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Clair-Maltby Comprehensive Environmental Impact Study

Year 2 Monitoring Report (2016 – 2017)
City of Guelph

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Year 2 Monitoring Report (2016 - 2017)
City of Guelph

Submitted to:

City of Guelph
1 Carden Street
Guelph, ON N1H 3A1

Submitted by:

Wood Environment & Infrastructure Solutions
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In association with:

Beacon Environmental Ltd.
Matrix Solutions Inc.
Daryl W. Cowell & Associates Inc.

May, 2018

TPB168050

May 1, 2018
TPB168050

City of Guelph
1 Carden Street
Guelph, ON N1H 3A1

Attention: Arun Hindupur, P.Eng.,
Infrastructure Planning Engineer

Dear Sir:

Re: Clair-Maltby Comprehensive Environmental Impact Study (CEIS)
Year 2 Monitoring Report (2016 – 2017)

The Clair-Maltby CEIS Team of Wood, Matrix Solutions and Beacon Environmental is pleased to provide the City of Guelph with the Year 2 (2016-2017) Monitoring Report. The Monitoring Report summarizes the findings of the surface water, groundwater. wetland and natural heritage monitoring conducted during 2016 and 2017. Although access to some private properties was limited, particularly for terrestrial natural heritage monitoring, which did not allow for field truthing in some areas of interest, the CEIS Team has been able to work with the access provided to establish sufficient numbers of sampling locations in a representative range of sites throughout the Primary Study Area. As such, the CEIS Team, is confident that the work undertaken will provide sufficient information to support a clear and integrated understanding of the Clair-Maltby natural systems.

We look forward to discussing our results with the City's Project Team, as well as the other technical and community advisory groups involved in this project.

Yours truly,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Per: Ron Scheckenberger M. Eng., P. Eng
Principal Consultant, Water Resources

Per: Steve Chipps P. Eng
Associate, Water Resources

RBS/cc

Executive Summary

To understand and assess the Clair Maltby study area's unique natural heritage character, a three (3) year monitoring program (2016-2018) was developed as part of the Comprehensive Environmental Impact Study (CEIS). The monitoring program is being conducted to supplement the available data from existing studies and reports and instrumentation. This report presents the results from the first two years (2016 and 2017) of this three (3) year monitoring program. The key components of this monitoring are related to surface water, groundwater, and terrestrial and aquatic natural heritage. The key components of this monitoring, in each of the related disciplines, along with key findings are provided in the following.

Three (3) overlapping study areas were identified for this project to support different types of analyses: the Secondary Plan Area (SPA) in which the land use planning is to occur, the Primary Study Area (PSA) which includes the SPA plus a 500 m zone around it to allow for consideration of natural heritage functions and connectivity in the landscape, and the Secondary Study Area (SSA), which is a much broader area encompassing portions of adjacent subwatersheds for the purposes of surface and groundwater analyses (ref. Map G-1).

The Clair Maltby SPA lies within the headwaters of the Hanlon, Torrance and Mill Creeks, and is entirely on lands within the Paris Moraine. This unique setting, along with the permeable nature of area soils and subsoils, and the predominantly hummocky landscape, has given rise to a distinct lack of open flowing watercourses. Furthermore, the hummocky topography creates an abundance of inward draining topographic features which have closed drainage resulting in no offsite drainage contributions, while serving to locally recharge the groundwater system, particularly in areas of permeable soils, which generally exist across the SPA. The well-drained soils and hummocky topography support a range of uplands and lowland habitats including woodlands, wetlands and successional meadows and thickets. The area also currently supports a number of residential estate lots, a few commercial uses, and areas currently supporting agricultural land uses.

The Year 1, 2016 field assessments (ref. Clair Maltby Comprehensive Environmental Impact Study, Year 1 Monitoring Report, March, 2017) provided insight into the study area characterization from a surface and groundwater perspective based on two (2) seasons of monitoring (i.e., summer and fall) and also informed monitoring modifications for Year 2, 2017 for the various disciplines.

The Year 2 (2017) program included three full seasons of monitoring for all disciplines including:

- Surface water quantity and quality monitoring at two flow stations and twelve wetland stations;
- Groundwater level and quality monitoring at twenty (20) wells and fourteen (14) mini-piezometers in the SPA, as well as twenty-seven (27) spot flow locations in the SSA; and
- A comprehensive range of assessments to verify and expand the understanding of the natural heritage in the SPA including surveys for: plants, vegetation communities, winter wildlife, calling amphibians, breeding birds, turtles and road wildlife movement / mortality.

Work in 2018 will include another three (3) seasons of surface and groundwater monitoring. It will also include targeted natural heritage assessments to fill key gaps identified in 2017, particularly in areas where access has been provided that was not available previously.

Surface Water Monitoring

One flow surface water monitoring station was established in each of the sub-watersheds that occur in the SPA, however given the lack of any permanent watercourses in the SPA, these stations were established in the SSA (Station 14 in Mill Creek Subwatershed and Station 15 in Hanlon Creek Subwatershed). Two locations within Hanlon Creek Watershed and within the SPA were initially monitored in 2016 (Stations 9A and 9B), however no flow was recorded and therefore Station 15 was established in early 2017 (ref. Map SW-1).

Results to-date from Station 14 in Mill Creek and Station 15 Hanlon Creek indicate that groundwater is an important contributor to baseflow at both stations, with Hanlon Creek baseflow remaining steady at 0.2 m^3/s for most of the monitoring period, while Station 14 at Mill Creek, the baseflow receded from 0.1 m^3/s to 0.05 m^3/s over the monitoring period.

In addition, water levels were measured at 12 wetlands across the SPA in both subwatersheds over 2017 (ref. Map GW-1). Notably, surface water level and shallow groundwater stations were established immediately adjacent to each other in order to be able to relate the surface and groundwater data. Assessment of the wetland water level data in relation to the shallow and deep groundwater level monitoring is discussed in the groundwater monitoring section.

Water quality (i.e. temperature and a range of chemical parameters) was also measured at all stations over 2016 and 2017 in the spring, summer and fall, with a targeted test for pesticides in half of the wetland stations in the fall of 2017. Analyses were informed by two (2) rainfall gauges within, or very close to, the SPA: one at the EMS station on Clair Road at the west corner of the study area, and one on the roof of the Guelph Home Building Supply in the eastern corner of the SPA (ref. Map SW-1).

Groundwater Monitoring

A comprehensive groundwater monitoring program was initiated in 2016, including:

- Downhole Geophysical Logging
- Drive Point Mini Piezometer Installations
- Groundwater Level Monitoring
- Groundwater Quality Sampling
- Borehole Drilling and Monitoring Well Installations
- Guelph Permeameter Testing
- Surface Water Spot Flow Measurements
- Pond Bathymetry Surveys
- Seeps and Springs Observations
- Single Well Hydraulic Response Testing

In total, 17 boreholes at 9 locations were advanced and all boreholes were completed as monitoring wells. A total of 18 drive point mini piezometers were installed at 14 locations identified as areas of potential groundwater – surface water interaction (Figure GW-1). Groundwater quality sampling has been conducted at all monitoring wells.

The 2017 field program included the following ongoing data collection that was first initiated in 2016:

- Groundwater Level Monitoring
- Groundwater Quality Sampling
- Surface Water Base Flow Measurements
- Seeps and Springs Observations

The majority of monitoring wells show water levels varying between 330 masl to 335 masl. Seasonal variations tend to indicated lows in early January and highs in early July. All monitoring well hydrographs show a downward groundwater flow gradient, except at MW9-D and MW9-S where the hydraulic gradient is consistently upwards throughout all seasons.

Wetlands surface water hydrographs show that for most of the year, most wetlands have a surface water elevation that exceeds, or is equal to the shallow groundwater (mini piezometer) elevations. As such, it is interpreted that the wetland is losing water to, or is in equilibrium with, the shallow groundwater. However, some wetlands show upward hydraulic gradients where the shallow elevations exceed the surface water elevations for most of the year and some wetlands show a pattern of seasonal reversal of hydraulic gradient.

Aquatic and Terrestrial Natural Heritage

The bulk of the aquatic and terrestrial natural heritage monitoring work to-date for this project was completed over 2017. The field work (i.e., surveys for: plants, vegetation communities, winter wildlife, calling amphibians, breeding birds, turtles and road wildlife movement / mortality) that was completed from public lands and properties where access was provided, was supplemented with available and relevant background data from sites within the SPA collected since 2004, as well as analysis of current air photos. This information was used to generate updated Ecological Land Classification (ELC) mapping for the SPA, including updated wetland mapping, and plant and wildlife species list for the PSA, including significant species lists.

This information will be used to:

- Update the Natural Heritage System (NHS) through the characterization analyses, including mapping of Significant Wetlands and other Wetlands, Significant Woodlands and Cultural Woodlands, and Candidate and Confirmed Significant Wildlife Habitat;
- Inform alternatives to the Community Structure Plan;
- Inform NHS policies specific to the Secondary Plan Area; and
- To scope the needs for site-specific studies.

Table of Contents

TABLE OF CONTENTS (cont'd)

LIST OF TABLES

TABLE OF CONTENTS (cont'd)

LIST OF MAPS

LIST OF APPENDICES

1.0 Introduction

The City of Guelph is undertaking the Clair-Maltby Master Environmental Servicing Plan (MESP) and Clair-Maltby Secondary Plan (CMSP) Study to comprehensively plan the last unplanned greenfield area in the City - the Clair-Maltby Secondary Planning Area. The MESP is intended to satisfy and fulfill the requirements of the Environmental Assessment Act and the Planning Act. A key component of the Clair-Maltby MESP and Secondary Plan process is the Comprehensive Environmental Impact Study (CEIS) and MESP technical studies being conducted by Wood with support from Matrix and Beacon.

Protection of the Paris Moraine, its associated functions, and the unique natural heritage character, presents specific challenges and opportunities. To understand and assess the area's unique natural heritage character, a three (3) year monitoring program (2016-2018) was developed as part of the CEIS. The monitoring program is being conducted to supplement the available data from existing studies and reports and instrumentation.

As part of the monitoring program, a range of field assessments commenced as of June 2016 in accordance with the "preliminary" CEIS Work Plan. Preliminary groundwater and surface water field assessments and monitoring were undertaken over the summer and fall of 2016 in order to inform the selection and refinement of monitoring locations, and to start data collection for ground and surface water as soon as possible, so that three (3) years of water-based monitoring data could be assessed. The Year 1, 2016 field assessments provided insight into the study area characterization from a surface and groundwater perspective based on two seasons of monitoring (i.e., summer and fall) and informed the proposed monitoring modifications for Year 2, 2017 for the various disciplines. The Year 2 (2017) program included three (3) full seasons of monitoring for all disciplines including:

- Surface water quantity and quality monitoring at two (2) flow stations and twelve (12) wetland stations;
- Groundwater level and quality monitoring at nine (9) wells and fourteen (14) mini-piezometers in the SPA, as well as twenty-seven (27) spot flow locations in the SSA; and
- A comprehensive range of assessments to verify and expand the understanding of the natural heritage in the SPA including surveys for: plants, vegetation communities, winter wildlife, calling amphibians, breeding birds, turtles and road wildlife movement / mortality.

Work in 2018 will include another three (3) seasons of surface and groundwater monitoring. It will also include targeted natural heritage assessments to fill key gaps identified in 2017, particularly in areas where access has been provided that was not available previously.

2.0 Defining the Study Areas

Three scales of study area (ref. Map G-1) have been identified for the CEIS, as per the following:

i. The Secondary Plan Area (SPA): The SPA is the area within which land use change will occur in accordance with an approved Secondary Plan. The SPA includes the lands south of Clair Road East, north of Maltby Road East, west of Victoria Road South, and approximately 1 km east of the Hanlon Expressway in the City of Guelph.

ii. The Primary Study Area (PSA): The PSA includes the SPA plus a 500 m zone beyond this boundary to allow for consideration of natural heritage functions and connectivity in the landscape.

iii. The Secondary Study Area (SSA): The SSA includes the PSA plus the receiving systems beyond the Clair-Maltby SPA. This area has been defined based on the area's hydrology and hydrogeology to ensure that landscape scale connectivity is considered from a groundwater and surface water perspective. The SSA is based on appropriate groundwater and surface water model boundaries, which inherently consider subwatershed boundaries (Mill Creek, Hanlon Creek, Torrance Creek, Irish Creek and Lower Speed River), as well as groundwater flow divides.

Notably, in the fall of 2016 the SPA (and consequently the PSA) were expanded slightly from the SPA in the original Terms of Reference to include the two large ponds / wetlands and associated lands located just south of Clair Road and west of Gordon Street.

3.0 Property Access

The landowner contact process was initiated in May 2016 with a landowner's information session (held Thursday May 26, 2016) and a subsequent mailout of requests for permission for property access to each of the landowners in the Secondary Plan Area. Permission forms provided options with respect to both the type(s) of field work that may be permitted, as well as the type(s) of follow-up contact required by the landowners.

To date, different types of access have been provided by different landowners, while some landowners have not provided any access, as shown in Map G-2.

After working with a number of landowners, fairly broad access has been provided for undertaking groundwater and surface water monitoring. The level of access provided for undertaking surface water and groundwater monitoring (ref. Map SW-1) is considered adequate in terms of both the numbers of stations and their representation across the PSA, supplemented with access on public lands and other sources of information, to obtain a good understanding of the surface and groundwater dynamics at a level that is appropriate to support a MESP and Secondary Plan.

More limited access has been provided for various types of ecological monitoring. To compensate for this limited access: (a) more effort has been placed on desktop analyses and on integration of data from site-specific studies in the PSA completed over the past decade (ref. Map NH-1), as well as other available background, and (b) monitoring stations were shifted as needed to suitable locations on public lands (including roadside stations) or lands where access has been granted (ref. Map G-2). Given the scale of the SPA, and the fact that a Natural Heritage System for the PSA has already been identified, based on field work done as part of the City's Natural Heritage Strategy, this approach is considered adequate to inform an MESP and Secondary Plan.

Notably, access for ecological monitoring was provided to one additional property (i.e. 1968-1992 Gordon Street) towards the end of 2017, as a result of a change in ownership and access is still being pursued with a few additional landowners. Although the bulk of the ecological monitoring for this study was undertaken in 2017, supplementary ecological monitoring work in 2018 will include properties where access has been recently granted.

4.0 Monitoring Summary

The Clair Maltby Secondary Plan Area lies within the headwaters of the Hanlon, Torrance and Mill Creeks. This unique setting, along with the permeable nature of area soils and subsoils, and the predominantly hummocky landscape, has given rise to a distinct lack of open flowing watercourses. While some depressional features exist, including those associated with roadway infrastructure (i.e. ditches), these tend to be dry with only occasional flowing water conditions. Furthermore, the hummocky topography creates an abundance of inward draining topographic features which have closed drainage resulting in no offsite drainage contributions, while serving to locally recharge the groundwater system, particularly in areas of permeable soils which generally exist across the Secondary Plan area. As such, within the SSA there is a lack of open water features and a lack of formal drainage outlets due to the hummocky topography.

The surface water three (3) year monitoring program has been developed with consideration to the lack of surface water features within the SSA. GRCA recommended that a spotflow program for the groundwater field assessment be utilized given the headwater conditions (i.e., small intermittent systems). Based on the need for a full seasonal understanding of the local flow regime, continuous water level monitoring has been conducted to supplement spotflow measurements, coupled with rainfall monitoring.

4.1 Rainfall Data

For this CEIS, rainfall data from three local stations are being used:

- From a rainfall gauge installed (July 14, 2016) on the roof of the Guelph Home Building Supply, located at 500 Maltby Road East (ref. Map SW-1) intended to remain in place for the duration of the monitoring for this project, with data downloaded on a monthly basis;
- From the City's rainfall gauge on the EMS Centre at 160 Clair Road West (ref. Figure SW-1); and
- From the University of Guelph's rainfall gauge at the Guelph Turfgrass Institute at 328 Victoria Road South (available on-line).

Monthly precipitation (rainfall) data from the Clair-Maltby gauge for the months of April to December 2017 have been summarized in Table 4.1.1 (2016 values have also been provided for comparison) and compared to the monthly totals from Environment Canada's (EC) Elora gauge. The rainfall gauges are approximately 30 km apart which explains the difference in monthly rainfall amounts.

Monthly rainfall totals for both the Clair-Maltby gauge and the Elora gauge for the months of August to November, 2016 were 276.4 mm and 371.1 mm, with the 1981-2010 climate normal for the same period being 326.2 mm. As such, the Clair-Maltby August to November rainfall total was approximately 15% below normal. It is worth noting that the months of April to June, 2016 were also considered below normal based on the Elora gauge monthly amounts compared to the monthly climate normal.

Table 4.1.1: Monthly Precipitation Totals for 2016 and 2017 and Climate Normals (mm)			
Month	**2016 & 2017 Total [2.]**	**1981-2010 Climate Normal [1]**	**Percent Difference [2]**
2016			
April	57.8 (NA)	74.5	-22.42% (NA)
May	57.3 (NA)	82.3	-30.38% (NA)
June	53.0 (NA)	82.4	-35.68% (NA)
July	102.4 (NA)	98.6	+3.85% (NA)
August	152.6 (134.4)	83.9	+81.88% (+60.19%)
September	77.1 (58.2)	87.8	-12.19% (-33.71%)
October	85.8 (43.8)	67.4	+27.30% (-35.01%)
November	55.6 (40)	87.1	-36.17% (-54.08%)
December	90.1 (NA)	71.2	+26.54% (NA)
TOTAL	731.7 (NA)	735.2	-0.48% (NA)
April	57.8 (NA)	74.5	-22.42% (NA)
2017			
April	92.0 (NA)	74.5	+23% (NA)
May	120.5 (107.2)	82.3	+46% (+30%)
June	117.8 (94.6)	82.4	+43% (+15%)
July	35.5 (37.4)	98.6	-64% (-62%)
August	68.1 (51.6)	83.9	-19% (-38%)
September	55.5 (23.8)	87.8	-37% (-73%)
October	85.8 (56.2)	67.4	+27% (-17%)
November	96.1 (69.8)	87.1	+10% (-20%)
December	55.6 (NA)	71.2	-22% (NA)
TOTAL	726.9 (NA)	735.2	-1% (NA)

Notes: [1] From Environment Canada Waterloo Wellington Airport
[2] First value is based on Environment Canada's Elora RCS gauge, value in brackets is based on Clair Maltby Project gauge

In addition to the monthly data presented in Table 4.1.1, daily rainfall totals for days with major storm events and high recorded water levels have been summarized in Table 4.1.2 for all data sources (ref. Map SW-1) (EC Elora, Clair-Maltby and City of Guelph's Clair Road rainfall gauges). Where storm systems have lasted multiple days, values have been summed. Daily rainfall amounts between the three (3) gauges for most storm events, demonstrate fairly consistent rainfall recordings. The City and the Wood rainfall gauges recorded 2017 storm event totals that are considered reliable, as there is limited deviation in the rainfall amounts, apart for the May 1, May 35 and October 24, 2017 events.

For 2017, five (5) storm events were above 25 mm and are considered significant, with the largest event occurring on June 23rd with a rainfall total of 39.4 mm over 9 hrs, which is comparable to 2 year storm event based on a 12 hour rainfall total of 39.9 mm at the Guelph Turfgrass Institute [Intensity Duration Frequency (IDF) relationship for 1954 to 2003]. Using the same IDF relationship all other events for 2017 would be considered to be less than a 2 year storm.

Table 4.1.2: Summary of Daily Rainfall Totals for Major Rainfall Events of 2016 and 2017 (mm)

Day (M/D/Y)	Environment Canada Elora RCS Gauge Total	Wood Clair Maltby Project Gauge Total	City of Guelph Clair Road Emergency Services Gauge Total
2016			
08/11/16 - 08/13/16	59.6	21.0	17.2
08/16/16	24.4	10.6	14.2
08/19/16 - 08/21/16	25.6	58.6	59.2
08/25/16 – 08/26/16	30.3	31.8	33.6
09/07/16 – 09/08/16	41.8	33.6	27.0
09/17/16 - 09/18/16	10.8	8.8	9.6
09/26/16	8.6	6.2	7.2
09/29/16 - 09/30/16	0	7.4	9.6
10/08/16	3.3	8.0	5.2
10/20/16 – 10/21/16	19.4	16.2	16.4
11/02/16 – 11/03/16	NA	8.6	NA
11/19/16	11.5	9.6	NA
11/24/16 – 11/26/16	10.0	10.4	NA
11/28/16 – 11/30/16	12.5	9.0	NA
2017			
04/06/17	22.3	28.2	30.2
04/20/17	NA	26.8	32.0
04/30/17	14.5	9.0	4.6
05/01/17	13.4	13.6	25.8
05/04/17	23.0	19.8	13.8
05/05/17	17.4	14.2	24.2
05/04/17 – 05/05/17	40.4	34.0	38.0
05/21/17	21.9	14.6	10.2
05/25/17	18.9	19.8	27.6
06/23/17	33.7	39.4	31.2
08/11/17	12.6	12.6	12.2
10/09/17	12.7	7.6	7.4
10/23/17	12.4	9.8	15.0
10/24/17	2.5	3.4	12.8
10/23/17- 10/24/17	14.9	13.2	27.8
11/02/17	23.4	12.0	12.2
11/18/17	22.5	16.4	22.2

Notes: "NA" indicates that data are not available.

4.2 Surface Water: Flow and Wetland Monitoring

The surface water monitoring has consisted of both water level and quality monitoring at two (2) flow stations outside the SPA (i.e. Stations 14 and 15) and twelve (12) wetland stations within the SPA (i.e. Stations 1 through 13, excluding 9A and 9B which were tested as potential flow stations in 2016 but found not to have sufficient flows) (ref. Map SW-1, Appendix SW-2).

The purpose of the wetland water level and quality monitoring is to (a) provide study-area wide baseline information of the pre-development condition of these features, and (b) help inform the understanding of surface and groundwater interactions in the PSA.

Sampling locations (ref. Map SW-1) were identified based on the objective of collecting samples:

a. From a representative selection of wetlands located within the PSA, as well as falling within both the Hanlon and Mill Creek Subwatersheds;
b. From wetlands expected to be protected for the long-term, therefore within confirmed Provincially Significant Wetlands (PSWs);
c. From wetlands expected to have standing water in them all year round, even in dry years;
d. From a representative selection of wetlands within different land use contexts (e.g. agricultural, natural, near roads); and
e. In proximity to proposed groundwater stations to allow for integration and comparison of the surface water and groundwater data from the same wetlands.

On April 18, 2017 Beacon staff installed Solinst 3000 Levelogger Edge Junior logging devices at each of the surface water monitoring locations detailed on Map SW-2 (with exception of Stations 1 and 2 installed by Matrix Solutions, and Station 7 installed by Wood staff). The Beacon and Wood devices were pre-programmed to record water pressure (psi) and temperature (degrees Celsius) measurements at 15 minute intervals. Loggers placed within the Stations 1 and 2 (installed by Matrix Solutions) wetlands measured the same parameters at hourly intervals. Each device was enclosed within a protective PVC sleeve which was perforated to allow infiltration of surrounding waters. T-bars were driven into the wetlands beds and the PVC sleeves were attached. Logging devices were suspended at the bottom of the PVC sleeve using aircraft cable or zip ties. Each PVC sleeve-bottom was capped to reduce fouling from wetland sediments. Once each PVC/logger device setup was completely installed, elevations were recorded using a RTK portable surveying unit. Three separate elevations were recorded at each water level Station including top of casing, a ground shot, and water level. These elevations were collected in order to be used alongside final data recordings collected by the Solinst loggers, to accurately graph individual wetland's seasonal water elevation fluctuations. In addition to the PVC/Solinst setups, a Solinst Barologger was installed approximately 50 m south of Station 6 to record barometric air pressure for the SPA and PSA for use in the barometric compensation process to calculate final wetland water elevations.

Wood was responsible for installation of the Station 7 logger, which was affixed to an existing staff gauge during the 2016 and 2017 field seasons.

Downloading of loggers coincided with water quality sampling events on May 1, August 10, and November 3, 2017. Manual measurements were collected by Beacon staff for Stations 3-13 (including

Station 7 staff gauge readings). Loggers were removed on November 29, 2017 to prevent internal damage associated with freezing temperatures, this included the removal of Station 7 as well. Matrix Solutions staff removed loggers from Station 1 and 2 on November 17, 2017. Final readings were downloaded from the loggers on November 30, 2017. For each data series, outlying data points – associated with logger downloads – were omitted from the data series and are not represented in the final wetland water level graphs.

The other notable events associated with wetland monitoring during 2017, included the damage incurred at Station 13. During the September 7, 2017 site visit it was found that the PVC/Solinst setup had been damaged and the logger and PVC sleeve was missing. Subsequent reconnaissance visits to Station 13 resulted in no logger being found and on September 27, 2017 a new Solinst logger and protective sleeve was installed approximately 8 m to the east of the original location. The original loss and damage to the Station 13 equipment was later found to be possibly related to a vehicular accident where a vehicle may have entered the wetland and collided with the logging apparatus. As a result, a large gap exists within the water elevation and temperature data for Station 13 between when the original logger was successfully downloaded on May 1, 2017, and the new logger was replaced on September 27, 2017.

4.2.1 Flow Levels

One (1) gauge to monitor flow quantity in the Mill Creek Subwatershed was established near the south-east limit of the PSA (Station 14).

To monitor flow quantity in the Hanlon Creek Subwatershed, two (2) gauge locations (Stations 9A – Kilkenny Place and 9B – Serena Lane) had been tested over the summer of 2016 to monitor the discharge from the Hanlon Creek Subwatershed, draining to the north. Some minor flow responses were observed at the Serena Lane monitoring location for storms on August 20, August 25, and September 7, 2016 (ref. plots in in Appendix SW-1). However, the responses were minimal, and not considered to be significant enough to continue the monitoring at this location in 2017. A new location outside the PSA in the Hanlon Creek Subwatershed was identified in consultation with the City and GRCA for surface water monitoring (Station 15) and established in April 2017.

In the absence of a station with flow in the Hanlon Creek Subwatershed in 2016, one surface water level logger and quality station was established in the southern extent of the large pond within Hall's Pond Provincially Significant Wetland (Station 7) in July 2016, with surface water level and quality data collected over the summer and fall of 2016. Although data from this station was used to inform the general surface water monitoring results in 2016, starting in 2017 data collected from this station was assessed in conjunction with data from the 11 other wetland monitoring stations (ref. Map SW-1).

Summary plots showing the observed water levels at Halls Pond for 2016 have been included in Appendix SW-1.

Continuous water level monitoring was conducted for an open watercourse south of the study limits, within the municipality of Puslinch. The site is located on a private property at the end of Hammersely Road (Station 14). The site had continuously observed flow at all times during the monitoring period, suggesting a potential groundwater flow contribution. Velocity metering was conducted at this site over the course of 2016, which has been used to develop a preliminary rating curve for the site. The rating curve fit has been completed using a simplified HEC-RAS hydraulic model, based on topographic survey data completed by Matrix Solutions on November 4, 2016.

Plots of the developed rating curves, and the resulting recorded flow series at the Hammersley Road Station 14 site and the Hanlon Channel Station 15 site, have been included in Appendix SW-1. Minimum and maximum water levels for both stations are provided in Table 4.2.1, with the Hammersley minimum and maximum water levels observed on November 29, 2017 and June 4, 2017 respectively. Minimum and maximum observed water levels for Station 14 occurred on April 30, 2017 and June 23, 2017.

Table 4.2.1: Observed 2017 Water Levels (m)

Minimum/ Maximum	Puslinch Channel (Station 14)	Hanlon Channel (Station 15)
Minimum Water Level	0.068	0.137
Maximum Water Level	0.248	0.327

Water levels and flows within the Hanlon Channel Station 15 site did not vary considerably during the monitoring period, with depths ranging from 0.14 m to 0.33 m and peak flows ranging from 0.02 m^3/s to 0.08 m^3/s respectively.

Peak flows for the major recorded storm events of 2016 and 2017 are presented in Table 4.2.2.

Table 4.2.2: Estimated Peak Flows at Monitoring Station 14 (Hammersley Road) and Station 15 (Hanlon) for Major Storm Events Based on 2016 and 2017 Rating Curves

Date (M/D/Y)	Observed Rainfall (mm)	Observed Peak Flow (m^3/s)
Station 14		
2016		
7/25/2016	19.2	0.02
8/20/2016	52.0	0.10
8/25/2016	24.0	0.06
9/7/2016	33.6	0.02
11/2/2016	4.2	0.02
2017		
04/06/2017	27.8	0.05
04/20/2017	26.8	0.05
05/05/2017	14.2	0.04
05/25/2017	18.6	0.03
06/23/2017	39.4	0.04
07/01/2017	11.4	0.02
08/11/2017	12.6	0.01

Table 4.2.2: Estimated Peak Flows at Monitoring Station 14 (Hammersley Road) and Station 15 (Hanlon) for Major Storm Events Based on 2016 and 2017 Rating Curves		
Date (M/D/Y)	**Observed Rainfall (mm)**	**Observed Peak Flow (m^3/s)**
11/05/2017	15.2	0.02
11/18/2017	15.4	0.02
Station 15 (Hanlon)		
04/06/2017	27.8	0.04
04/20/2017	26.8	0.04
05/05/2017	14.2	0.04
05/25/2017	18.6	0.06
06/23/2017	39.4	0.08
08/11/2017	12.6	0.05
11/18/2017	15.4	0.04

4.2.2 Wetland Levels

In general, wetland surface water levels in the PSA in 2017 followed a natural draw-down trend - peaking in early to mid-spring followed by a continuous decline until loggers were removed in late November, 2017. Stations 4, 5, 8, 11, and 13 displayed small rebounds in water levels in the late fall prior to logger removal.

The exception to the typical draw-down pattern displayed by the majority of the monitored wetlands was Station 10. Station 10 displayed a reverse model where levels were lower at the time of device installation and peaked around early July, 2017 before beginning a steady decline until logger removal on November 3, 2017. The early removal of the Station 10 logger was due to limitations associated with deep water.

Of all the wetland surface water stations, the majority retained standing water throughout the 2017 monitoring season, with exceptions being Stations 4 and 12. Standing water was observed at Station 4 on August 10, 2017 (approximately 0.3 m), followed by saturated soils with no standing water on November 3, 2017. Station 12, situated along the north side of Maltby Road, was found to only contain a very low water elevation on August 10, 2017, and was dry on November 29, 2017.

Minimal standing water was observed around the Station 3 logger on August 10, 2017. As with Stations 4 and 12, despite in-field observations of very little standing water, continuously logged data indicates the presence of water from late September until early November, 2017. However, despite a lack of standing water in the immediate vicinity of Station 3 in August, 2017, the central-portion of the wetland feature appeared to retain considerably more standing water.

A number of surface water manual measurements taken throughout the monitoring season that did not correspond to continuously logged data results. It is probable that errors occurred when measurements were conducted in the field. This is due to measuring from the wetland's beds to the surface of the water – many of the wetlands beds are composed of soft silts and thick vegetated mats in the summer which can make completing manual measurements difficult. In the 2018 monitoring season, it proposed that a water level tape (i.e. Bellringer) will be used, or the water's surface will be measured from above using a known elevation such as the top of pipe.

Graphed results detailing wetland surface water elevations from each station are summarized in Appendix GW-3 where they have been integrated with the results from the groundwater monitoring to facilitate interpretation. The preliminary findings based on 2017 data are discussed in Section 4.3 which focuses on groundwater.

4.2.3 Surface Water Quality (including Temperature)

The water level gauges include temperature sensors which provide a continuous scan of water temperature over the monitoring period. Although the gauges were not installed until July, 2016, in the following two years (2017-2018) the gauges will be installed from post-freshet (i.e. late March or early April) to freeze-up (typically late November to early December).

In addition to water temperature, the CEIS Work Plan included water quality sampling as part of the surface water monitoring effort. The water quality parameters recommended by GRCA (ref. Table 4.2.3) have been supplemented by metal and pesticides as agreed to by the City. Sampling has been as follows:

- Grab samples and in situ data were collected in both dry and wet periods in the summer and fall of 2016, and the spring, summer and fall of 2017 at each of the two (2) water gauge locations. This will be repeated in 2018.
- Grab samples and in situ data were also collected once in the summer and fall of 2016, and once in the spring, summer and fall of 2017 at each of the 12 wetland monitoring locations. Summer sampling was done during a "dry" period while spring and fall samplings were done in "wet" periods. This will be repeated in 2018.
- Due to the substantial expense of testing for pesticides, the Consulting Team recommended more targeted testing. As agreed, single samples at six (6) locations across the PSA were collected in the fall of 2017.

For this study, the target was to conduct "wet" sampling within 24 hours of at least 10 mm of rainfall within the previous 48 hours, and "dry" sampling after no rain had fallen for at least 48 hours. Actual sampling parameters are documented in Table 4.2.3.

Water quality sampling was undertaken in 2016 at Station 7 (in the Hanlon Creek Subwatershed) and Station 14 (in the Mill Creek Subwatershed) over the summer and fall. In 2017, water quality sampling was undertaken at Stations 1 through 15, with the exception of Station 9 which was removed as a sampling location due to persistent lack of flows, for a total of 14 sampling locations (ref. Map SW-1). As noted in 2016, there are no creeks in the PSA as the area is essentially a headwater drainage area on the Paris Moraine where wetlands and ponds of various sizes provide the primary drainage. Therefore, wetland water sampling is considered central to this study.

In 2018, water level and quality sampling will be repeated as described above with the exception of the pesticide sampling which was scoped to 2017.

Table 4.2.3: Water Quality Parameters Assessed		
Water Quality Parameter	**Mechanism of Analysis**	**Comments**
• Total Suspended Solids (TSS) • Total Dissolved Solids (TDS) • Orthophosphate (P) • Total Phosphorus (TP) • Dissolved Sulphate (SO^4) • Dissolved Chloride (Cl) • Total Kjeldahl Nitrogen (TKN) • Nitrite (NO^2) • Nitrate (NO^3) • Ammonia (NH^3)	To be analyzed from grab samples sent to a laboratory	Parameters suggested by GRCA in their comments on the Draft Clair-Maltby MESP Secondary Plan TOR (City of Guelph, 2015a).
• Water temperature	To be measured continuously by the data logger and verified in situ three times over the season by field staff (with a water quality meter)	Parameter suggested by GRCA in their comments on the Draft Clair-Maltby MESP Secondary Plan TOR (City of Guelph, 2015a).
• pH • Conductivity, and • Dissolved oxygen (DO)	To be measured in situ by field staff (with a water quality meter)	Parameters suggested by GRCA in their comments on the Draft Clair-Maltby MESP Secondary Plan TOR (City of Guelph, 2015a).
• Metals • Pesticides*	To be analyzed from grab samples sent to a laboratory	Additional parameters suggested by the Consulting Team and agreed to by City.

Note: * Due to the additional cost, pesticide sampling has been targeted be sampled at only six of the 14 stations and only once in the fall of 2017.

Table 4.2.4 summarizes the water quality sampling events of 2016 and 2017. The rainfall amounts for the summer and fall wet weather water quality events, are considered to be on the low side (i.e. <15 mm), that said, only two (2) rainfall events of 15 mm or greater were recorded during the summer and fall seasons for 2017. For the 2018 monitoring program, a continued effort will be made to sample wet weather events of greater magnitude, as possible.

Water quality samples were collected in close proximity to the established wetland water level Stations. With the exception of November 3, 2017 sampling at Station 3, where only saturated soils existed within the immediate vicinity of the water level Station, and both sampling and *in situ* monitoring was completed approximately 2 m south of the station where standing water existed.

Table 4.2.4: Summary of 2016 and 2017 Water Quality Sampling Events

Date	Sites Sampled	Type of Event	Inter-Event Period (days)[1]	24-Hour Rainfall Total (mm) [2.]
August 4, 2016	Station 7, Station 14	Dry	10	0
August 17, 2016	Station 7, Station 14	Wet	5	10.6
September 22, 2016	Station 7, Station 14	Wet	6	6.0
October 20, 2016	Station 7, Station 14	Wet	12	7.0
April 28, 2017	Station 14, Station 15	Dry	8	4.4
May 1, 2017	Stations 1-8, Stations 10-15	Wet	0	20.4
August 10, 2017	Stations 1-8, Stations 10-15	Dry	6	0.0
September 5, 2017	Station 14, Station 15	Wet	0	8.6
October 3, 2017	Station 14, Station 15	Dry	29	0.0
November 3, 2017	Stations 1-8, Stations 10-15	Wet/Pesticides	12	6.8

Notes: " NA" indicates not applicable (dry weather samples)
[1] Between sampling time and end of last event exceeding 5 mm
[2] Rainfall depth for 24-hour period prior to sampling

4.2.3.1 Temperature

Flow Stations

Tables 4.2.5 and 4.2.6 summarize the temperature monitoring results for the Puslinch Channel (Station 14) in 2016 and 2017, and Hanlon Creek (Station 15) respectively in 2017. Based on a comparison of 2016 to 2017, the monthly daily maximums trend lower for 2017 based on it being a wetter year than 2016.

Table 4.2.5: Observed 2016 and 2017 Water Temperatures – Puslinch Channel (Station 14)

Month	Monthly Extremes		Monthly Averages		
	Daily Minimum	Daily Maximum	Daily Minimum	Daily Average	Daily Maximum
2016					
July	9.26	16.06	10.77	12.28	14.33
August	9.80	18.78	11.22	12.86	14.92
September	7.90	17.20	10.09	11.38	12.91
October	4.06	15.05	7.99	9.24	10.47
November	1.95	11.35	5.28	6.45	7.61
December	1.55	7.46	3.69	4.30	4.85
2017					
April	2.15	15.42	6.52	7.82	9.57
May	5.81	15.21	8.58	9.55	10.95
June	9.00	16.28	10.24	11.30	12.84
July	9.94	15.36	10.84	11.73	13.05
August	8.67	13.82	10.22	11.18	12.66
September	7.83	14.33	9.95	10.59	12.35
October	6.18	14.04	8.01	9.57	11.00
November	2.05	9.78	4.80	5.68	6.58

Table 4.2.6: Observed 2017 Water Temperatures – Hanlon (Station 15)

Month	Monthly Extremes		Monthly Averages		
	Daily Minimum	Daily Maximum	Daily Minimum	Daily Average	Daily Maximum
April	5.31	17.53	8.79	10.64	13.07
May	8.05	17.98	10.35	11.83	14.27
June	11.18	27.91	12.98	15.21	19.00
July	12.75	23.24	14.10	16.68	20.87
August	11.83	22.28	13.32	15.61	19.24
September	10.70	20.58	12.60	14.89	18.79
October	9.25	18.51	11.55	13.08	15.43
November	6.24	13.00	8.62	9.52	11.12

Water temperature graphs have been provided in Appendix SW-1.

Wetland Stations

Overall, the wetland surface water temperatures in 2017 within the PSA all displayed a relatively consistent seasonal rise in temperatures from spring into summer, as air temperatures increased, and wetland water elevations fell (ref. Table 4.2.7 for a summary of each stations' minimum, maximum and average monthly temperatures). At Station 10, however, the trend was different and surface water levels peaked in July but temperatures continued to rise despite the increase in recorded surface depths. Within wetlands where water elevations declined significantly, surface water temperatures began to show greater variability, likely coinciding with daily air temperature changes. This trend was most pronounced at Station 12, where wetland conditions were likely dry in mid-September and exposure to the sun was high. Notably, temperature fluctuations at the two stations located with Hall's Pond (Station 5 and 7) began to fluctuate more in mid-August, as surface water levels dropped and exposure to the sun lengthens with minimal shading.

Table 4.2.7: 2017 Wetland Surface Water Temperatures

Station No.	April*			May			June			July			August			September			October			November**		
	Daily Min	Daily Avg	Daily Max	Daily Min	Daily Avg	Daily Max	Daily Min	Daily Avg	Daily Max	Daily Min	Daily Avg	Daily Max	Daily Min	Daily Avg	Daily Max	Daily Min	Daily Avg	Daily Max	Daily Min	Daily Avg	Daily Max	Daily Min	Daily Avg	Daily Max
Stn 1	11.98	13.13	14.52	13.81	14.72	15.99	20.32	21.34	22.78	22.22	23.16	24.39	21.21	22.51	24.27	19.22	20.88	23.02	13.41	14.47	15.84	4.91	5.55	6.37
Stn 2	12.68	13.53	14.52	14.22	14.75	15.36	19.16	19.35	19.62	20.26	20.37	20.55	20.13	20.44	20.84	18.05	18.66	19.25	12.28	13.07	13.83	5.68	6.10	6.57
Stn 3	10.83	11.11	11.42	12.16	12.37	12.65	17.18	17.38	17.68	18.65	18.85	19.17	17.61	18.35	19.23	15.83	17.24	18.94	11.09	12.66	14.60	3.27	4.28	5.50
Stn 4	8.06	8.32	8.62	10.10	10.32	10.66	14.78	14.96	15.21	16.34	16.45	16.59	15.62	15.83	16.17	12.91	13.52	14.27	9.61	10.39	11.25	3.27	3.68	4.18
Stn 5	9.64	9.91	10.27	10.48	10.60	10.76	14.97	15.06	15.17	16.54	16.58	16.64	17.28	18.07	19.00	15.31	18.44	21.83	11.10	12.51	14.09	4.96	5.33	5.83
Stn 6	9.62	9.98	10.42	11.22	11.48	11.89	16.01	16.16	16.39	17.68	17.77	17.89	16.52	16.72	17.00	14.01	14.50	15.18	10.08	10.83	11.78	2.94	3.35	3.90
Stn 7	11.02	12.30	13.89	14.10	14.98	16.09	19.62	20.28	21.13	20.78	21.51	22.74	19.04	20.33	22.06	15.65	18.62	24.24	7.06	11.98	23.59	1.84	2.78	3.88
Stn 8	8.86	8.92	9.00	10.43	10.50	10.57	13.98	14.03	14.08	15.40	15.42	15.45	15.66	15.70	15.74	14.55	14.63	14.71	12.56	12.64	12.75	8.08	8.14	8.22
Stn 10	12.14	12.61	13.15	13.26	13.52	13.88	17.70	17.76	17.85	18.49	18.52	18.56	18.32	18.37	18.42	16.83	16.96	17.11	13.13	13.38	13.67	8.07	8.13	8.23
Stn 11	9.44	9.75	10.17	11.05	11.30	11.65	15.08	15.30	15.57	17.06	17.19	17.37	16.22	16.50	16.85	14.54	15.19	15.95	10.82	11.57	12.45	5.36	5.52	5.78
Stn 12	8.04	9.24	10.86	10.91	11.87	13.11	15.98	16.93	17.96	16.92	17.95	19.07	14.56	16.79	19.05	11.44	14.11	17.03	7.93	10.35	12.82	1.87	3.14	4.57
Stn 13* **	12.72	13.61	14.72	12.70	12.88	14.50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	19.98	20.50	21.23	15.21	15.47	15.80	6.42	6.62	7.24

Notes: Stations 1 and 2 were removed on November 17, 2017
Stations 1 and 2 reflect 2017 temperature data that was recorded hourly
Station 7 reflects temperature from April 5 to Nov 29
* April temperatures include are the 18 to the 30, except Station 7 which began logging on April 5
** November Temperature logged until the 29, with the exception of Station 10 (Nov. 3), and Stations 1 & 2 (Nov. 17)
*** The Station 13 summer data was lost as a result of an accident with a vehicle going into Halligan's Pond and the logger being lost. A new logger was installed in September 2017.

In general, wetland temperatures in 2017 remained within the range to support cool or coldwater fish habitat, even during the summer months, suggesting most or all of them may be receiving some groundwater inputs to sustain their hydrology, with the exception of Stations 1 and 2. On average, Stations 1 and 2 maintained some of the highest average monthly temperatures of all wetlands sampled. This is presumed to be because, despite their relatively large size, as stated within the EIS (North-South Environmental Inc. 2015), these wetlands are maintained almost entirely by precipitation and surface runoff.

Graphed results of the wetland surface temperature data by watershed in the PSA is presented in Figures 4.2.1 and 4.2.2.

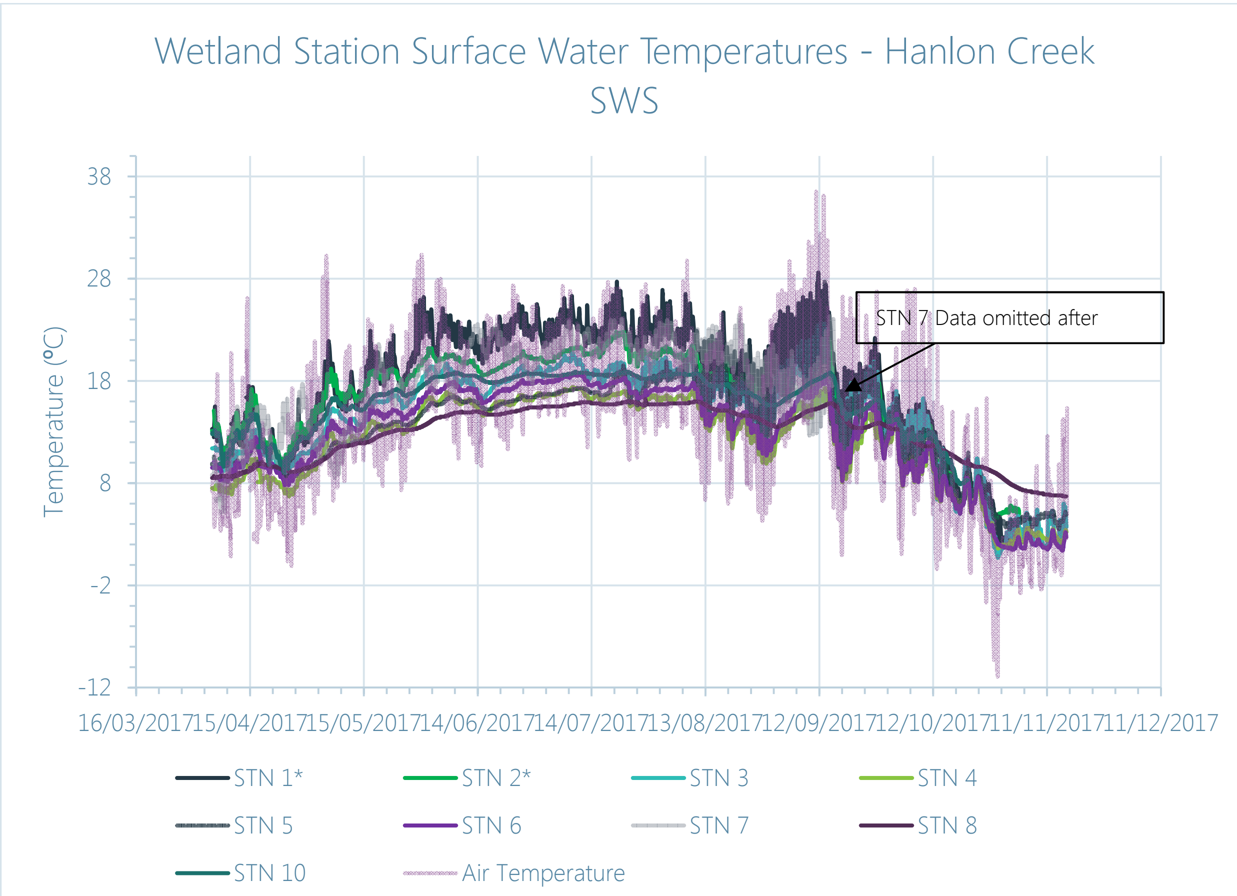

Figure 4.2.1: Surface water temperatures over 2017 in the wetland monitoring stations within the Hanlon Creek Watershed in the Primary Study Area.

(Note: The data for Station 7 were removed after mid-September due to a technical error).

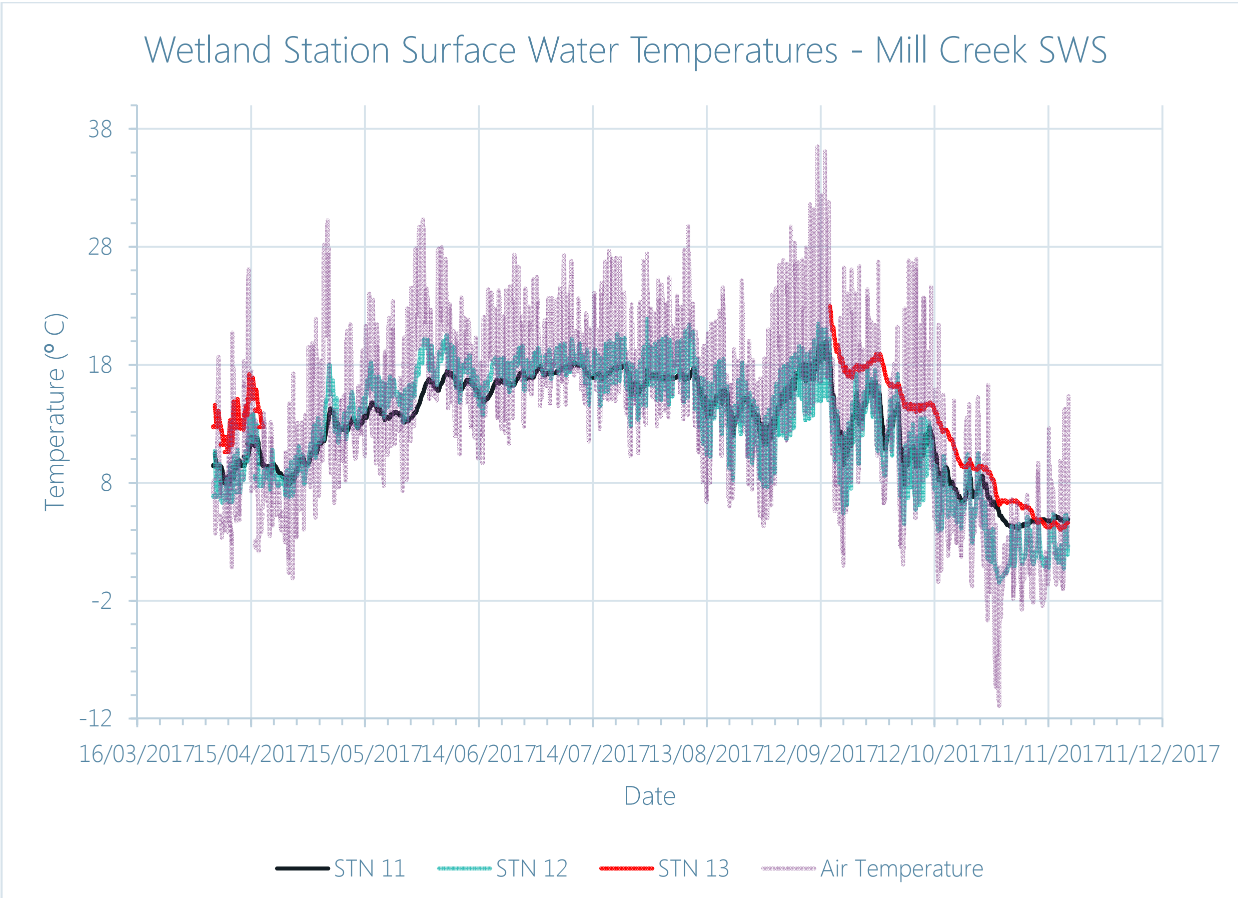

Figure 4.2.2: Surface water temperatures over 2017 in the wetland monitoring stations within the Mill Creek Watershed in the Primary Study Area.

(Note: The data for Station 13 were lost between late April 2017 and early September 2017 due to equipment loss).

4.2.3.2 Chemistry

Surface water quality parameters sampled and tested at the twelve wetland and two flow stations (ref. Map SW-1), data were assessed against three sets of established thresholds:

i. The Provincial Water Quality Objectives (PWQO);
ii. The Canadian Environmental Quality Guidelines (CEQG) for the Protection of Aquatic Life as prescribed by the Canadian Council of Ministers of the Environment; and
iii. The Canadian Drinking Water Quality (CDWQ) guidelines as prescribed by Health Canada.

PWQO and CEQG thresholds are intended to help manage water quality conditions for the protection of aquatic life. CDWQ guidelines base thresholds on the known human health effects associated with each contaminant, aesthetic qualities (taste, odour), and potential impairment to drink water infrastructure (Health Canada 2014). CDWQ standards include two sub-sets of thresholds including (a) an aesthetic objective (AO) and (b) maximum acceptable concentrations (MAC). For this project, AO thresholds were applied, as they are generally more restrictive than MAC for the majority of parameters tested as part of the surface water sampling program.

These three sets of standards were used in combination to provide a more complete list of potentially relevant exceedances for the various surface water quality parameters of interest tested within the PSA. However, it is important to recognize that the data collected for this project are primarily intended to serve as a baseline reference for the pre-development conditions of a representative series of wetlands in the PSA, and that documented exceedances simply flag which parameters exceed provincial and federal thresholds established for flowing water, not wetlands *per se*. In addition, some of the exceedances relate to human health (i.e. CDWQ) while others are related to aquatic biota (i.e. PWQO and CWQG).

Key water quality parameter concentrations for nutrients and metals parameters for the one wetland (Station 7) and one flow (Station 14) locations sampled in 2016 are presented in Table 4.2.8. Key water quality parameter concentrations for nutrients and metals parameters for the twelve wetland and two flow stations sampled in 2017 are presented in Table 4.2.9 and Table 4.2.10 respectively. For levels of metals refer to Table 4.2.9. Table 4.2.11 provides a summary of the *in situ* water quality parameters tested for all stations surveyed over 2016 and 2017. Exceedances based on PWQO have been highlighted in yellow, CEQG in blue, and CDWQ guidelines in orange. Results that exceed more than one threshold are highlighted in red.

A summary of all water quality exceedances documented at each station sampled in 2017 and 2017 are presented in Table 4.2.12 and Table 4.2.13 respectively.

Table 4.2.8: Comparison of Measured Concentrations for Key Water Quality Parameters at a Wetland (7) and a Flow (14) Station in 2016 (Nutrients and Metals)

Location	Contaminant Concentration (mg/L)												
	TSS	TKN	Total P	Ammonia	Chloride	Alum	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Zinc
PWQO (Yellow)	n/a	n/a	0.03	0.02[1]	n/a	0.075	0.0005	n/a	0.005[2]	0.3	0.001[2]	n/a	0.02
CEQG (Blue)	n/a	n/a	n/a	n/a	n/a	0.005	0.00004	0.001	0.002	0.3	0.001	n/a	0.03
CDWQ (Orange)	n/a	n/a	n/a	n/a	120	0.1	0.005	0.05	1	0.3	n/a	0.05	5
Station 7	6.8	1.41	0.054	0.028	9.92	0.027	<0.000010	<0.00050	<0.0010	0.371	0.00038	0.111	0.0043
Station 14	<2.0	0.26	0.0056	<0.02	38.0	<0.010	0.000050	<0.00050	<0.0010	<0.050	<0.0001	0.0103	0.0890
Station 7	10.7	1.65	0.0742	<0.02	10.1	0.027	<0.000010	<0.00050	<0.0010	0.457	0.00053	0.0780	0.0032
Station 14	2.5	<0.15	0.0094	0.043	33.5	<0.010	0.000052	<0.00050	<0.0010	<0.050	<0.0001	0.0145	0.0760
Station 7	79.4	2.3	0.173	0.025	12.3	0.263	0.000022	<0.00050	<0.0010	0.491	0.00207	0.0317	0.0100
Station 14	<2.0	0.21	0.0069	0.032	36.7	<0.010	0.000042	<0.00050	<0.0010	<0.050	<0.0001	0.0101	0.0759
Station 7	15.8	1.68	0.0743	0.082	12.7	<0.010	<0.000010	<0.00050	<0.0010	<0.050	<0.0001	0.0150	<0.0030
Station 14	4.0	0.31	0.0075	0.074	33.6	<0.010	0.000075	<0.00050	<0.0010	<0.050	<0.0001	0.0248	<0.0030

Notes: [1] PWQO is for un-ionized Ammonia
[2] PWQO varies with hardness as CaCO3, value presented is most stringent limit (lead) or based on initial PWQO (copper)

Table 4.2.9: Comparison of Measured Concentrations for Key Water Quality Parameters (Nutrients) 2017

Date	Location	Contaminant Concentration (mg/L)								
		TSS	TDS	TKN	Ortho-P	Total P	Sulfate	Ammonia	Nitrate	Nitrite
	PWQO (Yellow)	n/a	n/a	n/a	n/a	0.03	n/a	0.021	n/a	n/a
	CEQG (Blue)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	0.06
	CDWQ (Orange)	n/a	500	n/a	n/a	n/a	500	n/a	10	1
April 28,2017	Station 14	<2.0	284	0.33	0.0035	0.008	10.7	<0.020	0.298	<0.010
	Station 15	3.5	272	0.49	<0.0030	0.0106	20.9	0.029	2.73	<0.010
1-May-17	Station 1	15.4	189	1.59	0.0055	0.0902	3.81	0.113	<0.020	<0.010
	Station 2	<2.0	156	0.52	<0.0030	0.0139	1.72	0.097	<0.020	<0.010
	Station 3	2.2	435	0.78	<0.0030	0.0247	5.54	0.045	<0.020	<0.010
	Station 4	<2.0	189	1.08	0.0043	0.0324	5.94	0.101	0.03	<0.010
	Station 5	<2.0	257	0.96	0.0103	0.0248	3.2	0.133	<0.020	<0.010
	Station 6	<2.0	205	0.76	<0.0030	0.0159	3.72	0.118	<0.020	<0.010
	Station 7	4.3	135	0.96	<0.0030	0.0303	1.41	0.077	<0.020	<0.010
	Station 8	2.2	117	1	<0.0030	0.0321	1.7	0.07	<0.020	<0.010
	Station 10	<2.0	153	0.66	<0.0030	0.0117	0.95	0.055	<0.020	<0.010
	Station 11	<2.0	393	1.06	0.0072	0.0311	3.59	0.067	0.02	<0.010
	Station 12	16.9	347	0.85	0.0108	0.129	3.7	0.035	0.059	<0.010
	Station 13	4.5	440	1.01	<0.0030	0.0316	2.08	0.059	<0.020	<0.010
	Station 14	4.5	242	0.38	0.0033	0.0103	7.6	0.159	0.153	<0.010
	Station 15	3.3	613	0.6	<0.0030	0.0087	14.7	0.065	2.03	<0.010
10-Aug-17	Station 1	56.7	148	1.85	<0.0030	0.131	1.95	<0.020	<0.020	<0.010
	Station 2	<2.0	135	0.69	<0.0030	0.015	0.91	0.18	<0.020	<0.010
	Station 3	38.3	416	1.2	0.0032	0.0651	1.87	0.066	<0.020	<0.010
	Station 4	<2.0	184	1.53	0.0105	0.0295	1.29	0.052	<0.020	<0.010
	Station 5	13.1	218	1.51	<0.0030	0.038	0.95	<0.020	<0.020	<0.010
	Station 6	<2.0	235	0.68	<0.0030	0.0163	0.79	0.038	<0.020	<0.010
	Station 7	4.1	155	0.93	<0.0030	0.0321	<0.30	0.066	<0.020	<0.010
	Station 8	19.2	170	1.93	<0.0030	0.0625	0.9	0.038	<0.020	<0.010
	Station 10	<2.0	175	0.73	<0.0030	0.0163	0.94	<0.020	<0.020	<0.010
	Station 11	24.1	1070	3.75	0.0382	0.189	1.25	0.069	<0.020	<0.010
	Station 12	14.3	803	0.61	<0.0030	0.0216	2.27	<0.020	<0.020	<0.010
	Station 13	6.8	392	1.37	<0.0030	0.133	1.95	0.063	<0.020	<0.010
	Station 14	2.7	364	0.17	0.006	0.0067	18.7	<0.020	0.678	<0.010
	Station 15	2.9	626	0.61	0.0044	0.0065	18.3	<0.020	2.35	<0.010
5-Sep-17	Station 14	3.9	360	0.22	N/A	0.0105	15.5	0.194	0.551	<0.010
	Station 15	<2.0	654	0.41	N/A	0.0048	17.8	0.212	2.53	<0.010
3-Oct-17	Station 14	<2.0	391	<0.15	N/A	0.0042	18.2	0.067	0.689	<0.010
	Station 15	<2.0	664	0.21	N/A	0.0044	17.9	0.116	2.65	<0.010
3-Nov-17	Station 1	14	163	1.79	<0.0030	0.0842	2.51	0.036	<0.020	<0.010

Table 4.2.9: Comparison of Measured Concentrations for Key Water Quality Parameters (Nutrients) 2017

Date	Location	Contaminant Concentration (mg/L)								
		TSS	TDS	TKN	Ortho-P	Total P	Sulfate	Ammonia	Nitrate	Nitrite
	PWQO (Yellow)	**n/a**	**n/a**	**n/a**	**n/a**	**0.03**	**n/a**	**0.021**	**n/a**	**n/a**
	CEQG (Blue)	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**3**	**0.06**
	CDWQ (Orange)	**n/a**	**500**	**n/a**	**n/a**	**n/a**	**500**	**n/a**	**10**	**1**
	Station 2	7.7	108	0.72	<0.0030	0.0131	1.7	0.307	0.037	<0.010
	Station 3	55	386	4.22	0.0128	0.242	8.72	2.52	0.054	0.013
	Station 4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Station 5	26.4	271	3.48	0.0031	0.0874	4.49	1.65	0.029	<0.010
	Station 6	277	175	1.17	0.0073	0.0805	0.94	0.12	0.089	<0.010
	Station 7	10	156	1.22	<0.0030	0.062	0.67	0.053	<0.020	<0.010
	Station 8	4.6	148	1	0.0054	0.0252	0.85	0.118	<0.020	<0.010
	Station 10	<2.0	164	0.65	<0.0030	0.0065	0.42	0.08	<0.020	<0.010
	Station 11	23.2	631	2.6	0.173	0.362	17.3	0.66	0.048	<0.010
	Station 12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Station 13	15.6	399	1.16	<0.0030	0.0363	1.28	<0.020	<0.020	<0.010
	Station 14	<2.0	292	0.36	0.0103	0.0389	13.4	0.036	0.431	<0.010
	Station 15	2.7	661	0.51	<0.0030	0.0099	19.6	0.194	2.77	<0.010

LEGEND: Exceedances based on PWQO have been highlighted in yellow, CEQG in blue, and CDWQ guidelines in orange. Results that exceed more than one threshold are highlighted in red

Notes:
[1] PWQO is for un-ionized Ammonia
[2] PWQO varies with hardness as CaCO3, value presented is most stringent limit (lead) or based on initial PWQO (Aluminum)
n/a Not available

Table 4.2.10: Comparison of Measured Concentrations for Key Water Quality Parameters (Metals) 2017

Date	Location	Contaminant Concentration (mg/L)							
		Aluminum	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Zinc
	PWQO (Yellow)	0.075	0.0005	n/a	0.001[2]	0.3	0.0012	n/a	0.02
	CEQG (Blue)	0.005	0.00004	0.001	0.002	0.3	0.001	n/a	0.03
	CDWQ (Orange)	0.1	0.005	0.05	1	0.3	n/a	0.05	5
April 28,2017	Station 14	<0.0010	0.000028	<0.00050	<0.0010	<0.050	<0.000050	0.00635	0.0506
	Station 15	0.019	0.000034	<0.00050	<0.0010	0.143	0.000204	0.0417	0.0085
1-May-17	Station 1	0.019	<0.00001	<0.00050	<0.0010	0.174	0.000114	0.104	<0.0030
	Station 2	<0.010	0.000011	<0.00050	<0.0010	0.161	0.000117	0.0221	<0.0030
	Station 3	0.012	<0.000010	<0.00050	<0.0010	0.061	0.000103	0.0236	<0.0030
	Station 4	0.016	<0.000010	<0.00050	<0.0010	0.121	0.000097	0.0219	<0.0030
	Station 5	<0.010	0.000015	<0.00050	<0.0010	0.168	0.000121	0.0806	0.007
	Station 6	<0.010	<0.000010	<0.00050	<0.0010	0.06	0.000081	0.00361	<0.0030
	Station 7	<0.010	<0.000010	<0.00050	<0.0010	<0.050	0.000119	0.0223	<0.0030
	Station 8	0.022	<0.000010	<0.00050	<0.0010	0.248	0.000235	0.0254	<0.0030
	Station 10	<0.010	<0.000010	<0.00050	<0.0010	0.128	0.000152	0.00899	<0.0030
	Station 11	0.036	0.000011	<0.00050	<0.0010	0.313	0.000224	0.0247	0.0038
	Station 12	2.61	0.00019	0.00454	0.012	3.82	0.0204	0.246	0.0838
	Station 13	0.021	<0.000010	<0.00050	<0.0010	0.093	0.000365	0.0482	<0.0030
	Station 14	0.016	0.000064	<0.00050	<0.0010	0.063	0.000166	0.0173	0.0471
	Station 15	0.02	0.000029	<0.00050	<0.0010	0.149	0.000175	0.0444	0.0087
10-Aug-17	Station 1	0.0647	0.000014	<0.00050	<0.0010	0.416	0.000432	0.23	0.0058
	Station 2	0.0074	<0.000010	<0.00050	<0.0010	0.305	0.000109	0.0375	<0.0030
	Station 3	0.0074	<0.000010	<0.00050	<0.0010	0.493	0.000146	0.443	<0.0030
	Station 4	0.0085	<0.000010	<0.00050	<0.0010	0.155	0.0001	0.015	<0.0030
	Station 5	0.0199	<0.000010	<0.00050	<0.0010	0.289	0.000102	0.113	<0.0030
	Station 6	0.0065	<0.000010	<0.00050	<0.0010	0.066	0.000061	0.00643	<0.0030
	Station 7	<0.0050	<0.000010	<0.00050	<0.0010	0.081	<0.000050	0.0192	<0.0030
	Station 8	0.0052	<0.000010	<0.00050	<0.0010	0.415	0.000082	0.138	<0.0030
	Station 10	<0.0050	<0.000010	<0.00050	<0.0010	0.162	<0.000050	0.0192	<0.0030
	Station 11	0.0283	<0.000010	<0.00050	<0.0010	1.32	0.000183	1.69	0.004
	Station 12	0.0693	0.000018	<0.00050	<0.0010	1	0.000622	0.561	0.0088
	Station 13	0.0149	<0.000010	<0.00050	<0.0010	0.235	0.00015	0.145	<0.0030
	Station 14	0.0101	0.000075	<0.00050	<0.0010	<0.050	0.000112	0.0163	0.0871

Table 4.2.10: Comparison of Measured Concentrations for Key Water Quality Parameters (Metals) 2017

Date	Location	Contaminant Concentration (mg/L)							
		Aluminum	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Zinc
	PWQO (Yellow)	0.075	0.0005	n/a	0.001[2]	0.3	0.0012	n/a	0.02
	CEQG (Blue)	0.005	0.00004	0.001	0.002	0.3	0.001	n/a	0.03
	CDWQ (Orange)	0.1	0.005	0.05	1	0.3	n/a	0.05	5
	Station 15	0.0065	0.000018	<0.00050	<0.0010	0.139	0.000083	0.0179	0.0053
5-Sep-17	Station 14	0.0115	0.000076	<0.00050	<0.0010	0.056	0.00013	0.0501	0.0823
	Station 15	0.0058	0.000016	<0.00050	<0.0010	0.128	0.000116	0.0129	0.0055
3-Oct-17	Station 14	<0.0050	0.000057	<0.00050	<0.0010	<0.050	<0.000050	0.0133	0.0864
	Station 15	<0.0050	0.000022	<0.00050	<0.0010	0.113	0.000079	0.0279	0.0058
3-Nov-17	Station 1	0.0631	<0.000010	0.00055	<0.0010	0.179	0.000417	0.0982	<0.0030
	Station 2	0.0413	<0.000010	0.00056	0.0019	0.206	0.000477	0.0153	0.0377
	Station 3	0.0698	0.000021	0.00066	0.0014	0.328	0.00097	0.791	0.0101
	Station 4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Station 5	0.0736	<0.000010	0.00053	<0.0010	0.648	0.00045	0.461	<0.0030
	Station 6	0.0091	<0.000010	0.00169	<0.0010	0.386	0.000135	0.192	<0.0030
	Station 7	0.0298	<0.000010	<0.00050	0.0013	0.084	0.000307	0.0278	0.0038
	Station 8	0.018	<0.000010	<0.00050	<0.0010	0.178	0.000162	0.027	<0.0030
	Station 10	0.0106	<0.000010	0.00051	<0.0010	<0.050	<0.000050	0.00123	<0.0030
	Station 11	0.0529	0.000025	0.0006	0.001	1.02	0.000408	0.688	0.0136
	Station 12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Station 13	0.0327	<0.000010	0.00069	<0.0010	0.338	0.000557	0.126	<0.0030
	Station 14	0.0098	0.000061	<0.00050	<0.0010	<0.050	0.000099	0.0219	0.071
	Station 15	0.0238	0.000029	0.00055	<0.0010	0.184	0.000217	0.0518	0.0074

LEGEND: Exceedances based on PWQO have been highlighted in yellow, CEQG in blue, and CDWQ guidelines in orange. Results that exceed more than one threshold are highlighted in red.

Table 4.2.11: Comparison of Field Measured Parameters at a Wetland (7) and a Flow (14) Station in 2016 and 2017

Date	Air Temperature (deg C)	Location	Field Water Temperature (deg C)	Field Conductivity (mS/cm)	Laboratory Total Dissolved Solids (mg/L)	Field Dissolved Oxygen (mg/L)	Field pH
August 4, 2016	29.9	Station 7	23.01	0.214	178	4.44	7.12
		Station 14	10.97	0.441	388	13.51	7.52
August 17, 2016	25.4	Station 7	23.20	NA	170	2.97	8.13
		Station 14	12.30	NA	362	10.04	8.71
Sept. 22, 2016	27.6	Station 7	19.19	0.272	149	0.95	5.79
		Station 14	12.53	0.474	379	13.30	7.11
October 20, 2016	11.5	Station 7	13.394	NA	153	9.42	6.70
		Station 14	10.211	NA	350	9.59	7.46
April 28, 2017	16.3	Station 14	9.45	0.430	284	12.06	7.25
		Station 15	12.41	1.45	272	13.38	7.27
May 1, 2017	7.7	Station 1	10.76	0.332	189	9.89	7.45
		Station 2	11.01	0.260	156	9.88	7.42
		Station 3	10.88	0.591	435	7.68	7.26
		Station 4	8.07	0.370	189	4.10	6.85
		Station 5	9.47	0.369	257	9.76	7.22
		Station 6	9.61	0.308	205	9.18	7.66
		Station 7	11.85	0.195	135	9.00	7.33
		Station 8	10.4	0.171	117	4.05	6.84
		Station 10	10.54	0.234	153	9.71	7.40
		Station 11	8.97	0.549	393	9.30	7.27
		Station 12	10.60	0.400	347	9.91	7.81
		Station 13	11.66	0.868	440	9.66	7.47
		Station 14	8.09	0.347	242	10.87	7.34
		Station 15	10.07	0.936	613	12.08	7.40
August 10, 2017	24.5	Station 1	19.9	0.306	148	4.69	6.61
		Station 2	21.5	0.231	135	4.22	7.37
		Station 3	19.9	0.75	416	3.26	7.2
		Station 4	17.0	0.277	184	1.10	6.56
		Station 5	16.7	0.547	218	0.61	6.39
		Station 6	17.9	0.449	235	2.29	7.12
		Station 7	21.7	0.265	155	2.97	6.98
		Station 8	19.1	0.279	170	1.27	6.51
		Station 10	20.8	0.329	175	5.64	7.28
		Station 11	18.8	1.48	1070	1.26	7.00
		Station 12	17.8	1.13	803	2.02	6.01
		Station 13	26.2	0.77	392	5.59	8.20
		Station 14	12.2	0.649	364	9.78	7.66
		Station 15	20.8	1.11	626	10.7	7.61

Table 4.2.11: Comparison of Field Measured Parameters at a Wetland (7) and a Flow (14) Station in 2016 and 2017

Date	Air Temperature (deg C)	Location	Field Water Temperature (deg C)	Field Conductivity (mS/cm)	Laboratory Total Dissolved Solids (mg/L)	Field Dissolved Oxygen (mg/L)	Field pH
September 5, 2017	17.4	Station 14	11.2	0.613	360	9.17	7.84
		Station 15	17.4	1.127	654	12.06	7.56
October 3, 2017	24.6	Station 14	N/A	N/A	391	N/A	N/A
		Station 15	N/A	N/A	664	N/A	N/A
November 3, 2017	10.7	Station 1	7.98	0.293	163	13.97	7.89
		Station 2	8.39	0.233	108	13.47	8.01
		Station 3	10.27	0.799	386	9.17	7.25
		Station 4	N/A	N/A	N/A	N/A	N/A
		Station 5	9.70	0.575	271	5.22	6.84
		Station 6	8.72	0.423	175	7.94	6.90
		Station 7	8.24	0.252	156	8.04	7.33
		Station 8	8.28	0.237	148	9.73	7.25
		Station 10	7.58	0.298	164	12.21	7.70
		Station 11	9.43	1.009	631	2.90	6.85
		Station 12	N/A	N/A	N/A	N/A	N/A
		Station 13	8.63	0.820	399	12.23	7.98
		Station 14	8.26	0.557	292	12.24	7.82
		Station 15	12.57	1.133	661	13.01	7.74

Notes: NA. Not available

Notable water quality results from wetland and flow stations results included frequent Ammonia exceedances and exceedances for Total Phosphorus, Aluminum, Copper, Iron, Lead, and Zinc at various sampling stations at different times of the year in both 2016 and 2017. These findings are discussed further in the following text;

Nutrients

- For Ammonia, a threshold only exists under PWQO, not CEQG or CDWQ. Exceedances for Total Ammonia during the spring 2017 sampling were documented at all sampling stations except Station 14 in the dry sampling period, and at half of the stations (i.e. Stations 3, 4, 6, 7, 8, 11 and 13) during the summer sampling event, which was also under dry conditions. Regular Ammonia exceedances were also documented at Station 7 in 2016. Widespread exceedances of Ammonia may be attributed to runoff from adjacent agricultural or golf course nutrient applications in the spring. In addition, both the Hall's Pond subwatershed within the Hanlon Creek and the Mill Creek Subwatershed possess well-drained, hummocky headwater areas in the PSA which may facilitate leaching.
- Several exceedances for Total Phosphorus were documented in a number of the wetland stations (but not the flow stations) during the spring, summer and fall sampling events sampling events. In Station 1, the Neumann Pond Wetland, which is currently known to be maintained entirely by precipitation and surface runoff (ref. NSE, 2015) phosphorus inputs are presumed to be from runoff from the adjacent agricultural lands. Comparable exceedances close to Station 1 were previously documented in the 2013/2014 Monitoring Report for the Bird Landing Subdivision (i.e., 0.074 mg/L) (BluePlan Engineering 2014). Other notable exceedances for Total Phosphorus were recorded at Stations 3 and 8 during the August sampling event, and Stations 5 and 6 during the November sampling event, and Station 7 in 2016. These Stations all exist within close proximity to lands currently used for agriculture or golf course uses where additional nutrients may be introduced to the groundwater and surface water through leaching and runoff.
- None of the reference documents provide specific thresholds for Total Suspended Solids (TSS), for background conditions within natural surface water systems. The majority of sites exhibited clear visual conditions, with the exception of Station 6 on November 3, 2017 which indicated a level of 277 mg/L.
- For Total Dissolved Solids (TDS) CDWQ standards provide a theshold of 500 mg/L (Health Canada 2014). Exceedances for TDS were documented at Station 15 (in Hanlon Creek outside the PSA) throughout 2017 with the exception the April 28, 2017 dry sampling event. Station 15 consists of an actively flowing system downstream of an online storm water management facility. Exceedances were also found at Station 11 and 12 (both adjacent to Maltby Road) during the August 10, 2017 sampling event with levels of 1070 mg/L and 803 mg/L, respectively. The exceedances were the highest recorded levels of TDS for the 2017 monitoring season, while Station 15 had an average exceedance level of approximately 644 mg/L.
- PWQO, CEQG and CDWQ do not provide thresholds for Total Kjeldahl Nitrogen (TKN) or Orthophosphate:
  - For TKN, the majority of samples from 2017 resulted in levels between 0.3 to 2.0 mg/L, with the higher levels being found at Station 11 (3.75 mg/L) on August 10, and Stations 3 (4.22 mg/L), 5 (3.48 mg/L), and 11 (2.6mg/L) on November 3, 2017.

- The highest levels of Orthophosphate were documented from Station 11 (0.0382 mg/L) on August 10, 2017. Notably, Orthophosphate results were not provided from the September 5 or October 3 sampling events due to laboratory error.

- Sulfate concentrations were relatively low at all stations in 2017 compared to the thresholds set by CDWQ of 500 mg/L (Health Canada 2014). The highest recorded measurement was 20.9 mg/L at Station 15 on April 28, 2017.
- Thresholds exist for both Nitrate and Nitrite in the CEQG and CDWQ. However, no exceedances were documented for either parameter during the 2017 monitoring season.
- Acceptable Chloride levels under CEQG are defined at up to 120 mg/L (CCME 1999). CWDQ sets a much higher limit of up to 250 mg/L (Health Canada 2014). Within Table 4.2.9, Chloride exceedances were documented throughout 2017, most notably during the August and November sampling events, primarily at stations close to roads and at Station 15, downstream of a stormwater management Facility.

Metals

- Widespread exceedances of Aluminum were observed in 2017 when compared to the CEQG standard of 0.005 mg/L (CCME 1999), while one such exceedance was documented at Station 7 in 2016. During the November 3, 2017 event all stations sampled exceeded this limit. For PWQO limits, only one (1) exceedance was recorded during the 2017 sampling events at Station 12 in spring. Station 12 is within a few metres of an active roadway which may influence the wetland's water chemistry as a result of road runoff, but this would not explain the regular exceedances at stations further from roads.
- Sampling at Station 14 revealed repeated exceedances of Cadmium. Cadmium receives a restrictive limit of 0.00004 mg/L under the CEQG (CCME 1999). Only during the April sampling event did Station 14 not exceed the CEQG limit; Station 12 also exceeded CEQG standards once on May 1, 2017.
- Chromium exceeded the established thresholds on two occasions at two individual Stations during the 2017 monitoring season. Station 12 (0.00454 mg/L) on May 1 and Station 6 (0.00169 mg/L) on November 3, 2017.
- A few exceedances were documented for Copper in 2017. Mostly, exceedances occurred under the PWQO standards which are set at a more restrictive level of 0.001 mg/L (PWQO 1994). However Station 12 was found to exceed this limit as well as the CEQG limit of 0.002 mg/L (CCME 1999) on May 1. During November 2017, Stations 2, 3 and 7 were also found to have Copper levels slightly above the PWQO standard. All exceedances for Copper were recorded during sampling events that followed precipitation (i.e., wet events) which may indicate that surface runoff from surrounding lands may influence sample results.
- Thresholds for Iron are set at 0.3 mg/L for all three water quality criteria sets used in this study. Exceedances for Iron were recorded sporadically throughout the 2017 monitoring season at several different Stations, and at Station 7 in 2016. The highest Iron levels were recorded at Stations 11 and 12. Typically, high iron levels are a natural occurrence in areas where groundwater inputs exist as documented within the 1996 Mill Creek Subwatersheds Study.
- For Lead, one exceedance was recorded in 2017 at Station 12 during the May, 2017 sampling event and one was recorded at Station 7 in 2016. Again, close proximity to an active roadway and influence of

road runoff is assumed to have been a factor. The threshold for Lead is 0.001 mg/L for both the PWQO and CEQG.

- Manganese has a threshold of 0.05 mg/L under the CDWQ criteria (Health Canada 2014). Exceedances were observed throughout the 2017 monitoring season at various Stations. An increased number of exceedances were observed during, and after, the August, 2017 sampling event.
- During some sample events in 2016 and all sample events in 2017, Station 14 was found to exceed the PWQO level for Zinc. The Mill Creek Subwatershed Plan (1996) groundwater quality samples documented high levels of Zinc. Due to the likelihood of groundwater inputs at Station 14 (as indicated by consistently low summer temperature readings in 2016 and 2017), it is possible that these exceedances are a natural occurrence. Zinc exceedances were also recorded at Station 12 (also in Mill Creek Subwatershed) during the May and November sampling events. All exceedances with the exception of Station 14 on April 28, exceeded both PWQO and CEQG thresholds.

Pesticides

- For pesticides, sampling was conducted in conjunction with the fall wetland water quality sampling on November 3, 2017. No exceedances based on the available thresholds were recorded at any of the stations. However Endosulfan, Endrin, Hexachlorobenzene, Hexachloroethane, and Methoxychlor were detected at limits that were higher than the established PWQO and CEQW standards.

Table 4.2.12: Summary of PWQO Exceedances for the 2016 Monitoring Program

Date	Total Number of PWQO/CEQG/CDWQ Exceedances by Location	
	Station 7	Station 14
August 4, 2016	3/1/1	1/2/0
August 17, 2016	2/1/1	2/2/0
Sept. 22, 2016	5/3/2	2/2/0
October 20, 2016	2/0/0	1/1/0

Table 4.2.13: Summary of PWQO, CEQG, CDWQ Exceedances for the 2017 Monitoring Program

Date	1	2	3	4	5	6	7	8	10	11	12	13	14	15
April 28, 2017													1	3
May 1, 2017	4	1	3	3	2	1	2	3	1	4	9	4	3	4
August 10, 2017	3	2	5	2	3	2	2	5	0	6	5	4	3	3
September 5, 2017													4	3
October 3, 2017													2	2
November 3, 2017	3	3	4		4	5	3	1	1	6		5	4	4

Note: Data gaps in the table are explained by the fact that wetland Stations 1 through 13 (excluding 9, which had no standing water) were sampled once in the spring under wet conditions, once in the summer under dry conditions and once in the fall under wet conditions. Flow Stations 14 and 15 were each sampled under both wet and dry conditions in the spring, summer and fall.

4.3 Ground Water

The groundwater field program was designed to support refinements to the existing hydrogeological characterization and establish baseline conditions within the SPA and PSA. An understanding of the three dimensional and time-varying (e.g., seasonal) characteristics of the integrated surface water and groundwater flow systems will be required to support the establishment of Community Structure plans for the SPA. In addition, the field program will contribute to a water balance evaluation of groundwater function, identify constraints and opportunities, and provide monitoring locations that will form part of the long-term monitoring network.

The groundwater field work was coordinated with the work being completed by the other disciplines in recognition of the inter-relationship between the hydrogeological and hydrologic systems, other users of water for anthropogenic needs, and the local ecosystem.

Details of the field work completed in 2016 can be found in the Year 1 Monitoring Report (Amec Foster Wheeler, 2017). Field work initiated and completed in 2016 included:

- Borehole Drilling and Monitoring Well Installations
- Downhole Geophysical Logging
- Drive Point Mini Piezometer Installations
- Single Well Hydraulic Response Testing
- Guelph Permeameter Testing
- Pond Bathymetry Surveys

This section provides the methodology used by Matrix Solutions Inc. (Matrix) to complete the 2017 hydrogeological field program. Preliminary results are also provided. Specifically, the 2017 field program included the following ongoing data collection that was first initiated in 2016:

- Groundwater Level Monitoring
- Groundwater Quality Sampling
- Surface Water Base Flow Measurements
- Seeps and Springs Observations

The Characterization Report (to be prepared over 2018) will provide the detailed interpretation and assessment of the groundwater data and related data from other study components which will provide:

- The local hydrostratigraphic interpretation of the Paris Moraine,
- The overall three-dimensional connection of the local groundwater flow system to more regional system and
- The potential connection of the local wetland features to the groundwater flow system.

4.3.1 Summary of 2016 Borehole Drilling and Monitoring Well Installations

A drilling and well installation program was completed between July 25 and August 24, 2016. The installation of monitoring wells was intended to understand the function of the upper aquifer(s), vertical gradients, groundwater flow directions, and to collect water quality samples.

In total, 17 boreholes at 9 locations were advanced and all boreholes were completed as monitoring wells. The borehole locations were strategically positioned across the study area in a series of three transects trending northwest to southeast with each transect crossing a topographic low through the centre of the transect (Map GW-1). At each location, one shallow and one deep 152 mm borehole was drilled side by side and completed as an overburden monitoring well nest; except at MW07, where only one well was completed due to the availability of existing shallow monitoring wells in the area. The target depth for each deep borehole was just above the top of bedrock, which was guided by the City's Tier Three Water Budget Study. Monitoring well completion data are summarized in Appendix GW-1 (Table GW1.1). Geologic logs indicating borehole lithology and monitoring well construction details are provided in Appendix GW-2. Further details of the borehole drilling methods are described in the Year 1 Monitoring Report (Amec Foster Wheeler, 2017).

Matrix monitoring wells were installed in the following stratigraphic layers:

- MW01-S, MW02-S, MW02-D, MW03-S, MW03-D, MW05-S, MW05-D, MW06-S, MW06 D, MW07-D, MW08-S, MW08-D and MW09-S were completed in primarily sand/gravel to silty sand
- MW01-D, MW04-S, MW04-D, and MW09-D were completed in clayey to sandy silt

4.3.2 Summary of 2016 Drive Point Mini Piezometer Installations

In August and September 2016, a total of 18 drive point mini piezometers were installed by Matrix personnel at 14 wetland locations identified as areas of potential groundwater – surface water interaction and where property access was granted (Map GW-1). These locations were also coordinated with the wetland surface water quantity and quality stations, as well as flow stations where possible (Map SW-1). At four of the locations, pairs of shallow and deep mini piezometers were installed to more closely examine vertical hydraulic gradients. Installation details and observed vertical hydraulic gradients are presented in Appendix GW-1 (Table GW1.2). Further details of the installation are described in the Year 1 Monitoring Report (Amec Foster Wheeler, 2017).

The nested mini piezometers MP13-D and MP13-S were destroyed during a highway traffic collision in August 2017. Data were recovered from MP13-D but have not been successfully recovered from MP13-S.

4.3.3 Groundwater Level Monitoring

Groundwater levels were monitored at all monitoring wells and mini piezometers from their installation in 2016 through 2017 (Map GW-1) with the exception of the mini piezometers during the winter months and MP13-S and MP13-D following their destruction in August 2017. Three additional, pre-existing wells (MW1-11, MW2-11, and MW3-11) located at 132 Clair Road are also being monitored with the landowner's permission (Map GW-1). All wells and piezometers are being monitored using manual measurements approximately every three months and, with the exception of MW1-11 and MW2-11, are all equipped with a Solinst™ Levelogger Model 3001 non-vented pressure transducer automatically recording every 60 minutes. The pressure transducers were removed from the mini piezometers between December 13, 2016 and April 18, 2017 to protect them from freezing. The mini piezometer transducers were again removed on November 17, 2017 and will be re-installed in the spring of 2018. Data from a Solinst™ Barologger recording atmospheric pressure at MW02-S are used to correct the water level pressure recordings to gauge pressure. The manual water level is measured at each well and piezometer relative to the top of the PVC/steel pipe using a Solinst™ electronic water level tape.

Groundwater elevations at each station were calculated by subtracting measured depths to water from the surveyed top of casing/pipe elevations. Manual groundwater levels obtained from the monitoring wells and mini piezometers since their installation are presented in Appendix GW-1 (Table GW1.1 and Table GW1.2, respectively). Hydrographs can be found in Appendix GW-3 presenting groundwater fluctuations in each monitoring well outfitted with a pressure transducer. Wetland hydrographs are also included in Appendix GW-3 and include automatically recorded shallow groundwater elevations in the mini piezometers, surface water elevations and, where in close proximity to monitoring wells, deep overburden groundwater elevations are also included.

4.3.3.1 Monitoring Well Hydrographs

The monitoring well hydrographs show that the overburden groundwater elevations have fluctuated seasonally and reached a peak during the early summer of 2017 with the lowest elevations occurring in January of 2016 and 2017. The majority of monitoring wells show water levels varying between 330 masl to 335 masl. Seasonal variations tend to indicate lows in early January and highs in early July. The vertical groundwater flow gradients can be determined for a given monitoring well nest by comparing the recorded groundwater elevations in each of the nested wells that make up a well pair. Where the shallow groundwater elevation exceeds the deeper groundwater elevations the flow gradient is downwards. Where the gradient is reversed, groundwater flows upwards through the saturated zone. All monitoring well hydrographs show a downward groundwater flow gradient, except at MW9-D and MW9-S where the hydraulic gradient is consistently upwards throughout all seasons.

The monitoring well hydrographs show a series of distinct groundwater drawdown events that occurred through August and September 2017 at the following monitoring wells listed from largest drawdown to smallest:

- MW4-D and MW4-S
- MW5-D and MW5-S
- MW6-D and MW6-S

Given that this these months received less rainfall, and with the distinct drawdown and recovery pattern of a groundwater pumping well, it is likely the drawdown at these wells was a result of nearby irrigation pumping or water taking for construction purposes.

