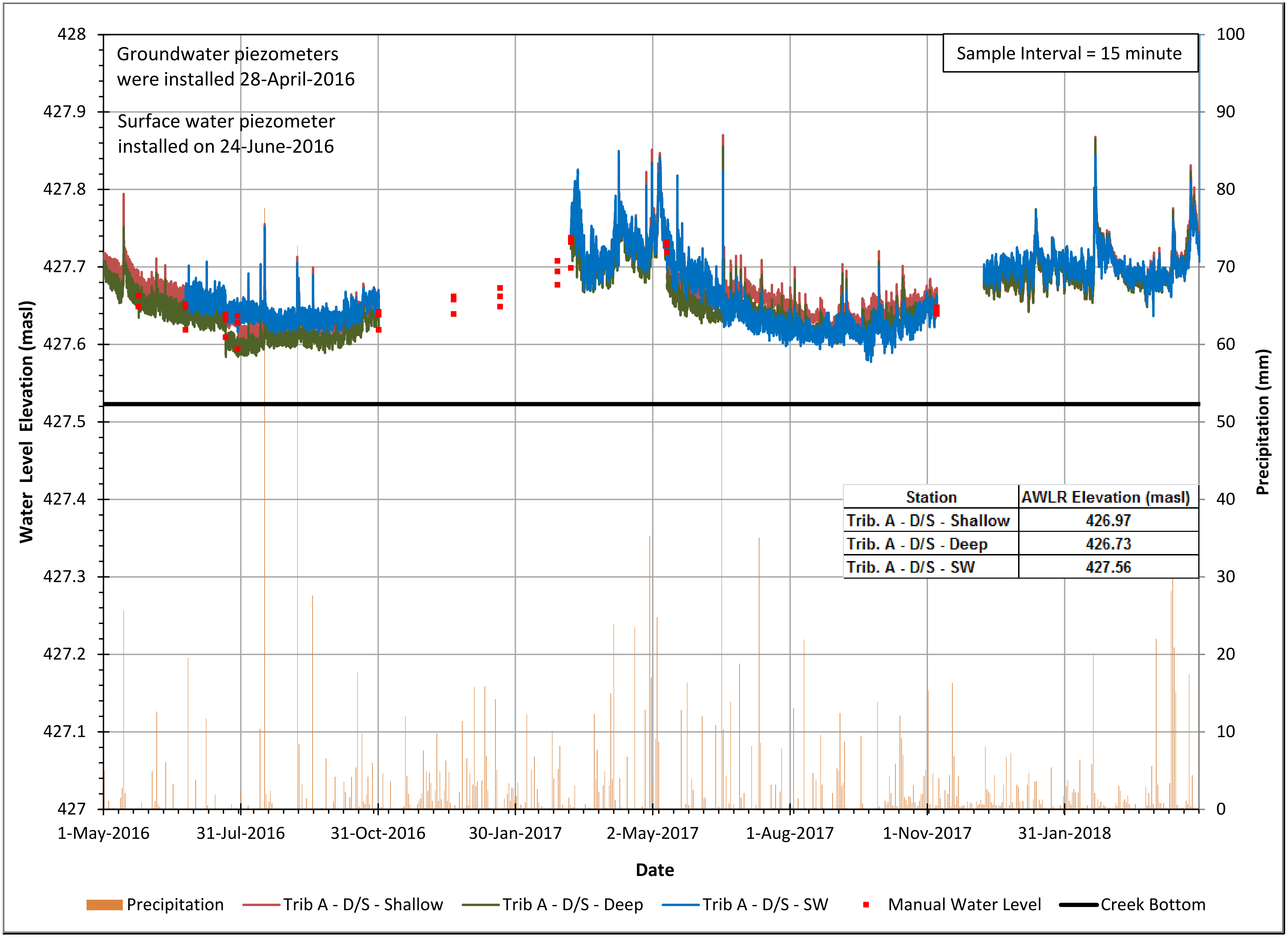
Appen dix C

Figure C-1 Township of Clearview - Sideroad 26/27
Groundwater-Surfacewater Comparison - Tributary A - Upstream Hydroraph



Station	AWLR Elevation (masl)
Trib. A - U/S - Shallow	436.29
Trib. A - U/S - Deep	435.89
Trib. A - U/S - SW	436.93

Figure C-2 Township of Clearview - Sideroad 26/27
Groundwater-Surfacewater Comparison - Tributary A - Downstream Hydrograph



Station	AWLR Elevation (masl)
Trib. A - D/S - Shallow	426.97
Trib. A - D/S - Deep	426.73
Trib. A - D/S - SW	427.56

Figure C-3Township of Clearview Sideroad 26/27
Groundwater-Surfacewater Comparison : Tributary C Hydrograph

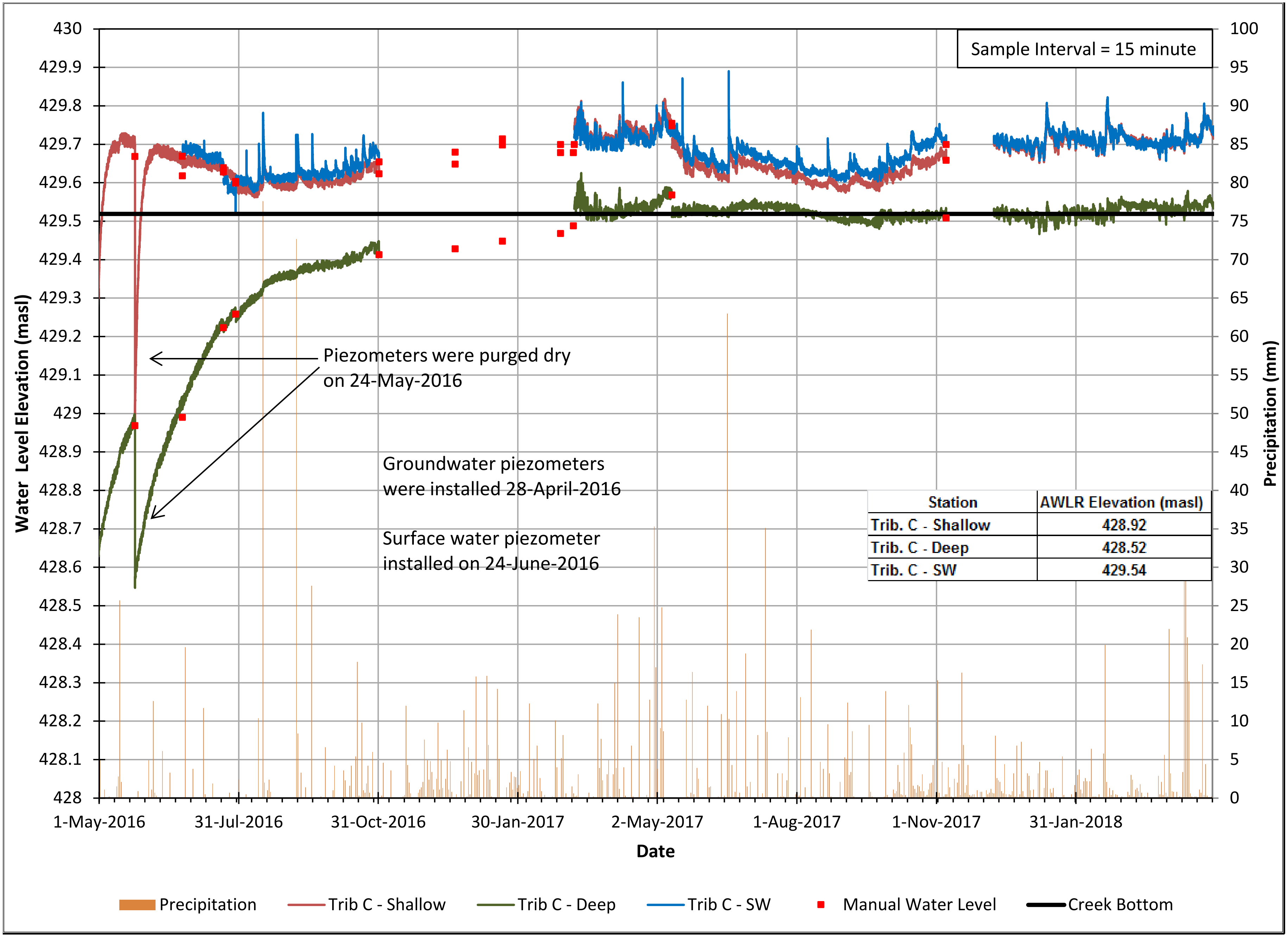
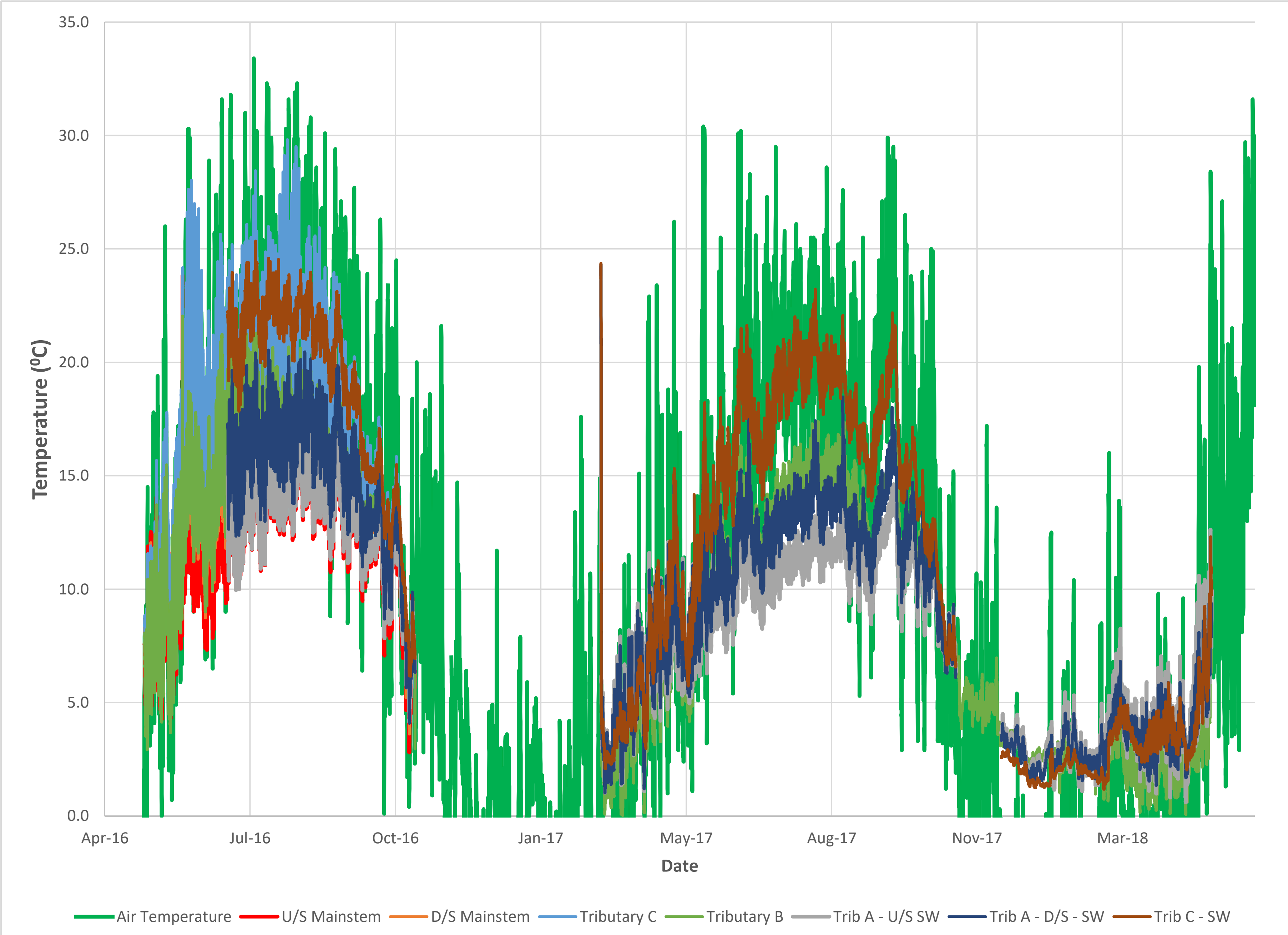


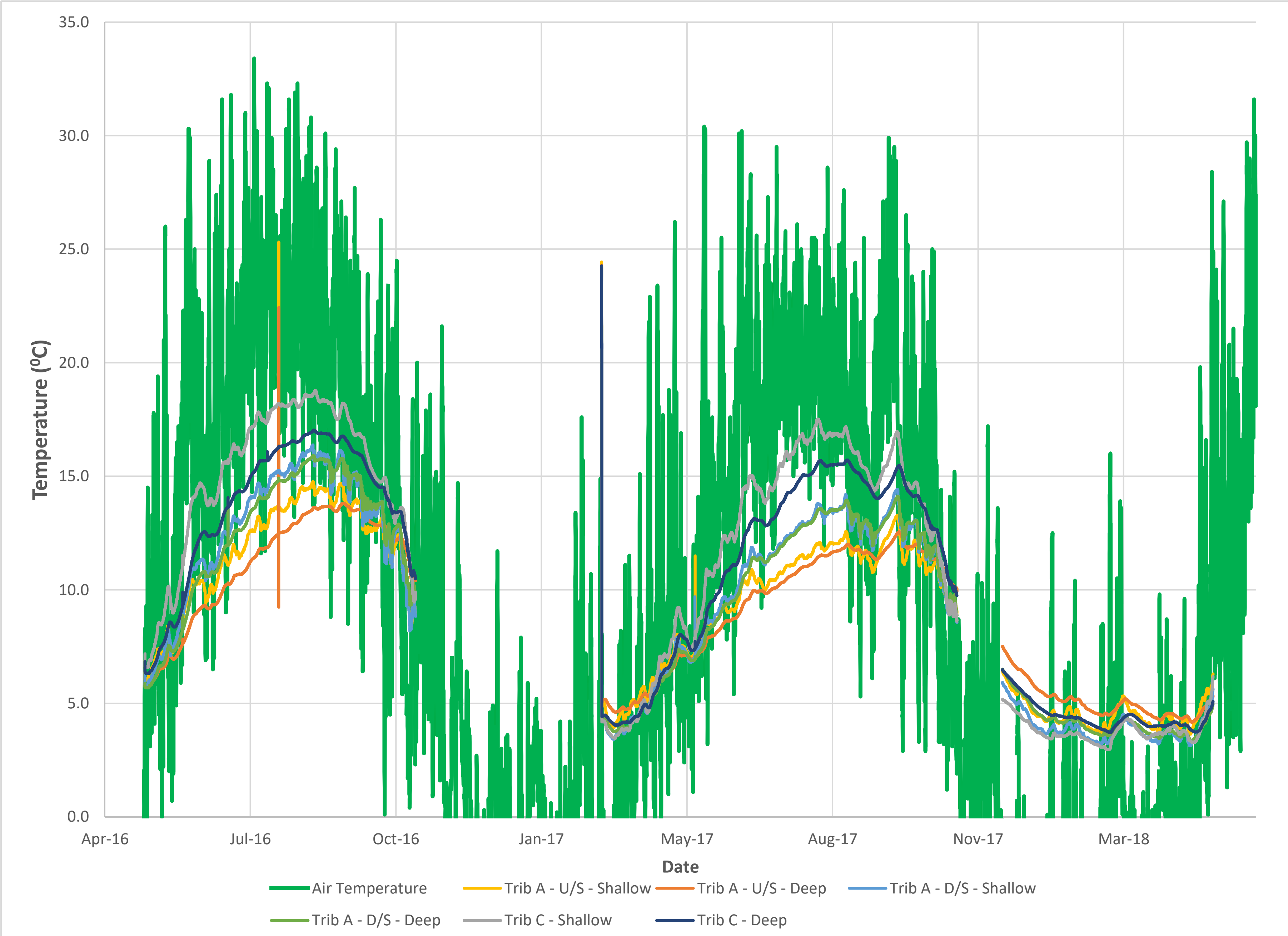
Figure C-4 Township of Clearview - Sideroad 26/27
Surfacewater Temperature Graph - All Locations



Prepared By: S.Q.
Printed On: 7/13/2018
File: 034587 Temperature graphs/C-4 SW TEMP ALL

Township of Clearview
Sideroad 26/27
Project No.: 300034587

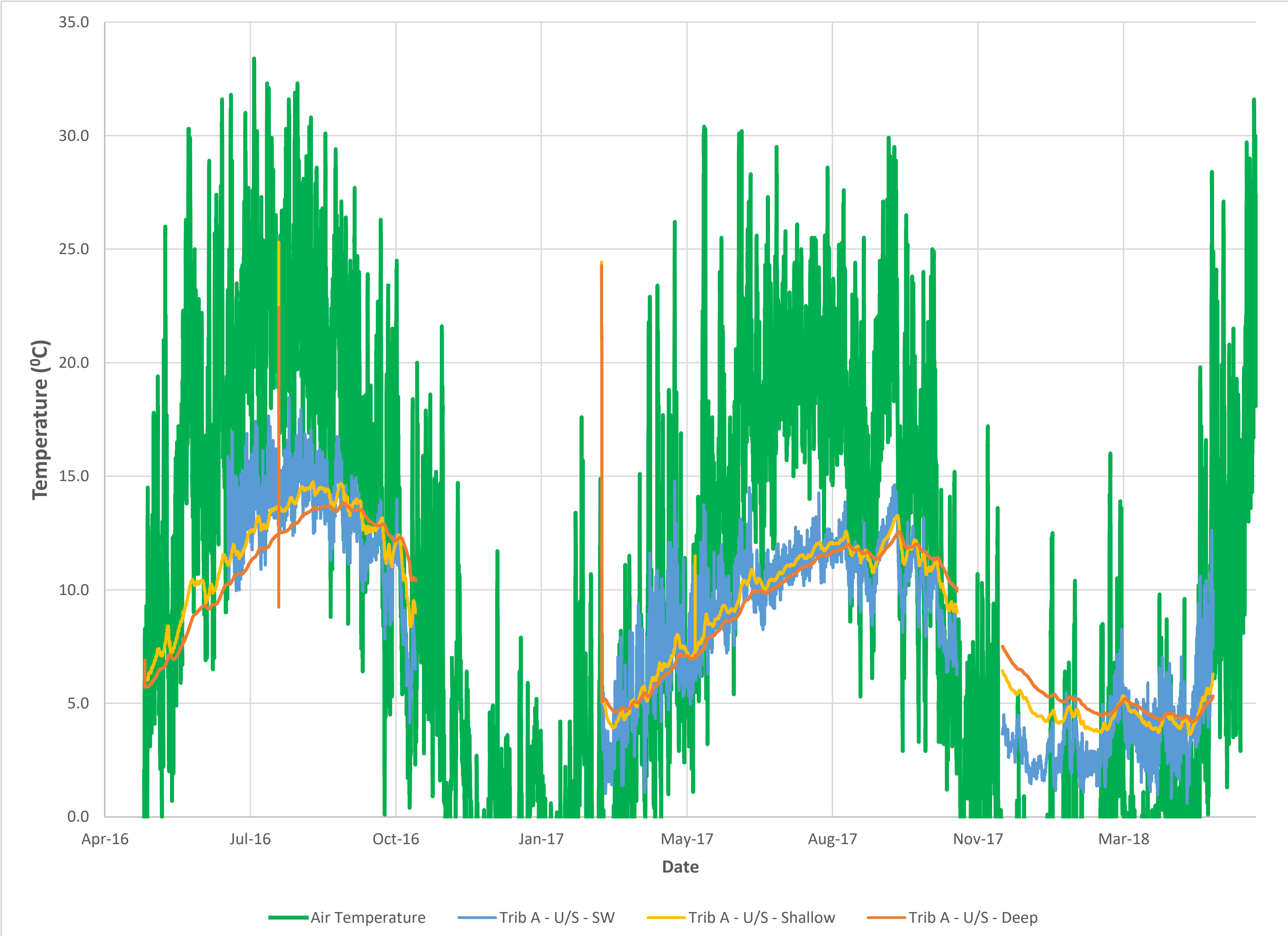
Figure C-5 Township of Clearview - Sideroad 26/27
Groundwater Temperature Graph - All Locations



Prepared By: S.Q.
Printed On: 7/13/2018
File: 034587 Temperature graphs/C-5 GW TEMP ALL

Township of Clearview
Sideroad 26/27
Project No.: 300034587

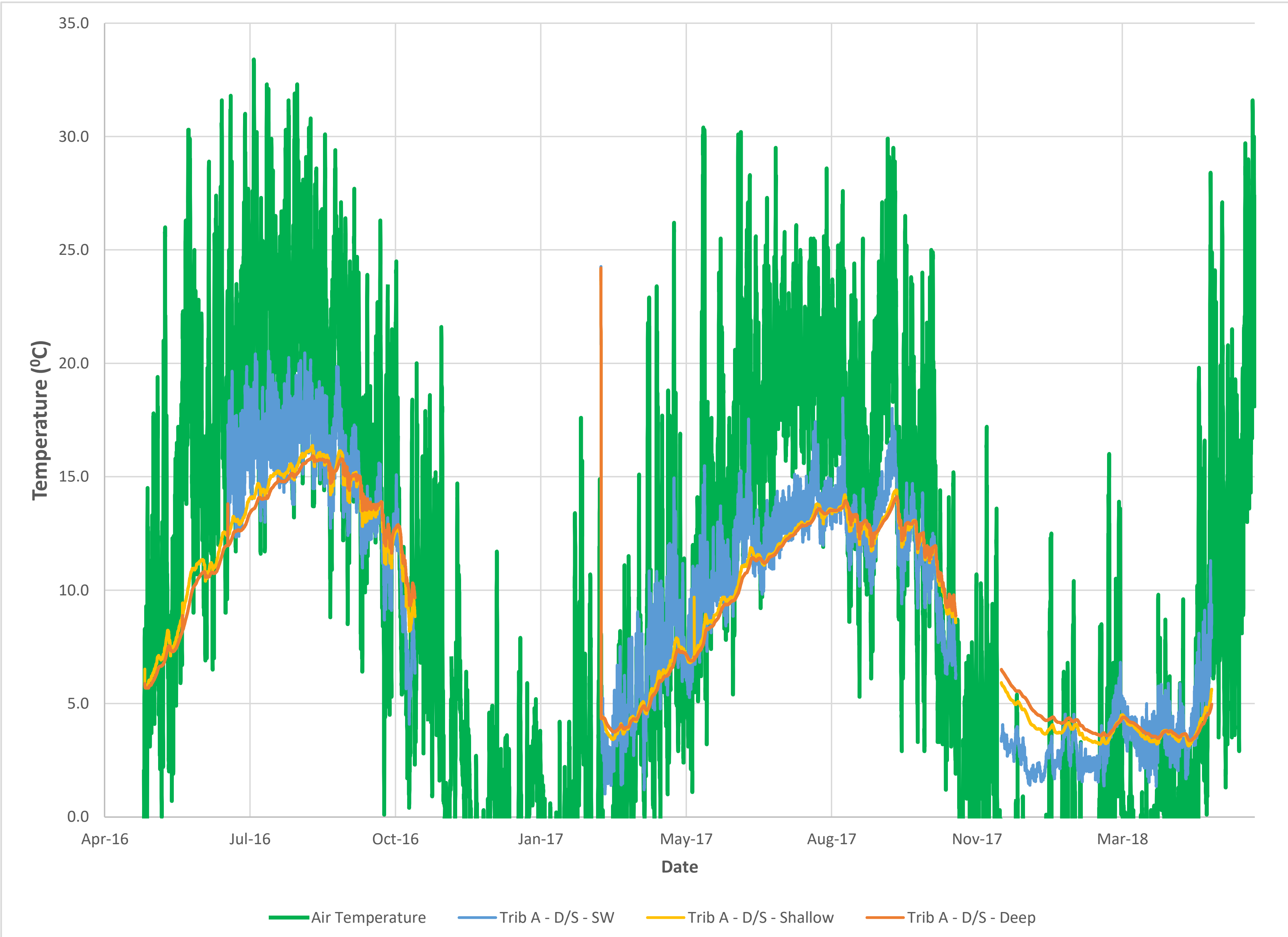
Figure C-6 Township of Clearview - Sideroad 26/27
Groundwater and Surface Water Temperature Graph - Tributary A Upstream



Prepared By: S.Q.
Printed On: 7/13/2018
File: 034587 Temperature graphs/C-6 GW & SW Trib A US

Township of Clearview
Sideroad 26/27
Project No.: 300034587

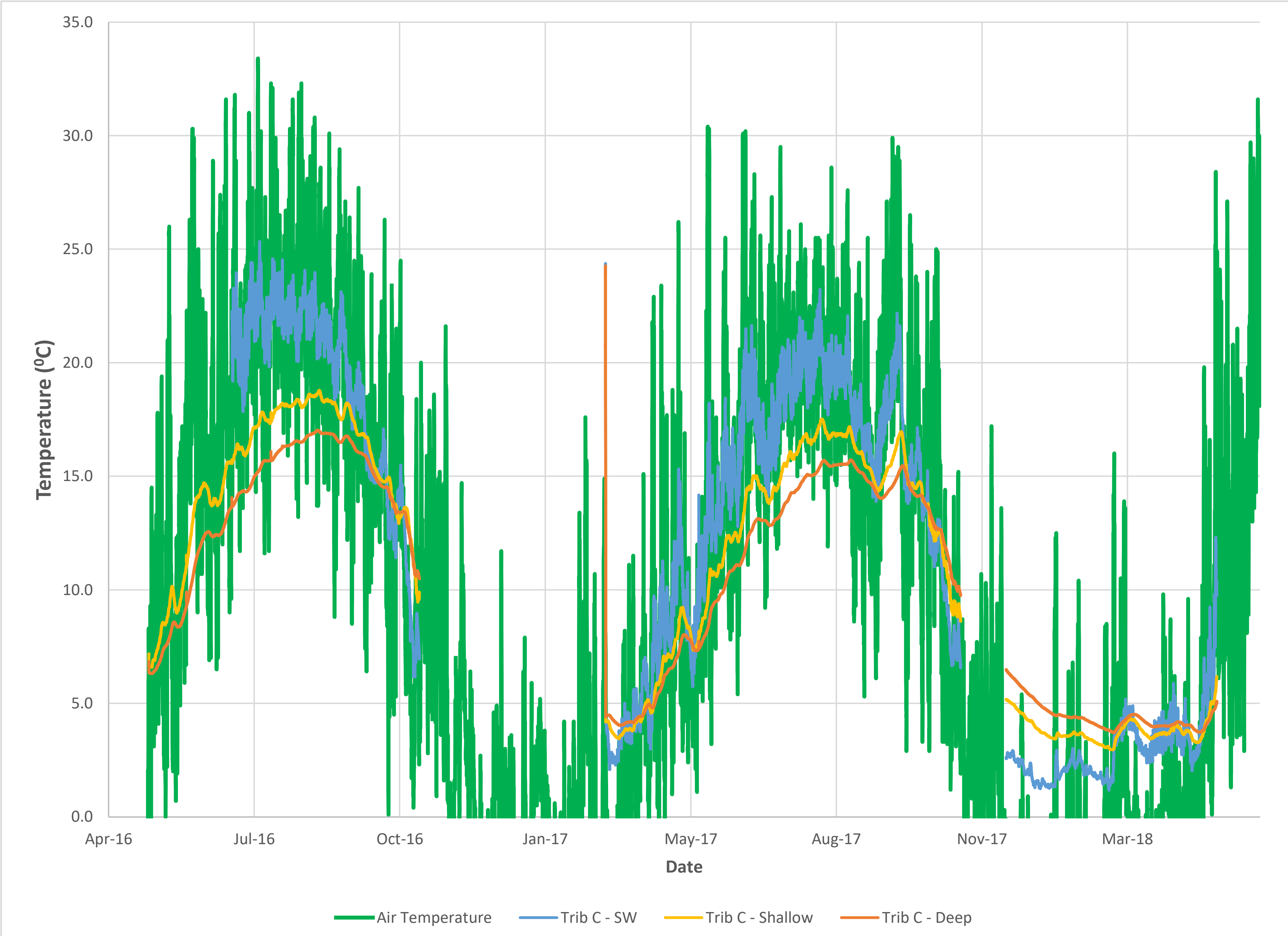
Figure C-7 Township of Clearview - Sideroad 26/27
Groundwater and Surface Water Temperature Graph - Tributary A Downstream



Prepared By: S.Q.
Printed On: 7/13/2018
File: 034587 Temperature graphs/C-7 GW & SW Trib A DS

Township of Clearview
Sideroad 26/27
Project No.: 300034587

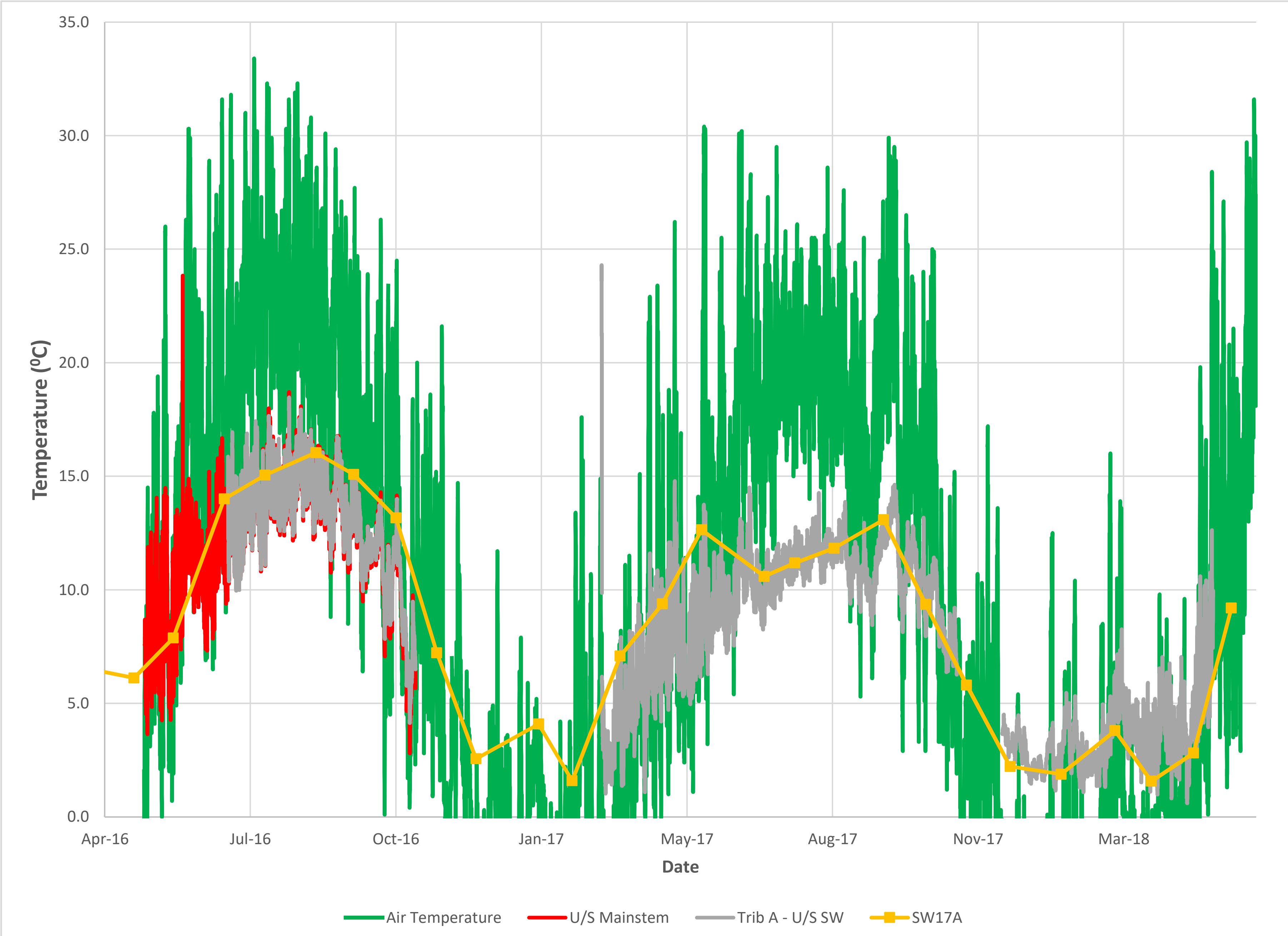
Figure C-8 Township of Clearview - Sideroad 26/27
Groundwater and Surface Water Temperature Graph - Tributary C



Prepared By: S.Q.
Printed On: 7/13/2018
File: 034587 Temperature graphs/C-8 GW & SW Trib C

Township of Clearview
Sideroad 26/27
Project No.: 300034587

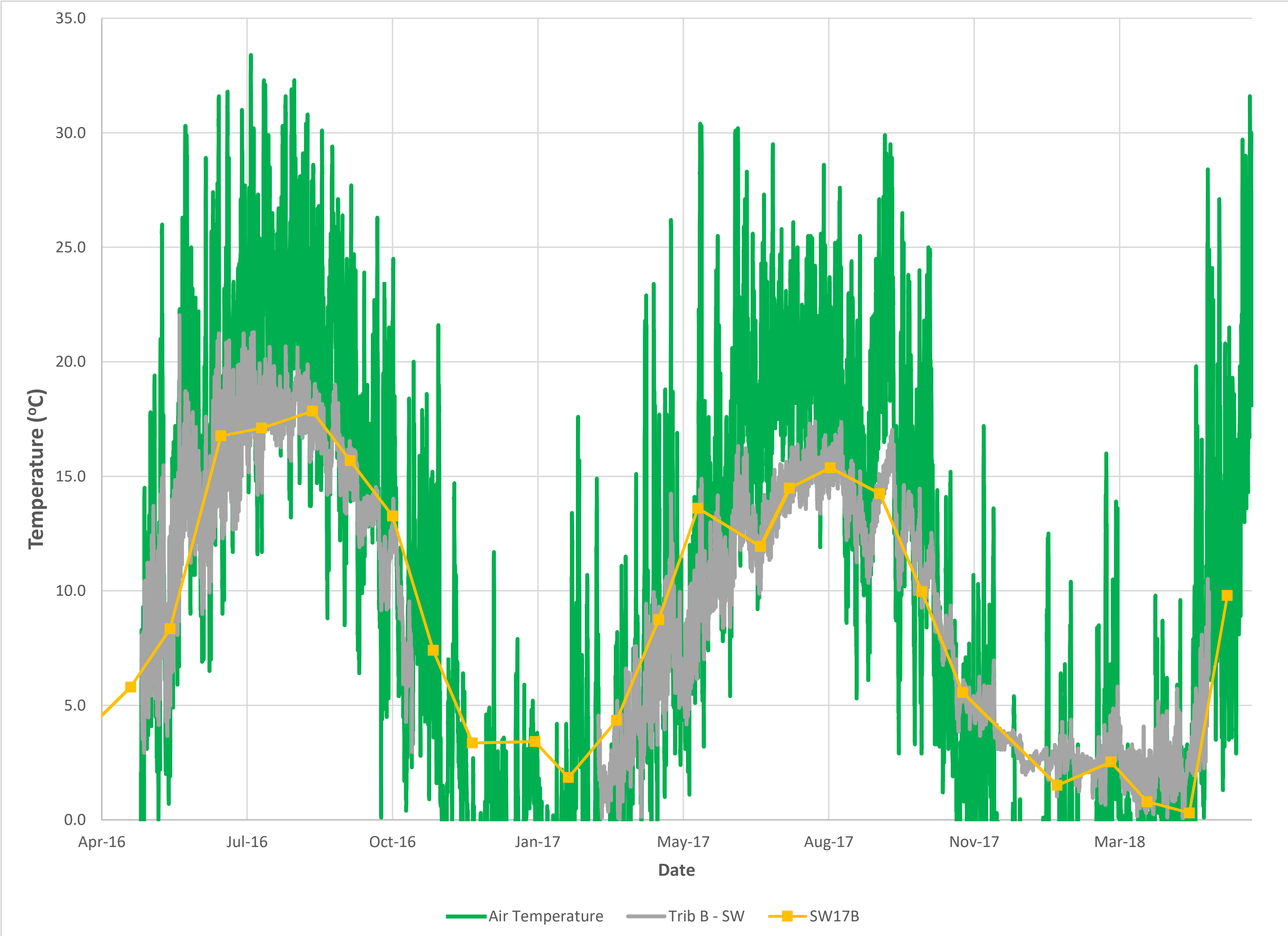
Figure C-9 Township of Clearview - Sideroad 26/27
Surfacewater Comparison : Temperature Graph



Prepared By: S.Q.
Printed On: 7/13/2018
File: 034587 Temperature graphs/C-9 Trib A Temp Graph

Township of Clearview
Sideroad 26/27
Project No.: 300034587

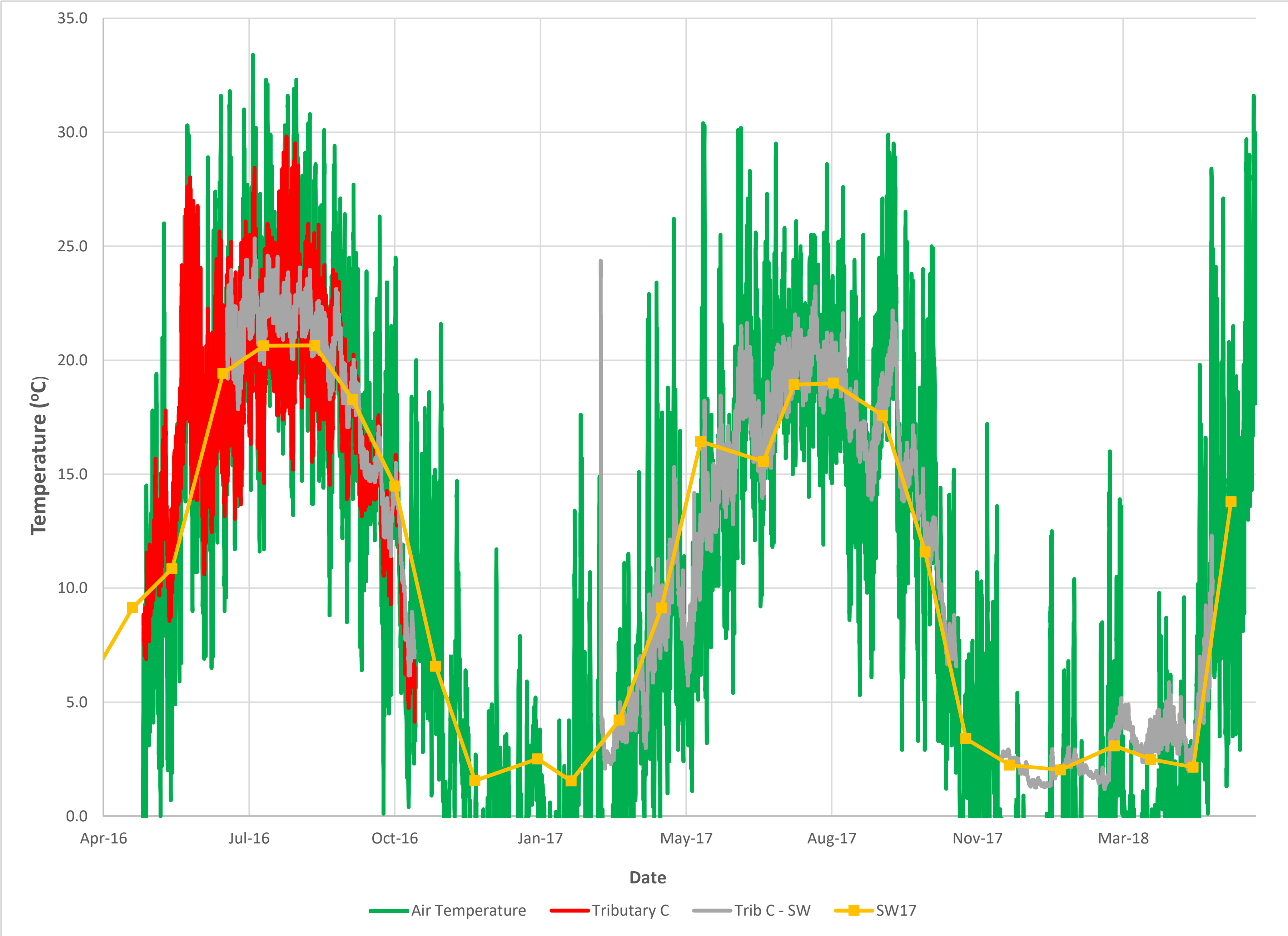
Figure C-10 Township of Clearview - Sideroad 26/27
Surfacewater Comparison : Temperature Graph



Prepared By: S.Q.
Printed On: 7/13/2018
File: 034587 Temperature graphs/C-10 Trib B Temp Graph

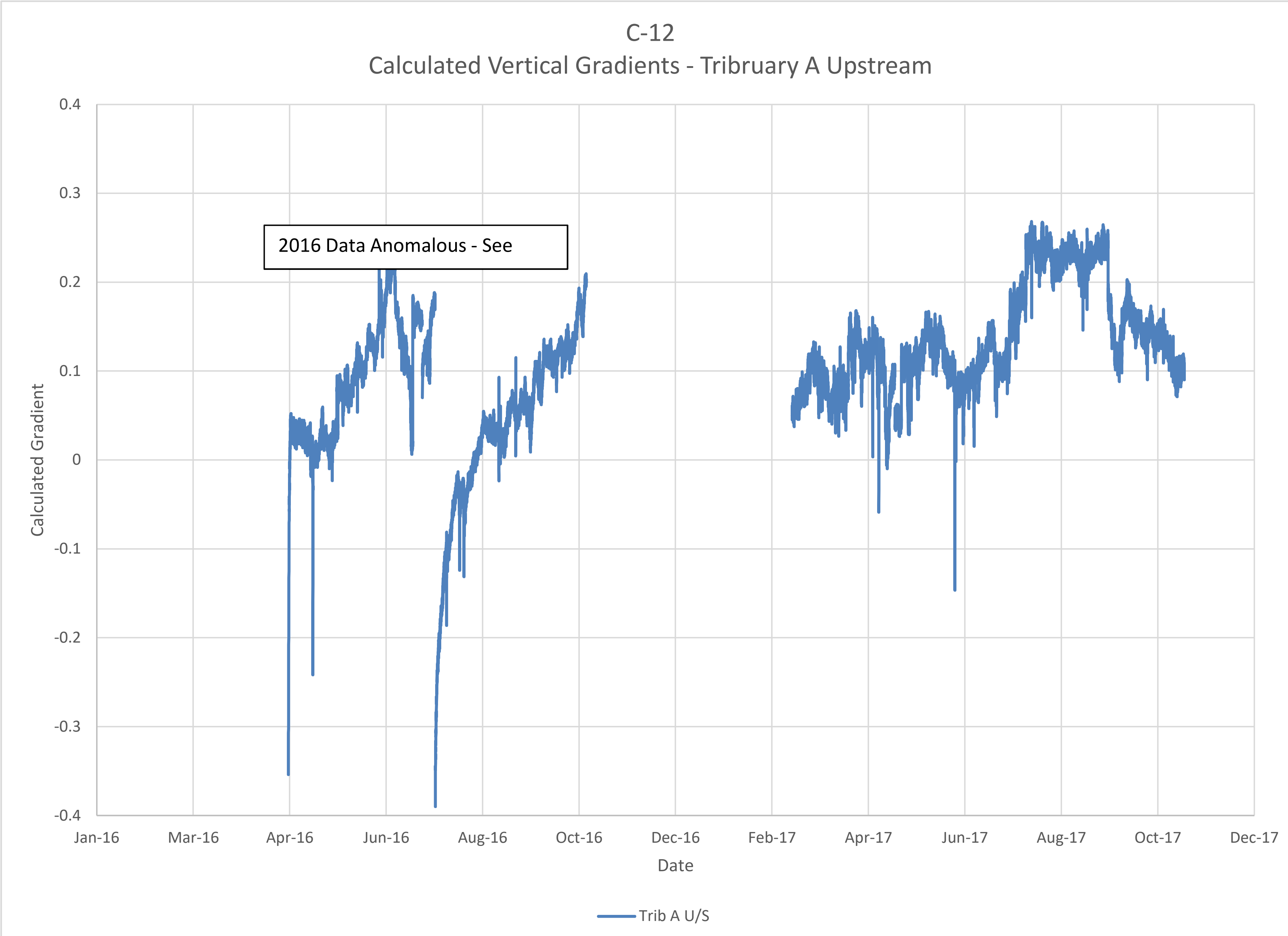
Township of Clearview
Sideroad 26/27
Project No.: 300034587

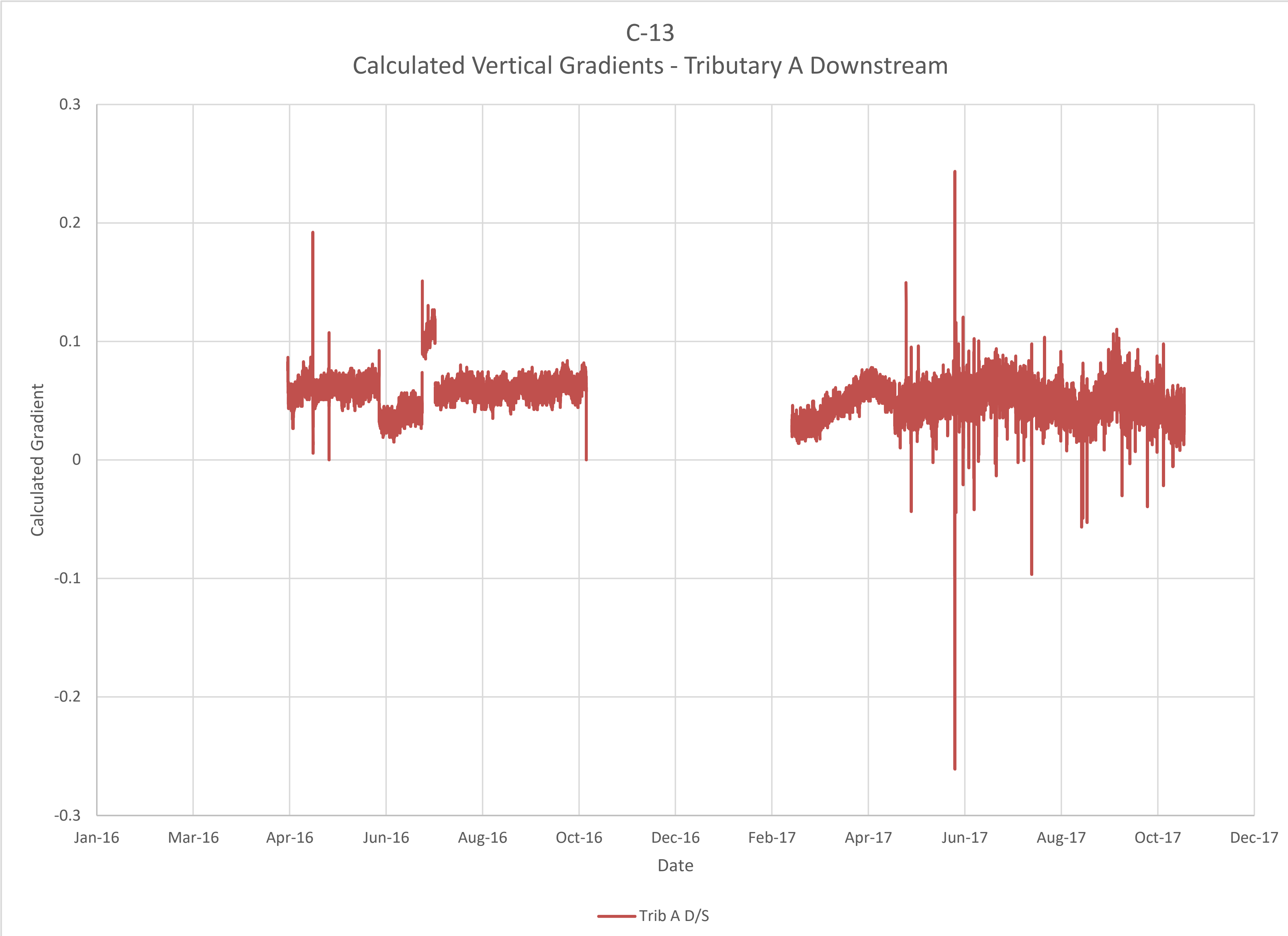
Figure C-11 Township of Clearview - Sideroad 26/27
Surfacewater Comparison : Temperature Graph



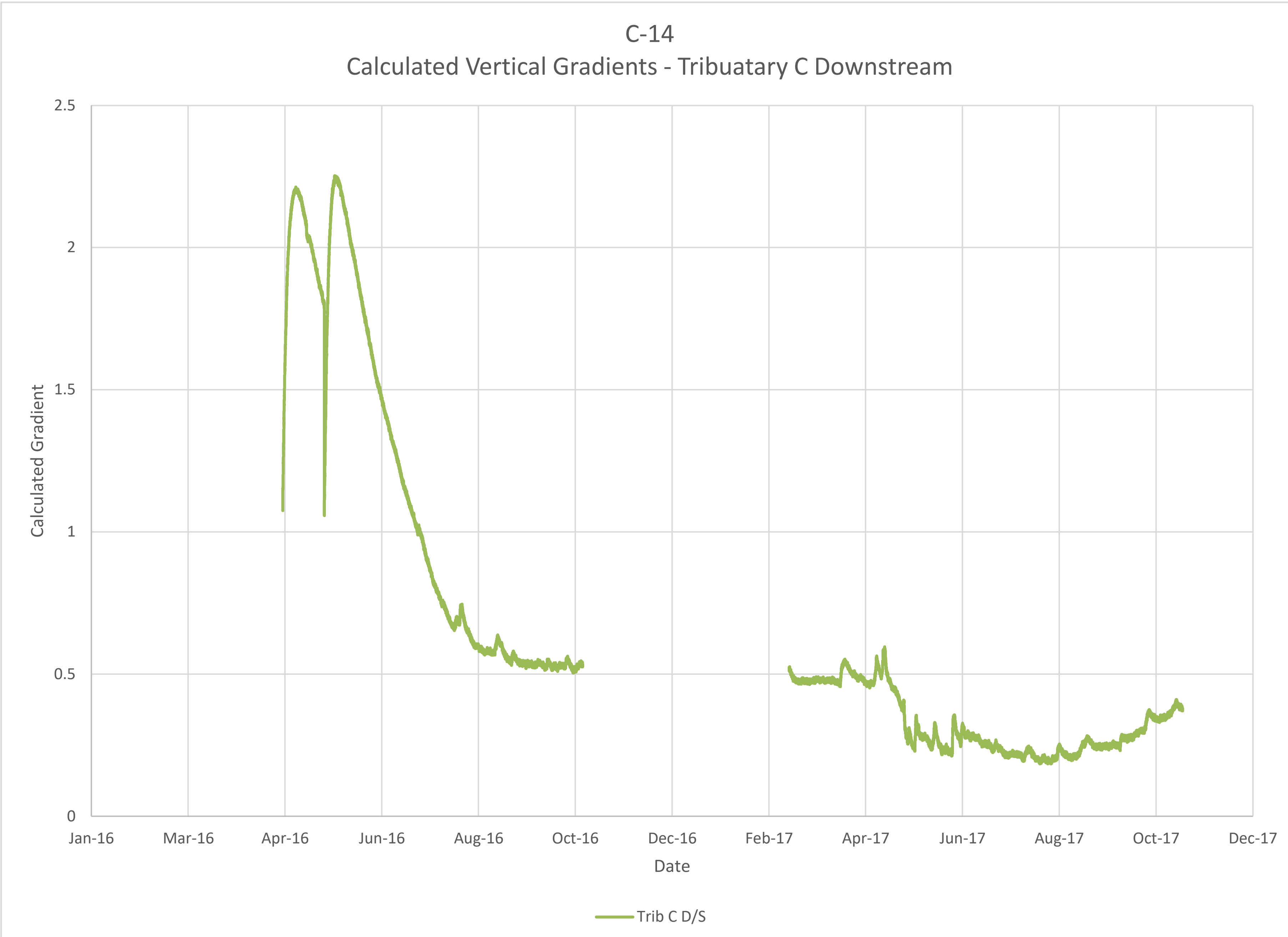
Prepared By: S.Q.
Printed On: 7/13/2018
File: 034587 Temperature graphs/C-11 Trib C Temp Graph

Township of Clearview
Sideroad 26/27
Project No.: 300034587


C-12
Calculated Vertical Gradients - Tribruary A Upstream
2016 Data Anomalous - See
Calculated Gradient
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
Jan-16
Mar-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
Jun-17
Aug-17
Oct-17
Dec-17
Date
Trib A U/S



C-13
Calculated Vertical Gradients - Tributary A Downstream
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
Calculated Gradient
Jan-16
Mar-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
Jun-17
Aug-17
Oct-17
Dec-17
Date
Trib A D/S


C-14
Calculated Vertical Gradients - Tribuatary C Downstream
Calculated Gradient
2.5
2
1.5
1
0.5
0
Jan-16
Mar-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
Jun-17
Aug-17
Oct-17
Dec-17
Date
Trib C D/S

Appendix B

ELC Field Data Sheets and Plant List

Ontario Plant List, Newmaster 1997

1	*COMMON NAME*	*ALTERNATIVE COMMON NA*	*SCIENTIFIC NAME*	*LOCATION*	ELCCode	GlobalRank	SRank	COSEWIC Status	SARO Status	Track	Coefficient Wetness	Coefficient Conservation	SARA Schedule	SARA Status	Introduced	Weediness Index	COMMENTS
x	Agrimony Species		*Agrimonia sp*		AGR__SP												
x	Alfalfa		*Medicago sativa ssp. sativa*		MEDSASA	G?	SE5				5	0			I		
x	Alternate-leaved Dogwood		*Cornus alternifolia*		CORALTE	G5	S5				5	6					
x	American Beech		*Fagus grandifolia*		FAGGRAN	G5	S4				3	6					
x	American Willow-herb		*Epilobium ciliatum ssp. ciliatum*		EPICICI	G5	S5				3	3					
x	Ash Species		*Fraxinus sp*		FRX__SP												
x	Avens Species		*Geum sp*		GEU__SP												
x	Brome)		*Bromus inermis ssp. inermis*		BROININ	G4G5	SE5				5				I		
x	Balsam Fir		*Abies balsamea*		ABIBALS	G5	S5			N	-3	5					
x	Balsam Poplar		*Populus balsamifera ssp. balsamifera*		POPBABA	G5	S5				-3	4					
x	Balsam Willow		*Salix pyrifolia*		SALPYRI	G5	S5				-4	10					
x	Baneberry Species		*Actaea sp*		ACT__SP												
x	Basswood		*Tilia americana*		TILAMER	G5	S5				3	4					
x	Bay-leaved Willow		*Salix pentandra*		SALPENT	G?	SE2				5	0			I		
x	Beaked Sedge		*Carex rostrata*			G5	S4?			N							
x	Beard-tongue Species		*Penstemon sp*		PEN__SP												
x	Bedstraw Species		*Galium sp*		GAL__SP												
x	Beggar-ticks Species		*Bidens sp*		BID__SP												
x	Bent Grass Species		*Agrostis sp*		AGO__SP												
x	Bindweed Species		*Calystegia sp*		CAS__SP												
x	Bird's-foot Trefoil		*Lotus corniculatus*		LOTCORN	G?	SE5				1	0			I		
x	Bittersweet Nightshade		*Solanum dulcamara*		SOLDULC	G?	SE5				0	0			I		
x	Black Ash		*Fraxinus nigra*		FRANIGR	G5	S5				-4	7					
x	Black Cherry		*Prunus serotina*		PRUSERO	G5	S5				3	3					
x	Black Raspberry		*Rubus occidentalis*		RUBOCCI	G5	S5				5	2					
x	Black-eyed Susan		*Rudbeckia hirta*		RUDHIRT	G5	S5				3	0					
x	Bladder Campion		*Silene latifolia*		SILLATI	G?	SE5				5	0			I		
x	Blue Cohosh		*Caulophyllum thalictroides*		CAUTHAL	G5	S5				5	6					
x	Blue Grass Species		*Poa sp*		POA__SP												
x	Blue Vervain		*Verbena hastata*		VERHAST	G5	S5				-4	4					
x	Bluebead Lily		*Clintonia borealis*		CLIBORE	G5	S5				-1	7					
x	Box Elder	Manitoba Maple	*Acer negundo*		ACENEGU	G5	S5				-2	0					
x	Bristly Greenbrier		*Smilax hispida*		SMIHISP	G5Q	S4				0	6					
x	Broad-leaved Cattail		*Typha latifolia*		TYPLATI	G5	S5				-5	3					
x	Bull Thistle		*Cirsium vulgare*		CIRVULG	G5	SE5				4	0			I		
x	Bulrush Species		*Scirpus sp*		SCI__SP												

Ontario Plant List, Newmaster 1997

1	*COMMON NAME*	*ALTERNATIVE COMMON N*	*SCIENTIFIC NAME*	*LOCATION*	ELCCode	GlobalRank	SRank	COSEWIC Status	SARO Status	Track	Coefficient Wetness	Coefficient Conservation	SARA Schedule	SARA Status	Introduced	Weediness Index	COMMENTS
x	Burdock Species		*Arctium sp*		ARC__SP												
x	Bur-reed Species		*Sparganium sp*		SPA__SP												
x	Butter-and-eggs		*Linaria vulgaris*		LINVULG	G?	SE5				5	0			I		
x	Buttercup Species		*Ranunculus sp*		RAN__SP												
x	Butternut		*Juglans cinerea*	*ON,QC,NB*	JUGCINE	G4	S3?	END	END		2	6	1	END			
x	Canada Anemone		*Anemone canadensis*		ANECANA	G5	S5				-3	3					
x	Canada Blue Grass		*Poa compressa*		POACOMP	G?	SE5				2	0					
x	Canada Blue-joint		*Calamagrostis canadensis*		CALCANA	G5	S5				-5	4					
x	Canada Enchanter's Nightshade		*Circaea lutetiana ssp. canadensis*		CIRLUCA	G5	S5				3	3					
x	Canada Goldenrod		*Solidago canadensis*		SOLCANA	G5	S5				3	1					
x	Canada Mayflower		*Maianthemum canadense*		MAICANA	G5	S5				0	5					
x	Canada Milkvetch		*Astragalus canadensis*		ASTCANA	G5	S4				-1	8					
x	Canada Thistle		*Cirsium arvense*		CIRARVE	G?	SE5				3	0			I		
x	Canada Wild Rye		*Elymus canadensis*		ELYCANA	G5	S4S5				1	8					
x	Canary Grass		*Phalaris canariensis*		PHACANA	G?	SE2				3	0			I		
x	Celandine		*Chelidonium majus*		CHEMAJU	G?	SE5				5	0			I		
x	Chicory		*Cichorium intybus*		CICINTY	G?	SE5				5	0			I		
x	Choke Cherry		*Prunus virginiana ssp. virginiana*		PRUVIVI	G5	S5				1	2					
x	Cinquefoil Species		*Potentilla sp*		POE__SP												
x	Clover Species		*Trifolium sp*		TRF__SP												
x	Coltsfoot		*Tussilago farfara*		TUSFARF	G?	SE5				3	0			I		
x	Common Apple		*Malus pumila*		MALPUMI	G5	SE5				5	0			I		
x	Common Blackberry		*Rubus allegheniensis*		RUBALLE	G5	S5				2	2					
x	Common Boneset		*Eupatorium perfoliatum*		EUPPERF	G5	S5				-4	2					
x	Common Buckthorn		*Rhamnus cathartica*		RHACATH	G?	SE5				3	0			I		
x	Common Burdock		*Arctium minus ssp. minus*		ARCMIMI	G?	SE5								I		
x	Common Dandelion		*Taraxacum officinale*		TAROFFI	G5	SE5				3	0			I		
x	Common Mullein		*Verbascum thapsus*		VERTHAP	G?	SE5				5	0			I		
x	Common Plantain		*Plantago major*		PLAMAJO	G5	SE5				-1	0			I		
x	Common Reed		*Phragmites australis*		PHRAUST	G5	S5				-4	0					
x	Common St. John's-wort		*Hypericum perforatum*		HYPPERF	G?	SE5				5	0			I		
x	Common Strawberry		*Fragaria virginiana ssp. virginiana*		FRAVIVI	G5	SU				1	2					

Ontario Plant List, Newmaster 1997

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x	Common Teasel		*Dipsacus fullonum ssp. sylvestris*		DIPFUSY	G?	SE5				5	0			I		
x	Common Vetch		*Vicia sativa ssp. nigra*		VICSANI	G?	SE5				4	0			I		
x	Common Yarrow		*Achillea millefolium ssp. millefolium*		ACHMIMI	G5T5?	SNA			N	3				I		
x	Cow Vetch		*Vicia cracca*		VICCRAC	G?	SE5				5	0			I		
x	Crabapple Species		*Malus sp*		MAU__SP												
x	Daisy Fleabane		*Erigeron annuus*		ERIANNU	G5	S5				1	0					
x	Dock Species		*Rumex sp*		RUM__SP												
x	Dutchman's-breeches		*Dicentra cucullaria*		DICCUCU	G5	S5				5	6					
x	Dwarf Enchanter's Nightshade		*Circaea alpina*		CIRALPI	G5	S5				-3	6					
x	Early Meadow-rue		*Thalictrum dioicum*		THADIOI	G5	S5				2	5					
x	Eastern Hemlock		*Tsuga canadensis*		TSUCANA	G5	S5				3	7					
x	Eastern White Cedar		*Thuja occidentalis*		THUOCCI	G5	S5				-3	4					
x	Eastern White Pine		*Pinus strobus*		PINSTRO	G5	S5				3	4					
x	Elecampane		*Inula helenium*		INUHELE	G?	SE5				5	0			I		
x	Enchanter's Nightshade Species		*Circaea sp*		CIR__SP												
x	European White Birch		*Betula pendula*		BETPEND	G?	SE4				-4				I		
x	Fescue Species		*Festuca sp*		FES__SP												
x	Field Horsetail		*Equisetum arvense*		EQUARVE	G5	S5				0	0					
x	Fleabane Species		*Erigeron sp*		ERI__SP												
x	Forget-me-not Species		*Myosotis sp*		MYO__SP												
x	Fowl Blue Grass		*Poa palustris*		POAPALU	G5	S5				-4	5					
x	Fowl Manna Grass		*Glyceria striata*		GLYSTRI	G5	S5				-5	3					
x	Fragrant Bedstraw		*Galium triflorum*		GALTRIL	G5	S5				2	4					
x	Fringed Loosestrife		*Lysimachia ciliata*		LYSCILI	G5	S5				-3	4					
x	Garlic Mustard		*Alliaria petiolata*		ALLPETI	G?	SE5				0				I		
x	Glaucous Honeysuckle		*Lonicera dioica*		LONDIOI	G5	S5				3	5					
x	Hardstem Bulrush		*Scirpus acutus*		SCIACUT	G5	S5				-5	6					
x	Hawkweed Species		*Hieracium sp*		HIE__SP												
x	Hawthorn Species		*Crataegus sp*		CRA__SP												
x	Heal-all		*Prunella vulgaris ssp. lanceolata*		PRUVULA	G5	S5				5	5					
x	Helleborine	Eastern Helleborine	*Epipactis helleborine*		EPIHELL	GNR	SNA			N	5				I		
x	Herb Robert		*Geranium robertianum*		GERROBE	G5	SE5				5	0			I		
x	Honeysuckle Species		*Lonicera sp*		LON__SP												
x	Hop Hornbeam		*Ostrya virginiana*		OSTVIRG	G5	S5				4	4					
x	Horsetail Species		*Equisetum sp*		EQU__SP												

Ontario Plant List, Newmaster 1997

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x	Jack-in-the-pulpit		*Arisaema triphyllum ssp. triphyllum*		ARITRTR	G5	S5										
x	Joe-pye-weed Species		*Eupatorium sp*		EUP__SP												
x	Kentucky Blue Grass		*Poa pratensis ssp. pratensis*		POAPRPR	G?	S5				1	0					
x	Lady Fern Species		*Athyrium sp*		ATH__SP												
x	Large-leaved Avens		*Geum macrophyllum*		GEUMACR	G5	S5				-4	9					
x	Little Green Sedge	Greenish Sedge	*Carex viridula*		CARVIRI	G5	S5			N	-5	5					
x	Loosestrife Species		*Lysimachia sp*		LYS__SP												
x	Manna Grass Species		*Glyceria sp*		GLY__SP												
x	Marsh Horsetail		*Equisetum palustre*		EQUPALU	G5	S5				-3	10					
x	Marsh Marigold		*Caltha palustris*		CALPALU	G5	S5				-5	5					
x	Mayapple		*Podophyllum peltatum*		PODPELT	G5	S5				3	5					
x	Meadow Horsetail		*Equisetum pratense*		EQUPRAT	G5	S5				-3	8					
x	Meadow-rue Species		*Thalictrum sp*		THA__SP												
x	Meadowsweet Species		*Spiraea sp*		SPR__SP												
x	Mint Species		*Mentha sp*		MEN__SP												
x	Motherwort		*Leonurus cardiaca ssp. cardiaca*		LEOCACA	G?	SE5				5	0			I		
x	Narrow-leaved Cattail		*Typha angustifolia*		TYPANGU	G5	SE5				-5	3					
x	Narrow-leaved Meadowsweet		*Spiraea alba*		SPIALBA	G5	S5				-4	3					
x	Nettle Species		*Urtica sp*		URT__SP												
x	Nightshade Species		*Solanum sp*		SOA__SP												
x	Osmunda Species		*Osmunda sp*		OSU__SP												
x	Ostrich Fern		*Matteuccia struthiopteris var. pensylvanica*		MATSTPE	G5	S5				-3	5					
x	Ox-eye Daisy		*Chrysanthemum leucanthemum*		CHRLEUC	G?	SE5				5	0			I		
x	Panic Grass		*Panicum columbianum var. siccanum*		PANCOSI	G5	S4				5	6					
x	Panic Grass Species		*Panicum sp*		PAN__SP												
x	Paper Birch (White Birch)		*Betula papyrifera*		BETPAPY	G5	S5				2	2					
x	Prickly Gooseberry		*Ribes cynosbati*		RIBCYNO	G5	S5				5	4					
x	Red Baneberry		*Actaea rubra*		ACTRUBR	G5	S5			N	5	5					
x	Red Clover		*Trifolium pratense*		TRIPRAT	G?	SE5				2	0			I		
x	Red Maple		*Acer rubrum*		ACERUBR	G5	S5			N	0	4					
x	Red Pine		*Pinus resinosa*		PINRESI	G5	S5				3	8					
x	Red Raspberry		*Rubus idaeus ssp. idaeus*		RUBIDID	G5	SE1				5	0			I		
x	Red Trillium		*Trillium erectum*		TRIEREC	G5	S5				1	6					
x	Red-osier Dogwood		*Cornus stolonifera*		CORSTOL	G5	S5				-3	2					
x	Reed Canary Grass		*Phalaris arundinacea*		PHAARUN	G5	S5				-4	0					
x	Reed Grass Species		*Calamagrostis sp*		CAA__SP												
x	Riverbank Grape		*Vitis riparia*		VITRIPA	G5	S5				-2	0					

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x	Rubus Species		*Rubus sp*		RUB__SP												
x	Running Strawberry-bush		*Euonymus obovata*		EUOOBOV	G5	S5				5	6					
x	Sedge Species		*Carex sp*		CAR__SP												
x	Selfheal		*Prunella vulgaris ssp. vulgaris*		PRUVUVU	G5	SE3				0	0			I		
x	Sensitive Fern		*Onoclea sensibilis*		ONOSENS	G5	S5				-3	4					
x	Silky Dogwood		*Cornus amomum ssp. obliqua*		CORAMOB	G5	S5				-4	5					
x	Silver Maple		*Acer saccharinum*		ACESACC	G5	S5			N	-3	5					
x	Solomon's Seal Species		*Polygonatum sp*		POM__SP												
x	Spotted Joe-pye-weed		*Eupatorium maculatum ssp. maculatum*		EUPMAMA	G5	S5				-5	3					
x	Spotted Touch-me-not		*Impatiens capensis*		IMPCAPE	G5	S5				-3	4					
x	Spring Beauty Species		*Claytonia sp*		CLA__SP												
x	Staghorn Sumac		*Rhus typhina*		RHUTYPH	G5	S5				5	1					
x	Strawberry Species		*Fragaria sp*		FRA__SP												
x	Sugar Maple		*Acer saccharum ssp. saccharum*		ACESASA	G5T5	S5			N	3	4					
x	Swamp Red Currant		*Ribes triste*		RIBTRIS	G5	S5				-5	6					
x	Sweetflag	Calamus	*Acorus calamus*		ACOCALA	G4?	SNA			N	-5				I		
x	Tall Meadow-rue		*Thalictrum pubescens*		THAPUBE	G5	S5				-2	5					
x	Tamarack		*Larix laricina*		LARLARI	G5	S5				-3	7					
x	Tartarian Honeysuckle		*Lonicera tatarica*		LONTATA	G?	SE5				3	0			I		
x	Thistle Species		*Cirsium sp*		CIS__SP												
x	Three-seeded Sedge		*Carex trisperma*		CARTRIS	G5	S5				-5	9					
x	Timothy		*Phleum pratense*		PHLPRAT	G?	SE5				3	0			I		
x	Trembling Aspen		*Populus tremuloides*		POPTREM	G5	S5				0	2					
x	Trillium Species		*Trillium sp*		TRI__SP												
x	Trout Lily Species		*Erythronium sp*		ERT__SP												
x	Tussock Sedge		*Carex stricta*		CARSTRI	G5	S5			N	-5	4					
x	Violet Species		*Viola sp*		VIO__SP												
x	Viper's Bugloss		*Echium vulgare*		ECHVULG	G?	SE5				5	0			I		
x	Virginia Creeper		*Parthenocissus quinquefolia*		PARQUIN	G5	S4?				1	6					
x	Virginia Spring Beauty		*Claytonia virginica*		CLAVIRG	G5	S5				3	5					
x	Water Horsetail		*Equisetum fluviatile*		EQUFLUV	G5	S5				-5	7					
x	Water Smartweed		*Polygonum amphibium*		POLAMPH	G5	S5				-5	5					
x	Water-cress		*Nasturtium officinale*		NASOFFI	G?	SE				-5	0			I		
x	White Ash		*Fraxinus americana*		FRAAMER	G5	S5				3	4					
x	White Avens		*Geum canadense*		GEUCANA	G5	S5				0	3					

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x	White Baneberry		*Actaea pachypoda*		ACTPACH	G5	S5			N	5	6					
x	White Clover		*Trifolium repens*		TRIREPE	G?	SE5				2	0			I		
x	White Elm		*Ulmus americana*		ULMAMER	G5?	S5				-2	3					
x	White Lettuce		*Prenanthes alba*		PREALBA	G5	S5				3	6					
x	White Snakeroot		*Eupatorium rugosum*		EUPRUGO	G5	S5				3	5					
x	White Spruce		*Picea glauca*		PICGLAU	G5	S5				3	6					
x	White Trillium		*Trillium grandiflorum*		TRIGRAN	G5	S5				5	5					
x	White Willow		*Salix alba*		SALALBA	G5	SE4				-3	0			I		
x	Wild Carrot		*Daucus carota*		DAUCARO	G?	SE5				5	0			I		
x	Wild Columbine		*Aquilegia canadensis*		AQUCANA	G5	S5				1	5					
x	Wild Mint		*Mentha arvensis ssp. borealis*		MENARBO	G5	S5				-3	3					
x	Wild Sarsaparilla		*Aralia nudicaulis*		ARANUDI	G5	S5				3	4					
x	Willow Species		*Salix sp*		SAL__SP												
x	Willow-herb Species		*Epilobium sp*		EPI__SP												
x	Wood Fern Species		*Dryopteris sp*		DRY__SP												
x	Woodland Horsetail		*Equisetum sylvaticum*		EQUSYLV	G5	S5				-3	7					
x	Yellow Avens		*Geum aleppicum*		GEUALEP	G5	S5				-1	2					
x	Yellow Birch		*Betula alleghaniensis*		BETALLE	G5	S5				0	6					
x	Yellow Sedge		*Carex flava*		CARFLAV	G5	S5			N	-5	5					
x	Yellow Trout Lily		*Erythronium americanum ssp. americanum*		ERYAMAM	G5	S5				5	5					

updated in 2013 from emails

1		**Rank Definitions**
1		
1	***SRANK***	
1	**Extirpated**—Species or	**SX**
1	**(Historical)**—The NH or SH	**SH**
	rarity (often 5 or fewer	**S1**
1	occurrences) or because of	
1	restricted range, very few	**S2**
	restricted range, relatively few	**S3**
1	populations (often 80 or fewer),	
1	**Secure**—Uncommon but not	**S4**
1	widespread, and abundant in	**S5**
1	state/province conservation	**SNR**
1	unrankable due to lack of	**SU**
1	conservation status rank is not	**SNA**
	indicate any range of	**S#S#**
1	uncertainty about the status of	
1	the province only in a cultivated	**C**
1	a ranking, Rank Uncertain (e.g.	**S?**
1	casual occurrence in the	**SA**

Ontario Plant List, Newmaster 1997

1	COMMON NAME	ALTERNATIVE COMMON NA	SCIENTIFIC NAME	LOCATIO N	ELCCode	GlobalRank	SRank	COSEWIC Status	SARO Status	Track	Coefficient Wetness	Coefficient Conservation	SARA Schedule	SARA Status	Introduced	Weediness Index	COMMENTS
1	**Breeding accidental.**		SAB														
1	**Non-breeding accidental.**		SAN														
1	native component of Ontario's		SE														
1	without persuasive		SR														
1	**Reported falsely from Ontario.**		SRF														
1	**Ontario,** with little likelihood of		SX														
1	migrants, winter vagrants, and eruptive species, too transitory		SZ														
1	**Breeding migrants/vagrants.**		SZB														
1	**Non-breeding migrants/vagrants.**		SZN														
1																	
1	***OESA Status***																
1	species that is at risk of extinction or extirpation		END														
1	no longer existing in the wild in		EXP														
1	native to Ontario that no longer		EXT														
1	species for which there is		IND														
1	**Category**. Any native species		NIAC														
1	species that is at risk of		THR														
1	that, on the basis of the best available scientific evidence, is		VUL														
1																	
1	***SARA Status***																
1	imminent extirpation or		END														
1	longer existing in the wild in		EXP														
1	longer exists.		EXT														
1	which there is insufficient		IND														
1	been evaluated and found to be		NAR														
1	special concern particularly		SC														
1	become endangered if nothing		THR														

ELC Community Summary Sheet	Polygon #	1

Project #: 3000 34587 Project Name: 26/27 SR Clearview Surveyor(s): NS/ PD/ DD Date: June/July 2016

Polygon Description

Community Series:	Ecosite:	Vegetation Type:
Deciduous Swamp	Mineral Deciduous Swamp	SWDM 4-3 W.Birch Poplar Mineral Deciduous Swamp.

System:	Topographic Feature:	Dominant Plant Form:
Terrestrial / Wetland / Aquatic	Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed

Cover:	History:	Community Class:
Open / Shrub / Treed	Natural / Cultural	Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			Soil Analysis	
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		Basal Area (m2/ha):	Soil Drainage: V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor	
Standing Snags: Rare / Occasional / Abundant / Dominant			Soil Moisture Regime: Dry / Fresh / Moist / Wet	
Deadfall Logs: Rare / Occasional / Abundant / Dominant			Effective Soil Texture: SiL w/ some Org.	
Health L / M / H	Sensitivity L / M / H	Botanical Quality L / M / H	Depth to Mottles / Gley Sample 1 M - 20 cm / G - cm, Sample 2 M - 17 cm / G - cm	
Slope: None / Gentle / Moderate / Steep Simple / Complex			Depth to G. Water: @ m At surface / <1m / >1m	Depth to Bedrock: @ m At surface / <1m / >1m

Vegetation Layer		Height	Cover	Dominant Sp. Per Vegetation Layer
1	Canopy			BETUPAP >> ULMUAME = FRAX SP.
2	Subcanopy			BETUPAP = POPUTRE = POPUBAL
3	Understorey			BETUPAP = POPUBAL > CORNSER
4	Groundlayer			TYPHANG = EQUIFLU

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	A	A	O	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

Mowed/ Brushed to edge of ROW (1/yr)
upland species closer to Road.
"Ditch" = Reed Canary.

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

WTDE Tracks

Comments:

Some open water pockets

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

Supplemental Plant Species List

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Polygon ID SWDM 4-3

Date

Time

Waypoint(s)

Photo(s)

Poly 1

plant species list for element # ______ | plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5	species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
BETU PAP	A	A	A					CARE VUL				O			
ULMU AME	O	O	O					CARE STI				O			
FRAX AME	O	O	O					CARE UTR				O			
FRAX NIG	O	O	O					CARE VIR				O			
SALIX sp.		O	O					EQUI ARV				O	O		
POPU BAL		A	A					TYPH ANG			A	O			
ACER RUB		O	O					TYPH LAT			O	O			
AB PICE ~~ATE~~MAR		R	R					SCIR AME			O	O			
LARI LAR	R							JUNC CAN			O	O			
BETU ALL	O	O	O					SCIR VAL			O	O			
ACER NEG		O	O					SPAR EME				O			
AB ~~[illegible]~~								POLYGON. sp.				R			
AB ~~[illegible]~~								ONOC SEN				O			
POPU TRE	A	A	A					EQUI FLU				A			
								GLYC GRAN				O			
								PHRAG. sp			O				
								PHAL ARU				O			
								EUPA MAC			O				
								ASTE sp.			O				
								GALIUM sp			O	O			
								MENT ARV				O			
AB CORN SER		O	O					CAN ANEM				O			
SALIX sp.		O	O					SOLI ALT			O				
SALI PYR		O						timothy			O				
SPIR ALB			O					polygon. sp.			O				
RIBE TRI			O					EUPA MAC			O				
RIBE CYN			O					EUPA PER			O				
								ANEM CAN				O			
								ASCL SYR				O			
								CALT PAL				O			
								CALA sp.				R			
								CALY sp.				R			
								CARE BRO				R			
								CARE CRI				R			
								CORO VAR				R			

EUPA PER R

Notes:

SW corner of 26/27 + Osprey T.L.

mowed to edge of fence line periodically.

upland grasses / Soli + Aster close to road to timothy, reed canary etc in "Ditch".

flat topography but transition close to fence WRT plants.

Some open water pockets

AB

ELC Community Summary Sheet	Polygon #	2

Project #: 3000 34587 Project Name: 26/27 S.R. Clearview Surveyor(s): NS/PD/DD Date: June/July 2016

Polygon Description

Community Series:	**Ecosite:**	**Vegetation Type:**
Mixed Swamp	Mineral Mixed Swamp	SWMM4-2 B.Ash-Conifer Mineral Mixed Swamp

System:	**Topographic Feature:**	**Dominant Plant Form:**
Terrestrial / Wetland / Aquatic	Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland / Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed

Cover:	**History:**	**Community Class:**
Open / Shrub / Treed	Natural / Cultural	Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			**Soil Analysis**
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant			**Soil Moisture Regime:** Dry / Fresh / Moist / Wet
Deadfall Logs: Rare / Occasional / Abundant / Dominant			**Effective Soil Texture:** SiL
Health L / M / H	**Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** Sample 1 M - 20 cm / G - cm, Sample 2 M - cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex			**Depth to G. Water:** @ m At surface / <1m / >1m; **Depth to Bedrock:** @ m At surface / <1m / >1m

	Vegetation Layer	Height	Cover	Dominant Sp. Per Vegetation Layer
1	Canopy			POPUTRE > FRAXNIG > THUJOCC
2	Subcanopy			THUJOCC < POPUTRE > FRAXNIG
3	Understorey			RUBUIDE = CORNSTO
4	Groundlayer			ONOCSEN = MATTSTR > CAREX SP.

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	O	A	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

Road noise - SR26/27 + Townline
- brushing w/in ROW.
- sediment from Road.

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:
main community ends @ property line
↑ invasive/non natives btwn Road + fence.

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

Polygon ID SWMM-4-2

Version: 26 June 2013

Supplemental Plant Species List

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Date

Time

Waypoint(s)

Photo(s)

Poly 2

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
POPUTRE	D	D	D				
FRAXNIG	A	A	A				
ULMUAME	O	O	O				
PICE ~~NIG~~ MAR	D	O	O				
THUJOCC		A	A				
ACERRUB		O	O				
LARILAR	R	R					
BETUALL	R	R					
POPUALL	R	R					
BETUPAP	A	O	O				
RUBUIDE		A	A				
RIBETRI		O	O				
RIBECYN		O	O				
CORNSTO		A	A				

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
ONOCSEN				D			
MATTSTR			D	D			
CARE sp			A	A			
CAREVIR			A	A			
MENTARV				A			
LYCOAME				O			
ASTEBOR			O	O			
SOLIALT			O	O			
SOLIRUG			O	O			
ASTEPUN			O	O			
PHALARU			R	R			
POAPAL			O	O			
ANEMCAN			R	R			
ASTELAT sp			O	O			
ASCLSYR			R	R			
BIDENS sp			O	O			
CALTPAL			O	O			
CALY sp			R	R			
COROVAR			O	O			
GALITRI			O	O			
GALIASP			O	O			
EUPAPER			O	O			

Notes:

Some open water!

Sloping up northward.

ELC Community Summary Sheet	Polygon #	3

Project #: 300034587 Project Name: 26/27 SR Clearview Surveyor(s): NS/DD/PP Date: June/July 2016

Polygon Description

Community Series:	Ecosite:	Vegetation Type:
Mixed Forest	Mixed Forest	FOMM4-2 Dry-Fresh W. Cedar Poplar Mixed Forest

System:	Topographic Feature:	Dominant Plant Form:
Terrestrial Wetland Aquatic	Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland / Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed

Cover:	History:	Community Class:
Open Shrub Treed	Natural Cultural	Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			Soil Analysis
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth	Basal Area (m2/ha):		Soil Drainage: V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant			Soil Moisture Regime: Dry / Fresh / Moist / Wet
Deadfall Logs: Rare / Occasional / Abundant / Dominant			Effective Soil Texture: SiL
Health L / M / H	Sensitivity L / M / H	Botanical Quality L / M / H	Depth to Mottles / Gley Sample 1 M - 60 cm / G - cm, Sample 2 M - 60 cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex			Depth to G. Water: @ m At surface / <1m / >1m; Depth to Bedrock: @ m At surface / <1m / >1m

Vegetation Layer		Height	Cover	Dominant Sp. Per Vegetation Layer
1	Canopy	2	4	POPUBAL > THUJOCC > POPUTRE
2	Subcanopy	3	3	THUJOCC > FRAXAME >> POPUBAL
3	Understorey	4	3	THUJOCC > FRAXAME > ACERSAS
4	Groundlayer			

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	A	A	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

edge disturbance @ ROW / Brushing.
Silt from Road.

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

❶ Polygon ID FoDM 4-2

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Date

Time

Waypoint(s)

Photo(s)

plant species list for element # ______ plant species list for element # ______

Notes: Poly 3

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5	species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
THUJOCC		A	A					GERAROB				A			
POPUTRE	D	A	A					ASTER sp				O			
FAGUGRA	O	O	O					TRILGRA				O			
FRAXAME	O	O	O					ANEMCAN				O			
# ACERNEG	[illegible]	O	O					ACTAPAC				O			
ACERSAS	O	O	O					ACTARUB				O			
ULMUAME	R	R	R					AGRIGRY				O			
PICEGLA	R	R	R					AGRI sp				R			
TSUGCAN	R	R	R					ALLIPET				O			
ABIEBAL	R	R	R					ALLITRI				A			
ACERRUB		O						ANEMACU				O			
BETUALL		R						AQUICAN				O			
BETUPAP		O						ARAINUD				A			
JUGLCIN	R							ARCTMIN				O			
PRUNSER	R	R						ARISTRI				O			
QUERRUB	R	R	R					ASARCAN				O			
POPUBAL	O	O	O					ASTEMAC				A			
FRAXNIG	O	O	O					ASTE sp				O			
								~~[illegible]~~ CARDDIP				O			
CORNSTO		R	O					ATHYFIL				R			
RIBECYN			O	O				CALACAN				O			
RHAMCAT			A	A				CARDIMP				O			
AMEL sp			R	O				IMPACAP				R			
CORNFOE			R	R				CAREX sp				O			
EUONOBO					R			CAULTHAL				A			
PARTQUI		O	O	O				CLINVUL				O			
PRUNVIR		R	O					INULHEL				R			
RHUSTYP			R					DAUCCAR				R			
SORBAC			R					DICECUC				R			
VIBULAN		R						DRYOCAR				O			
VITIRIP		O	O					DRYOMAR				O			
SALIX sp		O	O					ECHILOB				R			
								ECHIVUL				R			
								EQUIARV				O			
								ERIGANN				R			

❶ **Polygon ID** FODM 4-2

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Supplemental Plant Species List

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Date

Time

Waypoint(s)

Photo(s)

plant species list for element # ______ | plant species list for element # ______

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5	species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
								ERYTAME²					A		
								FRAGVIR					A		
								FRAGVES					O		
								GALIUM sp.					O		
								GERA sp.				O	O		
								GEUMALE				O	O		
								GRASS sp.				R	R		
								HIER sp				R	R		
								HYDRVIR				O			
								LACTCAN					R		
								MAIACAN					O		
								MAIA sp.				O			
								ONOCSEN				R			
								PLANMAJ					R		
								PODOPEL				O			
								POLYPUB				O			
								POLYACR				R			
								PRENALB				R			
								RANU sp.			O	O			
								SANGCAN			R	R			
								SOLADUL			R	R			
								SOLI sp.			R				
								SOLIALT			R				
								SOLIFLE			O				
								THALDIO			R				
								THALPUB			R				
								TUSSFAR				O			
								URTIDIO²			O				
								VIOL sp.			O	O			

Notes:

Poly 3

ELC Community Summary Sheet	Polygon #	4

Project #: 300034587 Project Name: 26/27 S.R. Clearview Surveyor(s): NS/DD/PJ Date: June/July 2014

Polygon Description

Community Series: Deciduous ~~Mixed~~ Forest	**Ecosite:** Mineral Deciduous Mixed Forest	**Vegetation Type:** FODM 5-8 Dry-Fresh Sugar Maple-White Ash Mineral Deciduous Forest

System: Terrestrial / Wetland / Aquatic	**Topographic Feature:** Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland / Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	**Dominant Plant Form:** Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed
Cover: Open / Shrub / Treed	**History:** Natural / Cultural	**Community Class:** Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			**Soil Analysis**
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant			**Soil Moisture Regime:** Dry / Fresh / Moist / Wet
Deadfall Logs: Rare / Occasional / Abundant / Dominant			**Effective Soil Texture:** SiL
Health L / M / H	**Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** Sample 1 M - 60 cm / G - cm, Sample 2 M - 70 cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex			**Depth to G. Water:** @ m At surface / <1m / >1m **Depth to Bedrock:** @ m At surface / <1m / >1m

	Vegetation Layer	Height	Cover	Dominant Sp. Per Vegetation Layer
1	Canopy	2	4	ACERSAC > FRAXAME > FRAX PEN
2	Subcanopy	3	3	" " "
3	Understorey	4	2	" " " = CORNSTO
4	Groundlayer	5	3	MAIACAN >> TRILRUB (mixed)

Height Codes – (1) >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – (0) None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	A	O	A	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation
edge disturbance - Road

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

❶ Polygon ID FODM 5-8

Version: 26 June 2013

Supplemental Plant Species List

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Date

Time

Waypoint(s)

Photo(s)

plant species list for element # ______

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
ACERSAC	A	A	A				
FRAXAME	A	A	A				
POPUTRE	O	O	O				
THUJOCC	R	R	R				
BETUPAP		R	R				
CARPCAR	R	R	R				
PICEGLA	R	R					
FAGUGRA		R					
ACERNEG		O	O				
OSTRVIR		R	R				
FRAXPEN	A	A	A				
FRAXNIG	O	O	O				
CORNSTO		O	O				
CORNALT		O	O				
RIBECYN		R	R				
RUBUIDA		O	O				
RUBUPUB			R				
VITIRIP		O	O				
PARTQUI		O	O				
CRATsp		O					

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
ARISTRI			O	O			
TRILGRA			O	O			
TRILRUB			A	A			
ACHIMIL			O	O			
ACTAPAC			O	O			
AGRIsp			R	R			
ACTARUB			O	O			
ALLIPET			O	O			
ALLITRI			O	O			
ANEMAME			O	O			
ANEMCAN			R	R			
AQUICAN			R	R			
ARAINUD			O	O			
ARCTMIN			O	O			
ASARCAN			R	R			
ASCLSYR			O	O			
ASTEsp			O	O			
ANTHFIL			R	R			
BRASSsp			R	R			
CALACAN			R	R			
CALYsp			R	R			
CARDDIP			O	O			
CAULTHA			O	O			
CHELMAJ			R	R			
CLINBOR			O	O			
PRUNVUL			R	R			
EPIPHEL			R	R			
DRYOCAR			R	R			
ERYTAME²			R	R			
FRAGVIR			O	O			
GERAROB			O	O			
HYDRVIR			R	R			
MAIACAN			A	A			

Notes: Heart's tongue Not Found.

Poly 4

ELC Community Summary Sheet

Polygon # 5.

Project #: 30003458? **Project Name:** 26/27 S.R. Clearview **Surveyor(s):** NS/PD/TW **Date:** June/July 2010

Polygon Description

Community Series:	**Ecosite:**	**Vegetation Type:**
Cultural	Mineral Fencerow	TAGM 5 Medium Mineral Fencerow

System:	**Topographic Feature:**	**Dominant Plant Form:**
Terrestrial / Wetland / Aquatic	Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland / Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed

Cover:	**History:**	**Community Class:**
Open / Shrub / Treed	Natural / Cultural	Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			**Soil Analysis**
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant			**Soil Moisture Regime:** Dry / Fresh / Moist / Wet
Deadfall Logs: Rare / Occasional / Abundant / Dominant			**Effective Soil Texture:**
Health L / M / H	**Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** **Sample 1** M - cm / G - cm, **Sample 2** M - cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex			**Depth to G. Water:** @ m At surface / <1m / >1m; **Depth to Bedrock:** @ m At surface / <1m / >1m

Vegetation Layer		**Height**	**Cover**	**Dominant Sp. Per Vegetation Layer**
1	Canopy			
2	Subcanopy	4	2	FRAX AME > MALUS sp = CRAT sp = ACER NEG
3	Understorey	3	3	RHAM CAT >> RUBUS ??
4	Groundlayer	2	3	SOLI ALT = ASTE sp = Grass sp

Height Codes – (1) >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – (0) None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	O	O	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

edge effects

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

❶ Polygon ID	TAGM5	Version: 20 June, 2013 **Supplemental Plant Species List**	Page 1 of 1
Date		**Waypoint(s)**	
Time		**Photo(s)**	

plant species list for element # ______

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
ACERSAC	R	R					
FRAXAME	R	O					
ULMUAME	R	R					
POPUTRE	R	R					
THUJOCC		R					
MALUS sp		O					
CRAT sp		O					
PICEGLA		R					
FAGUGRA		R					
OSTRVIR		R					
ACERNEG		O	O				
CORNALT		O	O				
RHAMCAT			A				
RUBUSTR			O				
LONITAR			R				

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
DAUCCAR			O				
ASTER sp			A				
SOLIALT			A				
LAPOCAN			O				
TARAOFF			O				
CANAANEM			O				
DIPSFUL			R				
ECHILOB			O				
INULHEL			R				
ERIGANN			O				
FRAGVIR				O			
GALIASP			O				
HESPMAT			O				
HEIRAUR			R				
HEIRCAE2			R				
GERAROB			O	O			
GEUMALE			O				
GRASS sp			A	A			
CAREX sp			O	O			
HYPEPER			O				
LINAVUL			O				

Notes: Poly 5

ELC Community Summary Sheet	**Polygon #** 6

Project #: 300034587 **Project Name:** 26/27 S.R. Clearview **Surveyor(s):** NS/DD/PP **Date:** June July 2016

Polygon Description

Community Series:	**Ecosite:**	**Vegetation Type:**
Cultural	Shrub Thicket	THDM 2-10 Apple Deciduous Shrub thicket

System:	**Topographic Feature:**	**Dominant Plant Form:**
Terrestrial / Wetland / Aquatic	Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland / Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed

Cover:	**History:**	**Community Class:**
Open / Shrub / Treed	Natural / Cultural	Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			**Soil Analysis**
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant			**Soil Moisture Regime:** Dry / Fresh / Moist / Wet
Deadfall Logs: Rare / Occasional / Abundant / Dominant			**Effective Soil Texture:**
Health L / M / H	**Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** **Sample 1** M - cm / G - cm, **Sample 2** M - cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex			**Depth to G. Water:** @ m At surface / <1m / >1m **Depth to Bedrock:** @ m At surface / <1m / >1m

Vegetation Layer		**Height**	**Cover**	**Dominant Sp. Per Vegetation Layer**
1	Canopy			
2	Subcanopy	3	3	MALU DOM > CRAT sp.
3	Understorey	4	3	RHAMCAT
4	Groundlayer	5	3	no dominant

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	O	O	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation
edge effects.

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

❶ Polygon ID THDM 2-10

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Date

Time

Waypoint(s)

Photo(s)

plant species list for element # ______ | plant species list for element # ______

Notes: Poly 6

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5	species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
POPUTRE	R	R						DAUCCAR				O			
ACERSAS	R	R						SOLIALT				O			
FRAXAME	R	R						TARAOFF				O			
OSTRVIR	R	R						ECHILOB				O			
ACERNEG		R						GALIASP				O			
								GRASS sp				O			
								HYPEPER				O			
								LINAVUL				O			
								HESPMAT				O			
								FRAGVIR				O			
								DIPSFUL				O			
								CANAANEN				O			
MALUDOM		D	A												
CRAT sp		A	A												
RHAMCAT		O	A												
CORNALT		R	R												
RUBUIDA		R	R												

ELC Community Summary Sheet	**Polygon #**	7.

Project #: 30003458 7 **Project Name:** 26/27 SR. Clearview **Surveyor(s):** NS/DD/PD **Date:** ~~June~~ July 2014

Polygon Description

Community Series: Cultural	**Ecosite:** Coniferous Plantation	**Vegetation Type:** TAGM Medium Mineral Coniferous Plantation

System: Terrestrial / Wetland / Aquatic	**Topographic Feature:** Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland / Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	**Dominant Plant Form:** Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed
Cover: Open / Shrub / Treed	**History:** Natural / Cultural	**Community Class:** Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			**Soil Analysis**	
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor	
Standing Snags: Rare / Occasional / Abundant / Dominant			**Soil Moisture Regime:** Dry / Fresh / Moist / Wet	
Deadfall Logs: Rare / Occasional / Abundant / Dominant			**Effective Soil Texture:**	
Health L / M / H	**Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** **Sample 1** M - cm / G - cm, **Sample 2** M - cm / G - cm	
Slope: None / Gentle / Moderate / Steep Simple / Complex			**Depth to G. Water:** @ m At surface / <1m / >1m	**Depth to Bedrock:** @ m At surface / <1m / >1m

Vegetation Layer		**Height**	**Cover**	**Dominant Sp. Per Vegetation Layer**
1	Canopy	3	3	PRUN RES
2	Subcanopy	3	2	PRUN RES
3	Understorey			
4	Groundlayer			

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	O	A	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

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Polygon ID TAGM1

Date

Time

Waypoint(s)

Photo(s)

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
PINURES	D	D	O				
FRAXAME		R	R				
ACERNEG		R	R				
CORNALT		R					
RHAMCAT		R					

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
GERAROB				O			
TARA OFF				O			
ERIG PEN				R			
ACHIMILL				R			

Notes:

Poly 70

ELC Community Summary Sheet

Polygon # 8

Project #: 30034587 **Project Name:** 20/27 S.R. ClearView **Surveyor(s):** NS / PD **Date:** June / July 2018

Polygon Description

Community Series: Cultural	**Ecosite:**	**Vegetation Type:** THDM 4-1 Native Deciduous Regen. Thicket

System: Terrestrial / Wetland / Aquatic	**Topographic Feature:** Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland / Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	**Dominant Plant Form:** Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed
Cover: Open / Shrub / Treed	**History:** Natural / Cultural	**Community Class:** Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description		**Soil Analysis**
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth	**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant		**Soil Moisture Regime:** Dry / Fresh / Moist / Wet
Deadfall Logs: Rare / Occasional / Abundant / Dominant		**Effective Soil Texture:** SiL
Health L / M / H · **Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** Sample 1 M- cm / G - cm, Sample 2 M- cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex		**Depth to G. Water:** @ m At surface / <1m / >1m · **Depth to Bedrock:** @ m At surface / <1m / >1m

	Vegetation Layer	Height	Cover	Dominant Sp. Per Vegetation Layer
1	Canopy	3	2	POPUTRE = FRAXAME > ACERNEG
2	Subcanopy	4	2	ACERNEG > FRAXAME
3	Understorey	5	2	RHAMCAT > ACERNEG = MALUDOM
4	Groundlayer	5	3	mixed

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	A	O	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

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❶ Polygon ID THDM 4-1

Date

Time

Waypoint(s)

Photo(s)

Notes: Poly 8

plant species list for element # ______

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
POPUTRE		R	R				
FRAX AME		R	R				
ACER NEG		R	R				
CORN ALT			O				
MALU DOM			O				
CRAT SP.			O				
RUBU STR			O				
RHAMCAT			A				

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
SOLI ALT				O			
Grass sp				O			
ASTE sp				O			
LAPOCAN				O			
TARAOFF				O			
SOLADUL				O			

ELC Community Summary Sheet	**Polygon #**	9

Project #: **Project Name:** 20127 SR Clearview **Surveyor(s):** NS/PD/TW **Date:** June/July 2016

Polygon Description

Community Series: Deciduous Swamp/Marsh	**Ecosite:** Mineral Deciduous Swamp/Mineral Meadow Marsh	**Vegetation Type:** SWDM 4-5 / MAMM 1-2/10 Poplar Mineral Decid Swamp/ Cattail Graminoid Mineral Meadow Marsh
System: Terrestrial / Wetland / Aquatic	**Topographic Feature:** Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	**Dominant Plant Form:** Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed
Cover: Open / Shrub / Treed	**History:** Natural / Cultural	**Community Class:** Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			**Soil Analysis**
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant			**Soil Moisture Regime:** Dry / Fresh / Moist / Wet
Deadfall Logs: Rare / Occasional / Abundant / Dominant			**Effective Soil Texture:** SiL / Organic
Health L / M / H	**Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** Sample 1 M - cm / G - cm, Sample 2 M - cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex			**Depth to G. Water:** @ m At surface / <1m / >1m; **Depth to Bedrock:** @ m At surface / <1m / >1m

Vegetation Layer		**Height**	**Cover**	**Dominant Sp. Per Vegetation Layer**
1	Canopy		1	POPUTRE > Willow sp. > FRAXNIG
2	Subcanopy		2	SALIX sp > POPUTRE
3	Understorey			CORNSTO > SALIX sp (PET + PYR)
4	Groundlayer			CAREX sp = EQUIARV > TYPHLAT << TYPHANG

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	O	O	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

edge road disturbance
silt

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:
groundwater - iron precipitate + NASTOFF.

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

❶ Polygon ID SWDM4-5/MAMM

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Date	1-2/10	**Waypoint(s)**	
Time		**Photo(s)**	

plant species list for element # ______ | plant species list for element # ______

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5	species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
POPUTRE	O	O	O					CAREX sp.		~~A~~	A	A	A		
POPUALL	R	R						EQUIARV			A	A			
ACERSAS²	R	R	R					EQUI				A			
ACERNEG		R	R					CAREVIR			A	A			
Salix sp.		O	O					TYPHLAT			A	A			
ACERSAC		O						TYPHANG			D	D			
~~Salix sp~~		~~O~~	~~O~~					POLYGON sp				R			
FRAXNIG		O	O					URTIDID				O			
THUJOCC		R	R					NASTOFF				O	O		
LARILAR		R						ANEMCAN				R			
POPUBAL		R						HYPEPER				R			
ULMUAME		R						IMPACAP				O			
ACER RUB		R	R					LYTHSAL				R			
[illegible]								SIUMSUA.				R			
								LYSICIL				R			
								LYSITHY				R			
								MIMURIN				R			
								CHELGLA.							
								MENTARV				A			
CORNSTO		O	O					SCUT GAL				R			
SALIPET			O					LYCOUNI				O			
SALIPYR			O					LYCOAME				A			
MYRIGAL			R					GALI sp.				O			
ALNUINC			R					ASTER sp.				O			
SPIRALB			O					BIDENS sp.				O			
RIBETRI			R	R				MUHLGLO				O			
								PHALARU				O			
								POAPAL				O			
								CAREX sp.				O			
								CAREXVIR				O			
								ELOCPAL				R			
								SCIR							

Notes: Poly 9

ELC Community Summary Sheet	Polygon #	10

Project #: 30084587 Project Name: 26/27 SR Clearview Surveyor(s): NS/TW/PD Date: June/July 2016

Polygon Description

Community Series: Deciduous Woodland	**Ecosite:** Mineral Deciduous Woodland	**Vegetation Type:** WODM 4-1 / WODM 4-3 Dry-Fresh Hawthorn-Apple / Sugar Maple Dec. Woodland

System: Terrestrial / Wetland / Aquatic	**Topographic Feature:** Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	**Dominant Plant Form:** Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed

Cover: Open / Shrub / Treed	**History:** Natural / Cultural	**Community Class:** Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			**Soil Analysis**	
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor	
Standing Snags: Rare / Occasional / Abundant / Dominant			**Soil Moisture Regime:** Dry / Fresh / Moist / Wet	
Deadfall Logs: Rare / Occasional / Abundant / Dominant			**Effective Soil Texture:**	
Health L / M / H	**Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** **Sample 1** M - cm / G - cm, **Sample 2** M - cm / G - cm	
Slope: None / Gentle / Moderate / Steep Simple / Complex			**Depth to G. Water:** @ m At surface / <1m / >1m	**Depth to Bedrock:** @ m At surface / <1m / >1m

Vegetation Layer		Height	Cover	Dominant Sp. Per Vegetation Layer
1	Canopy	2	1	ACERSAC
2	Subcanopy	2	2	POPUTRE > ACERSAC << MALUDOM > CRAT sp.
3	Understorey	3	2	MALUDOM < CRAT sp.
4	Groundlayer	4	2	Grass sp >> mixed

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	A	O	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

edge

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

Polygon ID WODM 4-1/WODM 4-3

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Photo(s)

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
ACERSAC	O	O	R				
POPUTRE	R	O	R				
ULMUAME		R	R				
OSTRVIR		R					
FRAXAME		R					
THUJOCC		R					
MALUDOM		A	O				
CRAT sp		A	A				

plant species list for element # ______

species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
SOLADUL				O			
ASTER sp.				O			
Grass sp.				O	A		
TARA OFF				O			
GERAROB				R			
LAPOCAN				R			
CAREX sp				O			

Notes:

Poly 10

ELC Community Summary Sheet	**Polygon #**	11

Project #: 300034587 **Project Name:** 26/27 SR Clearview **Surveyor(s):** NS/PD/TW **Date:** June/July 2018

Polygon Description

Community Series: Shallow Marsh	**Ecosite:** Mineral Shallow Marsh	**Vegetation Type:** MASM 1-1 Cattail Mineral Shallow Marsh

System:	**Topographic Feature:**	**Dominant Plant Form:**
Terrestrial / Wetland / Aquatic	Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed

Cover:	**History:**	**Community Class:**
Open / Shrub / Treed	Natural / Cultural	Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description		**Soil Analysis**
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth	**Basal Area (m2/ha):**	**Soil Drainage:** V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant		**Soil Moisture Regime:** Dry / Fresh / Moist / Wet
Deadfall Logs: Rare / Occasional / Abundant / Dominant		**Effective Soil Texture:** SiCL w/ Organics @ 40%
Health L / M / H · **Sensitivity** L / M / H	**Botanical Quality** L / M / H	**Depth to Mottles / Gley** Sample 1 M - 20 cm / G - cm, Sample 2 M - 18 cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex		**Depth to G. Water:** @ m At surface / <1m / >1m · **Depth to Bedrock:** @ m At surface / <1m / >1m

Vegetation Layer		**Height**	**Cover**	**Dominant Sp. Per Vegetation Layer**
1	Canopy			
2	Subcanopy			
3	Understorey	3	1	SALIPET = SPIRALB
4	Groundlayer	4	4	TYPHLAT < TYPHANG >> IMPACAP

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	O	R	R	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

edge - Road + ROW Brushing.
- No shoulder = sediment + vehicle tracks.

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:
Very adapted to road disturbance.

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

B

❶ Polygon ID MASM B-1 | Version: 26 June 2013 **Supplemental Plant Species List** | **Page** 1 **of** 2

Date Compiled - Sccel table

Time

Waypoint(s)

Photo(s)

plant species list for element # ______ | plant species list for element # ______

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5	species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
TILLAME	R	R						TYPHLAT			A				
THUJOCC	R	R						IMPACAP			A	A			
FRAXPEN		R						TYPHANG			D	D			
ACERNEG		R						EQUIARVE				A			
ULMUAME		R						MAIACAN					R		
								POLY sp.					R		
								NASTOFF					O		
								~~[illegible]~~							
								ANEMCAN					R		
								IMPACAP				O			
								LYTHSYR				R			
								EPILPAL				O			
								DECOVER				R			
								LYSICIL					R		
								MIMURIN					R		
								CHELGLA					R		
								LYCOUNI					O		
								SCUTGAL					R		
								MENTARV					O		
								ASTEBOR					R		
SALIX sp.		R	R					EUPAPER				R			
CORNSTO			R					EUPAMAC				O			
SALIPET			O					PETAFRI					R		
SALIPYR			R					SOLICAN				R			
MYRIGAL			R					MUHLGLO				O			
SPIRALB			O					PHALARU				O			
								POAPAL				O			
								PHRAAUS				R			
								GLYCER sp.				R			
								CAREVUL				R			
								CARETRI				R			
								CAREBEB				O			
								CARELAC				R			
								CAREVIR				O			
								SCIR sp.				O			

Notes:

Poly 11

EQUIFLU D

❶ **Polygon ID** MASM 1-1

Version: 26 June, 2013

Supplemental Plant Species List

Date

Time

Waypoint(s)

Photo(s)

plant species list for element # ______ | plant species list for element # ______

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5	species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
								SCIR ACU				O			
								ALIS PLA					R		
								SPAR EME					R		
								RUMEX sp				R			

Notes:

Poly 11

ELC Community Summary Sheet	Polygon #	12

Project #: 300034587 Project Name: 26/27 SR Clearview Surveyor(s): NS/DD Date: June/July 2018

Polygon Description

Community Series: Mineral Forest	Ecosite: Mixed Mineral Forest	Vegetation Type: Dry-Fresh W. Cedar Poplar Mixed Forest

System:	Topographic Feature:	Dominant Plant Form:
Terrestrial / Wetland / Aquatic	Lacustrine / Riverine / Bottomland / Terrace / Valley Slope / Tableland / Rolling Upland / Cliff / Talus / Crevice / Cave / Alvar / Rockland / Beach / Bar / Sand Dune / Bluff	Plankton / Submerged / Floating-leaved / Graminoid / Forb / Lichen / Bryophyte / Deciduous / Coniferous / Mixed

Cover:	History:	Community Class:
Open / Shrub / Treed	Natural / Cultural	Beach-Bar / Sand Dune / Bluff / Cliff / Talus / Alvar / Rock Barren / Crevice-Cave / Sand Barren / Tallgrass Prairie – Savannah & Woodland / Forest / Cultural / Swamp / Bog / Marsh / Open Water / Shallow Water

Stand Description			Soil Analysis
Community Age: Pioneer / Young / Mid-Aged / Mature / Old Growth		Basal Area (m2/ha):	Soil Drainage: V. Rapid / Rapid / Well / Moderately Well / Imperfect / Poor / V. Poor
Standing Snags: Rare / Occasional / Abundant / Dominant			Soil Moisture Regime: Dry / Fresh / Moist / Wet SiL
Deadfall Logs: Rare / Occasional / Abundant / Dominant			Effective Soil Texture: ✓
Health L / M / H	Sensitivity L / M / H	Botanical Quality L / M / H	Depth to Mottles / Gley Sample 1 M - 70 cm / G - cm, Sample 2 M - cm / G - cm
Slope: None / Gentle / Moderate / Steep Simple / Complex			Depth to G. Water: @ m At surface / <1m / >1m; Depth to Bedrock: @ m At surface / <1m / >1m

Vegetation Layer		Height	Cover	Dominant Sp. Per Vegetation Layer
1	Canopy	2	3	POPUBAL > THUJOCC
2	Subcanopy	4	3	THUJOCC > FRAXAME
3	Understorey	5	2	ACERSAS >> CORNSP
4	Groundlayer	6	1	CAULTHA > MAIACAN > Moss sp

Height Codes – **(1)** >20m, **(2)** 10-20m, **(3)** 2-10m, **(4)** 1-2m, **(5)** 0.5-1m, **(6)** 0.2-0.5m, **(7)** <0.2m
Cover Codes – **(0)** None, **(1)** 1-10%, **(2)** 10-25%, **(3)** 25-60%, **(4)** >60%

Size Class Analysis (Rare / Occasional / Abundant / Dominant)	A	A	O	R
	< 10cm DBH	10 – 24cm DBH	25 – 50cm DBH	> 50cm DBH

Evidence of Disturbance:
Tree cutting, exotic species, trails, dumping, noise, predation

Road edge.
sediment.

Wildlife / Habitat Observations:
Birds, mammals, calls, observed, dens, nests

Comments:

				Community Name	Code		% of Community
Inclusion		Complex					
Inclusion		Complex					
Inclusion		Complex					

❶ **Polygon ID** FomM42

Version: 26 June 2013 **Supplemental Plant Species List** **Page** 1 / 1

Date

Time

Waypoint(s)

Photo(s)

plant species list for element # ______ plant species list for element # ______

❷ species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5	species code	>10	2-10	0.5-2	0.5-0	0	0-0.5	>0.5
POPUBAL	D	O						MOSS sp.					A		
THUJOCC	A	D	A					CAUL THA				A			
FRAXAME		A	A					GERA ROB				O	O		
FRAXNIG		O						MAIACAN				A			
FRAXPEN		O	O					TRILGRA				O	O		
ACERSAS	O	O	A					TRILRUB					O		
PIGEMAR		R	O					CIRSARV					R		
ACERNEG		O	R					TARAOFF					R		
POPUTRE	O	O						POA sp.				O	O		
LARILAR		R						MATTSTR				R			
								ONOCSEN				R			
								IMPACAP				R			
								EQUI sp.				O			
CORNSTO		R	R												
CORNALT		R	R												
WILLOW sp		R													
RHAMCAT		R	R												
VITIRIP			R												
PARTQUI			R												

Notes: Poly 12

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

Breeding Bird Survey

WILD Canada Ecological Consulting
#75 – 39th Street North, Wasaga Beach, ON L9Z 2A3
telephone (705) 429-4936 **fax** (705) 429-1435 **web** www.wildcanada.ca

Technical Memorandum

	Date	July 23, 2014	FILE NO. 2014112
	RE	Breeding Bird Survey for 26/27 Sideroad, Township of Clearview	
To	ATTENTION	Nicholle Smith, Terrestrial Ecologist	
	COMPANY	R.J. Burnside & Associates Limited 292 Speedvale Avenue West, Unit 20 Guelph, Ontario N1H 1C4	
From	NAME	Scott Martin, Senior Ecologist / Principal WILD Canada Ecological Consulting	

Comments

In June, 2014, WILD Canada Ecological Consulting was contracted to conduct breeding bird surveys along the 26/27 Sideroad of Clearview Township, Simcoe County, from the Osprey-Clearview Townline, east to Clearview Township Concession 10, for the spring, 2014 breeding bird season. Two separate surveys were conducted, on June 30, 2014 and July 10, 2014, to best ascertain the bird species on territory and/or potentially using the area for breeding/nesting purposes.

Methodology

The surveys were conducted using "Point Counts", and were undertaken according to Ontario Breeding Bird Atlas protocols, as set out in the *Ontario Breeding Bird Atlas (OBBA) Guide for Participants* (March, 2001). Surveys began no earlier than 30 minutes prior to sunrise (dawn) and ended no later than 10:00 a.m. They were conducted within appropriate weather conditions; temperature of 10C or greater, wind no greater than 3 on the Beaufort scale, no heavy fog or current precipitation. 5-minute point counts were conducted at stations located approximately 250 metres apart.

According to the OBBA, Point Counts should be conducted at each station, a minimum of 7 days apart. The first survey was conducted on June 30, with the follow-up survey being conducted on July 10. As there were no property access permissions granted for the land on either side of Clearview Township Sideroad 26/27, and since this road is minimally-travelled, the counts were conducted from a safe location near the middle of the roadway.

Equipment

A Kestrel 3000 Pocket Weather Meter, which incorporates an anemometer, thermometer and hygrometer was used to measure the temperature and wind speed at ground level.

A Garmin Oregon 450 GPS unit was used to record the UTM coordinates of the Point Count Stations. This device was generally accurate to within 6-8 metres during these surveys.

In addition to audible songs and calls, Pentax 10x43 DCF ED binoculars were used to identify birds.

Results

A total of 47 bird species were recorded during these surveys.

Seventeen (17) species were confirmed to be on breeding territory, either through observation of fledged young or a mating pair or other appropriate signs of breeding evidence, or through the registration of territorial song on at least 2 days, a week or more apart, at the same place.

Two species recorded during these surveys are considered to be Species At Risk (SAR) in Ontario. These are the Wood Thrush *Hylocichla mustelina* (Special Concern), recorded at survey station #6 and #7, and Eastern Wood-Pewee *Contopus virens* (Special Concern), recorded at stations #3 and #6.

One SAR, Wood Thrush, was confirmed to be on breeding territory within a point count circle. This was recorded at station #6, within the 50m-100m circle from the count location.

Discussion

Clearview Township Sideroad 26/27 is a very narrow roadway with no shoulders. For the first several hundred metres, it is an all-season road. This section is still narrow enough to accurately hear and identify bird songs from the woodlands and fields on either side of the roadway. The eastern portion of the road is very narrow and is a seasonal road. For most of this portion, the tree canopy extends over all or most of the roadway. This encapsulates the surveyor within the woodland habitats and allows the birds to freely move throughout the point count station, allowing for accurate results, even from a roadway.

Appendix A

Woodland Breeding Birds Data Coding Cards

Survey #1

Survey #1

Woodland Breeding Bird Data Coding Card

pg. 1/3

Study Area: Clearview 26/27 **Parcel ID:** ______
Date: June 30/14 **Site ID:** ______
Time: 0522h → **Surveyor:** SAM **Point Numbers:** 1 – 4

Start Time	Point #	Species	Obs Code	< 50 m	50 – 100 m	Over 100 m	Flyovers
0522h	1	WTSP	S	1	2		
*		WOTH	S		1		
		NOWA	S	1			
		GCFL	S	2			
		COYE	S	1			
		AMRO	S	1			
		GRCA	S	1			
		INBU	S	1			
0535h	2	AMRO	S		2		
		RBGR	S		1		
		YRWA	S		1		
		EATO	S			1	
		SOSP	S			1	
		AMCR	X				X
		MODO	S		1		
		AMRE	S		1		
		BCCH	S	1			
		REVI	S	1			
		WTSP	S		1		
		BTNW	S	1			
0550h	3	AMCR	X				X (3)
		CHSP	S	1			
		INBU	S	1			
		SOSP	S	3			
		CEDW	S	1			
		OVBI	S	1			
		BTNW	S	1			
		YRWA	S	1			
0612h	4	NOFL	S	2	1		
		CEDW	S	1	1		
		SOSP	S	1	1		
		DOWO	S	1			
		BLJA	S	1			
		HOWR	S	1			
		INBU	S	1			

Start time: enter time point count began.

Species: use standard codes for species abbreviations.

Obs Code: enter breeding evidence according to OBBA codes.

Flyovers: place an X to denote flyovers, and/or a number to denote individuals observed in flocks.

* = SAR

Woodland Breeding Bird Data Coding Card

pg. 2/3

Study Area: Clearview 26/27 **Parcel ID:**

Date: June 30/14 **Site ID:**

Time: 0624h **Surveyor:** SAM **Point Numbers:** 5 - 9

	Start Time	Point #	Species	Obs Code	< 50 m	50 – 100 m	Over 100 m	Flyovers
	0624h	5	AMGO	X				X (2)
			COGR	X				X (6)
			RWBL	X	1			X (3)
			SOSP	S	1	2		
			SCTA	S	1			
			BHCO	S	1			
			HOWR	S	3			
			CHSP	S	1			
			MODO	S		1		
	0638h	6	OVBI	S	1	1		
			BLJA	S		1		
			BTNW	S	1	1		
*			WOTH	S	2			
			AMRO	S	1			
			AMRE	S	2			
	0704h	7	AMGO	X				X (1)
			FISP	S	1			
			AMRO	S	1			
			BHCO	S	1			
			MAWA	S		1		
			BAWW	S	1			
	0721h	8	AMGO					X (1)
			BLJA	S	1			X (1)
			FISP	S	1	1		
			SOSP	S	2			
			REVI	S	1			
*			EAWP	S	1			
	0738h	9	BHCO	S	1			
			SOSP	S	2	1		
			COYE	S	1			
			BCCH	S	3			
			COGR	H	1			
			AMRO	S	1			
			AMRE	S	1			

Start time: enter time point count began.

Species: use standard codes for species abbreviations.

Obs Code: enter breeding evidence according to OBBA codes.

Flyovers: place an X to denote flyovers, and/or a number to denote individuals observed in flocks.

* = SAR

Survey #1

Woodland Breeding Bird Data Coding Card

pg. 3/3

Study Area: Clearview 26/27 **Parcel ID:**

Date: June 30/14 **Site ID:**

Time: 0751h **Surveyor:** SAM **Point Numbers:** 10 – 11

Start Time	Point #	Species	Obs Code	< 50 m	50 – 100 m	Over 100 m	Flyovers
0751h	10	COGR	X				X (1)
		RBGR	S	1	2		
		BLJA	S	1			
		AMRO	S	1			
		WITU	S		1		
		REVI	S	1	1		
		BCCH	S	1			
		SOSP	S	1			
		GRCA	S	1			
0802h	11	AMGO	H				X (4)
		AMRO	S	1			
		CHSP	S	1			
		REVI	S	1			
		INBU	S	1			
		CSWA	S	2			
		BHVI	S	1			
		AMRE	S	1			
		NOFL	S		1		
		HOWR	S		1		
		MOWA	S		1		
		SOSP	S		1		

Start time: enter time point count began.

Species: use standard codes for species abbreviations.

Obs Code: enter breeding evidence according to OBBA codes.

Flyovers: place an X to denote flyovers, and/or a number to denote individuals observed in flocks.