The hydrographs for MW1-S/D, MW2-S/D, MW1-S/D, MW2-S/D, MW4-S/D, MW5-S/D, MW6-S/D, MW7-D and MW08-S demonstrate response that are potentially related to the start of seasonal recharge in early January. MW8-S appears to show 2 distinct recharge events in the second half of January 2017.

4.3.3.2 Wetland Hydrographs

Wetland hydrographs are compared similarly where groundwater and surface water elevations indicate vertical flow directions with water always moving towards the lowest hydrostatic elevation. Hydrographs show that for most of the year, most wetlands have a surface water elevation that exceeds, or is equal to the shallow groundwater (mini piezometer) elevations. As such, it is interpreted that the wetland is losing water to, or is in equilibrium with the shallow groundwater system as is shown in hydrographs for Stations 1, 2, 3, 5, 6, 7, 8, 9 and 13 (Appendix GW-3).

However, some wetlands show the reverse gradient where the shallow groundwater (mini piezometer) elevations exceed the surface water elevations for most of the year as shown in hydrographs for Stations 4, 10, 11, and 12 (Appendix GW-3).

Some wetlands show a pattern of seasonal reversal where the nest mini piezometers show a reversal of shallow groundwater flow direction where the water elevation in the deep mini piezometer eventually exceeds that of the shallow mini piezometer and in some cases it also exceeds the surface water elevation. This is shown in the following hydrographs:

- Station 1 (Neumann's Pond 1) – gradient in the shallow groundwater system becomes upwards for the second half of 2017 but returns to a downward gradient in the late fall of 2017.
- Station 7 (Hall's Pond) – gradient in the shallow groundwater system becomes upwards in July 2017 with the deep mini piezometer water elevation exceeding the surface water elevation for the remainder of 2017.
- Station 14 – the shallow groundwater elevation in the mini piezometer exceeds that of the surface water for the first half of 2017.

Lastly, hydrographs from monitoring wells located in close proximity to a wetland monitoring location show that some wetlands are located where the deep overburden groundwater system (monitoring well water elevations) are near to or exceed the surface water and shallow groundwater elevations associated with the wetland. In other hydrographs, it is shown that the deep overburden groundwater system is much lower than the surface water and shallow groundwater elevations associated with the wetland. These conditions are shown in the hydrographs (Appendix GW-3) for the following stations:

- Station 9 – the peak groundwater elevations from the nearby monitoring wells exceed the shallow (mini-piezometer) groundwater and surface water elevations in spring 2017.
- Station 10 – The groundwater elevations from the nearby monitoring well (200 m northeast) are near equal to the shallow groundwater and surface water elevations.
- Station 1 (Neumann's Pond 1) – The deep overburden groundwater elevations are significantly lower (approximately 10 m) than the wetland water elevations.
- Hall's Pond – A combined hydrograph included at the end of Appendix GW-3 shows all shallow (mini-piezometer) and deep (monitoring well) overburden groundwater elevations associated with Hall's Pond along with the surface water elevation. The shallow groundwater elevations exceed the deep elevations, suggesting a downwards groundwater flow direction. As shown in the hydrograph, the estimated bottom of the pond elevation is lower than the deep groundwater elevation. The depth of Hall's pond suggests a potentially continuous saturated system between the wetland and the deeper groundwater system in the overburden.

4.3.4 Groundwater Quality Sampling

Three separate groundwater quality sampling events were completed at the Matrix monitoring wells on the following dates:

- October 19 to 21, 2016,
- April 19, 2017, and
- October 4, 5 and 10, 2017.

The wells were purged prior to groundwater sampling to obtain samples that represent the water quality in the formation. Matrix personnel purged three casing volumes as per the CCME (1994) method or until dry before collecting groundwater samples using dedicated inertial lift Waterra™ sampling pumps or dedicated Waterra™ bailers.

Field measured parameters, including pH, EC, temperature, dissolved oxygen and turbidity, were conducted on groundwater samples collected from the wells once purging was complete. The instruments were checked for calibration and corrected where necessary prior to measuring the field parameters.

Groundwater samples from each Matrix monitoring well were collected into the appropriate, laboratory supplied, pre-labeled sample bottles. Each groundwater sample collected for dissolved metals analysis was field-filtered using disposable 0.45 micron filters.

Samples collected in 2016 and 2017 were analyzed for the following parameters:

- general and inorganic parameters, including pH, EC, calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), dissolved iron (Fe), dissolved manganese (Mn), chloride (Cl), carbonate (as CaCO3), bicarbonate (as CaCO3), hydroxide (as CaCO3), sulphate (SO4), nitrite nitrogen (NO2 N), nitrate nitrogen (NO3 N), total Kjeldahl nitrogen (TKN), total dissolved solids (TDS), total hardness (as CaCO3) and total alkalinity (as CaCO¬3).
- dissolved metals including silver (Ag), aluminum (Al), arsenic (As), boron (B), barium (Ba), beryllium (Be), bismuth (Bi), cadmium (Cd), cesium (Cs), cobalt (Co), chromium (Cr), copper (Cu), lithium (Li), molybdenum (Mo), nickel (Ni), phosphorus (P), lead (Pb), rubidium (Rb), sulfur (S), antimony (Sb), selenium (Se), silicon (Si), tin (Sn), strontium (Sr), tellurium (Te), thorium (Th), titanium (Ti), thallium (Tl), uranium (U), vanadium (V), tungsten (W), zinc (Zn), and zirconium (Zr)

Collected samples were stored in ice-chilled coolers and transported to ALS Laboratory Group in Waterloo, Ontario for analysis. A chain of custody form indicating sample numbers was submitted to and signed at the laboratory. Copies of the signed forms were placed in the project files and are available upon request. Laboratory results were downloaded into Matrix's database management system and are presented in Table GW1.3 (Field Parameters), Table GW1.4 (Routine Parameters), and Table GW1.5 (Dissolved Metals) within Appendix GW-1. Copies of the laboratory Certificates of Analysis are provided in Appendix GW-4.

Laboratory analytical results were compared against the Ontario Drinking Water Standards (MOE, 2006) to provide a relative characterization of the groundwater against the appropriate potable water standard in Ontario. All analytical results to date were reported below the Ontario Drinking Water Quality Standards with the exception of the following:

- Analytical results for dissolved iron exceeded the ODWS at MW02-S/D, MW05-S/D and MW06-S. The peak reported concentration to date is 2.91 mg/L (MW05-D, April 19, 2017) compared to the ODWS aesthetic objective of 0.3 mg/L.
- Analytical results for dissolved manganese exceeded the ODWS at MW02-S/D, MW04-S, MW05-S/D, MW06-S, MW07-D and MW09-D. The peak reported concentration to date is 0.482 mg/L (MW02-S, April 19, 2017) compared to the ODWS aesthetic objective of 0.05 mg/L.
- Analytical results for total dissolved solids (TDS) exceeded the ODWS at MW01-S and MW08-D. The peak reported concentration to date is 718 mg/L (MW08-D, April 19, 2017) compared to the ODWS aesthetic objective of 500 mg/L.
- Analytical results from all monitoring wells exceeded the ODWS for total hardness. Total hardness levels ranged between 131 mg/L (MW01-D) and 411 mg/L (MW06-S) compared to the ODWS operational guidelines of 80 to 100 mg/L.
- Analytical results from MW02-S exceeded the ODWS for arsenic on April 19, 2017 where the concentration was reported as 0.0315 mg/L compared to the ODWS interim maximum acceptable concentration of 0.025 mg/L.
- Analytical results from MW06-S exceeded the ODWS for aluminium on April 19, 2017 where the concentration was reported as 0.627 mg/L compared to the ODWS operational guideline of 0.1 mg/L.
- Analytical results from MW05-S exceeded the ODWS for uranium on October 19, 2016 where the concentration was reported as 0.024 mg/L compared to the ODWS maximum acceptable concentration of 0.02 mg/L.

4.3.4.1 Preliminary Discussion of Groundwater Quality Results

Piper plots were used to characterize the groundwater analytical results by plotting each sample of groundwater according to its relative proportion of each major groundwater constituent. The plots illustrate the predominant cations and anions constituting the water from each sample. Piper plots are provided in Appendix GW-5. The 2016 and 2017 analytical results show a consistent calcium-magnesium carbonate groundwater characterization.

The piper plots also show that chloride concentrations and TDS at MW08-D and MW01-S are observed to be consistently elevated over the results from other locations. Although elevated, chloride concentrations at these locations have remained below the ODWS, whereas TDS exceeds the ODWS. Additionally, MW08-D and MW01-S show relatively elevated concentrations of dissolved zinc, cadmium and lead over the analytical results from other groundwater sampling locations. These metals are often found in association with one another in the groundwater system, although, surface water analytical results show a similar relationship between total zinc, cadmium and lead at Stations 12 and 14.

4.3.5 Surface Water Base Flow Measurements

Surface water base flow measurements have been collected to observe the seasonal and spatial variability of base flow along watercourses. Base flows conditions are present during periods when overland flow to a watercourse is absent and the watercourse has returned to its "dry" weather level. It is during these conditions that areas of potential groundwater discharge and recharge along the length of a watercourse can be evaluated. For the purposes of the CEIS, "dry" weather conditions were considered to be following any period of three continuous days with less than 5 mm of cumulative rainfall. Base flow measurements were collected during spring (May 2017), summer (August 2016 and 2017) and fall (November 2016 and 2017) field events to capture seasonal variability.

Base flow locations were initially selected at watercourse crossings near the SPA and PSA and were also guided by preliminary particle tracking from the City's Tier Three Water Budget model. Initial locations included measurements within the Hanlon Creek, Mill Creek and Lower Speed River subwatersheds (Map GW-2). Since the initial base flow event, locations were refined with the addition of three locations in the Torrance Creek Subwatershed and an additional location in the Mill Creek Subwatershed for a total of 27 locations (Map GW-2).

Base flow measurements were completed by securing a measuring tape across the banks of the stream and dividing the cross section of the stream into approximately 10 panels of equal width. A Son-Tek FlowTracker Acoustic Doppler Velocimeter (ADV) was used to record the width, water depth and flow velocity in each panel to produce a final discharge value for the stream at each monitoring location. Surface water temperature was also collected at each location where the ADV was used. The surface water base flow measurement results collected to date are summarized in Table GW1.6 of Appendix GW-1 and are shown spatially on Map GW-2.

Stream discharge ranged across the regional study area from 0 L/s in headwater areas to 676 L/s (May 11, 2017) at the most downstream station along Mill Creek during the spring 2017 monitoring event. The summer and fall base flow measurements are consistent between 2016 and 2017 in spite of receiving significantly more rainfall in 2017 than in 2016 at the Clair Maltby CEIS rainfall gauge. The relative consistency of summer and fall measurements between 2016 (a dry year) and 2017 (a wet year) indicate:

i. That the measurements were completed during a period representative of base flow conditions, and
ii. Base flow to the surface water features (especially in the Mill Creek subwatershed) appear to be relatively consistent on a seasonal basis.

4.3.6 Springs and Seeps Observations

Matrix field staff observed and documented a series of springs on May 10, 2017 at 63 Brock Road in the Mill Creek Subwatershed, south of the SPA in the broader SSA, following an invitation by the property owner to visit the springs (Spring 1 on Map GW-1). The property owner reported that their domestic water well is approximately 21 m deep and flowed artesian groundwater to surface when it was originally constructed. The predominantly cedar forested area of the property contains numerous springs and pools of water along an area of topographic relief. Wood field staff observed an additional area of springs within the Mill Creek subwatershed on April 26, 2017 (Spring 2 on Map GW-1). More springs associated with this approximate ground surface elevation are anticipated in the Mill Creek, Hanlon Creek and Speed River subwatersheds.

During the background review, it was noted that two groundwater seeps were previously documented at 132 Clair Rd. (ref. Aquafor Beech 2012), south of Neumann's Pond 1 (Seep 1 and Seep 2 on Map GW-1). Beacon field staff also reported observing a seep at 2162 Gordon Street (Seep 3 on Map GW-1).

The Project Team will continue to look for these features during subsequent monitoring events and landowners in the area who have not provided access will be invited to provide data.

4.4 Natural Heritage

A Natural Heritage System (NHS) has been identified for the SPA, as mapped and described in the City's current Official Plan (2014 Consolidation). This NHS was based on the technical work and consultations undertaken as part of the City's Natural Heritage Strategy between 2004 and 2009 (Dougan & Associates 2009a, b) and incorporated into the City-wide Official Plan Amendment (OPA) 42 for the NHS in 2010. This NHS was then refined and finalized through the approval of the City of Guelph Official Plan Amendment 42 in 2014 by the Ontario Municipal Board.

The purpose of the natural heritage work undertaken through the Clair-Maltby Secondary Plan process has been to verify and update the NHS, as needed, within the SPA based on:

- Relevant changes to existing conditions based on site-specific studies completed within the PSA (ref. Appendix NH-1) over the past decade or so supplemented with targeted field studies, as well as analysis of current aerial photography;
- Application of current legislation, policies and guidelines, including:
  - Evaluation, Classification and Management of Headwater Drainage Features Guideline (CVC and TRCA 2014);
  - Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (MNRF 2015); and
  - Species currently listed as Endangered and Threatened under Ontario's Endangered Species Act (2007).

Supplemental natural heritage field studies undertaken as part Clair-Maltby Secondary Plan process have included:

- Scoped vegetation assessments and botanical surveys;
- Calling amphibian surveys and amphibian / reptile movement surveys over roads;
- Basking turtle surveys;
- Breeding bird surveys;
- Winter wildlife surveys (including deer and raptors); and
- Incidental surveys in conjunction with other targeted surveys for seeps, springs, terrestrial crayfish burrows and other wildlife.

Representative photos from this work are included in Appendix NH-2.

The following sections provide updates to both the aquatic and terrestrial natural heritage based on information from the field work and the various background sources. These updates focus on the SPA, but have also considered the broader PSA and, to a lesser extent, the SSA.

The updates provided are as accurate as possible given the nature of the access provided. However, this work does not preclude the need site-specific Environmental Impact Studies (EIS) or Environmental Assessments (EAs) that will be required for all proposed development within or adjacent to the NHS, and may result in additional changes to the NHS.

4.4.1 Aquatic Natural Heritage

As discussed herein, there are no permanent or intermittent watercourses in the SPA due to the topography soils and drainage. However, some of the wetlands and ponds in the SPA are capable of supporting fish and benthic invertebrates, and there is also an interest having at least a high-level understanding of the fish communities in the watercourses in the broader SSA so that potential impacts to these resources can be considered through the characterization process.

The characterization of the fish habitat of the study area is based entirely on background data obtained from MNRF (1999 – 2012) supplemented with data from site-specific studies in the PSA.

As discussed in Section 4.3, the water level and quality monitoring undertaken in wetlands across the SPA (for both surface water and groundwater) also provides information related to aquatic ecology where these features may support fish. The wetland monitoring provides a better understanding of the following in a representative range of wetlands in both the Hanlon Creek and Mill Creek Watersheds in the SPA: hydroperiods, the extent to which they are being supported by groundwater versus surface water, the range of water temperatures and the types of exceedances that are occurring under current conditions.

The findings of the fish community data for each of the watersheds in the SPA is provided in Section 4.4.1.2 below. Photographs of representative ponds and wetlands in the PSA are provided in Appendix SW-2.

4.4.1.1 Headwater Drainage Feature Assessment (HDFA)

As noted above, there are no known open flowing watercourses in the PSA, as it represents a headwaters area of the Hanlon, Torrance and Mill Creeks. Therefore, no fish sampling was proposed within the PSA. However, a scoped assessment using the current standard of practice for the evaluation of headwater drainage features (HDFs) (CVC and TRCA 2014) in the PSA was requested by the City's Environment Advisory Committee (EAC) in November 2016, and agreed to. The purpose of this assessment was, to the extent possible with the access provided, identify any potential or actual drainage pathways, particularly those connected to wetland or ponds that may support fish, to help assess the potential for such features to support seasonal aquatic habitats.

In 2017, the intent of the scoped HDFA was to build on available background information, including limited field observations, available mapping, and integrated surface water and groundwater modelling results to identify potential HDF areas. A review of aerial imagery of the PSA available through Google Earth® (2006-2017) and the City of Guelph (2006, 2009, 2012, 2016) was reviewed to identify any areas that exhibited evidence of saturation or concentrated surface flow that might indicate presence of an HDF. Emphasis was placed on seasonal coverage (i.e., spring) and wet years. Results of this desktop review were then cross-referenced with field data results from 2016 and 2017, including wetland mapping (based on the Ecological Land Classification (ELC) (Lee et al., 1998) system updates), observed seeps, surface water monitoring and shallow groundwater monitoring.

Map NH-3 illustrates the results of this review process, which has identified five (5) potential HDFs. Field confirmation of these potential locations is planned for Spring 2018 where access is provided. In addition to evaluating these potential features with respect to form and function, the connectivity of these potential HDFs to other existing features, primarily wetlands, will be assessed.

4.4.1.2 Fish Habitat

The MNRF Guelph District Office provided data from fisheries sampling completed within the PSA, as well as within the broader SSA, between 1999 and 2012. Notably, not all MNRF fish data provided included specifics on total numbers of individual species caught. In addition, some data points did not provide species information at all, but rather general habitat markers shared by similar species such as Trout redds.

Very little additional fish data was available for ponds / wetlands within the PSA. Of all the background studies screened (see list in Appendix NH-1), site-specific fisheries data was only available from two of them: the Neumann Pond in the Hanlon Creek Watershed (132 Clair Road West) (Aquafor Beech Limited 2012) in the SPA, and the ponds / ephemeral watercourse in the Southgate study area (385 Maltby Road West) (NRSI 2007) in the PSA and Mill Creek Watershed.

A summary of the fish communities in the Hanlon Creek and Mill Creek Watersheds is summarized in Table 4.4.1 and Table 4.4.2 respectively. Approximate locations of records are provided in Map NH-4.

Table 4.4.1: Fish Species Records for the Hanlon Creek Watershed in the Secondary Study Area (ref. Map NH-4)

Common Name	Scientific Name	Thermal Regime	Tolerance	Status		MNRF 1999		Aquafor Beech 2012	
				Regional / Local Rank	SRank	Fish Dot Code	# of Specimens	Fish Dot Code	# of Specimens
Brook Stickleback	*Culaea inconstans*	coolwater	intermediate	HR	S5	10-7	300+		
Brook Trout	*Salvelinus fontinalis*	coldwater	intolerant		S5	10-29	N/A		
Brown Bullhead	*Ameiurus nebulosus*	warmwater	tolerant	HR	S5			Neumann Pond A	16
Central Mudminnow	*Umbra limi*	coolwater	tolerant		S5	10-7	37		
Goldfish	*Carassius auratus*	warmwater	tolerant	E	SE			Neumann Pond A	767
Northern Redbelly Dace	*Phoxinus eos*	coolwater	intermediate	HR	S5	10-7	62		

Table 4.4.2: Fish Species Records for the Mill Creek Watershed in the Secondary Study Area (ref. Map NH-4)

Common Name	Scientific Name	Thermal Regime	Tolerance	Status		MNRF 2010		MNRF 2012	
				Regional / Local Rank	SRank	Fish Dot Code	# of Specimens	Fish Dot Code	# of Specimens
Brook Stickleback	*Culaea inconstans*	coolwater	intermediate	HR	S5	1-156	5	1-180	1
Blacknose Dace	*Rhinichthys obtusus*	coolwater	intermediate	HU	S5			1-180	1
Central Mudminnow	*Umbra limi*	coolwater	tolerant		S5	1-156	2	1-180	61
Northern Redbelly Dace	*Phoxinus eos*	coolwater	intermediate	HR	S5	1-156		1-180	25

The two species documented in the Neumann Pond are warmwater species. Brown Bullhead (*Ameiurus nebulosus*) is considered a tolerant, warm water species which is common throughout southern Ontario. It is tolerant of degraded water quality and can live in water with extremely low oxygen concentrations (North-South Environmental Inc. 2015).

North of the SPA, the southern portion of branch E in the Hanlon Creek wetlands (PEIL et al., 2004) includes MNRF records for exclusively cool and coldwater fish species. Notably, this species is quite dated. Of the four fish species identified, all except Brook Trout (*Salvelinus fontinalis*) are considered to have an intermediate to high tolerance to environmental fluctuations in temperature and pollution.

West of the Hanlon Expressway in the Hanlon Creek Business Park area, NSRI (2013) identified Blacknose Dace (*Rhinichthys obtusus*), Brook Stickleback (*Culaea inconstans*), Creek Chub (*Notropis atherinoides*), Fathead Minnow (*Pimephales promelas*), Northern Redbelly Dace (*Phoxinus eos*), and White Sucker (*Catostomus commersoni*) between 2006 and 2013. In 2008, NSRI also captured four Brook Trout specimens in the same study area, indicating the presence of cool to coldwater fish habitat in the Hanlon Creek Watershed northwest of the SPA.

In the Mill Creek Watershed (ref. Table 4.4.2), similar fish species were identified as within Hanlon Creek, with the exception of Brook Trout, which was exclave to Hanlon Creek, and Blacknose Dace (a minnow species with an intermediate tolerance to environmental perturbations) recorded only in Mill Creek in the SSA.

Based on this information, no fish Species at Risk (SAR) are known to occur in the SPA, or the adjacent PSA or SSA.

Fisheries sampling conducted within the PSA as part of the Southgate EIR (NSRI 2007) recorded Black-nosed Dace, Brook Stickleback, Central Mudminnow (*Umbra limi*), Northern Red-bellied Dace, and Dace spp. from minnow traps in ponds south of Maltby Road just outside the SPA. Two (2) culverts passing under Maltby Road in this location were also identified as potentially suitable for fish habitat (NSRI 2007). These species are consistent with those identified more recently by MNRF (ref. Table 4.4.2) indicating the presence of coolwater fish habitat.

4.4.2 Terrestrial Natural Heritage (including Wetlands)

4.4.2.1 Ecological Land Classification (ELC)

Ecological Land Classification (ELC) mapping (as per Lee et al. 1998) for the PSA within the City of Guelph was first undertaken between 2006 and 2008 as part of the City-wide Natural Heritage Strategy (Dougan & Associates 2009a, 2009b) based on interpretation of aerial photography supplemented by scoped field surveys. The focus of the field surveys was outside of the identified Provincially Significant Wetlands (PSWs) as the primary data gap at that time was the types and extent of upland communities, with an emphasis on the extent and types of woodlands. Plant species were documented incidentally as part of the ELC field work, particularly species considered uncommon or rare in Guelph and Wellington County, but comprehensive botanical surveys were not completed as part of this City-wide initiative to intended to support the identification of a Natural Heritage System (NHS).

The ELC mapping used as the basis for the City's current NHS is the ELC mapping developed for the Natural Heritage Strategy with some site-specific mapping refinements which were established through agreements reached between the City and appellants as part of the Ontario Municipal Board hearing process for OPA 42 and approved by the Ontario Municipal Board.

As part of the CEIS work in support of the Clair Maltby Secondary Plan, the City's ELC mapping from 2014 has been updated (ref. Map NH-5 as well as NH-5A through NH-5D) and a plant list specific to the study area has also been developed. These updates have been based on:

- A review of current aerial photography (spring 2017) with reference to older aerial photography (i.e. going back to 2012) where appropriate;
- Review of current wetlands mapping from MNRF (2013);
- Incorporation of ELC and plant data from site-specific studies in the PSA where available (ref. Map NH-1); and
- Field verification where access was provided on June 21 and 28, 2017 (i.e., 2162 Gordon Street; 1, 5 and 12 Kilkenny Place and 24 Serena Lane) (ref. Ref. Map NH-2, ELC Data Cards in Appendix NH-3).

Based on this information, distinct vegetation communities using ELC (as per Lee at al. 1998) were delineated on aerial photos to the finest level possible with the existing information. In the ELC system there are three nested levels of detail: Community Series (e.g., Coniferous Forest, FOC), Ecosite (e.g., Dry-Fresh Pine Coniferous Forest Ecosite, FOC1) and Vegetation Type (e.g., Dry-Fresh White Pine-Red Pine Coniferous Forest Type, FOC1-2). In general, ELC was mapped to the Community Series or Ecosite Level except where field verification has been completed within the last decade.

The ELC mapping includes areas in the PSA within the City of Guelph where access and/or data was available, however the refinements have been focussed within the SPA. Notably, the most current available aerial photography (i.e., 2017) was used in all cases except on one property (i.e. 2021 Gordon). In this case the City has instructed the Consulting Team to revert to the 2012 aerial photography as these lands are currently before the courts for adjudication related to NHS issues.

The SPA contains a mix of cultural communities, natural forests and wetlands. ELC Community Series types are summarized in Table 4.4.3. Under current conditions, 72.3% of the SPA is accounted for by some type of natural or semi-natural area. Approximately 47% (242 ha) of the SPA is comprised of cultural communities, which include meadow, thicket, savannah, cultural woodland, plantation, and hedgerows. These communities are largely lands that have been disturbed as a result of past agricultural land use (e.g., cropping, livestock grazing) and, over time, have gradually succeeded into semi-natural areas in the absence of ongoing management or use. Natural forests comprise about 16% (85 ha) of the SPA and include a total of 18 forest vegetation types/ecosites, including coniferous, mixed, and deciduous forest types (ref. Maps NH-5A through NH-5D). Wetlands and open water make up about 10% (51 ha) of the SPA, including treed swamps, thicket swamps, marshes, and shallow aquatic communities. The remainder of the SPA is in some type of residential (e.g., the estate lots of Rolling Hills) or commercial land use. A total of twenty-two (22) wetland vegetation types/ecosites were documented in the PSA (ref. Maps NH-5A through NH-5D).

Table 4.4.3: **Overview of Ecological Land Classification (ELC) Community Series Types in the Secondary Plan Area (SPA)**			
ELC Community Class/Series (ELC Codes)	**Total Area (Ha)**	**Percentage within SPA (%)**	**Percentage within ELC (natural and semi-natural cover) (%)**
Cultural Communities			
Cultural Meadow (CUM)	52.1	9.7	13.5
Cultural Plantation (CUP)	39.4	7.4	10.2
Cultural Savannah (CUS)	100.1	18.7	25.9
Cultural Thicket (CUT)	6.7	1.3	1.7
Cultural Woodland (CUW)	43.6	8.1	11.3
Hedgerow (H)	9	1.7	2.3
Upland Forests			
Forest (FOC/FOD/FOM)	85	15.9	22.0
Wetlands (including treed Swamps)			
Meadow Marsh/Shallow Marsh (MAM/MAS)	16.5	3.1	4.3
Open Water (OAO)	9.2	1.7	2.4
Shallow Aquatic (SAF/SAM/SAS)	8.7	1.6	2.2
Deciduous Swamp/Mixed Swamp (SWD/SWM)	10.1	1.9	2.6
Thicket Swamp (SWT)	6.7	1.3	1.7
TOTALS	**387.1**	**72.3**	**100.0**

4.4.2.2 Plants

Based on a review environmental studies prepared for various properties within and adjacent to the SPA (ref. Appendix NH-1), as well as site visits conducted by Beacon in 2017, a total of 467 species of vascular plants have been recorded in the PSA by various sources. A consolidated plant list is provided in Appendix NH-4. The list includes species recorded within the PSA and within 500 m of the study area.

To date, only one plant Species at Risk – Butternut (*Juglans cinerea)* – has been documented in the PSA. Butternut, a provincially and federally Endangered species, was documented by Beacon in 2017 in the SPA[1]. To date, no other Butternut have been documented in the PSA; however, the species was reported in the EIS for the Westminster Woods East lands north of Clair Road (North-South Environmental Inc. 2002), and it is possible that additional Butternuts occur in the SPA but have yet to be documented.

Based on the *Locally Significant Species List* (City of Guelph 2012), a total of 20 locally significant plant species have been documented within and/or adjacent to the SPA. According to this list, locally significant species include: Black Maple (*Acer nigrum*), Awned Sedge (*Carex atherodes*), Hop Sedge (Carex lupulina), Fireweed (*Chamerion angustifolium* ssp. *angustifolium*), Hairy Swamp Loosestrife (*Decadon verticillata*), Downy Willowherb (*Epilobium strictum*), Marsh Horsetail (Equisetum palustre), Meadow Horsetail (*Equisetum pratense*), Rough Avens (*Geum laciniatum*), Butternut, Interrupted Fern (*Osmunda claytoniana*), Canada Clearweed (*Pilea pumila*), Yellow Water Crowfoot (*Ranunculus flabellaris*), Small Yellow Water Buttercup (*Ranunculus gmelinii*), Rough-leaved Goldenrod (*Solidago patula*), Freshwater Cordgrass (*Spartina pectinatus*), Heart-leaved Aster (Symphyotrichum cordifolium), Highbush Blueberry (*Vaccinium corymbosum*), Wood Lily (*Lilium philadelphicum*), and Buttonbush (*Cephalanthus occidentalis*).The federal, provincial and local conservation statuses of all plants documented is provided in Appendix NH-4.

[1] Two Butternut trees were recorded at 2162 Gordon Street at the base of slope adjacent to a small pocket wetland.

4.4.3 Terrestrial Ecology: Wildlife

The wildlife surveys conducted by Beacon in 2017 are summarized in Table 4.4.4 below. This data has been supplemented with background information from other environmental studies in the PSA (ref. Appendix NH-1) to help provide a more complete picture of the nature and extent of the various wildlife communities in the SPA.

Table 4.4.4: Summary of Wildlife Surveys Undertaken by Beacon in 2017

Survey Type	Personnel	Date
Winter Wildlife Survey	Rob Aitken	February 15, 2017
Amphibian Movement (Frog/Salamander) Surveys	Anna Corrigan Joel Davey	March 27, 2017 April 27, 2017 September 27, 2017 October 4, 2017
Breeding Amphibian (Calling Frog/Toad) Surveys	Rob Aitken Anna Corrigan Joel Davey	April 10, 2017 May 16, 2017 June 22, 2017 June 23, 2017
Breeding Bird Surveys	Rob Aitken Anna Corrigan	June 7, 2017 June 20, 2017

The specific field survey methods and results for different groups of wildlife are described in the following sub-sections. See Map NH-2 for the locations of terrestrial monitoring stations and transects.

During all surveys, field staff screened for the presence of any provincially Endangered or Threatened species, as well as any other federally, provincially or locally significant species[2]. Staff also noted habitats that might qualify as Significant Wildlife Habitat (SWH). All of the species documented from the 2017 wildlife field studies and the supplemental background information screening for the PSA are summarized in a comprehensive wildlife list (ref. Appendix NH-5).

Significant terrestrial wildlife species are discussed in Section 4.4.4, while a comprehensive SWH screening for the PSA is provided in Section 4.4.5 and wildlife movement in relation to NHS linkages is discussed in Section 4.4.6.

[2] The County of Wellington has a Significant Wildlife List which was developed for and published in the City of Guelph Natural Heritage Strategy Phase 2: Terrestrial Inventory & Natural Heritage System (Volume 2, Appendices) (2009b).

4.4.3.1 Amphibian Breeding (Anurans)

Amphibian breeding surveys were undertaken in the PSA during the spring of 2017 to record the presence or absence of early, mid and late season breeding frogs and toads. Surveys were conducted following the Marsh Monitoring Protocol (Bird Studies Canada 2009). Survey details, including dates, times and weather conditions, are summarized in Table 4.4.5.

Table 4.4.5: Amphibian Breeding Survey Details

Survey Round	Date	Time	Weather Conditions
1	April 10, 2017	20:26 - 22:40	16-18 °C, 40% Cloud Cover, Wind 6-11 km/h, Rain on and off during survey
2	May 16, 2017	21:10 - 23:39	14-16 °C, 10-20% Cloud Cover, Wind 1-5 km/h, No precipitation
3	June 22, 2017	21:33 - 22:51	23-24 °C, 80% Cloud Cover, Wind 6-19 km/h, No precipitation
3	June 23, 2017	21:34 - 22:33	21 °C, 90% Cloud Cover, Wind 6-11 km/h, No precipitation

Surveys were conducted after dusk at twenty-two (22) survey stations established adjacent to suitable habitat for calling breeding amphibians where access was provided or along the road right-of-way (ROW; ref. Maps G-2 and NH-2). Surveys were conducted using the point count method whereby the surveyor stands at a set point for a specific period of time and records all species that can be heard calling from that location.

For call codes 1 and 2, the estimated number of calling individuals was recorded. The results of the nocturnal amphibian call surveys are summarized in Table 4.4.6.

Table 4.4.6: Amphibian Breeding Survey Results

Station Number (ref. Map NH-2)	April 22, 2017	May 16, 2017	June 22/23,2017
A1	SPPE-3	SPPE-3 GRTR-1(2) NLFR-1(1)	GRTR-2(5) GRFR-1(1)
A2	-	SPPE-1(2) GRTR-1(2) AMTO-2(3) SPPE-3* GRTR-2*	GRTR-1(2)
A3	SPPE-3	SPPE-3 GRTR-2(5)	-
A4	-	-	GRTR-2(9)
A5	-	AMTO-1(1)*	-
A6	SPPE-3	SPPE-2(6) AMTO-1(2)	-
A7	SPPE-3 WOFR-1(3) NLFR-1(2)	SPPE-3 GRTR-3 AMTO-1(1)	GRTR-2(5) GRFR-1(2)
A8	Station 7 drowned out this station	Station 7 drowned out this station	GRTR-2(4) GRFR-1(3)
A9	SPPE-2(7) WOFR-1(1)	SPPE-1(5)	GRTR-2(8) GRFR-1(1)
A10	SPPE-1(3)	SPPE-2(10) AMTO-1(2)	GRFR-1(1)
A11	SPPE-2(12) WOFR-1(1)*	SPPE-1(3) GRTR-2(5) AMTO-1(3)	GRTR-2(6) BULL-1(1)
A12	SPPE-1(2)	-	-
A13	SPPE-3 WOFR-3	SPPE-3 GRTR-2(5) AMTO-1(3)	GRTR-2(10) GRFR-1(1)
A14	SPPE-3 WOFR-1(3)	SPPE-1(2) GRTR-1(1) AMTO-1(3)	BULL-1(2)
A15	SPPE-3 WOFR-1(3)	SPPE-1(4) GRTR-1(1) AMTO-1(1) GRTR-2*	GRTR-3
A16	WOFR-1(2)	-	GRFR-1(1)
A17	SPPE-3 WOFR-1(3)	-	GRTR-3
A18	WOFR-1(3)	-	-
A19	SPPE-3 WOFR-3	SPPE-2(5)	GRTR-2(7)

Table 4.4.6: Amphibian Breeding Survey Results

Station Number (ref. Map NH-2)	April 22, 2017	May 16, 2017	June 22/23,2017
A20	SPPE-3 WOFR-1(1)	SPPE-2(10) GRTR-2(6)	GRTR-2(8)
A21	SPPE-3 WOFR-3	SPPE-3 GRTR-2(10)	GRTR-2(9)
A22	SPPE-3 WOFR-3	SPPE-3 GRTR-3 GRTR-1(1)*	GRTR-2(5) GRTR-1(1)*

Notes: SPPE = Spring Peeper, AMTO = American Toad, GRTR = Gray Tree Frog, GRFR = Green Frog, BULL = Bullfrog, NLFR = Northern Leopard Frog, WOFR = Wood Frog
Code 1 - Individuals can be counted; calls not simultaneous. Estimated number of individuals indicated in brackets
Code 2 - Calls distinguishable; some simultaneous calling. Estimated number of individuals indicated in brackets
Code 3 - Full chorus; calls continuous and overlapping.
*Calling detected from outside survey station

Six (6) species of breeding frogs and one (1) species of breeding toad were recorded during the breeding amphibian surveys in 2017. A majority of these species are ranked S5, meaning they are common, widespread and abundant in Ontario, with the exception of Bullfrog (*Rana catesbeiana*), which is ranked S4, meaning it is uncommon but not rare provincially. Bullfrog is also considered significant and rare in Wellington County.

These seven (7) anuran species were also recorded incidentally during the other field studies conducted in 2017. Additionally, Western Chorus Frog (*Pseudacris triseriata*) was recorded as breeding by Beacon staff, and was noted as breeding in the PSA in the supplemental background data. Western Chorus Frog is federally ranked as threatened, considered vulnerable in Ontario (ranked S3), and is rare and significant in Wellington County. This species is discussed further in Section 4.4.4.3.

In general, the PSA supports a very healthy population of amphibians, apparently dominated by an abundance of Spring Peepers, Gray Tree Frog and Wood Frog, with some Northern Leopard Frogs, American Toads and the occasional Bullfrog included in the mix. The species composition and abundance documented is comparable to that documented through the City's Natural Heritage Strategy amphibian surveys undertaken a little over a decade ago in this area (Dougan & Associates 2005). Once exception is Pickerel Frog (*Rana palustris*), an anuran species which is considered uncommon provincially (ranked as S4) and is rare and significant in Wellington County. Pickerel Frog was recorded as breeding in the PSA in previous field studies (Dougan & Associates 2005) but has not been documented since.

4.4.3.2 Amphibian Movement (Anurans and Salamanders)

Beacon also undertook visual road surveys to identify amphibian migration in the early spring and early fall, during or immediately after warm rain. Intensive amphibian movement monitoring undertaken on the former Dallan Lands just north of the SPA (east of the Cineplex theatre on Clair Road) (North-South Environmental Ltd. 2016) between 2014 and 2015 found that some of the most abundant movement was documented immediately following a warm rain (i.e., at temperatures of about 17°C) in both the spring and fall. Therefore, this methodology was adopted, except for one early spring round of surveys intended to try and capture salamander movement.

Transects for these surveys were identified in locations where there were prior and recent records of amphibian movement, or in locations where movement might be anticipated based on the presence of suitable habitat on either side of the road (ref. Map NH-2). Survey dates, times and weather conditions are presented in Table 4.4.7.

Table 4.4.7: Amphibian Movement Survey Details (2017)

Date	Time	Weather Conditions
March 27, 2017	20:10 - 00:15	8-11 °C, 100% Cloud Cover, Wind 0 km/h, Precipitation varied between dry, fog and drizzle
April 27, 2017	20:45 - 23:30	12-17 °C, 50-80% Cloud Cover, Wind 1-11 km/h, Thunderstorms in afternoon, drizzle during survey
September 27, 2017	19:38 - 21:55	14-18 °C, 70-80% Cloud Cover, Wind 1-11 km/h, No precipitation
October 4, 2017	19:25-22:06	14-18 °C, 100% Cloud Cover, Wind 1-19 km/h, Heavy rain in the last 24 hours, Fog during survey

Surveys were completed by walking slowly along the transects and identifying the location, species and number of live individuals attempting to cross the road or dead individuals that did not make it across successfully. While walking Transect W3 on Maltby Road (ref. Map NH-2), all existing wildlife culverts were checked for wildlife utilization. Results of the 2017 amphibian movement surveys are shown in Table 4.4.8.

Table 4.4.8: Amphibian Movement Survey Results (2017)

Transect # (ref. Map NH-2)	Species	27/03/2017		27/04/2017		27/09/2017		04/10/2017		Species Total	Transect Total
		Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead		
W1	Spring Peeper (*Pseudacris crucifer crucifer*)	-	-	-	-	-	-	4	6	**10**	**47**
	Green Frog (Rana *clamitans*)	-	-	-	-	-	-	7	3	**10**	
	Bullfrog (*Rana catesbeiana*)	-	-	-	-	-	-	-	1	**1**	
	Northern Leopard Frog (*Rana pipiens*)	-	-	-	-	-	-	-	2	**2**	
	Unknown Anuran spp.	-	-	-	-	-	-	-	24	**24**	
W2	Spring Peeper (*Pseudacris crucifer crucifer*)	7	1	-	-	1	-	23	6	**38**	**111**
	Gray Treefrog (*Hyla versicolor*)	-	-	1	-	-	-	2	-	**3**	
	Green Frog (*Rana clamitans*	-	-	5	-	-	-	8	2	**15**	
	Bullfrog (*Rana catesbeiana*)	-	-	-	-	-	-	-	1	**1**	
	Northern Leopard Frog (*Rana pipiens*)	3	-	-	-	1	-	1	15	**20**	
	Wood Frog (*Rana sylvatica*)	5	-	-	-	1	-	2	-	**8**	
	Unknown Anuran spp..	-	-	-	-	-	-	-	26	**26**	
W3	Spring Peeper (*Pseudacris crucifer crucifer*)	1	2	-	-	-	1	-	-	**4**	**174**
	American Toad (*Bufo americanus americanus*)	1	-	-	-	-	-	-	-	**1**	
	Gray Treefrog (*Hyla versicolor*)	-	-	-	2	-	-	-	-	**2**	
	Green Frog (*Rana clamitans*	-	-	2	1	-	-	6	19	**28**	
	Northern Leopard Frog (*Rana pipiens*)	1	2	-	-	1	2	4	38	**48**	
	Wood Frog (*Rana sylvatica*)	1	4	2	1	-	-	1	2	**11**	
	Western Chorus Frog (*Pseudacris triseriata*)	1	-	-	-	-	-	-	-	**1**	
	Unknown Anuran spp.	-	-	-	4	-	8	-	64	**76**	
	Blue-Spotted Salamander*	2	-	-	-	-	-	-	-	**2**	
	Eastern Newt (*Notophtalmus viridescens*)	-	-	-	-	-	-	-	1	**1**	
W4	Spring Peeper (*Pseudacris crucifer crucifer*)	-	1	-	-	-	-	-	3	**4**	**34**
	Gray Treefrog (*Hyla versicolor*)	-	-	-	6	-	-	1	2	**9**	
	Green Frog (*Rana clamitans*	-	-	-	-	-	-	-	1	**1**	
	Wood Frog (*Rana sylvatica*)	-	2	-	-	-	-	-	-	**2**	
	Unknown Anuran spp.	-	-	-	3	-	2	-	13	**18**	
W5	Spring Peeper (*Pseudacris crucifer crucifer*)	-	-	-	-	-	-	-	1	**1**	**69**
	Gray Treefrog (*Hyla versicolor*)	-	-	-	3	-	-	-	-	**3**	
	Green Frog (*Rana clamitans*	-	-	-	2	-	-	-	3	**5**	
	Bullfrog (*Rana catesbeiana*)	-	-	-	-	-	1	-	-	**1**	
	Northern Leopard Frog (*Rana pipiens*)	1	1	-	-	-	-	-	15	**17**	
	Unknown Anuran spp.	-	-	-	6	-	9	-	27	**42**	
W6	Spring Peeper (*Pseudacris crucifer crucifer*)	-	4	-	-	-	-	1	8	**13**	**73**
	Gray Treefrog (*Hyla versicolor*)	-	-	-	5	-	-	3	1	**9**	
	Wood Frog (*Rana sylvatica*)	-	2	-	-	-	-	-	-	**2**	
	Unknown Anuran spp.	-	-	-	10	-	16	-	23	**49**	
W7	Spring Peeper (*Pseudacris crucifer crucifer*)	-	-	-	-	-	-	-	1	**1**	**5**
	Gray Treefrog (*Hyla versicolor*)	-	-	-	-	-	-	1	-	**1**	
	Unknown Anuran spp.	-	-	-	1	-	2	-	-	**3**	
	Total	23	19	10	44	4	41	64	308	**513**	

Note: *Specimen was not captured or clipped for genetic testing but based on visual observation is identified as Blue-spotted dominated polyploid Salamander or Blue-spotted Salamander (*Ambystoma (2) laterale - jeffersonianum or Ambystoma laterale*).

The anuran species composition documented migrating across roads is similar to that recorded for breeding anurans (ref. Table 4.4.7) and reflects the presence of a healthy population of amphibians apparently dominated by an abundance of Spring Peepers, Gray Tree Frog and Wood Frog, with some Northern Leopard Frogs, American Toads and the occasional Bullfrog. Notably, most of the documented specimens over the four surveys in 2017 (i.e., 412 off 513, or 80.3%) were deceased (i.e., roadkill) and of these, almost half (i.e., 183 specimens or 36.8% of the total documented) could not be identified due to their condition beyond confirming they were anurans (i.e., frogs or toads).

The species of calling amphibians documented are also consistent with those documented during other amphibian movement surveys undertaken since 2000 in the PSA. These have included intensive amphibian movement surveys along Clair Road and Hawkins Drive in the area of the Hawkins SWM Pond and the wetland to the east in the northern section of the PSA over 2014 and 2015 (NSEI 2016), and along Maltby Road West in the vicinity of W3 (McEachren 2012, NRSI 2012b, c).

Two non-calling amphibian species documented during the movement surveys included one Eastern Newt (*Notophtalmus viridescens*) and two Blue-spotted Salamanders/Blue-spotted dominated polyploid Salamanders (identified as *Ambystoma laterale* or *Ambystoma (2) laterale - jeffersonianum* based on visual observation). Both of these species were recorded in Transect W3 (ref. Map NH-2) and are shown in Photos 4 and 6 in Appendix NH-2. Eastern Newt are ranked S5, meaning they are common, widespread and abundant in Ontario, while Blue-spotted Salamanders/Blue-spotted dominated polyploid Salamanders are considered uncommon provincially, and significant and rare in Wellington County.

In addition to the salamanders observed during the amphibian movement surveys, efforts were made to capture incidental observations of movement during the turtle surveys. Searches for salamanders were also completed by overturning small to medium-sized natural cover objects (e.g., logs and rocks) in proximity to wetland features. These efforts yielded one additional observation in 2017: a juvenile salamander that could not be identified was seen swimming in the pond just south of the South End Community Park (i.e., Turtle Basking Monitoring Station T1, ref. Map NH-2).

Based on the background review, Blue-spotted /Blue-spotted dominated polyploid Salamanders had been noted in the vicinity of Transect W3 in previous years. As part of previous studies, tail samples had been collected to verify if species were Jefferson/Jefferson dominated polyploid Salamanders (*Ambystoma jeffersonianum /Ambystoma laterale - (2) jeffersonianum*), but all the results came back negative for Jefferson Salamander (Dance Environmental Inc. 2014, NRSI 2012b, c). Furthermore, the MNRF response to an inquiry about the need for targeted salamander surveys as part of the Secondary Plan project from the City in the fall of 2015 stated:

> *Ministry staff have reviewed Guelph District data and are of the opinion that there is a very low likelihood of there being any JESA regulated habitat within the Clair Maltby Secondary Plan Area. Based on the information available, it appears that the area has been extensively surveyed and no recent records of JESA have been identified. Ministry staff are of the opinion that the Clair Maltby Secondary Plan Area should not require any further surveys at this time (T. McKenna, September 29, 2015).*

Therefore, comprehensive surveys for salamanders were not undertaken as part of this project (in accordance with the direction above). No incidental evidence from the 2017 studies supports the presence of Jefferson/Jefferson dominated polyploid Salamanders within the PSA.

Two non-calling amphibian species that are rare and significant in Wellington County (Dougan & Associates with Snell and Cecile 2009b) were recorded in previous studies, but were not observed in 2017: Yellow-spotted Salamander (*Ambystoma maculatum*) (NRSI 2012c, Timmerman et al. 2010, NRSI 2007) and Red-spotted Newt (*Notophtalmus viridescens viridescens*) (NRSI 2012c, Dougan & Associates 2005).

As can be seen in Table 4.4.8, Transect W3 had the highest species diversity and abundance (174 individuals) recorded during the amphibian movement surveys conducted in 2017, with the greatest abundance of movement documented in October 2017. Other transects that had relatively high numbers of amphibians crossing over 2017 included: Transect W2 (111 individuals), Transect W6 (73 individuals) and Transect W5 (69 individuals). Amphibian movement corridors are discussed further in Section 4.4.6.

The large migration on October 4, 2017 speaks to the stochastic nature of amphibian movement and the importance of timing surveys appropriately. The relatively high numbers recorded on this night is likely because the survey took place on a warm, foggy night soon after a thunderstorm. On this night, 372 amphibians were documented crossing the road on all 7 transects, of which 308 of them were documented as roadkill.

4.4.3.3 Turtles

Turtle surveys were conducted twice in 2017 within the PSA for the nine (9) ponds/wetlands that were identified as suitable overwintering and basking habitat for turtles. Notably, April 26 and 27, 2017 was one round of surveys spread over two dates. The nine survey stations were located where access had been granted or could be viewed from the road ROW (ref. Map NH-2). The turtle surveys were completed on sunny days when the air temperature was greater than 10°C and was greater than the water temperature (further details are provided in Table 4.4.9).

Table 4.4.9: Turtle Survey Details (2017)

Date	Time	Weather Conditions
April 26, 2017	14:00 - 15:00	18 °C, 90% Cloud Cover, Wind 6-19 km/h, No precipitation
April 27, 2017	10:30 - 16:15	25 °C, 10 - 50% Cloud Cover, Wind 1-28 km/h, No precipitation
May 18, 2017	10:00 - 16:30	25-29 °C, 30-40% Cloud Cover, Wind 12-38 km/h, No precipitation

During each survey, suitable basking areas within the selected wetlands/ponds were surveyed by slowly traveling around the outer edge of the feature, pausing frequently to scan for turtles. The species, number and general location of turtles observed were recorded and noted on field maps. The results are shown in Table 4.4.10.

Table 4.4.10: Turtle Survey Results (2017)

Location (ref. Map NH-2)	Species	Date	Number
T1 (Tim Horton's Pond)	Midland Painted Turtle (*Chrysemys picta marginata*)	April 27, 2017	36
		May 17, 2017	37
	Snapping Turtle (*Chelydra serpentine*)	April 27, 2017	1
		May 17, 2017	0
T2	Midland Painted Turtle (*Chrysemys picta marginata*)	April 27, 2017	10
		May 17, 2017	0
T3	Midland Painted Turtle (*Chrysemys picta marginata*)	April 27, 2017	8
		May 17, 2017	1
T4	Midland Painted Turtle (*Chrysemys picta marginata*)	April 27, 2017	0
		May 17, 2017	0
T5	Midland Painted Turtle (*Chrysemys picta marginata*)	April 27, 2017	2
		May 17, 2017	1
T6	Midland Painted Turtle (*Chrysemys picta marginata*)	April 27, 2017	0
		May 17, 2017	2
	Snapping Turtle (*Chelydra serpentine*)	April 27, 2017	1
		May 17, 2017	1
T7	Midland Painted Turtle (*Chrysemys picta marginata*)	April 27, 2017	4
		May 17, 2017	19
	Snapping Turtle (*Chelydra serpentine*)	April 27, 2017	2
		May 17, 2017	1
T8	Midland Painted Turtle (*Chrysemys picta marginata*)	April 27, 2017	37
		May 17, 2017	58
	Snapping Turtle (*Chelydra serpentine*)	April 27, 2017	1
		May 17, 2017	2
T9 (Halligan's Pond)	Midland Painted Turtle (*Chrysemys picta marginata*)	April 26, 2017	15
		May 17, 2017	5
	Red-eared Slider (*Trachemys scripta elegans*)	April 26, 2017	1
		May 17, 2017	0

Three (3) species of turtle were found in the PSA during the turtle surveys: Midland Painted Turtle (*Chrysemys picta marginata*), Red-eared Slider (*Trachemys scripta elegans*) and Snapping Turtle (*Chelydra serpentine*). Midland Painted Turtle is ranked S5, meaning it is considered common, widespread and abundant in Ontario. Red-eared Slider has a S-rank of SE since it is an exotic species (i.e., non-native). Snapping Turtle is listed as a species of Special Concern both federally and provincially, has an S-rank of S3 (uncommon in Ontario) and is considered significant and rare in Wellington County. A picture of a Snapping Turtle observed is shown in Photo 8 of Appendix NH-2.

In addition to the turtles recorded in and around the ponds surveyed areas, nine (9) dead turtles were noted along Gordon Street and Maltby Road during the 2017 field surveys, as follows:

- One (1) Snapping Turtle on Gordon Street;
- Three (3) Midland Painted Turtles on Gordon Street (see Photo 5 in Appendix NH-2);
- One (1) Turtle spp. on Gordon Street (unable to identify species due to decomposition);
- One (1) Snapping Turtle on Maltby Road (east of Gordon Street);
- Two (2) Midland Painted Turtles on Maltby Road (east of Gordon Street); and
- One (1) Midland Painted Turtles on Maltby Road (west of Gordon Street).

These results are comparable with others conducted in the PSA in terms of species diversity which also documented Midland Painted Turtle and Snapping Turtle (NSEI 2016, NSEI 2015, NSEI 2014, Dance Environmental Inc. 2014, McEachren 2012, NRSI 2012b, NRSI 2011, NRSI 2010, Timmerman et al. 2010, NRSI 2007, Stantec 2007). This year (2017) was the first time the exotic Red-eared Slider was observed within the PSA.

4.4.3.4 Snakes

Surveys for snakes were undertaken in conjunction with vegetation and turtle surveys, and included overturning selected natural cover objects (e.g., logs and rocks) and incidental observations within the PSA completed over the summer and fall of 2017. Targeted surveys for snakes were not included in the scope of work due to the intensive nature of the surveys required and their relatively low success rates, the somewhat broad scale of this study, and the expectation that such data would not change the outcome of the CEIS exercise.

Species that were observed incidentally during the field surveys conducted in 2017 are summarized in Table 4.4.11.

<table>
<tr><th colspan="4">Table 4.4.11: Incidental Snake Observations in 2017</th></tr>
<tr><th>Survey Dates</th><th>Species</th><th>Number of Individuals</th><th>Location (ref. Map NH-2)</th></tr>
<tr><td rowspan="7">Amphibian Movement Surveys (March 27, April 27, September 27, and October 4, 2017)</td><td rowspan="4">Eastern Garter Snake (Thamnophis sirtalis sirtalis)</td><td>2</td><td>Maltby Road West (W3)</td></tr>
<tr><td>1</td><td>Maltby Road East (W2)</td></tr>
<tr><td>1</td><td>Gordon Street (W5)</td></tr>
<tr><td>1</td><td>Victoria Road (W6)</td></tr>
<tr><td>Northern Water Snake (Nerodia sipedon sipedon)</td><td>1</td><td>Maltby Road East (W2)</td></tr>
<tr><td>Brown Snake (Storeria dekayi dekayi)</td><td>1</td><td>Maltby Road West (W3)</td></tr>
<tr><td>Snake spp. (roadkill)</td><td>1</td><td>Victoria Road (W7)</td></tr>
<tr><td rowspan="2">Turtle Surveys (April 26/27 and May 18, 2017)</td><td>Eastern Ribbon Snake (Thamnophis sauritus septentrionalis)</td><td>4*</td><td>Tim Horton's Pond - Station 1 (T1)</td></tr>
<tr><td>Eastern Garter Snake (Thamnophis sirtalis sirtalis)</td><td>4</td><td>Tim Horton's Pond - Station 1 (T1)</td></tr>
</table>

Note: * Four (4) Eastern Ribbon Snakes seen on April 7, 2017 and three (3) seen on May 18, 2017 so assumed 4 species located here in total.

In total, four (4) species of snakes were recorded in 2017. These species included: Eastern Garter Snake (*Thamnophis sirtalis sirtalis*), Northern Water Snake (*Nerodia sipedon sipedon*), Brown Snake (*Storeria dekayi dekayi*) and Eastern Ribbon Snake (*Thamnophis sauritus septentrionalis*). Note that one snake species could not be identified due to its condition on the road. The majority of these species are considered common, widespread and abundant provincially, with the exception of Eastern Ribbon Snake, which is ranked as S4 (uncommon in Ontario). This snake is also listed federally and provincially as Special Concern. A picture of an Eastern Ribbon Snake is shown in Photo 7 in Appendix NH-2. Northern Water Snake, Brown Snake and Eastern Ribbon Snake are all considered rare and significant in Wellington County.

These findings are consistent with other studies in the PSA which have documented the same snake species (NSEI 2016, NSEI 2015, NSEI 2014, Dance Environmental Inc. 2014, McEachren 2012, NRSI 2012b, NRSI 2012c, NRSI 2011, NRSI 2010, NRSI 2007, Black et al. 2005, NSEI 2001), except for Northern Water Snake, which was documented for the first time in the PSA in 2017. Previous field studies also documented Redbelly Snake (*Storeria o. occipitomaculata*) (NSEI 2016, NSEI 2015, NSEI 2014, Dance Environmental Inc. 2014, McEachren 2012, NRSI 2012c, NRSI 2011, NRSI 2010, NRSI 2007, Black et al. 2005, NSEI 2001), which is a rare and significant species in Wellington County, and was not documented in 2017.

4.4.3.5 Birds

Two rounds of surveys for breeding birds took place in the PSA to confirm what species of birds are nesting in the area. A total of fifteen (15) point count survey stations were surveyed along roads and where access was provided (ref. Maps G-2 and NH-2). Point count survey stations were established within and adjacent the various representative habitat types within the PSA (ref. Table 4.4.3). No stations were established along

Gordon Street, as it was assumed that there is too much traffic along this road, even in the early morning, to yield useful results.

Surveys were conducted using the protocols provided in the Ontario Breeding Bird Atlas (OBBA) Guide for Participants (Cadman et al. 2007) at an appropriate time of day (i.e., between dawn and five hours after dawn) and under suitable weather conditions (i.e., no thick fog or precipitation; winds generally less than 20 km/h). Observations made were recorded using a form based on the OBBA protocols (as provided in the Work Plan for this project). Observations made between point count stations will also be recorded. Survey details are presented in Table 4.4.12.

Table 4.4.12: Breeding Bird Survey Details

Date	Time	Weather Conditions
June 7, 2017	5:30 - 9:30	6-15 °C, 10% cloud cover, wind 1-11 km/h, No precipitation
June 20, 2017	5:21 - 8:55	16 °C, 100% cloud cover, wind 6-11 km/h, No precipitation

A total of sixty-seven (67) species of birds were recorded in the PSA in 2017, sixty (60) of which were breeding or suspected to be breeding. An additional forty-five (45) species were documented through other studies in the PSA since 2000, for a total of one-hundred and twelve (112) bird species recorded, 109 of which were confirmed breeding or suspected to be breeding. These differences likely related to variations in species composition over the years and limited access to certain habitat types in the SPA during the 2017 surveys. Most of the bird species documented are considered common, abundant and widespread in Ontario (S5) or uncommon in the Province (S4), or not a suitable target for conservation activities (SNA).

Of the one-hundred and twelve (112) bird species documented, six are SAR. Four are provincially Endangered or Threatened, and two are listed as Special Concern provincially:

- Yellow-breasted Chat (*Icteria virens*) (Endangered) – documented just west of the SPA on the 385 Maltby Road West lands (NRSI 2012b, NRSI 2012c, NRSI 2007);
- Barn Swallow (*Hirundo rustica*) (Threatened) - documented around the barn on 2162 Gordon Street during the field surveys conducted by Beacon in 2017, in the west section of the SPA on the 132 Clair Road West lands (NSEI 2015), west of SPA on the 424 Maltby Road property (Dance Environmental Inc. 2014), on the 385 Maltby Road West lands (NRSI 2012c, NRSI 2007), just north of SPA at the 1897 Gordon Street property (Aboud and Associates Inc. 2010), at 331 Clair Road (NRSI 2012a) and on 1858 Gordon Street (the former Pergola Lands) (Stantec 2014);
- Bobolink (*Dolichonyx oryzivorus*) (Threatened) - documented in the west section of the SPA on the 132 Clair Road West lands (NSEI 2015), north of the SPA near Dallan Drive (Stantec 2009) and at 1858 Gordon Street (Stantec 2014);
- Eastern Meadowlark (*Sturnella magna*) (Threatened) - documented west of the SPA on the 950 Southgate Drive property and east of the SPA on the 1825 Victoria Road South property during the breeding bird surveys conducted by Beacon in 2017, in the west section of the SPA on the 132 Clair Road West lands (NSEI 2015), west of the SPA on the 385 Maltby Road West lands (NRSI 2012c, NRSI 2007), and north of the SPA at 1858 Gordon Street (Stantec 2014);

- Eastern Wood-pewee (*Contopus virens*) (Special Concern) - documented throughout the SPA and PSA by Beacon in 2017, including breeding bird stations 2, 5, 6, 8, and 10, north of the SPA near Dallan Drive (NSEI 2014, Stantec 2007), and west of SPA at the 424 Maltby Road property (Dance Environmental Inc. 2014) and the 385 Maltby Road West lands (NRSI 2007); and
- Wood Thrush (*Hylocichla mustelina*) (Special Concern) - documented north of the SPA near Dallan Drive (NSEI 2014, Stantec 2007).

Significant Wildlife Species are discussed further in Section 4.4.4.

Forty-six (46) of the total one-hundred and twelve (112) bird species documented are considered significant in Wellington County, while 21 are considered rare in Wellington County (Dougan & Associates with Snell and Cecile 2009b*)*. These locally significant species are listed in Section 4.4.4.3 below. The Significant Wildlife list for Wellington County (Dougan & Associates with Snell and Cecile 2009b) qualifies that some species' habitats should only be considered significant if they support, or have recently supported, active nests. Four additional species of birds observed within the PSA and SPA (i.e., Great Blue Heron (*Ardea herodias*), Ring-billed Gull (*Larus delawarensis*), Herring Gull (*Larus argentatus*) and Cliff Swallow (*Petrochelidon pyrrhonota*)), would have been classified as significant had nest been documented.

A complete list of bird species documented within the PSA with details about their statuses is provided in Appendix NH-5.

4.4.3.6 Other Wildlife

Winter Wildlife

Winter wildlife surveys were included in the scope of work for this study to document site utilization by certain wildlife during the winter months and to help screen for certain types of SWH. This included searches for seepage areas, which can be observed in the winter (ref. Photo 15, Appendix NH-2).

Beacon only completed one winter wildlife survey under snow cover on February 15, 2017 along five established transects (ref. Map NH-2) due to the limited snowfall over the winter. An additional survey will be undertaken during the winter of 2018. These surveys specifically record evidence of mammal (with a particular focus on deer movement) and raptor use by walking transects in areas that are representative of the various habitats present within the PSA, and where access has been provided (ref. Map NH-2).

The winter wildlife surveys in 2017 documented evidence of: Eastern Cottontail (*Sylvilagus floridanus*), Gray Squirrel (*Sciurus carolinensis*), Coyote (*Canis latrans*), Raccoon (Procyon lotor), White-tailed Deer (*Odocoileus virginianus*).These results are consistent with previous studies' findings conducted in the PSA and SPA (NSEI 2016, NSEI 2015, Dance Environmental Inc. 2014, Stantec 2014, McEachren 2012, NRSI 2012b, NRSI 2012c, NRSI 2011, Aboud and Associates 2010, NRSI 2010, Timmerman et al. 2010, NRSI 2007, Stantec 2007, Black et al. 2005, NRSI 2001). The supplemental background information also indicates there are additional mammals present in the SPA and PSA including species such as Northern Short-tailed Shrew (*Blarina brevicauda*), Woodchuck (*Marmota monax*), Muskrat (*Ondatra zibethicus*) and Mink (*Mustela vison*). A complete list of mammals that were recorded by previous studies that were not observed by Beacon in 2017 are is provided in Appendix NH-5.

Additionally, common bird species that do not migrate were observed during the winter wildlife survey including Black-capped Chickadee (*Poecile atricapillus*), Wild Turkey (*Meleagris gallopavo*) and American

Crow (*Corvus brachyrhynchos*). These species of birds were observed during other field surveys conducted by Beacon in 2017, and have also been documented by numerous studies previously conducted in the PSA and SPA (for more details refer to Appendix NH-5).

No raptors or stick nests were observed during the winter wildlife surveys in 2017. However, there is suitable habitat for raptor wintering (one of the SWH types) in the PSA. Raptors (i.e., hawks and owls) require at least 20 ha that is comprised of a combination of forest (deciduous, coniferous or mixed) and open or semi-open successional uplands. A comprehensive screening for all SWH categories is provided in Section 4.4.5.

A large number of deer tracks were recorded in the agricultural fields and woodlands on 2162 Gordon Street (ref. Photo 1, Appendix NH-2). Wildlife linkages are discussed in Section 4.4.6.

Incidental Wildlife

Observations of wildlife in the PSA were made incidentally as part of all other targeted field surveys in 2017 (ref. Table 4.4.4.). This included scanning for Terrestrial (or Chimney) Crayfish around the margins of wet meadows and fields during surveys conducted between April and June 2017. This species is further discussed in the SWH screening in Section 4.4.5

Along with the incidental amphibian, reptile and bird species discussed in the preceding sub-sections, four (4) incidental mammal species, two (2) Odonate species (dragonflies and damselflies) and two (2) butterfly species were recorded by Beacon in 2017, as follows:

- Eastern Chipmunk (*Tamias striatus*);
- Red Squirrel (*Tamiasciurus hudsonicus*);
- Red Fox (*Vulpes Vulpes*);
- Domestic Dog (*Canis spp.*);
- Darner spp. (*Aeshna spp.*);
- Meadowfly spp. (*Sympetrum spp.*);
- Cabbage White (*Pieris rapae*); and,
- Monarch (*Danaus plexippus*).

All incidental wildlife recorded in 2017 and the supplemental field surveys are listed in Appendix NH-5. Incidental species that are considered significant are discussed in Section 4.4.4.

4.4.4 Significant Wildlife Species

Significant plant species documented within the PSA are discussed in Section 4.4.2.2. Significant wildlife species are discussed according to the following three categories, as different policies and regulation apply to each category:

a) Species at Risk (SAR) that are provincially Endangered and Threatened (which are subject to the *Endangered Species Act* (2007) under MNRF's jurisdiction) (ref. Section 4.4.4.1, Appendix NH-6);

b) Species of conservation concern under the City's policies for SWH (i.e., ranked as S1, S2 or S3 by the Ontario's Natural Heritage Information Centre (NHIC) and SAR not captured under (a)) (ref. Section 4.4.4.2, Appendix NH-7); and

c) Locally significant species (i.e., listed as rare or significant in the County of Wellington (Dougan & Associates with Snell and Cecile 2009b) but not captured under (a) or (b) (ref. Section 4.4.4.1, Appendix NH-5).

4.4.4.1 Provincially Endangered and Threatened Species at Risk

A list of twenty-four (24) wildlife SAR species that could potentially occur in the City of Guelph was provided for this project by the Guelph District MNRF on February 27, 2017. The thirteen (13) SAR that are provincially Endangered or Threatened from this list were screened in Appendix NH-6. This appendix describes the preferred habitat for each species, describes the known species range, indicates if suitable habitat is present in the SPA and/or PSA, and whether the species was confirmed in the SPA and/or PSA by recent field studies.

The following provincially Endangered or Threatened SAR have been confirmed in the SPA and/or PSA by Beacon or other studies (as noted in Appendix NH-5):

- Yellow-breasted Chat (*Icteria virens*) provincially and federally Endangered and confirmed as breeding in the southwestern portion of the PSA on 385 Maltby Road West (NRSI 2012b, NRSI 2012c, NRSI 2007);
- Barn Swallow (*Hirundo rustica*), provincially and federally Threatened and confirmed as nesting in barns/sheds in both the SPA and PSA near 2162 Gordon Street by Beacon, on 424 Maltby Road (Dance Environmental Inc. 2014) and 331 Clair Road (NRSI 2012a), and was also observed foraging in the west section of the SPA on the 132 Clair Road West lands (NSEI 2015), the 385 Maltby Road West lands (NRSI 2012c, NRSI 2007), north of SPA at the 1897 Gordon Street property (Aboud and Associates Inc. 2010) and on 1858 Gordon Street (former Pergola Lands) (Stantec 2014);
- Bobolink (*Dolichonyx oryzivorus*) provincially and federally Threatened and confirmed as breeding in grasslands in both the SPA and PSA in the west section of the SPA in the vicinity of the 132 Clair Road West lands (NSEI 2015), and north of the SPA near Dallan Drive (Stantec 2009) and Former Pergola Lands (Stantec 2014);
- Eastern Meadowlark (*Sturnella magna*) provincially and federally Threatened and confirmed as breeding in grasslands in both the SPA and PSA west of the SPA on the 950 Southgate Drive property and east of the SPA on the 1825 Victoria Road South property during the breeding bird surveys conducted by Beacon in 2017 (outside the City limits), in the west section of the SPA in the vicinity of the 132 Clair Road West lands (NSEI, 2015), west of the SPA on the 385 Maltby Road West lands (NRSI 2012c, NRSI 2007) and north of the SPA on the Former Pergola lands (Stantec 2014); and
- Eastern Small-footed Myotis (*Myotis leibii*), provincially Endangered, a bat species confirmed as breeding in the southwestern portion of the PSA within treed habitats on 424 Maltby Road West (Dance Environmental Inc. 2014).

Field studies for SAR bats were not included in the scope of work for this project, and were only undertaken by the most recent site-specific study in the PSA for 424 Maltby Road West (Dance Environmental Inc. 2014) as bats have only became listed as provincially Endangered in 2012, and provincial guidelines for assessing their habitat were still draft until April 2017. Therefore, site-specific surveys for SAR bats are likely to be required on properties with trees, particularly where trees are proposed for removal, as part of the EIS or EA process in the future.

Screening for all SAR listed in Appendix NH-6 should also be undertaken at the EIS or EA stage as suitable habitat is generally present in the area. Screening should also be undertaken for any newly listed species that may have suitable habitat in the SPA.

4.4.4.2 Species of Conservation Concern

In the City of Guelph, species of conservation concern (as defined under the City's SWH policies) (City of Guelph 2014) include:

- SAR that are not provincially Endangered or Threatened (i.e., that are only federally Endangered or Threatened, or Special Concern provincially or federally) (ref. Appendix NH-7), and
- Provincially "significant" for being ranked as S1, S2 or S3 by the NHIC.

A list of 24 wildlife SAR species that could potentially occur in the City of Guelph was provided for this project by the Guelph District MNRF on February 27, 2017. Western Chorus Frog, which is federally Threatened and has been documented in the PSA (ref. Section 4.4.3.1), was added to the list. The 12 SAR that are not provincially Endangered or Threatened from this list were screened in Appendix NH-7. This appendix describes the preferred habitat for each species, describes the known species range, indicates if suitable habitat is present in the SPA and/or PSA, and whether the species was confirmed in the SPA and/or PSA by recent field studies.

The following non-provincially Endangered or Threatened SAR have been confirmed in the SPA and/or PSA by Beacon or other studies (as noted in Appendix NH-7):

- Western Chorus Frog, federally Threatened, and confirmed in the western portion of the SPA and PSA by Beacon in 2017 along Transect W3 (ref. Map NH-2), by Dougan & Associates (2005) on 201 Maltby Road West and by NRSI (2012b and 2007) on the 385 Maltby Road West property, and was also previously noted near 161, 205 and 253 Clair Road East (NRSI 2016, Stantec 2009, Stantec 2007). Dougan & Associates (2005) also recorded Western Chorus Frog within the ponds east and west of Gordon Road in the SPA (near Transect W3, ref. to Map NH-2);
- Eastern Ribbon Snake, Special Concern provincially and federally and confirmed in the "Tim Horton's" pond (Basking Turtle Monitoring Station T1 ref. Map NH-2) behind the baseball diamonds south of Bishop MacDonell High School by Beacon in 2017, and also within ponds on the 385 Maltby Road West property (NRSI 2012b, NRSI 2012c, NRSI 2007);
- Snapping Turtle, Special Concern provincially and federally, was confirmed basking by Beacon in 2017 in various ponds in the SPA and PSA (ref. Section 4.4.3.3, Table 4.4.10, Map NH-2), and was also observed nesting within wetlands located in the northern central PSA in the vicinity of Dallan Drive. North-South Environmental (2016) noted Snapping Turtle basking and nesting close to the SWM Pond and wetland just east of Hawkins Drive, while Stantec (2007) observed nesting Snapping Turtle in a wetland south of Dallan Drive within the SPA. Additionally, Snapping Turtle was confirmed within the Halls' Pond Wetland Evaluation (Timmerman et al. 2010) and on the 385 Maltby Road West Lands (NRSI 2007) ;
- Wood Thrush (*Hylocichla mustelina*), Special Concern provincially and federally Threatened, confirmed in the forested mid-northern portion of the PSA in close proximity to Dallan Drive (NSEI 2014, Stantec 2007);
- Eastern Wood-pewee (*Contopus virens*), Special Concern provincially and federally, confirmed in various forested habitats in the SPA and PSA by Beacon in 2017, including Breeding Bird stations B2, B5, B6, B8, and B10, north of the SPA near Dallan Drive (NSEI 2014, Stantec 2007), and west of SPA at the 424 Maltby Road property (Dance Environmental Inc. 2014) and the 385 Maltby Road West lands (NRSI 2007); and

- Monarch (*Danaus plexippus*), Special Concern provincially and federally, confirmed in the SPA and PSA in some meadow habitats in the following locations: 132 Clair Road West (NSEI 2015), 161, 205 and 253 Clair Road East (NSEI 2014, Stantec 2007), 424 Maltby Road (Dance Environmental Inc. 2014), Westminster Wood East (Stantec 2009, 2007), along Victoria Road (McCormick Rankin Corporation, and Gamsby and Mannerow Limited 2003) and 385 Maltby Road West. Additionally, Monarch was noted dead on the side of the road twice during the amphibian movement surveys (as discussed in Section 4.4.3.2) on Transect W3 and W6 (ref. to Map NH-2).

There are no other wildlife species considered provincially significant confirmed in the SPA and/or PSA by Beacon or other studies other than those listed above (ref. Appendix NH-5).

Although not all species listed in Appendix NH-7 have been confirmed in the SPA, screening for all SAR listed should be undertaken at the EIS or EA stage as suitable habitat is generally present in the area. Screening should also be undertaken for any newly listed species that may have suitable habitat in the SPA.

4.4.4.3 Locally Significant Species

In the City of Guelph, "locally significant species" are those wildlife species listed in the Significant Species List for Wellington County developed as part of the Natural Heritage Strategy (Dougan & Associates with Snell & Cecile 2009b) that are not already captured as provincially Endangered or Threatened, or as conservation concern (as described in Section 4.4.4.2 above).

The detailed methods used for determining what wildlife are locally significant or rare are provided in the Natural Heritage Strategy, Phase 2, Volume 2 (Dougan & Associates with Snell & Cecile 2009b). In brief, the methods to identify species beyond those that are federally or provincially of Endangered, Threatened or Special Concern, or with NHIC statuses of S1, S2, S3 or S3/S4 were as follows:

- Most species identified as "significant" in Wellington County were also considered "rare", with the exception of a number of birds identified as "significant" based primarily on their specialized habitat requirements (e.g., area sensitivity) and not their relative abundance in the County;
- Species were generally confirmed as being documented in the County based on their presence in at least one of 10 km by 10 km UTM squares (also called "atlas squares") overlapping with the County;
- Birds with probable or confirmed breeding evidence 23.33% of the atlas squares or less were considered rare and significant;
- Amphibians and reptiles recorded in 23.33% of the atlas squares or less were considered rare and significant;
- Mammals documented in evidence 10% of the atlas squares or less and representing less than 1% of all records were considered rare and significant; and
- For damselflies, dragonflies and butterflies no locally significant or rare species were added beyond those already identified as provincially significant due to the lack of data.

Data from the field studies conducted by Beacon in 2017 and the background reports in the PSA (ref. Appendix NH-1) were screened for wildlife species that considered locally significant or rare. From this analysis, it was determined that forty-two (42) species of birds, six amphibian species, three species of reptile, one mammal, two Odonates and one butterfly species have been documented within the PSA. These species are listed in Table 4.4.13. Details of studies in which each of these species was documented is provided in Appendix NH-5.

Table 4.4.13: Summary of Locally Significant Wildlife Species in the Primary Study Area (PSA)

Common Name	Scientific Name	Wellington County Status*	Breeding Status**	Location
Birds				
Pied-billed Grebe	*Podilymbus podiceps*	S,R	Y	PSA and SPA
Ring-necked Duck	*Aythya collaris*	S,R	N	PSA and SPA
Common Merganser	*Mergus merganser*	S,R	N	SPA
Turkey Vulture	*Cathartes aura*	S,R	N	PSA
Osprey	*Pandion haliaetus*	S,R	Y	PSA and SPA
Northern Harrier	*Circus cyaneus*	S	Y	PSA
Sharp-shinned Hawk	*Accipiter striatus*	S	Y	PSA
Cooper's Hawk	*Accipiter cooperi*	S	Y	PSA and SPA
Red-shouldered Hawk	*Buteo lineatus*	S,R	N	PSA
Broad-winged Hawk	*Buteo platypterus*	S,R	Y	PSA
Sora	*Porzana carolina*	S,R	Y	PSA
Black-billed Cuckoo	*Coccyzus erythropthalmus*	S	Y	PSA
Yellow-billed Cuckoo	*Coccyzus americanus*	S,R	Y	PSA
Yellow-bellied Sapsucker	*Sphyrapicus varius*	S	Y	PSA
Hairy Woodpecker	*Picoides villosus*	S	Y	PSA and SPA
Northern Flicker	*Colaptes auratus*	S	Y	PSA and SPA
Pileated Woodpecker	*Dryocopus pileatus*	S	Y	PSA and SPA
Willow Flycatcher	*Empidonax traillii*	S	Y	PSA and SPA
Least Flycatcher	*Empidonax minimus*	S	Y	PSA and SPA
Eastern Kingbird	*Tyrannus tyrannus*	S	Y	PSA and SPA
Common Raven	*Corvus corax*	S,R	Y	PSA
Red-breasted Nuthatch	*Sitta canadensis*	S	Y	PSA
Brown Creeper	*Certhia americana*	S	Y	PSA
Winter Wren	*Troglodytes hiemalis*	S	Y	PSA
Ruby-crowned Kinglet	*Regulus calendula*	S,R	N	PSA
Brown Thrasher	*Toxostoma rufum*	S	Y	PSA and SPA
Magnolia Warbler	*Setophaga magnolia*	S,R	Y	PSA
Black-throated Green Warbler	*Setophaga virens*	S,R	Y	PSA
Pine Warbler	*Setophaga pinus*	S	Y	PSA and SPA
Black-and-white Warbler	*Mniotilta varia*	S	Y	PSA
American Redstart	*Setophaga ruticilla*	S	Y	PSA and SPA
Scarlet Tanager	*Piranga olivacea*	S,R	Y	SPA

Table 4.4.13: Summary of Locally Significant Wildlife Species in the Primary Study Area (PSA)				
Common Name	**Scientific Name**	**Wellington County Status***	**Breeding Status****	**Location**
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S	Y	PSA and SPA
Eastern Towhee	*Pipilio erythrophthalmus*	S	Y	PSA and SPA
Field Sparrow	*Spizella pusilla*	S	Y	PSA and SPA
Vesper Sparrow	*Pooecetes gramineus*	S	Y	PSA and SPA
Savannah Sparrow	*Passerculus sandwichensis*	S	Y	PSA and SPA
Grasshopper Sparrow	*Ammodramus savannarum*	S,R	Y	PSA
Dark-eyed Junco	*Junco hyemalis*	S,R	Y	PSA
Brewer's Blackbird	*Euphagus cyanocephalus*	S,R	Y	PSA
Baltimore Oriole	*Icterus galbula*	S	Y	PSA and SPA
Amphibians				
Bullfrog	*Rana catesbeiana*	S,R	Y	PSA and SPA
Pickerel Frog	*Rana palustris*	S,R	Y	PSA and SPA
Blue-spotted Salamander	*Ambystoma laterale*	S,R	Y	PSA
Blue-spotted dominated polyploid Salamander	*Ambystoma (2) laterale - jeffersonianum*	S,R	Y	PSA
Yellow (Spotted) Salamander	*Ambystoma maculatum*	S,R	Y	PSA and SPA
Red-spotted Newt	*Notophtalmus viridescens viridescens*	S,R	Y	PSA and SPA
Reptiles				
Northern Water Snake	*Nerodia sipedon sipedon*	S,R	Y	PSA
Brown Snake	*Storeria dekayi dekayi*	S,R	Y	PSA
Redbelly Snake	*Storeria o. occipitomaculata*	S,R	Y	PSA and SPA
Mammals				
Long-tailed Weasel	*Mustela frenata*	S,R	N	PSA
Insects				
Sweetflag Spreadwing	*Lestes forcipatus*	S,R	Y	PSA
Citrine Forktail	*Ischnura hastata*	S,R	Y	PSA
Giant Swallowtail	*Papilio cresphontes*	S,R	Y	PSA

Notes: *Significant Wildlife List for Wellington County from the City of Guelph Natural Heritage Strategy, Volume 2 (Dougan & Associates with Snell and Cecile 2009). S = Significant, R = Rare

**Species confirmed or suspected to be breeding. Y = Yes, N = No

5.0 OVERVIEW OF PROPOSED 2018 MONITORING

The following provides an overview of the proposed 2018 monitoring program.

5.1 Surface Water

The 2018 surface water field assessments will commence in early spring, with the same locations and monitoring equipment as the 2017 field program. As such the surface water flow monitoring program will include:

- Rainfall monitoring at Guelph Home Building Supply and EMS Station on Clair Road
- Continuous water level and temperature monitoring at flow Station 14 (Puslinch Channel, Mill Creek) and Station 15 (Hanlon Creek).
- Continuous water level and temperature monitoring at wetland Stations 1 through 13, excluding Station 9.
- Grab water quality sampling and *in situ* quality sampling at flow Stations 14 and 15 for dry weather and wet weather events throughout spring, summer and fall of 2018.
- Grab water quality sampling and *in situ* quality sampling at wetland Stations 1 through 13 (excluding Station 9) during a wet weather event in the spring and fall, and a dry weather event in the summer of 2018.

5.2 Groundwater

For groundwater monitoring, it is proposed to continue regular monitoring of all hydrogeological monitoring stations. This monitoring will include:

- Quarterly water level monitoring of monitoring wells (manual water levels and transducer downloads)
- Quarterly water level monitoring of mini-piezometers (manual water levels and transducer downloads). Transducers will be re-installed into the mini-piezometers in spring 2018.
- Water quality sampling in the spring and fall at all Matrix-installed monitoring wells. Samples will be analyzed for the same general and inorganic parameters and dissolved metals that were tested for in 2016 and 2017.
- Spot base flow measurements will continue at all 27 locations in the spring, summer and fall.

Ongoing documentation of observed seeps and / or springs as they are encountered through the field visits throughout the SSA.

5.3 Natural Heritage

The bulk of the natural heritage monitoring and assessments took place over 2017. In 2018 it is proposed that the following additional work be conducted to supplement the work done to date:

- Winter wildlife surveys to supplement the single survey done in 2017;
- Field verification of the potential headwater drainage features identified (ref. Map NH-3) based on primarily desktop information where access has been provided; and
- Ecological Land Classification (ELC) refinements, plant surveys, amphibian surveys and breeding bird surveys on properties where access was provided after the 2017 field season was complete.

  If suggestions for additional work are brought forward by the TAG, CWT, EAC and/or RSAC these will be considered and accommodated to the greatest extent possible within the scope of this project.

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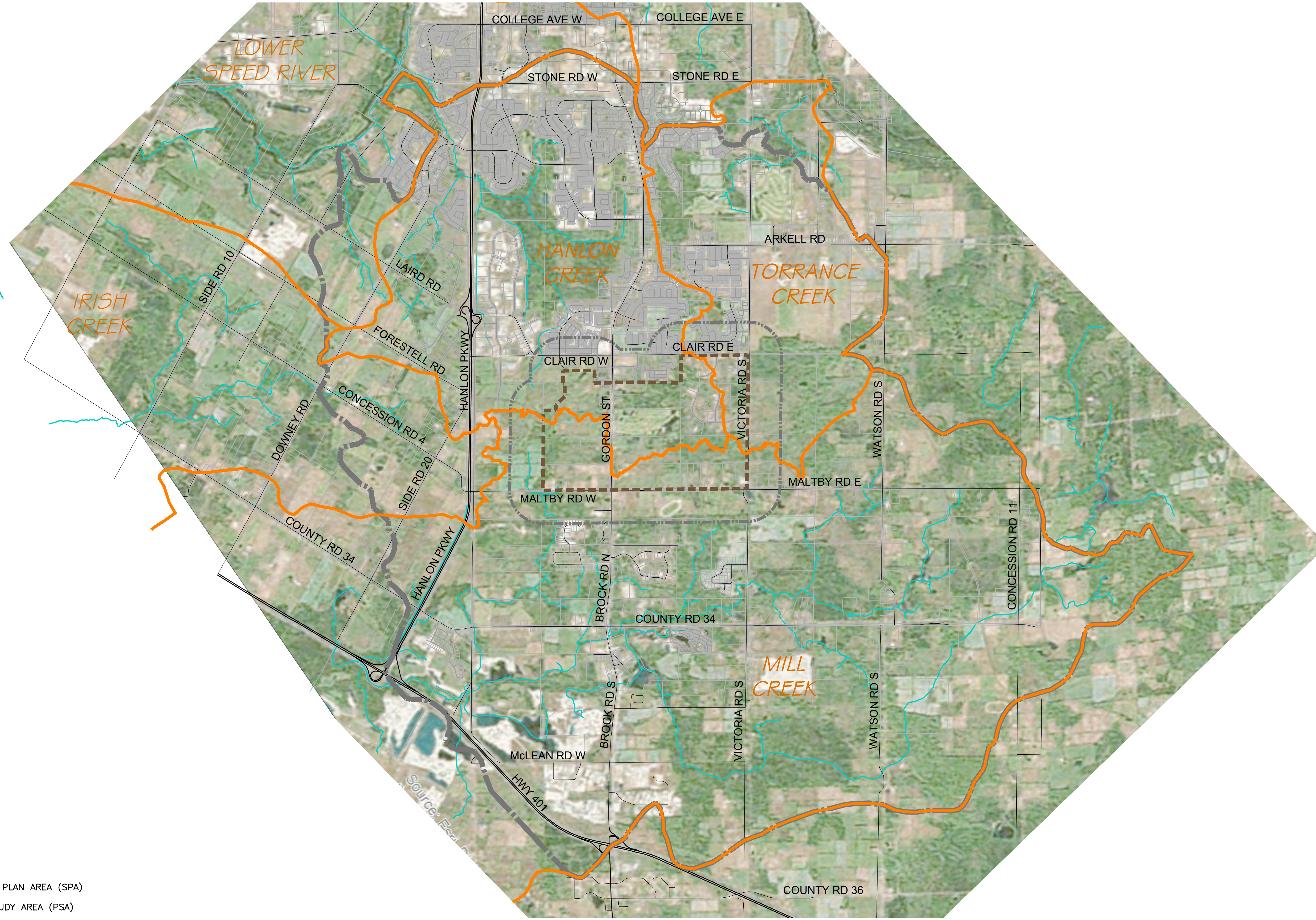
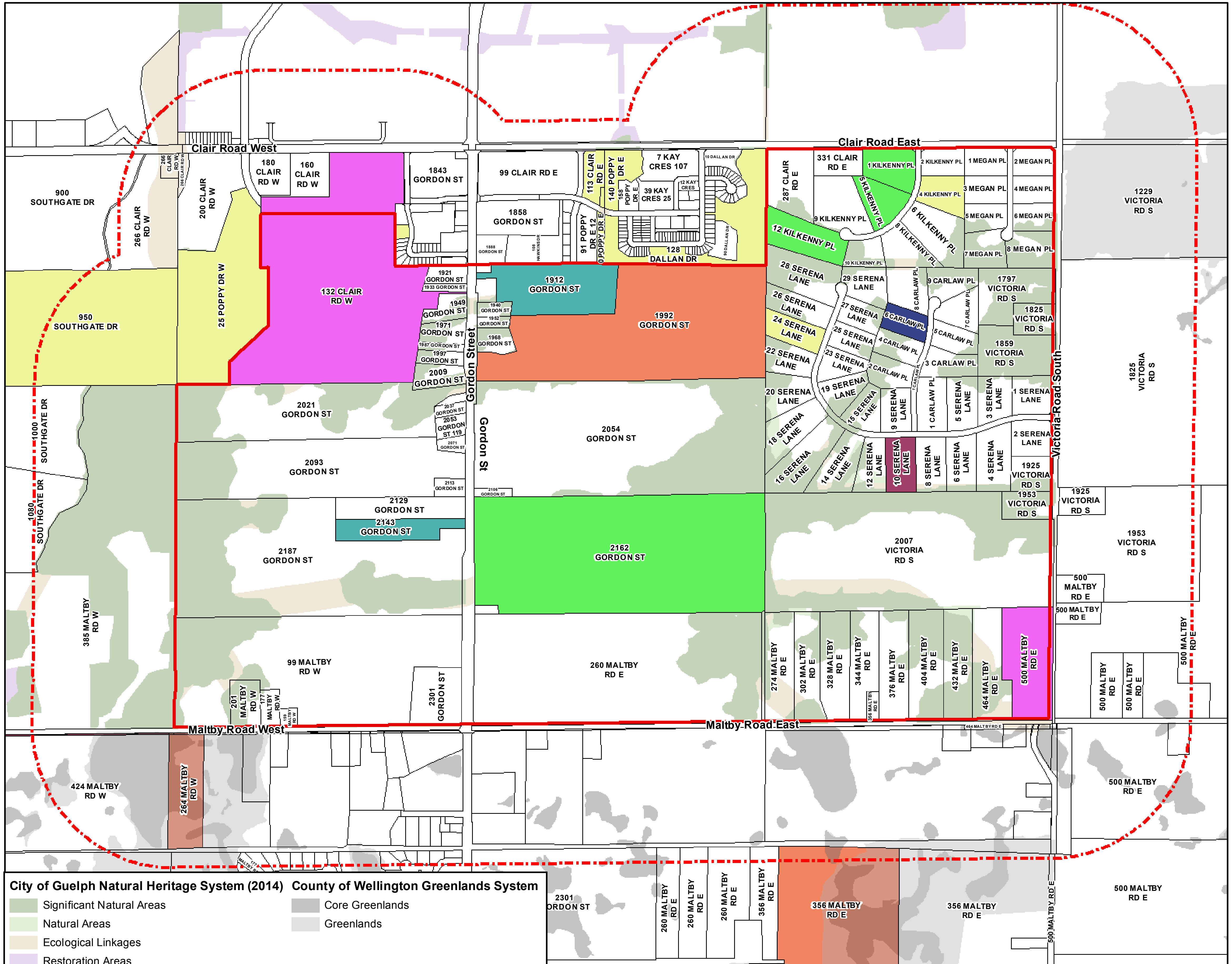


LEGEND

- SECONDARY PLAN AREA (SPA)
- PRIMARY STUDY AREA (PSA)
- SECONDARY STUDY AREA (SSA)
- SUBWATERSHED BOUNDARY
- WATERCOURSE
- ROADWAY
- PROPERTY BOUNDARY

CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN CITY OF GUELPH	STUDY AREA PLAN	wood.	SCALE VALID ONLY FOR 24"x36" VERSION Scale 1:30000 Consultant File No. TPB168050 Map-G1



Access

Map G-2

Clair-Maltby Secondary Plan
2017 Monitoring Report

Legend

- Secondary Plan Area
- Primary Study Area
- Parcel Fabric

Type of Access

- Deep groundwater monitoring (well)
- Deep groundwater, shallow ground water (mini-piezometers), and surface water monitoring
- Shallow groundwater and surface water monitoring
- Deep and shallow groundwater, surface water, amphibian, bird and vegetation monitoring
- Shallow groundwater, surface water and amphibian monitoring
- Shallow groundwater, surface water, amphibian, bird and vegetation monitoring
- Deep and shallow groundwater, surface water and amphibian monitoring

City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.