Appendix B

Woodland Breeding Bird Field Collection Forms

Survey #1

Visit #1

Woodland Breeding Bird Field Collection Form

Page 1 / 2

General Information

Study Area:	26/27 Clearview	**Parcel #:**		**Site ID:**	
Date:	June 30/14	**Start time:**	0522h	**End Time:**	0807h

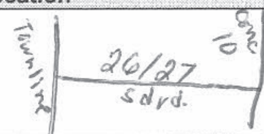
Weather Conditions:
Wind Direction: SW
Wind Scale: 2-3
Sky Condition: 1
Cloud Cover (%): 30
Temperature C: 18-20

Field Crew: SAM

Field Notes By: SAM

Site Location

26/27 Sideroad of Clearview Twp. Simcoe Cnty. From Osprey-Clearview Townline, east to Clearview Conc. 10



Point Count Locations

Easting:	558957	**Northing:**	4916022	**Number:**	1	WP034
Easting:	559187	**Northing:**	4916100	**Number:**	2	WP035
Easting:	559455	**Northing:**	4916186	**Number:**	3	WP036
Easting:	559715	**Northing:**	4916251	**Number:**	4	WP037
Easting:	559976	**Northing:**	4916338	**Number:**	5	WP038
Easting:	560264	**Northing:**	4916429	**Number:**	6	WP039

Habitat Description

Height of Vegetation (m): 8-10m

Predominant Species: Wt. Cedar, white spruce, Sugar maple, Alt. Dogwood

Description:

Photo Log

	Picture #	Description	Picture #	Description	
(2)	117-531	NW	543	W	6 (cont.)
	-532	SW	544	S	
(3)	533	NE	545	E	
	534	SE			
	535	west			
(4)	536	NE			
	537	SW			
5	538	E			
	539	S			
	540	W			
6	541	N			
	542	N			

Beaufort Wind Scale

0: 0-2 km/hr - calm, smoke rises vertically
1: 3-5 km/hr - light air movement
2: 6-11km/hr - wind felt on face, leaves rustle
3: 12-19 km/hr- leaves/small twigs in constant motion
4: 20-30 km/hr -dust / loose papers blow, small branches move
5 : 31-38 km/hr - fresh breeze - moderate branch moves
6: 39-49 km/hr - strong breeze - large branch moves

Sky Condition Indicators

0 Clear or few clouds
1 Partly cloudy
2 Cloudy (broken) or overcast
4 Fog or Smoke
5 Drizzle
7 Snow
8 Showers

Woodland Breeding Bird Field Collection Form

WILD CANADA

General Information

Study Area: 26/27 Clearview   Parcel #:   Site ID:

Date: June 28/14   Start time: 0522h   End Time: 0807h

Weather Conditions:
Wind Direction: SW   Wind Scale: 2
Sky Condition: 1   Cloud Cover (%): 10
Temperature C: 20

Field Crew: SAM

Field Notes By: SAM

Site Location

Point Count Locations

Easting:	560537	Northing:	4916516	Number:	7 / WP040
Easting:	560788	Northing:	4916596	Number:	8 / WP041
Easting:	561005	Northing:	4916663	Number:	9 / WP042
Easting:	561264	Northing:	4916739	Number:	10 / WP043
Easting:	561413	Northing:	4916779	Number:	11 / WP044
Easting:	561676	Northing:	4915420	Number:	12 / WP045

Habitat Description

Height of Vegetation (m): ~~3~~ 10-15m

Predominant Species:
White Ash, Trembling Aspen

Description:
roadside woodlots c̄ field beyond

Photo Log

	Picture #	Description	Picture #	Description	
7	117-546	S	558	W	11
	547	W	559	S	
	548	N	560	N	
8	549	S			
	550	SW			
	551	N			
9	552	SW			
	553	NW			
	554	NE			
10	555	E			
	556	S			
	557	W			

Beaufort Wind Scale

0: 0-2 km/hr - calm, smoke rises vertically
1: 3-5 km/hr - light air movement
2: 6-11km/hr - wind felt on face, leaves rustle
3: 12-19 km/hr- leaves/small twigs in constant motion
4: 20-30 km/hr -dust / loose papers blow, small branches move
5: 31-38 km/hr - fresh breeze - moderate branch moves
6: 39-49 km/hr - strong breeze - large branch moves

Sky Condition Indicators

0 Clear or few clouds
1 Partly cloudy
2 Cloudy (broken) or overcast
4 Fog or Smoke
5 Drizzle
7 Snow
8 Showers

Appendix C

Woodland Breeding Bird Station Mapping Cards

Survey #1

WOODLAND BREEDING BIRD STATION MAPPING CARD

survey 1

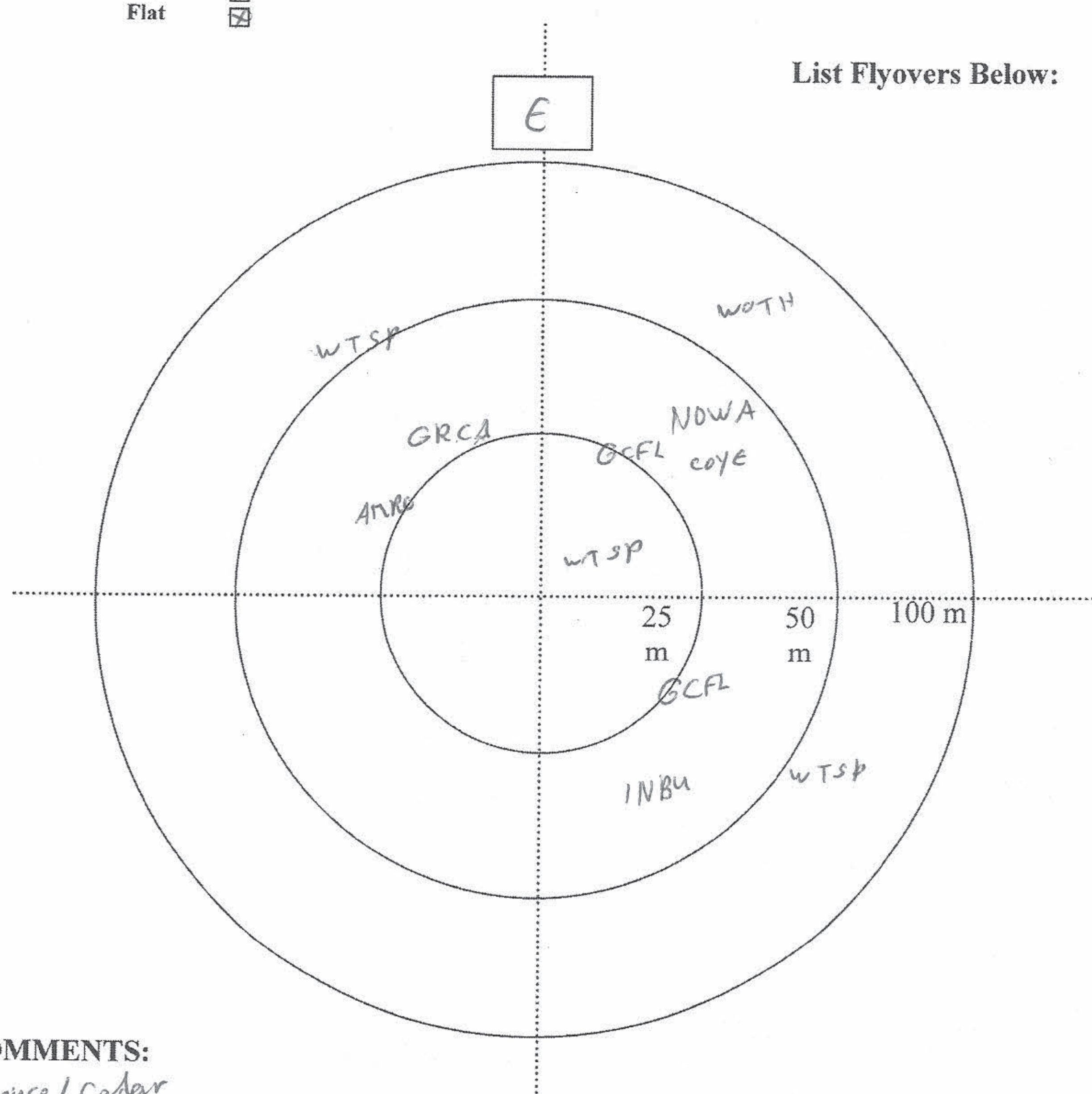
Study Area: Clearview 26/27
Date: June 30/14 **Surveyor:** SAM
Time Started: 0522 **Time Ended:** 0527
Parcel ID:
Site ID: WP034
Point Number: 1

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☐
- Flat ☒

Direction slope faces (Aspect) (ex. NE): /

List Flyovers Below:

18°C
wind = 2
cloud = 30%



COMMENTS:
Spruce/Cedar
c̄ Balsam Poplar

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
A	3	C K L	2

WOODLAND BREEDING BIRD STATION
MAPPING CARD

Survey 1

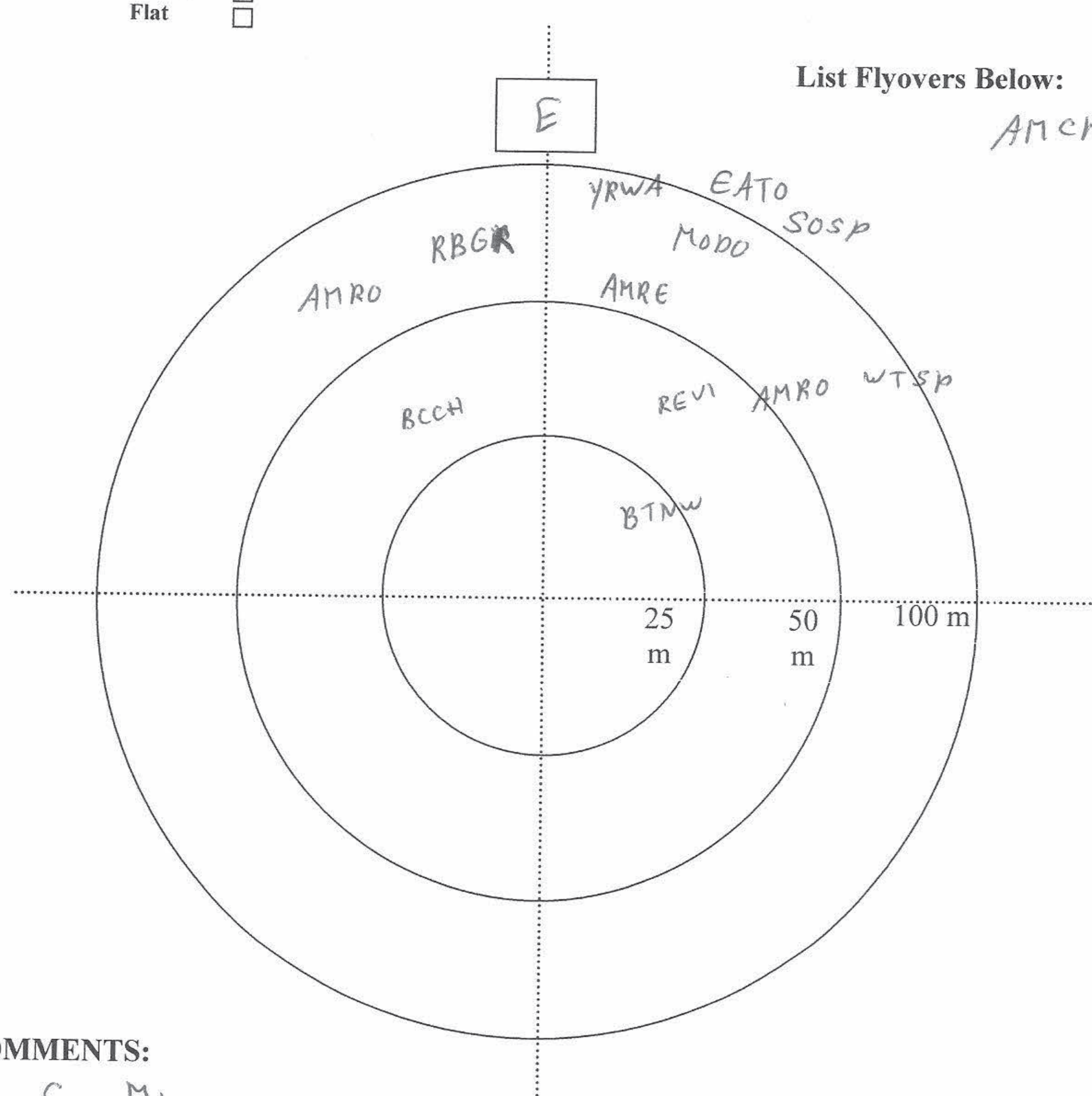
Study Area: Clearview 26/27
Parcel ID:
Date: June 30/14
Surveyor: SAM
Site ID: WP035
Time Started: 0535
Time Ended: 0540
Point Number: 2

Slope:
- **Vertical** ☐
- **Steep** ☐
- **Gentle** ☒
- **Flat** ☐

Direction slope faces (Aspect) (ex. NE): W

List Flyovers Below:

AMCR



COMMENTS:

Cw, Sw, Mh

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
~~C~~	~~1~~	~~B H~~	~~2, 8~~
A	~~$~~3	C KL	2

Woodland Breeding Bird Station Mapping Card

Study Area: Clearview 26/27

Date: June 30/14

Time Started: 0550

Surveyor: SAM

Time Ended: 0555

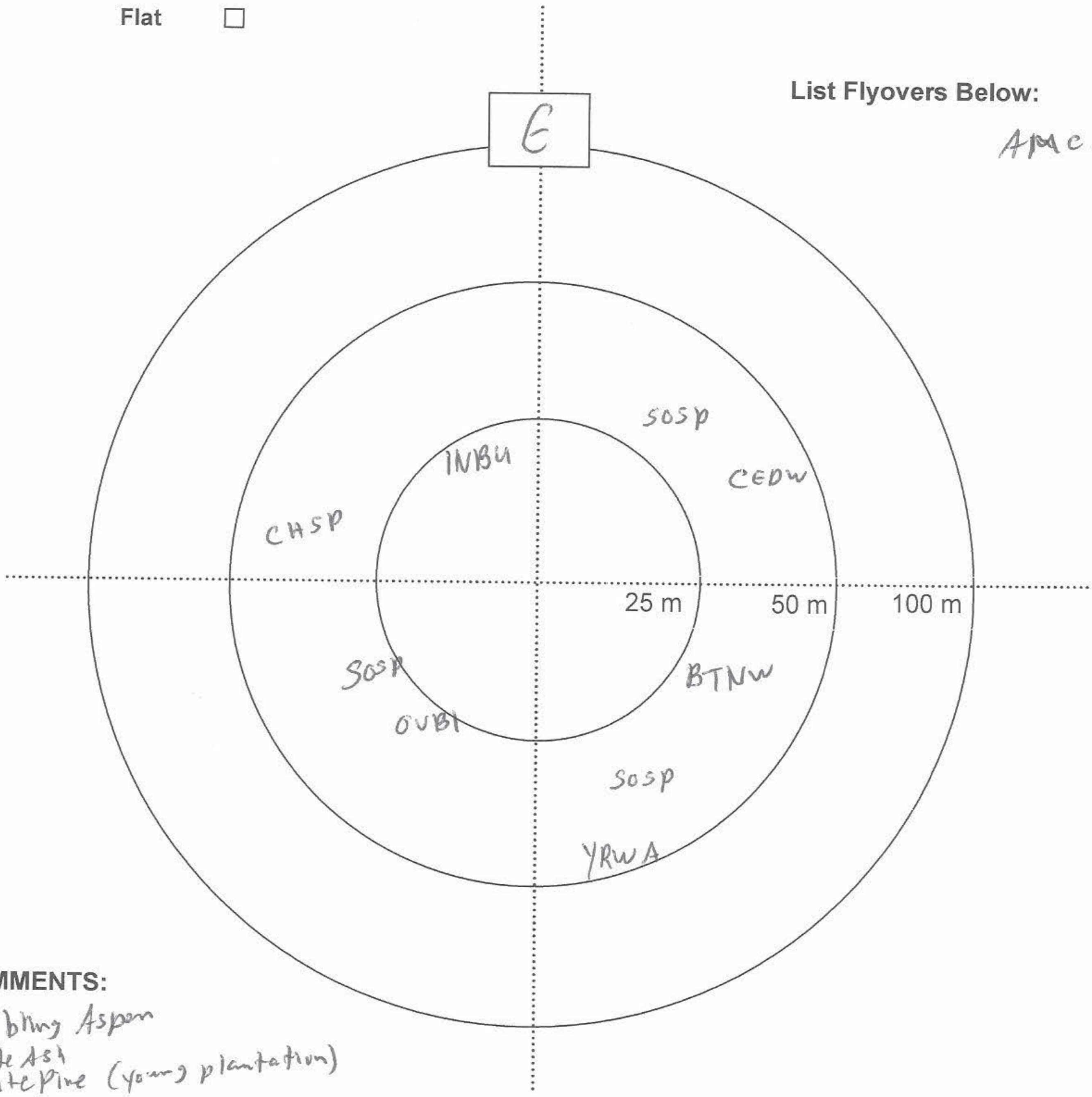
Parcel ID: Survey 1

Site ID: WP036

Point Number: 3

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E



List Flyovers Below:

AMCR III

COMMENTS:

Trembling Aspen
White Ash
White Pine (young plantation)

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
E	1	B, H	2, 8
A	1	C K L	2

WOODLAND BREEDING BIRD STATION
MAPPING CARD

Survey 1

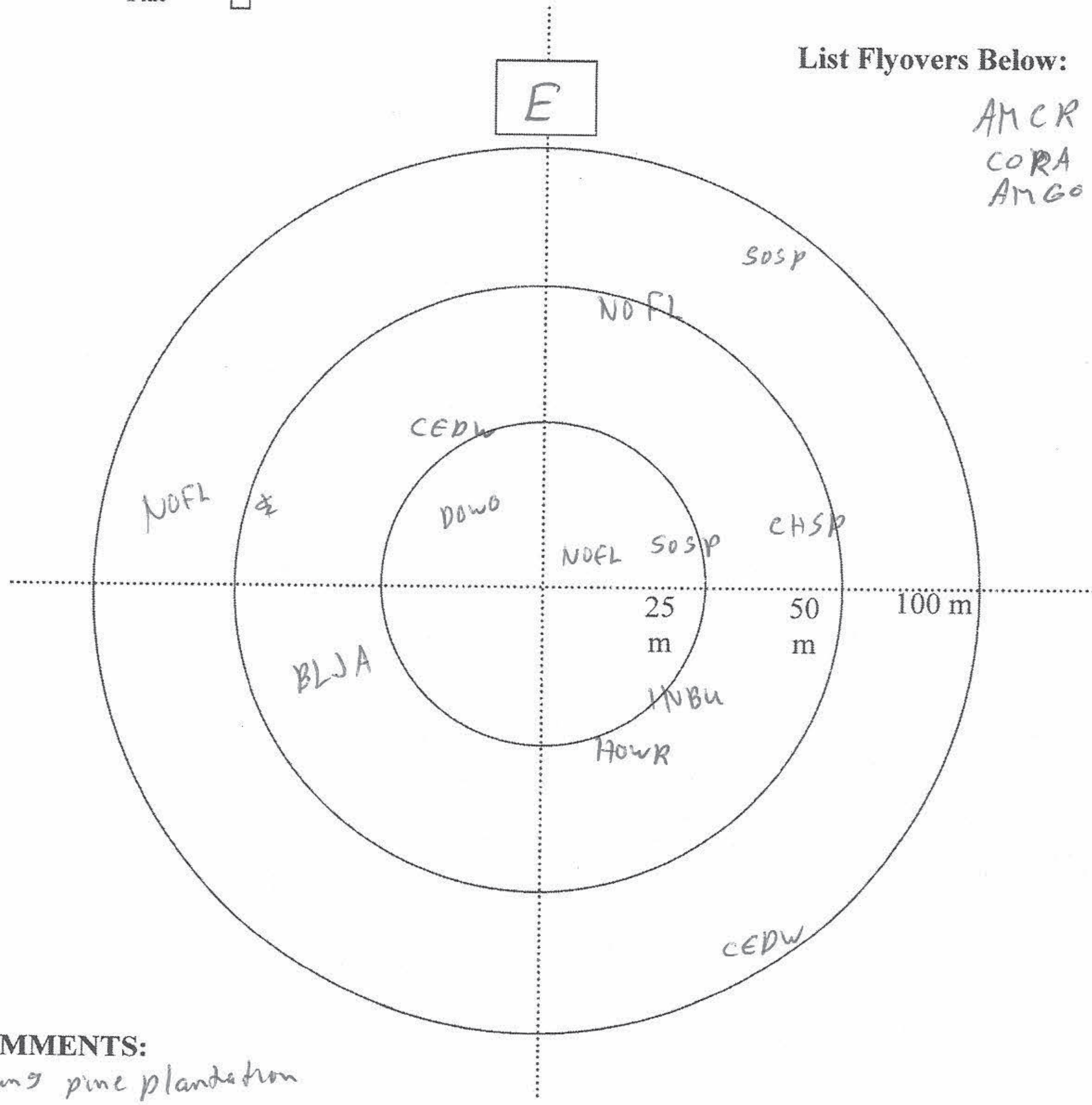
Study Area: Clearview 26/27
Date: June 30/14 **Surveyor:** SAM **Parcel ID:**
Time Started: 0612 **Time Ended:** 0617 **Site ID:** WP037
Point Number: 4

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☑
- Flat ☐

Direction slope faces (Aspect) (ex. NE): W

List Flyovers Below:

AMCR
CORA
AMGO IIII



COMMENTS:
Young pine plantation

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
A	2	A	4

WOODLAND BREEDING BIRD STATION MAPPING CARD

Survey 1

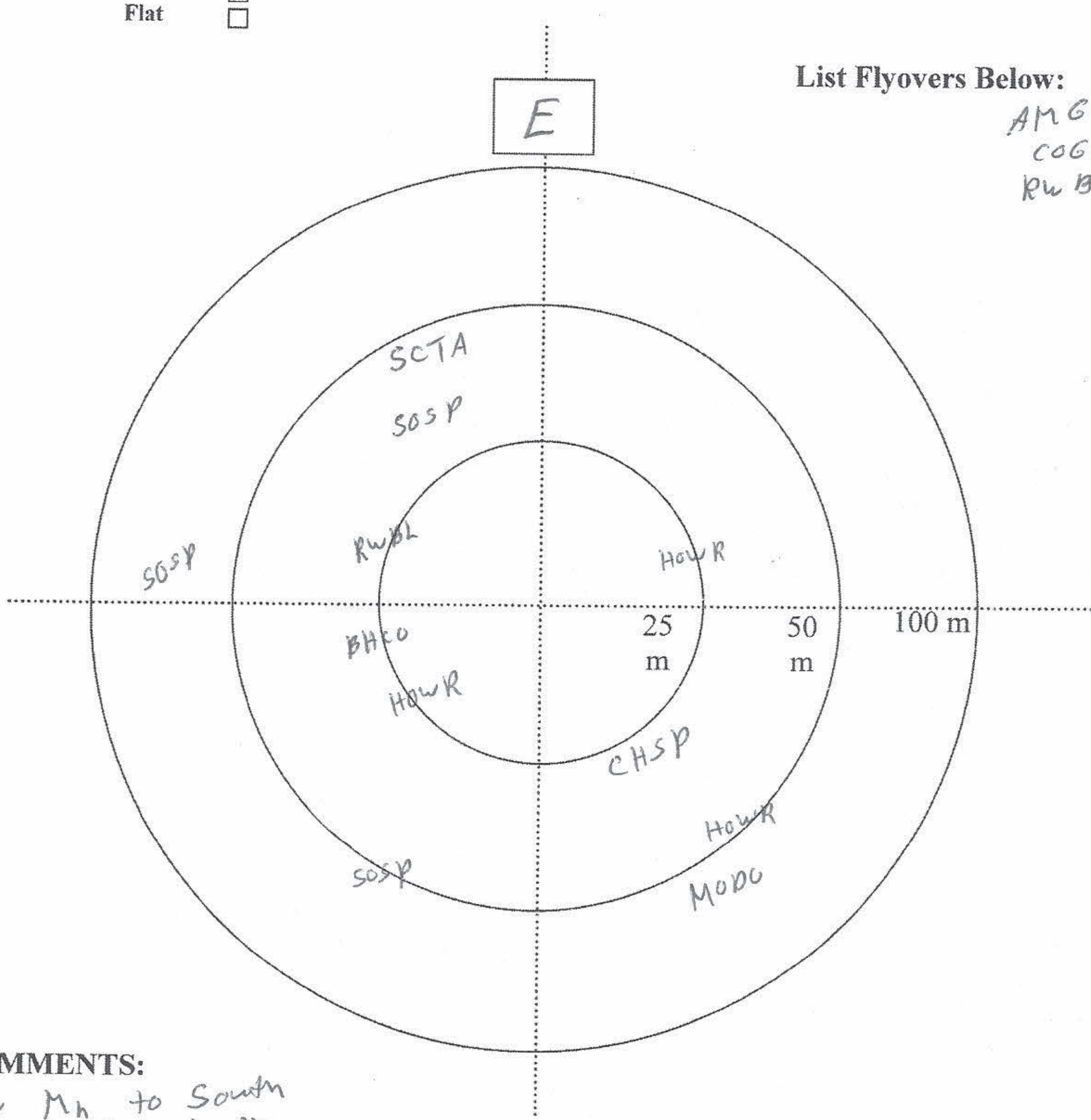
Study Area: Clearview 26/27
Date: June 30/14 **Surveyor:** SAM
Time Started: 0624 **Time Ended:** 0629

Parcel ID:
Site ID: WP038
Point Number: 5

Slope:
- Vertical ☐
- Steep ☒
- Gentle ☐
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:
AMGO ||
COGR ~~||||~~ |
RWBL |||



COMMENTS:
Aw Mh to South
Hay field to North
Aw young forest to NE

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
A	1	B, D, K	2
D	2	A, C, H	2, 4, 7, 8

WOODLAND BREEDING BIRD STATION
MAPPING CARD

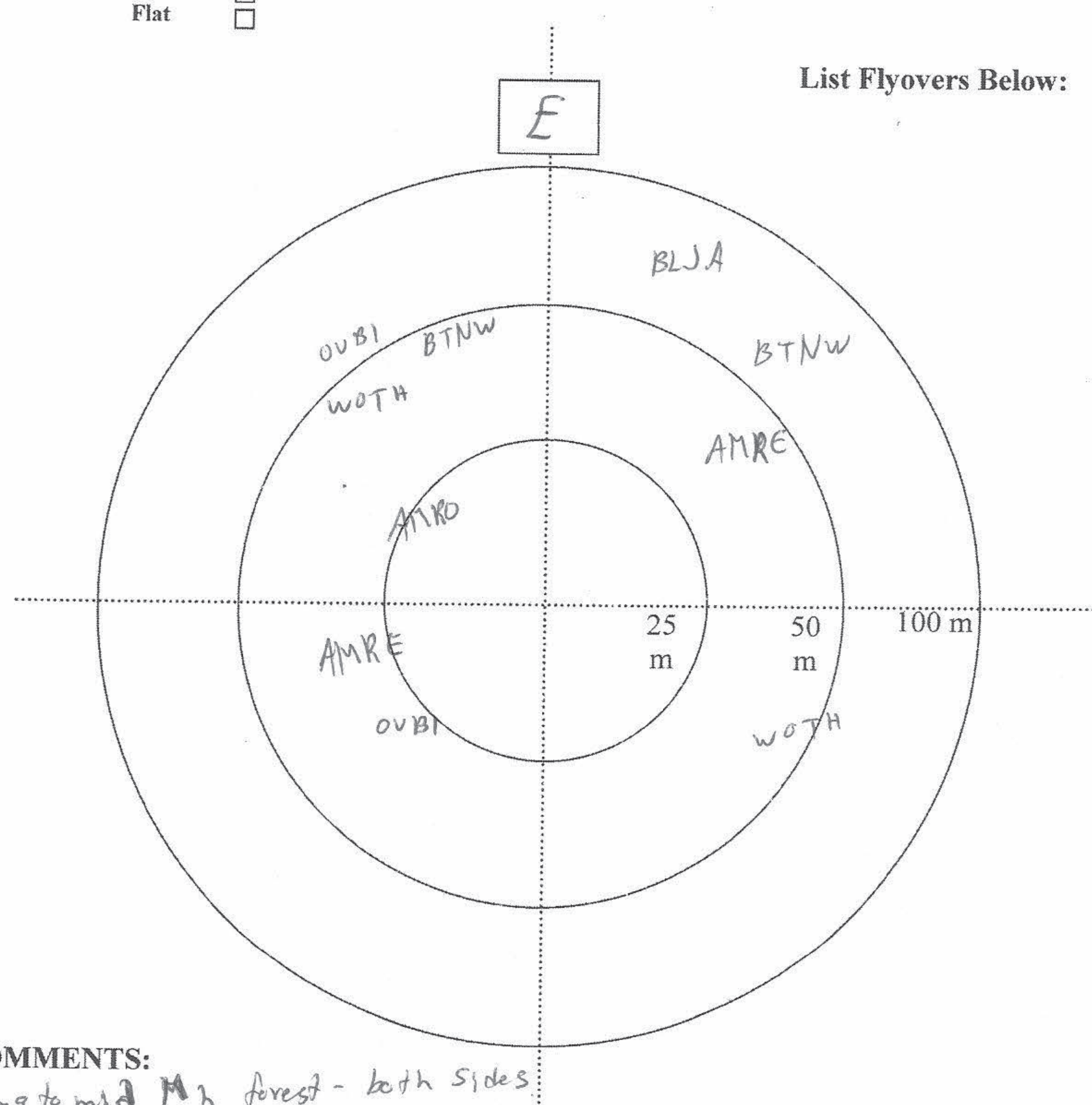
Survey1

Study Area: Clearview 26/27
Date: June30/14
Time Started: 0638
Surveyor: SAM
Time Ended: 0643
Parcel ID:
Site ID: WP039
Point Number: 6

Slope:
- Vertical ☐
- Steep ☒
- Gentle ☐
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:



COMMENTS:
young to mid Mx forest - both sides

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
A	1	C, D, I, K, L	2

WOODLAND BREEDING BIRD STATION MAPPING CARD

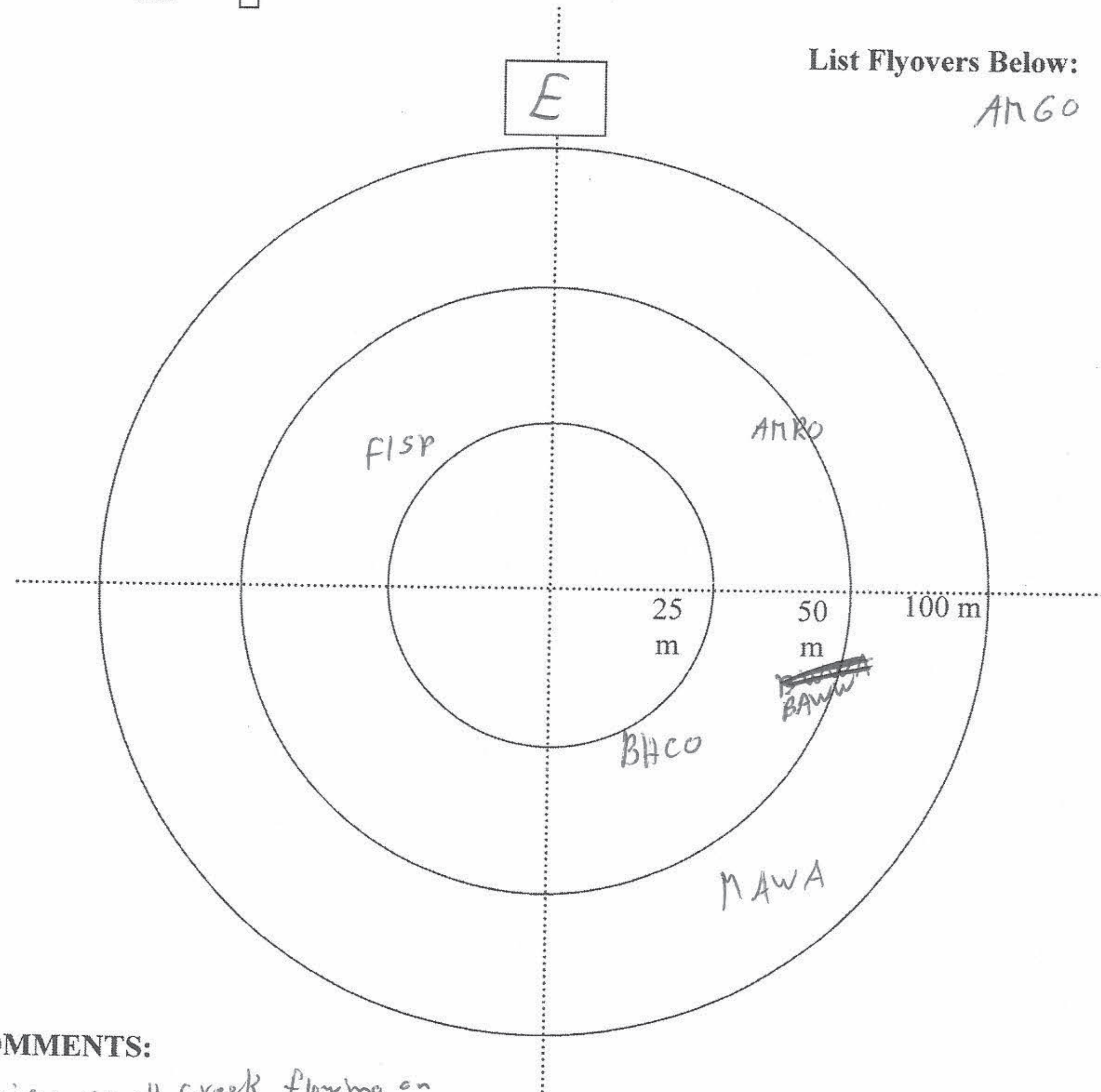
Surveyl

Study Area: Clearview 26/27
Date: June 30/14
Surveyor: SAM
Time Started: 0704
Time Ended: 0709
Parcel ID:
Site ID: WP 040
Point Number: 7

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:
AMGO



COMMENTS:
noisy small creek flowing on north side of road makes hearing calls more difficult

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
A	1	A, E, G, K	2

WOODLAND BREEDING BIRD STATION
MAPPING CARD

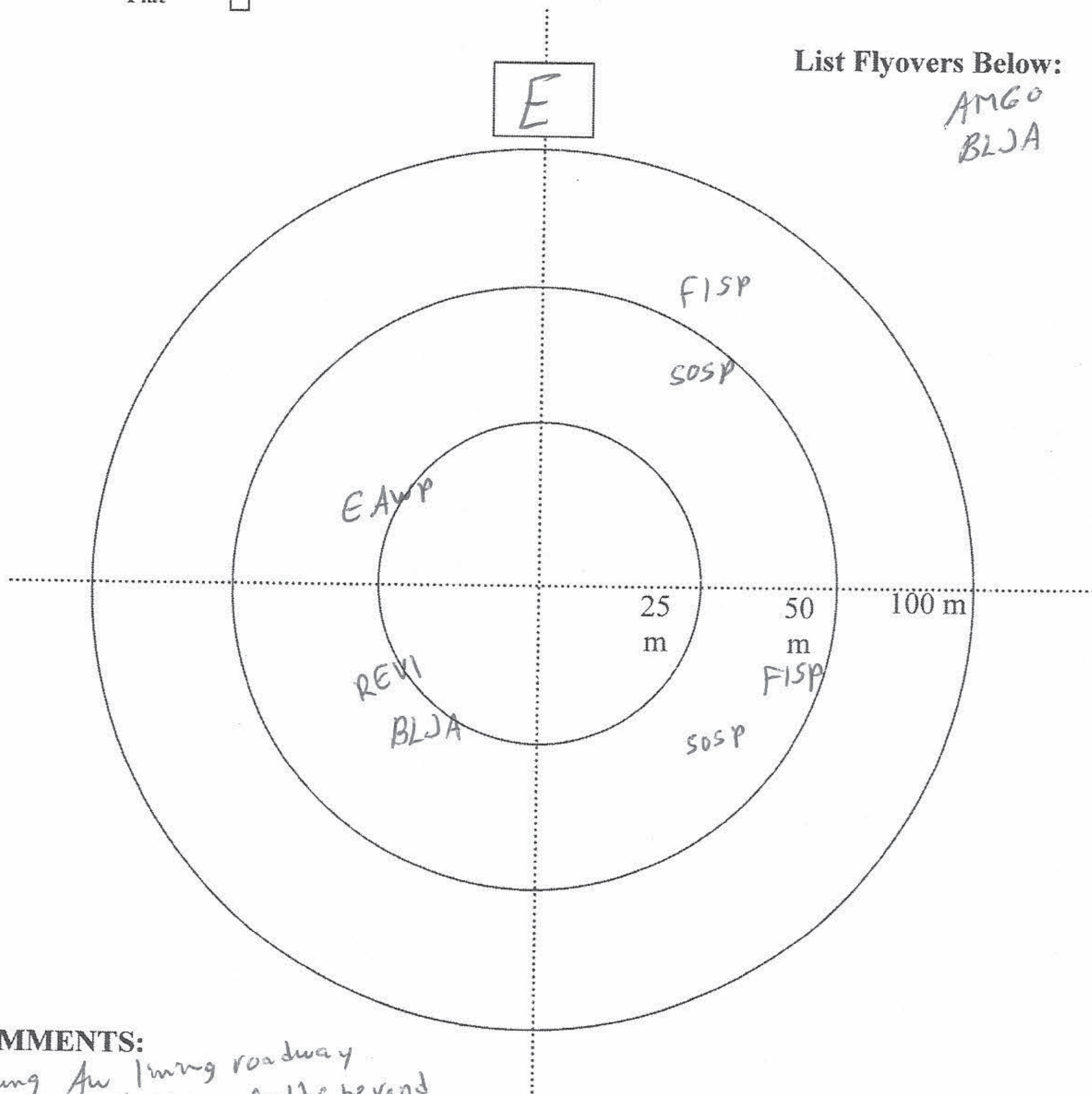
Survey 1

Study Area: Clearview 26/27
Date: June 30/14
Time Started: 0721
Surveyor: SAM
Time Ended: 0726
Parcel ID:
Site ID: WP041
Point Number: 8

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:
AMGO
BLJA



COMMENTS:
Young Aw lining roadway
= old field s& hay fields beyond

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
A	i	A9E, K	2
B	3, 5	C, F	4, 7

WOODLAND BREEDING BIRD STATION MAPPING CARD

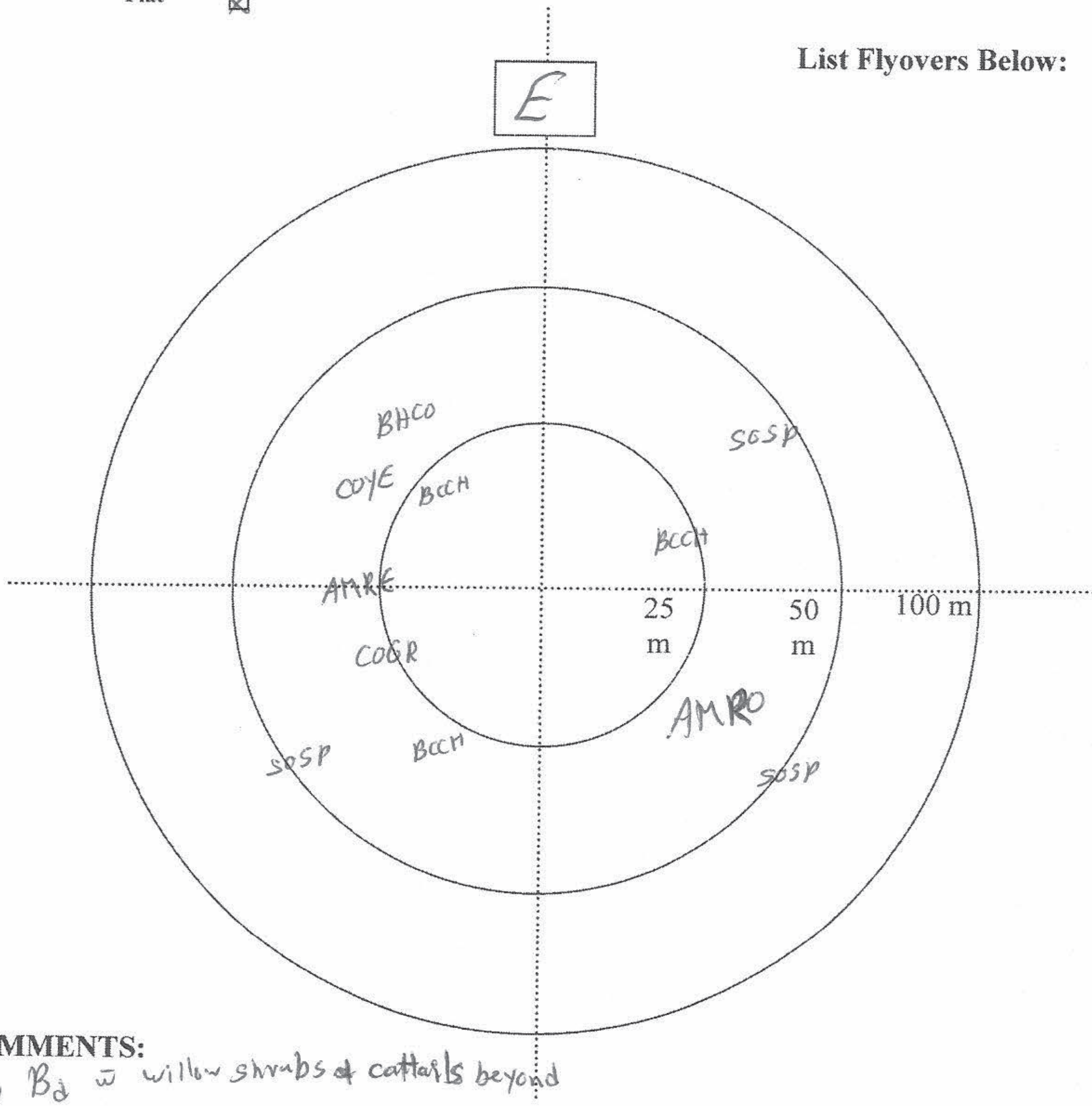
Survey1

Study Area: Clearview 26/27
Date: June 30/14
Time Started: 0738
Surveyor: SAM
Time Ended: 0743
Parcel ID:
Site ID: WP042
Point Number: 9

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☐
- Flat ☒

Direction slope faces (Aspect) (ex. NE): /

List Flyovers Below:



COMMENTS:
Aw Bd w̄ willow shrubs & cattails beyond
Cw

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
E	1, 2	B, C, H	2, 8, 7

Woodland Breeding Bird Station Mapping Card

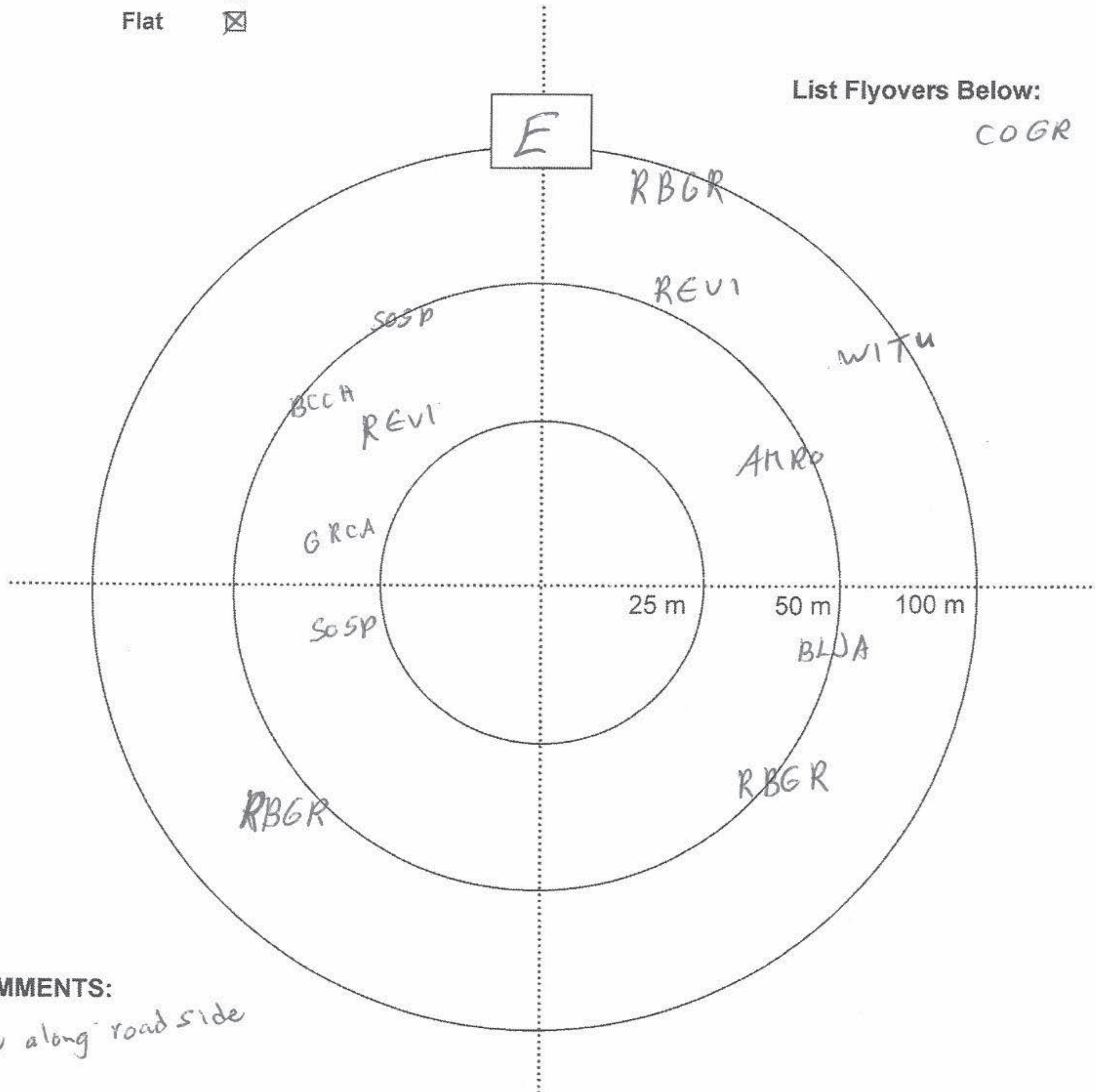
Survey1

Study Area: Clearview 26/27
Parcel ID:
Date: June 28/14
Surveyor: S.A.M.
Site ID: WP043
Time Started: 0751
Time Ended: 0756
Point Number: 10

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☐
- Flat ☒

Direction slope faces (Aspect) (ex. NE): /

List Flyovers Below:
COGR



COMMENTS:
Aw along road side

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
A	1	A K	2
B	1	C	7

Woodland Breeding Bird Station Mapping Card

Survey 1

Study Area: Clearview 26/27

Parcel ID:

Date: June 30/14

Surveyor: SAM

Site ID: WP044

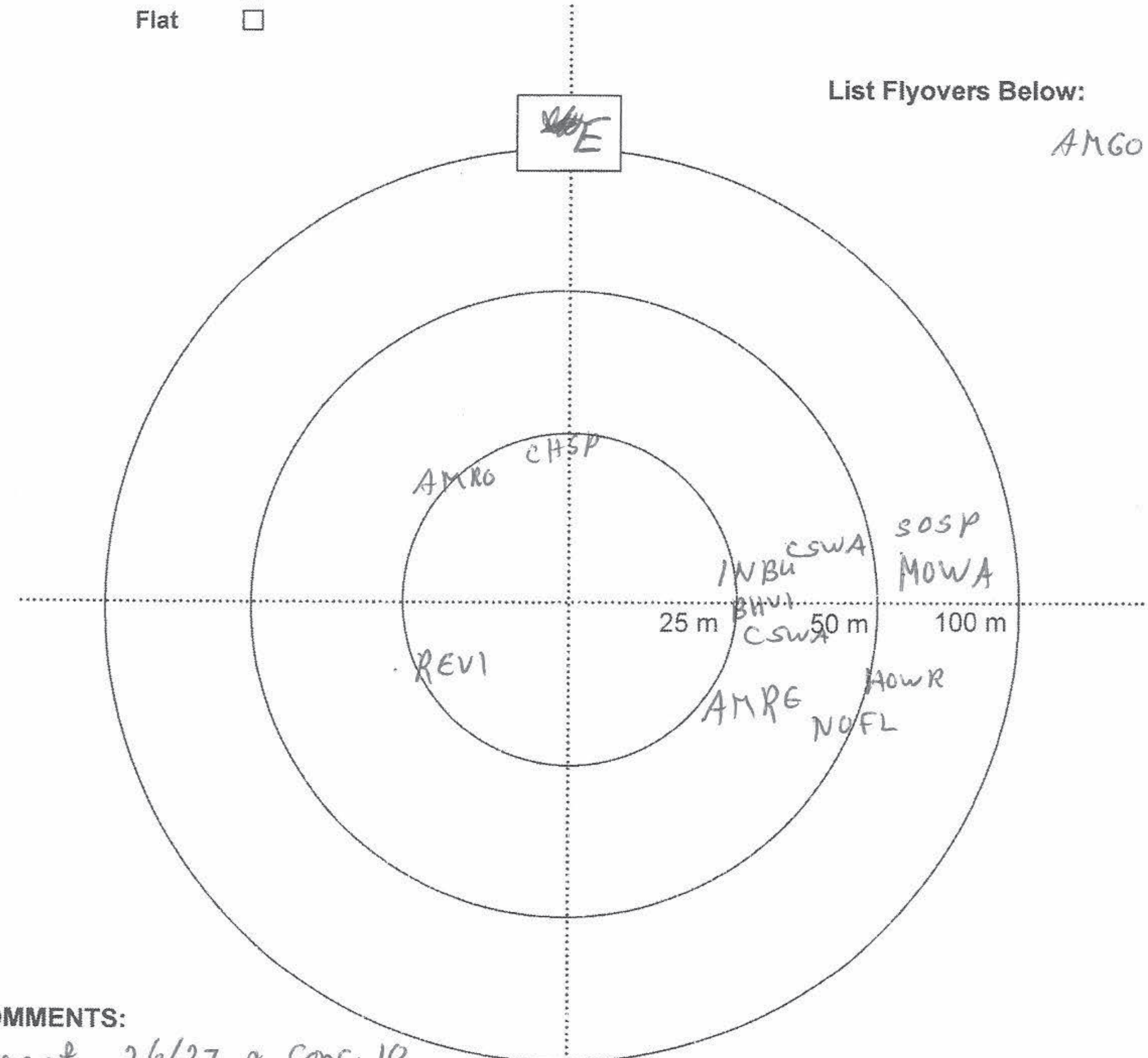
Time Started: 0802

Time Ended: 0807

Point Number: 11

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): W



List Flyovers Below:

AMGO |||| 4

COMMENTS:

corner of 26/27 & Conc. 10
Mn Aw young to mid-age

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION
A	1	C, E, I, K	2

Appendix D

Woodland Breeding Birds Data Coding Cards

Survey #2

Survey #2

Woodland Breeding Bird Data Coding Card

(pg. 1/4)

Study Area: Clearview 26/27 **Parcel ID:**

Date: July 10/14 **Site ID:**

Time: 0548h **Surveyor:** SAM **Point Numbers:** 1 – 4

Start Time	Point #	Species	Obs Code	< 50 m	50 – 100 m	Over 100 m	Flyovers
0548h	1	AMRO	~~S~~ T	2	1		
		REVI	S	1	1		
		WIWR	S	1			
		WTSP	~~S~~ T	2			
		HOWR	S	1			
		SOSP	S		1		
		RWBL	S			1	
		AMCR	X				x (1)
0559h	2	AMGO	X				x (1)
		AMRO	T	1	2		
		OVBI	S		1		
		HOWR	S	1	1		
		BCCH	S	1			
		SOSP	T		1		
		CHSP	S		1	~~8~~	
		RWBL	S			1	
		EATO	T			1	
0608h	3	AMGO	X				x (1)
		AMCR	X				x (1)
		SOSP	T	1	3		
*		EAWP	S		1		
		AMRO	S	1	2		
		CEDW	T	2			
		HOWR	S	2			
		REVI	S		1		
		INBU	T	1			
		BCCH	S	1			
0616h	4	AMGO	S	1			1
		AMCR	X				1
		CHSP	P T	2	2		
		HOWR	P T	2	1		
		BCCH	S	3			
		NOFL	T	1			
		WITU	S		1		
		EAPH	S	1			
		COGR	H		4		
		DOWO	FY	4			

Start time: enter time point count began.

Species: use standard codes for species abbreviations.

Obs Code: enter breeding evidence according to OBBA codes.

Flyovers: place an X to denote flyovers, and/or a number to denote individuals observed in flocks.

* = SAR

Survey #2

Woodland Breeding Bird Data Coding Card

(pg-2/4)

Study Area: Clearview 26/27 **Parcel ID:**

Date: July 10/14 **Site ID:**

Time: 0625h **Surveyor:** SAM **Point Numbers:** 5 – 7

	Start Time	Point #	Species	Obs Code	< 50 m	50 – 100 m	Over 100 m	Flyovers
	0625h	5	AMGO	X				1
			COGR	X				1
			BCCH	S		1		
			PIWO	S		1		
			INBU	S		1		
			BBCU	S		1		
			CHSP	T	1	1		
			YBSA	S	1			
			NOFL	FY	4			
			RWBL	S	2			
			SOSP	T	1			
			AMRO	S	2			
			VEER	S	1			
	0624h	6	AMRE	T		2		
*			WOTH	T		1		
*			EAWP	S	1			
			REVI	S	1			
			AMRO	T	3	1		
			BHVI	S	1			
			YBSA	S	1			
			CMWA	S	1			
	0650h	7	AMGO	X				1
			CHSP	S	1	1		
			GCFL	S		1		
*			WOTH	S		1		
			SOSP	S	3	1		
			EATO	FY		5		
			BCCH	S	1			
			BHCO	T	1			

Start time: enter time point count began.

Species: use standard codes for species abbreviations.

Obs Code: enter breeding evidence according to OBBA codes.

Flyovers: place an X to denote flyovers, and/or a number to denote individuals observed in flocks.

* = SAR

Survey #2

Woodland Breeding Bird Data Coding Card

(pg. 3/4)

Study Area: Clearview 26/27
Date: July 10/14
Time: 0701h
Surveyor: SAM
Parcel ID:
Site ID:
Point Numbers: 8 – 10

Start Time	Point #	Species	Obs Code	< 50 m	50 – 100 m	Over 100 m	Flyovers
0701h	8	AMGO	X				1
		AMCR	X				1
		BCCH	S	1			
		NOFL	S	1			
		AMRO	S	1	1		
		SOSP	T	1	1		
		GCFL	S	1			
		COYE	S	2			
		FISP	T	2			
		EATO	S	1	1		
		YBSA	S	1			
		WBNU	S	1			
		REVI	T	1			
		AMRE	S	1			
0712h	9	AMGO	S		1		1
		SOSP	T	3			
		AMRO	T	3			
		REVI	S	1			
		BCCH	T	1			
		COYE	T	3			
		INBU	S		1		
		GRCA	S		1		
		MODO	S	1			
		FISP	S	1			
0725h	10	AMCR	X				1
		REVI	T		1		
		AMRO	T	1	1		
		DOWO	S	2			
		PIWO	S	1			
		CHSP	P	2			
		SOSP	T	2			
		HOWR	S	1			
		FISP	S	1			
		DOWO	S	1			
		VESP	S	1			
		INBU	S	1			
		COYE	S	1			

Start time: enter time point count began.

Species: use standard codes for species abbreviations.

Obs Code: enter breeding evidence according to OBBA codes.

Flyovers: place an X to denote flyovers, and/or a number to denote individuals observed in flocks.

Survey #2

Woodland Breeding Bird Data Coding Card

Pg. 4/4

Study Area: Clearview 26/27 **Parcel ID:**

Date: July 10/14 **Site ID:**

Time: 0743h **Surveyor:** SAM **Point Numbers:** 11

Start Time	Point #	Species	Obs Code	< 50 m	50 – 100 m	Over 100 m	Flyovers
0743h	11	AMGO	X				1
		COGR	X				1
		INBU	T	2	2		
		BCCH	S	2	1		
		REVI	T	2			
		WBNU	S	1			
		CEDW	S	1			
		YBSA	S	1			
		HOWR	T	1			
		NOFL	S	1			
		AMRO	S	1			

Start time: enter time point count began.

Species: use standard codes for species abbreviations.

Obs Code: enter breeding evidence according to OBBA codes.

Flyovers: place an X to denote flyovers, and/or a number to denote individuals observed in flocks.

Appendix E

Woodland Breeding Bird Field Collection Forms

Survey #2

Visit #2

Woodland Breeding Bird Field Collection Form

WILD CANADA

Page 1 / 2

General Information

Study Area: Rd. 26/27 Clearview | Parcel #: | Site ID:

Date: July 10/14 | Start time: 0548 h | End Time: 0553 h

Weather Conditions:
Wind Direction: NW | Wind Scale: 1-2
Sky Condition: 1 | Cloud Cover (%): 10
Temperature C: 11

Field Crew: SAM
Field Notes By: SAM

Site Location

See info for visit #1

Point Count Locations

Easting:		Northing:		Number:	
Easting:		Northing:		Number:	
Easting:		Northing:		Number:	
Easting:		Northing:		Number:	
Easting:		Northing:		Number:	
Easting:		Northing:		Number:	

Habitat Description

Height of Vegetation (m):
Predominant Species:

Description:

Photo Log

Picture #	Description	Picture #	Description

Beaufort Wind Scale		
	0: 0-2 km/hr - calm, smoke rises vertically	4: 20-30 km/hr -dust / loose papers blow, small branches move
	1: 3-5 km/hr - light air movement	5: 31-38 km/hr - fresh breeze - moderate branch moves
	2: 6-11km/hr - wind felt on face, leaves rustle	6: 39-49 km/hr - strong breeze - large branch moves
	3: 12-19 km/hr- leaves/small twigs in constant motion	

Sky Condition Indicators		
	0 Clear or few clouds	5 Drizzle
	1 Partly cloudy	7 Snow
	2 Cloudy (broken) or overcast	8 Showers
	4 Fog or Smoke	

Appendix F

Woodland Breeding Bird Station Mapping Cards

Survey #2

WOODLAND BREEDING BIRD STATION MAPPING CARD

Visit #2

Study Area: 26/27 Sdrd Clearview **Parcel ID:**

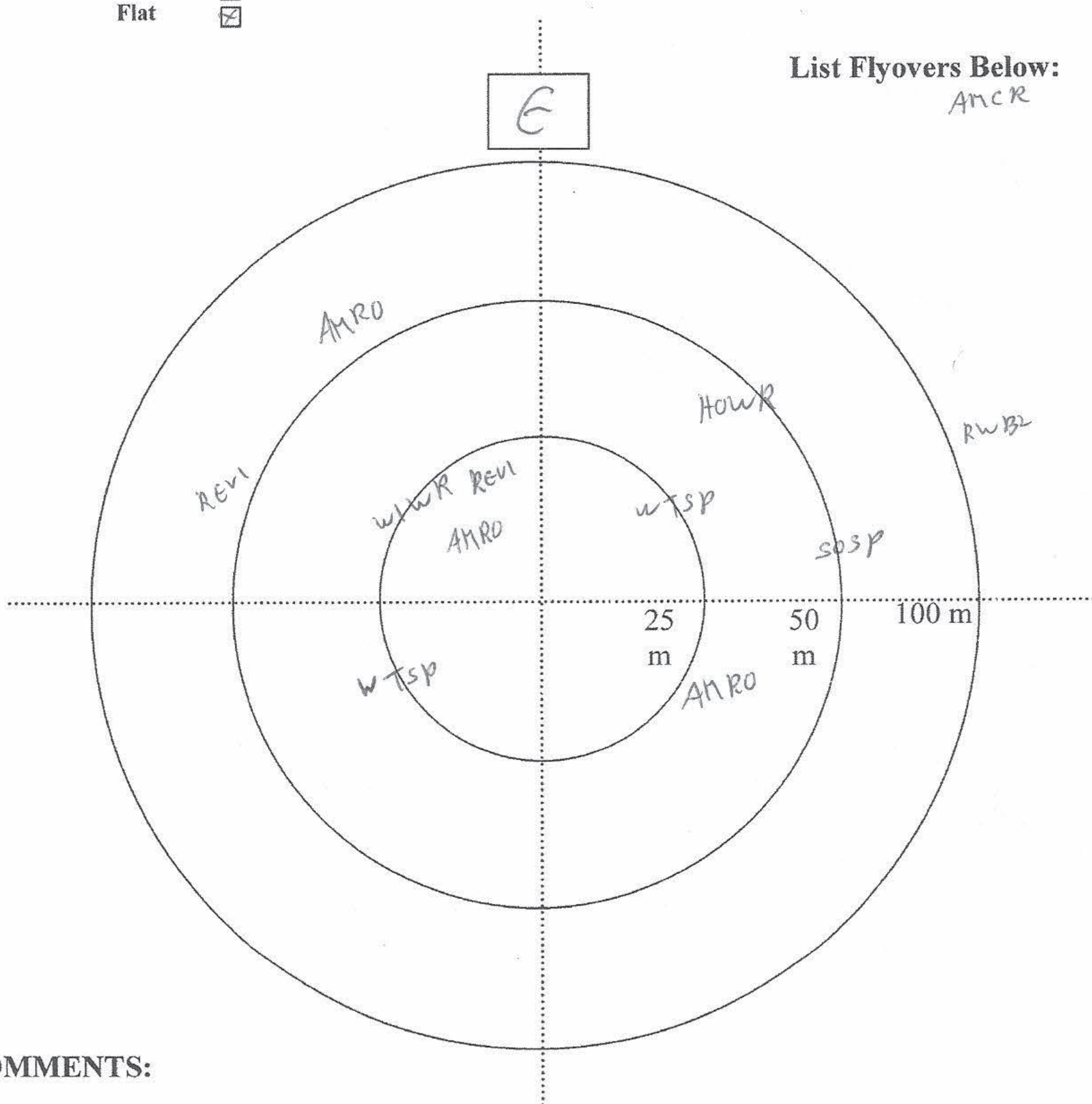
Date: July 10/14 **Surveyor:** SAM **Site ID:** WP034

Time Started: 0548h **Time Ended:** 0553h **Point Number:** 1

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☐
- Flat ☒

Direction slope faces (Aspect) (ex. NE): /

List Flyovers Below:
AMCR



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

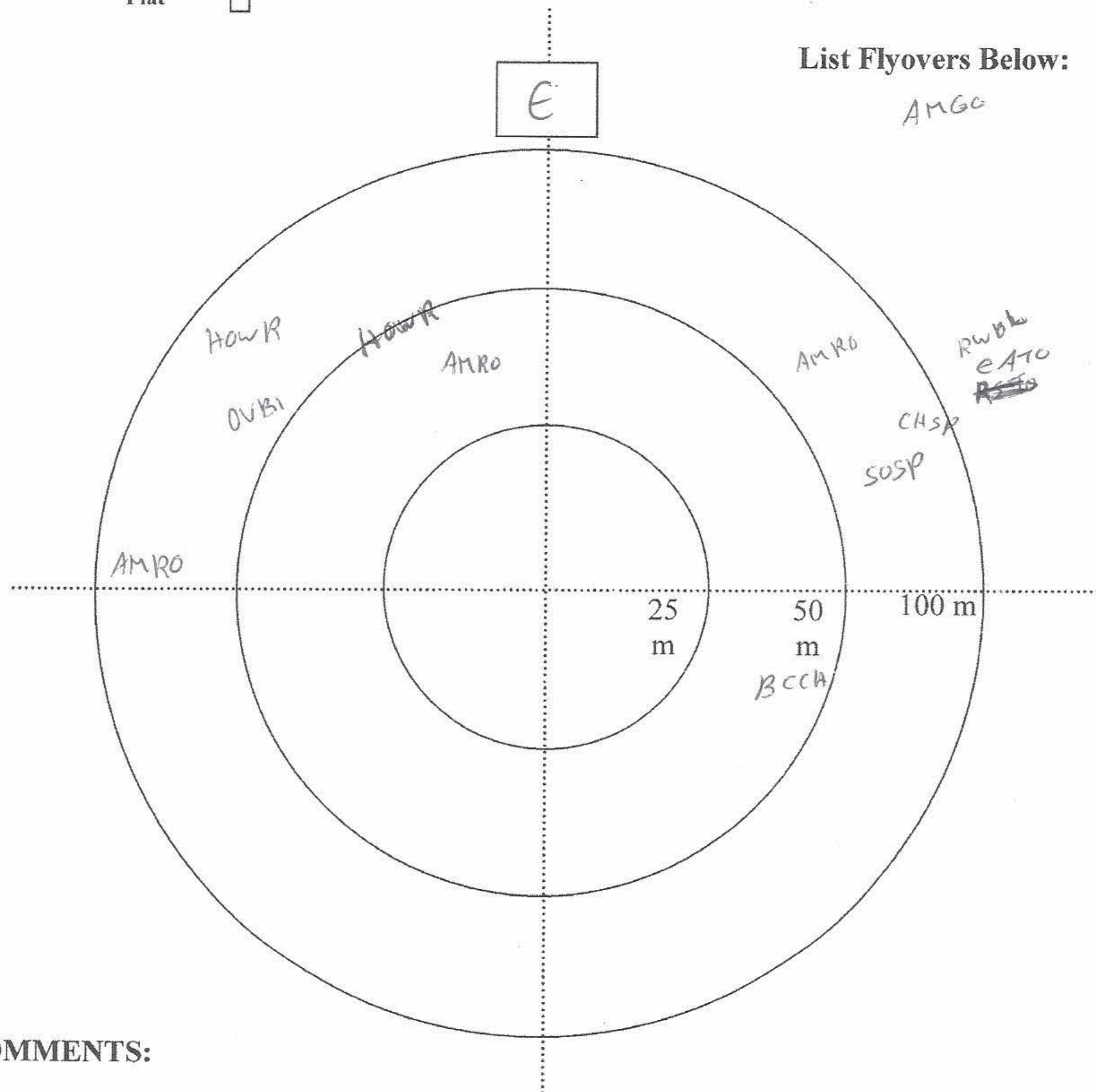
Visit #2

Study Area: Clearview 26/27
Parcel ID:
Date: July 10/14 **Surveyor:** SAM **Site ID:** WP035
Time Started: 0559h **Time Ended:** 0604h **Point Number:** 2

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): W

List Flyovers Below:
AMGO



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

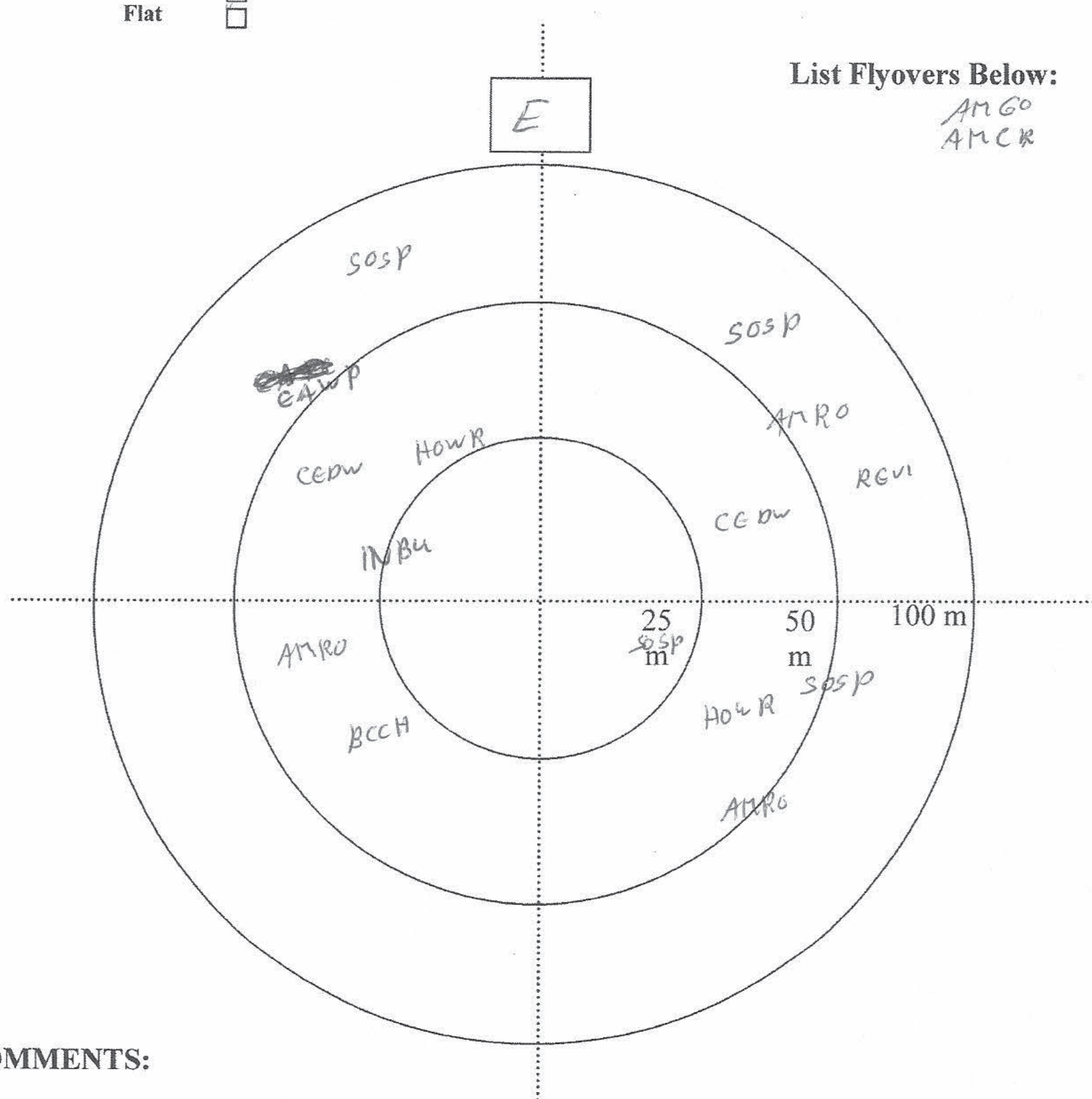
Visit #2

Study Area: 26/27 Sdrd Clearview
Parcel ID:
Date: July/10/14
Surveyor: SAM
Site ID: WP036
Time Started: 0608h
Time Ended: 0613h
Point Number: 3

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:
AMGO
AMCR



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

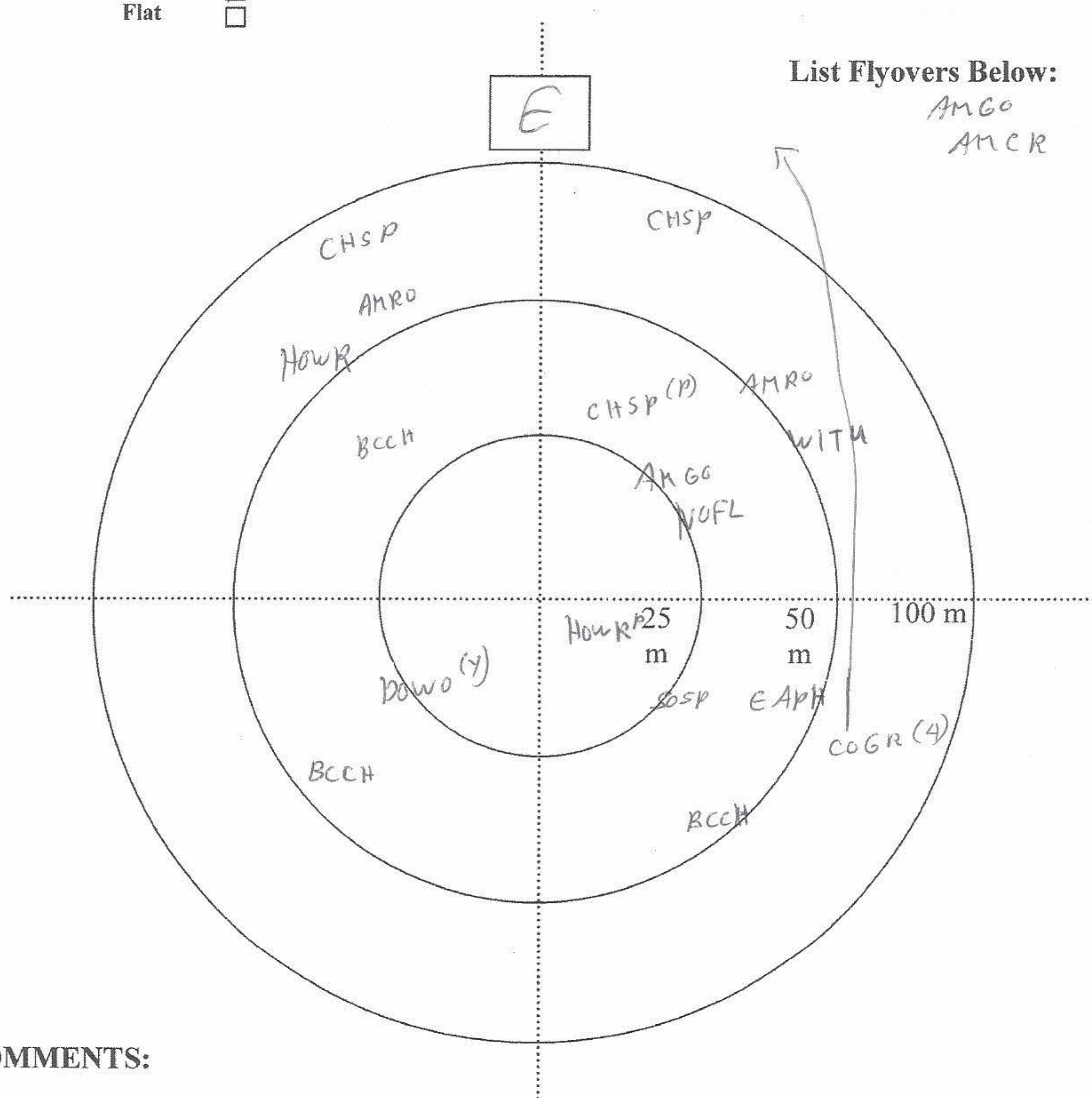
Visit #2

Study Area: Clearview 26/27
Parcel ID:
Date: July 10/14 **Surveyor:** SAM **Site ID:** WP039
Time Started: 0616h **Time Ended:** 0621h **Point Number:** 4

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): W

List Flyovers Below:
AMGO
AMCR



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

VISIT #2

Study Area: Clearview 26/27 **Parcel ID:**

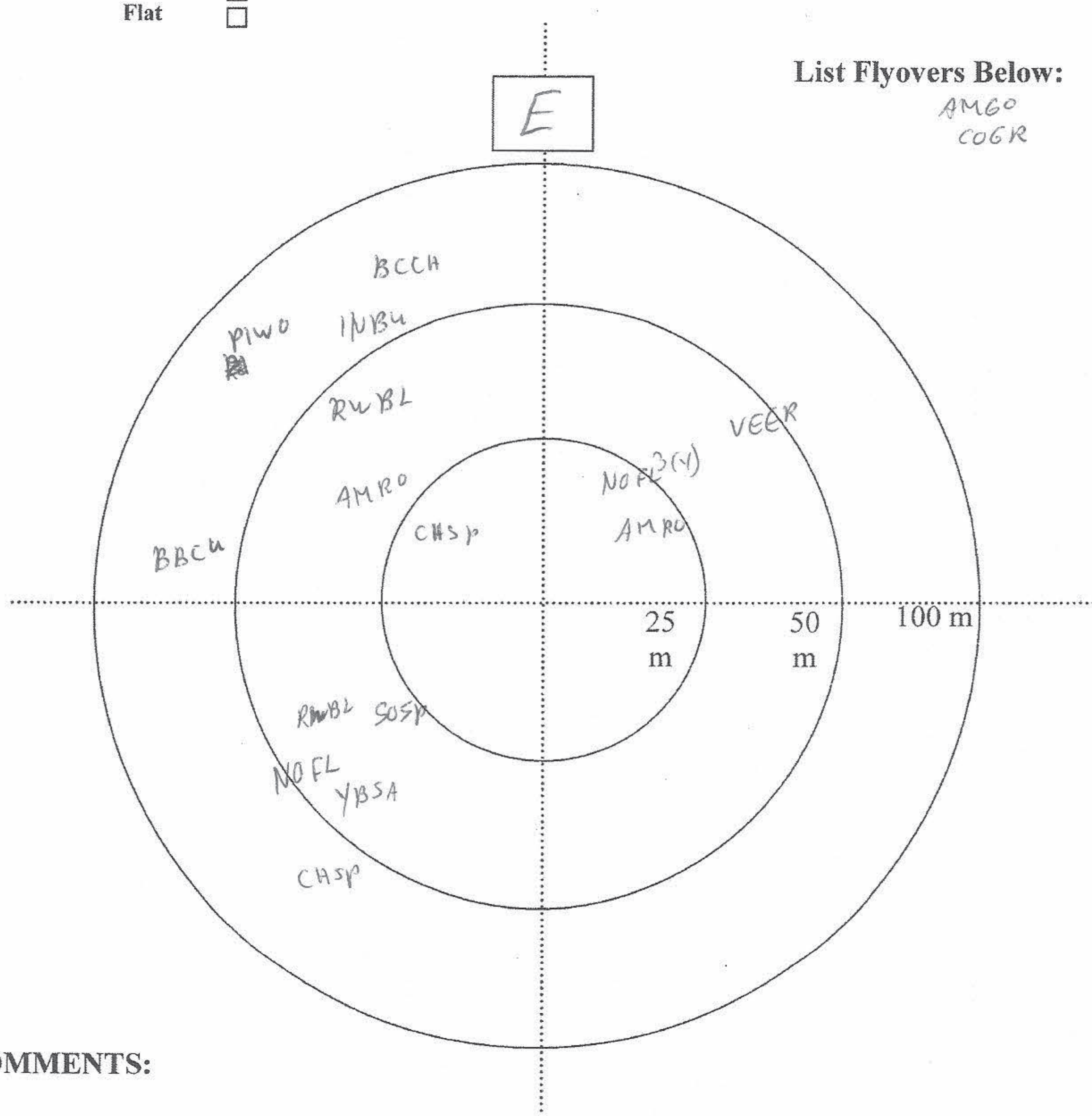
Date: July 10/14 **Surveyor:** SAM **Site ID:** WP038

Time Started: 0625h **Time Ended:** 0630h **Point Number:** 5

Slope:
- Vertical ☐
- Steep ☒
- Gentle ☐
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:
AMGO
COGR



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

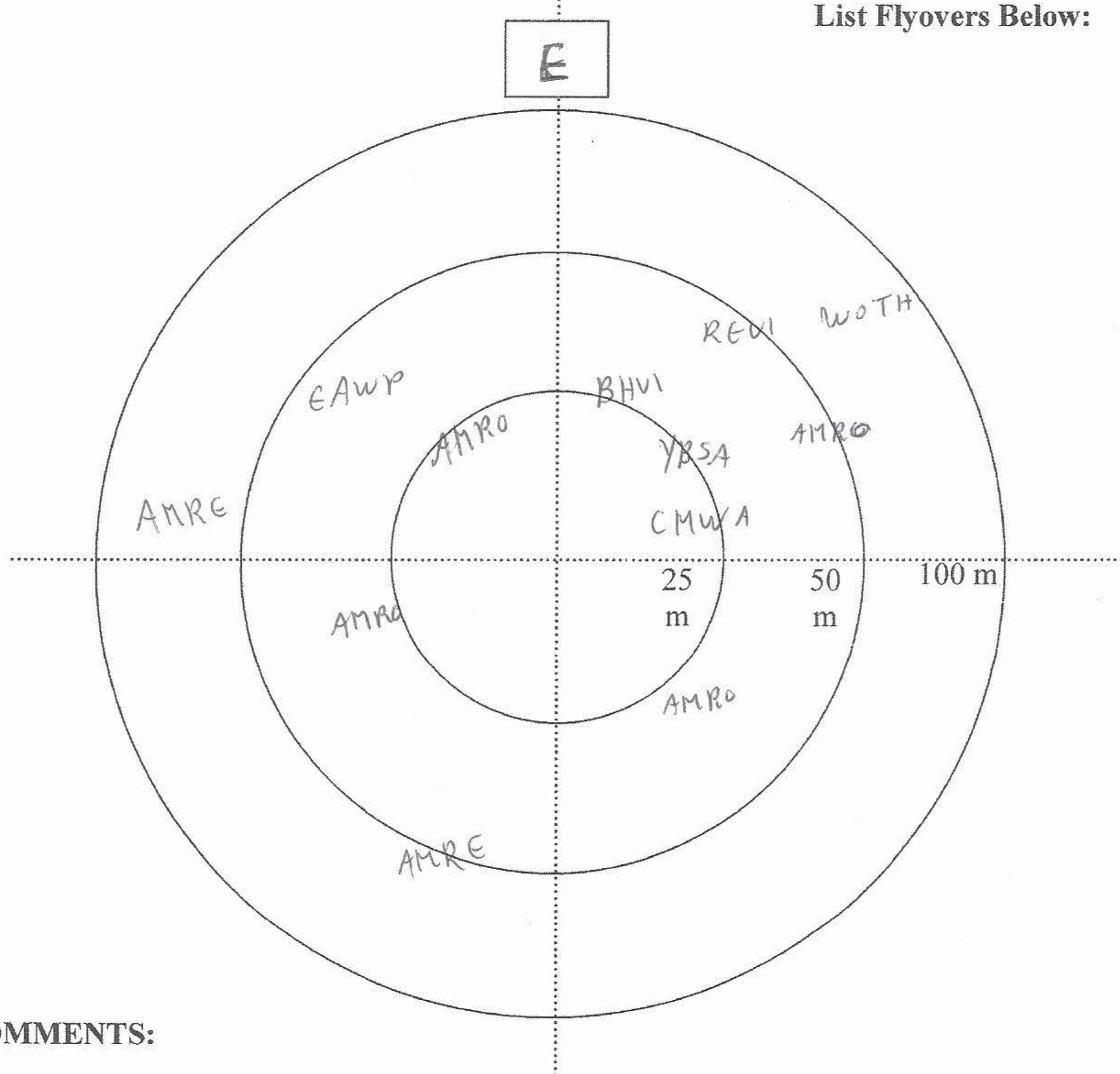
Visit #2

Study Area: Clearview 26/27 **Parcel ID:**
Date: July 10/14 **Surveyor:** SAM **Site ID:** WP039
Time Started: 0638h **Time Ended:** 0643h **Point Number:** 6

Slope:
- Vertical ☐
- Steep ☒
- Gentle ☐
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

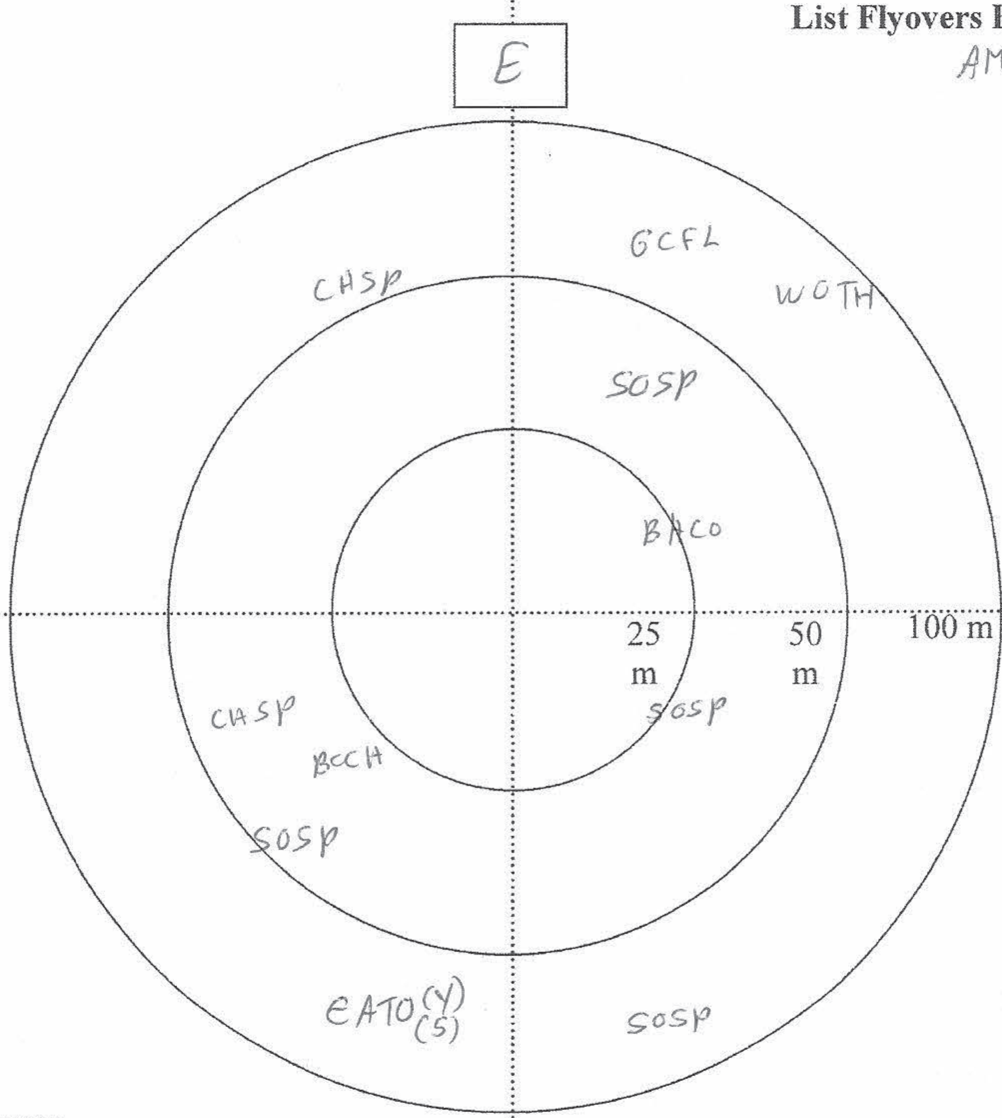
Visit #2

Study Area:	Clearview 26/27			**Parcel ID:**	
Date:	July 10/14	**Surveyor:**	SAK	**Site ID:**	WP040
Time Started:	0650h	**Time Ended:**	0655h	**Point Number:**	7

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:
AMGO



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

WILD CANADA

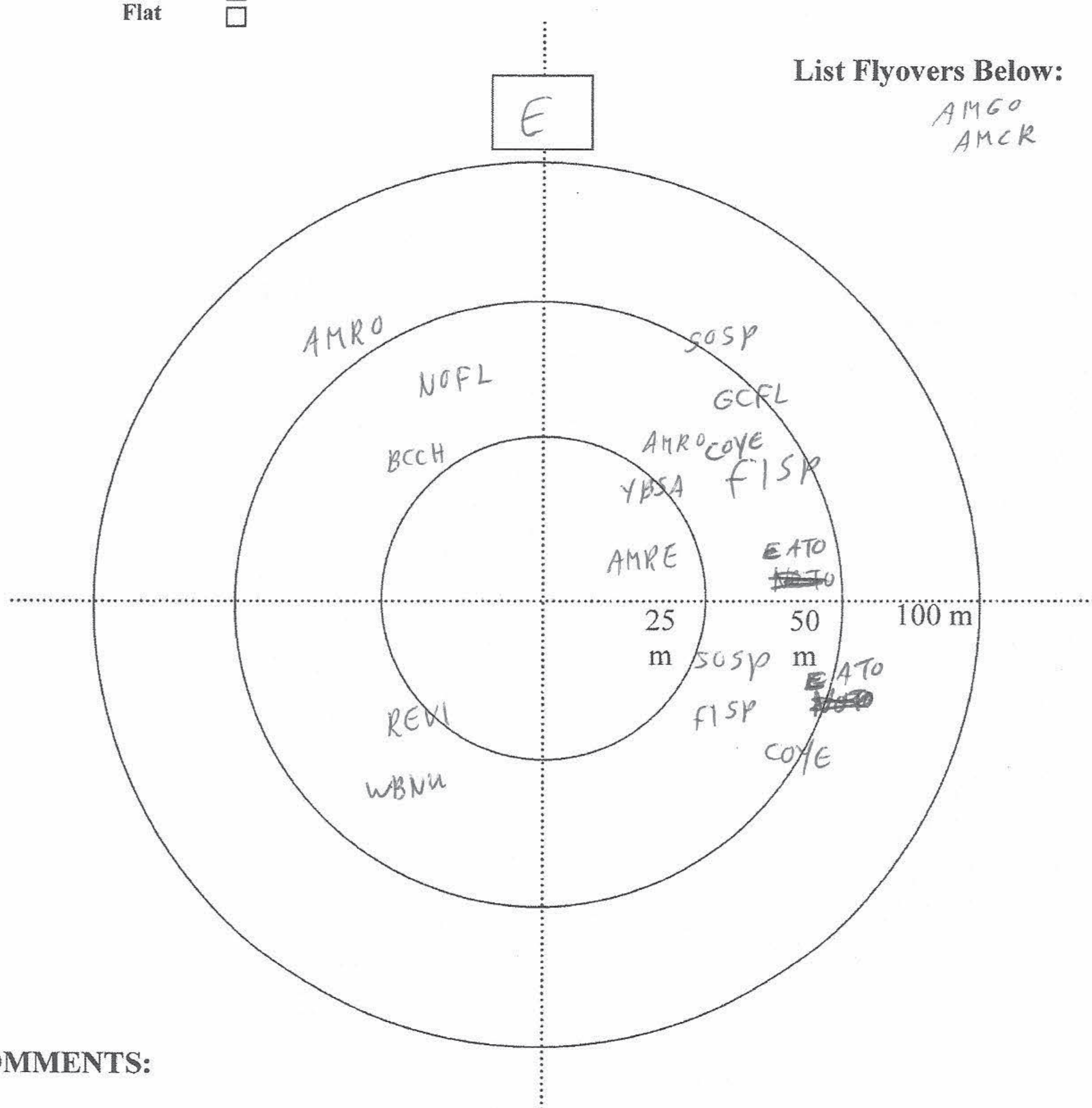
Visit #2

Study Area: Clearview 26/27
Parcel ID:
Date: July 10/14 **Surveyor:** SAM **Site ID:** WP041
Time Started: 0701h **Time Ended:** 0706h **Point Number:** 8

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): E

List Flyovers Below:
AMGO
AMCR



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

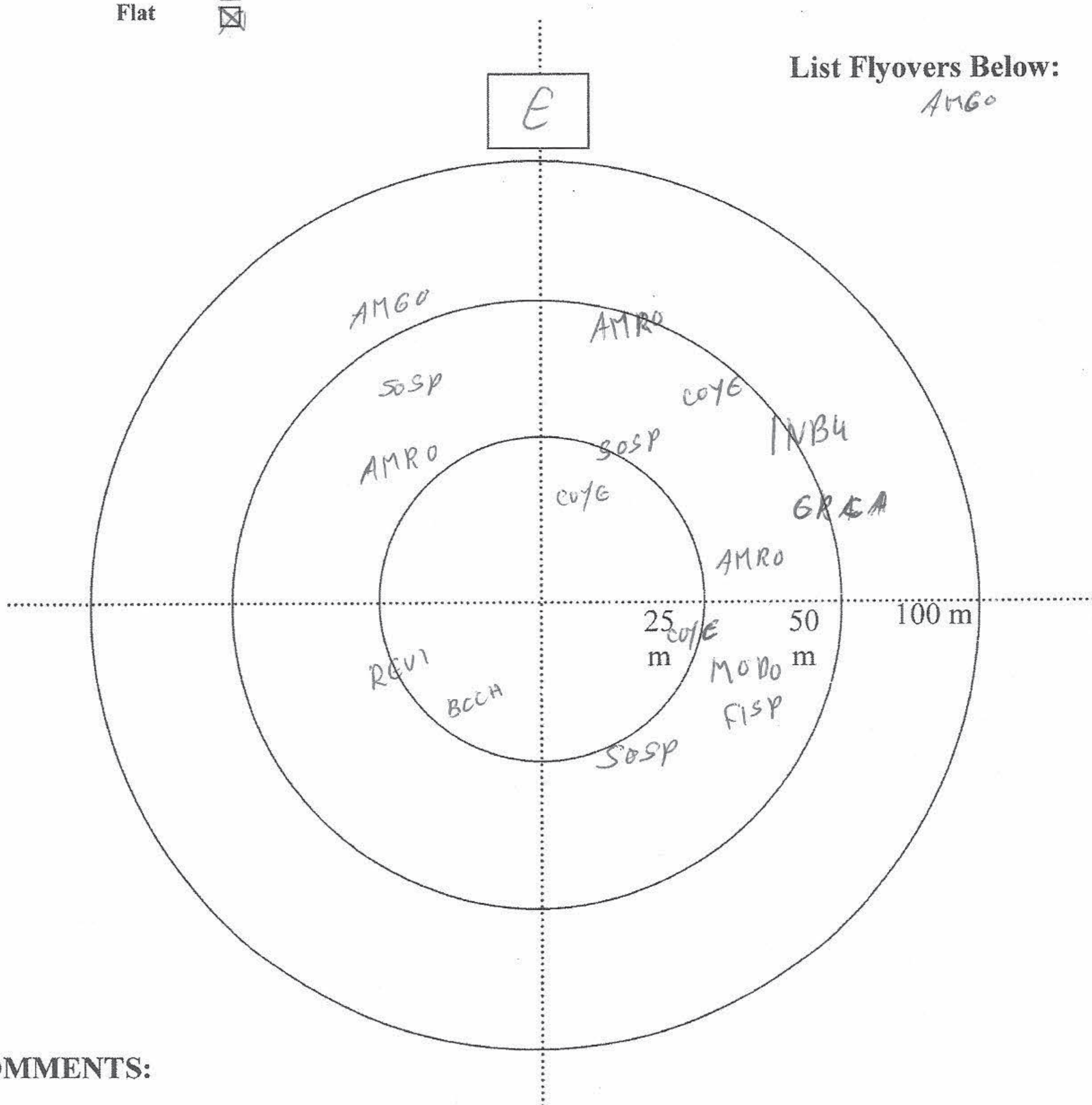
Visit #2

Study Area: Clearview 26/27 **Parcel ID:** ______
Date: July 10/14 **Surveyor:** SAM **Site ID:** WP042
Time Started: 0712 **Time Ended:** 0717 **Point Number:** 9

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☐
- Flat ☒

Direction slope faces (Aspect) (ex. NE): /

List Flyovers Below:
AMGO



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

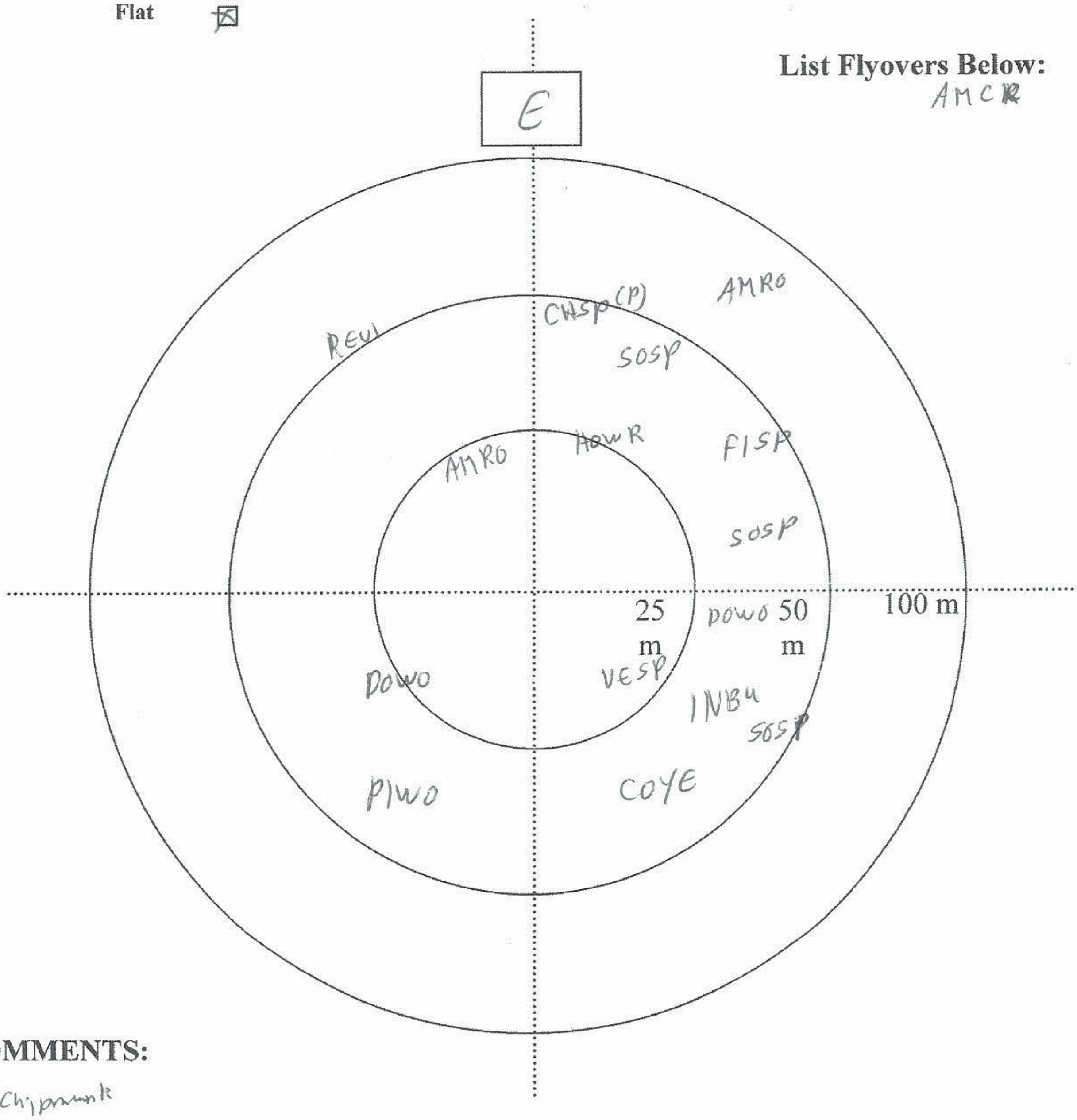
Visit #2

Study Area: Clearview 26/27
Date: July 16/14
Surveyor: SAM
Time Started: 0725h
Time Ended: 0730h
Parcel ID:
Site ID: WP043
Point Number: 10

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☐
- Flat ☒

Direction slope faces (Aspect) (ex. NE): /

List Flyovers Below:
AMCR



COMMENTS:

Chipmunk

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WOODLAND BREEDING BIRD STATION MAPPING CARD

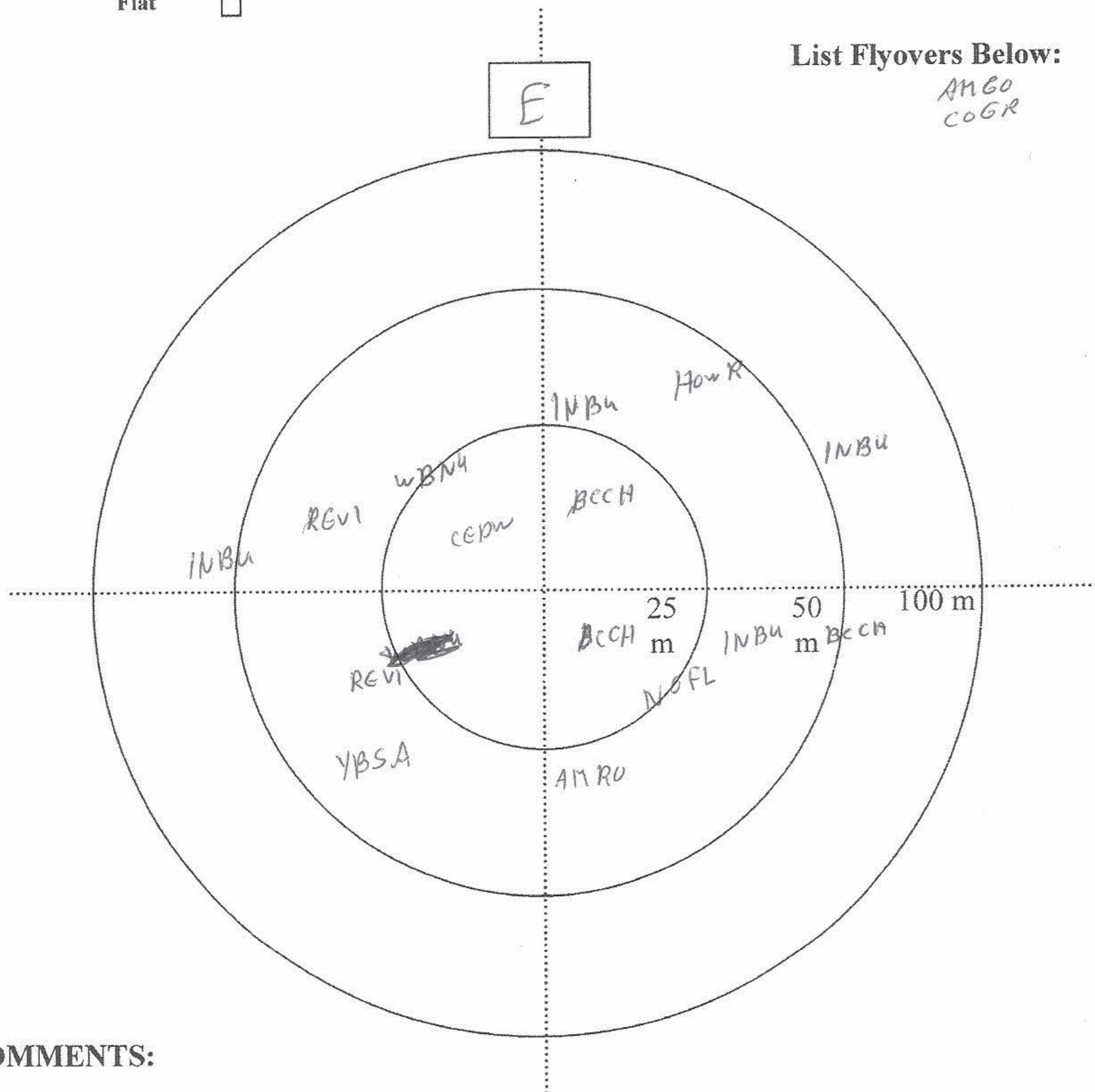
WILD CANADA

Study Area: Clearview 26/27 Sdrd.
Parcel ID:
Date: July 10/14
Surveyor: SAM
Site ID: WP044
Time Started: 0743h
Time Ended: 0748h
Point Number: 11

Slope:
- Vertical ☐
- Steep ☐
- Gentle ☒
- Flat ☐

Direction slope faces (Aspect) (ex. NE): W

List Flyovers Below:
AMGO
COGR



COMMENTS:

CLASSIFY HABITAT (within 100 m):

CLASS	SUBCLASS	STRUCTURE	MODIFICATION

WILD Canada Ecological Consulting
#75 – 39th Street North, Wasaga Beach, ON L9Z 2A3
telephone (705) 429-4936 **fax** (705) 429-1435 **web** www.wildcanada.ca

Memorandum

	Date	October 15, 2018 FILE NO. 018-013
	RE	Eastern Whip-poor-will Surveys along Sideroad 26/27, Clearview Twp.
To	ATTENTION	Nicholle Smith, Senior Terrestrial Ecologist
	COMPANY	R.J. Burnside & Associates Ltd.
From	NAME	Scott Martin

Comments

Nicholle,

In May, 2018, R.J. Burnside & Associates, Ltd. contracted WILD Canada Ecological Consulting to conduct surveys for Eastern Whip-poor-will (EWPW), a Species At Risk in Ontario, along Sideroad 26/27, Clearview Township, County of Simcoe, during the 2018 season. This memo-report discusses the results of those surveys.

In 2018, there were only two windows during which to conduct EWPW surveys, due to the timing of the full moons. These windows were May 21-29 (preferred), with May 30-6 as alternate), and June 20-28 (preferred), with June 29-July 6 as alternate. Due to the timing of the awarding of this contract, and the weather, the first survey was conducted on May 30, only one day after the prime conditions at full moon. The second survey was completed on June 26, within the preferred period of the week preceding and including the full moon.

Surveys were conducted according to the "Guidelines for Conducting Eastern Whip-poor-will Roadside Surveys in Ontario, 12 May 2014" (MNRF – Natural Heritage Information Centre, and Bird Studies Canada), which prescribes appropriate timing, spacing, moon and weather conditions for completing surveys. 8 individual point count stations were spaced evenly, 400m apart, along Sideroad 26/27, between Concession 10 North Nottawasaga Road at the east end and Osprey-Clearview Townline at the west end. Most point count sites were located adjacent to habitat, ranging from mature hardwood forest to semi-open meadow/thicket, to wetland/wet meadow, which should be quite suitable to EWPW for nesting or foraging.

While cloud cover was generally between 25-50%, the moon was visible for all but 3 points between both surveys. The temperature was 25C during the May 30 survey and 17C during the June 26 survey. There was no precipitation during either survey, and the wind was within acceptable limits, ranging between 1-3 on the Beaufort scale.

On both survey dates, to ensure that surveying was being conducted during appropriate moon/time/weather conditions, I visited an EWPW monitoring control site in Wasaga Beach, immediately prior to conducting the surveys along Sideroad 26/27. On both dates, EWPW were recorded calling at the control site.

No EWPW were recorded during the surveys on Sideroad 26/27. The surveys were conducted fully according to protocol – during preferred moon/sky conditions, temperatures, wind conditions, and at the proper times. While it was demonstrated, through the use of a control site, that the conditions on the survey dates were optimal for recording singing EWPW, and although much of the habitat bordering Sideroad 26/27 would seem suitable for EWPW, no EWPW were recorded along the surveyed portion of Clearview Sideroad 26/27 during these 2018 breeding season surveys. From these findings, it can be concluded that there are no EWPW actively breeding along the surveyed portion of Clearview Sideroad 26/27 in 2018.

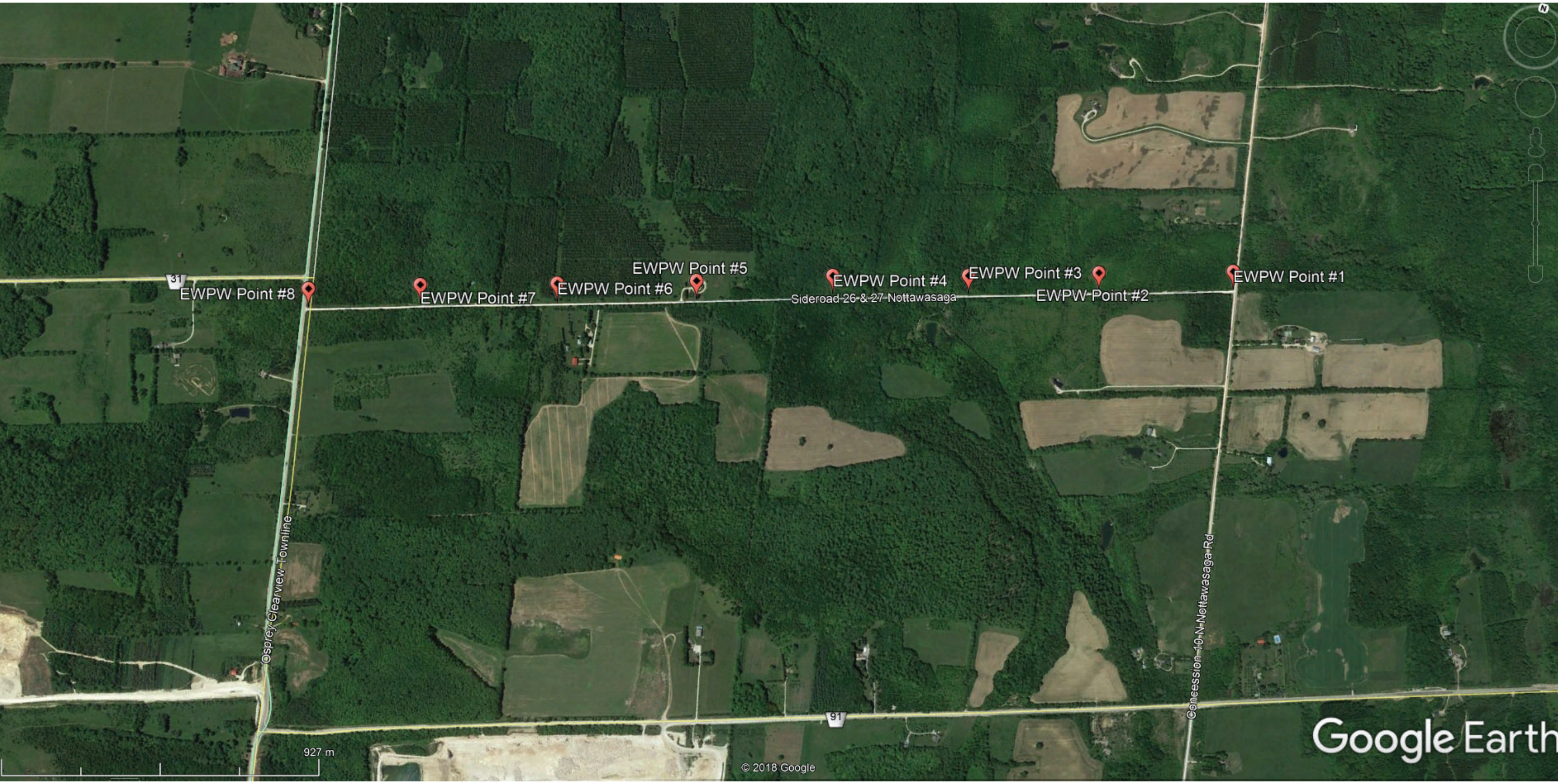
I have attached along with this memo-report two files. One is a jpeg, graphically showing the locations of the survey point count stations. The other is a pdf created from the scanned completed field data forms.

Please let me know if you require any further information regarding these surveys, and/or the results and conclusions.

Sincerely,

Scott A. Martin
Senior Ecologist / Owner
WILD Canada Ecological Consulting


EWPW Point #8
EWPW Point #7
EWPW Point #6
EWPW Point #5
EWPW Point #4
EWPW Point #3
EWPW Point #2
EWPW Point #1
Sideroad 26 & 27 Nottawasaga
Osprey-Clearview Townline
Concession 10 N Nottawasaga Rd
31
91


EWPW Point #5
EWPW Point #8
EWPW Point #7
EWPW Point #6
EWPW Point #4
EWPW Point #3
EWPW Point #1
Sideroad 26 & 27 Nottawasaga
EWPW Point #2
31
Osprey Clearview Townline
Concession 10 N Nottawasaga Rd
91
927 m
© 2018 Google
Google Earth

ONTARIO WHIP-POOR-WILL PROJECT: ROADSIDE SURVEY DATA FORM

ROUTE TYPE (circle one): Standard Owl Standard Woodcock Custom Whip-poor-will Other

Route Name: Sideroad 26/27 Clearview ROUTE NUMBER (if available): ____________

SURVEYOR: Scott Morth

E-mail: smorth@wildcanada.ca

Telephone 705-429-4936 day/ evening

ASSISTANTS: ____________

SURVEY DATE: Day 30 Month May Year 2018

Official Sunset 20:54 **Official Moonrise** 21:52

Weather at Start of Survey (chose one option for each section)

Temperature	25 °C check one: ☒measured OR ☐estimated
Wind	**0** Calm (0-2 km/h) **1** Light air (2-6 km/h) **2** Light breeze (7-11 km/h) **3** Gentle breeze (12-19 km/h) **4** Moderate breeze (20-30 km/h) **5** Fresh breeze (31-39 km/h) **X** Too windy (40+ km/h)
Precipitation	**0** None **1** Trace **2** Rain
Sky	**0** Clear (0-25% cloud cover) **1** Mostly Clear (25-50%) **2** Mostly Cloudy (50-75%) **3** Cloudy (75-00%)

Stop information (Spend at least 3 minutes listening for Whip-poor-wills at each stop. For stops with Whip-poor-wills fill in the additional information on page 2 of the data form).

Stop #	GPS Coordinates (Lat/Long) Datum (circle one): WGS84 NAD83 Other:	Odometer (km)	Start Time (24 h)	# EWPW in 1st 3-minutes	Additional EWPW in 2nd 3-min	Moon Visible? (Y/N)	Traffic Count (#)	Noise Level (circle one)
1	0561428 4916799	0.0 km	22:27	nil	nil	N low cloud	3	Slight Moderate High Excessive
2	0561052 4916680	0.4	22:39	nil	nil	N low cloud	Ø	Slight Moderate High Excessive
3	0560689 4916570	0.8	22:48	nil	nil	N	Ø	Slight Moderate High Excessive near creek
4	0560317 4916455	1.2	22:57	nil	nil	Y	Ø	Slight Moderate High Excessive
5	0559937 4916327	1.6	23:07	nil	nil	Y	Ø	Slight Moderate High Excessive Tree Frogs
6	0559563 4916210	2.0	23:16	nil	nil	Y	Ø	Slight Moderate High Excessive few frogs
7	0559199 4916097	2.4	23:26	nil	nil	Y	1	Slight Moderate High Excessive
8	0558834 4915981	2.8	23:36	nil	nil	Y	1	Slight Moderate High Excessive
9		___.__	__:__					Slight Moderate High Excessive
10		___.__	__:__					Slight Moderate High Excessive

Weather at End of Survey (chose one option for each section)

Temperature	23 °C check one: ☒measured OR ☐estimated
Wind	**0** Calm (0-2 km/h) **1** Light air (2-6 km/h) **2** Light breeze (7-11 km/h) **3** Gentle breeze (12-19 km/h) **4** Moderate breeze (20-30 km/h) **5** Fresh breeze (31-39 km/h) **X** Too windy (40+ km/h)
Precipitation	**0** None **1** Trace **2** Rain
Sky	**0** Clear (0-25% cloud cover) **1** Mostly Clear (25-50%) **2** Mostly Cloudy (50-75%) **3** Cloudy (75-00%)

ONTARIO WHIP-POOR-WILL PROJECT: ROADSIDE SURVEY DATA FORM

ROUTE TYPE (circle one): Standard Owl Standard Woodcock Custom Whip-poor-will Other

Route Name: Sideroad 26/27 Clearview ROUTE NUMBER (if available): N/A

SURVEYOR: Scott Martin

ASSISTANTS: /

E-mail: smartin@wildcanada.ca

Telephone 705-429-4936 day/ evening

SURVEY DATE: Day 26 Month June Year 2018

Official Sunset 21:10 Official **Moonrise** 19:48

Weather at Start of Survey (chose one option for each section)	
Temperature	17 °C check one: ☒measured OR ☐estimated
Wind	**0** Calm (0-2 km/h) **1** Light air (2-6 km/h) **2** Light breeze (7-11 km/h) **3** Gentle breeze (12-19 km/h) **4** Moderate breeze (20-30 km/h) **5** Fresh breeze (31-39 km/h) **X** Too windy (40+ km/h)
Precipitation	**0** None **1** Trace **2** Rain
Sky	**0** Clear (0-25% cloud cover) **1** Mostly Clear (25-50%) **2** Mostly Cloudy (50-75%) **3** Cloudy (75-00%)

Stop information (Spend at least 3 minutes listening for Whip-poor-wills at each stop. For stops with Whip-poor-wills fill in the additional information on page 2 of the data form).

Stop #	**GPS Coordinates (Lat/Long)** **Datum** (circle one): WGS84 NAD83 Other:	Odometer (km)	Start Time (24 h)	# EWPW in 1st 3-minutes	**Additional** EWPW in 2nd 3-min	Moon Visible? (Y/N)	Traffic Count (#)	Noise Level (circle one)
1	0561424 E 4916787 N	0.0 km	23:01	/		Y	Ø	Slight Moderate High Excessive
2	0561035 E 4916669 N	0.4	23:08	/		Y	Ø	Slight Moderate High Excessive
3	0560663 E 4916555 N	0.8	23:15	/		Y	Ø	Slight Moderate High Excessive
4	0560304 E 4916440 N	1.2	23:21	/		Y	Ø	Slight Moderate High Excessive
5	~~0560~~ 0559935 E 4916317 N	1.6	23:28	/		Y	Ø	Slight Moderate High Excessive
6	0559547 E 4916201 N	2.0	23:35	/		Y	Ø	Slight Moderate High Excessive
7	0559177 E 4916089 N	2.4	23:41	/		Y	Ø	Slight Moderate High Excessive
8	0558849 E 4915985	2.7	23:49	/		Y	Ø	Slight Moderate High Excessive
9		__.__	__:__					Slight Moderate High Excessive
10		__.__	__:__					Slight Moderate High Excessive

Weather at End of Survey (chose one option for each section)	
Temperature	17 °C check one: ☒measured OR ☐estimated
Wind	**0** Calm (0-2 km/h) **1** Light air (2-6 km/h) **2** Light breeze (7-11 km/h) **3** Gentle breeze (12-19 km/h) **4** Moderate breeze (20-30 km/h) **5** Fresh breeze (31-39 km/h) **X** Too windy (40+ km/h)
Precipitation	**0** None **1** Trace **2** Rain
Sky	**0** Clear (0-25% cloud cover) **1** Mostly Clear (25-50%) **2** Mostly Cloudy (50-75%) **3** Cloudy (75-00%)

Appendix D

DFO Submission

Appendix D

Clearview Sideroad 26/27 Improvements

Township of Clearview

R.J. Burnside & Associates Limited
128 Wellington Street West Suite 301
Barrie ON   L4N 8J6 CANADA

September 22, 2016
300034587.0000

Distribution List

No. of Hard Copies	PDF	Email	Organization Name
0	Yes	Yes	Fisheries and Oceans Canada
0	Yes	Yes	Nottawasaga Valley Conservation Authority
0	Yes	Yes	Township of Clearview

Record of Revisions

Revision	Date	Description
0	September 22, 2016	Initial Submission to Fisheries and Oceans Canada

R.J. Burnside & Associates Limited

Report Prepared By:

Jeremy Prahl, B.Sc., EP, Can-CISEC
Ecologist
JP:sr

Christopher Pfohl, C.E.T., EP, Can-CISEC
Senior Aquatic Ecologist
CP:sr

Report Reviewed By:

Christopher Wren

Christopher Wren, Ph.D.
Senior Fisheries Scientist
LRG Environmental

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Disclaimer

1.0 Background

R.J. Burnside & Associates Limited (Burnside) has been retained by the Township of Clearview (“Clearview”) to complete the design for proposed improvements to Clearview Sideroad 26/27, in order to facilitate the year round use of this road between Osprey Clearview Townline (County Road 95) and 10th Concession (the Study Area; see key map on drawing cover sheet).

Currently, Sideroad 26/27 has a gravel surface with a narrow base that is not maintained throughout the winter months between the last residence on the western half of the road and the 10th Concession. Road conditions vary between a passable road (with caution) and a one lane, heavily rutted surface. Surface water is inadequately conveyed through failing ditches and culverts or through surficial sheet flow across the road surface, causing granular washout into the adjacent forested and aquatic habitats (Photograph 1).

Five unnamed headwater tributaries of the Pretty River (referred to as Tributaries A through E, shown in Figures 1 and 2 located in Figures Appendix) transect the right-of-way (ROW) for Sideroad 26/27 within the Study Area. The proposed work will take place entirely within the existing road ROW. The Pretty River and its tributaries are considered cold water fish habitat supporting natural populations of Brook Trout (*Salvelinus fontinalis)*.

As a result of recent amendments to the federal *Fisheries Act 1985* a proponent led “self-assessment” is required for any project near water that could potentially impact fish or fish habitat, to determine whether “serious harm to fish” can be avoided. Burnside has determined that, based on the updated Decision Framework and guidance material developed by the Fisheries Protection Program (FPP) at Fisheries and Oceans Canada (DFO), the proposed works could potentially result in serious harm to fish. As such, a Request for Review application has been submitted to the FPP under separate cover.

Under the existing road conditions, sediment and coarse granular material is regularly flushed from the gravel road surface into the nearby tributaries. In particular, Tributary A runs parallel to Sideroad 26/27 for a distance of approximately 160 m, and is impacted by road runoff during spring melt and high precipitation events Photograph 1 and Photograph 2). The proposed road work will greatly reduce sedimentation from road runoff, by improving surface conditions through grading and stormwater management features.

Sediment loading into streams can impact fish and fish habitat by mechanisms including, but not limited to: direct clogging of fish gills (resulting in mortality or stress), reduced visual ability to capture food, altered fish movement and migration, deposition onto fish eggs, and smothering of benthic invertebrate food sources.

2.0 Proponent Contact Information

Steve Sage
Chief Administrative Officer
Township of Clearview
217 Gideon Street
Stayner, ON L0M 1S0
Phone: 705-426-6230 x228
Email: ssage@clearview.ca

3.0 Aquatic Environment

3.1 Approach and Methodology

Field investigations of the aquatic features and functions in the Study Area were initiated in 2014, in support of an Environmental Impact Statement (EIS) for the proposed road improvements. Further aquatic fieldwork was carried out in 2015 to support an EIS addendum (Burnside 2015), which addressed Nottawasaga Valley Conservation Authority and Niagara Escarpment Commission comments. Additional field investigations are being carried out in 2016 to address key knowledge gaps and inform ongoing permitting and approvals processes related to the proposed minor stream realignment and culvert replacements. In particular, mini-piezometers were installed to provide additional data on groundwater-surface water interactions. An electrofishing survey was undertaken in July, 2016 to obtain further information on fish communities in tributaries where work is being proposed. A summary of the completed and planned fisheries-related field investigations is provided in Table 1.

The primary focus of our work has been on a 160 m section of Tributary A, a third-order tributary of the Pretty River (refer to Figures 1 and 2). This feature flows from west to east within and immediately adjacent to the ROW, extending along the north side of, and parallel to, the existing three-season gravel road. The proposed works include a minor realignment (22 m) of Tributary A to accommodate road widening. The four smaller unnamed headwater tributaries of the Pretty River with crossings on Sideroad 26/27 (Tributaries B, C, D and E) were also assessed.

Table 1: Summary of completed and planned aquatics field investigations in the Study Area (May 2014 - Present)

Field Study	Methodology	Burnside Staff	Date(s)	Time(s)	Weather Conditions		
					Precipitation/ Cloud Cover[1]	Avg. Temp.	Wind[2]
Initial aquatic habitat assessment (all watercourses)	Components of the Ontario Stream Assessment Protocol (OSAP)	Jeremy Prahl (Ecologist)	2014-05-22	0900-1400	1	12°C	0-1
Brook Trout survey	Visual searches for young of the year Brook Trout	Jeremy Prahl	2015-05-05	1300-1530	0	10°C	1
Brook Trout survey and detailed aquatic habitat assessment of Tributary A	Visual searches for young of the year Brook Trout. Components of OSAP	Jeremy Prahl and Chris Pfohl, (Ecologist)	2015-05-12	1330-1800	2/5	16°C	1
Installation of in-stream groundwater piezometers and water temperature transducer. Brook Trout survey	Installation of streambed piezometers based on industry standards as confirmed by certified Hyrdrogeologists in the Province of Ontario Visual searches for young of the year Brook Trout	Jeremy Prahl, Chris Pfohl and Devin Soeting (Environmental Technologist)	2016-04-28	0900-1400	2	4°C	0-1

Field Study	Methodology	Burnside Staff	Date(s)	Time(s)	Weather Conditions		
					Precipitation/ Cloud Cover[1]	Avg. Temp.	Wind[2]
Data retrieval and equipment maintenance Brook Trout survey	Retrieve data and ensure proper functioning of instrumentation Visual searches for young of the year Brook Trout	Chris Pfohl and Devin Soeting	2016-05-24	1000-1300	0	18°C	1
Brook Trout survey	Visual searches for young of the year Brook Trout	Chris Pfohl and Devin Soeting	2016-06-09	0930-1330	0	13°C	0-1
Installation of surface water pressure transducers	Installation of in-stream piezometers for surface water measurement based on industry standards as confirmed by certified Hyrdrogeologists in the Province of Ontario	Jeremy Prahl	2016-06-24	1330-1700	0	24°C	0-1
Surface Water Sampling	Grab sampling for baseline chemical analysis	Devin Soeting	2016-07-29	0930-1015	0	27°C	0-1
Fish community sampling	Electrofishing; Fish collection permit secured from Midhurst District Ministry of Natural Resources and Forestry (MNRF)	Chris Pfohl, Jeremy Prahl and Chris Wren (LRG Environmental)	July 21, 2016	0930 - 1300	0	28°C	1-3
Spawning / Redd Survey	Visual search for structure and activity	TBD	Late Fall 2016	TBD	TBD	TBD	TBD

Field Study	Methodology	Burnside Staff	Date(s)	Time(s)	Weather Conditions		
					Precipitation/ Cloud Cover[1]	Avg. Temp.	Wind[2]

[1]NAAMP/ Beaufort Sky Codes
0 = clear (no cloud cover)
1 = partly cloudy (scattered or broken) or variable
2 = cloudy or overcast
3 = sandstorm, dust storm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

[2]Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

3.2 Aquatic Habitat Characterization

An initial aquatic assessment, generally following OSAP protocols, was completed at each watercourse crossing of SR26/27 in the springs of 2014 (see Figure 1 in Figures Appendix). A summary of existing conditions at each site is provided in Table 2, below.

Table 2: Summary of existing aquatic conditions at representative sites in the Study Area (May 22, 2014).

	Site 1 (Trib B)	**Site 2 (Trib A)**	**Site 3 (Trib C)**	**Site 4 (Trib D)**	**Site 5 (Trib E)**
Date	May 22, 2014	May 22, 2014	May 22, 2014	May 22, 2014	May 22, 2014
Time	10:00	10:30	11:30	12:00	12:30
Weather Conditions	sunc/cloud	sunc/cloud	sunc/cloud	sunc/cloud	sunc/cloud
Air Temperature	10°C	11°C	13°C	13°C	12°C
Water Clarity	clear	clear	clear	clear	clear
Water Colour	colourless	colourless	colourless	colourless	colourless
Thermal Regime (MNRF Aquatic Resource Area Mapping)	cool/coldwater	cool/coldwater	cool/coldwater	cool/coldwater	cool/coldwater
System	Pretty River	Pretty River	Pretty River	Pretty River	Pretty River
Reach Description	road crossing	parallel to road, within ROW	road crossing	road crossing	road crossing
Upstream Morphology	riffle, run; flow from roadside ditch	riffle, run, pool, stepped bed	riffle, run, flow from roadside trench	braided channel, wetland	run, flow from roadside trench
Downstream Morphology	riffle		riffle, run	riffle, run	riffle, run, pool, stepped bed
In-stream cover	overhanging vegetation	undercut banks, overhanging vegetation	undercut banks, overhanging vegetation, woody debris	aquatic vegetation	undercut banks, woody debris, overhanging vegetation

	Site 1 (Trib B)	**Site 2 (Trib A)**	**Site 3 (Trib C)**	**Site 4 (Trib D)**	**Site 5 (Trib E)**
Bank Stability	0% stable 20% vulnerable 80% eroding	80% stable 10% vulnerable 10% eroding	60% stable 20% vulnerable 20% eroding	70% stable 30% vulnerable 0% eroding	30% stable 60% vulnerable 10% eroding
Substrates	sand, gravel, organics	sand, gravel, cobble	sand, gravel	sand, silt, organics	sand, silt, organics
In-stream Aquatic Vegetation	sparse	moderate, along banks	moderate, along banks	moderate to dense	sparse
Riparian Vegetation	deciduous/coniferous trees, herbs, grasses	shrubs, grasses	deciduous trees, shrubs, grasses	shrubs, herbs, grasses	deciduous trees, shrubs, herbs, grasses
Canopy Cover	40%	10%	40%	0%	70%
Wetted Width (m)	0.2 - 0.4	0.5 - 1.0	0.3 - 0.7	0.5 - 1.0 (downstream)	0.3 - 1.0 (downstream)
Bankfull Width (m)	0.5 - 1.0	0.5 - 1.5	0.5 - 1.0	1.0 - 1.5 (downstream)	1.0 - 2.0 (downstream)
Depth at Thalweg (m)	0.05 – 0.10	0.10 – 0.45	0.05 – 0.15	0.05 – 0.10	0.10 – 0.30
Barriers to Fish Passage	none	none	none	none	perched culvert outlet (>1m)
Culvert Type	Corrugated Steel Pipe (CSP)	N/A	CSP	CSP	CSP

Two high-gradient headwater tributaries contribute flow to Tributary A immediately adjacent to the existing road. Based on available watercourse mapping, Tributary B (Aquatic Assessment Site 1) is a first order stream, whereas Tributary C (Aquatic Assessment Site 3) is a second order stream. Flows are conveyed beneath Sideroad 26/27 via shallow embedded corrugated steel pipes (CSPs; 500 mm in diameter) measuring 16.9 m and 14.7 m in length, respectively. Both culverts are partially obstructed with accumulated sand and gravel, providing very limited conveyance (Photograph 3). Stormwater and groundwater-sourced surface water routinely collects and is conveyed along the south side, and across the surface, of the existing gravel road (Photograph 4).

Upstream (south) of Sideroad 26/27, Tributaries B and C appear to be fed primarily by numerous groundwater seeps originating on the northeast-facing slope of the Niagara Escarpment. They are relatively small headwater features with poorly defined channels and are strongly associated with the groundwater-fed wetland pockets established on low to moderately-sloped terrain (Photograph 5 and Photograph 6). Over the course of the Study period (2014-2016), the flow path of Tributary B varied significantly. In the spring of 2016, the flow path previously identified in 2014 was completely abandoned and dry. Surface flow is currently directed to Tributary C, via the ditch on the south side of Sideroad 26/27.

In the few areas of Tributaries B and C where a defined channel exists, substrates are dominated by organics with sparse pockets of sand and gravel. During periods of high flow, wetted widths generally do not exceed 0.7 m and depths are less than 0.2 m. Based on 2012 aerial photography available through the County of Simcoe's online Interactive Map application (www.simcoe.ca/dpt/it/gis), Tributary C flows through an online pond located approximately 60 m south of the ROW (see Figures 1 and 2).

3.2.1 Detailed Aquatic Habitat Assessment – Tributary A

The upstream section of Tributary A (Reach 1; west of Sta. 6+019) consists of a channel with multiple flow paths, within a wetland community. Further downstream, the channel becomes confined, as the vegetated strip along the north side of the existing road and the adjacent woodland area form defined banks. Reach 2, which extends from Sta. 6+019 to Sta. 6+159, consists of a series of step-pool features interspersed with short riffles and runs (Photograph 7). Reach 3 extends downstream from Sta. 6+159 and consists of an extended riffle feature on lower-gradient terrain. The channel turns sharply away from the ROW at Sta. 6+165, and continues northeastward, beyond the Study Area. The average gradient over the full length of Tributary A (within the limits of the Study Area, defined above) is approximately 8-9%, gradually becoming less steep near the downstream end (approximately 4-5%).

Throughout the channelized section of Tributary A (i.e., Reaches 2 and 3), substrates are dominated by gravel, cobble and boulder, with deposits of sand and organics in areas of low velocity. Extensive sand and gravel washout from the Sideroad 26/27, impacting Tributary A, has been observed on several occasions (Photograph 8 and Photograph 9). Upon close inspection, the dimpled, sub-angular gravel predominant in the stream bed appears to match the material found on the surface of road (Photograph 10). This suggests that a significant portion of the smaller coarse material covering the stream bed is not derived from the native parent material, but rather from the municipal road, which is routinely re-surfaced with gravel.

At the time of the spring 2015 site visit, the wetted widths of Reaches 2 and 3 ranged from 0.6 m to 0.9 m and the maximum depth of pool features ranged from 0.18 m to 0.60 m. Bankfull width ranged from 1.5 m to 3.2 m. In Reach 3, the channel has vertical (undercut) banks and the bankfull width is similar to the wetted width (1.0 to 1.5 m). A grassed area, approximately 1.5 m to 3 m wide, buffers the road from the channel of Tributary A; however, road washout has eroded this buffer in two areas. Reach 2 is well shaded by deciduous trees and shrubs, mainly associated with the woodland along the north bank. Overhead cover in Reach 3 is more open, with some overhanging grasses and shrubs providing shade during the growing season.

As mentioned above, a minor channel realignment (22 m) of Tributary A will be required to accommodate the road reconstruction. The anticipated area of impact is located within the downstream section of Reach 2 and Reach 3 (between Stations 6+146.5 and 6+165; 18.5 m measured parallel to the ROW). Due to gradual bends in the channel, the actual watercourse feature in the area of impact is approximately 22 m in length, measured along the center line of the channel. The section of stream that is proposed to be realigned is shown in Photograph 11. The proposal is to create a new channel approximately one bankfull width (1.0 m) north of the existing channel, within the existing road allowance, which is marked by red wooden stakes (see Figures 2 and 3 in Figures Appendix). The resultant new channel will be straighter resulting in a new section length of approximately 18.5 m.

Detailed fish habitat information was collected along transects oriented perpendicular to flow, located at 2.0 m intervals along the ROW, to document fish habitat features. The corresponding data is presented in Table 3, below.

Table 3: Overview of fish habitat in Reaches 2 and 3 of Tributary A, between Station 6+146.5 and Station 6+165 (proposed realignment), May 12, 2015

Transect No.	*Station No.*	*Morphology*	*Wetted Width (m)*	*Max. Depth (m)*	*Substrate Composition (%)*[1]							*Cover Type Present*[2]						
					C/S	*Sa*	*Gr*	*Co*	*Bo*	*Br*	*Or*	*WM*	*Su*	*AV*	*Tu*	*OHG*	*OHS*	*UB*
1	6+163	Riffle	0.8	0.09	Tr	10	20	60	0	0	10	N	Y	N	Y	Y	Y	N
2	6+161	Riffle	0.9	0.11	Tr	5	50	40	0	0	Tr	N	Y	N	Y	Y	Y	Y
3	6+159	Riffle	0.6	0.10	Tr	10	60	30	0	0	Tr	N	Y	N	Y	Y	N	Y
4	6+157	Riffle	0.9	0.11	Tr	10	70	20	0	0	Tr	N	Y	N	Y	Y	Y	Y
5	6+155	Pool	1.0	0.18	Tr	40	50	10	0	0	Tr	N	Y	N	Y	Y	N	Y
6	6+153	Riffle	1.0	0.09	Tr	40	50	0	0	0	10	N	N	Y	Y	Y	Y	N
7	6+151	Riffle	1.2	0.13	Tr	70	20	5	0	0	5	N	N	N	Y	Y	Y	Y
8	6+149	Pool	0.9	0.18	Tr	60	20	10	0	0	10	N	N	N	Y	Y	N	N
9	6+147	Riffle	1.0	0.07	Tr	5	10	5	80	0	Tr	N	Y	Y	Y	Y	N	N

[1] C/S = Clay/Silt; Sa = Sand; Gr = Gravel; Co = Cobble; Bo = Boulder; Br = Bedrock; Or = Organics; and Tr = Trace
[2] WM = Woody Material; Su = Substrates; AV = Aquatic Vegetation; Tu = Turbidity; OHG = Overhanging Grasses; OHS = Overhanging Shrubs and Trees; and UB = Undercut Bank

Further east along the road alignment, there are two additional watercourse crossings that contribute flow to Tributary A north of the Study Area. Tributary D is first-order stream conveyed beneath Sideroad 26/27 via an existing CSP (Site 4; Sta. 6+510; Photograph 12). Within the ROW, the channel is dominated by organics, silt and sand substrates with dense aquatic/wetland vegetation upstream. No fish were observed at this site during our field investigations, but access from downstream areas may be possible.

Tributary E is a spring-fed first-order stream located mainly in the south ditch. It is conveyed beneath Sideroad 26/27 via a partially obstructed CSP with a perched outlet. This feature is a permanent barrier to fish movement (Site 5; Sta. 6+765; Photograph 13). The upstream channel is dominated by organic substrates and very little flow was noted (Photograph 14).

Water temperatures were recorded during the afternoon of May 22, 2015, from Tributaries A and C, using a waterproof quick-read digital thermometer. Surface water temperatures in Tributary A, upstream and downstream of the confluence of Tributary C, were 9.4°C and 10.5°C, respectively. Surface water temperature in Tributary C was 11.1°C while water temperatures in the eroded south ditch of the existing road were 14.4°C, on average. Following an extended period of hot weather in July 2016, the water temperature in Tributary A (upstream of Tributary C) was measured at 16°C, while the air temperature was 27°C.

Water temperatures measurements obtained from Tributary A were not sufficiently refined to allow for the confirmation of suspected groundwater upwelling sites, based on thermal gradient.

3.3 Fish Community

3.3.1 Methodologies

The native fish community was characterized over the course of three years through visual surveys (2014-2016) and electrofishing (2016). Young-of-the-year (YOY) Brook Trout visual surveys were carried out in the spring of 2015 (May 5 and 12) and 2016 (April 28, May 24, June 9) in Tributaries A, C and D. YOY were observed in Tributary A in 2015; however, none were observed in 2016. Given the eroded condition of the road following the 2016 spring run-off, it is possible that road washout and sedimentation may have impacted potential spawning areas (nests/redds). Spawning surveys will be conducted in late Fall 2016 to determine if and where resident fish are creating nests and attempt to characterize areas of groundwater upwelling for increased protection during construction.

Fish community sampling was conducted using a backpack electrofisher (Smith Root Model LR24) on July 21, 2016, to help determine whether Tributaries A, B, C, D and/or E, within the ROW, are occupied by fish. Tributary A was sampled intermittently to focus on small pools and undercuts that provide high quality cover. Tributary E was not sampled due to insufficient water depth.

3.3.2 Results

Juvenile and/or small adult Brook Trout were documented in Reaches 2 and 3 of Tributary A throughout the study period. In 2014 and 2015, YOY were also observed (seen) in small, low-velocity pockets of water along the margins of Tributary A. These observations confirm that Tributary A, adjacent to Clearview 26/27 Sideroad, provides coldwater habitat that supports a locally reproducing Brook Trout population. No other species were observed in Tributary A. The results of fish sampling by electrofishing are provided in Table 4, below.

No fish were observed in Tributaries B, C, D or E over the course of the three year study period (2014-2016). The existing culverts are in very poor condition and are likely acting as barriers to upstream fish passage during periods of low flow. As mentioned above, the culvert conveying flow to Tributary E is perched. Furthermore, the shallow, poorly defined, and organic substrate-dominated channels typical of the watercourses on the south side of Sideroad 26/27 do not provide high quality habitat for coldwater fish species. These headwater areas do however provide indirect/contributing fish habitat benefitting known occupied reaches, downstream.

Table 4: Summary of fish community sampling by electrofishing in Tributaries A, B, C, D and E (July 21, 2016).

	Tributary A	Tributary B	Tributary C	Tributary D	Tributary E
Electrofishing Effort (seconds)	437	41	35	65	0
Species Observed	Brook Trout	N/A	N/A	N/A	N/A
Number of fish caught/released	6	0	0	0	N/A
Size range (total length in mm)	105-180	N/A	N/A	N/A	N/A
Number of fish observed/escaped	7	N/A	N/A	N/A	N/A

4.0 Project Description

The following DFO work categories are applicable to the project:

- Watercourse Realignment.
- Culverts.
- Stormwater Management Facilities.

The general development concept includes improvements to Sideroad 26/27, between County Road 31 and the 10th Concession, to allow for year-round use of this road and to correct safety hazards, including sight line improvements. Proposed changes to the road include slope reductions, improvements to stormwater quality control (to an enhanced level), improvements to conveyance of surface water through new ditches and culverts, and potential surface paving. All works will be limited to the existing ROW created as part of the original road fabric for the Township. Drawing sheets A001-A008 and C001-C008 (with and without aerial photo base, respectively) illustrate Plan & Profile drawings and the proposed limits of disturbance within the ROW for Clearview Sideroad 26/27.

The following six project components are expected to have direct or indirect impacts on one or more of the identified watercourses:

a) Minor realignment of approximately 22 m of Tributary A (between Stations 6+146.5 and 6+165; 18.5 m in length measured parallel to the ROW), to accommodate for road widening within the existing right-of-way (refer to drawing sheets C006, C011,and C012).

b) Replacement and extension of an existing CSP culvert previously conveying Tributary B (a headwater drainage feature) at Station 5+945 (refer to sheet C005).

c) Replacement and extension of an existing CSP culvert conveying Tributary C at Station 6+125 with a concrete box culvert (refer to sheets C006 and C014).

d) Replacement and extension of an existing CSP culvert conveying Tributary D at Station 6+505 within a concrete box culvert (refer to sheets C007 and C015).

e) Replacement and extension of an existing CSP culvert conveying Tributary E at Station 6+765 (refer to sheet C007)

f) Relocation/reconfiguration of existing roadside surface drainage, partially fed by groundwater seeps and Tributary B (currently) from Sta. 6+040 to 6+130, along the south side of Sideroad 26/27 (refer to sheets C005, C006 and C010).

4.1 Proposed Channel Realignment

Based on the proposed road design, a short section of Tributary A will need to be realigned to provide space for the road shoulder and embankment. Currently, this section of watercourse is impacted by road run-off during spring melt that erodes surface gravel, which then is deposited in the watercourse downstream of Station 6+650. The proposed channel realignment consists of moving the watercourse slightly north by approximately one bankfull width (1.0-1.5 m). The location of the proposed channel realignment is illustrated in Figure 2, with more detail provided in Figure 3. The proposed realignment will reduce the length of the channel from about 22 m to 18.5 m due to slight straightening of the stream.

The proposed realignment will incorporate natural channel design techniques to replicate the existing habitat and morphology. Suitably sized riverstone will be installed in the channel bed and sod mats are proposed along the realigned channel banks. Existing substrate will be salvaged and used as a top layer in the new channel, to support the naturalization of bed material. Large stone (cobble/boulders 75 to 450 mm in diameter) will be incorporated along the toe of the channel bank to prevent unwanted erosion/scour of the adjacent road base and maintain fish passage. Seeding and plantings will be provided along the upper banks and in disturbed riparian areas, based on input from Nottawasaga Valley Conservation Authority (NVCA).

In June 2016, a geomorphic evaluation of the existing channel and proposed realignment of Tributary A was completed by John Parish (Fluvial Geomorphologist, PARISH Aquatic Services / Matrix Solutions Inc.; see Appendix A). The proposed realignment was deemed to be achievable, appropriate and potentially beneficial to the geomorphic function of the tributary, given the existing erosion and sedimentation issues.

Burnside plans to incorporate the following practices and measures in the construction staging design:

- Isolation of proposed realignment section with suitably sized cofferdams.
- Use of appropriate pumps fitted with intake screens to transfer creek flows.
- Salvage of fish and wildlife stranded in the work area.
- Downstream to upstream excavation of the new channel.
- Careful placement of stone, as directed by on-site Aquatic Ecologist for bed and banks.
- Grading of top of bank, seeding and use of erosion control measures to stabilize soils.
- Removal of downstream cofferdam prior to removal of upstream cofferdam, to re-establish creek flow.

More detailed construction notes are provided in the attached detailed design drawings (refer to sheet C013). An Aquatic Ecologist (Qualified Environmental Professional) will be present during all phases of the realignment to provide contractor guidance and support for stone placement as part of the channel design. Burnside has previously designed and overseen the construction of numerous natural channels and realignments approved by DFO and Conservations Authorities.

4.2 Culvert Replacements and Extensions

The four proposed replacement culverts will be aligned along existing natural watercourses. The existing culverts are undersized, resulting in frequent overtopping of the road, high stream velocities, channel and scour immediately downstream of the culverts.

The proposed new culverts will be of equal or greater diameter and longer than the respective existing culverts. They will be sized to convey the 25 year storm event without overtopping the road, in accordance with MTO directive B-100. The proposed precast concrete box culverts (to convey Tributaries C and D under SR 26/27) will be embedded with suitably sized round stone substrates, to a depth of 0.6 m. Replacement CSP culverts (Tributaries B and E) will be partially embedded to accommodate some deposition of native bed material. Concrete box culvert designs include a riverstone-lined low flow channel with defined bed and banks.

Additional information on methodologies and mitigation measures to be incorporated into the proposed culvert replacement designs is provided in Section 6.0, below.

4.3 Stormwater Management

The design for proposed road improvements include various design considerations and components that address water quantity and quality control.

Quantity Control

The Ministry of Environment Stormwater Management Planning and Design Manual (MOE SWMPDM, 2003) provides quantity control criteria applicable to the proposed road reconstruction, to ensure that the reconstruction does not result in increased flooding downstream. According to the MOE manual, stormwater peak flows should not exceed existing peak flow rates for the 2 through 100 year events.

Quantity control measures are not anticipated for the road reconstruction, as the road surface is sufficiently small and the adjacent areas sufficiently large that the additional impermeable surface area is not expected to have a significant impact on stormwater peak flows downstream of the road.

Hydrologic modelling was completed to compare existing and proposed peak flows for the 2 through 100 year events, as part of stormwater analysis for this project. The modelled comparison of existing and proposed peak flows reveals that proposed and existing peak flows are generally the same. Under the modelled storm events, the variance up or down at any of the site outlets is less than 0.1 m^3/s. This variance is not considered significant relative to the quantity control criteria for this project. Therefore, the quantity control criteria for this project are satisfied.

Quality Control

The MOE SWMPDM (2003) is also the current provincial standard for stormwater quality control in Ontario. It provides a prescriptive approach for mitigating the negative effects of development. The manual prescribes minimum sizes for various stormwater management practices to mitigate the impairment of downstream water quality resulting from the increased pollutant loading typically associated with development. The stormwater design will employ these mitigating practices to achieve an enhanced level of quality control for the project. Quality control designs include the use of enhanced grassed swales where grading constraints allow. In areas where grading constraints prevent the use of enhanced grassed swales, a Filtration System adapted from Figure 4.14 of the MOE SWMPDM (2003) will be employed (refer to design drawing sheet C010).

There is no quality control provided for the existing road runoff. Currently runoff travels uncontrolled off of the existing road surface carrying large amounts of sediment with it into the receiving natural stream system, as evidenced by frequent heavy rilling, washouts and washboarding of the road.

Through field observation, it appears that large quantities of road granulars are deposited in the downstream watercourse. It is assumed that coarser granulars settle out of the stream flow in the steeper headwater reaches and finer sediment is carried further downstream and is deposited in pools, and other lower velocity or lower gradient stream sections.

The proposed overall stormwater management strategy incorporates two main types of low impact development (LID) stormwater management practices, in a treatment train approach, to achieve enhanced quality control. The first method is a bioretention LID concept adapted to a rural road cross-section. The second is the use of enhanced grassed swales. Both methods receive good reviews in the CVC/TRCA LID Stormwater Management Planning and Design Guide for achieving quality control and water balance benefits.

According to the CVC/TRCA LID Stormwater Management Planning and Design Guide, "Performance results from both laboratory and field studies indicate that bioretention systems have the potential to be one of the most effective BMPs for pollutant removal/ Bioretention provides effective removal for many pollutants as a result of sedimentation, filtering, soil adsorption, microbial processes and plant uptake."

Refer to Table 4.5.1, excerpted from the CVC TRCA LID Guide, for details:

Table 4.5.1 Ability of bioretention to meet SWM objectives

BMP	Water Balance Benefit	Water Quality Improvement	Stream Channel Erosion Control Benefits
Bioretention with no underdrain	Yes	Yes – size for water quality storage requirement	Partial – based on available storage volume and infiltration rates
Bioretention with underdrain	Partial – based on available storage volume beneath the underdrain and soil infiltration rate	Yes – size for water quality storage requirement	Partial – based on available storage volume beneath the underdrain and soil infiltration rate
Bioretention with underdrain and impermeable liner	Partial – some volume reduction through evapotranspiration	Yes – size for water quality storage requirement	Partial – some volume reduction through evapotranspiration

Bioretention detains and infiltrates a portion of the stormwater that it receives and increases contact of stormwater with vegetation, the root zone and soil. It relies primarily on infiltration to achieve quality control. Pollutants are also removed through vegetative uptake.

Enhanced grassed swales similarly increase stormwater contact with vegetation and soil. They partially rely on infiltration to achieve quality control of stormwater. Enhanced grassed swales allow stormwater to infiltrate as they detain a portion of the stormwater behind check dams and allow it to infiltrate. Refer to Figure 4.8.2 excerpted from the CVC/TRCA LID Stormwater Management Planning and Design Guide, a photo of an enhanced grassed swale.

Figure 4.8.2 Enhanced grass swales feature check dams that temporarily pond runoff to increase pollutant retention and infiltration and decrease flow velocity

Enhanced grassed swales also slow down stormwater through the vegetated swale such that quiescent settling of particles can occur. Based on the CVC TRCA LID Stormwater Management Planning and Design Guide, "Median pollutant mass removal rates of swales from available performance studies are 76% for total suspended solids, 55% for total phosphorus, and 50% for total nitrogen (Deletic and Fletcher, 2006)." Furthermore, "Enhanced grass swales are well suited for conveying and treating runoff from highways and other roads because they are a linear practice and easily incorporated into road rights-of-way." Refer to the rock check dam detail found in Appendix B, "BSD-24 DRAFT, Typical Rock Check Dam Erosion Control Device". The note in the detail stating "100 mm of 50 mm clear stone cover" will be revised in the construction contract to reflect cover with a mixture of 50 mm clear stone and 150 to 300 mm stone to ensure the check dams stay in place under high flow conditions. The rock check dams are to be employed in series down the slope as shown in the photo above. The series will be located in all areas with ditch slopes exceeding 4%.

The proposed LID controls consisting of enhanced grass swales and bioretention are sized to provide enhanced quality control for road runoff prior to it entering the natural stream

From Sta. 5+420 west ditch slopes are relatively flat and the ditch does not contain any watercourses, therefore this section of road is treated by enhanced grassed swales. Rock check dams are placed within the ditches to slow stormwater velocities and achieve the necessary retained stormwater volume to provide enhanced quality control.

From Sideroad 26/27 Sta. 5+420 east, the bioretention level spreaders are to be constructed on both sides of the road and check dams are to be located in steep (greater than 4%) ditch sections.

In locations where bioretention is used, it is sized to exceed Ministry of Environment and Climate Change (MOECC) enhanced quality control requirements.

The proposed ditches are modified to achieve an enhanced grass swale design by densely vegetating the ditch with native vegetation, installing a series of rock check dams as noted above and in select locations installing a perforated underdrain surrounded by a granular jacket. The design reduces swale velocities and erosion, it increases dissolved oxygen levels through the use of a series of cascading pools formed by the check dams and it increases infiltration.

The bioretention component of the quality control design consists of a series of level spreaders constructed of coir logs attached to the side of the road embankment. The road embankment is to be restored with 75 mm topsoil. The embankment and level spreader is to be seeded with a native seed mix appropriate for riparian restoration. The coir log level spreader over time will be naturalized such that it will appear as a small vegetated berm on the road embankment. Following the naturalization process the soil and root system of the selected vegetation will successively take over the coir log to form the small berm. Similar concepts are employed in stream bank restoration projects as shown in the MNR Natural Hazards Manual. It is similar to the Live Fascine technique described in *River and Stream Systems: Erosion Hazard Limit*, Appendix 4 Biotechnical and Soil Bioengineering Methods (2002), wherein the successive vegetation stabilizes the bank. The MNR publication states:

> Live fascines perform several "living systems" and mechanical "protective" functions in the erosion control process and hydrology process as follows:
>
> - break up the slope length into a series of shorter slopes separated by benches;
> - provide surface stability for the planting or natural invasion and establishment of vegetation in the surrounding plant community, thus speed up the process of reestablishing functionality;
> - trap debris, seed, and vegetation on the slope face;
> - slow surface-water velocity and allow for more infiltration;
> - assist in drying excessively wet sites through transpiration as they root and produce top growth;
> - function as pole drains when placed at an angle on wet sites; and
> - reinforce the soil mantle via the root systems.

The level spreader intercepts road runoff, encouraging infiltration through the root zone and then the granular material of the road embankment prior to entering the enhanced swale. Vegetation on the enhanced grassed swale and level spreader addresses the existing erosion problem by stabilizing the road embankment. It encourages sheet flow, and intercepts pollutants. The proposed use of native species encourages native flora in the riparian zone. Refer to design drawing sheet C010 (Stormwater Management Concept), for bioretention details.

Descending the steep portion of the escarpment there are groundwater seep locations adjacent to the road. This groundwater input is valuable to the downstream coldwater fisheries; therefore it is necessary for the proposed ditch design to respect the need to maintain this groundwater input. The proposed ditch in a number of locations is at a higher elevation than the existing ditch. In order to mimic the existing hydrogeological conditions it is proposed that a perforated underdrain is to be placed in the existing ditch prior to placement of fill to create the new ditch. The underdrain will capture the ground water at the existing ditch elevation and daylight it to the enhanced grassed swale periodically as it descends the steep slope. The underdrain will be surrounded by a granular jacket to prevent clogging long term.

The proposed Stormwater Management Plan employing bioretention enhanced grassed swales and select use of perforated underdrains satisfies the project criteria and achieves enhanced quality control. It respects the hydrogeological constraints of the project by mimicking existing groundwater seeps descending the escarpment and preserving cold groundwater inputs to downstream cool/coldwater fisheries. The Plan is linear; controlling stormwater at the source thereby avoiding large land requirements into NEC protected lands which would be the typical result from traditional stormwater ponds. The proposed design considers NEC development limit criteria by limiting the development to a cross-section width even narrower than the Township minimum.

5.0 Anticipated Impacts to Fish Habitat

Various elements of the proposed road improvements have the capacity to impact fish habitat including:

- Loss of natural cover and inputs due to installation of new culverts which are generally longer and/or larger than existing culverts. However, the longer culverts will provide additional man-made cover which is known to be used by salmonids in small tributary streams. The impacts of the proposed culvert extensions are quantified in Table 5, below.

- Changes to external energy /nutrient inputs (food supply, nutrient concentrations) and loss of shade, resulting from southward expansion of road base and re-location of the the roadside drainage ditch currently providing year-round baseflow to downstream fish habitat.
- Relatively minor loss (<5 m^2) of aquatic habitat due to realignment of a short (22 m) section of Tributary A to 18.5 m.
- Erosion, sedimentation and loss of natural cover as a result of the construction process.

Table 5: Summary of anticipated areas of impact to fish habitat resulting from proposed culvert extensions

Culvert Location (Proposed)	Plan & Profile Sheet No.	Tributary	Existing Culvert Length (m)	Proposed Culvert Length (m)	Average Bankfull Width of Watercourse (m)	Area of Impact (m^2)
Sta. 5+945	C005 A005	B	12.3	16.9	0.6	10.1
Sta. 6+125	C006 A006	C	15.3	28.0	0.6	16.8
Sta. 6+510	C007 A007	D	9.5	24.0	1.3	31.2
Sta. 6+765	C007 A007	E	9.5	16.7	0.6	10.0

6.0 Mitigation Measures

The following mitigation measures will be implemented, to minimize or avoid impacts to fish and fish habitat, during construction of the channel and culvert replacement:

- All in-water construction to take place between July 1st and September 30th of any given year (or as otherwise directed by the MNRF).
- All in-water work to be performed in dry dewatered conditions.
- Flow should be maintained from upstream to downstream of the work area at all times.
- Stabilization works should follow the natural contour and profile of the watercourse using natural channel design techniques (riverstone and plantings).
- Any stockpiled materials will be stored and stabilized away from the watercourse.
- Vehicle and equipment re-fueling and maintenance will be conducted a minimum of 30 m away from the water.
- Any part of equipment entering the water should be free of fluid leaks and cleaned/degreased to prevent deleterious substances from entering the water.
- Only clean material free of fine particulates should be placed in the water.
- General erosion control notes will be part of the engineering drawings to be provided to the contractor.

- Sediment and erosion control measures should be implemented prior to work and maintained during the work phase, to prevent the entry of sediment into the water.
- All sediment and erosion control measures should be inspected daily to ensure they are functioning properly, and upgraded or maintained as required.
- If the sediment and erosion controls are not functioning properly, no further work should occur until the sediment and/or erosion control problem is addressed.
- Sediment and erosion control measures should be left in place until all disturbed areas in the construction area are stabilized.
- All disturbed areas should be stabilized and re-vegetated as soon as possible following construction to preconstruction conditions or better
- All erosion and sediment controls should be removed once the site is deemed stable. Any accumulated silt or sediment will be removed with care once the site is stabilized.

7.0 Anticipated Improvements to Fish Habitat

Road Improvements Adjacent to Subject Watercourses

The proposed road improvements will result in improved stormwater conveyance, significantly reducing erosion of the road base and sedimentation in adjacent watercourses. Stormwater quality control measures are also expected to reduce the concentration of pollutants and sediment in stormwater conveyed off the road surface (refer to Section 4.3 for more details).

Culvert Replacements

The new box culvert design for Tributaries C and D will incorporate a low flow channel with a defined bed and banks formed with natural riverstone substrates. The box culverts will be embedded to a depth of 0.6 m and will tie into the existing channel invert. Fish passage will be improved at these crossings by including a low flow channel, potentially allowing for periodic access to upstream reaches on the south side of the ROW.

All of the existing culverts are heavily impacted by accumulated sand and gravel. As such, replacement CSP culverts will generally offer improved conveyance and fish passage. Groundwater inputs will be more efficiently directed across SR 26/27 and into the receiving watercourse, reducing the potential for surface warming in the roadside ditch.

Channel Realignment (Tributary A)

Currently, road run-off is resulting in significant sediment and coarse material input to Tributary A during spring melt and large rain events. Erosion and sedimentation issues in Reach 3 will be addressed by providing some separation between the road and the watercourse through the channel realignment. Benefits to the natural geomorphic function of the tributary are also anticipated (refer to Geomorphic Evaluation; Appendix A).

8.0 Summary of Net Impact to Fish and Fish Habitat

Despite best efforts to minimize grading limits associated with the road widening, the proposed channel realignment in Tributary A will be required to achieve the minimum municipal road standard. The proposed realignment will impact approximately 22 m^2 of existing coldwater habitat. The realigned channel is expected to be slightly straighter than the existing condition (approximately 18.5 m in length), resulting in a small loss of overall habitat in Reach 3 of Tributary A (less than 5 m^2). Permanent changes to shade, food supply, nutrient concentrations and structural cover are unavoidable at the watercourse crossings and within the footprint of the road expansion, on the south side of Sideroad 26/27.

Given the proposed design elements and mitigation measures specifically intended to maintain and/or enhance fish habitat features and functions and/or water quality, we anticipate that net impacts to fish and fish habitat can be minimized and will not significantly alter the natural ecological function or productivity of the subject watercourses.

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Photo Log

Photo Log

Photograph 1

Heavy washout of road surface and active sedimentation of Tributary A near Sta. 6+150 (March 28, 2016).

Photograph 2

Active sediment loading from road runoff into Tributary A after rainfall event during spring melt (March 28, 2016).

Photograph 3

Road washout and partially obstructed culvert inlet, on south side of existing road at Sta. 5+940 (May 22, 2014).

Photograph 4

Extensive road washout along north side of road at existing culvert conveying Tributary B at Sta. 5+945 (May 22, 2014).

Photograph 5

Tributary B, downstream (north) of Sideroad 26/27 crossing, upstream of confluence with Tributary A (May 22, 2014).

Photograph 6

Tributary C, upstream (south) of Sideroad 26/27 crossing (May 22, 2014).

Photograph 7

Representative view of step-pool morphology in Reach 2 of Tributary A (April 27, 2015).

Photograph 8

Reach 3 of Tributary A (April 27, 2015).

Photograph 9

Road washout contributing coarse aggregate material to Reach 3 of Tributary A (April 27, 2015).

Photograph 10

Gravel substrates from the stream bed (left) compared to those found on the surface of Clearview Sideroad 26/27 (right) (April 27, 2015).

Photograph 11

Section of Tributary A that is proposed to be realigned (April 14, 2016).

Photograph 12

Tributary D downstream (north) of Sideroad 26/27 (May 22, 2014).

Photograph 13

Perched outlet of culvert conveying Tributary E, downstream (north) of Sideroad 26/27 (May 22, 2014).

Photograph 14

Inlet of culvert conveying Tributary D, upstream (south) of Sideroad 26/27 (May 22, 2014).

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Figures

Aquatic Assessment Sites

Amphibian Survey Stations

Watercourse (OHN)

Watercourse: Intermittent

Watercourse: Permanent

Waterbody (OHN)

Lake; Pond; River Segment of Width

SIMCOE COUNTY LAND INFORMATION NETWORK COOPERATIVE LINC

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

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This map is the product of a Geographic Information System (GIS). As such, the data represented on this map may be subject to updates and future reproductions may not be identical.

Datum: North American 1983	
Coord. System: NAD 1983 UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Rotation: 0	Scale Factor: 0.99960

N

Grid North

0 100 200 300 400 500 600 700 800

Metres

BURNSIDE

Client

TOWNSHIP OF CLEARVIEW

Figure Title

AQUATIC AND AMPHIBIAN SURVEY STATIONS

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

Drawn	Checked	Date	Figure No.
JP	NS	2015/06/01	1
Scale		Project No.	
H 1:10,000		300034587	

File Path: L:\Project\300034587 (Clearview SR 26-27 EIS)\034587_Amphibians Aquatics.mxd Print Date: 2015/06/01 Time: 03:54 PM

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

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Coord. System: NAD 1983 UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Rotation: 0	Scale Factor: 0.99960

N
Grid North

0 7.5 15 22.5 30 37.5 45 52.5 60
Metres

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TOWNSHIP OF CLEARVIEW

Figure Title

TRIBUTARY A AND PROPOSED REALIGNMENT

CLEARVIEW SIDEROAD 26/27 IMPROVEMENTS

Drawn	Checked	Date	Figure No.
JP	NS	2015/06/29	2
Scale		Project No.	
H 1:750		300034587	

File Path: L:\Project\300034587 (Clearview SR 26-27 EIS)\034587_Aquatics Zoomed.mxd Print Date: 2015/06/29 Time: 03:17 PM

Figure 3 - Proposed Channel Realignment Concept
Clearview Sideroad 26/27 Improvements

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

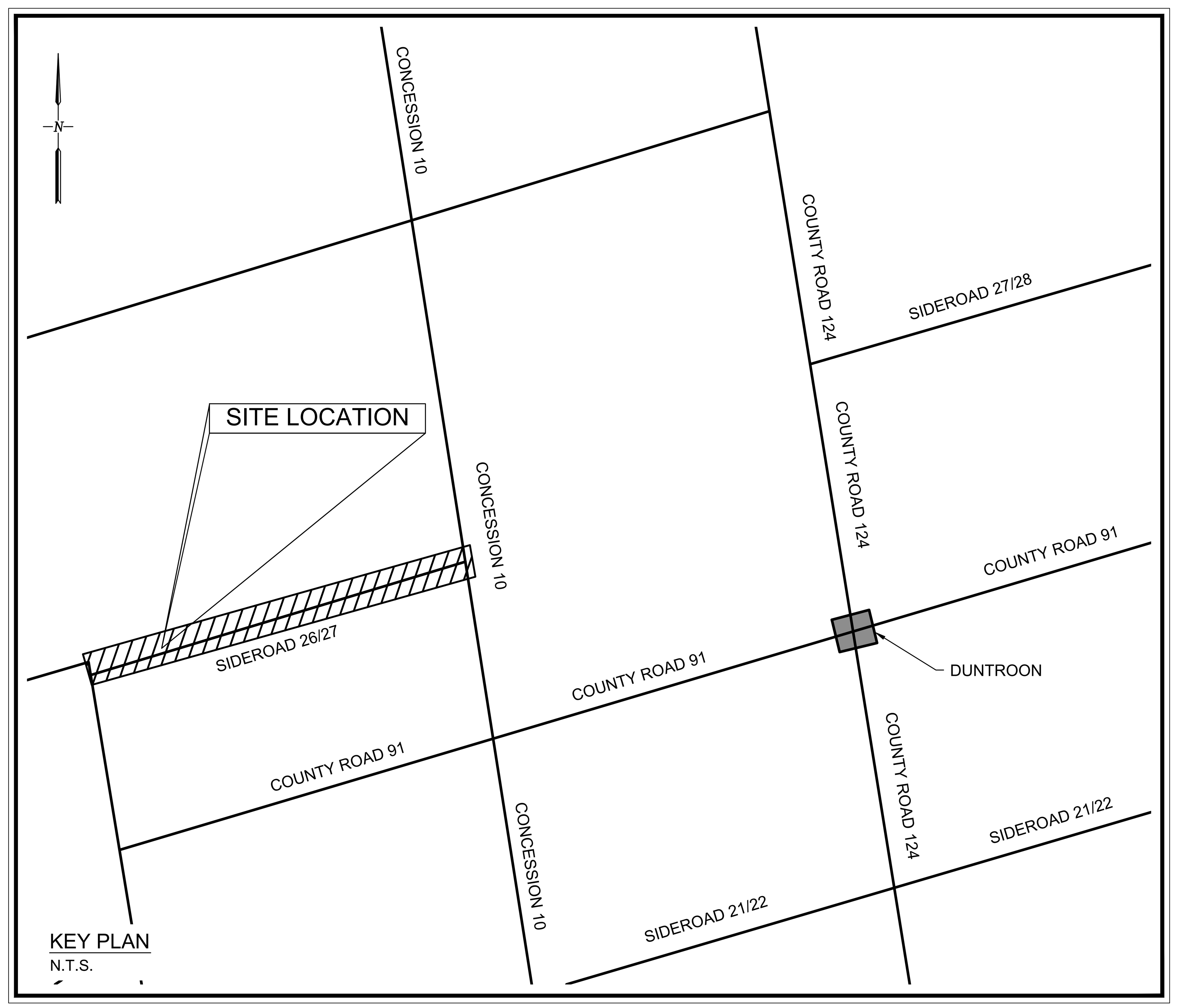
Drawings – Detailed Design

Drawings

TOWNSHIP OF CLEARVIEW

CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

CONTRACT No.



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CLEARVIEW

TOWNSHIP OF CLEARVIEW
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

Burnside Project No. 300034587

ISSUED FOR DFO SUBMISSION - 2016/09/22

BURNSIDE

TOWNSHIP OF CLEARVIEW - CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION - CONTRACT No.

Burnside Project No. 300034587 - ISSUED FOR DFO SUBMISSION - 2016/09/22

INDEX

LEGEND

EXISTING

SIB	STD IRON BAR
IB	IRON BAR
RIB	ROUND IRON BAR
HP	HYDRO POLE
THP	HYDRO POLE WITH TRANSFORMER
HPLS	UTILITY POLE WITH LIGHT STD
THPLS	UTILITY POLE WITH LIGHT STD AND TRANSFORMER
	BELL PED
BHP	BELL/HYDRO POLE
LS	LIGHT STD
	DECIDUOUS TREE
	CONIFEROUS TREE
MB	MAIL BOX
X	FENCE
	U/G BELL
	ROGER'S CABLE
	U/G BELL & ROGER'S CABLE (SHARED TRENCH)
216.10	GROUND ELEVATION

REMOVALS

	CLEARING & GRUBBING
	TREE REMOVAL
X	FENCE REMOVAL
	CULVERT REMOVAL

NEW CONSTRUCTION

	GRADING LIMIT (FILL)
	GRADING LIMIT (CUT)
	DITCH WITH FLOW DIRECTION
	STEEL BEAM GUIDE RAIL
	LIGHT-DUTY SILT FENCE (OPSD 219.110)
	HEAVY-DUTY SILT FENCE (OPSD 219.130)
	GRAVEL DRIVEWAY
	ASPHALT DRIVEWAY
	CONCRETE DRIVEWAY
	INTERLOCKING BRICK DRIVEWAY
	BOREHOLE

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PRELIMINARY

No.	Issue / Revision	Date	Auth.
3	PRELIMINARY VIA RECOMMENDATION	2014/07/08	
4	DESIGN REVISION	2015/04/10	
5	DESIGN REVISION	2015/05/08	
6	DESIGN REVISION	2015/05/29	
7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
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L0M 1S0

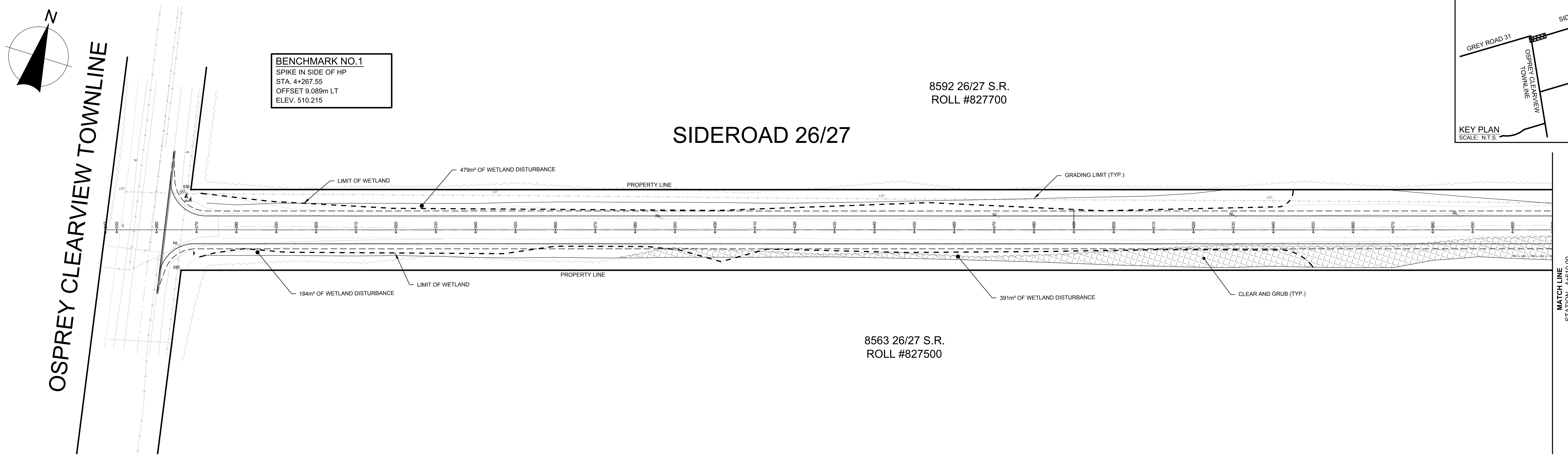
Drawing Title

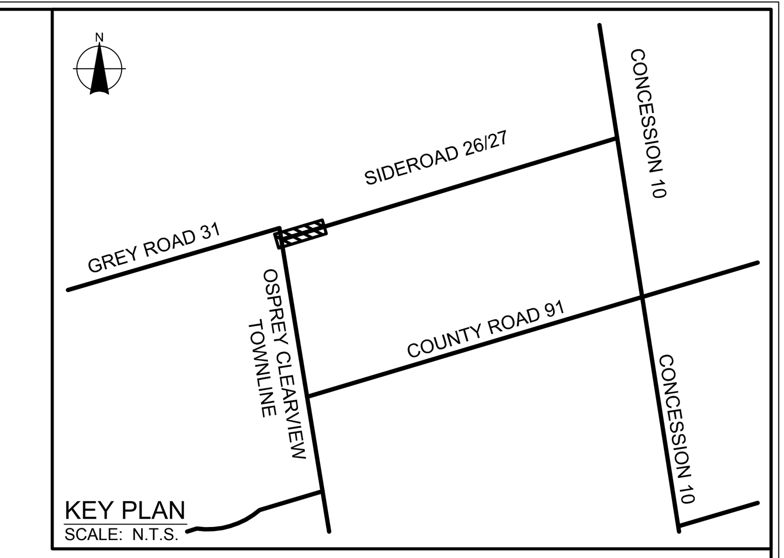
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

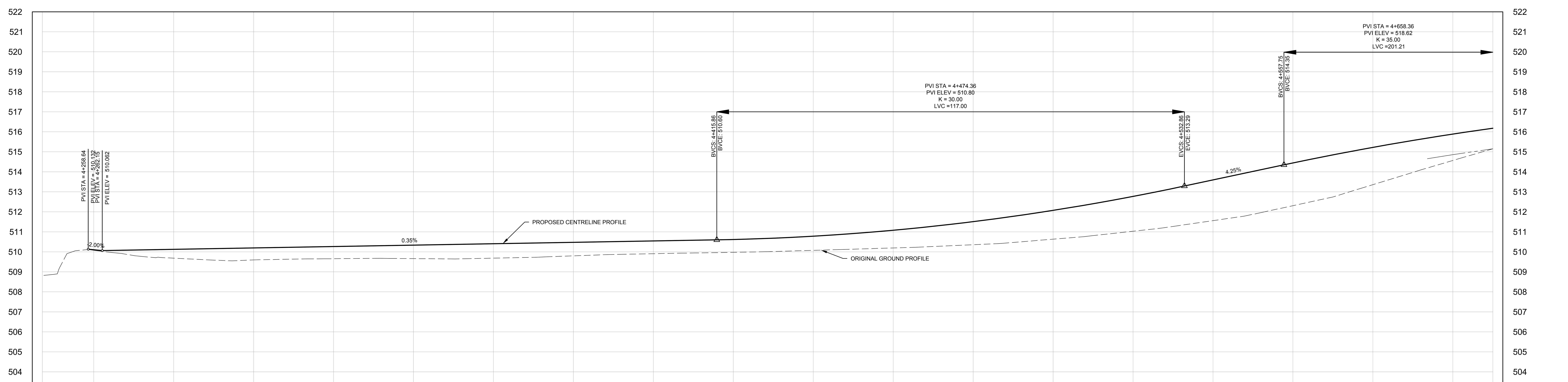
DRAWING LIST, LEGEND AND GENERAL NOTES
SIDEROAD 26/27

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES	JKV/DM	AES	JKV/DM	2016/09/22	**C000**
Scale: N.T.S.		Project No.: 300034587		Revision No.: 10	

File Name: 034587_COVER.dwg Date Plotted: September 20, 2016 - 9:20 AM







CHAINAGE	EXIST\PROP CENTERLINE ELEVATION (EXIST)	EXIST\PROP CENTERLINE ELEVATION (PROP)
4+247.15		
4+260	510.07	510.105
4+280	509.68	510.124
4+300	509.60	510.194
4+320	509.66	510.264
4+340	509.66	510.334
4+360	509.68	510.404
4+380	509.80	510.474
4+400	509.91	510.544
4+420	509.98	510.617
4+440	510.07	510.781
4+460	510.19	511.079
4+480	510.36	511.510
4+500	510.63	512.074
4+520	511.03	512.771
4+540	511.56	513.594
4+560	512.31	514.443
4+580	513.36	515.223
4+600	514.57	515.889
4+610	515.15	516.179

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7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

Metres Vertical 1:100 (0, 2.0, 4.0, 6.0, 8.0)
Metres Horizontal 1:500 (0, 5.0, 10.0, 20.0, 30.0, 40.0)

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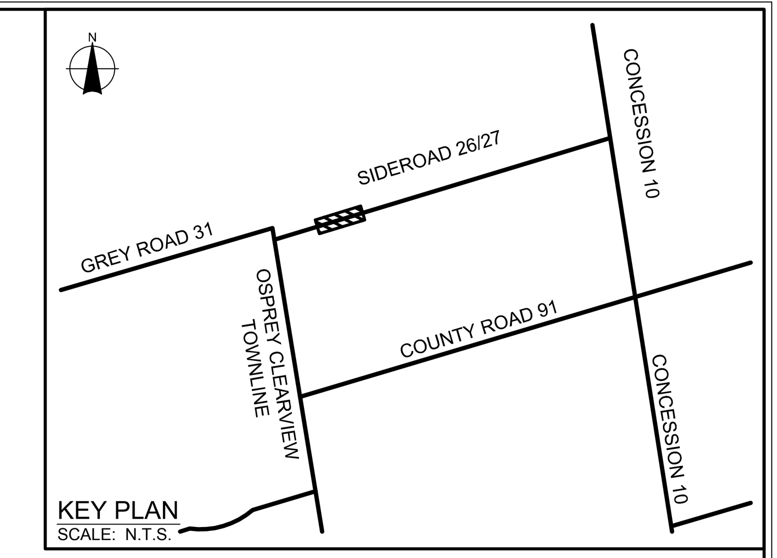
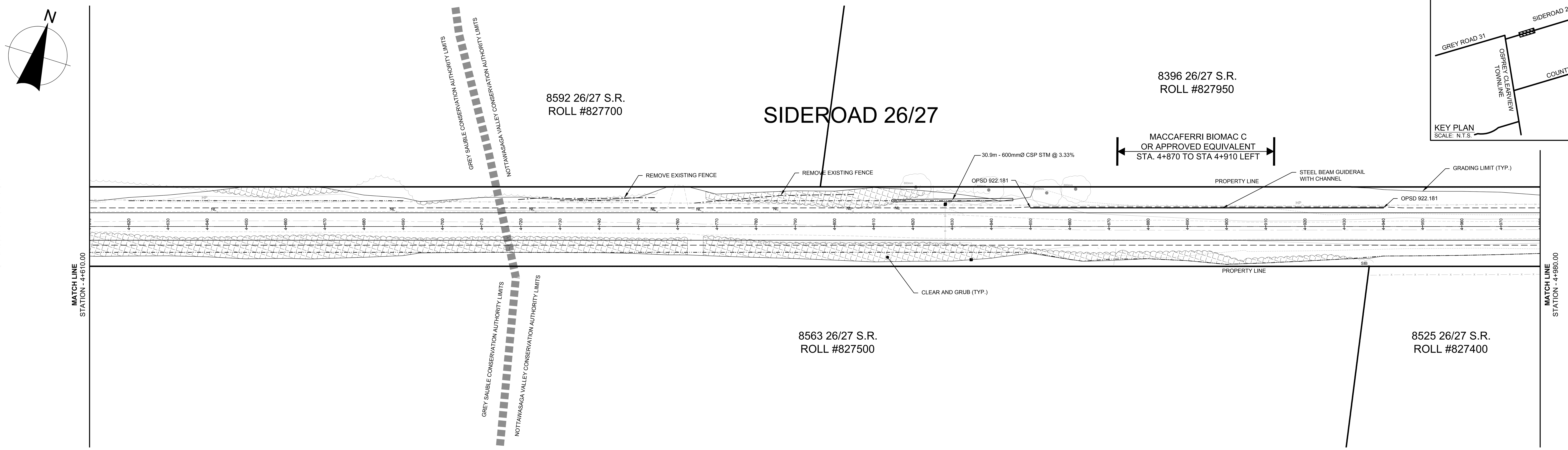
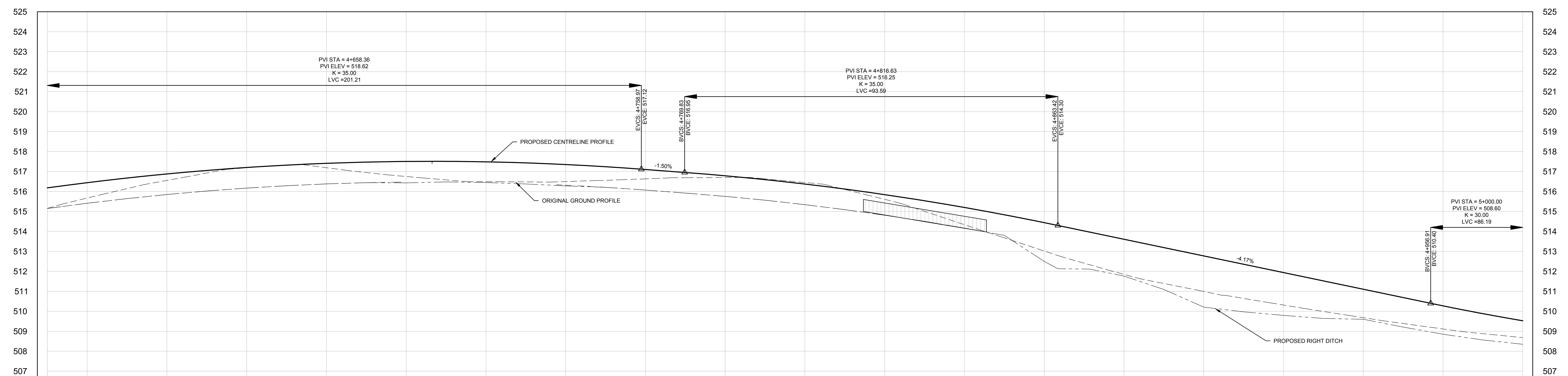
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
PLAN & PROFILE
SIDEROAD 26/27
4+247 to 4+610

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C001
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		10	

File Name: 300034587_PP_26&27.dwg Date Plotted: September 20, 2016 - 9:01 AM







CHAINAGE	EXIST\PROP CENTERLINE ELEVATION
4+610	515.15 / 516.179
4+620	515.67 / 516.440
4+640	516.55 / 516.877
4+660	517.18 / 517.200
4+680	517.19 / 517.409
4+700	516.75 / 517.503
4+720	516.49 / 517.483
4+740	516.50 / 517.349
4+760	516.63 / 517.101
4+780	516.70 / 516.786
4+800	516.45 / 516.371
4+820	515.60 / 515.842
4+840	514.34 / 515.198
4+860	513.02 / 514.440
4+880	511.85 / 513.607
4+900	510.99 / 512.773
4+920	510.31 / 511.938
4+940	509.68 / 511.104
4+960	509.11 / 510.271
4+980	508.68 / 509.523

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Metres Vertical 1:100
Metres Horizontal 1:500

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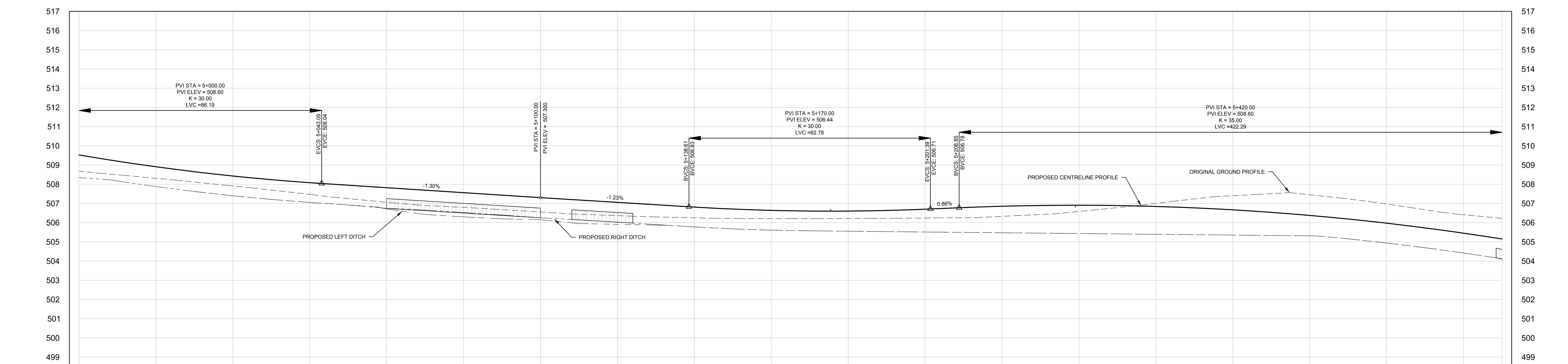
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
4+610 to 4+980

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C002
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 10	

File Name: 300034587_PP_26&27.dwg Date Plotted: September 20, 2016 - 9:02 AM



CHAINAGE	EXIST	PROP CENTERLINE ELEVATION
4+980	508.68	509.523
5+000	508.31	508.909
5+020	507.91	508.429
5+040	507.47	508.082
5+060	507.06	507.820
5+080	506.79	507.560
5+100	506.55	507.300
5+120	506.36	507.054
5+140	506.25	506.809
5+160	506.21	506.639
5+180	506.22	506.603
5+200	506.24	506.700
5+220	506.33	506.854
5+240	506.58	506.906
5+260	507.01	506.844
5+280	507.40	506.667
5+300	507.45	506.376
5+320	506.97	505.971
5+340	506.41	505.452
5+350	506.22	505.149

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7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
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Metres Vertical 1:100
Metres Horizontal 1:500

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Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
4+980 to 5+350

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C003
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		10	

File Name: 300034587_PP_26&27.dwg Date Plotted: September 20, 2016 - 9:02 AM

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Metres Vertical 1:100

Metres Horizontal 1:500

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STAYNER, ONTARIO
L0M 1S0

Drawing Title

CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
5+350 to 5+720

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C004
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		10	

File Name: 300034587_PP_26&27.dwg Date Plotted: September 20, 2016 - 9:02 AM

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Metres
Vertical 1:100

Metres
Horizontal 1:500

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L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
5+720 to 6+090

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C005
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		10	

File Name: 300034587_PP_26&27.dwg Date Plotted: September 20, 2016 - 10:07 AM

CHAINAGE	EXIST\PROP CENTERLINE ELEVATION
6+090	432.41 / 433.585
6+100	431.75 / 432.868
6+120	430.47 / 431.533
6+140	429.60 / 430.331
6+160	428.57 / 429.263
6+180	427.63 / 428.328
6+200	426.55 / 427.527
6+220	425.46 / 426.810
6+240	424.55 / 426.095
6+260	423.72 / 425.380
6+280	422.95 / 424.665
6+300	422.13 / 423.950
6+320	421.31 / 423.235
6+340	420.56 / 422.520
6+360	419.86 / 421.804
6+380	419.18 / 421.089
6+400	418.46 / 420.403
6+420	417.91 / 419.841
6+440	417.38 / 419.341
6+460	416.91 / 418.841

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Metres Vertical 1:100
Metres Horizontal 1:500

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Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
6+090 to 6+460

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C006
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 10	

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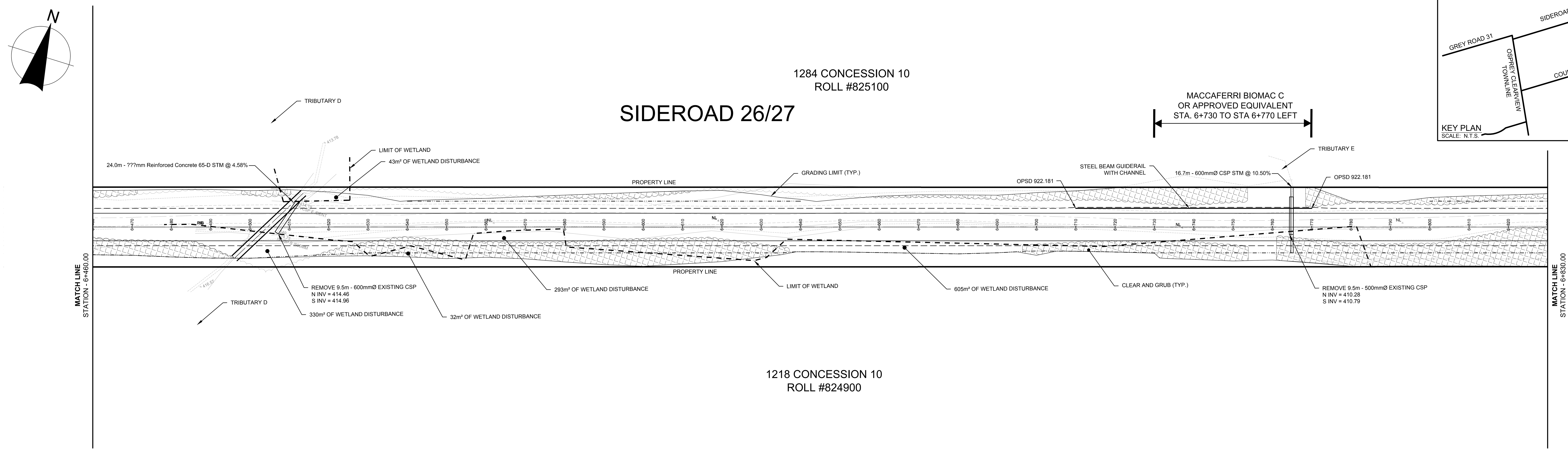

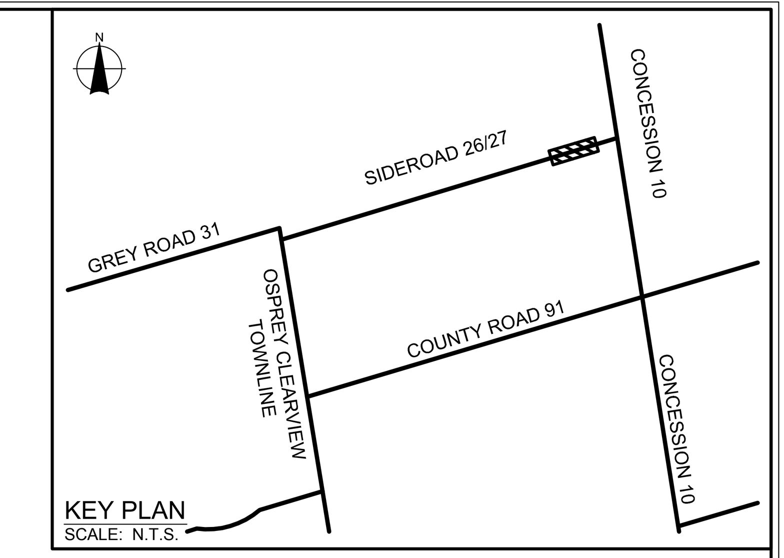

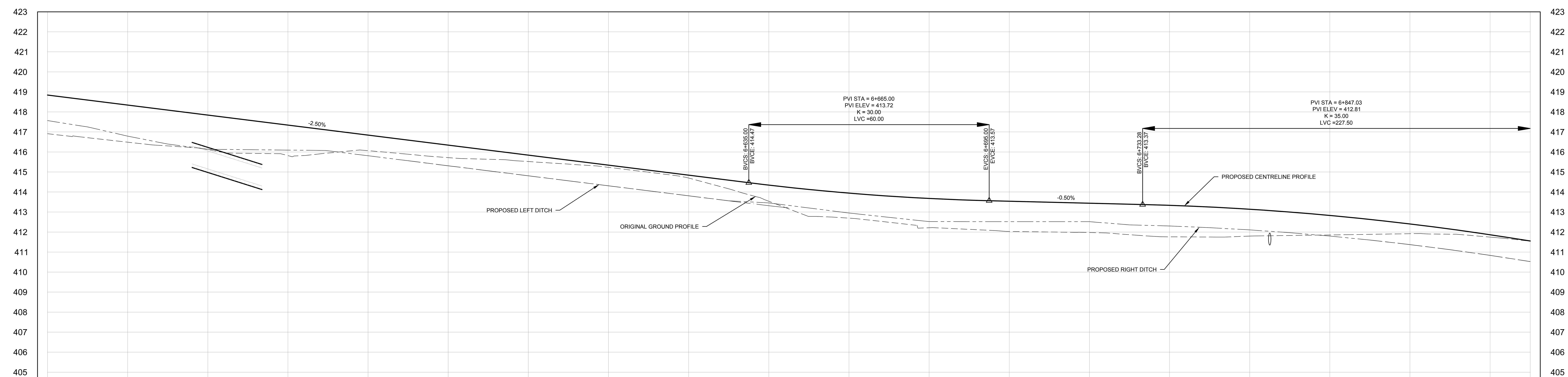

EXIST\PROP CENTERLINE ELEVATION	416.91 418.841	416.49 418.341	416.12 417.841	415.82 417.341	416.07 416.841	415.72 416.341	415.52 415.841	415.23 415.341	414.70 414.841	413.54 414.345	412.70 413.945	412.22 413.679	412.03 413.541	411.98 413.441	411.76 413.335	411.80 413.139	411.85 412.829	411.92 412.405	411.75 411.867	411.54 411.554	EXIST\PROP CENTERLINE ELEVATION
CHAINAGE	6+460	6+480	6+500	6+520	6+540	6+560	6+580	6+600	6+620	6+640	6+660	6+680	6+700	6+720	6+740	6+760	6+780	6+800	6+820	6+830	CHAINAGE

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10	ISSUED FOR DFO SUBMISSION	2016/09/22	

0 2.0 4.0 6.0 8.0
Metres
Vertical: 1:100

0 5.0 10.0 20.0 30.0 40.0
Metres
Horizontal: 1:500

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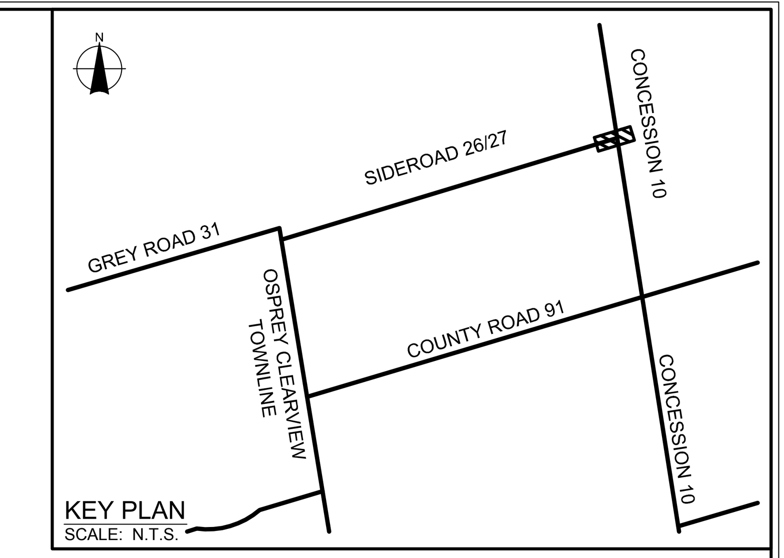
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

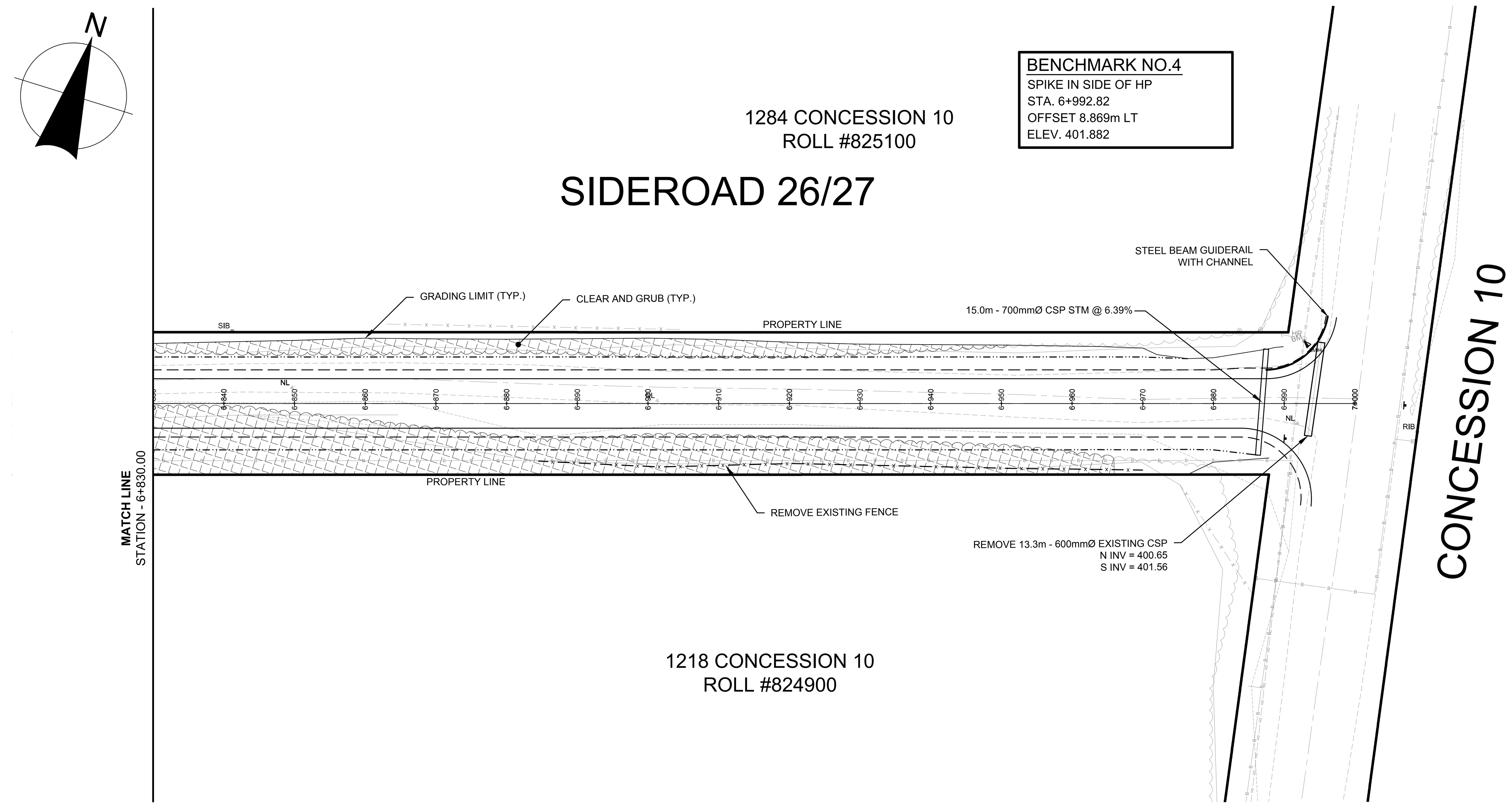
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

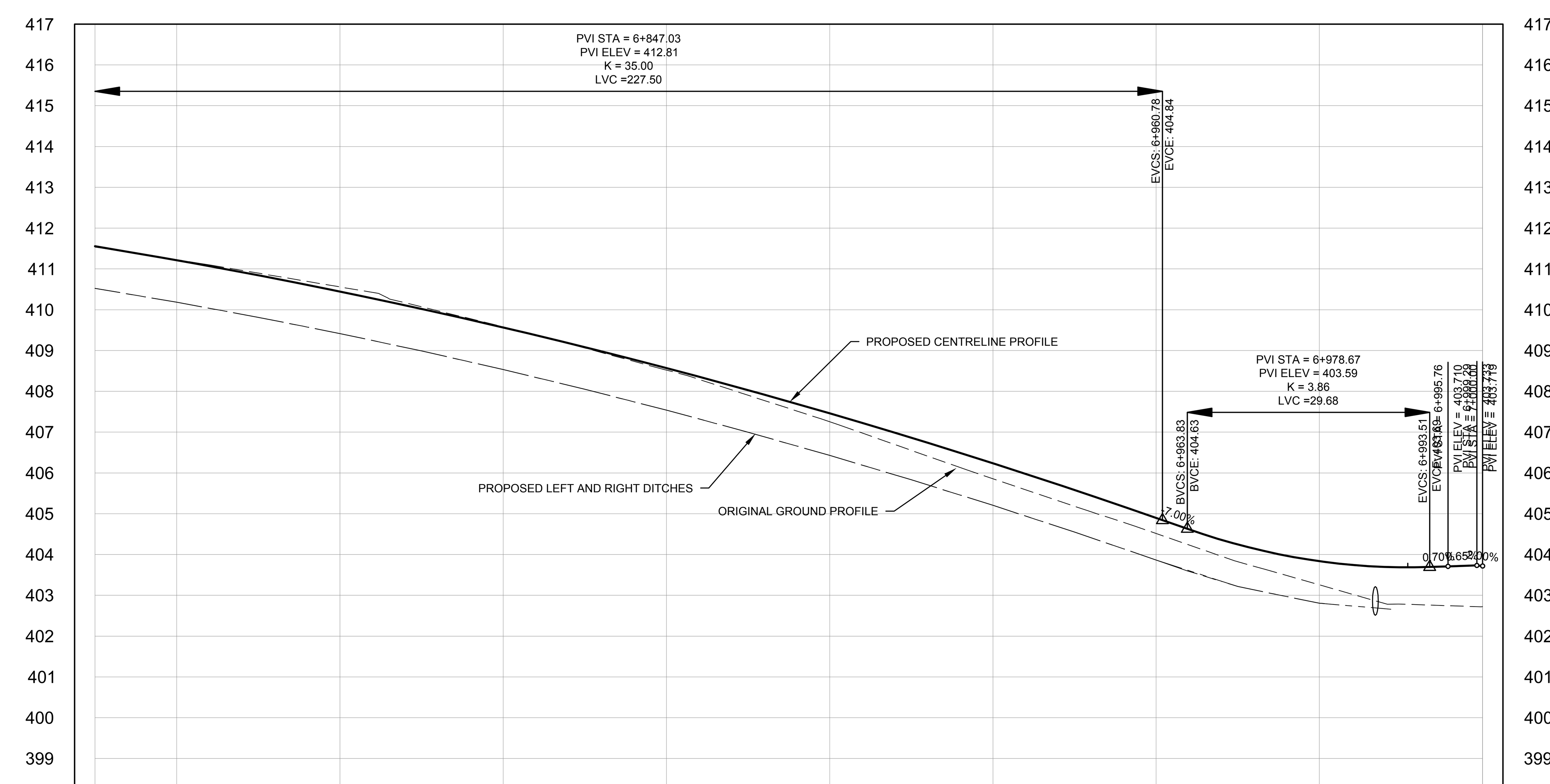
PLAN & PROFILE
SIDEROAD 26/27
6+460 to 6+830

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C007
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		10	

File Name: 300034587_PP_26&27.dwg Date Plotted: September 20, 2016 - 9:02 AM







EXIST\PROP CENTERLINE ELEVATION	411.54 / 411.554	411.23 / 411.214	410.56 / 410.447	409.58 / 409.566	408.52 / 408.570	407.25 / 407.460	405.86 / 406.236	404.52 / 404.898	403.26 / 403.837	402.72 / 403.719
CHAINAGE	6+830	6+840	6+860	6+880	6+900	6+920	6+940	6+960	6+980	7+000

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PRELIMINARY

No.	Issue / Revision	Date	Auth.
3	PRELIMINARY VIA RECOMMENDATION	2014/07/08	
4	DESIGN REVISION	2015/04/10	
5	DESIGN REVISION	2015/05/08	
6	DESIGN REVISION	2015/05/29	
7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

0 2.0 4.0 6.0 8.0
Metres
Vertical: 1:100
0 5.0 10.0 20.0 30.0 40.0
Metres
Horizontal: 1:500

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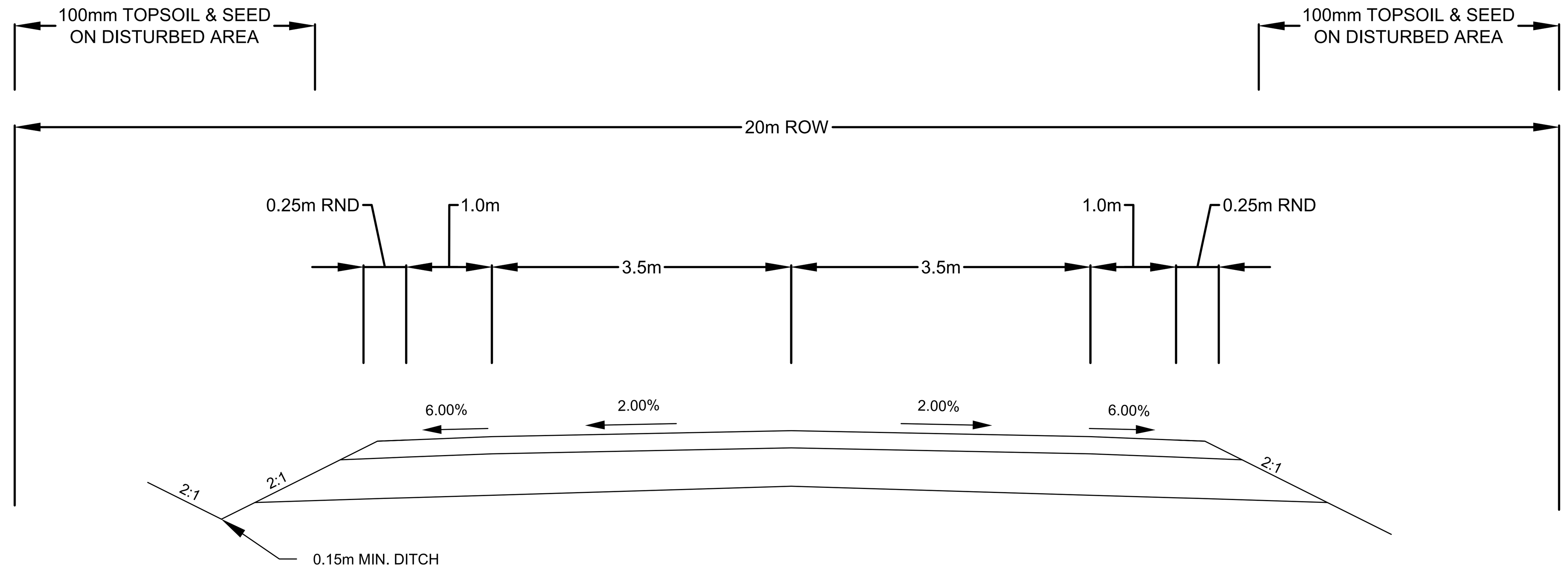
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
PLAN & PROFILE
SIDEROAD 26/27
6+830 to 7+000

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C008
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		10	

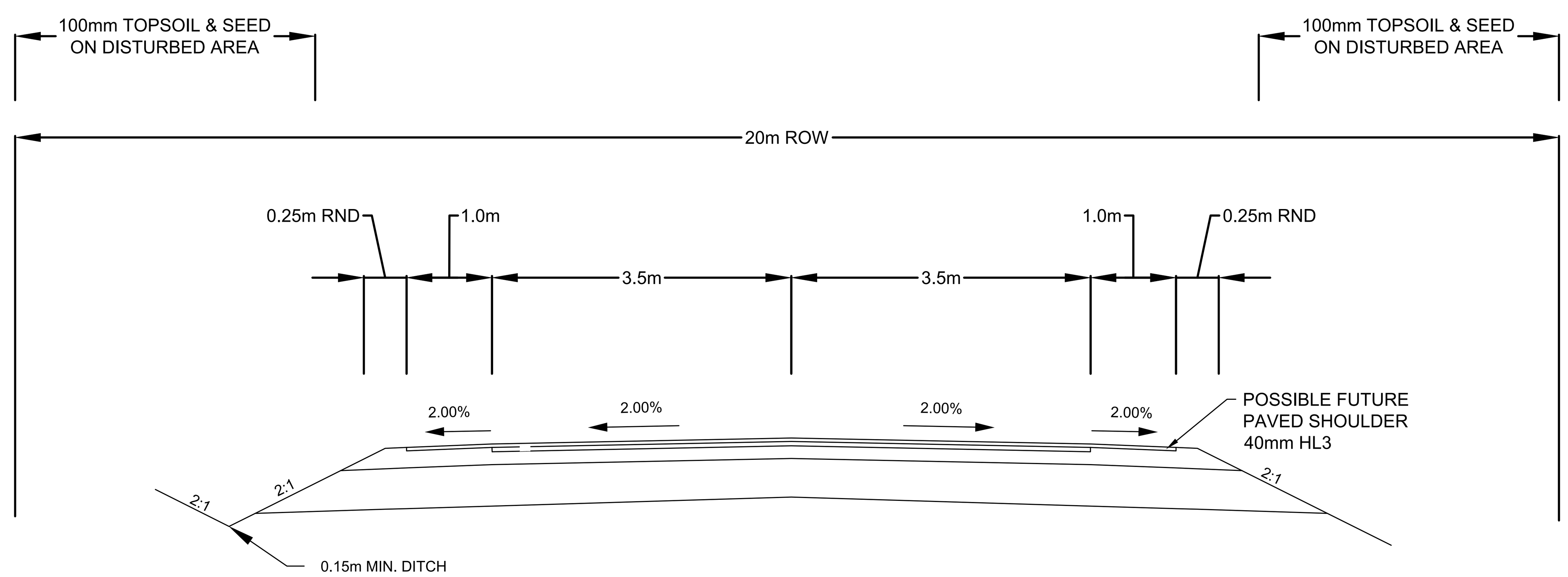
File Name: 300034587_PP_26&27.dwg Date Plotted: September 20, 2016 - 9:02 AM



NOTE:
ROAD TO BE COMPRISED OF
- 150mm GRANULAR A
- 450mm GRANULAR B

INTERIM TYPICAL ROAD CROSS-SECTION

SCALE 1:50



NOTE:
ROAD TO BE COMPRISED OF
- 40mm HL3 (FUTURE)
- 50mm HL8 (FUTURE)
- 150mm GRANULAR A
- 450mm GRANULAR B

ULTIMATE TYPICAL ROAD CROSS-SECTION

SCALE 1:50

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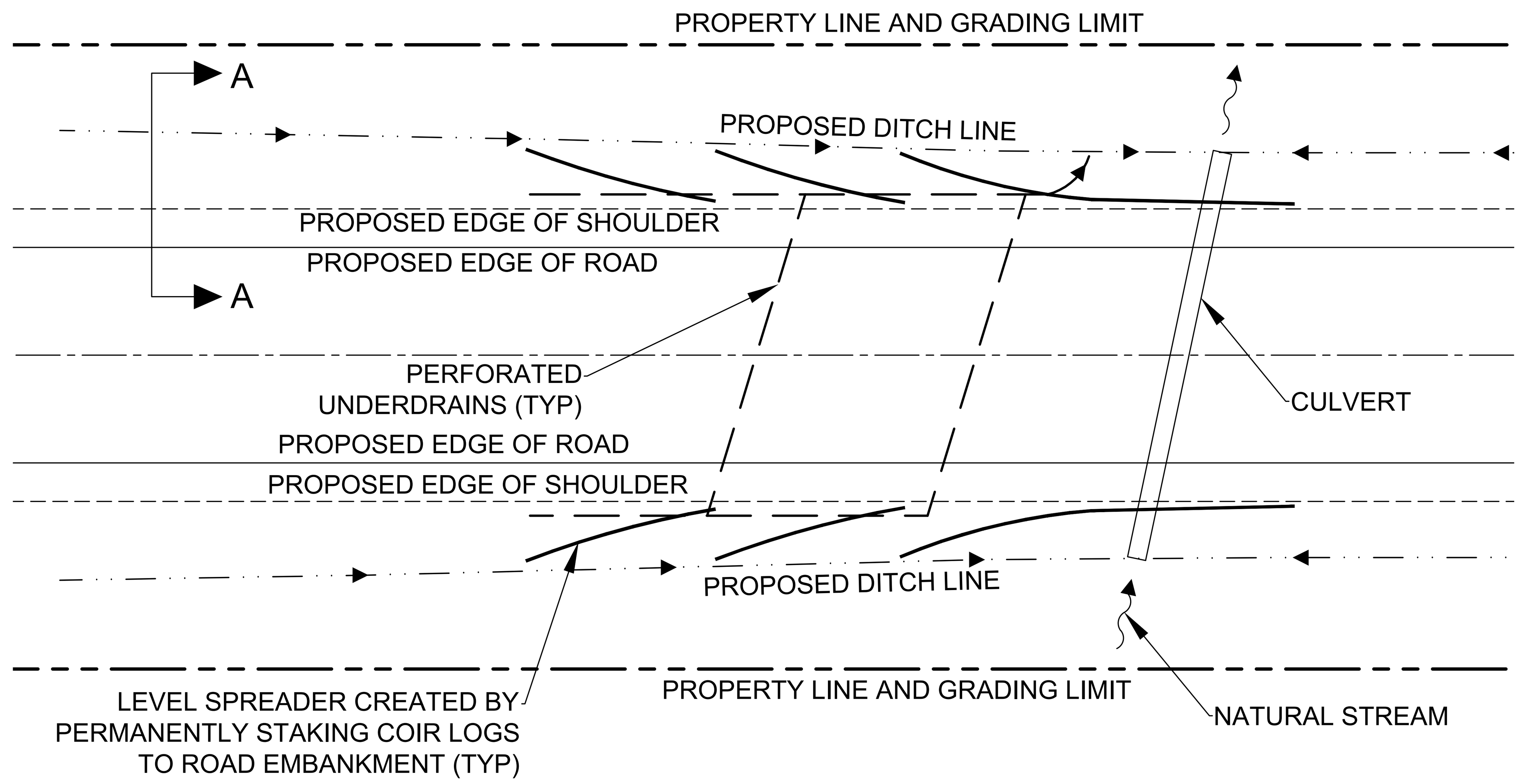
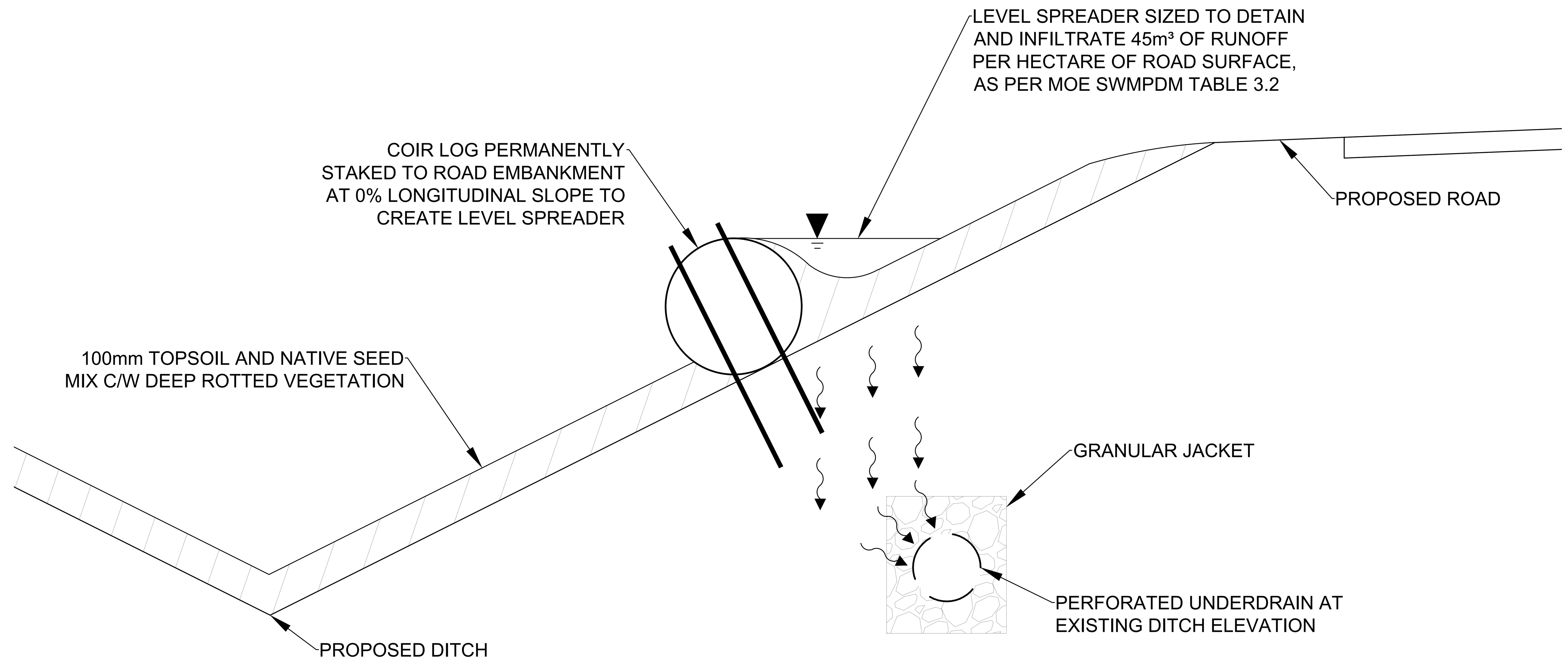
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
TYPICAL SECTIONS AND DETAILS
SIDEROAD 26/27

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2016/09/22	C009
Scale		Project No.		Revision No.	
N.T.S.		300034587		10	

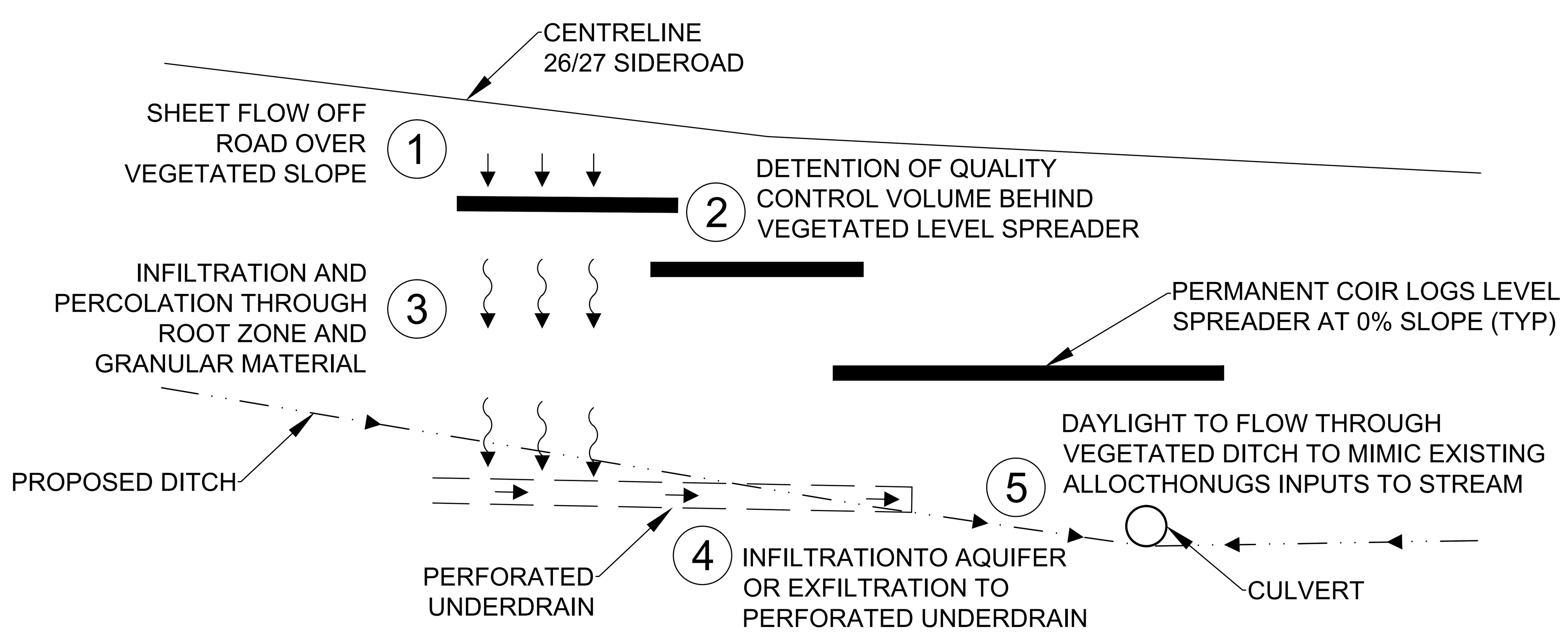
File Name: 034587_COVER.dwg Date Plotted: September 20, 2016 - 9:02 AM



BIORETENTION AND PERFORATION PIPE
STORMWATER MANAGEMENT CONCEPT PLAN
N.T.S.



SECTION A-A
N.T.S.



ROFILE
N.T.S.

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L0M 1S0

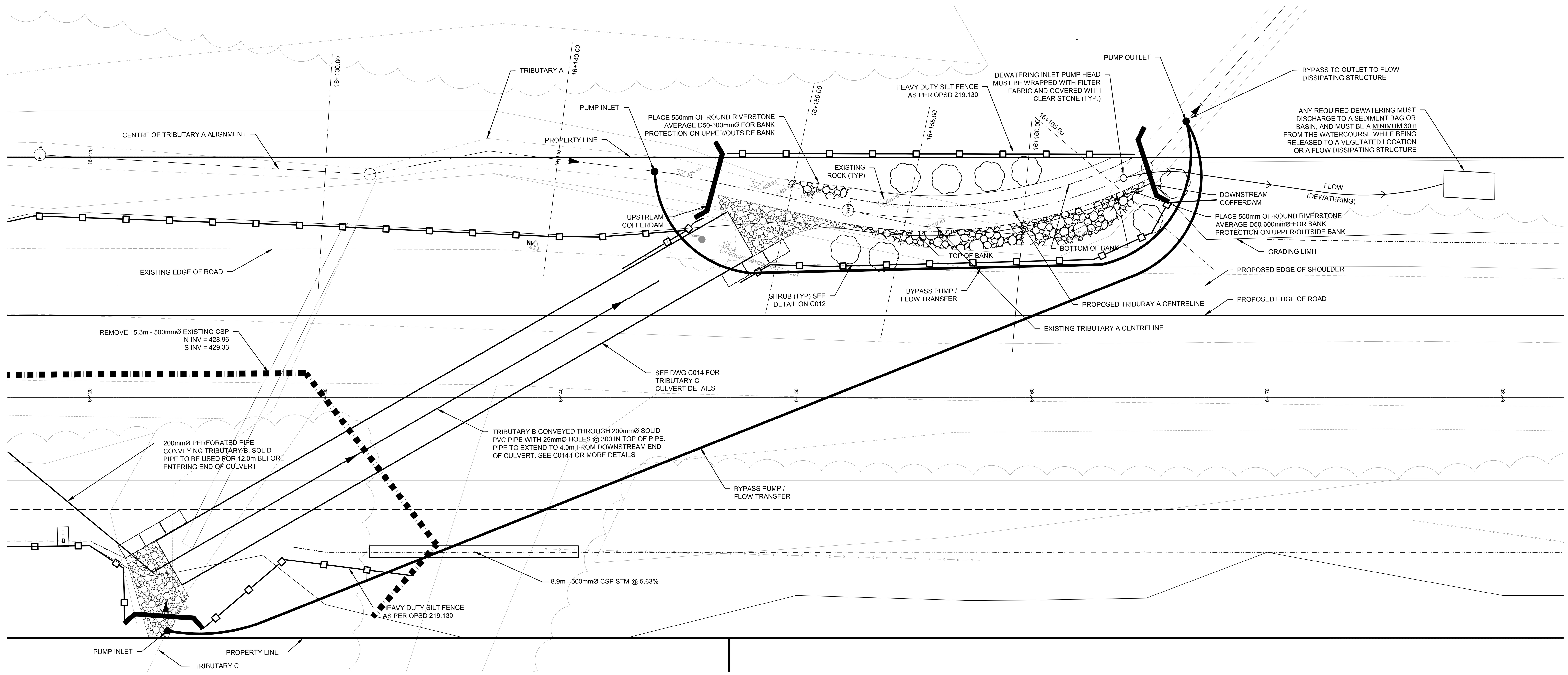
Drawing Title

CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

BIORETENTION AND PERFORATED PIPE
STORMWATER MANAGEMENT CONCEPT

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	C010
Scale		Project No.		Revision No.	
AS SHOWN		300034587		10	

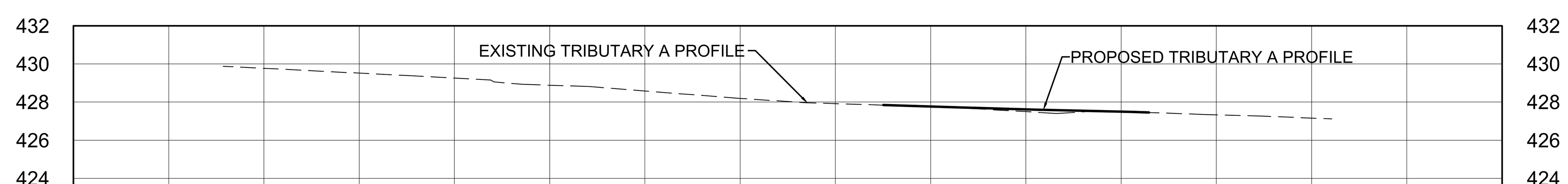
File Name: 034587_COVER.dwg Date Plotted: September 20, 2016 - 9:02 AM



PLAN - TRIBUTARY A
1:100

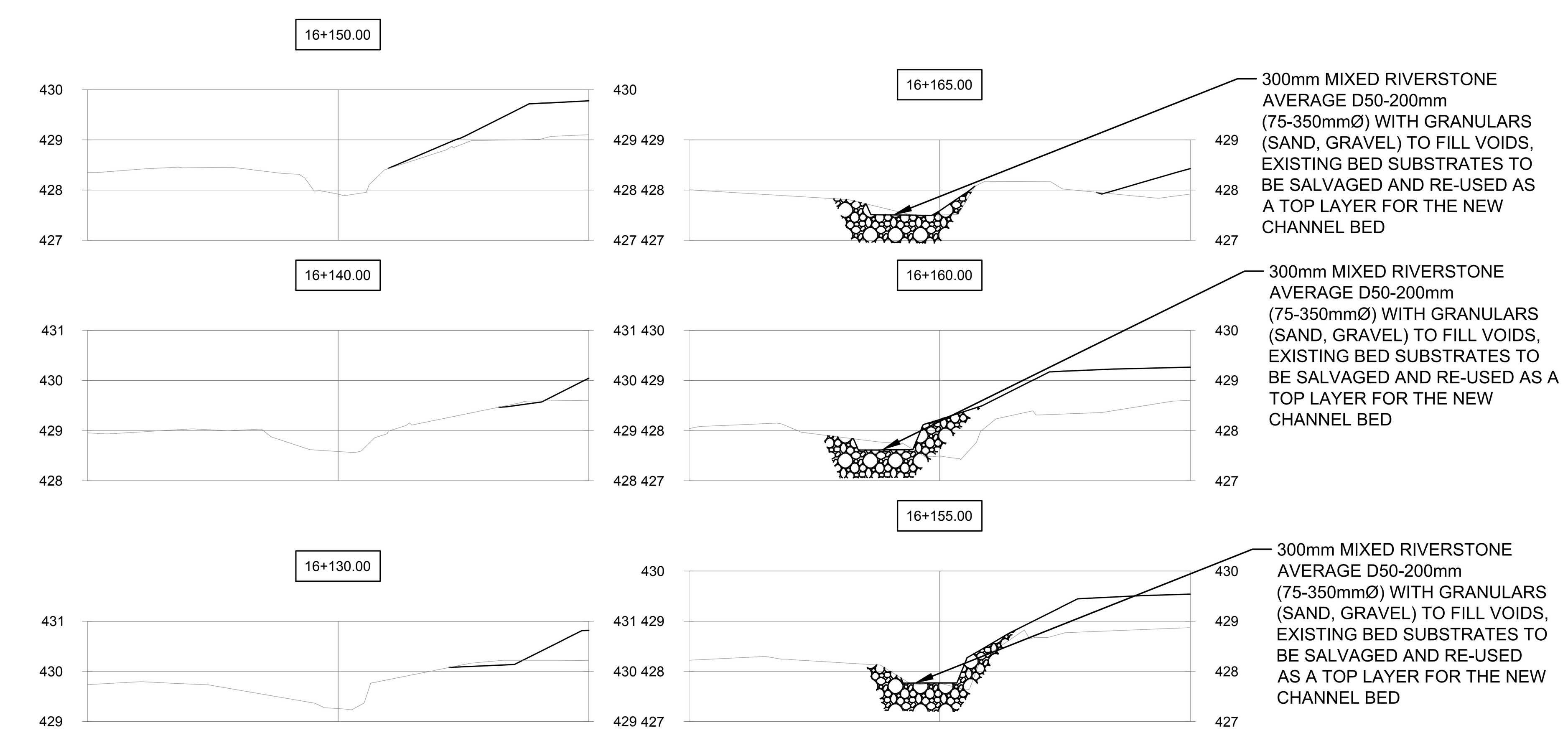
LEGEND (TEMPORARY WORK)

- HEAVY DUTY SILT FENCE BARRIER AS PER OPSD 219.130.
- STRAW BALE FLOW CHECK AS PER OPSD 219.18
- ROCK CHECK DAMS AS PER OPSD 219.210 OR 219.211.
- TEMPORARY COFFERDAM



CHAINAGE	EXIST\PROP CENTERLINE ELEVATION
16+110	
16+115	
16+120	429.77 / 429.772
16+125	429.52 / 429.519
16+130	429.26 / 429.258
16+135	428.88 / 428.883
16+140	428.58 / 428.583
16+145	428.19 / 428.192
16+150	427.92 / 427.918
16+155	427.77 / 427.766
16+160	427.50 / 427.497
16+165	427.50 / 427.501
16+170	427.33 / 427.333
16+175	427.16 / 427.162
16+180	
16+185	

PROFILE - TRIBUTARY A
N.T.S.



CROSS SECTIONS - TRIBUTARY A
N.T.S.

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9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

Metres Vertical 1:100 — 0, 2.0, 4.0, 6.0, 8.0
Metres Horizontal 1:500 — 0, 5.0, 10.0, 20.0, 30.0, 40.0

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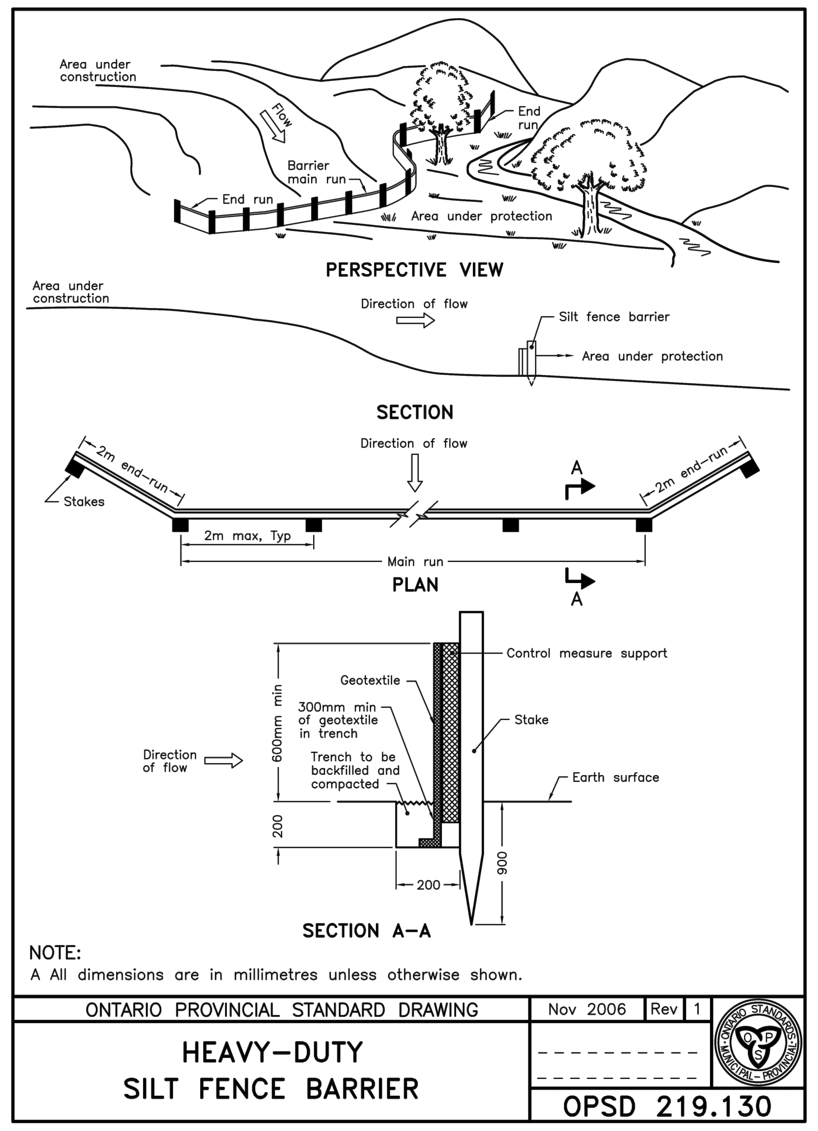
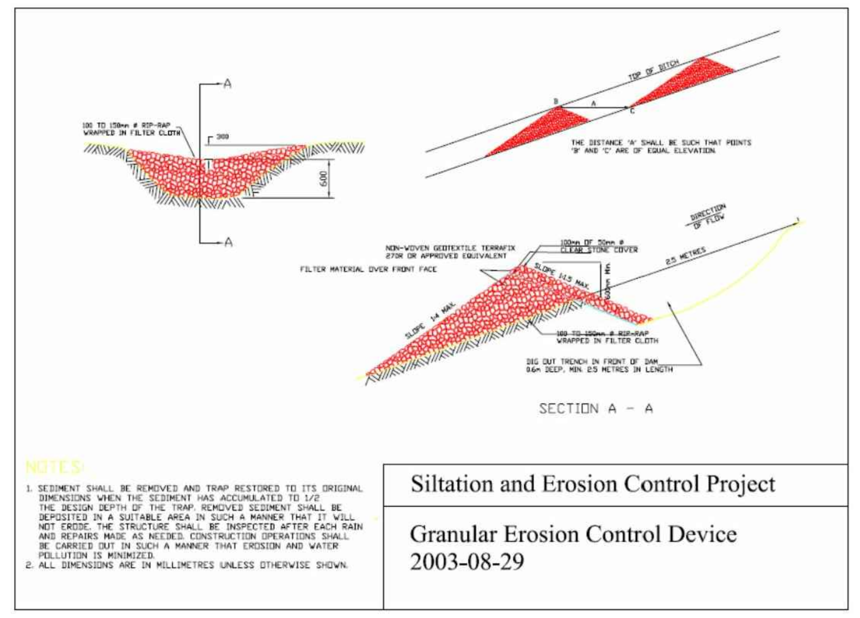
L0M 1S0

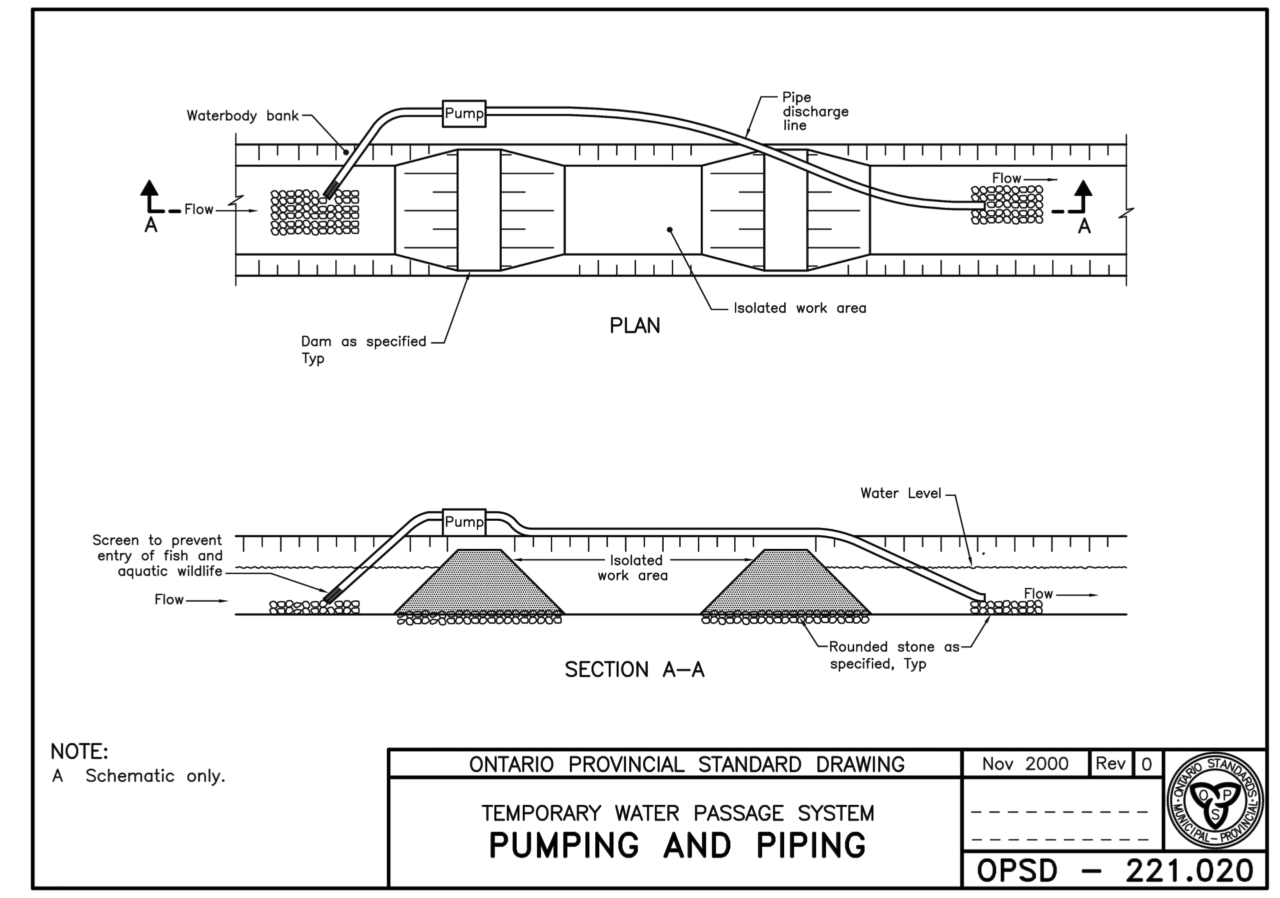
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
TRIBUTARY A REALIGNMENT PLAN AND PROFILE

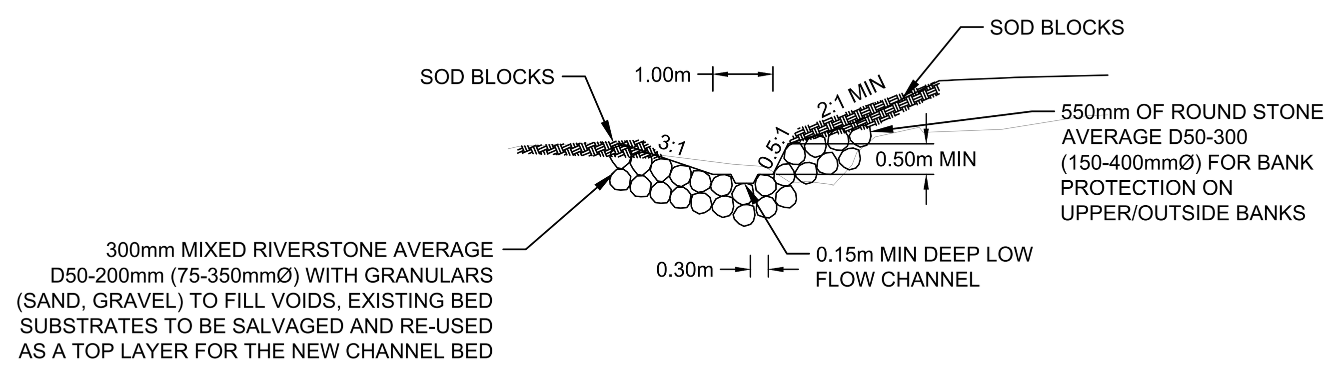
Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	C011
Scale		Project No.		Revision No.	
AS NOTED		300034587		10	

File Name: 034587_DETAILS.dwg Date Plotted: September 20, 2016 - 9:03 AM



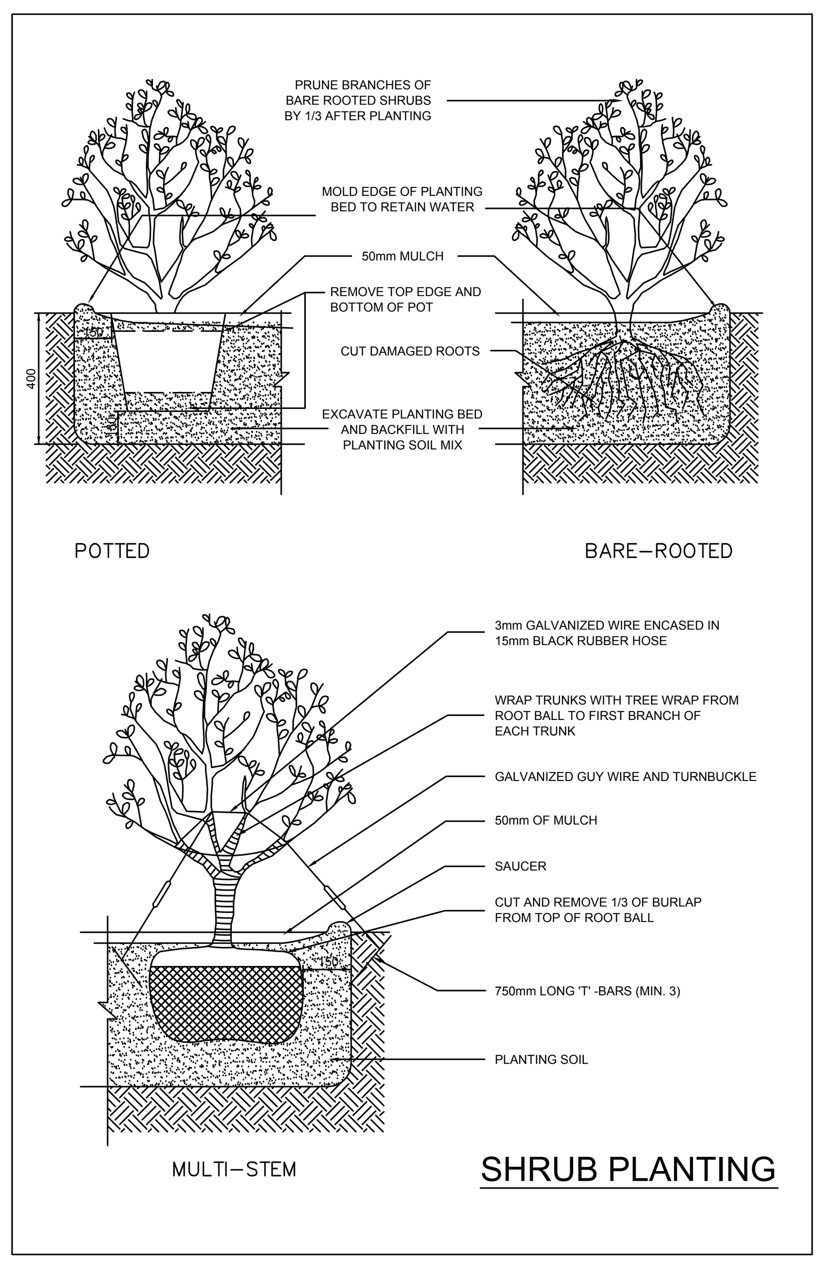




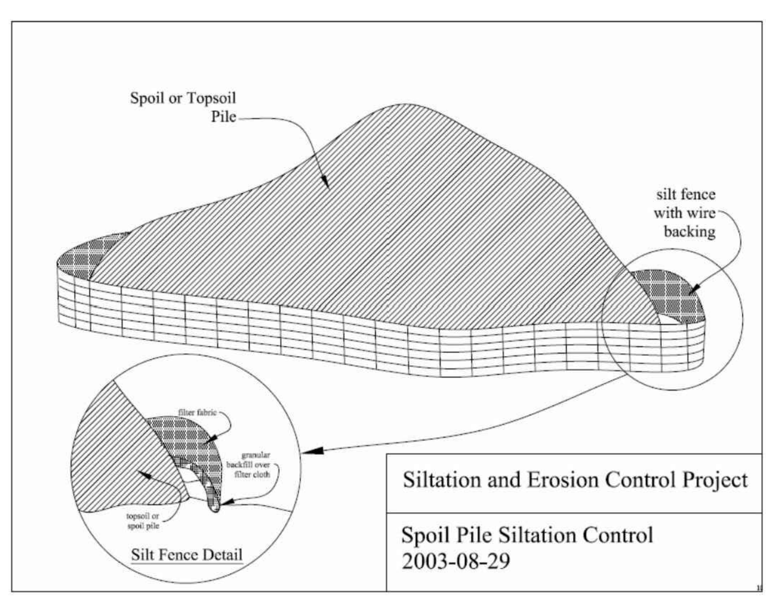


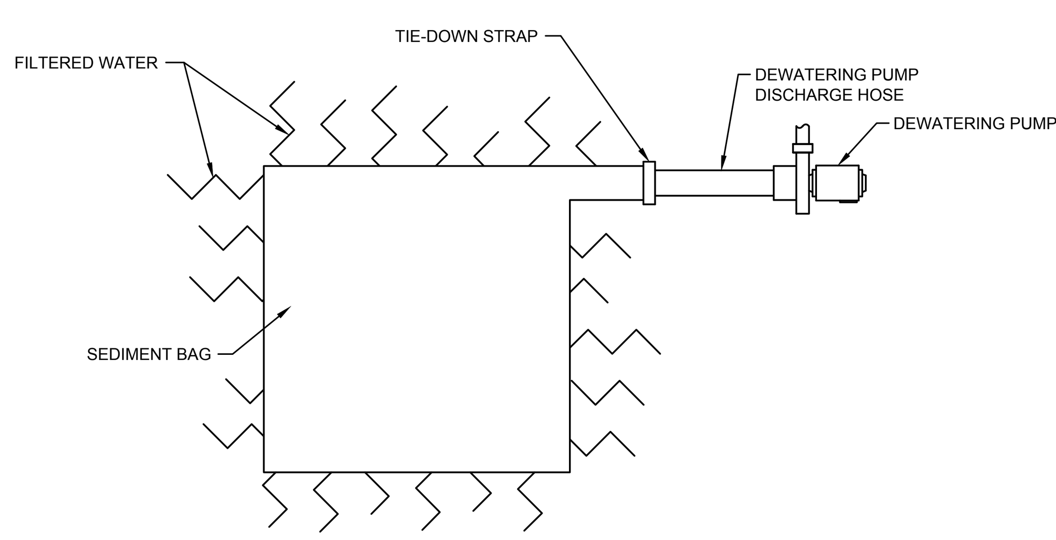
TRIBUTARY A TYPICAL SECTION
N.T.S

SOD BLOCKS WILL BE SALVAGED FROM THE PROPOSED CHANNEL REALIGNMENT AND RE-USED AS BANK MATERIAL WITHIN THE NEW CHANNEL. SOD BLOCKS ARE EXISTING VEGETATION, ROOT MASS AND TOPSOIL THAT CAN BE CUT USING AN EXCAVATOR AND PLACED ALONG THE BANKS OF THE CONSTRUCTED CHANNEL . SOD BLOCKS THAT ARE USED FOR THE BANKS SHOULD BE FRESHLY CUT AND BUCKET PACKED USING AN EXCAVATOR. ON-SITE DIRECTION FROM BURNSIDE WILL BE PROVIDED TO THE CONTRACTOR REGARDING THE USE OF SOD BLOCKS, WHERE AVAILABLE. THE QUANTITY OF AVAILABLE "SOD BLOCKS" HAS NOT BEEN DETERMINED AND ADDITIONAL MATERIAL, IF REQUIRED SHOULD BE ACCOUNTED FOR BY THE CONTRACTOR BASED ON SITE AND SEASONAL CONDITIONS

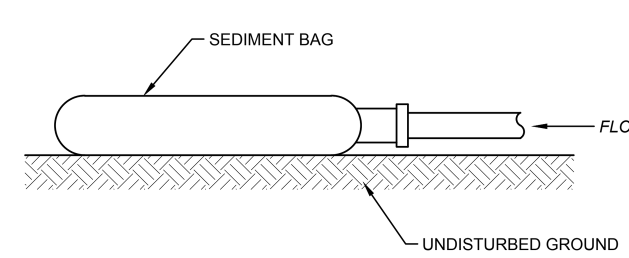


SHRUB PLANTING





SEDIMENT BAG - PLAN VIEW
N.T.S



SEDIMENT BAG - SECTION
N.T.S

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10	ISSUED FOR DFO SUBMISSION	2016/09/22	

Metres Vertical 1:100
Metres Horizontal 1:500

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217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
TRIBUTARY A REALIGNMENT AND CULVERT DETAILS

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	C012
Scale		Project No.		Revision No.	
AS NOTED		300034587		10	

File Name: 034587_DETAILS.dwg Date Plotted: September 20, 2016 - 9:04 AM

PROJECT DESCRIPTION

1. CONSTRUCT APPROXIMATELY 20m OF NEW CHANNEL USING NATURAL CHANNEL DESIGN METHODS WITH AN EMPHASIS ON REPLICATION OF EXISTING FISH HABITAT FEATURES.
2. INSTALL CONCRETE BOX CULVERT.
3. CHANNEL CONSTRUCTION AND CULVERT INSTALLATION TO BE COMPLETED IN THE DRY.

GENERAL NOTES

1. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, SEDIMENT OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR EQUIPMENT REFUELING AND MAINTENANCE WILL BE CONDUCTED AT LEAST 30m AWAY FROM THE WATER.
2. ALL TEMPORARY SOIL OR DIRT STOCKPILES ARE TO BE PROVIDED WITH THE NECESSARY SEDIMENT AND EROSION CONTROL FEATURES, INCLUDING SEEDING IF ANTICIPATED TO BE STORED MORE THAN ONE MONTH. STOCKPILES MUST NOT BE LOCATED IN AREAS OF CONCENTRATED FLOW AND MINIMUM OF 15m FROM TOP OF BANK.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF ANY CULVERT, PUMPS, CHANNELS OR ANY OTHER TEMPORARY MEASURES REQUIRED TO CONTROL THE FLOW. THE CONTRACTOR SHALL ASSESS THE RISK OF FLOODS, STORMS AND EVENTS THAT MAY AFFECT CONSTRUCTION AND DETERMINE THEIR OWN LEVEL OF RISK ASSOCIATED WITH ANY TEMPORARY WORK.
4. SOD BLOCKS WILL BE SALVAGED FROM THE PROPOSED CHANNEL REALIGNMENT AND RE-USED AS BANK MATERIAL WITHIN THE NEW CHANNEL. SOD BLOCKS ARE EXISTING VEGETATION, ROOT MASS AND TOPSOIL THAT CAN BE CUT USING AN EXCAVATOR AND PLACED ALONG THE BANKS OF THE CONSTRUCTED CHANNEL . SOD BLOCKS THAT ARE USED FOR THE BANKS SHOULD BE FRESHLY CUT AND BUCKET PACKED USING AN EXCAVATOR. ON-SITE DIRECTION FROM BURNSIDE WILL BE PROVIDED TO THE CONTRACTOR REGARDING THE USE OF SOD BLOCKS, WHERE AVAILABLE. THE QUANTITY OF AVAILABLE "SOD BLOCKS" HAS NOT BEEN DETERMINED AND ADDITIONAL MATERIAL, IF REQUIRED SHOULD BE ACCOUNTED FOR BY THE CONTRACTOR BASED ON SITE AND SEASONAL CONDITIONS.
5. THE CONTRACTOR SHALL MAINTAIN A COFFERDAM AT THE UPSTREAM AND DOWNSTREAM END OF THE NEWLY CONSTRUCTED CHANNEL TO PREVENT THE EXISTING WATER COURSES FROM ENTERING THE NEW CHANNEL UNTIL SUCH TIME THAT SUBSTANTIAL VEGETATIVE GROWTH HAS TAKEN PLACE AND THE CONTRACT ADMINISTRATOR HAS ACCEPTED THE WORKS AND PROVIDED INSTRUCTIONS TO CONNECT THE NEW CHANNEL TO THE EXISTING WATER COURSES.
6. THE DOWNSTREAM COFFERDAM SHALL BE REMOVED FIRST.
7. CONTRACTOR TO ISOLATE WORK AREA(S) SUCH THAT ALL WORK WILL BE COMPLETED IN THE DRY.
8. CONTINUALLY MONITOR PUMP OUTLET AREA AND STABILIZE IF REQUIRED.
9. ANY FISH OR AQUATIC LIFE SHALL BE REMOVED FROM THE CONSTRUCTION AREA BY A BURNSIDE QUALIFIED ENVIRONMENTAL PROFESSIONAL. PROVIDE A MINIMUM OF 48 HOURS NOTICE PRIOR TO REQUIRING FISH REMOVAL. IN THE EVENT OF FLOODING THAT REQUIRES ADDITIONAL REMOVAL OF FISH, THE CONTRACTOR WILL REQUIRED TO PAY FOR PROVIDING REMOVAL BY A QUALIFIED PROFESSIONAL. THE CONTRACTOR SHOULD SIZE THEIR WATERWAY CONTROL ACCORDINGLY.
10. SCREEN ANY WATER INTAKES OR OUTLET PIPES TO PREVENT ENTRAINMENT OR IMPINGEMENT OF FISH. ENTRAINMENT OCCURS WHEN A FISH IS DRAWN INTO A WATER INTAKE AND CANNOT ESCAPE. IMPINGEMENT OCCURS WHEN AN ENTRAPPED FISH IS HELD IN CONTACT WITH THE INTAKE SCREEN AND IS UNABLE TO FREE ITSELF. ENSURE REGULAR MAINTENANCE AND REPAIR OF SCREENS IS CARRIED OUT TO PREVENT DEBRIS-FOULING AND IMPINGEMENT OF FISH.
11. A BURNSIDE QUALIFIED PERSON SHALL BE ONSITE DURING THE PLACEMENT OF RIVERSTONE. PROVIDE A MINIMUM OF 48 HOURS NOTICE PRIOR TO PLACING OF RIVERSTONE.
12. IF DEWATERING IS TO EXCEED 50,000 L/DAY, A PERMIT TO TAKE WATER (PTTW) FROM THE MOECC WILL BE REQUIRED.
13. DISSIPATING STRUCTURE TO CONSIST OF MIXED RIVERSTONE D50-200mm. DISSIPATING STRUCTURE TO BE MONITORED AND REPAIRED AS REQUIRED TO AVOID EROSION OF EXISTING CHANNEL.

OPERATIONAL CONSTRAINT - MIGRATORY BIRDS CONVENTION ACT

1. THE CONTRACTOR MUST BE AWARE OF THE MIGRATORY BIRDS CONVENTION ACT (1994) AS IT RELATES TO HARMING MIGRATORY BIRDS OR THEIR NESTS, EGGS OR YOUNG.
2. ALL VEGETATION CLEARING SHOULD BE COMPLETED OUTSIDE OF THE CORE BREEDING SEASON (MAY THROUGH JULY).
3. IF THERE IS EVIDENCE THAT MIGRATORY BIRDS ARE ACTIVELY NESTING AN AREA THAT MAY BE AFFECTED BY CONSTRUCTION, ALL WORK IN THE IMMEDIATE VICINITY SHOULD STOP IMMEDIATELY
4. THE CONTRACTOR SHALL CONTACT THE CONTRACT ADMINISTRATOR FOR ADVICE AND ASSISTANCE. UNTIL PERMISSION IS GRANTED TO THE CONTRACTOR TO PROCEED WITH CONSTRUCTION , CONSTRUCTION ACTIVITIES WILL REMAIN SUSPENDED.

EROSION & SEDIMENTATION CONTROL NOTES

1. ALL SEDIMENTATION CONTROLS TO BE INSTALLED PRIOR TO EXECUTING ANY WORK.
2. ALL SEDIMENTATION CONTROLS TO BE INSPECTED DAILY AND REPAIRED/REPLACED AS NECESSARY.
3. ALL TEMPORARY EROSION & SEDIMENTATION CONTROLS SHALL REMAIN IN PLACE UNTIL SUCH TIME AS RE-VEGETATIVE MEASURES HAVE GERMINATED AND TAKEN HOLD.
4. ANY COFFERDAMS SHALL BE CONSTRUCTED OF CLEAN, NON-ERODIBLE MATERIALS SUCH AS, BUT NOT LIMITED TO; PEA GRAVEL BAGS, CLEAN GRAVEL AND PLASTIC SHEETING, PRECAST BARRIERS AND PLASTIC SHEETING, SHEET STEEL PILING, OR OTHER CLEAN MATERIAL APPROVED BY THE NVCA.
5. CONTROL OF CREEK BASE FLOWS AND STORM EVENT RUNOFF DURING CONSTRUCTION SHALL BE THE CONTRACTORS RESPONSIBILITY.
6. ALL DEWATERING/UNWATERING SHALL BE DISCHARGED INTO A FILTERED SUMP, SOCK OR SOAK PIT, LOCATED AT LEAST 30m FROM THE WATER COURSE.
7. TOPSOIL SHALL BE PLACED WITHIN 30 DAYS FROM COMPLETION ANY GRADING WORK TO FACILITATE SEEDING.
8. THE ESC PLAN IS A DYNAMIC DOCUMENT, WHICH MAY BE SUBJECT TO CHANGE OR MODIFICATION AS A RESULT OF SITE DEVELOPMENTS OR CHANGES ON SITE. ANY DEVIATION FROM APPROVED PLANS MUST BE DESIGNED BY A QUALIFIED PROFESSIONAL. IT IS EVERYONE'S RESPONSIBILITY TO PREVENT CONSTRUCTION RELATED SEDIMENT FROM IMPACTING AQUATIC RESOURCES AND OTHER NATURAL FEATURES.
9. ALL SILT AND SEDIMENTATION ITEMS AND LOCATIONS ARE SHOWN FOR ILLUSTRATION. CONTRACTOR SHALL PROVIDE DETAILED PLAN AND SEQUENCE FOR ENGINEER & NVCA REVIEW.

SEED AND MULCH - NVCA SEED MIX

1. THE SEED MIX SHALL BE 20% FOX SEDGE, 20% VIRGINIA WILD RYE, 15% FOWL BLUEGRASS, 10 % BLUNT BROOM SEDGE, 10% GREEN BULRUSH, 5% SOFT RUSH, 2% AUTUMN BENTGRASS, 2%TICKLEGRASS, 2% NODDING BUR MARIGOLD, 2% AMERICA MANNAGRASS, 2% BLUE VERVAIN, 2% WOOLGRASS, 1% SWAMP MILKWEED, 1% PURPLE STEMMED ASTER AND THE COVER TYPE SHALL BE HYDRAULIC MULCH. NATIVE SEED MIX/NURSE CROP OVER 10:1 TOPSOIL OVERBANK AREAS NEXT TO CHANNEL.

Notes

2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
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8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

0 2.0 4.0 6.0 8.0
Metres
Vertical 1:100

0 5.0 10.0 20.0 30.0 40.0
Metres
Horizontal 1:500

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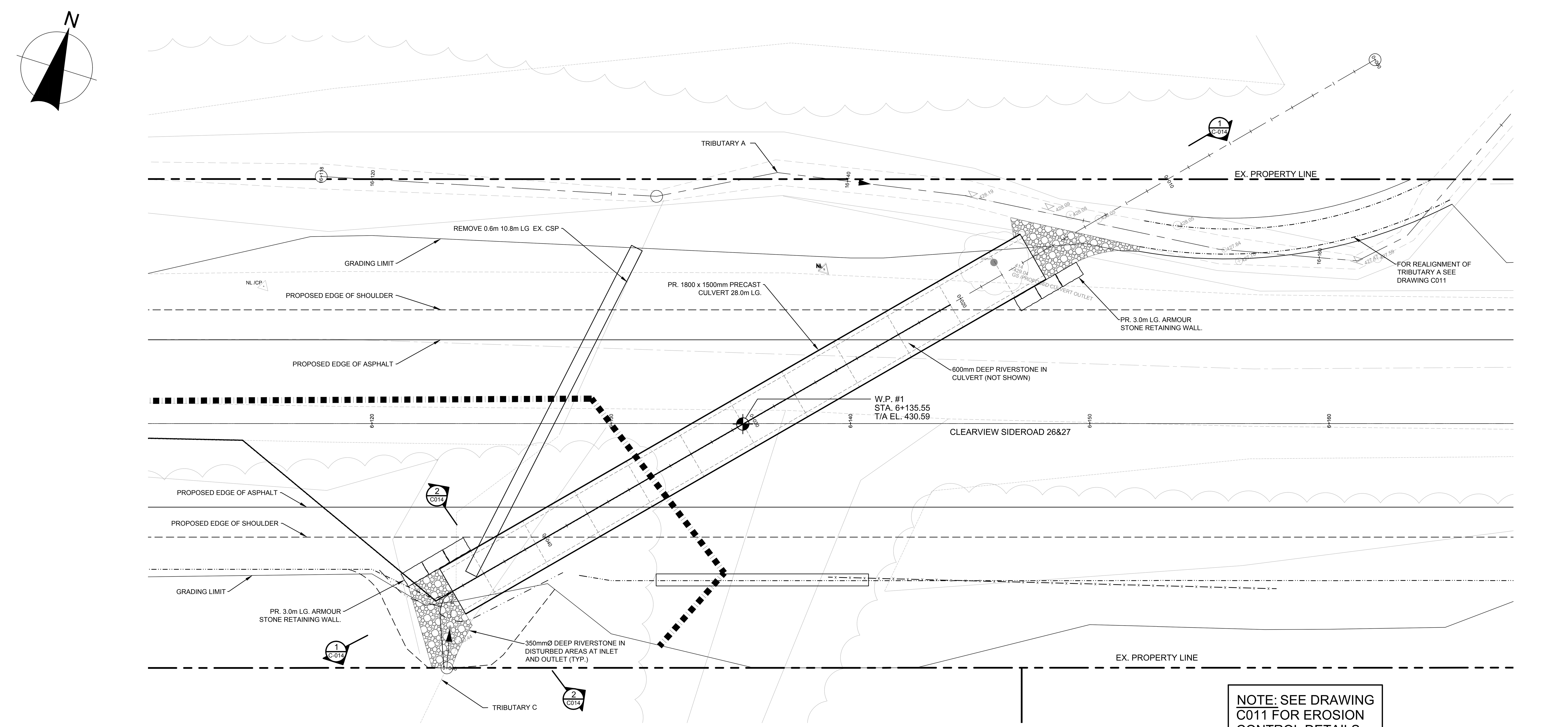
Client
TOWNSHIP OF CLEARVIEW
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
NOTES

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	C013
Scale		Project No.		Revision No.	
AS NOTED		300034587		10	



NOTE: SEE DRAWING C011 FOR EROSION CONTROL DETAILS

PLAN - DESCRIPTION
1:100

GENERAL NOTES:

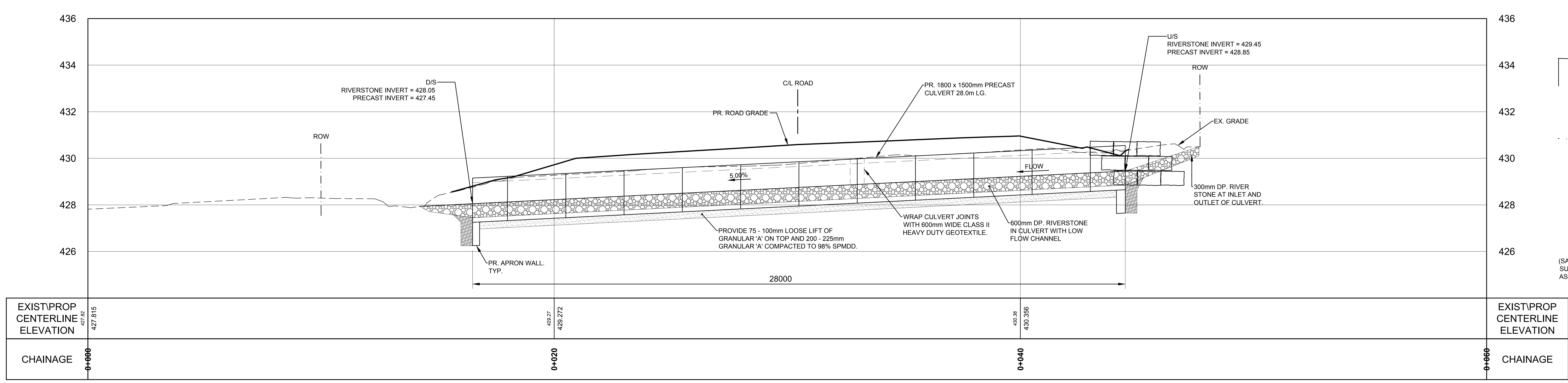
1. BOX CULVERT TO BE DESIGNED TO OPSD 1821 AND CANADIAN HIGHWAY BRIDGE DESIGN CODE (CHBDC) CAN/CSA-S6-14.
2. CLASS OF CONCRETE SHALL BE 35 MPa.
3. CLEAR COVER TO REINFORCING STEEL

   FOR STRUCTURES WITH GREATER THAN 600mm OF FILL AND NO DISTRIBUTION SLAB:

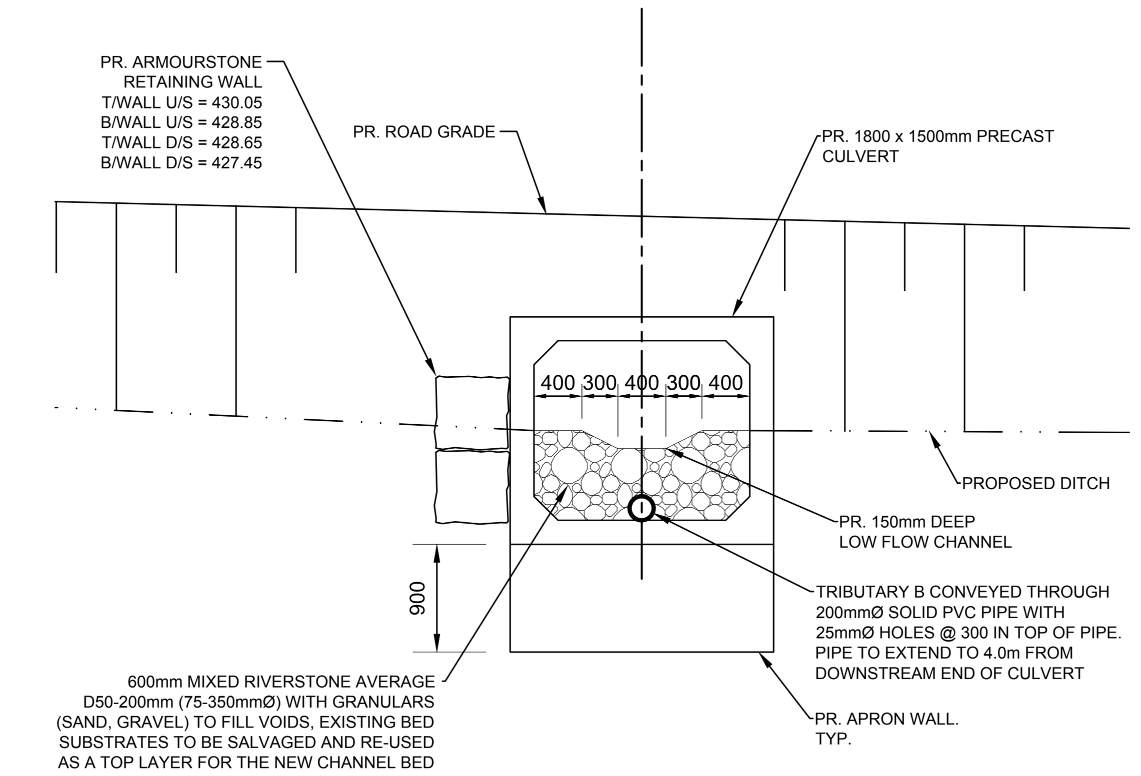
   EXTERIOR SURFACES 55 ± 10mm
   INTERIOR SURFACES 50 ± 10mm
4. REINFORCING BARS:

   STEEL:
   - REINFORCING STEEL (BLACK REBAR) SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
   - ALL LAP LENGTHS SHALL BE CONSIDERED TENSION CLASS 'B' UNLESS NOTED OTHERWISE.
   - BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
   - BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 AND SS12-2, (AVAILABLE UPON REQUEST) OR THE REINFORCED STEEL INSTITUTE OF ONTARIO OR CANADA (RSIO or RSIC), UNLESS INDICATED OTHERWISE.
5. ALL EXPOSED CORNERS TO HAVE 25mm X 25mm CHAMFER UNLESS OTHERWISE NOTED
6. WHERE REINFORCING IS TO BE EMBEDDED INTO EXISTING CONCRETE, THE REINFORCING SHALL BE FIXED USING NON-SHRINK EPOXY GROUT. DRILL HOLE DEPTH AND DIAMETER TO BE AS PER GROUT SUPPLIERS RECOMMENDATIONS TO FULLY DEVELOP THE REINFORCING BARS.
7. CONSTRUCTION NOTES
   - BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND EACH SIDE OF CULVERT, KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
   - THE CONTRACTOR SHALL CONFIRM ALL DIMENSIONS AND DETAILS BEFORE STARTING WORK.
   - THE CONTRACTOR IS RESPONSIBLE FOR THE VERIFICATION AND PROTECTION OF ALL EXISTING UTILITIES, SERVICES, STRUCTURES, ROADWAYS, ETC. DURING CONSTRUCTION.
   - GEOTECHNICAL REPORT BY PETO MacCALLUM FILE #14BF029 DATED MARCH, 2015.
8. RETAINING WALL NOTES
   - ARMOURSTONE BLOCKS ARE TO BE MINIMUM 600 H x 1000 W x600 D AND SHALL BE NEATLY STACKED.
   - THE CONTRACTOR SHALL VERIFIY THE REQUIRED BEARING CAPACITY USING A QUALIFIED GEOTECHNICAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO
   - IF THE REQUIRED BEARING CAPACITIES CAN NOT BE OBTAINED, THE CONTRACT ADMINISTRATOR SHALL PROVIDE THE CONTRACTOR WITH REVISED WALL GEOMETRY TO SUIT THE GEOTECHNICAL FIELD CAPACITY.