First Base Solutions
Web Mapping Service 2017

UTM Zone 17 N, NAD 83

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BEACON ENVIRONMENTAL

Project 216002
February, 2018

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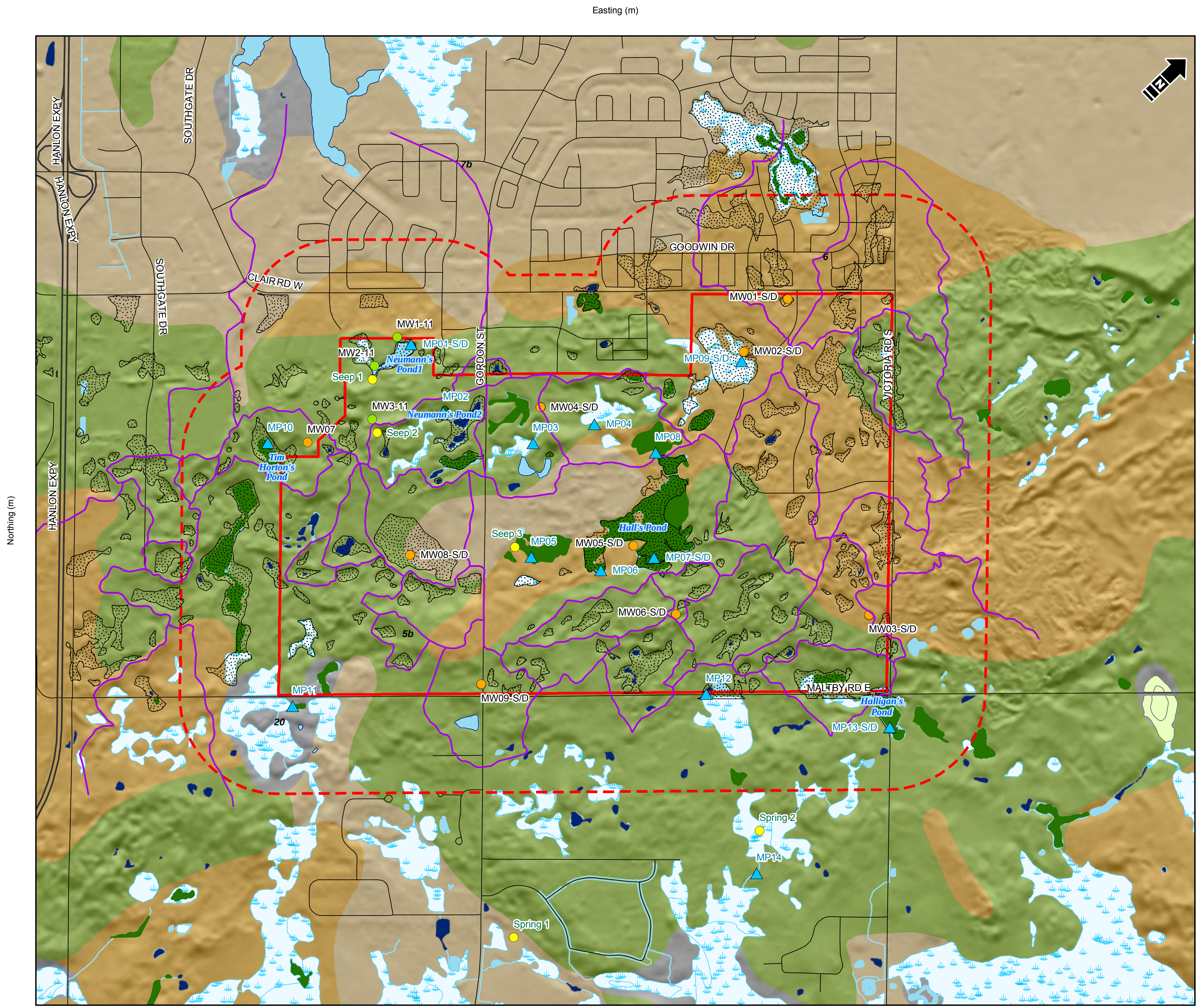

- Primary Study Area Boundary
- Secondary Plan Area Boundary
- Closed Depression
- Subcatchment
- Fen
- Bog
- Swamp
- Marsh
- Open Water
- Unknown Wetland
- Water Body
- Watercourse
- Highway
- Road
- Mini Piezometer
- Monitoring Well (Matrix)
- Monitoring Well (132 Clair Rd.)
- Observed Seep and Spring

Surficial Geology

- 5b: Stone-poor, sandy silt to silty sand till
- 6: Ice-contact stratified sand and gravel deposits
- 7b: Glaciofluvial Gravel Deposits
- 20: Organic deposits (e.g., peat, marl)

Reference: Data provided by the City of Guelph, GeoBase® and Province of Ontario used under license.
Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release— Data 128 – Revised.

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NAD 1983 UTM Zone 17N

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

City of Guelph
Clair-Maltby Comprehensive Environmental Impact Study
Year 2 Monitoring Report

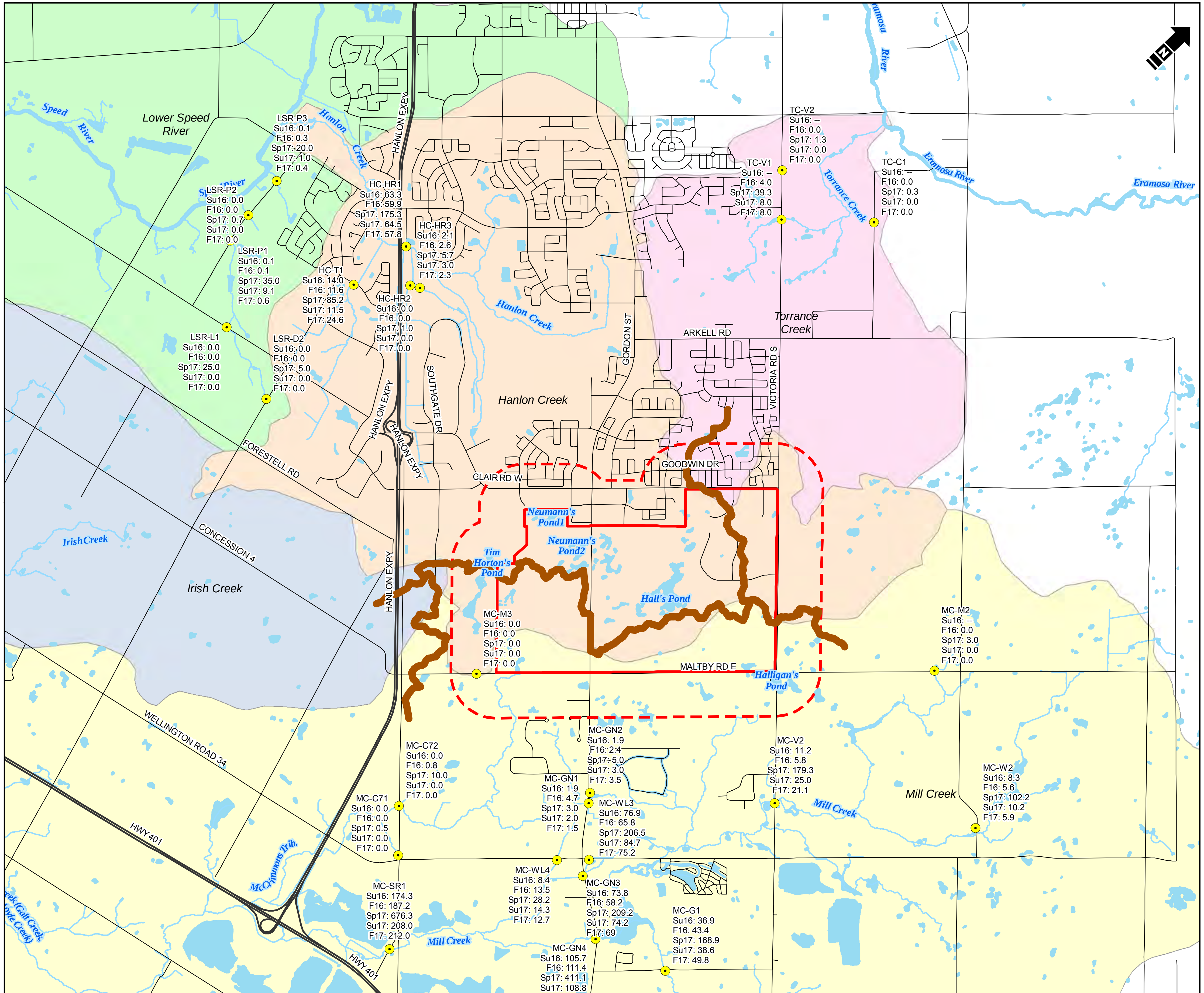
Hydrogeology Monitoring Locations – Regional Extent

Date:	Project:	Technical:	Reviewer:	Drawn:
23 Feb 2018	23089	S. Miller	D. Abbey	C. Curry

Figure GW-1

Easting (m)

Northing (m)



- Primary Study Area Boundary
- Secondary Plan Area Boundary
- Water Body
- Watercourse
- Updated Subwatershed Boundary (Wood PLC, 2018)
- Highway
- Road
- Spot Flow Location

Subwatershed

- Hanlon Creek
- Irish Creek
- Lower Speed River
- Mill Creek
- Torrance Creek

HC-D2	Spot Flow Location
Su16:0	Summer 2016 (Aug.30/31,Sept. 1) Flow Rate (L/s)
F16:0	Fall (Nov.9/10) Flow Rate (L/s)
Sp17:0	Spring 2017 (May 10/11) Flow Rate (L/s)
Su17:0	Summer 2017 (Aug.16) Flow Rate (L/s)
F17:0	Fall (Nov. 29) Flow Rate (L/s)

1:45,000 — 460 0 460 920 m

NAD 1983 UTM Zone 17N

Reference: Data provided by the City of Guelph and GeoBase® used under license.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

City of Guelph
Clair-Maltby Comprehensive Environmental Impact Study
Year 2 Monitoring Report

Surface Water Spotflow Results

Date:	Project:	Technical:	Reviewer:	Drawn:
23 Feb 2018	23089	S. Miller	D. Abbey	C. Curry

Figure GW-2

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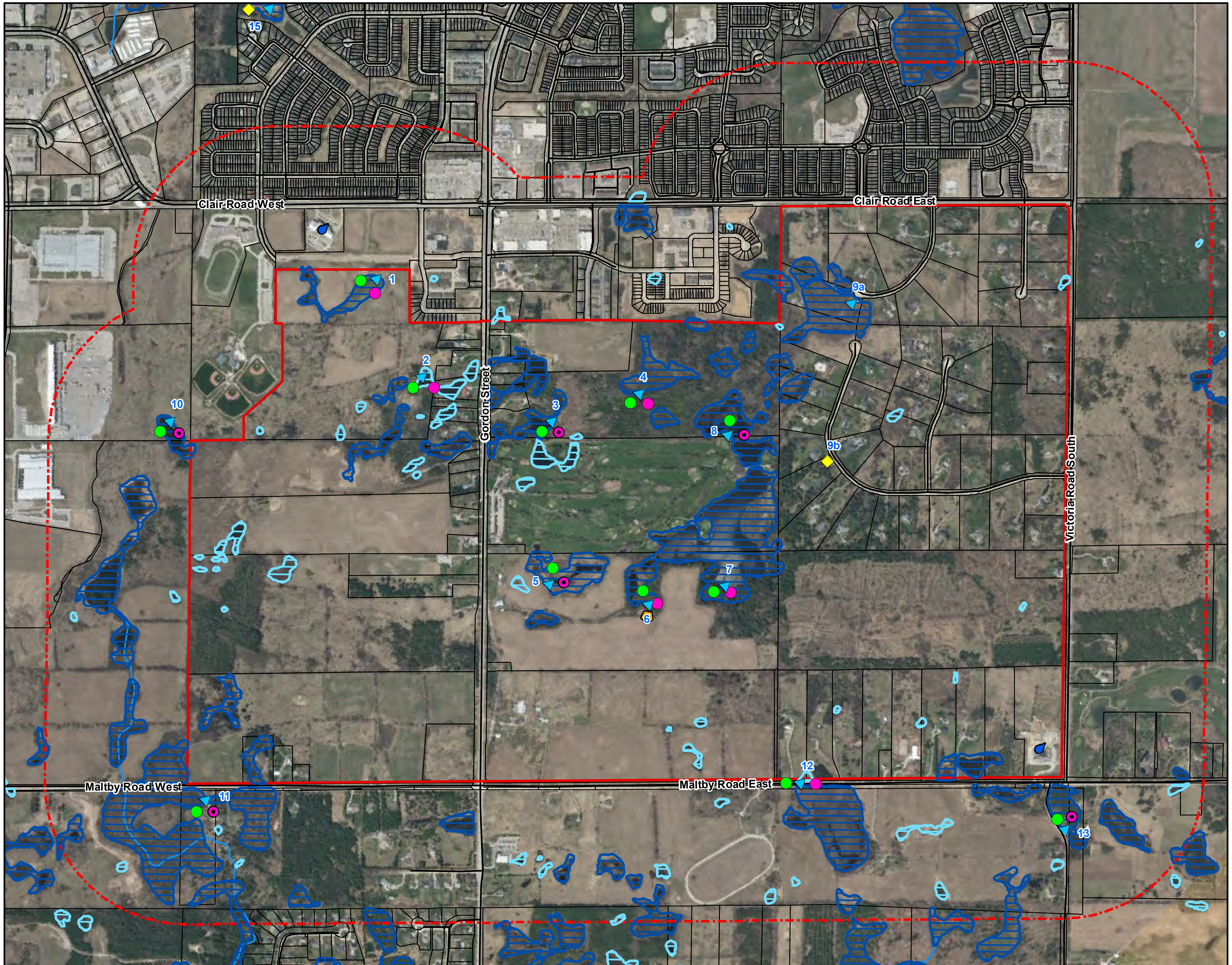

Surface Water Monitoring Locations

Map SW-1

Clair-Maltby Secondary Plan
2017 Monitoring Report

Legend

- Secondary Plan Area Boundary
- Primary Study Area Boundary
- Watercourse (MNRF 2017)
- Parcel Fabric

Monitoring Stations

- Surface Water Quality*
- Surface Water Quality* + Pesticides
- Surface Water Quantity
- Mini.piezometer
- Surface Water Flow
- Rain Gauge
- Baro Logger
- Provincially Significant Wetlands (MNRF 2017)
- Unevaluated Wetlands (MNRF 2017)

* Water Quality Sampling Parameters include: TSS, TDS, PTP, SO^4, Cl, TKN, NO^2, NO^3, NH^3, Temp, pH, Conductivity, DO and Metals.

First Base Solutions
Web Mapping Service 2017

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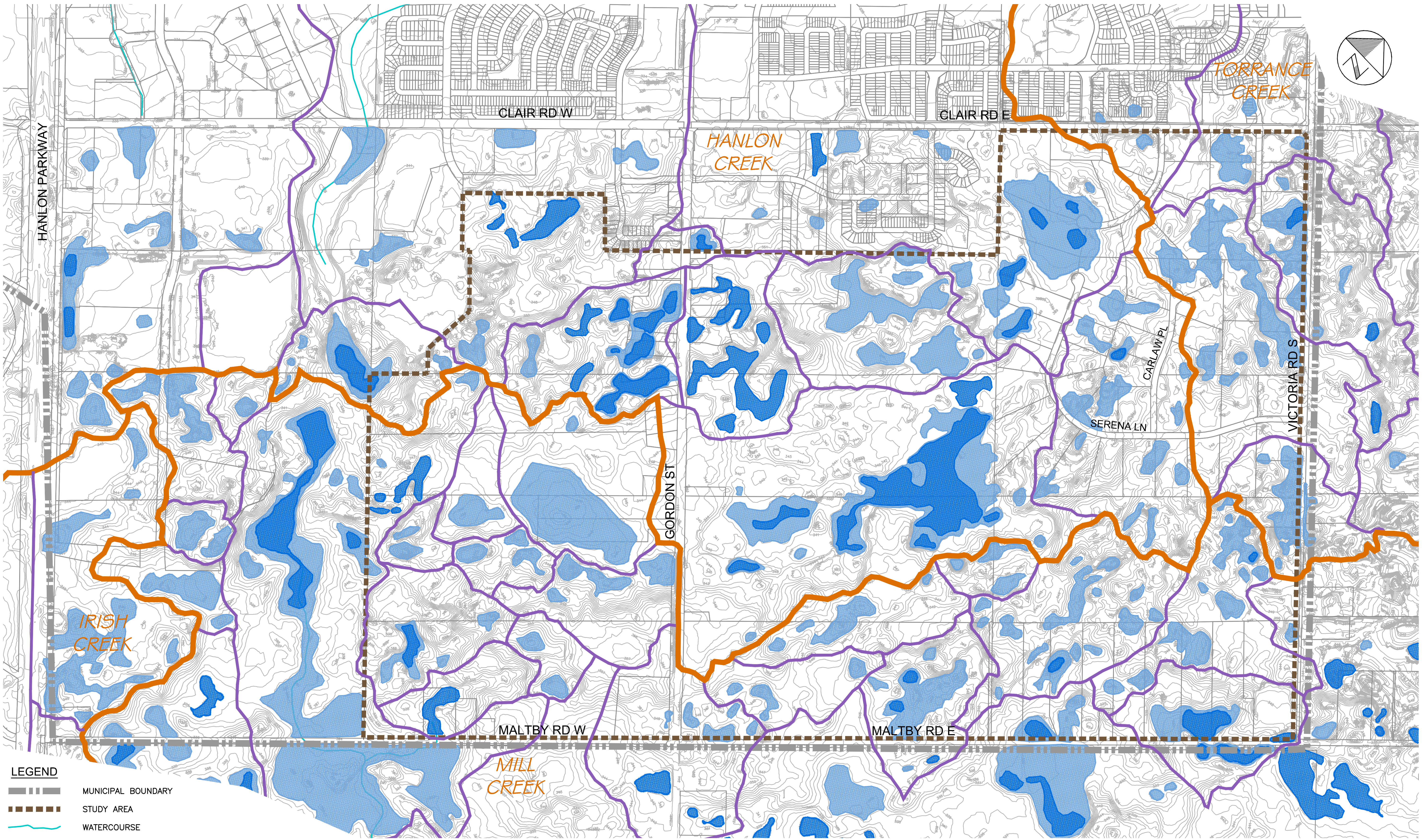
BEACON ENVIRONMENTAL

Project 216002
February, 2018



LEGEND

MUNICIPAL BOUNDARY
STUDY AREA
WATERCOURSE
CONTOUR (1m)
WATERSHED BOUNDARY
SUBCATCHMENT BOUNDARY
AREA OF DEPRESSION
AREA OF PONDING

SCALE VALID ONLY FOR 24"x36" VERSION

CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN CITY OF GUELPH	WATERSHED AND CATCHMENT BOUNDARIES	wood.	Scale 1:6000 (0 50 100 200) / Consultant File No. TPB168050 / Map-SW2

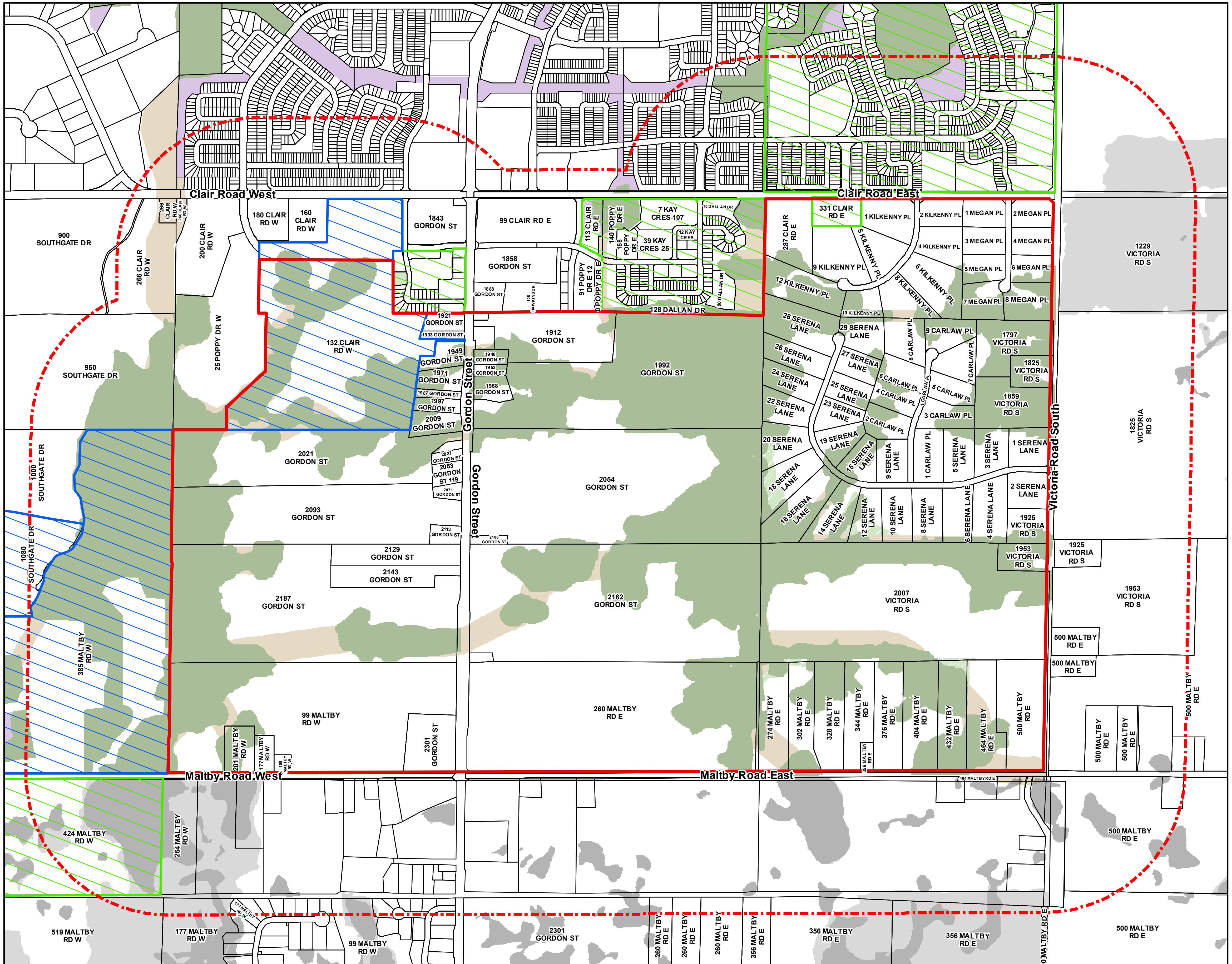
Path: P:\2016\Projects\TPB168050 – Clair Maltby\06_DES-ENG\01_CAD\02_DWGS\05_WR\01_PROJECT\2018-02(2017MonitRep)\MapSW2 ExistingDrainage.dwg

Plotted: 2018-05-02 Plotted By: richard.bartolo
Last Saved: 2018-02-23 Last Saved By: richard.bartolo

Available Site-Specific Natural Heritage Data

Map NH-1

Clair-Maltby Secondary Plan
2017 Monitoring Report



Legend

- Secondary Plan Area Boundary
- Primary Study Area Boundary
- Parcel Fabric

Available Natural Heritage Data

- Vegetation and Wildlife Data
- Vegetation, Wildlife and Fisheries Data

City of Guelph Natural Heritage System (2014)

- Significant Natural Areas
- Natural Areas
- Natural Areas Overlay
- Ecological Linkages
- Restoration Areas

County of Wellington Greenlands System

- Core Greenlands
- Greenlands

LIO: Paris Moraine ANSI, 2016;
Beacon Environmental: Available Nautral Heritage Data, Ecological Land Classification, Primary Study Area Boundary, 2016;
City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.

* This map shows data available from site-specific studies undertaken within the Primary Study Area between 2005 and 2016.

First Base Solutions
Web Mapping Service 2017

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BEACON ENVIRONMENTAL

Project 216002
February, 2018

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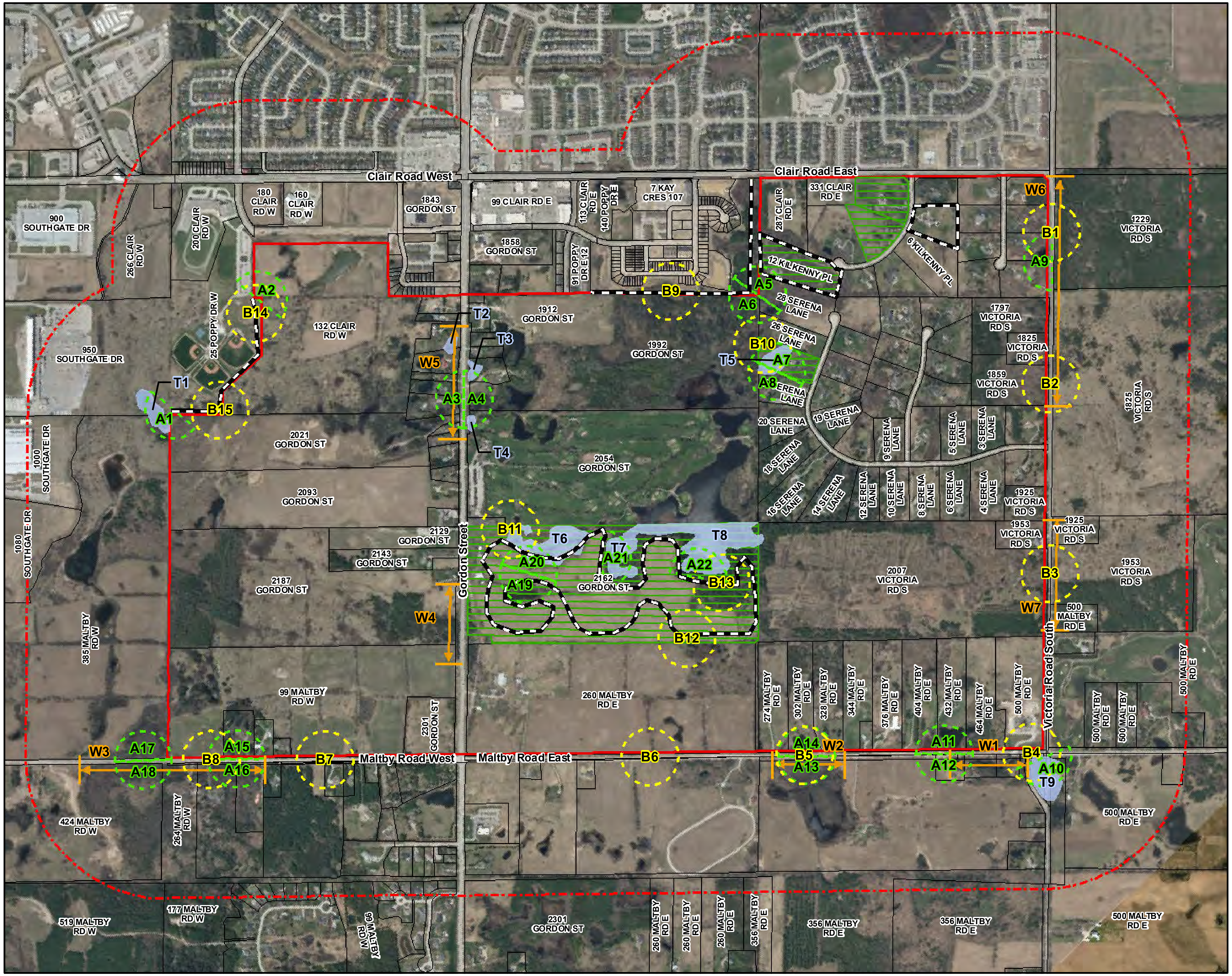

Terrestrial Monitoring Locations

Map NH-2

Clair-Maltby Secondary Plan
2017 Monitoring Report

Legend

- Secondary Plan Area Boundary
- Primary Study Area Boundary
- Site Specific Vegetation Assessments
- A1 Amphibian Monitoring Stations (22)
- B1 Breeding Bird Stations (15)
- Basking Turtle Monitoring Stations (8)
- Winter Wildlife Transects (5)
- Road Wildlife Transects (7)

Beacon Environmental: Watercourse, Amphibian Monitoring Stations, Breeding Bird Stations, Basking Turtle Monitoring Stations, Winter Wildlife Transects, Wildlife Road Transects, Primary Study Area Boundary, 2016;
City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016;
Ministry of Natural Resources and Forestry: Wetland, 2016

First Base Solutions
Web Mapping Service 2017

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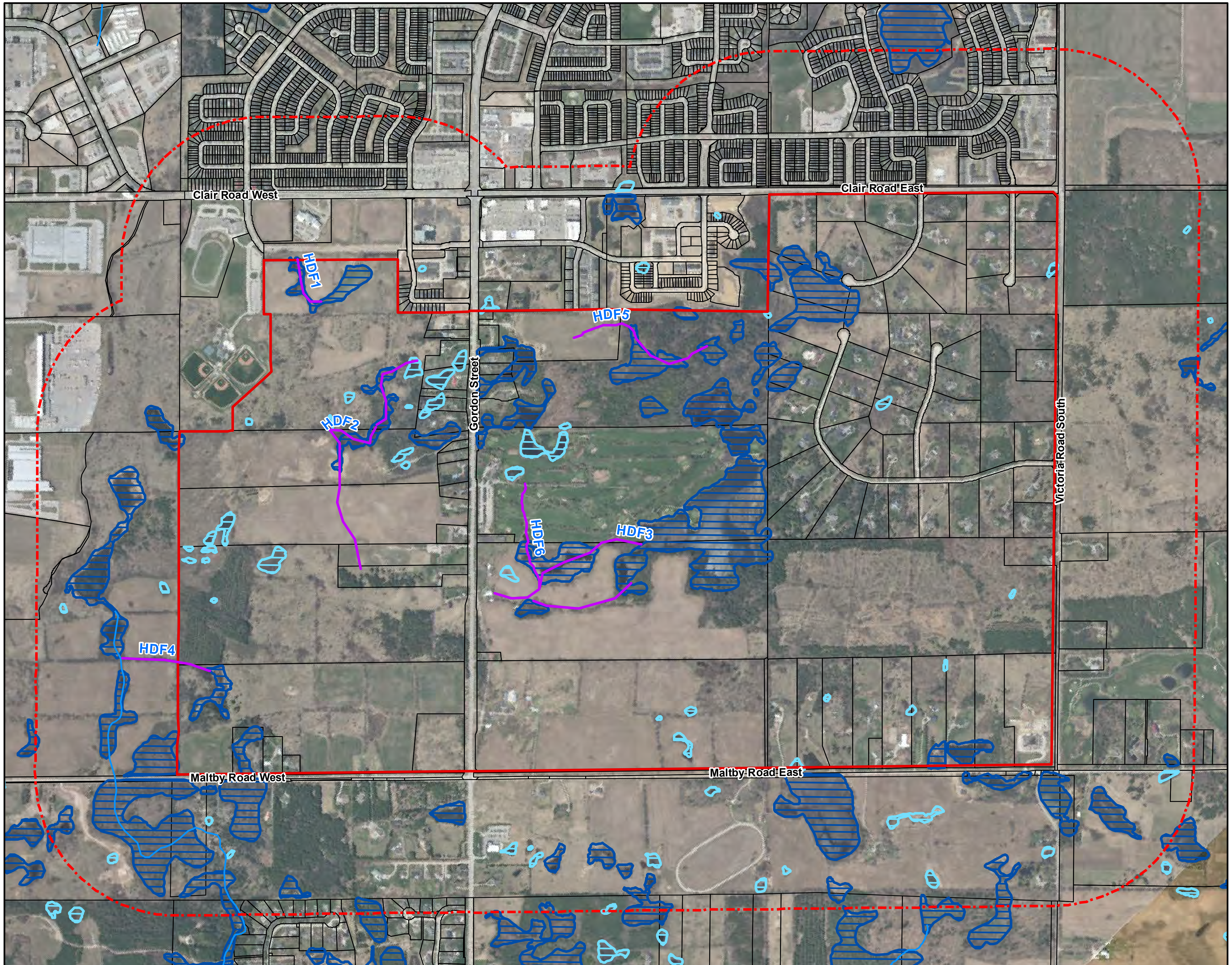
BEACON ENVIRONMENTAL

Project 216002
February, 2018



Preliminary Headwater Drainage Feature Assessment

Map NH-3

Clair-Maltby Secondary Plan
2017 Monitoring Report

Legend

- Secondary Plan Area Boundary
- Primary Study Area Boundary
- Potential Headwater Drainage Feature
- Watercourse (MNRF 2017)
- Parcel Fabric
- Provincially Significant Wetlands (MNRF 2017)
- Unevaluated Wetlands (MNRF 2017)

City of Guelph: Secondary Plan Area Boundary, 2016

First Base Solutions
Web Mapping Service 2017

UTM Zone 17 N, NAD 83

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BEACON ENVIRONMENTAL

Project 216002
February, 2018

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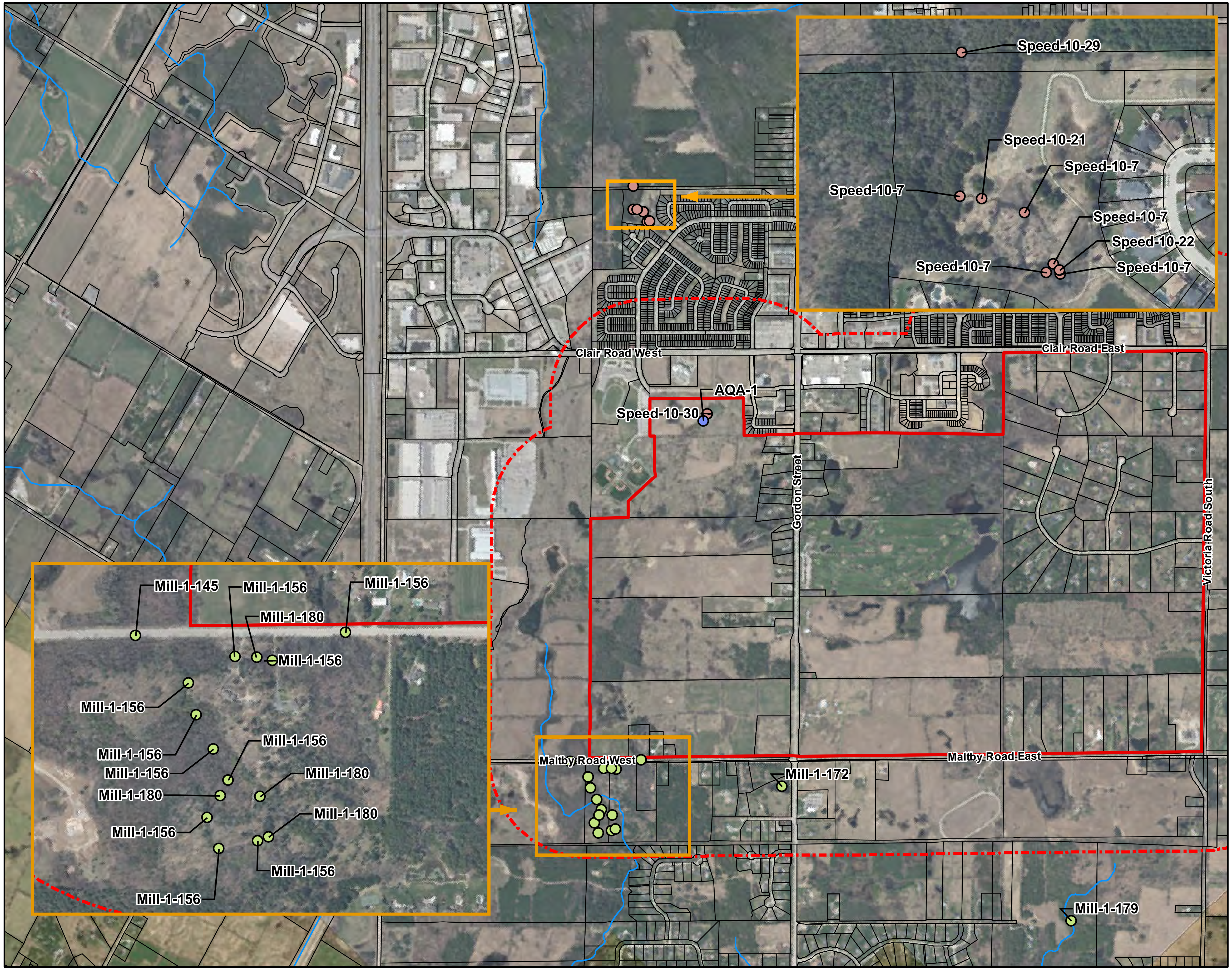

Fisheries Records

Map NH-4

Clair-Maltby Secondary Plan
2017 Monitoring Report

Legend

- Primary Study Area Boundary
- Secondary Plan Area Boundary
- Watercourse (MNRF 2017)
- Hanlon Creek (MNRF 1999)
- Mill Creek (MNRF 2010-2012)
- Aquafor Beech Limited Data (2012)

Beacon Environmental: Watercourse, Primary Study Area Boundary, 2016;
City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016;
Ministry of Natural Resources and Forestry: Hanlon Creek, Mill Creek;
Aquafor Beech Limited: Sample Data, 2011

First Base Solutions
Web Mapping Service 2017

UTM Zone 17 N, NAD 83

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BEACON ENVIRONMENTAL

Project 216002
February, 2018

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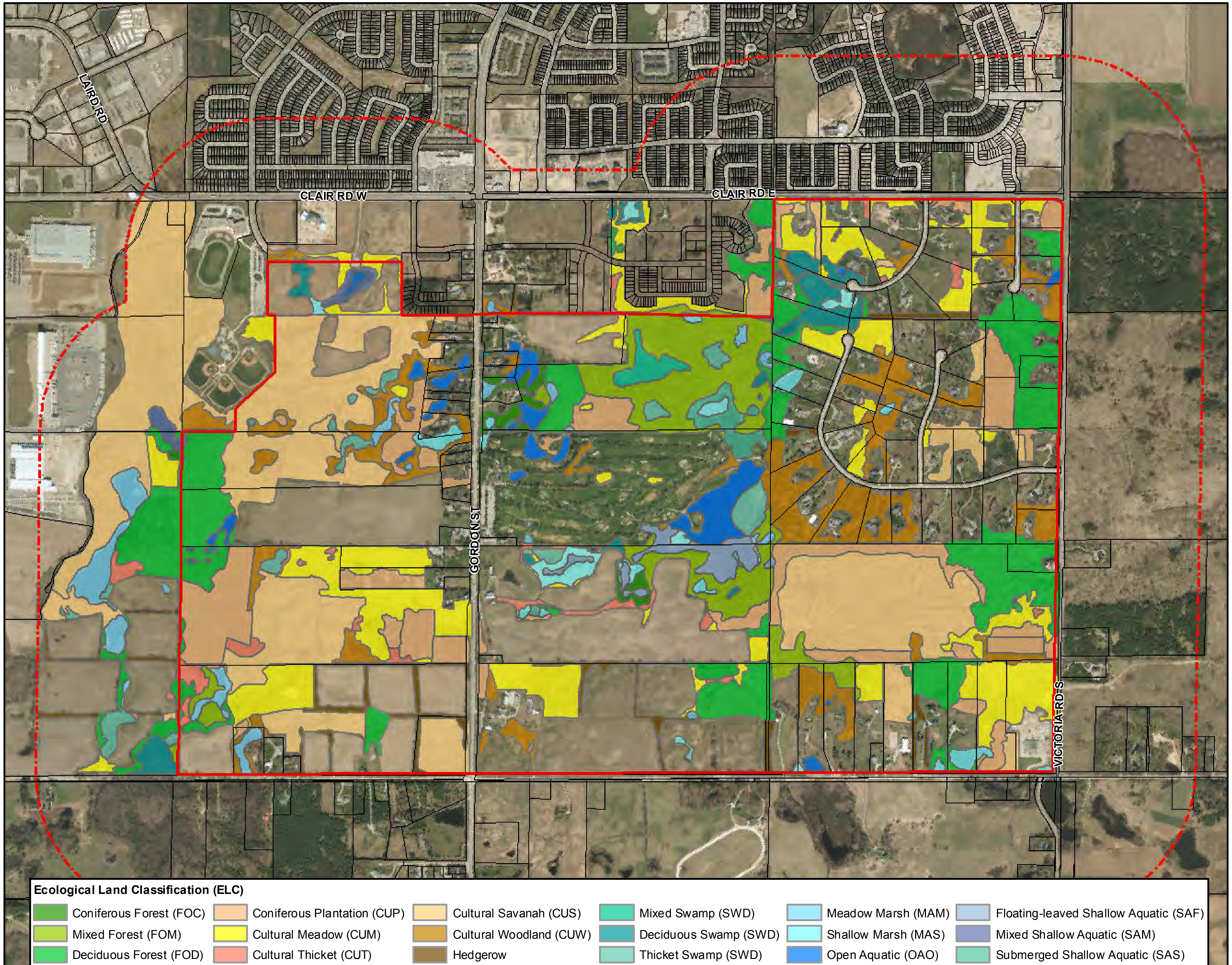

Refined Ecological Land Classification

Map NH-5

Clair-Maltby Master Environmental Servicing Plan (MESP) & Secondary Plan

Legend

- Primary Plan Area Boundary
- Secondary Study Area Boundary
- Parcel Fabric

Note: All ELC mapping has been updated from the City's 2014 ELC mapping using 2017 aerial photography except for the 2021 Gordon Street property where the City has indicated the 2014 ELC should be retained as the City and Owner are currently before the courts under the City's Tree By-law.

City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.

First Base Solutions
Web Mapping Service 2017

UTM Zone 17 N, NAD 83

0 125 250 500 Metres

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BEACON ENVIRONMENTAL

Project 216002
February, 2018

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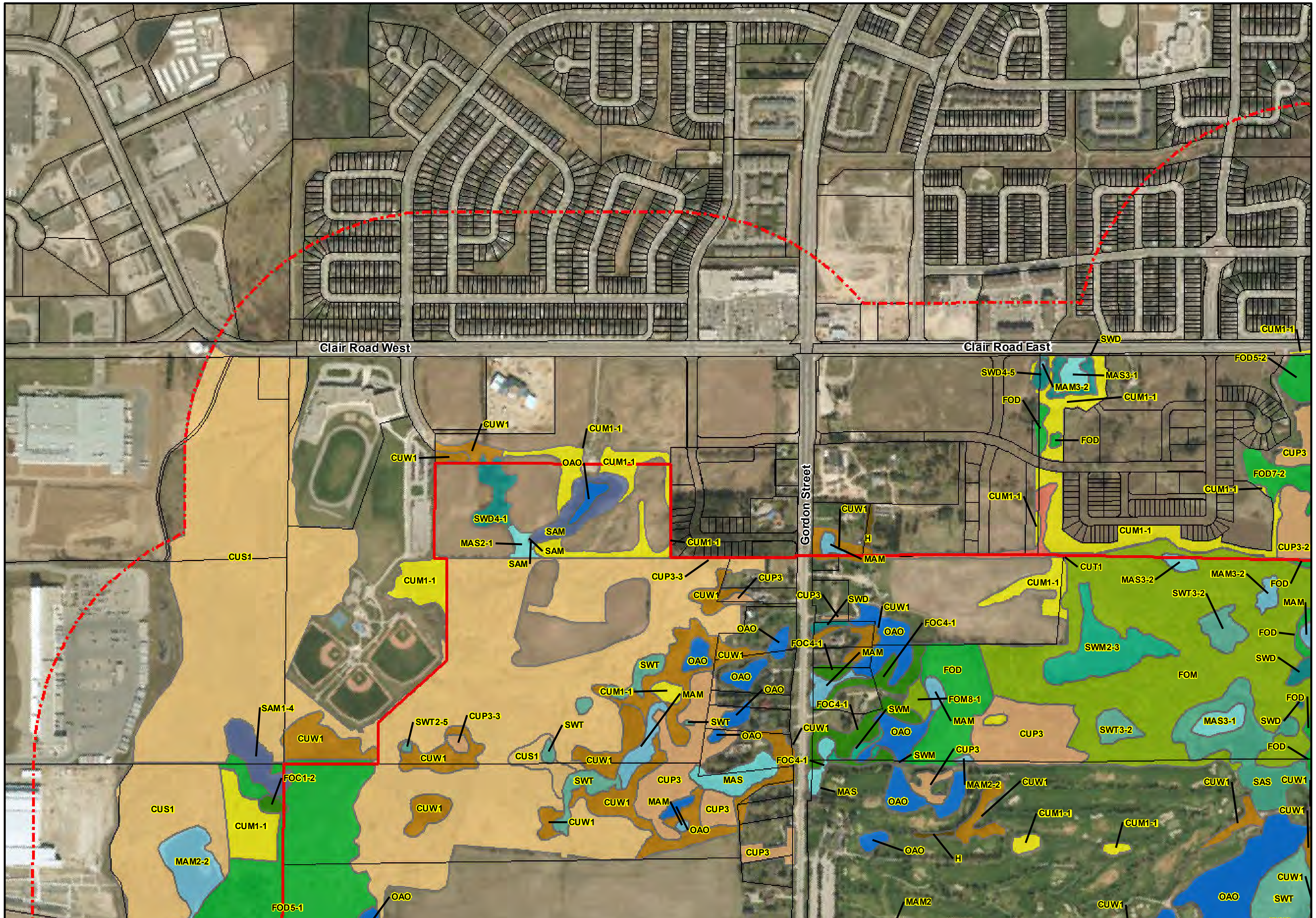
Refined Ecological Land Classification

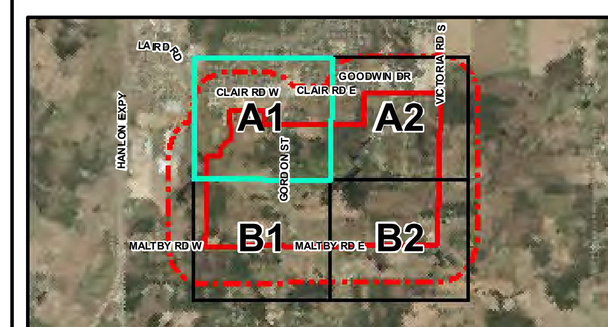
Map NH-5 Page A1

Clair-Maltby Master Environmental Servicing Plan (MESP) & Secondary Plan

Legend

- Primary Plan Area Boundary
- Secondary Study Area Boundary
- Parcel Fabric





Note: All ELC mapping has been updated from the City's 2014 ELC mapping using 2017 aerial photography except for the 2021 Gordon Street property where the City has indicated the 2014 ELC should be retained as the City and Owner are currently before the courts under the City's Tree By-law.

City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.

First Base Solutions Web Mapping Service 2017

UTM Zone 17 N, NAD 83

0 75 150 300 Metres

1:8,500

Ecological Land Classification (ELC)

- 216002_ClippedRoads_20180118
- Coniferous Forest (FOC)
- Mixed Forest (FOM)
- Deciduous Forest (FOD)
- Coniferous Plantation (CUP)
- Cultural Meadow (CUM)
- Cultural Thicket (CUT)
- Cultural Savanah (CUS)
- Cultural Woodland (CUW)
- Hedgerow
- Mixed Swamp (SWD)
- Deciduous Swamp (SWD)
- Thicket Swamp (SWD)
- Meadow Marsh (MAM)
- Shallow Marsh (MAS)
- Open Aquatic (OAO)
- Floating-leaved Shallow Aquatic (SAF)
- Mixed Shallow Aquatic (SAM)
- Submerged Shallow Aquatic (SAS)

BEACON ENVIRONMENTAL

Project 216002
February, 2018

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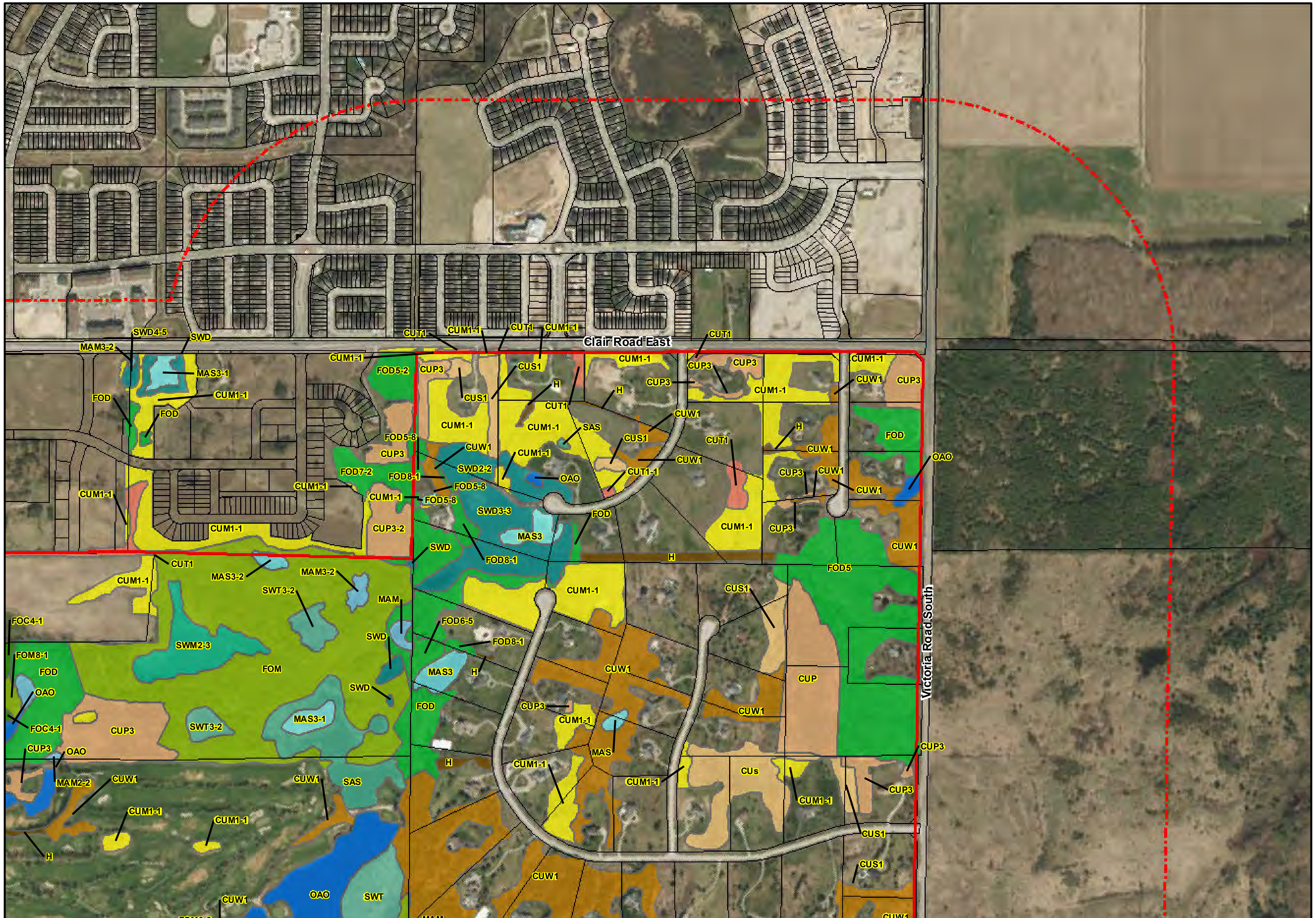
Refined Ecological Land Classification

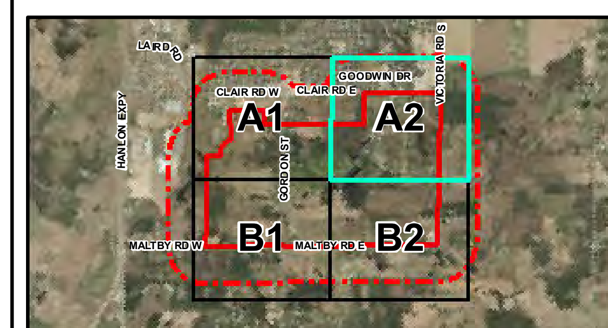
Map NH-5 Page A2

Clair-Maltby Master Environmental Servicing Plan (MESP) & Secondary Plan



Legend

- Primary Plan Area Boundary
- Secondary Study Area Boundary
- Parcel Fabric



Note: All ELC mapping has been updated from the City's 2014 ELC mapping using 2017 aerial photography except for the 2021 Gordon Street property where the City has indicated the 2014 ELC should be retained as the City and Owner are currently before the courts under the City's Tree By-law.

City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.

First Base Solutions Web Mapping Service 2017

UTM Zone 17 N, NAD 83

0 75 150 300 Metres

1:8,500

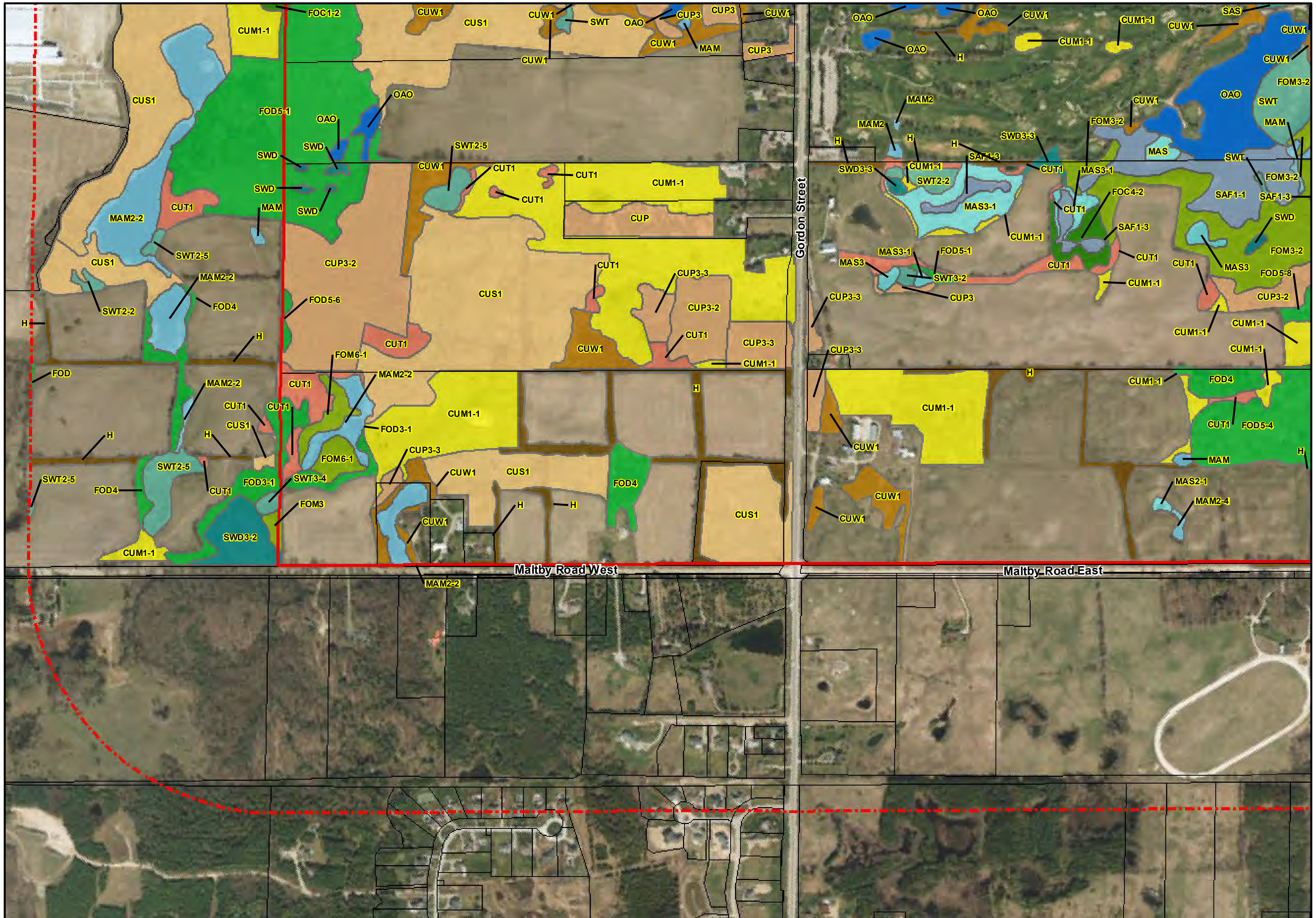
Ecological Land Classification (ELC)

- 216002_ClippedRoads_20180118
- Coniferous Forest (FOC)
- Mixed Forest (FOM)
- Deciduous Forest (FOD)
- Coniferous Plantation (CUP)
- Cultural Meadow (CUM)
- Cultural Thicket (CUT)
- Cultural Savanah (CUS)
- Cultural Woodland (CUW)
- Hedgerow
- Mixed Swamp (SWD)
- Deciduous Swamp (SWD)
- Thicket Swamp (SWD)
- Meadow Marsh (MAM)
- Shallow Marsh (MAS)
- Open Aquatic (OAO)
- Floating-leaved Shallow Aquatic (SAF)
- Mixed Shallow Aquatic (SAM)
- Submerged Shallow Aquatic (SAS)

BEACON ENVIRONMENTAL

Project 216002
February, 2018

C:\Dropbox\Dropbox (Beacon)\All GIS Projects\2016\216002 Clair Maltby Secondary Plan\MXD\2017 Monitoring Report\216002_MapNH5_RefinedELC_Mapbook_20180222.mxd



Ecological Land Classification (ELC)

216002_ClippedRoads_20180118	Deciduous Forest (FOD)	Cultural Thicket (CUT)	Hedgerow	Thicket Swamp (SWD)	Open Aquatic (OAO)
Coniferous Forest (FOC)	Coniferous Plantation (CUP)	Cultural Savanah (CUS)	Mixed Swamp (SWD)	Meadow Marsh (MAM)	Floating-leaved Shallow Aquatic (SAF)
Mixed Forest (FOM)	Cultural Meadow (CUM)	Cultural Woodland (CUW)	Deciduous Swamp (SWD)	Shallow Marsh (MAS)	Mixed Shallow Aquatic (SAM)
					Submerged Shallow Aquatic (SAS)

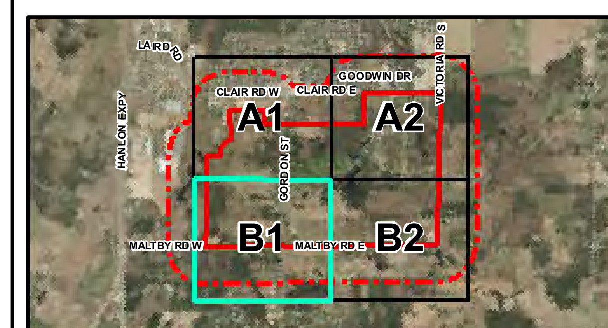
Refined Ecological Land Classification

Map NH-5 Page B1

Clair-Maltby Master Environmental Servicing Plan (MESP) & Secondary Plan

Legend

- Primary Plan Area Boundary
- Secondary Study Area Boundary
- Parcel Fabric



Note: All ELC mapping has been updated from the City's 2014 ELC mapping using 2017 aerial photography except for the 2021 Gordon Street property where the City has indicated the 2014 ELC should be retained as the City and Owner are currently before the courts under the City's Tree By-law.

City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.

First Base Solutions
Web Mapping Service 2017

UTM Zone 17 N, NAD 83

0 75 150 300 Metres

1:8,500

BEACON ENVIRONMENTAL

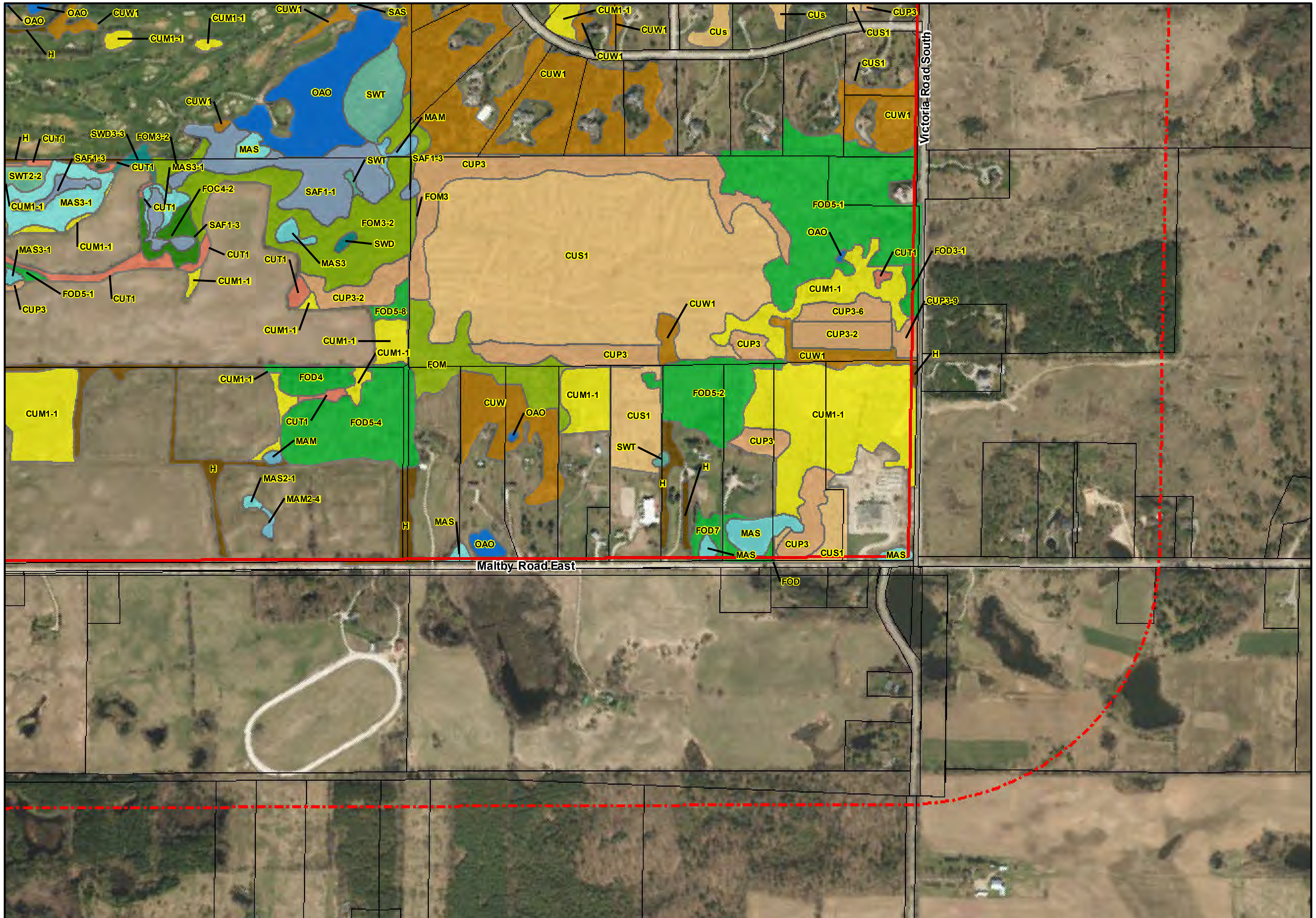
Project 216002
February, 2018

C:\Dropbox\Dropbox (Beacon)\All GIS Projects\2016\216002 Clair Maltby Secondary Plan\MXD\2017 Monitoring Report\216002_MapNH5_RefinedELC_Mapbook_20180222.mxd

Refined Ecological Land Classification

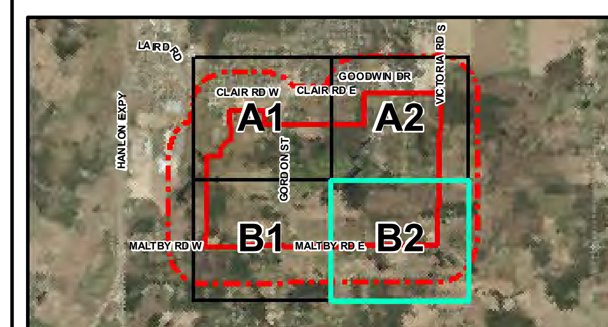
Map NH-5 Page B2

Clair-Maltby Master Environmental Servicing Plan (MESP) & Secondary Plan



Legend

- Primary Plan Area Boundary
- Secondary Study Area Boundary
- Parcel Fabric



Note: All ELC mapping has been updated from the City's 2014 ELC mapping using 2017 aerial photography except for the 2021 Gordon Street property where the City has indicated the 2014 ELC should be retained as the City and Owner are currently before the courts under the City's Tree By-law.

City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.

First Base Solutions
Web Mapping Service 2017

UTM Zone 17 N, NAD 83

0 75 150 300 Metres

1:8,500

Ecological Land Classification (ELC)

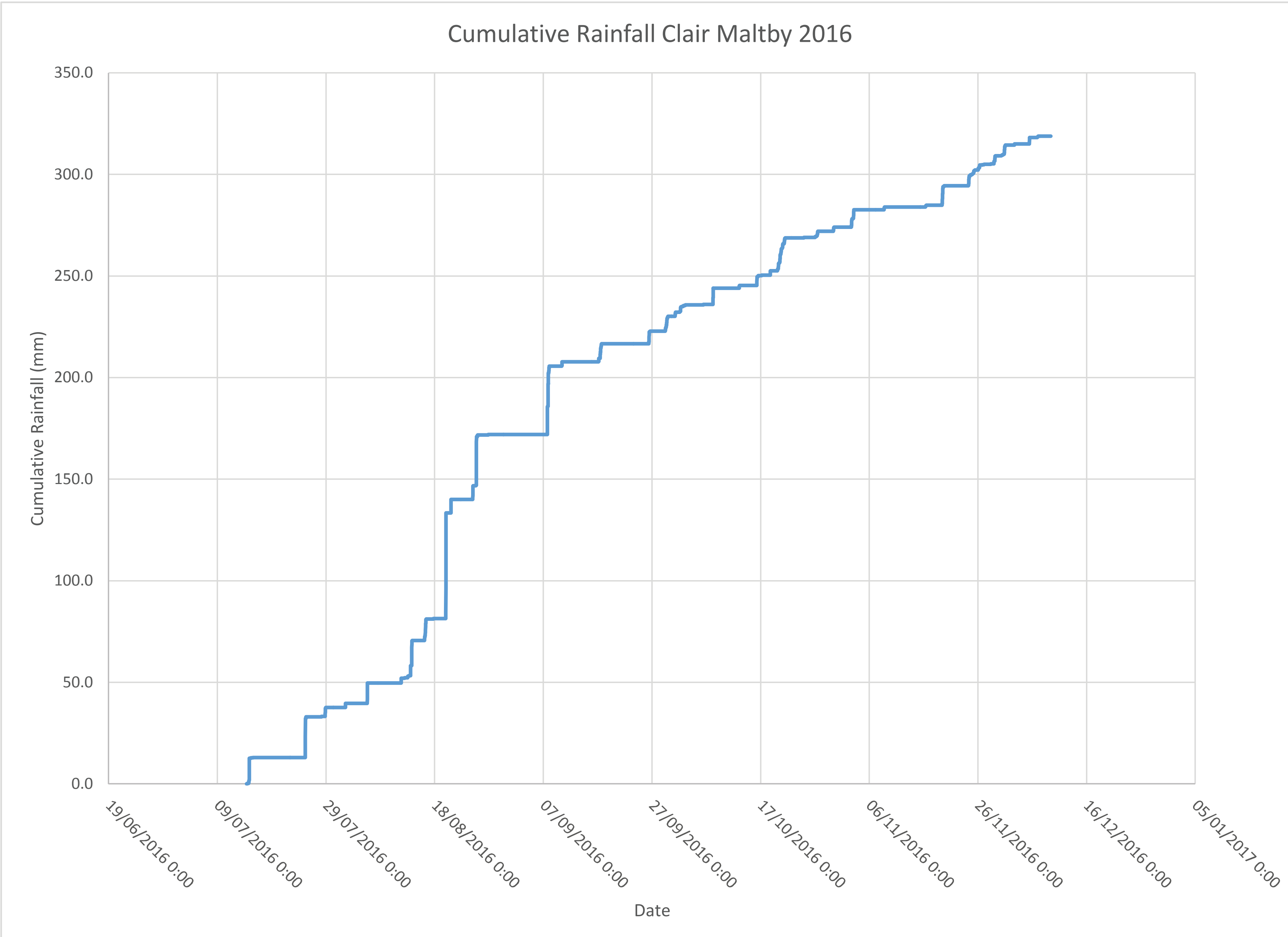
216002_ClippedRoads_20180118	Deciduous Forest (FOD)	Cultural Thicket (CUT)	Hedgerow	Thicket Swamp (SWD)	Open Aquatic (OAO)
Coniferous Forest (FOC)	Coniferous Plantation (CUP)	Cultural Savanah (CUS)	Mixed Swamp (SWD)	Meadow Marsh (MAM)	Floating-leaved Shallow Aquatic (SAF)
Mixed Forest (FOM)	Cultural Meadow (CUM)	Cultural Woodland (CUW)	Deciduous Swamp (SWD)	Shallow Marsh (MAS)	Mixed Shallow Aquatic (SAM)
					Submerged Shallow Aquatic (SAS)

BEACON ENVIRONMENTAL

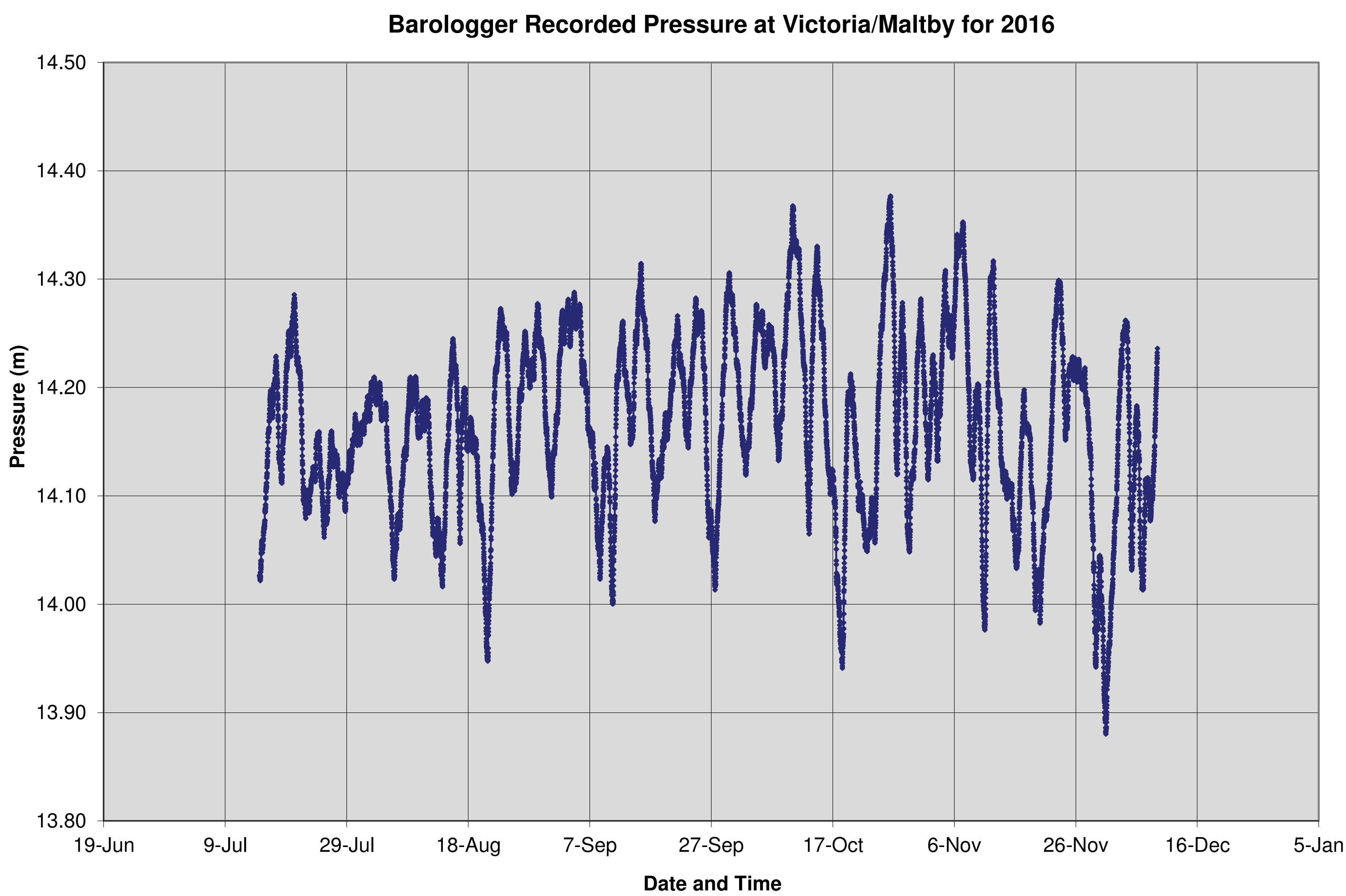
Project 216002
February, 2018

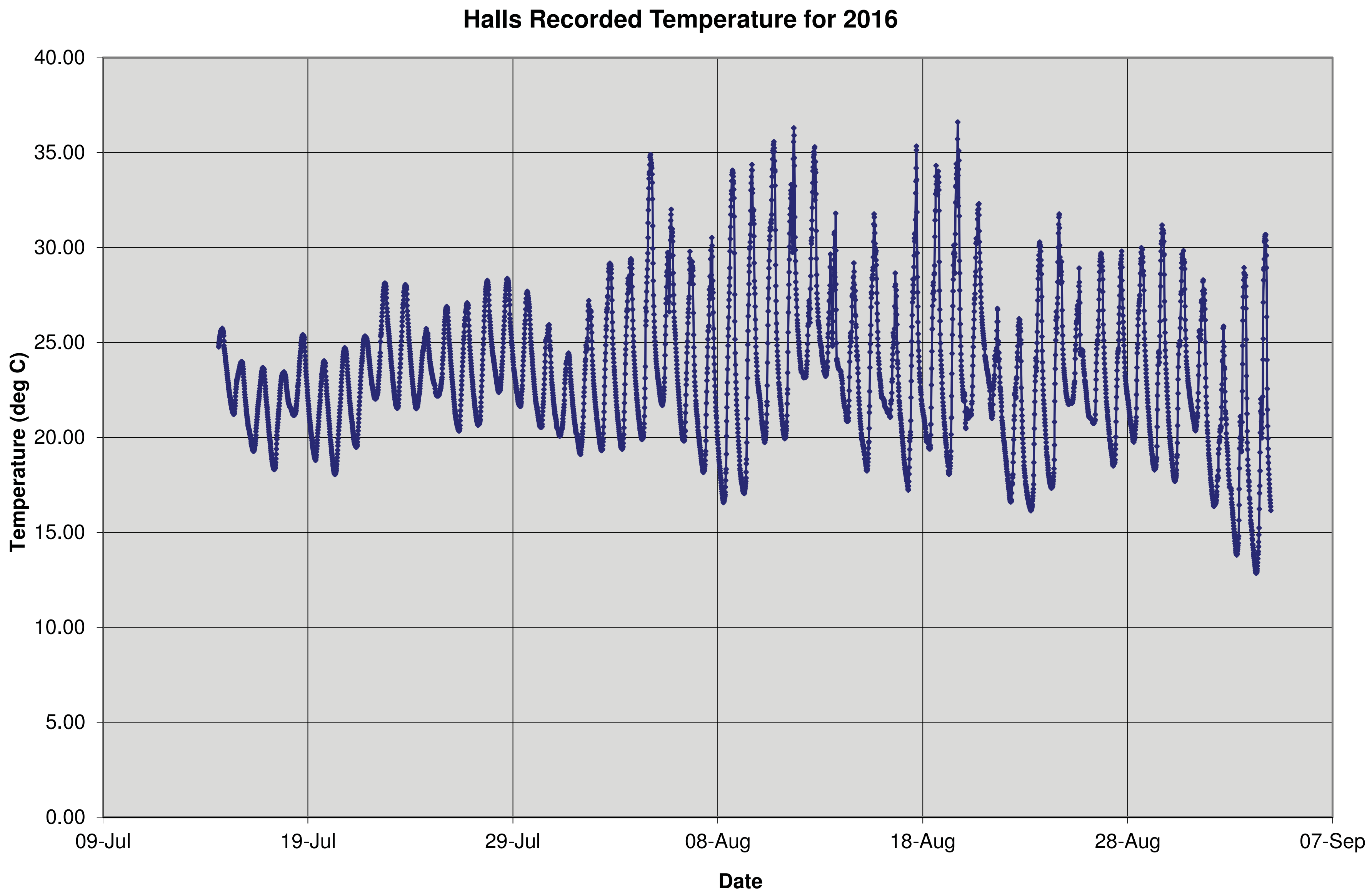
Appendix SW-1:
Surface Water

2016 Results

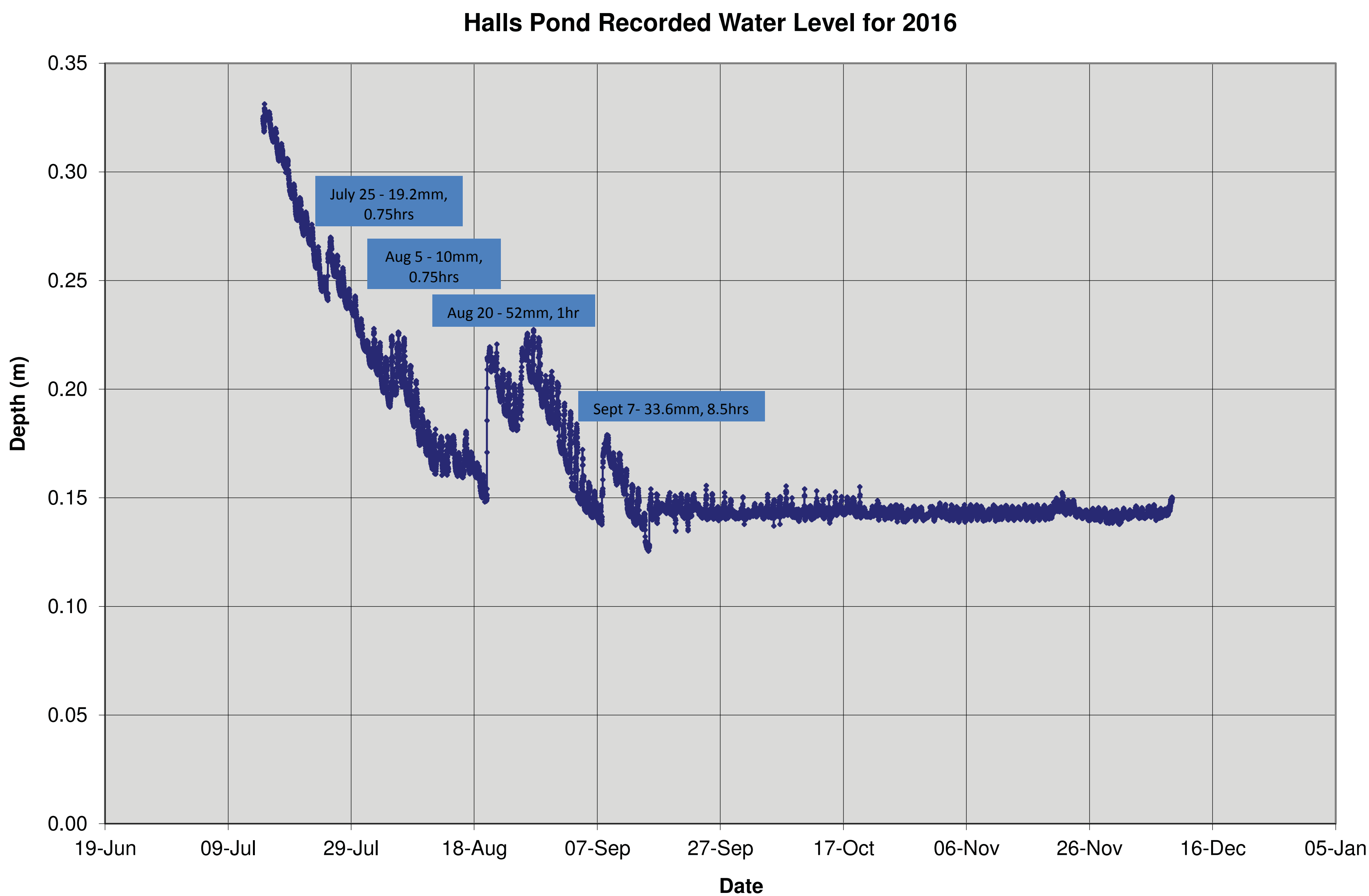


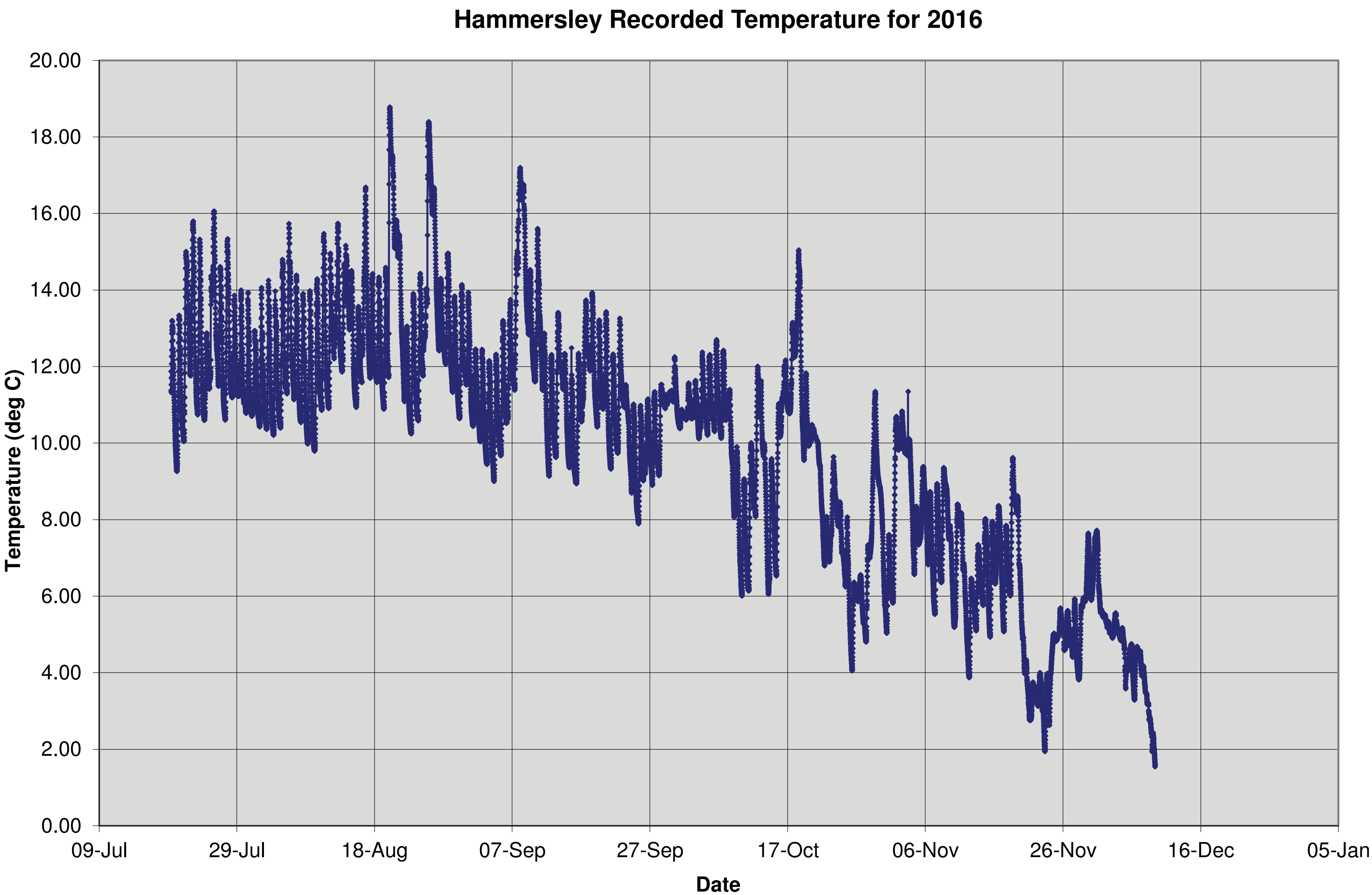
Cumulative Rainfall Clair Maltby 2016
Cumulative Rainfall (mm)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
19/06/2016 0:00
09/07/2016 0:00
29/07/2016 0:00
18/08/2016 0:00
07/09/2016 0:00
27/09/2016 0:00
17/10/2016 0:00
06/11/2016 0:00
26/11/2016 0:00
16/12/2016 0:00
05/01/2017 0:00
Date