   REQUIRED CAPACITY : ULS: 150 kPa



1 ELEVATION - CULVERT
1:250



2 SECTION
1:50

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PRELIMINARY

No.	Issue / Revision	Date	Auth.
3	PRELIMINARY VIA RECOMMENDATION	2014/07/08	
4	DESIGN REVISION	2015/04/10	
5	DESIGN REVISION	2015/05/08	
6	DESIGN REVISION	2015/05/29	
7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

Metres Vertical 1:100
Metres Horizontal 1:500

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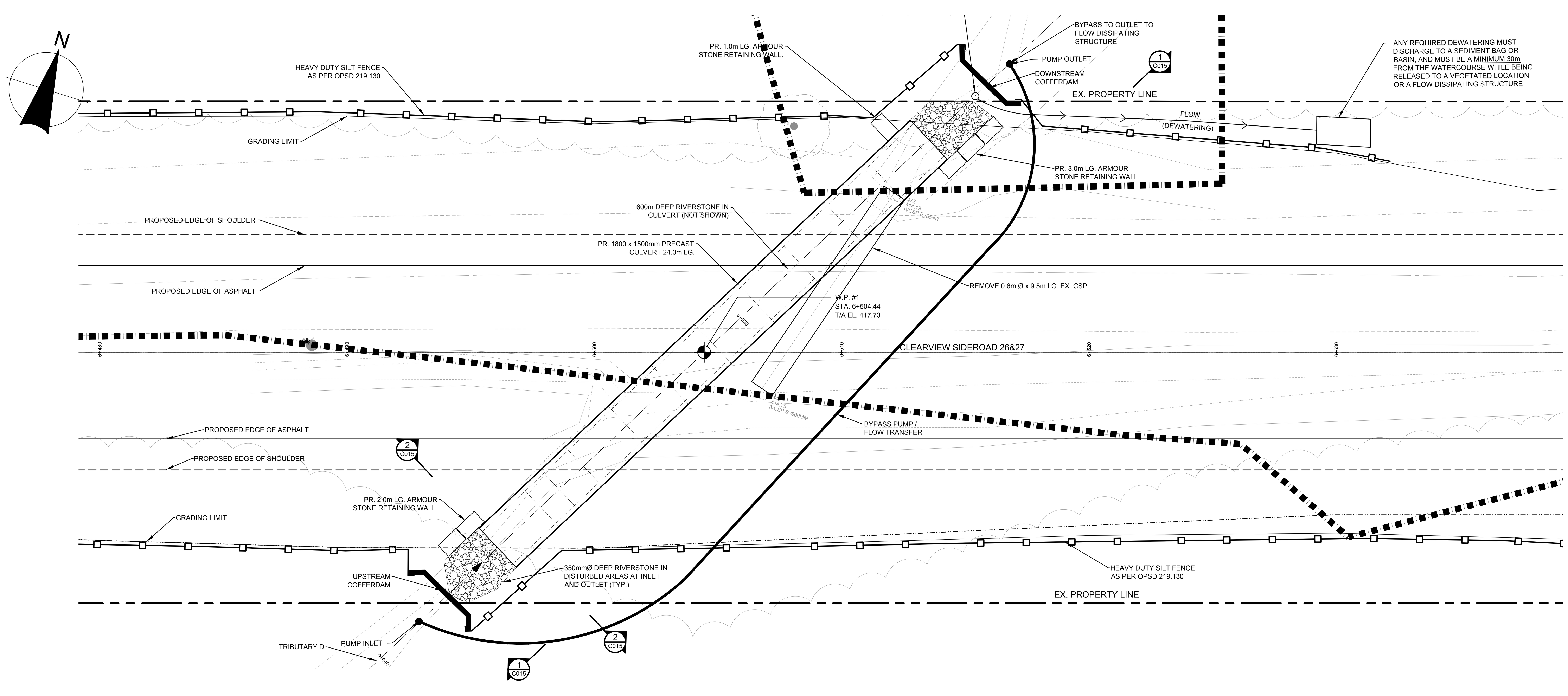
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
CULVERT DETAILS - TRIBUTARY C

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	C014
Scale		Project No.		Revision No.	
AS NOTED		300034587		10	



PLAN - DESCRIPTION

1:100

GENERAL NOTES:

1. BOX CULVERT TO BE DESIGNED TO OPSD 1821 AND CANADIAN HIGHWAY BRIDGE DESIGN CODE (CHBDC) CAN/CSA-S6-14.
2. CLASS OF CONCRETE SHALL BE 35 MPa.
3. CLEAR COVER TO REINFORCING STEEL

   FOR STRUCTURES WITH GREATER THAN 600mm OF FILL AND NO DISTRIBUTION SLAB:

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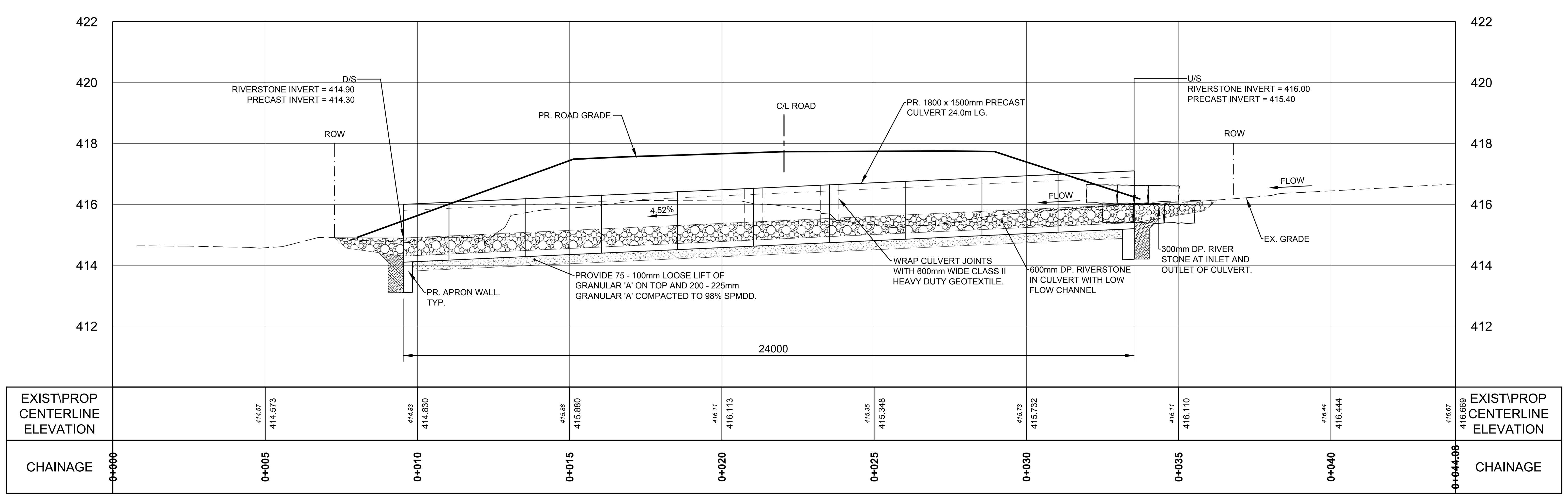
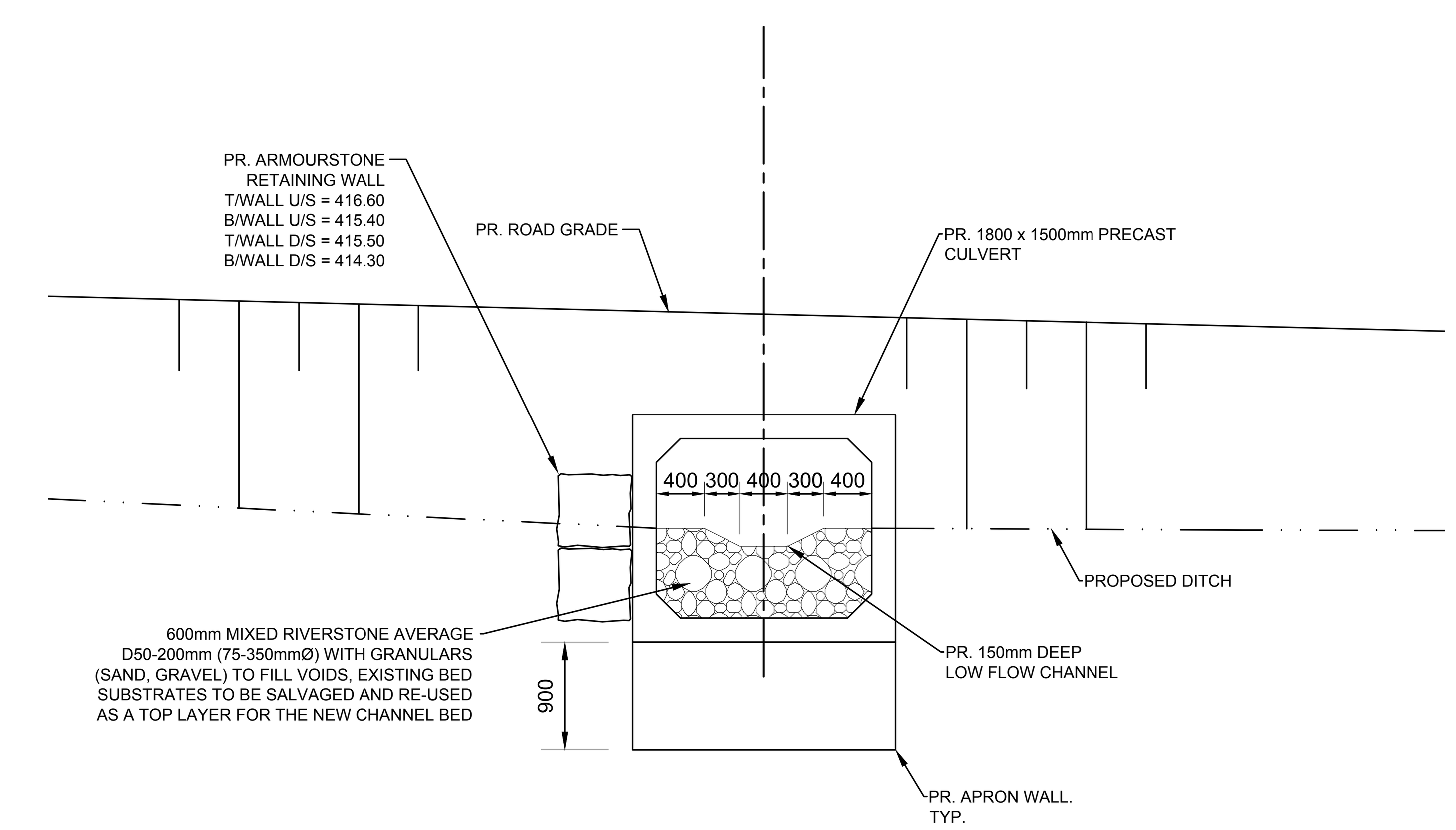
   REQUIRED CAPACITY : ULS: 150 kPa



1 - ELEVATION - CULVERT

1:100



2 - SECTION

1:50

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8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

Metres Vertical 1:100 — 0, 2.0, 4.0, 6.0, 8.0
Metres Horizontal 1:500 — 0, 5.0, 10.0, 20.0, 30.0, 40.0

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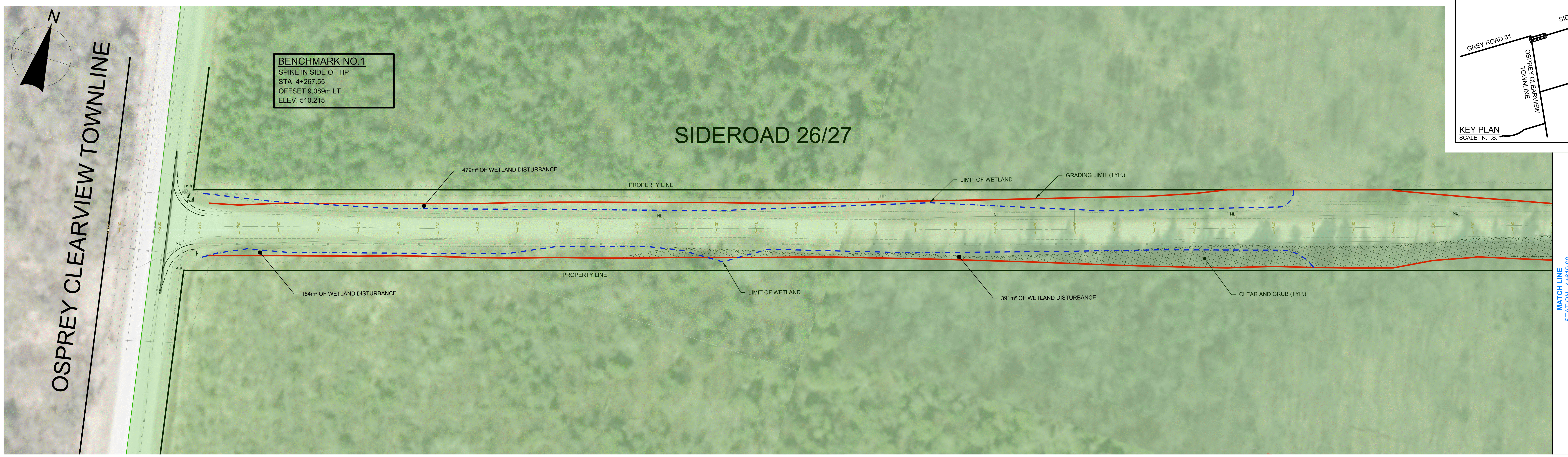
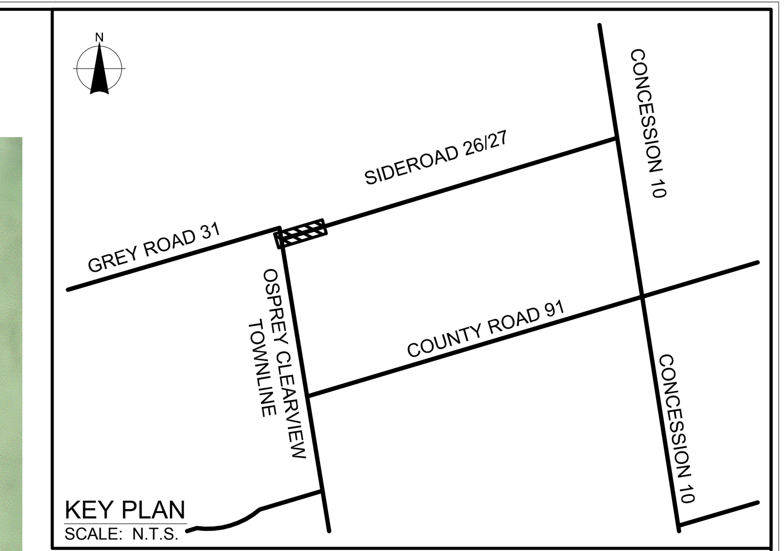
Client
TOWNSHIP OF CLEARVIEW
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

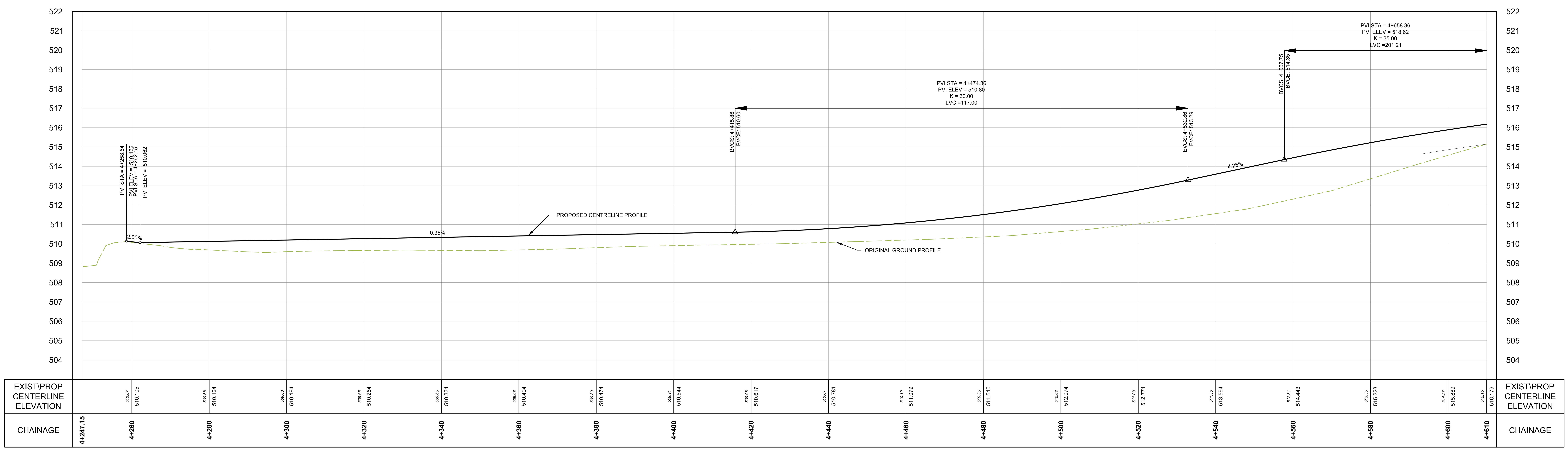
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
CULVERT DETAILS - TRIBUTARY D

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	C015
Scale: AS NOTED		Project No.: 300034587		Revision No.: 10	

File Name: 034587_DETAILS-2.dwg Date Plotted: September 20, 2016 - 9:05 AM







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8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

LEGEND

- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100

Metres Horizontal 1:500

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Client
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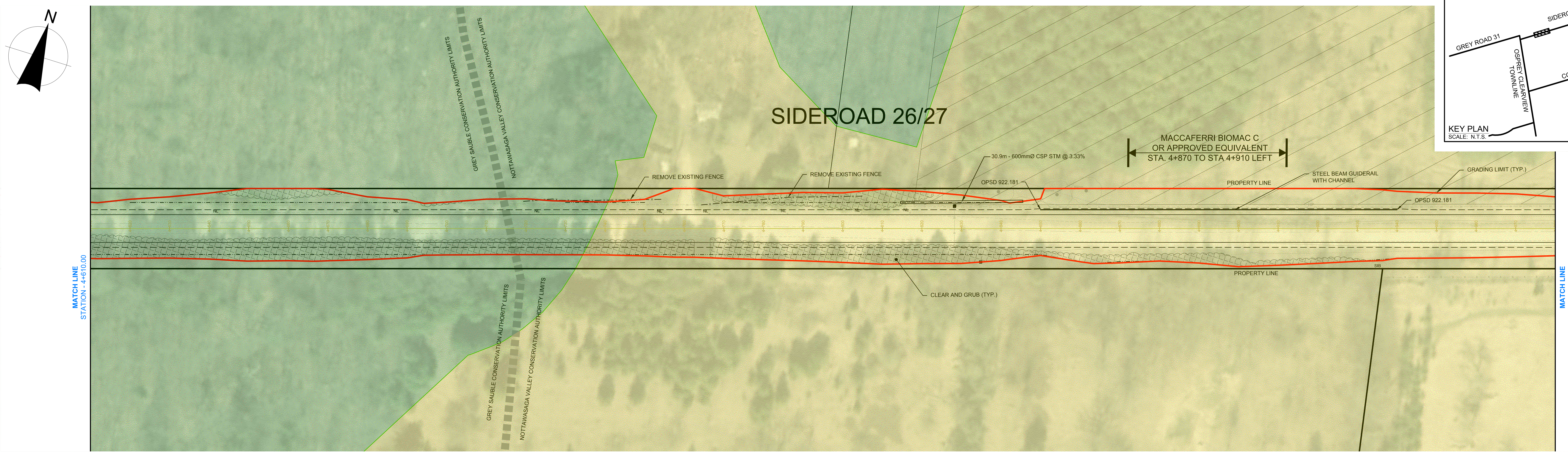
STAYNER, ONTARIO
L0M 1S0

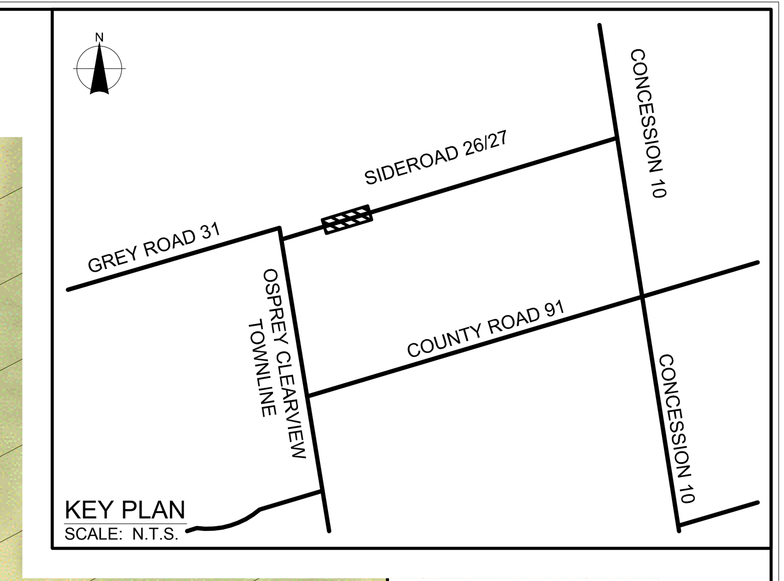
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

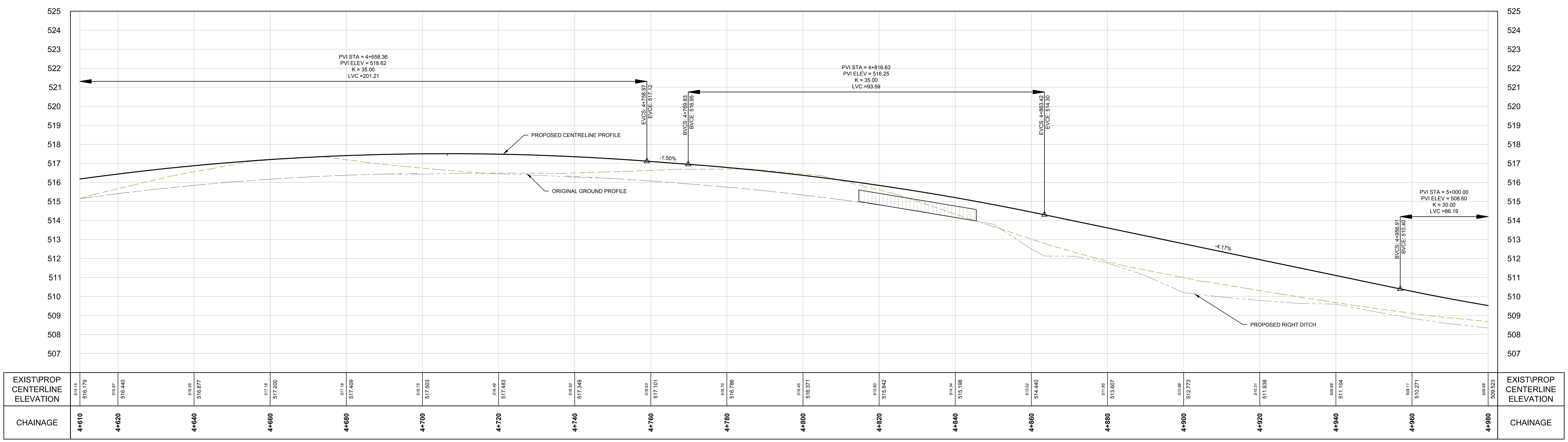
PLAN & PROFILE
SIDEROAD 26/27
4+247 TO 4+610

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	A001
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 10	

File Name: 300034587_PP_26&27-AERIAL.dwg Date Plotted: September 19, 2016 - 4:55 PM







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10	ISSUED FOR DFO SUBMISSION	2016/09/22	

LEGEND
- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100
Metres Horizontal 1:500

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Client
TOWNSHIP OF CLEARVIEW
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
4+610 TO 4+980

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	A002
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 10	

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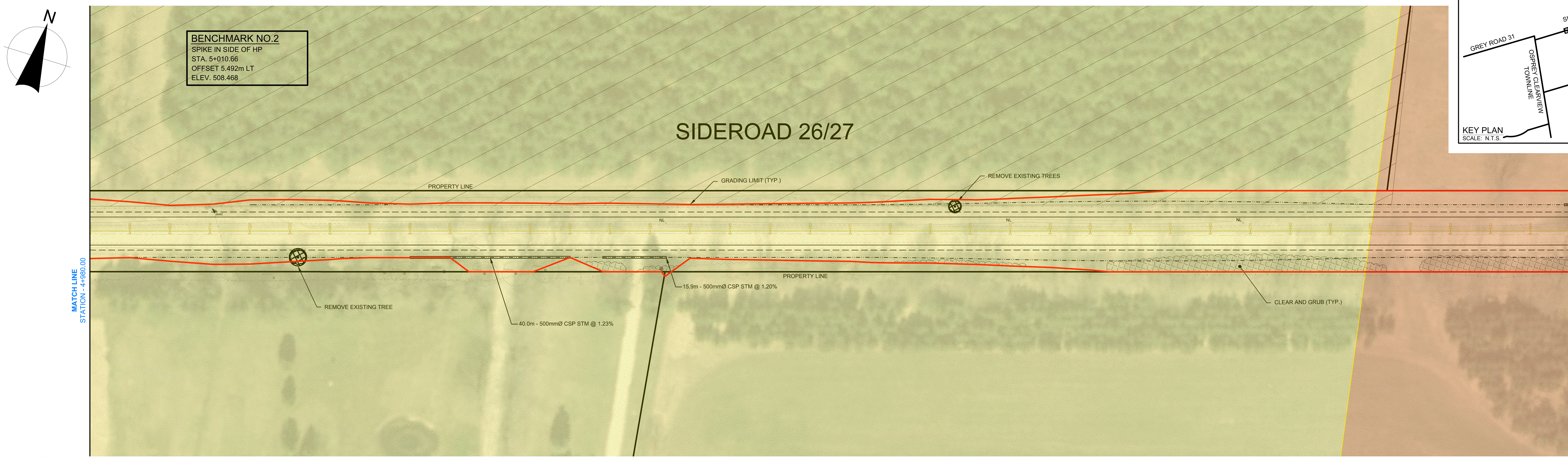

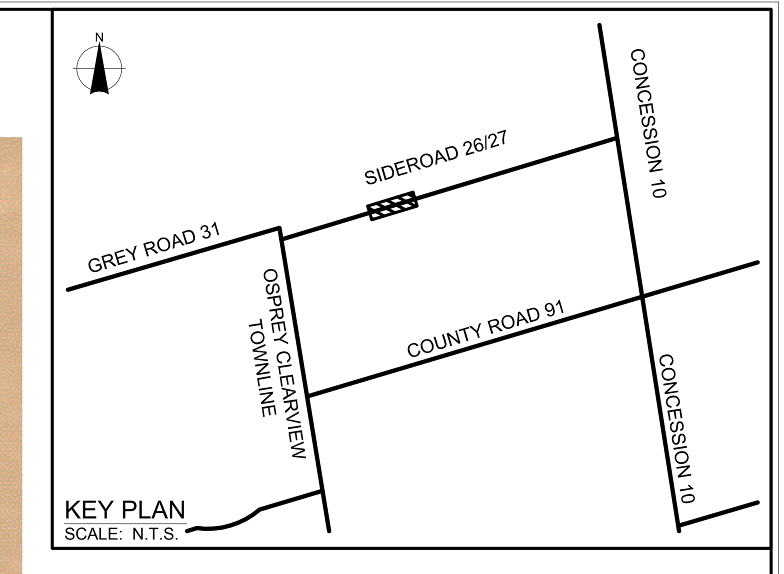

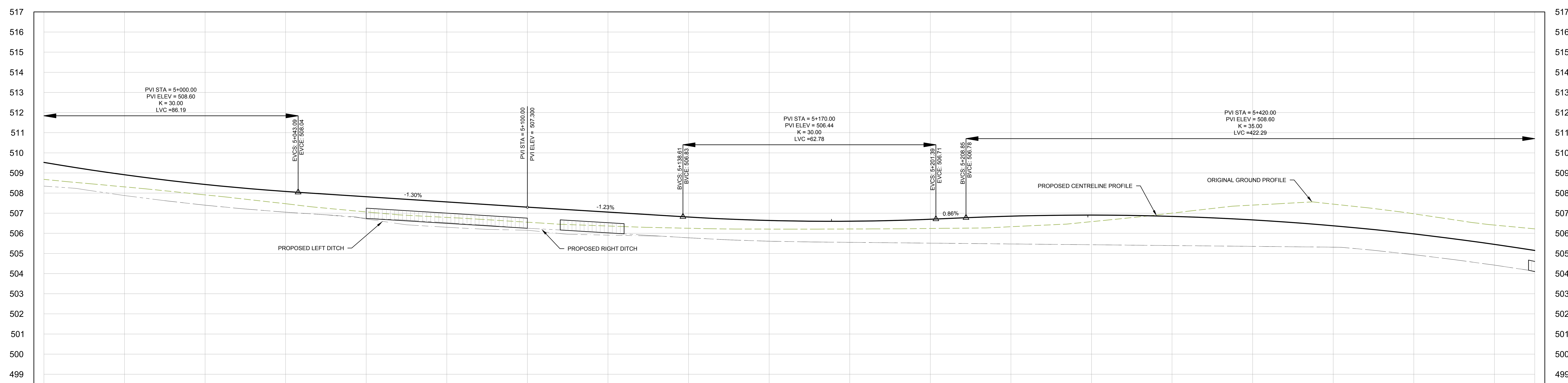

CHAINAGE	EXIST\PROP CENTERLINE ELEVATION
4+980	508.68 / 509.523
5+000	508.31 / 508.909
5+020	507.91 / 508.429
5+040	507.47 / 508.082
5+060	507.06 / 507.820
5+080	506.79 / 507.560
5+100	506.55 / 507.300
5+120	506.36 / 507.054
5+140	506.25 / 506.809
5+160	506.21 / 506.639
5+180	506.22 / 506.603
5+200	506.24 / 506.700
5+220	506.33 / 506.854
5+240	506.58 / 506.906
5+260	507.01 / 506.844
5+280	507.40 / 506.667
5+300	507.45 / 506.376
5+320	506.97 / 505.971
5+340	506.41 / 505.452
5+350	506.22 / 505.149

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9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

LEGEND

- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
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- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100

Metres Horizontal 1:500

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STAYNER, ONTARIO
L0M 1S0

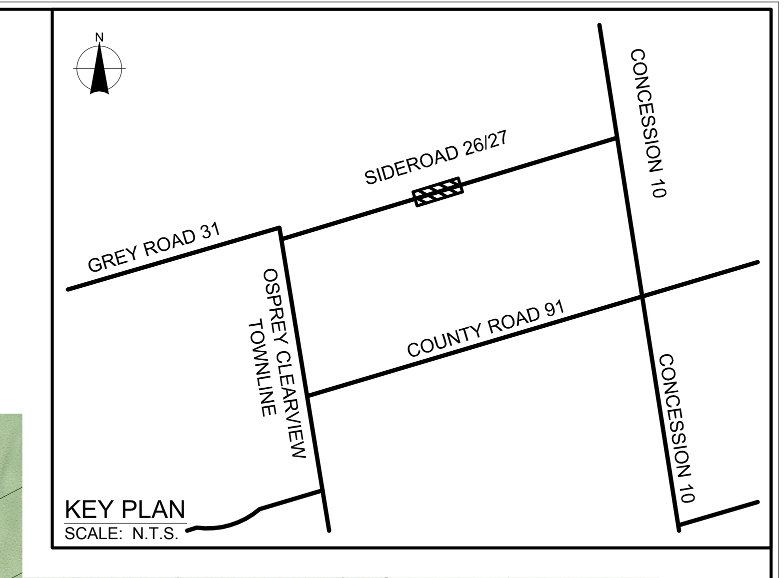
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

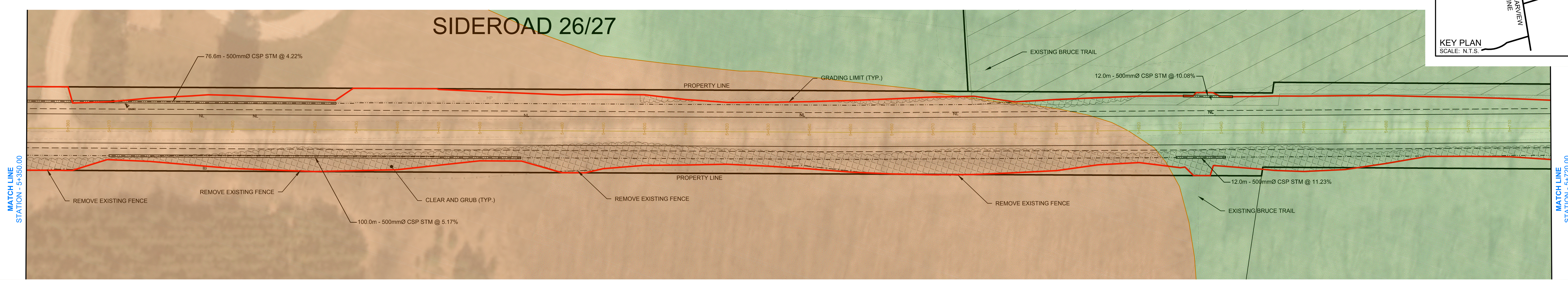
PLAN & PROFILE
SIDEROAD 26/27
4+980 TO 5+350

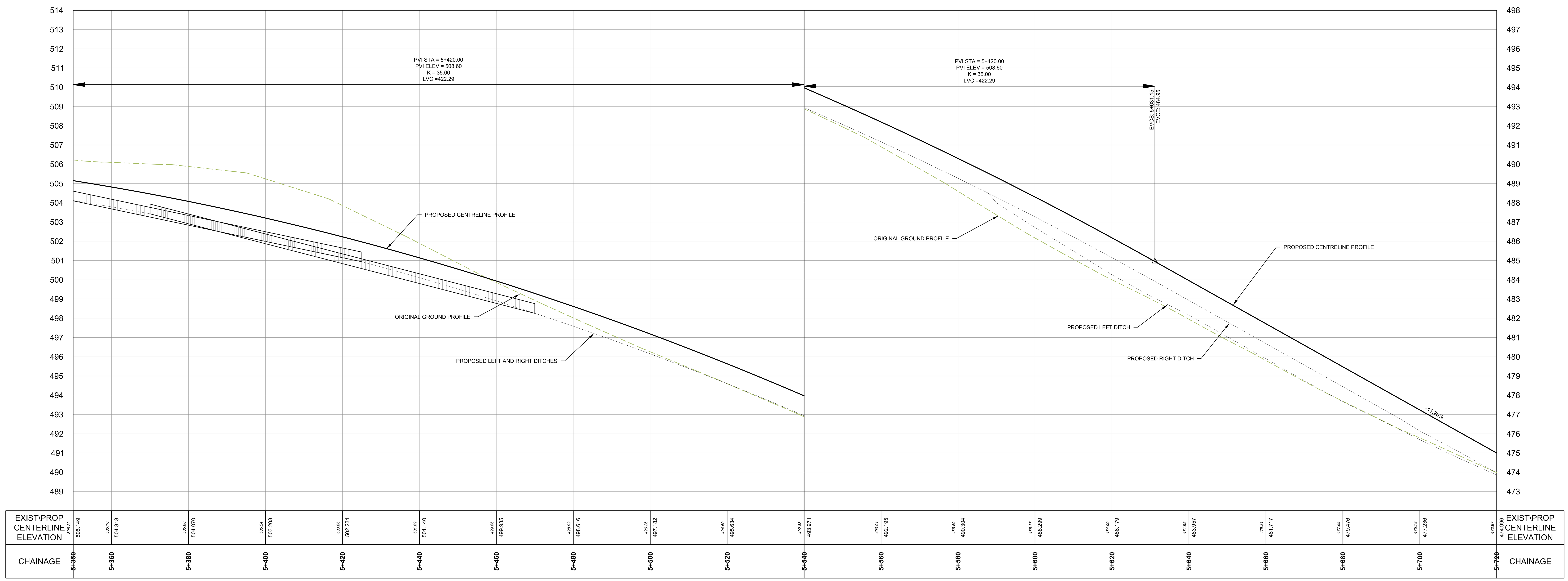
Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	A003
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 10	

File Name: 300034587_PP_26&27-AERIAL.dwg Date Plotted: September 19, 2016 - 4:55 PM

BENCHMARK NO.3
SPIKE IN SIDE OF HP
STA. 5+373.91
OFFSET 6.070m LT
ELEV. 506.428







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LEGEND

- ESCARPMENT RURAL AREA
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- ESCARPMENT NATURAL AREA
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- LIMIT OF WETLAND

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L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
PLAN & PROFILE
SIDEROAD 26/27
5+350 TO 5+720

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	A004
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		10	

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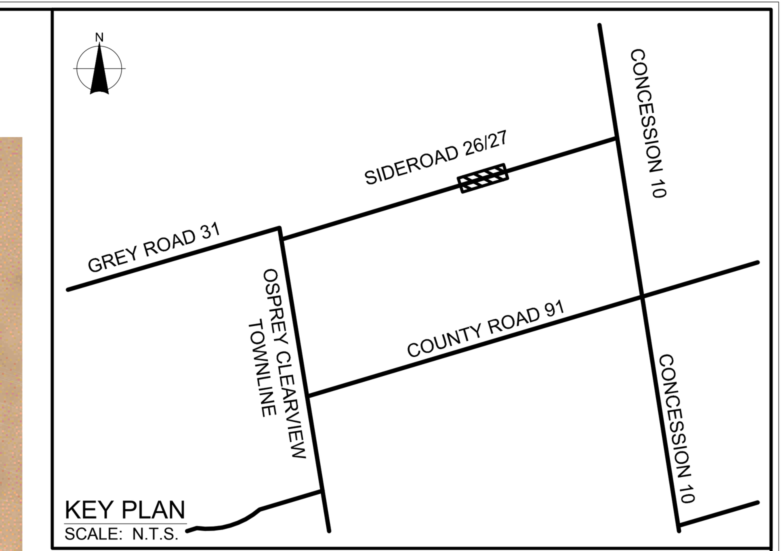

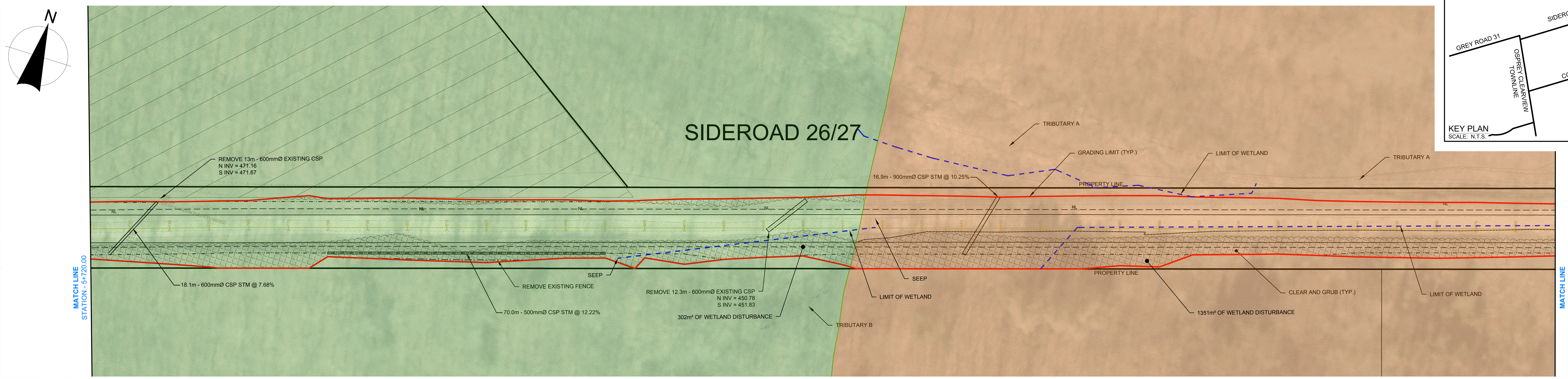

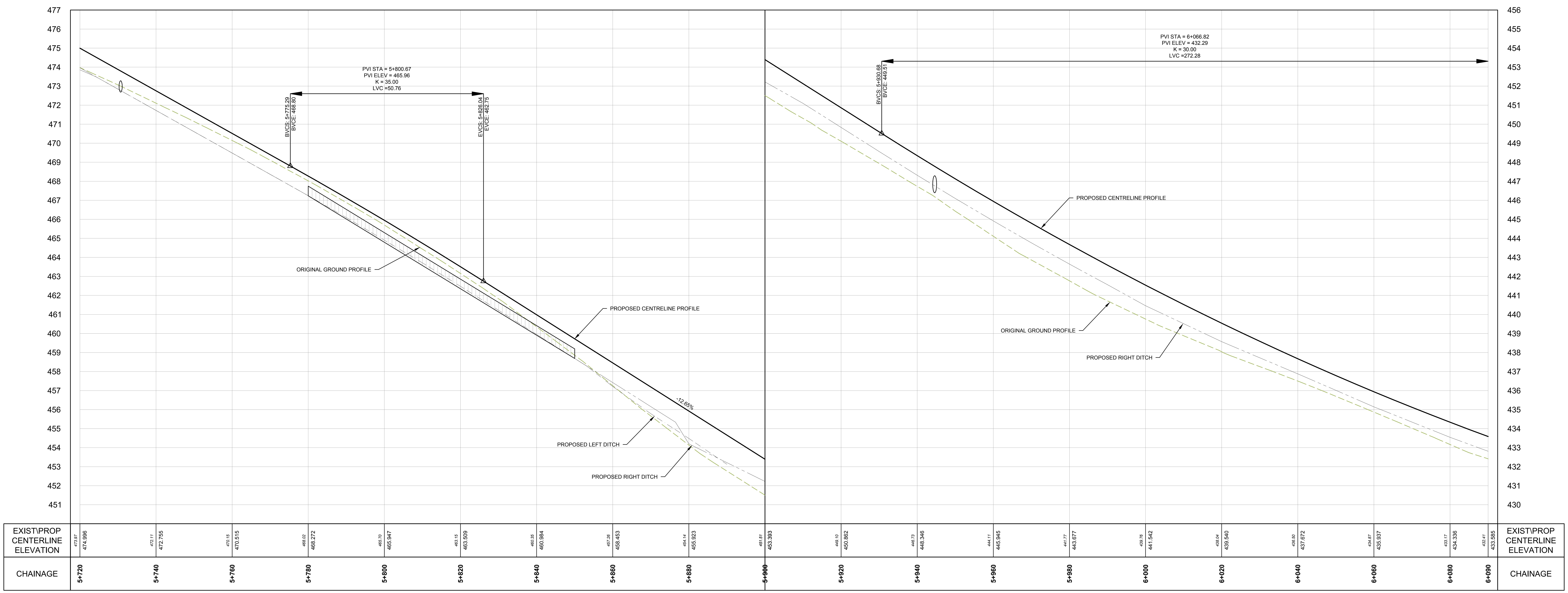

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PRELIMINARY

No.	Issue / Revision	Date	Auth.
3	PRELIMINARY VIA RECOMMENDATION	2014/07/08	
4	DESIGN REVISION	2015/04/10	
5	DESIGN REVISION	2015/05/08	
6	DESIGN REVISION	2015/05/29	
7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	

LEGEND

- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100
Metres Horizontal 1:500

R.J. Burnside & Associates Limited
3 Ronell Crescent,
Collingwood, Ontario, L9Y 4J6
telephone (705) 446-0515
fax (705) 446-2399
web www.rjburnside.com

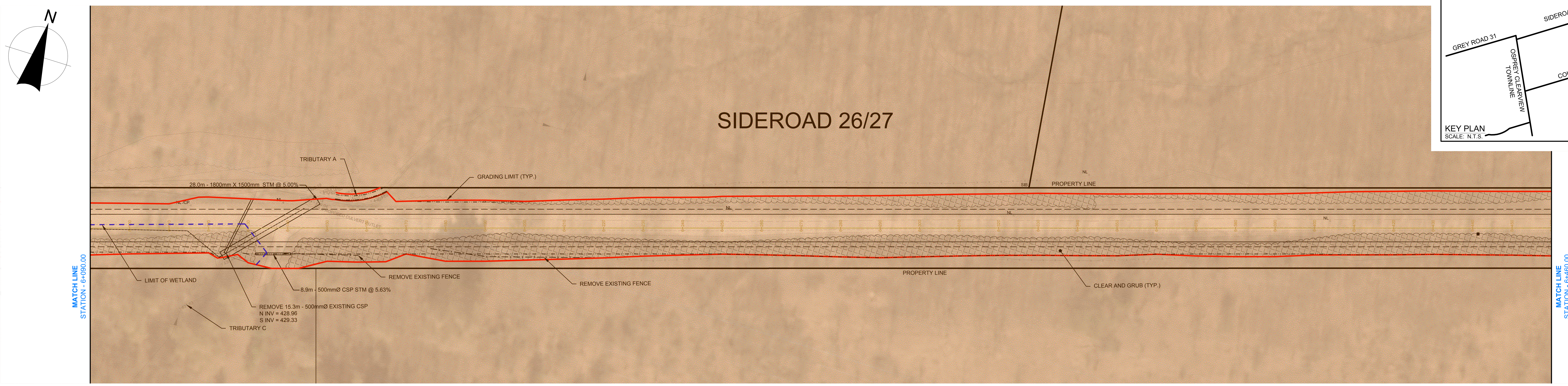
Client
TOWNSHIP OF CLEARVIEW
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

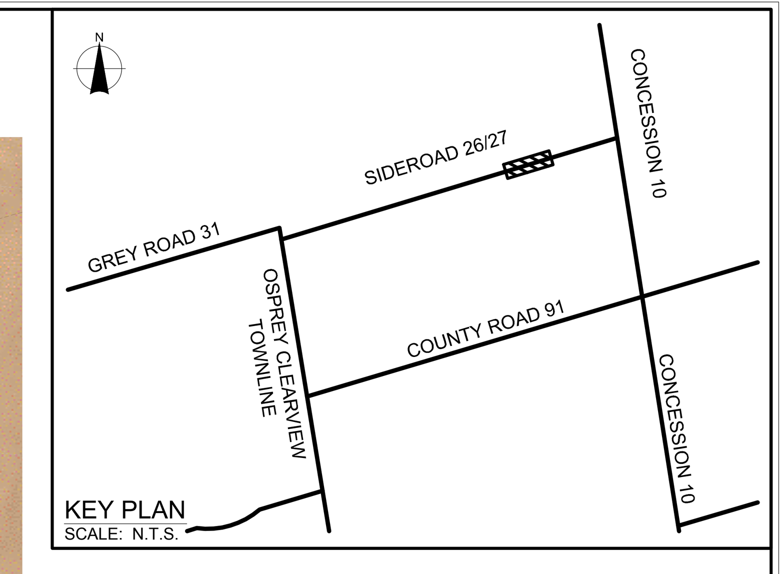
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

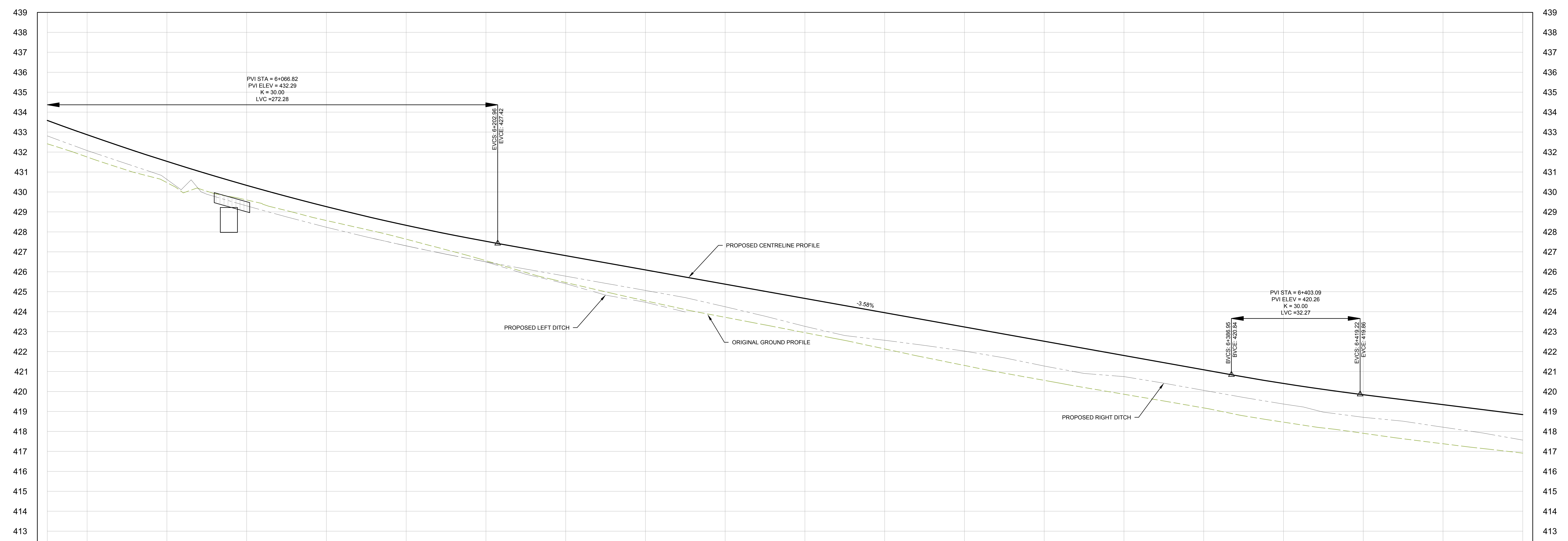
PLAN & PROFILE
SIDEROAD 26/27
5+720 TO 6+090

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	A005
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 10	

File Name: 300034587_PP_26&27-AERIAL.dwg Date Plotted: September 19, 2016 - 4:55 P







EXIST\PROP CENTERLINE ELEVATION	CHAINAGE
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431.75 / 432.868	6+100
430.47 / 431.533	6+120
429.60 / 430.331	6+140
428.57 / 429.263	6+160
427.63 / 428.328	6+180
426.55 / 427.527	6+200
425.46 / 426.810	6+220
424.55 / 426.095	6+240
423.72 / 425.380	6+260
422.95 / 424.665	6+280
422.13 / 423.950	6+300
421.31 / 423.235	6+320
420.56 / 422.520	6+340
419.86 / 421.804	6+360
419.18 / 421.089	6+380
418.46 / 420.403	6+400
417.91 / 419.841	6+420
417.38 / 419.341	6+440
416.91 / 418.841	6+460

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2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

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Metres Horizontal 1:500

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Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
6+090 TO 6+460

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	A006
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 10	

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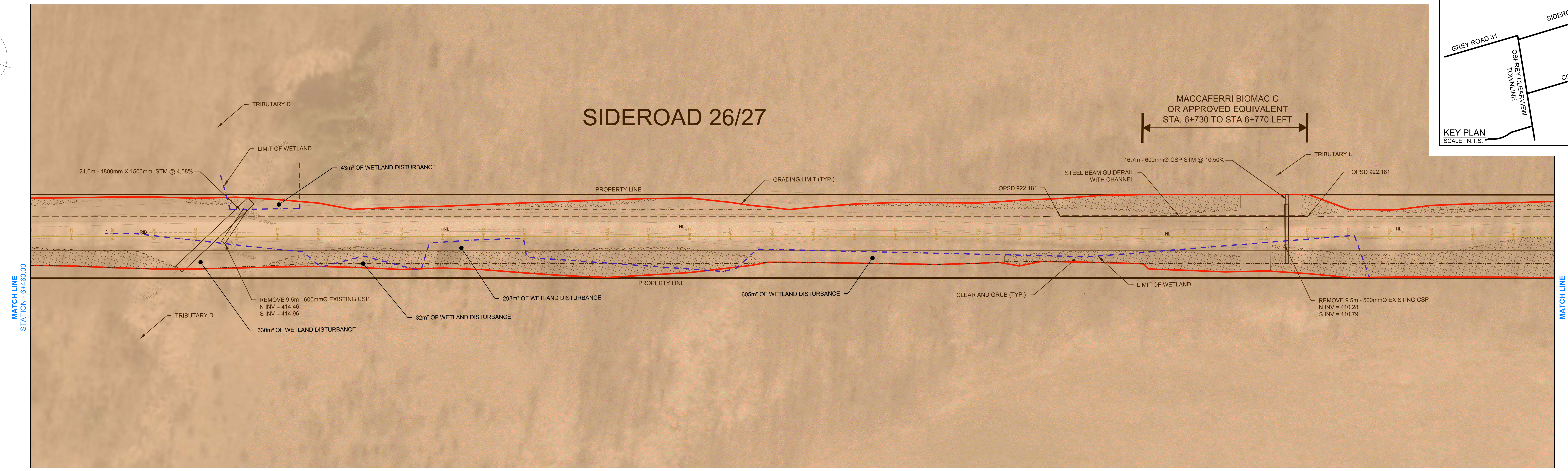

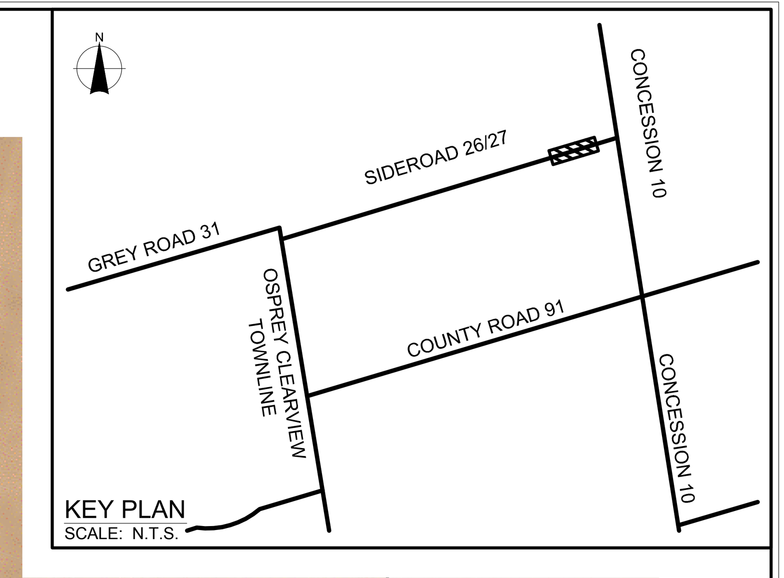

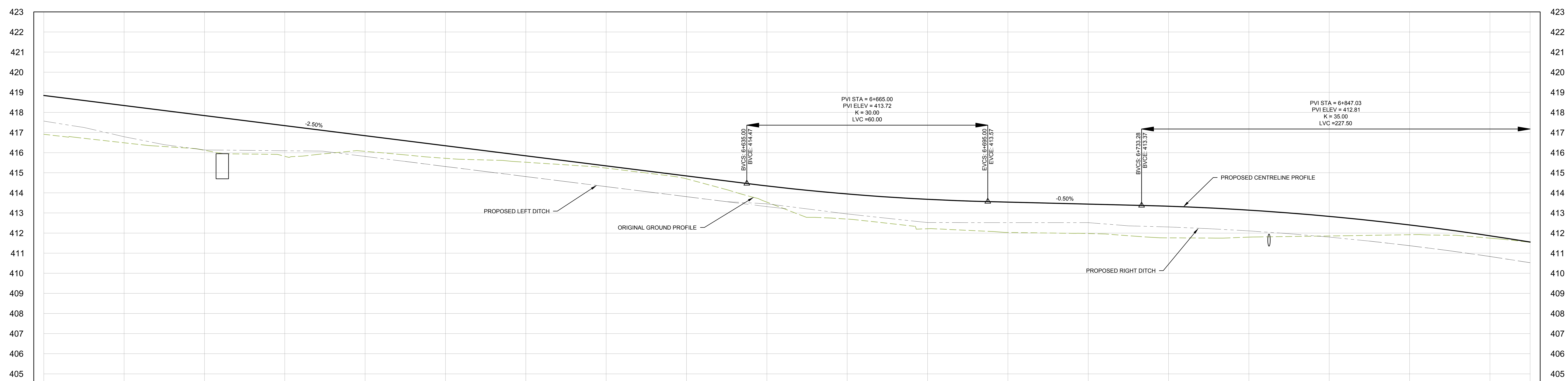

CHAINAGE	EXIST\PROP CENTERLINE ELEVATION (EXIST)	EXIST\PROP CENTERLINE ELEVATION (PROP)
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6+480	416.49	418.341
6+500	416.12	417.841
6+520	415.82	417.341
6+540	416.07	416.841
6+560	415.72	416.341
6+580	415.52	415.841
6+600	415.23	415.341
6+620	414.70	414.841
6+640	413.54	414.345
6+660	412.70	413.945
6+680	412.22	413.679
6+700	412.03	413.541
6+720	411.98	413.441
6+740	411.76	413.335
6+760	411.80	413.139
6+780	411.85	412.829
6+800	411.92	412.405
6+820	411.75	411.867
6+830	411.54	411.554

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Metres Vertical 1:100 — 0, 2.0, 4.0, 6.0, 8.0
Metres Horizontal 1:500 — 0, 5.0, 10.0, 20.0, 30.0, 40.0

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STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
6+460 TO 6+830

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	A007
Scale		Project No.		Revision No.	
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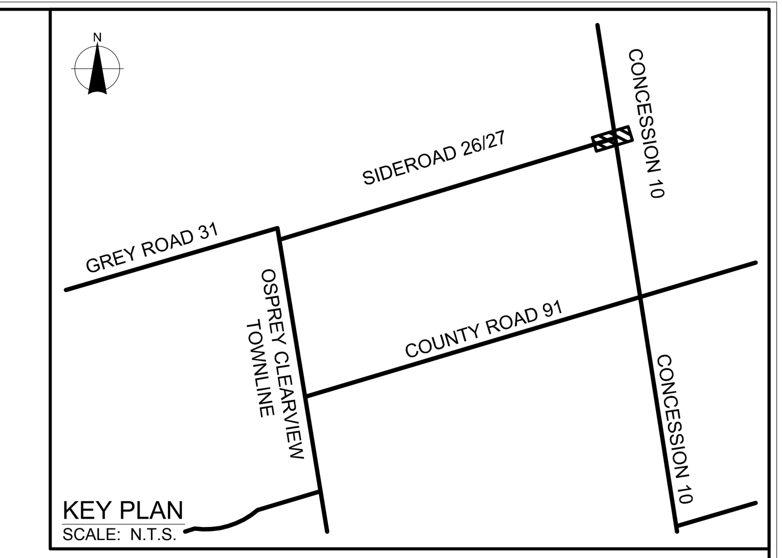

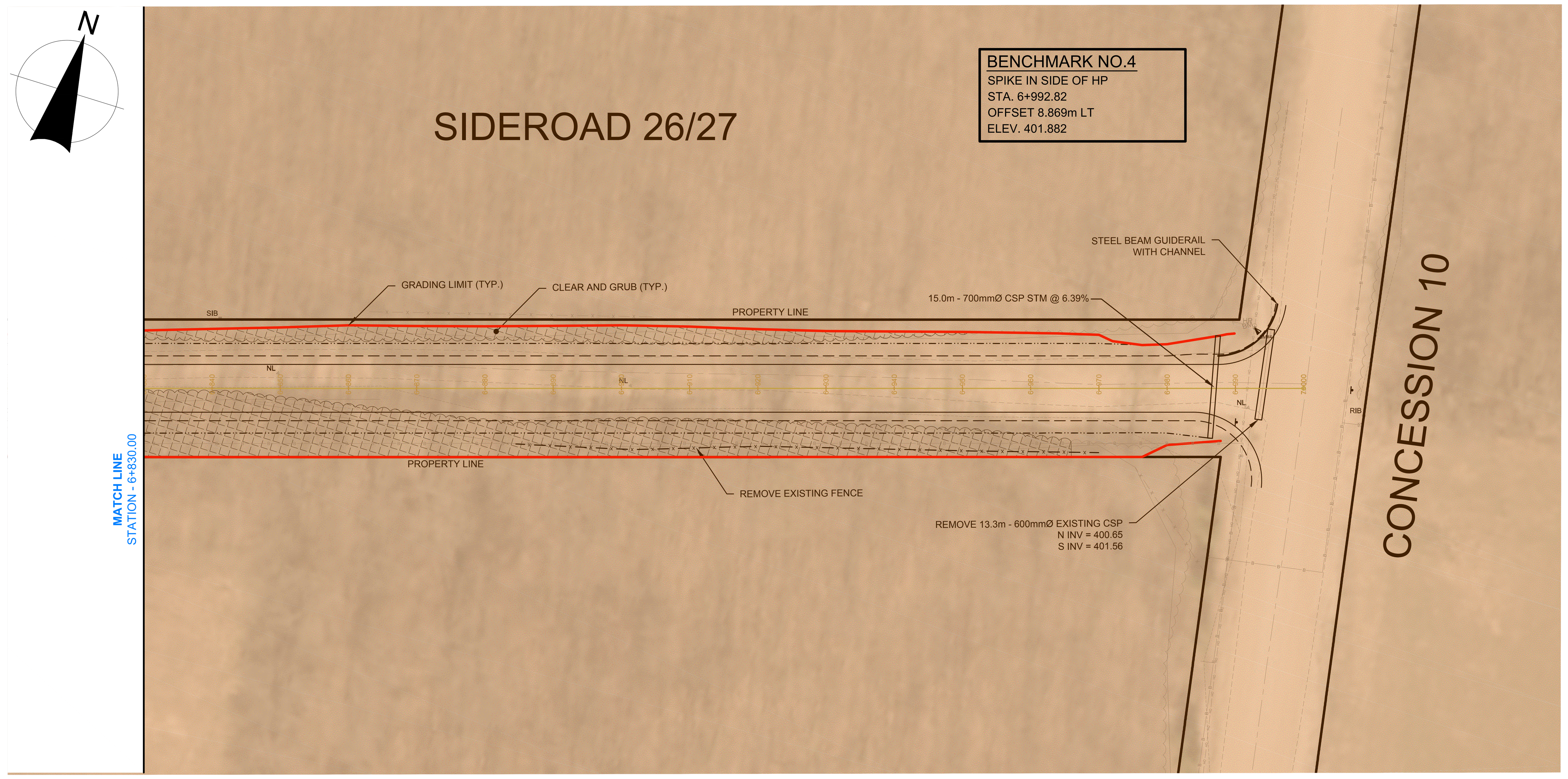

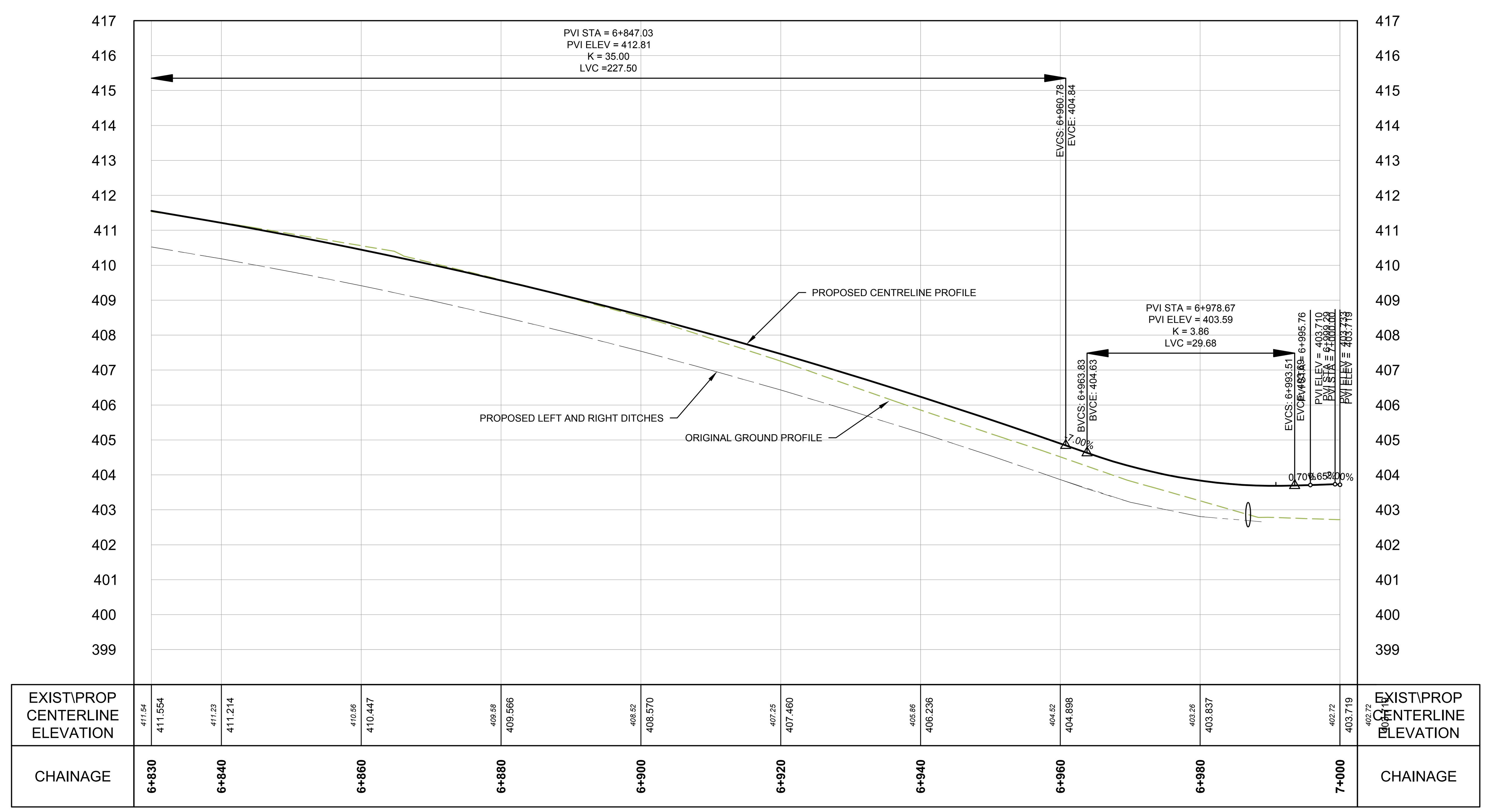

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- LIMIT OF WETLAND

Metres Vertical 1:100

Metres Horizontal 1:500

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BURNSIDE

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Client

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STAYNER, ONTARIO
L0M 1S0

Drawing Title

CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
6+830 TO 7+000

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2016/09/22	A008

Scale	Project No.	Revision No.
H 1:500 V 1:100	300034587	10

File Name: 300034587_PP_26&27-AERIAL.dwg Date Plotted: September 19, 2016 - 4:55 PM

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[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Geomorphic Evaluation – Proposed Channel Realignment

PARISH aquatic services
A Division of Matrix Solutions Inc.

MEMORANDUM

TO: Jeremy Prahl, RJ Burnside and Associates Limited

FROM: John Parish, PARISH Aquatic Services - Matrix Solutions Inc.

SUBJECT: Geomorphic Evaluation - Proposed Channel Realignment; Pretty River Tributary
Side Road 26/27, Clearview Township

DATE: July 5, 2016

1 INTRODUCTION

It is understood that Clearview Township is proposing to upgrade Side Road 26/27 to accommodate increased vehicular traffic volumes. The upgraded road will be wider with some profile modifications. Near the centre of the proposed length of the road work is a crossing of a tributary to the Pretty River. At this crossing, a culvert extension is proposed. In addition to the extension, a short section of the tributary channel must be realigned as it runs parallel to the road.

This memo summarizes the geomorphic review that was completed in order to support the proposed channel realignment design. It is understood that the channel is a coldwater tributary and supports a brook trout population. It is also understood that the proposed road work is subject to the NEC appeal and also requires regulatory approval. This memo is intended to assist with the regulatory review of the channel work.

The review has included a site inspection, discussion amongst team members, and a review of the drawings prepared by RJ Burnside.

2 SITE INSPECTION

As shown in the attached photographs from the geomorphic site visit, the tributary channel is interacting with the road and resultantly receives high loads of roadway materials (gravel and other coarse material). The channel has a bankfull width of 1.0 to 1.5 m and an average bankfull depth ranging from 0.25 to 0.35 m. The energy gradient was approximately 2% with sand, coarse gravel to cobble substrate present.

Aside from the material sourced from the road, there was little evidence of bank erosion or channel migration. Bed morphology is poorly defined, consisting of occasional small chute/steps followed by a small sour pool (see photo). There is a risk of the steps headcutting, however the risk is minor as they appear to be controlled by substantial vegetation and the flow regime.

3 PROPOSED CHANNEL REALIGNMENT

Based on the updated channel realignment drawing from RJ Burnside (May 10, 2016; Figure 6.3B), the design will realign approximately 20 m of channel length. The proposed design entails a cut on the inside of a small meander, resulting in a maximum of 5 m of loss of channel length. The existing channel cross-sectional dimensions and substrate are to be replicated along the design channel.

The proposed design was revised based upon geomorphic input and from biological support (C Wren and RJ Burnside). Given the constraints of the property and road work, the design has been optimized to achieve as much avoidance of channel alteration as possible. The proposed work removes the channel from the limit of road grading, yet maintains the work within the road Right-of-Way. As noted, the tributary channel currently receives high loads of gravel and coarse material. In achieving the proposed separation from the road, the channel will benefit from improved natural function with respect to sediment movement. In terms of constructability, the proposed realignment fits well with the existing channel planform and can be easily constructed in the dry.

4 SUMMARY

In summary, fluvial geomorphological input was provided into the proposed channel realignment design of a tributary to the Pretty River. Overall, the nature of the design is minor and can be easily implemented. The existing channel dimensions, substrate and bank conditions will be replicated in the proposed realigned channel. Given the nature of the creek and the setting, it is felt that the work is appropriate and provides benefits in terms of natural geomorphic function of the tributary.

Photo 1 - Chute and pool morphology

Photo 2 - Road material entering channel

Photo 3 - View of section of channel section next to road. Proposed site for realignment.

Photo 4 - Upstream section where channel approaches road

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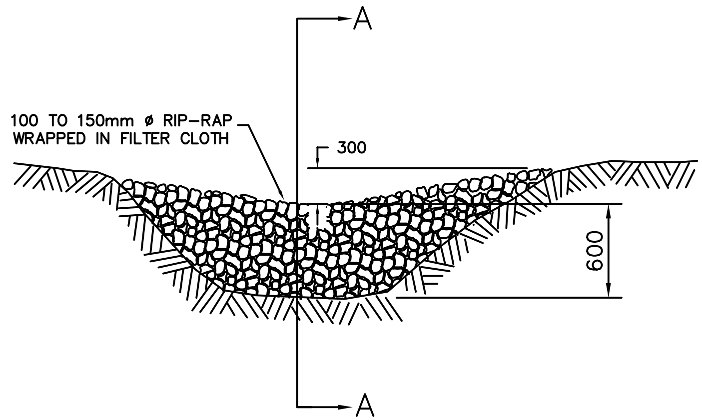
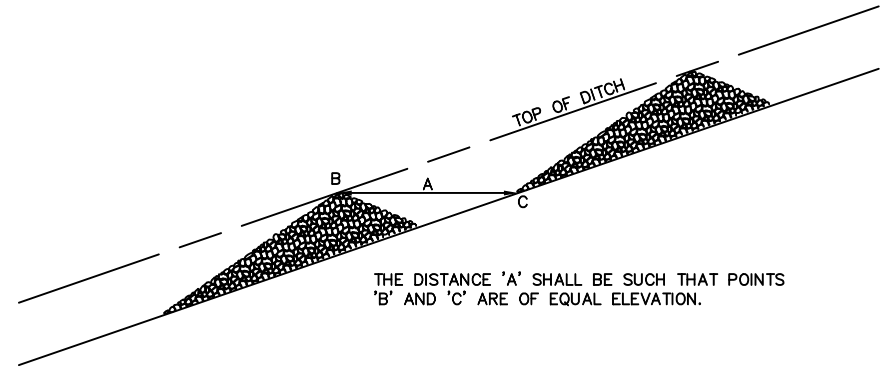
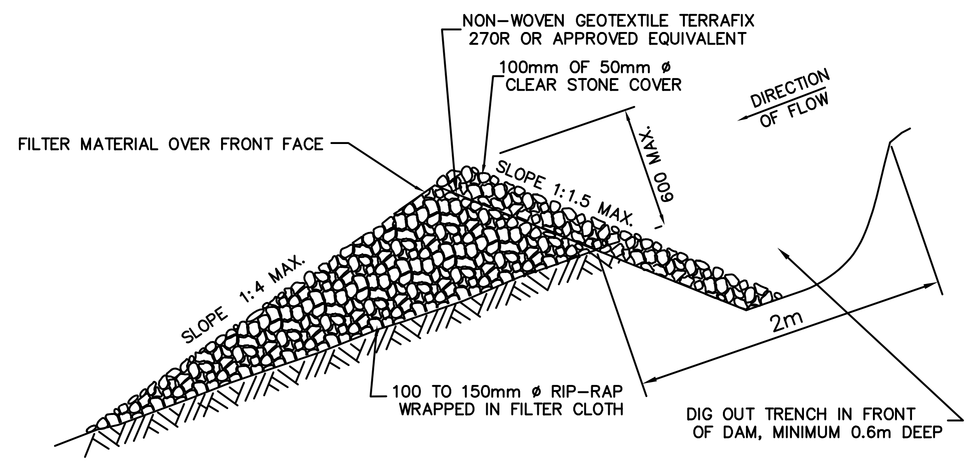
Appendix B

Typical Rock Check Dam Erosion Control Device







SECTION A - A

NOTES:

1. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA IN SUCH A MANNER THAT IT WILL NOT ERODE. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

Nottawasaga Valley Conservation Authority

TYPICAL ROCK CHECK DAM
EROSION CONTROL DEVICE

NO.	REVISION	APR'D	DATE
1	TRENCH ADDED AND FABRIC EXTENDED INTO IT		2003.02.19

APR'D:	DATE: 92.05.15
DRAWN: L.A.J.	SCALE: N.T.S.

BSD-24 DRAFT

Fisheries and Oceans Canada | Pêches et Océans Canada

103-1800 11th Avenue
Regina, Saskatchewan
S4P 0H8

June 19, 2017

Your file *Votre référence*

Our file *Notre référence*
16-HCAA-01366

Township of Clearview
ATTENTION: Steve Sage
217 Gideon Street
Stayner, Ontario
L0M 1S0

Dear Mr. Sage:

Subject: Implementation of mitigation measures to avoid and mitigate impacts to fish and fish habitat – Culvert replacements and Channel Realignment, Tributaries of Pretty River, Community of Duntroon, ON

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on September 22, 2016.

Your proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*.

Your proposal has also been reviewed to determine whether it will adversely impact listed aquatic species at risk and contravene sections 32, 33 or 58 of the *Species at Risk Act* (SARA).

Our review considered the following:

- DFO Request for Review, dated September 16, 2016.
- R.J. Burnside & Associates Limited's (Burnside) *Clearview Sideroad 26/27 Improvements, Township of Clearview* report, dated September 22, 2016.
- Burnside's *Clearview Sideroad 26/27 Reconstruction* engineered design drawings, latest revisions dated May 5, 2017.
- Burnside's *Technical Memorandum: Fall Spawning Survey Summary*, dated March 17, 2017.
- Email correspondence between Zing-Ying Ho (DFO) and Jeremy Prahl (Burnside) on January 20, March 22 and 29, May 3, 8, 11, and 24, 2017.
- Telephone conversation between Zing-Ying Ho and Jeremy Prahl on May 10, 2017.

We understand that you propose to:

- Infill a 22 m^2 (22 m x 1 m) section of Tributary A and create a new 18 m^2 (18 m x 1 m) section of new channel along Tributary A. The new channel will replicate the existing aquatic habitat and morphology by creating a low flow channel of minimum 0.15 m depth lined with 300 mm mixed riverstone (average D50-200 mm) and granular material (sand, gravel) to fill the voids, using the existing bed substrate as a top layer for the new channel bed. The upper and outside banks of the new channel will be protected using a 550 mm layer of round stone (D50-300 mm).
- Replace the existing 600 mm x 12.3 m CSP (corrugated steel pipe) culvert with a 900 mm x 16.9 m CSP culvert on Tributary B.
- Replace the existing 500 mm x 15.3 m CSP culvert with an 1800 mm x 1500 mm x 28 m concrete box culvert on Tributary C. The inlets and outlets will be armored with riverstone over a total area of 12 m^2 and 9.9 m^2 of Tributary C will be realigned to flow through the new box culvert.
- Replace the existing 600 mm x 9.5 m CSP culvert with an 1800 mm x 1500 mm x 24 m concrete box culvert on Tributary D. The inlets and outlets will be armored with riverstone over a total area of 10 m^2 and 23.3 m^2 of Tributary D will be realigned to flow through the new box culvert.
- Replace the existing 500 mm x 9.5 m CSP culvert with a 600 mm x 16.7 m CSP culvert on Tributary E.
- Construct a 150 mm deep low flow channel through each box culvert and line with 600 mm mixed riverstone (average D50-200 mm) and granular material (sand, gravel) to fill the voids, using the existing bed substrate as a top layer for the new channel bed.
- Ensure all in-water construction will take place between July 1 and September 30 of any given year (or as otherwise directed by the Ontario Ministry of Natural Resources and Forestry).
- Perform all in-water work in dry/dewatered conditions.
- Isolate the proposed realignment section with suitably sized cofferdams.
- Ensure any cofferdams will be constructed of clean, non-erodible materials such as, but not limited to, pea gravel bags, clean gravel and plastic sheeting, precast barriers and plastic sheeting, sheet steel piling, or other clean material.
- Discharge all dewatering/unwatering into a filtered sump, sock, or soak pit located at least 30 m from the watercourse.
- Ensure use of appropriate pumps fitted with intake screens to prevent entrainment or impingement of fish to transfer creek flows.
- Remove any fish or aquatic life from the construction area by a qualified environmental professional.
- Salvage sod blocks from the proposed channel realignment and re-use as bank material within the new channel.
- Control all activities, including maintenance procedures, to prevent the entry of petroleum products, debris, sediment, or other deleterious substances into the water. Conduct all vehicular equipment refueling and maintenance at least 30 m away from the water.

.../3

- Ensure any part of equipment entering the water is free of fluid leaks and cleaned/degreased to prevent deleterious substances from entering the water.
- Provide all temporary soil or dirt stockpiles with the necessary sediment and erosion control features, including seeding if anticipated to be stored more than one month. Ensure stockpiles are not located in areas of concentrated flow and ensure they are a minimum of 15 m from the top of the bank.
- Maintain flow from upstream to downstream of the work area at all times.
- Ensure stabilization works will follow the natural contour and profile of the watercourse using natural channel design techniques (riverstone and plantings).
- Place only clean material free of fine particulates in the water.
- Implement sediment and erosion control measures prior to work and maintain during the work phase to prevent the entry of sediment into the water.
- Inspect all sediment and erosion control measures daily to ensure they are functioning properly, and upgraded or maintained as required.
- Ensure no further work will occur if the sediment and erosion controls are not functioning properly until the sediment and/or erosion control problem is addressed.
- Leave the sediment and erosion control measures in place until all disturbed areas in the construction area are stabilized.
- Stabilize and re-vegetate all disturbed areas as soon as possible following construction to preconstruction conditions or better.

Since there are no SARA species or their habitats identified in the project area, no additional approvals under SARA will be required for your proposed activities.

To avoid the potential for serious harm to fish that is prohibited under the *Fisheries Act*, the mitigation measures listed below, in addition to those set out in your project plans, are to be followed:

- Screened pumps proposed for dewatering should have its fish screen designed according to DFO's *Freshwater Intake End-of-Pipe Fish Screen Guideline*.
- One hundred percent of downstream flows must be maintained at all times during the project.

Since project activities are to be conducted in the presence of an environmental monitor, DFO requests that a copy of the fish salvage results and any other environmental monitoring reports be sent to the attention of Zing-Ying Ho at the Regina DFO Office (103-1800 11th Avenue, Regina, SK, S4P 0H8) at the completion of the project.

Provided that you implement the required mitigation measures for your project, and follow the guidance available on the DFO website at http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html, the Program is of the view that your proposal should not result in serious harm to fish or contravene sections 32, 33 or 58 of the *Species at Risk Act*. No formal approval is required from the Program under the *Fisheries Act* or the *Species at Risk Act* in order to proceed with your proposal.

.../4

It remains your responsibility to ensure you avoid causing serious harm to fish in compliance with the *Fisheries Act*, and that you meet the requirements under the *Species at Risk Act* as it may apply to your project. If your plans have changed or if the description of your proposal is incomplete, or changes in the future, you should consult our website (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or consult with a qualified environmental consultant to determine if further review is required by the Program.

Please be advised that it is also your *Duty to Notify* DFO if you have caused, or are about to cause, serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery. Such notifications should be directed to http://www.dfo-mpo.gc.ca/pnw-ppe/violation-infraction/index-eng.html.

A copy of this letter should be kept on site while the work is in progress. It remains your responsibility to meet all other federal, territorial, provincial and municipal requirements that apply to your project.

If you have any questions, please contact Zing-Ying Ho at our Regina office at 306-780-8107, by fax at 306-780-8722, or by email at zing-ying.ho@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Vincent Harper
Senior Fisheries Protection Biologist
Fisheries Protection Program

cc: Zing-Ying Ho – DFO, Regina
Jeremy Prahl – Burnside, Barrie

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Appendix E

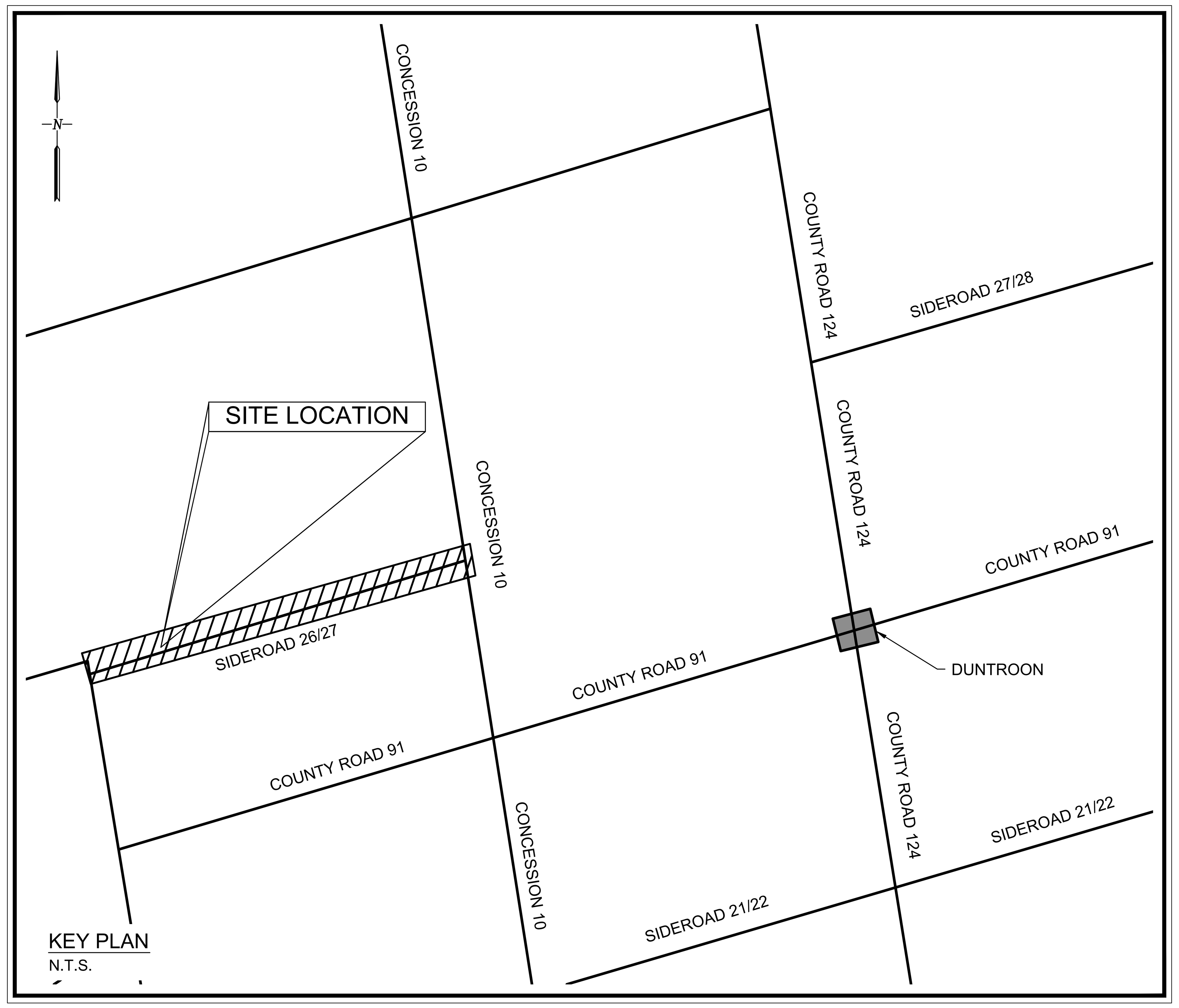
Detailed Design Drawings

Appendix E

TOWNSHIP OF CLEARVIEW

CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

CONTRACT No.



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CLEARVIEW

TOWNSHIP OF CLEARVIEW
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

Burnside Project No. 300034587

REVISED FOR E.I.S. - 2018/10/15

BURNSIDE

TOWNSHIP OF CLEARVIEW - CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION - CONTRACT No.
Burnside Project No. 300034587 - REVISED FOR E.I.S. - 2018/10/15

INDEX

LEGEND

EXISTING

SIB	STD IRON BAR
IB	IRON BAR
RIB	ROUND IRON BAR
HP	HYDRO POLE
THP	HYDRO POLE WITH TRANSFORMER
HPLS	UTILITY POLE WITH LIGHT STD
THPLS	UTILITY POLE WITH LIGHT STD AND TRANSFORMER
	BELL PED
BHP	BELL/HYDRO POLE
LS	LIGHT STD
400mm	DECIDUOUS TREE
300mm	CONIFEROUS TREE
MB	MAIL BOX
X	FENCE
B	U/G BELL
TV	ROGER'S CABLE
BT	U/G BELL & ROGER'S CABLE (SHARED TRENCH)
216.10	GROUND ELEVATION

REMOVALS

- CLEARING & GRUBBING
- TREE REMOVAL
- FENCE REMOVAL
- CULVERT REMOVAL

NEW CONSTRUCTION

- WETLAND LIMIT
- GRADING LIMIT
- EDGE OF TRAVELED LANE
- EDGE OF SHOULDER
- DITCH WITH FLOW DIRECTION
- STEEL BEAM GUIDE RAIL
- WETLAND EXCLUSION FENCE
- HEAVY-DUTY SILT FENCE (OPSD 219.130)
- GRAVEL DRIVEWAY
- ASPHALT DRIVEWAY
- CONCRETE DRIVEWAY
- INTERLOCKING BRICK DRIVEWAY
- BOREHOLE

GENERAL NOTES

1. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, SEDIMENT OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR EQUIPMENT REFUELING AND MAINTENANCE WILL BE CONDUCTED AT LEAST 30m AWAY FROM THE WATER.
2. ALL MEASUREMENTS ARE IN METRES, PIPE SIZES IN MILLIMETERS, UNLESS OTHERWISE NOTED.
3. ALL EXISTING UTILITIES AND SERVICES TO BE LOCATED ON SITE BY THE CONTRACTOR PRIOR TO CONSTRUCTION. LOCATION OF EXISTING SERVICES ARE NOT GUARANTEED. THE CONTRACTOR IS REQUIRED TO NOTIFY THE VARIOUS UTILITY COMPANIES 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK.
4. ALL RELEVANT ONTARIO PROVINCIAL STANDARDS SPECIFICATIONS (OPSS), ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD), AND THE TOWNSHIP OF CLEARVIEW'S STANDARDS SHALL APPLY TO THIS CONTRACT.
5. THE ORDER OF PRECEDENCE OF STANDARD DRAWINGS IS FIRSTLY TOWNSHIP OF CLEARVIEW STANDARD DRAWINGS (STD), AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).
6. NATIVE SUBGRADE SHALL HAVE A CROSSFALL OF 3% AND THE MATERIAL SHALL BE APPROVED BY A GEOTECHNICAL CONSULTANT WITH THE REVIEW OF A PROOF ROLL WITH A LOADED TANDEM AXLE DUMP TRUCK AND IS SUBJECT TO APPROVAL BY THE TOWNSHIP OF CLEARVIEW.
7. NATIVE MATERIAL SUITABLE FOR BACKFILL SHALL BE COMPACTED TO 98% STANDARD PROCTOR MAXIMUM DRY DENSITY, UNLESS OTHERWISE NOTED.
8. GRANULAR MATERIAL AND BEDDING MATERIAL SHALL BE PLACED IN LAYERS 150MM IN DEPTH AND COMPACTED TO 100% (ROAD GRAN 'A' & GRAN 'B') OR 100% (PIPE BEDDING AND COVER) STANDARD PROCTOR MAXIMUM DRY DENSITY OR AS DIRECTED BY THE GEOTECHNICAL CONSULTANT.
9. UTILITY CROSSING, WHERE REQUIRED, AND ANY EXISTING STRUCTURES SHALL BE PROPERLY SUPPORTED. ALL UTILITY CROSSINGS TO BE REVIEWED BY THE TOWNSHIP OF CLEARVIEW
10. DRIVEWAY ACCESS TO OCCUPIED RESIDENCES SHALL BE RESTORED AT THE END OF EACH WORKING DAY.
11. UNLESS OTHERWISE NOTED CULVERTS TO BE STANDARD GALVANIZED CSP. CULVERT BEDDING AND BACKFILL WITH GRANULAR MATERIALS TO BE AS PER OPSS. ALL CULVERTS TO HAVE MINIMUM 2.0MM THICKNESS AND ACHIEVE H20 HIGHWAY LOADING.
12. COVER TO BE 300MM MINIMUM AT THE SHOULDER OF THE ROAD FOR ROAD CROSSINGS AND ALL ENTRANCE CULVERTS.

EROSION & SEDIMENTATION CONTROL NOTES

1. ALL TEMPORARY SOIL OR DIRT STOCKPILES ARE TO BE PROVIDED WITH THE NECESSARY SEDIMENT AND EROSION CONTROL FEATURES, INCLUDING SEEDING IF ANTICIPATED TO BE STORED MORE THAN ONE MONTH. STOCKPILES MUST NOT BE LOCATED IN AREAS OF CONCENTRATED FLOW AND MINIMUM OF 15M FROM TOP OF BANK.
2. ALL SEDIMENTATION CONTROLS TO BE INSTALLED PRIOR TO EXECUTING ANY WORK.
3. ALL SEDIMENTATION CONTROLS TO BE INSPECTED DAILY AND REPAIRED/REPLACED AS NECESSARY.
4. ALL TEMPORARY EROSION & SEDIMENTATION CONTROLS SHALL REMAIN IN PLACE UNTIL SUCH TIME AS RE-VEGETATIVE MEASURES HAVE GERMINATED AND TAKEN HOLD.
5. ANY COFFERDAMS SHALL BE CONSTRUCTED OF CLEAN, NON-ERODIBLE MATERIALS SUCH AS, BUT NOT LIMITED TO; PEA GRAVEL BAGS, CLEAN GRAVEL AND PLASTIC SHEETING, PRECAST BARRIERS AND PLASTIC SHEETING, SHEET STEEL PILING, OR OTHER CLEAN MATERIAL APPROVED BY THE NVCA.
6. CONTROL OF CREEK BASE FLOWS AND STORM EVENT RUNOFF DURING CONSTRUCTION SHALL BE THE CONTRACTORS RESPONSIBILITY.
7. ALL DEWATERING/UNWATERING SHALL BE DISCHARGED INTO A FILTERED SUMP, SOCK OR SOAK PIT, LOCATED AT LEAST 30m FROM THE WATER COURSE.
8. TOPSOIL SHALL BE PLACED WITHIN 30 DAYS FROM COMPLETION ANY GRADING WORK TO FACILITATE SEEDING.
9. THE ESC PLAN IS A DYNAMIC DOCUMENT, WHICH MAY BE SUBJECT TO CHANGE OR MODIFICATION AS A RESULT OF SITE DEVELOPMENTS OR CHANGES ON SITE. ANY DEVIATION FROM APPROVED PLANS MUST BE DESIGNED BY A QUALIFIED PROFESSIONAL. IT IS EVERYONE'S RESPONSIBILITY TO PREVENT CONSTRUCTION RELATED SEDIMENT FROM IMPACTING AQUATIC RESOURCES AND OTHER NATURAL FEATURES.
10. ALL SILT AND SEDIMENTATION ITEMS AND LOCATIONS ARE SHOWN FOR ILLUSTRATION. CONTRACTOR SHALL PROVIDE DETAILED PLAN AND SEQUENCE FOR ENGINEER & NVCA REVIEW.

OPERATIONAL CONSTRAINT - MIGRATORY BIRDS CONVENTION ACT

1. THE CONTRACTOR MUST BE AWARE OF THE MIGRATORY BIRDS CONVENTION ACT (1994) AS IT RELATES TO HARMING MIGRATORY BIRDS OR THEIR NESTS, EGGS OR YOUNG.
2. ALL VEGETATION CLEARING SHOULD BE COMPLETED OUTSIDE OF THE CORE BREEDING SEASON (MAY THROUGH JULY).
3. IF THERE IS EVIDENCE THAT MIGRATORY BIRDS ARE ACTIVELY NESTING AN AREA THAT MAY BE AFFECTED BY CONSTRUCTION, ALL WORK IN THE IMMEDIATE VICINITY SHOULD STOP IMMEDIATELY
4. THE CONTRACTOR SHALL CONTACT THE CONTRACT ADMINISTRATOR FOR ADVICE AND ASSISTANCE. UNTIL PERMISSION IS GRANTED TO THE CONTRACTOR TO PROCEED WITH CONSTRUCTION , CONSTRUCTION ACTIVITIES WILL REMAIN SUSPENDED.

2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

NOT FOR CONSTRUCTION

No.	Issue / Revision	Date	Auth.
7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
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12	PSW DELINEATION AND EXCLUSION FENCING	2017/03/23	
13	PROFILE REVISION FOR 70km DESIGN SPEED	2017/05/05	
14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. MCNULTY
OCT 15/18
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
A. C. HOLVIK
100118965
Oct. 15, 2018
PROVINCE OF ONTARIO

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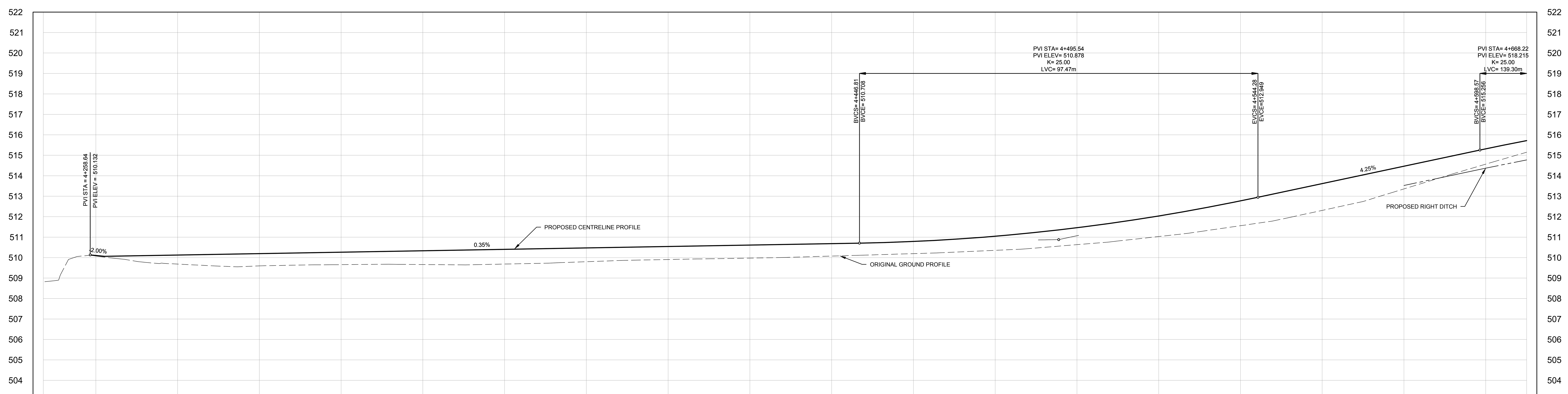
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

DRAWING LIST, LEGEND AND GENERAL NOTES
SIDEROAD 26/27

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES	JKV/DM	AES	JKV/DM	2018/10/15	C000
Scale		Project No.		Revision No.	
N.T.S.		300034587		14	

File Name: 034587_COVER.dwg Date Plotted: October 17, 2018 - 12:13 PM



EXIST\PROP CENTERLINE ELEVATION	CHAINAGE
	4+247.15
510.07 / 510.105	4+260
509.68 / 510.124	4+280
509.60 / 510.194	4+300
509.66 / 510.264	4+320
509.66 / 510.334	4+340
509.68 / 510.404	4+360
509.80 / 510.474	4+380
509.91 / 510.544	4+400
509.98 / 510.614	4+420
510.07 / 510.684	4+440
510.19 / 510.789	4+460
510.36 / 511.044	4+480
510.63 / 511.460	4+500
511.03 / 512.035	4+520
511.56 / 512.771	4+540
512.31 / 513.617	4+560
513.36 / 514.467	4+580
514.57 / 515.316	4+600
515.15 / 515.715	4+610

Notes

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14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER D. G. McNALTY PROVINCE OF ONTARIO Oct 15/18

Metres Vertical 1:100 (0 2.0 4.0 6.0 8.0)
Metres Horizontal 1:500 (0 5.0 10.0 20.0 30.0 40.0)

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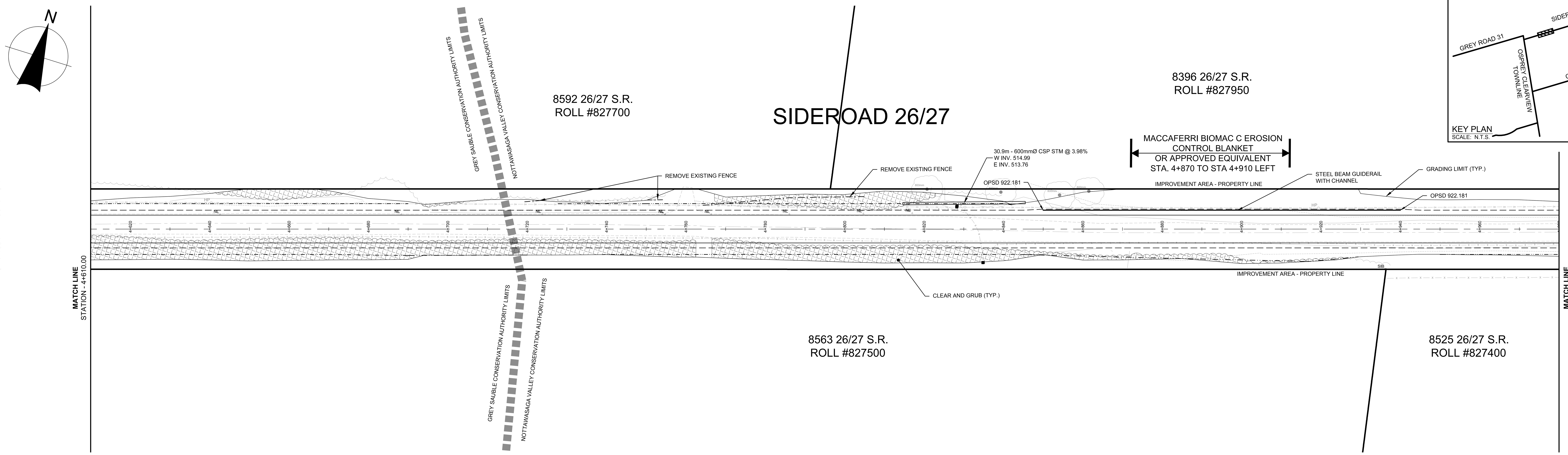
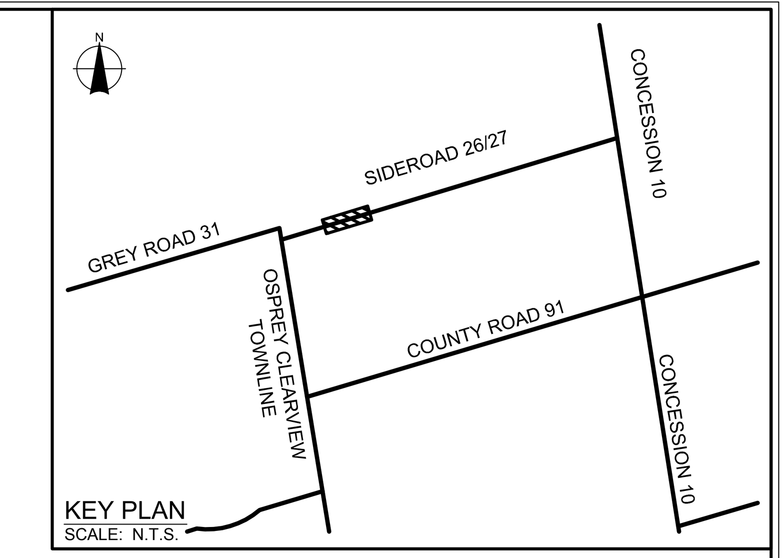
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

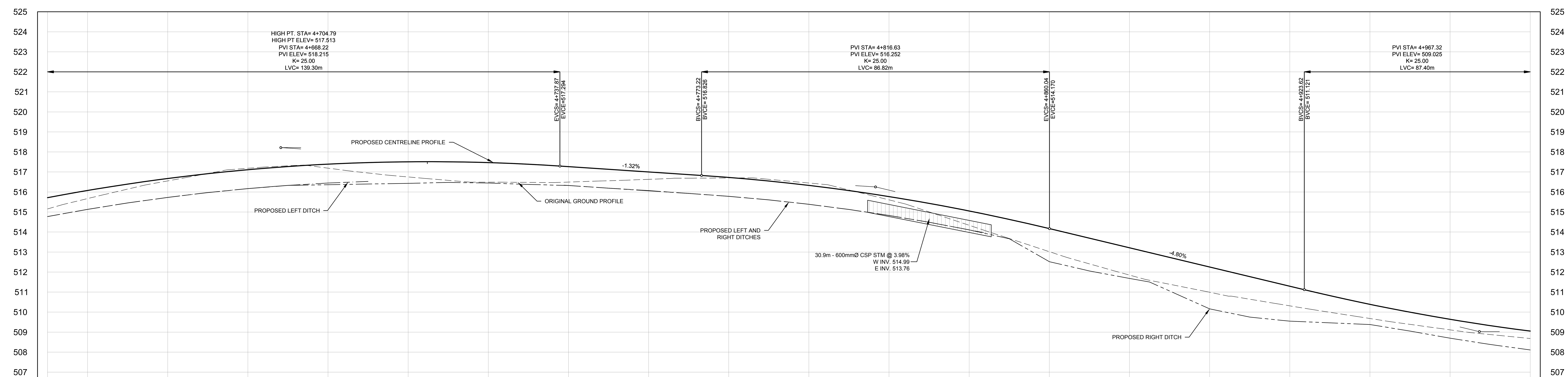
PLAN & PROFILE
SIDEROAD 26/27
4+247 to 4+610

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C001
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 14	

File Name: 300034587_PP_26&27.dwg Date Plotted: October 17, 2018 - 12:15 PM







CHAINAGE	EXIST\PROP CENTERLINE ELEVATION (EXIST)	EXIST\PROP CENTERLINE ELEVATION (PROP)
4+610	515.15	515.715
4+620	515.67	516.075
4+640	516.55	516.673
4+660	517.18	517.111
4+680	517.19	517.390
4+700	516.75	517.508
4+720	516.49	517.466
4+740	516.50	517.266
4+760	516.63	517.001
4+780	516.70	516.727
4+800	516.45	516.328
4+820	515.60	515.770
4+840	514.34	515.051
4+860	513.02	514.172
4+880	511.85	513.213
4+900	510.99	512.253
4+920	510.31	511.294
4+940	509.68	510.389
4+960	509.11	509.641
4+980	508.68	509.052

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14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. MAKITY
PROVINCE OF ONTARIO

Metres Vertical: 1:100 (0, 2.0, 4.0, 6.0, 8.0)
Metres Horizontal: 1:500 (0, 5.0, 10.0, 20.0, 30.0, 40.0)

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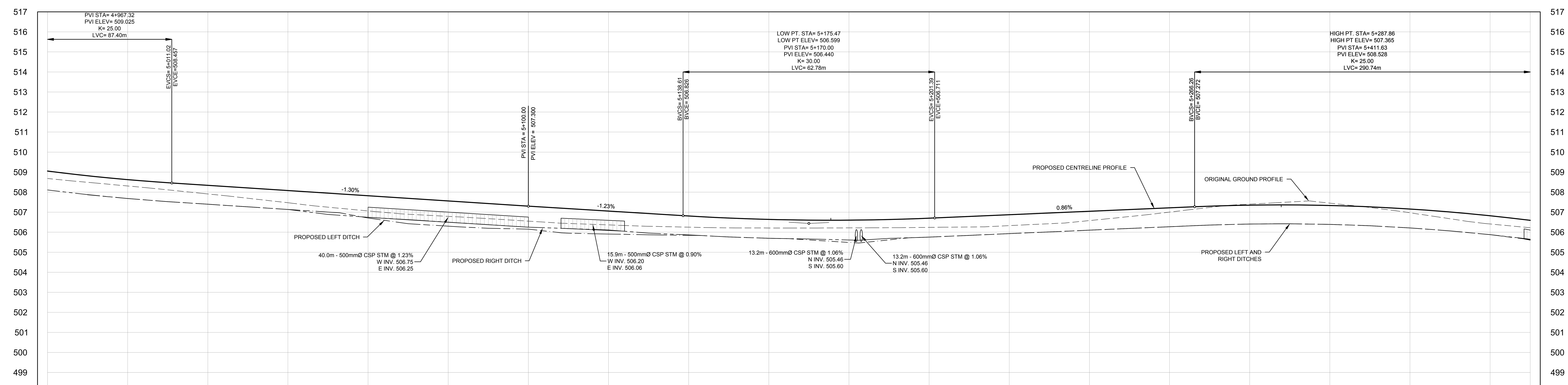
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
PLAN & PROFILE
SIDEROAD 26/27
4+610 to 4+980

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C002
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 14	

File Name: 300034587_PP_26&27.dwg Date Plotted: October 17, 2018 - 12:15 PM



CHAINAGE	EXIST\PROP CENTERLINE ELEVATION
4+980	508.68 / 509.052
5+000	508.31 / 508.624
5+020	507.91 / 508.340
5+040	507.47 / 508.080
5+060	507.06 / 507.820
5+080	506.79 / 507.560
5+100	506.55 / 507.300
5+120	506.36 / 507.054
5+140	506.25 / 506.809
5+160	506.21 / 506.639
5+180	506.22 / 506.603
5+200	506.24 / 506.700
5+220	506.33 / 506.872
5+240	506.58 / 507.045
5+260	507.01 / 507.218
5+280	507.40 / 507.353
5+300	507.45 / 507.335
5+320	506.97 / 507.158
5+340	506.41 / 506.821
5+350	506.22 / 506.593

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14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER D. G. McNULTY PROVINCE OF ONTARIO Oct 15/18

Metres Vertical 1:100 — 0 2.0 4.0 6.0 8.0
Metres Horizontal 1:500 — 0 5.0 10.0 20.0 30.0 40.0

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L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
PLAN & PROFILE
SIDEROAD 26/27
4+980 to 5+350

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C003
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 14	

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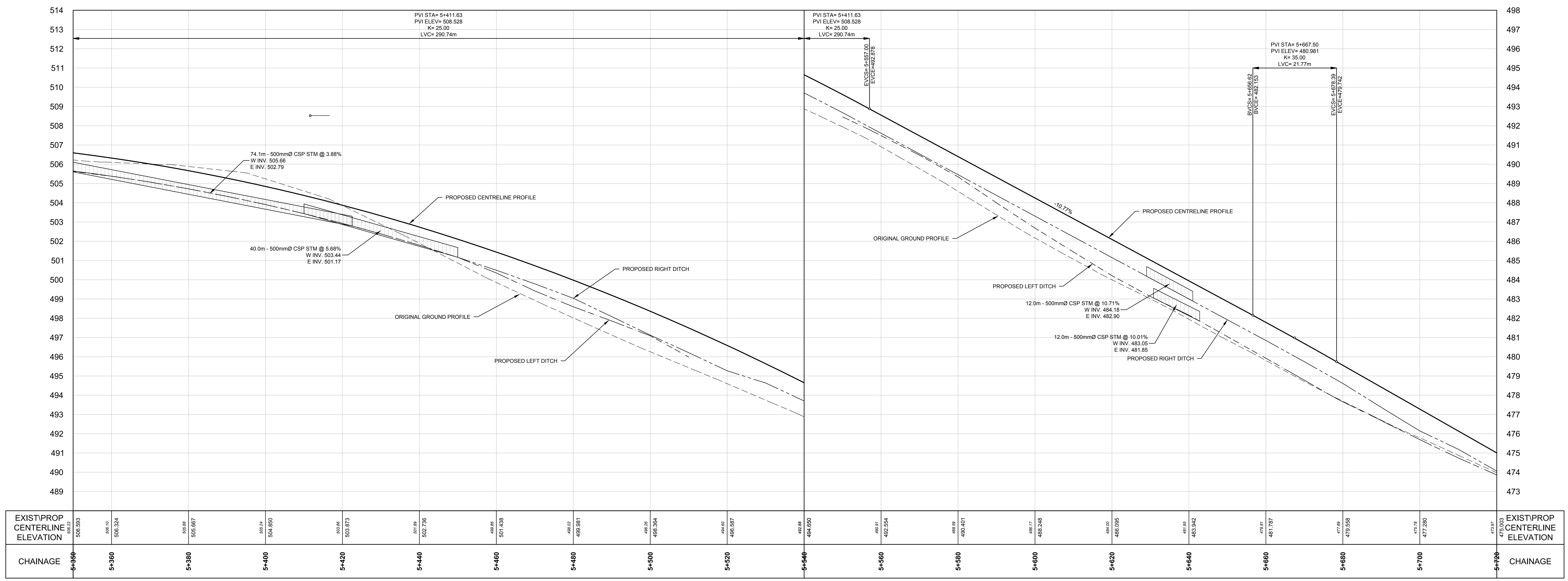

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REGISTERED PROFESSIONAL ENGINEER
D. G. MCNULTY
OCT 15/18
PROVINCE OF ONTARIO

Metres Vertical 1:100 — 0 2.0 4.0 6.0 8.0

Metres Horizontal 1:500 — 0 5.0 10.0 20.0 30.0 40.0

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L0M 1S0

Drawing Title

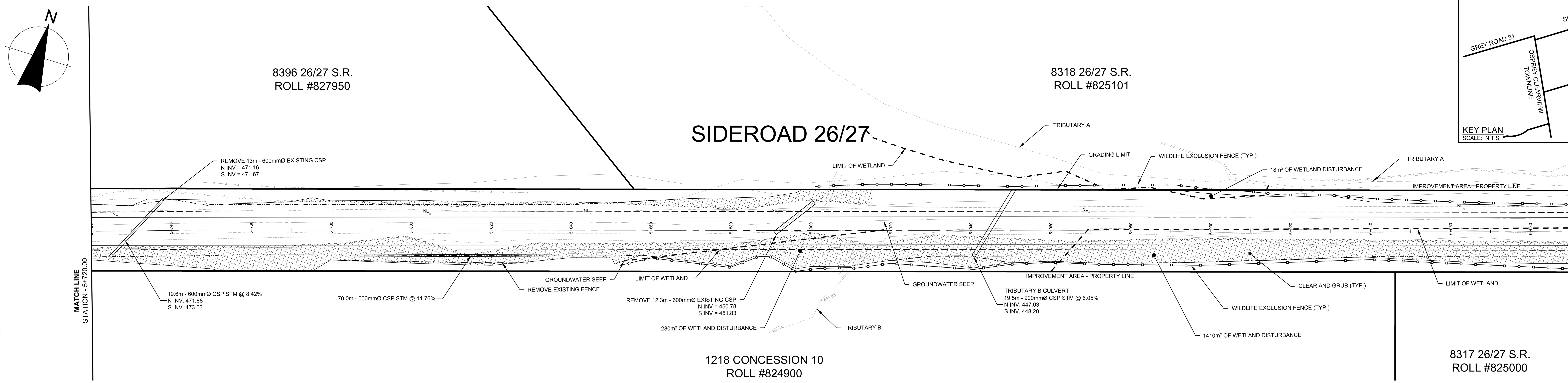
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

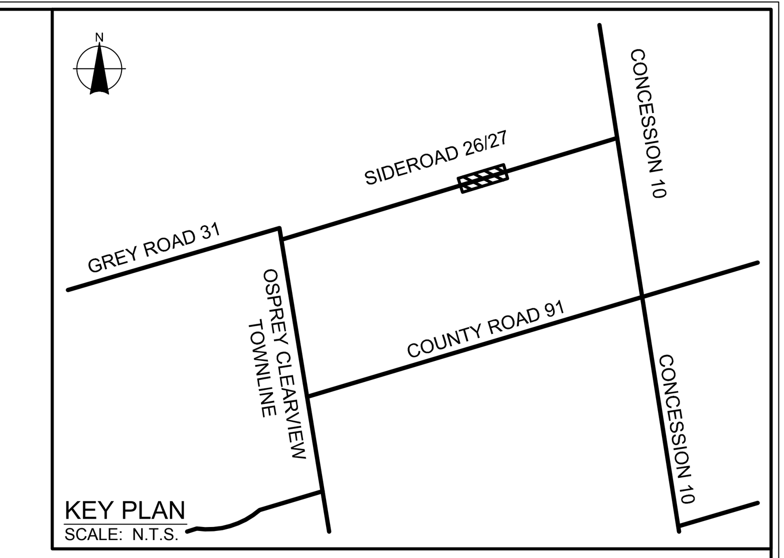
PLAN & PROFILE
SIDEROAD 26/27
5+350 to 5+720

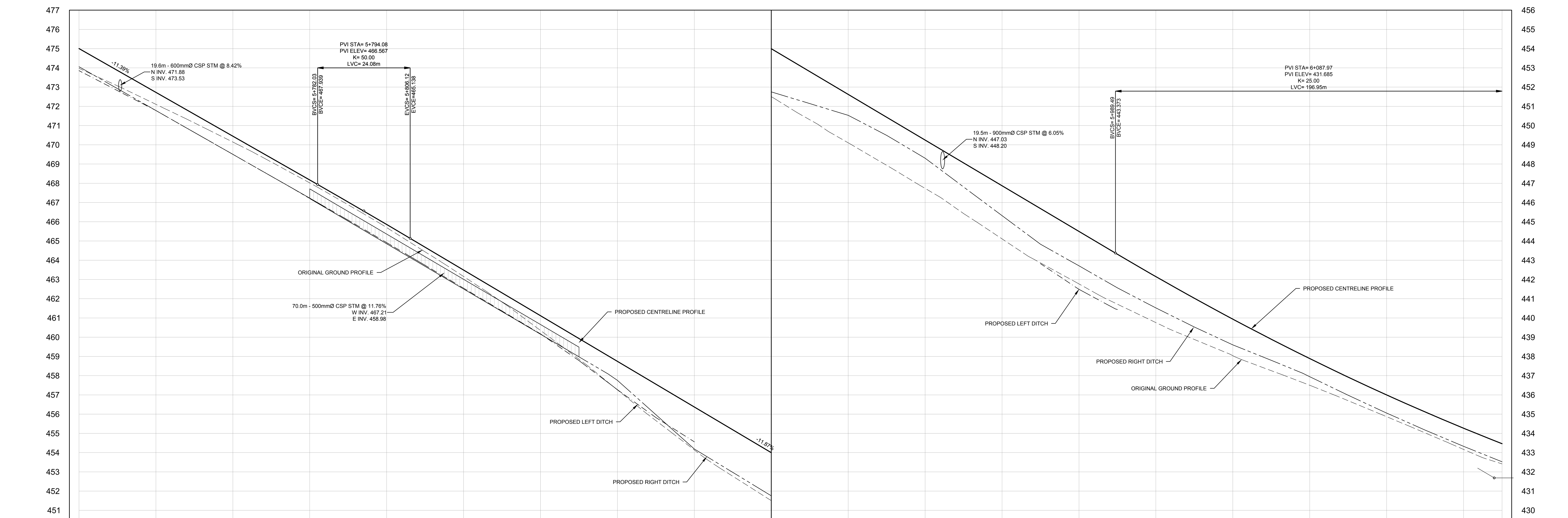
Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C004

Scale	Project No.	Revision No.
H 1:500 V 1:100	300034587	14

File Name: 300034587_PP_26&27.dwg Date Plotted: October 17, 2018 - 12:15 PM







CHAINAGE	EXIST\PROP CENTERLINE ELEVATION (EXIST)	EXIST\PROP CENTERLINE ELEVATION (PROP)
5+720	473.97	475.003
5+740	472.11	472.725
5+760	470.15	470.448
5+780	468.02	468.170
5+800	465.70	465.861
5+820	463.15	463.490
5+840	460.35	461.117
5+860	457.26	458.743
5+880	454.14	456.369
5+900	451.51	453.995
5+920	449.10	451.621
5+940	446.73	449.247
5+960	444.11	446.873
5+980	441.77	444.500
6+000	439.76	442.148
6+020	438.04	439.938
6+040	436.50	437.888
6+060	434.87	435.999
6+080	433.17	434.269
6+090	432.41	433.464

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REGISTERED PROFESSIONAL ENGINEER
D. G. MCNULTY
OCT15/18
PROVINCE OF ONTARIO

Metres Vertical 1:100 (0, 2.0, 4.0, 6.0, 8.0)
Metres Horizontal 1:500 (0, 5.0, 10.0, 20.0, 30.0, 40.0)

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L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
PLAN & PROFILE
SIDEROAD 26/27
5+720 to 6+090

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C005
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 14	

File Name: 300034587_PP_26&27.dwg Date Plotted: October 17, 2018 - 12:15 PM

CHAINAGE	6+090	6+100	6+120	6+140	6+160	6+180	6+200	6+220	6+240	6+260
EXIST\PROP CENTERLINE ELEVATION	432.41 / 433.464	431.75 / 432.699	430.47 / 431.289	429.60 / 430.039	428.57 / 428.950	427.63 / 428.020	426.55 / 427.213	425.46 / 426.415	424.55 / 425.617	423.72 / 424.819

CHAINAGE	6+280	6+300	6+320	6+340	6+360	6+380	6+400	6+420	6+440	6+460
EXIST\PROP CENTERLINE ELEVATION	422.95 / 424.020	422.13 / 423.222	421.31 / 422.424	420.56 / 421.626	419.86 / 420.828	419.18 / 420.032	418.46 / 419.327	417.91 / 418.756	417.38 / 418.318	416.91 / 417.985

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13	PROFILE REVISION FOR 70km DESIGN SPEED	2017/05/05	
14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. McNALTY
Oct 15/18
PROVINCE OF ONTARIO

Metres Vertical 1:100 — 0, 2.0, 4.0, 6.0, 8.0
Metres Horizontal 1:500 — 0, 5.0, 10.0, 20.0, 30.0, 40.0

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fax (705) 446-2399
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Client
TOWNSHIP OF CLEARVIEW
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

PLAN & PROFILE
SIDEROAD 26/27
6+090 to 6+460

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C006
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		14	

File Name: 300034587_PP_26&27.dwg Date Plotted: October 17, 2018 - 12:16 PM

CHAINAGE	EXIST\PROP CENTERLINE ELEVATION (EXIST)	EXIST\PROP CENTERLINE ELEVATION (PROP)
6+460	416.91	417.985
6+480	416.49	417.660
6+500	416.12	417.335
6+520	415.82	417.011
6+540	416.07	416.686
6+560	415.72	416.305
6+580	415.52	415.815
6+600	415.23	415.321
6+620	414.70	414.827
6+640	413.54	414.338
6+660	412.70	413.942
6+680	412.22	413.678
6+700	412.03	413.541
6+720	411.98	413.441
6+740	411.76	413.335
6+760	411.80	413.139
6+780	411.85	412.829
6+800	411.92	412.405
6+820	411.75	411.867
6+830	411.54	411.554

Notes

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NOT FOR CONSTRUCTION

No.	Issue / Revision	Date	Auth.
7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	
11	RE-ISSUED FOR DFO SUBMISSION	2017/03/22	
12	PSW DELINEATION AND EXCLUSION FENCING	2017/03/23	
13	PROFILE REVISION FOR 70km DESIGN SPEED	2017/05/05	
14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. MCNULTY
OCT 15/18
PROVINCE OF ONTARIO

Metres Vertical 1:100

Metres Horizontal 1:500

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Client
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217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

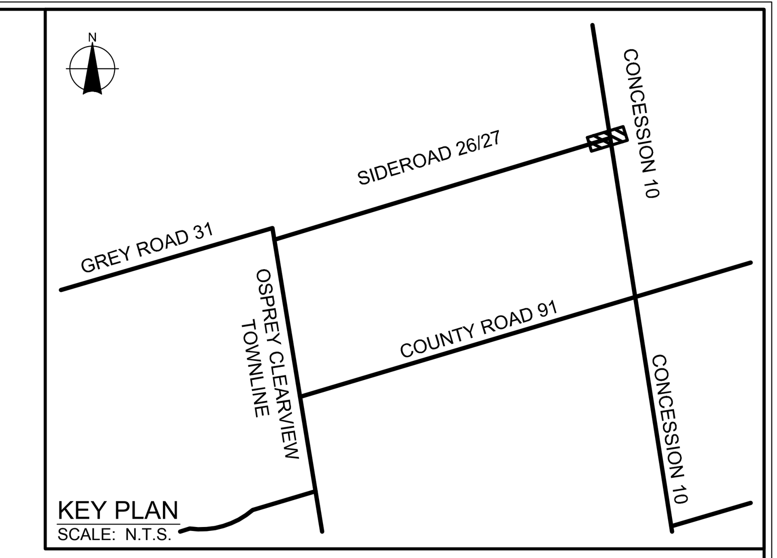
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

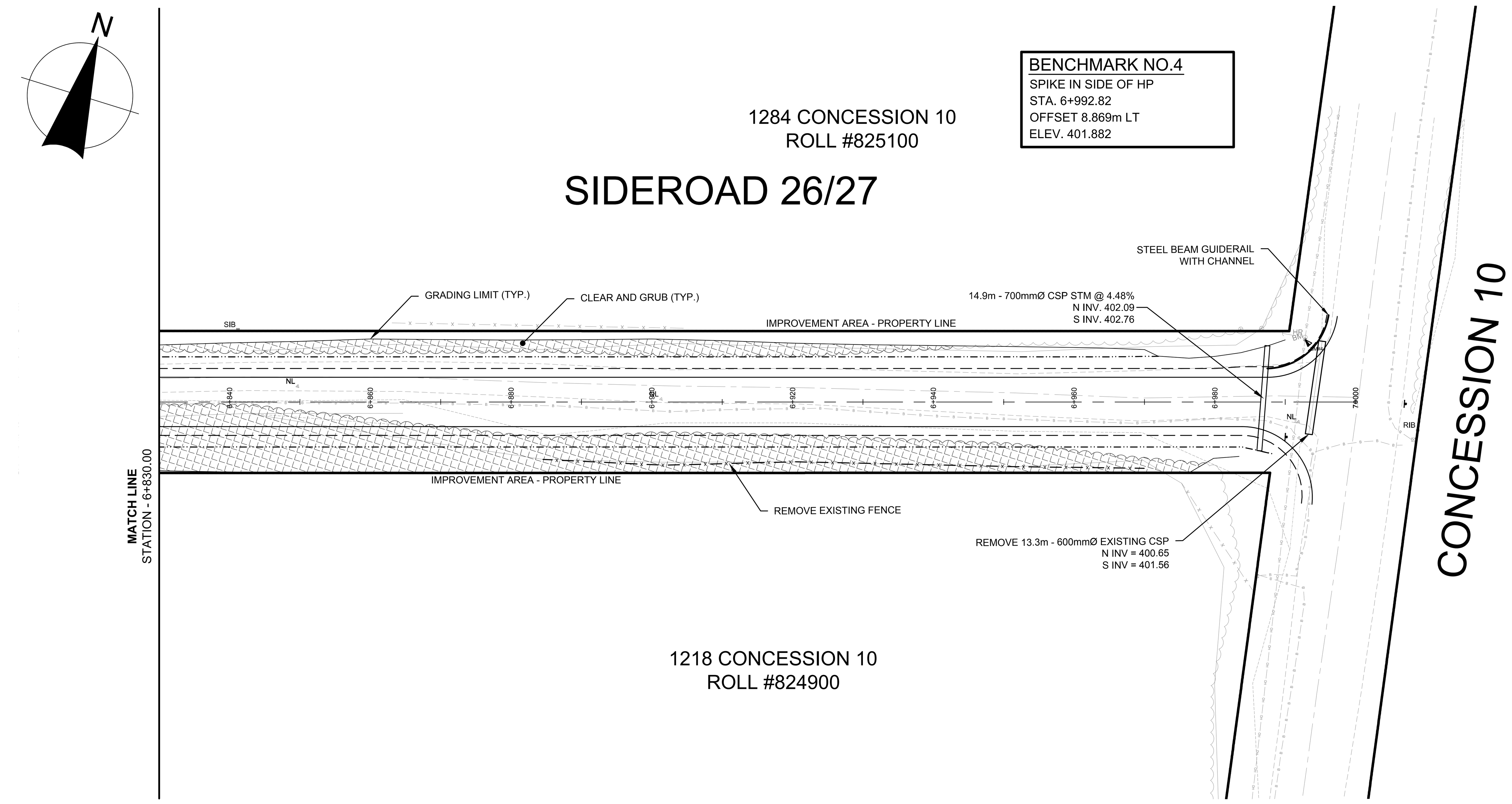
PLAN & PROFILE
SIDEROAD 26/27
6+460 to 6+830

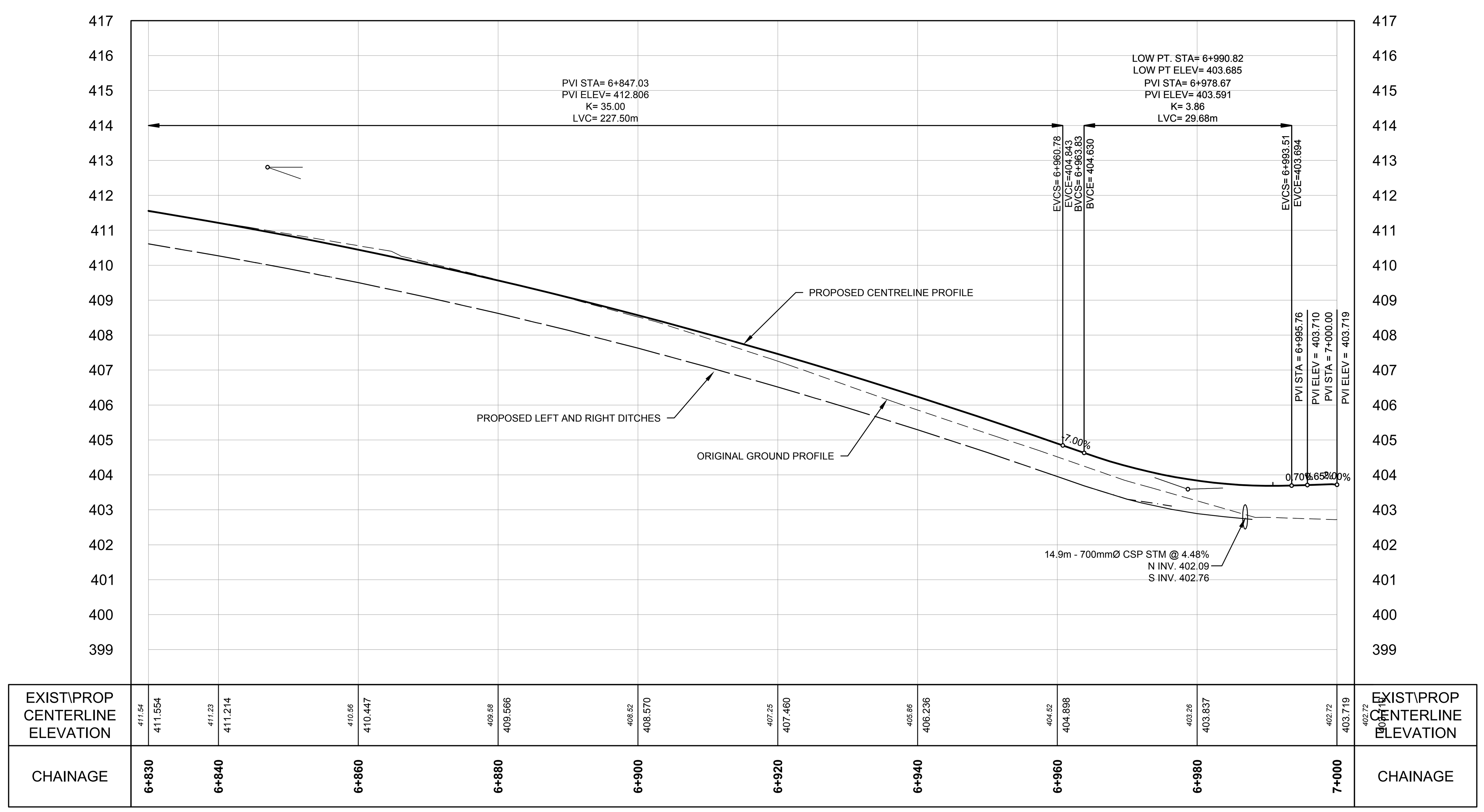
Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C007

Scale	Project No.	Revision No.
H 1:500 V 1:100	300034587	14

File Name: 300034587_PP_26&27.dwg Date Plotted: October 17, 2018 - 12:16 PM







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13	PROFILE REVISION FOR 70km DESIGN SPEED	2017/05/05	
14	REVISED FOR E.I.S.	2018/10/15	

PROVINCE OF ONTARIO
D. G. MEALEY
OCT 15/18

Metres Vertical 1:100
Metres Horizontal 1:500

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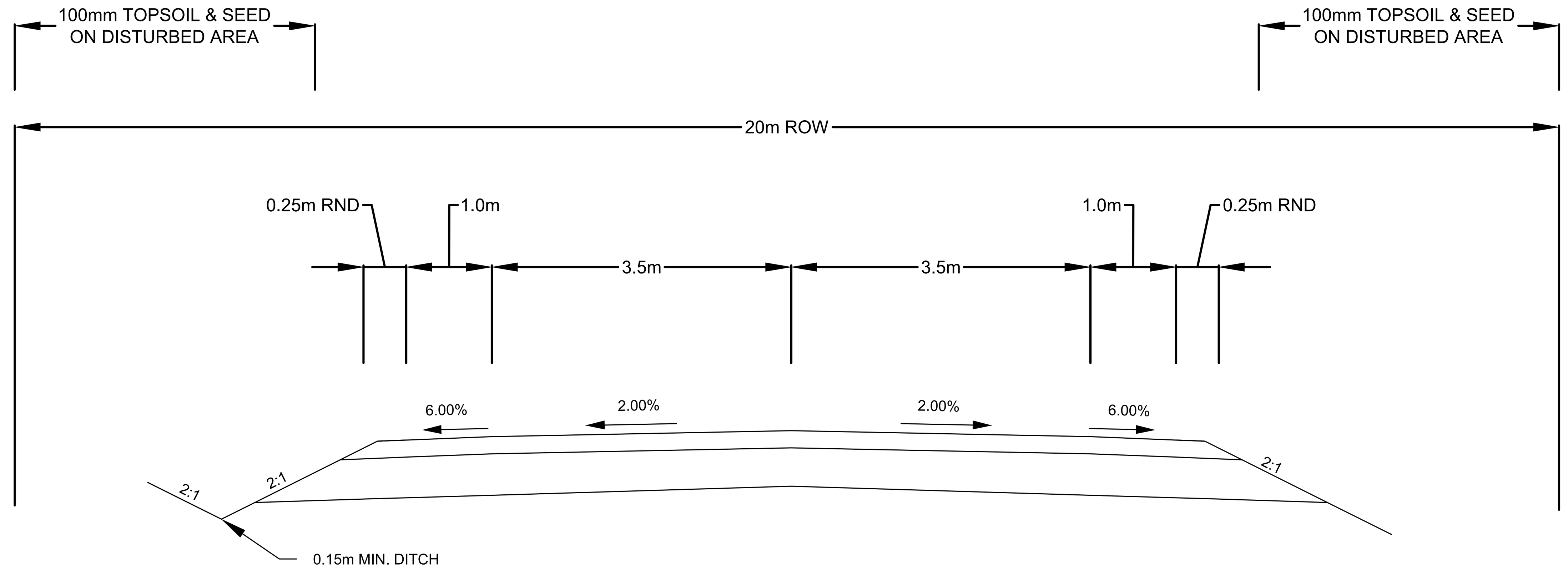
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
PLAN & PROFILE
SIDEROAD 26/27
6+830 to 7+000

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C008
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 14	

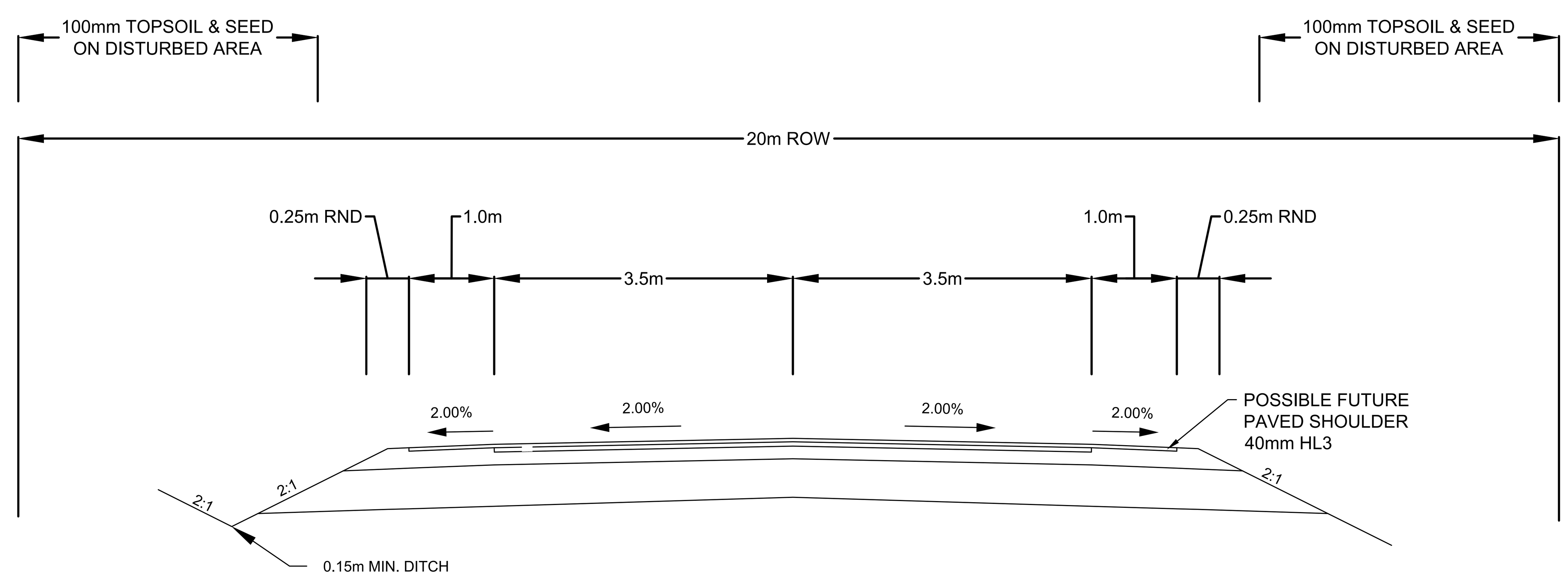
File Name: 300034587_PP_26&27.dwg Date Plotted: October 17, 2018 - 12:16 PM



NOTE:
ROAD TO BE COMPRISED OF
- 150mm GRANULAR A
- 450mm GRANULAR B

INTERIM TYPICAL ROAD CROSS-SECTION

SCALE 1:50



NOTE:
ROAD TO BE COMPRISED OF
- 40mm HL3 (FUTURE)
- 50mm HL8 (FUTURE)
- 150mm GRANULAR A
- 450mm GRANULAR B

ULTIMATE TYPICAL ROAD CROSS-SECTION

SCALE 1:50

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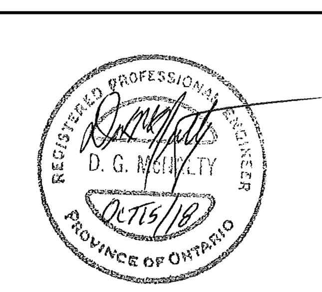
14	REVISED FOR E.I.S.	2018/10/15	



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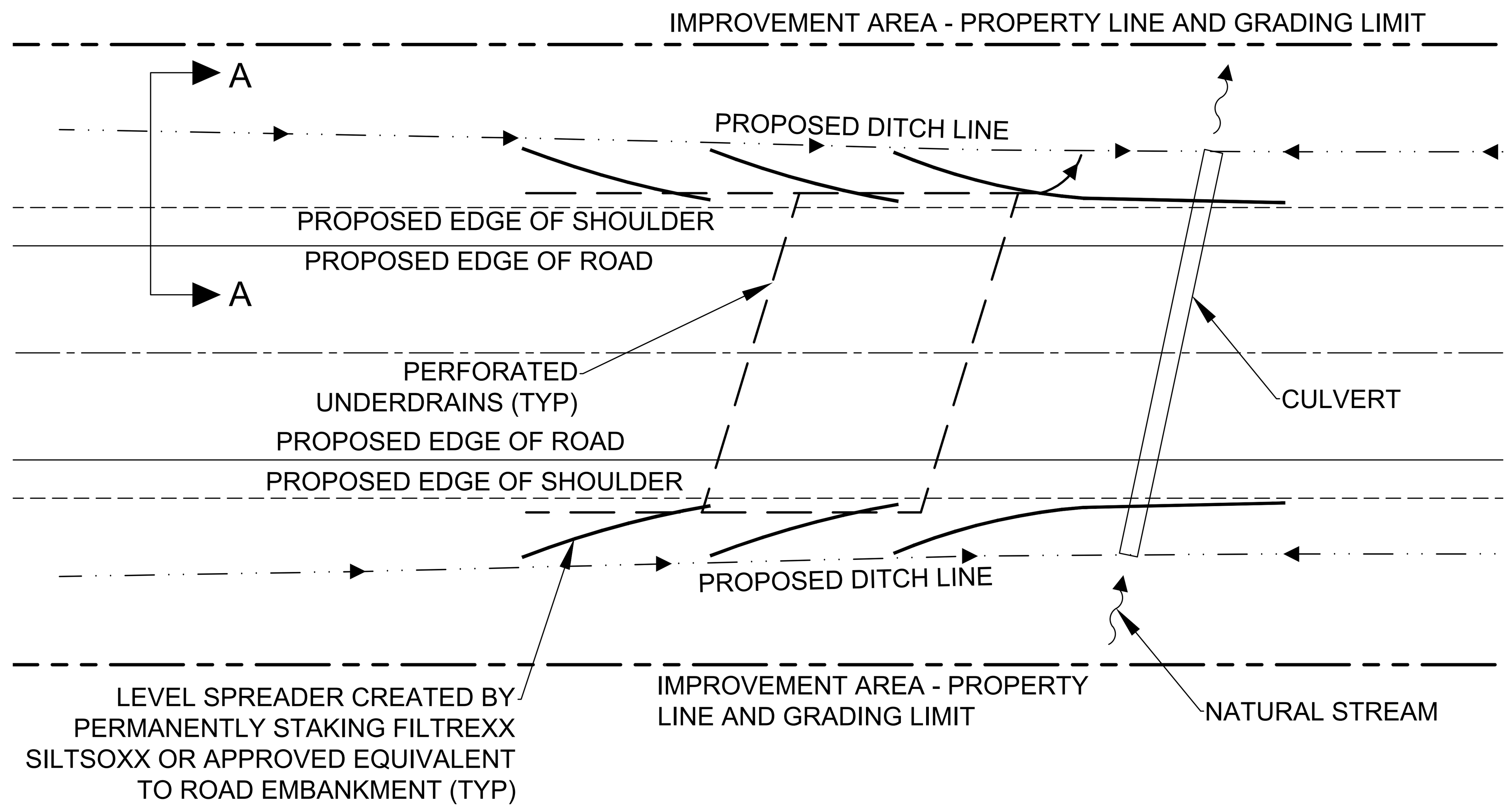
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

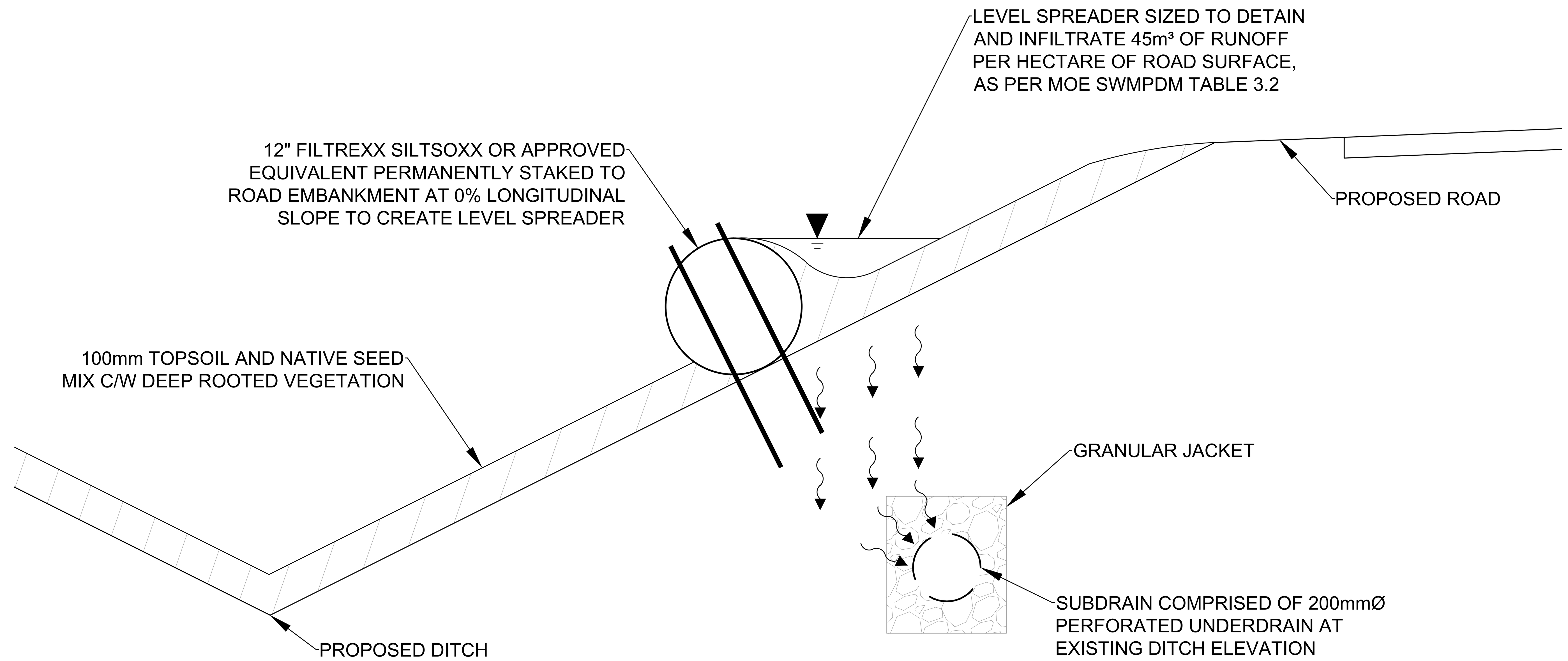
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
TYPICAL SECTIONS AND DETAILS
SIDEROAD 26/27

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV	AES	JKV	2018/10/15	C009
Scale		Project No.		Revision No.	
N.T.S.		300034587		14	

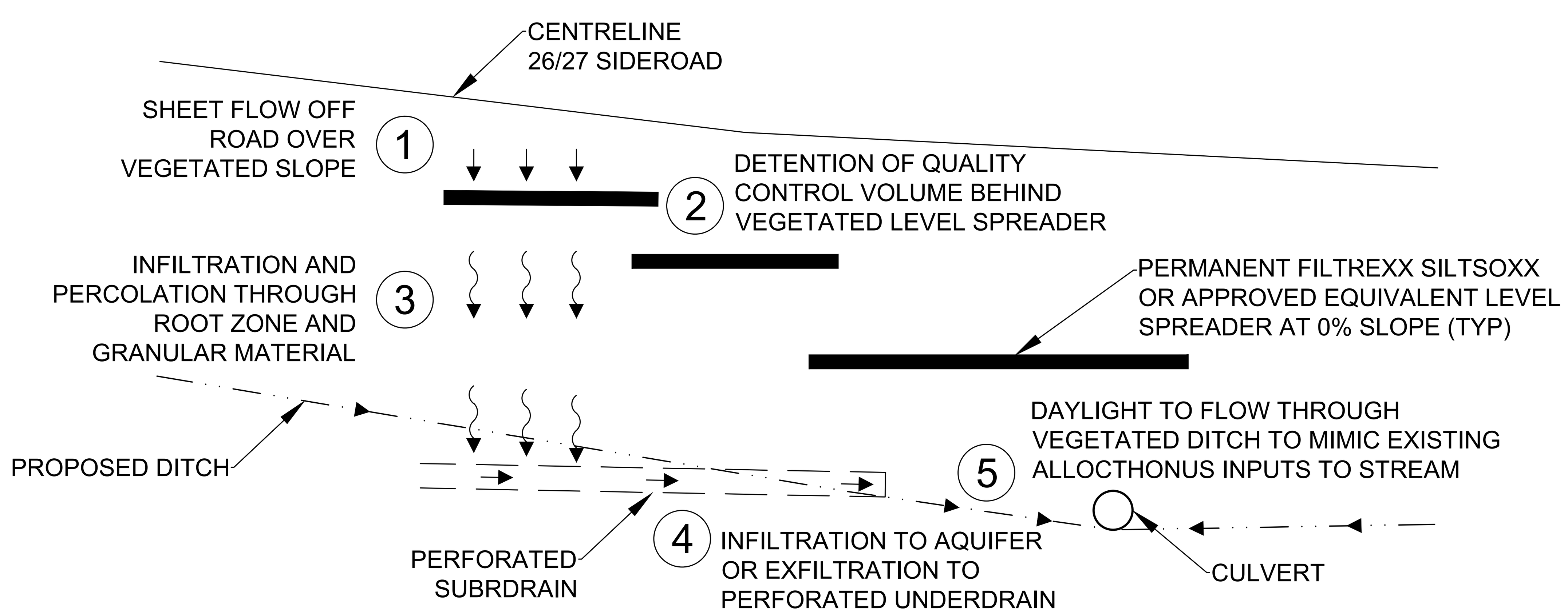
File Name: 034587_COVER.dwg Date Plotted: October 17, 2018 - 12:16 PM



BIORETENTION AND PERFORATED PIPE
STORMWATER MANAGEMENT CONCEPT PLAN
N.T.S.



SECTION A-A
N.T.S.



PROFILE
N.T.S.

NOTES

1. BIORETENTION DESIGN TO BE CONSTRUCTED IN DITCHES FROM STA. 5+420 TO STA. 6+960.
2. PERFORATED SUBDRAIN AND GRANULAR JACKET TO BE PLACED AT EXISTING DITCH ELEVATION BELOW THE PROPOSED LEFT DITCH FROM STA. 5+460 TO OUTLET TO TRIBUTARY A AT STA. 6+140 AND BELOW THE PROPOSED RIGHT DITCH FROM STA. 5+460 TO OUTLET THROUGH THE INVERT OF THE TRIBUTARY C CROSS CULVERT PER NOTES ON DRAWINGS C011 AND C012.

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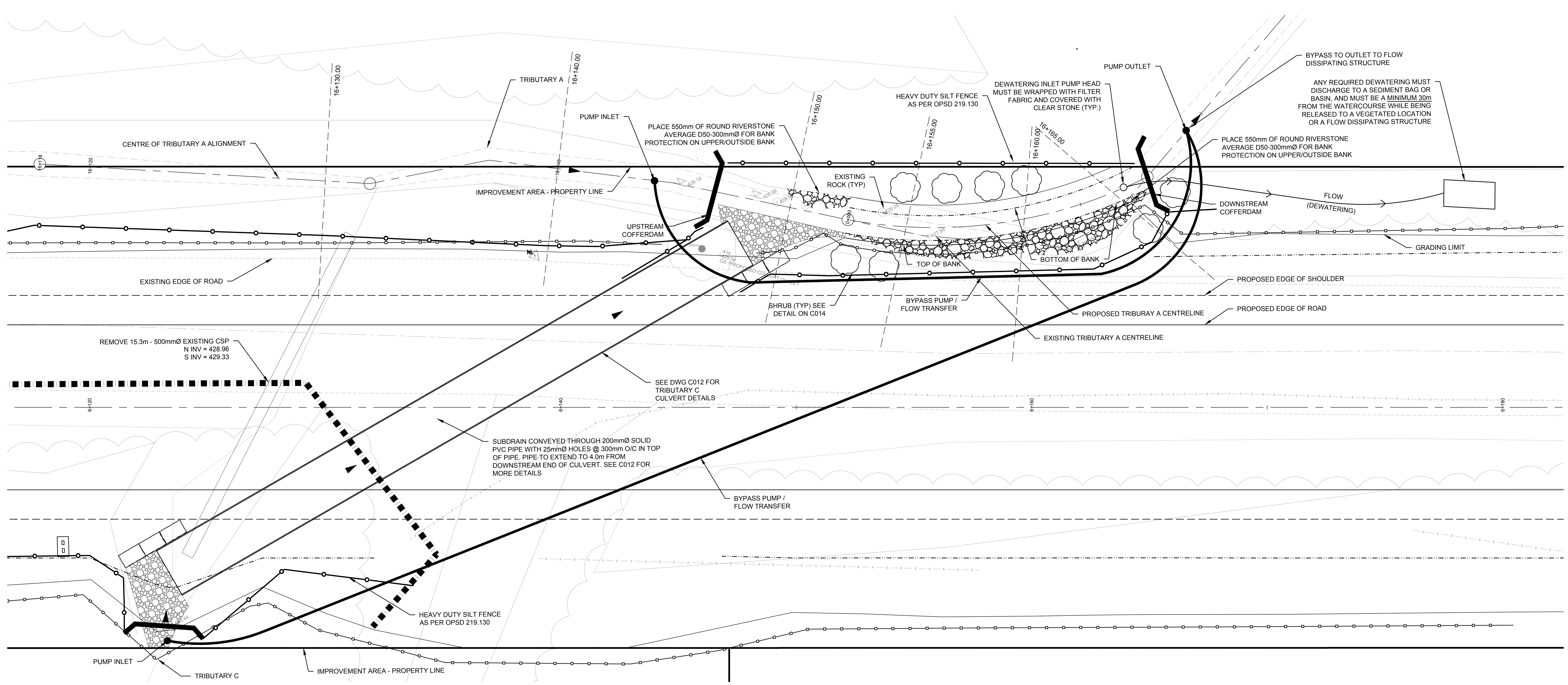
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
BIORETENTION AND PERFORATED PIPE
STORMWATER MANAGEMENT CONCEPT

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	C010
Scale		Project No.		Revision No.	
AS SHOWN		300034587		14	

File Name: 034587_COVER.dwg Date Plotted: October 17, 2018 - 12:16 PM



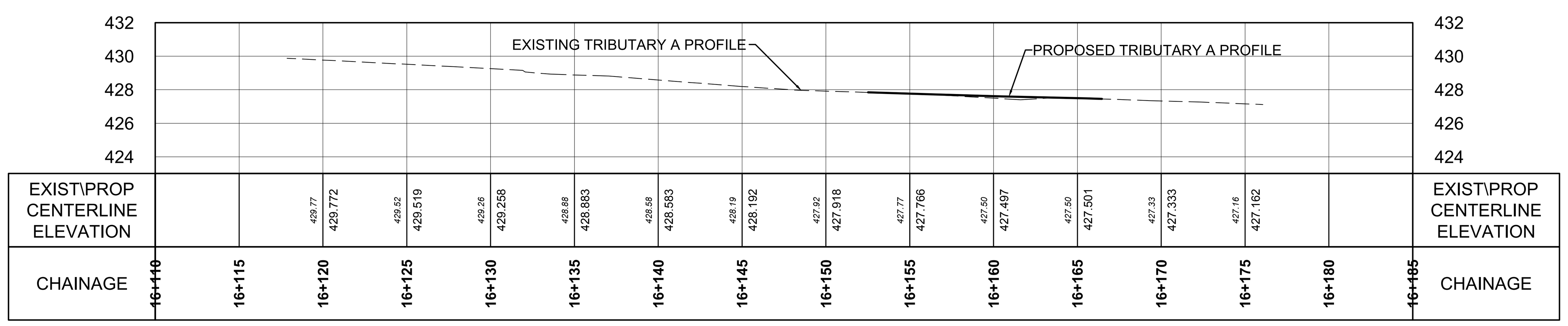
PLAN - TRIBUTARY A
1:100

LEGEND (TEMPORARY WORK)

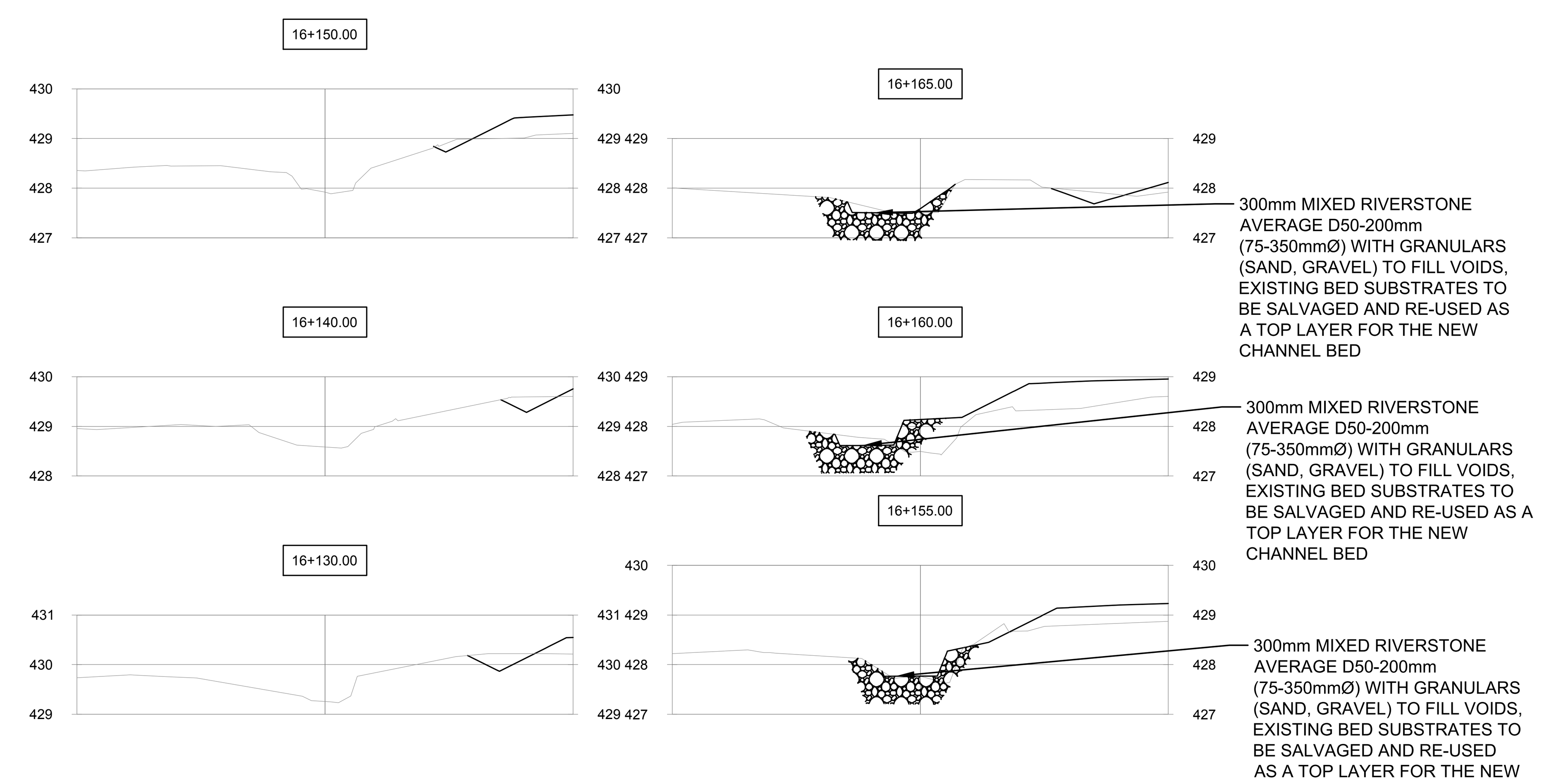
- HEAVY DUTY SILT FENCE BARRIER AS PER OPSD 219.130.
- STRAW BALE FLOW CHECK AS PER OPSD 219.18
- ROCK CHECK DAMS AS PER OPSD 219.210 OR 219.211.
- TEMPORARY COFFERDAM

TRIBUTARY A NOTES

1. CONSTRUCT APPROXIMATELY 20m OF NEW CHANNEL USING NATURAL CHANNEL DESIGN METHODS WITH AN EMPHASIS ON REPLICATION OF EXISTING FISH HABITAT FEATURES.
2. CHANNEL CONSTRUCTION TO BE COMPLETED IN THE DRY.
3. REFER TO DWG C000 AND C014 FOR ADDITIONAL NOTES.



PROFILE - TRIBUTARY A
N.T.S.



CROSS SECTIONS - TRIBUTARY A
N.T.S.

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NOT FOR CONSTRUCTION

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14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. MCNULTY
OCT 15/18
PROVINCE OF ONTARIO

Metres Vertical 1:100
Metres Horizontal 1:500

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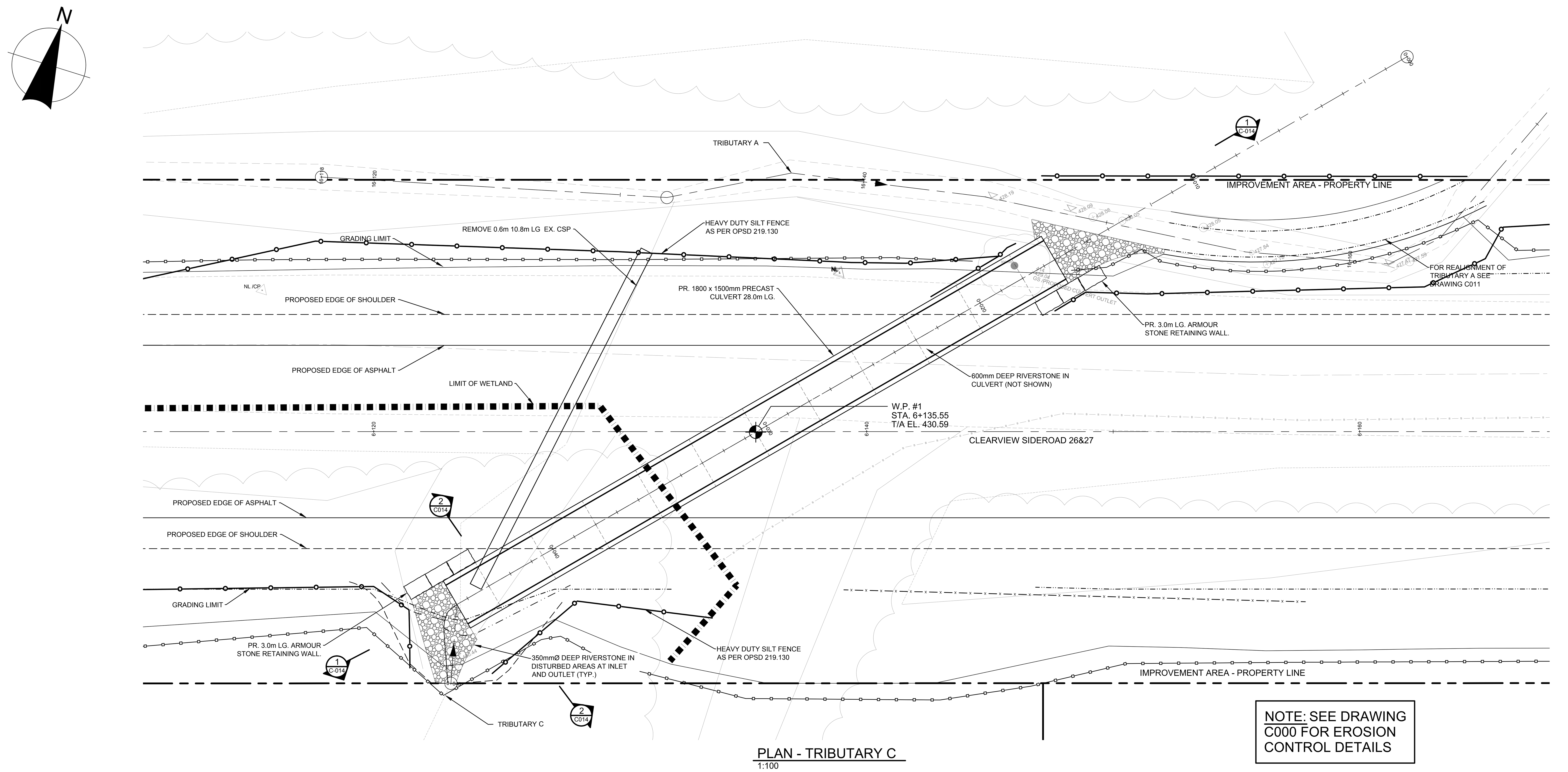
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
TRIBUTARY A REALIGNMENT PLAN AND PROFILE

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	C011
Scale		Project No.		Revision No.	
AS NOTED		300034587		14	

File Name: 034587_DETAILS.dwg Date Plotted: October 17, 2018 - 12:18 PM



PLAN - TRIBUTARY C

1:100

NOTE: SEE DRAWING C000 FOR EROSION CONTROL DETAILS

GENERAL NOTES:

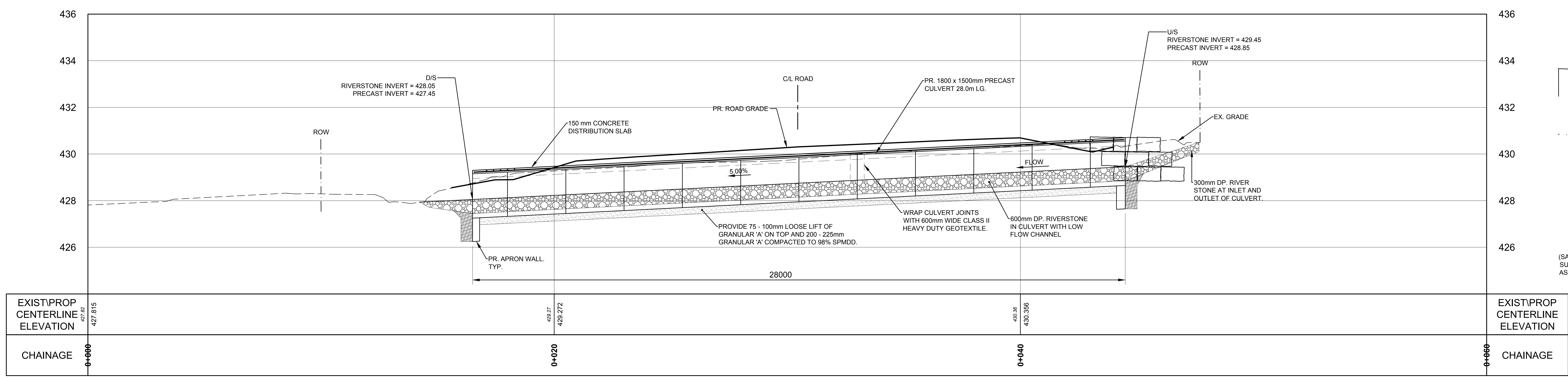
1. BOX CULVERT TO BE DESIGNED TO OPSD 1821 AND CANADIAN HIGHWAY BRIDGE DESIGN CODE (CHBDC) CAN/CSA-S6-14.
2. CLASS OF CONCRETE SHALL BE 35 MPa.
3. CLEAR COVER TO REINFORCING STEEL

   FOR STRUCTURES WITH GREATER THAN 600mm OF FILL AND NO DISTRIBUTION SLAB:

   EXTERIOR SURFACES 55 ± 10mm
   INTERIOR SURFACES 50 ± 10mm
4. REINFORCING BARS:

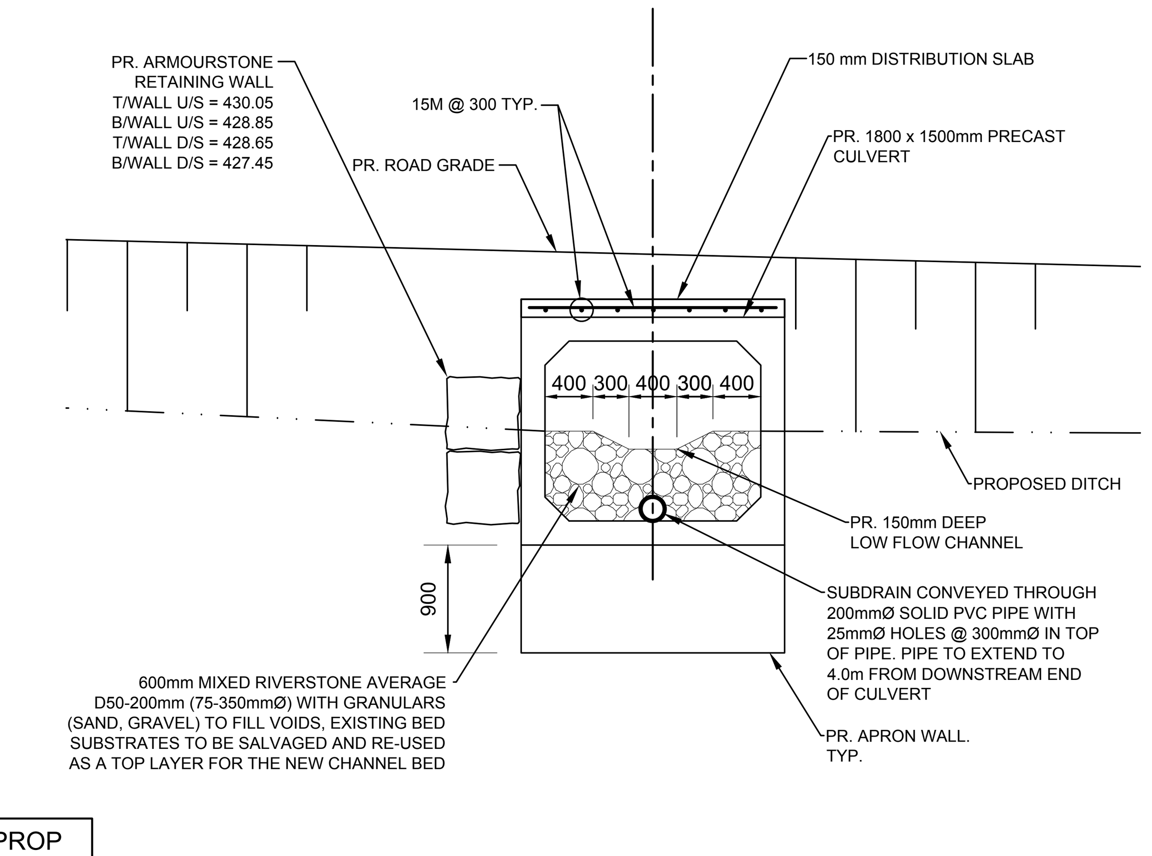
   STEEL:
   - REINFORCING STEEL (BLACK REBAR) SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
   - ALL LAP LENGTHS SHALL BE CONSIDERED TENSION CLASS 'B' UNLESS NOTED OTHERWISE.
   - BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
   - BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 AND SS12-2, (AVAILABLE UPON REQUEST) OR THE REINFORCED STEEL INSTITUTE OF ONTARIO OR CANADA (RSIO or RSIC), UNLESS INDICATED OTHERWISE.
5. ALL EXPOSED CORNERS TO HAVE 25mm X 25mm CHAMFER UNLESS OTHERWISE NOTED
6. WHERE REINFORCING IS TO BE EMBEDDED INTO EXISTING CONCRETE, THE REINFORCING SHALL BE FIXED USING NON-SHRINK EPOXY GROUT. DRILL HOLE DEPTH AND DIAMETER TO BE AS PER GROUT SUPPLIERS RECOMMENDATIONS TO FULLY DEVELOP THE REINFORCING BARS.
7. CONSTRUCTION NOTES
   - BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND EACH SIDE OF CULVERT, KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
   - THE CONTRACTOR SHALL CONFIRM ALL DIMENSIONS AND DETAILS BEFORE STARTING WORK.
   - THE CONTRACTOR IS RESPONSIBLE FOR THE VERIFICATION AND PROTECTION OF ALL EXISTING UTILITIES, SERVICES, STRUCTURES, ROADWAYS, ETC. DURING CONSTRUCTION.
   - GEOTECHNICAL REPORT BY PETO MacCALLUM FILE #14BF029 DATED MARCH, 2015.
8. RETAINING WALL NOTES
   - ARMOURSTONE BLOCKS ARE TO BE MINIMUM 600 H x 1000 W x600 D AND SHALL BE NEATLY STACKED.
   - THE CONTRACTOR SHALL VERIFIY THE REQUIRED BEARING CAPACITY USING A QUALIFIED GEOTECHNICAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO
   - IF THE REQUIRED BEARING CAPACITIES CAN NOT BE OBTAINED, THE CONTRACT ADMINISTRATOR SHALL PROVIDE THE CONTRACTOR WITH REVISED WALL GEOMETRY TO SUIT THE GEOTECHNICAL FIELD CAPACITY.

   REQUIRED CAPACITY : ULS: 150 kPa



1 ELEVATION - CULVERT

1:250



2 SECTION

1:50

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14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER D. G. MCNULTY OCT 15/18 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER A. C. HOLVIK 100118965 Oct. 15, 2018 PROVINCE OF ONTARIO

0 2.0 4.0 6.0 8.0 Metres Vertical 1:100

0 5.0 10.0 20.0 30.0 40.0 Metres Horizontal 1:500

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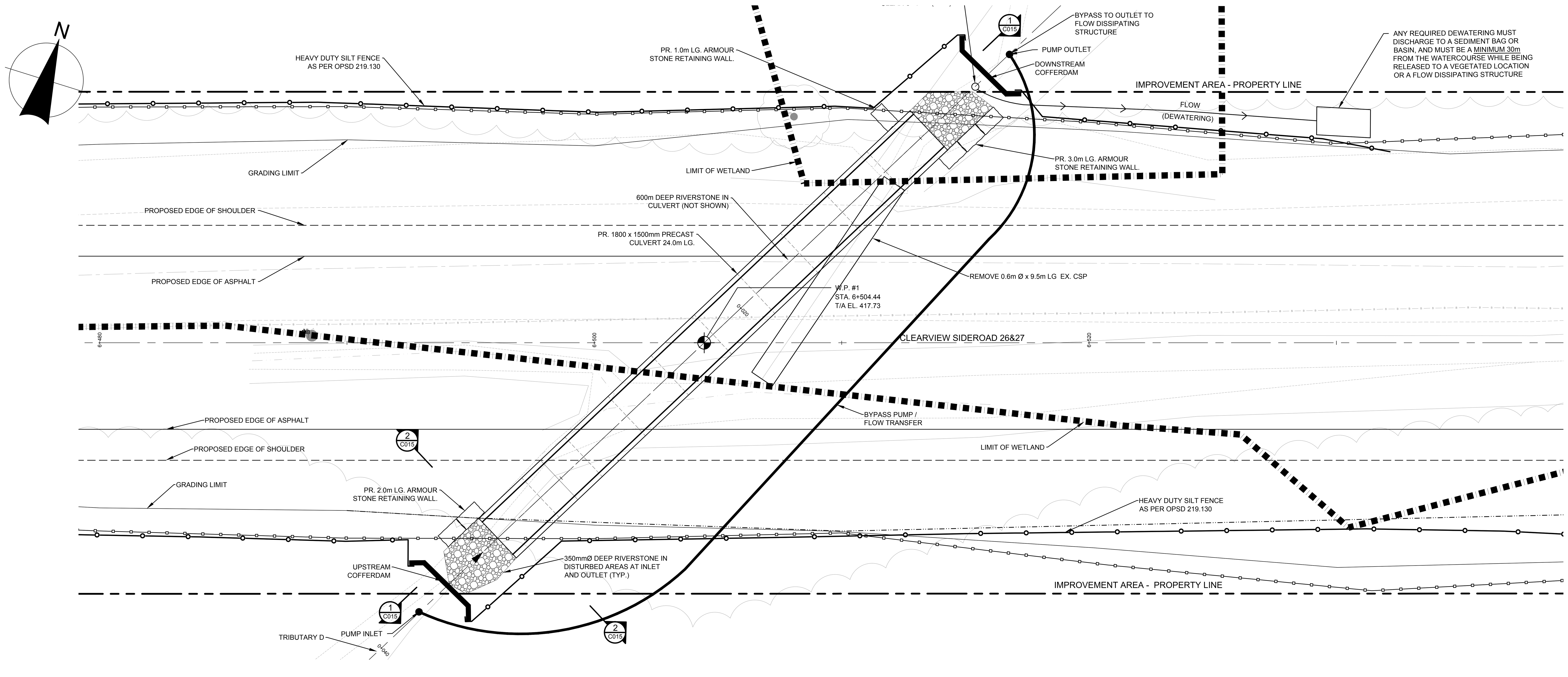
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
CULVERT DETAILS - TRIBUTARY C

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	C012
Scale		Project No.		Revision No.	
AS NOTED		300034587		14	

File Name: 034587_DETAILS-2.dwg Date Plotted: October 17, 2018 - 12:19 PM



PLAN - TRIBUTARY D
1:100

GENERAL NOTES:

1. BOX CULVERT TO BE DESIGNED TO OPSD 1821 AND CANADIAN HIGHWAY BRIDGE DESIGN CODE (CHBDC) CAN/CSA-S6-14.
2. CLASS OF CONCRETE SHALL BE 35 MPa.
3. CLEAR COVER TO REINFORCING STEEL

   FOR STRUCTURES WITH GREATER THAN 600mm OF FILL AND NO DISTRIBUTION SLAB:

   EXTERIOR SURFACES 55 ± 10mm
   INTERIOR SURFACES 50 ± 10mm
4. REINFORCING BARS:

   STEEL:
   - REINFORCING STEEL (BLACK REBAR) SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
   - ALL LAP LENGTHS SHALL BE CONSIDERED TENSION CLASS 'B' UNLESS NOTED OTHERWISE.
   - BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
   - BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 AND SS12-2, (AVAILABLE UPON REQUEST) OR THE REINFORCED STEEL INSTITUTE OF ONTARIO OR CANADA (RSIO or RSIC), UNLESS INDICATED OTHERWISE.
5. ALL EXPOSED CORNERS TO HAVE 25mm X 25mm CHAMFER UNLESS OTHERWISE NOTED
6. WHERE REINFORCING IS TO BE EMBEDDED INTO EXISTING CONCRETE, THE REINFORCING SHALL BE FIXED USING NON-SHRINK EPOXY GROUT. DRILL HOLE DEPTH AND DIAMETER TO BE AS PER GROUT SUPPLIERS RECOMMENDATIONS TO FULLY DEVELOP THE REINFORCING BARS.
7. CONSTRUCTION NOTES
   - BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND EACH SIDE OF CULVERT, KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
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   - GEOTECHNICAL REPORT BY PETO MacCALLUM FILE #14BF029 DATED MARCH, 2015.
8. RETAINING WALL NOTES
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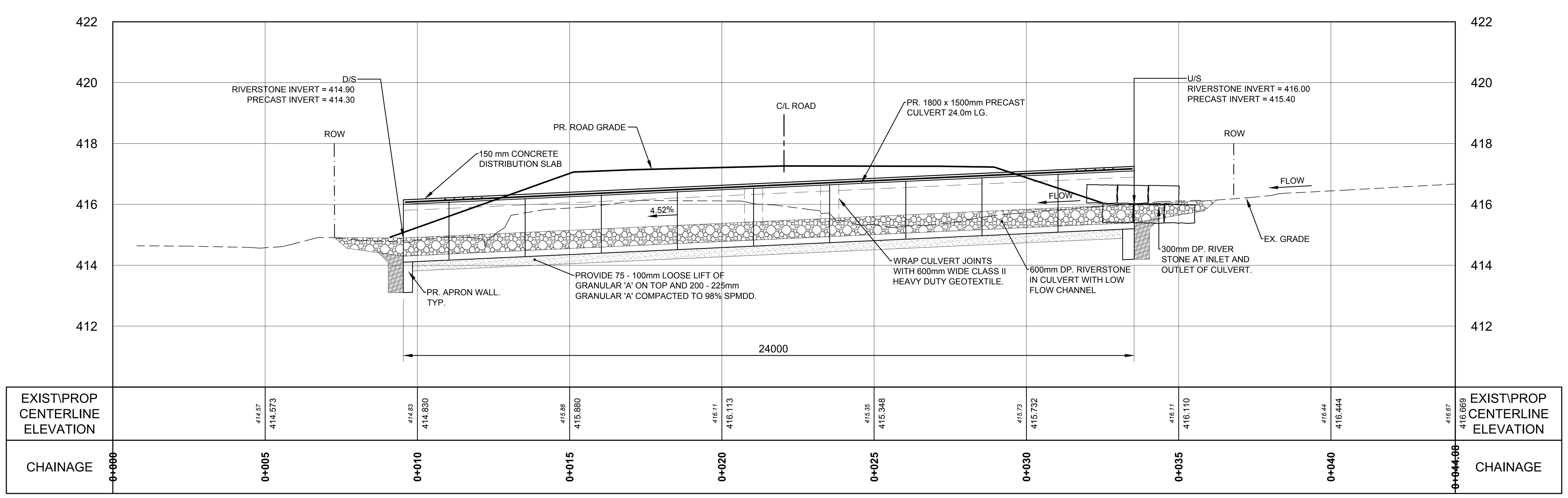
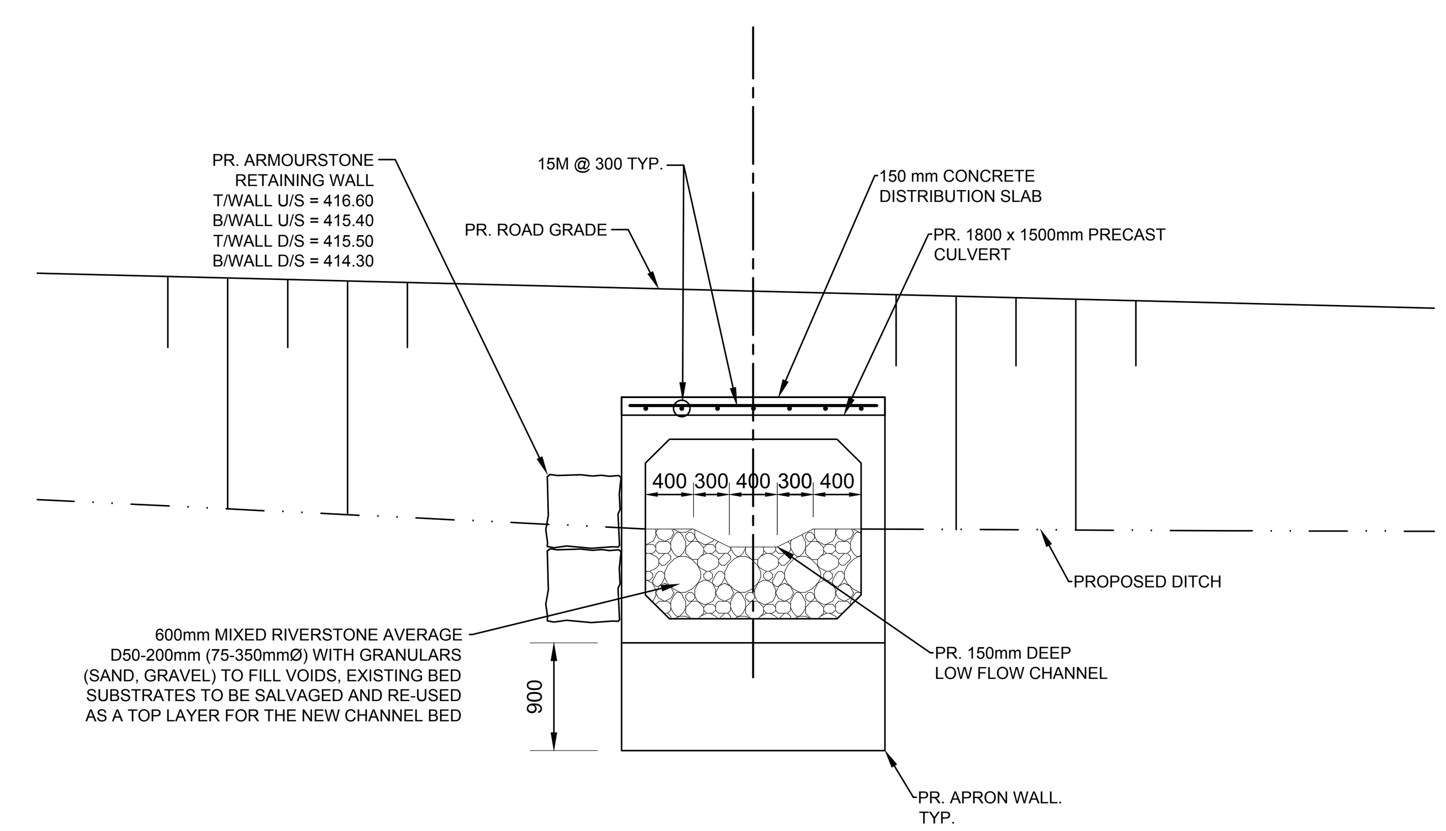
   - IF THE REQUIRED BEARING CAPACITIES CAN NOT BE OBTAINED, THE CONTRACT ADMINISTRATOR SHALL PROVIDE THE CONTRACTOR WITH REVISED WALL GEOMETRY TO SUIT THE GEOTECHNICAL FIELD CAPACITY.

REQUIRED CAPACITY : ULS: 150 kPa



1 ELEVATION - CULVERT
1:100



2 SECTION
1:50

Notes
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NOT FOR CONSTRUCTION

No.	Issue / Revision	Date	Auth.
7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	
11	RE-ISSUED FOR DFO SUBMISSION	2017/03/22	
12	PSW DELINEATION AND EXCLUSION FENCING	2017/03/23	
13	PROFILE REVISION FOR 70km DESIGN SPEED	2017/05/05	
14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER D. G. McNALTY PROVINCE OF ONTARIO Oct 15/18

LICENSED PROFESSIONAL ENGINEER A. C. KOLVIK 100118965 PROVINCE OF ONTARIO Oct. 15 2018

Metres Vertical: 1:100 — 0 2.0 4.0 6.0 8.0
Metres Horizontal: 1:500 — 0 5.0 10.0 20.0 30.0 40.0

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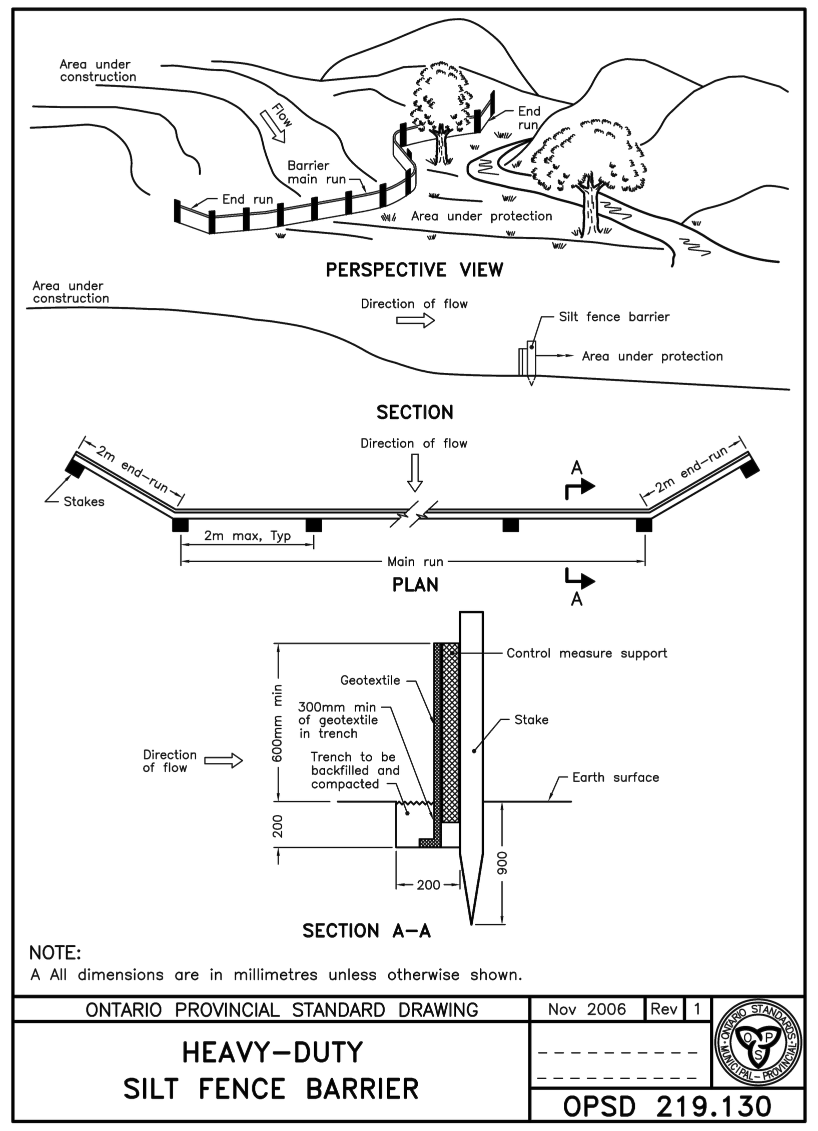
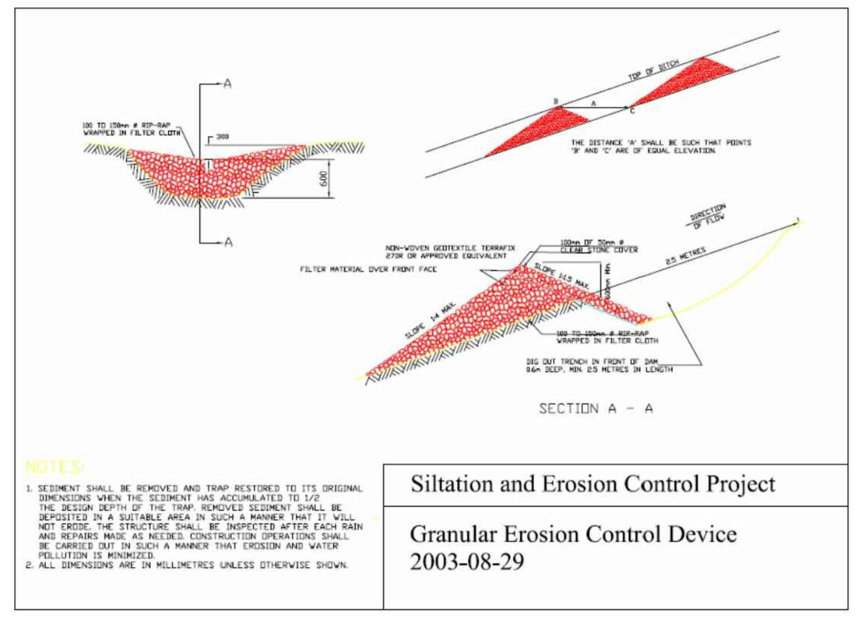
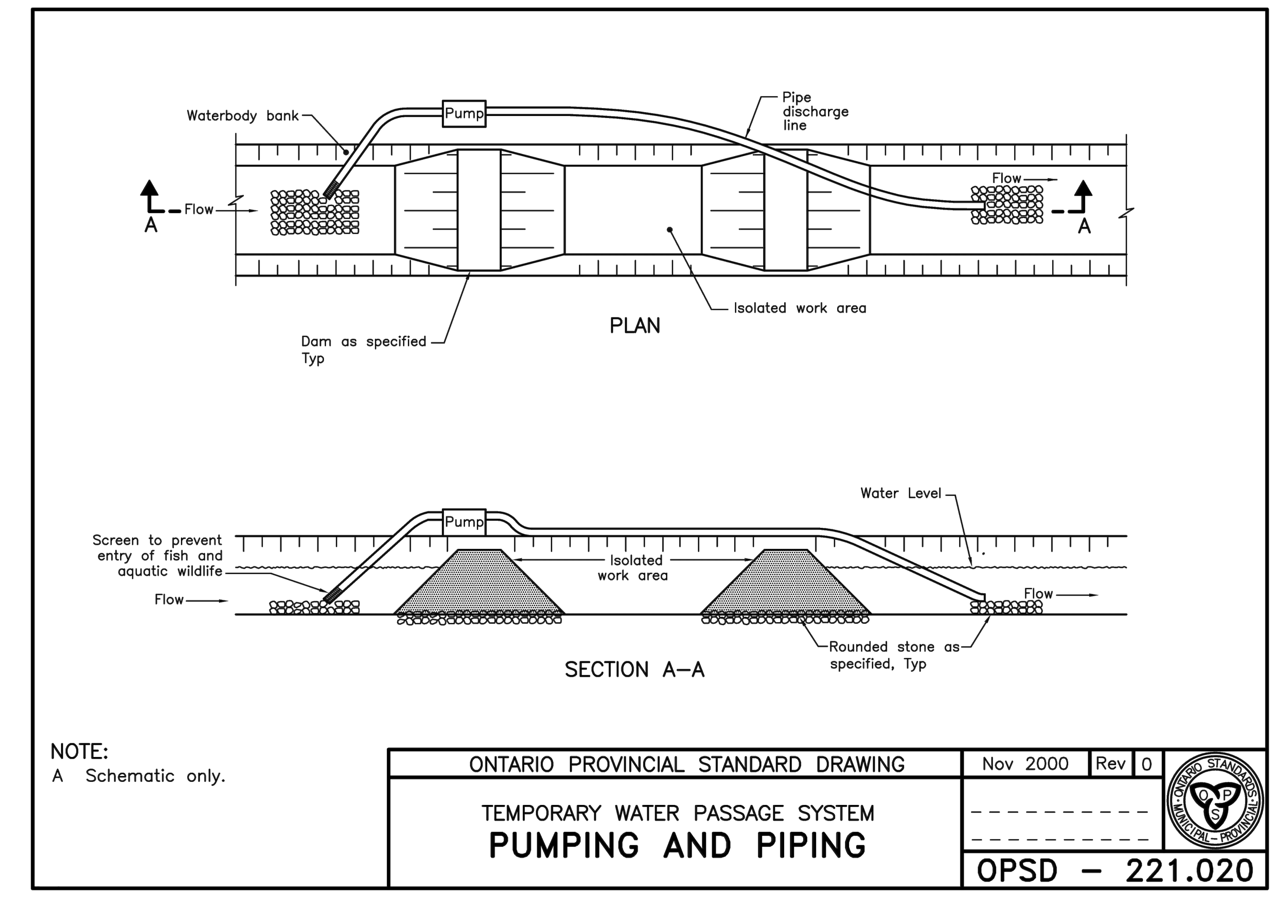
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

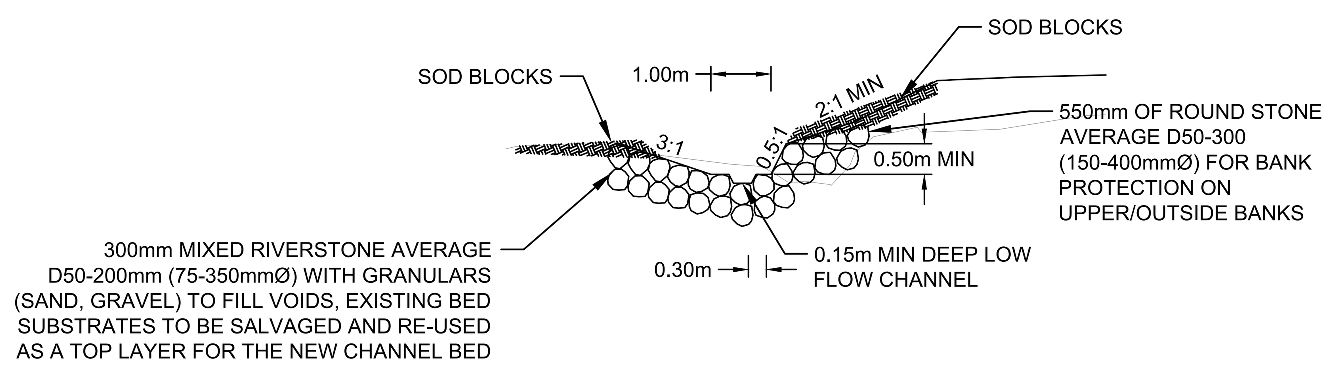
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
CULVERT DETAILS - TRIBUTARY D

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	C013
Scale		Project No.		Revision No.	
AS NOTED		300034587		14	





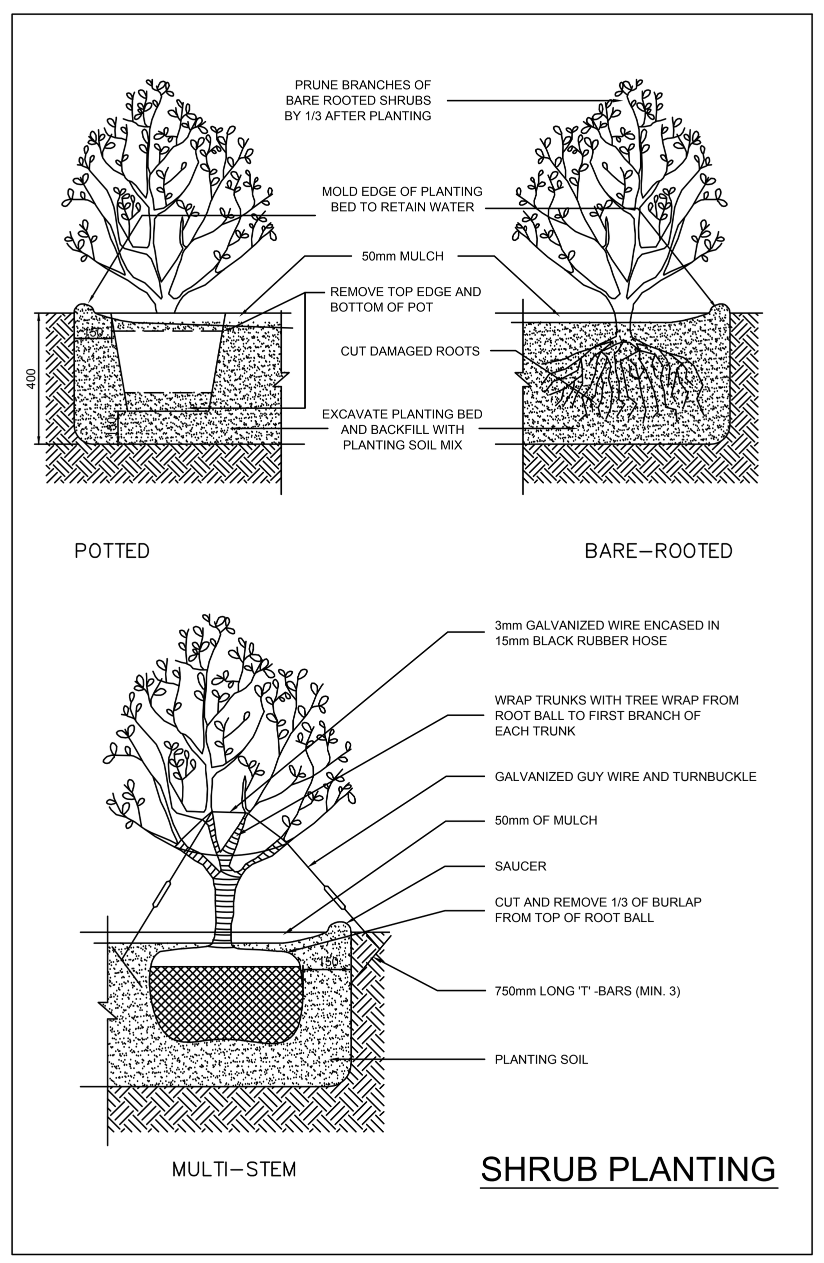




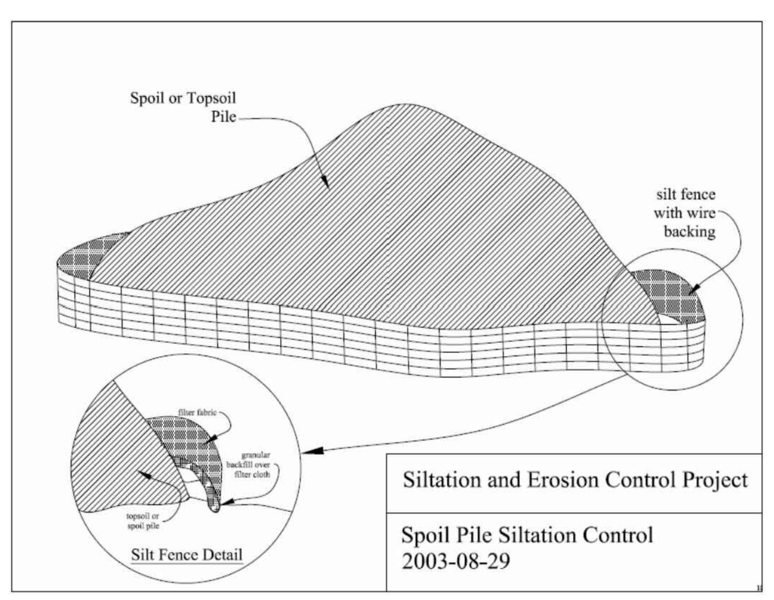
TRIBUTARY A TYPICAL SECTION

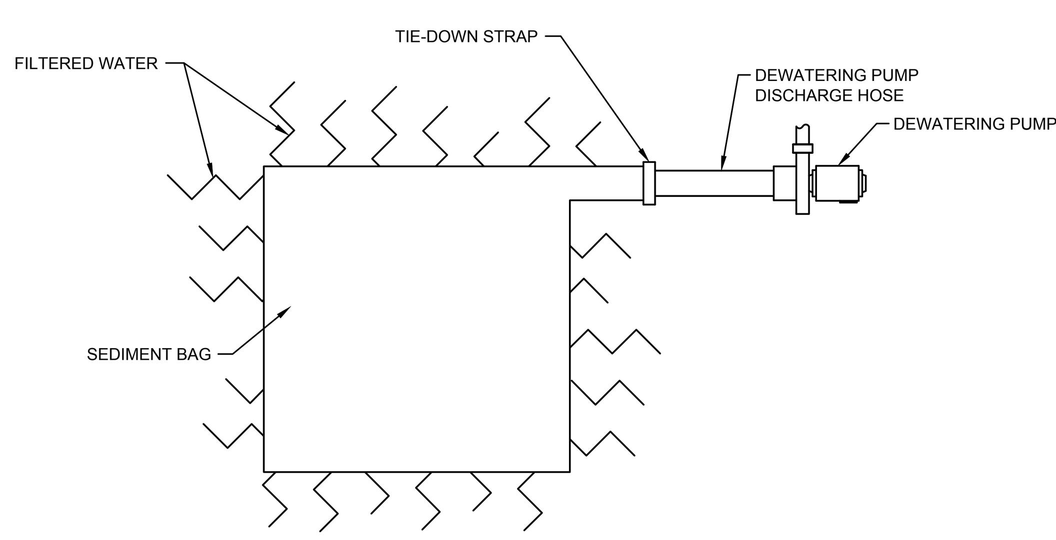
N.T.S

SOD BLOCKS WILL BE SALVAGED FROM THE PROPOSED CHANNEL REALIGNMENT AND RE-USED AS BANK MATERIAL WITHIN THE NEW CHANNEL. SOD BLOCKS ARE EXISTING VEGETATION, ROOT MASS AND TOPSOIL THAT CAN BE CUT USING AN EXCAVATOR AND PLACED ALONG THE BANKS OF THE CONSTRUCTED CHANNEL . SOD BLOCKS THAT ARE USED FOR THE BANKS SHOULD BE FRESHLY CUT AND BUCKET PACKED USING AN EXCAVATOR. ON-SITE DIRECTION FROM BURNSIDE WILL BE PROVIDED TO THE CONTRACTOR REGARDING THE USE OF SOD BLOCKS, WHERE AVAILABLE. THE QUANTITY OF AVAILABLE "SOD BLOCKS" HAS NOT BEEN DETERMINED AND ADDITIONAL MATERIAL, IF REQUIRED SHOULD BE ACCOUNTED FOR BY THE CONTRACTOR BASED ON SITE AND SEASONAL CONDITIONS



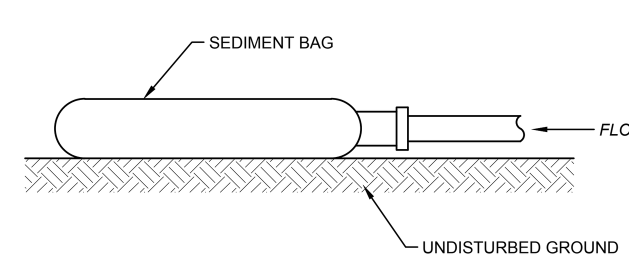
SHRUB PLANTING





SEDIMENT BAG - PLAN VIEW

N.T.S



SEDIMENT BAG - SECTION

N.T.S

GENERAL NOTES

1. REFER TO DWG C000 FOR ADDITIONAL NOTES.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF ANY CULVERT, PUMPS, CHANNELS OR ANY OTHER TEMPORARY MEASURES REQUIRED TO CONTROL THE FLOW. THE CONTRACTOR SHALL ASSESS THE RISK OF FLOODS, STORMS AND EVENTS THAT MAY AFFECT CONSTRUCTION AND DETERMINE THEIR OWN LEVEL OF RISK ASSOCIATED WITH ANY TEMPORARY WORK.
3. SOD BLOCKS WILL BE SALVAGED FROM THE PROPOSED CHANNEL REALIGNMENT AND RE-USED AS BANK MATERIAL WITHIN THE NEW CHANNEL. SOD BLOCKS ARE EXISTING VEGETATION, ROOT MASS AND TOPSOIL THAT CAN BE CUT USING AN EXCAVATOR AND PLACED ALONG THE BANKS OF THE CONSTRUCTED CHANNEL . SOD BLOCKS THAT ARE USED FOR THE BANKS SHOULD BE FRESHLY CUT AND BUCKET PACKED USING AN EXCAVATOR. ON-SITE DIRECTION FROM BURNSIDE WILL BE PROVIDED TO THE CONTRACTOR REGARDING THE USE OF SOD BLOCKS, WHERE AVAILABLE. THE QUANTITY OF AVAILABLE "SOD BLOCKS" HAS NOT BEEN DETERMINED AND ADDITIONAL MATERIAL, IF REQUIRED SHOULD BE ACCOUNTED FOR BY THE CONTRACTOR BASED ON SITE AND SEASONAL CONDITIONS.
4. THE CONTRACTOR SHALL MAINTAIN A COFFERDAM AT THE UPSTREAM AND DOWNSTREAM END OF THE NEWLY CONSTRUCTED CHANNEL TO PREVENT THE EXISTING WATER COURSES FROM ENTERING THE NEW CHANNEL UNTIL SUCH TIME THAT SUBSTANTIAL VEGETATIVE GROWTH HAS TAKEN PLACE AND THE CONTRACT ADMINISTRATOR HAS ACCEPTED THE WORKS AND PROVIDED INSTRUCTIONS TO CONNECT THE NEW CHANNEL TO THE EXISTING WATER COURSES.
5. THE DOWNSTREAM COFFERDAM SHALL BE REMOVED FIRST.
6. CONTRACTOR TO ISOLATE WORK AREA(S) SUCH THAT ALL WORK WILL BE COMPLETED IN THE DRY.
7. CONTINUALLY MONITOR PUMP OUTLET AREA AND STABILIZE IF REQUIRED.
8. ANY FISH OR AQUATIC LIFE SHALL BE REMOVED FROM THE CONSTRUCTION AREA BY A BURNSIDE QUALIFIED ENVIRONMENTAL PROFESSIONAL. PROVIDE A MINIMUM OF 48 HOURS NOTICE PRIOR TO REQUIRING FISH REMOVAL. IN THE EVENT OF FLOODING THAT REQUIRES ADDITIONAL REMOVAL OF FISH, THE CONTRACTOR WILL REQUIRED TO PAY FOR PROVIDING REMOVAL BY A QUALIFIED PROFESSIONAL. THE CONTRACTOR SHOULD SIZE THEIR WATERWAY CONTROL ACCORDINGLY.
9. SCREEN ANY WATER INTAKES OR OUTLET PIPES TO PREVENT ENTRAINMENT OR IMPINGEMENT OF FISH. ENTRAINMENT OCCURS WHEN A FISH IS DRAWN INTO A WATER INTAKE AND CANNOT ESCAPE. IMPINGEMENT OCCURS WHEN AN ENTRAPPED FISH IS HELD IN CONTACT WITH THE INTAKE SCREEN AND IS UNABLE TO FREE ITSELF. ENSURE REGULAR MAINTENANCE AND REPAIR OF SCREENS IS CARRIED OUT TO PREVENT DEBRIS-FOULING AND IMPINGEMENT OF FISH.
10. A BURNSIDE QUALIFIED PERSON SHALL BE ONSITE DURING THE PLACEMENT OF RIVERSTONE. PROVIDE A MINIMUM OF 48 HOURS NOTICE PRIOR TO PLACING OF RIVERSTONE.
11. IF DEWATERING IS TO EXCEED 50,000 L/DAY, A PERMIT TO TAKE WATER (PTTW) FROM THE MOECC WILL BE REQUIRED.
12. DISSIPATING STRUCTURE TO CONSIST OF MIXED RIVERSTONE D50-200mm. DISSIPATING STRUCTURE TO BE MONITORED AND REPAIRED AS REQUIRED TO AVOID EROSION OF EXISTING CHANNEL.

SEED AND MULCH - NVCA SEED MIX

1. THE SEED MIX SHALL BE 20% FOX SEDGE, 20% VIRGINIA WILD RYE, 15% FOWL BLUEGRASS, 10 % BLUNT BROOM SEDGE, 10% GREEN BULRUSH, 5% SOFT RUSH, 2% AUTUMN BENTGRASS, 2%TICKLEGRASS, 2% NODDING BUR MARIGOLD, 2% AMERICA MANNAGRASS, 2% BLUE VERVAIN, 2% WOOLGRASS, 1% SWAMP MILKWEED, 1% PURPLE STEMMED ASTER AND THE COVER TYPE SHALL BE HYDRAULIC MULCH. NATIVE SEED MIX/NURSE CROP OVER 10:1 TOPSOIL OVERBANK AREAS NEXT TO CHANNEL.
2. NVCA SEED MIX TO BE USED FOR RESTORATION OF CULVERTS AND FOR RESTORATION OF DITCHES AND ROAD EMBANKMENT FROM STA. 4+260 TO STA. 4+700 AND STA. 5+460 TO STA. 6+990.

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NOT FOR CONSTRUCTION

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REGISTERED PROFESSIONAL PLANNER
D. G. McNULTY
Oct 15/18
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
A. C. HOLVIK
100118965
Oct. 15, 2018
PROVINCE OF ONTARIO

Metres Vertical 1:100 — 0, 2.0, 4.0, 6.0, 8.0
Metres Horizontal 1:500 — 0, 5.0, 10.0, 20.0, 30.0, 40.0

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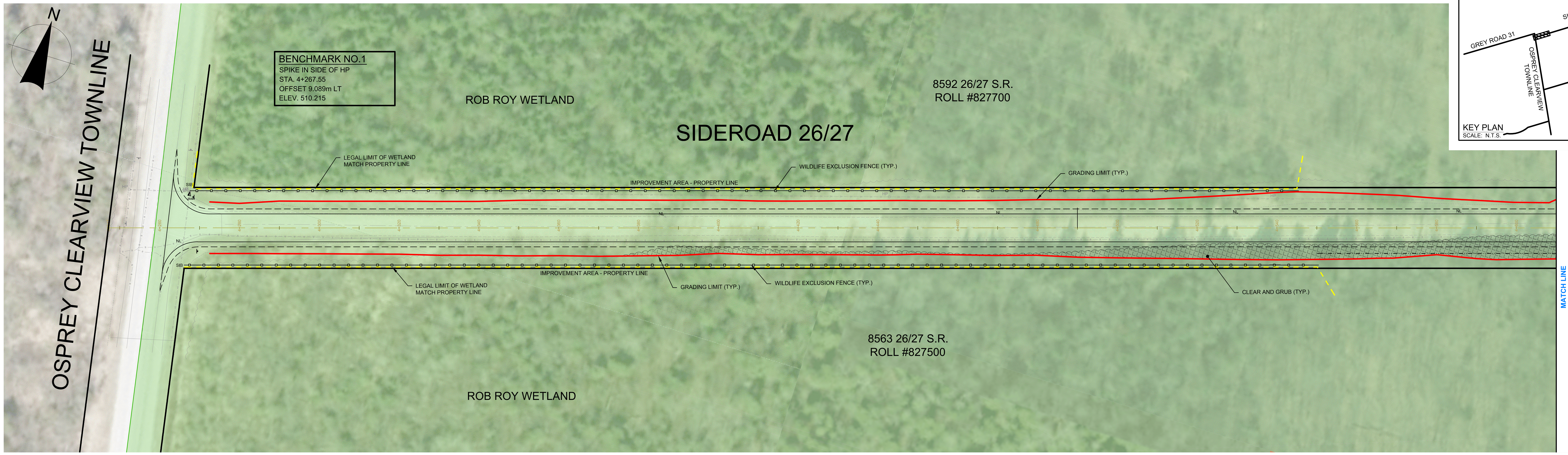
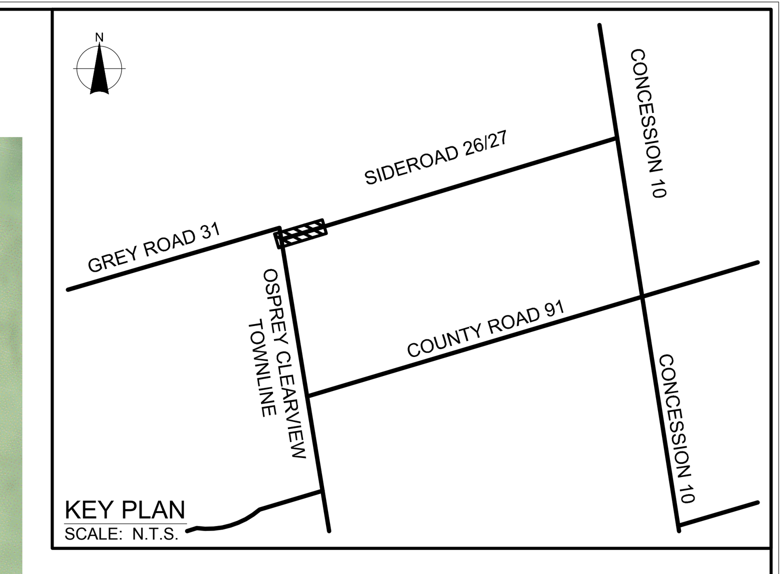
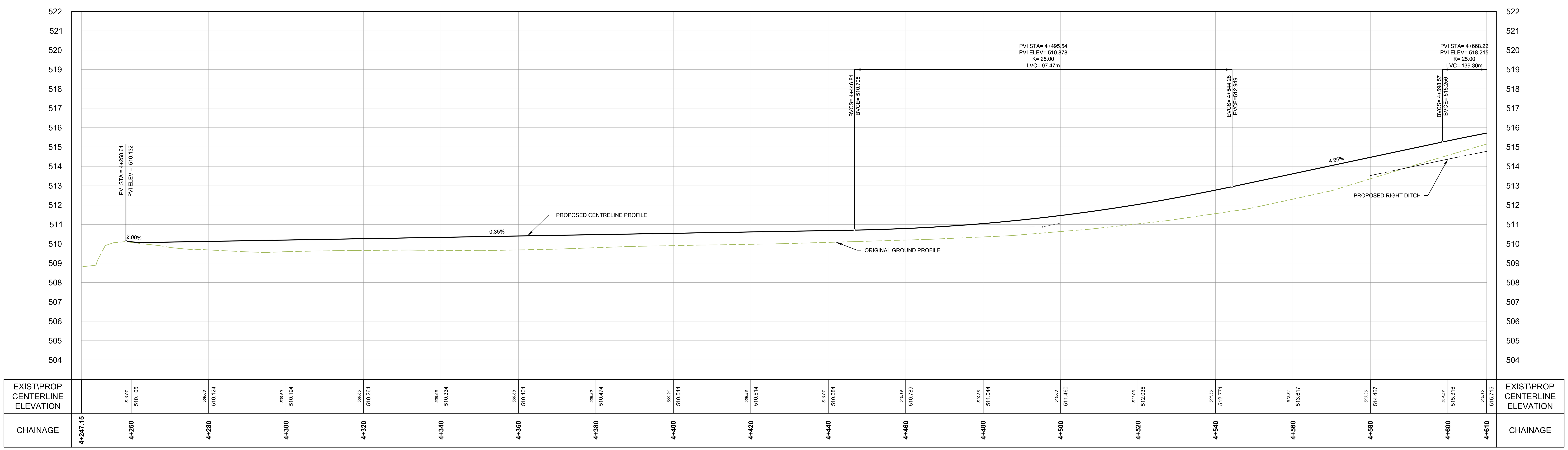
Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
TRIBUTARY A REALIGNMENT AND CULVERT DETAILS

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	C014
Scale: AS NOTED		Project No.: 300034587		Revision No.: 14	

File Name: 034587_DETAILS.dwg Date Plotted: October 17, 2018 - 12:20 PM







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14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. MCNULTY
OCT 15/18
PROVINCE OF ONTARIO

LEGEND

- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100
Metres Horizontal 1:500

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L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

AERIAL PLAN & PROFILE
SIDEROAD 26/27
4+247 TO 4+610

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	A001

Scale	Project No.	Revision No.
H 1:500 V 1:100	300034587	14

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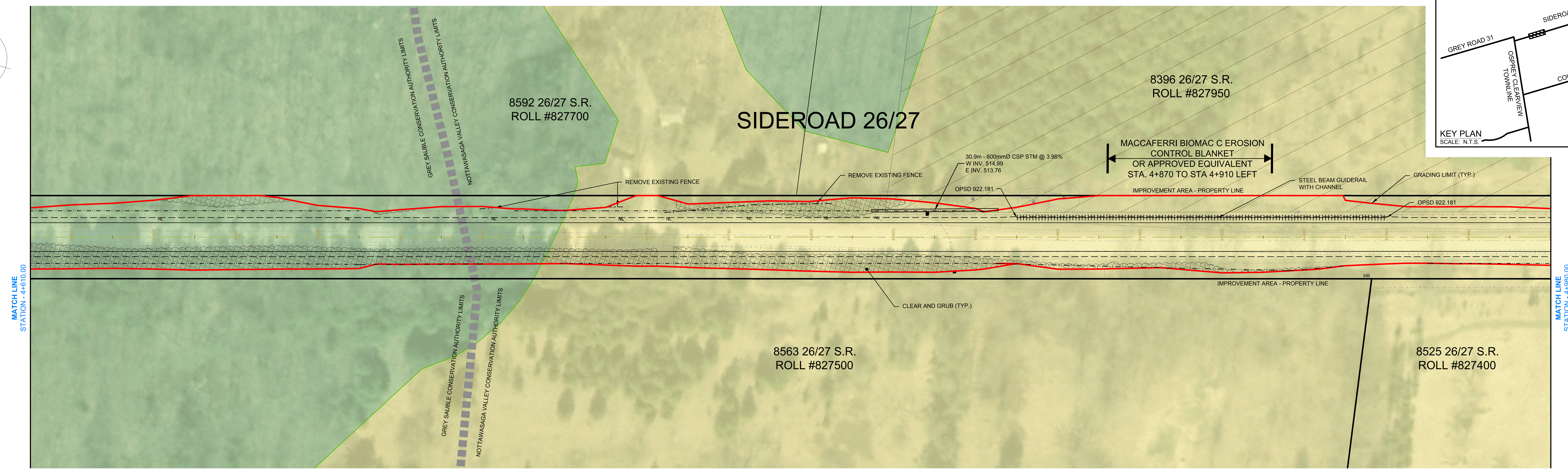

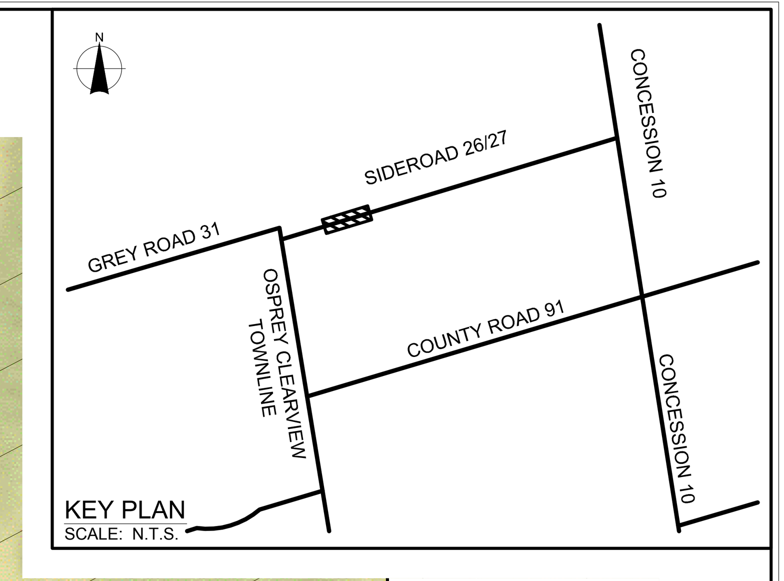

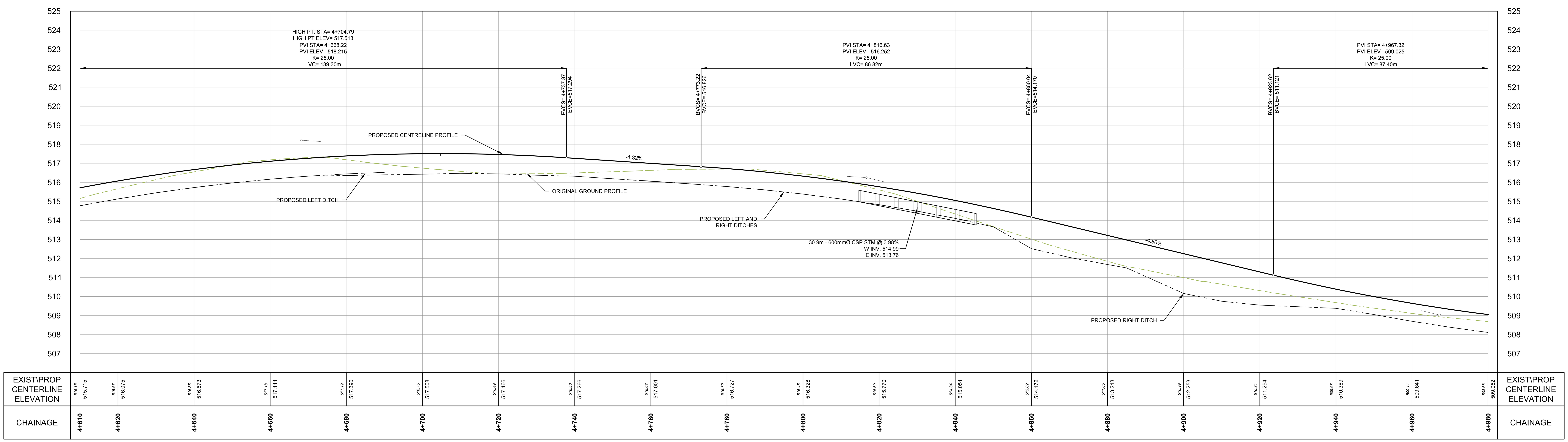

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14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. McNULTY
OCT 15/18
PROVINCE OF ONTARIO

LEGEND
- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100
Metres Horizontal 1:500

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STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

AERIAL PLAN & PROFILE
SIDEROAD 26/27
4+610 TO 4+980

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	A002
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		14	

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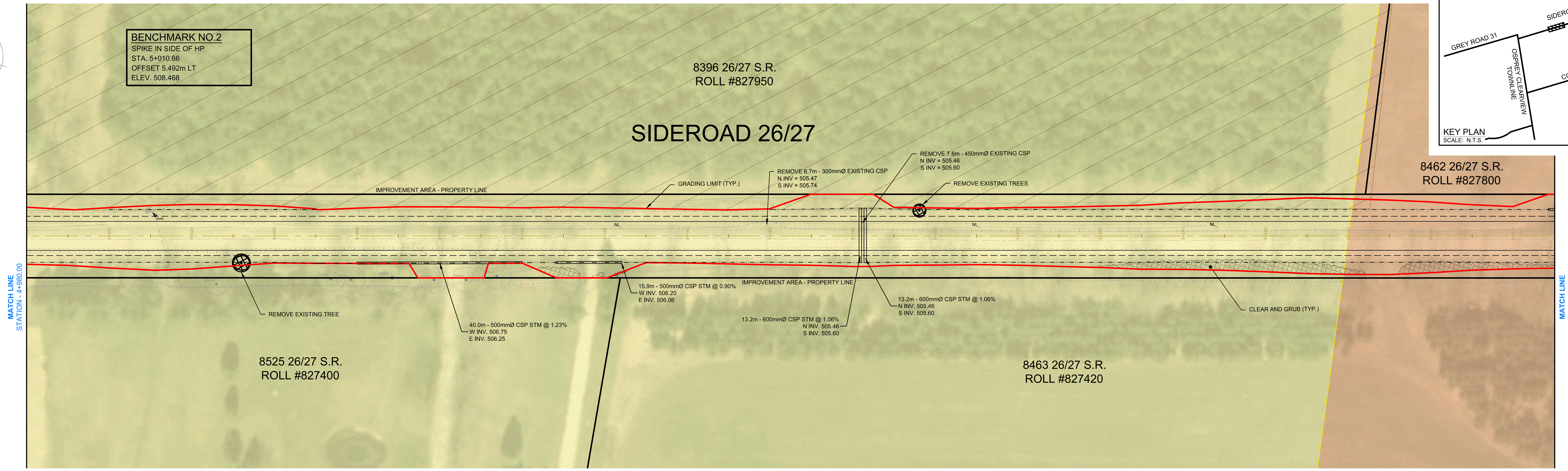

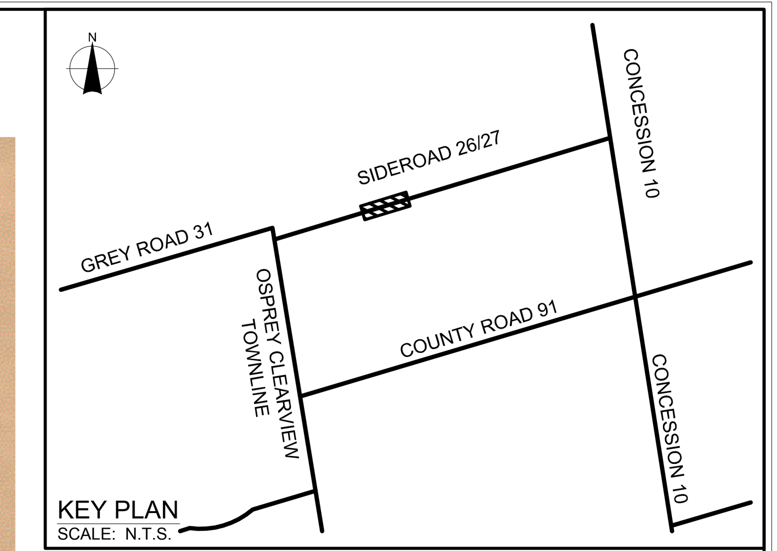

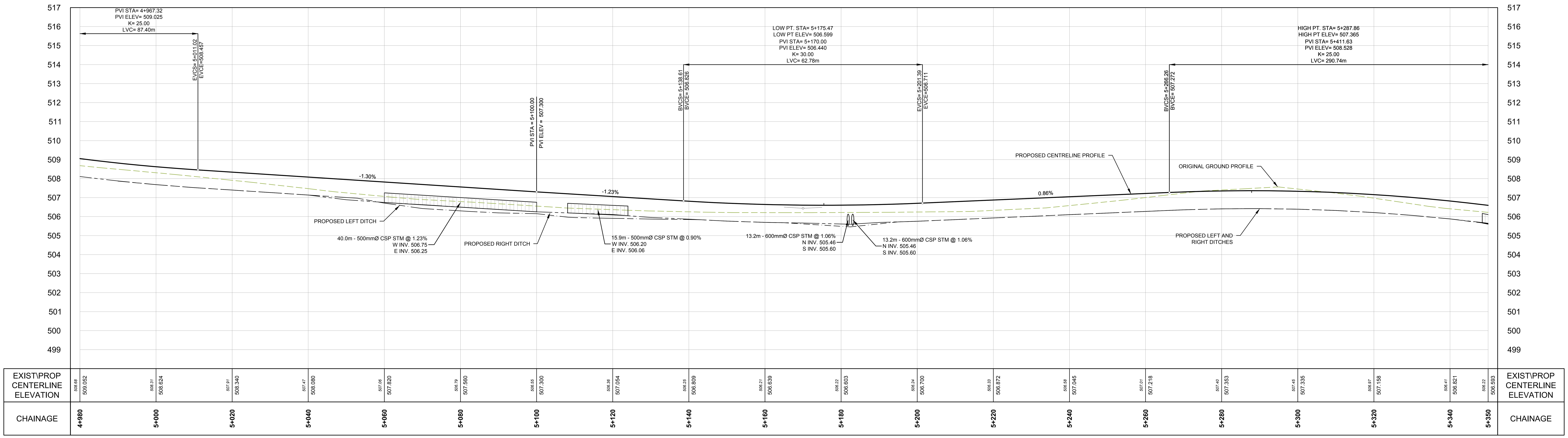

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REGISTERED PROFESSIONAL ENGINEER
D. G. McNULTY
OCT 15/18
PROVINCE OF ONTARIO

LEGEND
- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100
Metres Horizontal 1:500

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L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
AERIAL PLAN & PROFILE
SIDEROAD 26/27
4+980 TO 5+350

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	A003
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 14	

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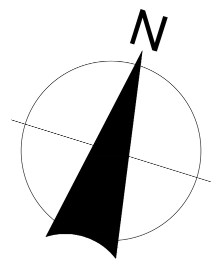
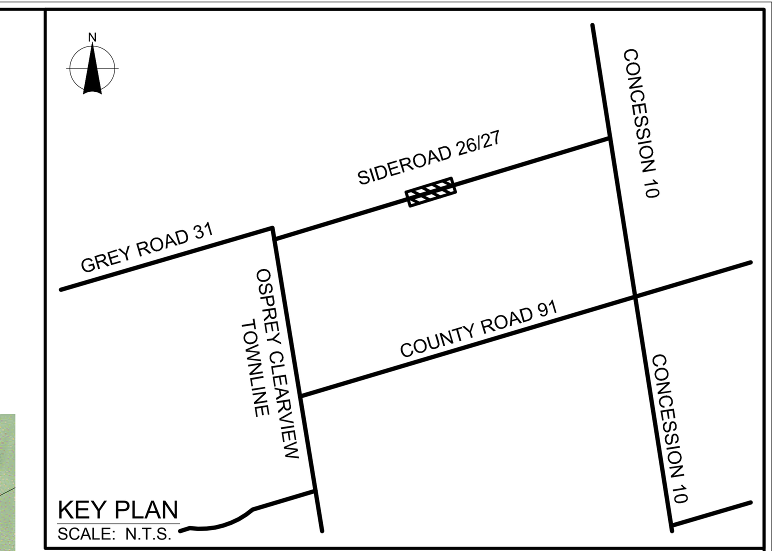
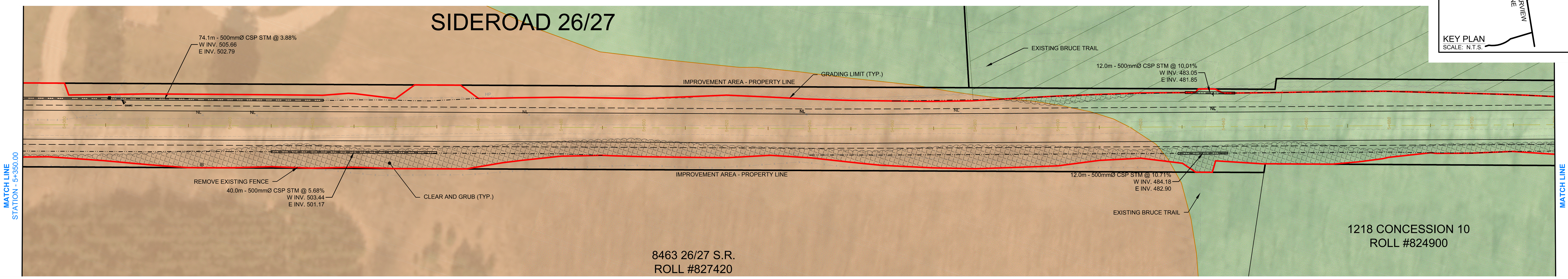
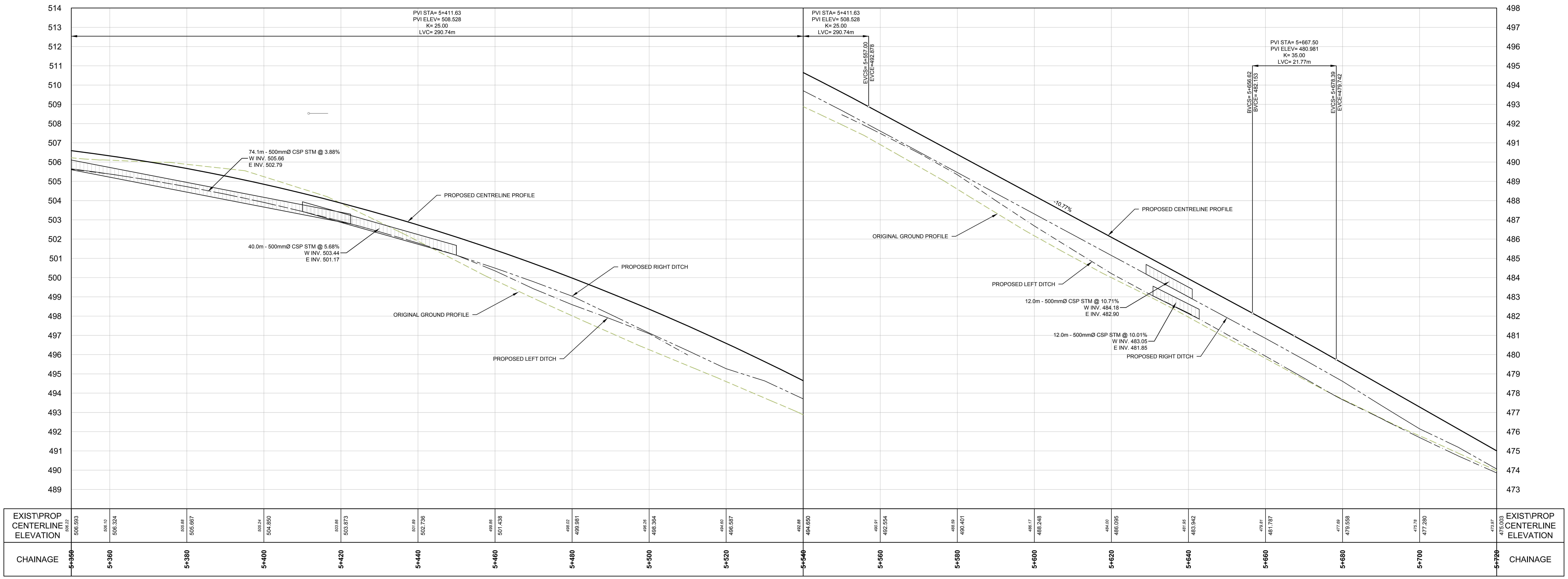


BENCHMARK NO.3
SPIKE IN SIDE OF HP
STA. 5+373.91
OFFSET 6.070m LT
ELEV. 506.428







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REGISTERED PROFESSIONAL ENGINEER
D. G. McNALTY
PROVINCE OF ONTARIO

LEGEND

- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100 (0 – 2.0 – 4.0 – 6.0 – 8.0)

Metres Horizontal 1:500 (0 – 5.0 – 10.0 – 20.0 – 30.0 – 40.0)

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L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

AERIAL PLAN & PROFILE
SIDEROAD 26/27
5+350 TO 5+720

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	A004
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 14	

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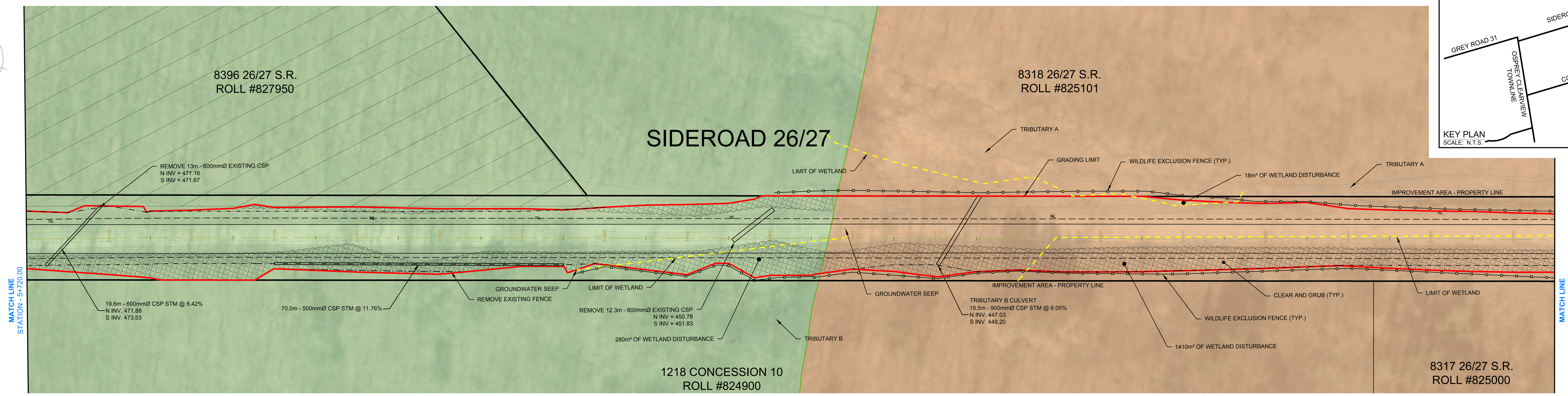

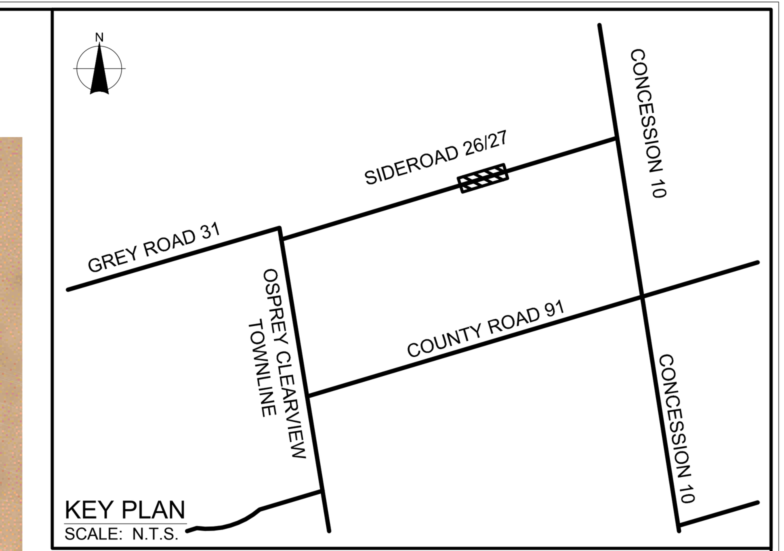

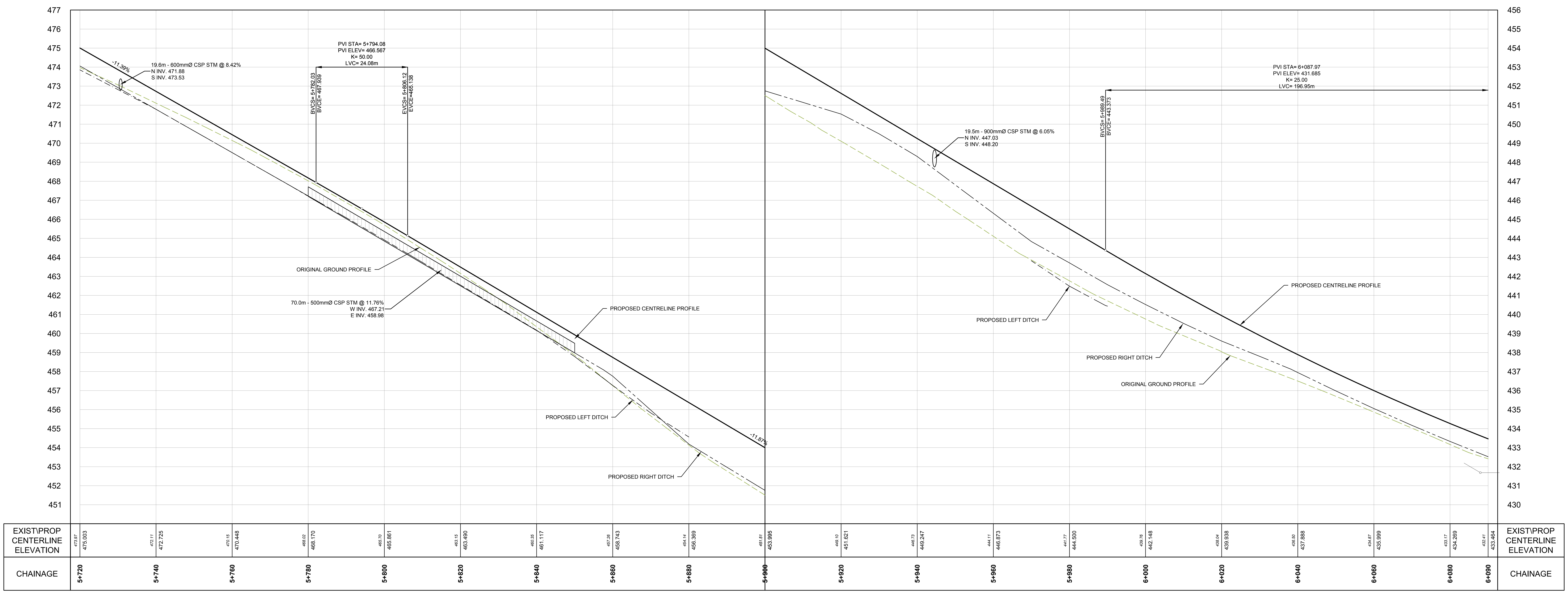

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12	PSW DELINEATION AND EXCLUSION FENCING	2017/03/23	
13	PROFILE REVISION FOR 70km DESIGN SPEED	2017/05/05	
14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. MCNULTY
OCT 15/18
PROVINCE OF ONTARIO

LEGEND

- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100 — 0, 2.0, 4.0, 6.0, 8.0
Metres Horizontal 1:500 — 0, 5.0, 10.0, 20.0, 30.0, 40.0

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STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
AERIAL PLAN & PROFILE
SIDEROAD 26/27
5+720 TO 6+090

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	A005
Scale: H 1:500 V 1:100		Project No.: 300034587		Revision No.: 14	

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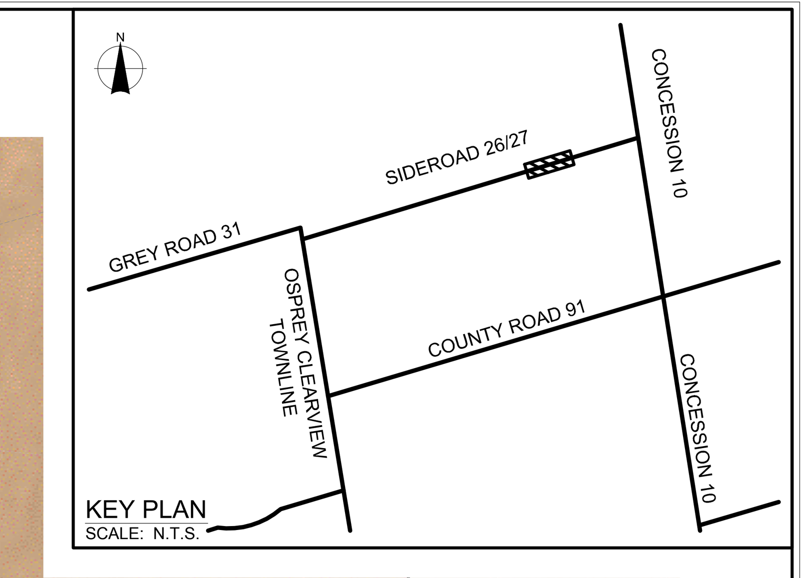

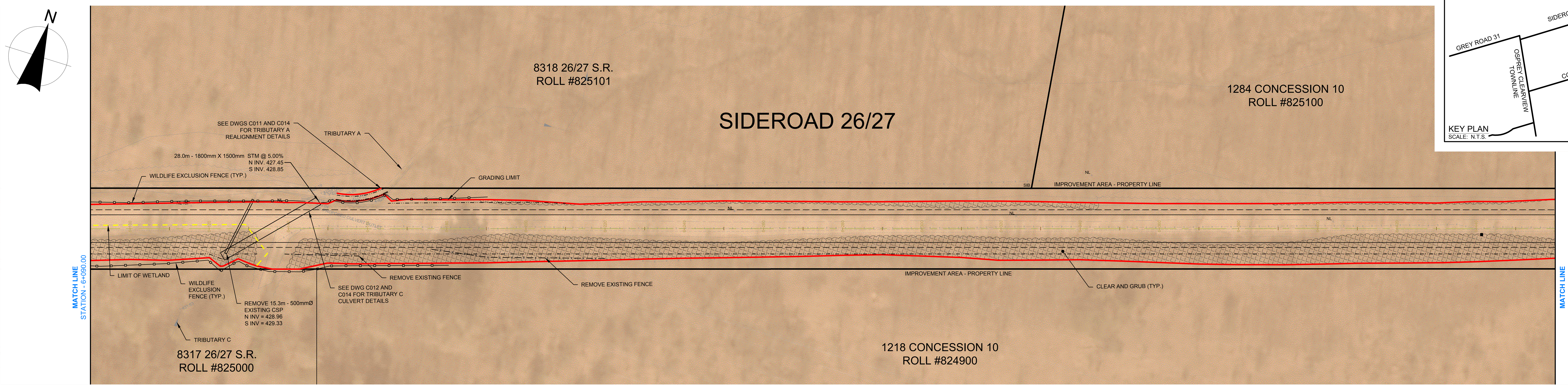

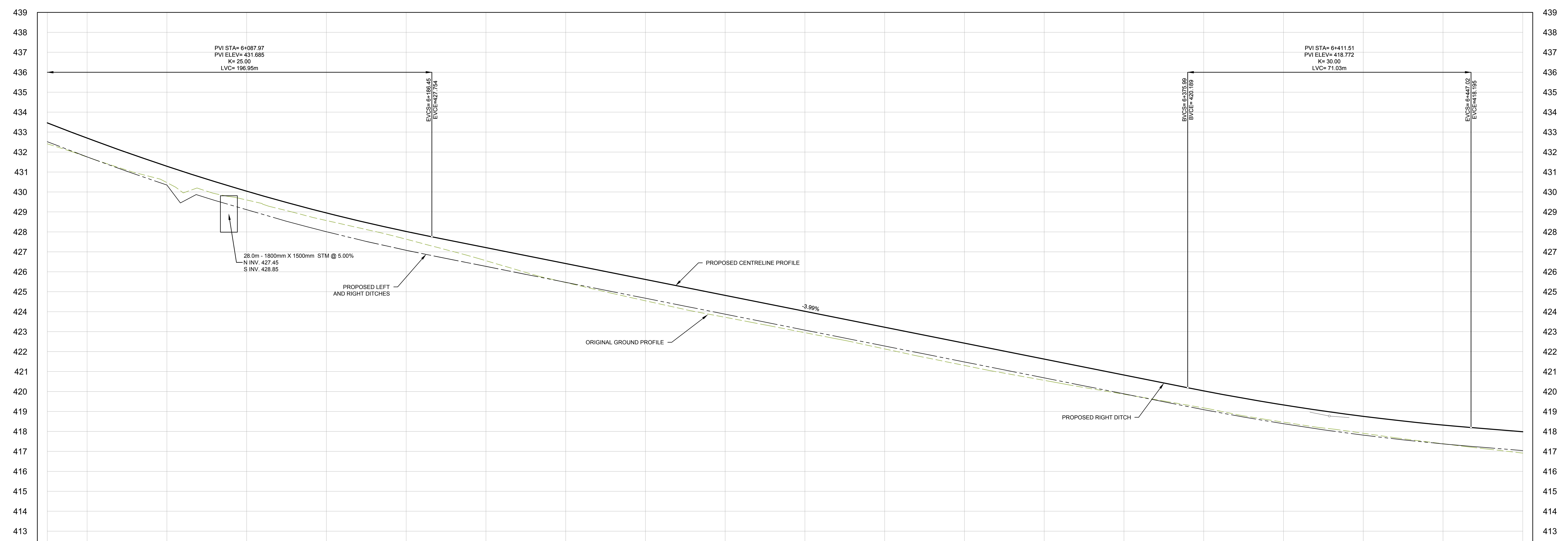

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6+160	428.57 / 428.950
6+180	427.63 / 428.020
6+200	426.55 / 427.213
6+220	425.46 / 426.415
6+240	424.55 / 425.617
6+260	423.72 / 424.819
6+280	422.95 / 424.020
6+300	422.13 / 423.222
6+320	421.31 / 422.424
6+340	420.56 / 421.626
6+360	419.86 / 420.828
6+380	419.18 / 420.032
6+400	418.46 / 419.327
6+420	417.91 / 418.756
6+440	417.38 / 418.318
6+460	416.91 / 417.985

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14	REVISED FOR E.I.S.	2018/10/15	

REGISTERED PROFESSIONAL ENGINEER
D. G. McNULTY
OCT 15/18
PROVINCE OF ONTARIO

LEGEND
- ESCARPMENT RURAL AREA
- ESCARPMENT PROTECTION AREA
- ESCARPMENT NATURAL AREA
- PUBLIC LAND (IN PARKS AND OPEN SPACE SYSTEM)
- PROPOSED GRADING LIMIT
- LIMIT OF WETLAND

Metres Vertical 1:100 (0 2.0 4.0 6.0 8.0)
Metres Horizontal 1:500 (0 5.0 10.0 20.0 30.0 40.0)

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STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
AERIAL PLAN & PROFILE
SIDEROAD 26/27
6+090 TO 6+460

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	A006
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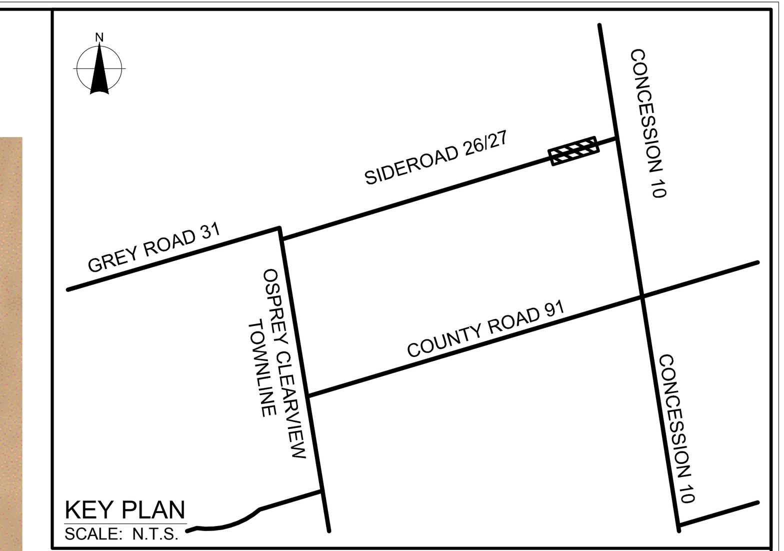

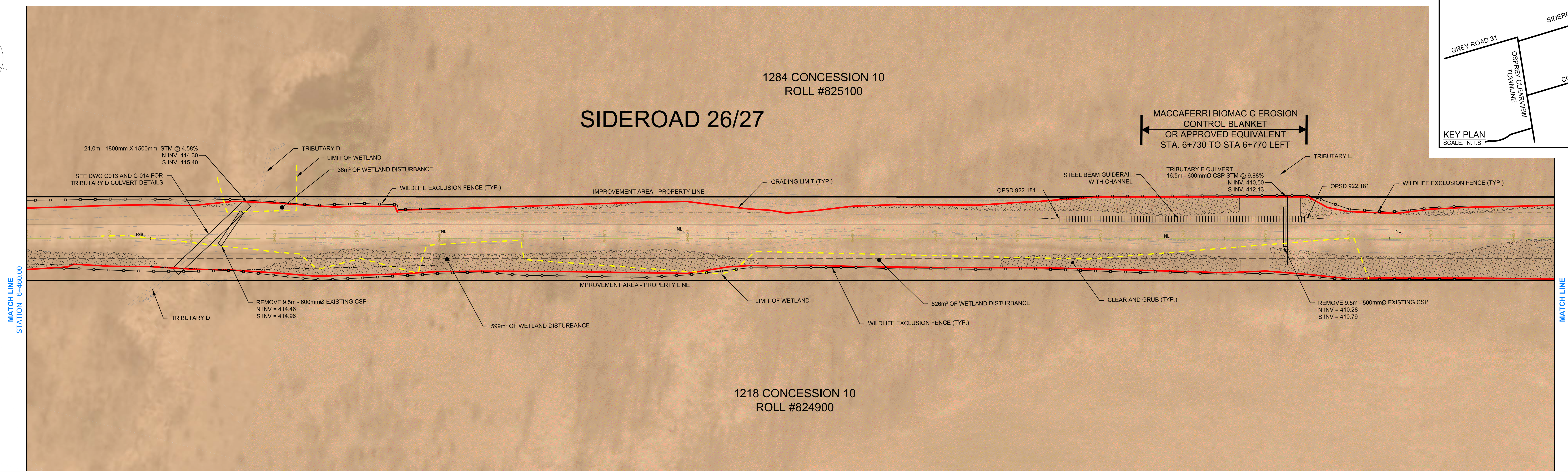

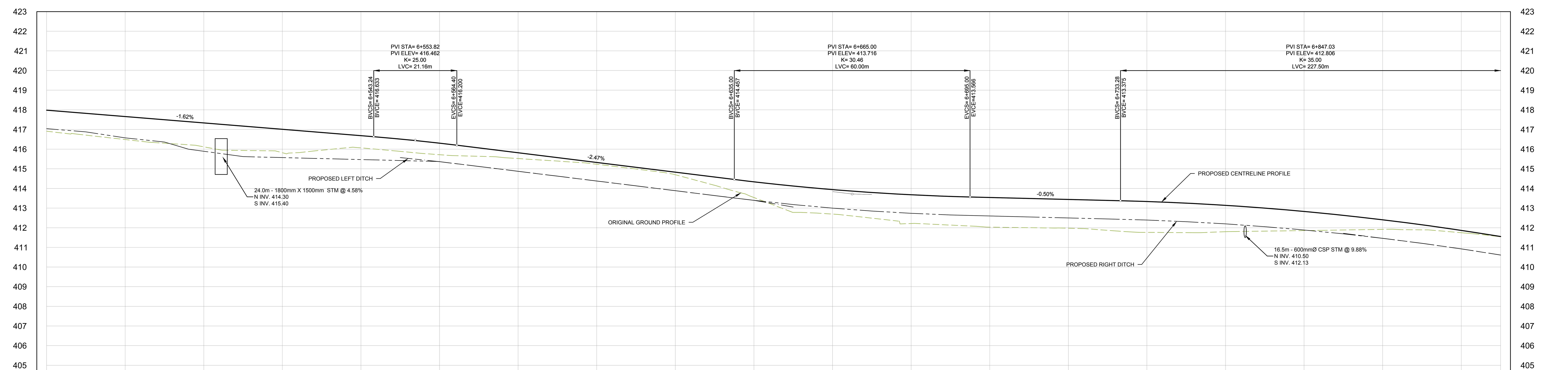

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6+560	415.72	416.305
6+580	415.52	415.815
6+600	415.23	415.321
6+620	414.70	414.827
6+640	413.54	414.338
6+660	412.70	413.942
6+680	412.22	413.678
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6+740	411.76	413.335
6+760	411.80	413.139
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6+800	411.92	412.405
6+820	411.75	411.867
6+830	411.54	411.554

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REGISTERED PROFESSIONAL ENGINEER
D. G. McNULTY
OCT15/18
PROVINCE OF ONTARIO

LEGEND

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0 2.0 4.0 6.0 8.0
Metres
Vertical: 1:100

0 5.0 10.0 20.0 30.0 40.0
Metres
Horizontal: 1:500

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L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

AERIAL PLAN & PROFILE
SIDEROAD 26/27
6+460 TO 6+830

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	A007

Scale	Project No.	Revision No.
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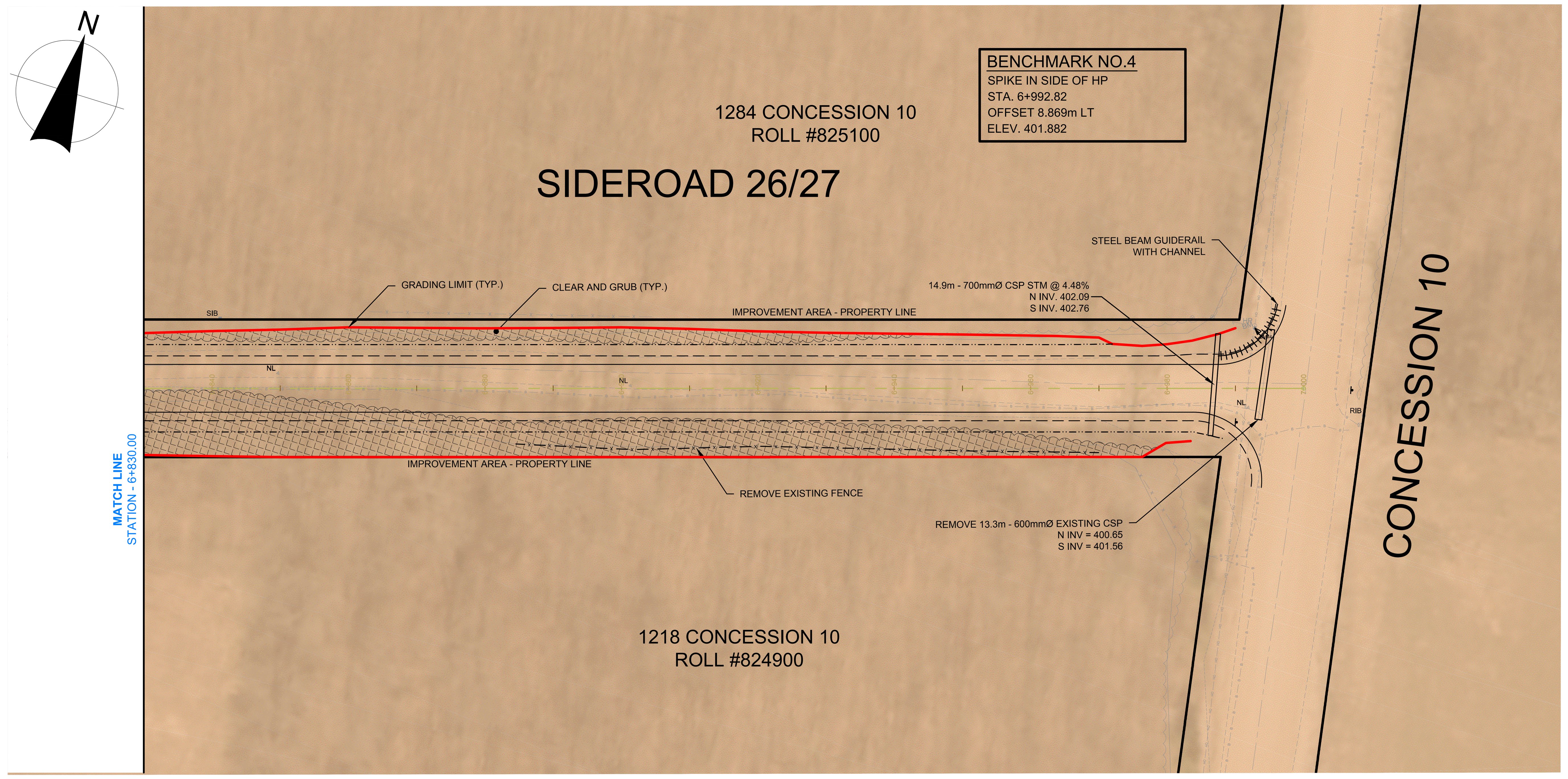

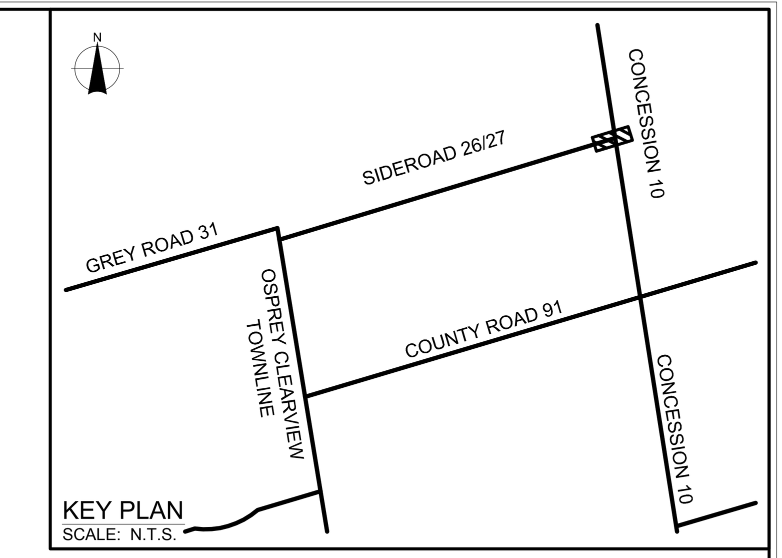

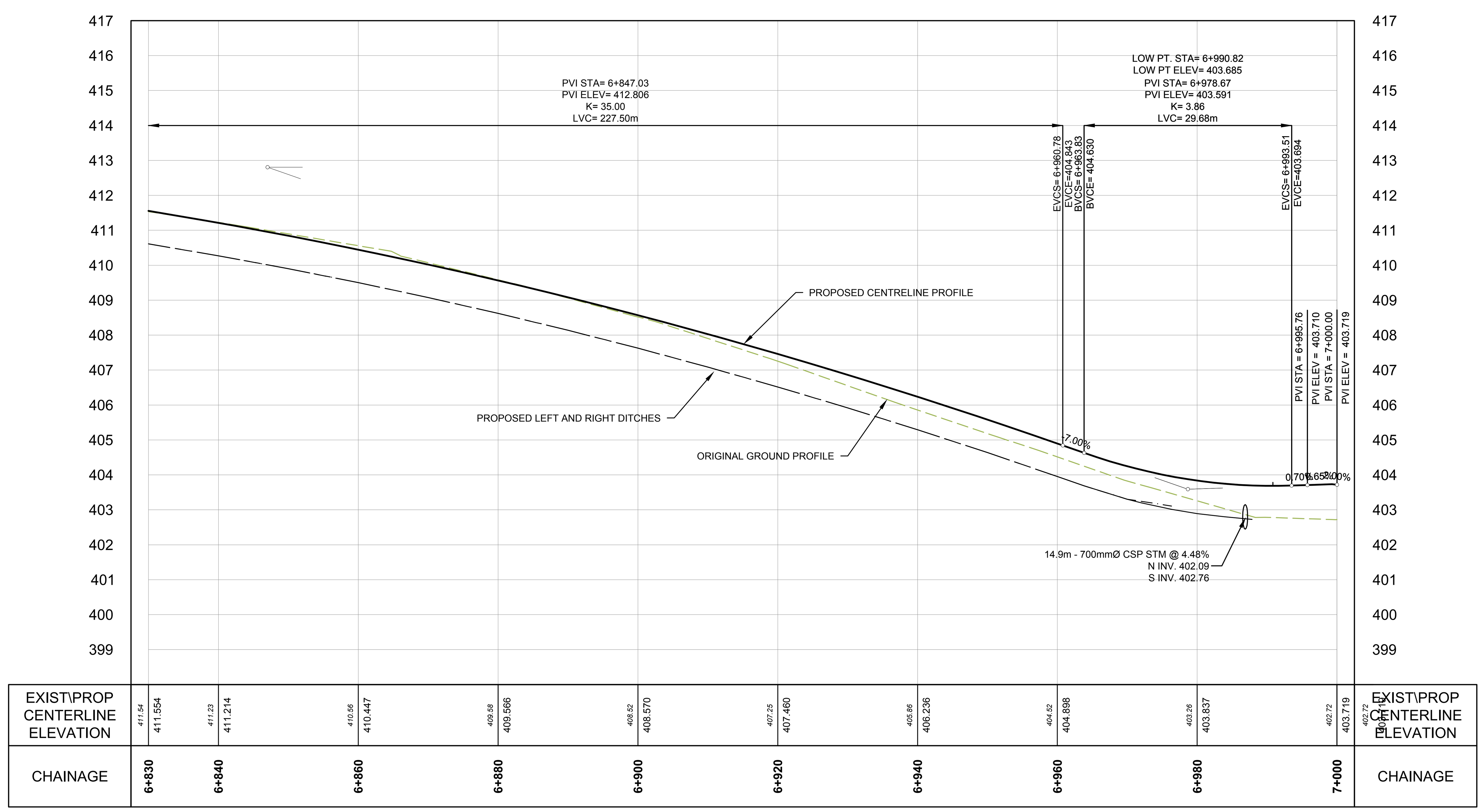

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CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION
AERIAL PLAN & PROFILE
SIDEROAD 26/27
6+830 TO 7+000

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AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	A008
Scale		Project No.		Revision No.	
H 1:500 V 1:100		300034587		14	

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[THE DIFFERENCE IS OUR PEOPLE]

Appendix F

SWM Report

Appendix F

Nottawasaga 26/27 Sideroad Stormwater Management Report

Township of Clearview

R.J. Burnside & Associates Limited
3 Ronell Crescent
Collingwood ON   L9Y 4J6 CANADA

October 2018
300034587.0000

Nottawasaga 26/27 Sideroad Stormwater Management Report
October 2018

Distribution List

No. of Hard Copies	PDF	Email	Organization Name
0	Yes		Township of Clearview (Client)
2	Yes	Yes	Nottawasaga Valley Conservation Authority (NVCA)

Record of Revisions

Revision	Date	Description
-	September 22, 2016	Initial Submission to NVCA.
1	October 15, 2018	Coir Logs Replaced with Silt Soxx

R.J. Burnside & Associates Limited

Report Prepared By:

LICENSED PROFESSIONAL ENGINEER
A. C. HOLVIK
100118965
Oct. 15, 2018
PROVINCE OF ONTARIO

Adrian Holvik, P.Eng.
Water Resources Engineer
ACH:sj

Report Reviewed By:

Don McNalty, P.Eng.
Vice President
DMcN:sj

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Disclaimer

1.0 Introduction

The following report has been compiled to illustrate the Stormwater Management Plan for the proposed improvements to 26/27 Sideroad. The plan addresses stormwater management comments and concerns presented to R.J. Burnside & Associates Limited (Burnside) and the Township of Clearview regarding the proposed improvements to 26/27 Sideroad. The comments, arising from their review of the Environmental Impact Study (EIS) have been provided by the Niagara Escarpment Commission (NEC), Nottawasaga Valley Conservation Authority (NVCA) and Ministry of Natural Resources and Forestry (MNRF). Grey-Sauble Conservation Authority (GSCA) also provided comments; however, they were satisfied with the initial findings of the Environmental Impact Study (EIS) submitted for this proposal.