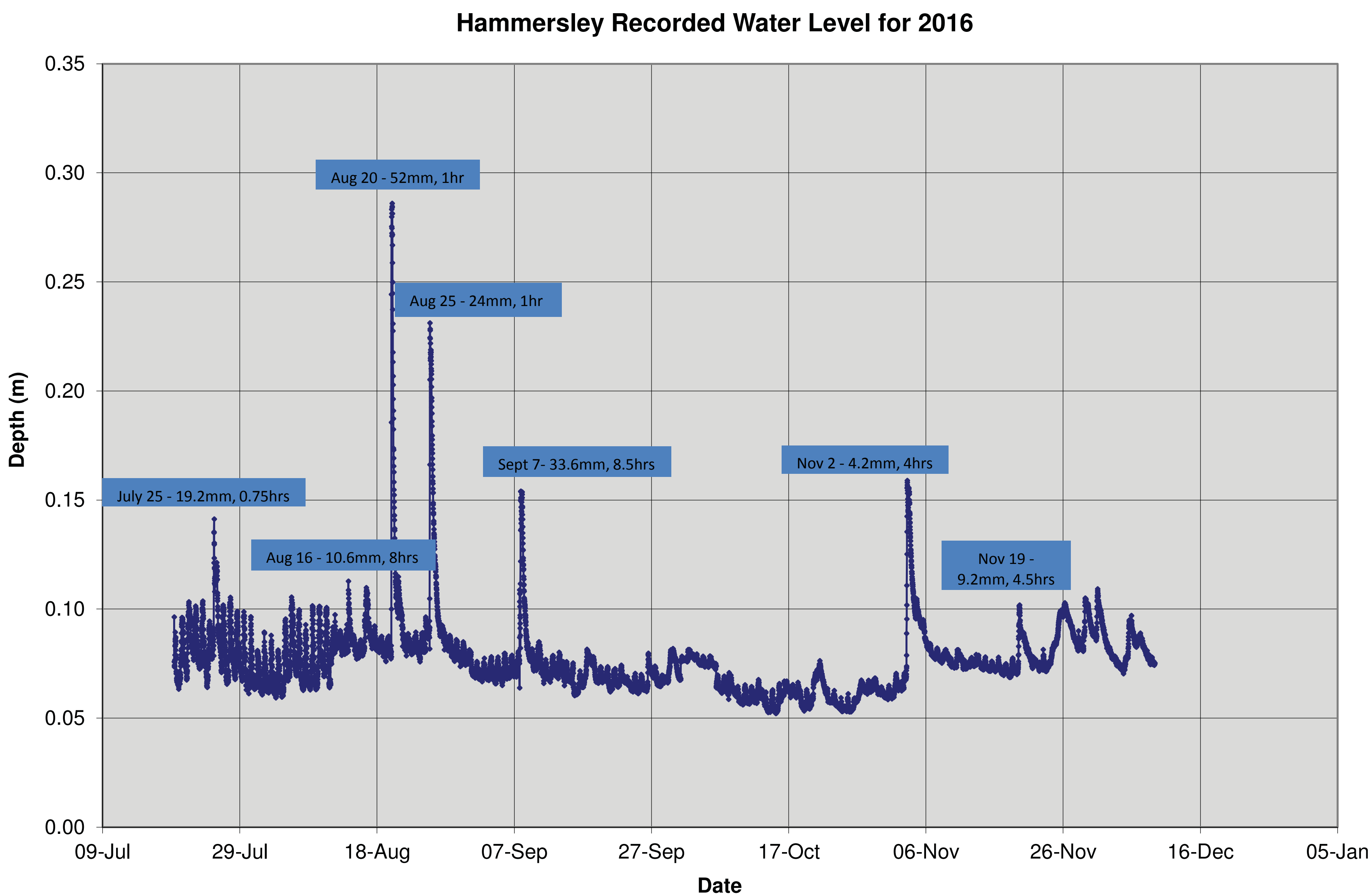

Barologger Recorded Pressure at Victoria/Maltby for 2016
Pressure (m)
14.50
14.40
14.30
14.20
14.10
14.00
13.90
13.80
19-Jun
9-Jul
29-Jul
18-Aug
7-Sep
27-Sep
17-Oct
6-Nov
26-Nov
16-Dec
5-Jan
Date and Time



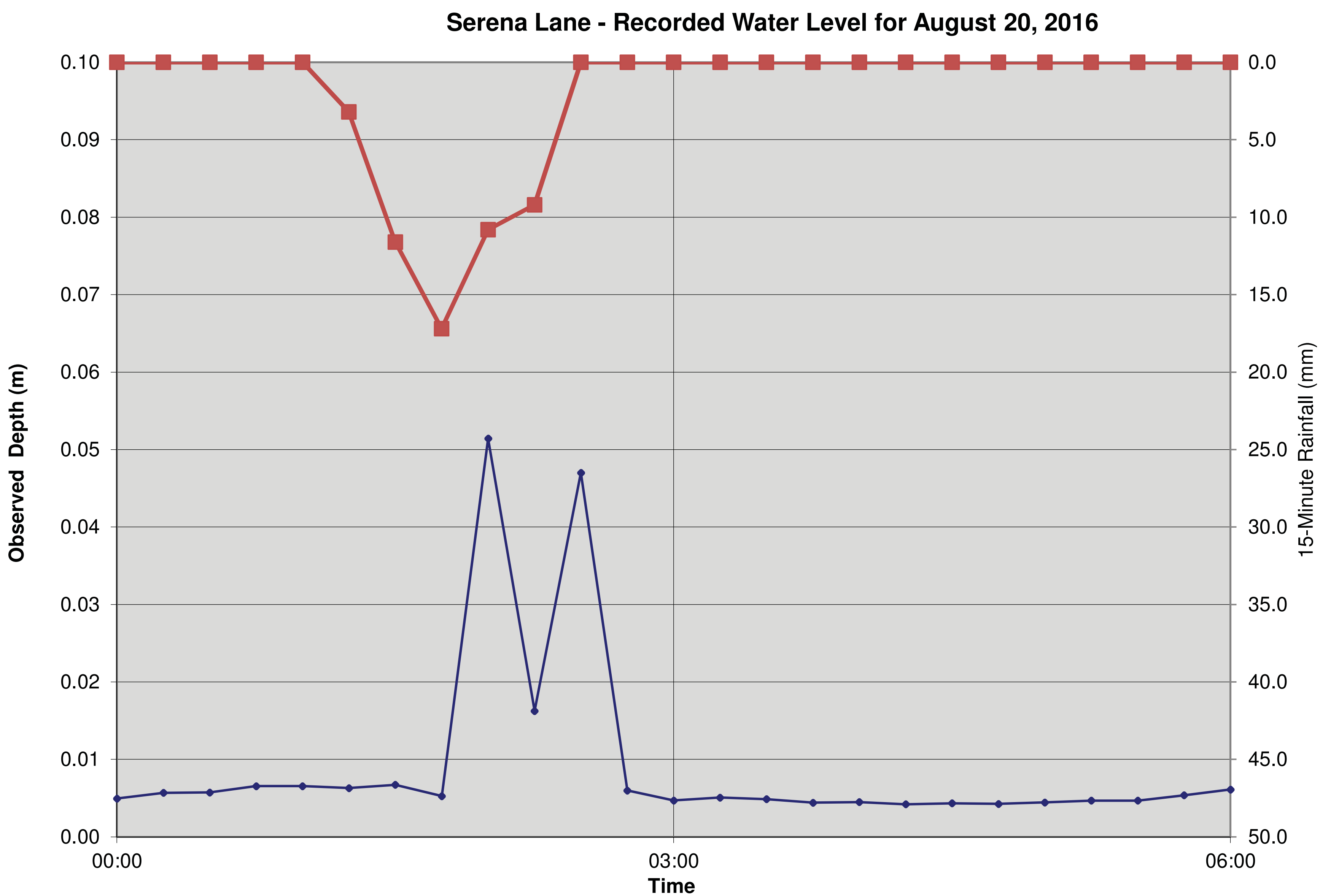
Halls Recorded Temperature for 2016
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temperature (deg C)
09-Jul
19-Jul
29-Jul
08-Aug
18-Aug
28-Aug
07-Sep
Date


Halls Pond Recorded Water Level for 2016
Depth (m)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
19-Jun
09-Jul
29-Jul
18-Aug
07-Sep
27-Sep
17-Oct
06-Nov
26-Nov
16-Dec
05-Jan
Date
July 25 - 19.2mm, 0.75hrs
Aug 5 - 10mm, 0.75hrs
Aug 20 - 52mm, 1hr
Sept 7- 33.6mm, 8.5hrs

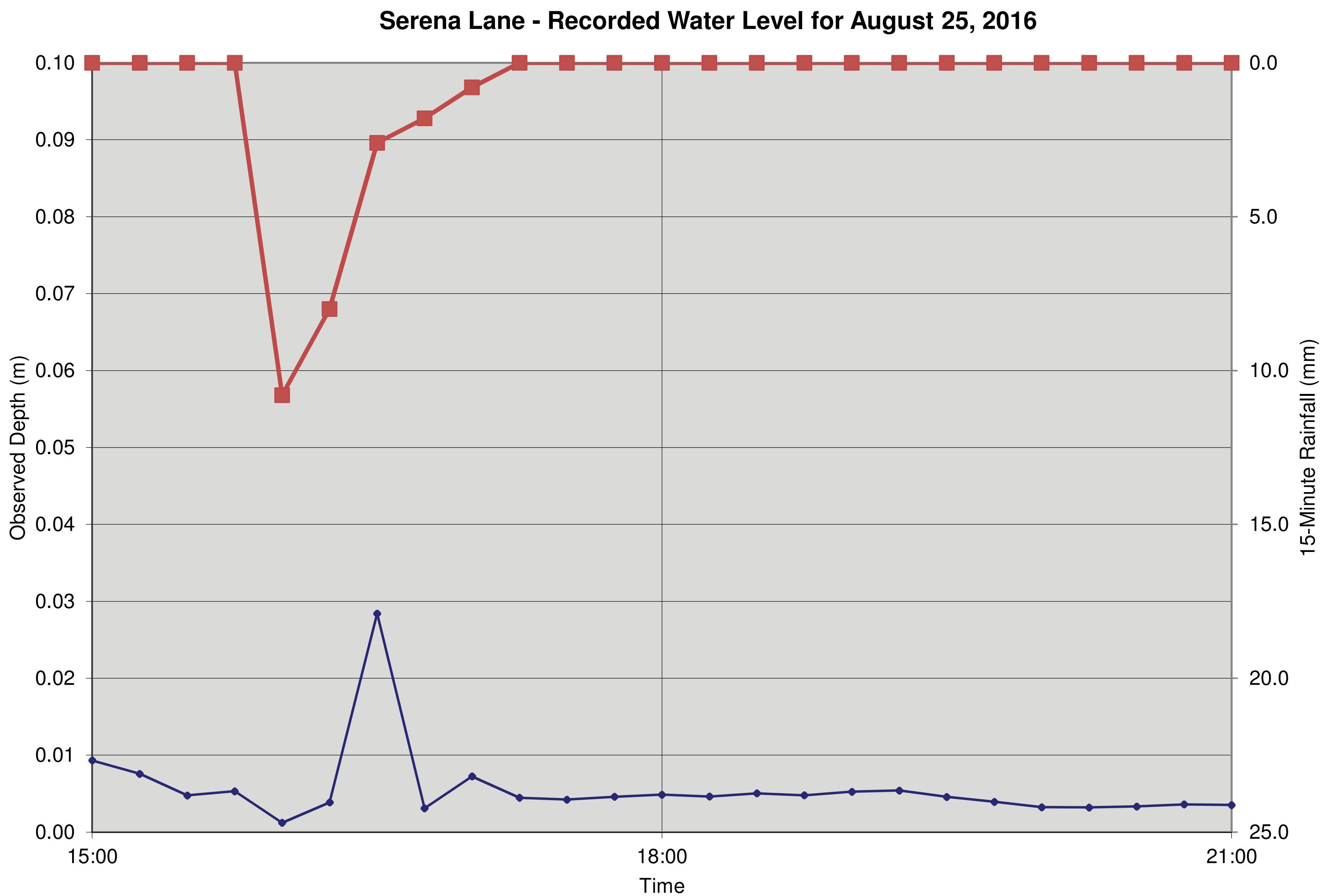

Hammersley Recorded Temperature for 2016
Temperature (deg C)
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
09-Jul
29-Jul
18-Aug
07-Sep
27-Sep
17-Oct
06-Nov
26-Nov
16-Dec
05-Jan
Date



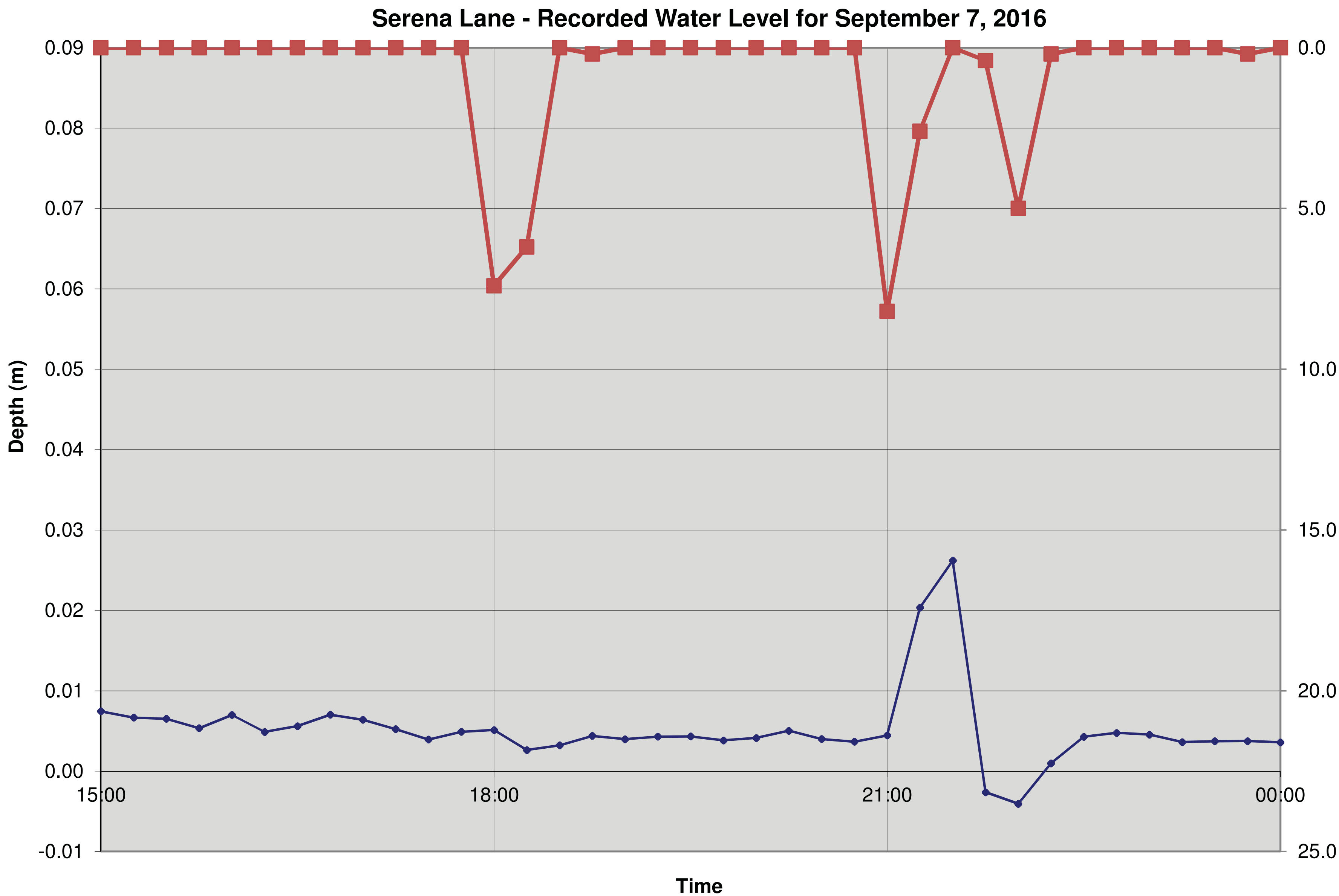
Hammersley Recorded Water Level for 2016
Depth (m)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
09-Jul
29-Jul
18-Aug
07-Sep
27-Sep
17-Oct
06-Nov
26-Nov
16-Dec
05-Jan
Date
Aug 20 - 52mm, 1hr
Aug 25 - 24mm, 1hr
Sept 7- 33.6mm, 8.5hrs
Nov 2 - 4.2mm, 4hrs
July 25 - 19.2mm, 0.75hrs
Aug 16 - 10.6mm, 8hrs
Nov 19 -
9.2mm, 4.5hrs



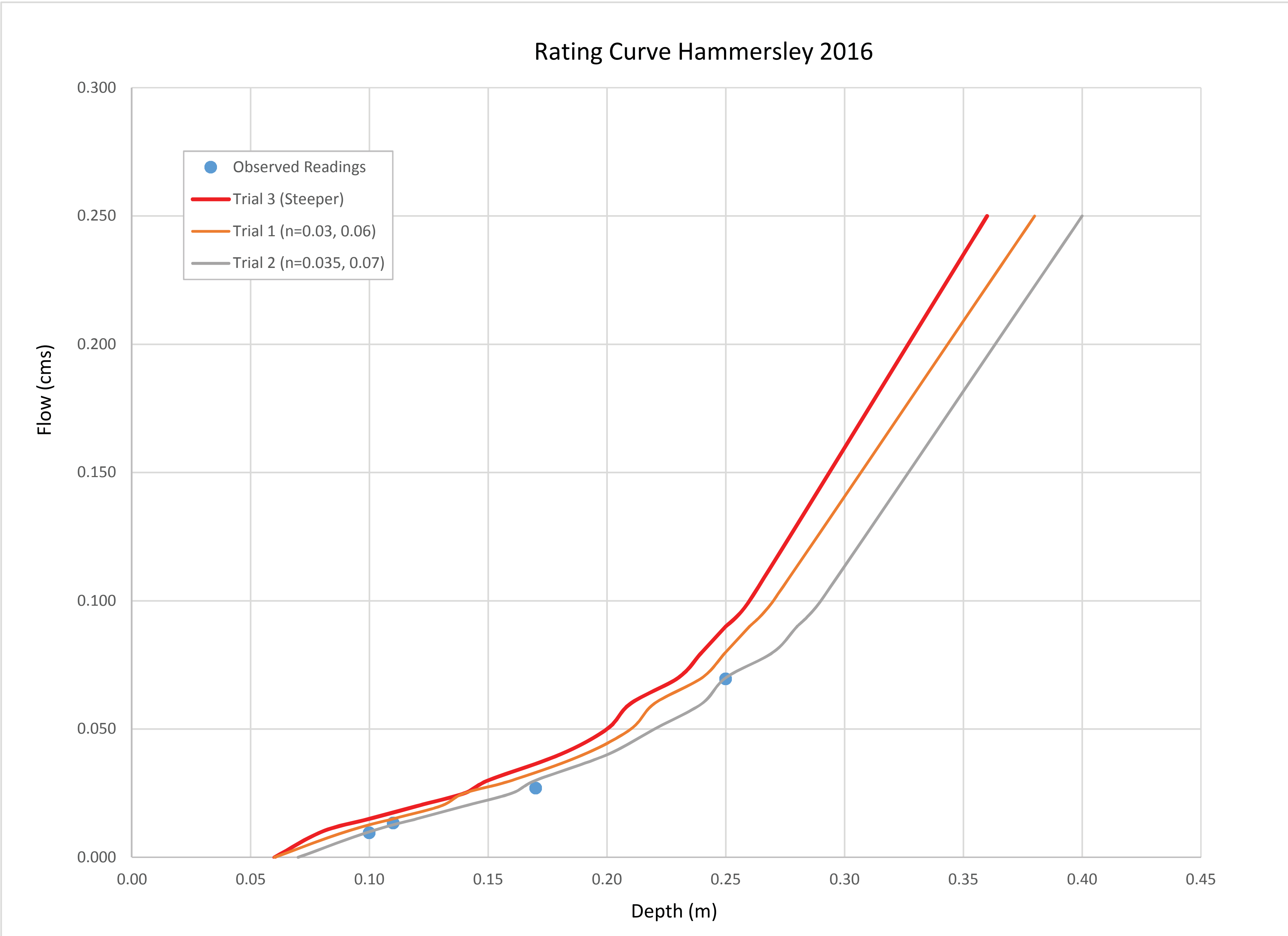
Serena Lane - Recorded Water Level for August 20, 2016
Observed Depth (m)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
15-Minute Rainfall (mm)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
00:00
03:00
06:00
Time



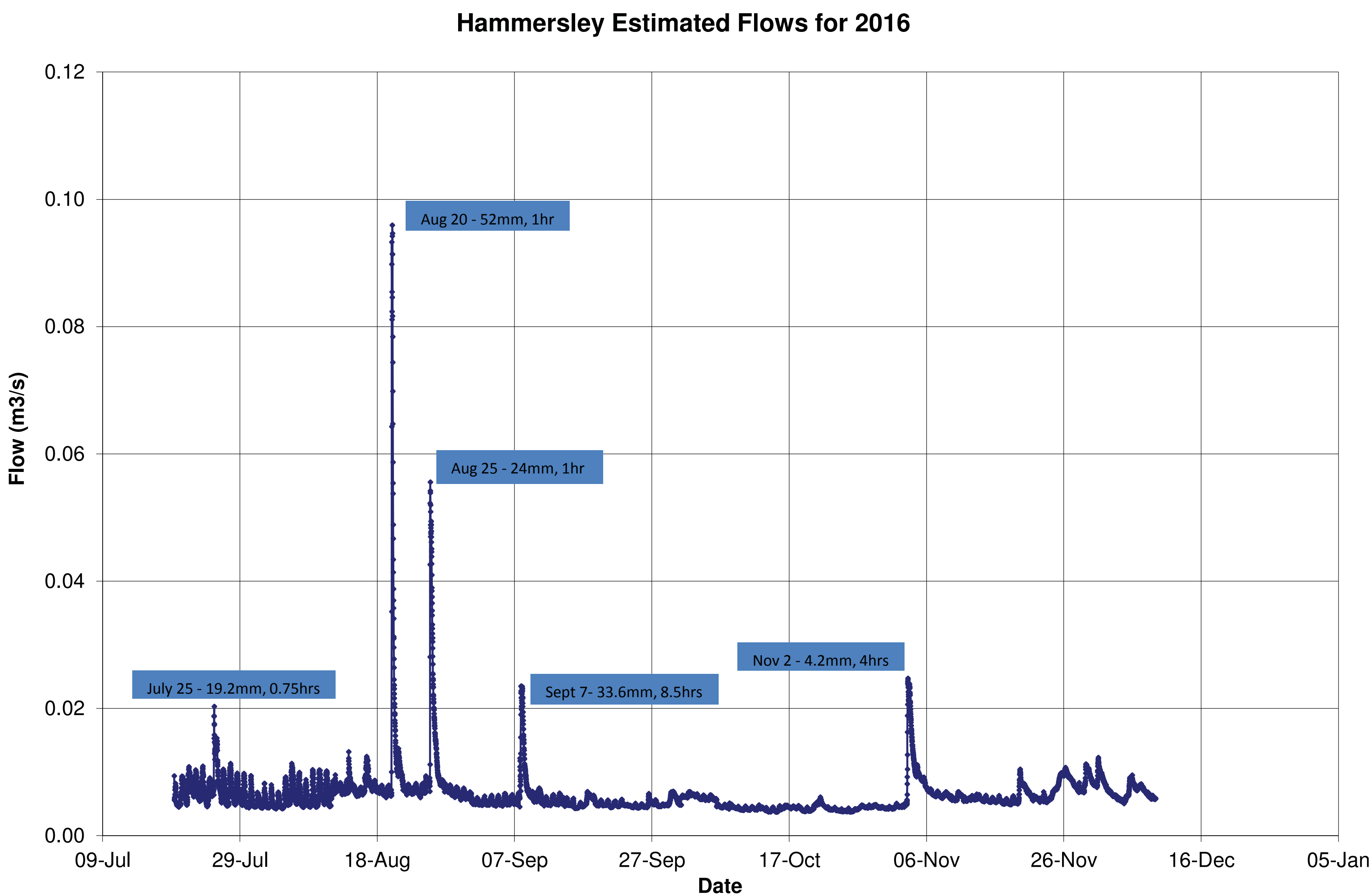
Serena Lane - Recorded Water Level for August 25, 2016
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Observed Depth (m)
0.0
5.0
10.0
15.0
20.0
25.0
15-Minute Rainfall (mm)
15:00
18:00
21:00
Time



Serena Lane - Recorded Water Level for September 7, 2016
Depth (m)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-0.01
0.0
5.0
10.0
15.0
20.0
25.0
15:00
18:00
21:00
00:00
Time



Rating Curve Hammersley 2016
Observed Readings
Trial 3 (Steeper)
Trial 1 (n=0.03, 0.06)
Trial 2 (n=0.035, 0.07)
Flow (cms)
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Depth (m)


Hammersley Estimated Flows for 2016
Flow (m3/s)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
09-Jul
29-Jul
18-Aug
07-Sep
27-Sep
17-Oct
06-Nov
26-Nov
16-Dec
05-Jan
Date
Aug 20 - 52mm, 1hr
Aug 25 - 24mm, 1hr
July 25 - 19.2mm, 0.75hrs
Sept 7- 33.6mm, 8.5hrs
Nov 2 - 4.2mm, 4hrs

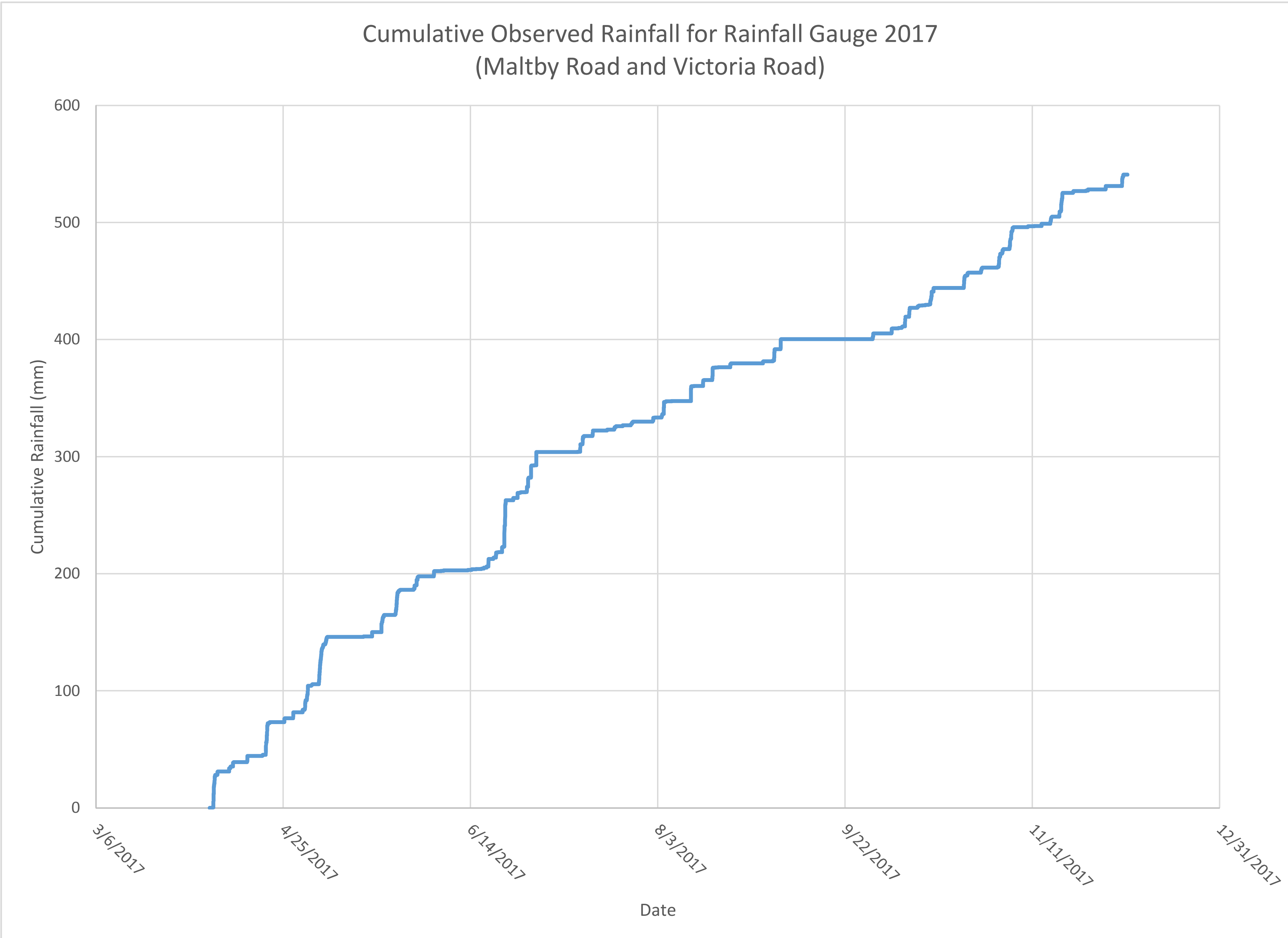
Station 7 WQ 2016 Summary 216002 - Clair/Maltby				4-Aug-2016 11:00	17-Aug-2016 11:40	22-Sep-2016 14:55	20-Oct-2016 13:55
Parameter	Lowest Detection Limit	Units	PWQO Surface Water Parameter Limits	8/4/2016 (11:00)	8/17/2016 (11:40)	9/22/2016 (14:55)	10/20/2016 (13:55)
Physical Tests (Water)							
Total Suspended Solids	2.0	mg/L		6.8	10.7	79.4	15.8
Total Dissolved Solids	20	mg/L		178	170	149	153
Anions and Nutrients (Water)							
Ammonia, Total (as N)	0.020	mg/L	0.02	0.028	<0.020	0.025	0.082
Bromide (Br)	0.10	mg/L		<0.10	<0.10	<0.10	<0.10
Chloride (Cl)	0.50	mg/L		9.92	10.1	12.3	12.7
Fluoride (F)	0.020	mg/L		0.042	0.043	0.067	0.044
Nitrate (as N)	0.020	mg/L		<0.020	<0.020	<0.020	<0.020
Nitrite (as N)	0.010	mg/L		<0.010	<0.010	<0.010	<0.010
Total Kjeldahl Nitrogen	0.15	mg/L		1.41	1.65	2.30	1.68
Orthophosphate-Dissolved (as P)	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030
Phosphorus, Total	0.0030	mg/L	0.03	**0.0540**	**0.0742**	**0.173**	**0.0743**
Sulfate (SO4)	0.30	mg/L		<0.30	<0.30	<0.30	<0.30
Total Metals (Water)							
Aluminum (Al)-Total	0.010	mg/L	0.075	**0.027**	**0.027**	**0.263**	<0.010
Antimony (Sb)-Total	0.00010	mg/L	0.02	<0.00010	0.00012	<0.00010	0.00018
Arsenic (As)-Total	0.00010	mg/L	0.1	0.00064	0.00079	0.00062	0.00049
Barium (Ba)-Total	0.00020	mg/L		0.0502	0.0130	0.0123	0.0084
Beryllium (Be)-Total	0.00010	mg/L	0.011	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (Bi)-Total	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Total	0.010	mg/L	0.2	0.013	0.014	0.015	0.011
Cadmium (Cd)-Total	0.000010	mg/L	0.0002	<0.000010	<0.000010	0.000022	<0.000010
Calcium (Ca)-Total	0.50	mg/L		32.7	30.9	24.4	30.6
Cesium (Cs)-Total	0.000010	mg/L		<0.000010	<0.000010	0.000026	<0.000010
Chromium (Cr)-Total	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	0.00010	mg/L	0.0009	<0.00010	<0.00010	0.00015	<0.00010
Copper (Cu)-Total	0.0010	mg/L	0.005	<0.0010	<0.0010	<0.0010	<0.0010
Iron (Fe)-Total	0.050	mg/L	0.3	**0.371**	**0.457**	**0.491**	<0.050
Lead (Pb)-Total	0.00010	mg/L	0.001	0.00038	0.00053	**0.00207**	<0.00010
Magnesium (Mg)-Total	0.050	mg/L		8.72	7.55	7.65	6.98
Manganese (Mn)-Total	0.00050	mg/L		0.111	0.0780	0.0317	0.0150
Molybdenum (Mo)-Total	0.000050	mg/L	0.04	<0.000050	<0.000050	0.000069	<0.000050
Nickel (Ni)-Total	0.00050	mg/L	0.025	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)-Total	0.050	mg/L		1.37	1.80	1.26	2.02
Rubidium (Rb)-Total	0.00020	mg/L		0.00045	0.00073	0.00088	0.00105
Selenium (Se)-Total	0.000050	mg/L	0.1	0.000062	0.000068	0.000082	<0.000050
Silicon (Si)-Total	0.050	mg/L		0.685	1.13	1.42	0.72
Silver (Ag)-Total	0.000050	mg/L	0.0001	<0.000050	<0.000050	<0.000050	<0.000050

Strontium (Sr)-Total	0.0010	mg/L		0.0650	0.0368	0.0340	0.0412
Sulfur (S)-Total	0.50	mg/L		0.52	<0.50	<0.50	<0.50
Tellurium (Te)-Total	0.00020	mg/L		<0.00020	<0.00020	<0.00020	<0.00020
Thallium (Tl)-Total	0.000010	mg/L	0.0003	<0.000010	<0.000010	<0.000010	<0.000010
Thorium (Th)-Total	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	0.00010	mg/L		0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	0.00030	mg/L		0.00051	0.00078	0.00690	<0.00030
Tungsten (W)-Total	0.00010	mg/L	0.03	<0.00010	<0.00010	<0.00010	<0.00010
Uranium (U)-Total	0.000010	mg/L	0.005	<0.000010	<0.000010	0.000016	<0.000010
Vanadium (V)-Total	0.00050	mg/L	0.006	<0.00050	<0.00050	0.00083	<0.00050
Zinc (Zn)-Total	0.0030	mg/L	0.02	0.0043	0.0032	0.0100	<0.0030
Zirconium (Zr)-Total	0.00030	mg/L	0.004	<0.00030	<0.00030	<0.00030	<0.00030

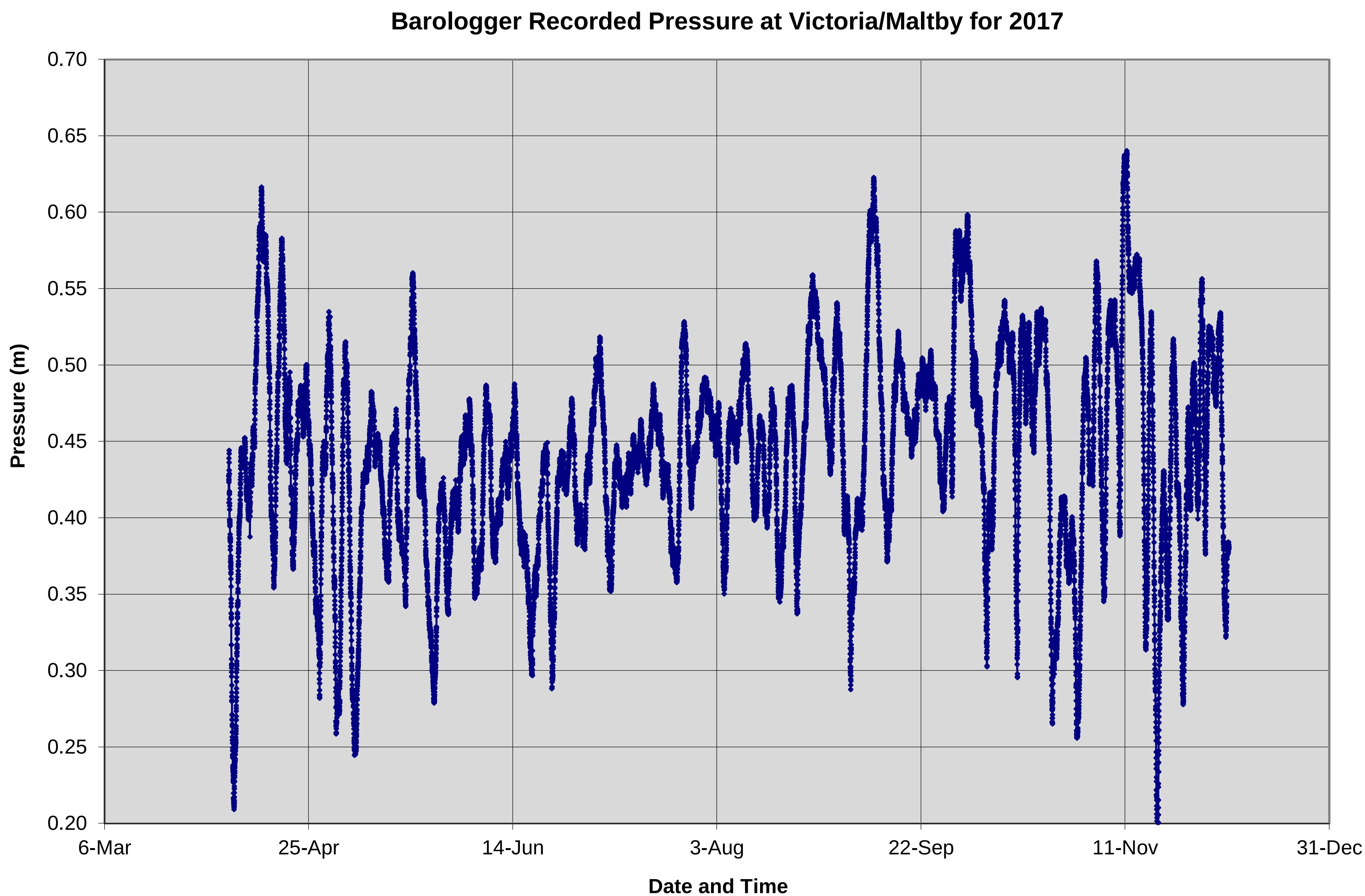
Station 14 WQ 2016 Summary 216002- Clair/Maltby				4-Aug-2016 10:12	17-Aug-2016 10:55	22-Sep-2016 14:17	20-Oct-2016 13:55
Parameter	Lowest Detection Limit	Units	PWQO Surface Water Parameter Limits	8/4/2016 (10:12)	8/17/2016 (10:55)	9/22/2016 (14:17)	10/20/2016 (13:55)
Physical Tests (Water)							
Total Suspended Solids	2.0	mg/L		<2.0	2.5	<2.0	4.0
Total Dissolved Solids	20	mg/L		388	362	379	350
Anions and Nutrients (Water)							
Ammonia, Total (as N)	0.020	mg/L	0.02	<0.020	0.043	0.032	0.074
Bromide (Br)	0.10	mg/L		<0.10	<0.10	<0.10	<0.10
Chloride (Cl)	0.50	mg/L		38.0	33.5	36.7	33.6
Fluoride (F)	0.020	mg/L		0.050	0.051	0.064	0.042
Nitrate (as N)	0.020	mg/L		0.741	0.610	0.704	0.497
Nitrite (as N)	0.010	mg/L		<0.010	<0.010	<0.010	<0.010
Total Kjeldahl Nitrogen	0.15	mg/L		0.26	<0.15	0.21	0.31
Orthophosphate-Dissolved (as P)	0.0030	mg/L		0.0046	0.0097	0.0050	<0.0030
Phosphorus, Total	0.0030	mg/L	0.03	0.0056	0.0094	0.0069	0.0075
Sulfate (SO4)	0.30	mg/L		20.0	17.2	18.9	18.1
Total Metals (Water)							
Aluminum (Al)-Total	0.010	mg/L	0.075	<0.010	<0.010	<0.010	<0.010
Antimony (Sb)-Total	0.00010	mg/L	0.02	<0.00010	0.00011	<0.00010	0.00018
Arsenic (As)-Total	0.00010	mg/L	0.1	0.00017	0.00020	0.00017	0.00049
Barium (Ba)-Total	0.00020	mg/L		0.0609	0.0519	0.0586	0.00840
Beryllium (Be)-Total	0.00010	mg/L	0.011	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (Bi)-Total	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Total	0.010	mg/L	0.2	0.010	0.011	0.011	0.011
Cadmium (Cd)-Total	0.000010	mg/L	0.0002	0.000050	0.000052	0.000042	<0.000010
Calcium (Ca)-Total	0.50	mg/L		83.0	74.8	80.2	30.6
Cesium (Cs)-Total	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010
Chromium (Cr)-Total	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	0.00010	mg/L	0.0009	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	0.0010	mg/L	0.005	<0.0010	<0.0010	<0.0010	<0.0010
Iron (Fe)-Total	0.050	mg/L	0.3	<0.050	<0.050	<0.050	<0.050
Lead (Pb)-Total	0.00010	mg/L	0.001	<0.00010	<0.00010	<0.00010	<0.00010
Magnesium (Mg)-Total	0.050	mg/L		28.0	24.8	24.8	6.98
Manganese (Mn)-Total	0.00050	mg/L		0.0103	0.0145	0.0101	0.0150
Molybdenum (Mo)-Total	0.000050	mg/L	0.04	0.000432	0.000412	0.000419	<0.000050
Nickel (Ni)-Total	0.00050	mg/L	0.025	<0.00050	<0.00050	0.00053	<0.00050
Potassium (K)-Total	0.050	mg/L		1.24	1.11	1.15	2.02
Rubidium (Rb)-Total	0.00020	mg/L		0.00135	0.00122	0.00127	0.00105
Selenium (Se)-Total	0.000050	mg/L	0.1	0.000154	0.000160	0.000145	<0.000050
Silicon (Si)-Total	0.050	mg/L		5.24	4.89	4.84	0.716
Silver (Ag)-Total	0.000050	mg/L	0.0001	<0.000050	<0.000050	<0.000050	<0.000050

Strontium (Sr)-Total	0.0010	mg/L		0.107	0.107	0.109	0.0412
Sulfur (S)-Total	0.50	mg/L		7.40	6.42	6.59	<0.50
Tellurium (Te)-Total	0.00020	mg/L		<0.00020	<0.00020	<0.00020	<0.00020
Thallium (Tl)-Total	0.000010	mg/L	0.0003	0.000017	0.000013	0.000012	<0.000010
Thorium (Th)-Total	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	0.00030	mg/L		<0.00030	<0.00030	<0.00030	<0.00030
Tungsten (W)-Total	0.00010	mg/L	0.03	<0.00010	<0.00010	<0.00010	<0.00010
Uranium (U)-Total	0.000010	mg/L	0.005	0.000577	0.000501	0.000538	<0.000010
Vanadium (V)-Total	0.00050	mg/L	0.006	<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Total	0.0030	mg/L	0.02	**0.0890**	**0.0760**	**0.0759**	<0.0030
Zirconium (Zr)-Total	0.00030	mg/L	0.004	<0.00030	<0.00030	<0.00030	<0.00030

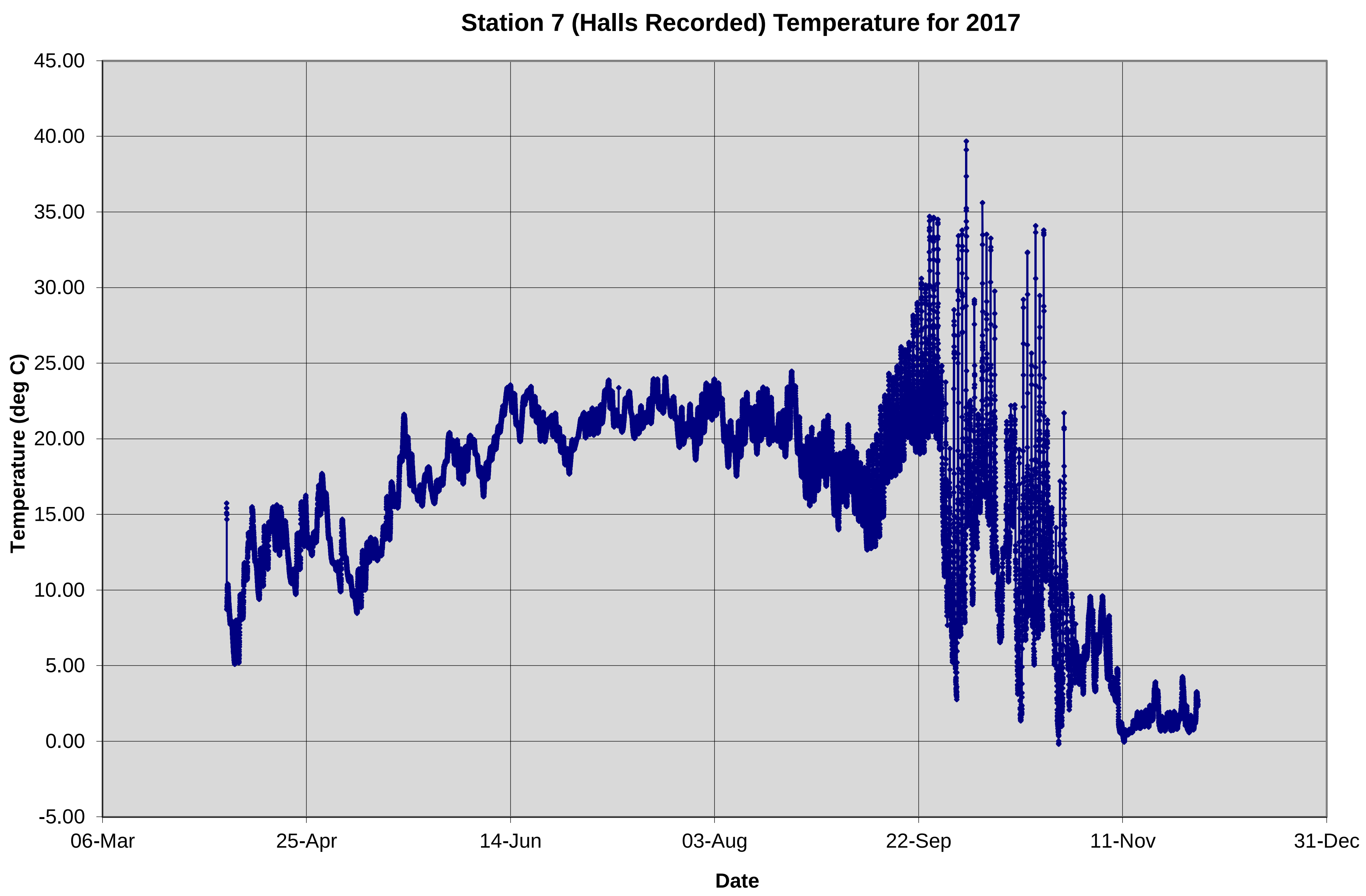
2017 Results



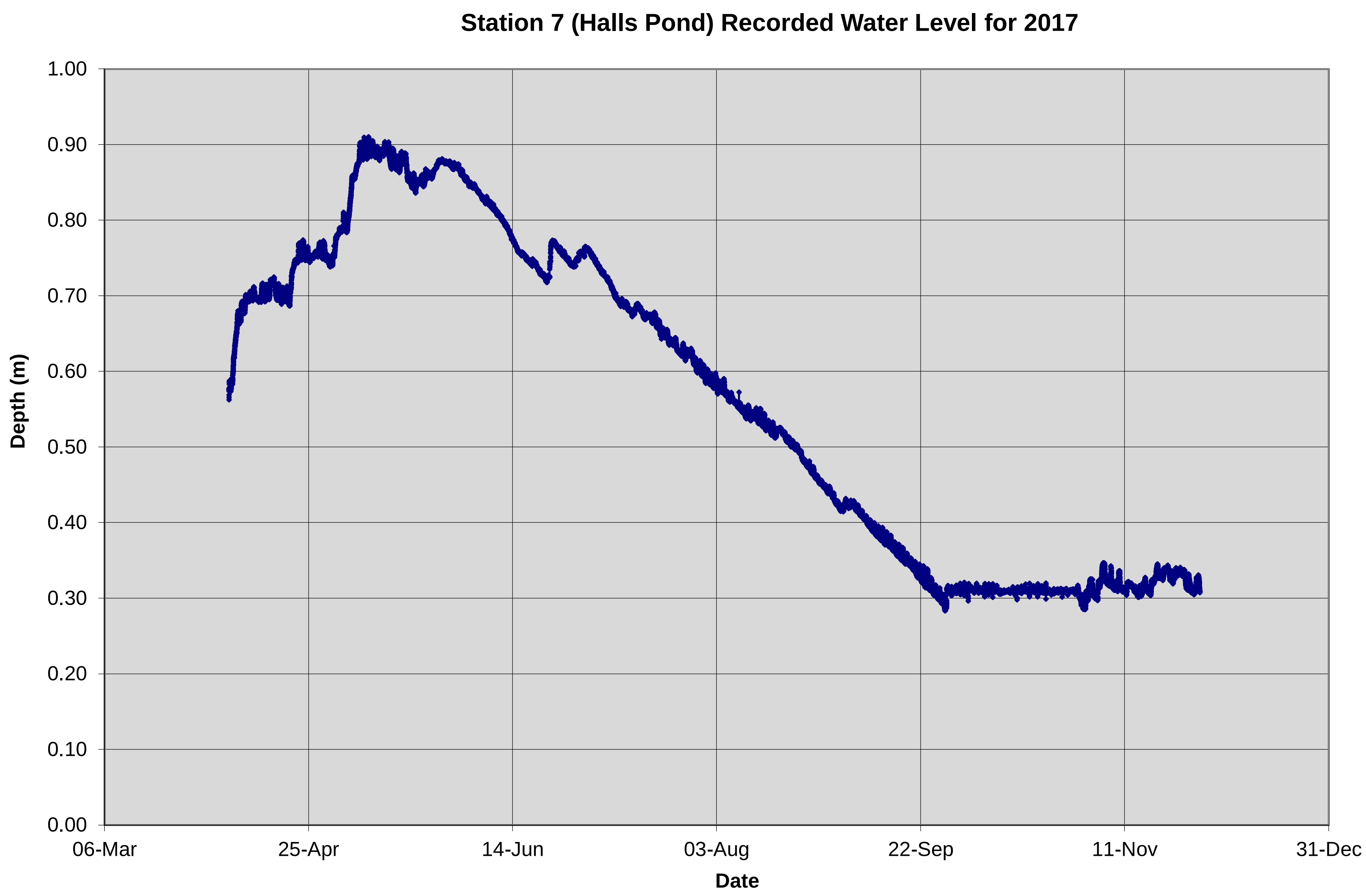
Cumulative Observed Rainfall for Rainfall Gauge 2017
(Maltby Road and Victoria Road)
Cumulative Rainfall (mm)
0
100
200
300
400
500
600
3/6/2017
4/25/2017
6/14/2017
8/3/2017
9/22/2017
11/11/2017
12/31/2017
Date

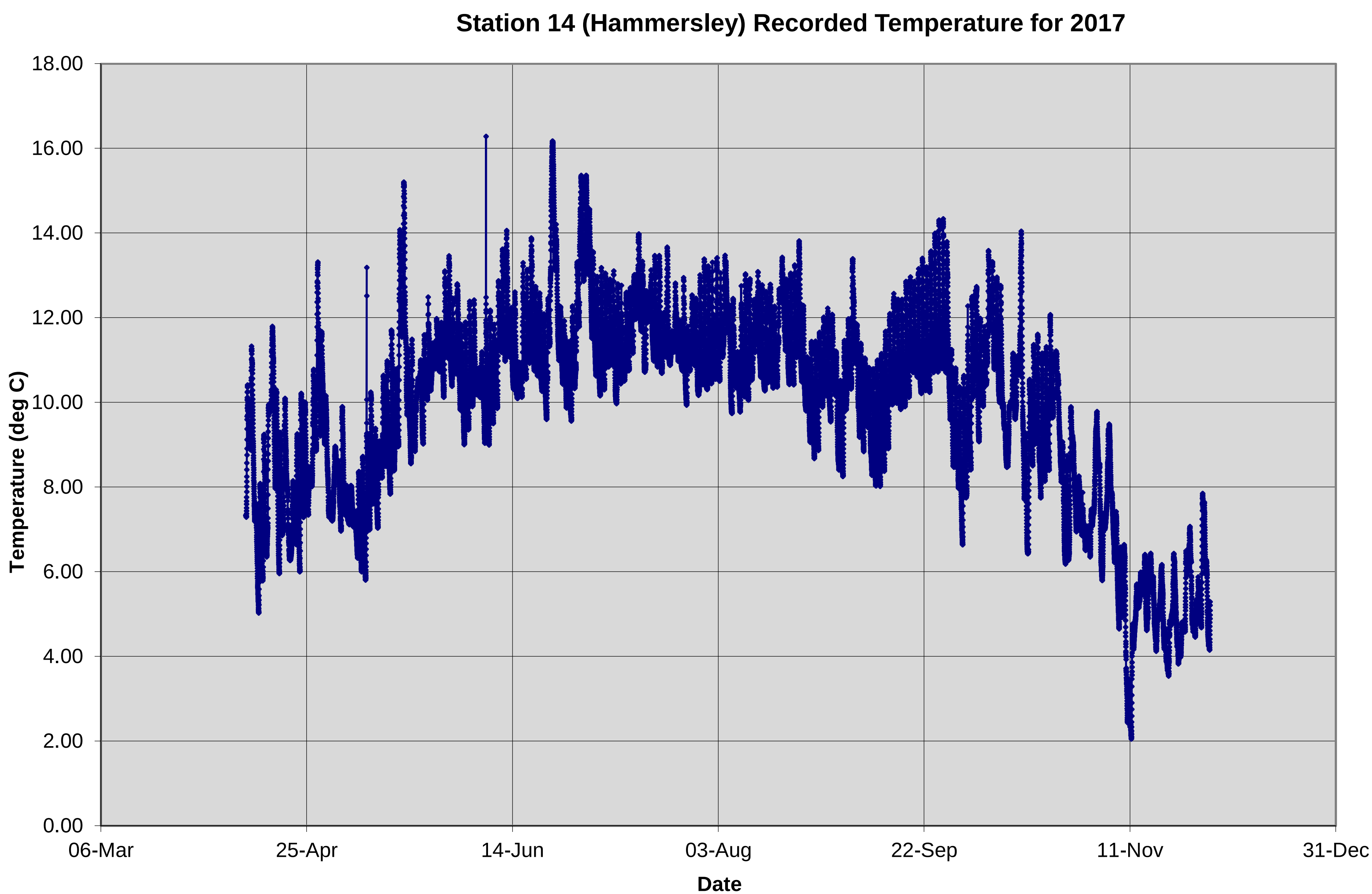


Barologger Recorded Pressure at Victoria/Maltby for 2017
Pressure (m)
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
6-Mar
25-Apr
14-Jun
3-Aug
22-Sep
11-Nov
31-Dec
Date and Time

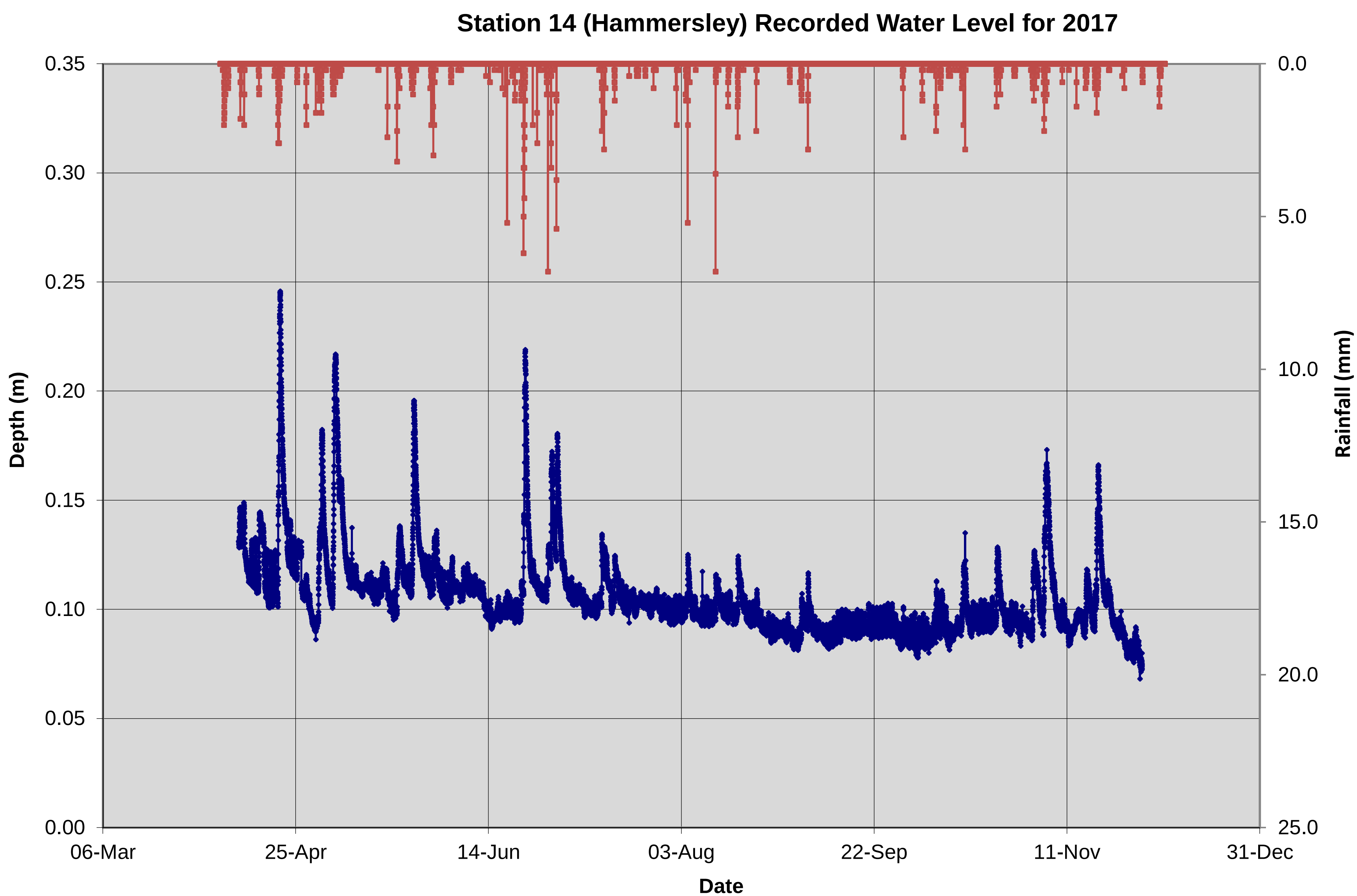


Station 7 (Halls Recorded) Temperature for 2017
Temperature (deg C)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
06-Mar
25-Apr
14-Jun
03-Aug
22-Sep
11-Nov
31-Dec
Date

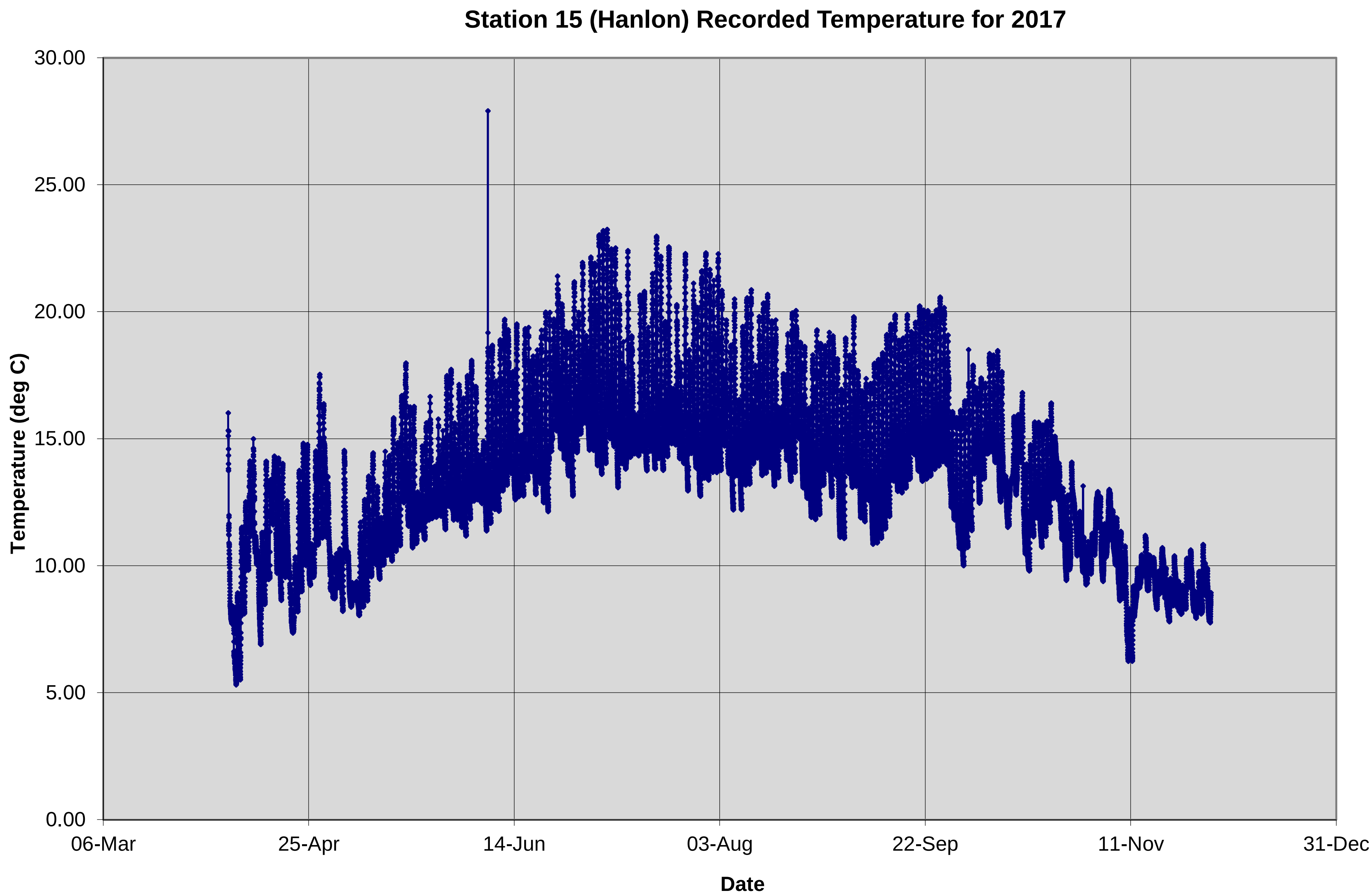

Station 7 (Halls Pond) Recorded Water Level for 2017
Depth (m)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
06-Mar
25-Apr
14-Jun
03-Aug
22-Sep
11-Nov
31-Dec
Date



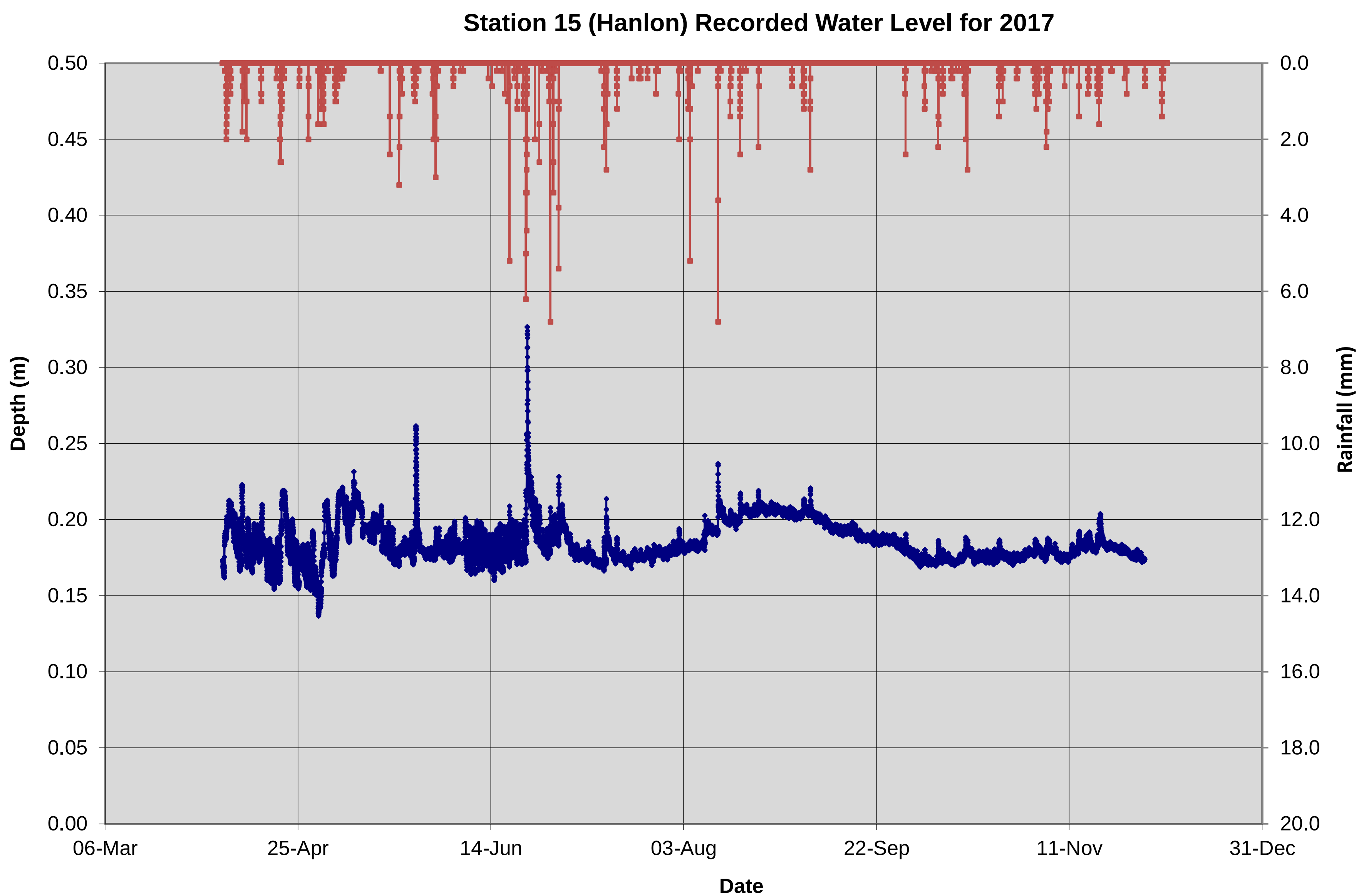
Station 14 (Hammersley) Recorded Temperature for 2017
Temperature (deg C)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
06-Mar
25-Apr
14-Jun
03-Aug
22-Sep
11-Nov
31-Dec
Date

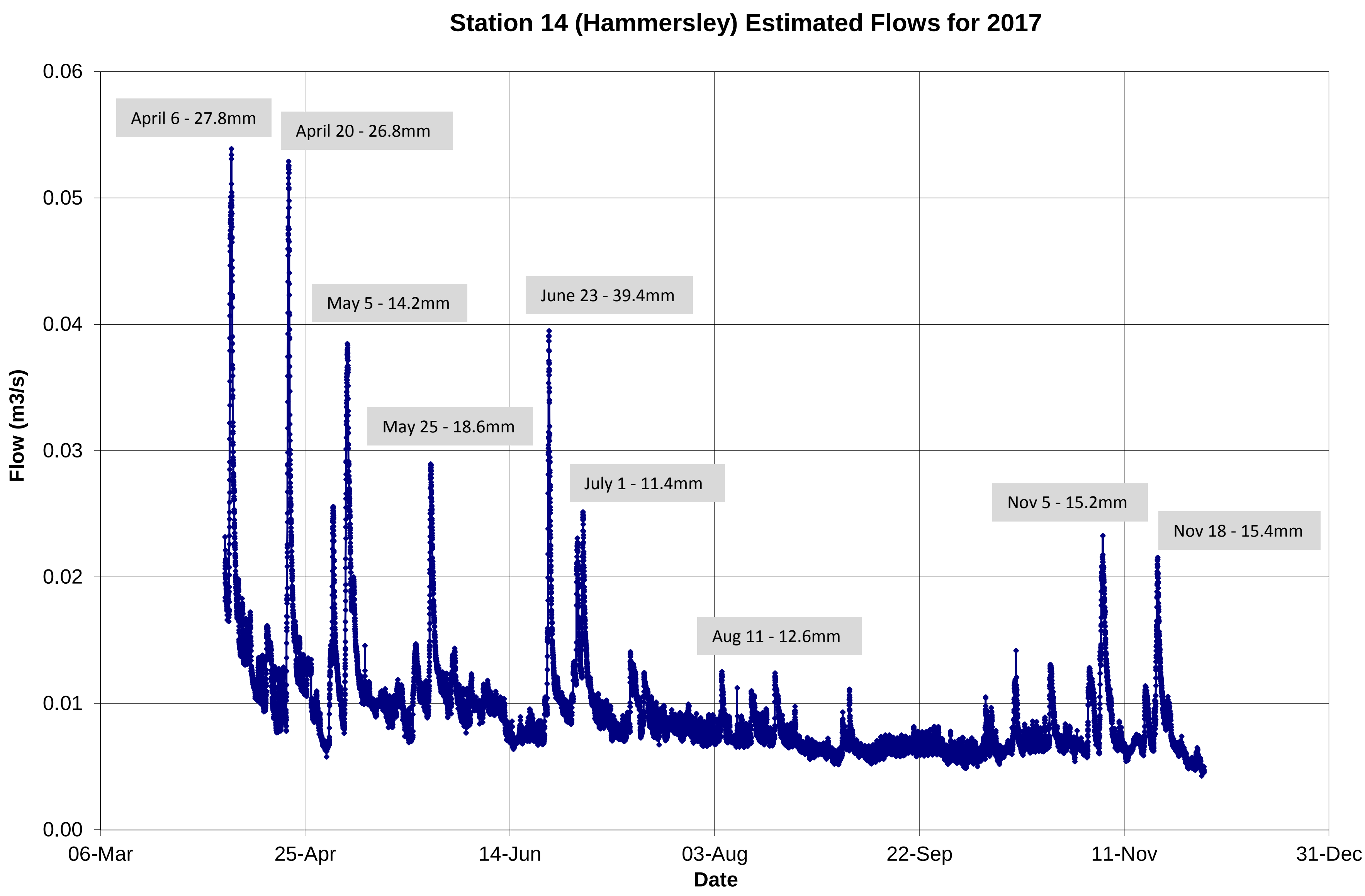


Station 14 (Hammersley) Recorded Water Level for 2017
Depth (m)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Rainfall (mm)
0.0
5.0
10.0
15.0
20.0
25.0
06-Mar
25-Apr
14-Jun
03-Aug
22-Sep
11-Nov
31-Dec
Date

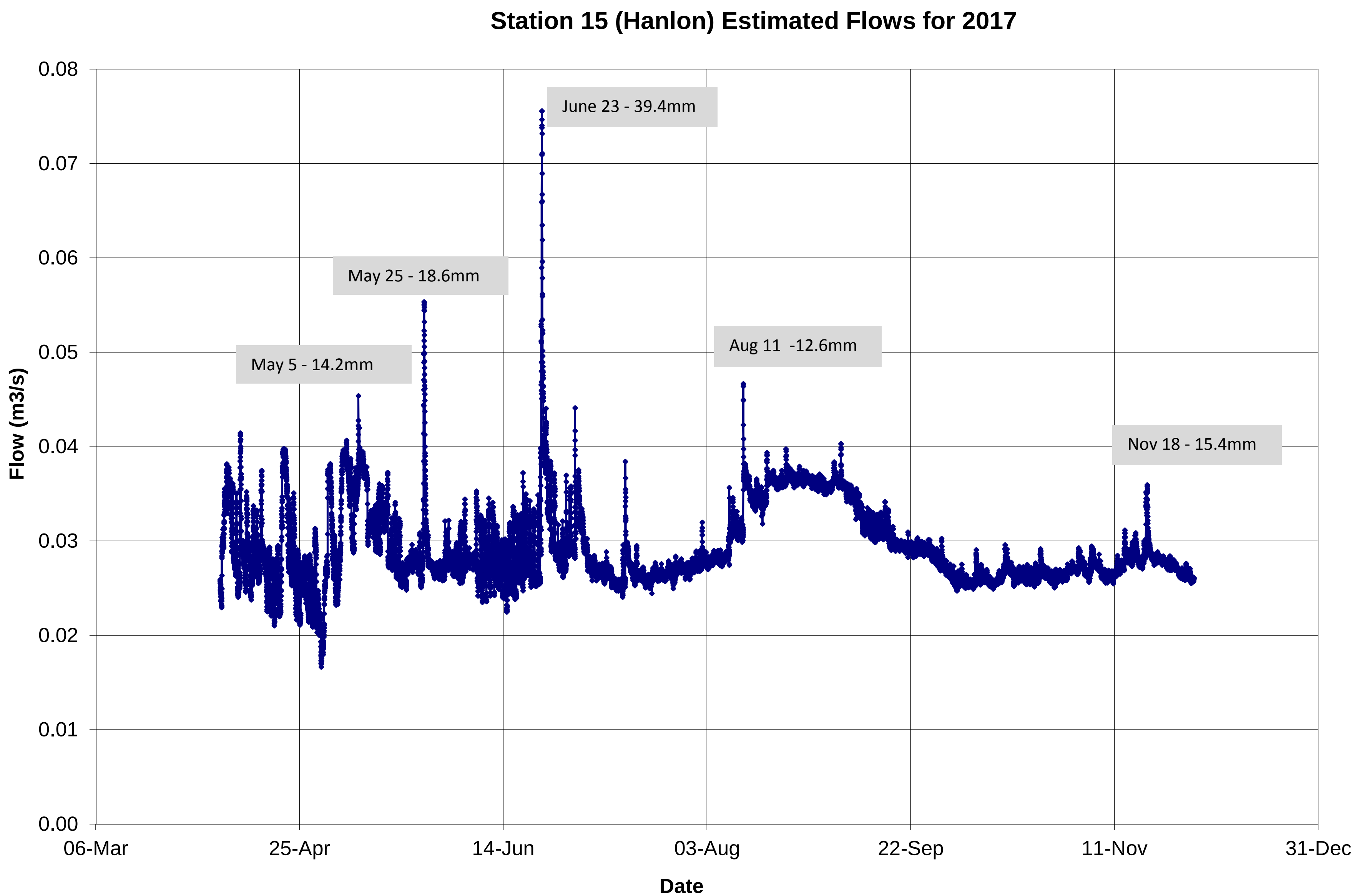


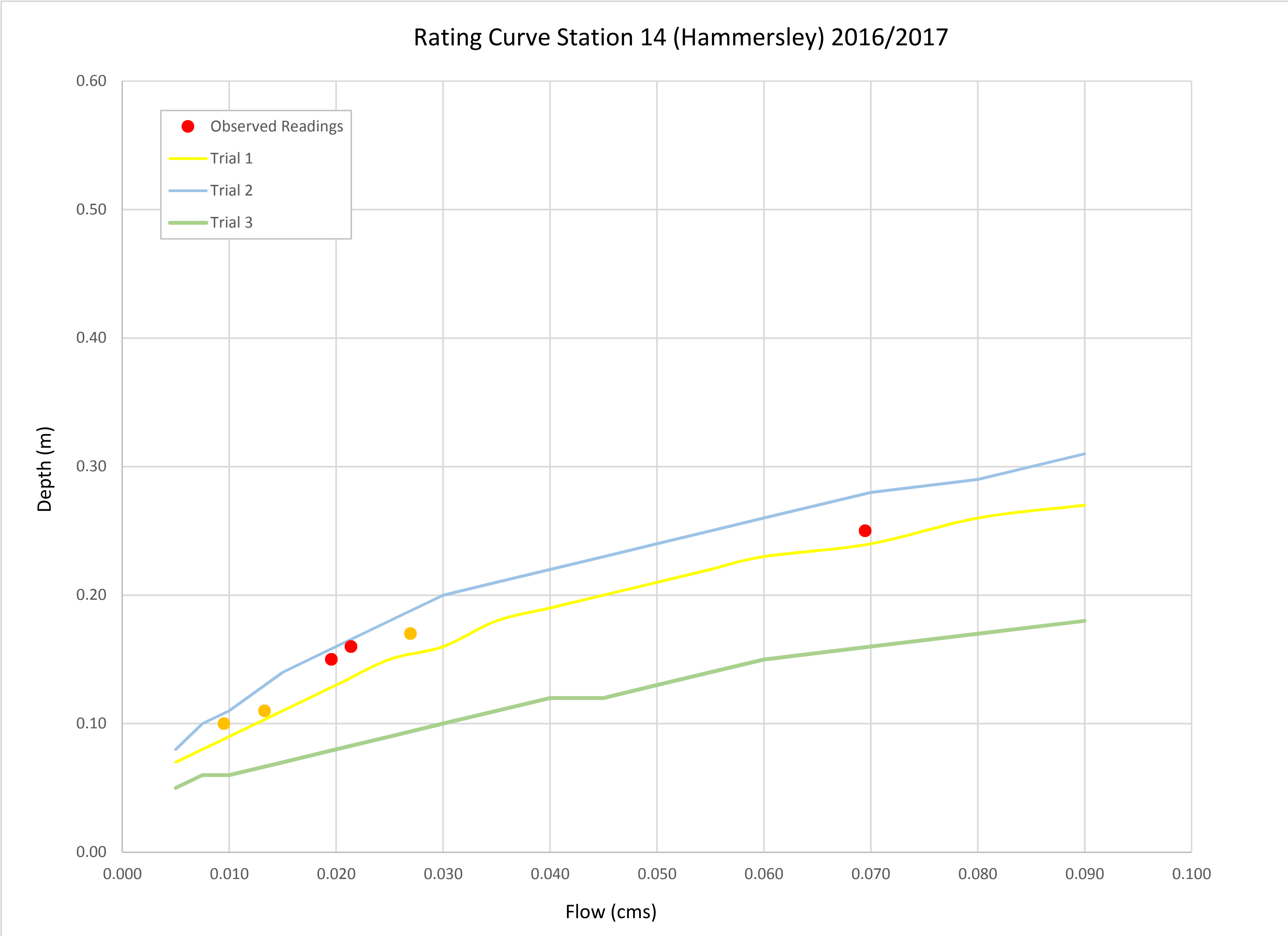
Station 15 (Hanlon) Recorded Temperature for 2017
Temperature (deg C)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
06-Mar
25-Apr
14-Jun
03-Aug
22-Sep
11-Nov
31-Dec
Date


Station 15 (Hanlon) Recorded Water Level for 2017
Depth (m)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Rainfall (mm)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
06-Mar
25-Apr
14-Jun
03-Aug
22-Sep
11-Nov
31-Dec
Date

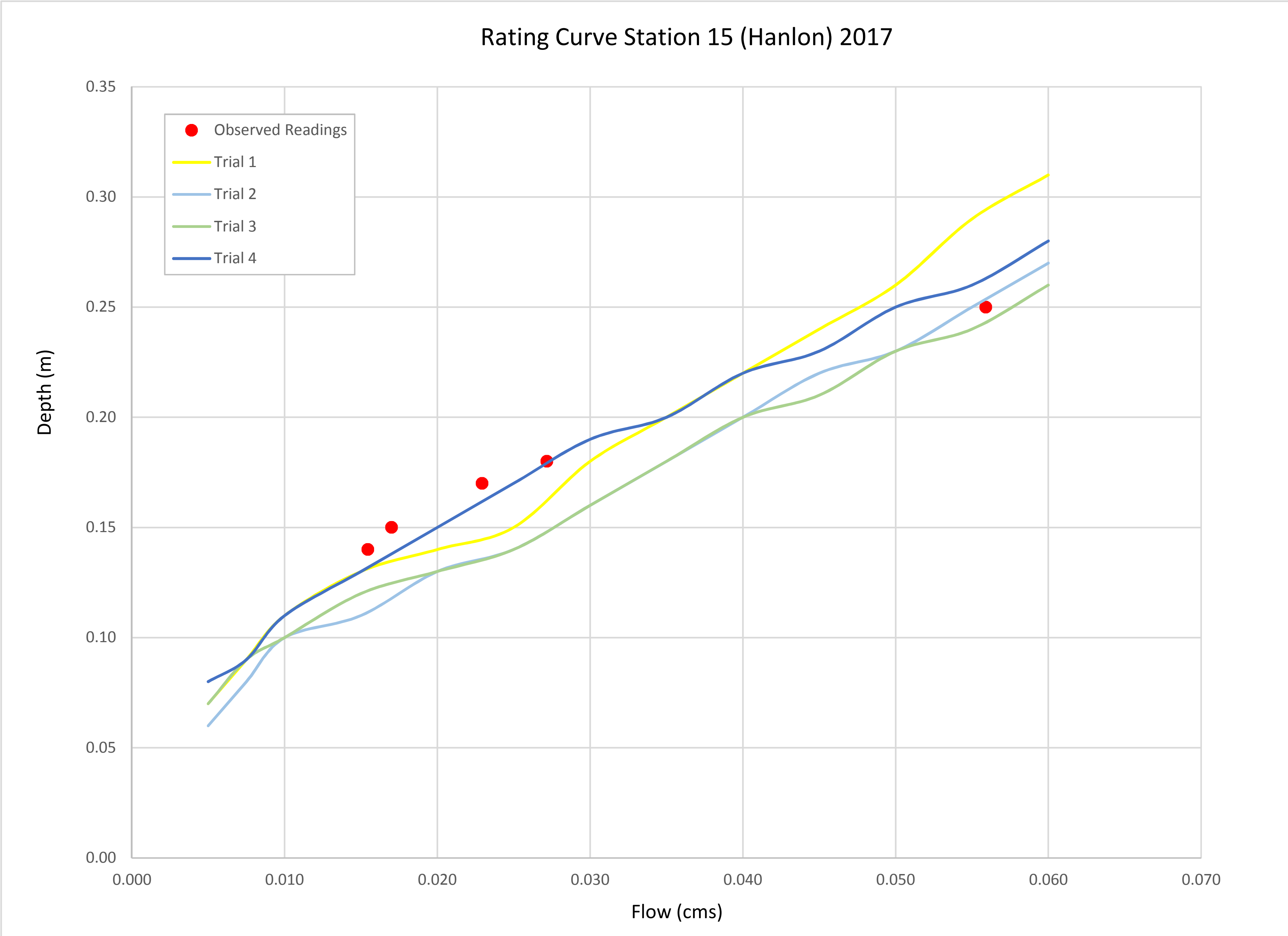


Station 14 (Hammersley) Estimated Flows for 2017
Flow (m3/s)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
April 6 - 27.8mm
April 20 - 26.8mm
May 5 - 14.2mm
May 25 - 18.6mm
June 23 - 39.4mm
July 1 - 11.4mm
Aug 11 - 12.6mm
Nov 5 - 15.2mm
Nov 18 - 15.4mm
06-Mar
25-Apr
14-Jun
03-Aug
22-Sep
11-Nov
31-Dec
Date


Station 15 (Hanlon) Estimated Flows for 2017
Flow (m3/s)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
June 23 - 39.4mm
May 25 - 18.6mm
May 5 - 14.2mm
Aug 11 -12.6mm
Nov 18 - 15.4mm
06-Mar
25-Apr
14-Jun
03-Aug
22-Sep
11-Nov
31-Dec
Date



Rating Curve Station 14 (Hammersley) 2016/2017
Observed Readings
Trial 1
Trial 2
Trial 3
Depth (m)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.000
0.010
0.020
0.030
0.040
0.050
0.060
0.070
0.080
0.090
0.100
Flow (cms)



Rating Curve Station 15 (Hanlon) 2017
Observed Readings
Trial 1
Trial 2
Trial 3
Trial 4
Depth (m)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.000
0.010
0.020
0.030
0.040
0.050
0.060
0.070
Flow (cms)

Appendix SW-2:

Wetland Level and Quality Monitoring Stations Photo Log (2016 - 2017)

Photo 1.
Wetland Station 1 – May 1, 2017.
(Photo provided by Matrix Solutions Inc.)

Photo 2.
Wetland Station 1 – August 10, 2017
(Photo provided by Matrix Solutions Inc.)

Photo 3.
Station 2 – May 1, 2017.
(Photo provided by Matrix Solutions Inc.)

Photo 4.
Station 2 – May 1, 2017
(Photo provided by Matrix Solutions Inc.)

Photo 5.
Station 2 – August 10, 2017
(Photo provided by Matrix Solutions Inc.)

Photo 6.
Station 2 – August 10, 2017
(Photo provided by Matrix Solutions Inc.)

Photo 7.
Station 3 – April 18, 2017.

Photo 8.
Station 3 – May 1, 2017

Photo 9.
Station 3 – August 10, 2017

Photo 10.
Station 3 – November 29, 2017

Photo 11.
Station 4 – April 18, 2017.

Photo 12.
Station 4 – May 1, 2017

Photo 13.
Station 4 – August 10, 2017

Photo 14.
Station 4 – November 3, 2017

Photo 15.
Station 5 – April 18, 2017.

Photo 16.
Station 5 – May 1, 2017

Photo 17.
Station 5 – August 10, 2017

Photo 18.
Station 5 – November 29, 2017

Photo 19.
Station 6 – April 18, 2017.

Photo 20.
Station 6 – May 1, 2017

Photo 21.
Station 6 – August 10, 2017

Photo 22.
Station 6 – November 3, 2017

Photo 23.
Station 7 – April 18, 2017.

Photo 24.
Station 7 – May 1, 2017

Photo 25.
Station 7 – August 10, 2017

Photo 26.
Station 7 – November 3, 2017

Photo 27.
Station 8 – April 18, 2017.

Photo 28.
Station 8 – May 1, 2017

Photo 29.
Station 8 – August 10, 2017

Photo 30.
Station 8 – November 3, 2017

Photo 31.
Station 10 – April 18, 2017.

Photo 32.
Station 10 – May 1, 2017

Photo 33.
Station 10 – August 10, 2017

Photo 34.
Station 10 – November 3, 2017

Photo 35.
Station 11 – April 18, 2017.

Photo 36.
Station 11 – May 1, 2017

Photo 37.
Station 11 – August 10, 2017

Photo 38.
Station 11 – November 3, 2017

Photo 39.
Station 12 – April 18, 2017.

Photo 40.
Station 12 – May 1, 2017

Photo 41.
Station 12 – August 10, 2017

Photo 42.
Station 12 – November 29, 2017

Photo 43.
Station 13 – April 18, 2017.

Photo 44.
Station 13 – May 1, 2017

Photo 45.
Station 13 (New Location) – September 27, 2017

Photo 46.
Station 13 (New Location) – November 29, 2017

Photo 47.
Station 14 – April 28, 2017.

Photo 48.
Station 14 – May 1, 2017

Photo 49.
Station 14 – August 10, 2017

Photo 50.
Station 14 – November 3, 2017

Photo 51.
Station 15 – April 28, 2017.