The stormwater comments have been addressed below through the provision of a detailed Stormwater Management Plan.

This report considers the hydraulic impact of the proposed changes to crossing structures on the waterways and surrounding areas. The Stormwater Management Plan outlined in this report considers quality and quantity control requirements to protect the downstream natural environment. It also considers the hydrogeologic regime that is to be preserved in the proposed design.

The drainage areas are delineated for each proposed outlet to the natural environment in order to determine the corresponding peak flows. Drainage analyses in this report are completed to ensure existing drainage patterns will be maintained under the proposed conditions. The drainage analysis involves the hydrologic and hydraulic review of all road crossing culverts, driveway culverts, roadside ditches and outlets to drainage features from the right-of-way.

2.0 Background

The proposed improvement area on Sideroad 26/27 extends from Osprey-Clearview Townline to 10 Concession. Existing conditions for this road include a gravel surface with a narrow base which is not maintained throughout the winter months between the last residence on the western half of the road and 10 Concession. Road conditions vary between a typical low volume rural road and a narrow road platform with a heavily rutted surface. Surface water is inadequately conveyed through ditches that are either failing due to high flow velocities or through flow across the road surface, causing granular washout after road surface grading into the adjacent forested and aquatic habitats.

Topography in this area is very undulating with a mix of upland forest communities, fields and valleys. The extent of the improvement area is included within various levels of Niagara Escarpment Plan Areas (Natural Area, Protection Area, Rural Area and Parks and Open Space), which triggered the requirement for preparation of an EIS, which was originally submitted in August 2014 and updated in October 2018.

This report has been generally organized around the various outlet locations used to drain the reconstructed road. This is the logical method for organizing the report as the criteria and constraints associated with the receiving watercourse provide the majority of the criteria governing the stormwater management design. The proposed stormwater management design preserves existing catchment boundaries and makes use of existing outlets.

This report seeks to summarize the stormwater constraints and criteria arising from the surrounding natural environment as detailed in the EIS report and Department of Fisheries and Oceans (DFO) Request for Review provided in Appendix D of the Township of Clearview 26/27 Sideroad Proposed Road Improvements Environmental Impact Study (2018). It also summarizes road and stormwater management design constraints and criteria set by the policies and design standards which apply to this project. The report will demonstrate that the chosen design satisfies the project constraints and criteria.

The proposed stormwater management design addresses the following requirements for the proposed road reconstruction: quantity control; quality control; conveyance; erosion and sediment control. The design addresses these requirements of the road while simultaneously respecting the requirements of the natural environment surrounding the road.

26/27 Sideroad currently drains to the following existing outlets as shown on Figure 1, Calculated Catchments-Existing:

- Rob Roy Wetland located at the west limit of the project;
- Tributary B at approximately 26/27 Sideroad Sta. 5+920;
- Tributary C at approximately 26/27 Sideroad Sta. 6+120;
- Tributary A at the confluence of Tributaries A and C;
- Tributary D at approximately 26/27 Sideroad Sta. 6+510;
- Tributary E at approximately 26/27 Sideroad Sta. 6+760;
- The Concession 10 ditch at the east limit of the proposed reconstruction project.

The Rob Roy Wetland belongs to a provincially significant wetland complex and it is located within the Grey Sauble Conservation Authority jurisdiction. The remaining site outlets are located within NVCA jurisdiction.

The Rob Roy Wetland currently receives drainage from the existing gravel road via grassed fill slopes. Refer to the EIS for details with respect to the Rob Roy Wetland.

Tributaries B, C, D and E cross the existing 26/27 Sideroad via road crossing culverts located at the approximate Stations listed above. Refer to the plan and profile drawings for details. Fish were not found south of the road in the aquatic investigations supporting this project. The culvert and channel south of the crossings is therefore considered supporting habitat for fish and not direct habitat.

Tributary A runs adjacent to the north side of 26/27 Sideroad in the existing ditch alignment from roughly Sta. 6+140 to 6+160. A slight realignment is proposed for this section of Tributary A as detailed in the DFO Request for Review. Tributary A is considered direct fish habitat.

There are also wetlands which are located in certain places immediately adjacent to the road, presenting unique challenges to the stormwater management design, especially since it utilizes a rural cross-section with ditches instead of storm sewers. The proposed stormwater management design seeks to address these challenges through the use of quality control devices that treat stormwater as close to the source as possible prior to contact with the adjacent wetlands. The design will improve erosion control adjacent to the wetlands thereby minimizing any undermining of wetland flora as occurs in the existing condition. The stormwater conveyance design minimizes ditch depths and widths to minimize encroachment into wetland features. Refer to the EIS for more detail concerning wetlands located adjacent to the road.

The culvert crossing drainage areas were delineated by Burnside using MNR Digital Elevation Modelling and verified by field visit. The drainage areas are shown in Figure 1, Calculated Catchments-Existing.

All of the crossings were determined to flow from south to north and are ineffective due to poor condition, obstructions, and limited size. The Township proposes to replace and reinstate the culverts with their existing drainage patterns.

Proposed crossing structures are to ensure sufficient capacity following road reconstruction. Considerations for the selection of crossing structures include:

- Increase the waterway area to accommodate the design flow event while providing required vertical clearances;
- Increase waterway area to improve Emergency access during the Regional Storm Event;
- Increase waterway area to accommodate low flow channel and natural embedment for watercourse crossings;
- Minimize in-stream work, as there is no need for false-work or shoring. This also minimizes disruption to fish habitat both during and after construction;

- Minimize the associated disruption to adjacent property owners in terms of road alignment and profile as well as land acquisition requirements.

3.0 Design Criteria

Design criteria for 26/27 Sideroad are derived from Township of Clearview Engineering Standards (October 2007), Nottawasaga Valley Conservation Authority Stormwater Technical Guide (NVCASTG, December 2013), Nottawasaga Valley Conservation Authority Natural Hazards Technical Guide (NHTG, December 2013), the Ministry of the Environment Stormwater Management Planning and Design Manual (MOE SWMPDM, 2003). The Low Impact Development Stormwater Management Planning and Design Guide (LIDSWMDG, Credit Valley Conservation, Toronto and Region Conservation, 2010) and Grey to Green LID guide for road right of way (CVC,2016) have also been consulted for Low Impact Development (LID) quality control measures proposed to service the reconstructed road. Criteria and constraints for the stormwater management design have also been carried forward from the EIS and reflect the requirements of the Niagara Escarpment Plan. In addition, the Stormwater Management Plan addresses the Department of Fisheries and Oceans (DFO) criteria with respect to protection of fish and fish habitat.

3.1 Peak Flow

Post-development stormwater peak flow rates evaluated at the outlet shall not exceed the existing peak flow rates for the outlet as follows:

a) Control post-development flows to pre-development levels for the 2- to 100-year storm events (Table 1.1, NVCASTG).

3.2 Conveyance

26/27 Sideroad is classed as a rural arterial road. The minimum design criteria for ditches and culverts are as follows:

a) Ditches shall be sized to convey the 5 year storm (Township Standards, Section 6.9).

b) Road crossing culverts shall be designed to convey the 25 year storm with at least one lane width clear (Township Standards, Section 6.9).

c) Road crossing culverts shall be designed to convey the 100 year storm without exceeding the crown of the road (Township Standards, Section 6.9).

d) The design must provide safe conveyance of the Regulatory flow through the site (Table 1.1, NVCASTG).

e) To ensure safe access for emergency vehicles Regulatory flow shall not exceed 0.3 m depth or 1.7 m/s velocity for the travelled lanes of the road. The product of depth x velocity must be less than 0.4 m^2/s (NVCA NHTG, 2013).

3.3 Water Quality

This study considers the MOE Stormwater Management Planning and Design Manual (SWMPDM) where needed to maintain water quality conditions post-reconstruction. The Nottawasaga Valley Watershed Management Plan states that all work within their sub-watershed needs to preserve the integrity of the receiving water bodies as follows.

a) Enhanced level quality control as per the latest MOE SWMPDM is required (Table 1.1, NVCASTG).

This design criteria is also applied to the catchment draining to the Rob Roy Wetland within Grey-Sauble Conservation Authority jurisdiction. Enhanced stormwater quality control protection for 80% total suspended solids (TSS) removal is desired at all 26/27 Sideroad outlet locations. Additional considerations may require a ‘best fit’ approach given considerations for available land, small drainage areas, steep slopes and sections of open grassed ditch along many portions of the road reconstruction.

In addition to the stormwater management practices employed in the proposed Stormwater Management Strategy, the overall strategy uses rock check dams and sediment basins to reduce scour of ditches and outlets, thereby controlling erosion sediment at the source. These devices promote sediment settling of stormwater runoff and minimize erosion potential as discussed further in Section 4.

3.4 Fisheries

Field investigations and analyses were completed in support of this project to characterize the aquatic environment. The investigations and analyses are summarized in the technical memorandum “DFO Request for Review Support Document”. Refer to that document provided in Appendix D of the Township of Clearview 26/27 Sideroad Proposed Road Improvements Environmental Impact Study (2018) for more detail.

Five unnamed headwater tributaries of the Pretty River (referred to as Tributaries A through E) transect the right-of-way for Sideroad 26/27 within the Study Area. The following project components are expected to have direct or indirect impacts on one or more of the identified watercourses:

a) Minor realignment of approximately 22 m of Tributary A (between Stations 6+146.5 and 6+165; 18.5 m in length measured parallel to the right-of-way), to accommodate for road widening, within the existing right-of-way.

b) Replacement and extension of an existing CSP culvert conveying Tributary C at Station 6+125.

c) Replacement and extension of an existing CSP culvert conveying Tributary D at Station 6+510.

d) Replacement and extension of an existing CSP culvert conveying Tributary E at Station 6+765.

e) Relocation/reconfiguration of existing roadside surface drainage, partially fed by groundwater seeps, along the south side of Sideroad 26/27 throughout the Improvement Area.

In order to address the expected impacts on watercourses the following criteria are applied to the stormwater management design.

a) Where possible, the cross culvert design will provide access to upstream fish habitat where existing culverts act as a fish barrier.

b) Where applicable, mitigate potential thermal and bacteriological impacts; to minimize thermal impacts, preventative measures (e.g. low-impact development practices) and mitigation measures should be applied (Table 1.1, NVCASTG).

c) DFO coldwater timing windows apply, therefore in water works are permitted from July 1 to September 30 within cold-water streams supporting fish.

d) Culvert design should include the use of natural substrate to line the bottom of the culvert and create a low flow channel through the culvert.

e) Maintain water quality using enhanced level quality control.

f) Isolate the construction disturbance and provide sediment and erosion control to protect the watercourse from construction sediment.

3.5 Hydrogeology

In order to preserve the current groundwater/surface water conditions, the following conservative design criteria were utilized:

a) Maintain groundwater inputs to streams.

b) Maintain groundwater table in vicinity of protected wetlands.

c) Maintain current infiltration to emulate existing gravel road.

3.6 Niagara Escarpment Plan

Although many of the natural heritage aspects of the Niagara Escarpment Plan are also captured within the criteria already listed in sections 3.1-3.5 with respect to quality and quantity control, conveyance, fisheries and hydrogeology, the Niagara Escarpment Plan provides some additional criteria to the project. As with any natural heritage policy framework there is some overlap of the criteria provided by the various agencies having jurisdiction over this project. Noting that the overlap exists, and that this report is written seeking approval by the Niagara Escarpment Commission, it is appropriate to enumerate the criteria arising from the NEP to demonstrate how the proposed Stormwater Management Plan fits into the criteria derived from the Niagara Escarpment Plan. The 26/27 Sideroad stormwater related criteria derived from the Niagara Escarpment Plan are as follows:

a) Proposed development limits shall not extend past existing development limits.

b) Maintain existing drainage boundaries.

c) Maintain water quality using enhanced level quality control.

d) Provide quantity control for stormwater.

e) Provide erosion and sediment control.

f) Do not cause HADD.

g) Do not destroy SAR or endangered species or their habitat.

h) Provide sediment and erosion control to protect the watercourse from construction sediment.

This report demonstrates how the proposed Stormwater Management Plan respects all of the above criteria.

4.0 Stormwater Management Plan

There is no quality control provided for the existing road runoff. Currently runoff travels uncontrolled off of the existing road surface carrying large amounts of sediment with it into the receiving natural stream system, as evidenced by frequent heavy rutting, washouts and washboarding of the road. Refer to the photos contained in Appendix B showing erosion and road sediment during a rainfall event.

Through field observation, it appears that large quantities of road granulars are deposited in the downstream watercourse. It is assumed that coarser granulars settle out of the stream flow in the steeper headwater reaches and finer sediment, as shown in the photos of silty road runoff (Appendix B), is carried further downstream and is deposited in pools, and other lower velocity or lower gradient stream sections.

The proposed overall stormwater management strategy incorporates two main types of low impact development (LID) stormwater management practices, in a treatment train approach, to achieve enhanced quality control. The first method is a bioretention LID concept adapted to a rural road cross-section. The second is the use of enhanced grassed swales. Both methods receive good reviews in the CVC/TRCA LID Stormwater Management Planning and Design Guide for achieving quality control and water balance benefits.

According to the CVC/TRCA LID Stormwater Management Planning and Design Guide, "Performance results from both laboratory and field studies indicate that bioretention systems have the potential to be one of the most effective BMPs for pollutant removal (TRCA, 2009b). Bioretention provides effective removal for many pollutants as a result of sedimentation, filtering, soil adsorption, microbial processes and plant uptake."

Refer to Table 4.5.1 excerpted from the CVC TRCA LID Guide for details.

Table 4.5.1 Ability of bioretention to meet SWM objectives

BMP	Water Balance Benefit	Water Quality Improvement	Stream Channel Erosion Control Benefits
Bioretention with no underdrain	Yes	Yes – size for water quality storage requirement	Partial – based on available storage volume and infiltration rates
Bioretention with underdrain	Partial – based on available storage volume beneath the underdrain and soil infiltration rate	Yes – size for water quality storage requirement	Partial – based on available storage volume beneath the underdrain and soil infiltration rate
Bioretention with underdrain and impermeable liner	Partial – some volume reduction through evapotranspiration	Yes – size for water quality storage requirement	Partial – some volume reduction through evapotranspiration

Bioretention detains and infiltrates a portion of the stormwater that it receives and increases contact of stormwater with vegetation, the root zone and soil. It relies primarily on infiltration to achieve quality control. Pollutants are also removed through vegetative uptake.

Enhanced grassed swales similarly increase stormwater contact with vegetation and soil. They partially rely on infiltration to achieve quality control of stormwater. Enhanced grassed swales allow stormwater to infiltrate as they detain a portion of the stormwater behind check dams and allow it to infiltrate. Refer to Figure 4.8.2 excerpted from the CVC/TRCA LID Stormwater Management Planning and Design Guide, a photo of an enhanced grassed swale.

Figure 4.8.2 Enhanced grass swales feature check dams that temporarily pond runoff to increase pollutant retention and infiltration and decrease flow velocity

Enhanced grassed swales also slow down stormwater through the vegetated swale such that quiescent settling of particles can occur. Based on the CVC TRCA LID Stormwater Management Planning and Design Guide, "Median pollutant mass removal rates of swales from available performance studies are 76% for total suspended solids, 55% for total phosphorus, and 50% for total nitrogen (Deletic and Fletcher, 2006)." Furthermore, "Enhanced grass swales are well suited for conveying and treating runoff from highways and other roads because they are a linear practice and easily incorporated into road rights-of-way." Refer to detail "BSD-24 DRAFT, Typical Rock Check Dam Erosion Control Device" for check dam details. The note in the detail stating "100 mm of 50 mm clear stone cover" will be revised in the construction contract to reflect cover with a mixture of 50 mm clear stone and 150 to 300 mm stone to ensure the check dams stay in place under high flow conditions. The rock check dams are to be employed in series down the slope as shown in the photo above. The series will be located in all areas with ditch slopes exceeding 4%.

During the selection process for the quality control design several alternatives were compared to determine the stormwater management design that best satisfied the stormwater management criteria to protect the downstream natural environment.

A traditional stormwater management pond is inappropriate for this project as it takes up a significant amount of space. It would be necessary to destroy a large area of natural area adjacent to the right-of-way in order to site a traditional SWM pond. This not only defeats the purpose of the SWM facility, which is to protect the environment, it also violates the NEC criteria with respect to encroachment of development limits into NEC protected areas.

Oil-grit separators were considered as a potential alternative. They are often used in retrofit designs such as improvement of an existing road, where a quality control design must be fit into an existing right-of-way; however, oil-grit separators are more appropriate for a storm sewer system. They do not provide any water balance benefits, and they would not address the existing erosion issues in ditches.

A traditional pervious pipe system would not be appropriate for this project because there is a complex hydrogeological component to the existing site and in many areas a high groundwater table is present. A traditional pervious pipe system would likely act as an area drain, potentially resulting in drained wetlands adjacent to the road.

Similarly, an infiltration trench may be appropriate in a few select areas, but the risk of draining adjacent wetlands and the presence of high groundwater disqualified an infiltration trench design.

A vegetated filter strip encourages a shallow flow depth of stormwater over a large vegetated area. It encourages infiltration and contact with vegetation to reduce pollutants in stormwater. It is a good concept that respects many of the criteria; however, it is not possible to site on this project due to the steep existing topography and shallow groundwater depths. The Stormwater Management concept that was chosen achieves the same effect and is constructible in a steep environment.

Refer to Table 3.4.1 excerpted from the CVC/TRCA LID Stormwater Management Planning and Design Guide for an overview comparison of site constraints for various LID Stormwater Management practices.

Table 3.4.1 Comparison of site constraints for a range of structural LID SWM practices

LID Stormwater Management Practice	Depth to high water table or bedrock[1] (m)	Typical Ratio of Impervious Drainage Area to Treatment Facility Area	Native Soil Infiltration Rate (mm/hr)[3]	Head[4] (m)	Space[5] %	Slope[6] %	Pollution Hot Spots[7]	Set backs[8]
Rain barrel	Not applicable	[5 to 50 m^2][2]	Not applicable	1	0	NA	Yes	None
Cistern	1	[50 to 3000 m^2][2]	Not applicable	1 to 2	0 to 1	NA	Yes	U, T
Green roof	Not applicable	1:1	Not applicable	0	0	0	Yes	None
Roof downspout disconnection	Not applicable	[5 to 100 m^2][2]	Amend if < 15 mm/hr[9]	0.5	5 to 20	1 to 5	Yes	B
Soakaway, infiltration trench or chamber	1	5:1 to 20:1	Not a constraint	1 to 2	0 to 1	< 15%	No	B, U, T, W
Bioretention	1	5:1 to 15:1	Underdrain required if < 15 mm/hr	1 to 2	5 to 10	0 to 2	No	B, U, W
Biofilter (filtration only Bioretention design)	Not applicable	5:1	Not applicable	1 to 2	2 to 5	0 to 2	Yes	B, T
Vegetated filter strip	1	5:1	Amend if < 15 mm/hr[9]	0 to 1	15 to 20	1 to 5	No	None
Permeable pavement	1	1:1 to 1.2:1	Underdrain required if < 15 mm/hr	0.5 to 1	0	1 to 5	No	U, W
Enhanced grass swale	1	5:1 to 10:1	Not applicable	1 to 3	5 to 15	0.5 to 6	No	B, U
Dry swale	1	5:1 to 15:1	Underdrain required if < 15 mm/hr	1 to 3	5 to 10	0.5 to 6	No	B, U, W
Perforated pipe system	1	5:1 to 10:1	Not a constraint	1 to 3	0	< 15%	No	B, U, T, W

Notes:
1. Minimum depth between the base of the facility and the elevation of the seasonally high water table or top of bedrock.
2 Values for rain barrels, cisterns and roof downspout disconnection represent typical ranges for impervious drainage area treated.
3. Infiltration rate estimates based on measurements of hydraulic conductivity under field saturated conditions at the proposed location and depth of the practice.
4. Vertical distance between the inlet and outlet of the LID practice.
5. Percent of open pervious land on the site that is required for the LID practice.
6. Slope at the LID practice location.
7. Suitable in pollution hot spots or runoff source areas where land uses or activities have the potential to generate highly contaminated runoff (*e.g.*, vehicle fueling, servicing or demolition areas, outdoor storage or handling areas for hazardous materials and some heavy industry sites).
8. Setback codes: B = Building foundation; U = Underground utilities; T = Trees; W = drinking water wellhead protection areas.
9. Native soils should be tilled and amended with compost to improve infiltration rate, moisture retention capacity and fertility.

The proposed LID controls consisting of enhanced grass swales and bioretention are sized to provide enhanced quality control for road runoff prior to it entering the natural stream. Refer to Appendix C for quality control volume calculations. From Sta. 5+420 west ditch slopes are relatively flat and the ditch does not contain any watercourses, therefore this section of road is treated by enhanced grassed swales. Rock check dams are placed within the ditches to slow stormwater velocities and achieve the necessary retained stormwater volume to provide enhanced quality control. Refer to “Quality Control Calculations-Ditch Storage Calculations For Areas Treated by Enhanced Swales Only”, contained in Appendix C. From 26/27 Sideroad Sta. 5+420 east the bioretention level spreaders are to be constructed on both sides of the road and check dams are to be located in steep (greater than 4%) ditch sections.

In locations where bioretention is used, it is sized to exceed Ministry of Environment and Climate Change (MOECC) enhanced quality control requirements. Calculations confirming bioretention volumes are contained in Appendix C. Refer to calculation sheet titled, “Quality Control Calculations-Bioretention”.

The proposed ditches are modified to achieve an enhanced grass swale design by densely vegetating the ditch with native vegetation, installing a series of rock check dams as noted above and in select locations installing a perforated underdrain surrounded by a granular jacket. The design reduces swale velocities and erosion, it increases dissolved oxygen levels through the use of a series of cascading pools formed by the check dams and it increases infiltration.

The bioretention component of the quality control design consists of a series of level spreaders constructed of Filtrexx Silt Soxx (or similar tubular filter media device) attached to the side of the road embankment. The road embankment is to be restored with 75 mm topsoil. The embankment and level spreader is to be seeded with a native seed mix appropriate for riparian restoration. The silt soxx level spreader over time will be naturalized such that it will appear as a small vegetated berm on the road embankment. Following the naturalization process the soil and root system of the selected vegetation will successively take over the silt soxx level spreader to form the small berm. Similar concepts are employed in stream bank restoration projects as shown in the MNR Natural Hazards Manual. It is similar to the Live Fascine technique described in *River and Stream Systems: Erosion Hazard Limit*, Appendix 4 Biotechnical and Soil Bioengineering Methods (2002), wherein the successive vegetation stabilizes the bank. The MNR publication states:

> Live fascines perform several "living systems" and mechanical "protective" functions in the erosion control process and hydrology process as follows:
>
> - break up the slope length into a series of shorter slopes separated by benches;
> - provide surface stability for the planting or natural invasion and establishment of vegetation in the surrounding plant community, thus speed up the process of reestablishing functionality;
> - trap debris, seed, and vegetation on the slope face;
> - slow surface-water velocity and allow for more infiltration;
> - assist in drying excessively wet sites through transpiration as they root and produce top growth;
> - function as pole drains when placed at an angle on wet sites; and
> - reinforce the soil mantle via the root systems.

The level spreader intercepts road runoff, encouraging infiltration through the root zone and then the granular material of the road embankment prior to entering the enhanced swale. Vegetation on the enhanced grassed swale and level spreader addresses the existing erosion problem by stabilizing the road embankment. It encourages sheet flow, and intercepts pollutants. The proposed use of native species encourages native flora in the riparian zone. Refer to Figure C-010, Stormwater Management Concept for bioretention details.

The proposed ditch in a number of locations is at a higher elevation than the existing ditch. In order to mimic the existing ditch elevation, it is proposed that a perforated underdrain is to be placed in the existing ditch prior to placement of fill to create the new ditch. The underdrain will capture the ground water at the existing ditch elevation and daylight it to the enhanced grassed swale periodically as it descends the steep slope. The underdrain will be surrounded by a granular jacket to prevent clogging long term.

The proposed Stormwater Management Plan employing bioretention, enhanced grassed swales and select use of perforated underdrains satisfies the project criteria. It achieves enhanced quality control. It mimics the infiltration that occurs on the existing gravel road. It preserves cold groundwater inputs to downstream cool/coldwater fisheries. It is linear, controlling stormwater at the source thereby avoiding large land requirements into NEC protected lands which would be the typical result from traditional stormwater ponds. The proposed design considers NEC development limit criteria by limiting the development width to a cross-section width even narrower than the Township minimum.

5.0 Hydrology Methodology

5.1 General

The hydrological model SWMHYMO (Stormwater Management Hydrologic Modelling Software) was used to assess peak flows for the site. SWMHYMO is a derivative of the original HYMO program and is similar to the OTTHYMO89 model. SWMHYMO is recognized throughout the industry as being an effective method by which runoff can be determined based on topography, soil conditions and land use. The SWMHYMO model also has the capability of sizing attenuation facilities using a reservoir routing routine.

Due to the relatively large agricultural and wooded external areas draining to the Township road crossings, the catchment areas below 20% overall imperviousness were modelled using the NASHYD command; catchment areas with 20% or greater imperviousness were modelled using the STANDHYD command.

The relative change in imperviousness from pre-development to post-development conditions is marginal but accounted for in the proposed design hydrologic model.

The drainage limits for each catchment are determined from Geographical Information System (GIS) generated contour mapping based on MNR digital elevation modelling (SWOOP, 2010). In general, the topography is contoured in a south to north direction towards 26/27 Sideroad.

5.2 Soil Conditions

According to the Simcoe County soil map, prepared for the Department of Agriculture in 1959, the site catchment areas and external catchment areas consist of Otonabee, Osprey and Farmington loam in hydrologic soil group (HSG) B, and Muck (HSG D). Refer to the soils map on Figure 1, Calculated Catchments-Existing.

The Runoff Curve Number and initial abstraction value for the individual drainage areas were computed by calculating weighted curve numbers and initial abstraction based on the corresponding land use and soil type following the Nottawasaga Valley Conservation Authority Stormwater Technical Guide (2013) and NRCS, Urban Hydrology for Small Watersheds, Technical Release 55 (June 1986). The calculations for each drainage area are included in Appendix D. The hydrologic soil groups were determined in accordance with the Ontario Ministry of Transportation (MTO) soil classification system.

5.3 Land Use Patterns

Land use patterns of individual catchment areas are determined by field investigations and aerial photography. As illustrated in Figure 1, Calculated Catchments-Existing, three separate land use patterns are predominant in the drainage areas analyzed. Agricultural lands occupy a majority of the drainage area, followed by forested tracts, wetlands, and roadways. Other minor land uses include low-density residential. The land uses present within each corresponding drainage area are determined using the GIS and CAD techniques described in Section 6 and are applied as a percentage of the total drainage area for each catchment. Refer to Appendix D for land use data.

5.4 Rainfall Data

The 24-hour SCS Type-II Storm rainfall distributions govern the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year storm event calculations. The storm distribution is based on the Intensity Duration Frequency (IDF) data available from Environment Canada for the Owen Sound rain gauge station (2012). The Regional storm event is the Timmins historical storm event.

When comparing flows generated by the 24-hour SCS Type-II, and the 4-hour Chicago Storm Distributions, the 24-hour SCS Type-II storm distribution generated the highest peak flows for the drainage areas associated with the road cross culverts and as a result was used for design purposes.

5.5 Time of Concentration

The area weighted Rational runoff coefficient (C) determines whether the Airport Method or Bransby-Williams Method is used to calculate the time of concentration. For C less than 0.40, NVCA prescribes using the Airport method while the Bransby-Williams method is used when C is greater than or equal to 0.40. The time of concentration is a function of “time to peak” which represents the time from the beginning of rainfall to the peak of the runoff hydrograph. The time of concentration depends on the physical characteristics of the watershed, such as length, slope, area and surface cover. The required overland flow lengths and slopes are determined from topographic mapping. Refer to hydrologic calculations in Appendix D and topographic mapping shown on Figure 1**,** Calculated Catchments-Existing.

6.0 Hydrologic Modelling for Quantity Control Calculations and the Design of Culverts and Ditches

Hydrology parameters of the drainage areas are determined by overlaying sub-catchment areas with digital surficial soils information and land use. The area weighted hydrology parameters for each catchment are summarized in Table 1 below, and detailed in Appendix D.

Table 1 – Hydrologic Modelling Parameters for Catchments

Catchment ID	Area (ha)	Runoff Coefficient	Curve Number CNII	Initial Abstraction Ia (mm)	Time to Peak tp (h)
Existing Conditions					
4300-1	10.0	0.21	69	8.8	0.6
4300-1 ROW	0.9	0.35	78	5.7	0.5
5900-1	36.0	0.19	60	8.3	0.6
5900-1 ROW	2.4	0.31	70	5.9	0.6
6120-1	16.3	0.16	59	9.2	0.4
6120-1 ROW	0.4	0.29	68	6.3	0.2
6500-1	4.2	0.20	61	8	0.3
6500-1+3 ROW	0.8	0.30	69	6.1	0.4
6500-3	11.6	0.16	59	9.2	0.4
6760-1	9.1	0.20	61	8.1	0.4
6760-1 ROW	0.6	0.30	69	6.1	0.4
XCULV 2627-1	7.9	0.19	61	8.4	0.4
XCULV 2627-1 ROW	0.4	0.28	68	6.4	0.2

Table 1 (cont.) Hydrologic Modelling Parameters for Catchments

Catchment ID	Area (ha)	Runoff Coefficient	Curve Number CNII	Initial Abstraction Ia (mm)	Time to Peak tp (h)
Post Reconstruction					
4300-1	10.0	0.22	69	8.8	0.6
4300-1 ROW	0.9	0.56	71(pervious)	8.0(pervious)	STANDHYD
5900-1	36.0	0.19	60	8.3	0.6
5900-1 ROW	2.4	0.53	61(pervious)	8.0(pervious)	STANDHYD
6120-1	16.3	0.16	59	9.2	0.4
6120-1 ROW	0.4	0.53	61(pervious)	8.0(pervious)	STANDHYD
6500-1	4.2	0.20	61	8.0	0.3
6500-1+3 ROW	0.8	0.53	61(pervious)	8.0(pervious)	STANDHYD
6500-3	11.6	0.16	59	9.2	0.4
6760-1	9.1	0.20	61	8.1	0.4
6760-1 ROW	0.6	0.53	61(pervious)	8.0(pervious)	STANDHYD
XCULV 2627-1	7.9	0.19	61	8.4	0.4
XCULV 2627-1 ROW	0.4	0.53	61(pervious)	8.0(pervious)	STANDHYD

Using the drainage areas illustrated in Figure 1, Calculated Catchments-Existing, the hydrologic parameters summarized in Table 1 and the SWMHYMO modelling program, the total peak flows are determined for the 2-year, 5-year, 10-year, 25-year, 50-year, 100-year and Regional storm events.

Peak flows were determined for each of the existing site outlet locations. The existing site outlet locations are shown schematically on Figure 1, Calculated Catchments-Existing and in more detail on the plan and profile drawings for the proposed road reconstruction. Existing peak flow rates are summarized in Table 2.

Table 2 – Existing Peak Flow Rates at Existing Site Outlet Locations

Outlet Name								
Design Storm	**Return Frequency**	**Sta. 4+300 Rob Roy Wetland m^3/s**	**Trib. B m^3/s**	**Trib. C m^3/s**	**Trib. B+C Confluence m^3/s**	**Trib. D m^3/s**	**Trib. E m^3/s**	**Culvert Crossing 26/27 SR at 10 Conc. m^3/s**
SCS Type II Design Storm, 24 hour duration	2-year	0.12	0.31	0.16	0.46	0.18	0.11	0.09
	5-year	0.20	0.51	0.27	0.76	0.30	0.18	0.15
	10-year	0.26	0.67	0.36	0.99	0.39	0.23	0.20
	25-year	0.34	0.89	0.48	1.32	0.51	0.31	0.26
	50-year	0.40	1.06	0.58	1.59	0.62	0.37	0.31
	100-year	0.47	1.25	0.68	1.86	0.73	0.43	0.37
Chicago Design Storm, 4 hour duration	2-year	0.073	0.15	0.07	0.21	0.08	0.05	0.04
	5-year	0.12	0.30	0.14	0.43	0.16	0.10	0.08
	10-year	0.16	0.42	0.21	0.60	0.23	0.14	0.12
	25-year	0.23	0.60	0.30	0.87	0.33	0.20	0.17
	50-year	0.29	0.74	0.38	1.09	0.41	0.25	0.21
	100-year	0.34	0.90	0.47	1.31	0.50	0.31	0.26
Timmins Regional Storm		0.75	2.18	1.04	3.20	1.07	0.64	0.55

Refer to existing conditions hydrologic calculations in Appendix E for details.

As can be seen when comparing existing and proposed catchments in Table 1 there are no proposed changes to external areas. As such, the external area hydrologic parameters stay the same in the existing and proposed conditions modelling.

In the proposed condition modelling an assumed paved road surface 9.0 m wide is modelled for the entire length of 26/27 Sideroad from the Townline to Concession 10. The proposal is for a gravel road with the potential for paving depending on traffic volumes. The 9.0 m paved width represents the maximum potential paving scenario and is assumed throughout this report as a conservative (maximum) paved surface which must be considered in the stormwater management calculations. The proposed paving is the only significant change from existing to proposed conditions, as reflected in the impervious values found in Appendix D.

The Table 1, proposed parameters were entered into the proposed condition SWMHYMO model yielding the results shown in Table 3.

Table 3 – Proposed Peak Flow Rates at Existing Site Outlet Locations

		Outlet Name						
Design Storm	**Return Frequency**	**Sta. 4+300 Rob Roy Wetland m^3/s**	**Trib. B m^3/s**	**Trib. C m^3/s**	**Trib. B+C Confluence m^3/s**	**Trib. D m^3/s**	**Trib. E m^3/s**	**Culvert Crossing 26/27 SR at 10 Conc. m^3/s**
SCS Type II Design Storm, 24 hour duration	2-year	0.11	0.30	0.16	0.44	0.17	0.11	0.09
	5-year	0.18	0.49	0.27	0.73	0.28	0.17	0.15
	10-year	0.24	0.64	0.36	0.96	0.37	0.22	0.19
	25-year	0.31	0.85	0.47	1.28	0.49	0.29	0.26
	50-year	0.37	1.01	0.57	1.54	0.59	0.35	0.31
	100-year	0.43	1.19	0.67	1.80	0.70	0.41	0.36
Chicago Design Storm, 4 hour duration	2-year	0.09	0.25	0.07	0.29	0.09	0.06	0.04
	5-year	0.13	0.33	0.15	0.42	0.16	0.10	0.08
	10-year	0.15	0.41	0.21	0.60	0.22	0.14	0.12
	25-year	0.22	0.58	0.30	0.86	0.32	0.20	0.17
	50-year	0.27	0.72	0.38	1.07	0.41	0.25	0.21
	100-year	0.33	0.87	0.47	1.29	0.49	0.30	0.26
Timmins Regional Storm		0.73	2.14	1.04	3.14	1.05	0.63	0.54

Refer to proposed condition hydrologic calculations in Appendix E for details.

A comparison of Tables 2 and 3 reveals that proposed and existing peak flows are generally the same. The majority of storm events show a slight decrease in the proposed condition with the exception being the 2 and 5 year Chicago events which show a slight increase. The variance up or down is less than 0.1 m^3/s and is not considered significant relative to the quantity control criteria for this project. Therefore, the quantity control criteria for this project are satisfied.

7.0 Hydraulics Methodology

Road crossing culvert hydraulics were modeled using HY-8 to evaluate existing and proposed water elevations upstream of each cross culvert. However, if there may be upstream flood damage risks, the NVCA has noted HEC-RAS hydraulic modelling is to be used. There are no such areas within this study limit and as such HEC-RAS was not required.

According to the MTO evaluation of HY-8, “HY8 was developed by the United States Federal Highway Administration (FHWA) to automate the culvert design methods described in FHWA publications: HDS-5, "Hydraulic Design of Highway Culverts"; HEC-14, "Hydraulic Design of Energy Dissipators for Culverts and Channels"; and, HEC-19, "Hydrology".” MTO completed an analysis of the HY-8 software and concluded, “The analysis outlined in the DMM (MTO Drainage Management Manual) is

in line with the design methods found in HDS-5. The theory found in HY-8 can therefore be applied to culverts under MTO jurisdiction because of the similarities between the DMM and HDS-5."
(http://www.mto.gov.on.ca/english/publications/drainage/software/hy8.shtml, accessed August 5, 2016).

To analyze a culvert, HY-8 accepts inputs for flow rate, the geometry and roughness of the culvert and downstream channel as well as the top of the road geometry. Based on the inputs entered into the model, HY-8 determines the headwater elevation.

Mannings roughness coefficients of 0.024 and 0.013 were used to model CSP and smooth concrete culverts respectively (USEPA, Storm Water Management Model Users Manual, November 2004).

Mannings roughness coefficients for the downstream channel were selected based on the values found in *Open Channel Hydraulics* (Sturm, 2001).

Due to the steepness of the watershed it was assumed that backwater effects on the downstream channel are negligible.

Driveway culverts and ditches were modeled and evaluated for the 5-year storm event from flows pro-rated by area. Driveway culverts were analyzed using HY-8 software and ditches were analyzed using Hydraulic Toolbox, developed by the Federal Highways Administration based on HEC-22.

Within the study area, there are some existing driveway/entrance culverts to ensure continuity of the open ditch drainage system. For the analysis, driveway culverts located near the end of a long grade run are assessed as the "worst case" along the run. This; therefore, verifies the capacity for the culverts further upstream, where the drainage area is smaller.

8.0 Proposed Stormwater Management Design

Burnside completed a topographic survey to identify existing culvert inverts, roadway and driveway elevations, and existing topographic data. Details of the culvert crossings are provided in the plan and profile drawing set accompanying this report.

The proposed stormwater management design and each proposed structure (cross culvert, driveway culvert, ditch) is discussed in Sections 4 and 8.

Section 4 presents the stormwater management design proposed to service the road and protect the natural watercourses and wetlands downstream. Section 8:

- Provides an overview of each section of the site with relevant background information and applicable criteria;

- Identifies stormwater management (SWM) requirements/opportunities and presents the proposed SWM design;
- Demonstrates how each proposed ditch or culvert satisfies the applicable criteria.

8.1 Section of 26/27 Sideroad from Station 4+707 to Osprey-Clearview Townline Draining to the Rob Roy Wetland Complex

8.1.1 Overview of 26/27 Sideroad from Station 4+707 to Osprey-Clearview Townline

The westernmost portion of the proposed reconstruction project drains west toward the Rob Roy Wetland Complex regulated by GSCA. Details concerning this wetland complex are contained in the EIS written for this project. The existing road is gravel within this section of the project with poorly defined grassed ditches and driveway culverts to provide drainage for the road.

The proposal is for a paved road with enhanced swales as described in Section 4. The proposal represents an increase in impervious area draining to the wetland; therefore, quality control is proposed. The quality control design is calculated based on the entire road surface, not just the additional road surface, therefore the proposed stormwater management should improve water quality to the wetland.

Hydrologic calculations indicate that proposed peak flows to the wetland match existing conditions. As such quantity control criteria are satisfied. There are no existing watercourses crossing the road; therefore, conveyance or fisheries criteria normally associated with crossing structures do not apply to this portion of the proposed project.

Proposed enhanced grassed swales and driveway culverts are shown on the plan and profile drawings. The enhanced grassed swale and driveway culvert design satisfy the hydraulic criteria as discussed in Sections 8.6 and 8.7.

8.1.2 Hydraulics for Section of 26/27 Sideroad Station 4+707 to Osprey-Clearview Townline

8.1.2.1 Road Crossing Culverts

In the existing condition there are no cross culverts connecting the north and south ditches for the portion of the 26/27 Sideroad draining west. The Rob Roy Wetland located north and south of the road are not connected by an equalization culvert. There is the potential to place an eco passage or equalization culvert crossing 26/27 Sideroad connecting two cells of the Rob Roy Wetland. This culvert would not serve a hydraulic function and therefore would be sized based on ecological requirements, not hydraulic criteria.

8.1.2.2 Summary for Section of 26/27 Sideroad Station 4+707 to Osprey-Clearview Townline

The proposed stormwater management design satisfies the project criteria for the section of 26/27 Sideroad from Sta. 4+707 to Osprey-Clearview Townline. Catchment boundaries are preserved in the proposed design. The design does not increase runoff peak flow to the outlet. Enhanced grassed swales and driveway culverts convey the 5 year event thereby satisfying conveyance criteria. The proposed enhanced grassed swales provide enhanced quality control for road runoff prior to release to the natural environment. Fisheries criteria are also satisfied through the provision of quality and quantity control. Erosion and sediment control is proposed as per Section 9.

8.2 Section of 26/27 Sideroad from Station 4+707 to 6+127 Draining to Tributaries A, B and C

8.2.1 Overview of 26/27 Sideroad from Station 4+707 to 6+127

The high point of 26/27 Sideroad at Sta. 4+707 forms the division between water flowing toward the Rob Roy Wetland Complex under GSCA jurisdiction and water flowing to tributaries of the Pretty River under NVCA jurisdiction. 26/27 Sideroad from the high point east to the limit of construction falls under NVCA jurisdiction. There are 2 high-gradient headwater tributaries, Tributary B and Tributary C, that contribute flow to Tributary A adjacent to the existing road. A detailed description of Tributaries A, B and C is provided in the DFO Request for Review provided in Appendix D of the Township of Clearview 26/27 Sideroad Proposed Road Improvements Environmental Impact Study (2018).

Young-of-the-year (YOY) brook trout (*Salvenlinus fontinalis*) were observed in small, low-velocity pockets of water along the banks of Tributary A, within Reaches 2 and 3. Several larger individuals (juveniles and/or adults) were also noted in pool features. These observations confirm that Tributary A, adjacent to Clearview 26/27 Sideroad, provides coldwater habitat that supports a locally reproducing brook trout population.

No fish were observed in Tributaries B, C, D or E over the course of Burnside's on-site investigations. Given the condition of the existing culverts conveying flows beneath the existing road to Tributary A, they are likely acting as barriers to upstream fish passage during periods of low flow. Furthermore, the shallow, poorly defined, and organics-dominated channels typical of these tributaries do not provide high quality habitat for coldwater fish species. Although Burnside is unable to confirm whether fish can access these headwater areas during periods of high flow, they undoubtedly provide indirect fish habitat that benefits populated downstream reaches. In light of this, the proposed stormwater management design seeks to maintain or improve the function of the watercourses located upstream of the road and where feasible improve access to these areas by fish.

The existing 26/27 Sideroad has a gravel surface. It is roughly 5-6 m wide and has a rural cross section. The proposed road will consist of a 9 m pavement width draining to proposed enhanced swales. The existing ditches from Sta.4+707 to the edge of existing pavement are grassed and have moderate slopes. From there eastward the ditches are steep and are mainly bare earth undergoing active erosion due to steep slopes causing excessive flow velocities. Proposed enhanced swales from this point eastward will be improved with native vegetation and erosion control in the form of stepped rock check dams.

At roughly Sta. 5+400 it will be necessary in the proposed design to use culverts to connect the enhanced swale at the top of the escarpment to the enhanced swale descending the escarpment. The culverts are necessary to minimize the limits of grading required (elimination of the full ditch at this location reduces the cross-section width) in order to satisfy NEP criteria limiting proposed development to existing development limits.

As the road descends the steep section of the escarpment it intersects Tributary B part way down on the south side and then confluences with Tributary C near the toe of the slope. Tributary B currently flows north out of the wooded area south of the road and then turns east to join the south ditch of 26/27 Sideroad to flow to Tributary C. It joins Tributary C where Tributary C crosses 26/27 Sideroad. Tributary C then flows into Tributary A immediately north of the road. This drainage route is maintained in the proposed Stormwater Management design.

A slight realignment of roughly 20 m of Tributary A is proposed with this project. For roughly 20 m near to its confluence with Tributary C, Tributary A cuts in close to the existing road, such that it acts as the existing road north ditch. The proposed road necessitates a slight shift of this portion of Tributary A. The proposed realignment is detailed in the DFO Request for Review. Essentially the existing channel morphology is to be shifted 1-2 m north of its current location.

It should also be noted here that historically Tributary B is mapped flowing directly north across the road to confluence with Tributary A. There is an old washed out stream bed located a short distance upslope from the current Tributary B location south of the road. There is also an abandoned culvert location that corresponds with the mapped location of Tributary B. However, Tributary B now flows down the escarpment instead of across the escarpment following the south ditch of 26/27 Sideroad as described in the preceding paragraph. The old Tributary B channel south of the road is showing signs of new regrowth on the forest floor. The old channel banks and bed appear to be an erodible soil and it appears the originally channel form was dictated in part by tree roots. The migration of the channel downslope appears to have occurred spontaneously and given the erodible nature of the channel bank material it may happen again even if the channel were trained back to its original position. Therefore, it is proposed to abandon the old Tributary B crossing culvert. As it is infeasible to train Tributary B back to its original location the recommendation is to allow Tributary B to remain in its existing form and to improve its function.

Tributary B and C are not considered direct fish habitat, but are considered supporting habitat for cool/coldwater species in Tributary A. The form and function of the supportive fish habitat will be maintained or enhanced in the proposed condition. The existing heavily eroded ditch which forms a portion of Tributary B will be replaced with a series of permanent rock check dams cascading down the escarpment with improved riparian vegetative cover to improve both dissolved oxygen levels and mitigate thermal impacts of road runoff. Refer to the EIS and DFO Request for Review for details concerning Tributaries A, B and C.

There is no quality control provided for the existing road runoff. Currently runoff travels uncontrolled off of the existing road surface carrying large amounts of sediment with it into the receiving natural stream system, as evidenced by frequent heavy rutting, washouts and washboarding of the road. Refer to the photos contained in Appendix B showing erosion of road sediment during a rainfall event.

Through field observation, it appears that large quantities of road granulars are deposited in the downstream watercourse. Washouts are aggravated by the existing undersized and partially obstructed cross culvert for Tributary C. The obstruction in the culvert causes frequent overtopping of the gravel road and washouts.

LID controls consisting of enhanced swales with a bioretention component, are proposed to provide enhanced quality control and water balance benefits for road runoff prior to it entering the natural stream. The enhanced swales will consist of a series of rock check dams placed in vegetated ditches descending the escarpment complete with a perforated underdrain surrounded by a granular jacket. The design reduces stream velocities and resulting erosion, it increases dissolved oxygen levels through the use of a series of cascading pools. The bioretention component of the quality control design consists of a series of level spreaders constructed of densely vegetated silt soxx attached to the road embankment. The road embankment is to be restored with 75 mm topsoil. The embankment and level spreader is to be seeded with a native seed mix appropriate for riparian restoration. The silt soxx level spreader, over time, will be naturalized such that it will appear as a small vegetated berm on the road embankment. The level spreader intercepts road runoff, encouraging infiltration through the root zone and then the granular material of the road embankment prior to entering the enhanced swale. Vegetation on the restored embankment and level spreader addresses the existing erosion problem by stabilizing the road embankment. It encourages sheet flow, and intercepts pollutants. The use of native species encourages native flora and fauna in the riparian zone. Refer to Section 4 for details.

Descending the steep portion of the escarpment the proposed ditch in a number of locations, is at a higher elevation than the existing ditch. In order to mimic the existing hydrogeological conditions, it is proposed that a perforated underdrain is to be placed in the existing ditch prior to placement of fill to create the new ditch. The underdrain will capture ground water at the existing ditch elevation and daylight it to the enhanced grassed swale periodically as it descends the steep slope. The underdrain will be surrounded by a granular jacket to prevent clogging long term.

The proposed crossing of Tributary C will be improved by replacing the existing undersized CSP culvert with an 1800 x 1500 mm concrete box culvert as described in section 8.2.2. In the existing condition the alignment of the culvert causes Tributary C to confluence with Tributary A at nearly right angles which increases the risk of scour of the Tributary A stream banks. The proposed culvert alignment adjusts the angle to roughly 45 degrees to reduce potential scour.

Natural substrate material will be used to line the culvert and a low flow channel will be provided in the proposed condition. Isolation of the site will be achieved through the erosion and sediment control and construction staging proposed on C-012 to C-014.

The downstream end of this culvert marks the confluence of Tributaries C and A. Hydrologic calculations were completed to evaluate peak flows at this point. The hydrologic calculations demonstrate that there is no significant change in peak flows from existing to proposed conditions, therefore the peak flow criteria are satisfied and there is no need to devise a separate quantity control facility to control peak flows to pre-development levels. Refer to detailed hydrologic modelling results in Section 6.

As mentioned above, the proposal is to protect the south ditch of 26/27 Sideroad from erosion, and strategically place rock check dams in the ditch as it descends the escarpment to dissipate energy and improve oxygenation of water as it flows down the escarpment. The proposed design of the south ditch will mimic the function of the stepped pools which occur in Tributary A as it descends the escarpment north of the right-of-way.

It is proposed that any areas graded to create the proposed south ditch will be restored with native vegetation appropriate to the groundwater and soil conditions to achieve improved riparian vegetation density. When this is considered in conjunction with the fact that the offset to proposed drip line from the centreline of the ditch will be roughly the same as existing conditions, it is anticipated that the shading of the channel will be better than existing conditions. This is one of the proposed mitigation strategies employed in the proposed stormwater management design.

8.2.2 Hydraulics for Section of 26/27 Sideroad Station 4+707 to 6+127

8.2.2.1 Road Crossing Culverts

The existing culvert crossing 26/27 Sideroad at Sta. 6+128 conveys Tributary C from south to north under the road. As discussed in Section 8.2.1, the existing confluence of Tributaries B into C is located just upstream of this culvert crossing; therefore, this culvert crossing conveys the combined flows from Tributaries B and C. The existing culvert also collects drainage from the south ditch of 26/27 Sideroad.

The existing 500 mm diameter CSP culvert has insufficient capacity. The 25 year storm surcharges the culvert and the Regional storm event overtops the roadway. The proposed road centerline elevation has been raised slightly and an 1800 x 1500 mm (w x h) box culvert is proposed to replace the existing culvert. The proposed design satisfies the requirement to pass the 25 year storm without surcharging, and the 100 year storm while maintaining one travel lane in the dry. It also satisfies the requirement to pass the Regional Storm with less than 0.3 m flood depth over the road and a depth x velocity product of less than 0.4 m^2/s. Table 4 summarizes the hydraulic characteristics of the crossing.

Table 4 – Culvert at Sta. 6+128 Hydraulic Headwater Elevations

	Existing	**Proposed (6+136)**
Culvert Description	500 mm ø CSP	1800 x 1500 mm (wxh) Conc. Box
Upstream Invert (m)	429.33	429.45 (R) 428.85 (P)
Downstream Invert (m)	428.96	428.05 (R) 427.45 (P)
Length (m)	10.74	28.00
Design Event		
25-Year Flood Elevation (m)	430.36 (1.32 cms)	430.06 (1.28 cms)
50-Year Flood Elevation (m)	430.39 (1.59 cms)	430.18 (1.56 cms)
100-Year Flood Elevation (m)	430.41 (1.86 cms)	430.25 (1.80 cms)
Regional Flood Elevation (m)	430.52 (3.20 cms) (1)	430.51 (3.14 cms) (1)
Culvert Upstream Obvert (m)	429.83	430.35
Low Point Top-of Road (m)	430.2	430.4

(R) = Riverstone Invert
(P) = Precast Invert
(1) Assumes 10 m flow width for road overtopping; Flow spills east prior to overtopping road

Table 4 demonstrates that the proposed culvert provides capacity to pass the 25 year event without surcharging, and the 100 year event with more than a lane width in the dry. The theoretical flow depth over the road in the Regional Event is 0.1 m (less than 0.3 m). Using a conservative flow width of 10 m over the road the velocity is 0.6 m/s (0.6 m^3s/ (10*0.1) m^2), giving a depth x velocity product of 0.06 m^2/s (<0.4 m^2/s). This satisfies the hydraulic and emergency access criteria for the culvert.

The proposed structure contains 0.6 m depth of riverstone and a 0.15 m deep low flow channel, thereby satisfying fisheries criteria. Buried within the riverstone embedment will be a 200 mm diameter pipe with perforations. This pipe conveys cool groundwater from the proposed perforated under drain installed at the existing ditch elevation descending the escarpment and allows it to upwell from the riverstone embedment. This enhancement improves fisheries habitat relative to the existing CSP culvert. It preserves the groundwater input into the coldwater stream and mitigates thermal impacts of paving the road. Refer to explanation of the perforated underdrain in Section 4 for more details.

8.2.3 Summary for Section of 26/27 Sideroad Station 4+707 to 6+127

The proposed stormwater management design satisfies the project criteria for the section of 26/27 Sideroad from Sta. 4+707 to 6+127. The proposed design preserves existing catchment boundaries. It does not cause a significant increase in peak flows to the outlet. Enhanced grassed swales and driveway culverts convey the 5 year event. The Tributary C crossing satisfies the 25 year, 100 year and Regional Storm Criteria. It also satisfies fisheries criteria. The proposed stormwater management design preserves or improves oxygenation and coldwater inputs to Tributaries B, C and A. The proposed Tributary C crossing provides improved access to potential fish habitat south of the road. The proposed bioretention LID and enhanced grassed swales provide enhanced quality control for road runoff prior to release to the natural environment. Existing hydrogeological conditions are preserved by placing perforated pipe in existing ditch inverts prior to filling any ditches. Erosion and sediment control is to be provided as per Section 9.

8.3 Section of 26/27 Sideroad from Station 6+127 to 6+510 Draining to Tributary D

8.3.1 Overview of 26/27 Sideroad from Station 6+127 to 6+510 Draining to Tributary D

Further east along the road alignment, there are two additional watercourse crossings (Tributary D and E) that contribute flow to Tributary A north of the Study Area. Tributary D is a first-order stream conveyed beneath 26/27 Sideroad via an existing CSP (Site 4; Sta. 6+510; Photo 1 and 3). Within the right-of-way, the Tributary D channel is dominated by organics, silt and sand substrates with dense aquatic/wetland vegetation upstream. No fish were observed at this site during field investigations, but access from downstream areas may be possible.

Tributary E is a first-order stream conveyed beneath 26/27 Sideroad via a partially obstructed CSP with a perched outlet which is a permanent barrier to fish movement (Site 5; Stn. 6+765; Photo 2). The upstream channel is dominating by organic substrates and very little flow was noted.

Photo 1: Tributary D downstream (north) of 26/27 Sideroad (May 22, 2014)

Photo 2: Perched outlet of culvert conveying Tributary E, downstream (north) of 26/27 Side Road (May 22, 2014)

Photo 3: Inlet of culvert conveying Tributary D, upstream (south) of 26/27 Side Road (May 22, 2014)

No fish were observed in Tributaries B, C, D or E over the course of Burnside's on-site investigations. Given the condition of the existing culverts conveying flows beneath the existing road to Tributary A, they are likely acting as barriers to upstream fish passage during periods of low flow. Furthermore, the shallow, poorly defined, and organics-dominated channels typical of these tributaries do not provide high quality habitat for coldwater fish species. Although we are unable to confirm whether fish can access these headwater areas during periods of high flow, they undoubtedly provide indirect fish habitat that benefits populated downstream reaches.

It is proposed that enhanced quality control be provided for road runoff using the bioretention LID and enhanced vegetated swale design described in section 4 prior to release to Tributary D. In addition, the proposed Tributary D culvert crossing represents a dramatic improvement in cross-sectional area, embedment and fish access relative to existing conditions as described in Section 8.3.2.

8.3.2 Hydraulics for Section of 26/27 Sideroad from Station 6+127 to 6+510 Draining to Tributary D

8.3.2.1 Road Crossing Culverts

The existing culvert crossing 26/27 Sideroad at Sta. 6+508 conveys Tributary D from south to north under the road. It also collects drainage from the south ditch of 26/27 Sideroad.

The existing 600 mm diameter CSP culvert has insufficient capacity. The 25 year storm surcharges the culvert and the Regional storm event overtops the roadway. The proposed road centerline elevation has been raised and an 1800 x 1500 mm (w x h) box culvert is proposed to replace the existing culvert. The proposed design passes the 25 year storm with only minor surcharging. It satisfies the requirement to convey the 100 year storm while maintaining one travel lane in the dry. It also satisfies the requirement to pass the Regional Storm with less than 0.3 m flood depth over the road and a depth x velocity product of less than 0.4 m^2/s. Table 5 summarizes the hydraulic characteristics.

Table 5 – Culvert at Sta. 6+508 Hydraulic Headwater Elevations

	Existing	**Proposed**
Culvert Description	600 mm ø CSP	1800 x 1500 mm (wxh) Conc. Box
Upstream Invert (m)	414.96	416.00 (R) 415.40 (P)
Downstream Invert (m)	414.46	414.90 (R) 414.30 (P)
Length (m)	9.49	24.0
Design Event		
25-Year Flood Elevation (m)	415.87 (0.51 cms) (1)	416.29 (0.49 cms)
50-Year Flood Elevation (m)	415.90 (0.62 cms) (1)	416.33 (0.59 cms)
100-Year Flood Elevation (m)	415.92 (0.73 cms) (1)	416.36 (0.70 cms)
Regional Flood Elevation (m)	415.96 (1.07 cms) (1)	416.48 (1.05 cms)
Culvert Upstream Obvert (m)	415.56	416.9
Low Point Top-of Road (m)	415.86	417.7

(R) = Riverstone Invert
(P) = Precast Invert
(1) Assumes 10 m flow width for road overtopping; Flow spills east prior to overtopping road

Table 5 shows very minor surcharging (0.06 m) under the 25 year event. It should be noted that the HY-8 calculation neglects any hydraulic capacity in the low flow channel; therefore the 0.06 m depth of surcharge does not justify increasing the culvert size, especially in light of the fact that the culvert satisfies the remaining culvert hydraulic and emergency access criteria. Table 5 demonstrates that the proposed culvert provides capacity to pass both the 100 year and Regional event with both travel lanes in the dry.

The proposed structure contains 1.2 m depth riverstone and a 0.15 m deep low flow channel, thereby satisfying fisheries criteria.

8.3.3 Summary for Section of 26/27 Sideroad from Station 6+127 to 6+510 Draining to Tributary D

The proposed stormwater management design satisfies the project criteria for the section of 26/27 Sideroad from Sta. 6+127 to 6+510. The proposed design preserves existing catchment boundaries. It does not cause a significant increase in peak flows to the outlet. Grassed swales convey the 5 year event. The Tributary D crossing only slightly surcharges in the 25 year event. It satisfies the 100 year and Regional Storm criteria. It also satisfies fisheries criteria. The proposed Tributary D crossing provides improved access to fish habitat south of the road. The proposed bioretention LID and grassed swales provide enhanced quality control for road runoff prior to release to the natural environment. Erosion and sediment control is proposed as per Section 9.

8.4 Section of 26/2 Sideroad from Station 6+510 to 6+767 Draining to Tributary E

8.4.1 Overview of 26/27 Sideroad from Station 6+510 to 6+767 Draining to Tributary E

The existing road from Sta.6+510 to 6+767 has a gravel surface and is drained via poorly defined ditches on both sides of the road. The ditches drain to Tributary E as described in the DFO request for review provided in Appendix D of the Township of Clearview 26/27 Sideroad Proposed Road Improvements Environmental Impact Study (2018).

As described in Section 8.3, Tributary E is conveyed beneath 26/27 Sideroad via a partially obstructed CSP with a perched outlet which is a permanent barrier to fish movement (Site 5; Stn 6+765; Photo 4). The upstream channel is dominating by organic substrates and very little flow was noted.

Photo 4: Perched outlet of culvert conveying Tributary E, downstream (north) of 26/27 Side Road (May 22, 2014)

No fish were observed in Tributary E over the course of Burnside’s on-site investigations. Furthermore, the shallow, poorly defined, and organics-dominated channels did not provide high quality habitat for coldwater fish species. Although Burnside was unable to confirm whether fish can access these headwater areas during periods of high flow, they undoubtedly provide indirect fish habitat that benefits populated downstream reaches. The existing channel elevations from the south side of the right of way to the north side represent a channel slope exceeding 15%. Therefore, the proposed replacement culvert at this location does not include riverstone embedment, nor is fish passage considered in the design.

The proposed culvert crossing will result in slightly reduced velocities at the downstream end of the culvert due to a larger cross-sectional area.

Proposed improvements to road drainage conditions include bioretention LID and grassed swales to provide enhanced quality control of runoff as per section 4 prior to release to Tributary E. Proposed grassed swales are designed to pass the 5 year event.

8.4.2 Hydraulics for Section of 26/27 Sideroad from Station 6+510 to 6+767 Draining to Tributary E

8.4.2.1 Road Crossing Culverts

The existing culvert crossing 26/27 Sideroad at Sta. 6+765 conveys Tributary E from south to north under the road. It also collects drainage from the south ditch of 26/27 Sideroad.

The existing 500 mm diameter CSP culvert has insufficient capacity. The 25 year storm surcharges the culvert. The proposed road centerline elevation has been raised and a 600 mm diameter CSP culvert is proposed to replace the existing culvert. The proposed design satisfies the requirement to pass the 25 year storm without surcharging, and the 100 year storm while maintaining one travel lane in the dry. It also satisfies the requirement to pass the Regional Storm with less than 0.3 m flood depth over the road and a depth x velocity product of less than 0.4 m^2/s. Table 6 summarizes the hydraulic characteristics of the crossing.

Table 6 – Culvert at Sta. 6+765 Hydraulic Headwater Elevations

	Existing	**Proposed**
Culvert Description	500 mm ø CSP	600 mm ø CSP
Upstream Invert (m)	410.79	412.04
Downstream Invert (m)	410.28	410.29
Length (m)	9.56	16.76
Design Event		
25-Year Flood Elevation (m)	411.54 (0.31 cms)	412.58 (0.29 cms)
50-Year Flood Elevation (m)	411.61 (0.37 cms) (1)	412.69 (0.35 cms)
100-Year Flood Elevation (m)	411.62 (0.43 cms) (1)	412.77 (0.41 cms)
Regional Flood Elevation (m)	411.66 (0.64 cms) (1)	413.08 (0.63 cms)
Culvert Upstream Obvert (m)	411.29	412.64
Low Point Top-of Road (m)	411.59	413.05

(1) Assumes 10 m flow width for road overtopping; Flow spills east prior to overtopping road

Table 6 demonstrates that the proposed culvert provides capacity to pass the 25 year event without surcharging, and the 100 year event with more than a lane width in the dry. The theoretical flow depth over the road in the Regional Event is 0.03 m (less than 0.3 m). This satisfies the hydraulic and emergency access criteria for the culvert.

The existing channel is steep and shallow at this location and the upstream watercourse does not provide high quality habitat for coldwater fish species; therefore, there is no value in adding native substrate to this culvert.

8.4.3 Summary for Section of 26/27 Sideroad from Station 6+510 to 6+767 Draining to Tributary E

The proposed stormwater management design satisfies the project criteria for the section of 26/27 Sideroad from Sta. 6+510 to 6+767. The proposed design preserves existing catchment boundaries. It does not cause a significant increase in peak flows to the outlet. Grassed swales convey the 5 year event. The Tributary E crossing satisfies the 25 year, 100 year and Regional Storm criteria. The proposed bioretention LID and grassed swales provide enhanced quality control for road runoff prior to release to the natural environment. Erosion and sediment control is proposed as per Section 9.

8.5 Section of 26/27 Sideroad from Station 6+767 to Nottawasaga Concession 10

8.5.1 Overview of 26/27 Sideroad from Station 6+767 to Nottawasaga Concession 10

The existing road from Sta.6+510 to 6+767 has a gravel surface and is drained via poorly defined ditches on both sides of the road. The ditches drain to the Concession 10 ditch which drains north. Quantity control and enhanced quality control criteria, as well as conveyance criteria apply to this section of 26/27 Sideroad; however, fisheries criteria do not apply as it does not contain a watercourse.

The proposed road will have a paved surface 9.0 m wide. Proposed bioretention and grass swales will provide “enhanced” quality control of stormwater runoff from the road prior to outletting to the Concession 10 ditch, as described in Section 4.

The proposed road reconstruction does not increase peak flows to the outlet; thereby satisfying the quantity control criteria for the project.

8.5.2 Hydraulics for Section of 26/27 Sideroad from Station 6+767 to Nottawasaga Concession 10

8.5.2.1 Road Crossing Culverts

The existing 500 mm diameter CSP culvert located just west of the intersection of 26/27 Sideroad and Nottawasaga Concession 10 collects drainage from the south ditch of 26/27 Sideroad and the west ditch of Nottawasaga Concession 10 conveying it north to the Nottawasaga Concession 10 west ditch. It has sufficient capacity to satisfy the project criteria; however, the proposed road centerline elevation has been raised, necessitating replacement of the existing culvert. A 700 mm diameter CSP culvert is proposed to replace the existing culvert. The proposed design satisfies the requirement to pass the 25 year storm without surcharging, and the 100 year storm while maintaining one travel lane in the dry. It also satisfies the requirement to pass the Regional Storm with less than 0.3 m flood depth over the road and a depth x velocity product of less than 0.4 m^2/s. Table 7 summarizes the hydraulic characteristics of the crossing.

Table 7 – Culvert at Sta. 6+994 (Outletting to Concession 10 Ditch) Hydraulic Headwater Elevations

	Existing	**Proposed**
Culvert Description	600 mm ø CSP	700 mm ø CSP
Upstream Invert (m)	401.56	402.98
Downstream Invert (m)	400.65	402.02
Length (m)	13.38	15.06
Design Event		
25-Year Flood Elevation (m)	402.14 (0.26 cms)	403.44 (0.26 cms)
50-Year Flood Elevation (m)	402.24 (0.31 cms)	403.51 (0.31 cms) (1)
100-Year Flood Elevation (m)	402.35 (0.37 cms)	403.55 (0.36 cms) (1)
Regional Flood Elevation (m)	402.80 (0.55 cms)	403.64 (0.54 cms) (1)
Culvert Upstream Obvert (m)	402.16	403.68
Low Point Top-of Road (m)	402.8	403.6

(1) Assumes 10 m flow width for road overtopping

Table 7 demonstrates that the proposed culvert provides capacity to pass the 25 year event without surcharging, and the 100 year event with more than a lane width in the dry. The theoretical flow depth over the road in the Regional Event is 0.04 m (less than 0.3 m). This satisfies the hydraulic and emergency access criteria for the culvert.

Natural stone embedment is not proposed for this culvert as it is not located on a watercourse.

8.5.3 Summary for Section of 26/27 Sideroad from Station 6+767 to Nottawasaga Concession 10

The proposed stormwater management design satisfies the project criteria for the section of 26/27 Sideroad from Sta. 6+767 to Concession 10. The proposed design preserves existing catchment boundaries. It does not cause a significant increase in peak flows to the outlet. Grassed swales convey the 5 year event. The Tributary E crossing satisfies the 25 year, 100 year and Regional Storm criteria. The proposed bioretention LID and grassed swales provide enhanced quality control for road runoff prior to release to the natural environment. Erosion and sediment control is proposed as per Section 9.

8.6 Driveway Culverts

Proposed culverts were evaluated using HY-8 modelling software, to determine their ability to convey the 5 year event as per the project criteria.

As noted in Section 5, driveway culverts located near the end of a long grade run are assessed as the "worst case" along the run. Table 8 summarizes the findings from the HY-8 calculations included in Appendix F.

All driveway culverts within the study area are proposed to be replaced with minimum 500 mm diameter corrugated steel pipe culverts unless specified otherwise in the table below. Culverts within the same ditch run as those listed in Table 8 shall be constructed with the same diameter CSP as those listed in Table 8.

Driveway culverts are to be sized to pass the 5-year runoff event with a minimum of 0.30 m freeboard. The table below summarizes the proposed culverts for each driveway.

The analysis was completed using 5 year peak flows pro-rated according to distance away from the outlet. It is assumed that a culvert located at the high point along the road receives 0% of the peak flow generated by the catchment; whereas a culvert located at the outlet receives 100% of the peak flow.

Table 8 – Proposed Driveway Culvert Inventory

Driveway Location (Road Chainage)	Road Side	5-yr Flow (m^3/s)	Proposed				
			Dia (mm)	Length (m)	Min. Slope (%)	Capacity (m^3/s)	Freeboard (m)
5+120	SOUTH	0.1	600	15	1.2	0.2	0.30
5+350	NORTH	0.3	600	77	4.1	0.3	0.30
5+780	SOUTH	0.5	700	70	12.1	0.5	0.30

Table 8 demonstrates that the above captioned culverts convey the 5 year peak flow with 0.3 m freeboard. As the above listed driveway culverts represent the worst case culverts, all of the proposed driveway culverts satisfy the ditch and driveway culvert criteria.

8.7 Grassed Swale Hydraulic Capacity

26/27 Sideroad ditches are to be sized to convey at least the 5 year storm runoff peak flow. Table 9 summarizes the ditch section geometry and the minimum ditch depth required. All ditch capacity calculations assume 2:1 side slopes, a triangular cross-section, and a Manning's roughness coefficient of 0.035. Peak flows are prorated similar to the method used for the driveway culvert capacity calculations.

Table 9 – Proposed Ditch Inventory

Ditch Location (Road Chainage)	Road Side	5-yr Flow (m^3/s)	Slope (%)	Minimum Depth Required (m)
4+440	SOUTH	0.2	0.35	0.45
4+620	SOUTH	0.1	2.0	0.24
4+920	SOUTH	0.13	1.3	0.28
5+160	SOUTH	0.25	0.3	0.47
6+120	SOUTH	0.7	3.6	0.44
6+500	SOUTH	0.3	2.5	0.34
6+760	SOUTH	0.2	0.5	0.40
6+980	SOUTH	0.15	7.0	0.22

To confirm capacity of the proposed ditches, conservative sections were chosen along with conservative peak flows. Instead of exhaustively calculating the hydraulic capacity of each ditch section within the limits of the study, only the most conservative (worst case) sections were chosen for analysis. For example, the sections with the lowest slope along the centreline of the ditch; and the sections receiving the highest peak flow runoff.

The hydraulic modelling program Hydraulic Toolbox (HEC-22) was used to calculate hydraulic capacity for each representative ditch section. The modelling results were compared with the 5 year peak flow results from SWMHYMO, to ensure the 5 year storm runoff can be contained in the ditch. In some instances, where only a portion of the catchment drains to the particular ditch section, peak flows from SWMHYMO are pro-rated.

For sections of grassed swale that exceed 4% longitudinal slope, a series of check dams are proposed. Within the project limits the grassed swales exceeding 4% slope are between Sta. 5+440 and 6+120, and from Sta. 6+860 to Concession 10. The assumed check dam height is 0.5 m. Given 2:1 side slopes in the enhanced swales, the crest width for a given check dam is 2.0 m. Based on the weir calculation provided in Appendix F, a 0.3 m clearance is recommended from the check dam crest elevation to the edge of paving. 0.3 m flow depth over the check dam will provide 0.7 m^3/s capacity, thereby conveying the maximum 5 year peak flow found in the hydrologic modelling for the project area.

Based on the above analysis, it was found that all ditches have adequate hydraulic capacity. The hydraulic capacity calculations are included in Appendix F.

9.0 Erosion and Sediment Control

9.1 Temporary Erosion and Sediment Control

Site isolation plans were developed specifically to protect Tributaries A, B, C and D during construction phases until the site greens up. Please refer to Drawings C-011 to C-014 for details concerning protection of these outlets.

For the remainder of the site, the recommended erosion and sediment control during construction consists of the following:

- Complete the works in phases;
- Retain existing vegetation as much as possible;
- Re-vegetation immediately upon completion of earthworks;
- Install temporary check dams in ditches and maintain until vegetation matures;
- Install heavy duty silt fencing in all locations where sheet flow leaves the site;
- When required install slope stabilization methods;
- Inspect erosion and sediment control works weekly and following any significant rainfall (25 mm depth or greater over 24 hours) or melt event and repair as needed.

10.0 Permanent Erosion and Sediment Control

The permanent sediment and erosion control design was developed to satisfy multiple criteria. The criteria are:

- Reduce maintenance requirements;
- Minimize erosion;
- Minimize sediment/pollutant loading to the outlet;
- Promote infiltration.

For ditches with slopes up to 4.0%, native vegetative lining is recommended. Vegetated ditches enhance stormwater quality by removing pollutants and trapping sediment while providing reinforcement to stabilize ditch slopes and prevent scour.

For ditch areas that exceed 4.0% slope, stepped permanent rock check dams are recommended as per detail “BSD-24 DRAFT, Typical Rock Check Dam Erosion Control Device”. The note in the detail stating “100 mm of 50 mm clear stone cover” will be revised in the construction contract to reflect cover with a mixture of 50 mm clear stone and 150 to 300 mm stone to ensure the check dams stay in place under high flow conditions. The check dams are recommended to reinforce the ditch, dissipate energy and reduce flow velocities. Dense native vegetation is recommended to line the ditch between check dams. The stepped check dam design addresses the active erosion occurring in the existing ditch as it descends the escarpment.

The proposed quality control design promotes infiltration, thereby reducing erosion. It provides enhanced level quality control, thereby reducing sedimentation downstream. It encourages sheet flow through the use of naturalized level spreaders which will reduce potential scour of the road embankment.

Proposed culvert crossings for Tributaries C and D have improved scour protection at the inlet and outlet through the use of an enlarged flow area and river stone embedment. The Tributary C crossing is adjusted in the proposed condition from a near right angle confluence with Tributary A to approximately a 45 degree confluence. This adjustment reduces potential scour on the opposite bank of Tributary A.

11.0 Closing

The proposed stormwater management design represents the most practical solution to provide stormwater management for the proposed 26/27 Sideroad reconstruction project to protect the natural environment that surrounds the road and receives its stormwater. The proposed design includes improvements to address existing failing ditches, extensive areas of erosion, pollutants in stormwater resulting from vehicular traffic, poorly aligned watercourse crossings, fish barriers and flooding. The proposed design addresses the challenge of placing the required stormwater management devices in a narrow footprint to minimize the development limits. The stormwater management design:

- Utilizes bio-retention and enhanced grassed swales, both of which are recognized LID practices for providing effective removal of pollutants;
- Provides enhanced level quality control of stormwater prior to release to the natural environment;
- Satisfies the quantity control criteria;
- Provides conveyance of the 5 year storm in ditches and driveway culverts;
- Satisfies emergency access criteria;
- Provides conveyance of the 100 year event through road crossing culverts with 1 lane clear;
- Provides improved fish passage by un-perching culverts, providing a larger flow area, natural river stone embedment and a low flow channel where beneficial and feasible;
- Preserves groundwater inputs to fisheries;
- Provides a series of stepped rock check dams to improve oxygenation of water and dissipate energy prior to discharge of enhanced swales to Tributary C;
- Provides groundwater inputs within a culvert to improve fish habitat within the culvert;
- Provides recommendations for isolation of the site to keep construction sediment out of the natural environment, respect fisheries timing windows, and prevent a potential HADD.

We trust that the information presented in this report has demonstrated that the Stormwater Management design for 26/27 Sideroad will satisfy the project criteria; therefore, we recommend approval of the proposed design for construction.

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Appendix A

Figures

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
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3. Simcoe County
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Projection: Transverse Mercator	
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False Easting: 500,000m	False Northing: 0m
Page Orientation: 0°	Scale Factor: 0.99960

N
True North

0 100 200 300 400
Metres

Existing Watercourse
Soil Type Boundary (see note 1.)
Subcatchments
Contour

Note 1. Soil boundaries have an assessed spatial accuracy of +/- 200m.

BURNSIDE

Client
TOWNSHIP OF CLEARVIEW

Map Title
26 -27 SIDEROAD ROAD IMPROVEMENTS
CALCULATED CATCHMENTS
EXISTING

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Scale		Project No.	
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False Easting: 500,000m	False Northing: 0m
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True North

0 50 100
Metres

Edge of Gravel: Post Construction
Subcatchments
Contour

Note 1. Imagery reflects ground conditions in 2015 (leaf on image) and 2013 (leaf off image). Note 2. Contours generated from 2010 SWOOP photogrammetric terrain model.

Map No. 2-1 | Map No. 2-2 | Map No. 2-3 | Map No. 2-4

BURNSIDE

Client: **TOWNSHIP OF CLEARVIEW**

Map Title: **26 -27 SIDEROAD ROAD IMPROVEMENTS**
CALCULATED CATCHMENTS
PROPOSED

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True North

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Metres

Edge of Gravel: Post Construction

Existing Watercourse

Subcatchments

Contour

Note 1. Imagery reflects ground conditions in 2015 (leaf on image) and 2013 (leaf off image). Note 2. Contours generated from 2010 SWOOP photogrammetric terrain model.

Map No. 2-1 | Map No. 2-2 | Map No. 2-3 | Map No. 2-4

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Client

TOWNSHIP OF CLEARVIEW

Map Title

26 -27 SIDEROAD ROAD IMPROVEMENTS

CALCULATED CATCHMENTS PROPOSED

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Sources:

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True North

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Metres

Edge of Gravel: Post Construction
Existing Watercourse
Subcatchments
Contour

Note 1. Imagery reflects ground conditions in 2015 (leaf on image) and 2013 (leaf off image). Note 2. Contours generated from 2010 SWOOP photogrammetric terrain model.

Map No. 2-1 | Map No. 2-2 | Map No. 2-3 | Map No. 2-4

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Client
TOWNSHIP OF CLEARVIEW

Map Title
26 -27 SIDEROAD ROAD IMPROVEMENTS
CALCULATED CATCHMENTS
PROPOSED

Drawn	Checked	Date	Map No.
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Scale		Project No.	
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True North

0 50 100
Metres

Edge of Gravel: Post Construction
Existing Watercourse
Subcatchments
Contour

Note 1. Imagery reflects ground conditions in 2015 (leaf on image) and 2013 (leaf off image). Note 2. Contours generated from 2010 SWOOP photogrammetric terrain model.

Map No. 2-1 | Map No. 2-2 | Map No. 2-3 | Map No. 2-4

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Client
TOWNSHIP OF CLEARVIEW

Map Title
26 -27 SIDEROAD ROAD IMPROVEMENTS
CALCULATED CATCHMENTS PROPOSED

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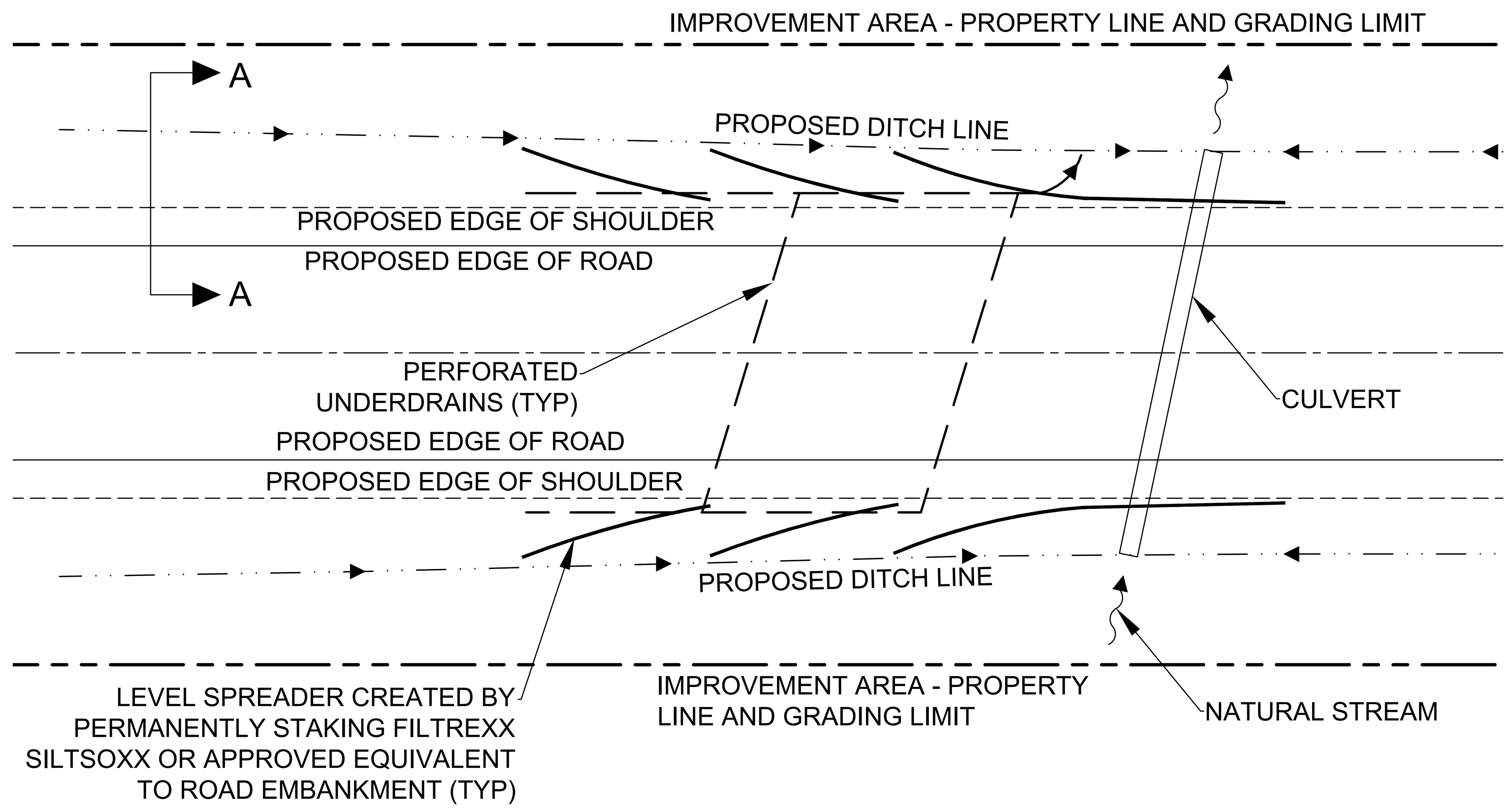
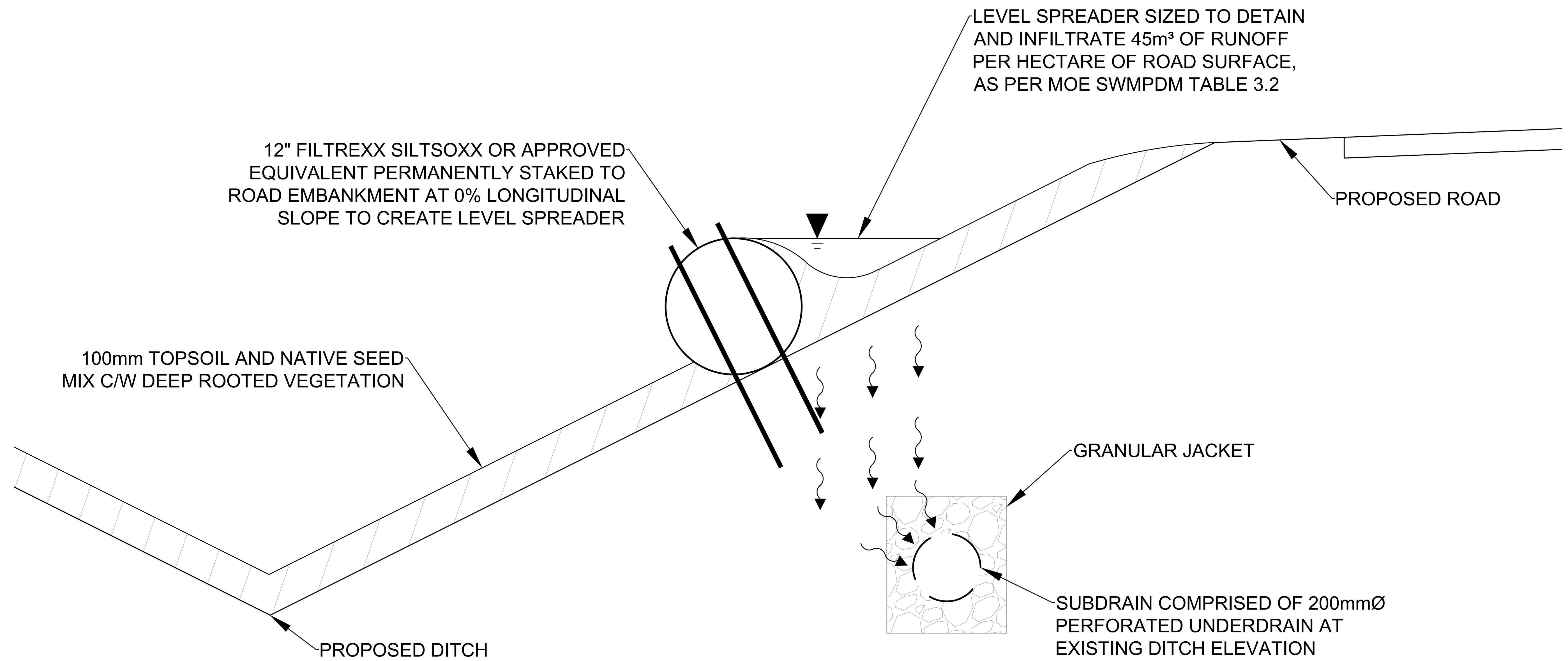
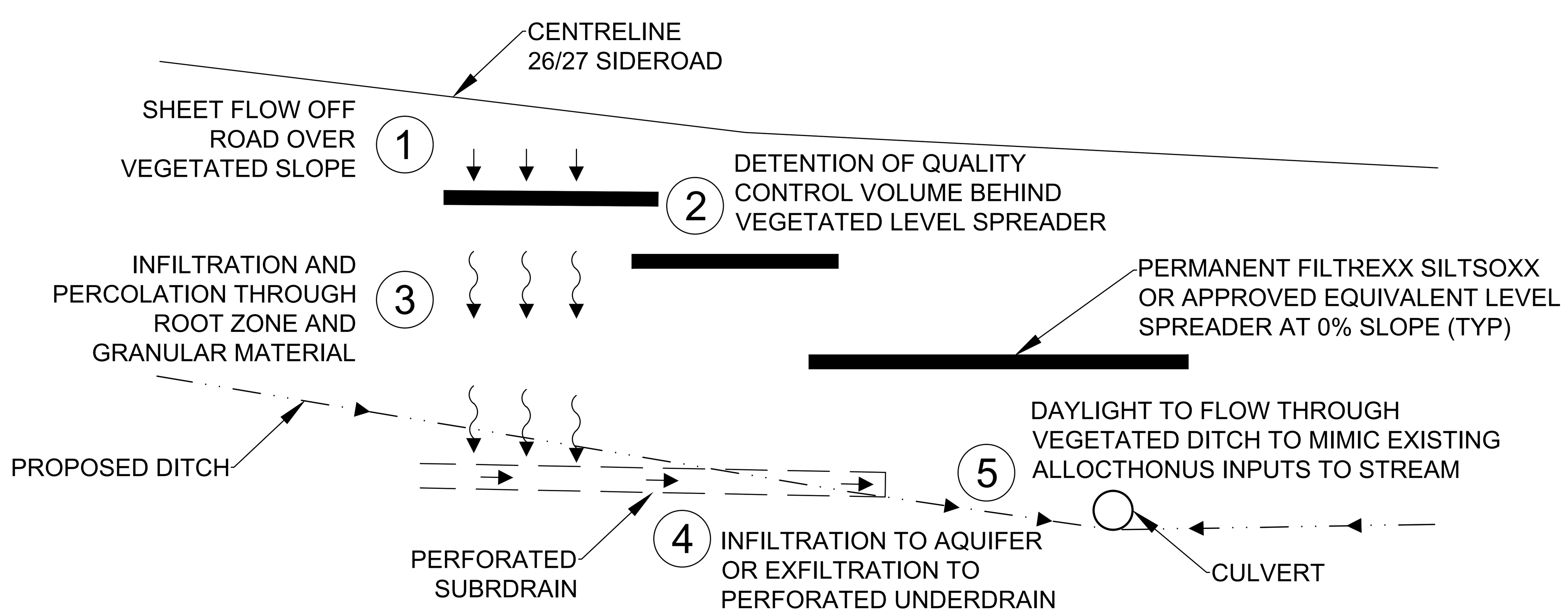


BIORETENTION AND PERFORATED PIPE
STORMWATER MANAGEMENT CONCEPT PLAN
N.T.S.



SECTION A-A
N.T.S.



PROFILE
N.T.S.

NOTES

1. BIORETENTION DESIGN TO BE CONSTRUCTED IN DITCHES FROM STA. 5+420 TO STA. 6+960.
2. PERFORATED SUBDRAIN AND GRANULAR JACKET TO BE PLACED AT EXISTING DITCH ELEVATION BELOW THE PROPOSED LEFT DITCH FROM STA. 5+460 TO OUTLET TO TRIBUTARY A AT STA. 6+140 AND BELOW THE PROPOSED RIGHT DITCH FROM STA. 5+460 TO OUTLET THROUGH THE INVERT OF THE TRIBUTARY C CROSS CULVERT PER NOTES ON DRAWINGS C011 AND C012.

Notes
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2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

NOT FOR CONSTRUCTION

No.	Issue / Revision	Date	Auth.
7	DESIGN REVISION	2015/07/30	
8	DESIGN REVISION	2016/05/20	
9	WETLAND DELINEATION	2016/07/13	
10	ISSUED FOR DFO SUBMISSION	2016/09/22	
11	RE-ISSUED FOR DFO SUBMISSION	2017/03/22	
12	PSW DELINEATION AND EXCLUSION FENCING	2017/03/23	
13	PROFILE REVISION FOR 70km DESIGN SPEED	2017/05/05	
14	REVISED FOR E.I.S.	2018/10/15	

LICENSED PROFESSIONAL ENGINEER
A. C. KOLVIK
100118965
Oct. 15 2018
PROVINCE OF ONTARIO

BURNSIDE

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TOWNSHIP OF CLEARVIEW
217 GIDION STREET
STAYNER, ONTARIO
L0M 1S0

Drawing Title
CLEARVIEW SIDEROAD 26/27 RECONSTRUCTION

BIORETENTION AND PERFORATED PIPE
STORMWATER MANAGEMENT CONCEPT

Drawn	Checked	Designed	Checked	Date	Drawing No.
AES/JSE	JKV/DM	AES	JKV/DM	2018/10/15	C010
Scale		Project No.		Revision No.	
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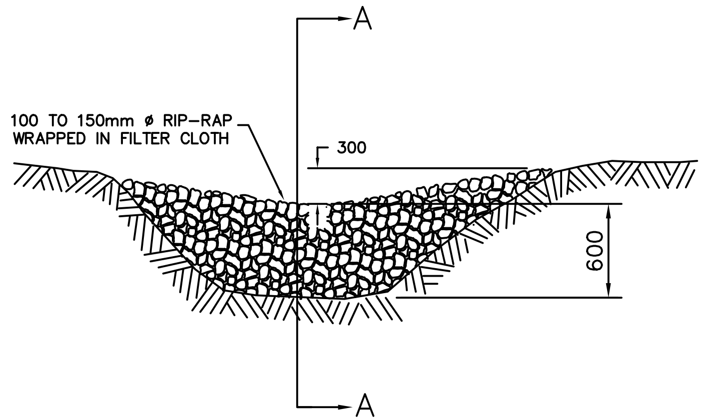

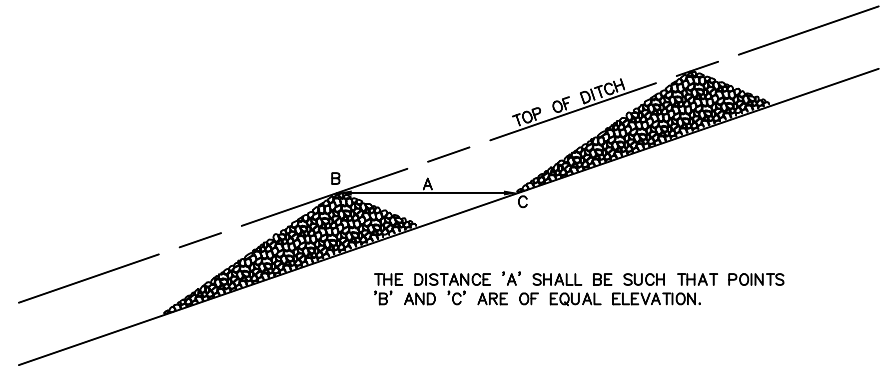

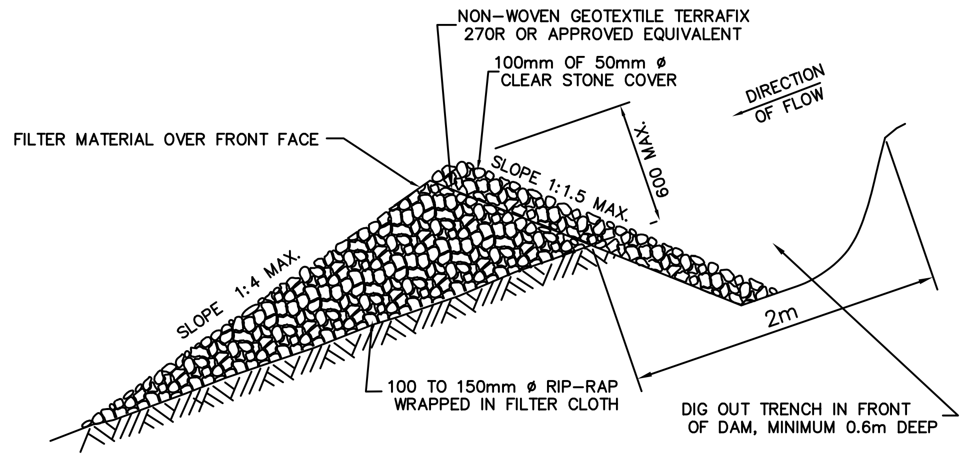

SECTION A - A

NOTES:

1. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA IN SUCH A MANNER THAT IT WILL NOT ERODE. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

Nottawasaga Valley Conservation Authority

TYPICAL ROCK CHECK DAM
EROSION CONTROL DEVICE

NO.	REVISION	APR'D	DATE
1	TRENCH ADDED AND FABRIC EXTENDED INTO IT		2003.02.19

APR'D:	DATE: 92.05.15
DRAWN: L.A.J.	SCALE: N.T.S.

BSD-24 DRAFT

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Appendix B

Photographs

Appendix B

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 1 – Looking West

Photo 2 – Looking West

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 3 –Looking West

Photo 4 –Looking North

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 5 – Looking East

Photo 6 – Looking East

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 7 – Looking East

Photo 8 – Looking North

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 9 – Looking North

Photo 10 – Looking West

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 11 – Looking East

Photo 12 – Looking East

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 13 – Facing East

Photo 14 – Facing East

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 15 – Facing East

Photo 16 – Facing North

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 17 – Facing North

Photo 18 – Facing North

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 19 – Facing North

Photo 20 – Facing North

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 21 – Facing West

Photo 22 – Facing Northwest

Draining to Tributary A – Uphill from Old Tributary B Crossing

Photo 23 – Facing Northwest

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 1 – Looking North

Photo 2 – Looking North

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 3 –Looking North

Photo 4 –Looking Northeast

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 5 – Looking Northeast

Photo 6 – Looking Northeast

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 7 – Looking Northeast

Photo 8 – Looking North

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 9 – Looking West

Photo 10 – Looking West

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 11 – Looking West

Photo 12 – Looking West

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 13 – Looking West

Photo 14 – Looking West

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 15 – Looking West

Photo 16 – Looking East

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 17 – Looking East

Photo 18 – Looking East

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 19 – Looking West

Photo 20 – Looking West

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 21 – Looking West

Photo 22 – Looking West

Draining to Tributary A – Outlets to Tributary A, Downhill from Old Tributary B Crossing

Photo 23 – Looking West

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 1 – Looking East

Photo 2 – Looking East

Photo 3 –Looking East

Photo 4 –Looking East

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 5 – Looking East

Photo 6 – Looking East

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 7 – Looking East

Photo 8 – Looking East

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 9 – Looking East

Photo 10 – Looking East

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 11 – Looking East

Photo 12 – Looking North

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 13 – Looking North

Photo 14 – Looking North

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 15 – Looking North

Photo 16 – Looking North

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 17 – Looking North

Photo 18 – Looking North

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 19 – Looking North

Photo 20 – Looking North

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 21 – Looking North

Photo 22 – Looking North

Draining to Tributary A –Outlets to Tributary A Downstream of Confluence with Tributary C

Photo 23 – Looking West

Draining to Tributary B

Photo 1 – 100_7906 North Side of Road Looking West

Photo 2 – 100_7907 Looking West

Draining to Tributary B

Photo 3 – 100_7908 North Side Old Tributary B Culvert

Photo 4 – 100_7909 North Side Old Tributary B Culvert

Draining to Tributary B

Photo 5 – 100_7911 Looking North from Old Tributary B Culvert

Photo 6 – 100_7913 Looking North from Old Tributary B Culvert

Draining to Tributary B

Photo 7 – 100_7915 Looking North from Old Tributary B Culvert

Draining to Tributary C

Photo 1 – 100_7920 South Side of Road West of Old Tributary B Crossing

Photo 2 – 100_7921 South Side of Road West of Old Tributary B Crossing

Draining to Tributary C

Photo 3 – 100_7922 South Side of Road West of Old Tributary B Crossing

Photo 4 – 100_7923 South Side of Road West of Old Tributary B Crossing

Draining to Tributary C

Photo 5 – 100_7927 South Side of Road West of Old Tributary B Crossing

Photo 6 – 100_7928 South Side of Road West of Old Tributary B Crossing

Project Title:	Clearview 26/27 Sideroad Reconstruction
File No.:	300034587.0000
Date of Photos:	August 13, 2016

Draining to Tributary C

Photo 7 – 100_7929 South Side of Road West of Old Tributary B Crossing

Photo 8 – 100_7930 South Side of Road West of Old Tributary B Crossing

Draining to Tributary C

Photo 9 – 100_7931 South Side of Road West of Old Tributary B Crossing

Draining to Tributary D

Photo 1 –North Side of Road

Photo 2 –North Side of Road

Draining to Tributary D

Photo 3 –North Side of Road

Photo 4 –North Side of Road

Draining to Tributary D

Photo 5 – North Side of Road

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Appendix C

Quality Control Calculations

Appendix C

Appendix C

Quality Control Calculations-Bioretention

<u>9.0 m Paved Width – Required Quality Control Volume</u>

Quality Control Volume for:

Coir log level spreader – Infiltration

Infiltration (per MOE SWMPDM Table 3.2)

$$\text{SWM Vol} = 40\ m^3/ha + (100\% - 85\%) \times \frac{(40\ m^3/ha) - (35\ m^3/ha)}{85\% - 70\%}$$

$$\text{SWM Vol} = 40 + 15 \times \frac{5}{15}$$

SWM Vol = 45 m^3/ha

$$\text{SWM Vol} = \frac{45\ m^3\ (\text{SWM Vol})}{10{,}000\ m^2\ (\text{ximp})}$$

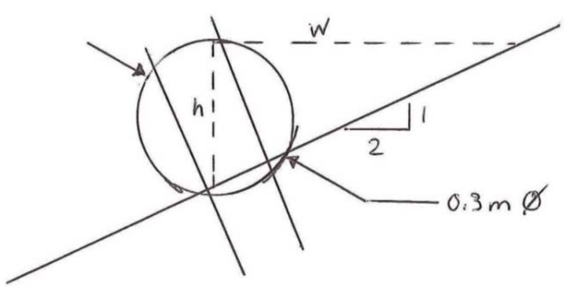
$$\text{SWM Vol} = \frac{0.0045\ m^3\ (\text{SWM Vol})}{m^2\ (\text{ximp})}$$

Rd. ximp = 9 m^2 (ximp) (linear m of Rd.)

$$= \text{SWM Vol} = 9\ m^2\ (\text{ximp}) \times \frac{0.0045\ m^3\ (\text{SWM Vol})}{m^2\ (\text{ximp})}$$

= SWM Vol = 0.0405 m^3/m of Rd.

Level Spreader Vol (x2, both sides of Rd.)



h ≈ 0.3 m

w= 0.6 m

A = ½ x 0.3 x 0.6 = 0.09 m^2

V = 1 m x 0.09 m^2 x 2 (sides of Rd.) per m length of Rd.
V = 0.18 m^3/m length of Rd.

Vactual is $\frac{0.18}{0.04}$ ≈ 4 times the required volume

QUALITY CONTROL CALCULATIONS
DITCH STORAGE CALCULATIONS FOR AREAS TREATED BY ENHANCED SWALES ONLY

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Project:	26/27 SR
File:	034587
Designed by:	A.Holvik
Checked by:	A.Holvik
Date:	9-Sep-16

Outlet	**Impervious Area Upstream of Outlet**					**Quality Control**			
Outlet Location	**Beginning Station (m)**	**Ending Station (m)**	**Asphalt Length (m)**	**Asphalt Width (m)**	**Asphalt Area (ha)**	**Required Storage (m^3/ha)** [1]	**Required Storage (m^3)** [4]	**Proposed Storage (m^3)**[5]	**Design Exceeds Required Storage by: (m^3)**
Rob Roy Wetland	4707	4260	447	9	0.4	45	18	24.8	7
Tributary B [2]	4707	5470	763	4.5	0.3	45	15	16.2	1
Tributary A [3]	4707	5425	718	4.5	0.3	45	15	16.2	2
		Total	Total	Total	1.1	135	48	57	9

NOTE: [1] Based on extrapolation of MOESWMPDM Table 3.2 infiltration values.
[2] South lane drains to Tributary B
[3] North lane drains to Tributary A
[4] Quality Control volume applies to the asphalt area treated by Enhanced Grass Swales only. For asphalt area that drains to Bioretention, refer to Bioretention calculations.
[5] Refer to "Ditch Storage Calculations" sheet

DITCH STORAGE CALCULATIONS

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Project:	26/27 SR
File:	034587
Designed by:	A.Holvik
Checked by:	A.Holvik
Date:	9-Sep-16

User Input:
Ditch Sta. 4707 to 4640 — North Ditch

Drawing number	-	
Ditch Sta. (m)	4707	
Ditch Elev. (m)	516.4	
Ditch Sta. (m)	4640	
Ditch Elev. (m)	515.9	
Ditch Side Slope (__H:1V)	2	
Ditch Slope (%)	0.75	
Ditch Depth (m)	0.4	
Bottom Width (m)	0.1	
Depth of Freeboard Required (m)	0.1	
Length of Ditch to apply Check Dams to (m)	67	
Ponded depth at toe of Check Dam (m)	0.15	<--- Adjust to achieve desired check dam spacing
Ponded depth immediately upstream of Check Dam (m)	0.3	
Check Dam Spacing (m)	20.1	20.1 <---Calculated
Total Number of Check Dams	3	60.3 <---Total ponded length
Total Storage Provided (cu.m)	**7.69**	
Does furthest u/s check dam pond freely until depth=0	n	(Y/N)

Check - does furthest upstream check dam pond freely upstream, or does ponding get blocked by something or spill somewhere?

Notes:

-Storage volume for a trapezoidal ditch is calculated as the volume of a triangular pyramid (v-ditch) plus the volume of the projection of a triangle (flat bottom section)
-downstream outlet location is Sta. Rob Roy Wetland
-ditch depth measured to spill point.
- 0.1m clearance required over check dams to top of ditch
- drawings used: Plan and Profiles and cross-sections 2016/09/02

Triangular Pyramid Volume Calculations (V-ditch component)

A1=	0.18	(m sq.)	triangle area immediately u/s of dam = 0.5*b*h
b1=	1.2	(m)	
h1=	0.3	(m)	
Dist1=	40.2	(m)	ponded distance u/s of A1 to water depth=0
Volume1=	2.412	(cu. m)	Volume of triangular pyramid1
A2=	0.045	(m sq.)	*Volume2 represents portion of Volume1 excluded
b2=	0.6	(m)	because an u/s check dam encroaches on the "tip
h2=	0.15	(m)	of the pyramid"
Dist2=	20.1	(m)	
Volume2=	0.3015	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =	0.746269 % is:	2.1105	cu.m
Subtot. Storage for furthest u/s Check dam =		2.412	cu.m

Volume Calculations for Non-pyramid portion of trapezoid ditch (i.e. projection of a triangle) to add to V-ditch volume

A1=	6.03	(m sq.)	profile view ponded area u/s of dam
Volume1=	0.603	(cu. m)	
A2=	1.5075	(m sq.)	
Volume2=	0.15075	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =	0.7 % is:	0.45225	cu.m
Subtot. Storage for furthest u/s Check dam =		0.603	cu.m
Total Storage per Check dam @ ditch slope =		2.56275	cu.m
Total Storage for furthest u/s Check dam =		3.015	cu.m

User Input:
Ditch Sta. 4707 to 4620 — South Ditch

Drawing number	-	
Ditch Sta. (m)	4707	
Ditch Elev. (m)	516.4	
Ditch Sta. (m)	4620	
Ditch Elev. (m)	515.5	
Ditch Side Slope (__H:1V)	2	
Ditch Slope (%)	1.03	
Ditch Depth (m)	0.5	
Bottom Width (m)	0.1	
Depth of Freeboard Required (m)	0.1	
Length of Ditch to apply Check Dams to (m)	87	
Ponded depth at toe of Check Dam (m)	0.19	<--- Adjust to achieve desired check dam spacing
Ponded depth immediately upstream of Check Dam (m)	0.4	
Check Dam Spacing (m)	20.3	20.3 <---Calculated
Total Number of Check Dams	4	81.2 <---Total ponded length
Total Storage Provided (cu.m)	**17.13**	
Does furthest u/s check dam pond freely until depth=0	n	(Y/N)

Check - does furthest upstream check dam pond freely upstream, or does ponding get blocked by something or spill somewhere?

Notes:

-Storage volume for a trapezoidal ditch is calculated as the volume of a triangular pyramid (v-ditch) plus the volume of the projection of a triangle (flat bottom section)
-downstream outlet location is Sta. Rob Roy Wetland
-ditch depth measured to spill point.
-0.1m clearance required over check dams to top of ditch
-drawings used: Plan and Profiles and cross-sections 2016/09/02

Triangular Pyramid Volume Calculations (V-ditch component)

A1=	0.32	(m sq.)	triangle area immediately u/s of dam = 0.5*b*h
b1=	1.6	(m)	
h1=	0.4	(m)	
Dist1=	38.6666667	(m)	ponded distance u/s of A1 to water depth=0
Volume1=	4.12444444	(cu. m)	Volume of triangular pyramid1
A2=	0.0722	(m sq.)	*Volume2 represents portion of Volume1 excluded
b2=	0.76	(m)	because an u/s check dam encroaches on the "tip
h2=	0.19	(m)	of the pyramid"
Dist2=	18.3666667	(m)	
Volume2=	0.44202444	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =	1.034483 % is:	3.68242	cu.m
Subtot. Storage for furthest u/s Check dam =		4.12444	cu.m

Volume Calculations for Non-pyramid portion of trapezoid ditch (i.e. projection of a triangle) to add to V-ditch volume

A1=	7.73333333	(m sq.)	profile view ponded area u/s of dam
Volume1=	0.77333333	(cu. m)	
A2=	1.74483333	(m sq.)	
Volume2=	0.17448333	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =	1.0 % is:	0.59885	cu.m
Subtot. Storage for furthest u/s Check dam =		0.77333	cu.m
Total Storage per Check dam @ ditch slope =		4.28127	cu.m
Total Storage for furthest u/s Check dam =		4.89778	cu.m

DITCH STORAGE CALCULATIONS

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Project:	26/27 SR
File:	034587
Designed by:	A.Holvik
Checked by:	A.Holvik
Date:	9-Sep-16

User Input:

Ditch Sta. 5140 to 5300	North Ditch		
Drawing number	-		
Ditch Sta. (m)	5140		
Ditch Elev. (m)	505.8		
Ditch Sta. (m)	5300		
Ditch Elev. (m)	505.3		
Ditch Side Slope (__H:1V)	2		
Ditch Slope (%)	0.31		
Ditch Depth (m)	0.7		
Bottom Width (m)	0.1		
Depth of Freeboard Required (m)	0.3		
Length of Ditch to apply Check Dams to (m)	160		
Ponded depth at toe of Check Dam (m)	0.0001	<--- Adjust to achieve desired check dam spacing	
Ponded depth immediately upstream of Check Dam (m)	0.4		
Check Dam Spacing (m)	127.968	127.968	<---Calculated
Total Number of Check Dams	1	128	<---Total ponded length
Total Storage Provided (cu.m)	**16.21**		
Does furthest u/s check dam pond freely until depth=0	y	(Y/N)	

Check - does furthest upstream check dam pond freely upstream, or does ponding get blocked by something or spill somewhere?

Notes:

-Storage volume for a trapezoidal ditch is calculated as the volume of a triangular pyramid (v-ditch) plus the volume of the projection of a triangle (flat bottom section)
-downstream outlet location is Sta. **Trib A**
-ditch depth measured to spill point.
-0.1m clearance required over check dams to top of ditch
-drawings used: Plan and Profiles and cross-sections 2016/09/02

Triangular Pyramid Volume Calculations (V-ditch component)

A1=	0.32	(m sq.)	triangle area immediately u/s of dam = 0.5*b*h
b1=	1.6	(m)	
h1=	0.4	(m)	
Dist1=	128	(m)	ponded distance u/s of A1 to water depth=0
Volume1=	13.6533333	(cu. m)	Volume of triangular pyramid1
A2=	0.00000002	(m sq.)	*Volume2 represents portion of Volume1 excluded
b2=	0.0004	(m)	because an u/s check dam encroaches on the "tip
h2=	0.0001	(m)	of the pyramid"
Dist2=	0.032	(m)	
Volume2=	2.1333E-10	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =	0.3125	% is:	13.6533 cu.m
Subtot. Storage for furthest u/s Check dam =			13.6533 cu.m

Volume Calculations for Non-pyramid portion of trapezoid ditch (i.e. projection of a triangle) to add to V-ditch volume

A1=	25.6	(m sq.)	profile view ponded area u/s of dam
Volume1=	2.56	(cu. m)	
A2=	0.0000016	(m sq.)	
Volume2=	0.00000016	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =	0.3	% is:	2.56 cu.m
Subtot. Storage for furthest u/s Check dam =			2.56 cu.m
Total Storage per Check dam @ ditch slope =			16.2133 cu.m
Total Storage for furthest u/s Check dam =			16.2133 cu.m

User Input:

Ditch Sta. 5140 to 5300	South Ditch		
Drawing number	-		
Ditch Sta. (m)	5140		
Ditch Elev. (m)	505.8		
Ditch Sta. (m)	5300		
Ditch Elev. (m)	505.3		
Ditch Side Slope (__H:1V)	2		
Ditch Slope (%)	0.31		
Ditch Depth (m)	0.7		
Bottom Width (m)	0.1		
Depth of Freeboard Required (m)	0.3		
Length of Ditch to apply Check Dams to (m)	160		
Ponded depth at toe of Check Dam (m)	0.0001	<--- Adjust to achieve desired check dam spacing	
Ponded depth immediately upstream of Check Dam (m)	0.4		
Check Dam Spacing (m)	127.968	127.968	<---Calculated
Total Number of Check Dams	1	128	<---Total ponded length
Total Storage Provided (cu.m)	**16.21**		
Does furthest u/s check dam pond freely until depth=0	y	(Y/N)	

Check - does furthest upstream check dam pond freely upstream, or does ponding get blocked by something or spill somewhere?

Notes:

-Storage volume for a trapezoidal ditch is calculated as the volume of a triangular pyramid (v-ditch) plus the volume of the projection of a triangle (flat bottom section)
-downstream outlet location is Sta. **Trib B**
-ditch depth measured to spill point.
-0.1m clearance required over check dams to top of ditch
-drawings used: Plan and Profiles and cross-sections 2016/09/02

Triangular Pyramid Volume Calculations (V-ditch component)

A1=	0.32	(m sq.)	triangle area immediately u/s of dam = 0.5*b*h
b1=	1.6	(m)	
h1=	0.4	(m)	
Dist1=	128	(m)	ponded distance u/s of A1 to water depth=0
Volume1=	13.6533333	(cu. m)	Volume of triangular pyramid1
A2=	0.00000002	(m sq.)	*Volume2 represents portion of Volume1 excluded
b2=	0.0004	(m)	because an u/s check dam encroaches on the "tip
h2=	0.0001	(m)	of the pyramid"
Dist2=	0.032	(m)	
Volume2=	2.1333E-10	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =	0.3125	% is:	13.6533 cu.m
Subtot. Storage for furthest u/s Check dam =			13.6533 cu.m

Volume Calculations for Non-pyramid portion of trapezoid ditch (i.e. projection of a triangle) to add to V-ditch volume

A1=	25.6	(m sq.)	profile view ponded area u/s of dam
Volume1=	2.56	(cu. m)	
A2=	0.0000016	(m sq.)	
Volume2=	0.00000016	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =	0.3	% is:	2.56 cu.m
Subtot. Storage for furthest u/s Check dam =			2.56 cu.m
Total Storage per Check dam @ ditch slope =			16.2133 cu.m
Total Storage for furthest u/s Check dam =			16.2133 cu.m

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Appendix D

Hydrologic Calculations

- Existing Conditions Hydrologic Parameters Calculations;
- Proposed Conditions Hydrologic Parameters Calculations.