Photo 52.
Station 15 – August 10, 2017

Photo 53.
Station 15 – September 5, 2017

Photo 54.
Station 15 – November 3, 2017

Appendix GW-1: Ground Water Tables

TABLE GW1.1

Monitoring Well Summary

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	UTM NAD83 Zone 17N		Elevation[1] (masl)								Depth (mbgs)								Hydraulic Conductivity (m/s)	Method	Stratigraphy of Screened Interval
	Northing	Easting	Ground Surface	Top of Casing	Oct. 2016 Ground Water	Dec. 2016 Ground Water	Jan. 2017 Ground Water	April 2017 Ground Water	July 2017 Ground Water	Oct. 2017 Ground Water	Top of Screen	Base of Screen	Oct. 2016 Water	Dec. 2016 Water	Jan. 2017 Water	April 2017 Water	July 2017 Water	Oct. 2017 Water			
MW01-D	4817765	566644	337.27	337.85	331.52	331.26	331.26	332.94	332.93	331.95	19.6	21.1	5.75	6.01	5.25	4.33	4.34	5.32	5.8E-07	BR	Clayey Silt (Till)
MW01-S	4817763	566642	337.20	337.71	331.72	331.51	331.51	333.22	333.15	332.28	11.9	13.4	5.48	5.69	4.95	3.98	4.05	4.92	2.1E-04	BR	Sand, Gravel
MW02-D	4817419	566681	335.29	336.11	331.32	331.12	331.12	332.89	332.79	331.74	18.9	20.4	3.98	4.17	3.37	2.41	2.51	3.55	1.5E-03	SG	Gravely Sand
MW02-S	4817425	566682	335.40	336.36	332.00	331.80	331.80	333.60	334.19	332.53	6.7	8.2	3.40	3.60	2.85	1.80	1.21	2.87	2.1E-03	SG	Sandy Gravel
MW03-D	4816950	568080	350.05	350.80	330.89	330.58	330.58	331.31	332.40	331.60	32.6	34.1	19.17	19.48	19.55	18.75	17.66	18.45	2.8E-04	BR	Sand, Gravel
MW03-S	4816949	568083	349.95	350.70	331.17	330.80	330.80	331.45	332.57	331.81	21.6	23.2	18.78	19.15	19.27	18.50	17.38	18.14	NA	SG	Sand
MW04-D	4816485	566169	349.60	350.47	334.60	334.43	334.43	336.18	336.04	334.94	26.8	28.3	15.00	15.17	14.71	13.42	13.56	14.66	2.2E-06	BR	Sandy Silt
MW04-S	4816488	566171	349.63	350.54	336.01	335.80	335.80	337.45	337.69	336.60	19.4	20.9	13.63	13.83	13.58	12.19	11.95	13.03	8.2E-08	KGS	Silt (Till)
MW05-D	4816337	567001	340.17	341.10	334.66	334.46	334.46	335.88	335.93	335.18	22.6	24.1	5.51	5.71	5.32	4.29	4.24	4.99	2.5E-04	KGS	Sand, Gravel
MW05-S	4816335	566999	340.16	341.11	335.07	334.86	334.86	336.32	336.31	335.56	15.2	16.8	5.09	5.31	4.86	3.84	3.85	4.60	5.4E-04	KGS	Sand, Gravel
MW06-D	4816250	567400	352.38	353.20	334.40	334.14	334.14	335.31	335.58	334.94	35.1	36.6	17.98	18.24	18.09	17.07	16.80	17.44	7.6E-06	KGS	Silty Sand
MW06-S	4816247	567401	352.41	353.34	334.71	334.42	334.42	335.40	335.79	335.23	21.4	22.9	17.69	17.99	17.98	17.00	16.61	17.18	5.4E-06	KGS	Silt and Sand
MW07-D	4815512	565479	347.04	347.89	329.61	329.31	329.31	330.25	330.82	330.12	33.1	34.6	17.43	17.73	17.60	16.79	16.22	16.92	4.8E-04	BR	Sand, Gravel
MW08-D	4815489	566248	338.48	339.45	330.90	330.57	330.57	331.66	332.42	331.60	17.7	19.2	7.58	7.91	7.96	6.82	6.06	6.88	2.3E-04	KGS	Sand, Gravel
MW08-S	4815494	566250	338.48	339.40	334.08	333.81	333.81	335.26	334.72	334.22	6.1	7.6	4.40	4.67	4.09	3.22	3.76	4.26	6.6E-04	KGS	Sand, Gravel
MW09-D	4815295	566970	350.51	351.15	331.14	330.81	330.81	331.77	332.77	331.92	32.0	33.5	19.37	19.69	19.77	18.74	17.74	18.59	7.2E-06	BR	Sandy Silt
MW09-S	4815292	566972	350.46	350.98	331.02	330.74	330.74	331.58	332.61	331.74	21.6	23.2	19.44	19.72	19.82	18.88	17.85	18.72	2.2E-04	KGS	Sand, Gravel
MW1-11*	4816210	565410	346.40	347.32	329.85	329.62	329.62	330.71	330.88	---	15.3[AB]	18.3[AB]	16.55	16.77	16.46	15.69	15.52	---	--	--	--
MW2-11*	4816026	565434	343.36	344.37	329.91	329.67	329.67	330.64	330.98	---	12.0[AB]	15.0[AB]	13.45	13.69	13.47	12.72	12.38	---	--	--	--
MW3-11*	4815829	565622	349.03	349.90	331.41	331.48	331.48	331.47	331.48	---	11.6[AB]	17.8[AB]	17.62	17.56	17.55	17.56	17.55	---	--	---	--

Notes:

[1] - elevations are geodetic

[AB] - As reported by Aquifer Beach Ltd. (2012)

* - Pre-existing monitoring well at 132 Clair Road

masl - metres above sea level

NA - not available

BR - Bouwer and Rice method (1976)

KGS - Hyder et al method (1994)

SG - Springer-Gelhar (1991)

(orange shading) - Indicates an upward flow gradient at the well

Notes:

Water levels were recorded on the following dates:

October 19, 20, 21, 2016

December 13, 2016

January 26, 2017

April 19, 2017

July 17, 2017

October 4, 5, 10, 2017

TABLE GW1.2

Mini Piezometer Summary

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	UTM NAD83 Zone 17N		Elevation[1] (masl)															Depth (mbgs)
					Oct. 2016		Dec. 2016		Jan. 2017		April 2017		July 2017		Nov. 2017		
	Northing	Easting	Ground Surface	Top of Casing	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Ground Surface to Screen Base
MP01-D	4816236	565484	341.95	342.86	dry	340.64	dry	340.77	342.11	341.30	342.47	342.10	342.37	342.07	341.91	341.16	1.99
MP01-S	4816236	565484	341.95	342.78	dry	dry	dry	dry	342.12	341.83	342.48	342.26	342.38	341.94	341.94	341.31	1.15
MP02	4816113	565844	345.90	347.16	dry	dry	dry	dry	346.18	345.58	346.78	346.21	346.94	346.43	346.30	345.84	1.04
MP03	4816332	566274	347.42	348.28	dry	347.09	dry	347.23	347.55	347.52	348.08	348.08	347.74	347.74	347.27	347.27	1.44
MP04	4816622	566419	339.30	340.33	dry	339.09	dry	339.25	339.67	339.66	339.74	339.74	339.69	339.68	339.38	339.38	1.27
MP05	4815925	566681	337.70	338.36	dry	337.49	dry	337.64	338.13	338.13	338.16	338.16	338.09	338.09	337.72	337.72	1.64
MP06	4816131	566973	337.39	338.24	dry	337.00	dry	337.02	337.73	337.69	337.94	337.93	337.90	337.89	337.48	337.42	1.45
MP07-D	4816369	567115	337.26	338.37	dry	336.45	dry	336.75	337.43	336.82	337.89	337.49	337.86	337.83	337.42	frozen	2.42
MP07-S	4816369	567115	337.29	338.22	dry	336.97	dry	336.96	337.38	337.32	337.87	337.81	337.85	337.81	337.39	337.31	1.37
MP08	4816745	566739	337.40	338.72	337.38	337.28	337.40	337.29	337.68	337.67	337.86	337.86	337.84	337.82	337.57	337.56	0.98
MP09-D	4817378	566708	333.14	334.00	dry	331.63	dry	331.92	332.99	332.26	333.68	332.46	333.54	333.02	dry	332.89	2.04
MP09-S	4817379	566707	333.14	334.30	dry	332.47	dry	332.45	332.99	332.33	333.74	332.73	333.59	333.07	dry	332.88	1.14
MP10	4815366	565340	330.11	331.58	NA	NA	dry	329.95	330.13	330.10	330.46	330.46	331.07	331.07	330.43	330.42	0.97
MP11	4814531	566385	333.03	334.04	dry	332.98	333.19	333.16	333.33	333.33	333.33	333.34	333.29	333.31	333.19	333.16	1.29
MP12	4816079	567796	334.34	335.61	NA	NA	dry	334.16	334.38	334.33	334.58	334.58	334.59	334.60	334.41	334.31	1.47
MP13-D	4816631	568562	334.03	335.21	dry	333.29	333.99	333.38	334.30	333.99	334.57	334.27	334.43	333.99	destroyed	destroyed	2.17
MP13-S	4816631	568563	334.07	335.04	dry	333.51	333.99	333.74	334.28	333.83	334.56	334.18	334.42	334.42	destroyed	destroyed	1.16
MP14	4815633	568626	326.80	327.54	326.90	326.56	326.90	326.85	326.96	327.11	326.92	327.04	326.93	326.81	326.93	326.74	0.86

Notes:

[1] - elevations are geodetic

masl - metres above sea level

NA - not available

(yellow) - Indicates an upward flow gradient in the GW system

(green) - Indicates groundwater elevation above surface water elevation

Notes:

Water levels were recorded on the following dates:

October 20 and 21, 2016
December 13, 2016
January 26, 2017
April 18, 2017
July 17, 2017
November 17, 2017

TABLE B1.3

Groundwater Quality Results - Field Parameters

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Field Temp °C	Field pH	Field EC^{25} µS/cm	Field DO% % Saturation	Field Turbidity NTU
MW01-D	20-Oct-16	23089161020003	10.4	7.20	439	71.3	269.2
MW01-D	19-Apr-17	23089170419003	9.6	8.6	590	3	280.8
MW01-D	04-Oct-17	23089171004003	13.8	7.07	602	3.81	---
MW01-S	20-Oct-16	23089161020004	11.4	7.5	975	70.1	224.1
MW01-S	19-Apr-17	23089170419004	8.9	8	938	6.45	23.25
MW01-S	04-Oct-17	23089171004004	12.5	6.83	932	6.6	---
MW02-D	20-Oct-16	23089161020002	10.5	7.3	753	15.4	136.7
MW02-D	19-Apr-17	23089170419002	9	7.8	742	1.57	11.33
MW02-D	04-Oct-17	23089171004001	10.8	3.71	724	2.84	4.59
MW02-S	20-Oct-16	23089161020001	12.4	7	880	19.1	122.6
MW02-S	19-Apr-17	23089170419001	8.8	7.4	804	2.64	28.9
MW02-S	04-Oct-17	23089171004002	13	6.07	740	2.99	133.2
MW03-D	20-Oct-16	23089161020005	8.4	8.1	547	22	449.7
MW03-D	19-Apr-17	23089170419006	8.9	8.1	558	1.88	160.3
MW03-D	10-Oct-17	23089171010003	8.82	6.95	534	6.09	23.92
MW03-S	20-Oct-16	23089161020006	8.8	7.7	676	54.2	---
MW03-S	19-Apr-17	23089170419005	9	7.9	666	6.13	962.3
MW03-S	10-Oct-17	23089171010002	11.17	6.67	712	7.62	>1100
MW04-D	20-Oct-16	23089161020008	8.7	8.2	504	23.1	---
MW04-D	19-Apr-17	23089170419008	8.7	8.6	540	3.53	85.33
MW04-D	04-Oct-17	23089171004006	11.2	6.71	489	2.41	395.1
MW04-S	20-Oct-16	23089161020007	9.3	8.3	598	45.6	---
MW04-S	19-Apr-17	23089170419007	10.7	8.4	567	4.72	>1100
MW04-S	04-Oct-17	23089171004005	11.9	6.6	570	8.94	>1000
MW05-D	19-Oct-16	23089161019007	9.9	7.4	683	15.1	856.7
MW05-D	19-Apr-17	23089170419010	9.8	8.3	690	1.54	>1100
MW05-D	05-Oct-17	23089171005001	12.3	6.18	678	1.95	>1100
MW05-S	19-Oct-16	23089161019006	9.8	7.3	790	22.2	478
MW05-S	19-Apr-17	23089170419009	9.8	7.6	673	1.5	30.02
MW05-S	05-Oct-17	23089171005002	12.3	6.47	646	2.2	32.43

TABLE B1.3

Groundwater Quality Results - Field Parameters

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Field Temp °C	Field pH	Field EC[25] µS/cm	Field DO% % Saturation	Field Turbidity NTU
MW06-D	19-Oct-16	23089161019004	10.4	8.1	474	25.3	185.8
MW06-D	19-Apr-17	23089170419012	9.4	8.3	444	2.78	66.92
MW06-D	05-Oct-17	23089171005003	11.22	7.11	431	3.64	37.91
MW06-S	19-Oct-16	23089161019005	10.8	8.2	616	33.3	973.5
MW06-S	19-Apr-17	23089170419011	10.5	8.1	616	2.07	>1100
MW06-S	04-Oct-17	23089171004009	12.1	6.56	628	4.63	1097
MW07-D	19-Oct-16	23089161019001	10.1	7.4	709	42.7	428
MW07-D	19-Apr-17	23089170419015	9.5	7.9	686	3.96	86.81
MW07-D	10-Oct-17	23089171010001	10.01	6.45	683	3.4	200
MW08-D	19-Oct-16	23089161019002	10.3	7	1188	35	>1100
MW08-D	19-Apr-17	23089170419014	9.8	7.8	1119	2.63	811.9
MW08-D	05-Oct-17	23089171005004	9.89	7.1	1179	5.48	262.6
MW08-S	19-Oct-16	23089161019003	11.9	7.3	597	22.6	727.8
MW08-S	19-Apr-17	23089170419013	9.8	7.7	669	1.09	>1100
MW08-S	05-Oct-17	23089171005005	10.78	7	653	3.23	903.7
MW09-D	21-Oct-16	23089161021001	8.5	8.4	486	30	---
MW09-D	19-Apr-17	23089170419017	8.6	8.3	485	4.65	686.9
MW09-D	04-Oct-17	23089171004008	11.7	6.27	467	4.36	139.7
MW09-S	21-Oct-16	23089161021002	8.4	7.8	635	69.1	---
MW09-S	19-Apr-17	23089170419016	9.5	8.1	680	5.37	>1100
MW09-S	04-Oct-17	23089171004007	11.37	6.51	626	8.8	>1100

Notes:

--- - not analyzed

25 - field EC corrected to 25°C

NTU - nephelometric turbidity units

TABLE B1.4

Groundwater Quality Results - Routine Parameters

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Temp at lab °C	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Fe mg/L	Mn mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Alkalinity-T mg/L	HCO_3 mg/L	Hardness-T mg/L	TDS mg/L
MW01-D	20-Oct-16	23089161020003	7.96	411	5.3	20.7	19.3	33.7	0.798	<0.010	0.0157	13.2	23.4	<0.050	<0.10	0.67	188	188	***131***	246
MW01-D	19-Apr-17	23089170419003	8.17	586	2.4	34.2	29.2	34.4	0.849	0.018	0.0133	40.8	37.5	<0.010	<0.020	1.9	246	246	***206***	304
MW01-D	04-Oct-17	23089171004003	8.21	590	3.3	38.6	32.4	35.6	0.888	0.031	0.0314	42.2	38.8	<0.010	<0.020	<0.15	236	236	***230***	348
MW01-S	20-Oct-16	23089161020004	7.2	947	5.3	87.8	29	49	1.65	<0.010	0.00157	106	49.3	<0.010	2.12	0.43	291	291	***339***	***550***
MW01-S	19-Apr-17	23089170419004	7.89	938	2.4	96	28.5	48.2	1.57	<0.010	<0.00050	98.5	50.4	<0.010	2.2	0.38	285	285	***357***	497
MW01-S	04-Oct-17	23089171004004	8.04	935	3.3	95.2	29.9	50	1.85	<0.010	0.0006	101	52.2	<0.010	1.73	<0.15	299	299	***361***	***542***
MW02-D	20-Oct-16	23089161020002	7.15	723	5.3	97	26.7	8.9	1.01	***0.452***	***0.157***	18.4	34.9	<0.010	<0.020	0.44	354	354	***352***	416
MW02-D	19-Apr-17	23089170419002	7.8	741	2.4	100	28.1	6.04	0.855	***1.04***	***0.109***	16.2	31.9	<0.010	<0.020	0.4	364	364	***366***	397
MW02-D	04-Oct-17	23089171004001	8	720	3.3	103	30.2	6.55	0.871	***1.82***	***0.092***	16.3	35	<0.010	<0.020	0.26	378	378	***382***	440
MW02-S	20-Oct-16	23089161020001	6.85	862	5.3	98.3	25.1	32.8	0.868	***1.27***	***0.459***	61.3	20.2	<0.010	<0.020	0.48	375	375	***349***	495
MW02-S	19-Apr-17	23089170419001	7.64	803	2.4	113	28.3	12.2	0.539	***1.66***	***0.482***	21	21.9	<0.010	<0.020	0.42	397	397	***399***	421
MW02-S	04-Oct-17	23089171004002	7.81	737	3.3	98.8	24.4	21.4	0.633	***1.39***	***0.465***	29.4	7.54	<0.010	<0.020	0.35	377	377	***347***	396
MW03-D	20-Oct-16	23089161020005	7.54	517	5.3	57.9	25.4	4.38	0.986	0.222	0.0174	12.6	27.7	<0.010	<0.020	0.23	248	248	***249***	293
MW03-D	19-Apr-17	23089170419006	8.03	547	2.4	64	25.9	4.22	1.01	0.209	0.014	13.4	28.6	<0.010	<0.020	0.25	258	258	***267***	301
MW03-D	10-Oct-17	23089171010003	8.09	536	4.7	65.7	27.2	4.48	1.03	0.227	0.0134	12.9	27.2	<0.010	<0.020	<0.15	250	250	***276***	287
MW03-S	20-Oct-16	23089161020006	7.38	680	5.3	80.5	28	13.7	1.62	<0.010	0.013	28.6	20.4	<0.010	1.65	<1.5	317	317	***316***	385
MW03-S	19-Apr-17	23089170419005	7.94	697	2.4	87.2	28.3	12.1	1.57	<0.010	0.00384	24.2	19.8	<0.010	1.6	<1.5	321	321	***334***	377
MW03-S	10-Oct-17	23089171010002	8.1	711	4.7	88.9	29.6	15.2	1.55	<0.010	0.00663	31.6	20.6	<0.010	1.83	0.21	308	308	***344***	406
MW04-D	20-Oct-16	23089161020008	7.76	484	5.3	41.9	26.6	13.5	1.48	0.288	0.0135	9.95	25.7	<0.010	<0.020	0.18	239	239	***214***	278
MW04-D	19-Apr-17	23089170419008	8.13	518	2.4	50.4	23.3	16.4	1.28	0.056	0.0156	7.3	20.9	<0.010	<0.020	<0.15	264	264	***222***	269
MW04-D	04-Oct-17	23089171004006	8.08	490	3.3	50.7	26.5	13.9	1.24	0.249	0.0135	7.39	20.8	<0.010	<0.020	<1.5	261	261	***236***	244
MW04-S	20-Oct-16	23089161020007	7.66	568	5.3	53.2	25.4	18.5	2.8	<0.010	***0.0575***	26.8	48.8	0.028	<0.020	5	227	227	***237***	323
MW04-S	19-Apr-17	23089170419007	8.07	560	2.4	63.1	24.8	11	1.51	<0.010	0.0181	23.4	45.6	<0.010	0.149	<1.5	233	233	***260***	336
MW04-S	04-Oct-17	23089171004005	8.11	557	3.3	64.5	27.2	8.63	1.34	<0.010	0.0257	23.3	45.2	<0.010	0.039	1.7	249	249	***273***	352
MW05-D	19-Oct-16	23089161019007	7.17	663	8.7	94.3	27	4.71	0.837	***2.25***	***0.0829***	11.9	36	<0.010	<0.020	4.1	366	366	***347***	396
MW05-D	19-Apr-17	23089170419010	7.87	689	2.4	89	25.8	3.98	0.745	***2.91***	***0.08***	11.6	34.3	<0.010	<0.020	<1.5	354	354	***328***	448
MW05-D	05-Oct-17	23089171005001	8	674	3.3	96.3	26.7	4.04	0.776	***2.76***	***0.0828***	11.7	36.9	<0.010	<0.020	1.39	336	336	***350***	402
MW05-S	19-Oct-16	23089161019006	7.17	750	8.7	105	35.8	5.53	1.63	***0.346***	***0.159***	10	89.4	0.056	0.429	0.62	327	327	***410***	430
MW05-S	19-Apr-17	23089170419009	7.85	674	2.4	89.7	29.1	3.66	1.28	***0.733***	***0.0976***	10.8	39.4	<0.010	<0.020	0.25	307	307	***344***	422
MW05-S	05-Oct-17	23089171005002	8.08	644	3.3	85.7	29.8	5.27	1.4	0.288	***0.0972***	10.2	48	0.012	0.384	0.22	309	309	***337***	364
MW06-D	19-Oct-16	23089161019004	7.64	460	8.7	50.9	20.8	15.1	1.28	0.067	0.0154	4.32	24.7	<0.010	<0.020	0.19	229	229	***213***	259
MW06-D	19-Apr-17	23089170419012	8.12	436	2.4	51.8	20.2	6.2	1.05	0.089	0.0137	3.55	15.3	<0.010	<0.020	<0.15	224	224	***213***	260
MW06-D	05-Oct-17	23089171005003	8.17	431	3.3	54	20.2	5.81	1.14	0.07	0.0163	3.34	16.6	<0.010	0.046	<0.15	221	221	***218***	235
Ontario Drinking Water Quality Standards[+]			**6.5 - 8.5** [OG]	**NS**	**NS**	**NS**	**NS**	**200** [AO,Na]	**NS**	**0.3** [AO]	**0.05** [AO]	**250** [AO]	**500** [AO]	**1** [MAC]	**10** [MAC]	**NS**	**30 - 500** [OG]	**NS**	**80 - 100** [OG]	**500** [AO]

TABLE B1.4

Groundwater Quality Results - Routine Parameters

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Temp at lab °C	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Fe mg/L	Mn mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Alkalinity-T mg/L	HCO_3 mg/L	Hardness-T mg/L	TDS mg/L
MW06-S	19-Oct-16	23089161019005	7.53	602	8.7	69.2	29.7	13	2.2	0.012	0.0453	9.21	55.6	<0.010	<0.020	0.28	282	282	*295*	351
MW06-S	19-Apr-17	23089170419011	8.08	616	2.4	99.5	39.5	5.2	1.78	*0.79*	*0.121*	8.23	70.5	<0.010	<0.020	<1.5	316	316	*411*	404
MW06-S	04-Oct-17	23089171004009	8.01	625	3.3	73.3	31	10.6	1.45	*0.589*	0.0452	11.4	76.4	<0.010	<0.020	<0.15	271	271	*311*	400
MW07-D	19-Oct-16	23089161019001	7.44	696	8.7	79.3	30.7	17.1	1.55	0.024	*0.0787*	39.6	47.4	0.028	0.318	<0.15	276	276	*325*	386
MW07-D	19-Apr-17	23089170419015	7.99	682	2.4	77.7	27.9	13.2	1.4	0.021	*0.0654*	32.4	42.1	0.012	0.125	<0.15	281	281	*309*	413
MW07-D	10-Oct-17	23089171010001	8.12	701	4.7	76.4	29	18	1.65	0.028	*0.0696*	40.4	41.2	<0.010	0.578	0.19	285	285	*310*	416
MW08-D	19-Oct-16	23089161019002	7.23	1180	8.7	105	30.5	88.3	3.18	<0.010	0.0434	189	32	<0.050	1.49	0.51	336	336	*388*	*639*
MW08-D	19-Apr-17	23089170419014	7.88	1180	2.4	100	28.8	85.2	3.37	<0.010	0.0191	167	29.5	0.015	1.51	<1.5	354	354	*369*	*718*
MW08-D	05-Oct-17	23089171005004	8.09	1180	3.3	101	29.3	88.6	3.42	<0.010	0.021	170	29.9	0.014	1.31	<0.15	321	321	*374*	*663*
MW08-S	19-Oct-16	23089161019003	7.25	569	8.7	77.7	22.8	4.17	1.29	<0.010	0.00707	14.4	4.79	<0.010	1.04	0.76	288	288	*288*	295
MW08-S	19-Apr-17	23089170419013	7.78	664	2.4	92	24.2	3.74	0.87	<0.010	0.0013	13.5	5.89	<0.010	1.81	<1.5	354	354	*329*	385
MW08-S	05-Oct-17	23089171005005	7.93	656	3.3	95.1	24.6	3.25	0.744	<0.010	0.00133	15.9	4.95	<0.010	4.19	0.15	321	321	*339*	352
MW09-D	21-Oct-16	23089161021001	7.56	445	12	54.4	22.3	12.1	1.08	0.024	0.0367	2.79	7.88	<0.010	<0.020	0.48	237	237	*228*	272
MW09-D	19-Apr-17	23089170419017	8.12	469	2.4	53.9	20.8	10.1	0.997	0.06	*0.0551*	3.06	4.98	<0.010	<0.020	0.84	294	294	*220*	312
MW09-D	04-Oct-17	23089171004008	7.98	466	3.3	59.8	21.8	7.31	0.99	0.084	*0.0581*	2.56	4.55	<0.010	<0.020	0.29	264	264	*239*	278
MW09-S	21-Oct-16	23089161021002	7.28	583	12	89.3	23.4	4.69	3.34	<0.010	0.00469	14.1	16.9	<0.010	7	1.91	260	260	*319*	346
MW09-S	19-Apr-17	23089170419016	7.96	659	2.4	89.1	23.5	5.71	3.63	<0.010	0.00068	19.9	15	<0.010	7.17	1.6	338	338	*319*	430
MW09-S	04-Oct-17	23089171004007	7.88	620	3.3	87.2	23.9	5.41	4.35	0.109	0.00058	14.7	17	<0.010	7.09	<1.5	283	283	*316*	376
Ontario Drinking Water Quality Standards[+]			**6.5 - 8.5 [OG]**	**NS**	**NS**	**NS**	**NS**	**200 [AO,Na]**	**NS**	**0.3 [AO]**	**0.05 [AO]**	**250 [AO]**	**500 [AO]**	**1 [MAC]**	**10 [MAC]**	**NS**	**30 - 500 [OG]**	**NS**	**80 - 100 [OG]**	**500 [AO]**

Notes:

- --- - not analyzed
- NS - not specified
- [25] - field EC corrected to 25°C
- [AO] - aesthetic objective
- [OG] - operational guidelines
- [MAC] - maximum acceptable concentration
- [Na] - the local Medical Officer or Health should be notified when sodium concentrations exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium rest
- [+] - *Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines* (MOE 2006)
- ***Italics*** - values do not meet applicable guidelines

TABLE GW1.5

Groundwater Quality Results - Dissolved Metals

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cs mg/L	Cr mg/L	Co mg/L	Cu mg/L	Pb mg/L	Li mg/L	Mo mg/L	Ni mg/L	P mg/L
MW01-D	20-Oct-16	23089161020003	0.007	0.00024	0.00763	0.0345	<0.00010	<0.000050	0.078	<0.000010	<0.000010	<0.00050	0.00022	0.00059	<0.000050	0.002	0.00453	0.00152	<0.050
MW01-D	19-Apr-17	23089170419003	<0.0050	0.00015	0.0127	0.049	<0.00010	<0.000050	0.072	<0.000010	<0.000010	<0.00050	0.00042	0.00069	<0.000050	0.002	0.00312	0.00245	<0.050
MW01-D	04-Oct-17	23089171004003	<0.0050	0.00017	0.00876	0.044	<0.00010	<0.000050	0.065	0.000011	<0.000010	<0.00050	0.00072	0.00104	<0.000050	0.005	0.00293	0.00291	<0.050
MW01-S	20-Oct-16	23089161020004	<0.0050	<0.00010	0.00012	0.0573	<0.00010	<0.000050	0.021	0.000195	<0.000010	<0.00050	<0.00010	0.00129	0.00018	0.002	0.000284	0.00082	<0.050
MW01-S	19-Apr-17	23089170419004	<0.0050	<0.00010	0.00011	0.056	<0.00010	<0.000050	0.019	0.000183	<0.000010	<0.00050	<0.00010	0.00143	0.00026	0.002	0.000425	0.00069	<0.050
MW01-S	04-Oct-17	23089171004004	<0.0050	<0.00010	0.00014	0.0609	<0.00010	<0.000050	0.021	0.000192	<0.000010	<0.00050	<0.00010	0.00191	0.000214	0.003	0.000578	0.00157	<0.050
MW02-D	20-Oct-16	23089161020002	<0.0050	0.00046	0.0104	0.0901	<0.00010	<0.000050	0.015	<0.000010	<0.000010	<0.00050	0.00137	0.00056	0.000163	0.002	0.00136	0.00619	<0.050
MW02-D	19-Apr-17	23089170419002	<0.0050	<0.00010	0.0049	0.0885	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	0.00059	<0.00020	0.000281	0.002	0.000484	0.003	<0.050
MW02-D	04-Oct-17	23089171004001	<0.0050	<0.00010	0.00358	0.0906	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	0.00028	0.0004	0.000126	0.003	0.000396	0.00154	<0.050
MW02-S	20-Oct-16	23089161020001	0.0064	0.00049	0.023	0.0647	<0.00010	<0.000050	0.028	<0.000010	<0.000010	<0.00050	0.003	0.00056	0.000266	0.001	0.00192	0.0126	<0.050
MW02-S	19-Apr-17	23089170419001	0.0052	0.00013	***0.0315***	0.0482	<0.00010	<0.000050	0.019	<0.000010	<0.000010	<0.00050	0.00182	0.00023	0.000066	0.002	0.000828	0.00841	<0.050
MW02-S	04-Oct-17	23089171004002	0.0093	0.00011	0.0197	0.0471	<0.00010	<0.000050	0.02	<0.000010	<0.000010	<0.00050	0.00101	0.00063	0.000066	0.002	0.000821	0.00491	<0.050
MW03-D	20-Oct-16	23089161020005	<0.0050	<0.00010	0.00238	0.0806	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	0.00013	0.00032	<0.000050	0.002	0.000905	<0.00050	<0.050
MW03-D	19-Apr-17	23089170419006	<0.0050	<0.00010	0.00244	0.0778	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	<0.00010	0.00082	<0.000050	0.003	0.000864	<0.00050	<0.050
MW03-D	10-Oct-17	23089171010003	<0.0050	<0.00010	0.00233	0.0787	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	<0.00010	0.00042	<0.000050	0.003	0.000809	<0.00050	<0.050
MW03-S	20-Oct-16	23089161020006	<0.0050	<0.00010	0.00019	0.0832	<0.00010	<0.000050	0.011	0.000064	<0.000010	<0.00050	<0.00010	0.00081	0.000158	<0.0010	0.000447	0.00083	<0.050
MW03-S	19-Apr-17	23089170419005	<0.0050	<0.00010	0.00024	0.087	<0.00010	<0.000050	0.011	0.000051	<0.000010	<0.00050	<0.00010	0.00052	0.000086	<0.0010	0.000289	0.0005	<0.050
MW03-S	10-Oct-17	23089171010002	<0.0050	<0.00010	0.0003	0.094	<0.00010	<0.000050	0.01	0.00006	0.00001	<0.00050	<0.00010	0.00126	0.00009	<0.0010	0.000247	0.00077	<0.050
Ontario Drinking Water Quality Standards[+]			**0.1[OG]**	**0.006[IMAC]**	**0.025[IMAC]**	**1[MAC]**	**NS**	**NS**	**5[IMAC]**	**0.005[MAC]**	**NS**	**0.05[MAC]**	**NS**	**1[AO]**	**0.01[MAC,Pb]**	**NS**	**NS**	**NS**	**NS**

Monitoring Well	Sample Date	MSI Sample Number	Rb mg/L	Se mg/L	Si mg/L	Ag mg/L	S mg/L	Sr mg/L	Te mg/L	Tl mg/L	Th mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	W mg/L	Zn mg/L	Zr mg/L
MW01-D	20-Oct-16	23089161020003	0.00082	<0.000050	4.6	<0.000050	7.99	0.314	<0.00020	<0.000010	<0.00010	0.00014	<0.00030	0.00232	0.001	<0.00010	0.0042	<0.00030
MW01-D	19-Apr-17	23089170419003	0.00073	<0.000050	5.63	<0.000050	12.1	0.483	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00123	0.00086	<0.00010	0.0032	<0.00030
MW01-D	04-Oct-17	23089171004003	0.00045	<0.000050	6.23	<0.000050	14.2	0.461	<0.00020	<0.000010	<0.00010	0.00013	<0.00030	0.000498	<0.00050	<0.00010	0.0074	<0.00030
MW01-S	20-Oct-16	23089161020004	0.0026	0.000229	4	<0.000050	16.5	0.326	<0.00020	0.000021	<0.00010	<0.00010	<0.00030	0.000809	<0.00050	<0.00010	0.111	<0.00030
MW01-S	19-Apr-17	23089170419004	0.00221	0.000324	3.79	<0.000050	18.3	0.385	<0.00020	0.00002	<0.00010	<0.00010	<0.00030	0.000961	<0.00050	<0.00010	0.097	<0.00030
MW01-S	04-Oct-17	23089171004004	0.00275	0.000192	4.45	<0.000050	19.8	0.411	<0.00020	0.000023	<0.00010	<0.00010	<0.00030	0.000941	<0.00050	<0.00010	0.103	<0.00030
MW02-D	20-Oct-16	23089161020002	0.00129	<0.000050	5.6	<0.000050	11.2	0.142	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00489	<0.00050	<0.00010	0.0404	<0.00030
MW02-D	19-Apr-17	23089170419002	0.0011	<0.000050	7.59	<0.000050	11.3	0.133	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000766	<0.00050	<0.00010	0.0354	<0.00030
MW02-D	04-Oct-17	23089171004001	0.0011	<0.000050	8.38	<0.000050	12.7	0.122	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000309	<0.00050	<0.00010	0.0183	<0.00030
MW02-S	20-Oct-16	23089161020001	0.00182	0.000151	3.84	<0.000050	6.4	0.144	<0.00020	<0.000010	<0.00010	<0.00010	<0.00040	0.00961	0.00128	<0.00010	0.183	0.00053
MW02-S	19-Apr-17	23089170419001	0.00084	0.000112	3.75	<0.000050	8.23	0.148	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00506	0.00085	<0.00010	0.0772	0.00054
MW02-S	04-Oct-17	23089171004002	0.00126	0.000096	4.18	<0.000050	4.24	0.117	<0.00020	<0.000010	<0.00010	<0.00010	0.00042	0.00242	0.00141	<0.00010	0.0574	0.00052
MW03-D	20-Oct-16	23089161020005	0.00056	<0.000050	6.41	<0.000050	8.95	0.109	<0.00020	<0.000010	<0.00010	0.00012	<0.00030	0.00149	<0.00050	<0.00010	0.0053	<0.00030
MW03-D	19-Apr-17	23089170419006	0.00054	0.00009	7.24	<0.000050	9.98	0.115	<0.00020	<0.000010	<0.00010	0.00017	<0.00030	0.000915	<0.00050	<0.00010	0.0087	<0.00030
MW03-D	10-Oct-17	23089171010003	0.0005	<0.000050	6.78	<0.000050	9.11	0.111	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000646	<0.00050	<0.00010	0.0072	<0.00030
MW03-S	20-Oct-16	23089161020006	0.00205	0.000258	5.02	<0.000050	6.67	0.11	<0.00020	0.000024	<0.00010	<0.00010	<0.00030	0.00102	<0.00050	<0.00010	0.0648	<0.00030
MW03-S	19-Apr-17	23089170419005	0.00327	0.000309	5.44	<0.000050	7.06	0.099	<0.00020	0.000021	<0.00010	<0.00010	<0.00030	0.000608	<0.00050	<0.00010	0.0239	<0.00030
MW03-S	10-Oct-17	23089171010002	0.00416	0.000261	5.34	<0.000050	6.96	0.102	<0.00020	0.000035	<0.00010	<0.00010	<0.00030	0.000484	<0.00050	<0.00010	0.0485	<0.00030
Ontario Drinking Water Quality Standards[+]			**NS**	**0.01[MAC]**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**0.02[MAC]**	**NS**	**NS**	**5[AO]**	**NS**

Notes:

--- - not analyzed

NS - not specified

[AO] - aesthetic objective from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2017)

[OG] - operational guidelines

[MAC] - maximum acceptable concentration from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2017)

[IMAC] - interim maximum acceptable concentration

[Pb] - standard applies to water at the point of consumption. Since lead is a component in some plumbing systems, first flush water may contain higher concentrations of lead than water that has been flushed for five minutes.

[+] - *Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines* (MOE 2006)

Italics - values do not meet applicable guidelines

TABLE GW1.5

Groundwater Quality Results - Dissolved Metals

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cs mg/L	Cr mg/L	Co mg/L	Cu mg/L	Pb mg/L	Li mg/L	Mo mg/L	Ni mg/L	P mg/L
MW04-D	20-Oct-16	23089161020008	<0.0050	<0.00010	0.00812	0.0637	<0.00010	<0.000050	0.015	<0.000010	<0.000010	<0.00050	<0.00010	0.00033	<0.000050	0.003	0.00315	<0.00050	<0.050
MW04-D	19-Apr-17	23089170419008	<0.0050	<0.00010	0.00758	0.0538	<0.00010	<0.000050	0.016	<0.000010	<0.000010	<0.00050	0.00013	0.00023	<0.000050	0.003	0.00213	0.00052	<0.050
MW04-D	04-Oct-17	23089171004006	<0.0050	<0.00010	0.01	0.0575	<0.00010	<0.000050	0.016	<0.000010	<0.000010	<0.00050	<0.00010	<0.00020	<0.000050	0.006	0.00142	<0.00050	<0.050
MW04-S	20-Oct-16	23089161020007	<0.0050	0.0004	0.0003	0.0793	<0.00010	<0.000050	0.018	<0.000010	<0.000010	<0.00050	0.00023	0.00037	<0.000050	<0.0010	0.0066	0.00647	<0.050
MW04-S	19-Apr-17	23089170419007	<0.0050	0.00027	0.00227	0.0615	<0.00010	<0.000050	0.013	<0.000010	<0.000010	<0.00050	<0.00010	0.00038	<0.000050	0.002	0.00418	0.00091	<0.050
MW04-S	04-Oct-17	23089171004005	<0.0050	<0.00010	0.00272	0.0612	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	0.00014	0.00057	<0.000050	0.004	0.00182	0.0006	<0.050
MW05-D	19-Oct-16	23089161019007	<0.0050	<0.00010	0.0008	0.145	<0.00010	<0.000050	<0.010	<0.000010	0.000011	<0.00050	0.00011	<0.00020	<0.000050	0.002	0.000176	0.0009	<0.050
MW05-D	19-Apr-17	23089170419010	<0.0050	<0.00010	0.00029	0.118	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	<0.00010	0.00025	<0.000050	0.002	0.000089	<0.00050	<0.050
MW05-D	05-Oct-17	23089171005001	<0.0050	<0.00010	0.00025	0.124	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	<0.00010	<0.00020	<0.000050	0.003	0.000177	<0.00050	<0.050
MW05-S	19-Oct-16	23089161019006	<0.0050	0.00041	0.00333	0.126	<0.00010	<0.000050	<0.010	0.000019	<0.000010	<0.00050	0.00092	0.00046	0.000154	0.004	0.0235	0.00372	<0.050
MW05-S	19-Apr-17	23089170419009	<0.0050	<0.00010	0.00553	0.127	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	0.00018	0.00025	0.000141	0.003	0.0044	0.00109	<0.050
MW05-S	05-Oct-17	23089171005002	<0.0050	<0.00010	0.00304	0.122	<0.00010	<0.000050	<0.010	0.00001	<0.000010	0.00274	0.00028	<0.00020	0.000071	0.005	0.00492	0.00131	<0.050
MW06-D	19-Oct-16	23089161019004	<0.0050	<0.00010	0.00166	0.121	<0.00010	<0.000050	0.012	<0.000010	<0.000010	<0.00050	0.00013	0.00037	<0.000050	0.003	0.0023	<0.00050	<0.050
MW06-D	19-Apr-17	23089170419012	<0.0050	<0.00010	0.0015	0.112	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	<0.00010	<0.00020	<0.000050	0.002	0.000896	<0.00050	<0.050
MW06-D	05-Oct-17	23089171005003	<0.0050	<0.00010	0.00129	0.111	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	<0.00010	0.00041	<0.000050	0.003	0.000828	<0.00050	<0.050
MW06-S	19-Oct-16	23089161019005	<0.0050	0.0003	0.00104	0.124	<0.00010	<0.000050	0.014	<0.000010	<0.000010	<0.00050	0.0002	0.00046	<0.000050	0.002	0.00323	<0.00050	<0.050
MW06-S	19-Apr-17	23089170419011	*0.627*	<0.0010	0.0015	0.129	<0.0010	<0.00050	<0.10	<0.00010	0.00011	<0.0050	<0.0010	<0.0020	0.00511	<0.010	0.00181	<0.0050	<0.50
MW06-S	04-Oct-17	23089171004009	<0.0050	<0.00010	0.00165	0.121	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	0.00131	0.00011	0.00029	<0.000050	0.003	0.00251	0.00067	<0.050
Ontario Drinking Water Quality Standards^{+}			0.1^{OG}	0.006^{IMAC}	0.025^{IMAC}	1^{MAC}	NS	NS	5^{IMAC}	0.005^{MAC}	NS	0.05^{MAC}	NS	1^{AO}	0.01^{MAC,Pb}	NS	NS	NS	NS

Monitoring Well	Sample Date	MSI Sample Number	Rb mg/L	Se mg/L	Si mg/L	Ag mg/L	S mg/L	Sr mg/L	Te mg/L	Tl mg/L	Th mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	W mg/L	Zn mg/L	Zr mg/L
MW04-D	20-Oct-16	23089161020008	0.00062	<0.000050	8.69	<0.000050	8.32	0.158	<0.00020	<0.000010	<0.00010	0.00013	<0.00030	0.00112	<0.00050	<0.00010	0.0272	<0.00030
MW04-D	19-Apr-17	23089170419008	0.00089	0.000252	9.28	<0.000050	7.48	0.145	<0.00020	<0.000010	<0.00010	0.00029	<0.00030	0.00109	0.00071	<0.00010	0.0038	<0.00030
MW04-D	04-Oct-17	23089171004006	0.00052	0.000073	10.9	<0.000050	7.58	0.149	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000633	<0.00050	<0.00010	<0.0010	<0.00030
MW04-S	20-Oct-16	23089161020007	0.00208	0.000206	5.85	<0.000050	15.5	0.256	<0.00020	0.000014	<0.00010	0.0007	<0.00030	0.00248	<0.00050	<0.00010	0.0039	<0.00030
MW04-S	19-Apr-17	23089170419007	0.00089	0.000063	8.05	<0.000050	15.1	0.145	<0.00020	<0.000010	<0.00010	0.00036	<0.00030	0.00241	0.0006	<0.00010	0.0017	<0.00030
MW04-S	04-Oct-17	23089171004005	0.00079	<0.000050	9.81	<0.000050	15.9	0.135	<0.00020	0.000013	<0.00010	<0.00010	<0.00030	0.00165	0.00067	<0.00010	0.0025	<0.00030
MW05-D	19-Oct-16	23089161019007	0.00075	<0.000050	9.08	<0.000050	11.6	0.135	<0.00020	<0.000010	<0.00010	<0.00010	0.00038	0.000113	0.00062	<0.00010	0.0019	0.00051
MW05-D	19-Apr-17	23089170419010	0.00046	0.000168	9.2	<0.000050	12.1	0.138	<0.00020	<0.000010	<0.00010	<0.00010	0.00032	0.000034	0.00054	<0.00010	0.0049	0.00067
MW05-D	05-Oct-17	23089171005001	0.00054	0.000064	10.2	<0.000050	13.5	0.127	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000042	0.00062	<0.00010	<0.0010	0.00059
MW05-S	19-Oct-16	23089161019006	0.0024	0.000167	4.01	<0.000050	31	0.143	<0.00020	0.00002	<0.00010	<0.00010	<0.00030	*0.024*	<0.00050	<0.00010	0.0276	<0.00030
MW05-S	19-Apr-17	23089170419009	0.00065	<0.000050	5.06	<0.000050	17.2	0.126	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00825	<0.00050	<0.00010	0.0099	<0.00030
MW05-S	05-Oct-17	23089171005002	0.00081	<0.000050	5.02	<0.000050	18.1	0.107	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00511	<0.00050	<0.00010	0.0106	<0.00030
MW06-D	19-Oct-16	23089161019004	0.00075	<0.000050	6.43	<0.000050	8.63	0.123	<0.00020	<0.000010	<0.00010	0.00016	<0.00030	0.00202	<0.00050	<0.00010	0.0038	<0.00030
MW06-D	19-Apr-17	23089170419012	0.0005	0.000272	7.31	<0.000050	5.5	0.126	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000905	<0.00050	<0.00010	0.002	<0.00030
MW06-D	05-Oct-17	23089171005003	0.00075	<0.000050	7.72	<0.000050	6.15	0.112	<0.00020	<0.000010	<0.00010	0.00011	<0.00030	0.000595	<0.00050	<0.00010	0.0317	<0.00030
MW06-S	19-Oct-16	23089161019005	0.00159	0.000053	4.2	<0.000050	18.1	0.256	<0.00020	<0.000010	<0.00010	0.00061	<0.00030	0.00545	<0.00050	<0.00010	0.0509	<0.00030
MW06-S	19-Apr-17	23089170419011	0.0027	<0.00050	7.54	<0.00050	24.4	0.177	<0.0020	<0.00010	<0.0010	<0.0010	<0.030	0.00376	<0.0050	<0.0010	0.013	<0.0030
MW06-S	04-Oct-17	23089171004009	0.00095	<0.000050	6.39	<0.000050	28.7	0.137	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00241	<0.00050	<0.00010	0.0028	<0.00030
Ontario Drinking Water Quality Standards^{+}			NS	0.01^{MAC}	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.02^{MAC}	NS	NS	5^{AO}	NS

Notes:

--- - not analyzed

NS - not specified

^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2017)

^{OG} - operational guidelines

^{MAC} - maximum acceptable concentration from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2017)

^{IMAC} - interim maximum acceptable concentration

^{Pb} - standard applies to water at the point of consumption. Since lead is a component in some plumbing systems, first flush water may contain higher concentrations of lead than water that has been flushed for five minutes.

$^{+}$ - *Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines* (MOE 2006)

Italics - values do not meet applicable guidelines

TABLE GW1.5

Groundwater Quality Results - Dissolved Metals

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cs mg/L	Cr mg/L	Co mg/L	Cu mg/L	Pb mg/L	Li mg/L	Mo mg/L	Ni mg/L	P mg/L
MW07-D	19-Oct-16	23089161019001	<0.0050	0.00017	0.00037	0.127	<0.00010	<0.000050	<0.010	0.000015	<0.000010	<0.00050	0.00062	0.00103	0.000155	0.003	0.00118	0.00174	<0.050
MW07-D	19-Apr-17	23089170419015	<0.0050	<0.00010	0.00036	0.115	<0.00010	<0.000050	<0.010	<0.000010	<0.000010	<0.00050	0.00028	0.00024	0.000098	0.003	0.000928	0.00127	<0.050
MW07-D	10-Oct-17	23089171010001	<0.0050	0.00018	0.00045	0.122	<0.00010	<0.000050	<0.010	0.000039	<0.000010	<0.00050	0.00037	0.0184	0.000758	0.003	0.000794	0.00211	<0.050
MW08-D	19-Oct-16	23089161019002	<0.0050	0.00012	<0.00010	0.144	<0.00010	<0.000050	0.013	0.000067	<0.000010	<0.00050	0.00085	0.00201	0.000614	0.003	0.000662	0.0031	<0.050
MW08-D	19-Apr-17	23089170419014	<0.0050	<0.00010	0.0001	0.121	<0.00010	<0.000050	0.014	0.000073	<0.000010	<0.00050	0.00044	0.0014	0.000425	0.003	0.000684	0.00224	<0.050
MW08-D	05-Oct-17	23089171005004	<0.0050	<0.00010	<0.00010	0.144	<0.00010	<0.000050	0.013	0.000084	<0.000010	<0.00050	0.00047	0.00111	0.000347	0.004	0.000605	0.00236	<0.050
MW08-S	19-Oct-16	23089161019003	<0.0050	0.00036	0.00028	0.0167	<0.00010	<0.000050	0.011	0.000043	<0.000010	<0.00050	0.00018	0.00158	0.000051	<0.0010	0.000655	0.00945	<0.050
MW08-S	19-Apr-17	23089170419013	<0.0050	<0.00010	0.00019	0.0136	<0.00010	<0.000050	0.01	0.000056	<0.000010	<0.00050	<0.00010	0.00061	0.000051	<0.0010	<0.000050	<0.00050	<0.050
MW08-S	05-Oct-17	23089171005005	<0.0050	<0.00010	0.00019	0.013	<0.00010	<0.000050	<0.010	0.000046	<0.000010	<0.00050	<0.00010	0.00074	<0.000050	0.001	<0.000050	<0.00050	<0.050
MW09-D	21-Oct-16	23089161021001	<0.0050	0.00013	0.0039	0.0908	<0.00010	<0.000050	0.017	0.000019	<0.000010	<0.00050	0.00023	0.00054	0.000113	0.003	0.00634	0.00068	<0.050
MW09-D	19-Apr-17	23089170419017	<0.0050	<0.00010	0.00448	0.0898	<0.00010	<0.000050	0.014	<0.000010	<0.000010	<0.00050	0.00023	0.00026	<0.000050	0.002	0.00269	0.00068	<0.050
MW09-D	04-Oct-17	23089171004008	<0.0050	<0.00010	0.00443	0.0954	<0.00010	<0.000050	0.013	0.000016	<0.000010	<0.00050	0.00037	0.00096	<0.000050	0.004	0.00153	0.00067	<0.050
MW09-S	21-Oct-16	23089161021002	<0.0050	<0.00010	0.00012	0.0869	<0.00010	<0.000050	0.012	0.000036	<0.000010	<0.00050	<0.00010	0.00112	0.00006	<0.0010	0.000203	<0.00050	<0.050
MW09-S	19-Apr-17	23089170419016	<0.0050	<0.00010	<0.00010	0.0876	<0.00010	<0.000050	0.013	0.000049	<0.000010	<0.00050	<0.00010	0.00103	0.000082	0.001	0.000194	<0.00050	<0.050
MW09-S	04-Oct-17	23089171004007	<0.0050	<0.00010	0.00011	0.0944	<0.00010	<0.000050	0.013	0.000043	<0.000010	<0.00050	<0.00010	0.00136	0.000069	0.002	0.000192	<0.00050	<0.050
Ontario Drinking Water Quality Standards^{+}			**0.1^{OG}**	**0.006^{IMAC}**	**0.025^{IMAC}**	**1^{MAC}**	**NS**	**NS**	**5^{IMAC}**	**0.005^{MAC}**	**NS**	**0.05^{MAC}**	**NS**	**1^{AO}**	**0.01^{MAC,Pb}**	**NS**	**NS**	**NS**	**NS**

Monitoring Well	Sample Date	MSI Sample Number	Rb mg/L	Se mg/L	Si mg/L	Ag mg/L	S mg/L	Sr mg/L	Te mg/L	Tl mg/L	Th mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	W mg/L	Zn mg/L	Zr mg/L
MW07-D	19-Oct-16	23089161019001	0.00127	0.000098	6.12	<0.000050	15.5	0.114	<0.00020	0.000018	<0.00010	0.00055	<0.00030	0.00148	<0.00050	<0.00010	0.0149	<0.00030
MW07-D	19-Apr-17	23089170419015	0.00109	0.000058	6.96	<0.000050	14.7	0.115	<0.00020	0.000019	<0.00010	<0.00010	<0.00030	0.00095	<0.00050	<0.00010	0.0107	<0.00030
MW07-D	10-Oct-17	23089171010001	0.00122	0.000055	6.21	<0.000050	13.6	0.112	<0.00020	0.000016	<0.00010	0.00054	<0.00030	0.000807	<0.00050	<0.00010	0.0543	<0.00030
MW08-D	19-Oct-16	23089161019002	0.00225	0.000251	5.51	<0.000050	10.9	0.18	<0.00020	0.000048	<0.00010	<0.00010	<0.00030	0.000649	<0.00050	<0.00010	0.192	<0.00030
MW08-D	19-Apr-17	23089170419014	0.00149	0.000276	5.43	<0.000050	10.9	0.164	<0.00020	0.000032	<0.00010	<0.00010	<0.00030	0.000549	<0.00050	<0.00010	0.151	<0.00030
MW08-D	05-Oct-17	23089171005004	0.00233	0.000249	5.69	<0.000050	11.5	0.152	<0.00020	0.000051	<0.00010	<0.00010	<0.00030	0.000491	<0.00050	<0.00010	0.198	<0.00030
MW08-S	19-Oct-16	23089161019003	0.00069	0.000132	3.66	<0.000050	1.48	0.115	<0.00020	<0.000010	<0.00010	0.00123	<0.00030	0.000231	<0.00050	<0.00010	0.0101	<0.00030
MW08-S	19-Apr-17	23089170419013	0.00032	0.000105	4.18	<0.000050	2.17	0.11	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000181	<0.00050	<0.00010	0.0075	<0.00030
MW08-S	05-Oct-17	23089171005005	0.00031	0.000059	4.33	<0.000050	1.96	0.0997	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000143	<0.00050	<0.00010	0.0082	<0.00030
MW09-D	21-Oct-16	23089161021001	0.00167	<0.000050	7.26	<0.000050	2.24	0.166	<0.00020	0.00002	<0.00010	0.00027	<0.00030	0.00104	<0.00050	<0.00010	0.0146	<0.00030
MW09-D	19-Apr-17	23089170419017	0.00123	<0.000050	7.31	<0.000050	1.85	0.148	<0.00020	0.000019	<0.00010	<0.00010	<0.00030	0.000792	<0.00050	<0.00010	0.0087	<0.00030
MW09-D	04-Oct-17	23089171004008	0.00078	<0.000050	8.2	<0.000050	1.96	0.137	<0.00020	0.000017	<0.00010	<0.00010	<0.00030	0.000429	<0.00050	<0.00010	0.0167	<0.00030
MW09-S	21-Oct-16	23089161021002	0.00047	0.000314	4.43	<0.000050	5.6	0.0948	<0.00020	<0.000010	<0.00010	0.00027	<0.00030	0.000262	<0.00050	<0.00010	0.0604	<0.00030
MW09-S	19-Apr-17	23089170419016	0.0006	0.000325	4.36	<0.000050	5.32	0.105	<0.00020	<0.000010	<0.00010	0.00013	<0.00030	0.000294	<0.00050	<0.00010	0.0214	<0.00030
MW09-S	04-Oct-17	23089171004007	0.00057	0.000366	4.45	<0.000050	5.92	0.0906	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.000268	<0.00050	<0.00010	0.0249	<0.00030
Ontario Drinking Water Quality Standards^{+}			**NS**	**0.01^{MAC}**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**0.02^{MAC}**	**NS**	**NS**	**5^{AO}**	**NS**

Notes:

--- - not analyzed

NS - not specified

^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2017)

^{OG} - operational guidelines

^{MAC} - maximum acceptable concentration from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2017)

^{IMAC} - interim maximum acceptable concentration

^{Pb} - standard applies to water at the point of consumption. Since lead is a component in some plumbing systems, first flush water may contain higher concentrations of lead than water that has been flushed for five minutes.

$^{+}$ - *Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines* (MOE 2006)

Italics - values do not meet applicable guidelines

TABLE GW1.6

Surface Water Base Flow Results

City of Guelph

Clair - Maltby Master Environmental Servicing Plan (MESP) and Secondary Plan (SP)

Spot Flow Location	Subwatershed	UTM NAD83 Zone 17N		Spot Flows																							
		Northing	Easting	Summer 2016				Fall 2016				Spring 2017				Summer 2017				Fall 2017			
				Flow (L/s)	SW Temp °C	Date	Method	Flow (L/s)	SW Temp °C	Date	Method	Flow (L/s)	SW Temp °C	Date	Method	Flow (L/s)	SW Temp °C	Date	Method	Flow (L/s)	SW Temp °C	Date	Method
HC-HR1	Hanlon Creek	4817074	562217	63.3	18.1	Aug 31	FT	59.9	6.3	Nov 10	FT	175.3	8.3	May 11	FT	64.5	16.4	Aug 16	FT	57.8	5.9	Nov 29	FT
HC-HR2	Hanlon Creek	4816810	562558	0.0	---	Aug 31	V	0.0	---	Nov 10	V	1.0	---	May 11	V	0.0	---	Aug 16	V	0.0	---	Nov 29	V
HC-HR3	Hanlon Creek	4816866	562652	2.1	---	Sept 1	L	2.6	10.2	Nov 10	FT	5.7	11.9	May 11	FT	3.0	---	Aug 16	V	2.3	7.2	Nov 29	FT
HC-T1	Hanlon Creek	4816367	562118	14.0	16.5	Sept 1	FT	11.6	6.3	Nov 10	FT	85.2	10.3	May 11	FT	11.5	18.7	Aug 16	FT	24.6	4.6	Nov 29	FT
LSR-D2	Lower Speed River	4814794	562355	0.0	---	Sept 1	V	0.0	---	Nov 10	V	5.0	---	May 11	V	0.0	---	Aug 16	V	0.0	---	Nov 29	V
LSR-L1	Lower Speed River	4815033	561481	0.0	---	Aug 31	V	0.0	---	Nov 10	V	25.0	9.8	May 11	FT	0.0	---	Aug 16	V	0.0	---	Nov 29	V
LSR-P1	Lower Speed River	4815726	560821	0.1	---	Sept 1	B	0.1	---	Nov 10	B	35.0	---	May 11	B	9.1	22.0	Aug 16	FT	0.6	---	Nov 29	L
LSR-P2	Lower Speed River	4816066	560757	0.0	---	Sept 1	V	0.0	---	Nov 10	V	0.7	---	May 11	B	0.0	---	Aug 16	V	0.0	---	Nov 29	V
LSR-P3	Lower Speed River	4816551	560703	0.1	---	Sept 1	V	0.3	---	Nov 10	B	20.0	---	May 11	V	1.0	---	Aug 16	L	0.4	---	Nov 29	B
MC-C71	Mill Creek	4812339	566992	0.0	---	Aug 31	V	0.0	---	Nov 9	V	0.5	---	May 10	V	0.0	---	Aug 16	V	0.0	---	Nov 29	V
MC-C72	Mill Creek	4812723	566606	0.0	---	Aug 31	V	0.8	---	Nov 9	L	10.0	---	May 10	V	0.0	---	Aug 16	V	0.0	---	Nov 29	V
MC-G1	Mill Creek	4813575	569960	36.9	15.2	Aug 30	FT	43.4	7.6	Nov 9	FT	168.9	9.5	May 10	FT	38.6	13.9	Aug 16	FT	49.8	4.8	Nov 29	FT
MC-GN1	Mill Creek	4814253	568042	1.9	21.5	Aug 30	FT	4.7	8.3	Nov 9	FT	3.0	---	May 10	B	2.0	---	Aug 16	V	1.5	---	Nov 29	V
MC-GN2	Mill Creek	4814342	567968	1.9	---	Aug 30	B	2.4	---	Nov 9	B	5.0	---	May 10	B	3.0	---	Aug 16	B	3.5	---	Nov 29	B
MC-GN3	Mill Creek	4813648	568576	73.8	16.9	Aug 31	FT	58.2	8.4	Nov 9	FT	209.2	12.8	May 10	FT	74.2	16.2	Aug 16	FT	69.0	5.0	Nov 29	FT
MC-GN4	Mill Creek	4813263	569173	105.7	23.9	Aug 31	FT	111.4	8.7	Nov 9	FT	411.1	13.1	May 10	FT	108.8	23.5	Aug 16	FT	131.7	3.6	Nov 29	FT
MC-M2	Mill Creek	4818016	569639	---	---	---	---	0.0	---	Nov 10	V	3.0	---	May 11	V	0.0	---	Aug 16	V	0.0	---	Nov 29	V
MC-M3	Mill Creek	4814352	566152	0.0	---	Aug 31	V	0.0	---	Nov 9	V	0.0	---	May 10	V	0.0	---	Aug 16	V	0.0	---	Nov 29	V
MC-SR1	Mill Creek	4811552	567674	174.3	21.9	Aug 31	FT	187.2	8.1	Nov 9	FT	676.3	10.8	May 11	FT	208.0	18.3	Aug 16	FT	212.0	4.2	Nov 29	FT
MC-V1	Mill Creek	4813756	571458	16.5	16.4	Aug 30	FT	12.0	7.4	Nov 9	FT	62.8	10.1	May 10	FT	15.3	15.0	Aug 16	FT	15.4	4.1	Nov 29	FT
MC-V2	Mill Creek	4815732	569467	11.2	20.9	Aug 30	FT	5.8	8.0	Nov 9	FT	179.3	9.9	May 11	FT	25.0	18.1	Aug 16	FT	21.1	4.0	Nov 29	FT
MC-W2	Mill Creek	4817137	571205	8.3	---	Aug 30	FT	5.6	6.3	Nov 10	FT	102.2	10.7	May 11	FT	10.2	14.4	Aug 16	FT	5.9	7.1	Nov 29	FT
MC-WL3	Mill Creek	4813824	568493	76.9	17.9	Aug 30	FT	65.8	8.0	Nov 9	FT	206.5	12.8	May 10	FT	84.7	15.7	Aug 16	FT	75.2	5.1	Nov 29	FT
MC-WL4	Mill Creek	4813565	568249	8.4	18.8	Aug 31	FT	13.5	8.1	Nov 9	FT	28.2	13.0	May 10	FT	14.3	14.8	Aug 16	FT	12.7	4.2	Nov 29	FT
TC-C1	Torrance Creek	4820979	565613	---	---	---	---	0.0	---	Nov 10	V	0.3	---	May 10	B	0.0	---	Aug 16	V	0.0	---	Nov 29	V
TC-V1	Torrance Creek	4820265	564884	---	---	---	---	4.0	3.4	Nov 10	FT	39.3	10.2	May 10	FT	8.0	---	Aug 16	V	8.0	---	Nov 29	L
TC-V2	Torrance Creek	4820648	564494	---	---	---	---	0.0	---	Nov 10	V	1.3	9.9	May 10	FT	0.0	---	Aug 16	V	0.0	---	Nov 29	V

Notes:

--- - not recorded

FT - Son-Tek FlowTracker

L - Measured leaf velocity and multiplied by simplified cross-sectional area to estimate discharge

B - Discharge collected in a bucket over a measured amount of time

V - Visual estimate

Appendix GW-2:
Geophysical Logs

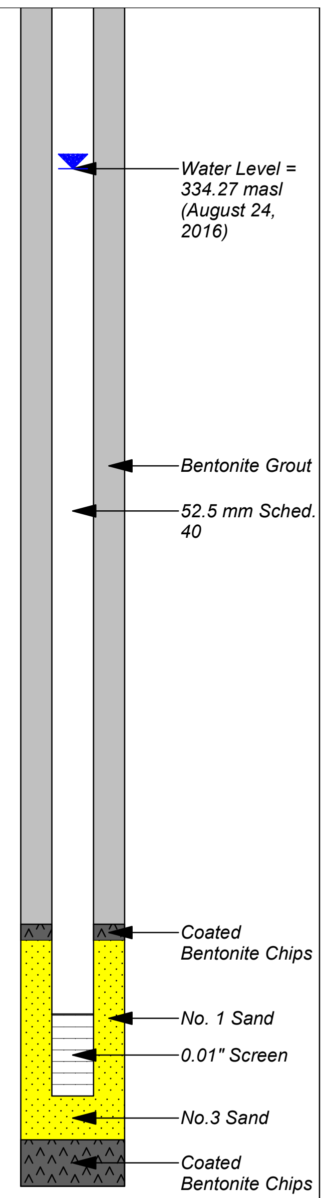
DRILLING LOG | Clair - Maltby Subwatershed Study | MW1-D

Client: **City of Guelph**	Date: **August 18, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.51 m**
Project Area: **Clair - Maltby**	Ground Elevation: **337.27 m asl**	Screened Interval: **18.75 - 20.27 m**	Northing: **4817765.42**
Project No.(MSI): **23089**	Total Depth: **21.64 m**	Slot Size: **0.01"**	Easting: **566643.99**
Field Staff: **J. Melchin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **17.37 - 21.09 m**	

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
CLAYEY SILT, trace fine to coarse sand, brown, dry	0 / 337.27
SANDY GRAVEL, coarse sand, fine to very coarse gravel, brown, poorly sorted, angular to subrounded, dry **@ 9.75 m bgs: drill producing water**	1.52 / 335.75
CLAYEY SILT, some fine to coarse sand, trace fine gravel, grey (TILL)	14.63 / 322.64
PROBABLE BEDROCK **END OF BOREHOLE @ 21.95 m bgs**	21.95 / 315.32

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS	NA	NA
10	CS	NA	NA
15	CS	NA	NA
20	CS	NA	NA
25	CS	NA	NA
30	CS	NA	NA
35	CS	NA	NA
40	CS	NA	NA
45	CS	NA	NA
50	CS	NA	NA
55	CS	NA	NA
60	CS	NA	NA
65	CS	NA	NA
70	CS	NA	NA

Completion Details



NOTES: **m asl = metres above sea level**
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

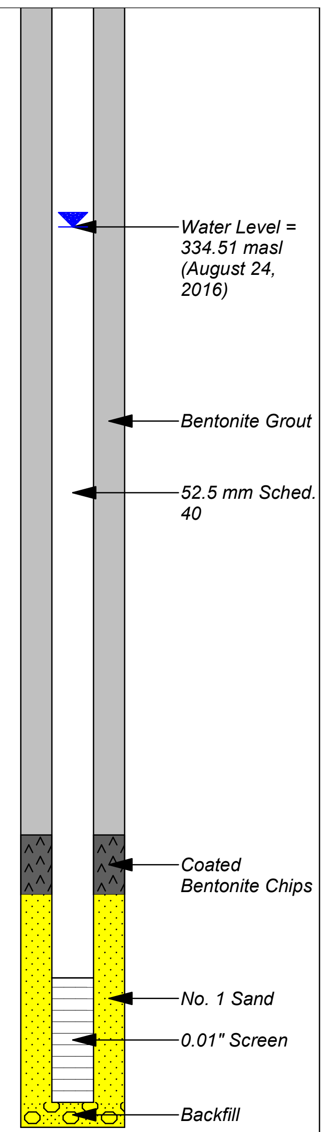
DRILLING LOG | Clair - Maltby Subwatershed Study | MW1-S

Client: **City of Guelph**	Date: **August 19, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.42 m**
Project Area: **Clair - Maltby**	Ground Elevation: **337.20 masl**	Screened Interval: **11.89 - 13.41 m**	Northing: **4817762.85**
Project No.(MSI): **23089**	Total Depth: **13.72 m**	Slot Size: **0.01"**	Easting: **566641.90**
Field Staff: **J. Melchin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **10.87 - 13.41 m**	

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
CLAYEY SILT, trace fine to coarse sand, brown, dry	0 / 337.20
SANDY GRAVEL, coarse sand, fine to very coarse gravel, brown, poorly sorted, angular to subrounded, dry	1.52 / 335.67
@ 9.14 m bgs: drill producing water	
END OF BOREHOLE @ 13.72 m bgs	13.72 / 323.48

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS	NA	NA
10	CS	NA	NA
15	CS	NA	NA
20	CS	NA	NA
25	CS	NA	NA
30	CS	NA	NA
35	CS	NA	NA
40	CS	NA	NA
45	CS	NA	NA

Completion Details



NOTES: 0.00 to 7.62 m bgs logged from MW1-D
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

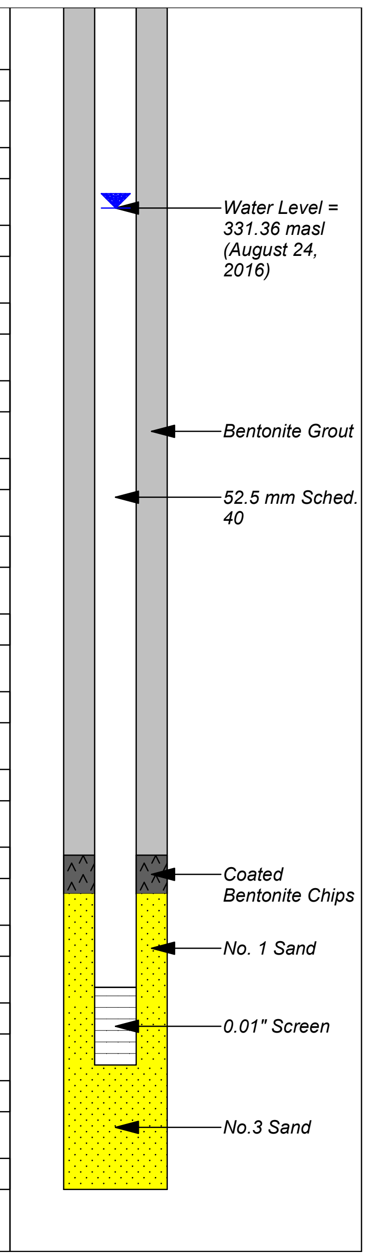
DRILLING LOG — Clair - Maltby Subwatershed Study — MW2-D

Client: **City of Guelph**	Date: **August 3, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.83 m**
Project Area: **Clair - Maltby**	Ground Elevation: **335.29 masl**	Screened Interval: **19.20 - 20.73 m**	Northing: **4817418.83**
Project No.(MSI): **23089**	Total Depth: **23.16 m**	Slot Size: **0.01"**	Easting: **566680.83**
Field Staff: **S. Miller/J. Melchin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **17.37 - 23.16 m**	

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
SANDY GRAVEL, fine to coarse sand, medium to fine gravel fining downwards, brown, poorly sorted, angular to subrounded, dry **@4.57 m bgs: moist** **@ 6.10 m bgs: drill producing water**	0 / 335.29
GRAVELLY SAND, fine to coarse sand, fine to medium gravel, grey, poorly sorted, angular to sub rounded, saturated	9.14 / 326.15
fine to very fine SAND, fining downwards, grey, well sorted, saturated	10.67 / 324.63
SILTY fine SAND, grey, moderately well sorted, saturated	15.85 / 319.44
GRAVELY SAND, medium to coarse sand, fine to medium gravel, poorly sorted, subangular to subrounded, saturated	18.29 / 317.01
END OF BOREHOLE @ 23.16 m bgs	23.16 / 312.13

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS	NA	NA
10	CS	NA	NA
15	CS	NA	NA
20	CS	NA	NA
25	CS	NA	NA
30	CS	NA	NA
35	CS	NA	NA
40	CS	NA	NA
45	CS	NA	NA
50	CS	NA	NA
55	CS	NA	NA
60	CS	NA	NA
65	CS	NA	NA
70	CS	NA	NA
75	CS	NA	NA

Completion Details



NOTES:
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

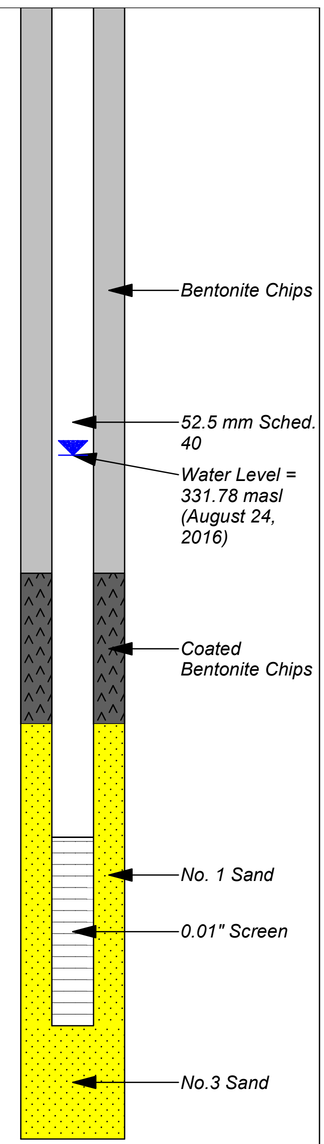
Matrix Solutions Inc.

DRILLING LOG | Clair - Maltby Subwatershed Study | MW2-S

Client: **City of Guelph**	Date: **August 4, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.91 m**
Project Area: **Clair - Maltby**	Ground Elevation: **335.40 masl**	Screened Interval: **6.71 - 8.23 m**	Northing: **4817425.33**
Project No.(MSI): **23089**	Total Depth: **9.14 m**	Slot Size: **0.01"**	Easting: **566681.67**
Field Staff: **S. Miller/J. Melchin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **5.79 - 9.14 m**	

m asl	m bgs	Lithology	Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)	Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
335.40	0		**SANDY GRAVEL, fine to coarse sand, medium to fine gravel fining downwards, brown, poorly sorted, angular to subrounded, dry**	0 / 335.40				
					5	CS	NA	NA
					10	CS	NA	NA
			@ 4.57 m bgs: moist		15	CS	NA	NA
			@ 6.10 m bgs: drill producing water		20	CS	NA	NA
					25	CS	NA	NA
				9.14 / 326.26	30	CS	NA	NA
			END OF BOREHOLE @ 9.14 m bgs					

Completion Details



NOTES: **0.00 to 6.10 m bgs logged from MW2-D**
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

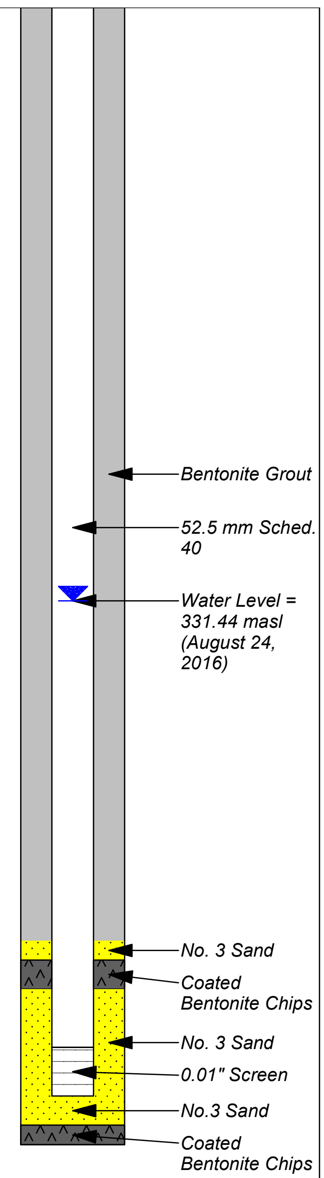
DRILLING LOG — Clair - Maltby Subwatershed Study — MW3-D

Client: **City of Guelph**	Date: **July 25, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.70 m**
Project Area: **Clair - Maltby**	Ground Elevation: **350.05 masl**	Screened Interval: **32.61 - 34.14 m**	Northing: **4816950.32**
Project No.(MSI): **23089**	Total Depth: **35.66 m**	Slot Size: **0.01"**	Easting: **568080.23**
Field Staff: **S. Miller**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **30.78 - 35.05 m**	

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
fine to medium SAND, some fine to coarse gravel, brown, poorly sorted, subangular to subrounded gravel, dry	0 / 350.05
@18.90 m bgs: moist	
medium SAND, brown, well sorted, wet, loose	24.38 / 325.67
fine to coarse GRAVEL, some coarse sand, poorly sorted, angular to subrounded, wet	25.91 / 324.14
SILTY fine to coarse SAND, trace fine to coarse gravel, grey, poorly sorted, wet	33.53 / 316.52
PROBABLE BEDROCK	35.36 / 314.70
END OF BOREHOLE @ 35.66 m bgs	35.66 / 314.39

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS	NA	NA
10	CS	NA	NA
15	CS	NA	NA
20	CS	NA	NA
25	CS	NA	NA
30	CS	NA	NA
35	CS	NA	NA
40	CS	NA	NA
45	CS	NA	NA
50	CS	NA	NA
55	CS	NA	NA
60	CS	NA	NA
65	CS	NA	NA
70	CS	NA	NA
75	CS	NA	NA
80	CS	NA	NA
85	CS	NA	NA
90	CS	NA	NA
95	CS	NA	NA
100	CS	NA	NA
105	CS	NA	NA
110	CS	NA	NA
115	CS	NA	NA

Completion Details



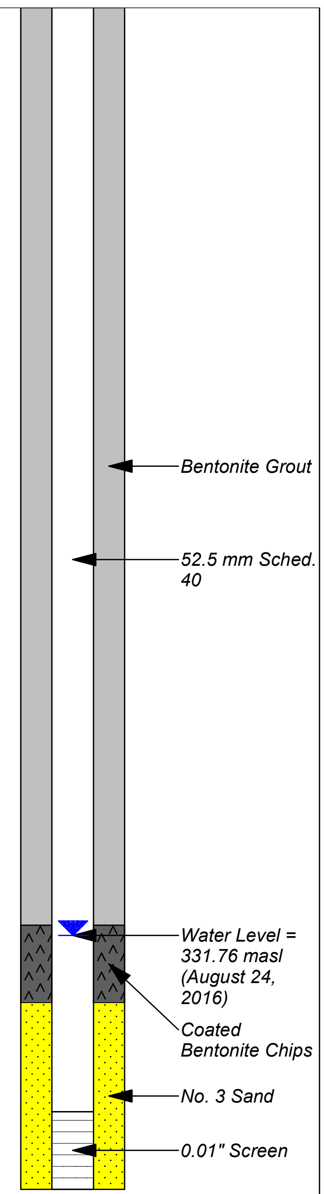
NOTES: m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

DRILLING LOG | Clair - Maltby Subwatershed Study | MW3-S

Client: **City of Guelph**	Date: **July 26, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.68 m**
Project Area: **Clair - Maltby**	Ground Elevation: **349.95 masl**	Screened Interval: **21.64 - 23.16 m**	Northing: **4816948.56**
Project No.(MSI): **23089**	Total Depth: **23.16 m**	Slot Size: **0.01"**	Easting: **568083.16**
Field Staff: **S. Miller**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **19.51 - 23.16 m**	

m asl	m bgs	Lithology	Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)	Sample ID	Sample Type	Blow Counts (N Value)	% Recovery	Completion Details
	0		**fine to medium SAND, some fine to coarse gravel, brown, poorly sorted, subangular to subrounded gravel, dry**	0 / 349.95					
349	1				5	CS	NA	NA	
348	2								
347	3				10	CS	NA	NA	
346	4								
345	5				15	CS	NA	NA	
344	6				20	CS	NA	NA	
343	7								
342	8				25	CS	NA	NA	
341	9				30	CS	NA	NA	
340	10								
339	11				35	CS	NA	NA	
338	12				40	CS	NA	NA	
337	13								
336	14				45	CS	NA	NA	
335	15				50	CS	NA	NA	
334	16								
333	17				55	CS	NA	NA	
332	18		**@18.90 m bgs: moist**		60	CS	NA	NA	
331	19								
330	20				65	CS	NA	NA	
329	21				70	CS	NA	NA	
328	22								
327	23			23.16 / 326.78	75	CS	NA	NA	
326	24		**END OF BOREHOLE @ 23.16 m bgs**						



NOTES: **0.00 to 19.81 m bgs logged from MW3-D**
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

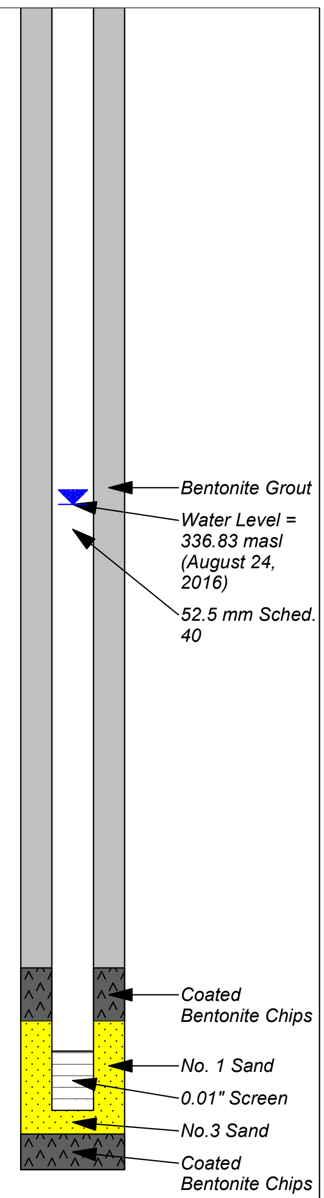
DRILLING LOG — Clair - Maltby Subwatershed Study — MW4-D

Client: **City of Guelph**	Date: **August 22, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.76 m**
Project Area: **Clair - Maltby**	Ground Elevation: **349.60 masl**	Screened Interval: **26.82 - 28.35 m**	Northing: **4816485.40**
Project No.(MSI): **23089**	Total Depth: **29.87 m**	Slot Size: **0.01"**	Easting: **566169.17**
Field Staff: **D. Martin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **26.00 - 29.08 m**	

Depth (m bgs)/ Elev. (m asl)	Stratigraphic Description
0 / 349.60	**SILTY fine to coarse SAND, some fine to medium gravel, grey, poorly sorted, angular, damp (TILL)** **@6.10 m bgs: cleaner SILTY SAND lense, trace fine gravel**
9.91 / 339.69	**fine to coarse SAND, some fine gravel, trace silt, grey, poorly sorted, subrounded, damp**
11.43 / 338.17	**fine to course SANDY SILT to SILTY SAND, occasional layers of fine to medium gravel, grey, very poorly sorted, angular (possible TILL)** **@13.72 m bgs: saturated** **@ 16.76 m bgs: lense of increased SILT content** **@ 22.86 m bgs: layer of fine GRAVELY coarse SAND, trace silt, poorly sorted** **@ 27.43 m bgs: layer of fine GRAVELY coarse SAND, trace silt, poorly sorted** **@ 28.96 m bgs: layer of fine GRAVELY coarse SAND, trace silt, poorly sorted**
29.57 / 320.03	**PROBABLE BEDROCK**
29.87 / 319.73	**END OF BOREHOLE @ 29.87 m bgs**

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS	NA	NA
10	CS	NA	NA
15	CS	NA	NA
20	CS	NA	NA
25	CS	NA	NA
30	CS	NA	NA
35	CS	NA	NA
40	CS	NA	NA
45	CS	NA	NA
50	CS	NA	NA
55	CS	NA	NA
60	CS	NA	NA
65	CS	NA	NA
70	CS	NA	NA
75	CS	NA	NA
80	CS	NA	NA
85	CS	NA	NA
90	CS	NA	NA
95	CS	NA	NA
97	CS	NA	NA

Completion Details



NOTES:
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

DRILLING LOG | Clair - Maltby Subwatershed Study | MW4-S

Client: **City of Guelph**
Project Area: **Clair - Maltby**
Project No.(MSI): **23089**
Field Staff: **D. Martin**
Driller: **Highland Water Well Drilling Inc**

Date: **August 22 - 23, 2016**
Ground Elevation: **349.63 masl**
Total Depth: **21.34 m**
Drill Rig: **Foremost DR-12**
Boring Diameter: **152 mm**

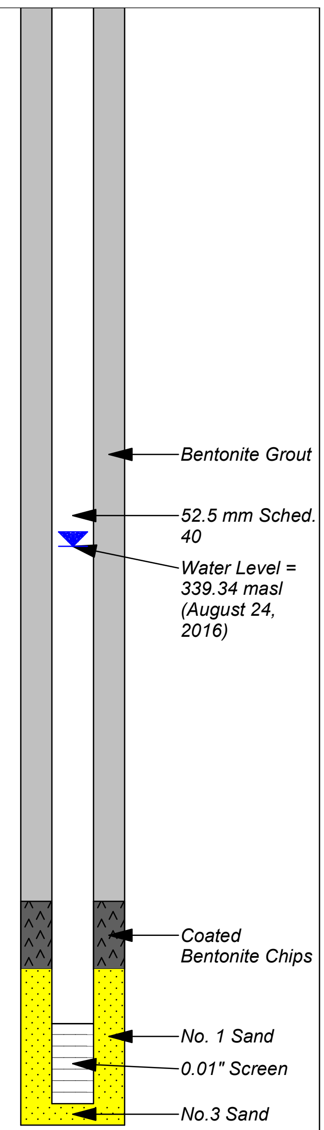
Screen Type: **52.5 mm PVC Sched. 40**
Screened Interval: **19.40 - 20.93 m**
Slot Size: **0.01"**
Casing Diameter: **52.5 mm**
Sand Pack: **18.36 - 21.34 m**

Stick Up: **0.81 m**
Northing: **4816488.20**
Easting: **566170.83**
Datum/Zone: **NAD83 17T**

m bgs	Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
0 – 9.91	**SILTY fine to coarse SAND, some fine to medium gravel, grey, poorly sorted, angular, damp (TILL)** **@6.10 m bgs: cleaner SILTY SAND lense, trace fine gravel**	0 / 349.63
9.91 – 11.43	**fine to coarse SAND, some fine gravel, trace silt, grey, poorly sorted, subrounded, damp**	9.91 / 339.73
11.43 – 21.34	**fine to course SANDY SILT to SILTY SAND, occasional layers of fine to medium gravel, grey, very poorly sorted, angular, damp (possible TILL)** **@13.72 m bgs: saturated** **@ 16.76 m bgs: lense of increased SILT content**	11.43 / 338.20
21.34	**END OF BOREHOLE @ 21.34 m bgs**	21.34 / 328.30

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS	NA	NA
10	CS	NA	NA
15	CS	NA	NA
20	CS	NA	NA
25	CS	NA	NA
30	CS	NA	NA
35	CS	NA	NA
40	CS	NA	NA
45	CS	NA	NA
50	CS	NA	NA
55	CS	NA	NA
60	CS	NA	NA
65	CS	NA	NA
70	CS	NA	NA

Completion Details



NOTES:
0.00 to 16.76 m bgs logged from MW4-D
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

DRILLING LOG — Clair - Maltby Subwatershed Study — MW5-D

Client: **City of Guelph**
Project Area: **Clair - Maltby**
Project No.(MSI): **23089**
Field Staff: **D. Martin**
Driller: **Highland Water Well Drilling Inc**

Date: **August 10 - 11, 2016**
Ground Elevation: **340.17 masl**
Total Depth: **25.30 m**
Drill Rig: **Foremost DR-12**
Boring Diameter: **152 mm**

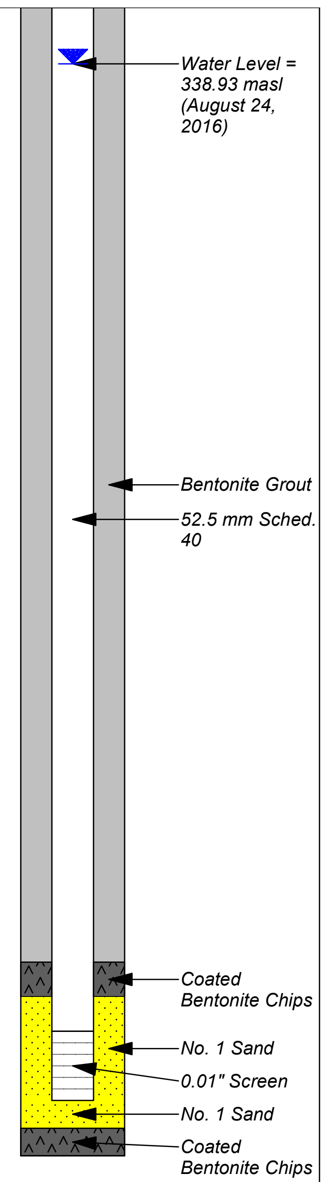
Screen Type: **52.5 mm PVC Sched. 40**
Screened Interval: **22.56 - 24.08 m**
Slot Size: **0.01"**
Casing Diameter: **52.5 mm**
Sand Pack: **21.79 - 24.69 m**

Stick Up: **0.71 m**
Northing: **4816336.75**
Easting: **567001.03**
Datum/Zone: **NAD83 17T**

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
fine clean GRAVEL, well sorted, angular to sub rounded, dry	0 / 340.17
medium to coarse SAND and fine to medium GRAVEL, brown, moderately well sorted, well rounded, dry	1.52 / 338.64
SILTY GRAVELY fine to coarse SAND, fine gravel, brown, poorly sorted, angular to subangular, saturated (TILL)	3.05 / 337.12
coarse SAND and fine GRAVEL, brown, moderately well sorted, well rounded, saturated	8.38 / 331.79
SILTY very coarse SAND, some fine gravel, grey, poorly sorted, angular, saturated	11.43 / 328.74
fine to very coarse GRAVEL up to COBBLES, some coarse sand, poorly sorted, subrounded	14.48 / 325.69
coarse SAND fining downwards to fine SAND, grey, well sorted, sub rounded, saturated **@22.86 m bgs: very trace SILT**	16.76 / 323.40
PROBABLE BEDROCK	24.38 / 315.78
END OF BOREHOLE @ 25.30 m bgs	25.30 / 314.87

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS	NA	NA
10	CS	NA	NA
15	CS	NA	NA
20	CS	NA	NA
25	CS	NA	NA
30	CS	NA	NA
35	CS	NA	NA
40	CS	NA	NA
45	CS	NA	NA
50	CS	NA	NA
55	CS	NA	NA
60	CS	NA	NA
65	CS	NA	NA
70	CS	NA	NA
75	CS	NA	NA
80	CS	NA	NA
83	CS	NA	NA

Completion Details



NOTES:
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

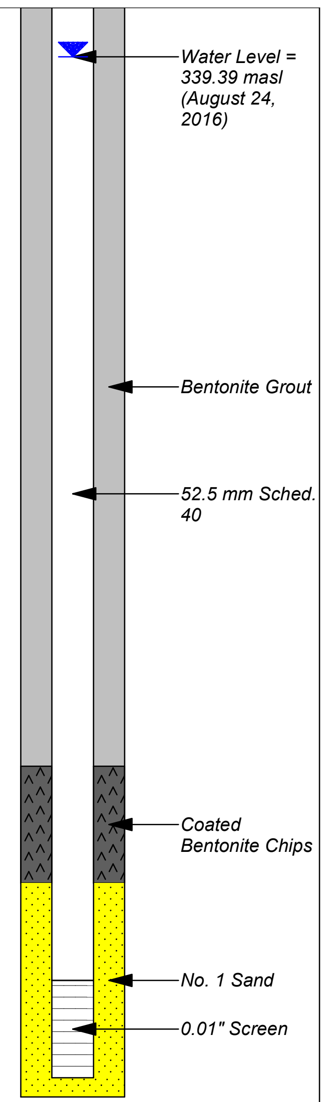
DRILLING LOG | Clair - Maltby Subwatershed Study | MW5-S

Client: **City of Guelph**	Date: **August 11, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.76 m**
Project Area: **Clair - Maltby**	Ground Elevation: **340.16 masl**	Screened Interval: **15.24 - 16.76 m**	Northing: **4816334.91**
Project No.(MSI): **23089**	Total Depth: **17.07 m**	Slot Size: **0.01"**	Easting: **566998.56**
Field Staff: **D. Martin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **13.72 - 16.76 m**	

Depth (m bgs)/ Elev. (m asl)	Stratigraphic Description
0 / 340.16	**fine GRAVEL, well sorted, angular to sub rounded, dry**
1.52 / 338.64	**medium to coarse SAND and fine to medium GRAVEL, brown, moderately well sorted, well rounded, dry**
3.05 / 337.12	**SILTY GRAVELY fine to coarse SAND, fine gravel, brown, poorly sorted, angular to subangular, saturated (TILL)**
8.38 / 331.78	**coarse SAND and fine GRAVEL, brown, moderately well sorted, well rounded, saturated**
11.43 / 328.73	**SILTY very coarse SAND, some fine gravel, grey, poorly sorted, angular, saturated**
14.48 / 325.69	**fine to very coarse GRAVEL up to COBBLES, some coarse sand, fine to very coarse gravel, poorly sorted, subrounded**
17.07 / 323.09	**END OF BOREHOLE @ 17.07 m bgs**

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS	NA	NA
10	CS	NA	NA
15	CS	NA	NA
20	CS	NA	NA
25	CS	NA	NA
30	CS	NA	NA
35	CS	NA	NA
40	CS	NA	NA
45	CS	NA	NA
50	CS	NA	NA
55	CS	NA	NA

Completion Details



NOTES: **0.00 to 10.67 m bgs logged from MW5-D**
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

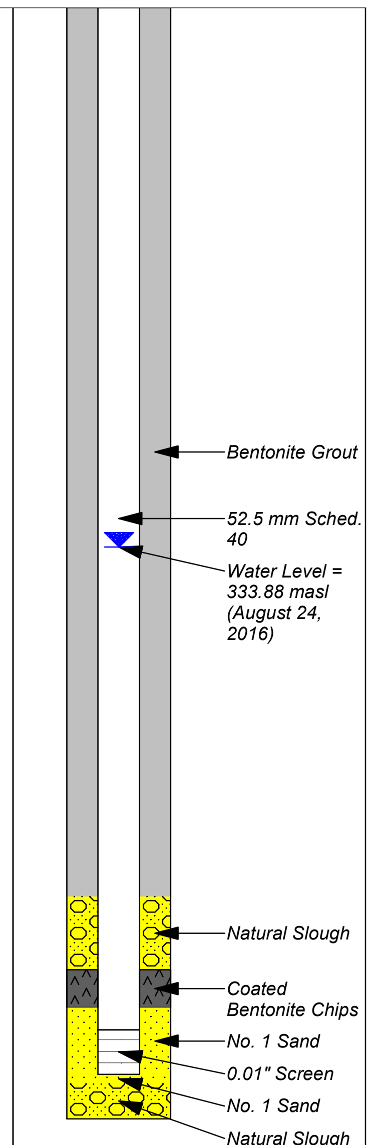
DRILLING LOG — Clair - Maltby Subwatershed Study — MW6-D

Client: **City of Guelph**	Date: **August 15, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.79 m**
Project Area: **Clair - Maltby**	Ground Elevation: **352.38 masl**	Screened Interval: **35.05 - 36.58 m**	Northing: **4816249.90**
Project No.(MSI): **23089**	Total Depth: **38.10 m**	Slot Size: **0.01"**	Easting: **567400.42**
Field Staff: **D. Martin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **34.32 - 36.88 m**	

Depth (m bgs)/ Elev. (m asl)	Stratigraphic Description
0 / 352.38	**GRAVELY SAND, fine to coarse sand, fine to medium gravel, brown, poorly sorted, subangular to subrounded, dry to damp**
	@ 9.91 to 12.95 m bgs: GRAVEL, some fine to coarse SAND
14.48 / 337.90	**fine to very coarse SANDY SILT to SILTY SAND, brown, poorly sorted, angular to subangular, damp**
16.00 / 336.38	**fine to medium SAND coarsening downwards to a GRAVELY SAND, angular to subrounded, damp @18.29 m bgs: saturated**
22.10 / 330.28	**SILT, trace clay, trace coarse sand, grey, poorly sorted, saturated**
23.62 / 328.76	**SILTY fine to medium SAND, fining downwards, brown, poorly sorted, saturated, very loose**
35.81 / 316.57	**GRAVELY SAND (fine to medium gravel, fine to coarse sand), trace silt, grey, poorly sorted, saturated**
37.19 / 315.19	**SILTY CLAY, some fine GRAVEL, grey, poorly sorted, angular to subangular, saturated (TILL)**
37.80 / 314.58	**END OF BOREHOLE @ 37.80 m bgs**

Sample ID	Sample Type
5	CS
10	CS
15	CS
20	CS
25	CS
30	CS
35	CS
40	CS
45	CS
50	CS
55	CS
60	CS
65	CS
70	CS
75	CS
80	CS
85	CS
90	CS
95	CS
100	CS
105	CS
110	CS
115	CS
120	CS
124	CS

Completion Details



NOTES: m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

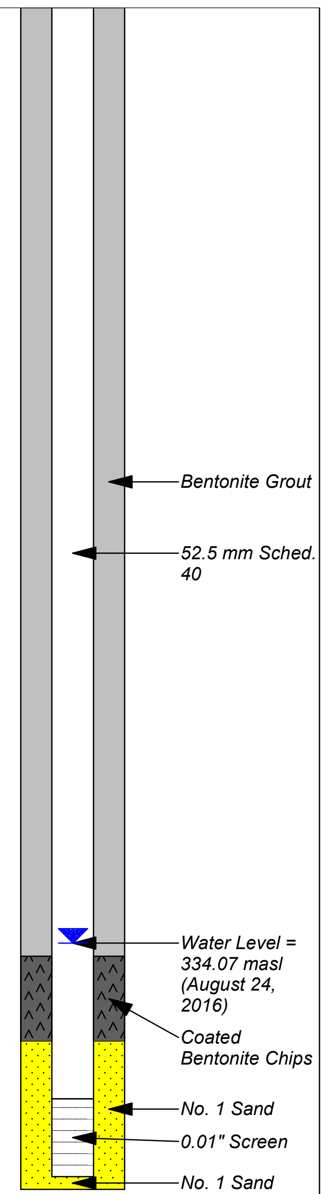
DRILLING LOG | Clair - Maltby Subwatershed Study | MW6-S

Client: **City of Guelph**	Date: **August 16-17, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.79 m**
Project Area: **Clair - Maltby**	Ground Elevation: **352.41 masl**	Screened Interval: **21.39 - 22.91 m**	Northing: **4816246.66**
Project No.(MSI): **23089**	Total Depth: **23.17 m**	Slot Size: **0.01"**	Easting: **567401.07**
Field Staff: **D. Martin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **20.27 - 23.16 m**	

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
GRAVELY SAND, fine to coarse sand, fine to medium gravel, brown, poorly sorted, subangular to subrounded, dry to damp	0 / 352.41
@ 9.91 to 12.95 m bgs: GRAVEL, some fine to coarse SAND	
fine to very coarse SANDY SILT to SILTY SAND, brown, poorly sorted, angular to subangular, damp	14.48 / 337.93
fine to medium SAND coarsening downwards to a poorly sorted GRAVELY SAND, angular to subrounded, damp **@18.29 m bgs: saturated**	16.00 / 336.40
SILT, trace clay, trace coarse sand, grey, poorly sorted, saturated	22.10 / 330.31
END OF BOREHOLE @ 22.86 m bgs	22.86 / 329.55

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS		
10	CS		
15	CS		
20	CS		
25	CS		
30	CS		
35	CS		
40	CS		
45	CS		
50	CS		
55	CS		
60	CS		
65	CS		
70	CS		
75	CS		

Completion Details



NOTES: **0.00 to 15.24 m bgs logged from MW6-D**
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

DRILLING LOG — Clair - Maltby Subwatershed Study — MW7-D

Client: **City of Guelph**
Project Area: **Clair - Maltby**
Project No.(MSI): **23089**
Field Staff: **D. Martin**
Driller: **Highland Water Well Drilling Inc**

Date: **August 23, 2016**
Ground Elevation: **347.04 masl**
Total Depth: **35.46 m**
Drill Rig: **Foremost DR-12**
Boring Diameter: **152 mm**

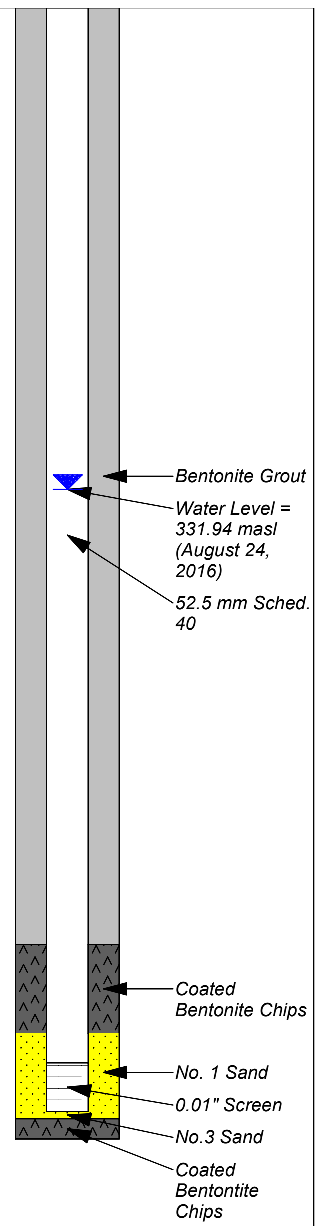
Screen Type: **52.5 mm PVC Sched. 40**
Screened Interval: **33.07 - 34.59 m**
Slot Size: **0.01"**
Casing Diameter: **52.5 mm**
Sand Pack: **32.16 - 34.82 m**

Stick Up: **0.76 m**
Northing: **4815512.35**
Easting: **565478.72**
Datum/Zone: **NAD83 17T**

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
GRAVELY SAND (fine to medium gravel, medium to coarse sand), brown, poorly sorted, subrounded, dry	0 / 347.04
SILT, trace clay coarsening downwards to SANDY SILT, trace fine gravel, brown, angular, dry	5.33 / 341.70
SANDY GRAVEL, medium to coarse sand, fine to medium gravel, brown, poorly sorted, angular to subangular, moist	11.43 / 335.61
medium to coarse SAND fining downwards, grey, well sorted, saturated	20.57 / 326.46
SANDY SILT to SILTY SAND fining downwards to SILT, grey, well sorted, saturated	26.67 / 320.37
CLAYEY SILT, grey, moderately well sorted, saturated	31.24 / 315.79
SANDY GRAVEL, fine gravel, fine to coarse sand, grey, poorly sorted, angular to subangular, saturated	32.77 / 314.27
END OF BOREHOLE @ 35.36 m bgs	35.36 / 311.68

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS		
10	CS		
15	CS		
20	CS		
25	CS		
30	CS		
35	CS		
40	CS		
45	CS		
50	CS		
55	CS		
60	CS		
65	CS		
70	CS		
75	CS		
80	CS		
85	CS		
90	CS		
95	CS		
100	CS		
105	CS		
110	CS		
115	CS		

Completion Details



NOTES: m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

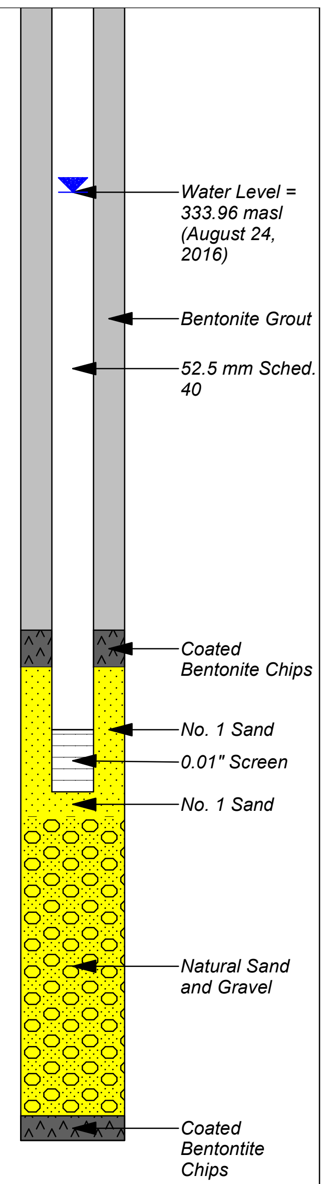
DRILLING LOG — Clair - Maltby Subwatershed Study — MW8-D

Client: **City of Guelph**	Date: **August 9, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.87 m**
Project Area: **Clair - Maltby**	Ground Elevation: **338.48 masl**	Screened Interval: **17.68 - 19.20 m**	Northing: **4815489.34**
Project No.(MSI): **23089**	Total Depth: **27.74 m**	Slot Size: **0.01"**	Easting: **566248.11**
Field Staff: **D. Martin/J. Melchin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc.**	Boring Diameter: **152 mm**	Sand Pack: **16.15 - 19.81 m**	

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
fine to coarse SAND and fine to medium GRAVEL, trace silt, brown, poorly sorted, angular to sub-rounded, damp to moist **@4.57 m bgs: saturated**	0 / 338.48
very coarse SAND and fine GRAVEL, slight coarsening downwards to medium coarse gravel, grey, moderately well sorted, saturated	12.95 / 325.52
SILTY CLAY, some fine to coarse sand, some fine to medium gravel, grey, very poorly sorted, angular, saturated (TILL)	23.62 / 314.86
SAND and fine GRAVEL, poorly sorted, subrounded	27.13 / 311.35
PROBABLE BEDROCK	27.43 / 311.05
END OF BOREHOLE @ 27.74 m bgs	27.74 / 310.74

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS		
10	CS		
15	CS		
20	CS		
25	CS		
30	CS		
35	CS		
40	CS		
45	CS		
50	CS		
55	CS		
60	CS		
65	CS		
70	CS		
75	CS		
80	CS		
85	CS		
90	CS		

Completion Details



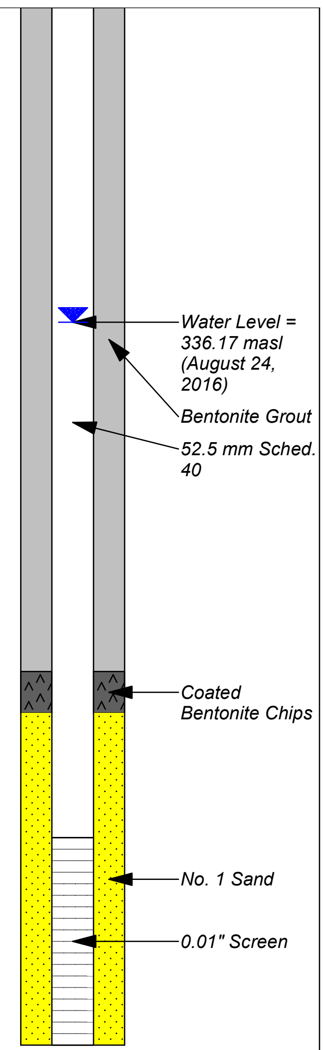
NOTES: **m asl = metres above sea level**
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

DRILLING LOG — Clair - Maltby Subwatershed Study — MW8-S

Client: **City of Guelph**	Date: **August 10, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.84 m**
Project Area: **Clair - Maltby**	Ground Elevation: **338.48 masl**	Screened Interval: **6.10 - 7.62 m**	Northing: **4815493.95**
Project No.(MSI): **23089**	Total Depth: **7.62 m**	Slot Size: **0.01"**	Easting: **566250.11**
Field Staff: **D. Martin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **5.18 - 7.62 m**	

m asl	m bgs	Lithology	Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)	Sample ID	Sample Type	Blow Counts (N Value)	% Recovery	Completion Details
	0		**fine to coarse SAND and fine to medium GRAVEL, trace silt, brown, poorly sorted, angular to sub-rounded, damp to moist**	0 / 338.48					
338									
	1								
337					5	CS			
	2								
336									
	3				10	CS			
335									
	4								
334			**@4.57 m bgs: saturated**		15	CS			
	5								
333									
	6				20	CS			
332									
	7								
331				7.62 / 330.86	25	CS			
			END OF BOREHOLE @ 7.62 m bgs						
	8								
330									
	9								



NOTES: **0.00 to 6.10 m bgs logged from MW8-D**
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

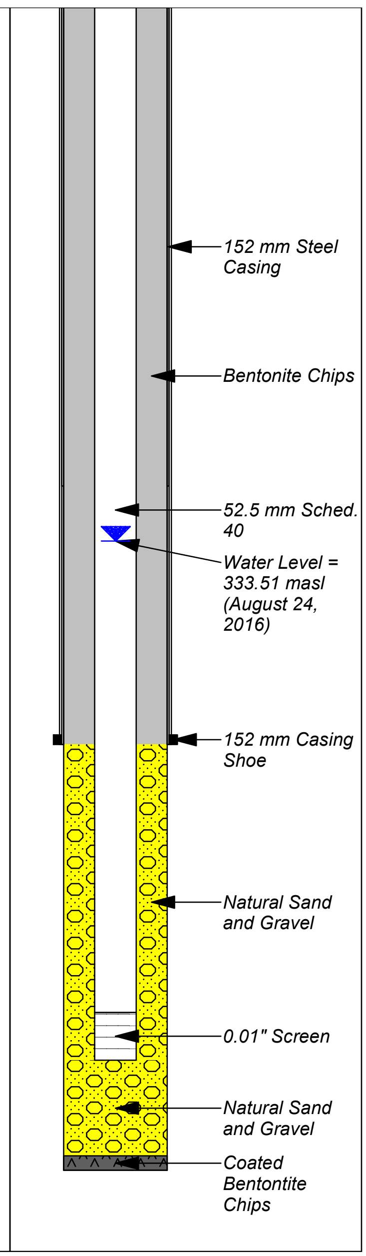
DRILLING LOG | Clair - Maltby Subwatershed Study | MW9-D

Client: **City of Guelph**	Date: **August 4, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.55 m**
Project Area: **Clair - Maltby**	Ground Elevation: **350.51 masl**	Screened Interval: **32.00 - 33.53 m**	Northing: **4815294.75**
Project No.(MSI): **23089**	Total Depth: **37.03 m**	Slot Size: **0.01"**	Easting: **566970.16**
Field Staff: **S. Miller/J. Melchin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **29.26 - 36.58 m**	

m asl	m bgs	Lithology	Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
350.51	0		**GRAVELY SAND (fine gravel, medium to coarse sand) coarsening with depth, brown, moderately well sorted, subrounded to rounded, dry** **@1.52 m bgs: some silt, trace clay** **@ 15.24 m bgs: trace silt**	0 / 350.51
334.50	16.00		**fine to medium SAND, brown, moderately well sorted, dry**	16.00 / 334.50
332.98	17.53		**medium to coarse SAND and fine GRAVEL, brown, moderately well sorted, subrounded to rounded, saturated**	17.53 / 332.98
326.88	23.62		**medium to very coarse SAND, trace fine gravel, fining slightly with depth, brown, subrounded, saturated**	23.62 / 326.88
322.31	28.19		**very fine SANDY SILT, fining downwards to silt, grey, well sorted, saturated**	28.19 / 322.31
319.26	31.24		**fine to medium GRAVEL, trace to some coarse sand, grey, subangular to subrounded, saturated**	31.24 / 319.26
313.93	36.58		**PROBABLE BEDROCK**	36.58 / 313.93
313.47	37.03		**END OF BOREHOLE @ 37.03 m bgs**	37.03 / 313.47

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS		
10	CS		
15	CS		
20	CS		
25	CS		
30	CS		
35	CS		
40	CS		
45	CS		
50	CS		
55	CS		
60	CS		
65	CS		
70	CS		
75	CS		
80	CS		
85	CS		
90	CS		
95	CS		
100	CS		
105	CS		
110	CS		
115	CS		
120	CS		

Completion Details



NOTES: m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

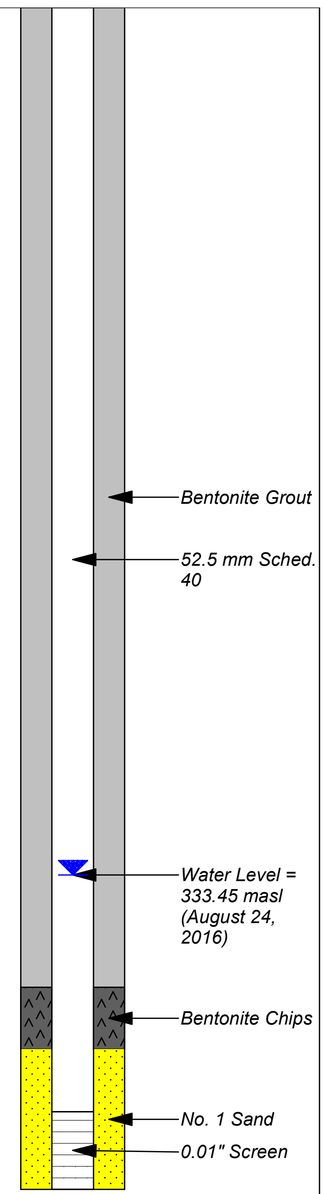
DRILLING LOG — Clair - Maltby Subwatershed Study — MW9-S

Client: **City of Guelph**	Date: **August 8, 2016**	Screen Type: **52.5 mm PVC Sched. 40**	Stick Up: **0.46 m**
Project Area: **Clair - Maltby**	Ground Elevation: **350.46 masl**	Screened Interval: **21.64 - 23.16 m**	Northing: **4815292.49**
Project No.(MSI): **23089**	Total Depth: **23.16 m**	Slot Size: **0.01"**	Easting: **566972.15**
Field Staff: **S.Miller/J. Melchin**	Drill Rig: **Foremost DR-12**	Casing Diameter: **52.5 mm**	Datum/Zone: **NAD83 17T**
Driller: **Highland Water Well Drilling Inc**	Boring Diameter: **152 mm**	Sand Pack: **20.42 - 23.16 m**	

Stratigraphic Description	Depth (m bgs)/ Elev. (m asl)
GRAVELY SAND, fine gravel, medium to coarse sand coarsening with depth, brown, subrounded to rounded, dry **@1.52 m bgs: some silt, trace clay** **@ 15.24 m bgs: trace silt**	0 / 350.46
fine to medium SAND, brown, moderately well sorted, dry	16.00 / 334.45
medium to coarse SAND and fine GRAVEL, brown, subrounded to rounded, saturated	17.53 / 332.93
END OF BOREHOLE @ 23.16 m bgs	23.16 / 327.29

Sample ID	Sample Type	Blow Counts (N Value)	% Recovery
5	CS		
10	CS		
15	CS		
20	CS		
25	CS		
30	CS		
35	CS		
40	CS		
45	CS		
50	CS		
55	CS		
60	CS		
65	CS		
70	CS		
75	CS		

Completion Details



NOTES:
0.00 to 18.29 m bgs logged from MW9-D
m asl = metres above sea level
m bgs = metres below ground surface
CS = cyclone sample

Matrix Solutions Inc.

Aquafor Beech Limited
920 Princess St
Kingston, Ontario
K7L 1H1

Log of Borehole: MW-1

Project No.: 65188

Project: Neumann Property EIS

Client: Neumann Group

Location: Guelph, ON

Enclosure: 1

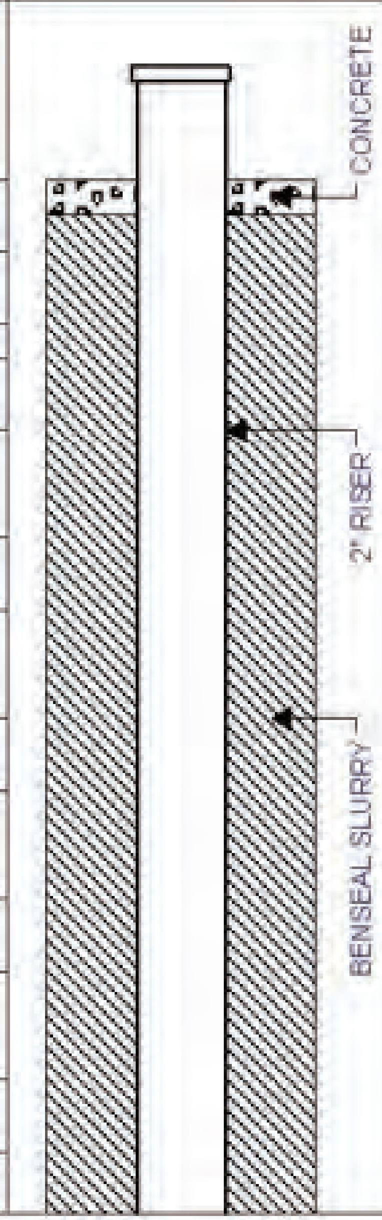
Project Manager: Barry Gorman

SUBSURFACE PROFILE / SAMPLE

Depth (ft)	Description	Depth/Elev.	Number	'N' Blows/ft
0	Ground Surface	346.2 / 0.0		
0–2	***Topsoil*** brown silty sand loam		1	16
2–4	***Silty sand ,gravel, trace clay***		2	10
6			3	30
10–12	grinding on boulder - moisture 7% Sand 49%, silt 41%, clay 11% light brown, cobbles, dry		4	23
16			5	36
20–22	Sand 45%, silt 48%, clay 7% moist, cobbles - moisture 8.4%		6	35
26	coarse sand with cobbles		7	33

Depth scale: ft -4 to 28; m 1, 3, 5, 7

Well Completion Details



Drilled By: Aardvark Drilling Inc

Drill Method: Hollow-stem auger

Drill Date: Nov. 14, 2011

Hole Size: 210 mm

Datum:

Aquafor Beech Limited
920 Princess St
Kingston, Ontario
K7L 1H1

Log of Borehole: MW-1

Project No.: 65188

Project: Neumann Property EIS

Client: Neumann Group

Location: Guelph, ON

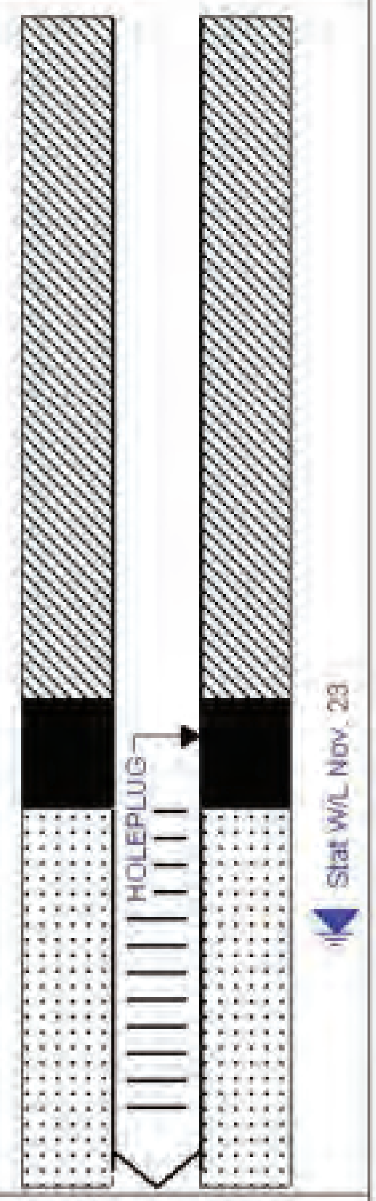
Enclosure: 1

Project Manager: Barry Gorman

SUBSURFACE PROFILE / SAMPLE

Depth (ft)	Depth (m)	Description	Depth/Elev.	Number	Type	'N' Blows/ft
30		Sand 50%, silt41%, clay 9%				
30–32				8		64
32	10	moisture 7.3%				
34						
36		reddish tint		9		28
38						
40	12		306.2 40.0			
40–42		***Gravel and sand***		10		24
42		Gravel 57%, sand 26%, silt and clay 17%, moisture 4%				
44						
46	14			11		78
48						
50		Gravel 55%, sand 30%, silt and clay 15%				
52	16	some Precambrian pebbles - moisture 3.4%		12		86
54						
56		wet		13		65
58	18					
60			286.2 60.0			

Well Completion Details



Drilled By: Aardvark Drilling Inc

Drill Method: Hollow-stem auger

Drill Date: Nov. 14, 2011

Hole Size: 210 mm

Datum:

Sheet: 2 of 2

Log of Borehole: MW-2

Aquafor Beech Limited
920 Princess St
Kingston, Ontario
K7L 1H1

Project No.: 65188

Project: Neumann Property EIS

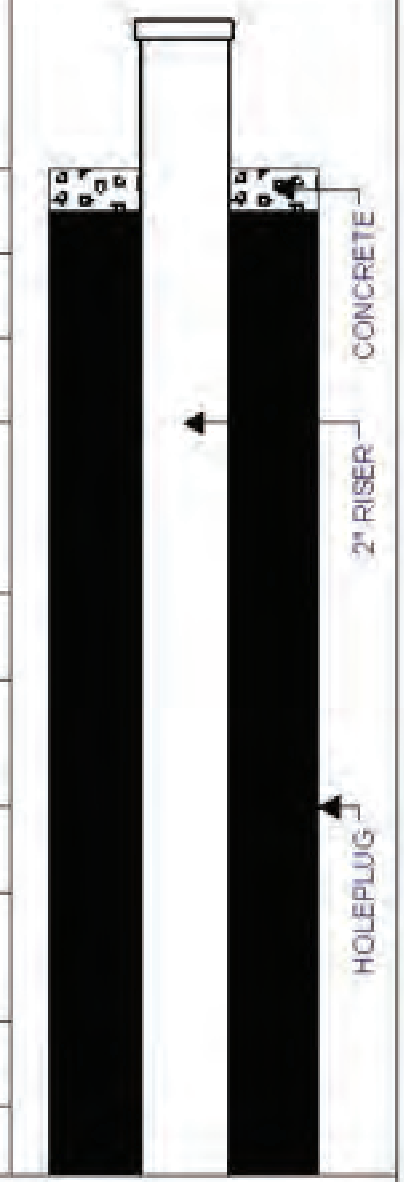
Client: Neumann Group

Location: Guelph, ON

Enclosure: 2

Project Manager: Barry Gorman

SUBSURFACE PROFILE			SAMPLE			
Depth (ft / m)	Description	Depth/Elev.	Number	Type	'N' Blows/ft	Well Completion Details
0	Ground Surface	344.0 / 0.0				
0	Topsoil					
	Sandy silt loam		1		5	
3 / 1	Silty sand and gravel dry	341.0 / 3.0	2		24	
			3		34	
10–12 / 3	gravel 33%, sand 37%, silt 24%, clay 6%, damp, moisture 17.7%		4		34	
16 / 5	high gravel and cobble content, dry		5		34	
20–22			6		47	



Drilled By: Aardvark Drilling Inc

Drill Method: Hollow-stem auger

Drill Date: Nov. 23-24, 2011

Hole Size: 210 mm

Datum:

Sheet: 1 of 2

Aquafor Beech Limited
920 Princess St
Kingston, Ontario
K7L 1H1

Log of Borehole: MW-2

Project No.: 65188

Project: Neumann Property EIS

Client: Neumann Group

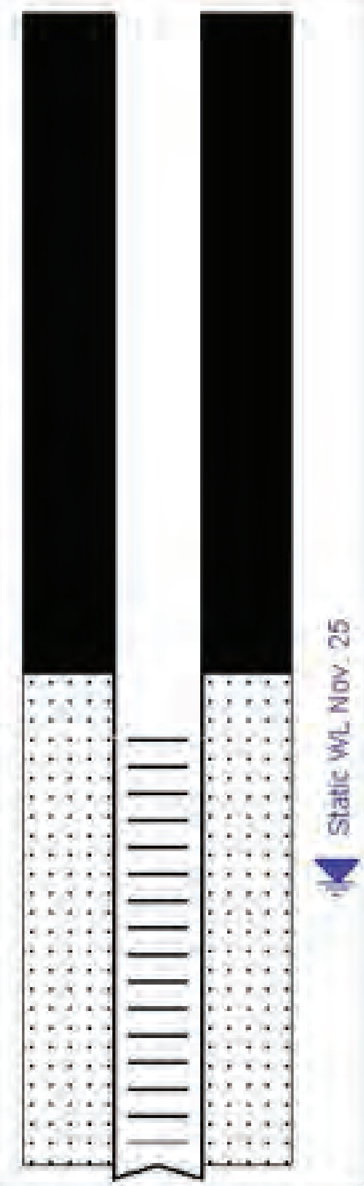
Enclosure: 2

Location: Guelph, ON

Project Manager: Barry Gorman

SUBSURFACE PROFILE				SAMPLE			
Depth	Symbol	Description	Depth/Elev.	Number	Type	'N' Blows/ft	Well Completion Details
		damp		7		48	
29 / 9			314.0				
		Silt with gravel gravel 16%, sand 16%m silt 24%, clay 6%, moisture 6.7%	30.0	8		61	
35 / 11		cobbles		9		100+	
			304.0				
41		**Sand and gravel** sand and gravel, dry	40.0	10		69	
43 / 13							
45		coarse grey sand 45-46, wet		11		72	
47		grinding on cobbles					
49 / 15			294.0				
			50.0				

Depth scale: 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 (ft); 9, 11, 13, 15 (m)



Drilled By: Aardvark Drilling Inc

Drill Method: Hollow-stem auger

Drill Date: Nov. 23-24, 2011

Hole Size: 210 mm

Datum:

Aquafor Beech Limited
920 Princess St
Kingston, Ontario
K7L 1H1

Log of Borehole: MW-3

Project No.: 65188

Project: Neumann Property EIS

Client: Neumann Group

Location: Guelph, ON

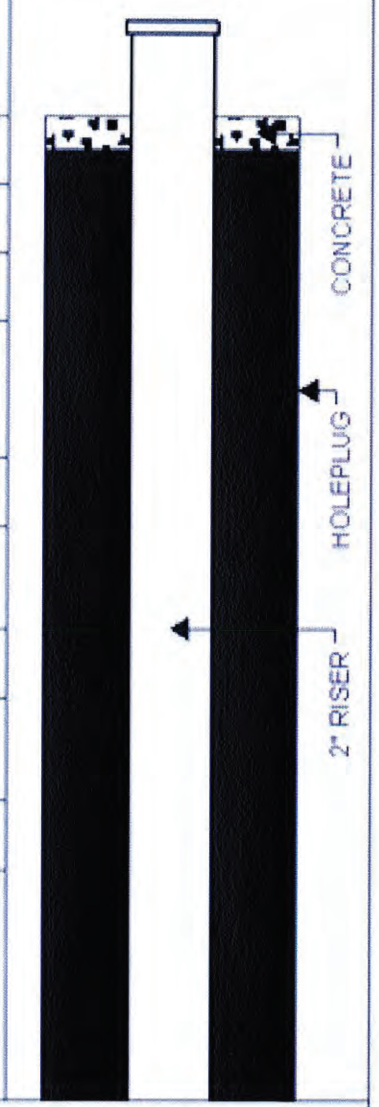
Enclosure: 3

Project Manager: Barry Gorman

SUBSURFACE PROFILE: Description	Depth/Elev	SAMPLE: Number	Type	'N' Blows/ft.
Ground Surface	349.0 / 0.0			
Topsoil		1		3
Coarse Sand with silt		2		5
light brown		3		5
grinding on cobbles	337.0 / 12.0	4		15
Silt and clay with gravel gravel 7%, sand 8%, silt 50%, clay 35%, moisture 8.0% grinding on boulder	329.0 / 20.0	5		63
Gravel with silt and clay still dry grinding on boulders and cobbles		6		100+

Depth scale: ft -4 to 28; m 1 to 7

Well Completion Details



Drilled By: Aardvark Drilling Inc.

Drill Method: Hollow-stem auger

Drill Date: Nov. 24, 2011

Hole Size: 210 mm

Datum:

Sheet: 1 of 2

Aquafor Beech Limited
920 Princess St
Kingston, Ontario
K7L 1H1

Log of Borehole: MW-3

Project No.: 65188

Project: Neumann Property EIS

Client: Neumann Group

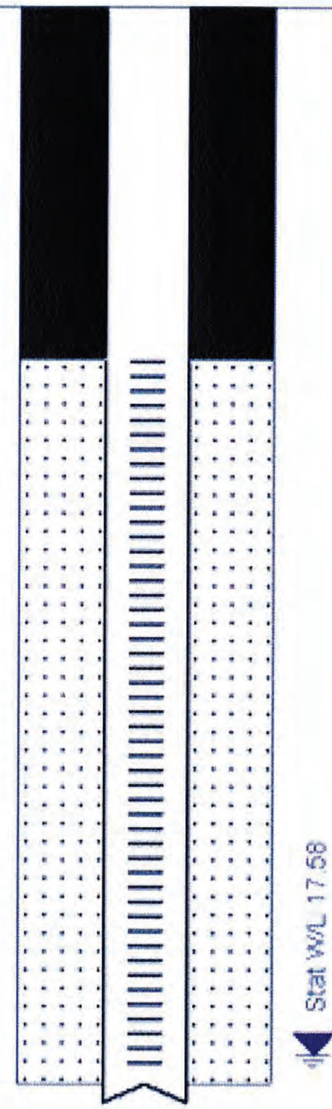
Location: Guelph, ON

Enclosure: 3

Project Manager: Barry Gorman

SUBSURFACE PROFILE				SAMPLE		
Depth (ft / m)	Symbol	Description	Depth/Elev	Number	Type	'N' Blows/ft.
30 – 32		brown, still dry		7		40
34 – 36 (10)		cobbles and boulders				
40 – 42 (12)				8		56
42 – 44		gravel 40%, sand 31%, silt 16%, clay 13%, moisture 3%				
44		red & grey shale fragments, wet				
45 – 46 (14)		same, still wet		9		82
51		cobbles, spoon wet		10		100+
52 – 53 (16)		gravel 43%, sand 11%, silt 22%, clay 24%, moisture 6.3%				
56		boulders and cobbles to TD		11		100+
58 – 60 (18)			290.5 58.5			

Well Completion Details



Drilled By: Aardvark Drilling Inc.

Drill Method: Hollow-stem auger

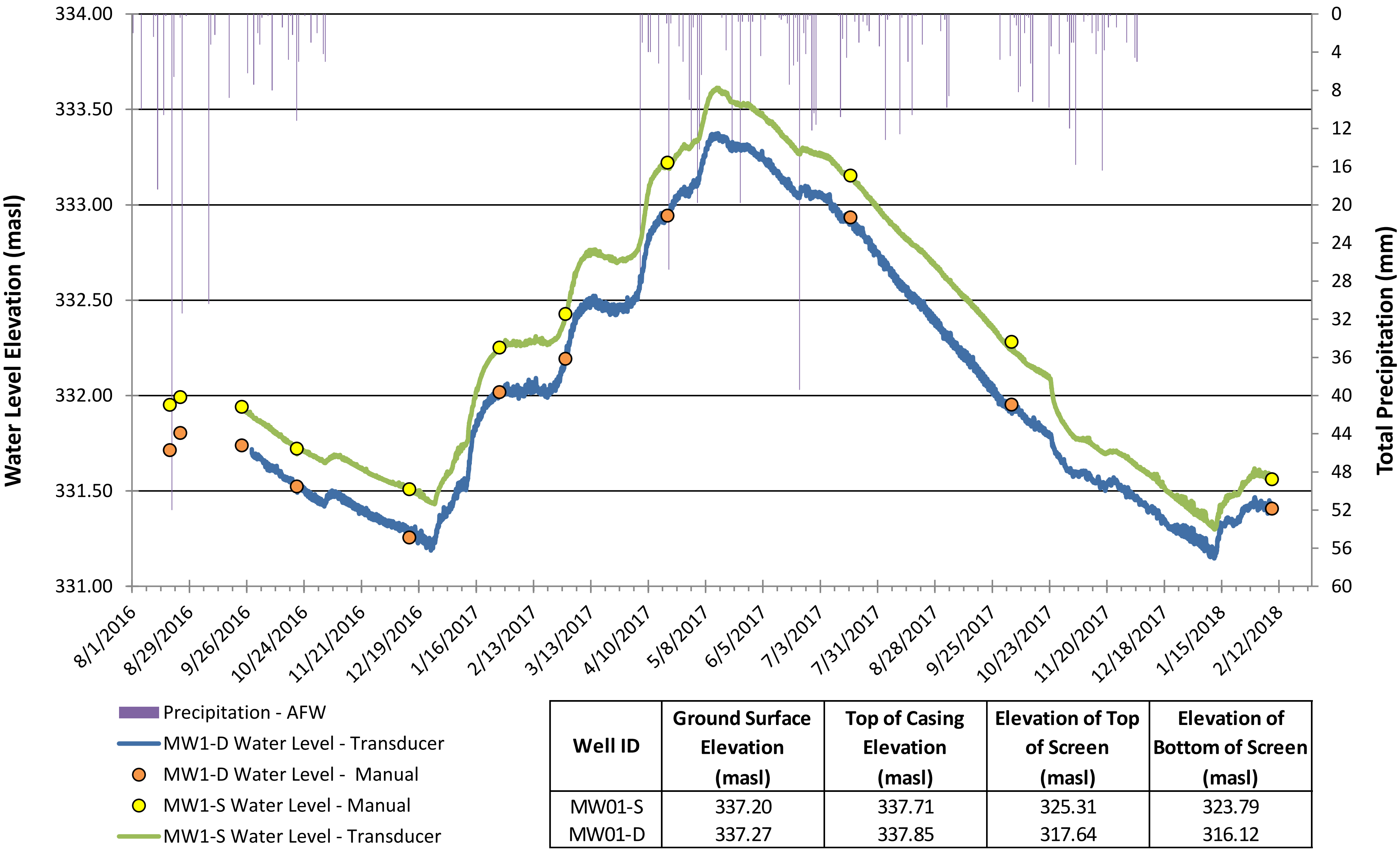
Drill Date: Nov. 24, 2011

Hole Size: 210 mm

Datum:

Appendix GW-3: Monitoring Well Hydrographs

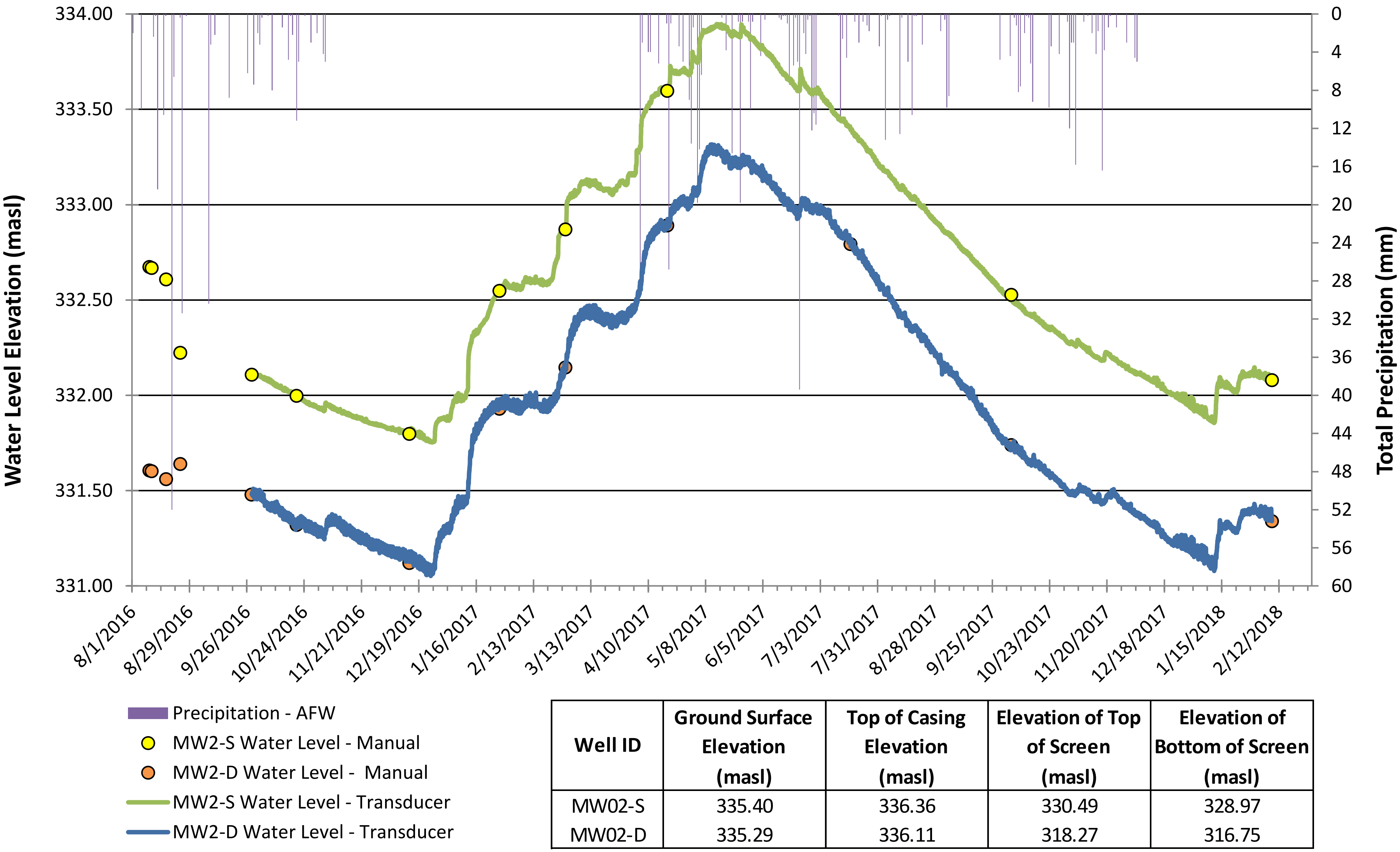
Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW1-D & MW1-S



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW01-S	337.20	337.71	325.31	323.79
MW01-D	337.27	337.85	317.64	316.12

Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

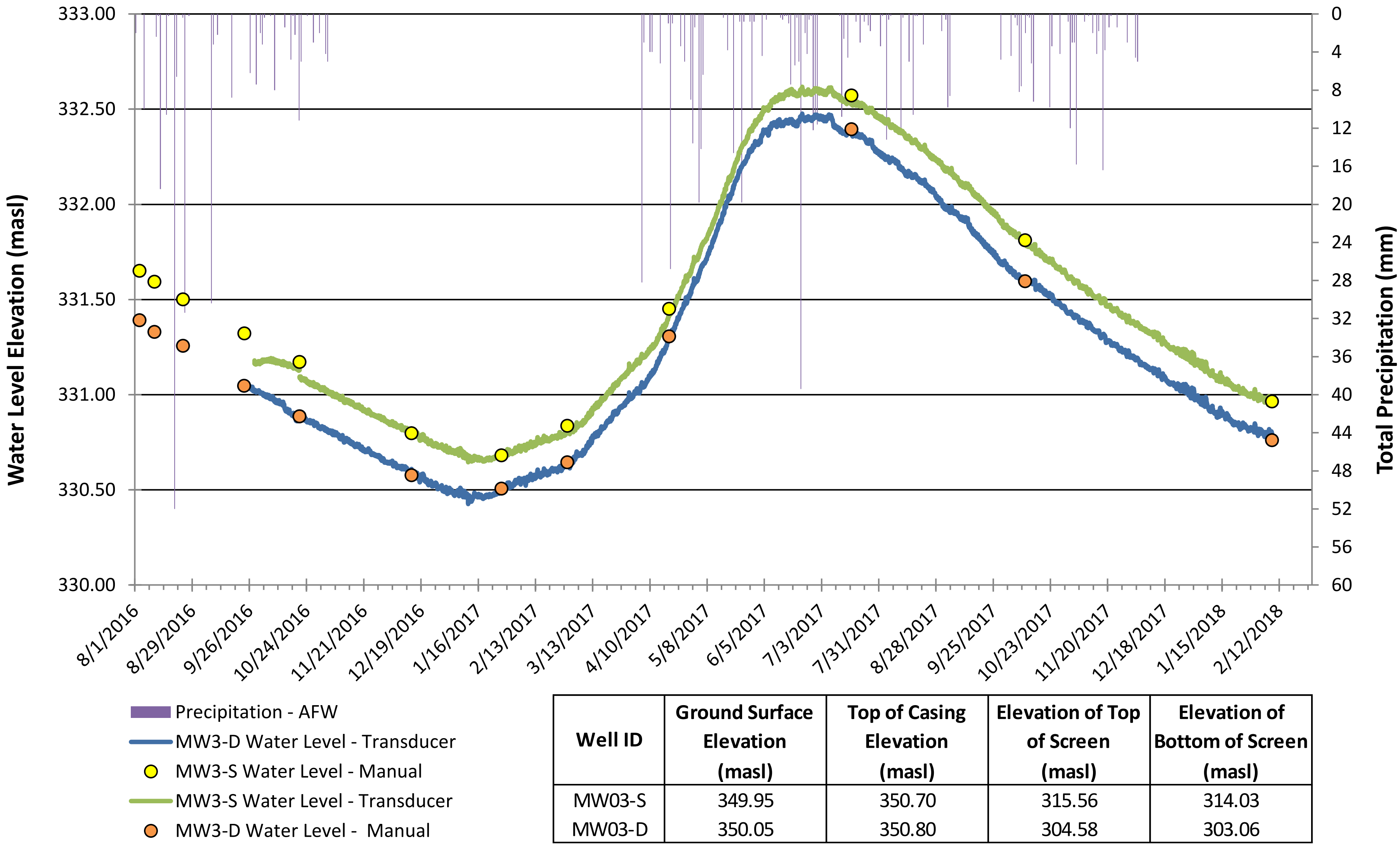
Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW2-D & MW2-S



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW02-S	335.40	336.36	330.49	328.97
MW02-D	335.29	336.11	318.27	316.75

Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

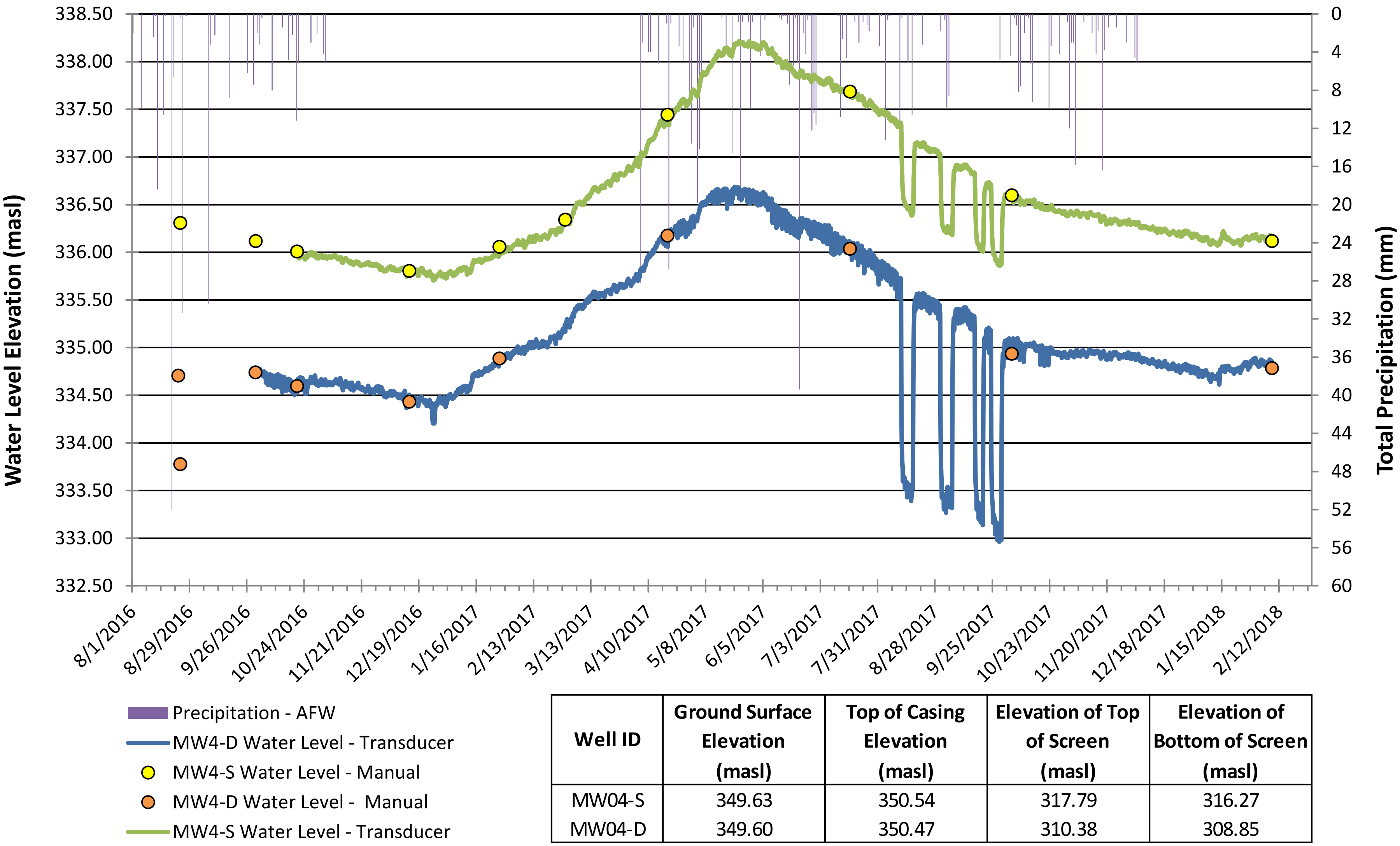
Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW3-D & MW3-S



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW03-S	349.95	350.70	315.56	314.03
MW03-D	350.05	350.80	304.58	303.06

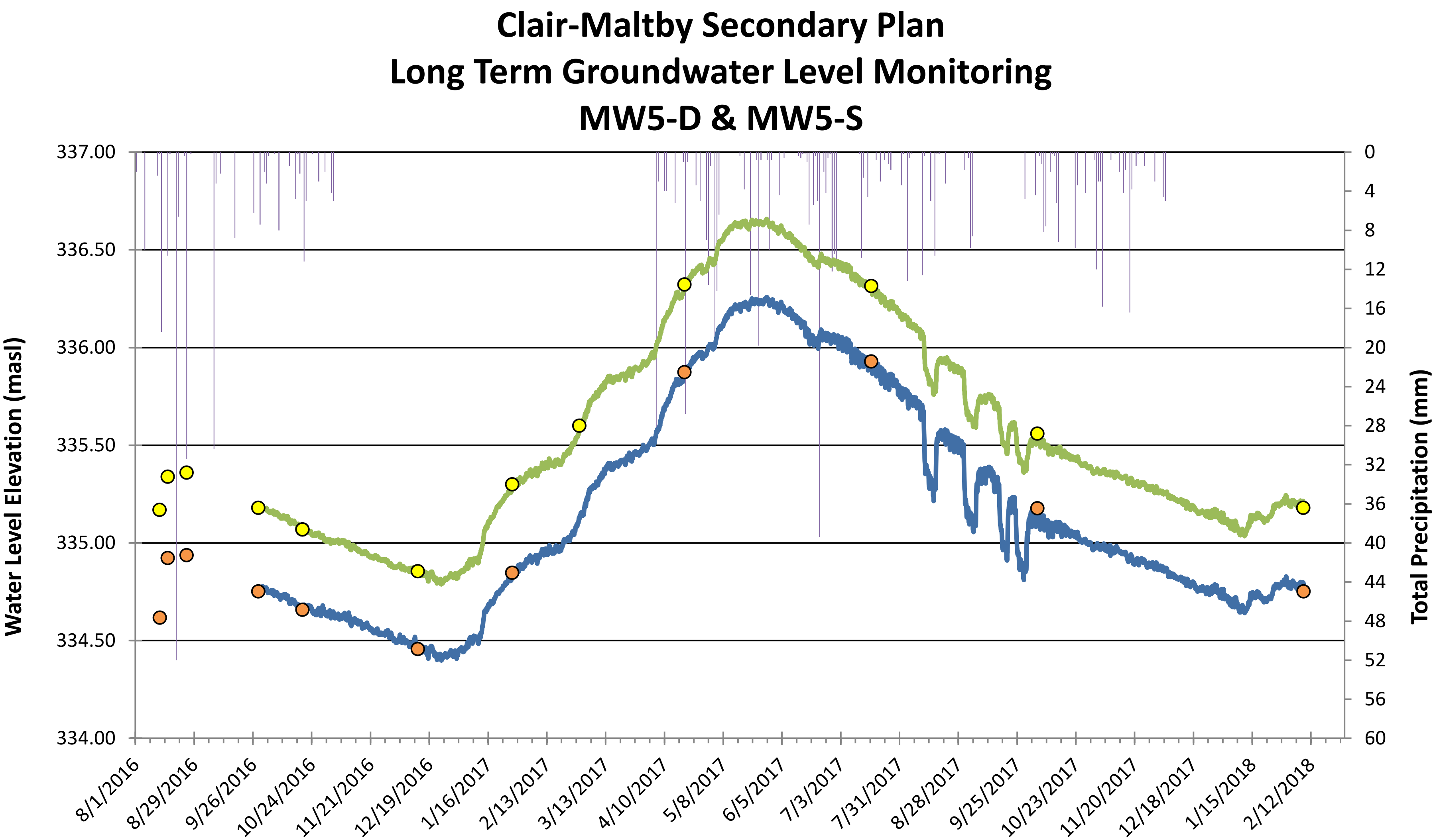
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW4-D & MW4-S



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW04-S	349.63	350.54	317.79	316.27
MW04-D	349.60	350.47	310.38	308.85

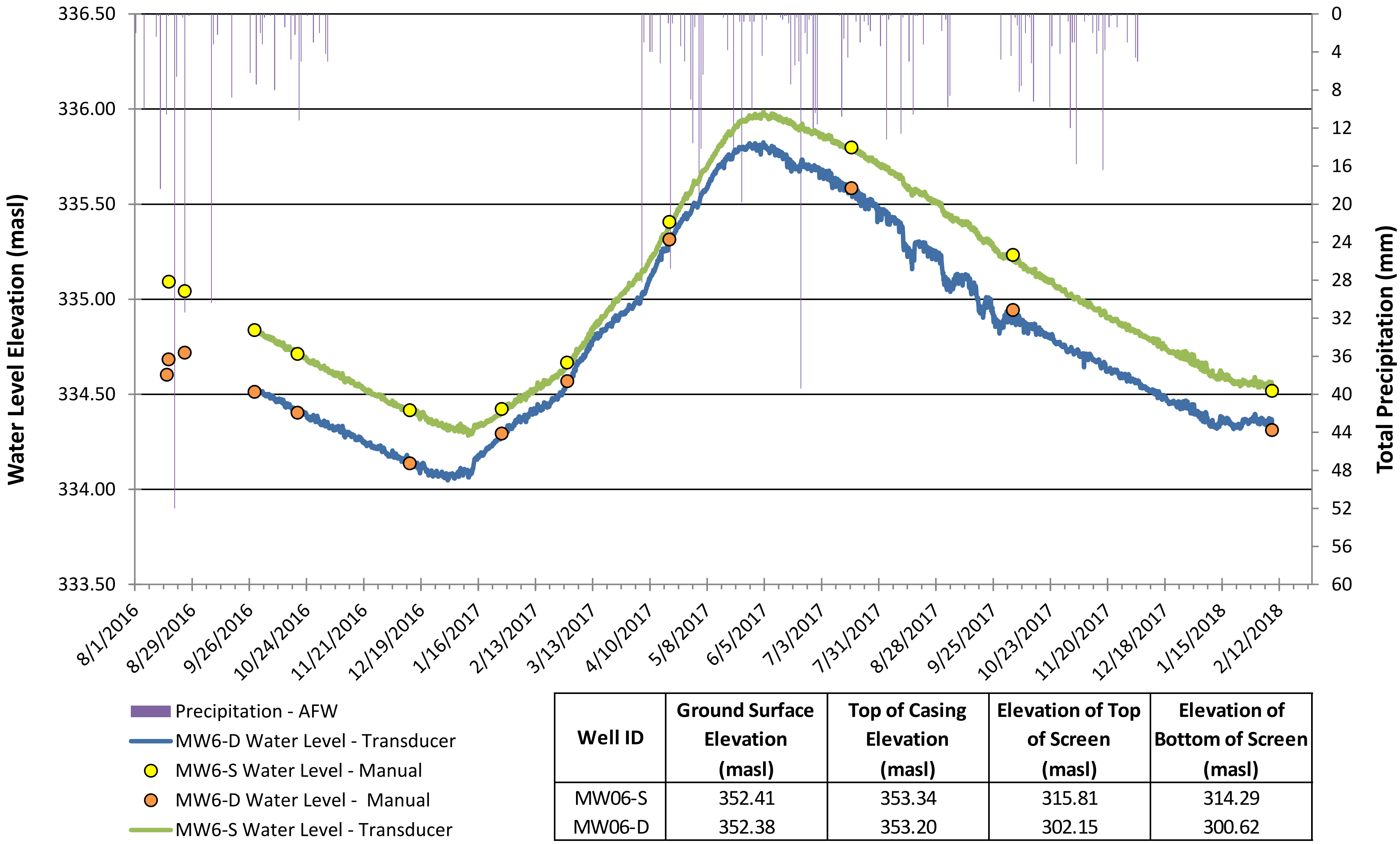
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW05-S	340.16	341.11	321.96	320.43
MW05-D	340.17	341.10	314.64	313.12

Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

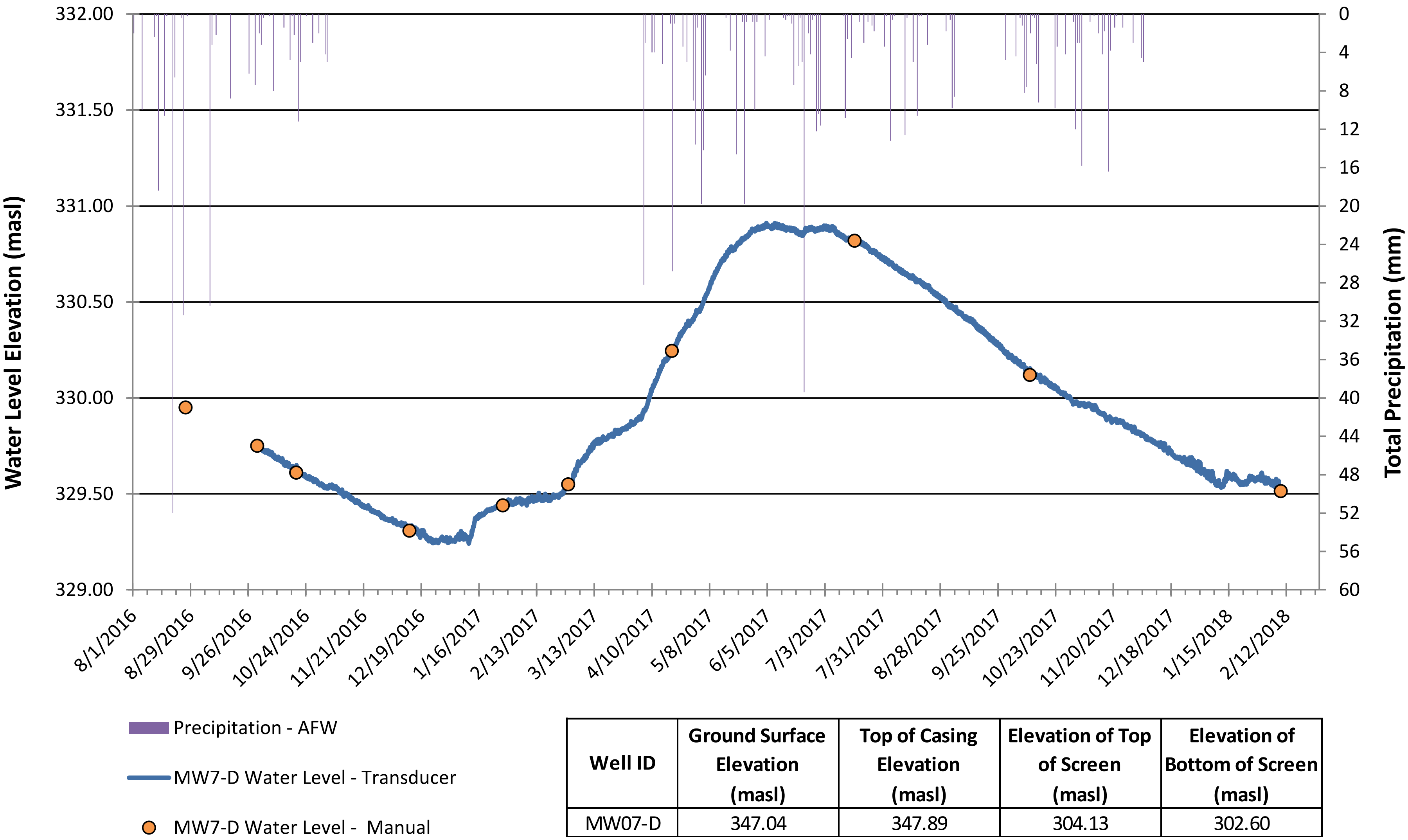
Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW6-D & MW6-S



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW06-S	352.41	353.34	315.81	314.29
MW06-D	352.38	353.20	302.15	300.62

Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

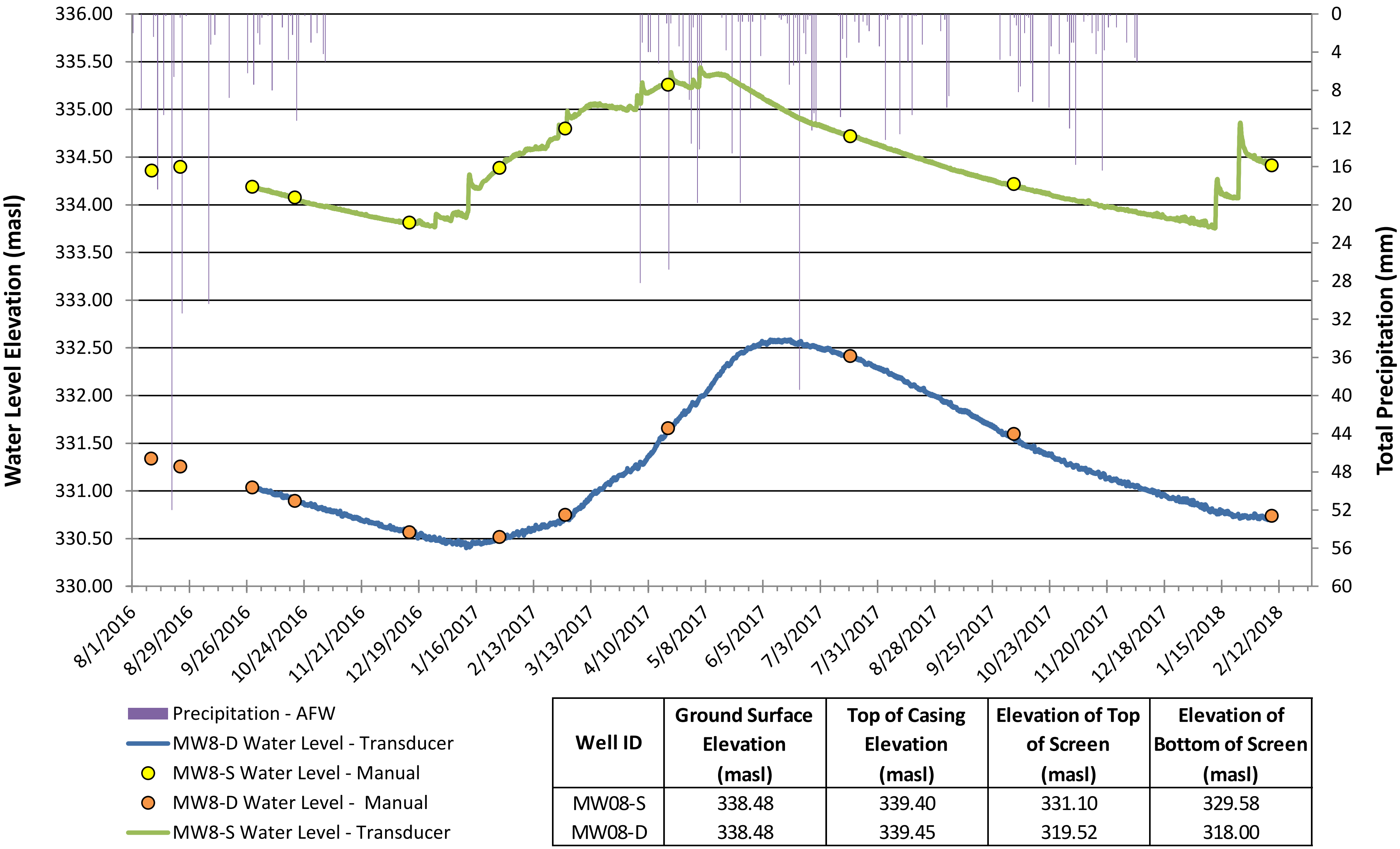
Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW7-D



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW07-D	347.04	347.89	304.13	302.60

Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

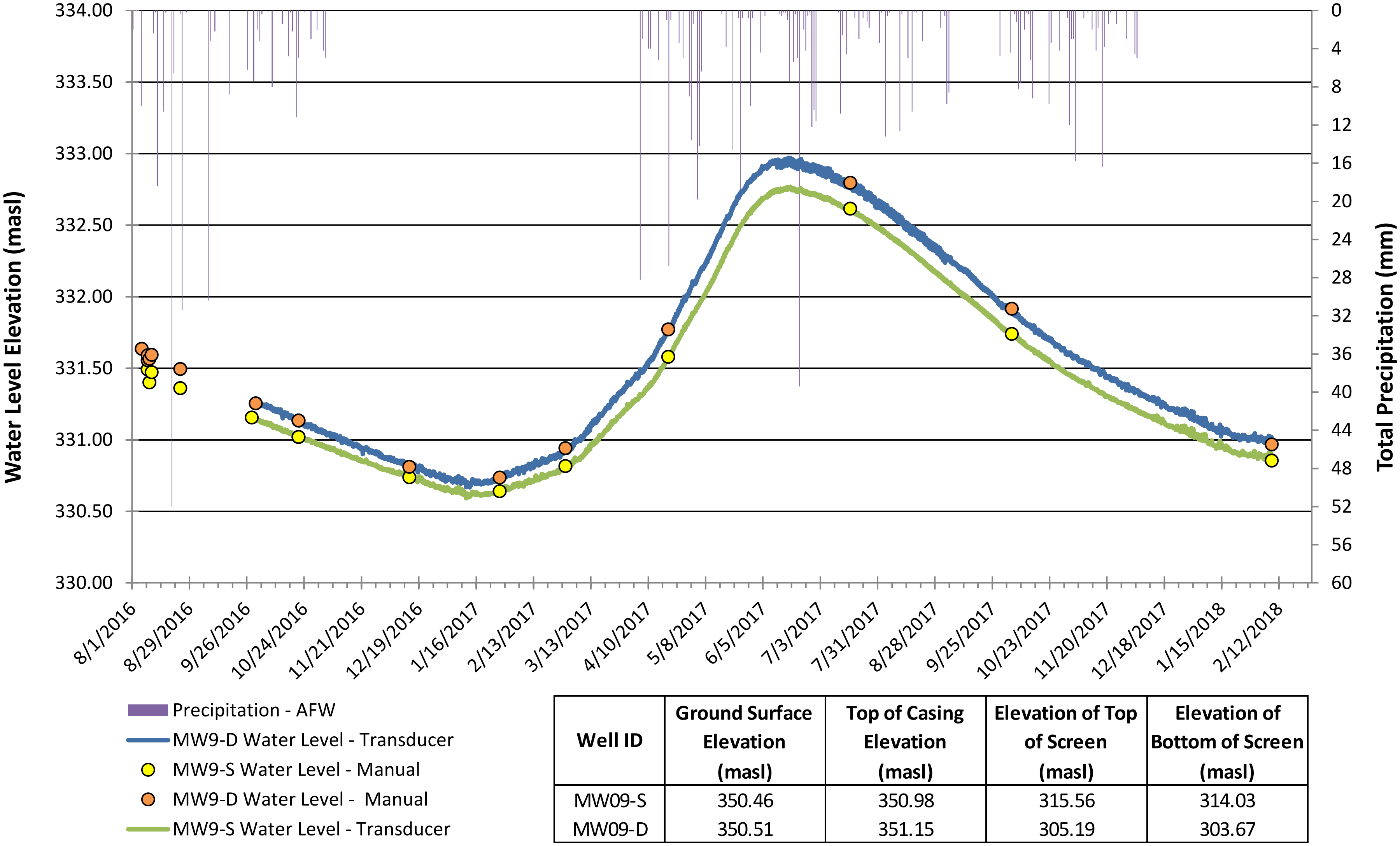
Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW8-D & MW8-S



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW08-S	338.48	339.40	331.10	329.58
MW08-D	338.48	339.45	319.52	318.00

Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E

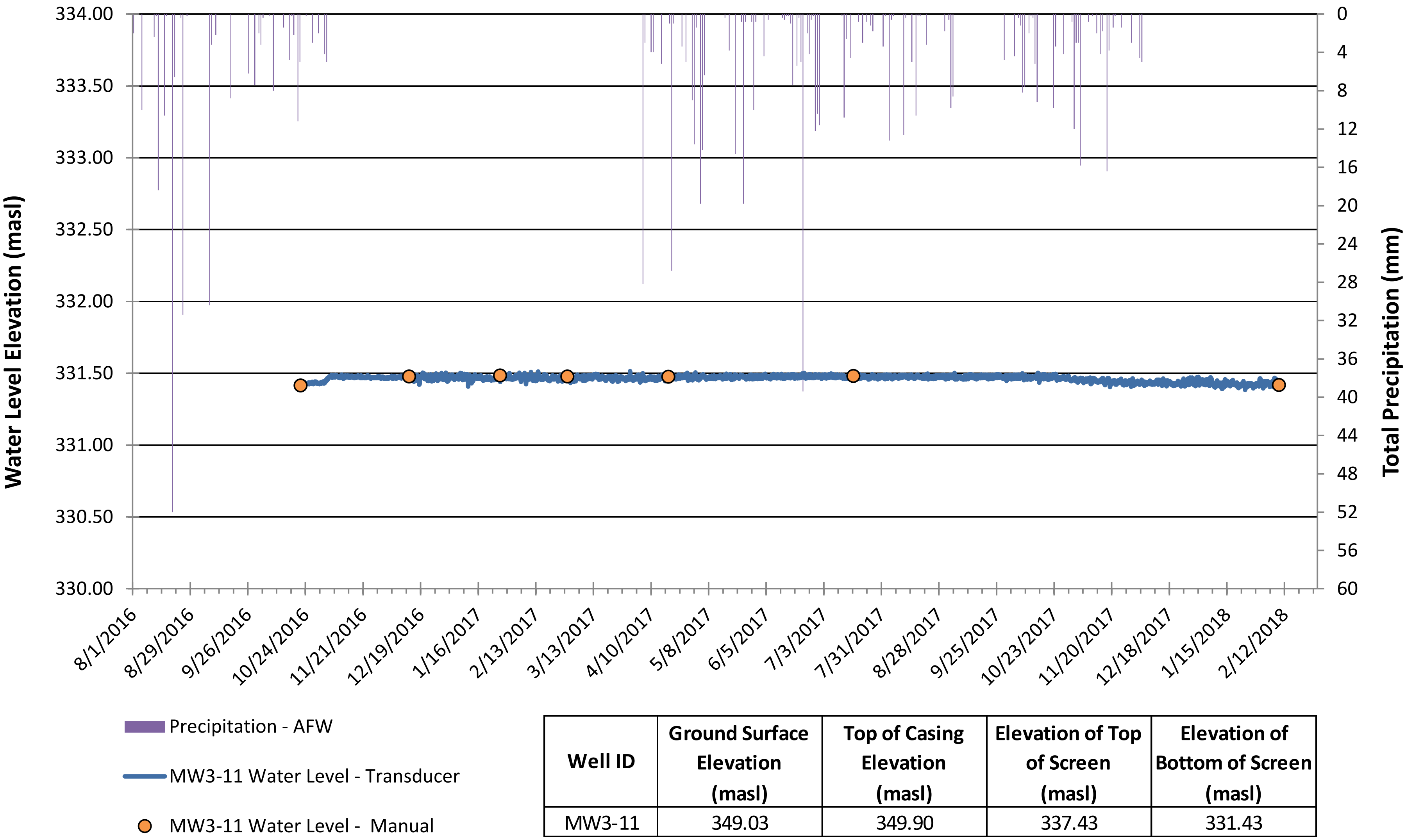
Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW9-D & MW9-S



Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW09-S	350.46	350.98	315.56	314.03
MW09-D	350.51	351.15	305.19	303.67

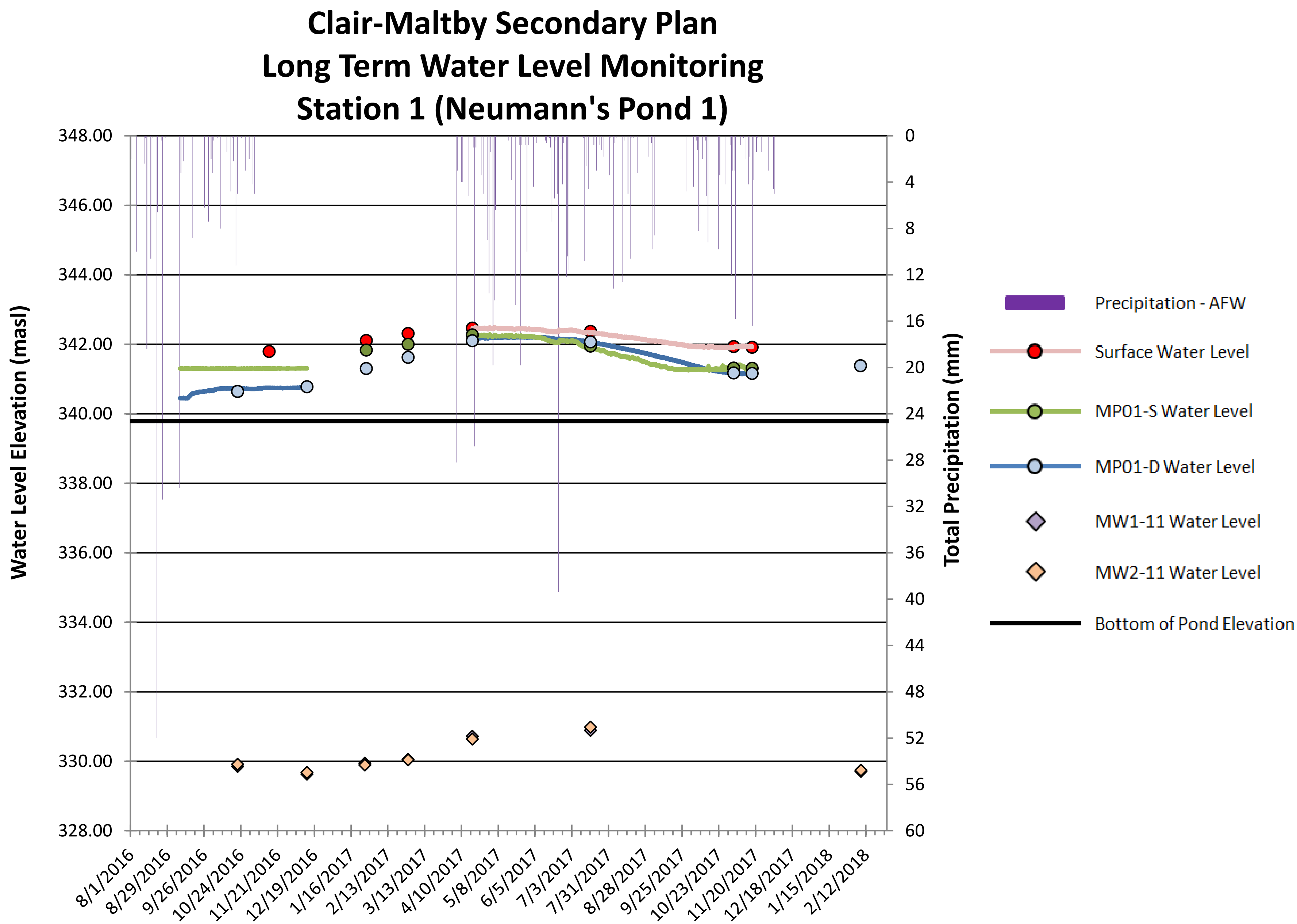
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E

Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW3-11

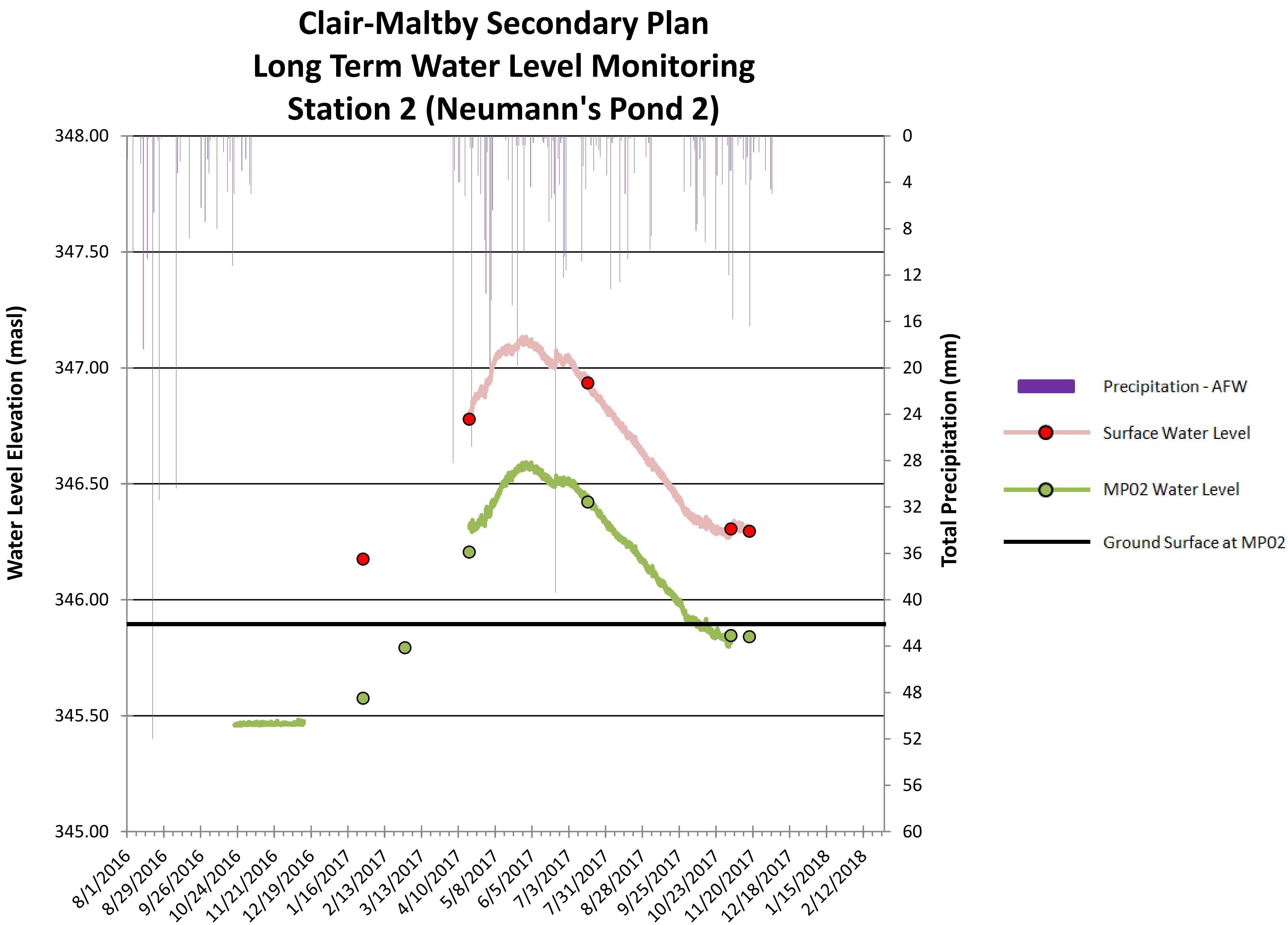


Well ID	Ground Surface Elevation (masl)	Top of Casing Elevation (masl)	Elevation of Top of Screen (masl)	Elevation of Bottom of Screen (masl)
MW3-11	349.03	349.90	337.43	331.43

Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E

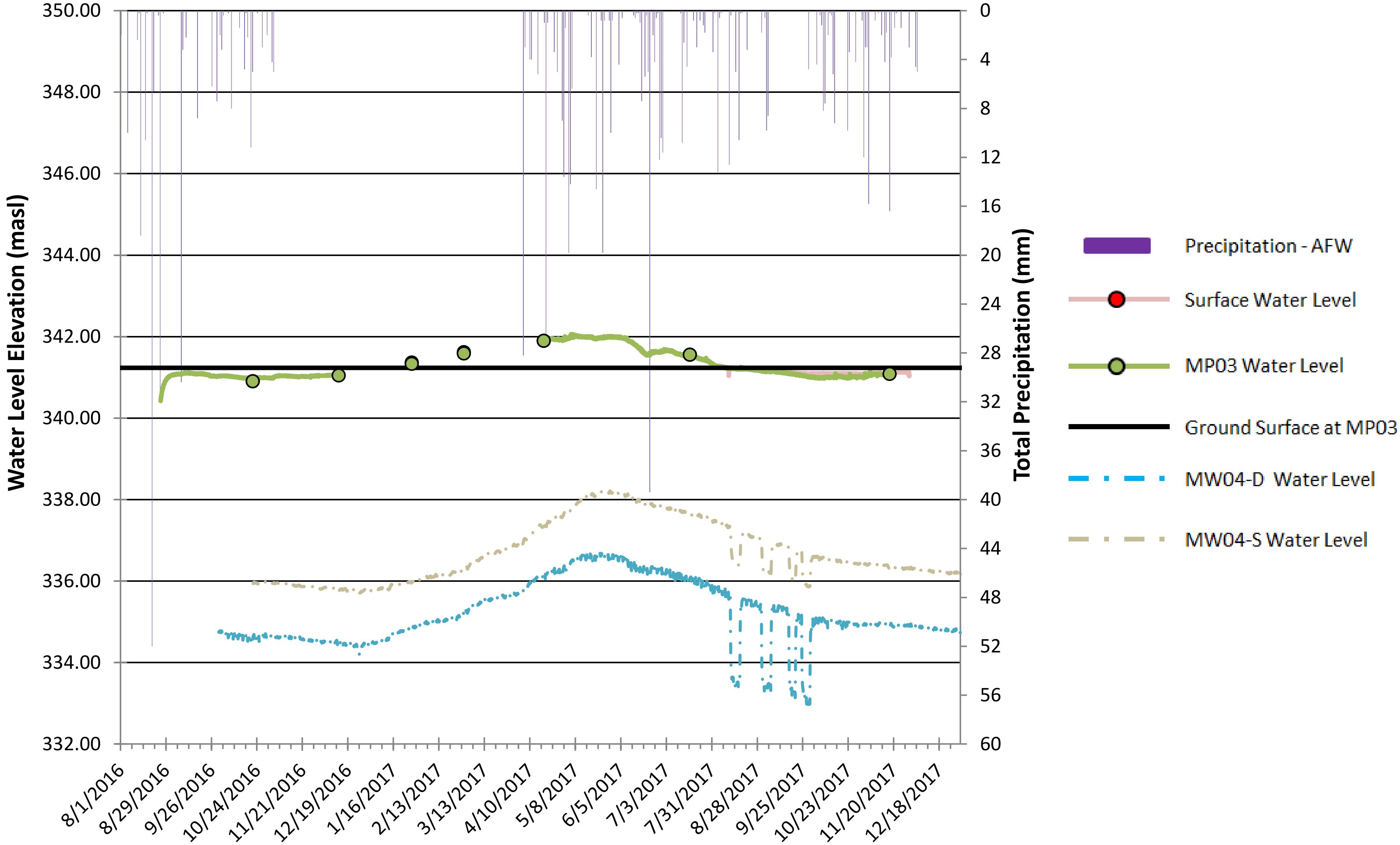


Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



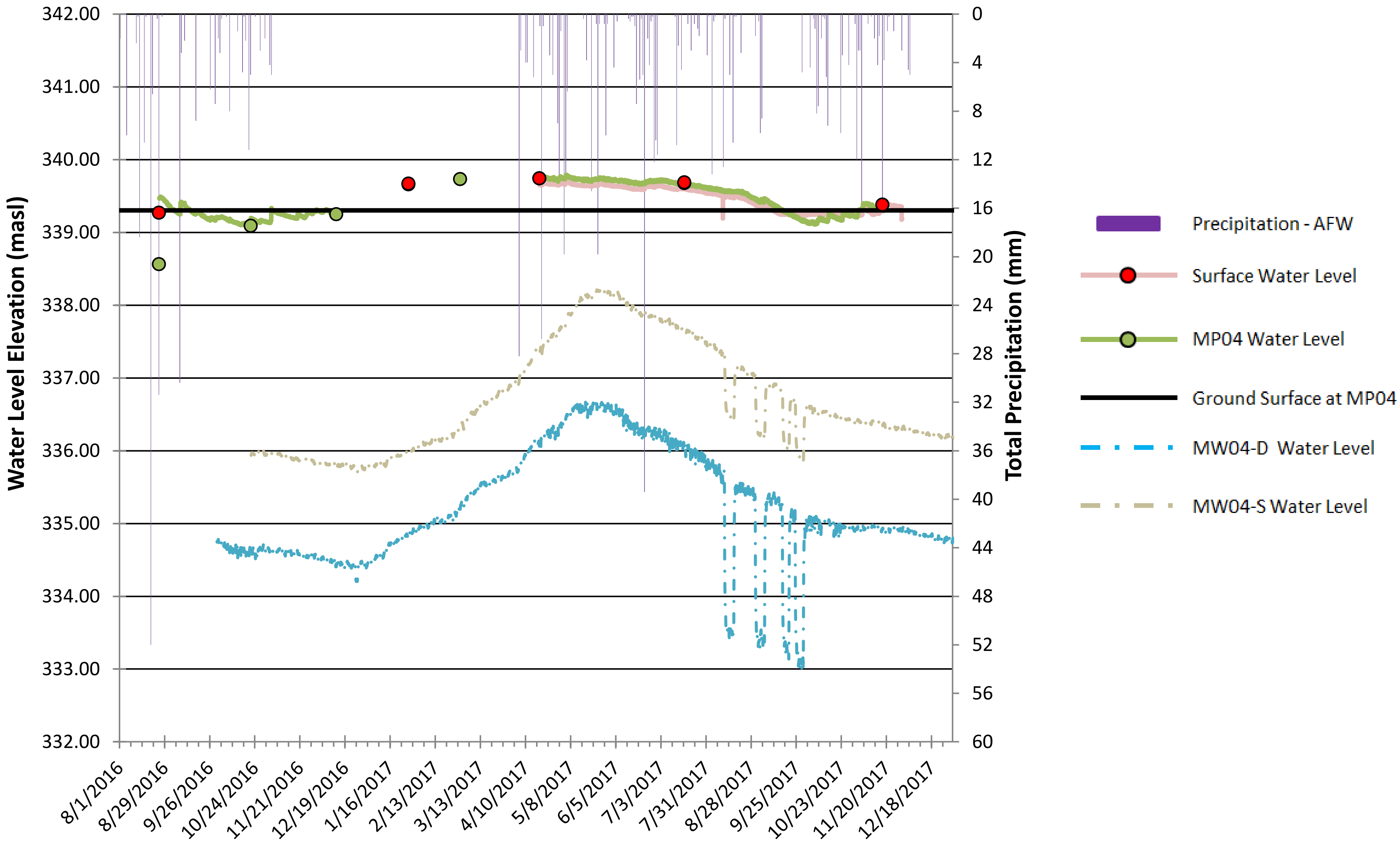
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