Appendix D.1

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Existing Conditions Hydrologic Parameters Calculations

Project Name: 26/27 SR
Project No: 034587
Location: Clearview Twp.
Date: August 24, 2016

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EXISTING CONDITIONS
Runoff Coefficient, SCS Curve Number, Initial Rainfall Abstraction Data

Catchment	Landuse, Original	Hydrologic Land Cover	Hydrologic Soil Group	Total Catchment Area (Ha)	Area (Ha)	Catchment Percent, CP (%)	Initial Abstraction Value, Ia	Ia x CP/100	Coefficient Value, C	C x CP/100	CNII	CNII x CP/100	Ave CNII of non-Rd Areas only	CNIII	CNIII x CP/100	Ave CNIII of non-Rd Areas only	
4300-1	Field/Meadow	Field/Meadow	B	10.00	2.96	29.6	8	2	0.2	0.06	61	18		78	23		
4300-1	Field/Meadow	Field/Meadow	D	10.00	2.63	26.2	8	2	0.3	0.08	80	21		90	24		
4300-1	Forest/Woodlot	Forest/Woodlot	B	10.00	2.28	22.8	10	2	0.13	0.03	58	13		76	17		
4300-1	Forest/Woodlot	Forest/Woodlot	D	10.00	2.01	20.1	10	2	0.2	0.04	77	15		89	18		
4300-1	Roads: Gravel	Pavement	NOTE	10.00	0.12	1.2	2	0	0.5	0.01	89	1	69	94	1	83	
4300-1					**10.00**	**100.0**	**38**	**9**	**1.33**	**0.21**	**365**	**69**		**427**	**83**		**<------------ Area Weighted Values**
4300-1 ROW	Field/Meadow	Field/Meadow	B	0.89	0.26	28.7	8	2	0.2	0.06	61	18		78	22		
4300-1 ROW	Field/Meadow	Field/Meadow	D	0.89	0.30	33.5	8	3	0.3	0.10	80	27		90	30		
4300-1 ROW	Roads: Gravel	Pavement	NOTE	0.89	0.34	37.8	2	1	0.5	0.19	90	34	71	94	36	85	
4300-1 ROW					**0.89**	**100.0**	**18**	**6**	**1.00**	**0.35**	**231**	**78**		**262**	**88**		**<------------ Area Weighted Values**
5900-1	Field/Meadow	Field/Meadow	B	35.95	25.63	71.3	8	6	0.2	0.14	61	43		78	56		
5900-1	Forest/Woodlot	Forest/Woodlot	B	35.95	8.51	23.7	10	2	0.13	0.03	58	14		76	18		
5900-1	Urban (30% imp)	Urban (30% imp)	B	35.95	1.81	5.0	5	0	0.4	0.02	65	3		75	4		
5900-1					**35.95**	**100.0**	**23**	**8**	**0.73**	**0.19**	**184**	**60**		**229**	**78**		**<------------ Area Weighted Values**
5900-1 ROW	Field/Meadow	Field/Meadow	B	2.42	1.57	64.8	8	5	0.2	0.13	61	40		78	51		
5900-1 ROW	Roads: Gravel	Pavement	NOTE	2.42	0.85	35.2	2	1	0.5	0.18	87	31	61	92	32	78	
5900-1 ROW					**2.42**	**100.0**	**10**	**6**	**0.70**	**0.31**	**148**	**70**		**170**	**83**		**<------------ Area Weighted Values**
6120-1	Field/Meadow	Field/Meadow	B	16.34	6.34	38.8	8	3	0.2	0.08	61	24		78	30		
6120-1	Forest/Woodlot	Forest/Woodlot	B	16.34	10.00	61.2	10	6	0.13	0.08	58	35		76	47		
6120-1					**16.34**	**100.0**	**18**	**9**	**0.33**	**0.16**	**119**	**59**		**154**	**77**		**<------------ Area Weighted Values**
6120-1 ROW	Field/Meadow	Field/Meadow	B	0.43	0.31	71.3	8	6	0.2	0.14	61	43		78	56		
6120-1 ROW	Roads: Gravel	Pavement	NOTE	0.43	0.12	28.7	2	1	0.5	0.14	87	25	61	92	26	78	
6120-1 ROW					**0.43**	**100.0**	**10**	**6**	**0.70**	**0.29**	**148**	**68**		**170**	**82**		**<------------ Area Weighted Values**
6500-1	Field/Meadow	Field/Meadow	B	4.22	4.22	100.0	8	8	0.2	0.20	61	61		78	78		
6500-1					**4.22**	**100.0**	**8**	**8**	**0.20**	**0.20**	**61**	**61**		**78**	**78**		**<------------ Area Weighted Values**
6500-1+3 ROW	Field/Meadow	Field/Meadow	B	0.77	0.53	68.0	8	5	0.2	0.14	61	41		78	53		
6500-1+3 ROW	Roads: Gravel	Pavement	NOTE	0.77	0.25	32.0	2	1	0.5	0.16	87	28	61	92	29	78	
6500-1+3 ROW					**0.77**	**100.0**	**10**	**6**	**0.70**	**0.30**	**148**	**69**		**170**	**83**		**<------------ Area Weighted Values**
6500-3	Field/Meadow	Field/Meadow	B	11.57	4.51	39.0	8	3	0.2	0.08	61	24		78	31		
6500-3	Forest/Woodlot	Forest/Woodlot	B	11.57	7.06	61.0	10	6	0.13	0.08	58	35		76	46		
6500-3					**11.57**	**100.0**	**18**	**9**	**0.33**	**0.16**	**119**	**59**		**154**	**77**		**<------------ Area Weighted Values**
6760-1	Field/Meadow	Field/Meadow	B	9.13	8.61	94.3	8	8	0.2	0.19	61	58		78	74		
6760-1	Forest/Woodlot	Forest/Woodlot	B	9.13	0.52	5.7	10	1	0.13	0.01	58	3		76	4		
6760-1					**9.13**	**100.0**	**18**	**8**	**0.33**	**0.20**	**119**	**61**		**154**	**78**		**<------------ Area Weighted Values**
6760-1 ROW	Field/Meadow	Field/Meadow	B	0.57	0.39	68.3	8	5	0.2	0.14	61	42		78	53		
6760-1 ROW	Roads: Gravel	Pavement	NOTE	0.57	0.18	31.7	2	1	0.5	0.16	87	28	61	92	29	78	
6760-1 ROW					**0.57**	**100.0**	**10**	**6**	**0.70**	**0.30**	**148**	**69**		**170**	**83**		**<------------ Area Weighted Values**
XCULV 2627-1	Roads: Gravel	Pavement	NOTE	7.89	0.16	2.1	2	0	0.5	0.01	87	2	60	92	2	78	
XCULV 2627-1	Forest/Woodlot	Forest/Woodlot	B	7.89	0.14	1.8	10	0	0.13	0.00	58	1		76	1		
XCULV 2627-1	Forest/Woodlot	Forest/Woodlot	B	7.89	2.10	26.7	10	3	0.13	0.03	58	15		76	20		
XCULV 2627-1	Field/Meadow	Field/Meadow	B	7.89	0.10	1.3	8	0	0.2	0.00	61	1		78	1		
XCULV 2627-1	Field/Meadow	Field/Meadow	B	7.89	5.38	68.2	8	5	0.2	0.14	61	42		78	53		
XCULV 2627-1					**7.89**	**100.0**	**38**	**8**	**1.16**	**0.19**	**325**	**61**		**400**	**78**		**<------------ Area Weighted Values**
XCULV 2627-1 ROW	Field/Meadow	Field/Meadow	B	0.38	0.28	72.6	8	6	0.2	0.15	61	44		78	57		
XCULV 2627-1 ROW	Roads: Gravel	Pavement	NOTE	0.38	0.10	27.4	2	1	0.5	0.14	87	24	61	92	25	78	
XCULV 2627-1 ROW					**0.38**	**100.0**	**10**	**6**	**0.70**	**0.28**	**148**	**68**		**170**	**82**		**<------------ Area Weighted Values**

NOTE: **Gravel Roads assume 70% impervious, remaining 30% uses CN of remainder of catchment.**

BURNSIDE

Project:	26/27 SR
Project No.:	034587
Modelled by:	A. Holvik
Date:	18-Aug-16

EXISTING CONDITIONS

Input Information

Design Spreadsheet

Catchment Number	Area (ha)	Length (m)	Max Elev. (m)	Min Elev (m)	Slope (%)	Runoff Coefficient	Height (m)	Time of Concentration (hr)	Time to Peak (hr)	
4300-1	10.0	690.00	533.00	511.00	3.19	0.21	22.0	0.868	0.6	<------ Airport Method
4300-1 ROW	0.9	450.00	517.00	511.00	1.33	0.35	6.0	0.788	0.5	<------ Airport Method
5900-1	36.0	1,200.00	533.00	451.00	6.83	0.19	82.0	0.910	0.6	<------ Airport Method
5900-1 ROW	2.4	1,200.00	516.00	451.00	5.42	0.31	65.0	0.853	0.6	<------ Airport Method
6120-1	16.3	680.00	525.00	431.00	13.82	0.16	94.0	0.561	0.4	<------ Airport Method
6120-1 ROW	0.4	200.00	451.00	431.00	10.00	0.29	20.0	0.292	0.2	<------ Airport Method
6500-1	4.2	390.00	451.00	417.00	8.72	0.20	34.0	0.474	0.3	<------ Airport Method
6500-1+3 ROW	0.8	400.00	431.00	417.00	3.50	0.30	14.0	0.576	0.4	<------ Airport Method
6500-3	11.6	700.00	525.00	417.00	15.43	0.16	108.0	0.549	0.4	<------ Airport Method
6760-1	9.1	570.00	450.00	413.00	6.49	0.20	37.0	0.631	0.4	<------ Airport Method
6760-1 ROW	0.6	280.00	417.00	413.00	1.43	0.30	4.0	0.648	0.4	<------ Airport Method
XCULV 2627-1	7.9	490.00	437.00	403.00	6.94	0.19	34.0	0.579	0.4	<------ Airport Method
XCULV 2627-1 ROW	0.4	190.00	414.00	403.00	5.79	0.28	11.0	0.345	0.2	<------ Airport Method

Appendix D.2

Proposed Conditions Hydrologic Parameters Calculations

Project Name: 26/27 SR
Project No: 034587
Location: Clearview Twp.
Date: August 24, 2016

BURNSIDE
R. J. Burnside & Associates Limited

PROPOSED CONDITIONS

Runoff Coefficient, SCS Curve Number, Initial Rainfall Abstraction Data

Catchment	Landuse, Original	Hydrologic Land Cover	Hydrologic Soil Group	Total Catchment Area (ha)	Area (ha)	Catchment Percent, CF (%)	Coefficient Value, C	C x CF/100	CN	CN x CF/100		CN*	CN* x CF/100		Initial Abstraction Value, Ia	Ia x CF/100		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		
4300-1	Field/Meadow	Field/Meadow	B	10.00	2.96	29.6	0.2	0.06	61	18		78.25	23.19		8	2.4		
4300-1	Forest/Woodlot	Forest/Woodlot	D	10.00	2.01	20.1	0.2	0.04	77	15		88.51	17.76		10	2.0		
4300-1	Field/Meadow	Field/Meadow	D	10.00	2.63	26.2	0.3	0.08	80	21		90.2	23.67		8	2.1		
4300-1	Roads	Pavement	N	10.00	0.12	1.2	0.9	0.01	98	1		99.12	1.23		2	0.0		
TOTAL					10.00	100.0	1.73	0.22	374.00	69		432.13	83.20		38.00	8.8		<---- Area Weighted Values
4300-1 ROW	Field/Meadow	Field/Meadow	B	0.89	0.22	24.2	0.2	0.05	61	15		78.25	18.92		8	1.9		
4300-1 ROW	Field/Meadow	Field/Meadow	D	0.89	0.25	28.2	0.3	0.08	80	23		90.2	25.46		8	2.3		
4300-1 ROW	Roads	Pavement	N	0.89	0.42	47.6	0.9	0.43	98	47		99.12	47.17		2	1.0		
TOTAL					0.89	100.0	1.40	0.56	239.00	71	(Pervious)	267.57	84.69	(Pervious)	18.00	8.0	(Pervious)	<---- Area Weighted Values
5900-1	Forest/Woodlot	Forest/Woodlot	B	35.95	8.51	23.7	0.13	0.03	58	14		76.05	18.00		10	2.4		
5900-1	Field/Meadow	Field/Meadow	B	35.95	25.63	71.3	0.2	0.14	61	43		78.25	55.79		8	5.7		
5900-1	Urban (30% imp)	Urban (30% imp)	B	35.95	1.81	5.0	0.4	0.02	65	3		74.9	3.77		5	0.3		
TOTAL					35.95	100.0	0.73	0.19	184.00	60		229.20	77.56		23.00	8.3		<---- Area Weighted Values
5900-1 ROW	Field/Meadow	Field/Meadow	B	2.42	1.26	52.2	0.2	0.10	61	32		78.25	40.85		8	4.2		
5900-1 ROW	Roads	Pavement	N	2.42	1.16	47.8	0.9	0.43	98	47		99.12	47.37		2	1.0		
TOTAL					2.42	100.0	1.10	0.53	159.00	61	(Pervious)	177.37	78.25	(Pervious)	10.00	8.0	(Pervious)	<---- Area Weighted Values
6120-1	Forest/Woodlot	Forest/Woodlot	B	16.34	10.00	61.2	0.13	0.08	58	35		76.05	46.54		10	6.1		
6120-1	Field/Meadow	Field/Meadow	B	16.34	6.34	38.8	0.2	0.08	61	24		78.25	30.37		8	3.1		
TOTAL					16.34	100.0	0.33	0.16	119.00	59		154.30	76.90		18.00	9.2		<---- Area Weighted Values
6120-1 ROW	Field/Meadow	Field/Meadow	B	0.43	0.23	52.7	0.2	0.11	61	32		78.25	41.27		8	4.2		
6120-1 ROW	Roads	Pavement	N	0.43	0.20	47.3	0.9	0.43	98	46		99.12	46.84		2	0.9		
TOTAL					0.43	100.0	1.10	0.53	159.00	61	(Pervious)	177.37	78.25	(Pervious)	10.00	8.0	(Pervious)	<---- Area Weighted Values
6500-1	Field/Meadow	Field/Meadow	B	4.22	4.22	100.0	0.2	0.20	61	61		78.25	78.25		8	8.0		
TOTAL					4.22	100.0	0.20	0.20	61.00	61		78.25	78.25		8.00	8.0		<---- Area Weighted Values
6500-3	Forest/Woodlot	Forest/Woodlot	B	11.57	7.06	61.0	0.13	0.08	58	35		76.05	46.39		10	6.1		
6500-3	Field/Meadow	Field/Meadow	B	11.57	4.51	39.0	0.2	0.08	61	24		78.25	30.52		8	3.1		
TOTAL					11.57	100.0	0.33	0.16	119.00	59		154.30	76.91		18.00	9.2		<---- Area Weighted Values
6500-1+3 ROW	Field/Meadow	Field/Meadow	B	0.77	0.41	52.9	0.2	0.11	61	32		78.25	41.42		8	4.2		
6500-1+3 ROW	Roads	Pavement	N	0.77	0.36	47.1	0.9	0.42	98	46		99.12	46.65		2	0.9		
TOTAL					0.77	100.0	1.10	0.53	159.00	61	(Pervious)	177.37	78.25	(Pervious)	10.00	8.0	(Pervious)	<---- Area Weighted Values
6500-1 ROW	Field/Meadow	Field/Meadow	B	0.70	0.37	53.0	0.2	0.11	61	32		78.25	41.44		8	4.2		
6500-1 ROW	Roads	Pavement	N	0.70	0.33	47.0	0.9	0.42	98	46		99.12	46.63		2	0.9		
TOTAL					2.25	300.0	3.30	1.59	477.00	68	(Pervious)	532.11	82.13	(Pervious)	30.00	6.9	(Pervious)	<---- Area Weighted Values
6500-3 ROW	Field/Meadow	Field/Meadow	B	0.07	0.04	52.7	0.2	0.11	61	32		78.25	41.28		8	4.2		
6500-3 ROW	Roads	Pavement	N	0.07	0.03	47.3	0.9	0.43	98	46		99.12	46.83		2	0.9		
TOTAL					0.07	100.0	1.10	0.53	159.00	61	(Pervious)	177.37	78.25	(Pervious)	10.00	8.0	(Pervious)	<---- Area Weighted Values
6760-1	Forest/Woodlot	Forest/Woodlot	B	9.13	0.52	5.7	0.13	0.01	58	3		76.05	4.31		10	0.6		
6760-1	Field/Meadow	Field/Meadow	B	9.13	8.61	94.3	0.2	0.19	61	58		78.25	73.81		8	7.5		
TOTAL					9.13	100.0	0.33	0.20	119.00	61		154.30	78.13		18.00	8.1		<---- Area Weighted Values
6760-1 ROW	Field/Meadow	Field/Meadow	B	0.57	0.30	52.2	0.2	0.10	61	32		78.25	40.88		8	4.2		
6760-1 ROW	Roads	Pavement	N	0.57	0.27	47.8	0.9	0.43	98	47		99.12	47.34		2	1.0		
TOTAL					0.57	100.0	1.10	0.53	159.00	61	(Pervious)	177.37	78.25	(Pervious)	10.00	8.0	(Pervious)	<---- Area Weighted Values
XCULV 2627-1	Forest/Woodlot	Forest/Woodlot	B	7.89	0.14	1.8	0.13	0.00	58	1		76.05	1.35		10	0.2		
XCULV 2627-1	Forest/Woodlot	Forest/Woodlot	B	7.89	2.10	26.7	0.13	0.03	58	15		76.05	20.28		10	2.7		
XCULV 2627-1	Field/Meadow	Field/Meadow	B	7.89	0.10	1.3	0.2	0.00	61	1		78.25	1.00		8	0.1		
XCULV 2627-1	Field/Meadow	Field/Meadow	B	7.89	5.38	68.2	0.2	0.14	61	42		78.25	53.37		8	5.5		
XCULV 2627-1	Roads	Pavement	N	7.89	0.16	2.1	0.9	0.02	98	2		99.12	2.06		2	0.0		
TOTAL					7.89	100.0	1.56	0.19	336.00	61		407.72	78.06		38.00	8.4		<---- Area Weighted Values
XCULV 2627-1 ROW	Field/Meadow	Field/Meadow	B	0.38	0.20	52.7	0.2	0.11	61	32		78.25	41.24		8	4.2		
XCULV 2627-1 ROW	Roads	Pavement	N	0.38	0.18	47.3	0.9	0.43	98	46		99.12	46.88		2	0.9		
TOTAL					0.38	100.0	1.10	0.53	159.00	61	(Pervious)	177.37	78.25	(Pervious)	10.00	8.0	(Pervious)	<---- Area Weighted Values

NOTE: Gravel Roads assume 70% impervious, remaining 30% uses CN of remainder of catchment.

BURNSIDE

Project:	26/27 SR
Project No.:	034587
Modelled by:	A. Holvik
Date:	18-Aug-16

PROPOSED CONDITIONS

Input Information

Catchment Number	Area (ha)	Length (m)	Max Elev. (m)	Min Elev (m)	Slope (%)	Runoff Coefficient	Height (m)
4300-1	10.0	690.00	533.00	511.00	3.19	0.22	22.0
4300-1 ROW	0.9	450.00	517.00	511.00	1.33	0.56	6.0
5900-1	36.0	1,200.00	533.00	451.00	6.83	0.19	82.0
5900-1 ROW	2.4	1,200.00	516.00	451.00	5.42	0.53	65.0
6120-1	16.3	680.00	525.00	431.00	13.82	0.16	94.0
6120-1 ROW	0.4	200.00	451.00	431.00	10.00	0.53	20.0
6500-1	4.2	390.00	451.00	417.00	8.72	0.20	34.0
6500-1+3 ROW	0.8	400.00	431.00	417.00	3.50	0.53	14.0
6500-3	11.6	700.00	525.00	417.00	15.43	0.16	108.0
6760-1	9.1	570.00	450.00	413.00	6.49	0.20	37.0
6760-1 ROW	0.6	280.00	417.00	413.00	1.43	0.53	4.0
XCULV 2627-1	7.9	490.00	437.00	403.00	6.94	0.19	34.0
XCULV 2627-1 ROW	0.4	190.00	414.00	403.00	5.79	0.53	11.0

Design Spreadsheet

Time of Concentration (hr)	Time to Peak (hr)		
0.858	0.6	<------	Airport Method
0.409	0.3	<------	Bransby Williams Method
0.910	0.6	<------	Airport Method
0.746	0.5	<------	Bransby Williams Method
0.561	0.4	<------	Airport Method
0.131	0.1	<------	Bransby Williams Method
0.474	0.3	<------	Airport Method
0.304	0.2	<------	Bransby Williams Method
0.549	0.4	<------	Airport Method
0.631	0.4	<------	Airport Method
0.263	0.2	<------	Bransby Williams Method
0.579	0.4	<------	Airport Method
0.140	0.1	<------	Bransby Williams Method

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Appendix E

SWMHYMO – Hydrologic Calculations

- Existing Conditions
  - SWMHYMO Data Files
  - SWMHYMO Summary Files.
- Proposed Conditions
  - SWMHYMO Data Files
  - SWMHYMO Summary Files.

Appendix E

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

- Existing Conditions
- SWMHYMO Data and Summary Files

Appendix E.1

```
2     Metric units
*#****************************************************************************
*#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
*#  Date         : 06-17-2016
*#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
*#  Company      : R.J. Burnside and Associates
*#  License #    :  3846413
*#****************************************************************************
*#-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*% 2-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                    ["2SCS24.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
READ STORM           STORM_FILENAME=["STORM.001"]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[1], NHYD=["4300-1  "], DT=[1 ]min, AREA=[10.0 ](ha),
                     DWF=[0](cms),  CN/C=[69], IA=[8.8](mm),
                     N=[3], TP=[.6 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["4300-1RO"], DT=[1 ]min, AREA=[0.9  ](ha),
                     DWF=[0](cms),  CN/C=[78], IA=[5.7](mm),
                     N=[3], TP=[.5 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[3], NHYD=["4300  "], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[1], NHYD=["5900-1  "], DT=[1 ]min, AREA=[36.0 ](ha),
                     DWF=[0](cms),  CN/C=[60], IA=[8.3](mm),
                     N=[3], TP=[.6 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["5900-1RO"], DT=[1 ]min, AREA=[2.4  ](ha),
                     DWF=[0](cms),  CN/C=[70], IA=[5.9](mm),
                     N=[3], TP=[.6 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[3], NHYD=["TRIBB "], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[1], NHYD=["6120-1  "], DT=[1 ]min, AREA=[16.3 ](ha),
                     DWF=[0](cms),  CN/C=[59], IA=[9.2](mm),
                     N=[3], TP=[.4 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["6120-1RO"], DT=[1 ]min, AREA=[0.40 ](ha),
                     DWF=[0](cms),  CN/C=[68], IA=[6.3](mm),
                     N=[3], TP=[.2 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[4], NHYD=["TRIBC "], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[5], NHYD=["TRIBBC"], IDs to add=[4,3]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[1], NHYD=["6500-1  "], DT=[1 ]min, AREA=[4.2  ](ha),
                     DWF=[0](cms),  CN/C=[61], IA=[8.0](mm),
                     N=[3], TP=[.3 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["6500-3  "], DT=[1 ]min, AREA=[11.6 ](ha),
                     DWF=[0](cms),  CN/C=[59], IA=[9.2](mm),
                     N=[3], TP=[.4 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[3], NHYD=["65001+3R"], DT=[1 ]min, AREA=[0.8  ](ha),
                     DWF=[0](cms),  CN/C=[69], IA=[6.1](mm),
                     N=[3], TP=[.4 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[4], NHYD=["TRIBD "], IDs to add=[1,2,3]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[1], NHYD=["6760-1  "], DT=[1 ]min, AREA=[9.1  ](ha),
                     DWF=[0](cms),  CN/C=[61], IA=[8.1](mm),
                     N=[3], TP=[.4 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["6760-1RO"], DT=[1 ]min, AREA=[0.6  ](ha),
                     DWF=[0](cms),  CN/C=[69], IA=[6.1](mm),
                     N=[3], TP=[.4 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[6], NHYD=["TRIBE "], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[1], NHYD=["XCULV2  "], DT=[1 ]min, AREA=[7.9  ](ha),
                     DWF=[0](cms),  CN/C=[61], IA=[8.4](mm),
                     N=[3], TP=[.4 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["XCULV2RO"], DT=[1 ]min, AREA=[0.4  ](ha),
                     DWF=[0](cms),  CN/C=[68], IA=[6.4](mm),
                     N=[3], TP=[.2 ]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[7], NHYD=["XCULV2"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[9], NHYD=["TRIBA "], IDs to add=[5,4,6,7]
*%-----------------|-------------------------------------------------------------|
*% 5-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                    ["5SCS24.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 10-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                    ["10SCS24.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 25-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                    ["25SCS24.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 50-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                    ["50SCS24.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 100-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                    ["100SCS24.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 2-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
*%                    ["2CHI4.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 5-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[8]
*%                    ["5CHI4.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 10-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[9]
*%                    ["10CHI4.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 25-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[10]
*%                    ["25CHI4.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 50-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[11]
*%                    ["50CHI4.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% 100-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[12]
*%                    ["100CHI4.stm"] <--storm filename
*%-----------------|-------------------------------------------------------------|
*% Timmins Regional Storm Distribution (12-hour)
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[13]
*%                    ["12REGTIM.089"] <--storm filename
*%-----------------|-------------------------------------------------------------|
FINISH
```

```
================================================================================
  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999   =========
  S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9 9   9  Ver  4.05
      S   W W   M   M  H   H    Y    M   M  O   O      9999  9999  Sept 2011
  SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9  =========
                                                      9   9 9   9  # 3846413
       StormWater Management HYdrologic Model          999   999   =========
 ******************************************************************************
 *****************************  SWMHYMO Ver/4.05  ****************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                    *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.           *********
 *********                  Ottawa,  Ontario: (613) 836-3884            *********
 *********                  Gatineau, Quebec: (819) 243-6858            *********
 *********                  E-Mail: swmhymo@jfsa.Com                    *********
 ******************************************************************************
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: R.J. Burnside and Associates                 +++++++++
 +++++++++                Stayner              SERIAL#:3846413         +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********           Maximum value for ID numbers  :    10              *********
 *********           Max. number of rainfall points: 105408             *********
 *********           Max. number of flow points    : 105408             *********
 ******************************************************************************
 ***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
 *****-------------------------------------------------------------------*****
 *****    ID:  Hydrograph IDentification numbers, (1-10).                 *****
 *****  NHYD:  Hydrograph reference numbers, (6 digits or characters).    *****
 *****  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  *****
 ***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    *****
 ***** TpeakDate_hh:mm is the date and time of the peak flow.             *****
 *****  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       *****
 *****  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       *****
 *****     *:  see WARNING or NOTE message printed at end of run.         *****
 *****    **:  see  ERROR  message printed at end of run.                 *****
 ******************************************************************************
 ******************************************************************************
:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
 ******************************************************************************
 **********************   S U M M A R Y   O U T P U T   **********************
 ******************************************************************************
 *         DATE: 2016-08-18     TIME: 19:52:58     RUN COUNTER: 000048        *
 ******************************************************************************
 * Input   filename: C:\SWMHYMO\034587~1\4-HOUR~1\2627SR.dat                  *
 * Output  filename: C:\SWMHYMO\034587~1\4-HOUR~1\2627SR.out                  *
 * Summary filename: C:\SWMHYMO\034587~1\4-HOUR~1\2627SR.sum                  *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 ******************************************************************************
#*****************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*****************************************************************************
#-----------------|-----------------------------------------------------------|
 RUN:COMMAND#
 001:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   1 ]
 001:0002------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=12.00:SDUR=  24.00:PTOT=  47.30]
 001:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .105 No_date   12:35    9.71
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 001:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .018 No_date   12:26   15.28
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 001:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .105 No_date   12:35    9.71
                      + 02:4300-1RO        .90     .018 No_date   12:26   15.28
      [DT= 1.00]  SUM=  03:4300          10.90     .122 No_date   12:33   10.17
 001:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .280 No_date   12:35    7.30
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 001:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .031 No_date   12:34   11.41
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 001:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .280 No_date   12:35    7.30
                      + 02:5900-1RO       2.40     .031 No_date   12:34   11.41
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .310 No_date   12:35    7.56
 001:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .155 No_date   12:21    6.76
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 001:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .010 No_date   12:07   10.47
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 001:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .155 No_date   12:21    6.76
                      + 02:6120-1RO        .40     .010 No_date   12:07   10.47
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .161 No_date   12:20    6.85
 001:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .161 No_date   12:20    6.85
                      + 03:TRIBB         38.40     .310 No_date   12:35    7.56
      [DT= 1.00]  SUM=  05:TRIBBC        55.10     .455 No_date   12:29    7.34
 001:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .056 No_date   12:14    7.66
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 001:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .110 No_date   12:21    6.76
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 001:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .013 No_date   12:20   10.93
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 001:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .056 No_date   12:14    7.66
                      + 02:6500-3        11.60     .110 No_date   12:21    6.76
                      + 03:65001+3R        .80     .013 No_date   12:20   10.93
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .176 No_date   12:18    7.19
 001:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .099 No_date   12:21    7.62
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 001:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .010 No_date   12:20   10.93
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 001:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .099 No_date   12:21    7.62
                      + 02:6760-1RO        .60     .010 No_date   12:20   10.93
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .109 No_date   12:21    7.83
 001:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .085 No_date   12:21    7.52
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 001:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .010 No_date   12:07   10.43
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 001:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .085 No_date   12:21    7.52
                      + 02:XCULV2RO        .40     .010 No_date   12:07   10.43
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .091 No_date   12:19    7.66
 001:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10     .455 No_date   12:29    7.34
                      + 04:TRIBD         16.60     .176 No_date   12:18    7.19
                      + 06:TRIBE          9.70     .109 No_date   12:21    7.83
                      + 07:XCULV2         8.30     .091 No_date   12:19    7.66
      [DT= 1.00]  SUM=  09:TRIBA         89.70     .816 No_date   12:24    7.40
   ** END OF RUN :    1
*******************************************************************************
 RUN:COMMAND#
 002:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   2 ]
#*****************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*****************************************************************************
#-----------------|-----------------------------------------------------------|
 002:0002------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=12.00:SDUR=  24.00:PTOT=  59.30]
 002:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .173 No_date   12:34   15.49
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 002:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .027 No_date   12:26   22.94
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 002:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .173 No_date   12:34   15.49
                      + 02:4300-1RO        .90     .027 No_date   12:26   22.94
      [DT= 1.00]  SUM=  03:4300          10.90     .200 No_date   12:33   16.11
 002:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .466 No_date   12:34   11.80
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 002:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .048 No_date   12:33   17.57
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 002:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .466 No_date   12:34   11.80
                      + 02:5900-1RO       2.40     .048 No_date   12:33   17.57
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .514 No_date   12:34   12.17
 002:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .262 No_date   12:20   11.08
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 002:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .015 No_date   12:07   16.28
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 002:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .262 No_date   12:20   11.08
                      + 02:6120-1RO        .40     .015 No_date   12:07   16.28
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .272 No_date   12:19   11.20
 002:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .272 No_date   12:19   11.20
                      + 03:TRIBB         38.40     .514 No_date   12:34   12.17
      [DT= 1.00]  SUM=  05:TRIBBC        55.10     .760 No_date   12:28   11.87
 002:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .092 No_date   12:13   12.32
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 002:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .187 No_date   12:20   11.08
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 002:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .020 No_date   12:19   16.91
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 002:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .092 No_date   12:13   12.32
                      + 02:6500-3        11.60     .187 No_date   12:20   11.08
                      + 03:65001+3R        .80     .020 No_date   12:19   16.91
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .295 No_date   12:18   11.67
 002:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .164 No_date   12:20   12.27
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 002:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .015 No_date   12:19   16.91
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 002:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .164 No_date   12:20   12.27
                      + 02:6760-1RO        .60     .015 No_date   12:19   16.91
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .179 No_date   12:20   12.56
```

```
 002:0020--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .141 No_date   12:20   12.15
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 002:0021--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .015 No_date   12:07   16.23
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 002:0022--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .141 No_date   12:20   12.15
                     +  02:XCULV2RO        .40     .015 No_date   12:07   16.23
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .151 No_date   12:18   12.34
 002:0023--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10     .760 No_date   12:28   11.87
                     +  04:TRIBD         16.60     .295 No_date   12:18   11.67
                     +  06:TRIBE          9.70     .179 No_date   12:20   12.56
                     +  07:XCULV2         8.30     .151 No_date   12:18   12.34
      [DT= 1.00]  SUM=  09:TRIBA         89.70    1.360 No_date   12:23   11.95
   ** END OF RUN :   2
*****************************************************************************
 RUN:COMMAND#
 003:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   3 ]
#****************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#****************************************************************************
#-----------------|----------------------------------------------------------|
 003:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=12.00:SDUR=  24.00:PTOT=  67.30]
 003:0003--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .225 No_date   12:33   19.83
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 003:0004--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .034 No_date   12:25   28.48
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 003:0005--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .225 No_date   12:33   19.83
                     +  02:4300-1RO        .90     .034 No_date   12:25   28.48
      [DT= 1.00]  SUM=  03:4300          10.90     .258 No_date   12:32   20.54
 003:0006--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .609 No_date   12:34   15.25
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 003:0007--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .061 No_date   12:33   22.14
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 003:0008--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .609 No_date   12:34   15.25
                     +  02:5900-1RO       2.40     .061 No_date   12:33   22.14
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .670 No_date   12:33   15.68
 003:0009--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .345 No_date   12:20   14.39
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 003:0010--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .019 No_date   12:07   20.61
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 003:0011--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .345 No_date   12:20   14.39
                     +  02:6120-1RO        .40     .019 No_date   12:07   20.61
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .358 No_date   12:19   14.54
 003:0012--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .358 No_date   12:19   14.54
                     +  03:TRIBB         38.40     .670 No_date   12:33   15.68
      [DT= 1.00]  SUM=  05:TRIBBC        55.10     .994 No_date   12:27   15.33
 003:0013--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .120 No_date   12:13   15.86
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 003:0014--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .246 No_date   12:20   14.39
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 003:0015--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .026 No_date   12:19   21.36
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 003:0016--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .120 No_date   12:13   15.86
                     +  02:6500-3        11.60     .246 No_date   12:20   14.39
                     +  03:65001+3R        .80     .026 No_date   12:19   21.36
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .386 No_date   12:17   15.10
 003:0017--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .214 No_date   12:20   15.82
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 003:0018--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .020 No_date   12:19   21.36
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 003:0019--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .214 No_date   12:20   15.82
                     +  02:6760-1RO        .60     .020 No_date   12:19   21.36
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .233 No_date   12:20   16.16
 003:0020--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .184 No_date   12:20   15.68
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 003:0021--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .019 No_date   12:07   20.55
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 003:0022--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .184 No_date   12:20   15.68
                     +  02:XCULV2RO        .40     .019 No_date   12:07   20.55
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .197 No_date   12:18   15.91
 003:0023--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10     .994 No_date   12:27   15.33
                     +  04:TRIBD         16.60     .386 No_date   12:17   15.10
                     +  06:TRIBE          9.70     .233 No_date   12:20   16.16
                     +  07:XCULV2         8.30     .197 No_date   12:18   15.91
      [DT= 1.00]  SUM=  09:TRIBA         89.70    1.778 No_date   12:22   15.43
   ** END OF RUN :   3
*****************************************************************************
 RUN:COMMAND#
 004:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   4 ]
#****************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#****************************************************************************
#-----------------|----------------------------------------------------------|
 004:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=12.00:SDUR=  24.00:PTOT=  77.40]
 004:0003--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .296 No_date   12:33   25.76
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 004:0004--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .044 No_date   12:25   35.86
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 004:0005--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .296 No_date   12:33   25.76
                     +  02:4300-1RO        .90     .044 No_date   12:25   35.86
      [DT= 1.00]  SUM=  03:4300          10.90     .338 No_date   12:32   26.59
 004:0006--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .809 No_date   12:33   20.03
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 004:0007--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .079 No_date   12:32   28.34
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 004:0008--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .809 No_date   12:33   20.03
                     +  02:5900-1RO       2.40     .079 No_date   12:32   28.34
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .888 No_date   12:33   20.55
 004:0009--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .462 No_date   12:20   19.01
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 004:0010--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .025 No_date   12:06   26.52
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 004:0011--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .462 No_date   12:20   19.01
                     +  02:6120-1RO        .40     .025 No_date   12:06   26.52
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .479 No_date   12:19   19.19
 004:0012--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .479 No_date   12:19   19.19
                     +  03:TRIBB         38.40     .888 No_date   12:33   20.55
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    1.321 No_date   12:27   20.13
 004:0013--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .159 No_date   12:13   20.78
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 004:0014--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .329 No_date   12:20   19.01
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 004:0015--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .034 No_date   12:19   27.42
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 004:0016--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .159 No_date   12:13   20.78
                     +  02:6500-3        11.60     .329 No_date   12:20   19.01
                     +  03:65001+3R        .80     .034 No_date   12:19   27.42
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .514 No_date   12:17   19.86
 004:0017--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .283 No_date   12:19   20.73
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 004:0018--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .025 No_date   12:19   27.42
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 004:0019--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .283 No_date   12:19   20.73
                     +  02:6760-1RO        .60     .025 No_date   12:19   27.42
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .308 No_date   12:19   21.14
 004:0020--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .244 No_date   12:20   20.57
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 004:0021--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .025 No_date   12:06   26.46
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 004:0022--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .244 No_date   12:20   20.57
                     +  02:XCULV2RO        .40     .025 No_date   12:06   26.46
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .261 No_date   12:18   20.86
 004:0023--------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.321 No_date   12:27   20.13
                     +  04:TRIBD         16.60     .514 No_date   12:17   19.86
                     +  06:TRIBE          9.70     .308 No_date   12:19   21.14
                     +  07:XCULV2         8.30     .261 No_date   12:18   20.86
      [DT= 1.00]  SUM=  09:TRIBA         89.70    2.364 No_date   12:22   20.26
   ** END OF RUN :   4
*****************************************************************************
 RUN:COMMAND#
 005:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   5 ]
#****************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#****************************************************************************
```

```
#-----------------|---------------------------------------------------------|
 005:0002----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=12.00:SDUR=  24.00:PTOT=  84.90]
 005:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .352 No_date   12:33   30.45
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 005:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .051 No_date   12:25   41.58
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 005:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .352 No_date   12:33   30.45
                      + 02:4300-1RO        .90     .051 No_date   12:25   41.58
      [DT= 1.00]  SUM=  03:4300          10.90     .401 No_date   12:31   31.37
 005:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .971 No_date   12:33   23.86
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 005:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .093 No_date   12:32   33.22
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 005:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .971 No_date   12:33   23.86
                      + 02:5900-1RO       2.40     .093 No_date   12:32   33.22
      [DT= 1.00]  SUM=  03:TRIBB         38.40    1.064 No_date   12:33   24.44
 005:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .556 No_date   12:19   22.72
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .030 No_date   12:06   31.18
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 005:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .556 No_date   12:19   22.72
                      + 02:6120-1RO        .40     .030 No_date   12:06   31.18
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .576 No_date   12:19   22.92
 005:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .576 No_date   12:19   22.92
                      + 03:TRIBB         38.40    1.064 No_date   12:33   24.44
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    1.585 No_date   12:27   23.98
 005:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .190 No_date   12:13   24.71
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 005:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .396 No_date   12:19   22.72
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .040 No_date   12:19   32.19
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .190 No_date   12:13   24.71
                      + 02:6500-3        11.60     .396 No_date   12:19   22.72
                      + 03:65001+3R        .80     .040 No_date   12:19   32.19
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .617 No_date   12:17   23.68
 005:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .339 No_date   12:19   24.66
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .030 No_date   12:19   32.19
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .339 No_date   12:19   24.66
                      + 02:6760-1RO        .60     .030 No_date   12:19   32.19
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .369 No_date   12:19   25.12
 005:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .292 No_date   12:19   24.50
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .030 No_date   12:06   31.12
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 005:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .292 No_date   12:19   24.50
                      + 02:XCULV2RO        .40     .030 No_date   12:06   31.12
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .313 No_date   12:18   24.82
 005:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.585 No_date   12:27   23.98
                      + 04:TRIBD         16.60     .617 No_date   12:17   23.68
                      + 06:TRIBE          9.70     .369 No_date   12:19   25.12
                      + 07:XCULV2         8.30     .313 No_date   12:18   24.82
      [DT= 1.00]  SUM=  09:TRIBA         89.70    2.835 No_date   12:22   24.13
   ** END OF RUN :   5
******************************************************************************
 RUN:COMMAND#
 006:0001----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   6 ]
#*****************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*****************************************************************************
#-----------------|---------------------------------------------------------|
 006:0002----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=12.00:SDUR=  24.00:PTOT=  92.30]
 006:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .411 No_date   12:32   35.28
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 006:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .058 No_date   12:25   47.39
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 006:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .411 No_date   12:32   35.28
                      + 02:4300-1RO        .90     .058 No_date   12:25   47.39
      [DT= 1.00]  SUM=  03:4300          10.90     .467 No_date   12:31   36.28
 006:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00    1.140 No_date   12:33   27.85
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 006:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .107 No_date   12:32   38.23
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 006:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00    1.140 No_date   12:33   27.85
                      + 02:5900-1RO       2.40     .107 No_date   12:32   38.23
      [DT= 1.00]  SUM=  03:TRIBB         38.40    1.247 No_date   12:33   28.50
 006:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .655 No_date   12:19   26.60
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .034 No_date   12:06   35.98
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 006:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .655 No_date   12:19   26.60
                      + 02:6120-1RO        .40     .034 No_date   12:06   35.98
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .678 No_date   12:19   26.83
 006:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .678 No_date   12:19   26.83
                      + 03:TRIBB         38.40    1.247 No_date   12:33   28.50
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    1.862 No_date   12:27   27.99
 006:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .223 No_date   12:13   28.81
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 006:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .466 No_date   12:19   26.60
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .046 No_date   12:19   37.09
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .223 No_date   12:13   28.81
                      + 02:6500-3        11.60     .466 No_date   12:19   26.60
                      + 03:65001+3R        .80     .046 No_date   12:19   37.09
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .725 No_date   12:17   27.66
 006:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .398 No_date   12:19   28.75
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .034 No_date   12:19   37.09
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .398 No_date   12:19   28.75
                      + 02:6760-1RO        .60     .034 No_date   12:19   37.09
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .432 No_date   12:19   29.27
 006:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .343 No_date   12:19   28.58
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .034 No_date   12:06   35.92
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 006:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .343 No_date   12:19   28.58
                      + 02:XCULV2RO        .40     .034 No_date   12:06   35.92
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .366 No_date   12:18   28.93
 006:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.862 No_date   12:27   27.99
                      + 04:TRIBD         16.60     .725 No_date   12:17   27.66
                      + 06:TRIBE          9.70     .432 No_date   12:19   29.27
                      + 07:XCULV2         8.30     .366 No_date   12:18   28.93
      [DT= 1.00]  SUM=  09:TRIBA         89.70    3.328 No_date   12:22   28.16
   ** END OF RUN :   6
******************************************************************************
 RUN:COMMAND#
 007:0001----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   7 ]
#*****************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*****************************************************************************
#-----------------|---------------------------------------------------------|
 007:0002----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  32.54]
 007:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .050 No_date    2:15    4.09
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 007:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .010 No_date    2:00    7.32
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 007:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .050 No_date    2:15    4.09
                      + 02:4300-1RO        .90     .010 No_date    2:00    7.32
      [DT= 1.00]  SUM=  03:4300          10.90     .060 No_date    2:12    4.36
 007:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .134 No_date    2:15    3.04
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 007:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .016 No_date    2:10    5.24
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 007:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .134 No_date    2:15    3.04
                      + 02:5900-1RO       2.40     .016 No_date    2:10    5.24
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .151 No_date    2:14    3.17
 007:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .066 No_date    1:56    2.73
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .005 No_date    1:34    4.72
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 007:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .066 No_date    1:56    2.73
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                       + 02:6120-1RO        .40      .005 No_date    1:34    4.72
      [DT= 1.00]  SUM=   04:TRIBC          16.70      .069 No_date    1:55    2.77
 007:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             04:TRIBC          16.70      .069 No_date    1:55    2.77
                       + 03:TRIBB          38.40      .151 No_date    2:14    3.17
      [DT= 1.00]  SUM=   05:TRIBBC         55.10      .214 No_date    2:08    3.05
 007:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6500-1          4.20      .025 No_date    1:45    3.22
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 007:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6500-3         11.60      .047 No_date    1:56    2.73
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        03:65001+3R         .80      .007 No_date    1:52    4.97
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6500-1          4.20      .025 No_date    1:45    3.22
                       + 02:6500-3         11.60      .047 No_date    1:56    2.73
                       + 03:65001+3R         .80      .007 No_date    1:52    4.97
      [DT= 1.00]  SUM=   04:TRIBD          16.60      .077 No_date    1:52    2.96
 007:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6760-1          9.10      .045 No_date    1:55    3.20
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6760-1RO         .60      .005 No_date    1:52    4.97
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6760-1          9.10      .045 No_date    1:55    3.20
                       + 02:6760-1RO         .60      .005 No_date    1:52    4.97
      [DT= 1.00]  SUM=   06:TRIBE           9.70      .050 No_date    1:54    3.31
 007:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:XCULV2          7.90      .038 No_date    1:55    3.12
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:XCULV2RO         .40      .005 No_date    1:34    4.69
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 007:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:XCULV2          7.90      .038 No_date    1:55    3.12
                       + 02:XCULV2RO         .40      .005 No_date    1:34    4.69
      [DT= 1.00]  SUM=   07:XCULV2          8.30      .041 No_date    1:53    3.20
 007:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             05:TRIBBC         55.10      .214 No_date    2:08    3.05
                       + 04:TRIBD          16.60      .077 No_date    1:52    2.96
                       + 06:TRIBE           9.70      .050 No_date    1:54    3.31
                       + 07:XCULV2          8.30      .041 No_date    1:53    3.20
      [DT= 1.00]  SUM=   09:TRIBA          89.70      .372 No_date    2:01    3.08
   ** END OF RUN :    7

*******************************************************************************





 RUN:COMMAND#
 008:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   8 ]
#*******************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*******************************************************************************
#-----------------|-----------------------------------------------------------|
 008:0002------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  42.22]
 008:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:4300-1         10.00      .100 No_date    2:10    7.57
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 008:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:4300-1RO         .90      .018 No_date    1:58   12.33
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 008:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:4300-1         10.00      .100 No_date    2:10    7.57
                       + 02:4300-1RO         .90      .018 No_date    1:58   12.33
      [DT= 1.00]  SUM=   03:4300           10.90      .116 No_date    2:08    7.97
 008:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:5900-1         36.00      .266 No_date    2:10    5.66
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 008:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:5900-1RO        2.40      .030 No_date    2:07    9.09
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 008:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:5900-1         36.00      .266 No_date    2:10    5.66
                       + 02:5900-1RO        2.40      .030 No_date    2:07    9.09
      [DT= 1.00]  SUM=   03:TRIBB          38.40      .296 No_date    2:10    5.88
 008:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6120-1         16.30      .139 No_date    1:53    5.20
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6120-1RO         .40      .009 No_date    1:33    8.30
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 008:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6120-1         16.30      .139 No_date    1:53    5.20
                       + 02:6120-1RO         .40      .009 No_date    1:33    8.30
      [DT= 1.00]  SUM=   04:TRIBC          16.70      .144 No_date    1:52    5.28
 008:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             04:TRIBC          16.70      .144 No_date    1:52    5.28
                       + 03:TRIBB          38.40      .296 No_date    2:10    5.88
      [DT= 1.00]  SUM=   05:TRIBBC         55.10      .427 No_date    2:04    5.70
 008:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6500-1          4.20      .050 No_date    1:43    5.96
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 008:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6500-3         11.60      .099 No_date    1:53    5.20
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        03:65001+3R         .80      .012 No_date    1:50    8.69
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6500-1          4.20      .050 No_date    1:43    5.96
                       + 02:6500-3         11.60      .099 No_date    1:53    5.20
                       + 03:65001+3R         .80      .012 No_date    1:50    8.69
      [DT= 1.00]  SUM=   04:TRIBD          16.60      .158 No_date    1:49    5.56
 008:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6760-1          9.10      .091 No_date    1:52    5.93
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6760-1RO         .60      .009 No_date    1:50    8.68
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6760-1          9.10      .091 No_date    1:52    5.93
                       + 02:6760-1RO         .60      .009 No_date    1:50    8.68
      [DT= 1.00]  SUM=   06:TRIBE           9.70      .100 No_date    1:52    6.10
 008:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:XCULV2          7.90      .077 No_date    1:52    5.83
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:XCULV2RO         .40      .009 No_date    1:33    8.26
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 008:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:XCULV2          7.90      .077 No_date    1:52    5.83
                       + 02:XCULV2RO         .40      .009 No_date    1:33    8.26
      [DT= 1.00]  SUM=   07:XCULV2          8.30      .083 No_date    1:50    5.95
 008:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             05:TRIBBC         55.10      .427 No_date    2:04    5.70
                       + 04:TRIBD          16.60      .158 No_date    1:49    5.56
                       + 06:TRIBE           9.70      .100 No_date    1:52    6.10
                       + 07:XCULV2          8.30      .083 No_date    1:50    5.95
      [DT= 1.00]  SUM=   09:TRIBA          89.70      .750 No_date    1:57    5.74
   ** END OF RUN :    8

*******************************************************************************





 RUN:COMMAND#
 009:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   9 ]
#*******************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*******************************************************************************
#-----------------|-----------------------------------------------------------|
 009:0002------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  48.66]
 009:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:4300-1         10.00      .140 No_date    2:09   10.32
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 009:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:4300-1RO         .90      .024 No_date    1:57   16.10
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 009:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:4300-1         10.00      .140 No_date    2:09   10.32
                       + 02:4300-1RO         .90      .024 No_date    1:57   16.10
      [DT= 1.00]  SUM=   03:4300           10.90      .162 No_date    2:07   10.80
 009:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:5900-1         36.00      .375 No_date    2:09    7.77
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 009:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:5900-1RO        2.40      .041 No_date    2:06   12.06
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 009:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:5900-1         36.00      .375 No_date    2:09    7.77
                       + 02:5900-1RO        2.40      .041 No_date    2:06   12.06
      [DT= 1.00]  SUM=   03:TRIBB          38.40      .416 No_date    2:09    8.04
 009:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6120-1         16.30      .200 No_date    1:51    7.21
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6120-1RO         .40      .013 No_date    1:32   11.08
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 009:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6120-1         16.30      .200 No_date    1:51    7.21
                       + 02:6120-1RO         .40      .013 No_date    1:32   11.08
      [DT= 1.00]  SUM=   04:TRIBC          16.70      .207 No_date    1:51    7.30
 009:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             04:TRIBC          16.70      .207 No_date    1:51    7.30
                       + 03:TRIBB          38.40      .416 No_date    2:09    8.04
      [DT= 1.00]  SUM=   05:TRIBBC         55.10      .603 No_date    2:02    7.81
 009:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6500-1          4.20      .071 No_date    1:42    8.14
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 009:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6500-3         11.60      .142 No_date    1:51    7.21
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        03:65001+3R         .80      .017 No_date    1:49   11.56
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6500-1          4.20      .071 No_date    1:42    8.14
                       + 02:6500-3         11.60      .142 No_date    1:51    7.21
                       + 03:65001+3R         .80      .017 No_date    1:49   11.56
      [DT= 1.00]  SUM=   04:TRIBD          16.60      .226 No_date    1:48    7.65
 009:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6760-1          9.10      .128 No_date    1:51    8.10
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6760-1RO         .60      .013 No_date    1:49   11.56
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6760-1          9.10      .128 No_date    1:51    8.10
                       + 02:6760-1RO         .60      .013 No_date    1:49   11.56
      [DT= 1.00]  SUM=   06:TRIBE           9.70      .141 No_date    1:51    8.32
 009:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:XCULV2          7.90      .109 No_date    1:51    8.00
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
```

```
     CALIB NASHYD       02:XCULV2RO        .40     .013 No_date    1:32   11.04
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 009:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .109 No_date    1:51    8.00
                      + 02:XCULV2RO        .40     .013 No_date    1:32   11.04
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .117 No_date    1:49    8.14
 009:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10     .603 No_date    2:02    7.81
                      + 04:TRIBD         16.60     .226 No_date    1:48    7.65
                      + 06:TRIBE          9.70     .141 No_date    1:51    8.32
                      + 07:XCULV2         8.30     .117 No_date    1:49    8.14
      [DT= 1.00]  SUM=  09:TRIBA         89.70    1.063 No_date    1:55    7.87
   ** END OF RUN :   9

********************************************************************************

 RUN:COMMAND#
 010:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  10 ]
#*******************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*******************************************************************************
#-----------------|-------------------------------------------------------------|
 010:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  57.12]
 010:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .200 No_date    2:07   14.37
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 010:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .032 No_date    1:56   21.48
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 010:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .200 No_date    2:07   14.37
                      + 02:4300-1RO        .90     .032 No_date    1:56   21.48
      [DT= 1.00]  SUM=  03:4300          10.90     .231 No_date    2:05   14.96
 010:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .540 No_date    2:07   10.92
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 010:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .056 No_date    2:05   16.39
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 010:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .540 No_date    2:07   10.92
                      + 02:5900-1RO       2.40     .056 No_date    2:05   16.39
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .597 No_date    2:07   11.27
 010:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .293 No_date    1:50   10.23
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .018 No_date    1:32   15.16
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 010:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .293 No_date    1:50   10.23
                      + 02:6120-1RO        .40     .018 No_date    1:32   15.16
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .304 No_date    1:49   10.35
 010:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .304 No_date    1:49   10.35
                      + 03:TRIBB         38.40     .597 No_date    2:07   11.27
      [DT= 1.00]  SUM=  05:TRIBBC        55.10     .870 No_date    2:01   10.99
 010:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .104 No_date    1:41   11.41
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 010:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .209 No_date    1:50   10.23
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .024 No_date    1:48   15.76
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .104 No_date    1:41   11.41
                      + 02:6500-3        11.60     .209 No_date    1:50   10.23
                      + 03:65001+3R        .80     .024 No_date    1:48   15.76
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .330 No_date    1:47   10.79
 010:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .186 No_date    1:50   11.37
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .018 No_date    1:48   15.76
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .186 No_date    1:50   11.37
                      + 02:6760-1RO        .60     .018 No_date    1:48   15.76
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .203 No_date    1:50   11.64
 010:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .159 No_date    1:50   11.24
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .018 No_date    1:32   15.11
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 010:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .159 No_date    1:50   11.24
                      + 02:XCULV2RO        .40     .018 No_date    1:32   15.11
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .170 No_date    1:48   11.43
 010:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10     .870 No_date    2:01   10.99
                      + 04:TRIBD         16.60     .330 No_date    1:47   10.79
                      + 06:TRIBE          9.70     .203 No_date    1:50   11.64
                      + 07:XCULV2         8.30     .170 No_date    1:48   11.43
      [DT= 1.00]  SUM=  09:TRIBA         89.70    1.538 No_date    1:54   11.06
   ** END OF RUN :  10

********************************************************************************

 RUN:COMMAND#
 011:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  11 ]
#*******************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*******************************************************************************
#-----------------|-------------------------------------------------------------|
 011:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  63.10]
 011:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .248 No_date    2:06   17.51
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 011:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .039 No_date    1:55   25.53
      [CN= 78.0: N= 3.00]
      [Tp=  .50:DT= 1.00]
 011:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .248 No_date    2:06   17.51
                      + 02:4300-1RO        .90     .039 No_date    1:55   25.53
      [DT= 1.00]  SUM=  03:4300          10.90     .285 No_date    2:05   18.17
 011:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .673 No_date    2:07   13.40
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 011:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .069 No_date    2:04   19.70
      [CN= 70.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 011:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .673 No_date    2:07   13.40
                      + 02:5900-1RO       2.40     .069 No_date    2:04   19.70
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .742 No_date    2:06   13.79
 011:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .370 No_date    1:50   12.61
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .022 No_date    1:32   18.30
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 011:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .370 No_date    1:50   12.61
                      + 02:6120-1RO        .40     .022 No_date    1:32   18.30
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .383 No_date    1:49   12.74
 011:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .383 No_date    1:49   12.74
                      + 03:TRIBB         38.40     .742 No_date    2:06   13.79
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    1.085 No_date    2:00   13.47
 011:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .130 No_date    1:41   13.96
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 011:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .263 No_date    1:50   12.61
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .029 No_date    1:48   18.99
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .130 No_date    1:41   13.96
                      + 02:6500-3        11.60     .263 No_date    1:50   12.61
                      + 03:65001+3R        .80     .029 No_date    1:48   18.99
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .414 No_date    1:46   13.26
 011:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .232 No_date    1:49   13.91
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .022 No_date    1:48   18.99
      [CN= 69.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .232 No_date    1:49   13.91
                      + 02:6760-1RO        .60     .022 No_date    1:48   18.99
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .254 No_date    1:49   14.23
 011:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .199 No_date    1:49   13.78
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .022 No_date    1:32   18.24
      [CN= 68.0: N= 3.00]
      [Tp=  .20:DT= 1.00]
 011:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .199 No_date    1:49   13.78
                      + 02:XCULV2RO        .40     .022 No_date    1:32   18.24
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .212 No_date    1:48   14.00
 011:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.085 No_date    2:00   13.47
                      + 04:TRIBD         16.60     .414 No_date    1:46   13.26
                      + 06:TRIBE          9.70     .254 No_date    1:49   14.23
                      + 07:XCULV2         8.30     .212 No_date    1:48   14.00
      [DT= 1.00]  SUM=  09:TRIBA         89.70    1.922 No_date    1:53   13.56
   ** END OF RUN :  11

********************************************************************************

 RUN:COMMAND#
 012:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  12 ]
#*******************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*******************************************************************************
#-----------------|-------------------------------------------------------------|
 012:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
```

```
       [SDT=10.00:SDUR=   4.00:PTOT=  68.90]
 012:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .298 No_date    2:05   20.73
       [CN= 69.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 012:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .046 No_date    1:55   29.62
       [CN= 78.0: N= 3.00]
       [Tp=  .50:DT= 1.00]
 012:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .298 No_date    2:05   20.73
                      + 02:4300-1RO        .90     .046 No_date    1:55   29.62
       [DT= 1.00]  SUM= 03:4300          10.90     .342 No_date    2:04   21.47
 012:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .814 No_date    2:06   15.97
       [CN= 60.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 012:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .082 No_date    2:04   23.10
       [CN= 70.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 012:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .814 No_date    2:06   15.97
                      + 02:5900-1RO       2.40     .082 No_date    2:04   23.10
       [DT= 1.00]  SUM= 03:TRIBB         38.40     .895 No_date    2:06   16.42
 012:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .451 No_date    1:49   15.09
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 012:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .026 No_date    1:31   21.52
       [CN= 68.0: N= 3.00]
       [Tp=  .20:DT= 1.00]
 012:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .451 No_date    1:49   15.09
                      + 02:6120-1RO        .40     .026 No_date    1:31   21.52
       [DT= 1.00]  SUM= 04:TRIBC         16.70     .467 No_date    1:48   15.24
 012:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .467 No_date    1:48   15.24
                      + 03:TRIBB         38.40     .895 No_date    2:06   16.42
       [DT= 1.00]  SUM= 05:TRIBBC        55.10    1.313 No_date    1:59   16.06
 012:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .157 No_date    1:40   16.61
       [CN= 61.0: N= 3.00]
       [Tp=  .30:DT= 1.00]
 012:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .321 No_date    1:49   15.09
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 012:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .035 No_date    1:48   22.29
       [CN= 69.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 012:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .157 No_date    1:40   16.61
                      + 02:6500-3        11.60     .321 No_date    1:49   15.09
                      + 03:65001+3R        .80     .035 No_date    1:48   22.29
       [DT= 1.00]  SUM= 04:TRIBD         16.60     .503 No_date    1:46   15.82
 012:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .281 No_date    1:49   16.56
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 012:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .026 No_date    1:48   22.29
       [CN= 69.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 012:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .281 No_date    1:49   16.56
                      + 02:6760-1RO        .60     .026 No_date    1:48   22.29
       [DT= 1.00]  SUM= 06:TRIBE          9.70     .307 No_date    1:49   16.92
 012:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .241 No_date    1:49   16.42
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 012:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .026 No_date    1:31   21.46
       [CN= 68.0: N= 3.00]
       [Tp=  .20:DT= 1.00]
 012:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .241 No_date    1:49   16.42
                      + 02:XCULV2RO        .40     .026 No_date    1:31   21.46
       [DT= 1.00]  SUM= 07:XCULV2         8.30     .257 No_date    1:47   16.66
 012:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.313 No_date    1:59   16.06
                      + 04:TRIBD         16.60     .503 No_date    1:46   15.82
                      + 06:TRIBE          9.70     .307 No_date    1:49   16.92
                      + 07:XCULV2         8.30     .257 No_date    1:47   16.66
       [DT= 1.00]  SUM= 09:TRIBA         89.70    2.329 No_date    1:53   16.17
   ** END OF RUN :  12

*******************************************************************************





 RUN:COMMAND#
 013:0001-----------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  =  13 ]
#******************************************************************************
#  Project Name: [SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#******************************************************************************
#-----------------|-----------------------------------------------------------|
 013:0002-----------------------------------------------------------------------
     READ STORM
       Filename = STORM.001
       Comment  =
       [SDT=60.00:SDUR=  12.00:PTOT= 193.00]
 013:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .677 No_date    7:18  113.74
       [CN= 69.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 013:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:4300-1RO        .90     .077 No_date    7:11  135.48
       [CN= 78.0: N= 3.00]
       [Tp=  .50:DT= 1.00]
 013:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .677 No_date    7:18  113.74
                      + 02:4300-1RO        .90     .077 No_date    7:11  135.48
       [DT= 1.00]  SUM= 03:4300          10.90     .753 No_date    7:17  115.53
 013:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00    2.030 No_date    7:19   96.36
       [CN= 60.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 013:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:5900-1RO       2.40     .168 No_date    7:18  118.28
       [CN= 70.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 013:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00    2.030 No_date    7:19   96.36
                      + 02:5900-1RO       2.40     .168 No_date    7:18  118.28
       [DT= 1.00]  SUM= 03:TRIBB         38.40    2.197 No_date    7:19   97.73
 013:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30    1.014 No_date    7:08   93.76
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 013:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6120-1RO        .40     .033 No_date    7:01  113.83
       [CN= 68.0: N= 3.00]
       [Tp=  .20:DT= 1.00]
 013:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30    1.014 No_date    7:08   93.76
                      + 02:6120-1RO        .40     .033 No_date    7:01  113.83
       [DT= 1.00]  SUM= 04:TRIBC         16.70    1.044 No_date    7:07   94.24
 013:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70    1.044 No_date    7:07   94.24
                      + 03:TRIBB         38.40    2.197 No_date    7:19   97.73
       [DT= 1.00]  SUM= 05:TRIBBC        55.10    3.203 No_date    7:14   96.67
 013:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .290 No_date    7:04   98.52
       [CN= 61.0: N= 3.00]
       [Tp=  .30:DT= 1.00]
 013:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .721 No_date    7:08   93.76
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 013:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       03:65001+3R        .80     .062 No_date    7:07  116.05
       [CN= 69.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 013:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .290 No_date    7:04   98.52
                      + 02:6500-3        11.60     .721 No_date    7:08   93.76
                      + 03:65001+3R        .80     .062 No_date    7:07  116.05
       [DT= 1.00]  SUM= 04:TRIBD         16.60    1.071 No_date    7:06   96.04
 013:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .595 No_date    7:08   98.44
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 013:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6760-1RO        .60     .046 No_date    7:07  116.05
       [CN= 69.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 013:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .595 No_date    7:08   98.44
                      + 02:6760-1RO        .60     .046 No_date    7:07  116.05
       [DT= 1.00]  SUM= 06:TRIBE          9.70     .641 No_date    7:08   99.53
 013:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .515 No_date    7:08   98.21
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 013:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:XCULV2RO        .40     .033 No_date    7:01  113.74
       [CN= 68.0: N= 3.00]
       [Tp=  .20:DT= 1.00]
 013:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .515 No_date    7:08   98.21
                      + 02:XCULV2RO        .40     .033 No_date    7:01  113.74
       [DT= 1.00]  SUM= 07:XCULV2         8.30     .547 No_date    7:07   98.96
 013:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    3.203 No_date    7:14   96.67
                      + 04:TRIBD         16.60    1.071 No_date    7:06   96.04
                      + 06:TRIBE          9.70     .641 No_date    7:08   99.53
                      + 07:XCULV2         8.30     .547 No_date    7:07   98.96
       [DT= 1.00]  SUM= 09:TRIBA         89.70    5.433 No_date    7:10   97.07
 013:0002-----------------------------------------------------------------------
       FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2016-08-18     at 19:53:04
================================================================================

```

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Proposed Conditions

- SWMHYMO Data and Summary Files

Appendix E.2

```
2     Metric units
*#****************************************************************************
*#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
*#  Date        : 06-17-2016
*#  Modeller    : [DESIGNED BY: AH, VERIFIED BY: AH]
*#  Company     : R.J. Burnside and Associates
*#  License #   :  3846413
*#****************************************************************************
*#----------------|-----------------------------------------------------------|
*%----------------|-----------------------------------------------------------|
*% 2-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["4300-1  "], DT=[1 ]min, AREA=[10.0 ](ha),
                    DWF=[0](cms),  CN/C=[69], IA=[8.8](mm),
                    N=[3], TP=[.6 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[2], NHYD=["4300RO"], DT=[1](min), AREA=[0.9 ](ha),
                    XIMP=[0.48], TIMP=[0.48], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[71],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[1.3](%),
                                         LGP=[450](m), MNP=[0.25], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[4.5](m), MNI=[0.013], SCI=[0](hrs)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["4300  "], IDs to add=[1,2]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["5900-1  "], DT=[1 ]min, AREA=[36.0 ](ha),
                    DWF=[0](cms),  CN/C=[60], IA=[8.3](mm),
                    N=[3], TP=[.6 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[2], NHYD=["5900RO"], DT=[1](min), AREA=[2.4 ](ha),
                    XIMP=[0.48], TIMP=[0.48], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[61],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[5.4](%),
                                         LGP=[1200](m), MNP=[0.25], SCP=[0](hrs)
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[4.5](m), MNI=[0.013], SCI=[0](hrs)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["TRIBB "], IDs to add=[1,2]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["6120-1  "], DT=[1 ]min, AREA=[16.3 ](ha),
                    DWF=[0](cms),  CN/C=[59], IA=[9.2](mm),
                    N=[3], TP=[.4 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[2], NHYD=["6120RO"], DT=[1](min), AREA=[0.4 ](ha),
                    XIMP=[0.47], TIMP=[0.47], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[61],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[10.0](%),
                                         LGP=[200](m), MNP=[0.25], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[4.5](m), MNI=[0.013], SCI=[0](hrs)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[4], NHYD=["TRIBC "], IDs to add=[1,2]
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[5], NHYD=["TRIBBC"], IDs to add=[4,3]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["6500-1  "], DT=[1 ]min, AREA=[4.2  ](ha),
                    DWF=[0](cms),  CN/C=[61], IA=[8.0](mm),
                    N=[3], TP=[.3 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["6500-3  "], DT=[1 ]min, AREA=[11.6 ](ha),
                    DWF=[0](cms),  CN/C=[59], IA=[9.2](mm),
                    N=[3], TP=[.4 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[3], NHYD=["650013"], DT=[1](min), AREA=[0.8 ](ha),
                    XIMP=[0.47], TIMP=[0.47], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[61],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[3.5](%),
                                         LGP=[400](m), MNP=[0.25], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[4.5](m), MNI=[0.013], SCI=[0](hrs)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[4], NHYD=["TRIBD "], IDs to add=[1,2,3]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["6760-1  "], DT=[1 ]min, AREA=[9.1  ](ha),
                    DWF=[0](cms),  CN/C=[61], IA=[8.1](mm),
                    N=[3], TP=[.4 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[2], NHYD=["6760RO"], DT=[1](min), AREA=[0.6 ](ha),
                    XIMP=[0.48], TIMP=[0.48], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[61],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[1.4](%),
                                         LGP=[280](m), MNP=[0.25], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[4.5](m), MNI=[0.013], SCI=[0](hrs)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[6], NHYD=["TRIBE "], IDs to add=[1,2]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["XCULV2  "], DT=[1 ]min, AREA=[7.9  ](ha),
                    DWF=[0](cms),  CN/C=[61], IA=[8.4](mm),
                    N=[3], TP=[.4 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[2], NHYD=["XCUL2R"], DT=[1](min), AREA=[0.4 ](ha),
                    XIMP=[0.47], TIMP=[0.47], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[61],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[5.8](%),
                                         LGP=[190](m), MNP=[0.25], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[4.5](m), MNI=[0.013], SCI=[0](hrs)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[7], NHYD=["XCULV2"], IDs to add=[1,2]
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[9], NHYD=["TRIBA "], IDs to add=[5,4,6,7]
*%----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 10-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["10SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 50-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["50SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                   ["100SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 2-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
*%                   ["2CHI4.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 5-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[8]
*%                   ["5CHI4.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 10-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[9]
*%                   ["10CHI4.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 25-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[10]
*%                   ["25CHI4.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 50-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[11]
*%                   ["50CHI4.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 100-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[12]
*%                   ["100CHI4.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% Timmins Regional Storm Distribution (12-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[13]
*%                   ["12REGTIM.O89"] <--storm filename
*%----------------|-----------------------------------------------------------|
FINISH
CALIB STANDHYD      ID=[1], NHYD=["RR0.60"], DT=[1](min), AREA=[0.60](ha),
                    XIMP=[0.95], TIMP=[0.95], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[49],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[2.0](%),
                                         LGP=[1](m), MNP=[0.25], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[1.0](%),
                                         LGI=[315](m), MNI=[0.013], SCI=[0](hrs)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["SR5900-1"], DT=[1 ]min, AREA=[37.7 ](ha),
                    DWF=[0](cms),  CN/C=[68], IA=[8.3](mm),
                    N=[3], TP=[.5 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["SR6120-1"], DT=[1 ]min, AREA=[16.7 ](ha),
                    DWF=[0](cms),  CN/C=[64], IA=[9.0](mm),
                    N=[3], TP=[.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[3], NHYD=["SR6500-1"], DT=[1 ]min, AREA=[4.7  ](ha),
                    DWF=[0](cms),  CN/C=[61], IA=[9.4](mm),
                    N=[3], TP=[.27]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[4], NHYD=["SR6500-3"], DT=[1 ]min, AREA=[11.6 ](ha),
                    DWF=[0](cms),  CN/C=[60], IA=[9.7](mm),
                    N=[3], TP=[.3 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[7], NHYD=["SR6500"], IDs to add=[3,4]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[5], NHYD=["SR6760-1"], DT=[1 ]min, AREA=[9.5  ](ha),
                    DWF=[0](cms),  CN/C=[68], IA=[8.3](mm),
                    N=[3], TP=[.33]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[6], NHYD=["XC2627-1"], DT=[1 ]min, AREA=[8.9  ](ha),
                    DWF=[0](cms),  CN/C=[69], IA=[8.1](mm),
                    N=[3], TP=[.29]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[7], NHYD=["TOSMLMN"], IDs to add=[1,2,3,4,5,6]
*%----------------|-----------------------------------------------------------|
SAVE HYD            ID=[6 ],   # OF PCYCLES=[5],  ICASEsh=[1]
                    HYD_COMMENT=["   "]
*%----------------|-----------------------------------------------------------|
COMPUTE DUALHYD     IDin=[7 ], CINLET=[.86](cms), NINLET=[1 ],
                    MAJID=[2 ], MajNHYD=["OVF" ],
                    MINID=[1 ], MinNHYD=["FBMI"],
                    TMJSTO=[0  ](cu-m)
*%----------------|-----------------------------------------------------------|
PRINT HYD           ID=[  ],   # OF PCYCLES=[ ]
*%----------------|-----------------------------------------------------------|
*% 100-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["100CHI4.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% Timmins Regional Storm Distribution (12-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
*%                   ["12REGTIM.O89"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 10-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["10SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 50-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["50SCS24.stm"] <--storm filename
*%----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Distribution for Owen Sound, ON. (24-hour)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
```

```
*%                    ["100SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 2-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
*%                    ["2CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 5-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[8]
*%                    ["5CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 10-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[9]
*%                    ["10CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 25-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[10]
*%                    ["25CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 50-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[11]
*%                    ["50CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year Chicago Storm Distribution for Owen Sound, ON. (24-hour)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[12]
*%                    ["100CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm Distribution (12-hour)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[13]
*%                    ["12REGTIM.O89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
```

```
===============================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9  9   9  Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999   9999  Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9  =========
                                                       9   9  9   9  # 3846413
        StormWater Management HYdrologic Model          999   999    =========

  ****************************************************************************
  **************************** SWMHYMO Ver/4.05 *****************************
  *********  A single event and continuous hydrologic simulation model  *********
  *********     based on the principles of HYMO and its successors      *********
  *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
  ****************************************************************************
  ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
  *********                  Ottawa,  Ontario: (613) 836-3884            *********
  *********                  Gatineau, Quebec: (819) 243-6858            *********
  *********                  E-Mail: swmhymo@jfsa.Com                    *********
  ****************************************************************************

  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
  +++++++++ Licensed user: R.J. Burnside and Associates                +++++++++
  +++++++++                Stayner                  SERIAL#:3846413    +++++++++
  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

  ****************************************************************************
  *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
  *********           Maximum value for ID numbers  :     10          *********
  *********           Max. number of rainfall points: 105408          *********
  *********           Max. number of flow points    : 105408          *********
  ****************************************************************************

  ***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
  *****-------------------------------------------------------------------*****
  *****     ID:  Hydrograph IDentification numbers, (1-10).                *****
  *****   NHYD:  Hydrograph reference numbers, (6 digits or characters).   *****
  *****   AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  *****
  ***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    *****
  ***** TpeakDate_hh:mm is the date and time of the peak flow.             *****
  *****   R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).      *****
  *****   R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).      *****
  *****      *:  see WARNING or NOTE message printed at end of run.        *****
  *****     **:  see  ERROR  message printed at end of run.                *****
  ****************************************************************************
  ****************************************************************************

 ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

  ****************************************************************************

  **********************   S U M M A R Y   O U T P U T   **********************
  ****************************************************************************
  *         DATE: 2016-08-18     TIME: 23:01:32     RUN COUNTER: 000049        *
  ****************************************************************************
  * Input   filename: C:\SWMHYMO\034587~1\POST\4-HOUR~1\POST26~1.DAT          *
  * Output  filename: C:\SWMHYMO\034587~1\POST\4-HOUR~1\POST26~1.out          *
  * Summary filename: C:\SWMHYMO\034587~1\POST\4-HOUR~1\POST26~1.sum          *
  * User comments:                                                             *
  * 1:_________________________________________________________________________*
  * 2:_________________________________________________________________________*
  * 3:_________________________________________________________________________*
  ****************************************************************************


 #***************************************************************************
 #  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
 #  Date         : 06-17-2016
 #  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
 #  Company      : R.J. Burnside and Associates
 #  License #    :  3846413
 #***************************************************************************
 #-----------------|---------------------------------------------------------|
  RUN:COMMAND#
  001:0001------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  =   1 ]
  001:0002------------------------------------------------------------------
      READ STORM
       Filename = STORM.001
       Comment  =
       [SDT=12.00:SDUR=  24.00:PTOT=  47.30]
  001:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:4300-1        10.00     .105 No_date   12:35    9.71
       [CN= 69.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
  001:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     02:4300RO          .90     .064 No_date   12:00   27.36
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 71.0]
       [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  001:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:4300-1        10.00     .105 No_date   12:35    9.71
                      +  02:4300RO          .90     .064 No_date   12:00   27.36
       [DT= 1.00]  SUM=  03:4300          10.90     .112 No_date   12:35   11.17
  001:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:5900-1        36.00     .280 No_date   12:35    7.30
       [CN= 60.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
  001:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     02:5900RO         2.40     .171 No_date   12:00   25.73
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  001:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:5900-1        36.00     .280 No_date   12:35    7.30
                      +  02:5900RO         2.40     .171 No_date   12:00   25.73
       [DT= 1.00]  SUM=  03:TRIBB         38.40     .296 No_date   12:35    8.45
  001:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:6120-1        16.30     .155 No_date   12:21    6.76
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
  001:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     02:6120RO          .40     .028 No_date   12:00   25.35
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  001:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:6120-1        16.30     .155 No_date   12:21    6.76
                      +  02:6120RO          .40     .028 No_date   12:00   25.35
       [DT= 1.00]  SUM=  04:TRIBC         16.70     .159 No_date   12:21    7.21
  001:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            04:TRIBC         16.70     .159 No_date   12:21    7.21
                      +  03:TRIBB         38.40     .296 No_date   12:35    8.45
       [DT= 1.00]  SUM=  05:TRIBBC        55.10     .441 No_date   12:29    8.08
  001:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:6500-1         4.20     .056 No_date   12:14    7.66
       [CN= 61.0: N= 3.00]
       [Tp=  .30:DT= 1.00]
  001:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       02:6500-3        11.60     .110 No_date   12:21    6.76
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
  001:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     03:650013          .80     .056 No_date   12:00   25.35
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  001:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:6500-1         4.20     .056 No_date   12:14    7.66
                      +  02:6500-3        11.60     .110 No_date   12:21    6.76
                      +  03:650013          .80     .056 No_date   12:00   25.35
       [DT= 1.00]  SUM=  04:TRIBD         16.60     .171 No_date   12:18    7.89
  001:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:6760-1         9.10     .099 No_date   12:21    7.62
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
  001:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     02:6760RO          .60     .043 No_date   12:00   25.73
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  001:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:6760-1         9.10     .099 No_date   12:21    7.62
                      +  02:6760RO          .60     .043 No_date   12:00   25.73
       [DT= 1.00]  SUM=  06:TRIBE          9.70     .105 No_date   12:21    8.74
  001:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:XCULV2         7.90     .085 No_date   12:21    7.52
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
  001:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     02:XCUL2R          .40     .028 No_date   12:00   25.35
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  001:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:XCULV2         7.90     .085 No_date   12:21    7.52
                      +  02:XCUL2R          .40     .028 No_date   12:00   25.35
       [DT= 1.00]  SUM=  07:XCULV2         8.30     .089 No_date   12:21    8.38
  001:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            05:TRIBBC        55.10     .441 No_date   12:29    8.08
                      +  04:TRIBD         16.60     .171 No_date   12:18    7.89
                      +  06:TRIBE          9.70     .105 No_date   12:21    8.74
                      +  07:XCULV2         8.30     .089 No_date   12:21    8.38
       [DT= 1.00]  SUM=  09:TRIBA         89.70     .797 No_date   12:24    8.14
   ** END OF RUN :   1

 ****************************************************************************






  RUN:COMMAND#
  002:0001------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  =   2 ]
 #***************************************************************************
 #  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
 #  Date         : 06-17-2016
 #  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
 #  Company      : R.J. Burnside and Associates
 #  License #    :  3846413
 #***************************************************************************
 #-----------------|---------------------------------------------------------|
  002:0002------------------------------------------------------------------
      READ STORM
       Filename = STORM.001
       Comment  =
       [SDT=12.00:SDUR=  24.00:PTOT=  59.30]
  002:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:4300-1        10.00     .173 No_date   12:34   15.49
       [CN= 69.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
  002:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     02:4300RO          .90     .081 No_date   12:00   36.33
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 71.0]
       [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  002:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:4300-1        10.00     .173 No_date   12:34   15.49
                      +  02:4300RO          .90     .081 No_date   12:00   36.33
       [DT= 1.00]  SUM=  03:4300          10.90     .184 No_date   12:34   17.21
  002:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:5900-1        36.00     .466 No_date   12:34   11.80
       [CN= 60.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
  002:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     02:5900RO         2.40     .215 No_date   12:00   33.91
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  002:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:5900-1        36.00     .466 No_date   12:34   11.80
                      +  02:5900RO         2.40     .215 No_date   12:00   33.91
       [DT= 1.00]  SUM=  03:TRIBB         38.40     .488 No_date   12:34   13.19
  002:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:6120-1        16.30     .262 No_date   12:20   11.08
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
  002:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     02:6120RO          .40     .036 No_date   12:00   33.46
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
  002:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            01:6120-1        16.30     .262 No_date   12:20   11.08
                      +  02:6120RO          .40     .036 No_date   12:00   33.46
       [DT= 1.00]  SUM=  04:TRIBC         16.70     .269 No_date   12:20   11.61
  002:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      ADD HYD            04:TRIBC         16.70     .269 No_date   12:20   11.61
                      +  03:TRIBB         38.40     .488 No_date   12:34   13.19
       [DT= 1.00]  SUM=  05:TRIBBC        55.10     .733 No_date   12:24   12.71
  002:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       01:6500-1         4.20     .092 No_date   12:13   12.32
       [CN= 61.0: N= 3.00]
       [Tp=  .30:DT= 1.00]
  002:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB NASHYD       02:6500-3        11.60     .187 No_date   12:20   11.08
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
  002:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
      CALIB STANDHYD     03:650013          .80     .070 No_date   12:00   33.46
       [XIMP=.47:TIMP=.47]
```

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       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 002:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:6500-1         4.20     .092 No_date   12:13   12.32
                        +  02:6500-3        11.60     .187 No_date   12:20   11.08
                        +  03:650013          .80     .070 No_date   12:00   33.46
       [DT= 1.00]  SUM=  04:TRIBD          16.60     .284 No_date   12:18   12.47
 002:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:6760-1         9.10     .164 No_date   12:20   12.27
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 002:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:6760RO          .60     .054 No_date   12:00   33.91
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 002:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:6760-1         9.10     .164 No_date   12:20   12.27
                        +  02:6760RO          .60     .054 No_date   12:00   33.91
       [DT= 1.00]  SUM=  06:TRIBE           9.70     .172 No_date   12:20   13.61
 002:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:XCULV2         7.90     .141 No_date   12:20   12.15
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 002:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:XCUL2R          .40     .036 No_date   12:00   33.46
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 002:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:XCULV2         7.90     .141 No_date   12:20   12.15
                        +  02:XCUL2R          .40     .036 No_date   12:00   33.46
       [DT= 1.00]  SUM=  07:XCULV2          8.30     .147 No_date   12:20   13.17
 002:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               05:TRIBBC        55.10     .733 No_date   12:24   12.71
                        +  04:TRIBD         16.60     .284 No_date   12:18   12.47
                        +  06:TRIBE          9.70     .172 No_date   12:20   13.61
                        +  07:XCULV2         8.30     .147 No_date   12:20   13.17
       [DT= 1.00]  SUM=  09:TRIBA          89.70    1.321 No_date   12:23   12.81
  ** END OF RUN :   2

*******************************************************************************

 RUN:COMMAND#
 003:0001-----------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  =   3 ]
#******************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#******************************************************************************
#-----------------|------------------------------------------------------------|
 003:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
       [SDT=12.00:SDUR=  24.00:PTOT=  67.30]
 003:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:4300-1        10.00     .225 No_date   12:33   19.83
       [CN= 69.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 003:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:4300RO          .90     .093 No_date   12:00   42.56
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 71.0]
       [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 003:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:4300-1        10.00     .225 No_date   12:33   19.83
                        +  02:4300RO          .90     .093 No_date   12:00   42.56
       [DT= 1.00]  SUM=  03:4300           10.90     .239 No_date   12:34   21.70
 003:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:5900-1        36.00     .609 No_date   12:34   15.25
       [CN= 60.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 003:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:5900RO         2.40     .245 No_date   12:00   39.59
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 003:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:5900-1        36.00     .609 No_date   12:34   15.25
                        +  02:5900RO         2.40     .245 No_date   12:00   39.59
       [DT= 1.00]  SUM=  03:TRIBB          38.40     .637 No_date   12:34   16.77
 003:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:6120-1        16.30     .345 No_date   12:20   14.39
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 003:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:6120RO          .40     .042 No_date   12:00   39.10
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 003:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:6120-1        16.30     .345 No_date   12:20   14.39
                        +  02:6120RO          .40     .042 No_date   12:00   39.10
       [DT= 1.00]  SUM=  04:TRIBC          16.70     .355 No_date   12:20   14.98
 003:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               04:TRIBC         16.70     .355 No_date   12:20   14.98
                        +  03:TRIBB         38.40     .637 No_date   12:34   16.77
       [DT= 1.00]  SUM=  05:TRIBBC         55.10     .960 No_date   12:24   16.23
 003:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:6500-1         4.20     .120 No_date   12:13   15.86
       [CN= 61.0: N= 3.00]
       [Tp=  .30:DT= 1.00]
 003:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          02:6500-3        11.60     .246 No_date   12:20   14.39
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 003:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        03:650013          .80     .080 No_date   12:00   39.10
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 003:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:6500-1         4.20     .120 No_date   12:13   15.86
                        +  02:6500-3        11.60     .246 No_date   12:20   14.39
                        +  03:650013          .80     .080 No_date   12:00   39.10
       [DT= 1.00]  SUM=  04:TRIBD          16.60     .371 No_date   12:17   15.95
 003:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:6760-1         9.10     .214 No_date   12:20   15.82
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 003:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:6760RO          .60     .061 No_date   12:00   39.59
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 003:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:6760-1         9.10     .214 No_date   12:20   15.82
                        +  02:6760RO          .60     .061 No_date   12:00   39.59
       [DT= 1.00]  SUM=  06:TRIBE           9.70     .222 No_date   12:20   17.29
 003:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:XCULV2         7.90     .184 No_date   12:20   15.68
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 003:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:XCUL2R          .40     .041 No_date   12:00   39.10
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 003:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:XCULV2         7.90     .184 No_date   12:20   15.68
                        +  02:XCUL2R          .40     .041 No_date   12:00   39.10
       [DT= 1.00]  SUM=  07:XCULV2          8.30     .192 No_date   12:20   16.81
 003:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               05:TRIBBC        55.10     .960 No_date   12:24   16.23
                        +  04:TRIBD         16.60     .371 No_date   12:17   15.95
                        +  06:TRIBE          9.70     .222 No_date   12:20   17.29
                        +  07:XCULV2         8.30     .192 No_date   12:20   16.81
       [DT= 1.00]  SUM=  09:TRIBA          89.70    1.725 No_date   12:23   16.34
  ** END OF RUN :   3

*******************************************************************************

 RUN:COMMAND#
 004:0001-----------------------------------------------------------------------
     START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2    (1=imperial, 2=metric output)]
       [NSTORM=   1 ]
       [NRUN  =   4 ]
#******************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#******************************************************************************
#-----------------|------------------------------------------------------------|
 004:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
       [SDT=12.00:SDUR=  24.00:PTOT=  77.40]
 004:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:4300-1        10.00     .296 No_date   12:33   25.76
       [CN= 69.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 004:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:4300RO          .90     .106 No_date   12:00   50.66
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 71.0]
       [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 004:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:4300-1        10.00     .296 No_date   12:33   25.76
                        +  02:4300RO          .90     .106 No_date   12:00   50.66
       [DT= 1.00]  SUM=  03:4300           10.90     .309 No_date   12:33   27.81
 004:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:5900-1        36.00     .809 No_date   12:33   20.03
       [CN= 60.0: N= 3.00]
       [Tp=  .60:DT= 1.00]
 004:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:5900RO         2.40     .283 No_date   12:00   47.00
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 004:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:5900-1        36.00     .809 No_date   12:33   20.03
                        +  02:5900RO         2.40     .283 No_date   12:00   47.00
       [DT= 1.00]  SUM=  03:TRIBB          38.40     .845 No_date   12:34   21.71
 004:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:6120-1        16.30     .462 No_date   12:20   19.01
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 004:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:6120RO          .40     .049 No_date   12:00   46.45
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 004:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:6120-1        16.30     .462 No_date   12:20   19.01
                        +  02:6120RO          .40     .049 No_date   12:00   46.45
       [DT= 1.00]  SUM=  04:TRIBC          16.70     .474 No_date   12:20   19.66
 004:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               04:TRIBC         16.70     .474 No_date   12:20   19.66
                        +  03:TRIBB         38.40     .845 No_date   12:34   21.71
       [DT= 1.00]  SUM=  05:TRIBBC         55.10    1.278 No_date   12:24   21.09
 004:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:6500-1         4.20     .159 No_date   12:13   20.78
       [CN= 61.0: N= 3.00]
       [Tp=  .30:DT= 1.00]
 004:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          02:6500-3        11.60     .329 No_date   12:20   19.01
       [CN= 59.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 004:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        03:650013          .80     .093 No_date   12:00   46.45
       [XIMP=.47:TIMP=.47]
       [LOSS= 2 :CN= 61.0]
       [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 004:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD               01:6500-1         4.20     .159 No_date   12:13   20.78
                        +  02:6500-3        11.60     .329 No_date   12:20   19.01
                        +  03:650013          .80     .093 No_date   12:00   46.45
       [DT= 1.00]  SUM=  04:TRIBD          16.60     .494 No_date   12:17   20.78
 004:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD          01:6760-1         9.10     .283 No_date   12:19   20.73
       [CN= 61.0: N= 3.00]
       [Tp=  .40:DT= 1.00]
 004:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD        02:6760RO          .60     .071 No_date   12:00   47.00
       [XIMP=.48:TIMP=.48]
       [LOSS= 2 :CN= 61.0]
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      [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 004:0019---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .283 No_date  12:19  20.73
                      + 02:6760RO          .60     .071 No_date  12:00  47.00
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .293 No_date  12:20  22.35
 004:0020---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .244 No_date  12:20  20.57
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 004:0021---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:XCUL2R          .40     .048 No_date  12:00  46.45
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 004:0022---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .244 No_date  12:20  20.57
                      + 02:XCUL2R          .40     .048 No_date  12:00  46.45
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .255 No_date  12:20  21.82
 004:0023---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.278 No_date  12:24  21.09
                      + 04:TRIBD         16.60     .494 No_date  12:17  20.78
                      + 06:TRIBE          9.70     .293 No_date  12:20  22.35
                      + 07:XCULV2         8.30     .255 No_date  12:20  21.82
      [DT= 1.00]  SUM=  09:TRIBA         89.70    2.291 No_date  12:23  21.24
  ** END OF RUN :   4

*******************************************************************************





 RUN:COMMAND#
 005:0001----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   5 ]
#******************************************************************************
# Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
# Date        : 06-17-2016
# Modeller    : [DESIGNED BY: AH, VERIFIED BY: AH]
# Company     : R.J. Burnside and Associates
# License #   :  3846413
#******************************************************************************
#-----------------|-----------------------------------------------------------|
 005:0002----------------------------------------------------------------------
     READ STORM
       Filename = STORM.001
       Comment  =
      [SDT=12.00:SDUR=  24.00:PTOT=  84.90]
 005:0003---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .352 No_date  12:33  30.45
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 005:0004---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:4300RO          .90     .117 No_date  12:00  56.82
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 005:0005---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .352 No_date  12:33  30.45
                      + 02:4300RO          .90     .117 No_date  12:00  56.82
      [DT= 1.00]  SUM=  03:4300          10.90     .368 No_date  12:33  32.62
 005:0006---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .971 No_date  12:33  23.86
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 005:0007---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:5900RO         2.40     .311 No_date  12:00  52.64
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 005:0008---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .971 No_date  12:33  23.86
                      + 02:5900RO         2.40     .311 No_date  12:00  52.64
      [DT= 1.00]  SUM=  03:TRIBB         38.40    1.014 No_date  12:33  25.66
 005:0009---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .556 No_date  12:19  22.72
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0010---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6120RO          .40     .055 No_date  12:00  52.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 005:0011---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .556 No_date  12:19  22.72
                      + 02:6120RO          .40     .055 No_date  12:00  52.06
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .570 No_date  12:19  23.42
 005:0012---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .570 No_date  12:19  23.42
                      + 03:TRIBB         38.40    1.014 No_date  12:33  25.66
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    1.535 No_date  12:24  24.98
 005:0013---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .190 No_date  12:13  24.71
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 005:0014---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .396 No_date  12:19  22.72
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0015---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:650013          .80     .102 No_date  12:00  52.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 005:0016---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .190 No_date  12:13  24.71
                      + 02:6500-3        11.60     .396 No_date  12:19  22.72
                      + 03:650013          .80     .102 No_date  12:00  52.06
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .594 No_date  12:17  24.64
 005:0017---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .339 No_date  12:19  24.66
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0018---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6760RO          .60     .078 No_date  12:00  52.64
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 005:0019---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .339 No_date  12:19  24.66
                      + 02:6760RO          .60     .078 No_date  12:00  52.64
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .351 No_date  12:19  26.39
 005:0020---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .292 No_date  12:19  24.50
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 005:0021---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:XCUL2R          .40     .054 No_date  12:00  52.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 005:0022---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .292 No_date  12:19  24.50
                      + 02:XCUL2R          .40     .054 No_date  12:00  52.06
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .306 No_date  12:19  25.83
 005:0023---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.535 No_date  12:24  24.98
                      + 04:TRIBD         16.60     .594 No_date  12:17  24.64
                      + 06:TRIBE          9.70     .351 No_date  12:19  26.39
                      + 07:XCULV2         8.30     .306 No_date  12:19  25.83
      [DT= 1.00]  SUM=  09:TRIBA         89.70    2.750 No_date  12:22  25.15
  ** END OF RUN :   5

*******************************************************************************





 RUN:COMMAND#
 006:0001----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   6 ]
#******************************************************************************
# Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
# Date        : 06-17-2016
# Modeller    : [DESIGNED BY: AH, VERIFIED BY: AH]
# Company     : R.J. Burnside and Associates
# License #   :  3846413
#******************************************************************************
#-----------------|-----------------------------------------------------------|
 006:0002----------------------------------------------------------------------
     READ STORM
       Filename = STORM.001
       Comment  =
      [SDT=12.00:SDUR=  24.00:PTOT=  92.30]
 006:0003---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .411 No_date  12:32  35.28
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 006:0004---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:4300RO          .90     .128 No_date  12:00  63.00
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 006:0005---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .411 No_date  12:32  35.28
                      + 02:4300RO          .90     .128 No_date  12:00  63.00
      [DT= 1.00]  SUM=  03:4300          10.90     .430 No_date  12:33  37.57
 006:0006---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00    1.140 No_date  12:33  27.85
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 006:0007---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:5900RO         2.40     .339 No_date  12:00  58.32
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 006:0008---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00    1.140 No_date  12:33  27.85
                      + 02:5900RO         2.40     .339 No_date  12:00  58.32
      [DT= 1.00]  SUM=  03:TRIBB         38.40    1.190 No_date  12:33  29.76
 006:0009---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .655 No_date  12:19  26.60
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0010---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6120RO          .40     .061 No_date  12:00  57.71
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 006:0011---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .655 No_date  12:19  26.60
                      + 02:6120RO          .40     .061 No_date  12:00  57.71
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .671 No_date  12:19  27.35
 006:0012---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .671 No_date  12:19  27.35
                      + 03:TRIBB         38.40    1.190 No_date  12:33  29.76
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    1.804 No_date  12:24  29.03
 006:0013---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .223 No_date  12:13  28.81
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 006:0014---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .466 No_date  12:19  26.60
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0015---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:650013          .80     .112 No_date  12:00  57.71
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 006:0016---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .223 No_date  12:13  28.81
                      + 02:6500-3        11.60     .466 No_date  12:19  26.60
                      + 03:650013          .80     .112 No_date  12:00  57.71
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .698 No_date  12:17  28.66
 006:0017---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .398 No_date  12:19  28.75
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0018---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6760RO          .60     .085 No_date  12:00  58.32
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 006:0019---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .398 No_date  12:19  28.75
                      + 02:6760RO          .60     .085 No_date  12:00  58.32
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .412 No_date  12:19  30.58
 006:0020---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .343 No_date  12:19  28.58
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 006:0021---------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:XCUL2R          .40     .060 No_date  12:00  57.71
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
```

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 006:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:XCULV2          7.90      .343 No_date   12:19   28.58
                       + 02:XCUL2R           .40      .060 No_date   12:00   57.71
      [DT= 1.00]  SUM=  07:XCULV2          8.30      .359 No_date   12:19   29.98
 006:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             05:TRIBBC         55.10     1.804 No_date   12:24   29.03
                       + 04:TRIBD          16.60      .698 No_date   12:17   28.66
                       + 06:TRIBE           9.70      .412 No_date   12:19   30.58
                       + 07:XCULV2          8.30      .359 No_date   12:19   29.98
      [DT= 1.00]  SUM=  09:TRIBA          89.70     3.229 No_date   12:22   29.21
   ** END OF RUN :   6

********************************************************************************

 RUN:COMMAND#
 007:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   7 ]
#*******************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*******************************************************************************
#-----------------|-------------------------------------------------------------|
 007:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  32.54]
 007:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:4300-1         10.00      .050 No_date    2:15    4.09
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 007:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:4300RO           .90      .091 No_date    1:20   17.10
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 007:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:4300-1         10.00      .050 No_date    2:15    4.09
                       + 02:4300RO           .90      .091 No_date    1:20   17.10
      [DT= 1.00]  SUM=  03:4300           10.90      .092 No_date    1:20    5.16
 007:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:5900-1         36.00      .134 No_date    2:15    3.04
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 007:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:5900RO          2.40      .243 No_date    1:20   16.34
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 007:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:5900-1         36.00      .134 No_date    2:15    3.04
                       + 02:5900RO          2.40      .243 No_date    1:20   16.34
      [DT= 1.00]  SUM=  03:TRIBB          38.40      .246 No_date    1:20    3.87
 007:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6120-1         16.30      .066 No_date    1:56    2.73
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:6120RO           .40      .040 No_date    1:20   16.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 007:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6120-1         16.30      .066 No_date    1:56    2.73
                       + 02:6120RO           .40      .040 No_date    1:20   16.06
      [DT= 1.00]  SUM=  04:TRIBC          16.70      .070 No_date    1:56    3.05
 007:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             04:TRIBC          16.70      .070 No_date    1:56    3.05
                       + 03:TRIBB          38.40      .246 No_date    1:20    3.87
      [DT= 1.00]  SUM=  05:TRIBBC         55.10      .290 No_date    1:20    3.62
 007:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6500-1          4.20      .025 No_date    1:45    3.22
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 007:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6500-3         11.60      .047 No_date    1:56    2.73
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      03:650013           .80      .079 No_date    1:20   16.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 007:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6500-1          4.20      .025 No_date    1:45    3.22
                       + 02:6500-3         11.60      .047 No_date    1:56    2.73
                       + 03:650013           .80      .079 No_date    1:20   16.06
      [DT= 1.00]  SUM=  04:TRIBD          16.60      .085 No_date    1:20    3.49
 007:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6760-1          9.10      .045 No_date    1:55    3.20
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:6760RO           .60      .061 No_date    1:20   16.34
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 007:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6760-1          9.10      .045 No_date    1:55    3.20
                       + 02:6760RO           .60      .061 No_date    1:20   16.34
      [DT= 1.00]  SUM=  06:TRIBE           9.70      .064 No_date    1:20    4.01
 007:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:XCULV2          7.90      .038 No_date    1:55    3.12
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 007:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:XCUL2R           .40      .040 No_date    1:20   16.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 007:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:XCULV2          7.90      .038 No_date    1:55    3.12
                       + 02:XCUL2R           .40      .040 No_date    1:20   16.06
      [DT= 1.00]  SUM=  07:XCULV2          8.30      .042 No_date    1:20    3.75
 007:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             05:TRIBBC         55.10      .290 No_date    1:20    3.62
                       + 04:TRIBD          16.60      .085 No_date    1:20    3.49
                       + 06:TRIBE           9.70      .064 No_date    1:20    4.01
                       + 07:XCULV2          8.30      .042 No_date    1:20    3.75
      [DT= 1.00]  SUM=  09:TRIBA          89.70      .480 No_date    1:20    3.65
   ** END OF RUN :   7

********************************************************************************

 RUN:COMMAND#
 008:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   8 ]
#*******************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*******************************************************************************
#-----------------|-------------------------------------------------------------|
 008:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  42.22]
 008:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:4300-1         10.00      .100 No_date    2:10    7.57
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 008:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:4300RO           .90      .121 No_date    1:20   23.72
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 008:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:4300-1         10.00      .100 No_date    2:10    7.57
                       + 02:4300RO           .90      .121 No_date    1:20   23.72
      [DT= 1.00]  SUM=  03:4300           10.90      .125 No_date    1:20    8.91
 008:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:5900-1         36.00      .266 No_date    2:10    5.66
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 008:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:5900RO          2.40      .323 No_date    1:20   22.41
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 008:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:5900-1         36.00      .266 No_date    2:10    5.66
                       + 02:5900RO          2.40      .323 No_date    1:20   22.41
      [DT= 1.00]  SUM=  03:TRIBB          38.40      .334 No_date    1:20    6.71
 008:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6120-1         16.30      .139 No_date    1:53    5.20
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:6120RO           .40      .053 No_date    1:20   22.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 008:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6120-1         16.30      .139 No_date    1:53    5.20
                       + 02:6120RO           .40      .053 No_date    1:20   22.06
      [DT= 1.00]  SUM=  04:TRIBC          16.70      .145 No_date    1:50    5.61
 008:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             04:TRIBC          16.70      .145 No_date    1:50    5.61
                       + 03:TRIBB          38.40      .334 No_date    1:20    6.71
      [DT= 1.00]  SUM=  05:TRIBBC         55.10      .424 No_date    2:00    6.38
 008:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6500-1          4.20      .050 No_date    1:43    5.96
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 008:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        02:6500-3         11.60      .099 No_date    1:53    5.20
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      03:650013           .80      .105 No_date    1:20   22.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 008:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6500-1          4.20      .050 No_date    1:43    5.96
                       + 02:6500-3         11.60      .099 No_date    1:53    5.20
                       + 03:650013           .80      .105 No_date    1:20   22.06
      [DT= 1.00]  SUM=  04:TRIBD          16.60      .158 No_date    1:49    6.21
 008:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:6760-1          9.10      .091 No_date    1:52    5.93
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:6760RO           .60      .081 No_date    1:20   22.41
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 008:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:6760-1          9.10      .091 No_date    1:52    5.93
                       + 02:6760RO           .60      .081 No_date    1:20   22.41
      [DT= 1.00]  SUM=  06:TRIBE           9.70      .099 No_date    1:50    6.94
 008:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD        01:XCULV2          7.90      .077 No_date    1:52    5.83
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 008:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD      02:XCUL2R           .40      .053 No_date    1:20   22.06
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 008:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             01:XCULV2          7.90      .077 No_date    1:52    5.83
                       + 02:XCUL2R           .40      .053 No_date    1:20   22.06
      [DT= 1.00]  SUM=  07:XCULV2          8.30      .083 No_date    1:50    6.61
 008:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD             05:TRIBBC         55.10      .424 No_date    2:00    6.38
                       + 04:TRIBD          16.60      .158 No_date    1:49    6.21
                       + 06:TRIBE           9.70      .099 No_date    1:50    6.94
                       + 07:XCULV2          8.30      .083 No_date    1:50    6.61
      [DT= 1.00]  SUM=  09:TRIBA          89.70      .747 No_date    1:57    6.43
   ** END OF RUN :   8

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 RUN:COMMAND#
 009:0001----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   9 ]
#*****************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*****************************************************************************
#-----------------|-----------------------------------------------------------|
 009:0002----------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  48.66]
 009:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .140 No_date    2:09   10.32
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 009:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:4300RO          .90     .141 No_date    1:20   28.35
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 009:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .140 No_date    2:09   10.32
                     +  02:4300RO          .90     .141 No_date    1:20   28.35
      [DT= 1.00]  SUM=  03:4300          10.90     .154 No_date    2:10   11.81
 009:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .375 No_date    2:09    7.77
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 009:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:5900RO         2.40     .375 No_date    1:20   26.63
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 009:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .375 No_date    2:09    7.77
                     +  02:5900RO         2.40     .375 No_date    1:20   26.63
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .406 No_date    2:09    8.95
 009:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .200 No_date    1:51    7.21
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6120RO          .40     .061 No_date    1:20   26.24
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 009:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .200 No_date    1:51    7.21
                     +  02:6120RO          .40     .061 No_date    1:20   26.24
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .208 No_date    1:50    7.66
 009:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .208 No_date    1:50    7.66
                     +  03:TRIBB         38.40     .406 No_date    2:09    8.95
      [DT= 1.00]  SUM=  05:TRIBBC        55.10     .597 No_date    2:00    8.56
 009:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .071 No_date    1:42    8.14
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 009:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .142 No_date    1:51    7.21
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:650013          .80     .123 No_date    1:20   26.24
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 009:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .071 No_date    1:42    8.14
                     +  02:6500-3        11.60     .142 No_date    1:51    7.21
                     +  03:650013          .80     .123 No_date    1:20   26.24
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .224 No_date    1:48    8.36
 009:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .128 No_date    1:51    8.10
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6760RO          .60     .094 No_date    1:20   26.63
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 009:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .128 No_date    1:51    8.10
                     +  02:6760RO          .60     .094 No_date    1:20   26.63
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .139 No_date    1:50    9.25
 009:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .109 No_date    1:51    8.00
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 009:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:XCUL2R          .40     .061 No_date    1:20   26.24
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 009:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .109 No_date    1:51    8.00
                     +  02:XCUL2R          .40     .061 No_date    1:20   26.24
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .117 No_date    1:50    8.88
 009:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10     .597 No_date    2:00    8.56
                     +  04:TRIBD         16.60     .224 No_date    1:48    8.36
                     +  06:TRIBE          9.70     .139 No_date    1:50    9.25
                     +  07:XCULV2         8.30     .117 No_date    1:50    8.88
      [DT= 1.00]  SUM=  09:TRIBA         89.70    1.052 No_date    1:56    8.63
  ** END OF RUN :   9

*****************************************************************************





 RUN:COMMAND#
 010:0001----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  10 ]
#*****************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*****************************************************************************
#-----------------|-----------------------------------------------------------|
 010:0002----------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  57.12]
 010:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .200 No_date    2:07   14.37
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 010:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:4300RO          .90     .166 No_date    1:20   34.66
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious     area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 010:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .200 No_date    2:07   14.37
                     +  02:4300RO          .90     .166 No_date    1:20   34.66
      [DT= 1.00]  SUM=  03:4300          10.90     .219 No_date    2:08   16.05
 010:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .540 No_date    2:07   10.92
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 010:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:5900RO         2.40     .442 No_date    1:20   32.39
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 010:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .540 No_date    2:07   10.92
                     +  02:5900RO         2.40     .442 No_date    1:20   32.39
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .579 No_date    2:08   12.27
 010:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .293 No_date    1:50   10.23
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6120RO          .40     .073 No_date    1:20   31.95
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 010:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .293 No_date    1:50   10.23
                     +  02:6120RO          .40     .073 No_date    1:20   31.95
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .304 No_date    1:50   10.75
 010:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .304 No_date    1:50   10.75
                     +  03:TRIBB         38.40     .579 No_date    2:08   12.27
      [DT= 1.00]  SUM=  05:TRIBBC        55.10     .858 No_date    2:00   11.81
 010:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .104 No_date    1:41   11.41
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 010:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .209 No_date    1:50   10.23
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:650013          .80     .145 No_date    1:20   31.95
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 010:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .104 No_date    1:41   11.41
                     +  02:6500-3        11.60     .209 No_date    1:50   10.23
                     +  03:650013          .80     .145 No_date    1:20   31.95
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .324 No_date    1:47   11.57
 010:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .186 No_date    1:50   11.37
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6760RO          .60     .111 No_date    1:20   32.39
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 010:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .186 No_date    1:50   11.37
                     +  02:6760RO          .60     .111 No_date    1:20   32.39
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .199 No_date    1:50   12.67
 010:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .159 No_date    1:50   11.24
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 010:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:XCUL2R          .40     .072 No_date    1:20   31.95
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 010:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .159 No_date    1:50   11.24
                     +  02:XCUL2R          .40     .072 No_date    1:20   31.95
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .169 No_date    1:50   12.24
 010:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10     .858 No_date    2:00   11.81
                     +  04:TRIBD         16.60     .324 No_date    1:47   11.57
                     +  06:TRIBE          9.70     .199 No_date    1:50   12.67
                     +  07:XCULV2         8.30     .169 No_date    1:50   12.24
      [DT= 1.00]  SUM=  09:TRIBA         89.70    1.514 No_date    1:55   11.90
  ** END OF RUN :  10

*****************************************************************************





 RUN:COMMAND#
 011:0001----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  11 ]
#*****************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#*****************************************************************************
```

```
#-----------------|-----------------------------------------------------------|
 011:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  63.10]
 011:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .248 No_date    2:06   17.51
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 011:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:4300RO          .90     .185 No_date    1:20   39.27
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious    area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 011:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .248 No_date    2:06   17.51
                      + 02:4300RO          .90     .185 No_date    1:20   39.27
      [DT= 1.00]  SUM=  03:4300          10.90     .271 No_date    2:06   19.30
 011:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .673 No_date    2:07   13.40
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 011:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:5900RO         2.40     .492 No_date    1:20   36.59
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 011:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .673 No_date    2:07   13.40
                      + 02:5900RO         2.40     .492 No_date    1:20   36.59
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .719 No_date    2:07   14.85
 011:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .370 No_date    1:50   12.61
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6120RO          .40     .081 No_date    1:20   36.11
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 011:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .370 No_date    1:50   12.61
                      + 02:6120RO          .40     .081 No_date    1:20   36.11
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .383 No_date    1:50   13.17
 011:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .383 No_date    1:50   13.17
                      + 03:TRIBB         38.40     .719 No_date    2:07   14.85
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    1.068 No_date    2:00   14.34
 011:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .130 No_date    1:41   13.96
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 011:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .263 No_date    1:50   12.61
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:650013          .80     .161 No_date    1:20   36.11
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 011:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .130 No_date    1:41   13.96
                      + 02:6500-3        11.60     .263 No_date    1:50   12.61
                      + 03:650013          .80     .161 No_date    1:20   36.11
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .406 No_date    1:47   14.08
 011:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .232 No_date    1:49   13.91
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6760RO          .60     .123 No_date    1:20   36.59
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 011:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .232 No_date    1:49   13.91
                      + 02:6760RO          .60     .123 No_date    1:20   36.59
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .248 No_date    1:50   15.32
 011:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .199 No_date    1:49   13.78
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 011:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:XCUL2R          .40     .081 No_date    1:20   36.11
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 011:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .199 No_date    1:49   13.78
                      + 02:XCUL2R          .40     .081 No_date    1:20   36.11
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .211 No_date    1:49   14.86
 011:0023--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.068 No_date    2:00   14.34
                      + 04:TRIBD         16.60     .406 No_date    1:47   14.08
                      + 06:TRIBE          9.70     .248 No_date    1:50   15.32
                      + 07:XCULV2         8.30     .211 No_date    1:49   14.86
      [DT= 1.00]  SUM=  09:TRIBA         89.70    1.889 No_date    1:50   14.45
  ** END OF RUN :  11

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 RUN:COMMAND#
 012:0001-----------------------------------------------------------------------
     START
      [TZERO =     .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  12 ]
#******************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#******************************************************************************
#-----------------|-----------------------------------------------------------|
 012:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  68.90]
 012:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .298 No_date    2:05   20.73
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 012:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:4300RO          .90     .203 No_date    1:20   43.83
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious    area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 012:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .298 No_date    2:05   20.73
                      + 02:4300RO          .90     .203 No_date    1:20   43.83
      [DT= 1.00]  SUM=  03:4300          10.90     .325 No_date    2:05   22.64
 012:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00     .814 No_date    2:06   15.97
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 012:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:5900RO         2.40     .540 No_date    1:20   40.75
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 012:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00     .814 No_date    2:06   15.97
                      + 02:5900RO         2.40     .540 No_date    1:20   40.75
      [DT= 1.00]  SUM=  03:TRIBB         38.40     .867 No_date    2:07   17.52
 012:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30     .451 No_date    1:49   15.09
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 012:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6120RO          .40     .089 No_date    1:20   40.25
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 012:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30     .451 No_date    1:49   15.09
                      + 02:6120RO          .40     .089 No_date    1:20   40.25
      [DT= 1.00]  SUM=  04:TRIBC         16.70     .466 No_date    1:49   15.69
 012:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70     .466 No_date    1:49   15.69
                      + 03:TRIBB         38.40     .867 No_date    2:07   17.52
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    1.290 No_date    1:59   16.97
 012:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .157 No_date    1:40   16.61
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 012:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .321 No_date    1:49   15.09
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 012:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:650013          .80     .176 No_date    1:20   40.25
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 012:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .157 No_date    1:40   16.61
                      + 02:6500-3        11.60     .321 No_date    1:49   15.09
                      + 03:650013          .80     .176 No_date    1:20   40.25
      [DT= 1.00]  SUM=  04:TRIBD         16.60     .489 No_date    1:46   16.69
 012:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .281 No_date    1:49   16.56
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 012:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6760RO          .60     .135 No_date    1:20   40.75
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 012:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .281 No_date    1:49   16.56
                      + 02:6760RO          .60     .135 No_date    1:20   40.75
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .299 No_date    1:49   18.06
 012:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .241 No_date    1:49   16.42
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 012:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:XCUL2R          .40     .089 No_date    1:20   40.25
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious    area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 012:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .241 No_date    1:49   16.42
                      + 02:XCUL2R          .40     .089 No_date    1:20   40.25
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .255 No_date    1:49   17.57
 012:0023--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    1.290 No_date    1:59   16.97
                      + 04:TRIBD         16.60     .489 No_date    1:46   16.69
                      + 06:TRIBE          9.70     .299 No_date    1:49   18.06
                      + 07:XCULV2         8.30     .255 No_date    1:49   17.57
      [DT= 1.00]  SUM=  09:TRIBA         89.70    2.284 No_date    1:50   17.09
  ** END OF RUN :  12

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 RUN:COMMAND#
 013:0001-----------------------------------------------------------------------
     START
      [TZERO =     .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  13 ]
#******************************************************************************
#  Project Name: [POST SR2627 TLN TO CONC 10]    Project Number: [300034587]
#  Date         : 06-17-2016
#  Modeller     : [DESIGNED BY: AH, VERIFIED BY: AH]
#  Company      : R.J. Burnside and Associates
#  License #    :  3846413
#******************************************************************************
#-----------------|-----------------------------------------------------------|
 013:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=60.00:SDUR=  12.00:PTOT= 193.00]
 013:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:4300-1        10.00     .677 No_date    7:18  113.74
      [CN= 69.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 013:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:4300RO          .90     .073 No_date    7:00  153.32
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 71.0]
      [Pervious    area: IAper= 8.00:SLPP=1.30:LGP= 450.:MNP=.250:SCP=   .0]
      [Impervious  area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
```

```
 013:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:4300-1        10.00     .677 No_date    7:18  113.74
                      + 02:4300RO          .90     .073 No_date    7:00  153.32
      [DT= 1.00]  SUM=  03:4300          10.90     .727 No_date    7:18  117.01
 013:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:5900-1        36.00    2.030 No_date    7:19   96.36
      [CN= 60.0: N= 3.00]
      [Tp=  .60:DT= 1.00]
 013:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:5900RO         2.40     .171 No_date    7:00  142.91
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.40:LGP=1200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 013:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:5900-1        36.00    2.030 No_date    7:19   96.36
                      + 02:5900RO         2.40     .171 No_date    7:00  142.91
      [DT= 1.00]  SUM=  03:TRIBB         38.40    2.137 No_date    7:19   99.27
 013:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6120-1        16.30    1.014 No_date    7:08   93.76
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 013:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6120RO          .40     .036 No_date    7:00  141.99
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=****:LGP= 200.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 013:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6120-1        16.30    1.014 No_date    7:08   93.76
                      + 02:6120RO          .40     .036 No_date    7:00  141.99
      [DT= 1.00]  SUM=  04:TRIBC         16.70    1.038 No_date    7:08   94.92
 013:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            04:TRIBC         16.70    1.038 No_date    7:08   94.92
                      + 03:TRIBB         38.40    2.137 No_date    7:19   99.27
      [DT= 1.00]  SUM=  05:TRIBBC        55.10    3.138 No_date    7:14   97.95
 013:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6500-1         4.20     .290 No_date    7:04   98.52
      [CN= 61.0: N= 3.00]
      [Tp=  .30:DT= 1.00]
 013:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:6500-3        11.60     .721 No_date    7:08   93.76
      [CN= 59.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 013:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:650013          .80     .065 No_date    7:00  141.99
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=3.50:LGP= 400.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 013:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6500-1         4.20     .290 No_date    7:04   98.52
                      + 02:6500-3        11.60     .721 No_date    7:08   93.76
                      + 03:650013          .80     .065 No_date    7:00  141.99
      [DT= 1.00]  SUM=  04:TRIBD         16.60    1.051 No_date    7:07   97.29
 013:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:6760-1         9.10     .595 No_date    7:08   98.44
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 013:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:6760RO          .60     .048 No_date    7:00  142.91
      [XIMP=.48:TIMP=.48]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=1.40:LGP= 280.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 013:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:6760-1         9.10     .595 No_date    7:08   98.44
                      + 02:6760RO          .60     .048 No_date    7:00  142.91
      [DT= 1.00]  SUM=  06:TRIBE          9.70     .626 No_date    7:08  101.19
 013:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:XCULV2         7.90     .515 No_date    7:08   98.21
      [CN= 61.0: N= 3.00]
      [Tp=  .40:DT= 1.00]
 013:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:XCUL2R          .40     .036 No_date    7:00  141.99
      [XIMP=.47:TIMP=.47]
      [LOSS= 2 :CN= 61.0]
      [Pervious     area: IAper= 8.00:SLPP=5.80:LGP= 190.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=   5.:MNI=.013:SCI=   .0]
 013:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:XCULV2         7.90     .515 No_date    7:08   98.21
                      + 02:XCUL2R          .40     .036 No_date    7:00  141.99
      [DT= 1.00]  SUM=  07:XCULV2         8.30     .540 No_date    7:08  100.32
 013:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            05:TRIBBC        55.10    3.138 No_date    7:14   97.95
                      + 04:TRIBD         16.60    1.051 No_date    7:07   97.29
                      + 06:TRIBE          9.70     .626 No_date    7:08  101.19
                      + 07:XCULV2         8.30     .540 No_date    7:08  100.32
      [DT= 1.00]  SUM=  09:TRIBA         89.70    5.327 No_date    7:10   98.40
 013:0002-----------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2016-08-18     at 23:01:39
================================================================================
```

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix F

Hydraulic Files

- Existing Conditions Cross Culverts;
- Proposed Conditions Cross Culverts;
- Proposed Conditions Driveway Culverts;
- Ditch Capacity Calculations;
- Check Dam Capacity – Weir Calculation.

BURNSIDE
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Appendix F.1

Existing Conditions

Cross Culverts

- Existing conditions culvert capacities were modeled using HY-8.