Clair-Maltby Secondary Plan
Long Term Water Level Monitoring
Station 3

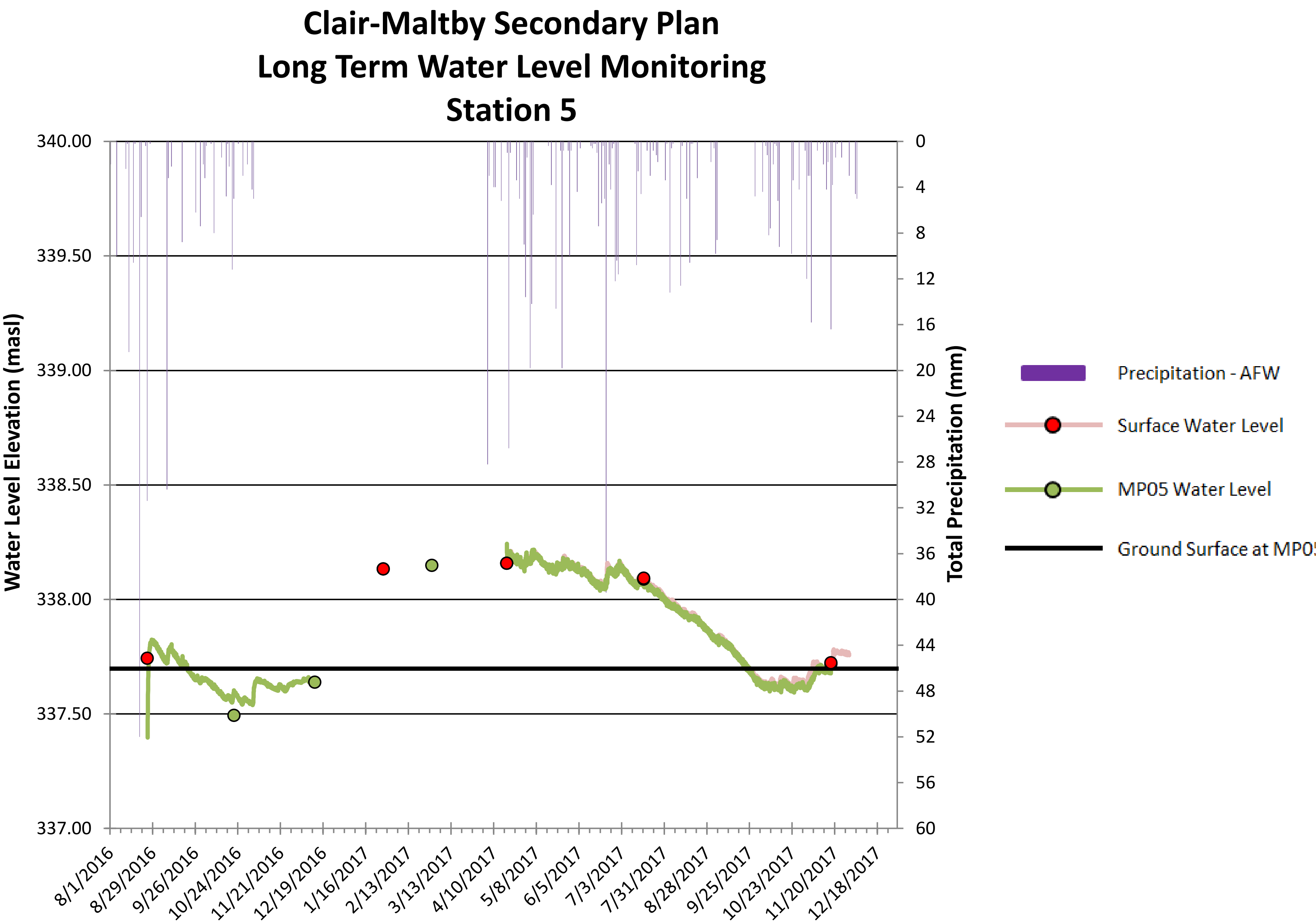


Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

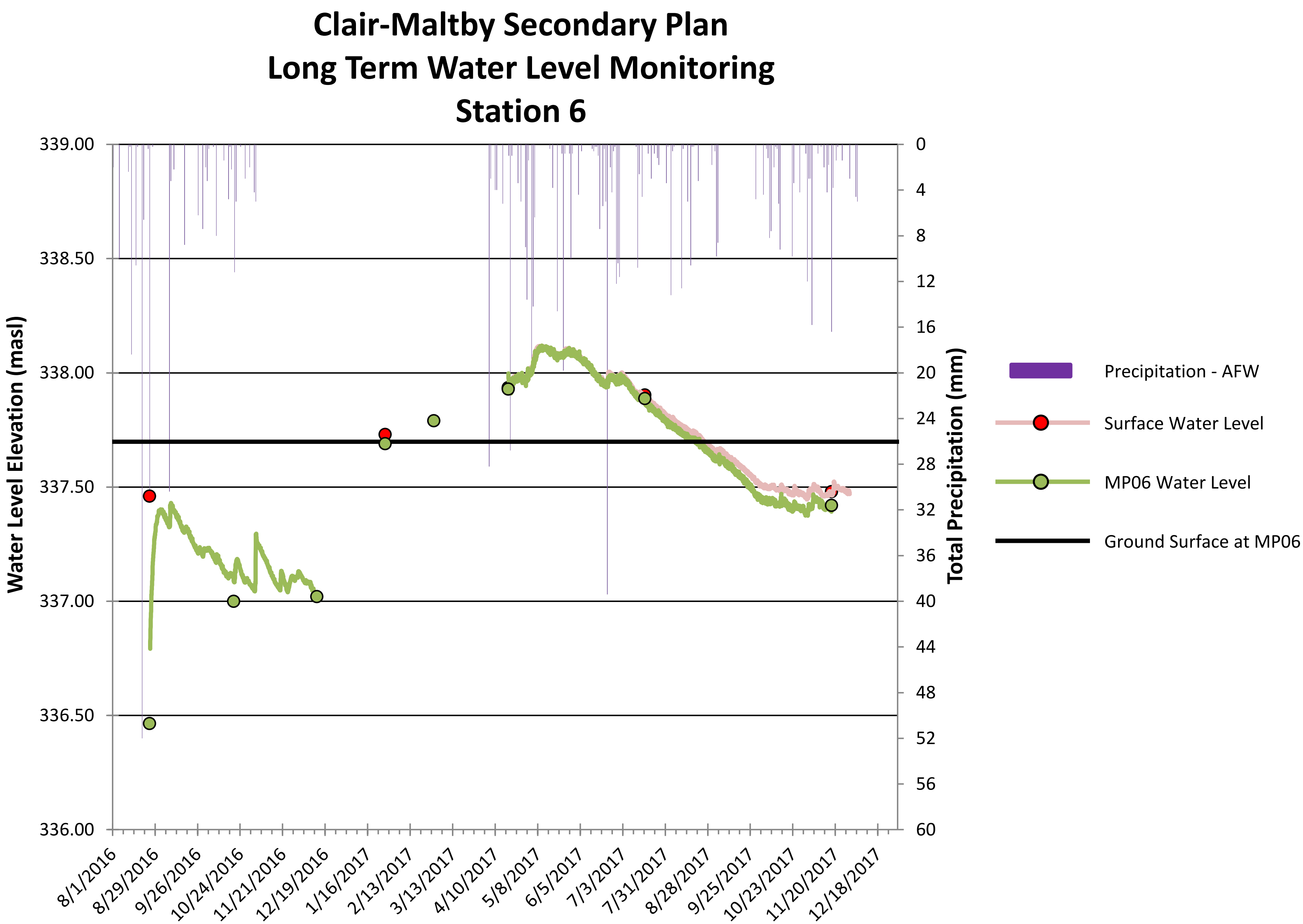
Clair-Maltby Secondary Plan
Long Term Water Level Monitoring
Station 4



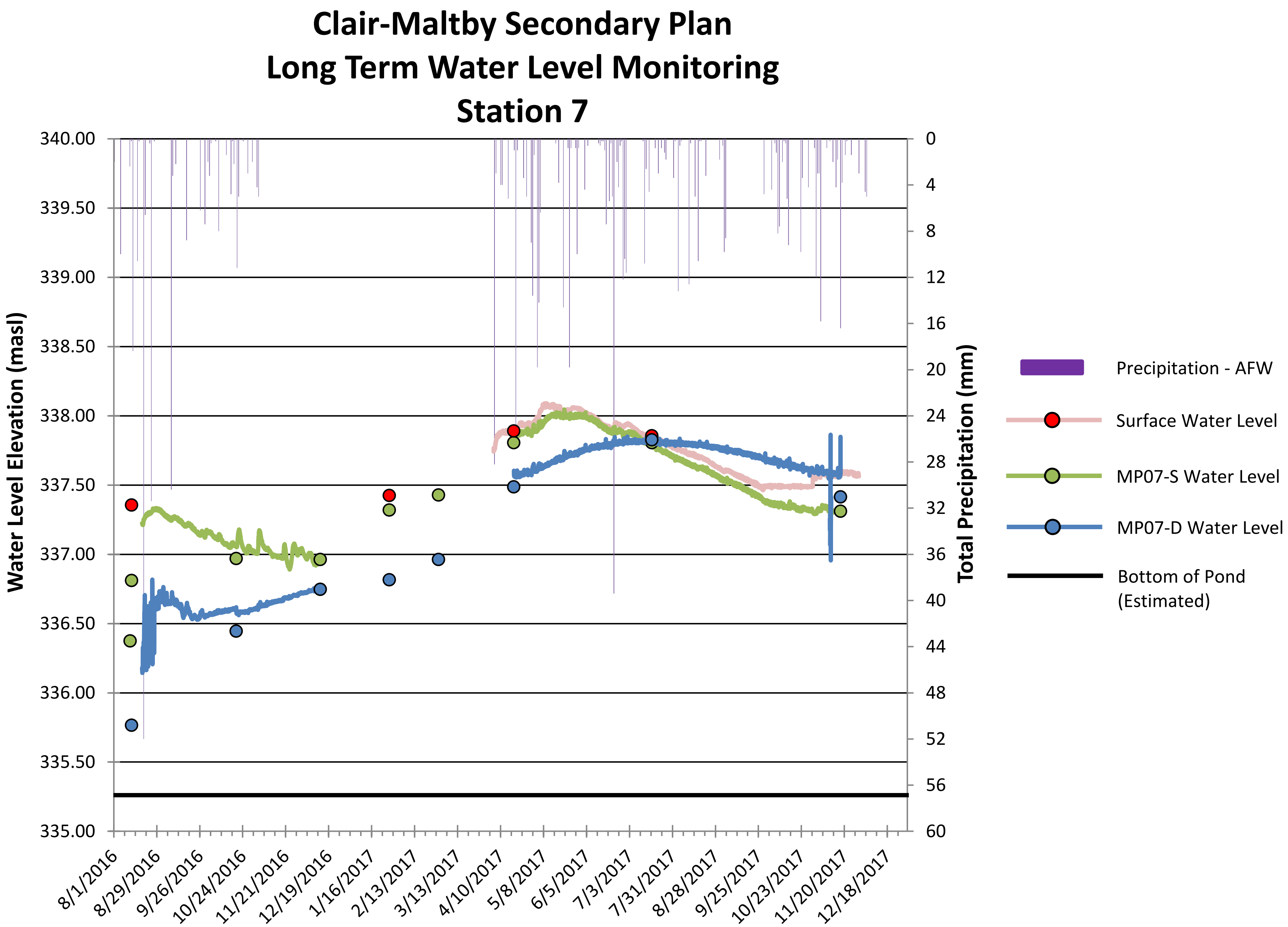
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



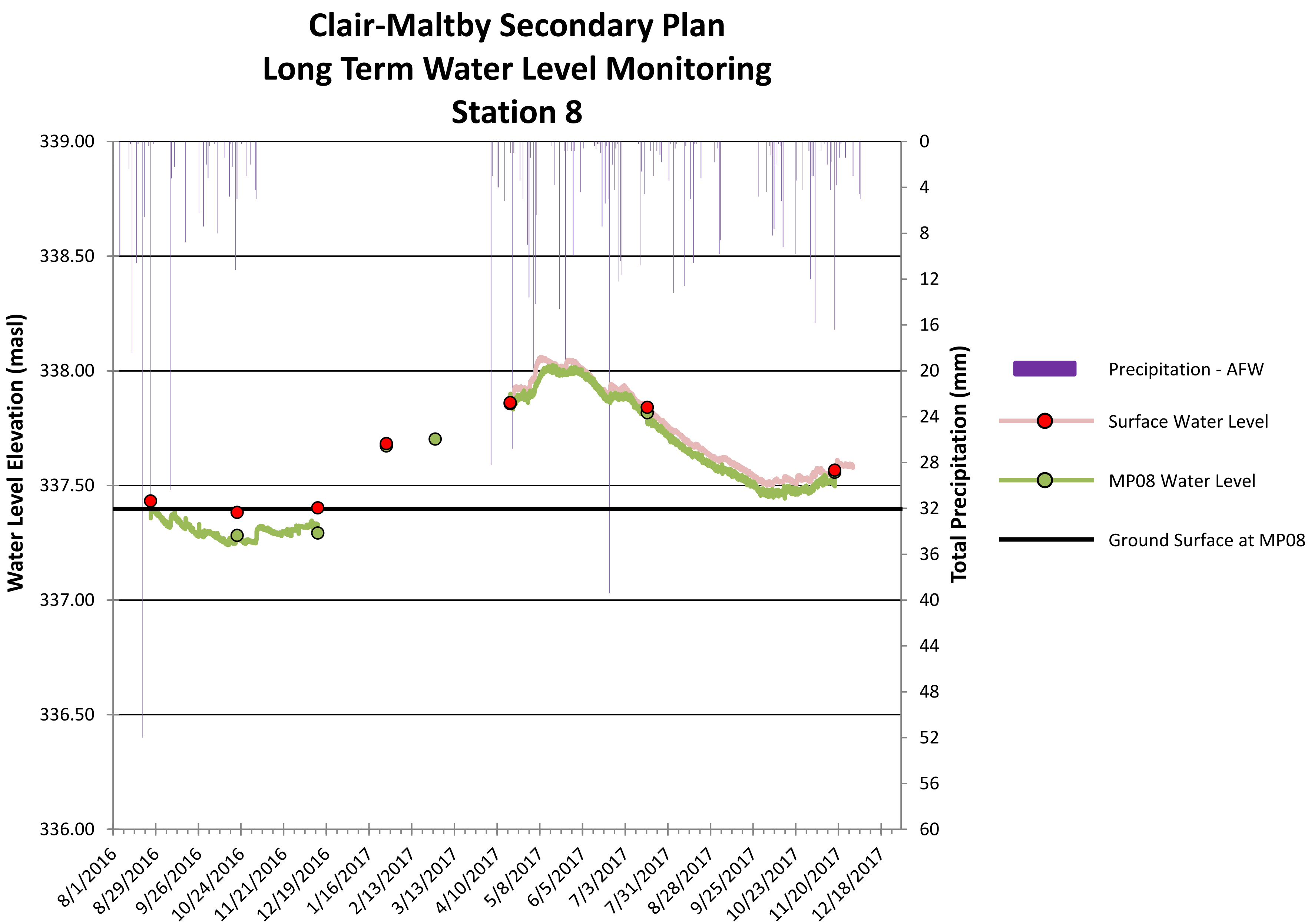
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



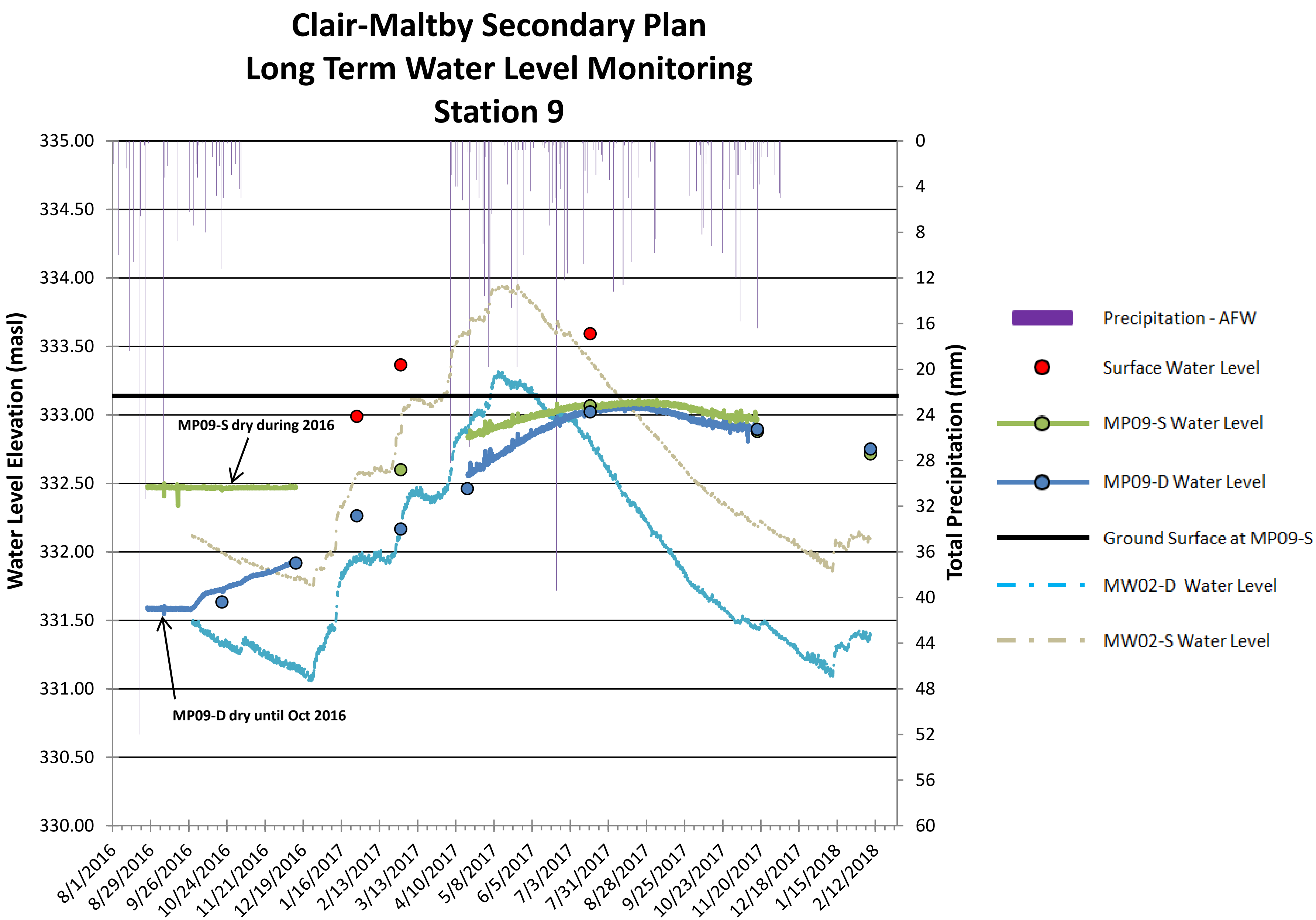
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



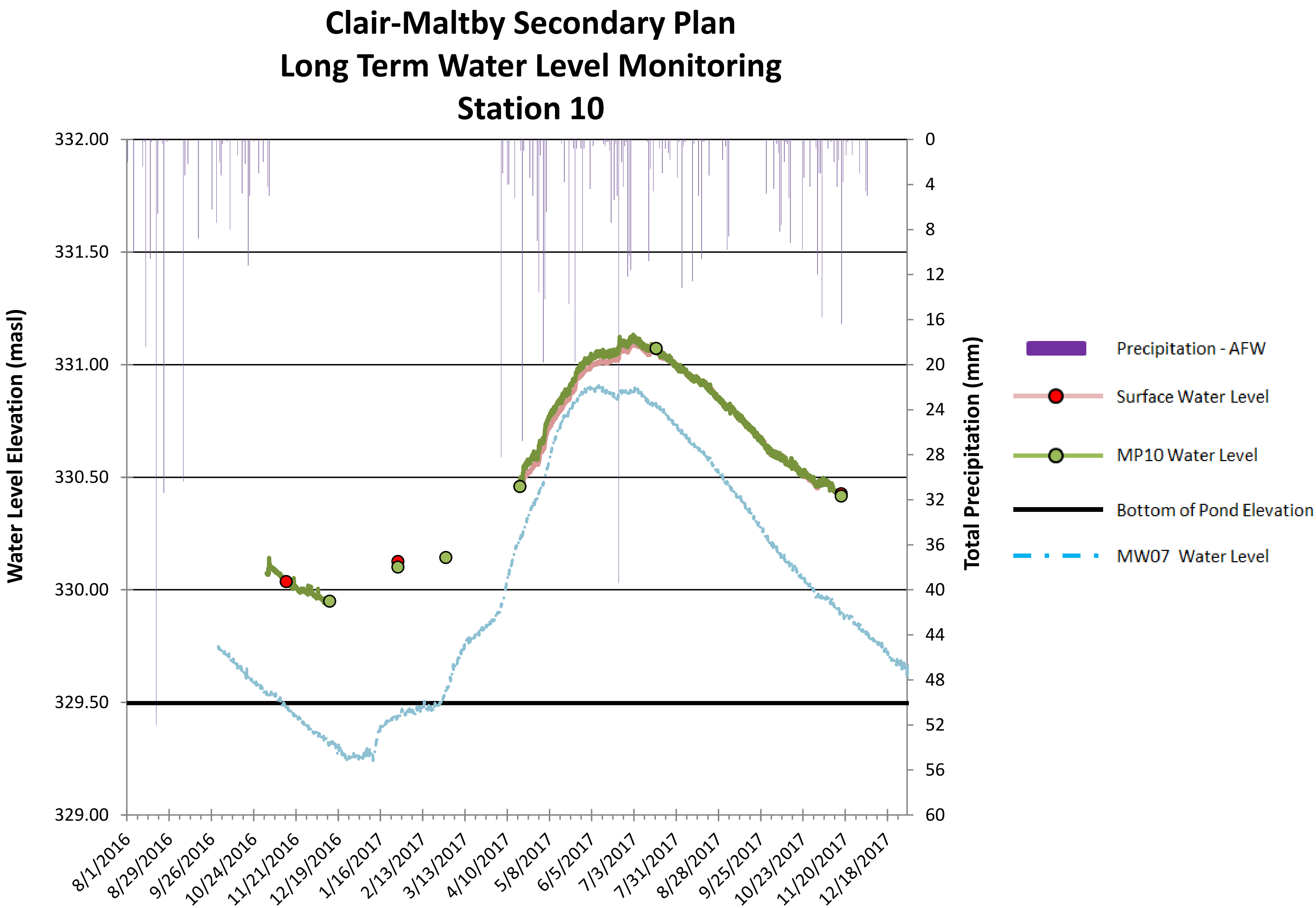
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

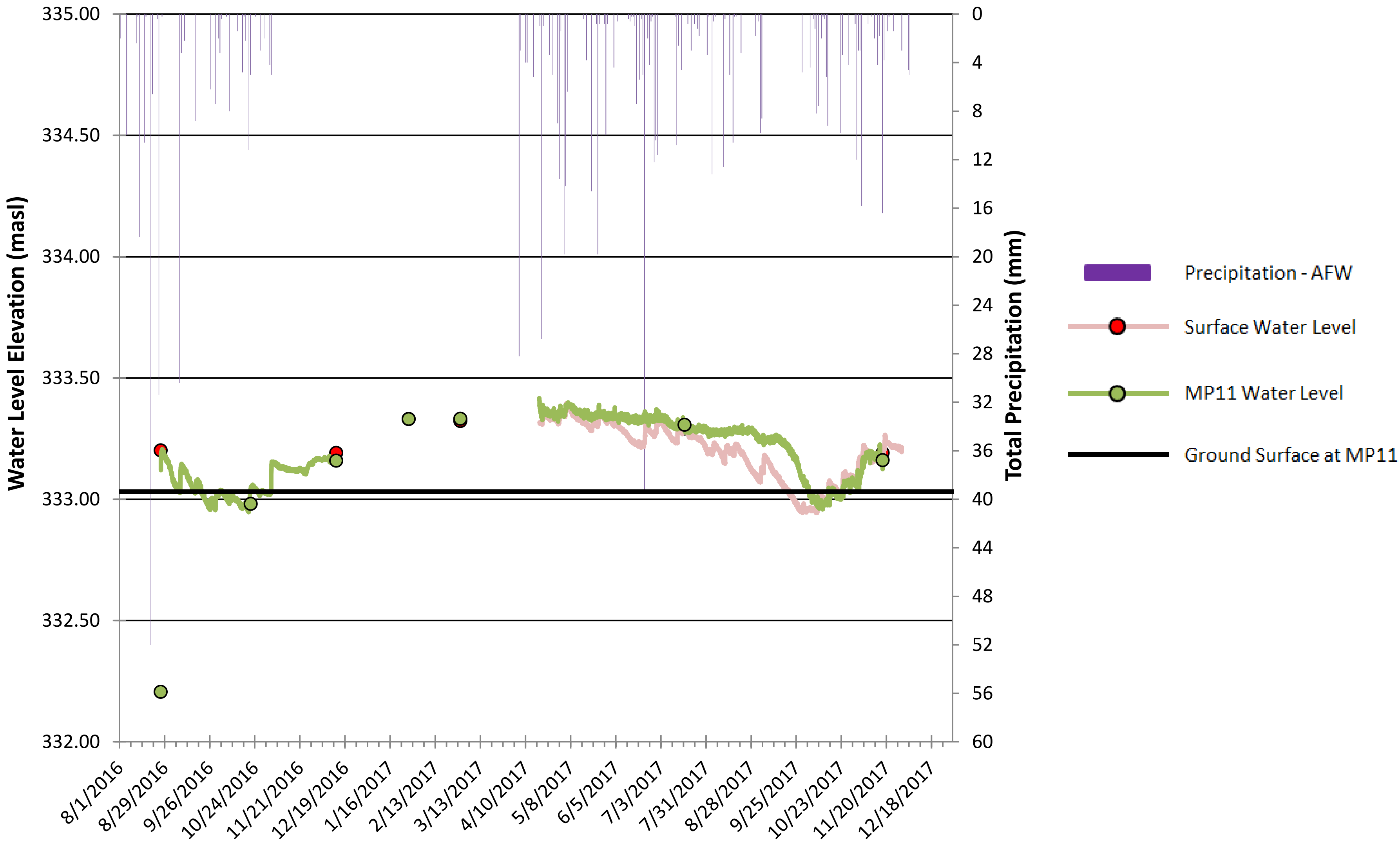


Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



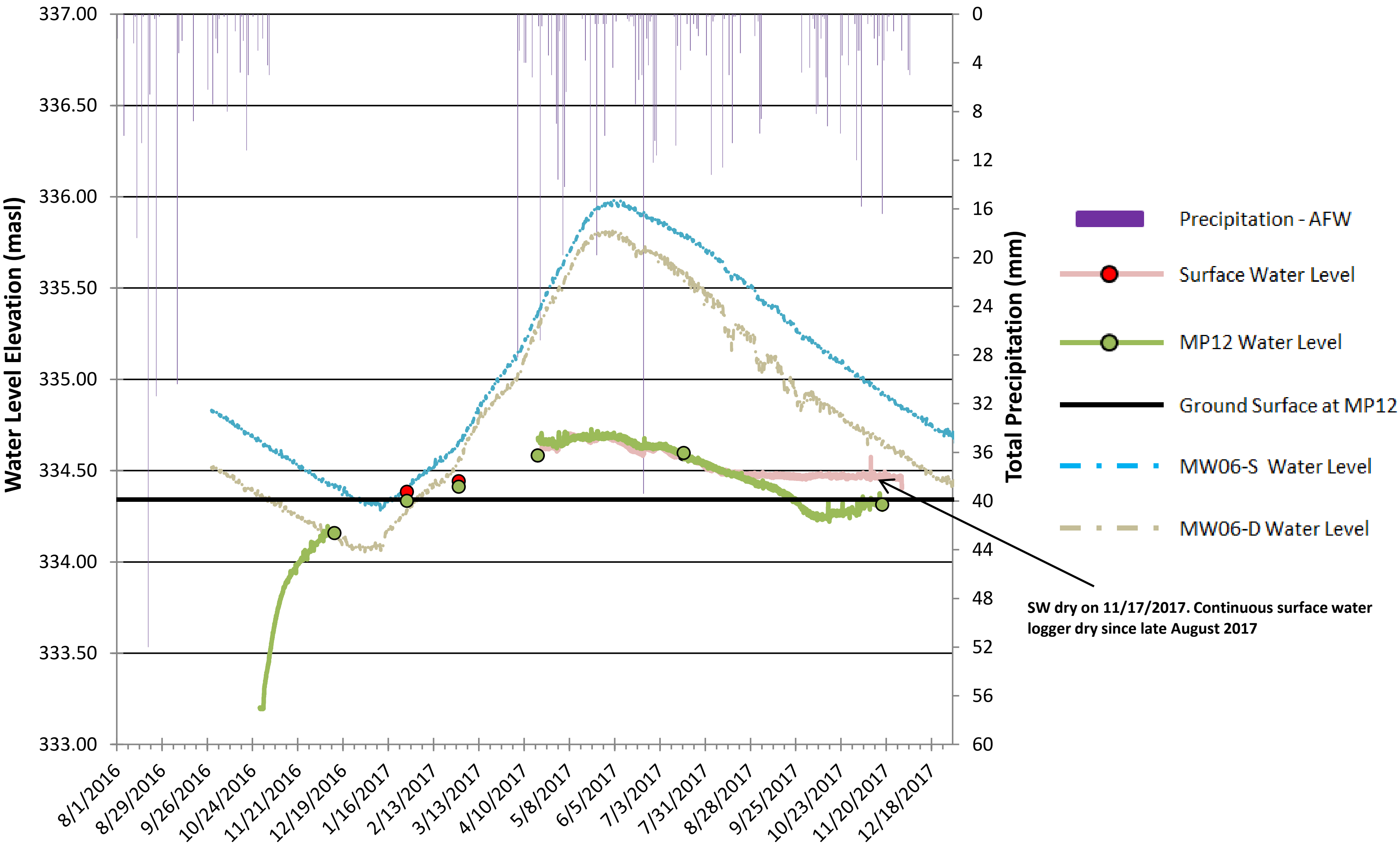
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

Clair-Maltby Secondary Plan
Long Term Water Level Monitoring
Station 11



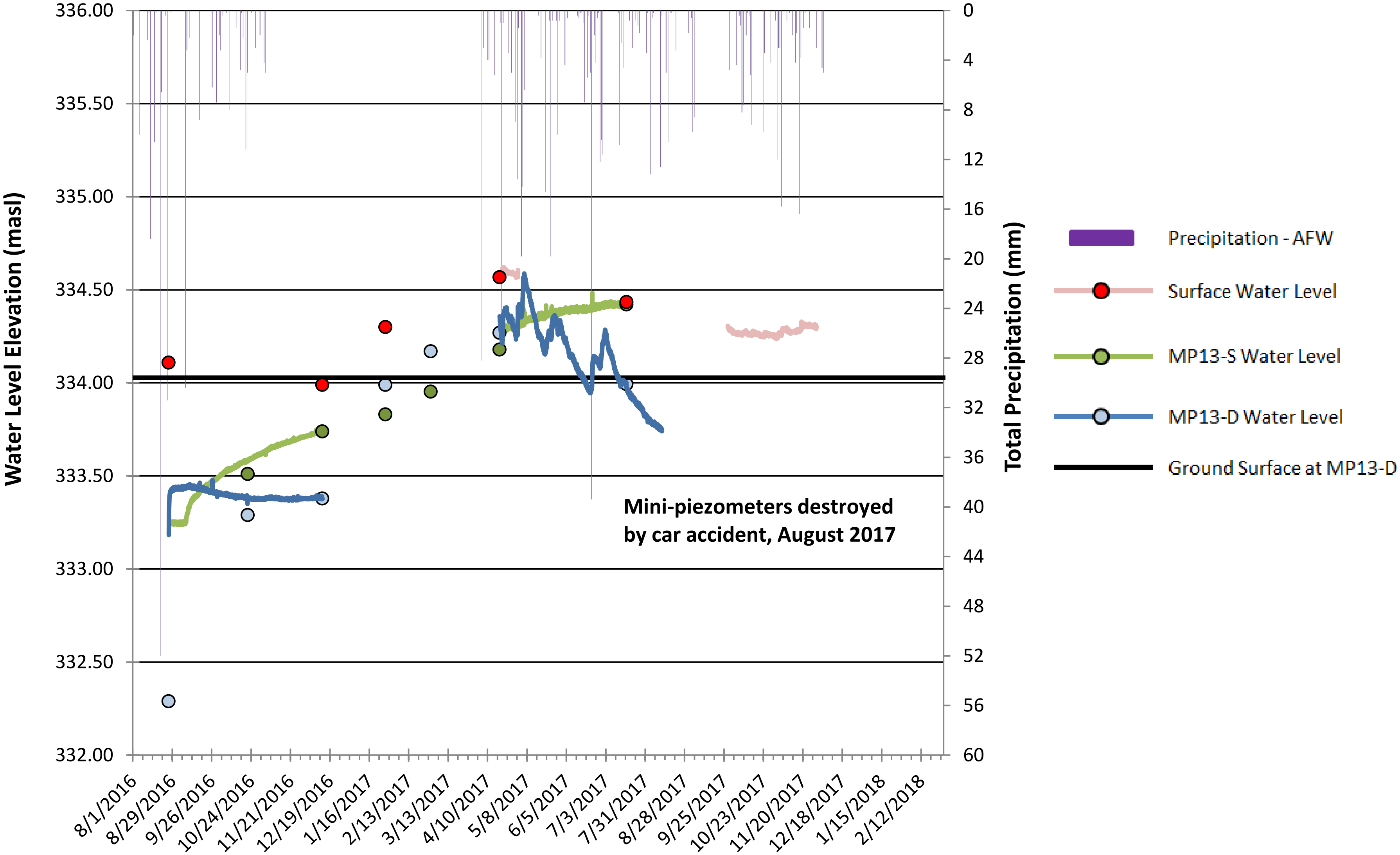
Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

Clair-Maltby Secondary Plan
Long Term Water Level Monitoring
Station 12

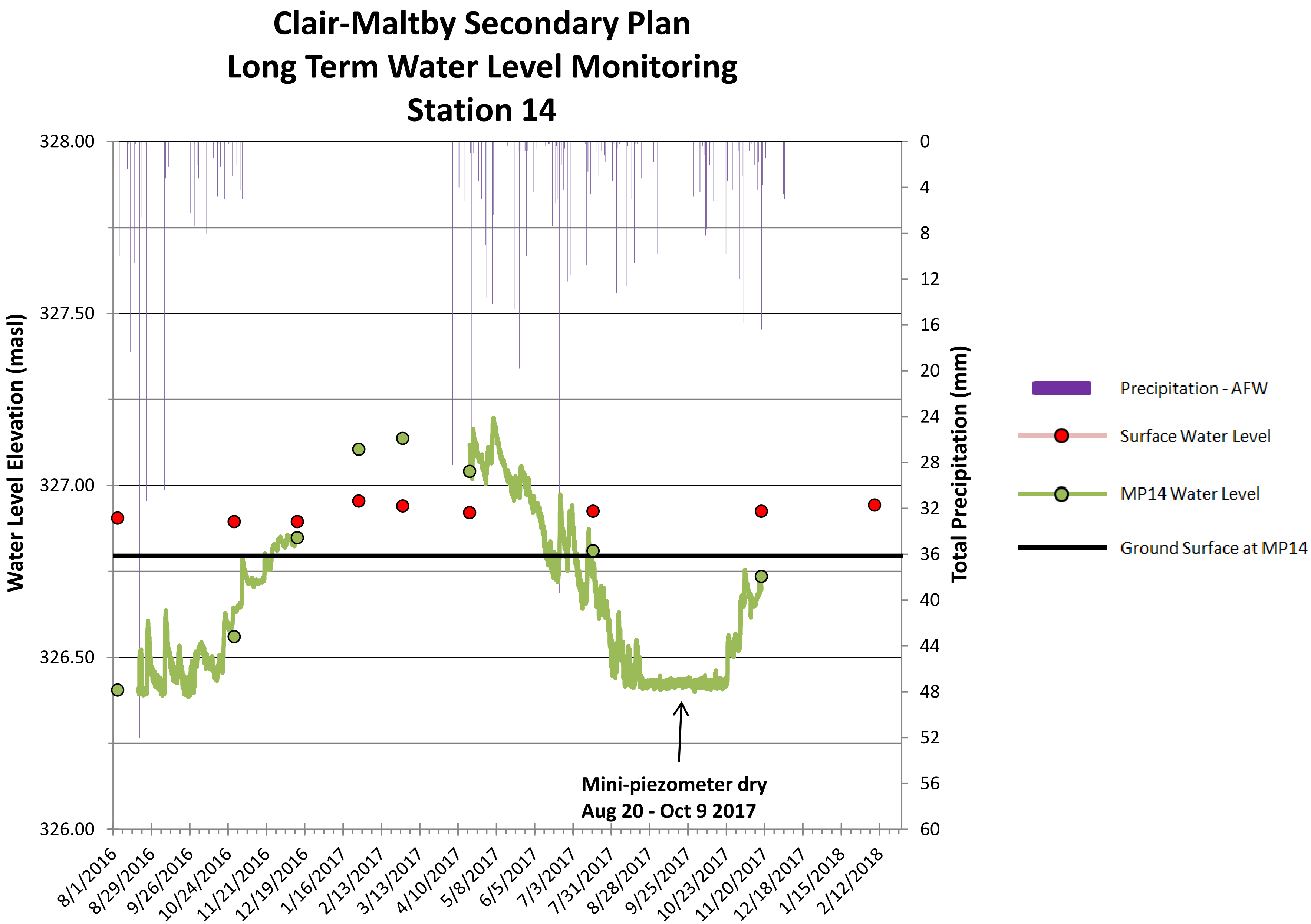


Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

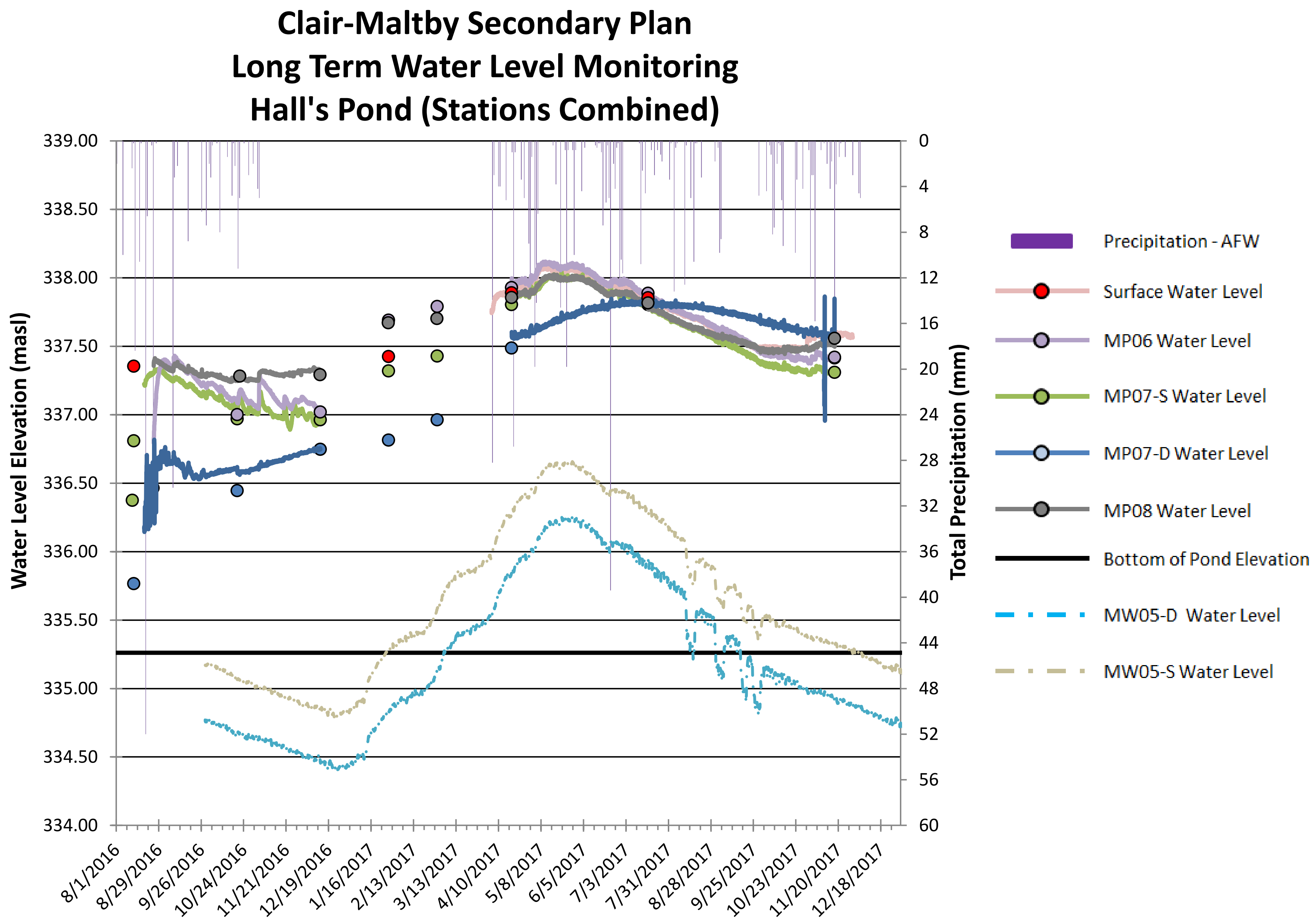
Clair-Maltby Secondary Plan
Long Term Water Level Monitoring
Station 13 (Halligan's Pond)



Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

Appendix GW-4:
Laboratory Certificates of Analysis

MATRIX SOLUTIONS INC.
ATTN: Scott Miller
31 Beacon Point Court
Breslau ON N0B 1M0

Date Received: 19-OCT-16
Report Date: 27-OCT-16 09:12 (MT)
Version: FINAL

Client Phone: 519-772-3777

Certificate of Analysis

Lab Work Order #: L1845890

Project P.O. #: CLAIRE-MALTBY
Job Reference: 23089-528
C of C Numbers: 81837
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1845890-1	L1845890-2	L1845890-3	L1845890-4	L1845890-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	19-OCT-16	19-OCT-16	19-OCT-16	19-OCT-16	19-OCT-16
	Sampled Time	10:30	12:30	12:50	15:30	15:55
	Client ID	23089161019001 MW7	23089161019002 MW8D	23089161019003 MW8S	23089161019004 MW6D	23089161019005 MW6S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	696	1180	569	460	602
	pH (pH units)	7.44	7.23	7.25	7.64	7.53
	Total Dissolved Solids (mg/L)	386 DLDS	639 DLDS	295 DLDS	259 DLDS	351 DLDS
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	276	336	288	229	282
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Total (as CaCO3) (mg/L)	276	336	288	229	282
	Chloride (Cl) (mg/L)	39.6	189 DLDS	14.4	4.32	9.21
	Computed Conductivity (uS/cm)	630	1060	493	416	561
	Conductivity % Difference (%)	-9.8	-10.7	-14.3	-10.0	-7.1
	Hardness (as CaCO3) (mg/L)	325	388	288	213	295
	Ion Balance (%)	109	101	112	112	108
	Langelier Index	0.3	0.3	0.2	0.3	0.4
	Nitrate (as N) (mg/L)	0.318	1.49 DLDS	1.04	<0.020	<0.020
	Nitrite (as N) (mg/L)	0.028	<0.050 DLDS	<0.010	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	<0.15	0.51	0.76	0.19	0.28
	Saturation pH (pH)	7.11	6.95	7.08	7.35	7.16
	TDS (Calculated) (mg/L)	383	656	303	254	348
	Sulfate (SO4) (mg/L)	47.4	32.0 DLDS	4.79	24.7	55.6
	Anion Sum (me/L)	6.67	11.6	5.31	4.40	6.05
	Cation Sum (me/L)	7.27	11.7	5.96	4.94	6.52
	Cation - Anion Balance (%)	4.3	0.3	5.8	5.7	3.8
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	0.00017	0.00012	0.00036	<0.00010	0.00030
	Arsenic (As)-Dissolved (mg/L)	0.00037	<0.00010	0.00028	0.00166	0.00104
	Barium (Ba)-Dissolved (mg/L)	0.127	0.144	0.0167	0.121	0.124
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	0.013	0.011	0.012	0.014
	Cadmium (Cd)-Dissolved (mg/L)	0.000015	0.000067	0.000043	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	79.3	105	77.7	50.9	69.2
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	0.00062	0.00085	0.00018	0.00013	0.00020
	Copper (Cu)-Dissolved (mg/L)	0.00103	0.00201	0.00158	0.00037	0.00046
	Iron (Fe)-Dissolved (mg/L)	0.024	<0.010	<0.010	0.067	0.012

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1845890-6	L1845890-7			
	Description	WATER	WATER			
	Sampled Date	19-OCT-16	19-OCT-16			
	Sampled Time	17:15	17:30			
	Client ID	23089161019006 MW5S	23089161019007 MW5D			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	750	663			
	pH (pH units)	7.17	7.17			
	Total Dissolved Solids (mg/L)	430 DLDS	396 DLDS			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	327	366			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10			
	Alkalinity, Total (as CaCO3) (mg/L)	327	366			
	Chloride (Cl) (mg/L)	10.0	11.9			
	Computed Conductivity (uS/cm)	712	617			
	Conductivity % Difference (%)	-5.3	-7.2			
	Hardness (as CaCO3) (mg/L)	410	347			
	Ion Balance (%)	112	101			
	Langelier Index	0.2	0.3			
	Nitrate (as N) (mg/L)	0.429	<0.020			
	Nitrite (as N) (mg/L)	0.056	<0.010			
	Total Kjeldahl Nitrogen (mg/L)	0.62	4.1 DLM			
	Saturation pH (pH)	6.94	6.92			
	TDS (Calculated) (mg/L)	446	394			
	Sulfate (SO4) (mg/L)	89.4	36.0			
	Anion Sum (me/L)	7.54	7.09			
	Cation Sum (me/L)	8.48	7.16			
	Cation - Anion Balance (%)	5.9	0.4			
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050			
	Antimony (Sb)-Dissolved (mg/L)	0.00041	<0.00010			
	Arsenic (As)-Dissolved (mg/L)	0.00333	0.00080			
	Barium (Ba)-Dissolved (mg/L)	0.126	0.145			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.000019	<0.000010			
	Calcium (Ca)-Dissolved (mg/L)	105	94.3			
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	0.000011			
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050			
	Cobalt (Co)-Dissolved (mg/L)	0.00092	0.00011			
	Copper (Cu)-Dissolved (mg/L)	0.00046	<0.00020			
	Iron (Fe)-Dissolved (mg/L)	0.346	2.25			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1845890-1	L1845890-2	L1845890-3	L1845890-4	L1845890-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	19-OCT-16	19-OCT-16	19-OCT-16	19-OCT-16	19-OCT-16
	Sampled Time	10:30	12:30	12:50	15:30	15:55
	Client ID	23089161019001 MW7	23089161019002 MW8D	23089161019003 MW8S	23089161019004 MW6D	23089161019005 MW6S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	0.000155	0.000614	0.000051	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0032	0.0034	<0.0010	0.0027	0.0017
	Magnesium (Mg)-Dissolved (mg/L)	30.7	30.5	22.8	20.8	29.7
	Manganese (Mn)-Dissolved (mg/L)	0.0787	0.0434	0.00707	0.0154	0.0453
	Molybdenum (Mo)-Dissolved (mg/L)	0.00118	0.000662	0.000655	0.00230	0.00323
	Nickel (Ni)-Dissolved (mg/L)	0.00174	0.00310	0.00945	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.55	3.18	1.29	1.28	2.20
	Rubidium (Rb)-Dissolved (mg/L)	0.00127	0.00225	0.00069	0.00075	0.00159
	Selenium (Se)-Dissolved (mg/L)	0.000098	0.000251	0.000132	<0.000050	0.000053
	Silicon (Si)-Dissolved (mg/L)	6.12	5.51	3.66	6.43	4.20
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Dissolved (mg/L)	17.1	88.3	4.17	15.1	13.0
	Strontium (Sr)-Dissolved (mg/L)	0.114	0.180	0.115	0.123	0.256
	Sulfur (S)-Dissolved (mg/L)	15.5	10.9	1.48	8.63	18.1
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	0.000018	0.000048	<0.000010	<0.000010	<0.000010
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	0.00055	<0.00010	0.00123	0.00016	0.00061
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Dissolved (mg/L)	0.00148	0.000649	0.000231	0.00202	0.00545
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0149	0.192	0.0101	0.0038	0.0509
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1845890-6	L1845890-7			
	Description	WATER	WATER			
	Sampled Date	19-OCT-16	19-OCT-16			
	Sampled Time	17:15	17:30			
	Client ID	23089161019006 MW5S	23089161019007 MW5D			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	0.000154	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0043	0.0018			
	Magnesium (Mg)-Dissolved (mg/L)	35.8	27.0			
	Manganese (Mn)-Dissolved (mg/L)	0.159	0.0829			
	Molybdenum (Mo)-Dissolved (mg/L)	0.0235	0.000176			
	Nickel (Ni)-Dissolved (mg/L)	0.00372	0.00090			
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.63	0.837			
	Rubidium (Rb)-Dissolved (mg/L)	0.00240	0.00075			
	Selenium (Se)-Dissolved (mg/L)	0.000167	<0.000050			
	Silicon (Si)-Dissolved (mg/L)	4.01	9.08			
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050			
	Sodium (Na)-Dissolved (mg/L)	5.53	4.71			
	Strontium (Sr)-Dissolved (mg/L)	0.143	0.135			
	Sulfur (S)-Dissolved (mg/L)	31.0	11.6			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	0.000020	<0.000010			
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	0.00038			
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.0240	0.000113			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00062			
	Zinc (Zn)-Dissolved (mg/L)	0.0276	0.0019			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	0.00051			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Sulfate (SO4)	MS-B	L1845890-1, -2, -3, -4, -5, -6, -7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SPEC-WT	Water	Speciated Alkalinity	EPA 310.2
CL-IC-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PH-ALK-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5°C overnight and then 180–10°C for 1hr.

TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N

Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Reference Information

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

81837

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: MATRIX SOLUTIONS INC.
31 Beacon Point Court
Breslau ON N0B 1M0
Contact: Scott Miller

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-WT	**Water**							
Batch R3576806								
WG2415367-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			102.8		%		80-120	20-OCT-16
WG2415367-2 LCS								
Alkalinity, Total (as CaCO3)			102.5		%		85-115	20-OCT-16
WG2415367-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	20-OCT-16
CL-IC-WT	**Water**							
Batch R3579307								
WG2415943-12 LCS								
Chloride (Cl)			100.7		%		70-130	23-OCT-16
WG2415943-7 LCS								
Chloride (Cl)			101.0		%		70-130	23-OCT-16
WG2415943-11 MB								
Chloride (Cl)			<0.50		mg/L		0.5	23-OCT-16
WG2415943-6 MB								
Chloride (Cl)			<0.50		mg/L		0.5	23-OCT-16
EC-WT	**Water**							
Batch R3575583								
WG2414036-14 LCS								
Conductivity			102.1		%		90-110	20-OCT-16
WG2414036-13 MB								
Conductivity			<3.0		umhos/cm		3	20-OCT-16
MET-D-CCMS-WT	**Water**							
Batch R3576471								
WG2415171-2 LCS								
Aluminum (Al)-Dissolved			97.1		%		80-120	20-OCT-16
Antimony (Sb)-Dissolved			97.4		%		80-120	20-OCT-16
Arsenic (As)-Dissolved			96.9		%		80-120	20-OCT-16
Barium (Ba)-Dissolved			101.5		%		80-120	20-OCT-16
Beryllium (Be)-Dissolved			95.4		%		80-120	20-OCT-16
Bismuth (Bi)-Dissolved			101.0		%		80-120	20-OCT-16
Boron (B)-Dissolved			93.5		%		80-120	20-OCT-16
Cadmium (Cd)-Dissolved			95.4		%		80-120	20-OCT-16
Calcium (Ca)-Dissolved			97.3		%		80-120	20-OCT-16
Cesium (Cs)-Dissolved			97.2		%		80-120	20-OCT-16
Chromium (Cr)-Dissolved			95.8		%		80-120	20-OCT-16
Cobalt (Co)-Dissolved			96.3		%		80-120	20-OCT-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3576471								
WG2415171-2 LCS								
Copper (Cu)-Dissolved			96.5		%		80-120	20-OCT-16
Iron (Fe)-Dissolved			93.5		%		80-120	20-OCT-16
Lead (Pb)-Dissolved			97.6		%		80-120	20-OCT-16
Lithium (Li)-Dissolved			93.9		%		80-120	20-OCT-16
Magnesium (Mg)-Dissolved			96.9		%		80-120	20-OCT-16
Manganese (Mn)-Dissolved			97.5		%		80-120	20-OCT-16
Molybdenum (Mo)-Dissolved			94.4		%		80-120	20-OCT-16
Nickel (Ni)-Dissolved			96.2		%		80-120	20-OCT-16
Phosphorus (P)-Dissolved			92.5		%		80-120	20-OCT-16
Potassium (K)-Dissolved			97.0		%		80-120	20-OCT-16
Rubidium (Rb)-Dissolved			101.7		%		80-120	20-OCT-16
Selenium (Se)-Dissolved			95.6		%		80-120	21-OCT-16
Silicon (Si)-Dissolved			101.3		%		80-120	20-OCT-16
Silver (Ag)-Dissolved			100.8		%		80-120	21-OCT-16
Sodium (Na)-Dissolved			97.5		%		80-120	20-OCT-16
Strontium (Sr)-Dissolved			99.8		%		80-120	20-OCT-16
Sulfur (S)-Dissolved			96.0		%		80-120	20-OCT-16
Tellurium (Te)-Dissolved			96.3		%		80-120	20-OCT-16
Thallium (Tl)-Dissolved			96.0		%		80-120	20-OCT-16
Thorium (Th)-Dissolved			94.6		%		80-120	20-OCT-16
Tin (Sn)-Dissolved			94.1		%		80-120	20-OCT-16
Titanium (Ti)-Dissolved			95.9		%		80-120	20-OCT-16
Tungsten (W)-Dissolved			97.5		%		80-120	20-OCT-16
Uranium (U)-Dissolved			99.2		%		80-120	20-OCT-16
Vanadium (V)-Dissolved			97.5		%		80-120	20-OCT-16
Zinc (Zn)-Dissolved			91.7		%		80-120	20-OCT-16
Zirconium (Zr)-Dissolved			91.4		%		80-120	20-OCT-16
WG2415171-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	20-OCT-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	20-OCT-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	20-OCT-16
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	20-OCT-16
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	20-OCT-16
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	20-OCT-16

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3576471								
WG2415171-1 MB								
Boron (B)-Dissolved			<0.010		mg/L		0.01	20-OCT-16
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	20-OCT-16
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	20-OCT-16
Cesium (Cs)-Dissolved			<0.000010		mg/L		0.00001	20-OCT-16
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	20-OCT-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	20-OCT-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	20-OCT-16
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	20-OCT-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	20-OCT-16
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	20-OCT-16
Magnesium (Mg)-Dissolved			<0.050		mg/L		0.05	20-OCT-16
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	20-OCT-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	20-OCT-16
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	20-OCT-16
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	20-OCT-16
Potassium (K)-Dissolved			<0.050		mg/L		0.05	20-OCT-16
Rubidium (Rb)-Dissolved			<0.00020		mg/L		0.0002	20-OCT-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	21-OCT-16
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	20-OCT-16
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	21-OCT-16
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	20-OCT-16
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	20-OCT-16
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	20-OCT-16
Tellurium (Te)-Dissolved			<0.00020		mg/L		0.0002	20-OCT-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	20-OCT-16
Thorium (Th)-Dissolved			<0.00010		mg/L		0.0001	20-OCT-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	20-OCT-16
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	20-OCT-16
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	20-OCT-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	20-OCT-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	20-OCT-16
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	20-OCT-16
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	20-OCT-16
NO2-IC-WT	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-WT	**Water**							
Batch R3579307								
WG2415943-12 LCS								
Nitrite (as N)			103.5		%		70-130	23-OCT-16
WG2415943-7 LCS								
Nitrite (as N)			104.0		%		70-130	23-OCT-16
WG2415943-11 MB								
Nitrite (as N)			<0.010		mg/L		0.01	23-OCT-16
WG2415943-6 MB								
Nitrite (as N)			<0.010		mg/L		0.01	23-OCT-16
NO3-IC-WT	**Water**							
Batch R3579307								
WG2415943-12 LCS								
Nitrate (as N)			100.2		%		70-130	23-OCT-16
WG2415943-7 LCS								
Nitrate (as N)			100.5		%		70-130	23-OCT-16
WG2415943-11 MB								
Nitrate (as N)			<0.020		mg/L		0.02	23-OCT-16
WG2415943-6 MB								
Nitrate (as N)			<0.020		mg/L		0.02	23-OCT-16
PH-ALK-WT	**Water**							
Batch R3575575								
WG2414537-10 LCS								
pH			6.97		pH units		6.9-7.1	20-OCT-16
SO4-IC-N-WT	**Water**							
Batch R3579307								
WG2415943-12 LCS								
Sulfate (SO4)			100.8		%		90-110	23-OCT-16
WG2415943-7 LCS								
Sulfate (SO4)			100.6		%		90-110	23-OCT-16
WG2415943-11 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	23-OCT-16
WG2415943-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	23-OCT-16
SOLIDS-TDS-WT	**Water**							
Batch R3580302								
WG2418394-2 LCS								
Total Dissolved Solids			95.4		%		85-115	25-OCT-16
WG2418394-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TDS-WT	**Water**							
Batch R3580302								
WG2418394-1 MB								
Total Dissolved Solids			<10		mg/L		10	25-OCT-16
TKN-WT	**Water**							
Batch R3577223								
WG2415564-2 LCS								
Total Kjeldahl Nitrogen			98.3		%		75-125	21-OCT-16
WG2415564-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	21-OCT-16

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

L1845890 ESmith e8 19-Oct-16 19D

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

COC # M 81837

Page: 1 of 1

Lab Submitted to : ALS Waterloo
Lab Agreement no : Q 58595
Lab Job ID:

Invoice to: Require Report: Y ✓ N___

Company Name: MATRIX SOLUTIONS
Contact Name: Scott Miller
Address: 31 Beacon Point Court
Bresina ON PC:
Phone / Fax#: Ph: Fax:

Copy of Report to:
Matrix Solutions - Data Management
Suite 200, 150 - 13th Avenue SW
Calgary, Alberta, Canada
T2R 0V2
Ph: 403-237-0606 Fax: 403-263-2493
Fax draft copy of invoice to Matrix Solutions Inc.

Matrix Project #: 23089-528
Matrix Proj. Name: Claire-Maltby
Location:
Sampler's Name(s): S. Miller

AFE #:

REGULATORY REQUIREMENTS: (check)
- [ ] Alberta Tier 1
- [ ] SPIGEC
- [ ] Freshwater Aquatic Life (Low Level Metals)
- [ ] Canadian Drinking Water
- [ ] BC Regs
- [ ] Other: 149006.02.03

SERVICE REQUESTED:
- [ ] **RUSH** (Please ensure you contact the lab) **Due Date:**
- [x] REGULAR Turnaround

REPORT DISTRIBUTION: always send to data_management@matrix-solutions.com
- [ ] Additional Emails: Smiller@matrix-solutions.com

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (cm)	Sample Type	Date/Time Sampled	Quantity # of Jars	Quantity # of Bags	Analysis Required: Q58595												Lab Sample Number
1	23089161019001	MW7	—	Water	Oct 19 10:30	3	—	X												1
2	002	MW8D	—	↓	12:30	3	—	X												2
3	003	MW8S	—	↓	12:50	3	—	X												3
4	004	MW6D	—	↓	15:30	3	—	X												4
5	005	MW6S	—	↓	15:55	3	—	X												5
6	006	MW5S	—	↓	17:15	3	—	X												6
7	23089161019 007	MW5D	—	↓	Oct 19 17:30	3	—	X												7
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				

L1845890-COFC

*For metals in water samples indicate if you want Total (T), Dissolved (D) or Extractable (E) as part of "Analysis Required" Preserved/Filtered

Relinquished by: Scott Miller Date/Time: Oct 19/16 19:30
Signature: [signature]
Received by: EVS Date/Time: Oct 19 2016 19:35
Signature: [signature]

COMMENTS/SPECIAL INSTRUCTIONS: Call Scott with any questions 403 589 1599
See Quote Q58595 Metals are dissolved & field filtered

TEMP on arrival: 8.7 ECS.

MATRIX SOLUTIONS INC.
ATTN: Scott Miller
31 Beacon Point Court
Breslau ON N0B 1M0

Date Received: 20-OCT-16
Report Date: 28-OCT-16 14:49 (MT)
Version: FINAL

Client Phone: 519-772-3777

Certificate of Analysis

Lab Work Order #: L1846629

Project P.O. #: NOT SUBMITTED
Job Reference: 23089-528 CLAIRE-MALTBY
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1846629-1	L1846629-2	L1846629-3	L1846629-4	L1846629-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	20-OCT-16	20-OCT-16	20-OCT-16	20-OCT-16	20-OCT-16
	Sampled Time	11:30	11:40	12:05	12:15	14:30
	Client ID	23089161020001-MW25	23089161020002-MW2D	23089161020003-MW1D	23089161020004-MW1S	23089161020005-MW3D
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	862	723	411	947	517
	pH (pH units)	6.85	7.15	7.96	7.20	7.54
	Total Dissolved Solids (mg/L)	DLDS 495	DLDS 416	DLDS 246	DLDS 550	DLDS 293
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	375	354	188	291	248
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Total (as CaCO3) (mg/L)	375	354	188	291	248
	Chloride (Cl) (mg/L)	61.3	18.4	DLDS 13.2	106	12.6
	Computed Conductivity (uS/cm)	732	631	365	822	457
	Conductivity % Difference (%)	-16.3	-13.5	-11.8	-14.2	-12.2
	Hardness (as CaCO3) (mg/L)	349	352	131	339	249
	Ion Balance (%)	101	106	104	100	103
	Langelier Index	0.0	0.2	0.2	0.1	0.3
	Nitrate (as N) (mg/L)	<0.020	<0.020	DLDS <0.10	2.12	<0.020
	Nitrite (as N) (mg/L)	<0.010	<0.010	DLDS <0.050	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	0.48	0.44	0.67	0.43	0.23
	Saturation pH (pH)	6.90	6.92	7.81	7.07	7.27
	TDS (Calculated) (mg/L)	464	399	223	507	278
	Sulfate (SO4) (mg/L)	20.2	34.9	DLDS 23.4	49.3	27.7
	Anion Sum (me/L)	8.30	7.05	3.96	8.95	5.02
	Cation Sum (me/L)	8.42	7.45	4.10	8.95	5.19
	Cation - Anion Balance (%)	0.7	2.7	1.7	0.0	1.7
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0064	<0.0050	0.0070	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	0.00049	0.00046	0.00024	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.0230	0.0104	0.00763	0.00012	0.00238
	Barium (Ba)-Dissolved (mg/L)	0.0647	0.0901	0.0345	0.0573	0.0806
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.028	0.015	0.078	0.021	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	0.000195	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	98.3	97.0	20.7	87.8	57.9
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	0.00300	0.00137	0.00022	<0.00010	0.00013
	Copper (Cu)-Dissolved (mg/L)	0.00056	0.00056	0.00059	0.00129	0.00032
	Iron (Fe)-Dissolved (mg/L)	1.27	0.452	<0.010	<0.010	0.222

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1846629-6	L1846629-7	L1846629-8		
	Description	WATER	WATER	WATER		
	Sampled Date	20-OCT-16	20-OCT-16	20-OCT-16		
	Sampled Time	14:45	16:45	16:55		
	Client ID	23089161020006-MW3S	23089161020007-MW4S	23089161020008-MW4D		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	680	568	484		
	pH (pH units)	7.38	7.66	7.76		
	Total Dissolved Solids (mg/L)	DLDS 385	DLDS 323	DLDS 278		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	317	227	239		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10		
	Alkalinity, Total (as CaCO3) (mg/L)	317	227	239		
	Chloride (Cl) (mg/L)	28.6	26.8	9.95		
	Computed Conductivity (uS/cm)	595	513	430		
	Conductivity % Difference (%)	-13.4	-10.2	-11.8		
	Hardness (as CaCO3) (mg/L)	316	237	214		
	Ion Balance (%)	106	102	103		
	Langelier Index	0.3	0.3	0.3		
	Nitrate (as N) (mg/L)	1.65	<0.020	<0.020		
	Nitrite (as N) (mg/L)	<0.010	0.028	<0.010		
	Total Kjeldahl Nitrogen (mg/L)	DLM <1.5	DLM 5.0	0.18		
	Saturation pH (pH)	7.04	7.35	7.42		
	TDS (Calculated) (mg/L)	370	312	263		
	Sulfate (SO4) (mg/L)	20.4	48.8	25.7		
	Anion Sum (me/L)	6.56	5.51	4.76		
	Cation Sum (me/L)	6.96	5.62	4.91		
	Cation - Anion Balance (%)	3.0	1.0	1.6		
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	0.00040	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	0.00019	0.00030	0.00812		
	Barium (Ba)-Dissolved (mg/L)	0.0832	0.0793	0.0637		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	0.011	0.018	0.015		
	Cadmium (Cd)-Dissolved (mg/L)	0.000064	<0.000010	<0.000010		
	Calcium (Ca)-Dissolved (mg/L)	80.5	53.2	41.9		
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00023	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00081	0.00037	0.00033		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	0.288		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1846629-1	L1846629-2	L1846629-3	L1846629-4	L1846629-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	20-OCT-16	20-OCT-16	20-OCT-16	20-OCT-16	20-OCT-16
	Sampled Time	11:30	11:40	12:05	12:15	14:30
	Client ID	23089161020001-MW25	23089161020002-MW2D	23089161020003-MW1D	23089161020004-MW1S	23089161020005-MW3D
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	0.000266	0.000163	<0.000050	0.000180	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0014	0.0017	0.0016	0.0016	0.0023
	Magnesium (Mg)-Dissolved (mg/L)	25.1	26.7	19.3	29.0	25.4
	Manganese (Mn)-Dissolved (mg/L)	0.459	0.157	0.0157	0.00157	0.0174
	Molybdenum (Mo)-Dissolved (mg/L)	0.00192	0.00136	0.00453	0.000284	0.000905
	Nickel (Ni)-Dissolved (mg/L)	0.0126	0.00619	0.00152	0.00082	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.868	1.01	0.798	1.65	0.986
	Rubidium (Rb)-Dissolved (mg/L)	0.00182	0.00129	0.00082	0.00260	0.00056
	Selenium (Se)-Dissolved (mg/L)	0.000151	<0.000050	<0.000050	0.000229	<0.000050
	Silicon (Si)-Dissolved (mg/L)	3.84	5.60	4.60	4.00	6.41
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Dissolved (mg/L)	32.8	8.90	33.7	49.0	4.38
	Strontium (Sr)-Dissolved (mg/L)	0.144	0.142	0.314	0.326	0.109
	Sulfur (S)-Dissolved (mg/L)	6.40	11.2	7.99	16.5	8.95
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	0.000021	<0.000010
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	0.00014	<0.00010	0.00012
	Titanium (Ti)-Dissolved (mg/L)	DLUI <0.00040	<0.00030	<0.00030	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Dissolved (mg/L)	0.00961	0.00489	0.00232	0.000809	0.00149
	Vanadium (V)-Dissolved (mg/L)	0.00128	<0.00050	0.00100	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.183	0.0404	0.0042	0.111	0.0053
	Zirconium (Zr)-Dissolved (mg/L)	0.00053	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1846629-6	L1846629-7	L1846629-8		
	Description	WATER	WATER	WATER		
	Sampled Date	20-OCT-16	20-OCT-16	20-OCT-16		
	Sampled Time	14:45	16:45	16:55		
	Client ID	23089161020006-MW3S	23089161020007-MW4S	23089161020008-MW4D		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	0.000158	<0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	0.0029		
	Magnesium (Mg)-Dissolved (mg/L)	28.0	25.4	26.6		
	Manganese (Mn)-Dissolved (mg/L)	0.0130	0.0575	0.0135		
	Molybdenum (Mo)-Dissolved (mg/L)	0.000447	0.00660	0.00315		
	Nickel (Ni)-Dissolved (mg/L)	0.00083	0.00647	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	1.62	2.80	1.48		
	Rubidium (Rb)-Dissolved (mg/L)	0.00205	0.00208	0.00062		
	Selenium (Se)-Dissolved (mg/L)	0.000258	0.000206	<0.000050		
	Silicon (Si)-Dissolved (mg/L)	5.02	5.85	8.69		
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Sodium (Na)-Dissolved (mg/L)	13.7	18.5	13.5		
	Strontium (Sr)-Dissolved (mg/L)	0.110	0.256	0.158		
	Sulfur (S)-Dissolved (mg/L)	6.67	15.5	8.32		
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)	0.000024	0.000014	<0.000010		
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)	<0.00010	0.00070	0.00013		
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Uranium (U)-Dissolved (mg/L)	0.00102	0.00248	0.00112		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	0.0648	0.0039	0.0272		
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1846629-1, -2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DLUI	Detection Limit Raised: Unknown Interference generated an apparent false positive test result.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SPEC-WT	Water	Speciated Alkalinity	EPA 310.2
CL-IC-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PH-ALK-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5°C overnight and then 180–10°C for 1hr.

TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N

Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.

Reference Information

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1846629 Report Date: 28-OCT-16

Client: MATRIX SOLUTIONS INC.
31 Beacon Point Court
Breslau ON N0B 1M0
Contact: Scott Miller

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-WT	**Water**							
Batch R3577280								
WG2416369-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			98.9		%		80-120	21-OCT-16
WG2416369-4 DUP		**L1846629-1**						
Alkalinity, Total (as CaCO3)		375	373		mg/L	0.5	20	21-OCT-16
WG2416369-2 LCS								
Alkalinity, Total (as CaCO3)			100.2		%		85-115	21-OCT-16
WG2416369-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	21-OCT-16
CL-IC-WT	**Water**							
Batch R3580587								
WG2418167-9 DUP		**L1846629-2**						
Chloride (Cl)		18.4	18.4		mg/L	0.2	25	25-OCT-16
WG2418167-7 LCS								
Chloride (Cl)			100.9		%		70-130	25-OCT-16
WG2418167-6 MB								
Chloride (Cl)			<0.50		mg/L		0.5	25-OCT-16
WG2418167-10 MS		**L1846629-2**						
Chloride (Cl)			101.4		%		70-130	25-OCT-16
EC-WT	**Water**							
Batch R3577079								
WG2416125-8 DUP		**L1846629-1**						
Conductivity		862	866		umhos/cm	0.1	10	22-OCT-16
WG2416125-2 LCS								
Conductivity			99.5		%		90-110	22-OCT-16
WG2416125-6 LCS								
Conductivity			100.0		%		90-110	22-OCT-16
WG2416125-1 MB								
Conductivity			<3.0		umhos/cm		3	22-OCT-16
WG2416125-5 MB								
Conductivity			<3.0		umhos/cm		3	22-OCT-16
Batch R3582038								
WG2420644-4 DUP		**L1846629-3**						
Conductivity		411	416		umhos/cm	0.0	10	28-OCT-16
WG2420644-2 LCS								
Conductivity			99.9		%		90-110	28-OCT-16
WG2420644-1 MB								
Conductivity			<3.0		umhos/cm		3	28-OCT-16
MET-D-CCMS-WT	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3578737								
WG2416020-2 LCS								
Aluminum (Al)-Dissolved			91.6		%		80-120	21-OCT-16
Antimony (Sb)-Dissolved			100.8		%		80-120	21-OCT-16
Arsenic (As)-Dissolved			93.6		%		80-120	21-OCT-16
Barium (Ba)-Dissolved			93.9		%		80-120	21-OCT-16
Beryllium (Be)-Dissolved			85.4		%		80-120	21-OCT-16
Bismuth (Bi)-Dissolved			98.1		%		80-120	21-OCT-16
Boron (B)-Dissolved			88.0		%		80-120	21-OCT-16
Cadmium (Cd)-Dissolved			95.5		%		80-120	21-OCT-16
Calcium (Ca)-Dissolved			89.8		%		80-120	21-OCT-16
Cesium (Cs)-Dissolved			97.0		%		80-120	21-OCT-16
Chromium (Cr)-Dissolved			93.0		%		80-120	21-OCT-16
Cobalt (Co)-Dissolved			93.4		%		80-120	21-OCT-16
Copper (Cu)-Dissolved			95.1		%		80-120	21-OCT-16
Iron (Fe)-Dissolved			93.7		%		80-120	21-OCT-16
Lead (Pb)-Dissolved			97.0		%		80-120	21-OCT-16
Lithium (Li)-Dissolved			85.6		%		80-120	21-OCT-16
Magnesium (Mg)-Dissolved			93.1		%		80-120	21-OCT-16
Manganese (Mn)-Dissolved			92.8		%		80-120	21-OCT-16
Molybdenum (Mo)-Dissolved			92.4		%		80-120	21-OCT-16
Nickel (Ni)-Dissolved			94.4		%		80-120	21-OCT-16
Phosphorus (P)-Dissolved			96.3		%		80-120	21-OCT-16
Potassium (K)-Dissolved			93.3		%		80-120	21-OCT-16
Rubidium (Rb)-Dissolved			93.1		%		80-120	21-OCT-16
Selenium (Se)-Dissolved			96.8		%		80-120	21-OCT-16
Silicon (Si)-Dissolved			97.2		%		80-120	21-OCT-16
Silver (Ag)-Dissolved			93.1		%		80-120	21-OCT-16
Sodium (Na)-Dissolved			93.3		%		80-120	21-OCT-16
Strontium (Sr)-Dissolved			96.6		%		80-120	21-OCT-16
Sulfur (S)-Dissolved			91.4		%		80-120	21-OCT-16
Tellurium (Te)-Dissolved			92.1		%		80-120	21-OCT-16
Thallium (Tl)-Dissolved			95.0		%		80-120	21-OCT-16
Thorium (Th)-Dissolved			94.2		%		80-120	21-OCT-16
Tin (Sn)-Dissolved			95.4		%		80-120	21-OCT-16
Titanium (Ti)-Dissolved			88.9		%		80-120	21-OCT-16

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3578737								
WG2416020-2 LCS								
Tungsten (W)-Dissolved			96.0		%		80-120	21-OCT-16
Uranium (U)-Dissolved			100.5		%		80-120	21-OCT-16
Vanadium (V)-Dissolved			94.2		%		80-120	21-OCT-16
Zinc (Zn)-Dissolved			91.6		%		80-120	21-OCT-16
Zirconium (Zr)-Dissolved			88.4		%		80-120	21-OCT-16
WG2416020-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	21-OCT-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	21-OCT-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	21-OCT-16
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	21-OCT-16
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	21-OCT-16
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	21-OCT-16
Boron (B)-Dissolved			<0.010		mg/L		0.01	21-OCT-16
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	21-OCT-16
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	21-OCT-16
Cesium (Cs)-Dissolved			<0.000010		mg/L		0.00001	21-OCT-16
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	21-OCT-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	21-OCT-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	21-OCT-16
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	21-OCT-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	21-OCT-16
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	21-OCT-16
Magnesium (Mg)-Dissolved			<0.050		mg/L		0.05	21-OCT-16
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	21-OCT-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	21-OCT-16
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	21-OCT-16
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	21-OCT-16
Potassium (K)-Dissolved			<0.050		mg/L		0.05	21-OCT-16
Rubidium (Rb)-Dissolved			<0.00020		mg/L		0.0002	21-OCT-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	21-OCT-16
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	21-OCT-16
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	21-OCT-16
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	21-OCT-16
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	21-OCT-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3578737								
WG2416020-1 MB								
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	21-OCT-16
Tellurium (Te)-Dissolved			<0.00020		mg/L		0.0002	21-OCT-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	21-OCT-16
Thorium (Th)-Dissolved			<0.00010		mg/L		0.0001	21-OCT-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	21-OCT-16
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	21-OCT-16
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	21-OCT-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	21-OCT-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	21-OCT-16
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	21-OCT-16
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	21-OCT-16
NO2-IC-WT	**Water**							
Batch R3580587								
WG2418167-9 DUP		**L1846629-2**						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	25	25-OCT-16
WG2418167-7 LCS								
Nitrite (as N)			104.0		%		70-130	25-OCT-16
WG2418167-6 MB								
Nitrite (as N)			<0.010		mg/L		0.01	25-OCT-16
WG2418167-10 MS		**L1846629-2**						
Nitrite (as N)			101.0		%		70-130	25-OCT-16
NO3-IC-WT	**Water**							
Batch R3580587								
WG2418167-9 DUP		**L1846629-2**						
Nitrate (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	25	25-OCT-16
WG2418167-7 LCS								
Nitrate (as N)			99.9		%		70-130	25-OCT-16
WG2418167-6 MB								
Nitrate (as N)			<0.020		mg/L		0.02	25-OCT-16
WG2418167-10 MS		**L1846629-2**						
Nitrate (as N)			100.1		%		70-130	25-OCT-16
PH-ALK-WT	**Water**							
Batch R3576742								
WG2415568-10 LCS								
pH			6.99		pH units		6.9-7.1	21-OCT-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT	**Water**							
Batch R3580587								
WG2418167-9 DUP		**L1846629-2**						
Sulfate (SO4)		34.9	34.9		mg/L	0.1	20	25-OCT-16
WG2418167-7 LCS								
Sulfate (SO4)			100.8		%		90-110	25-OCT-16
WG2418167-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	25-OCT-16
WG2418167-10 MS		**L1846629-2**						
Sulfate (SO4)			98.3		%		75-125	25-OCT-16
SOLIDS-TDS-WT	**Water**							
Batch R3580302								
WG2418394-2 LCS								
Total Dissolved Solids			95.4		%		85-115	25-OCT-16
WG2418394-1 MB								
Total Dissolved Solids			<10		mg/L		10	25-OCT-16
TKN-WT	**Water**							
Batch R3579625								
WG2417137-3 DUP		**L1846629-2**						
Total Kjeldahl Nitrogen		0.44	0.39		mg/L	10	20	25-OCT-16
WG2417133-2 LCS								
Total Kjeldahl Nitrogen			93.5		%		75-125	25-OCT-16
WG2417137-2 LCS								
Total Kjeldahl Nitrogen			97.8		%		75-125	25-OCT-16
WG2417133-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	25-OCT-16
WG2417137-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	25-OCT-16
WG2417137-4 MS		**L1846629-2**						
Total Kjeldahl Nitrogen			112.8		%		70-130	25-OCT-16
Batch R3580613								
WG2417995-2 LCS								
Total Kjeldahl Nitrogen			112.2		%		75-125	26-OCT-16
WG2417995-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	26-OCT-16

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

COC # M 81838

Page: 1 of 1

Lab Submitted to : ALS Waterloo
Lab Agreement no : Q58595
Lab Job ID:

Invoice to: Require Report: Y ✓ N __

Company Name: MATRIX SOLUTIONS
Contact Name: Scott Miller
Address: 31 Beacon Pt Court
PC:
Phone / Fax#: Ph: Fax:
AFE #: 149006.02.03

Copy of Report to:
Matrix Solutions - Data Management
Suite 200, 150 - 13th Avenue SW
Calgary, Alberta, Canada
T2R 0V2
Ph: 403-237-0606 Fax: 403-263-2493
Fax draft copy of invoice to Matrix Solutions Inc.

Matrix Project #: 23089-528
Matrix Proj. Name: Claire-Maltby
Location:
Sampler's Name(s): S. Miller

REGULATORY REQUIREMENTS: (check)
- [ ] Alberta Tier 1
- [ ] SPIGEC
- [ ] Freshwater Aquatic Life (Low Level Metals)
- [ ] Canadian Drinking Water
- [ ] BC Regs
- [ ] Other:

SERVICE REQUESTED:
- [ ] RUSH (Please ensure you contact the lab) Due Date:
- [x] REGULAR Turnaround

REPORT DISTRIBUTION: always send to data_management@matrix-solutions.com
- [x] Additional Emails: smiller@matrix-solutions.com

Analysis Required: Q58595

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (cm)	Sample Type	Date/Time Sampled	Quantity # of Jars	Quantity # of Bags	Q58595	Lab Sample Number
1	23089161020001	MW25	–	Water	oct 20 11:30	3	–	X	1
2	↓ 002	MW2D	–	↓	11:40	3	–	X	2
3	003	MW1D	–		12:05	3	–	X	3
4	004	MW15	–		12:15	3	–	X	4
5	005	MW30	–		14:30	3	–	X	5
6	006	MW35	–		14:45	3	–	X	6
7	007	MW45	–	↓	16:45	3	–	X	7
8	23089161020008	MW4D	–	Water	oct 20 16:55	3	–	X	8
9									
10									
11									
12									
13									
14									
15									

L1846629-COFC

*For metals in water samples indicate if you want Total (T), Dissolved (D) or Extractable (E) as part of "Analysis Required" Preserved/Filtered

Relinquished by: Scott Miller Date/Time: Oct 20/16 18:30
Signature: [signature]
Received by: 5.3 Date/Time: Oct 20 16 @ 18:30
Signature: Amanda Farkas

COMMENTS/SPECIAL INSTRUCTIONS: CALL Scott With Questions 403 589-1599
Metals were field filtered. See Q58595

MATRIX SOLUTIONS INC.
ATTN: Scott Miller
31 Beacon Point Court
Breslau ON N0B 1M0

Date Received: 21-OCT-16
Report Date: 01-NOV-16 08:17 (MT)
Version: FINAL

Client Phone: 519-772-3777

Certificate of Analysis

Lab Work Order #: L1847231

Project P.O. #: CLAIRE-MALTBY

Job Reference: 23089-528

C of C Numbers: 81839

Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1847231-1	L1847231-2			
	Description	WATER	WATER			
	Sampled Date	21-OCT-16	21-OCT-16			
	Sampled Time	11:30	11:45			
	Client ID	23089161021001 MW9D	23089161021002 MW95			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	445	583			
	pH (pH units)	7.56	7.28			
	Total Dissolved Solids (mg/L)	272 DLDS	346 DLDS			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	237	260			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10			
	Alkalinity, Total (as CaCO3) (mg/L)	237	260			
	Chloride (Cl) (mg/L)	2.79	14.1			
	Computed Conductivity (uS/cm)	404	547			
	Conductivity % Difference (%)	-9.6	-6.4			
	Hardness (as CaCO3) (mg/L)	228	319			
	Ion Balance (%)	123	121			
	Langelier Index	0.3	0.2			
	Nitrate (as N) (mg/L)	<0.020	7.00			
	Nitrite (as N) (mg/L)	<0.010	<0.010			
	Total Kjeldahl Nitrogen (mg/L)	0.48	1.91			
	Saturation pH (pH)	7.30	7.08			
	TDS (Calculated) (mg/L)	243	339			
	Sulfate (SO4) (mg/L)	7.88	16.9			
	Anion Sum (me/L)	4.15	5.51			
	Cation Sum (me/L)	5.11	6.67			
	Cation - Anion Balance (%)	10.4	9.5			
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050			
	Antimony (Sb)-Dissolved (mg/L)	0.00013	<0.00010			
	Arsenic (As)-Dissolved (mg/L)	0.00390	0.00012			
	Barium (Ba)-Dissolved (mg/L)	0.0908	0.0869			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050			
	Boron (B)-Dissolved (mg/L)	0.017	0.012			
	Cadmium (Cd)-Dissolved (mg/L)	0.000019	0.000036			
	Calcium (Ca)-Dissolved (mg/L)	54.4	89.3			
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010			
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050			
	Cobalt (Co)-Dissolved (mg/L)	0.00023	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	0.00054	0.00112			
	Iron (Fe)-Dissolved (mg/L)	0.024	<0.010			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1847231-1	L1847231-2			
	Description	WATER	WATER			
	Sampled Date	21-OCT-16	21-OCT-16			
	Sampled Time	11:30	11:45			
	Client ID	23089161021001 MW9D	23089161021002 MW95			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	0.000113	0.000060			
	Lithium (Li)-Dissolved (mg/L)	0.0027	<0.0010			
	Magnesium (Mg)-Dissolved (mg/L)	22.3	23.4			
	Manganese (Mn)-Dissolved (mg/L)	0.0367	0.00469			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00634	0.000203			
	Nickel (Ni)-Dissolved (mg/L)	0.00068	<0.00050			
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.08	3.34			
	Rubidium (Rb)-Dissolved (mg/L)	0.00167	0.00047			
	Selenium (Se)-Dissolved (mg/L)	<0.000050	0.000314			
	Silicon (Si)-Dissolved (mg/L)	7.26	4.43			
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050			
	Sodium (Na)-Dissolved (mg/L)	12.1	4.69			
	Strontium (Sr)-Dissolved (mg/L)	0.166	0.0948			
	Sulfur (S)-Dissolved (mg/L)	2.24	5.60			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	0.000020	<0.000010			
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	0.00027	0.00027			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030			
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.00104	0.000262			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	0.0146	0.0604			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1847231-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1847231-1, -2
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1847231-1, -2
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1847231-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1847231-1, -2
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1847231-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1847231-1, -2
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1847231-1, -2
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1847231-1, -2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SPEC-WT	Water	Speciated Alkalinity	EPA 310.2
CL-IC-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

ALS Test Code	Matrix	Test Description	Method Reference**
IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
PH-ALK-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

ALS Test Code	Matrix	Test Description	Method Reference**
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5°C overnight and then 180–10°C for 1hr.