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 46.6154 cfs

Design Flow: 65.6853 cfs

Maximum Flow: 113.007 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta6128

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
430.36	1.32	0.40	0.92	7
430.38	1.51	0.40	1.11	4
430.40	1.70	0.39	1.30	4
430.41	1.86	0.39	1.47	4
430.43	2.07	0.38	1.68	3
430.45	2.26	0.38	1.88	3
430.46	2.45	0.38	2.07	3
430.48	2.64	0.38	2.26	3
430.49	2.82	0.37	2.45	3
430.51	3.01	0.37	2.64	3
430.52	3.20	0.37	2.83	3
430.20	0.35	0.35	0.00	Overtopping

Project Units: SI Units (Metric)

Rating Curve Plot for Crossing: Sta6128

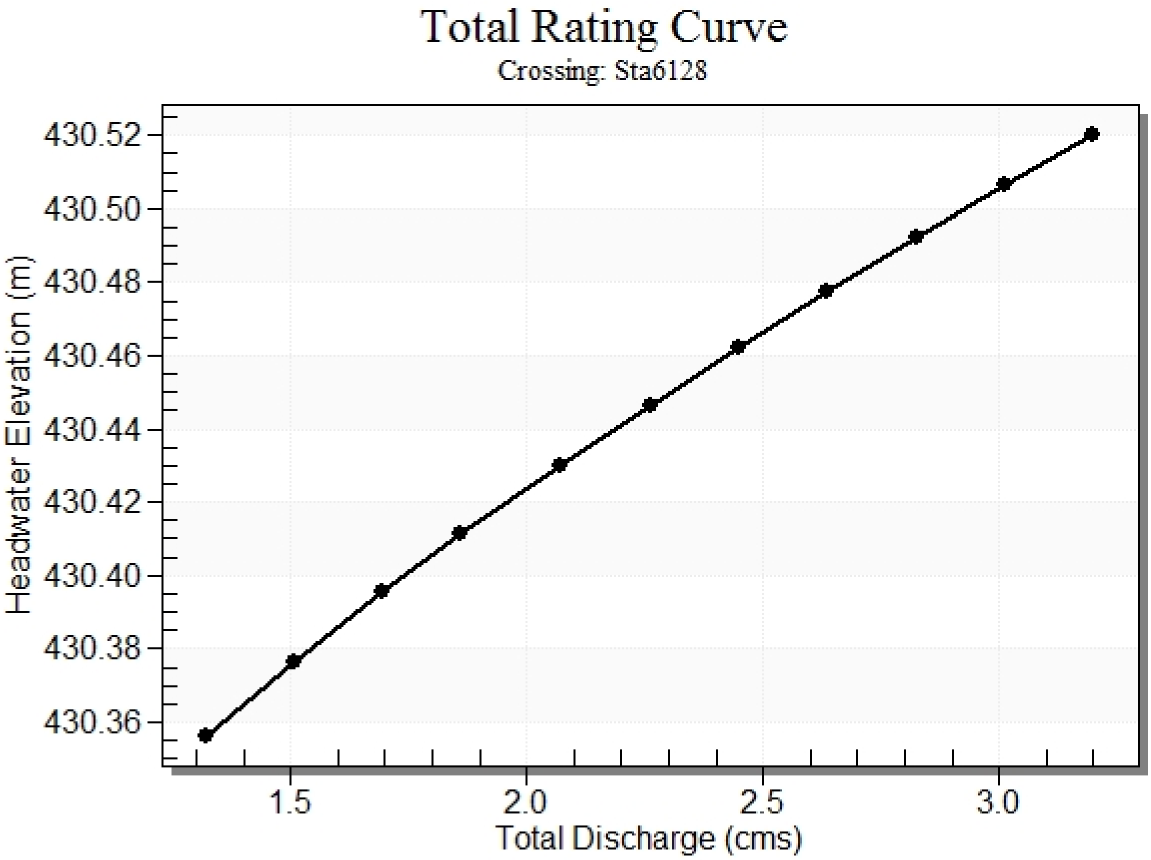


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
1.32	0.40	430.36	1.026	1.014	4-FFf	0.437	0.426	0.437	0.589	2.185	1.621
1.51	0.40	430.38	1.022	1.046	4-FFf	0.435	0.426	0.500	0.625	2.013	1.677
1.70	0.39	430.40	1.008	1.065	4-FFf	0.429	0.424	0.500	0.660	1.993	1.727
1.86	0.39	430.41	0.997	1.081	4-FFf	0.423	0.423	0.500	0.687	1.978	1.767
2.07	0.38	430.43	0.984	1.100	4-FFf	0.417	0.421	0.500	0.721	1.958	1.816
2.26	0.38	430.45	0.973	1.116	4-FFf	0.412	0.419	0.500	0.750	1.942	1.856
2.45	0.38	430.46	0.963	1.132	4-FFf	0.408	0.418	0.500	0.777	1.928	1.893
2.64	0.38	430.48	0.954	1.147	4-FFf	0.405	0.417	0.500	0.802	1.913	1.929
2.82	0.37	430.49	0.945	1.162	4-FFf	0.402	0.415	0.500	0.827	1.900	1.962
3.01	0.37	430.51	0.937	1.176	4-FFf	0.400	0.414	0.500	0.851	1.888	1.994
3.20	0.37	430.52	0.929	1.190	4-FFf	0.398	0.413	0.500	0.873	1.876	2.024

****

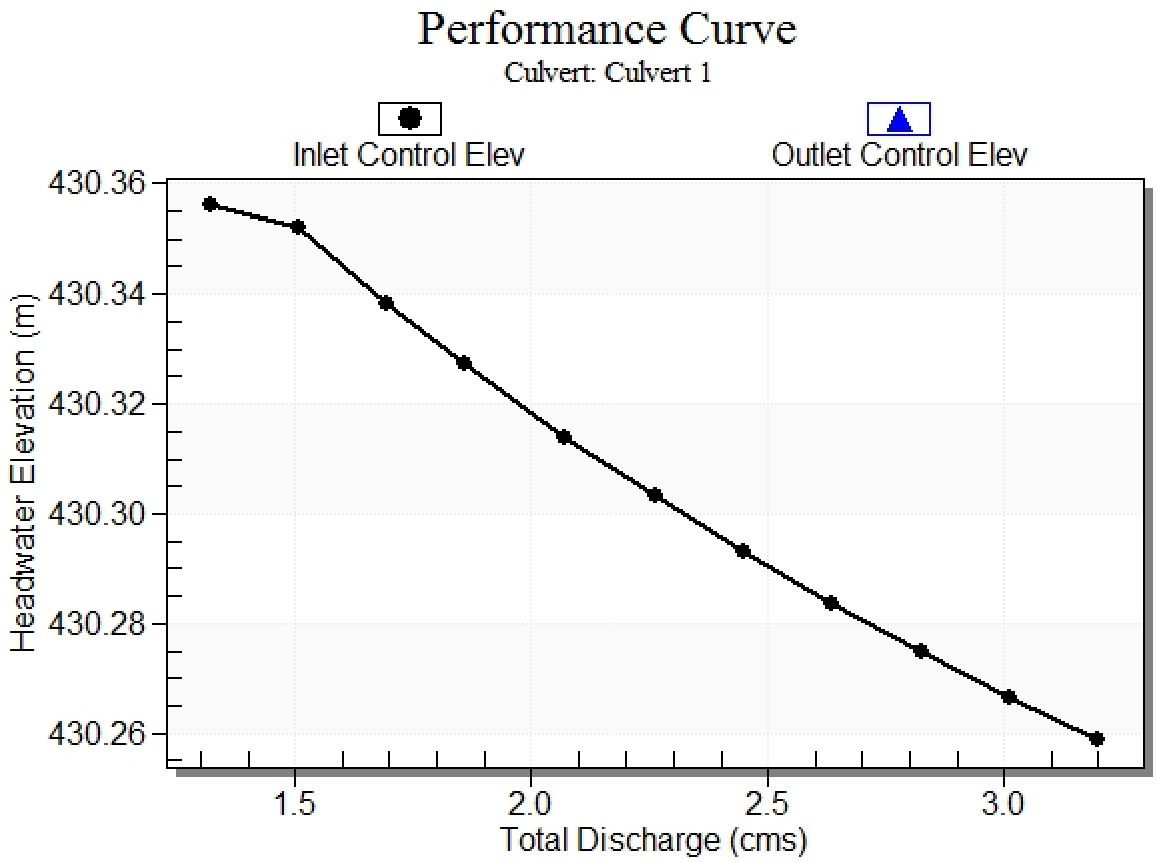
Straight Culvert

Inlet Elevation (invert): 429.33 m, Outlet Elevation (invert): 428.96 m

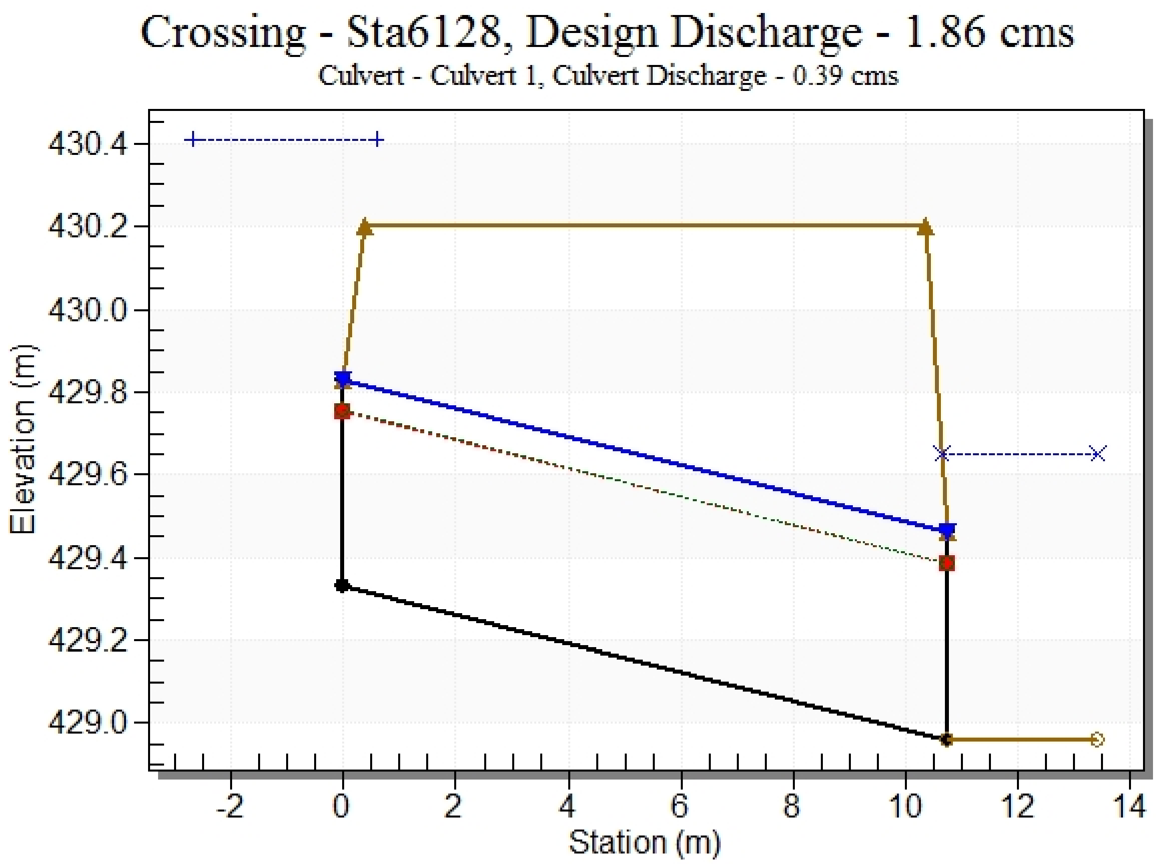
Culvert Length: 10.75 m, Culvert Slope: 0.0345

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 429.33 m

Outlet Station: 10.74 m

Outlet Elevation: 428.96 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 500.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Sta6128)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
1.32	429.55	0.59	1.62	115.41	0.86
1.51	429.59	0.63	1.68	122.61	0.87
1.70	429.62	0.66	1.73	129.29	0.88
1.86	429.65	0.69	1.77	134.76	0.88
2.07	429.68	0.72	1.82	141.41	0.89
2.26	429.71	0.75	1.86	146.97	0.89
2.45	429.74	0.78	1.89	152.25	0.89
2.64	429.76	0.80	1.93	157.29	0.90
2.82	429.79	0.83	1.96	162.12	0.90
3.01	429.81	0.85	1.99	166.76	0.90
3.20	429.83	0.87	2.02	171.21	0.91

Tailwater Channel Data - Sta6128

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 0.50 m

Side Slope (H:V): 1.50 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0400

Channel Invert Elevation: 428.96 m

Roadway Data for Crossing: Sta6128

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 430.20 m

Roadway Surface: Gravel

Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 18.0105 cfs

Design Flow: 25.7797 cfs

Maximum Flow: 37.7867 cfs

Table 4 - Summary of Culvert Flows at Crossing: Sta6508

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
415.87	0.51	0.49	0.02	7
415.88	0.57	0.50	0.06	6
415.90	0.62	0.51	0.11	5
415.91	0.68	0.51	0.16	4
415.92	0.73	0.52	0.21	4
415.92	0.79	0.52	0.27	4
415.93	0.85	0.52	0.32	3
415.94	0.90	0.53	0.37	3
415.95	0.96	0.53	0.43	3
415.95	1.01	0.53	0.48	3
415.96	1.07	0.54	0.53	3
415.86	0.49	0.49	0.00	Overtopping

Rating Curve Plot for Crossing: Sta6508

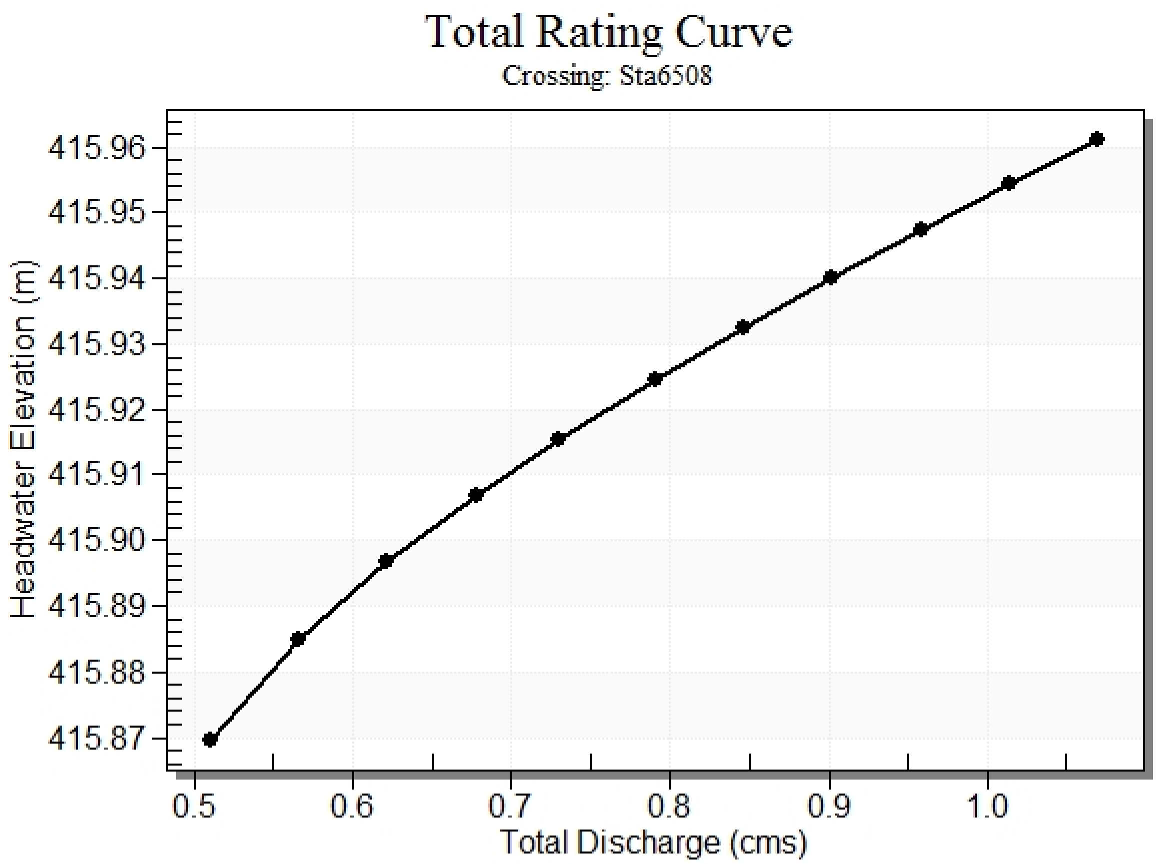


Table 5 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.51	0.49	415.87	0.910	0.535	6-FFc	0.351	0.460	0.460	0.386	2.130	1.140
0.57	0.50	415.88	0.925	0.551	6-FFc	0.355	0.463	0.463	0.401	2.146	1.170
0.62	0.51	415.90	0.937	0.564	6-FFc	0.357	0.466	0.466	0.416	2.159	1.198
0.68	0.51	415.91	0.946	0.575	6-FFc	0.359	0.468	0.468	0.430	2.169	1.224
0.73	0.52	415.92	0.955	0.584	6-FFc	0.361	0.469	0.469	0.442	2.178	1.247
0.79	0.52	415.92	0.965	0.594	6-FFc	0.363	0.471	0.471	0.455	2.188	1.272
0.85	0.52	415.93	0.972	0.602	6-FFc	0.365	0.473	0.473	0.467	2.195	1.294
0.90	0.53	415.94	0.980	0.552	6-FFt	0.366	0.474	0.478	0.478	2.184	1.315
0.96	0.53	415.95	0.987	0.570	6-FFt	0.368	0.475	0.489	0.489	2.149	1.335
1.01	0.53	415.95	0.994	0.587	6-FFt	0.369	0.477	0.500	0.500	2.116	1.354
1.07	0.54	415.96	1.001	0.604	6-FFt	0.370	0.478	0.510	0.510	2.100	1.372

****

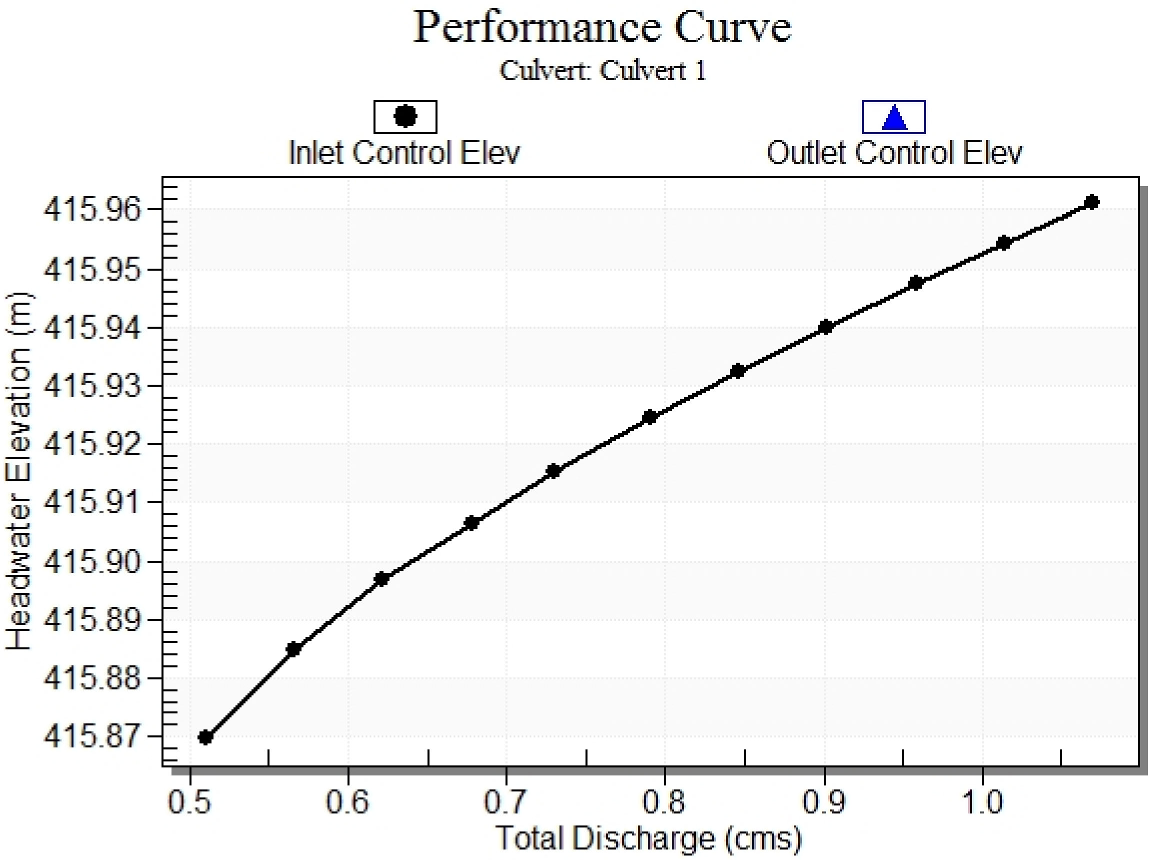
Straight Culvert

Inlet Elevation (invert): 414.96 m,   Outlet Elevation (invert): 414.46 m

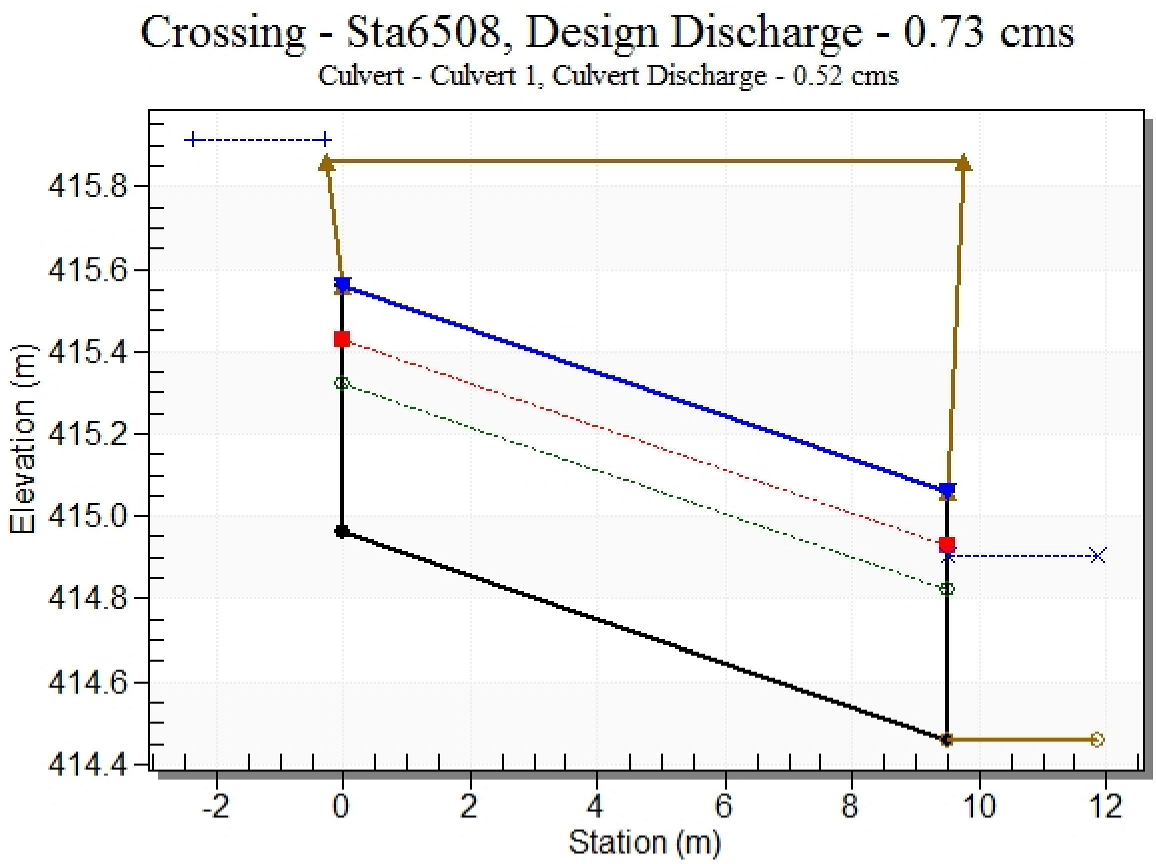
Culvert Length: 9.50 m,   Culvert Slope: 0.0527

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 414.96 m

Outlet Station: 9.49 m

Outlet Elevation: 414.46 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 600.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 6 - Downstream Channel Rating Curve (Crossing: Sta6508)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.51	414.85	0.39	1.14	75.70	0.83
0.57	414.86	0.40	1.17	78.71	0.83
0.62	414.88	0.42	1.20	81.55	0.84
0.68	414.89	0.43	1.22	84.23	0.84
0.73	414.90	0.44	1.25	86.59	0.85
0.79	414.91	0.45	1.27	89.20	0.85
0.85	414.93	0.47	1.29	91.52	0.86
0.90	414.94	0.48	1.32	93.74	0.86
0.96	414.95	0.49	1.33	95.88	0.86
1.01	414.96	0.50	1.35	97.95	0.86
1.07	414.97	0.51	1.37	99.94	0.87

Tailwater Channel Data - Sta6508

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0400

Channel Invert Elevation: 414.46 m

Roadway Data for Crossing: Sta6508

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 415.86 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 10.9475 cfs

Design Flow: 15.1853 cfs

Maximum Flow: 22.6014 cfs

Table 7 - Summary of Culvert Flows at Crossing: Sta6765

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
411.54	0.31	0.31	0.00	1
411.60	0.34	0.33	0.01	16
411.61	0.38	0.33	0.04	5
411.62	0.41	0.34	0.07	5
411.62	0.43	0.34	0.09	4
411.63	0.48	0.34	0.13	4
411.64	0.51	0.34	0.16	3
411.64	0.54	0.34	0.20	3
411.65	0.57	0.35	0.23	3
411.65	0.61	0.35	0.26	3
411.66	0.64	0.35	0.29	3
411.59	0.33	0.33	0.00	Overtopping

Rating Curve Plot for Crossing: Sta6765

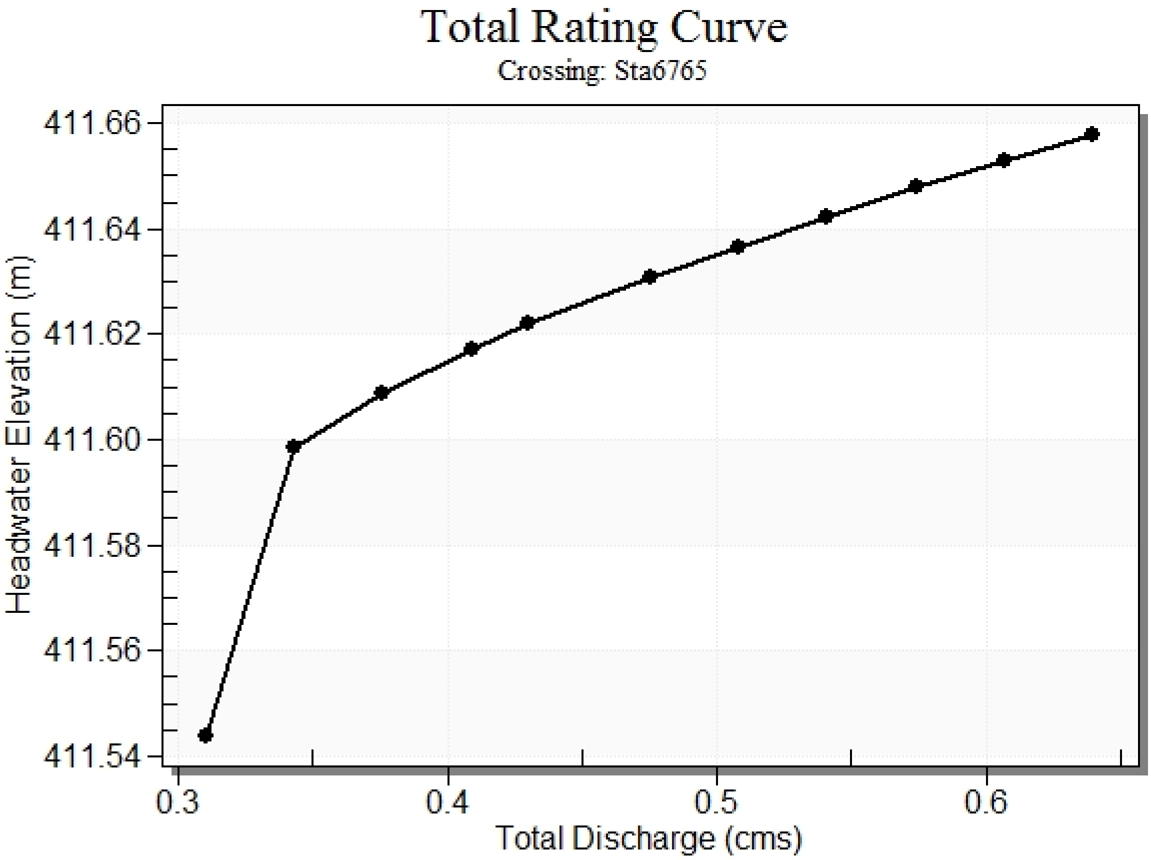


Table 8 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.31	0.31	411.54	0.754	0.554	6-FFc	0.360	0.380	0.380	-100.000	1.938	0.000
0.34	0.33	411.60	0.808	0.641	6-FFc	0.380	0.392	0.392	-100.000	1.996	0.000
0.38	0.33	411.61	0.819	0.657	6-FFc	0.383	0.394	0.394	-100.000	2.007	0.000
0.41	0.34	411.62	0.827	0.670	6-FFc	0.387	0.396	0.396	-100.000	2.016	0.000
0.43	0.34	411.62	0.832	0.677	6-FFc	0.388	0.397	0.397	-100.000	2.021	0.000
0.48	0.34	411.63	0.841	0.691	6-FFc	0.391	0.398	0.398	-100.000	2.031	0.000
0.51	0.34	411.64	0.846	0.700	6-FFc	0.393	0.400	0.400	-100.000	2.037	0.000
0.54	0.34	411.64	0.852	0.709	6-FFc	0.395	0.401	0.401	-100.000	2.043	0.000
0.57	0.35	411.65	0.858	0.718	6-FFc	0.397	0.401	0.401	-100.000	2.049	0.000
0.61	0.35	411.65	0.863	0.726	6-FFc	0.399	0.402	0.402	-100.000	2.054	0.000
0.64	0.35	411.66	0.868	0.733	6-FFc	0.401	0.403	0.403	-100.000	2.059	0.000

****

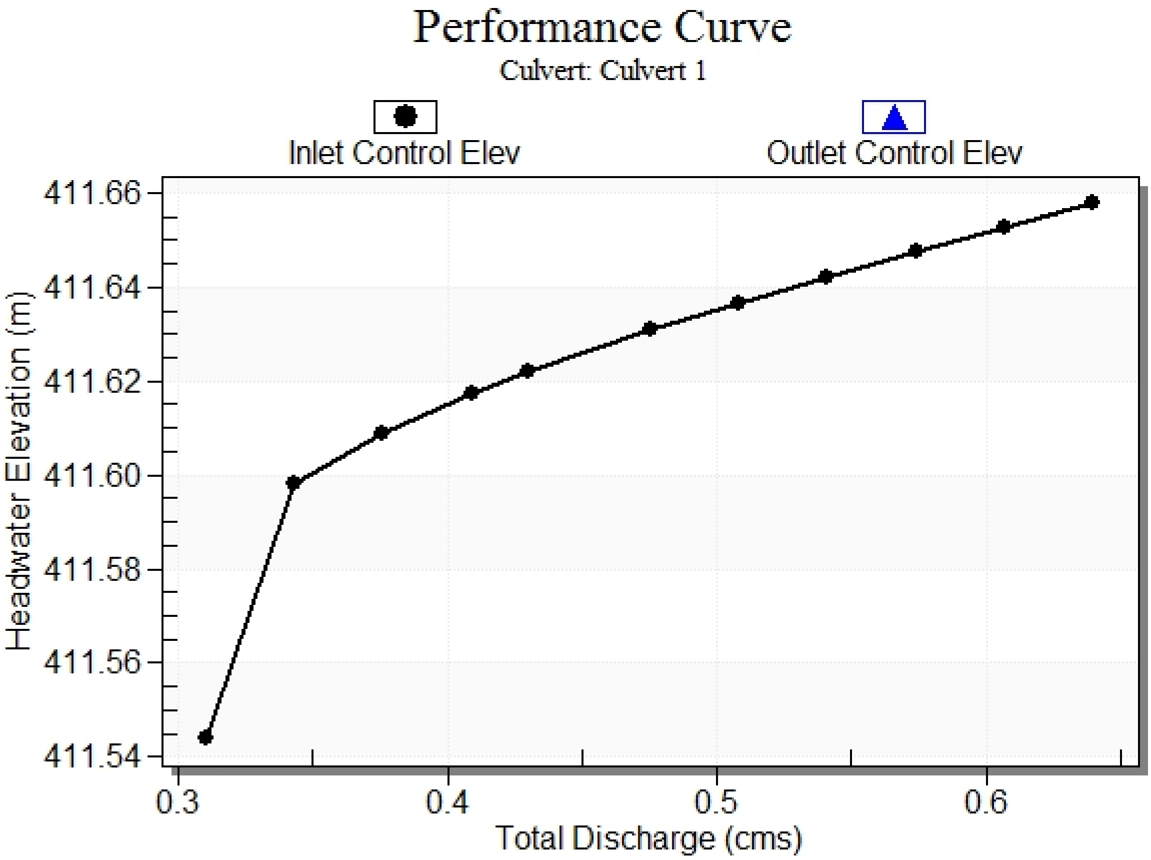
Straight Culvert

Inlet Elevation (invert): 410.79 m, Outlet Elevation (invert): 410.28 m

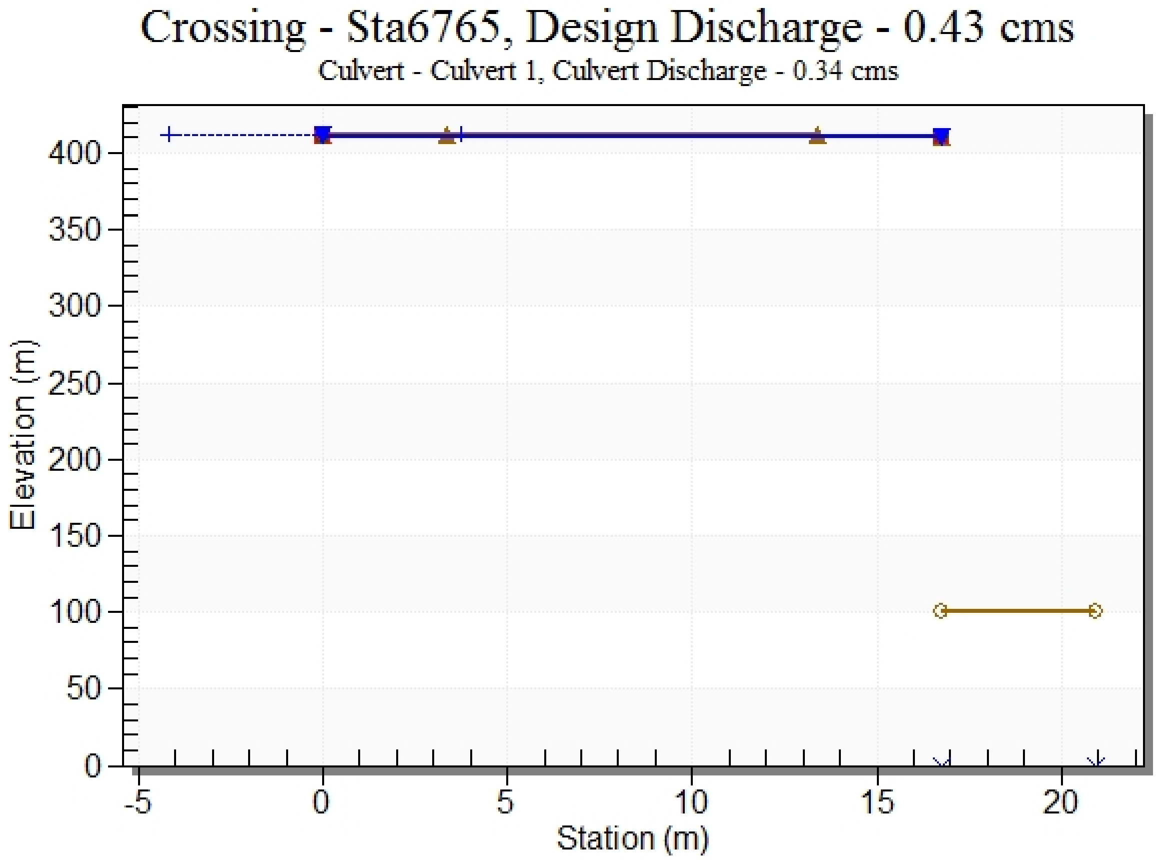
Culvert Length: 16.77 m, Culvert Slope: 0.0304

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 410.79 m

Outlet Station: 16.76 m

Outlet Elevation: 410.28 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 500.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: Sta6765)

Flow (cms)	Water Surface Elev (m)	Depth (m)
10.95	0.00	-100.00
12.11	0.00	-100.00
13.28	0.00	-100.00
14.44	0.00	-100.00
15.19	0.00	-100.00
16.77	0.00	-100.00
17.94	0.00	-100.00
19.11	0.00	-100.00
20.27	0.00	-100.00
21.44	0.00	-100.00
22.60	0.00	-100.00

Tailwater Channel Data - Sta6765

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 0.00 m

Roadway Data for Crossing: Sta6765

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 411.59 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.18181 cfs

Design Flow: 13.0664 cfs

Maximum Flow: 19.4231 cfs

Table 10 - Summary of Culvert Flows at Crossing: Sta6994

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
402.14	0.26	0.26	0.00	1
402.19	0.29	0.29	0.00	1
402.24	0.32	0.32	0.00	1
402.30	0.35	0.35	0.00	1
402.35	0.37	0.37	0.00	1
402.43	0.40	0.40	0.00	1
402.50	0.43	0.43	0.00	1
402.57	0.46	0.46	0.00	1
402.65	0.49	0.49	0.00	1
402.73	0.52	0.52	0.00	1
402.80	0.55	0.55	0.00	30
402.80	0.55	0.55	0.00	Overtopping

Rating Curve Plot for Crossing: Sta6994

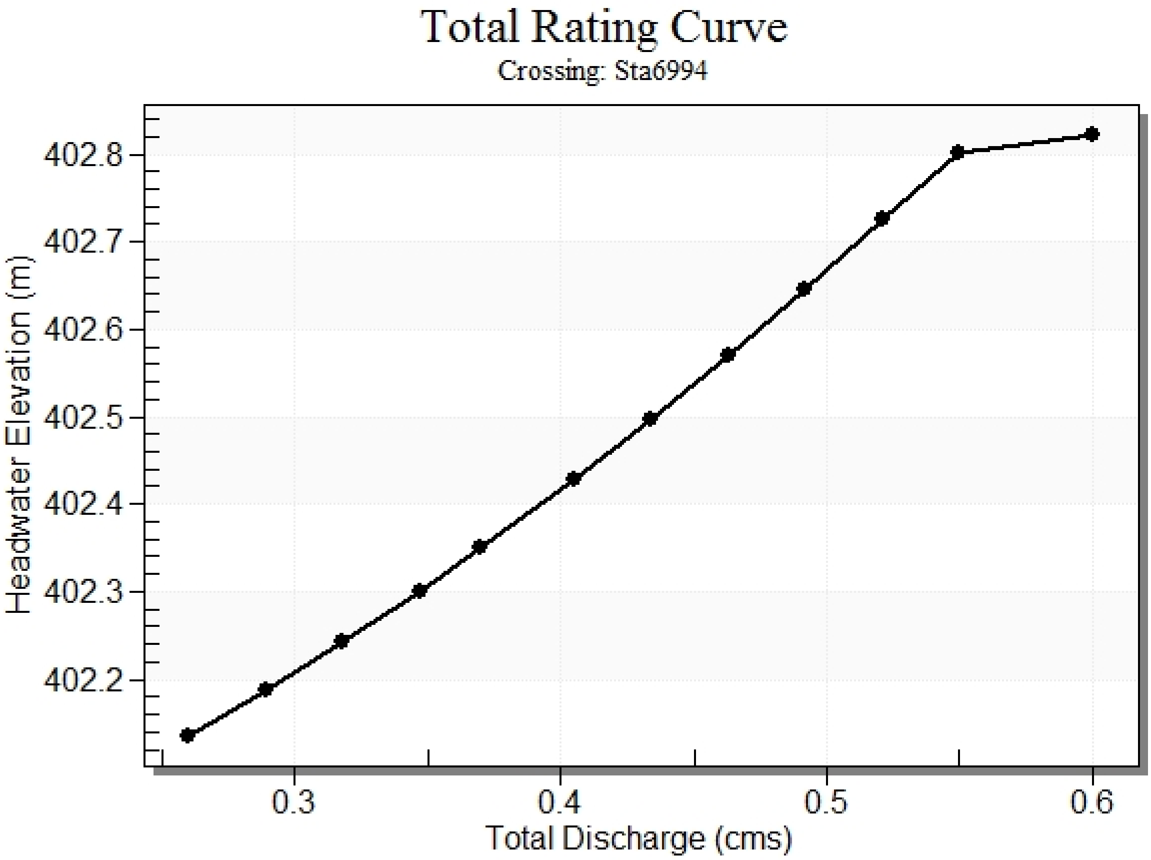


Table 11 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.26	0.26	402.14	0.513	0.576	4-FFf	0.225	0.330	0.600	0.325	0.920	0.821
0.29	0.29	402.19	0.554	0.628	4-FFf	0.237	0.349	0.600	0.338	1.022	0.843
0.32	0.32	402.24	0.596	0.683	4-FFf	0.250	0.367	0.600	0.350	1.125	0.864
0.35	0.35	402.30	0.640	0.741	4-FFf	0.263	0.385	0.600	0.362	1.227	0.883
0.37	0.37	402.35	0.676	0.789	4-FFf	0.273	0.397	0.600	0.371	1.309	0.897
0.40	0.40	402.43	0.734	0.868	4-FFf	0.288	0.416	0.600	0.384	1.432	0.917
0.43	0.43	402.50	0.786	0.937	4-FFf	0.299	0.430	0.600	0.394	1.535	0.933
0.46	0.46	402.57	0.841	1.009	4-FFf	0.311	0.445	0.600	0.403	1.638	0.949
0.49	0.49	402.65	0.900	1.085	4-FFf	0.323	0.459	0.600	0.413	1.740	0.963
0.52	0.52	402.73	0.962	1.165	4-FFf	0.335	0.472	0.600	0.422	1.843	0.977
0.55	0.55	402.80	1.022	1.242	4-FFf	0.345	0.483	0.600	0.430	1.936	0.990

****

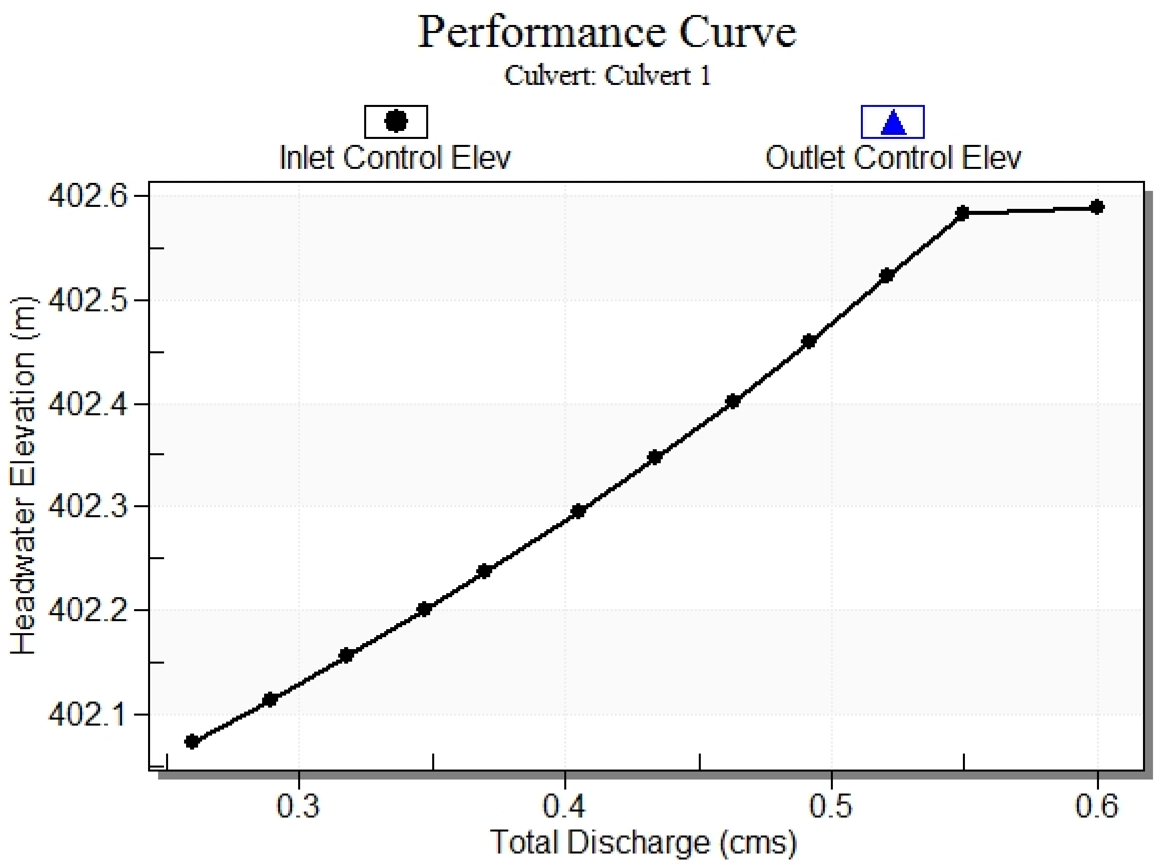
Straight Culvert

Inlet Elevation (invert): 401.56 m, Outlet Elevation (invert): 400.65 m

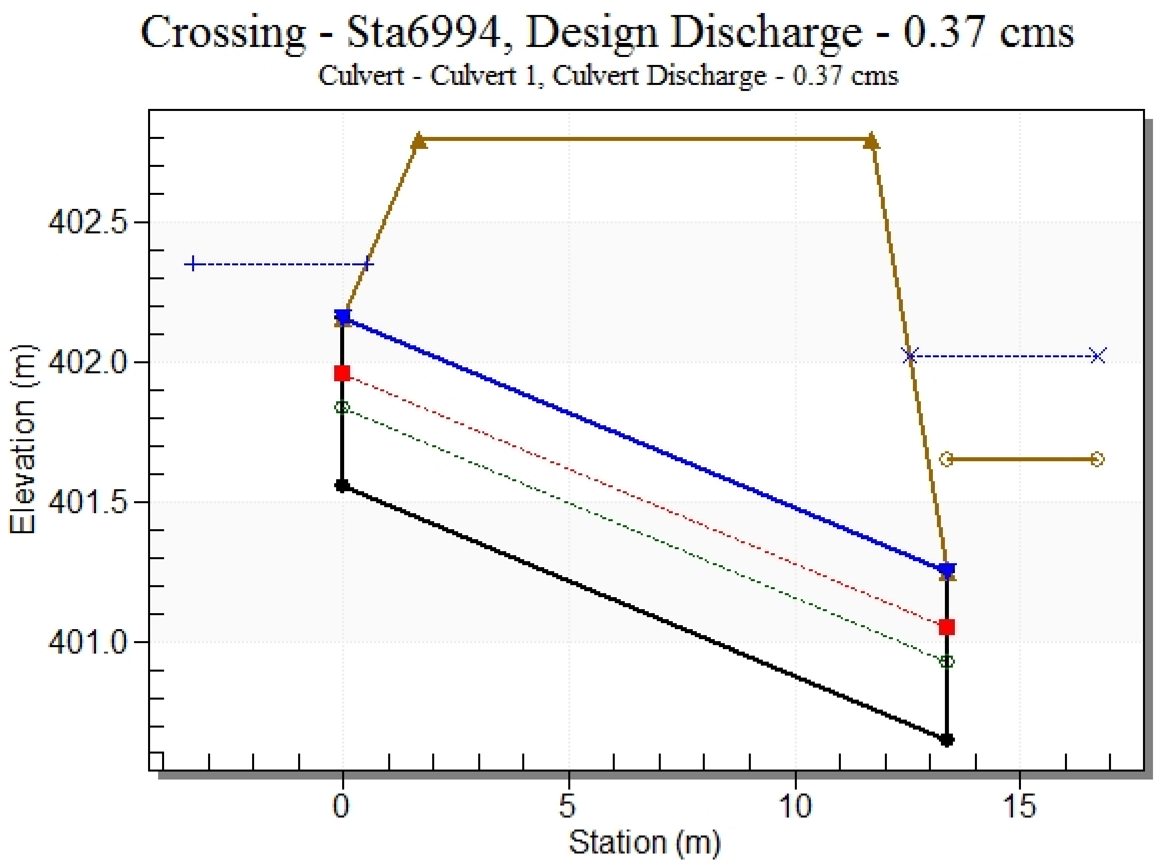
Culvert Length: 13.41 m, Culvert Slope: 0.0680

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 401.56 m

Outlet Station: 13.38 m

Outlet Elevation: 400.65 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 600.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 12 - Downstream Channel Rating Curve (Crossing: Sta6994)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.26	401.97	0.32	0.82	31.84	0.65
0.29	401.99	0.34	0.84	33.13	0.65
0.32	402.00	0.35	0.86	34.34	0.66
0.35	402.01	0.36	0.88	35.48	0.66
0.37	402.02	0.37	0.90	36.35	0.66
0.40	402.03	0.38	0.92	37.60	0.67
0.43	402.04	0.39	0.93	38.59	0.67
0.46	402.05	0.40	0.95	39.54	0.67
0.49	402.06	0.41	0.96	40.45	0.68
0.52	402.07	0.42	0.98	41.32	0.68
0.55	402.08	0.43	0.99	42.17	0.68

Tailwater Channel Data - Sta6994

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 401.65 m

Roadway Data for Crossing: Sta6994

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 402.80 m

Roadway Surface: Gravel

Roadway Top Width: 10.00 m

Proposed Conditions, Cross Culverts

- Proposed conditions culvert capacities were calculated using HY-8.

Appendix F.2

HY-8 Culvert Analysis Report

Project Units: **SI Units (Metric)**

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 45.2028 cfs

Design Flow: 63.5664 cfs

Maximum Flow: 110.888 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta6128

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
430.06	1.28	1.28	0.00	1
430.13	1.47	1.47	0.00	1
430.19	1.65	1.65	0.00	1
430.25	1.80	1.80	0.00	1
430.32	2.02	2.02	0.00	1
430.39	2.21	2.21	0.00	1
430.43	2.40	2.32	0.07	7
430.45	2.58	2.39	0.20	6
430.47	2.77	2.44	0.32	5
430.49	2.95	2.49	0.46	4
430.51	3.14	2.54	0.60	4
430.40	2.24	2.24	0.00	Overtopping

Rating Curve Plot for Crossing: Sta6128

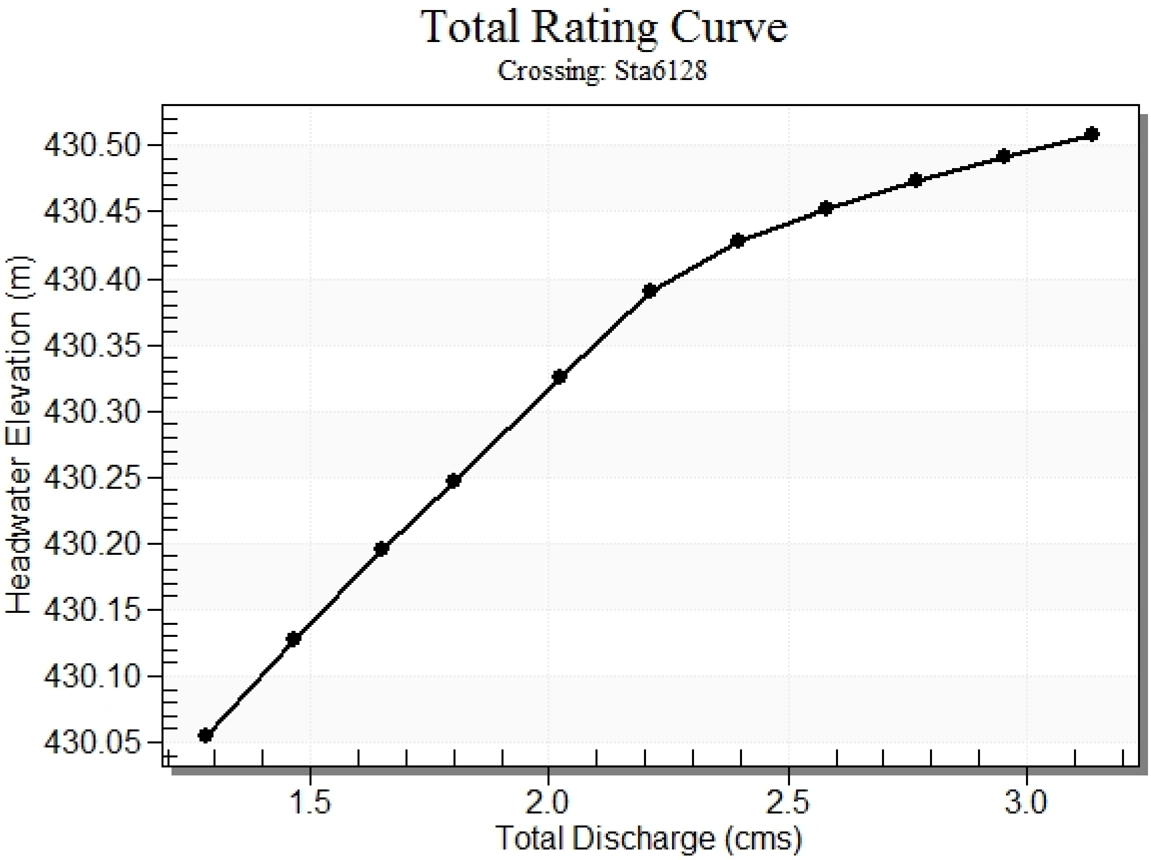


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
1.28	1.28	430.06	0.605	0.177	4-FFf	0.269	0.374	0.900	0.580	0.869	1.609
1.47	1.47	430.13	0.677	0.241	4-FFf	0.292	0.410	0.900	0.617	0.995	1.665
1.65	1.65	430.19	0.745	0.307	4-FFf	0.315	0.442	0.900	0.652	1.122	1.715
1.80	1.80	430.25	0.797	0.360	4-FFf	0.332	0.465	0.900	0.677	1.222	1.753
2.02	2.02	430.32	0.875	0.442	4-FFf	0.355	0.503	0.900	0.714	1.374	1.805
2.21	2.21	430.39	0.940	0.513	4-FFf	0.375	0.534	0.900	0.742	1.501	1.845
2.40	2.32	430.43	0.978	0.566	4-FFf	0.386	0.550	0.900	0.769	1.574	1.883
2.58	2.39	430.45	1.002	0.609	4-FFf	0.393	0.561	0.900	0.795	1.620	1.919
2.77	2.44	430.47	1.023	0.649	4-FFf	0.399	0.570	0.900	0.820	1.659	1.952
2.95	2.49	430.49	1.041	0.686	4-FFf	0.404	0.579	0.900	0.843	1.693	1.984
3.14	2.54	430.51	1.059	0.722	4-FFf	0.409	0.586	0.900	0.866	1.726	2.015

****

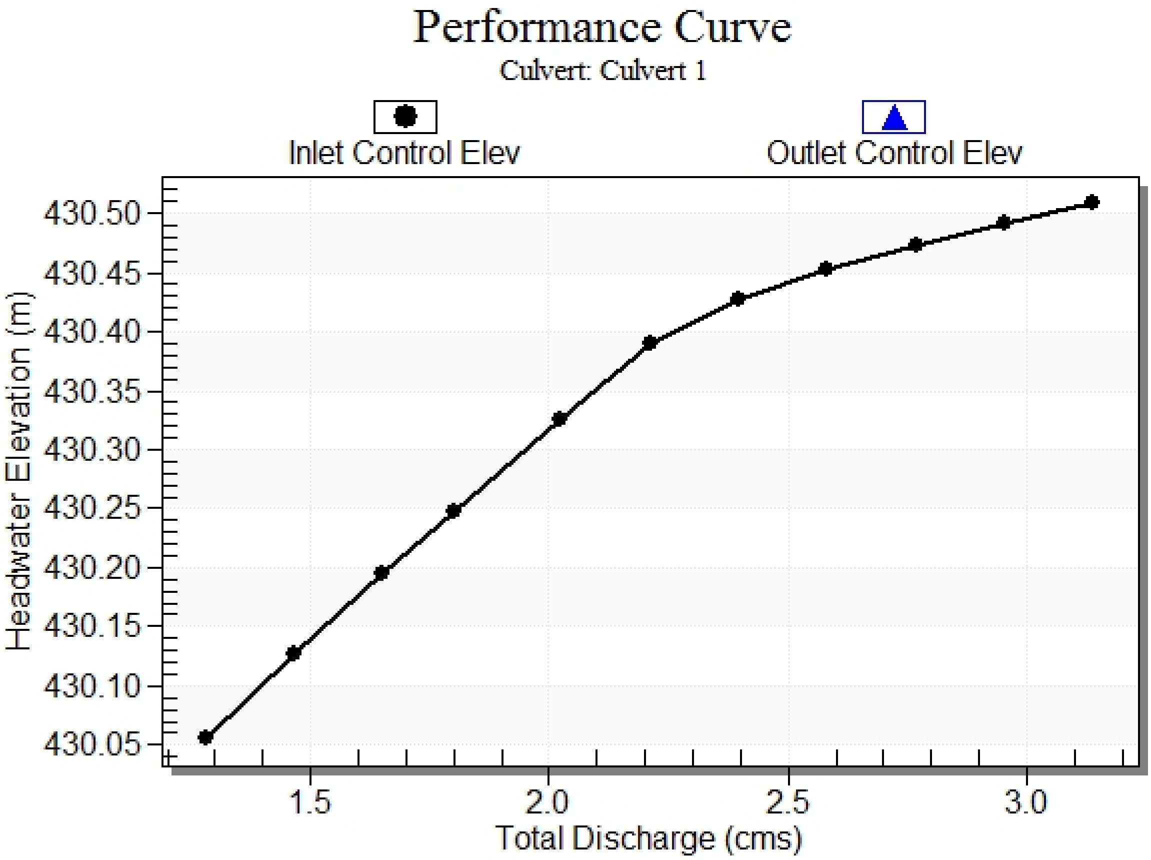
Straight Culvert

Inlet Elevation (invert): 429.45 m, Outlet Elevation (invert): 428.05 m

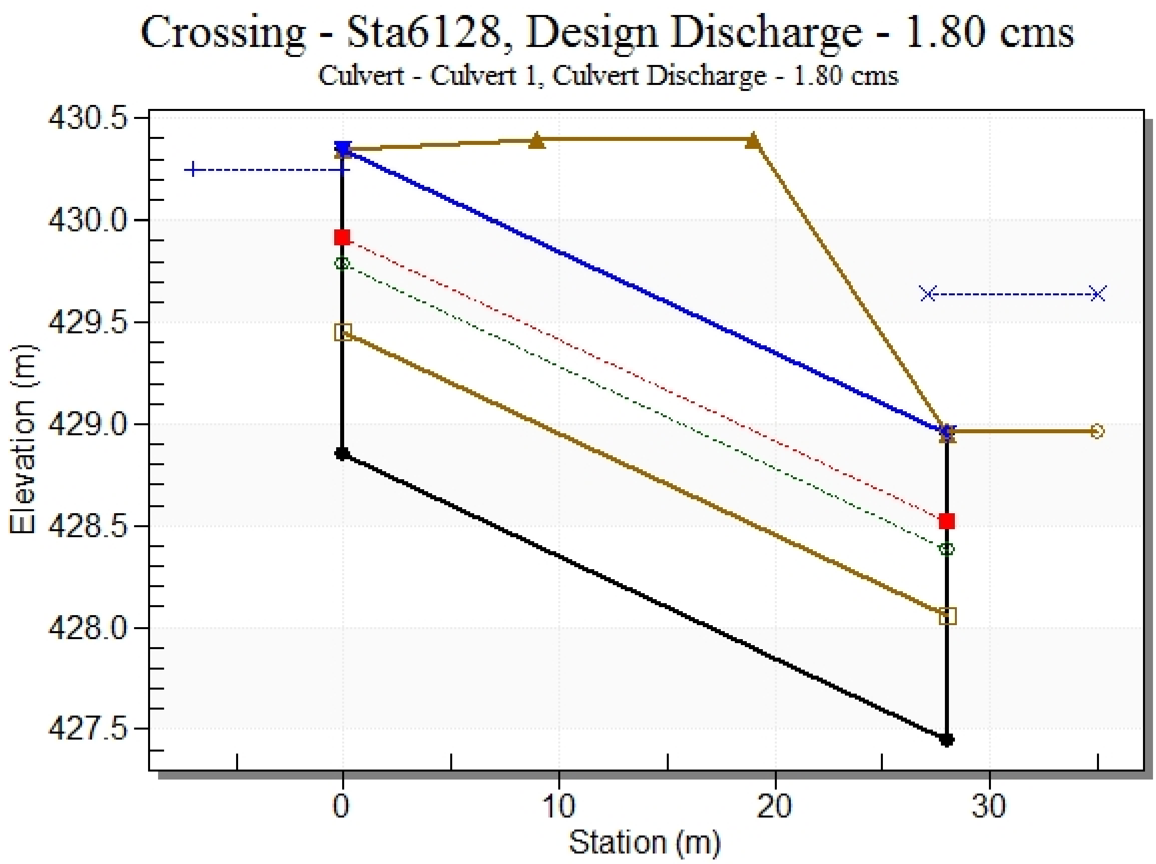
Culvert Length: 28.03 m, Culvert Slope: 0.0500

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 428.85 m

Outlet Station: 28.00 m

Outlet Elevation: 427.45 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 1800.00 mm

Barrel Rise: 1500.00 mm

Barrel Material: Concrete

Embedment: 600.00 mm

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Sta6128)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
1.28	429.54	0.58	1.61	113.80	0.86
1.47	429.58	0.62	1.66	121.05	0.87
1.65	429.61	0.65	1.72	127.77	0.87
1.80	429.64	0.68	1.75	132.79	0.88
2.02	429.67	0.71	1.81	139.94	0.88
2.21	429.70	0.74	1.85	145.52	0.89
2.40	429.73	0.77	1.88	150.82	0.89
2.58	429.76	0.80	1.92	155.87	0.90
2.77	429.78	0.82	1.95	160.70	0.90
2.95	429.80	0.84	1.98	165.35	0.90
3.14	429.83	0.87	2.01	169.81	0.91

Tailwater Channel Data - Sta6128

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 0.50 m

Side Slope (H:V): 1.50 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0400

Channel Invert Elevation: 428.96 m

Roadway Data for Crossing: Sta6128

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 430.40 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 17.3042 cfs

Design Flow: 24.7203 cfs

Maximum Flow: 37.0804 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta6508

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
416.29	0.49	0.49	0.00	1
416.31	0.55	0.55	0.00	1
416.33	0.60	0.60	0.00	1
416.35	0.66	0.66	0.00	1
416.36	0.70	0.70	0.00	1
416.39	0.77	0.77	0.00	1
416.41	0.83	0.83	0.00	1
416.43	0.88	0.88	0.00	1
416.44	0.94	0.94	0.00	1
416.46	0.99	0.99	0.00	1
416.48	1.05	1.05	0.00	1
417.78	4.49	4.49	0.00	Overtopping

Rating Curve Plot for Crossing: Sta6508

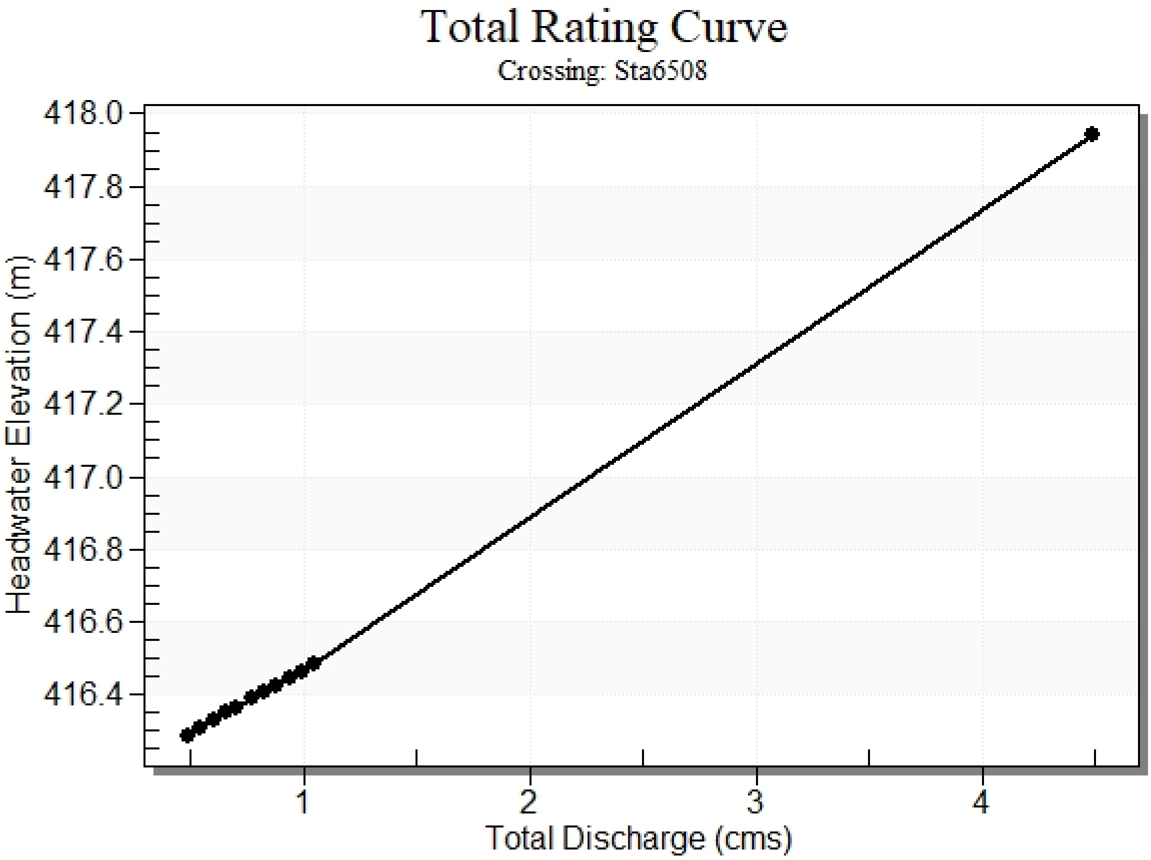


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.49	0.49	416.29	0.288	0.0*	6-FFt	0.160	0.199	0.380	0.380	0.697	1.129
0.55	0.55	416.31	0.309	0.0*	6-FFt	0.170	0.213	0.396	0.396	0.746	1.160
0.60	0.60	416.33	0.330	0.0*	6-FFt	0.181	0.227	0.411	0.411	0.793	1.189
0.66	0.66	416.35	0.350	0.0*	6-FFt	0.191	0.242	0.425	0.425	0.838	1.215
0.70	0.70	416.36	0.365	0.0*	6-FFt	0.198	0.250	0.435	0.435	0.871	1.234
0.77	0.77	416.39	0.389	0.0*	6-FFt	0.210	0.267	0.451	0.451	0.925	1.264
0.83	0.83	416.41	0.407	0.0*	6-FFt	0.219	0.280	0.463	0.463	0.966	1.286
0.88	0.88	416.43	0.426	0.0*	6-FFt	0.227	0.292	0.474	0.474	1.007	1.308
0.94	0.94	416.44	0.443	0.0*	6-FFt	0.236	0.304	0.485	0.485	1.046	1.328
0.99	0.99	416.46	0.462	0.0*	6-FFt	0.244	0.316	0.496	0.496	1.085	1.347
1.05	1.05	416.48	0.482	0.0*	6-FFt	0.253	0.328	0.506	0.506	1.123	1.366

* Full Flow Headwater elevation is below inlet invert.

****

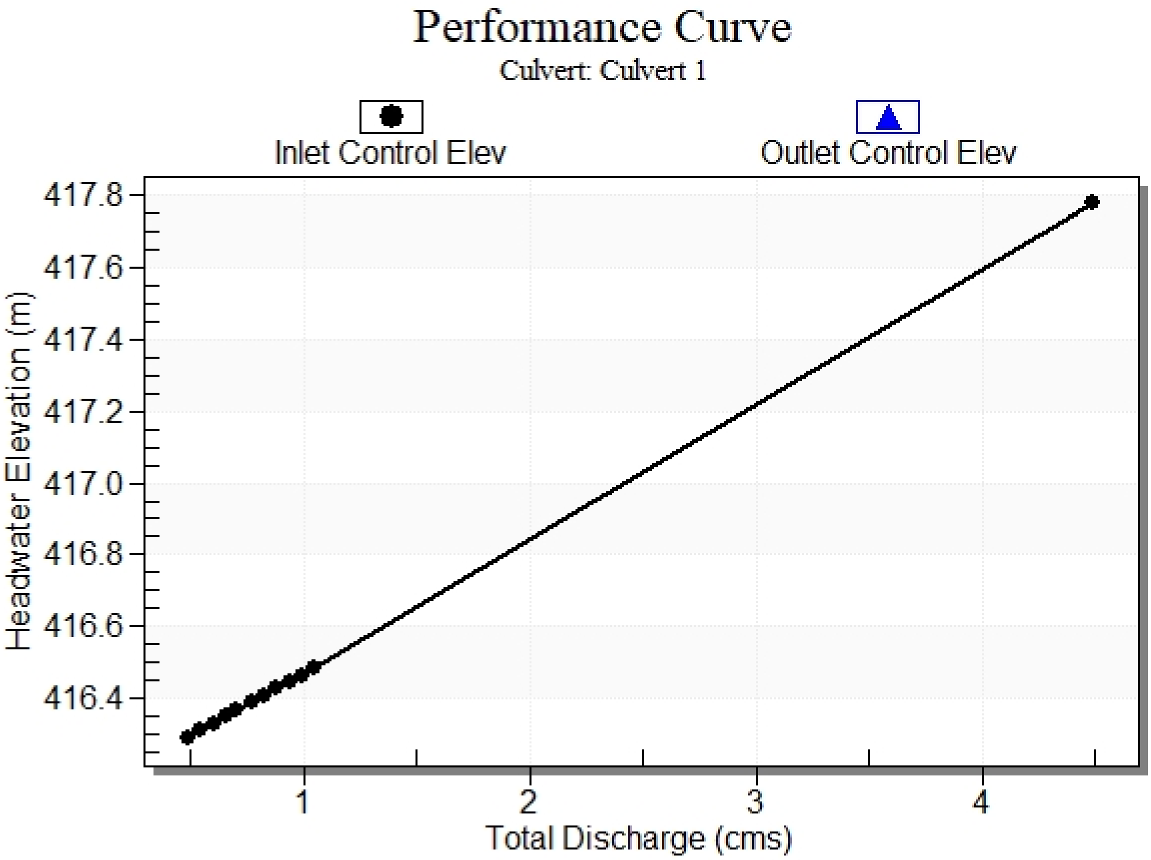
Straight Culvert

Inlet Elevation (invert): 416.00 m, Outlet Elevation (invert): 414.90 m

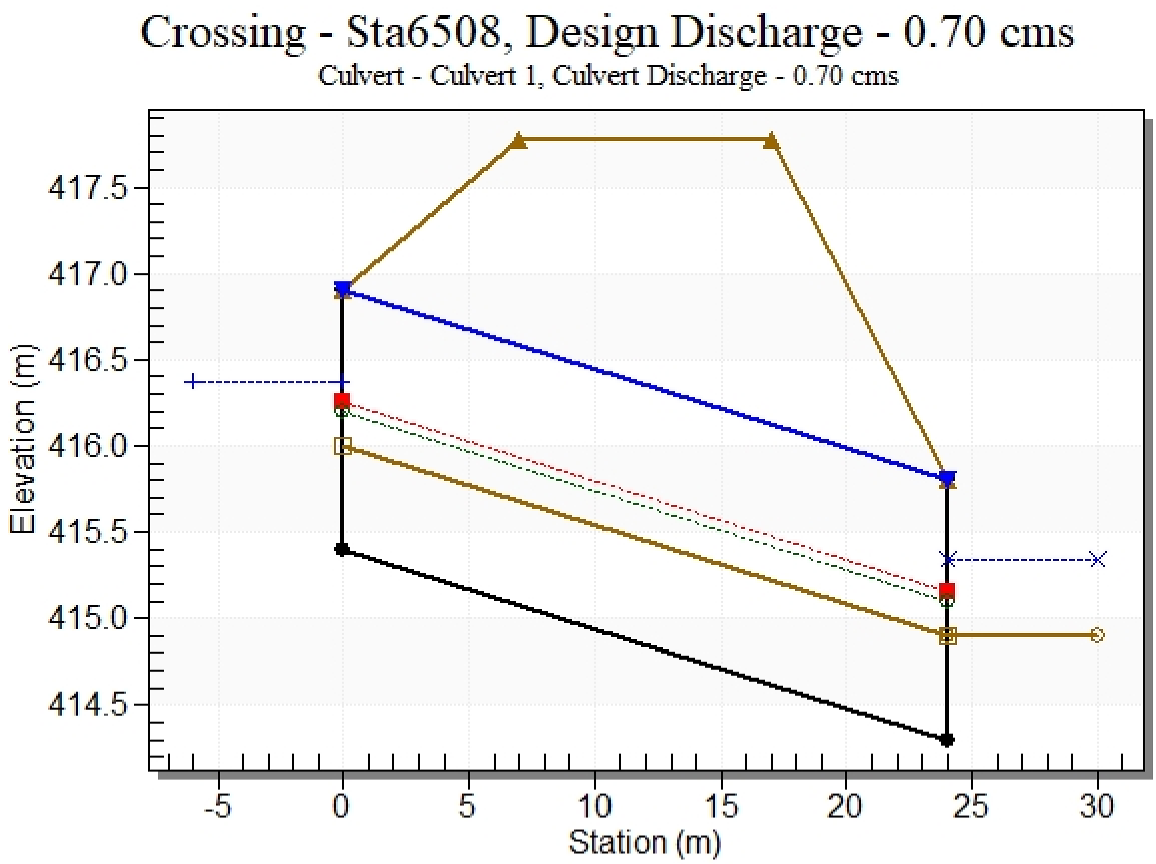
Culvert Length: 24.03 m, Culvert Slope: 0.0458

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 415.40 m

Outlet Station: 24.00 m

Outlet Elevation: 414.30 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 1800.00 mm

Barrel Rise: 1500.00 mm

Barrel Material: Concrete

Embedment: 600.00 mm

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Sta6508)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.49	415.28	0.38	1.13	74.57	0.83
0.55	415.30	0.40	1.16	77.66	0.83
0.60	415.31	0.41	1.19	80.55	0.84
0.66	415.32	0.42	1.22	83.28	0.84
0.70	415.33	0.43	1.23	85.24	0.84
0.77	415.35	0.45	1.26	88.34	0.85
0.83	415.36	0.46	1.29	90.70	0.85
0.88	415.37	0.47	1.31	92.96	0.86
0.94	415.39	0.49	1.33	95.13	0.86
0.99	415.40	0.50	1.35	97.22	0.86
1.05	415.41	0.51	1.37	99.24	0.87

Tailwater Channel Data - Sta6508

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0400

Channel Invert Elevation: 414.90 m

Roadway Data for Crossing: Sta6508

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 417.78 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 10.2413 cfs

Design Flow: 14.479 cfs

Maximum Flow: 22.2482 cfs

Table 7 - Summary of Culvert Flows at Crossing: Sta6765

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
412.58	0.29	0.29	0.00	1
412.63	0.32	0.32	0.00	1
412.69	0.36	0.36	0.00	1
412.74	0.39	0.39	0.00	1
412.77	0.41	0.41	0.00	1
412.86	0.46	0.46	0.00	1
412.93	0.49	0.49	0.00	1
413.01	0.53	0.53	0.00	1
413.06	0.56	0.55	0.01	16
413.07	0.60	0.55	0.04	5
413.08	0.63	0.56	0.07	5
413.05	0.55	0.55	0.00	Overtopping

Rating Curve Plot for Crossing: Sta6765

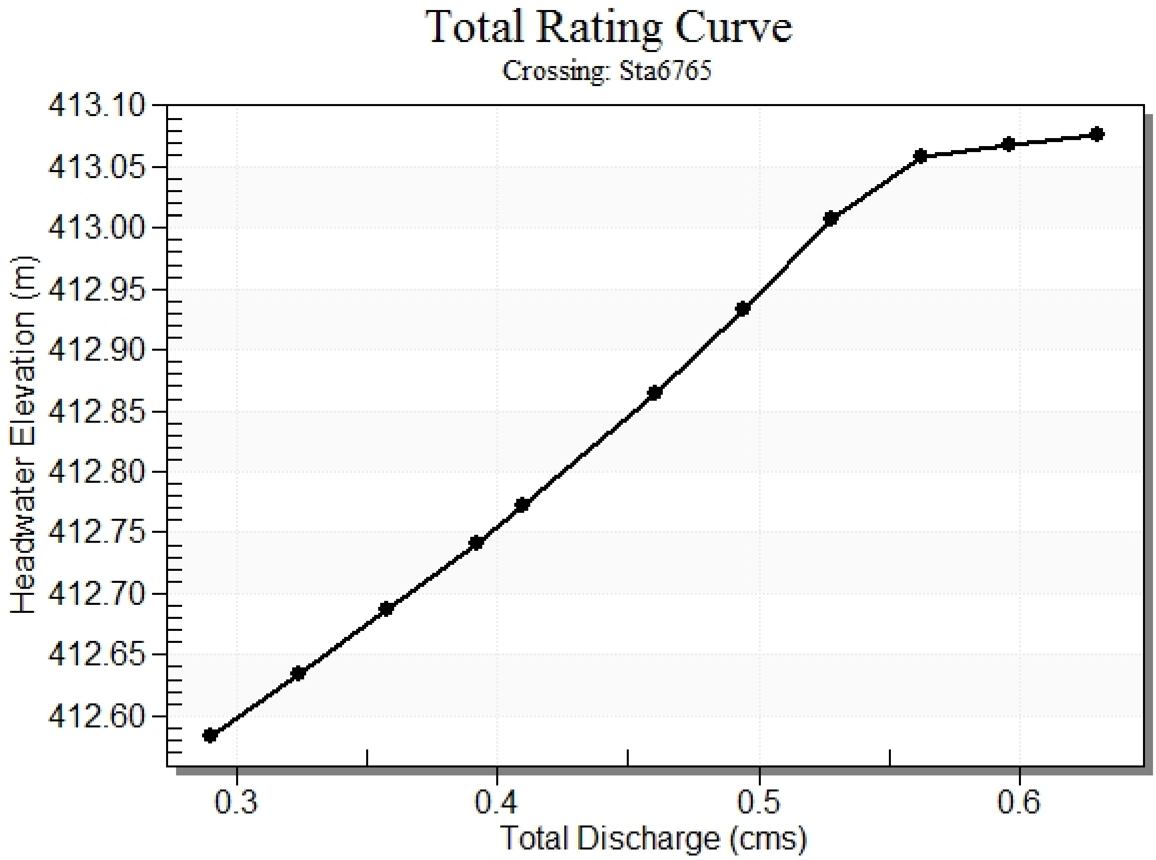


Table 8 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.29	0.29	412.58	0.544	0.0*	6-FFc	0.212	0.350	0.350	-100.000	1.695	0.000
0.32	0.32	412.63	0.594	0.0*	6-FFc	0.225	0.370	0.370	-100.000	1.770	0.000
0.36	0.36	412.69	0.646	0.0*	6-FFc	0.237	0.391	0.391	-100.000	1.835	0.000
0.39	0.39	412.74	0.701	0.0*	6-FFc	0.250	0.409	0.409	-100.000	1.912	0.000
0.41	0.41	412.77	0.732	0.0*	6-FFc	0.256	0.418	0.418	-100.000	1.950	0.000
0.46	0.46	412.86	0.824	0.0*	6-FFc	0.274	0.444	0.444	-100.000	2.048	0.000
0.49	0.49	412.93	0.893	0.0*	6-FFc	0.285	0.460	0.460	-100.000	2.129	0.000
0.53	0.53	413.01	0.967	0.0*	6-FFc	0.296	0.475	0.475	-100.000	2.205	0.000
0.56	0.55	413.06	1.018	0.0*	6-FFc	0.303	0.484	0.484	-100.000	2.254	0.000
0.60	0.55	413.07	1.028	0.0*	6-FFc	0.305	0.485	0.485	-100.000	2.264	0.000
0.63	0.56	413.08	1.037	0.0*	6-FFc	0.306	0.487	0.487	-100.000	2.272	0.000

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 412.04 m,   Outlet Elevation (invert): 410.29 m

Culvert Length: 16.85 m,   Culvert Slope: 0.1044

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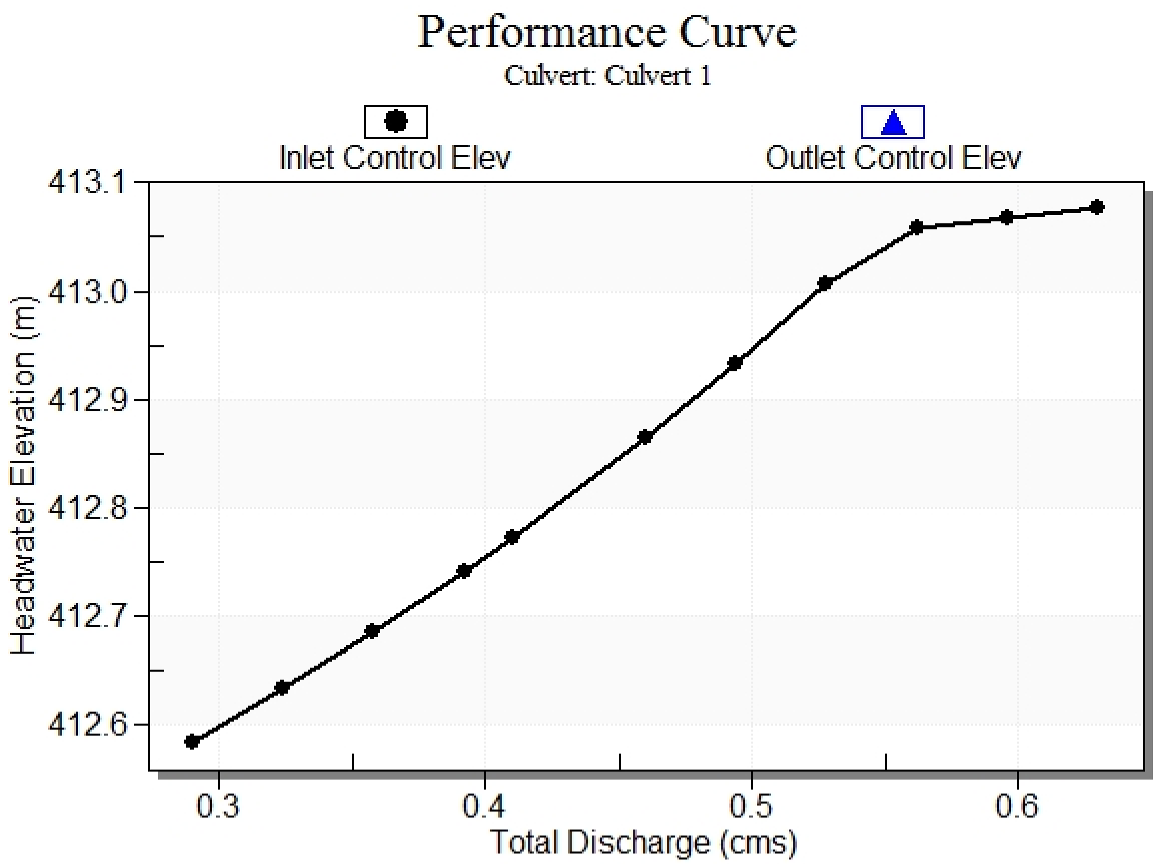
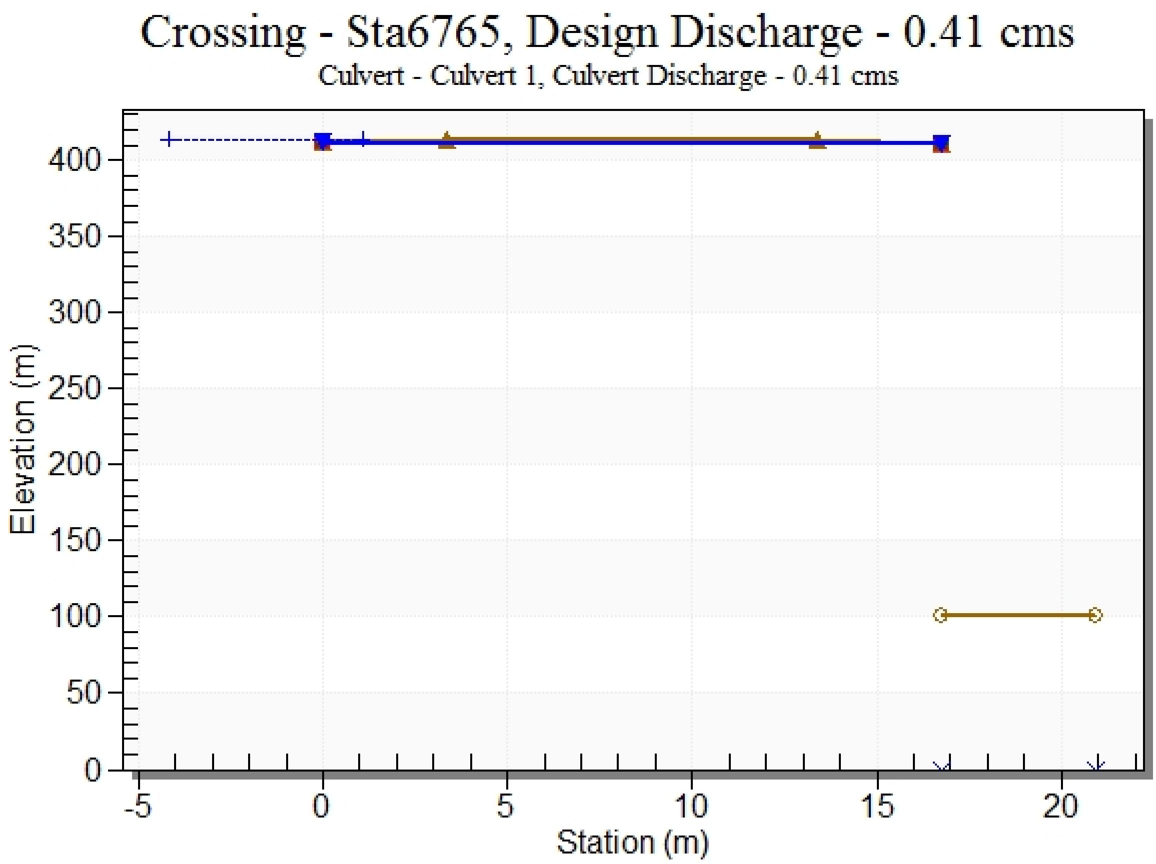
Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 412.04 m

Outlet Station: 16.76 m

Outlet Elevation: 410.29 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 600.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: Sta6765)

Flow (cms)	Water Surface Elev (m)	Depth (m)
10.24	0.00	-100.00
11.44	0.00	-100.00
12.64	0.00	-100.00
13.84	0.00	-100.00
14.48	0.00	-100.00
16.24	0.00	-100.00
17.45	0.00	-100.00
18.65	0.00	-100.00
19.85	0.00	-100.00
21.05	0.00	-100.00
22.25	0.00	-100.00

Tailwater Channel Data - Sta6765

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 0.00 m

Roadway Data for Crossing: Sta6765

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 413.05 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.18181 cfs

Design Flow: 12.7133 cfs

Maximum Flow: 19.0699 cfs

Table 10 - Summary of Culvert Flows at Crossing: Sta6994

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
403.44	0.26	0.26	0.00	1
403.48	0.29	0.29	0.00	1
403.51	0.32	0.32	0.00	1
403.54	0.34	0.34	0.00	1
403.55	0.36	0.36	0.00	1
403.60	0.40	0.40	0.00	1
403.61	0.43	0.41	0.02	6
403.62	0.46	0.42	0.04	5
403.62	0.48	0.42	0.06	4
403.63	0.51	0.43	0.08	4
403.64	0.54	0.43	0.11	3
403.60	0.40	0.40	0.00	Overtopping

Rating Curve Plot for Crossing: Sta6994

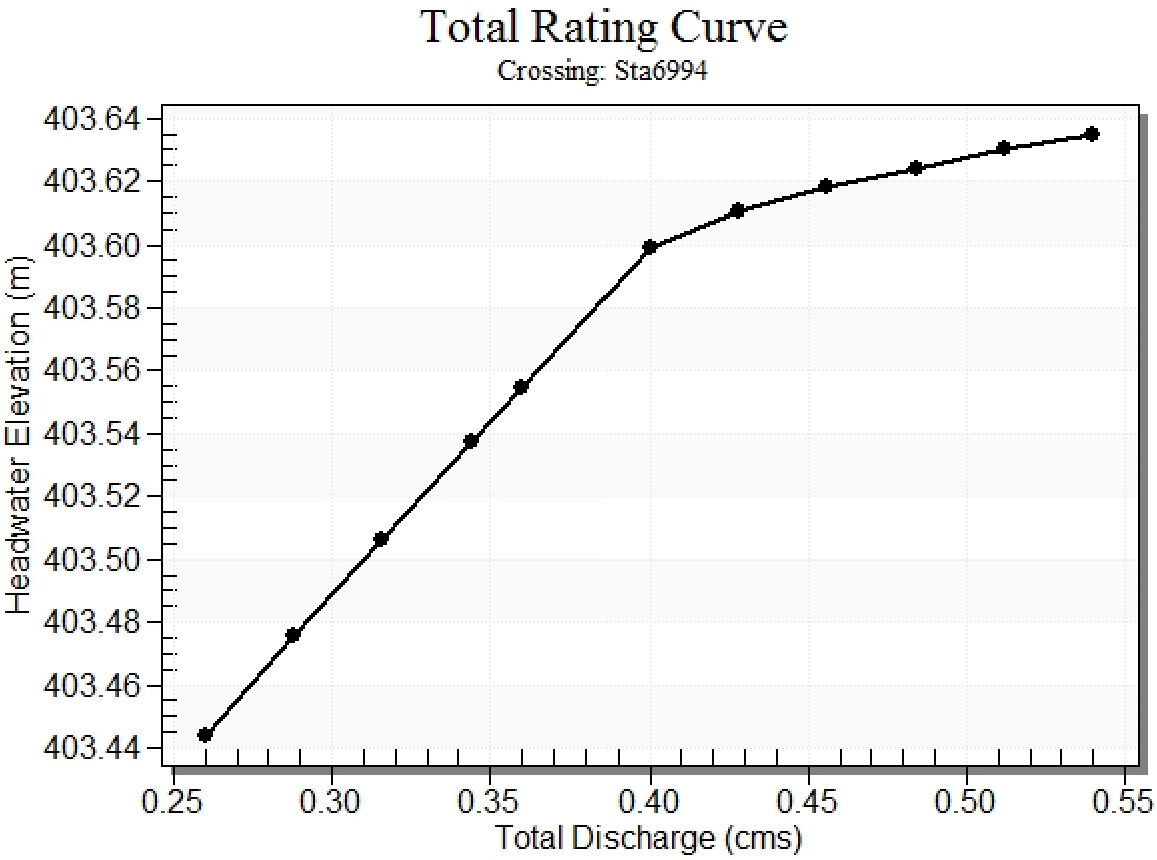


Table 11 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.26	0.26	403.44	0.464	0.0*	6-FFt	0.213	0.316	0.325	0.325	1.488	0.821
0.29	0.29	403.48	0.495	0.0*	6-FFt	0.225	0.334	0.338	0.338	1.568	0.843
0.32	0.32	403.51	0.526	0.0*	6-FFc	0.237	0.350	0.350	0.350	1.642	0.862
0.34	0.34	403.54	0.557	0.0*	6-FFc	0.248	0.365	0.365	0.361	1.693	0.881
0.36	0.36	403.55	0.575	0.0*	6-FFc	0.255	0.374	0.374	0.367	1.721	0.891
0.40	0.40	403.60	0.619	0.0*	6-FFc	0.269	0.395	0.395	0.382	1.785	0.915
0.43	0.41	403.61	0.630	0.0*	6-FFc	0.273	0.400	0.400	0.392	1.803	0.930
0.46	0.42	403.62	0.638	0.0*	6-FFc	0.275	0.404	0.404	0.401	1.814	0.945
0.48	0.42	403.62	0.644	0.0*	6-FFt	0.277	0.406	0.410	0.410	1.803	0.959
0.51	0.43	403.63	0.650	0.0*	6-FFt	0.279	0.409	0.419	0.419	1.779	0.973
0.54	0.43	403.64	0.655	0.0*	6-FFt	0.280	0.411	0.427	0.427	1.755	0.986

* Full Flow Headwater elevation is below inlet invert.

****

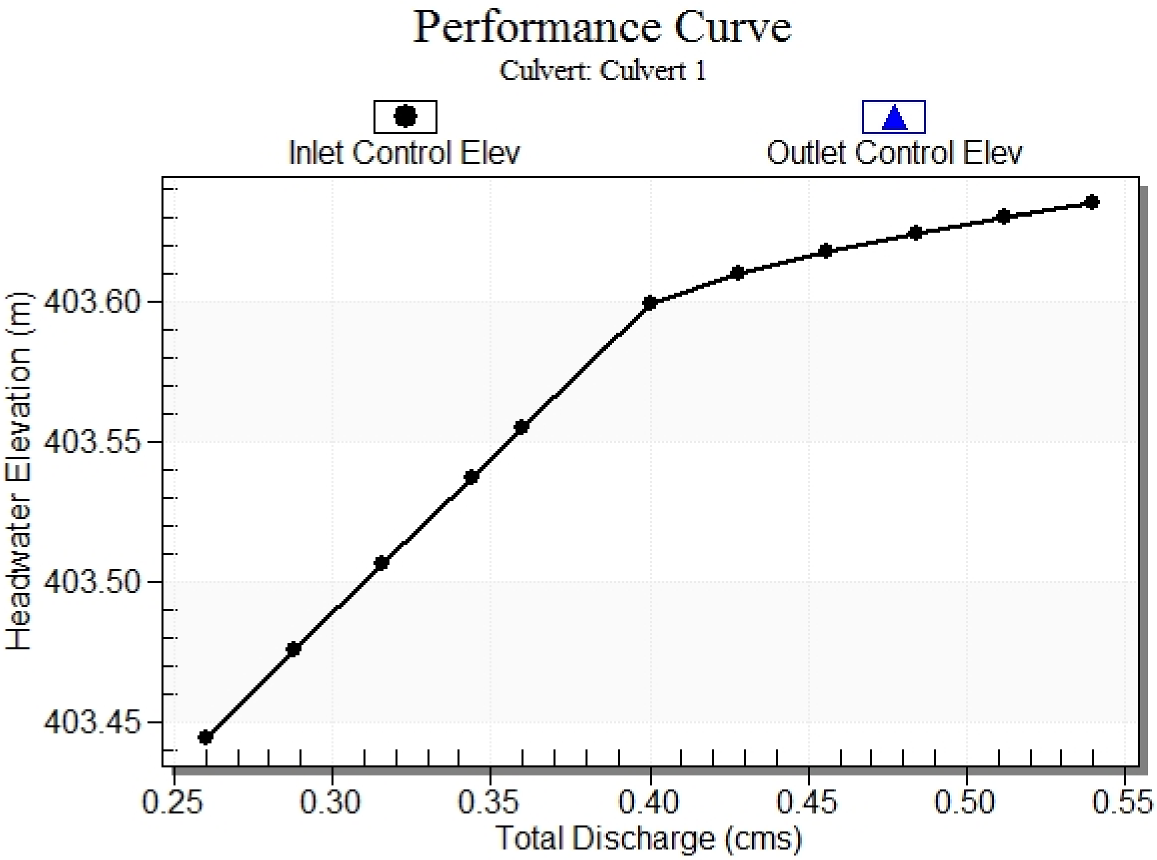
Straight Culvert

Inlet Elevation (invert): 402.98 m, Outlet Elevation (invert): 402.02 m

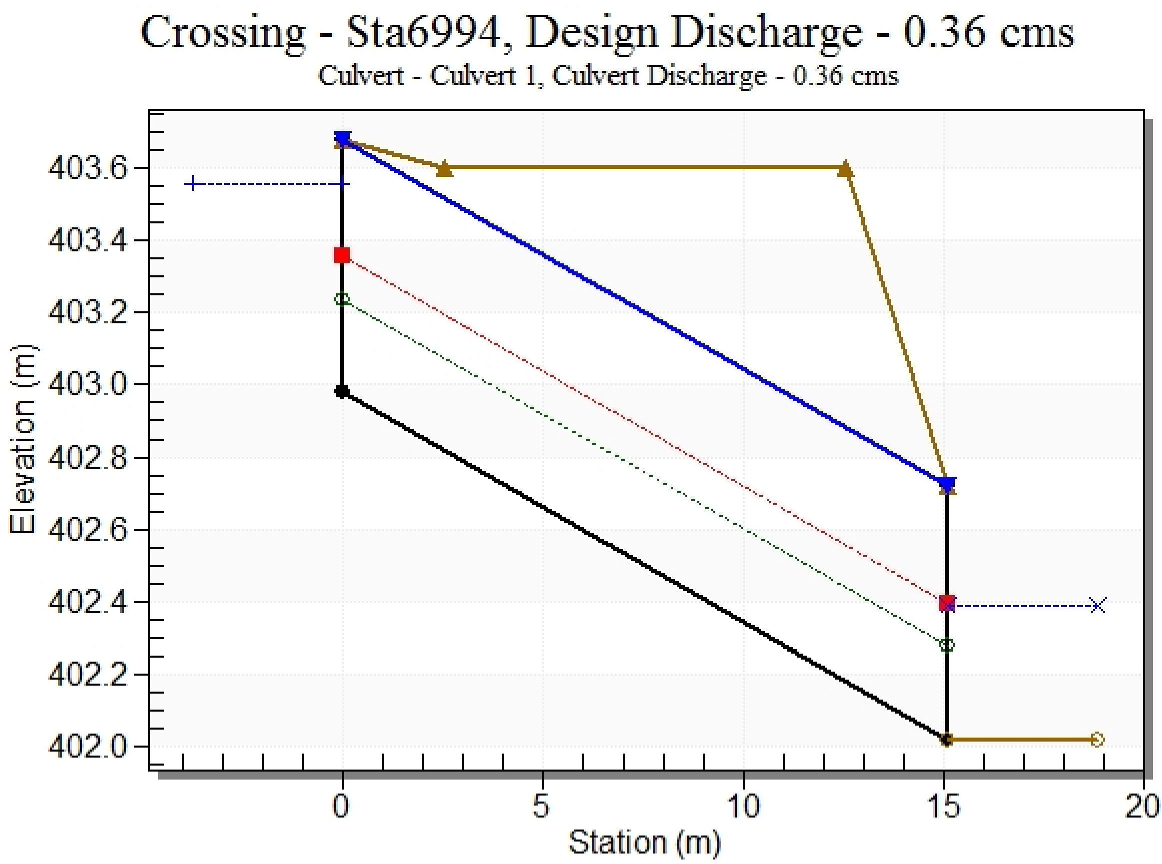
Culvert Length: 15.09 m, Culvert Slope: 0.0637

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 402.98 m

Outlet Station: 15.06 m

Outlet Elevation: 402.02 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 700.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 12 - Downstream Channel Rating Curve (Crossing: Sta6994)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.26	402.34	0.32	0.82	31.84	0.65
0.29	402.36	0.34	0.84	33.09	0.65
0.32	402.37	0.35	0.86	34.26	0.66
0.34	402.38	0.36	0.88	35.37	0.66
0.36	402.39	0.37	0.89	35.98	0.66
0.40	402.40	0.38	0.91	37.43	0.67
0.43	402.41	0.39	0.93	38.39	0.67
0.46	402.42	0.40	0.95	39.31	0.67
0.48	402.43	0.41	0.96	40.20	0.68
0.51	402.44	0.42	0.97	41.06	0.68
0.54	402.45	0.43	0.99	41.88	0.68

Tailwater Channel Data - Sta6994

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 402.02 m

Roadway Data for Crossing: Sta6994

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 403.60 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

BURNSIDE

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Proposed Conditions, Driveway Culverts

- Driveway culverts at critical locations were designed using HY-8.

Appendix F.3

HY-8 Culvert Analysis Report

Project Units: **SI Units (Metric)**

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 17.6573 cfs

Maximum Flow: 25.7797 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta5120

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
100.12	0.00	0.00	0.00	1
100.37	0.07	0.07	0.00	1
100.49	0.15	0.15	0.00	1
100.59	0.22	0.22	0.00	1
100.69	0.29	0.29	0.00	1
100.80	0.37	0.37	0.00	1
100.93	0.44	0.44	0.00	1
101.05	0.50	0.50	0.00	1
101.25	0.58	0.58	0.00	1
101.46	0.66	0.66	0.00	1
101.70	0.73	0.73	0.00	1
105.00	1.39	1.39	0.00	Overtopping

Rating Curve Plot for Crossing: Sta5120

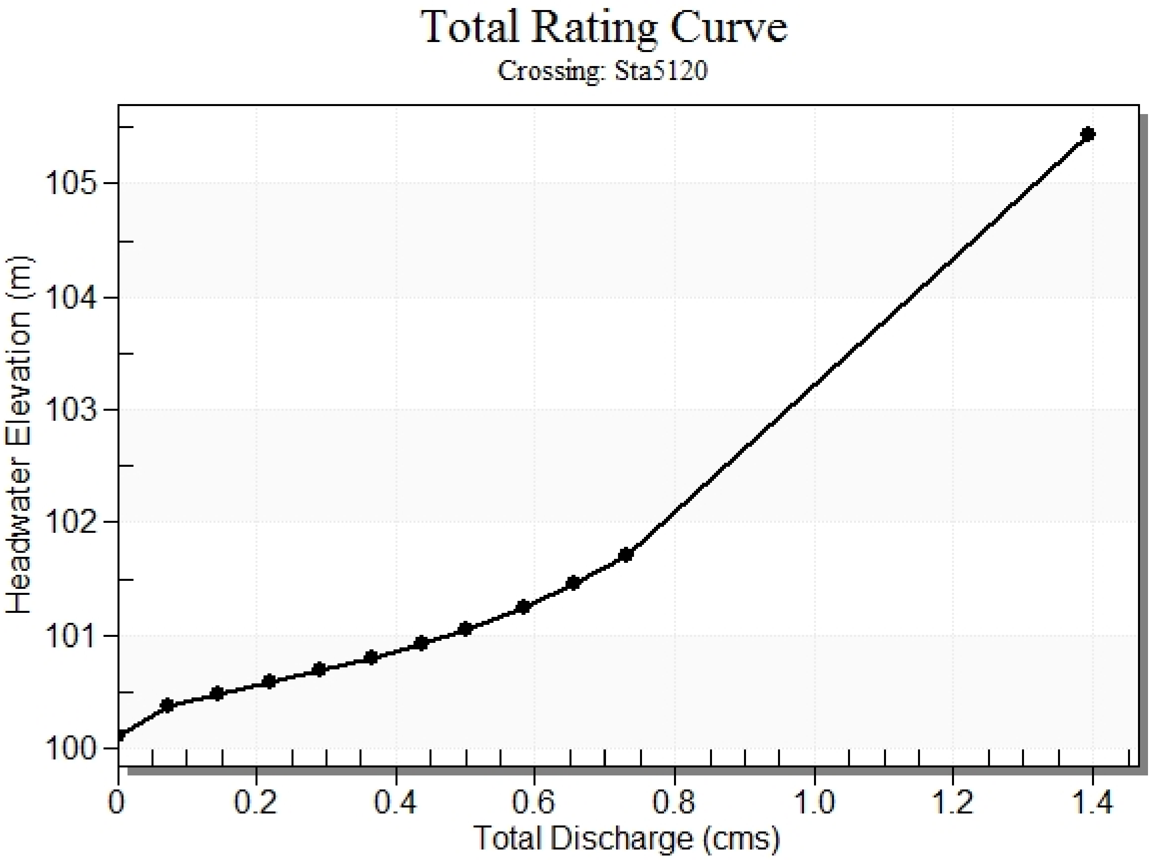


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	100.12	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
0.07	0.07	100.37	0.252	0.133	6-FFt	0.181	0.170	0.242	0.242	0.682	0.622
0.15	0.15	100.49	0.369	0.239	6-FFt	0.263	0.244	0.314	0.314	0.975	0.740
0.22	0.22	100.59	0.472	0.347	6-FFt	0.335	0.303	0.366	0.366	1.214	0.819
0.29	0.29	100.69	0.575	0.467	6-FFt	0.407	0.351	0.407	0.407	1.431	0.880
0.37	0.37	100.80	0.685	0.604	6-FFt	0.492	0.395	0.443	0.443	1.630	0.931
0.44	0.44	100.93	0.810	0.759	6-FFt	0.600	0.432	0.474	0.474	1.831	0.974
0.50	0.50	101.05	0.933	0.906	6-FFt	0.600	0.462	0.498	0.498	1.989	1.007
0.58	0.58	101.25	1.129	1.128	6-FFt	0.600	0.497	0.528	0.528	2.221	1.047
0.66	0.66	101.46	1.329	1.343	6-FFt	0.600	0.522	0.552	0.552	2.414	1.078
0.73	0.73	101.70	1.559	1.579	6-FFt	0.600	0.541	0.574	0.574	2.621	1.107

****

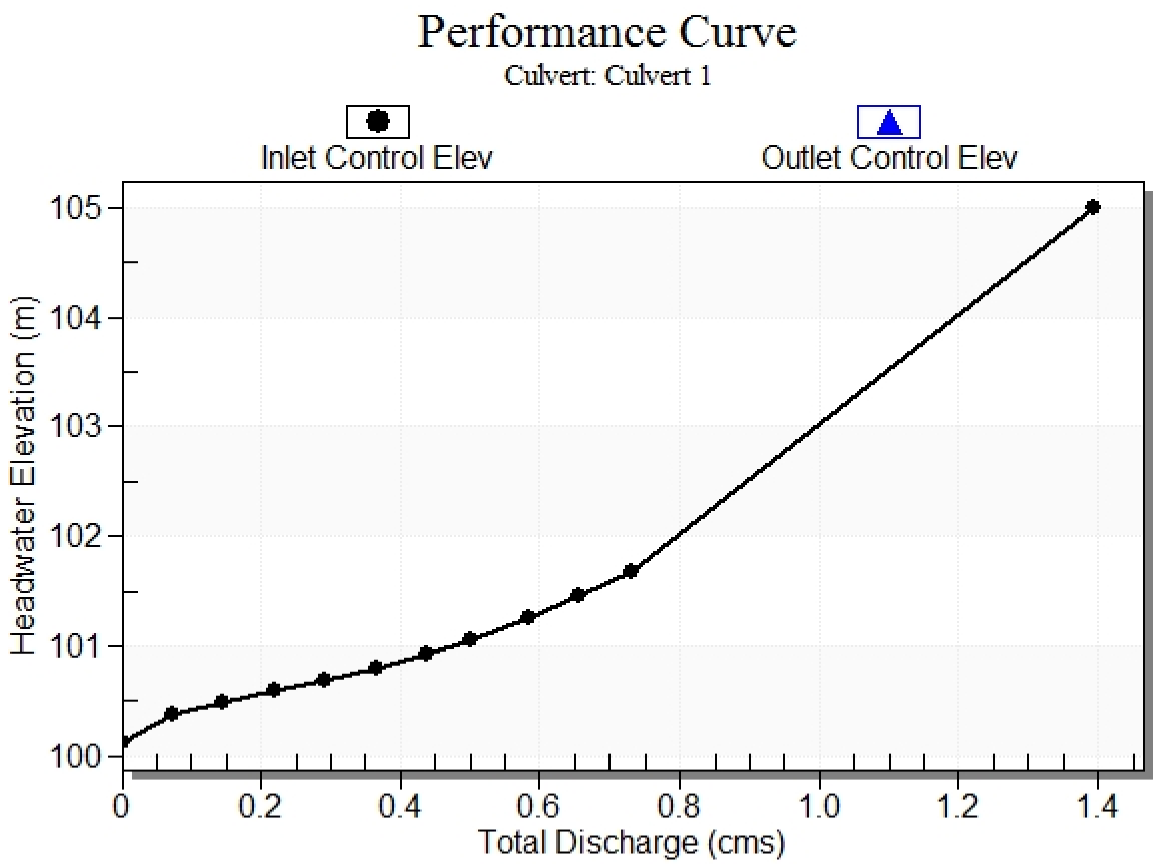
Straight Culvert

Inlet Elevation (invert): 100.12 m, Outlet Elevation (invert): 100.00 m

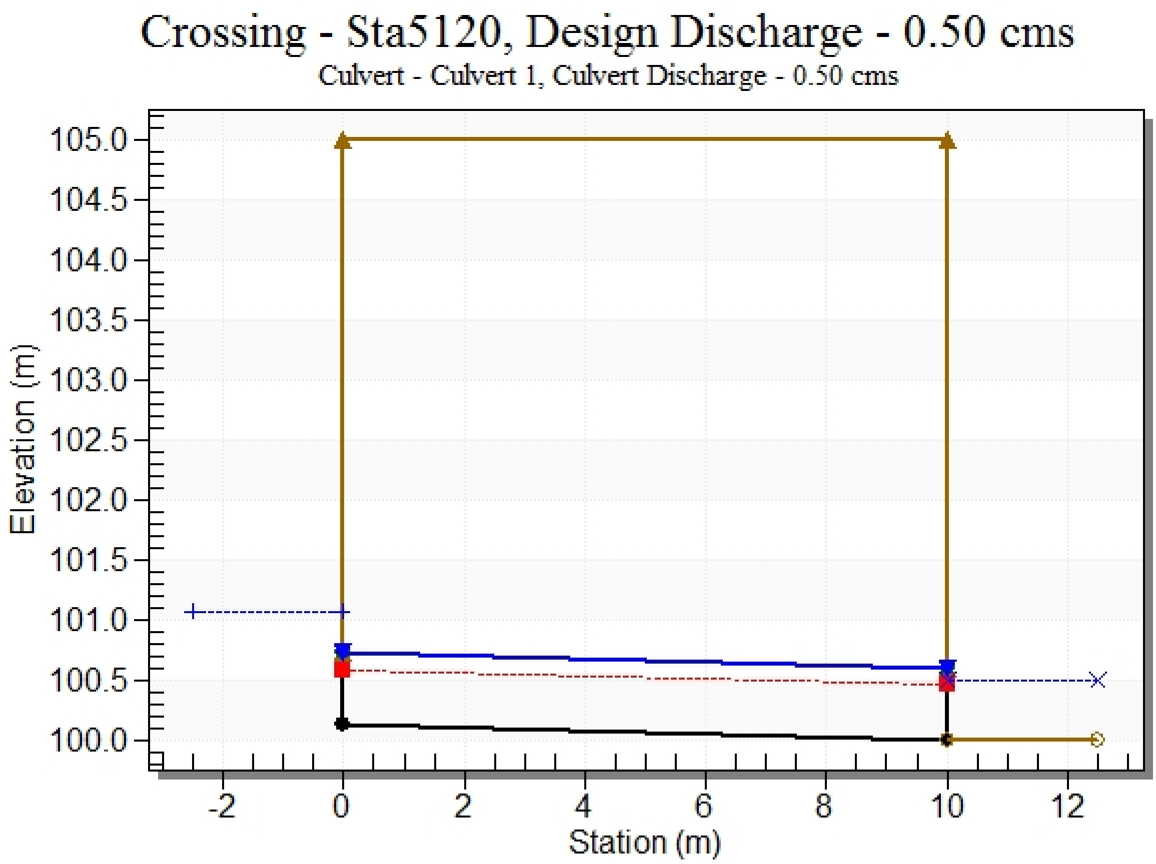
Culvert Length: 10.00 m, Culvert Slope: 0.0120

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 100.12 m

Outlet Station: 10.00 m

Outlet Elevation: 100.00 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 600.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Sta5120)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	100.00	0.00	0.00	0.00	0.00
0.07	100.24	0.24	0.62	28.49	0.57
0.15	100.31	0.31	0.74	36.94	0.60
0.22	100.37	0.37	0.82	43.01	0.61
0.29	100.41	0.41	0.88	47.91	0.62
0.37	100.44	0.44	0.93	52.09	0.63
0.44	100.47	0.47	0.97	55.78	0.64
0.50	100.50	0.50	1.01	58.62	0.64
0.58	100.53	0.53	1.05	62.13	0.65
0.66	100.55	0.55	1.08	64.94	0.65
0.73	100.57	0.57	1.11	67.55	0.66

Tailwater Channel Data - Sta5120

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0120

Channel Manning's n: 0.0400

Channel Invert Elevation: 100.00 m

Roadway Data for Crossing: Sta5120

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 105.00 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 17.6573 cfs

Maximum Flow: 25.7797 cfs

Table 4 - Summary of Culvert Flows at Crossing: Sta5350

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
504.10	0.00	0.00	0.00	1
504.35	0.07	0.07	0.00	1
504.46	0.15	0.15	0.00	1
504.56	0.22	0.22	0.00	1
504.67	0.29	0.29	0.00	1
504.78	0.37	0.37	0.00	1
504.90	0.44	0.44	0.00	1
505.02	0.50	0.50	0.00	1
505.22	0.58	0.58	0.00	1
505.42	0.66	0.66	0.00	1
505.81	0.73	0.73	0.00	1
508.00	0.90	0.90	0.00	Overtopping

Rating Curve Plot for Crossing: Sta5350

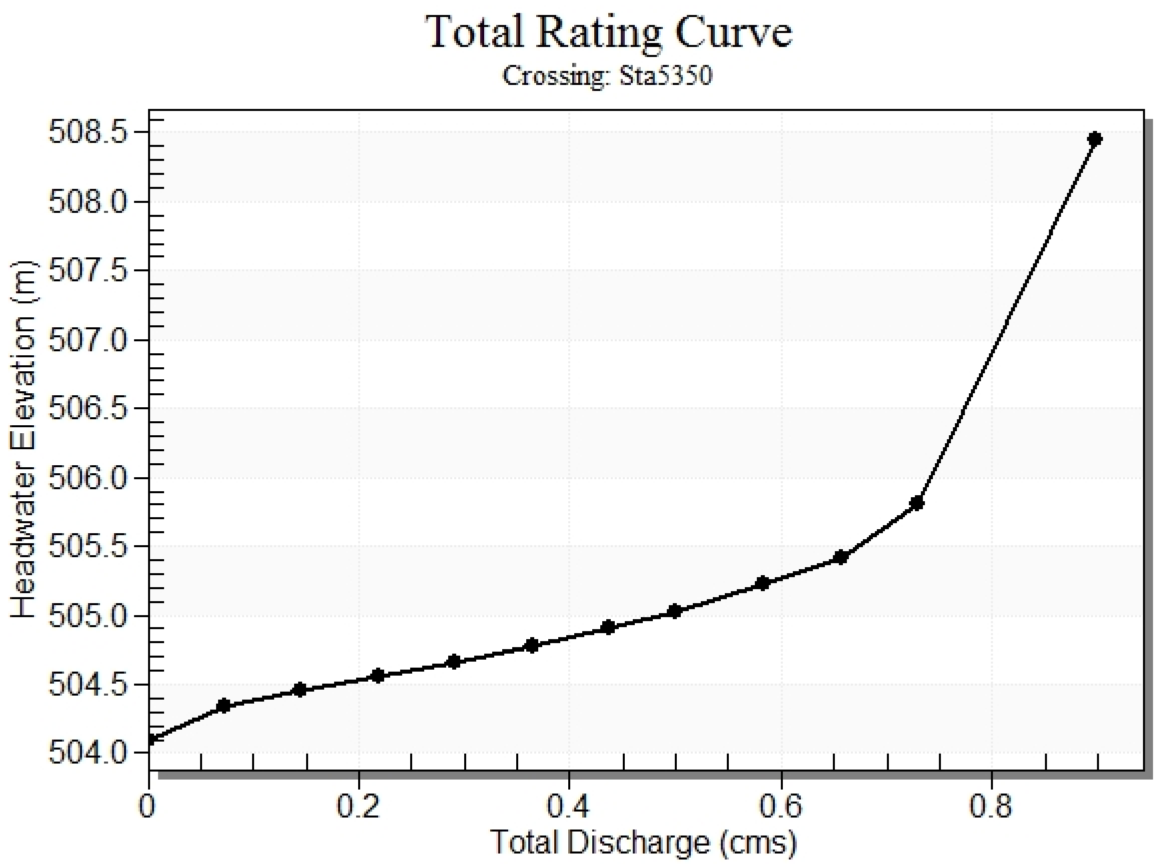


Table 5 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	504.10	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
0.07	0.07	504.35	0.245	0.0*	6-FFt	0.131	0.170	0.193	0.193	0.924	0.977
0.15	0.15	504.46	0.360	0.0*	6-FFt	0.188	0.244	0.251	0.251	1.304	1.162
0.22	0.22	504.56	0.464	0.0*	6-FFc	0.234	0.303	0.303	0.292	1.531	1.286
0.29	0.29	504.67	0.566	0.0*	6-FFc	0.275	0.351	0.351	0.325	1.699	1.382
0.37	0.37	504.78	0.676	0.0*	6-FFc	0.313	0.395	0.395	0.353	1.850	1.462
0.44	0.44	504.90	0.801	0.0*	6-FFc	0.351	0.432	0.432	0.378	2.008	1.530
0.50	0.50	505.02	0.924	0.0*	6-FFc	0.383	0.462	0.462	0.398	2.143	1.581
0.58	0.58	505.22	1.120	0.162	6-FFc	0.430	0.497	0.497	0.421	2.331	1.644
0.66	0.66	505.42	1.320	0.896	6-FFc	0.478	0.522	0.522	0.441	2.525	1.693
0.73	0.73	505.81	1.550	1.711	6-FFc	0.600	0.541	0.541	0.458	2.719	1.738

* Full Flow Headwater elevation is below inlet invert.

****

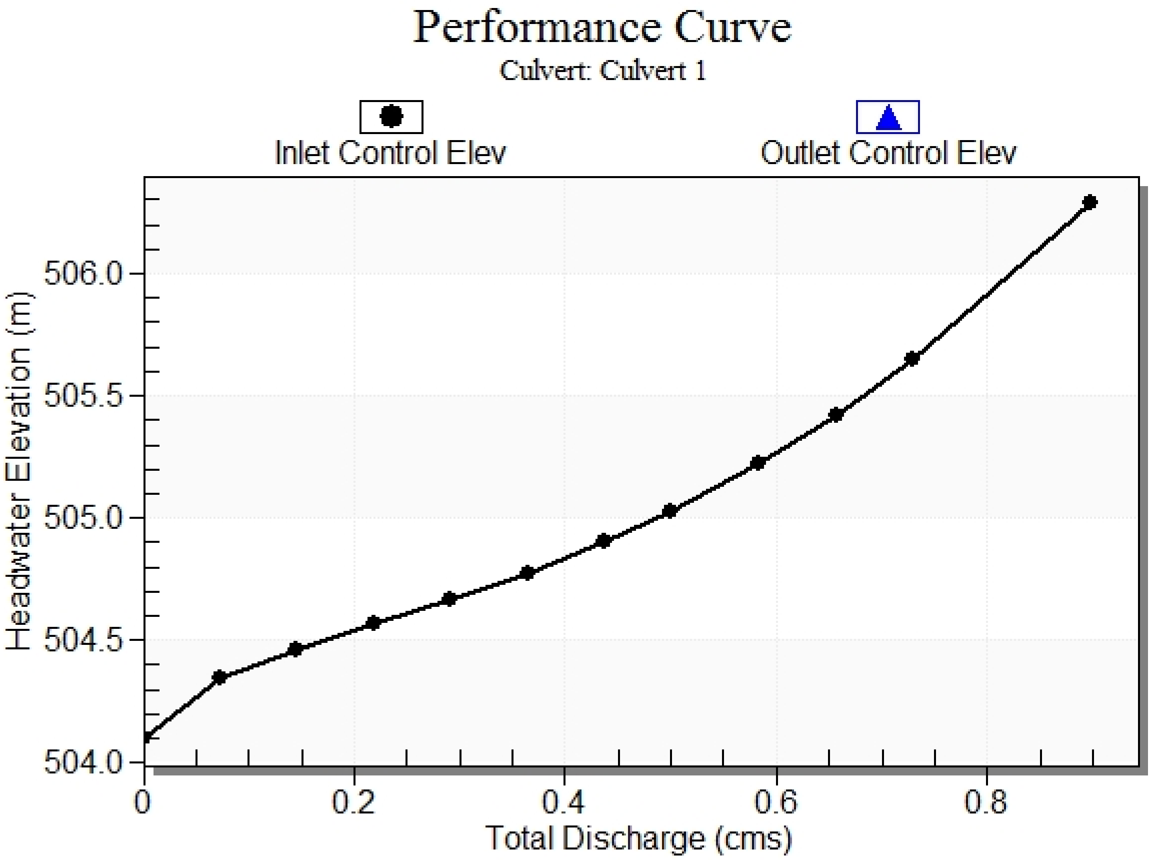
Straight Culvert

Inlet Elevation (invert): 504.10 m,   Outlet Elevation (invert): 501.00 m

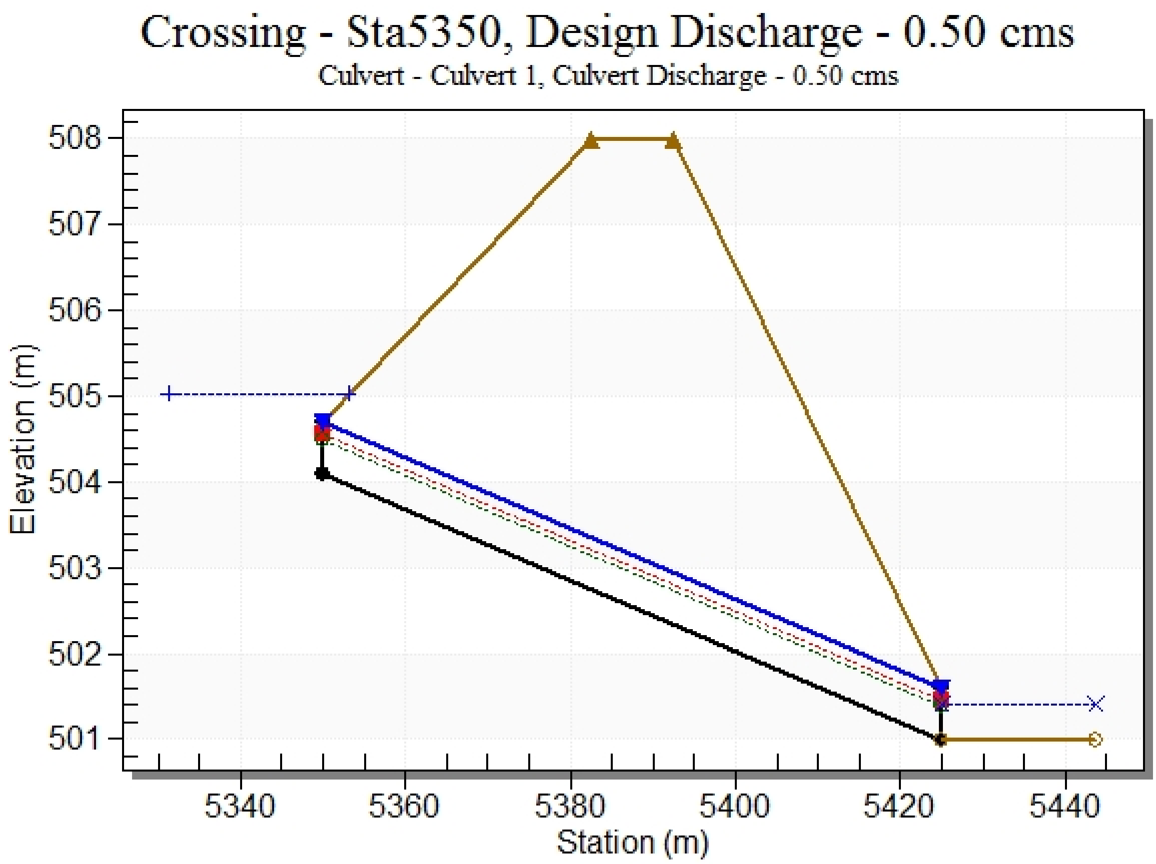
Culvert Length: 75.06 m,   Culvert Slope: 0.0413

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 5350.00 m

Inlet Elevation: 504.10 m

Outlet Station: 5425.00 m

Outlet Elevation: 501.00 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 600.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 6 - Downstream Channel Rating Curve (Crossing: Sta5350)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	501.00	0.00	0.00	0.00	0.00
0.07	501.19	0.19	0.98	75.77	1.00
0.15	501.25	0.25	1.16	98.26	1.05
0.22	501.29	0.29	1.29	114.40	1.08
0.29	501.32	0.32	1.38	127.43	1.09
0.37	501.35	0.35	1.46	138.55	1.11
0.44	501.38	0.38	1.53	148.35	1.12
0.50	501.40	0.40	1.58	155.90	1.13
0.58	501.42	0.42	1.64	165.25	1.14
0.66	501.44	0.44	1.69	172.72	1.15
0.73	501.46	0.46	1.74	179.68	1.16

Tailwater Channel Data - Sta5350

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0400

Channel Invert Elevation: 501.00 m

Roadway Data for Crossing: Sta5350

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 508.00 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 17.6573 cfs

Maximum Flow: 25.7797 cfs

Table 7 - Summary of Culvert Flows at Crossing: Sta5780

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
467.30	0.00	0.00	0.00	1
467.52	0.07	0.07	0.00	1
467.61	0.15	0.15	0.00	1
467.70	0.22	0.22	0.00	1
467.78	0.29	0.29	0.00	1
467.86	0.37	0.37	0.00	1
467.94	0.44	0.44	0.00	1
468.02	0.50	0.50	0.00	1
468.12	0.58	0.58	0.00	1
468.23	0.66	0.66	0.00	1
468.34	0.73	0.73	0.00	1
470.00	1.37	1.37	0.00	Overtopping

Rating Curve Plot for Crossing: Sta5780

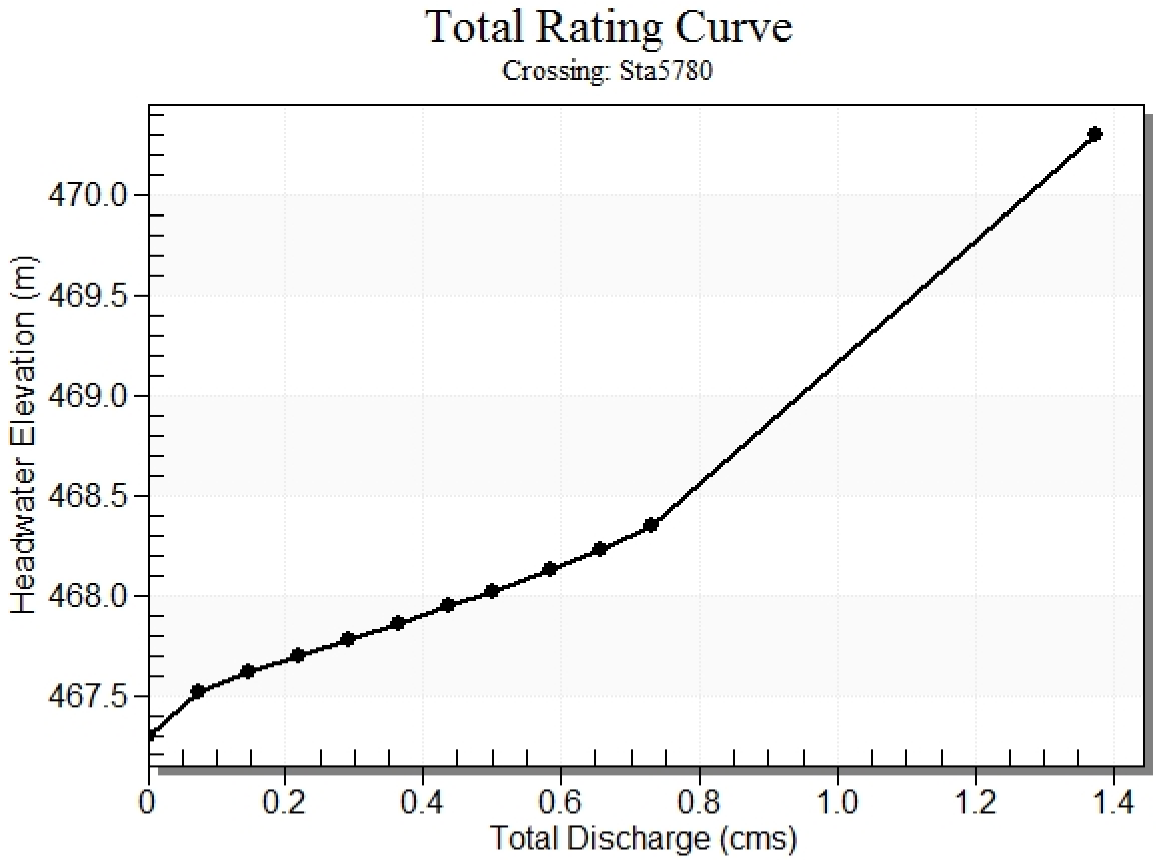


Table 8 - Culvert Summary Table: Culvert 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	467.30	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
0.07	0.07	467.52	0.216	0.0*	6-FFc	0.092	0.163	0.163	0.155	1.063	1.521
0.15	0.15	467.61	0.312	0.0*	6-FFc	0.135	0.233	0.233	0.201	1.296	1.808
0.22	0.22	467.70	0.397	0.0*	6-FFc	0.164	0.288	0.288	0.234	1.465	2.001
0.29	0.29	467.78	0.480	0.0*	6-FFc	0.193	0.336	0.336	0.261	1.599	2.151
0.37	0.37	467.86	0.560	0.0*	6-FFc	0.215	0.377	0.377	0.283	1.730	2.274
0.44	0.44	467.94	0.642	0.0*	6-FFc	0.237	0.414	0.414	0.303	1.850	2.380
0.50	0.50	468.02	0.715	0.0*	6-FFc	0.256	0.444	0.444	0.319	1.942	2.460
0.58	0.58	468.12	0.823	0.0*	6-FFc	0.277	0.480	0.480	0.338	2.077	2.557
0.66	0.66	468.23	0.926	0.0*	6-FFc	0.296	0.511	0.511	0.353	2.184	2.634
0.73	0.73	468.34	1.042	0.0*	6-FFc	0.315	0.538	0.538	0.367	2.306	2.704

* Full Flow Headwater elevation is below inlet invert.

****

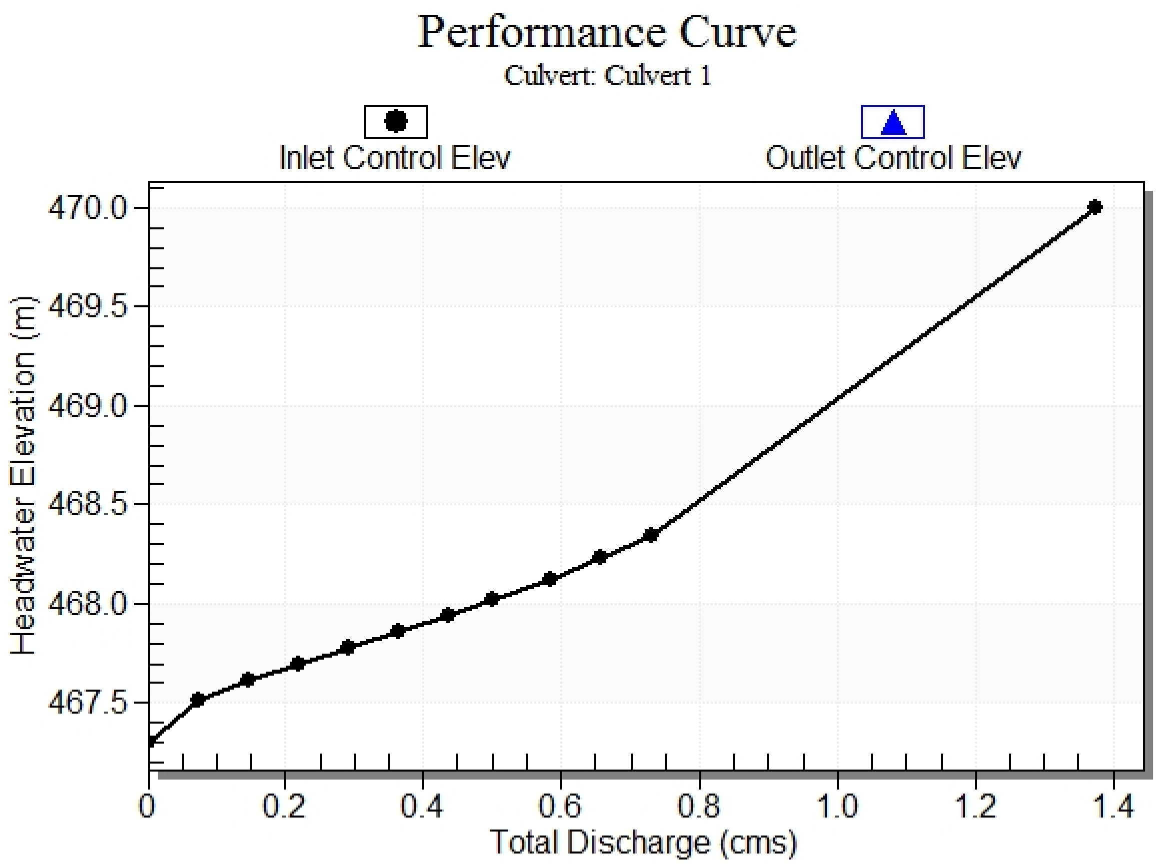
Straight Culvert

Inlet Elevation (invert): 467.30 m, Outlet Elevation (invert): 458.80 m

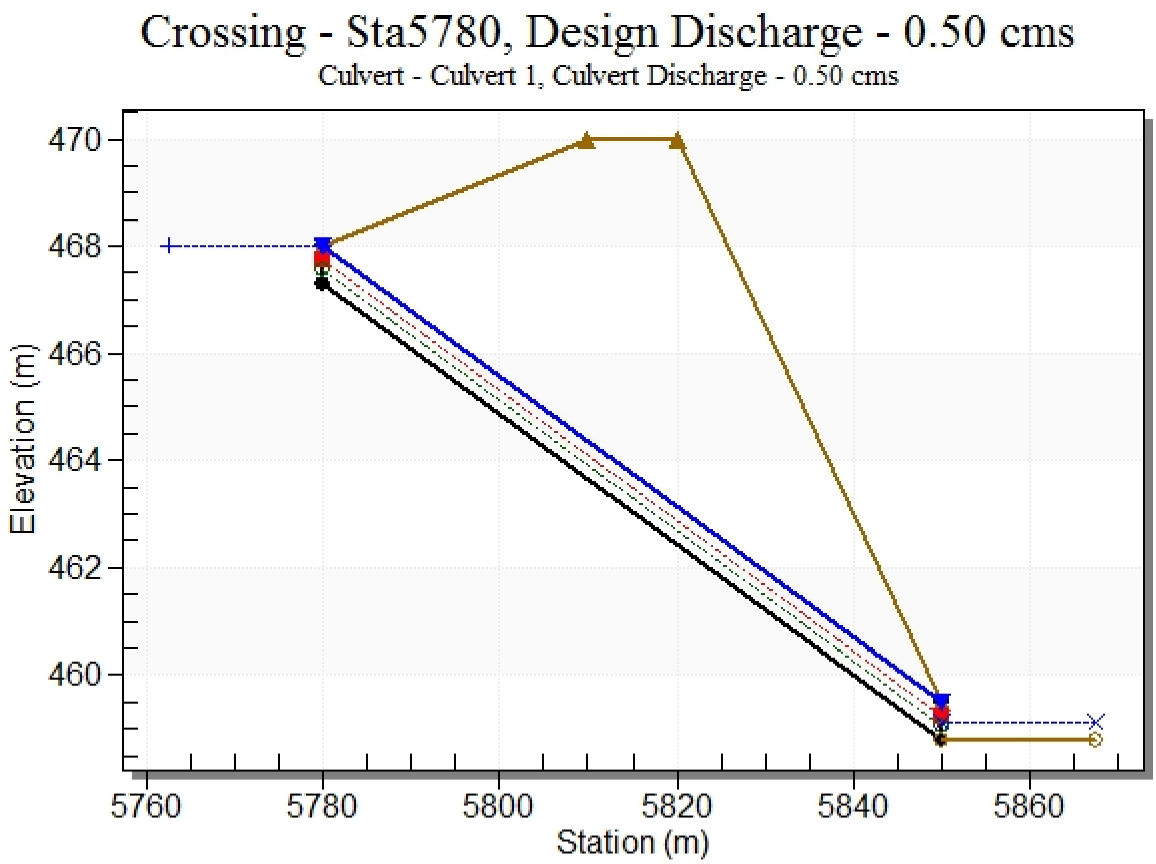
Culvert Length: 70.51 m, Culvert Slope: 0.1214

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 5780.00 m

Inlet Elevation: 467.30 m

Outlet Station: 5850.00 m

Outlet Elevation: 458.80 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 700.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: Sta5780)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	458.80	0.00	0.00	0.00	0.00
0.07	458.95	0.15	1.52	197.42	1.74
0.15	459.00	0.20	1.81	256.03	1.82
0.22	459.03	0.23	2.00	298.07	1.87
0.29	459.06	0.26	2.15	332.02	1.90
0.37	459.08	0.28	2.27	361.00	1.93
0.44	459.10	0.30	2.38	386.55	1.95
0.50	459.12	0.32	2.46	406.22	1.97
0.58	459.14	0.34	2.56	430.58	1.99
0.66	459.15	0.35	2.63	450.03	2.00
0.73	459.17	0.37	2.70	468.16	2.01

Tailwater Channel Data - Sta5780

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.1300

Channel Manning's n: 0.0400

Channel Invert Elevation: 458.80 m

Roadway Data for Crossing: Sta5780

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 m

Crest Elevation: 470.00 m

Roadway Surface: Paved

Roadway Top Width: 10.00 m

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Ditch Capacity Calculations

- Ditches at critical locations were sized using Hydraulic Toolbox (HEC-22).

Appendix F.4

Hydraulic Analysis Report

Project Data

Project Title: 2627_Enhanced Swales

Designer:

Project Date: Sunday, August 28, 2016

Project Units: SI Units (Metric)

Notes:

Channel Analysis: 4440 Channel Analysis

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 (m/m)

Side Slope 2 (Z2): 2.0000 (m/m)

Longitudinal Slope: 0.0035 (m/m)

Manning's n: 0.0350

Flow: 0.2000 (cms)

Result Parameters

Depth: 0.4235 (m)

Area of Flow: 0.3587 (m^2)

Wetted Perimeter: 1.8940 (m)

Hydraulic Radius: 0.1894 (m)

Average Velocity: 0.5575 (m/s)

Top Width: 1.6941 (m)

Froude Number: 0.3867

Critical Depth: 0.2896 (m)

Critical Velocity: 1.1922 (m/s)

Critical Slope: 0.0266 (m/m)

Critical Top Width: 1.1585 (m)

Calculated Max Shear Stress: 14.5300 (N/m^2)

Calculated Avg Shear Stress: 6.4980 (N/m^2)

Channel Analysis: 4620 Channel Analysis

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 (m/m)

Side Slope 2 (Z2): 2.0000 (m/m)

Longitudinal Slope: 0.0200 (m/m)

Manning's n: 0.0350

Flow: 0.1000 (cms)

Result Parameters

Depth: 0.2355 (m)

Area of Flow: 0.1110 (m^2)

Wetted Perimeter: 1.0534 (m)

Hydraulic Radius: 0.1053 (m)

Average Velocity: 0.9013 (m/s)

Top Width: 0.9421 (m)

Froude Number: 0.8383

Critical Depth: 0.2195 (m)

Critical Velocity: 1.0378 (m/s)

Critical Slope: 0.0291 (m/m)

Critical Top Width: 0.8780 (m)

Calculated Max Shear Stress: 46.1756 (N/m^2)

Calculated Avg Shear Stress: 20.6503 (N/m^2)

Channel Analysis: 4920 Channel Analysis

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 (m/m)

Side Slope 2 (Z2): 2.0000 (m/m)

Longitudinal Slope: 0.0130 (m/m)

Manning's n: 0.0350

Flow: 0.1300 (cms)

Result Parameters

Depth: 0.2818 (m)

Area of Flow: 0.1588 (m^2)

Wetted Perimeter: 1.2600 (m)

Hydraulic Radius: 0.1260 (m)

Average Velocity: 0.8188 (m/s)

Top Width: 1.1270 (m)

Froude Number: 0.6964

Critical Depth: 0.2438 (m)

Critical Velocity: 1.0938 (m/s)

Critical Slope: 0.0281 (m/m)

Critical Top Width: 0.9751 (m)

Calculated Max Shear Stress: 35.9032 (N/m^2)

Calculated Avg Shear Stress: 16.0564 (N/m^2)

Channel Analysis: 5160 Channel Analysis

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 (m/m)

Side Slope 2 (Z2): 2.0000 (m/m)

Longitudinal Slope: 0.0030 (m/m)

Manning's n: 0.0350

Flow: 0.2500 (cms)

Result Parameters

Depth: 0.4740 (m)

Area of Flow: 0.4493 (m^2)

Wetted Perimeter: 2.1197 (m)

Hydraulic Radius: 0.2120 (m)

Average Velocity: 0.5564 (m/s)

Top Width: 1.8960 (m)

Froude Number: 0.3648

Critical Depth: 0.3167 (m)

Critical Velocity: 1.2466 (m/s)

Critical Slope: 0.0258 (m/m)

Critical Top Width: 1.2666 (m)

Calculated Max Shear Stress: 13.9384 (N/m^2)

Calculated Avg Shear Stress: 6.2335 (N/m^2)

Channel Analysis: 6120 Channel Analysis

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 (m/m)

Side Slope 2 (Z2): 2.0000 (m/m)

Longitudinal Slope: 0.0350 (m/m)

Manning's n: 0.0350

Flow: 0.7000 (cms)

Result Parameters

Depth: 0.4399 (m)

Area of Flow: 0.3871 (m^2)

Wetted Perimeter: 1.9675 (m)

Hydraulic Radius: 0.1968 (m)

Average Velocity: 1.8083 (m/s)

Top Width: 1.7598 (m)

Froude Number: 1.2307

Critical Depth: 0.4780 (m)

Critical Velocity: 1.5316 (m/s)

Critical Slope: 0.0225 (m/m)

Critical Top Width: 1.9121 (m)

Calculated Max Shear Stress: 150.9359 (N/m^2)

Calculated Avg Shear Stress: 67.5006 (N/m^2)

Channel Analysis: 6500 Channel Analysis

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 (m/m)

Side Slope 2 (Z2): 2.0000 (m/m)

Longitudinal Slope: 0.0250 (m/m)

Manning's n: 0.0350

Flow: 0.3000 (cms)

Result Parameters

Depth: 0.3410 (m)

Area of Flow: 0.2326 (m^2)

Wetted Perimeter: 1.5252 (m)

Hydraulic Radius: 0.1525 (m)

Average Velocity: 1.2897 (m/s)

Top Width: 1.3642 (m)

Froude Number: 0.9969

Critical Depth: 0.3406 (m)

Critical Velocity: 1.2929 (m/s)

Critical Slope: 0.0252 (m/m)

Critical Top Width: 1.3625 (m)

Calculated Max Shear Stress: 83.5742 (N/m^2)

Calculated Avg Shear Stress: 37.3755 (N/m^2)

Channel Analysis: 6760 Channel Analysis

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 (m/m)

Side Slope 2 (Z2): 2.0000 (m/m)

Longitudinal Slope: 0.0050 (m/m)

Manning's n: 0.0350

Flow: 0.2000 (cms)

Result Parameters

Depth: 0.3961 (m)

Area of Flow: 0.3138 (m^2)

Wetted Perimeter: 1.7715 (m)

Hydraulic Radius: 0.1772 (m)

Average Velocity: 0.6373 (m/s)

Top Width: 1.5845 (m)

Froude Number: 0.4571

Critical Depth: 0.2896 (m)

Critical Velocity: 1.1922 (m/s)

Critical Slope: 0.0266 (m/m)

Critical Top Width: 1.1585 (m)

Calculated Max Shear Stress: 19.4144 (N/m^2)

Calculated Avg Shear Stress: 8.6824 (N/m^2)

Channel Analysis: 6980 Channel Analysis

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 (m/m)

Side Slope 2 (Z2): 2.0000 (m/m)

Longitudinal Slope: 0.0700 (m/m)

Manning's n: 0.0350

Flow: 0.1500 (cms)

Result Parameters

Depth: 0.2168 (m)

Area of Flow: 0.0940 (m^2)

Wetted Perimeter: 0.9696 (m)

Hydraulic Radius: 0.0970 (m)

Average Velocity: 1.5955 (m/s)

Top Width: 0.8672 (m)

Froude Number: 1.5468

Critical Depth: 0.2581 (m)

Critical Velocity: 1.1255 (m/s)

Critical Slope: 0.0276 (m/m)

Critical Top Width: 1.0326 (m)

Calculated Max Shear Stress: 148.7653 (N/m^2)

Calculated Avg Shear Stress: 66.5299 (N/m^2)

Appendix F.5

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Check Dam Capacity – Weir Calculation

Project Name:	26/27 SR
Project No.:	034587
Location:	Clearview Twp.
Created By:	A. Holvik
Checked By:	A. Holvik
Date Created:	26-Aug-2016
Date Modified:	8/28/2016

R. J. Burnside & Associates Limited
3 Ronell Crescent, Collingwood, Ontario
telephone (705) 446-0515 fax (705) 446-2399
web www.rjburnside.com

User Input Cells

Weir Calculations - Input Parameters	
Width (m) =	2.00
Coefficient, C =	1.60
Rectangular =	n
Side Slope X:1 =	2.00
Crest Elevation (m) =	0.00
Incremental Depth (m) =	0.05

Weir Equation **$Q = CL(H^{1.5})$**

Notes:
Weir equation applies to sharp crested rectangular and broad crested configurations.
Sharp Crested Rectangluar Weir Coefficient, C = 1.84
Broad Crested Weir Coefficient, C = f(H, h, and L) ranging between 1.25-3.1

Weir Calculations - Output Results

W.S. Elevation (m)	Head (m)	Trapezoid Width (m)	Rectangle Width (m)	Weir Q (m^3/sec)	Water Surface Elevation Notes
0.000	0.000	2.000	2.000	**0.000**	
0.050	0.050	2.100	2.000	**0.038**	
0.100	0.100	2.200	2.000	**0.111**	
0.150	0.150	2.300	2.000	**0.214**	
0.200	0.200	2.400	2.000	**0.343**	
0.250	0.250	2.500	2.000	**0.500**	
0.300	0.300	2.600	2.000	**0.684**	
0.350	0.350	2.700	2.000	**0.895**	