ALS Test Code	Matrix	Test Description	Method Reference**
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N

Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location

Reference Information

WT ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

81839

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Quality Control Report

Workorder: L1847231 Report Date: 01-NOV-16

Client: MATRIX SOLUTIONS INC.
31 Beacon Point Court
Breslau ON N0B 1M0
Contact: Scott Miller

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-WT	**Water**							
Batch R3579263								
WG2417846-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			96.8		%		80-120	24-OCT-16
WG2417846-2 LCS								
Alkalinity, Total (as CaCO3)			104.4		%		85-115	24-OCT-16
WG2417846-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	24-OCT-16
CL-IC-WT	**Water**							
Batch R3581637								
WG2420201-12 LCS								
Chloride (Cl)			100.5		%		70-130	27-OCT-16
WG2420201-11 MB								
Chloride (Cl)			<0.50		mg/L		0.5	27-OCT-16
EC-WT	**Water**							
Batch R3579021								
WG2416673-2 LCS								
Conductivity			97.8		%		90-110	22-OCT-16
WG2416673-1 MB								
Conductivity			<3.0		umhos/cm		3	22-OCT-16
MET-D-CCMS-WT	**Water**							
Batch R3579149								
WG2417038-2 LCS								
Aluminum (Al)-Dissolved			104.3		%		80-120	25-OCT-16
Antimony (Sb)-Dissolved			98.1		%		80-120	25-OCT-16
Arsenic (As)-Dissolved			95.9		%		80-120	25-OCT-16
Barium (Ba)-Dissolved			97.3		%		80-120	25-OCT-16
Beryllium (Be)-Dissolved			101.8		%		80-120	25-OCT-16
Bismuth (Bi)-Dissolved			98.7		%		80-120	25-OCT-16
Boron (B)-Dissolved			100.6		%		80-120	25-OCT-16
Cadmium (Cd)-Dissolved			93.1		%		80-120	25-OCT-16
Calcium (Ca)-Dissolved			99.9		%		80-120	25-OCT-16
Cesium (Cs)-Dissolved			98.7		%		80-120	25-OCT-16
Chromium (Cr)-Dissolved			94.2		%		80-120	25-OCT-16
Cobalt (Co)-Dissolved			93.6		%		80-120	25-OCT-16
Copper (Cu)-Dissolved			91.7		%		80-120	25-OCT-16
Iron (Fe)-Dissolved			84.7		%		80-120	25-OCT-16
Lead (Pb)-Dissolved			95.2		%		80-120	25-OCT-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3579149								
WG2417038-2 LCS								
Lithium (Li)-Dissolved			106.8		%		80-120	25-OCT-16
Magnesium (Mg)-Dissolved			99.0		%		80-120	25-OCT-16
Manganese (Mn)-Dissolved			96.8		%		80-120	25-OCT-16
Molybdenum (Mo)-Dissolved			93.4		%		80-120	25-OCT-16
Nickel (Ni)-Dissolved			93.1		%		80-120	25-OCT-16
Phosphorus (P)-Dissolved			101.3		%		80-120	25-OCT-16
Potassium (K)-Dissolved			95.6		%		80-120	25-OCT-16
Rubidium (Rb)-Dissolved			99.8		%		80-120	25-OCT-16
Selenium (Se)-Dissolved			87.2		%		80-120	25-OCT-16
Silicon (Si)-Dissolved			106.1		%		80-120	25-OCT-16
Silver (Ag)-Dissolved			94.1		%		80-120	25-OCT-16
Sodium (Na)-Dissolved			96.8		%		80-120	25-OCT-16
Strontium (Sr)-Dissolved			98.7		%		80-120	25-OCT-16
Sulfur (S)-Dissolved			100.4		%		80-120	25-OCT-16
Tellurium (Te)-Dissolved			94.0		%		80-120	25-OCT-16
Thallium (Tl)-Dissolved			96.7		%		80-120	25-OCT-16
Thorium (Th)-Dissolved			92.1		%		80-120	25-OCT-16
Tin (Sn)-Dissolved			95.0		%		80-120	25-OCT-16
Titanium (Ti)-Dissolved			94.7		%		80-120	25-OCT-16
Tungsten (W)-Dissolved			93.5		%		80-120	25-OCT-16
Uranium (U)-Dissolved			93.2		%		80-120	25-OCT-16
Vanadium (V)-Dissolved			96.7		%		80-120	25-OCT-16
Zinc (Zn)-Dissolved			89.5		%		80-120	25-OCT-16
Zirconium (Zr)-Dissolved			93.7		%		80-120	25-OCT-16
WG2417038-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	25-OCT-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	25-OCT-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	25-OCT-16
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	25-OCT-16
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	25-OCT-16
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	25-OCT-16
Boron (B)-Dissolved			<0.010		mg/L		0.01	25-OCT-16
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	25-OCT-16
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	25-OCT-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3579149								
WG2417038-1 MB								
Cesium (Cs)-Dissolved			<0.000010		mg/L		0.00001	25-OCT-16
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	25-OCT-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	25-OCT-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	25-OCT-16
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	25-OCT-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	25-OCT-16
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	25-OCT-16
Magnesium (Mg)-Dissolved			<0.050		mg/L		0.05	25-OCT-16
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	25-OCT-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	25-OCT-16
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	25-OCT-16
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	25-OCT-16
Potassium (K)-Dissolved			<0.050		mg/L		0.05	25-OCT-16
Rubidium (Rb)-Dissolved			<0.00020		mg/L		0.0002	25-OCT-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	25-OCT-16
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	25-OCT-16
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	25-OCT-16
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	25-OCT-16
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	25-OCT-16
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	25-OCT-16
Tellurium (Te)-Dissolved			<0.00020		mg/L		0.0002	25-OCT-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	25-OCT-16
Thorium (Th)-Dissolved			<0.00010		mg/L		0.0001	25-OCT-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	25-OCT-16
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	25-OCT-16
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	25-OCT-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	25-OCT-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	25-OCT-16
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	25-OCT-16
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	25-OCT-16
NO2-IC-WT	**Water**							

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-WT	**Water**							
Batch R3581637								
WG2420201-12 LCS								
Nitrite (as N)			102.9		%		70-130	27-OCT-16
WG2420201-11 MB								
Nitrite (as N)			<0.010		mg/L		0.01	27-OCT-16
NO3-IC-WT	**Water**							
Batch R3581637								
WG2420201-12 LCS								
Nitrate (as N)			100.3		%		70-130	27-OCT-16
WG2420201-11 MB								
Nitrate (as N)			<0.020		mg/L		0.02	27-OCT-16
PH-ALK-WT	**Water**							
Batch R3577157								
WG2416472-9 DUP		**L1847231-2**						
pH		7.28	7.32	J	pH units	0.04	0.2	22-OCT-16
WG2416472-4 LCS								
pH			6.96		pH units		6.9-7.1	22-OCT-16
WG2416472-7 LCS								
pH			6.94		pH units		6.9-7.1	22-OCT-16
SO4-IC-N-WT	**Water**							
Batch R3581637								
WG2420201-12 LCS								
Sulfate (SO4)			100.3		%		90-110	27-OCT-16
WG2420201-11 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	27-OCT-16
SOLIDS-TDS-WT	**Water**							
Batch R3583278								
WG2419582-3 DUP		**L1847231-1**						
Total Dissolved Solids		272	270		mg/L	0.9	20	26-OCT-16
WG2419582-2 LCS								
Total Dissolved Solids			96.4		%		85-115	26-OCT-16
WG2419582-1 MB								
Total Dissolved Solids			<10		mg/L		10	26-OCT-16
TKN-WT	**Water**							
Batch R3584321								
WG2418960-2 LCS								
Total Kjeldahl Nitrogen			91.0		%		75-125	31-OCT-16
WG2418960-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	**Water**							
Batch R3584321								
WG2418960-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	31-OCT-16

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

L1847231 ESmith EB 21-Oct-16 21E

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

COC # M81839

Page: 1 of 1

Lab Submitted to: ALS Waterloo
Lab Agreement no: ~~Q5889~~ Q58595
Lab Job ID:

Invoice to: Require Report: Y___ N___

Company Name: MATRIX SOLUTIONS
Contact Name: 31 Beacon Point Court
Address: Breslau, ON
PC:
Phone / Fax#: Ph: Fax:

Copy of Report to:
Matrix Solutions - Data Management
Suite 200, 150 - 13th Avenue SW
Calgary, Alberta, Canada
T2R 0V2
Ph: 403-237-0606 Fax: 403-263-2493
Fax draft copy of invoice to Matrix Solutions Inc.

Matrix Project #: 23089 - 528
Matrix Proj. Name: Claire - Maltby
Location:
Sampler's Name(s): S. Miller

AFE #: 149006.02.03

REGULATORY REQUIREMENTS: (check)
- [ ] Alberta Tier 1
- [ ] SPIGEC
- [ ] Freshwater Aquatic Life (Low Level Metals)
- [ ] Canadian Drinking Water
- [ ] BC Regs
- [ ] Other:

SERVICE REQUESTED:
- [ ] RUSH (Please ensure you contact the lab) Due Date:
- [x] REGULAR Turnaround

REPORT DISTRIBUTION: always send to data_management@matrix-solutions.com
- [x] Additional Emails: Smiller@matrix-solutions.com

Analysis Required: Q58595

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (cm)	Sample Type	Date/Time Sampled	Quantity # of Jars	Bags	Q58595													Lab Sample Number
1	23089161021001	MW9D		Water	Oct 21 11:30	3	—	X													1
2	23089161021002	MW95		Water	Oct 21 11:45	3	—	X													2
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					

L1847231-COFC

*For metals in water samples indicate if you want Total (T), Dissolved (D) or Extractable (E) as part of "Analysis Required" Preserved/Filtered

Relinquished by: [signature] Date/Time: Oct 21 18:15
Signature: Scott Miller

Received by: EKS Date/Time: Oct/20/2016 18:20
Signature: [signature]

COMMENTS/SPECIAL INSTRUCTIONS
CALL Scott With Questions 403 589 1599
Metals are Dissolved and were Field Filtered.
temp: 12.0°C
EKS.

MATRIX SOLUTIONS INC.
ATTN: Scott Miller
31 Beacon Point Court
Breslau ON N0B 1M0

Date Received: 20-APR-17
Report Date: 27-APR-17 14:14 (MT)
Version: FINAL

Client Phone: 519-772-3777

Certificate of Analysis

Lab Work Order #: L1915040

Project P.O. #:	NOT SUBMITTED
Job Reference:	23089 - CLAIR MALTBY CEIS
C of C Numbers:	81841, 81842
Legal Site Desc:	

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1915040-1	L1915040-2	L1915040-3	L1915040-4	L1915040-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	19-APR-17	19-APR-17	19-APR-17	19-APR-17	19-APR-17
	Sampled Time	09:50	09:55	10:40	10:45	11:25
	Client ID	23089170419001 MW02-S	23089170419002 MW02-D	23089170419003 MW01-D	23089170419004 MW01-S	23089170419005 MW03-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	803	741	586	938	697
	pH (pH units)	7.64	7.80	8.17	7.89	7.94
	Total Dissolved Solids (mg/L)	421 DLDS	397 DLDS	304 DLDS	497 DLDS	377 DLDS
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	397	364	246	285	321
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Total (as CaCO3) (mg/L)	397	364	246	285	321
	Chloride (Cl) (mg/L)	21.0	16.2	40.8	98.5	24.2
	Computed Conductivity (uS/cm)	688	638	531	823	604
	Conductivity % Difference (%)	-15.4	-14.9	-9.8	-13.0	-14.3
	Hardness (as CaCO3) (mg/L)	399	366	206	357	334
	Ion Balance (%)	112	107	93.5	107	111
	Langelier Index	0.8	0.9	0.7	0.9	0.9
	Nitrate (as N) (mg/L)	<0.020	<0.020	<0.020	2.20	1.60
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	0.42	0.40	1.9	0.38	<1.5
	Saturation pH (pH)	6.82	6.90	7.51	7.04	7.01
	TDS (Calculated) (mg/L)	435	401	324	504	373
	Sulfate (SO4) (mg/L)	21.9	31.9	37.5	50.4	19.8
	Anion Sum (me/L)	7.58	7.12	6.02	8.70	6.52
	Cation Sum (me/L)	8.52	7.59	5.63	9.27	7.25
	Cation - Anion Balance (%)	5.8	3.2	-3.3	3.2	5.3
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0052	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	0.00013	<0.00010	0.00015	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.0315	0.00490	0.0127	0.00011	0.00024
	Barium (Ba)-Dissolved (mg/L)	0.0482	0.0885	0.0490	0.0560	0.0870
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.019	<0.010	0.072	0.019	0.011
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	0.000183	0.000051
	Calcium (Ca)-Dissolved (mg/L)	113	100	34.2	96.0	87.2
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	0.00182	0.00059	0.00042	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00023	<0.00020	0.00069	0.00143	0.00052

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1915040-6	L1915040-7	L1915040-8	L1915040-9	L1915040-10
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	19-APR-17	19-APR-17	19-APR-17	19-APR-17	19-APR-17
	Sampled Time	12:15	12:54	13:20	14:30	14:35
	Client ID	23089170419006 MW03-D	23089170419007 MW04-S	23089170419008 MW04-D	23089170419009 MW05-S	23089170419010 MW05-D
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	547	560	518	674	689
	pH (pH units)	8.03	8.07	8.13	7.85	7.87
	Total Dissolved Solids (mg/L)	301 DLDS	336 DLDS	269 DLDS	422 DLDS	448 DLDS
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	258	233	264	307	354
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Total (as CaCO3) (mg/L)	258	233	264	307	354
	Chloride (Cl) (mg/L)	13.4	23.4	7.30	10.8	11.6
	Computed Conductivity (uS/cm)	483	515	449	585	594
	Conductivity % Difference (%)	-12.5	-8.3	-14.3	-14.2	-14.8
	Hardness (as CaCO3) (mg/L)	267	260	222	344	328
	Ion Balance (%)	106	104	103	114	98.0
	Langelier Index	0.8	0.8	0.8	0.8	0.9
	Nitrate (as N) (mg/L)	<0.020	0.149	<0.020	<0.020	<0.020
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	0.25	<1.5 DLM	<0.15	0.25	<1.5 DLM
	Saturation pH (pH)	7.21	7.27	7.30	7.01	6.95
	TDS (Calculated) (mg/L)	292	310	278	358	378
	Sulfate (SO4) (mg/L)	28.6	45.6	20.9	39.4	34.3
	Anion Sum (me/L)	5.24	5.48	5.02	6.19	6.89
	Cation Sum (me/L)	5.54	5.71	5.17	7.07	6.76
	Cation - Anion Balance (%)	2.7	2.1	1.5	6.6	-1.0
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	0.00027	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00244	0.00227	0.00758	0.00553	0.00029
	Barium (Ba)-Dissolved (mg/L)	0.0778	0.0615	0.0538	0.127	0.118
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	0.013	0.016	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	64.0	63.1	50.4	89.7	89.0
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	0.00013	0.00018	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00082	0.00038	0.00023	0.00025	0.00025

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1915040-11	L1915040-12	L1915040-13	L1915040-14	L1915040-15
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	19-APR-17	19-APR-17	19-APR-17	19-APR-17	19-APR-17
	Sampled Time	15:36	15:50	16:55	17:05	18:30
	Client ID	23089170419011 MW06-S	23089170419012 MW06-D	23089170419013 MW08-S	23089170419014 MW08-D	23089170419015 MW07
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	616	436	664	1180	682
	pH (pH units)	8.08	8.12	7.78	7.88	7.99
	Total Dissolved Solids (mg/L)	404	260 DLDS	385 DLDS	718 DLDS	413 DLDS
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	316	224	354	354	281
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Total (as CaCO3) (mg/L)	316	224	354	354	281
	Chloride (Cl) (mg/L)	8.23	3.55	13.5	167	32.4
	Computed Conductivity (uS/cm)	681	387	569	1010	597
	Conductivity % Difference (%)	10.1	-11.9	-15.4	-15.6	-13.4
	Hardness (as CaCO3) (mg/L)	411	213	329	369	309
	Ion Balance (%)	122	110	105	99.1	105
	Langelier Index	1.1	0.8	0.8	0.9	0.9
	Nitrate (as N) (mg/L)	<0.020	<0.020	1.81	1.51	0.125
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	0.015	0.012
	Total Kjeldahl Nitrogen (mg/L)	<1.5 DLM	<0.15	<1.5 DLM	<1.5 DLM	<0.15
	Saturation pH (pH)	6.97	7.35	6.94	6.94	7.11
	TDS (Calculated) (mg/L)	414	233	360	633	364
	Sulfate (SO4) (mg/L)	70.5	15.3	5.89	29.5	42.1
	Anion Sum (me/L)	6.94	4.14	6.46	11.3	6.45
	Cation Sum (me/L)	8.49	4.54	6.77	11.2	6.78
	Cation - Anion Balance (%)	10.1	4.6	2.3	-0.5	2.5
Dissolved Metals	Dissolved Metals Filtration Location	LAB FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.627 DLM	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.0010 DLM	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.0015 DLM	0.00150	0.00019	0.00010	0.00036
	Barium (Ba)-Dissolved (mg/L)	0.129 DLM	0.112	0.0136	0.121	0.115
	Beryllium (Be)-Dissolved (mg/L)	<0.0010 DLM	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050 DLM	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.10 DLM	<0.010	0.010	0.014	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.00010 DLM	<0.000010	0.000056	0.000073	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	99.5 DLM	51.8	92.0	100	77.7
	Cesium (Cs)-Dissolved (mg/L)	0.00011 DLM	<0.000010	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	<0.0050 DLM	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	<0.0010 DLM	<0.00010	<0.00010	0.00044	0.00028
	Copper (Cu)-Dissolved (mg/L)	<0.0020 DLM	<0.00020	0.00061	0.00140	0.00024

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1915040-16	L1915040-17			
	Description	WATER	WATER			
	Sampled Date	19-APR-17	19-APR-17			
	Sampled Time	19:30	19:50			
	Client ID	23089170419016 MW09-S	23089170419017 MW09-D			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	659	469			
	pH (pH units)	7.96	8.12			
	Total Dissolved Solids (mg/L)	430 DLDS	312 DLDS			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	338	294			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10			
	Alkalinity, Total (as CaCO3) (mg/L)	338	294			
	Chloride (Cl) (mg/L)	19.9	3.06			
	Computed Conductivity (uS/cm)	604	427			
	Conductivity % Difference (%)	-8.9	-9.4			
	Hardness (as CaCO3) (mg/L)	319	220			
	Ion Balance (%)	96.3	96.1			
	Langelier Index	1.0	0.9			
	Nitrate (as N) (mg/L)	7.17	<0.020			
	Nitrite (as N) (mg/L)	<0.010	<0.010			
	Total Kjeldahl Nitrogen (mg/L)	1.6 DLM	0.84			
	Saturation pH (pH)	6.97	7.22			
	TDS (Calculated) (mg/L)	391	270			
	Sulfate (SO4) (mg/L)	15.0	4.98			
	Anion Sum (me/L)	6.97	5.07			
	Cation Sum (me/L)	6.72	4.87			
	Cation - Anion Balance (%)	-1.9	-2.0			
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050			
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010			
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00448			
	Barium (Ba)-Dissolved (mg/L)	0.0876	0.0898			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050			
	Boron (B)-Dissolved (mg/L)	0.013	0.014			
	Cadmium (Cd)-Dissolved (mg/L)	0.000049	<0.000010			
	Calcium (Ca)-Dissolved (mg/L)	89.1	53.9			
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010			
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050			
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00023			
	Copper (Cu)-Dissolved (mg/L)	0.00103	0.00026			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L1915040-1	L1915040-2	L1915040-3	L1915040-4	L1915040-5
	Sample ID	L1915040-1	L1915040-2	L1915040-3	L1915040-4	L1915040-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	19-APR-17	19-APR-17	19-APR-17	19-APR-17	19-APR-17
	Sampled Time	09:50	09:55	10:40	10:45	11:25
	Client ID	23089170419001 MW02-S	23089170419002 MW02-D	23089170419003 MW01-D	23089170419004 MW01-S	23089170419005 MW03-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Iron (Fe)-Dissolved (mg/L)	1.66	1.04	0.018	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	0.000066	0.000281	<0.000050	0.000260	0.000086
	Lithium (Li)-Dissolved (mg/L)	0.0017	0.0016	0.0024	0.0018	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	28.3	28.1	29.2	28.5	28.3
	Manganese (Mn)-Dissolved (mg/L)	0.482	0.109	0.0133	<0.00050	0.00384
	Molybdenum (Mo)-Dissolved (mg/L)	0.000828	0.000484	0.00312	0.000425	0.000289
	Nickel (Ni)-Dissolved (mg/L)	0.00841	0.00300	0.00245	0.00069	0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.539	0.855	0.849	1.57	1.57
	Rubidium (Rb)-Dissolved (mg/L)	0.00084	0.00110	0.00073	0.00221	0.00327
	Selenium (Se)-Dissolved (mg/L)	0.000112	<0.000050	<0.000050	0.000324	0.000309
	Silicon (Si)-Dissolved (mg/L)	3.75	7.59	5.63	3.79	5.44
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Dissolved (mg/L)	12.2	6.04	34.4	48.2	12.1
	Strontium (Sr)-Dissolved (mg/L)	0.148	0.133	0.483	0.385	0.0990
	Sulfur (S)-Dissolved (mg/L)	8.23	11.3	12.1	18.3	7.06
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	0.000020	0.000021
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Dissolved (mg/L)	0.00506	0.000766	0.00123	0.000961	0.000608
	Vanadium (V)-Dissolved (mg/L)	0.00085	<0.00050	0.00086	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0772	0.0354	0.0032	0.0970	0.0239
	Zirconium (Zr)-Dissolved (mg/L)	0.00054	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1915040-6	L1915040-7	L1915040-8	L1915040-9	L1915040-10
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	19-APR-17	19-APR-17	19-APR-17	19-APR-17	19-APR-17
	Sampled Time	12:15	12:54	13:20	14:30	14:35
	Client ID	23089170419006 MW03-D	23089170419007 MW04-S	23089170419008 MW04-D	23089170419009 MW05-S	23089170419010 MW05-D
Grouping	**Analyte**					
WATER						
Dissolved Metals	Iron (Fe)-Dissolved (mg/L)	0.209	<0.010	0.056	0.733	2.91
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	0.000141	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0027	0.0021	0.0030	0.0028	0.0016
	Magnesium (Mg)-Dissolved (mg/L)	25.9	24.8	23.3	29.1	25.8
	Manganese (Mn)-Dissolved (mg/L)	0.0140	0.0181	0.0156	0.0976	0.0800
	Molybdenum (Mo)-Dissolved (mg/L)	0.000864	0.00418	0.00213	0.00440	0.000089
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00091	0.00052	0.00109	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.01	1.51	1.28	1.28	0.745
	Rubidium (Rb)-Dissolved (mg/L)	0.00054	0.00089	0.00089	0.00065	0.00046
	Selenium (Se)-Dissolved (mg/L)	0.000090	0.000063	0.000252	<0.000050	0.000168
	Silicon (Si)-Dissolved (mg/L)	7.24	8.05	9.28	5.06	9.20
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Dissolved (mg/L)	4.22	11.0	16.4	3.66	3.98
	Strontium (Sr)-Dissolved (mg/L)	0.115	0.145	0.145	0.126	0.138
	Sulfur (S)-Dissolved (mg/L)	9.98	15.1	7.48	17.2	12.1
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	0.00017	0.00036	0.00029	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00032
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Dissolved (mg/L)	0.000915	0.00241	0.00109	0.00825	0.000034
	Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00060	0.00071	<0.00050	0.00054
	Zinc (Zn)-Dissolved (mg/L)	0.0087	0.0017	0.0038	0.0099	0.0049
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00067

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L1915040-11	L1915040-12	L1915040-13	L1915040-14	L1915040-15
	Sample ID	L1915040-11	L1915040-12	L1915040-13	L1915040-14	L1915040-15
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	19-APR-17	19-APR-17	19-APR-17	19-APR-17	19-APR-17
	Sampled Time	15:36	15:50	16:55	17:05	18:30
	Client ID	23089170419011 MW06-S	23089170419012 MW06-D	23089170419013 MW08-S	23089170419014 MW08-D	23089170419015 MW07
Grouping	**Analyte**					
WATER						
Dissolved Metals	Iron (Fe)-Dissolved (mg/L)	DLM 0.79	0.089	<0.010	<0.010	0.021
	Lead (Pb)-Dissolved (mg/L)	DLM 0.00511	<0.000050	0.000051	0.000425	0.000098
	Lithium (Li)-Dissolved (mg/L)	DLM <0.010	0.0021	<0.0010	0.0028	0.0033
	Magnesium (Mg)-Dissolved (mg/L)	DLM 39.5	20.2	24.2	28.8	27.9
	Manganese (Mn)-Dissolved (mg/L)	DLM 0.121	0.0137	0.00130	0.0191	0.0654
	Molybdenum (Mo)-Dissolved (mg/L)	DLM 0.00181	0.000896	<0.000050	0.000684	0.000928
	Nickel (Ni)-Dissolved (mg/L)	DLM <0.0050	<0.00050	<0.00050	0.00224	0.00127
	Phosphorus (P)-Dissolved (mg/L)	DLM <0.50	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	DLM 1.78	1.05	0.870	3.37	1.40
	Rubidium (Rb)-Dissolved (mg/L)	DLM 0.0027	0.00050	0.00032	0.00149	0.00109
	Selenium (Se)-Dissolved (mg/L)	DLM <0.00050	0.000272	0.000105	0.000276	0.000058
	Silicon (Si)-Dissolved (mg/L)	DLM 7.54	7.31	4.18	5.43	6.96
	Silver (Ag)-Dissolved (mg/L)	DLM <0.00050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Dissolved (mg/L)	DLM 5.2	6.20	3.74	85.2	13.2
	Strontium (Sr)-Dissolved (mg/L)	DLM 0.177	0.126	0.110	0.164	0.115
	Sulfur (S)-Dissolved (mg/L)	DLM 24.4	5.50	2.17	10.9	14.7
	Tellurium (Te)-Dissolved (mg/L)	DLM <0.0020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	DLM <0.00010	<0.000010	<0.000010	0.000032	0.000019
	Thorium (Th)-Dissolved (mg/L)	DLM <0.0010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	DLM <0.0010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	DLUI <0.030	<0.00030	<0.00030	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	DLM <0.0010	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Dissolved (mg/L)	DLM 0.00376	0.000905	0.000181	0.000549	0.000950
	Vanadium (V)-Dissolved (mg/L)	DLM <0.0050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	DLM 0.013	0.0020	0.0075	0.151	0.0107
	Zirconium (Zr)-Dissolved (mg/L)	DLM <0.0030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1915040-16	L1915040-17			
	Description	WATER	WATER			
	Sampled Date	19-APR-17	19-APR-17			
	Sampled Time	19:30	19:50			
	Client ID	23089170419016 MW09-S	23089170419017 MW09-D			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Iron (Fe)-Dissolved (mg/L)	<0.010	0.060			
	Lead (Pb)-Dissolved (mg/L)	0.000082	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0013	0.0023			
	Magnesium (Mg)-Dissolved (mg/L)	23.5	20.8			
	Manganese (Mn)-Dissolved (mg/L)	0.00068	0.0551			
	Molybdenum (Mo)-Dissolved (mg/L)	0.000194	0.00269			
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00068			
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050			
	Potassium (K)-Dissolved (mg/L)	3.63	0.997			
	Rubidium (Rb)-Dissolved (mg/L)	0.00060	0.00123			
	Selenium (Se)-Dissolved (mg/L)	0.000325	<0.000050			
	Silicon (Si)-Dissolved (mg/L)	4.36	7.31			
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050			
	Sodium (Na)-Dissolved (mg/L)	5.71	10.1			
	Strontium (Sr)-Dissolved (mg/L)	0.105	0.148			
	Sulfur (S)-Dissolved (mg/L)	5.32	1.85			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	0.000019			
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	0.00013	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030			
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.000294	0.000792			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	0.0214	0.0087			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Additional Comments for Sample Listed:

Samplenum	Matrix	Report Remarks	Sample Comments
L1915040-11	Water	Note: DLM - Sample diluted due to presence of precipitate in field filtered dissolved metals bottle.	

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Chloride (Cl)	MS-B	L1915040-1, -10, -11, -12, -13, -14, -15, -16, -17, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1915040-1, -10, -12, -13, -14, -15, -16, -17, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DLUI	Detection Limit Raised: Unknown Interference generated an apparent false positive test result.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SPEC-WT	Water	Speciated Alkalinity	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PH-ALK-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5°C overnight and then 180–10°C for 1hr.

TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N

Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Reference Information

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

81841	81842

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: MATRIX SOLUTIONS INC.
31 Beacon Point Court
Breslau ON N0B 1M0
Contact: Scott Miller

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-WT	**Water**							
Batch R3708449								
WG2516437-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			103.8		%		80-120	25-APR-17
WG2516437-7 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			106.0		%		80-120	25-APR-17
WG2516437-2 LCS								
Alkalinity, Total (as CaCO3)			99.7		%		85-115	25-APR-17
WG2516437-6 LCS								
Alkalinity, Total (as CaCO3)			101.5		%		85-115	25-APR-17
WG2516437-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	25-APR-17
WG2516437-5 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	25-APR-17
CL-IC-N-WT	**Water**							
Batch R3707808								
WG2515789-12 LCS								
Chloride (Cl)			104.7		%		90-110	24-APR-17
WG2515789-7 LCS								
Chloride (Cl)			104.0		%		90-110	24-APR-17
WG2515789-11 MB								
Chloride (Cl)			<0.50		mg/L		0.5	24-APR-17
WG2515789-6 MB								
Chloride (Cl)			<0.50		mg/L		0.5	24-APR-17
EC-WT	**Water**							
Batch R3704104								
WG2514681-24 DUP		**L1915040-1**						
Conductivity		803	799		umhos/cm	0.4	10	21-APR-17
WG2514681-21 LCS								
Conductivity			105.0		%		90-110	21-APR-17
WG2514681-22 MB								
Conductivity			<3.0		umhos/cm		3	21-APR-17
MET-D-CCMS-WT	**Water**							
Batch R3704331								
WG2514539-2 LCS								
Aluminum (Al)-Dissolved			97.1		%		80-120	21-APR-17
Antimony (Sb)-Dissolved			97.5		%		80-120	21-APR-17
Arsenic (As)-Dissolved			97.8		%		80-120	21-APR-17
Barium (Ba)-Dissolved			101.9		%		80-120	21-APR-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3704331								
WG2514539-2 LCS								
Beryllium (Be)-Dissolved			93.1		%		80-120	21-APR-17
Bismuth (Bi)-Dissolved			100.3		%		80-120	21-APR-17
Boron (B)-Dissolved			94.1		%		80-120	21-APR-17
Cadmium (Cd)-Dissolved			102.4		%		80-120	21-APR-17
Calcium (Ca)-Dissolved			96.4		%		80-120	21-APR-17
Cesium (Cs)-Dissolved			101.7		%		80-120	21-APR-17
Chromium (Cr)-Dissolved			95.1		%		80-120	21-APR-17
Cobalt (Co)-Dissolved			96.9		%		80-120	21-APR-17
Copper (Cu)-Dissolved			95.4		%		80-120	21-APR-17
Iron (Fe)-Dissolved			97.8		%		80-120	21-APR-17
Lead (Pb)-Dissolved			101.4		%		80-120	21-APR-17
Lithium (Li)-Dissolved			91.8		%		80-120	21-APR-17
Magnesium (Mg)-Dissolved			97.6		%		80-120	21-APR-17
Manganese (Mn)-Dissolved			97.2		%		80-120	21-APR-17
Molybdenum (Mo)-Dissolved			96.6		%		80-120	21-APR-17
Nickel (Ni)-Dissolved			96.6		%		80-120	21-APR-17
Phosphorus (P)-Dissolved			83.9		%		80-120	21-APR-17
Potassium (K)-Dissolved			96.3		%		80-120	21-APR-17
Rubidium (Rb)-Dissolved			97.9		%		80-120	21-APR-17
Selenium (Se)-Dissolved			98.3		%		80-120	21-APR-17
Silicon (Si)-Dissolved			102.6		%		80-120	21-APR-17
Silver (Ag)-Dissolved			103.4		%		80-120	21-APR-17
Sodium (Na)-Dissolved			96.5		%		80-120	21-APR-17
Strontium (Sr)-Dissolved			99.6		%		80-120	21-APR-17
Sulfur (S)-Dissolved			93.1		%		80-120	21-APR-17
Tellurium (Te)-Dissolved			100.3		%		80-120	21-APR-17
Thallium (Tl)-Dissolved			95.7		%		80-120	21-APR-17
Thorium (Th)-Dissolved			100.4		%		80-120	21-APR-17
Tin (Sn)-Dissolved			97.1		%		80-120	21-APR-17
Titanium (Ti)-Dissolved			94.2		%		80-120	21-APR-17
Tungsten (W)-Dissolved			100.2		%		80-120	21-APR-17
Uranium (U)-Dissolved			103.7		%		80-120	21-APR-17
Vanadium (V)-Dissolved			98.3		%		80-120	21-APR-17
Zinc (Zn)-Dissolved			91.5		%		80-120	21-APR-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3704331								
WG2514539-2 LCS								
Zirconium (Zr)-Dissolved			99.8		%		80-120	21-APR-17
WG2514539-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	21-APR-17
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	21-APR-17
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	21-APR-17
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	21-APR-17
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	21-APR-17
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	21-APR-17
Boron (B)-Dissolved			<0.010		mg/L		0.01	21-APR-17
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	21-APR-17
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	21-APR-17
Cesium (Cs)-Dissolved			<0.000010		mg/L		0.00001	21-APR-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	21-APR-17
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	21-APR-17
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	21-APR-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	21-APR-17
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	21-APR-17
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	21-APR-17
Magnesium (Mg)-Dissolved			<0.050		mg/L		0.05	21-APR-17
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	21-APR-17
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	21-APR-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	21-APR-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	21-APR-17
Potassium (K)-Dissolved			<0.050		mg/L		0.05	21-APR-17
Rubidium (Rb)-Dissolved			<0.00020		mg/L		0.0002	21-APR-17
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	21-APR-17
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	21-APR-17
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	21-APR-17
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	21-APR-17
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	21-APR-17
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	21-APR-17
Tellurium (Te)-Dissolved			<0.00020		mg/L		0.0002	21-APR-17
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	21-APR-17
Thorium (Th)-Dissolved			<0.00010		mg/L		0.0001	21-APR-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3704331								
WG2514539-1 MB								
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	21-APR-17
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	21-APR-17
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	21-APR-17
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	21-APR-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	21-APR-17
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	21-APR-17
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	21-APR-17
Batch R3707090								
WG2516000-2 LCS								
Aluminum (Al)-Dissolved			101.7		%		80-120	24-APR-17
Antimony (Sb)-Dissolved			100.2		%		80-120	24-APR-17
Arsenic (As)-Dissolved			99.1		%		80-120	24-APR-17
Barium (Ba)-Dissolved			102.3		%		80-120	24-APR-17
Beryllium (Be)-Dissolved			93.4		%		80-120	24-APR-17
Bismuth (Bi)-Dissolved			100.2		%		80-120	24-APR-17
Boron (B)-Dissolved			92.3		%		80-120	24-APR-17
Cadmium (Cd)-Dissolved			99.3		%		80-120	24-APR-17
Calcium (Ca)-Dissolved			95.0		%		80-120	24-APR-17
Cesium (Cs)-Dissolved			104.3		%		80-120	24-APR-17
Chromium (Cr)-Dissolved			99.3		%		80-120	24-APR-17
Cobalt (Co)-Dissolved			98.4		%		80-120	24-APR-17
Copper (Cu)-Dissolved			96.3		%		80-120	24-APR-17
Iron (Fe)-Dissolved			99.9		%		80-120	24-APR-17
Lead (Pb)-Dissolved			100.6		%		80-120	24-APR-17
Lithium (Li)-Dissolved			90.4		%		80-120	24-APR-17
Magnesium (Mg)-Dissolved			98.8		%		80-120	24-APR-17
Manganese (Mn)-Dissolved			98.1		%		80-120	24-APR-17
Molybdenum (Mo)-Dissolved			91.6		%		80-120	24-APR-17
Nickel (Ni)-Dissolved			98.9		%		80-120	24-APR-17
Phosphorus (P)-Dissolved			106.3		%		80-120	24-APR-17
Potassium (K)-Dissolved			99.2		%		80-120	24-APR-17
Rubidium (Rb)-Dissolved			101.0		%		80-120	24-APR-17
Selenium (Se)-Dissolved			99.3		%		80-120	24-APR-17
Silicon (Si)-Dissolved			109.7		%		80-120	24-APR-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3707090								
WG2516000-2 LCS								
Silver (Ag)-Dissolved			98.6		%		80-120	24-APR-17
Sodium (Na)-Dissolved			102.1		%		80-120	24-APR-17
Strontium (Sr)-Dissolved			90.0		%		80-120	24-APR-17
Sulfur (S)-Dissolved			99.8		%		80-120	24-APR-17
Tellurium (Te)-Dissolved			99.0		%		80-120	24-APR-17
Thallium (Tl)-Dissolved			96.9		%		80-120	24-APR-17
Thorium (Th)-Dissolved			100.6		%		80-120	24-APR-17
Tin (Sn)-Dissolved			99.0		%		80-120	24-APR-17
Titanium (Ti)-Dissolved			95.3		%		80-120	24-APR-17
Tungsten (W)-Dissolved			101.9		%		80-120	24-APR-17
Uranium (U)-Dissolved			105.1		%		80-120	24-APR-17
Vanadium (V)-Dissolved			101.3		%		80-120	24-APR-17
Zinc (Zn)-Dissolved			95.8		%		80-120	24-APR-17
Zirconium (Zr)-Dissolved			94.9		%		80-120	24-APR-17
WG2516000-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	24-APR-17
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	24-APR-17
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	24-APR-17
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	24-APR-17
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	24-APR-17
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	24-APR-17
Boron (B)-Dissolved			<0.010		mg/L		0.01	24-APR-17
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	24-APR-17
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	24-APR-17
Cesium (Cs)-Dissolved			<0.000010		mg/L		0.00001	24-APR-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	24-APR-17
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	24-APR-17
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	24-APR-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	24-APR-17
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	24-APR-17
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	24-APR-17
Magnesium (Mg)-Dissolved			<0.050		mg/L		0.05	24-APR-17
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	24-APR-17
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	24-APR-17

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3707090								
WG2516000-1 MB								
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	24-APR-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	24-APR-17
Potassium (K)-Dissolved			<0.050		mg/L		0.05	24-APR-17
Rubidium (Rb)-Dissolved			<0.00020		mg/L		0.0002	24-APR-17
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	24-APR-17
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	24-APR-17
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	24-APR-17
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	24-APR-17
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	24-APR-17
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	24-APR-17
Tellurium (Te)-Dissolved			<0.00020		mg/L		0.0002	24-APR-17
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	24-APR-17
Thorium (Th)-Dissolved			<0.00010		mg/L		0.0001	24-APR-17
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	24-APR-17
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	24-APR-17
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	24-APR-17
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	24-APR-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	24-APR-17
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	24-APR-17
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	24-APR-17
NO2-IC-WT	**Water**							
Batch R3707808								
WG2515789-12 LCS								
Nitrite (as N)			105.3		%		70-130	24-APR-17
WG2515789-7 LCS								
Nitrite (as N)			105.2		%		70-130	24-APR-17
WG2515789-11 MB								
Nitrite (as N)			<0.010		mg/L		0.01	24-APR-17
WG2515789-6 MB								
Nitrite (as N)			<0.010		mg/L		0.01	24-APR-17
NO3-IC-WT	**Water**							
Batch R3707808								
WG2515789-12 LCS								
Nitrate (as N)			102.8		%		70-130	24-APR-17
WG2515789-7 LCS								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-WT	**Water**							
Batch R3707808								
WG2515789-7 LCS								
Nitrate (as N)			102.9		%		70-130	24-APR-17
WG2515789-11 MB								
Nitrate (as N)			<0.020		mg/L		0.02	24-APR-17
WG2515789-6 MB								
Nitrate (as N)			<0.020		mg/L		0.02	24-APR-17
PH-ALK-WT	**Water**							
Batch R3704104								
WG2514681-24 DUP		**L1915040-1**						
pH		7.64	7.59	J	pH units	0.03	0.2	21-APR-17
WG2514681-21 LCS								
pH			6.99		pH units		6.9-7.1	21-APR-17
SO4-IC-N-WT	**Water**							
Batch R3707808								
WG2515789-12 LCS								
Sulfate (SO4)			104.9		%		90-110	24-APR-17
WG2515789-7 LCS								
Sulfate (SO4)			104.1		%		90-110	24-APR-17
WG2515789-11 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	24-APR-17
WG2515789-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	24-APR-17
SOLIDS-TDS-WT	**Water**							
Batch R3705867								
WG2514834-2 LCS								
Total Dissolved Solids			99.5		%		85-115	21-APR-17
WG2514834-1 MB								
Total Dissolved Solids			<10		mg/L		10	21-APR-17
Batch R3708455								
WG2516324-3 DUP		**L1915040-9**						
Total Dissolved Solids		422	411		mg/L	2.5	20	25-APR-17
WG2516324-2 LCS								
Total Dissolved Solids			98.3		%		85-115	25-APR-17
WG2516324-1 MB								
Total Dissolved Solids			<10		mg/L		10	25-APR-17
TKN-WT	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	**Water**							
Batch R3708045								
WG2516286-2 LCS								
Total Kjeldahl Nitrogen			106.8		%		75-125	25-APR-17
WG2516286-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	25-APR-17
Batch R3708706								
WG2516550-3 DUP		**L1915040-9**						
Total Kjeldahl Nitrogen		0.25	0.26		mg/L	4.8	20	26-APR-17
WG2516550-2 LCS								
Total Kjeldahl Nitrogen			90.7		%		75-125	26-APR-17
WG2516550-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	26-APR-17
WG2516550-4 MS		**L1915040-9**						
Total Kjeldahl Nitrogen			92.9		%		70-130	26-APR-17

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

COC # M 81841

Page: 1 of 2

Lab Submitted to : ALS Waterloo
Lab Agreement no : Q58595
Lab Job ID:

Invoice to: Require Report: Y X N

Company Name: MATRIX SOLUTIONS INC
Contact Name: Scott Miller
Address:
PC:
Phone / Fax#: Ph: Fax:

Copy of Report to:
Matrix Solutions - Data Management
Suite 200, 150 - 13th Avenue SW
Calgary, Alberta, Canada
T2R 0V2
Ph: 403-237-0606 Fax: 403-263-2493
Fax draft copy of invoice to Matrix Solutions Inc.

Matrix Project # : 23089
Matrix Proj. Name: Clair Maltby CEIS
Location:
Sampler's Name(s): SM / DM

AFE #: 147164

REGULATORY REQUIREMENTS: (check)
- [ ] Alberta Tier 1
- [ ] SPIGEC
- [ ] Freshwater Aquatic Life (Low Level Metals)
- [ ] Canadian Drinking Water
- [ ] BC Regs
- [X] Other: ODWQS

SERVICE REQUESTED:
- [ ] RUSH (Please ensure you contact the lab) Due Date:
- [X] REGULAR Turnaround

REPORT DISTRIBUTION: always send to data_management@matrix-solutions.com
- [X] Additional Emails smiller@matrix-solutions.com

Analysis Required

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (cm)	Sample Type	Date/Time Sampled	Quantity # of Jars	Bags	Q58595	Lab Sample Number
1	23089170419001	MW02-S		WATER	04/19/17 9:50	3		X	1
2	23089170419002	MW02-D			04/19/17 9:55	3		X	2
3	23089170419003	MW01-D			04/19/17 10:40	3		X	3
4	23089170419004	MW01-S			04/19/17 10:45	3		X	4
5	23089170419005	MW03-S			04/19/17 11:25	3		X	5
6	23089170419006	MW03-D			04/19/17 12:15	3		X	6
7	23089170419007	MW04-S			04/19/17 12:54	3		X	7
8	23089170419008	MW04-D			04/19/17 13:20	3		X	8
9	23089170419009	MW05-S			04/19/17 14:30	3		X	9
10	23089170419010	MW05-D			04/19/17 14:35	3		X	10
11	23089170419011	MW06-S			04/19/17 15:36	3		X	11
12	23089170419012	MW06-D			04/19/17 15:50	3		X	12
13	23089170419013	MW08-S			04/19/17 16:55	3		X	13
14	23089170419014	MW08-D			04/19/17 17:05	3		X	14
15	23089170419015	MW07		WATER	04/19/17 18:30	3		X	15

L1915040-COFC

L1915040 on 20/4/17 April 20

*For metals in water samples indicate if you want Total (T), Dissolved (D) or Extractable (E) as part of "Analysis Required" Preserved/Filtered

Relinquished by: Scott Miller Date/Time: April 20/17 9:40
Signature:
Received by: Date/Time:
Signature: 20APR 17 e 840 e 24 / 1.4°C

COMMENTS/SPECIAL INSTRUCTIONS

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

COC # M 81842

Lab Submitted to : ALS Waterloo
Lab Agreement no : Q58595
Lab Job ID:

Invoice to: Require Report: Y X N___

Company Name: MATRIX SOLUTIONS
Contact Name:
Address:
PC:
Phone / Fax#: Ph: Fax:

AFE #: 147164

Copy of Report to:
Matrix Solutions - Data Management
Suite 200, 150 - 13th Avenue SW
Calgary, Alberta, Canada
T2R 0V2
Ph: 403-237-0606 Fax: 403-263-2493
Fax draft copy of invoice to Matrix Solutions Inc.

Matrix Project # : 23089
Matrix Proj. Name: Clair Maltby CEIS
Location:
Sampler's Name(s): SM/DM

REGULATORY REQUIREMENTS: (check)
- [ ] Alberta Tier 1
- [ ] SPIGEC
- [ ] Freshwater Aquatic Life (Low Level Metals)
- [ ] Canadian Drinking Water
- [ ] BC Regs
- [X] Other: ODWQS

SERVICE REQUESTED:
- [ ] RUSH (Please ensure you contact the lab) Due Date:
- [X] REGULAR Turnaround

REPORT DISTRIBUTION: always send to data_management@matrix-solutions.com
- [X] Additional Emails: smiller@matrix-solutions.com

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (cm)	Sample Type	Date/Time Sampled	Quantity # of Jars	Quantity # of Bags	Analysis Required: Q58595												Lab Sample Number
1	23089170419016	MW09-S	|	WATER	04/19/17 19:30	3		X												16
2	23089170419017	MW09-D	|	WATER	04/19/17 19:50	3		X												17
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10		L1915040																		
11		ag																		
12		20/4/17																		
13		April 20C																		
14																				
15																				

L1915040-COFC

*For metals in water samples indicate if you want Total (T), Dissolved (D) or Extractable (E) as part of "Analysis Required" Preserved/Filtered

Relinquished by: Scott Miller Date/Time: April 20/17 9:40
Signature:

Received by: Date/Time:
Signature: 20APR17C 940 e 2.4/1.4

COMMENTS/SPECIAL INSTRUCTIONS

MATRIX SOLUTIONS INC.
ATTN: Scott Miller
31 Beacon Point Court
Breslau ON N0B 1M0

Date Received: 05-OCT-17
Report Date: 13-OCT-17 14:02 (MT)
Version: FINAL

Client Phone: 519-772-3777

Certificate of Analysis

Lab Work Order #: L2003176

Project P.O. #: NOT SUBMITTED
Job Reference: 23089 - CLAIR MALTBY CEIS
C of C Numbers: M81843
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2003176-1	L2003176-2	L2003176-3	L2003176-4	L2003176-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	04-OCT-17	04-OCT-17	04-OCT-17	04-OCT-17	04-OCT-17
	Sampled Time	10:20	10:30	11:30	11:45	13:20
	Client ID	2308917004001 MW02-D	2308917004002 MW02-S	2308917004003 MW01-D	2308917004004 MW01-S	2308917004005 MW04-S
WATER						
Physical Tests	Conductivity (umhos/cm)	720	737	590	935	557
	pH (pH units)	8.00	7.81	8.21	8.04	8.11
	Total Dissolved Solids (mg/L)	DLDS 440	DLDS 396	DLDS 348	DLDS 542	DLM 352
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	378	377	236	299	249
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Total (as CaCO3) (mg/L)	378	377	236	299	249
	Bromide (Br) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl) (mg/L)	16.3	29.4	42.2	101	23.3
	Computed Conductivity (uS/cm)	665	648	552	843	530
	Conductivity % Difference (%)	-7.9	-12.8	-6.6	-10.4	-5.0
	Fluoride (F) (mg/L)	0.045	0.077	0.136	0.084	0.086
	Hardness (as CaCO3) (mg/L)	382	347	230	361	273
	Ion Balance (%)	107	109	104	104	102
	Langelier Index	1.1	0.9	0.7	1.0	0.9
	Nitrate (as N) (mg/L)	<0.020	<0.020	<0.020	1.73	0.039
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	0.26	0.35	<0.15	<0.15	DLM 1.7
	Saturation pH (pH)	6.87	6.89	7.48	7.02	7.23
	TDS (Calculated) (mg/L)	419	408	330	518	320
	Sulfate (SO4) (mg/L)	35.0	7.54	38.8	52.2	45.2
	Anion Sum (me/L)	7.45	7.20	5.94	9.03	5.74
	Cation Sum (me/L)	7.94	7.89	6.16	9.43	5.86
	Cation - Anion Balance (%)	3.2	4.5	1.8	2.2	1.1
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	0.0093	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	0.00011	0.00017	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00358	0.0197	0.00876	0.00014	0.00272
	Barium (Ba)-Dissolved (mg/L)	0.0906	0.0471	0.0440	0.0609	0.0612
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	0.020	0.065	0.021	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	0.000011	0.000192	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	103	98.8	38.6	95.2	64.5
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	0.00028	0.00101	0.00072	<0.00010	0.00014

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte					
	Sample ID	L2003176-6	L2003176-7	L2003176-8	L2003176-9	L2003176-10
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	04-OCT-17	04-OCT-17	04-OCT-17	04-OCT-17	05-OCT-17
	Sampled Time	13:45	14:50	16:00	17:20	11:50
	Client ID	2308917004006 MW04-D	2308917004007 MW02-D	2308917004008 MW09-D	2308917004009 MW06-S	2308917005001 MW05-D
WATER						
Physical Tests	Conductivity (umhos/cm)	490	620	466	625	674
	pH (pH units)	8.08	7.88	7.98	8.01	8.00
	Total Dissolved Solids (mg/L)	244 DLM	376 DLDS	278 DLDS	400 DLDS	402 DLDS
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	261	283	264	271	336
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10	<10	<10
	Alkalinity, Total (as CaCO3) (mg/L)	261	283	264	271	336
	Bromide (Br) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl) (mg/L)	7.39	14.7	2.56	11.4	11.7
	Computed Conductivity (uS/cm)	455	563	419	595	607
	Conductivity % Difference (%)	-7.5	-9.6	-10.5	-5.0	-10.5
	Fluoride (F) (mg/L)	0.170	0.027	0.076	0.066	0.057
	Hardness (as CaCO3) (mg/L)	236	316	239	311	350
	Ion Balance (%)	107	112	113	105	108
	Langelier Index	0.8	0.8	0.8	0.9	1.1
	Nitrate (as N) (mg/L)	<0.020	7.09	<0.020	<0.020	<0.020
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	<1.5 DLM	<1.5 DLM	0.29	<0.15	1.39
	Saturation pH (pH)	7.30	7.05	7.22	7.15	6.95
	TDS (Calculated) (mg/L)	277	353	256	367	378
	Sulfate (SO4) (mg/L)	20.8	17.0	4.55	76.4	36.9
	Anion Sum (me/L)	4.98	5.94	4.54	6.40	6.67
	Cation Sum (me/L)	5.35	6.67	5.13	6.71	7.20
	Cation - Anion Balance (%)	3.6	5.7	6.0	2.4	3.8
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.0100	0.00011	0.00443	0.00165	0.00025
	Barium (Ba)-Dissolved (mg/L)	0.0575	0.0944	0.0954	0.121	0.124
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.016	0.013	0.013	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	0.000043	0.000016	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	50.7	87.2	59.8	73.3	96.3
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00131	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	0.00037	0.00011	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2003176-11	L2003176-12	L2003176-13	L2003176-14
	Description	WATER	WATER	WATER	WATER
	Sampled Date	05-OCT-17	05-OCT-17	05-OCT-17	05-OCT-17
	Sampled Time	12:20	12:45	13:42	13:53
	Client ID	2308917005002 MW05-S	2308917005003 MW06-D	2308917005004 MW08-D	2308917005005 MW08-S
Grouping	**Analyte**				
WATER					
Physical Tests	Conductivity (umhos/cm)	644	431	1180	656
	pH (pH units)	8.08	8.17	8.09	7.93
	Total Dissolved Solids (mg/L)	364 DLDS	235 DLDS	663 DLDS	352 DLDS
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	309	221	321	321
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10	<10
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10	<10
	Alkalinity, Total (as CaCO3) (mg/L)	309	221	321	321
	Bromide (Br) (mg/L)	<0.10	<0.10	0.19	<0.10
	Chloride (Cl) (mg/L)	10.2	3.34	170	15.9
	Computed Conductivity (uS/cm)	595	392	1010	572
	Conductivity % Difference (%)	-8.0	-9.4	-15.3	-13.8
	Fluoride (F) (mg/L)	0.057	0.053	0.043	0.045
	Hardness (as CaCO3) (mg/L)	337	218	374	339
	Ion Balance (%)	109	112	105	112
	Langelier Index	1.0	0.8	1.1	1.0
	Nitrate (as N) (mg/L)	0.384	0.046	1.31	4.19
	Nitrite (as N) (mg/L)	0.012	<0.010	0.014	<0.010
	Total Kjeldahl Nitrogen (mg/L)	0.22	<0.15	<0.15	0.15 TKNI
	Saturation pH (pH)	7.03	7.34	6.98	6.96
	TDS (Calculated) (mg/L)	367	234	621	356
	Sulfate (SO4) (mg/L)	48.0	16.6	29.9	4.95
	Anion Sum (me/L)	6.44	4.13	10.8	6.17
	Cation Sum (me/L)	6.99	4.64	11.4	6.94
	Cation - Anion Balance (%)	4.1	5.8	2.6	5.9
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00304	0.00129	<0.00010	0.00019
	Barium (Ba)-Dissolved (mg/L)	0.122	0.111	0.144	0.0130
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	0.013	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.000010	<0.000010	0.000084	0.000046
	Calcium (Ca)-Dissolved (mg/L)	85.7	54.0	101	95.1
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	0.00274	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	0.00028	<0.00010	0.00047	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2003176-1	L2003176-2	L2003176-3	L2003176-4	L2003176-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	04-OCT-17	04-OCT-17	04-OCT-17	04-OCT-17	04-OCT-17
	Sampled Time	10:20	10:30	11:30	11:45	13:20
	Client ID	2308917004001 MW02-D	2308917004002 MW02-S	2308917004003 MW01-D	2308917004004 MW01-S	2308917004005 MW04-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	0.00040	0.00063	0.00104	0.00191	0.00057
	Iron (Fe)-Dissolved (mg/L)	1.82	1.39	0.031	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	0.000126	0.000066	<0.000050	0.000214	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0026	0.0024	0.0048	0.0031	0.0040
	Magnesium (Mg)-Dissolved (mg/L)	30.2	24.4	32.4	29.9	27.2
	Manganese (Mn)-Dissolved (mg/L)	0.0920	0.465	0.0314	0.00060	0.0257
	Molybdenum (Mo)-Dissolved (mg/L)	0.000396	0.000821	0.00293	0.000578	0.00182
	Nickel (Ni)-Dissolved (mg/L)	0.00154	0.00491	0.00291	0.00157	0.00060
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.871	0.633	0.888	1.85	1.34
	Rubidium (Rb)-Dissolved (mg/L)	0.00110	0.00126	0.00045	0.00275	0.00079
	Selenium (Se)-Dissolved (mg/L)	<0.000050	0.000096	<0.000050	0.000192	<0.000050
	Silicon (Si)-Dissolved (mg/L)	8.38	4.18	6.23	4.45	9.81
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Dissolved (mg/L)	6.55	21.4	35.6	50.0	8.63
	Strontium (Sr)-Dissolved (mg/L)	0.122	0.117	0.461	0.411	0.135
	Sulfur (S)-Dissolved (mg/L)	12.7	4.24	14.2	19.8	15.9
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	0.000023	0.000013
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	0.00013	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	0.00042	<0.00030	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Dissolved (mg/L)	0.000309	0.00242	0.000498	0.000941	0.00165
	Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00141	<0.00050	<0.00050	0.00067
	Zinc (Zn)-Dissolved (mg/L)	0.0183	0.0574	0.0074	0.103	0.0025
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	0.00052	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2003176-6 WATER 04-OCT-17 13:45 2308917004006 MW04-D	L2003176-7 WATER 04-OCT-17 14:50 2308917004007 MW02-D	L2003176-8 WATER 04-OCT-17 16:00 2308917004008 MW09-D	L2003176-9 WATER 04-OCT-17 17:20 2308917004009 MW06-S	L2003176-10 WATER 05-OCT-17 11:50 2308917005001 MW05-D
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	<0.00020	0.00136	0.00096	0.00029	<0.00020
	Iron (Fe)-Dissolved (mg/L)	0.249	0.109	0.084	0.589	2.76
	Lead (Pb)-Dissolved (mg/L)	<0.000050	0.000069	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0061	0.0022	0.0035	0.0029	0.0025
	Magnesium (Mg)-Dissolved (mg/L)	26.5	23.9	21.8	31.0	26.7
	Manganese (Mn)-Dissolved (mg/L)	0.0135	0.00058	0.0581	0.0452	0.0828
	Molybdenum (Mo)-Dissolved (mg/L)	0.00142	0.000192	0.00153	0.00251	0.000177
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	0.00067	0.00067	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.24	4.35	0.990	1.45	0.776
	Rubidium (Rb)-Dissolved (mg/L)	0.00052	0.00057	0.00078	0.00095	0.00054
	Selenium (Se)-Dissolved (mg/L)	0.000073	0.000366	<0.000050	<0.000050	0.000064
	Silicon (Si)-Dissolved (mg/L)	10.9	4.45	8.20	6.39	10.2
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Dissolved (mg/L)	13.9	5.41	7.31	10.6	4.04
	Strontium (Sr)-Dissolved (mg/L)	0.149	0.0906	0.137	0.137	0.127
	Sulfur (S)-Dissolved (mg/L)	7.58	5.92	1.96	28.7	13.5
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	0.000017	<0.000010	<0.000010
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Dissolved (mg/L)	0.000633	0.000268	0.000429	0.00241	0.000042
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00062
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	0.0249	0.0167	0.0028	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00059

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2003176-11	L2003176-12	L2003176-13	L2003176-14
	Description	WATER	WATER	WATER	WATER
	Sampled Date	05-OCT-17	05-OCT-17	05-OCT-17	05-OCT-17
	Sampled Time	12:20	12:45	13:42	13:53
	Client ID	2308917005002 MW05-S	2308917005003 MW06-D	2308917005004 MW08-D	2308917005005 MW08-S
Grouping	**Analyte**				
WATER					
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	<0.00020	0.00041	0.00111	0.00074
	Iron (Fe)-Dissolved (mg/L)	0.288	0.070	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	0.000071	<0.000050	0.000347	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0048	0.0029	0.0036	0.0012
	Magnesium (Mg)-Dissolved (mg/L)	29.8	20.2	29.3	24.6
	Manganese (Mn)-Dissolved (mg/L)	0.0972	0.0163	0.0210	0.00133
	Molybdenum (Mo)-Dissolved (mg/L)	0.00492	0.000828	0.000605	<0.000050
	Nickel (Ni)-Dissolved (mg/L)	0.00131	<0.00050	0.00236	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.40	1.14	3.42	0.744
	Rubidium (Rb)-Dissolved (mg/L)	0.00081	0.00075	0.00233	0.00031
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	0.000249	0.000059
	Silicon (Si)-Dissolved (mg/L)	5.02	7.72	5.69	4.33
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Dissolved (mg/L)	5.27	5.81	88.6	3.25
	Strontium (Sr)-Dissolved (mg/L)	0.107	0.112	0.152	0.0997
	Sulfur (S)-Dissolved (mg/L)	18.1	6.15	11.5	1.96
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	0.000051	<0.000010
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	0.00011	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Dissolved (mg/L)	0.00511	0.000595	0.000491	0.000143
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0106	0.0317	0.198	0.0082
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Zinc (Zn)-Dissolved	MS-B	L2003176-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
TKNI	TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-AUTO-WT	Water	Automated Speciated Alkalinity	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SPECIATED-WT	Water	pH Measurement for Spec. Alk	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-IC-N-WT	Water	Bromide in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

ALS Test Code	Matrix	Test Description	Method Reference**
F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

Reference Information

NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N

Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

M81843

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Quality Control Report

Workorder: L2003176 Report Date: 13-OCT-17

Client: MATRIX SOLUTIONS INC.
31 Beacon Point Court
Breslau ON N0B 1M0
Contact: Scott Miller

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-AUTO-WT	**Water**							
Batch R3852508								
WG2636421-7 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			107.4		%		80-120	11-OCT-17
WG2636421-6 LCS								
Alkalinity, Total (as CaCO3)			107.0		%		85-115	11-OCT-17
WG2636421-5 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	11-OCT-17
ALK-SPECIATED-WT	**Water**							
Batch R3850309								
WG2634088-28 DUP		**L2003176-8**						
pH		7.98	7.99	J	pH units	0.03	0.2	06-OCT-17
WG2634088-32 DUP		**L2003176-10**						
pH		8.00	8.02	J	pH units	0.01	0.2	06-OCT-17
BR-IC-N-WT	**Water**							
Batch R3851990								
WG2635493-4 DUP		**L2003176-2**						
Bromide (Br)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	10-OCT-17
WG2635493-8 DUP		**L2003176-12**						
Bromide (Br)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	10-OCT-17
WG2635493-2 LCS								
Bromide (Br)			102.8		%		85-115	10-OCT-17
WG2635493-7 LCS								
Bromide (Br)			100.7		%		85-115	10-OCT-17
WG2635493-1 MB								
Bromide (Br)			<0.10		mg/L		0.1	10-OCT-17
WG2635493-6 MB								
Bromide (Br)			<0.10		mg/L		0.1	10-OCT-17
WG2635493-5 MS		**L2003176-2**						
Bromide (Br)			84.1		%		75-125	10-OCT-17
WG2635493-9 MS		**L2003176-12**						
Bromide (Br)			88.2		%		75-125	10-OCT-17
CL-IC-N-WT	**Water**							
Batch R3851990								
WG2635493-4 DUP		**L2003176-2**						
Chloride (Cl)		29.4	29.5		mg/L	0.3	20	10-OCT-17
WG2635493-8 DUP		**L2003176-12**						
Chloride (Cl)		3.34	3.35		mg/L	0.4	20	10-OCT-17
WG2635493-2 LCS								
Chloride (Cl)			101.0		%		90-110	10-OCT-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT	**Water**							
Batch R3851990								
WG2635493-7 LCS								
Chloride (Cl)			101.3		%		90-110	10-OCT-17
WG2635493-1 MB								
Chloride (Cl)			<0.50		mg/L		0.5	10-OCT-17
WG2635493-6 MB								
Chloride (Cl)			<0.50		mg/L		0.5	10-OCT-17
WG2635493-5 MS		**L2003176-2**						
Chloride (Cl)			107.9		%		75-125	10-OCT-17
WG2635493-9 MS		**L2003176-12**						
Chloride (Cl)			98.5		%		75-125	10-OCT-17
EC-WT	**Water**							
Batch R3850309								
WG2634088-28 DUP		**L2003176-8**						
Conductivity		466	466		umhos/cm	0.0	10	06-OCT-17
WG2634088-32 DUP		**L2003176-10**						
Conductivity		674	670		umhos/cm	0.1	10	06-OCT-17
WG2634088-18 LCS								
Conductivity			101.9		%		90-110	06-OCT-17
WG2634088-22 LCS								
Conductivity			102.1		%		90-110	06-OCT-17
WG2634088-26 LCS								
Conductivity			102.6		%		90-110	06-OCT-17
WG2634088-30 LCS								
Conductivity			102.3		%		90-110	06-OCT-17
WG2634088-17 MB								
Conductivity			<3.0		umhos/cm		3	06-OCT-17
WG2634088-21 MB								
Conductivity			<3.0		umhos/cm		3	06-OCT-17
WG2634088-25 MB								
Conductivity			<3.0		umhos/cm		3	06-OCT-17
WG2634088-29 MB								
Conductivity			<3.0		umhos/cm		3	06-OCT-17
F-IC-N-WT	**Water**							
Batch R3851990								
WG2635493-4 DUP		**L2003176-2**						
Fluoride (F)		0.077	0.077		mg/L	0.5	20	10-OCT-17
WG2635493-8 DUP		**L2003176-12**						
Fluoride (F)		0.053	0.054		mg/L	0.2	20	10-OCT-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F-IC-N-WT	**Water**							
Batch R3851990								
WG2635493-2 LCS								
Fluoride (F)			102.4		%		90-110	10-OCT-17
WG2635493-7 LCS								
Fluoride (F)			104.6		%		90-110	10-OCT-17
WG2635493-1 MB								
Fluoride (F)			<0.020		mg/L		0.02	10-OCT-17
WG2635493-6 MB								
Fluoride (F)			<0.020		mg/L		0.02	10-OCT-17
WG2635493-5 MS		**L2003176-2**						
Fluoride (F)			101.7		%		75-125	10-OCT-17
WG2635493-9 MS		**L2003176-12**						
Fluoride (F)			98.3		%		75-125	10-OCT-17
MET-D-CCMS-WT	**Water**							
Batch R3850907								
WG2633658-2 LCS								
Aluminum (Al)-Dissolved			97.9		%		80-120	06-OCT-17
Antimony (Sb)-Dissolved			94.8		%		80-120	06-OCT-17
Arsenic (As)-Dissolved			99.8		%		80-120	06-OCT-17
Barium (Ba)-Dissolved			102.7		%		80-120	06-OCT-17
Beryllium (Be)-Dissolved			93.9		%		80-120	06-OCT-17
Bismuth (Bi)-Dissolved			98.5		%		80-120	06-OCT-17
Boron (B)-Dissolved			92.4		%		80-120	06-OCT-17
Cadmium (Cd)-Dissolved			97.7		%		80-120	06-OCT-17
Calcium (Ca)-Dissolved			96.9		%		80-120	06-OCT-17
Cesium (Cs)-Dissolved			103.7		%		80-120	06-OCT-17
Chromium (Cr)-Dissolved			99.5		%		80-120	06-OCT-17
Cobalt (Co)-Dissolved			98.6		%		80-120	06-OCT-17
Copper (Cu)-Dissolved			98.0		%		80-120	06-OCT-17
Iron (Fe)-Dissolved			96.6		%		80-120	06-OCT-17
Lead (Pb)-Dissolved			97.3		%		80-120	06-OCT-17
Lithium (Li)-Dissolved			91.2		%		80-120	06-OCT-17
Magnesium (Mg)-Dissolved			99.0		%		80-120	06-OCT-17
Manganese (Mn)-Dissolved			100.4		%		80-120	06-OCT-17
Molybdenum (Mo)-Dissolved			97.6		%		80-120	06-OCT-17
Nickel (Ni)-Dissolved			99.4		%		80-120	06-OCT-17
Phosphorus (P)-Dissolved			100.9		%		80-120	06-OCT-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3850907								
WG2633658-2 LCS								
Potassium (K)-Dissolved			92.9		%		80-120	06-OCT-17
Rubidium (Rb)-Dissolved			99.1		%		80-120	06-OCT-17
Selenium (Se)-Dissolved			96.0		%		80-120	06-OCT-17
Silicon (Si)-Dissolved			100.6		%		60-140	06-OCT-17
Silver (Ag)-Dissolved			103.0		%		80-120	06-OCT-17
Sodium (Na)-Dissolved			99.9		%		80-120	06-OCT-17
Strontium (Sr)-Dissolved			95.0		%		80-120	06-OCT-17
Sulfur (S)-Dissolved			86.4		%		80-120	06-OCT-17
Tellurium (Te)-Dissolved			93.0		%		80-120	06-OCT-17
Thallium (Tl)-Dissolved			95.1		%		80-120	06-OCT-17
Thorium (Th)-Dissolved			95.6		%		80-120	06-OCT-17
Tin (Sn)-Dissolved			99.0		%		80-120	06-OCT-17
Titanium (Ti)-Dissolved			97.3		%		80-120	06-OCT-17
Tungsten (W)-Dissolved			99.1		%		80-120	06-OCT-17
Uranium (U)-Dissolved			98.0		%		80-120	06-OCT-17
Vanadium (V)-Dissolved			99.98		%		80-120	06-OCT-17
Zinc (Zn)-Dissolved			94.4		%		80-120	06-OCT-17
Zirconium (Zr)-Dissolved			96.0		%		80-120	06-OCT-17
WG2633658-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	06-OCT-17
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-17
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-17
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-17
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-17
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	06-OCT-17
Boron (B)-Dissolved			<0.010		mg/L		0.01	06-OCT-17
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	06-OCT-17
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	06-OCT-17
Cesium (Cs)-Dissolved			<0.000010		mg/L		0.00001	06-OCT-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	06-OCT-17
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-17
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	06-OCT-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	06-OCT-17
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	06-OCT-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3850907								
WG2633658-1 MB								
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	06-OCT-17
Magnesium (Mg)-Dissolved			<0.050		mg/L		0.05	06-OCT-17
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	06-OCT-17
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	06-OCT-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	06-OCT-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	06-OCT-17
Potassium (K)-Dissolved			<0.050		mg/L		0.05	06-OCT-17
Rubidium (Rb)-Dissolved			<0.00020		mg/L		0.0002	06-OCT-17
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	06-OCT-17
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	06-OCT-17
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	06-OCT-17
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	06-OCT-17
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	06-OCT-17
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	06-OCT-17
Tellurium (Te)-Dissolved			<0.00020		mg/L		0.0002	06-OCT-17
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	06-OCT-17
Thorium (Th)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-17
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-17
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	06-OCT-17
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-17
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	06-OCT-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	06-OCT-17
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	06-OCT-17
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	06-OCT-17
NO2-IC-WT	**Water**							
Batch R3851990								
WG2635493-4 DUP		**L2003176-2**						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	25	10-OCT-17
WG2635493-8 DUP		**L2003176-12**						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	25	10-OCT-17
WG2635493-2 LCS								
Nitrite (as N)			101.2		%		70-130	10-OCT-17
WG2635493-7 LCS								
Nitrite (as N)			99.99		%		70-130	10-OCT-17
WG2635493-1 MB								

Quality Control Report

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-WT		**Water**							
Batch	**R3851990**								
WG2635493-1	**MB**								
Nitrite (as N)				<0.010		mg/L		0.01	10-OCT-17
WG2635493-6	**MB**								
Nitrite (as N)				<0.010		mg/L		0.01	10-OCT-17
WG2635493-5	**MS**		**L2003176-2**						
Nitrite (as N)				100.5		%		70-130	10-OCT-17
WG2635493-9	**MS**		**L2003176-12**						
Nitrite (as N)				98.1		%		70-130	10-OCT-17
NO3-IC-WT		**Water**							
Batch	**R3851990**								
WG2635493-4	**DUP**		**L2003176-2**						
Nitrate (as N)			<0.020	<0.020	RPD-NA	mg/L	N/A	25	10-OCT-17
WG2635493-8	**DUP**		**L2003176-12**						
Nitrate (as N)			0.046	0.048		mg/L	4.0	25	10-OCT-17
WG2635493-2	**LCS**								
Nitrate (as N)				101.1		%		70-130	10-OCT-17
WG2635493-7	**LCS**								
Nitrate (as N)				100.5		%		70-130	10-OCT-17
WG2635493-1	**MB**								
Nitrate (as N)				<0.020		mg/L		0.02	10-OCT-17
WG2635493-6	**MB**								
Nitrate (as N)				<0.020		mg/L		0.02	10-OCT-17
WG2635493-5	**MS**		**L2003176-2**						
Nitrate (as N)				98.7		%		70-130	10-OCT-17
WG2635493-9	**MS**		**L2003176-12**						
Nitrate (as N)				97.4		%		70-130	10-OCT-17
SO4-IC-N-WT		**Water**							
Batch	**R3851990**								
WG2635493-4	**DUP**		**L2003176-2**						
Sulfate (SO4)			7.54	7.60		mg/L	0.7	20	10-OCT-17
WG2635493-8	**DUP**		**L2003176-12**						
Sulfate (SO4)			16.6	16.3		mg/L	1.6	20	10-OCT-17
WG2635493-2	**LCS**								
Sulfate (SO4)				101.4		%		90-110	10-OCT-17
WG2635493-7	**LCS**								
Sulfate (SO4)				101.6		%		90-110	10-OCT-17
WG2635493-1	**MB**								
Sulfate (SO4)				<0.30		mg/L		0.3	10-OCT-17

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT	**Water**							
Batch R3851990								
WG2635493-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	10-OCT-17
WG2635493-5 MS		**L2003176-2**						
Sulfate (SO4)			104.8		%		75-125	10-OCT-17
WG2635493-9 MS		**L2003176-12**						
Sulfate (SO4)			97.4		%		75-125	10-OCT-17
SOLIDS-TDS-WT	**Water**							
Batch R3849767								
WG2634902-2 LCS								
Total Dissolved Solids			99.2		%		85-115	08-OCT-17
WG2634902-1 MB								
Total Dissolved Solids			<10		mg/L		10	08-OCT-17
Batch R3851648								
WG2635084-2 LCS								
Total Dissolved Solids			99.7		%		85-115	09-OCT-17
WG2635084-1 MB								
Total Dissolved Solids			<10		mg/L		10	09-OCT-17
TKN-WT	**Water**							
Batch R3851316								
WG2635198-2 LCS								
Total Kjeldahl Nitrogen			96.4		%		75-125	10-OCT-17
WG2635198-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	10-OCT-17
Batch R3852943								
WG2636240-3 DUP		**L2003176-5**						
Total Kjeldahl Nitrogen		1.7	1.7		mg/L	2.0	20	12-OCT-17
WG2636240-2 LCS								
Total Kjeldahl Nitrogen			95.0		%		75-125	12-OCT-17
WG2636240-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	12-OCT-17
WG2636240-4 MS		**L2003176-5**						
Total Kjeldahl Nitrogen			98.4		%		70-130	12-OCT-17

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

L2003176

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

COC # M 81843

Page: 1 of 1

Lab Submitted to: ALS Waterloo
Lab Agreement no: Q58595
Lab Job ID:

Invoice to: Require Report: Y___ N___
Company Name: Matrix Solutions Inc.
Contact Name: Scott Miller
Address:
PC:
Phone / Fax#: Ph: Fax:

Copy of Report to:
Matrix Solutions - Data Management
Suite 200, 150 - 13th Avenue SW
Calgary, Alberta, Canada
T2R 0V2
Ph: 403-237-0606 Fax: 403-263-2493
Fax draft copy of invoice to Matrix Solutions Inc.

Matrix Project #: 23089
Matrix Proj. Name: Clair Maltby CEIS
Location:
Sampler's Name(s): ~~SM~~ SM

AFE #: ~~2300~~ 147164

REGULATORY REQUIREMENTS: (check)
- [ ] Alberta Tier 1
- [ ] SPIGEC
- [ ] Freshwater Aquatic Life (Low Level Metals)
- [ ] Canadian Drinking Water
- [ ] BC Regs
- [X] Other: ODWQS

SERVICE REQUESTED:
- [ ] RUSH (Please ensure you contact the lab) Due Date:
- [X] REGULAR Turnaround

REPORT DISTRIBUTION: always send to data_management@matrix-solutions.com
- [ ] Additional Emails: Smiller@matrix-solutions.com

Analysis Required: Q58595

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (cm)	Sample Type	Date/Time Sampled	Jars	Bags	Q58595	Lab Sample Number
1	23089171004001	MW02-D	—	H2O	Oct 4/17 10:20	3	—	X	1
2	23089171004002	MW02-S	—	H2O	Oct 4/17 10:30	3	—	X	2
3	23089171004003	MW01-D	—	H2O	Oct 4/17 11:30	3	—	X	3
4	23089171004004	MW01-S	—	H2O	Oct 4/17 11:45	3	—	X	4
5	23089171004005	MW04-S	—	H2O	Oct 4/17 13:20	3	—	X	5
6	23089171004006	MW04-D	—	H2O	Oct 4/17 13:45	3	—	X	6
7	23089171004007	MW09-S	—	H2O	Oct 4/17 14:50	3	—	X	7
8	23089171004008	MW09-D	—	H2O	Oct 4/17 16:00	3	—	X	8
9	23089171004009	MW06-S	—	H2O	Oct 4/17 17:20	3	—	X	9
10	23089171005001	MW05-D	—	H2O	Oct 5/17 11:50	3	—	X	10
11	23089171005002	MW05-S	—	H2O	Oct 5/17 12:00	3	—	X	11
12	23089171005003	MW06-D	—	H2O	Oct 5/17 12:45	3	—	X	12
13	23089171005004	MW08-D	—	H2O	Oct 5/17 13:42	3	—	X	13
14	23089171005005	MW08-S	—	H2O	Oct 5/17 13:53	3	—	X	14
15									

L2003176-COFC

*For metals in water samples indicate if you want Total (T), Dissolved (D) or Extractable (E) as part of "Analysis Required" Preserved/Filtered

Relinquished by: Scott Miller Date/Time: Oct 5/17 17:15
Signature:
Received by: RW Date/Time: Oct-05-2017 17:15 3.3C
Signature:

COMMENTS/SPECIAL INSTRUCTIONS: Dissolved metals were all field filtered. Please see Q58595 for specific analyses.

MATRIX SOLUTIONS INC.
ATTN: Scott Miller
31 Beacon Point Court
Breslau ON N0B 1M0

Date Received: 11-OCT-17
Report Date: 18-OCT-17 11:59 (MT)
Version: FINAL

Client Phone: 519-772-3777

Certificate of Analysis

Lab Work Order #: L2004753

Project P.O. #: 23089
Job Reference: 23089 - CLAIR MALTOY CEIS
C of C Numbers: 81854
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2004753-1	L2004753-2	L2004753-3		
	Description	WATER	WATER	WATER		
	Sampled Date	10-OCT-17	10-OCT-17	10-OCT-17		
	Sampled Time	14:45	15:45	16:57		
	Client ID	23089171010001	23089171010002	23089171010003		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (umhos/cm)	701	711	536		
	pH (pH units)	8.12	8.10	8.09		
	Total Dissolved Solids (mg/L)	DLDS 416	DLDS 406	DLDS 287		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	285	308	250		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<10	<10	<10		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<10	<10	<10		
	Alkalinity, Total (as CaCO3) (mg/L)	285	308	250		
	Bromide (Br) (mg/L)	<0.10	<0.10	<0.10		
	Chloride (Cl) (mg/L)	40.4	31.6	12.9		
	Computed Conductivity (uS/cm)	624	625	484		
	Conductivity % Difference (%)	-11.6	-12.9	-10.2		
	Fluoride (F) (mg/L)	0.049	0.046	0.070		
	Hardness (as CaCO3) (mg/L)	310	344	276		
	Ion Balance (%)	104	116	113		
	Langelier Index	1.0	1.1	0.9		
	Nitrate (as N) (mg/L)	0.578	1.83	<0.020		
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010		
	Total Kjeldahl Nitrogen (mg/L)	0.19	0.21	<0.15		
	Saturation pH (pH)	7.11	7.02	7.22		
	TDS (Calculated) (mg/L)	380	380	288		
	Sulfate (SO4) (mg/L)	41.2	20.6	27.2		
	Anion Sum (me/L)	6.78	6.56	5.08		
	Cation Sum (me/L)	7.03	7.57	5.74		
	Cation - Anion Balance (%)	1.8	7.2	6.1		
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050		
	Antimony (Sb)-Dissolved (mg/L)	0.00018	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	0.00045	0.00030	0.00233		
	Barium (Ba)-Dissolved (mg/L)	0.122	0.0940	0.0787		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	<0.010	0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	0.000039	0.000060	<0.000010		
	Calcium (Ca)-Dissolved (mg/L)	76.4	88.9	65.7		
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	0.000010	<0.000010		
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Cobalt (Co)-Dissolved (mg/L)	0.00037	<0.00010	<0.00010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2004753-1	L2004753-2	L2004753-3		
	Description	WATER	WATER	WATER		
	Sampled Date	10-OCT-17	10-OCT-17	10-OCT-17		
	Sampled Time	14:45	15:45	16:57		
	Client ID	23089171010001	23089171010002	23089171010003		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	0.0184	0.00126	0.00042		
	Iron (Fe)-Dissolved (mg/L)	0.028	<0.010	0.227		
	Lead (Pb)-Dissolved (mg/L)	0.000758	0.000090	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	0.0029	<0.0010	0.0025		
	Magnesium (Mg)-Dissolved (mg/L)	29.0	29.6	27.2		
	Manganese (Mn)-Dissolved (mg/L)	0.0696	0.00663	0.0134		
	Molybdenum (Mo)-Dissolved (mg/L)	0.000794	0.000247	0.000809		
	Nickel (Ni)-Dissolved (mg/L)	0.00211	0.00077	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	1.65	1.55	1.03		
	Rubidium (Rb)-Dissolved (mg/L)	0.00122	0.00416	0.00050		
	Selenium (Se)-Dissolved (mg/L)	0.000055	0.000261	<0.000050		
	Silicon (Si)-Dissolved (mg/L)	6.21	5.34	6.78		
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Sodium (Na)-Dissolved (mg/L)	18.0	15.2	4.48		
	Strontium (Sr)-Dissolved (mg/L)	0.112	0.102	0.111		
	Sulfur (S)-Dissolved (mg/L)	13.6	6.96	9.11		
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)	0.000016	0.000035	<0.000010		
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)	0.00054	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Uranium (U)-Dissolved (mg/L)	0.000807	0.000484	0.000646		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	0.0543	0.0485	0.0072		
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Boron (B)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2004753-1, -2, -3
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2004753-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-AUTO-WT	Water	Automated Speciated Alkalinity	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SPECIATED-WT	Water	pH Measurement for Spec. Alk	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-IC-N-WT	Water	Bromide in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

ALS Test Code	Matrix	Test Description	Method Reference**
F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N

Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

81854

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: MATRIX SOLUTIONS INC.
31 Beacon Point Court
Breslau ON N0B 1M0

Contact: Scott Miller

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-AUTO-WT	**Water**							
Batch R3857326								
WG2640384-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			101.2		%		80-120	16-OCT-17
WG2640384-2 LCS								
Alkalinity, Total (as CaCO3)			102.9		%		85-115	16-OCT-17
WG2640384-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	16-OCT-17
Batch R3858293								
WG2641806-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			95.8		%		80-120	17-OCT-17
WG2641806-4 DUP		**L2004753-2**						
Alkalinity, Total (as CaCO3)		308	296		mg/L	3.8	20	17-OCT-17
WG2641806-2 LCS								
Alkalinity, Total (as CaCO3)			99.3		%		85-115	17-OCT-17
WG2641806-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	17-OCT-17
ALK-SPECIATED-WT	**Water**							
Batch R3852519								
WG2636416-14 LCS								
pH			7.00		pH units		6.9-7.1	11-OCT-17
BR-IC-N-WT	**Water**							
Batch R3853963								
WG2637481-9 DUP		**L2004753-2**						
Bromide (Br)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	12-OCT-17
WG2637481-7 LCS								
Bromide (Br)			101.7		%		85-115	12-OCT-17
WG2637481-6 MB								
Bromide (Br)			<0.10		mg/L		0.1	12-OCT-17
WG2637481-10 MS		**L2004753-2**						
Bromide (Br)			100.2		%		75-125	12-OCT-17
CL-IC-N-WT	**Water**							
Batch R3853963								
WG2637481-9 DUP		**L2004753-2**						
Chloride (Cl)		31.6	31.6		mg/L	0.0	20	12-OCT-17
WG2637481-7 LCS								
Chloride (Cl)			100.8		%		90-110	12-OCT-17
WG2637481-6 MB								
Chloride (Cl)			<0.50		mg/L		0.5	12-OCT-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT	**Water**							
Batch R3853963								
WG2637481-10 MS		**L2004753-2**						
Chloride (Cl)			99.4		%		75-125	12-OCT-17
EC-WT	**Water**							
Batch R3852519								
WG2636416-14 LCS								
Conductivity			101.8		%		90-110	11-OCT-17
WG2636416-13 MB								
Conductivity			<3.0		umhos/cm		3	11-OCT-17
F-IC-N-WT	**Water**							
Batch R3853963								
WG2637481-9 DUP		**L2004753-2**						
Fluoride (F)		0.046	0.044		mg/L	4.0	20	12-OCT-17
WG2637481-7 LCS								
Fluoride (F)			100.9		%		90-110	12-OCT-17
WG2637481-6 MB								
Fluoride (F)			<0.020		mg/L		0.02	12-OCT-17
WG2637481-10 MS		**L2004753-2**						
Fluoride (F)			95.1		%		75-125	12-OCT-17
MET-D-CCMS-WT	**Water**							
Batch R3852586								
WG2637230-2 LCS								
Aluminum (Al)-Dissolved			97.1		%		80-120	12-OCT-17
Antimony (Sb)-Dissolved			107.4		%		80-120	12-OCT-17
Arsenic (As)-Dissolved			100.9		%		80-120	12-OCT-17
Barium (Ba)-Dissolved			104.0		%		80-120	12-OCT-17
Beryllium (Be)-Dissolved			95.3		%		80-120	12-OCT-17
Bismuth (Bi)-Dissolved			97.4		%		80-120	12-OCT-17
Boron (B)-Dissolved			89.5		%		80-120	12-OCT-17
Cadmium (Cd)-Dissolved			100.6		%		80-120	12-OCT-17
Calcium (Ca)-Dissolved			99.3		%		80-120	12-OCT-17
Cesium (Cs)-Dissolved			105.0		%		80-120	12-OCT-17
Chromium (Cr)-Dissolved			99.8		%		80-120	12-OCT-17
Cobalt (Co)-Dissolved			99.99		%		80-120	12-OCT-17
Copper (Cu)-Dissolved			97.1		%		80-120	12-OCT-17
Iron (Fe)-Dissolved			97.7		%		80-120	12-OCT-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3852586								
WG2637230-2 LCS								
Lead (Pb)-Dissolved			99.6		%		80-120	12-OCT-17
Lithium (Li)-Dissolved			106.0		%		80-120	12-OCT-17
Magnesium (Mg)-Dissolved			99.7		%		80-120	12-OCT-17
Manganese (Mn)-Dissolved			102.5		%		80-120	12-OCT-17
Molybdenum (Mo)-Dissolved			101.6		%		80-120	12-OCT-17
Nickel (Ni)-Dissolved			99.1		%		80-120	12-OCT-17
Phosphorus (P)-Dissolved			103.3		%		80-120	12-OCT-17
Potassium (K)-Dissolved			103.0		%		80-120	12-OCT-17
Rubidium (Rb)-Dissolved			103.4		%		80-120	12-OCT-17
Selenium (Se)-Dissolved			98.1		%		80-120	12-OCT-17
Silicon (Si)-Dissolved			99.3		%		60-140	12-OCT-17
Silver (Ag)-Dissolved			104.4		%		80-120	12-OCT-17
Sodium (Na)-Dissolved			101.3		%		80-120	12-OCT-17
Strontium (Sr)-Dissolved			99.5		%		80-120	12-OCT-17
Sulfur (S)-Dissolved			92.9		%		80-120	12-OCT-17
Tellurium (Te)-Dissolved			99.4		%		80-120	12-OCT-17
Thallium (Tl)-Dissolved			98.0		%		80-120	12-OCT-17
Thorium (Th)-Dissolved			98.7		%		80-120	12-OCT-17
Tin (Sn)-Dissolved			102.2		%		80-120	12-OCT-17
Titanium (Ti)-Dissolved			93.6		%		80-120	12-OCT-17
Tungsten (W)-Dissolved			101.7		%		80-120	12-OCT-17
Uranium (U)-Dissolved			101.8		%		80-120	12-OCT-17
Vanadium (V)-Dissolved			100.1		%		80-120	12-OCT-17
Zinc (Zn)-Dissolved			93.7		%		80-120	12-OCT-17
Zirconium (Zr)-Dissolved			100.4		%		80-120	12-OCT-17
WG2637230-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	12-OCT-17
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	12-OCT-17
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	12-OCT-17
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	12-OCT-17
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	12-OCT-17
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	12-OCT-17
Boron (B)-Dissolved			<0.010		mg/L		0.01	12-OCT-17
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	12-OCT-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3852586								
WG2637230-1 MB								
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	12-OCT-17
Cesium (Cs)-Dissolved			<0.000010		mg/L		0.00001	12-OCT-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	12-OCT-17
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	12-OCT-17
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	12-OCT-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	12-OCT-17
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	12-OCT-17
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	12-OCT-17
Magnesium (Mg)-Dissolved			<0.050		mg/L		0.05	12-OCT-17
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	12-OCT-17
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	12-OCT-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	12-OCT-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	12-OCT-17
Potassium (K)-Dissolved			<0.050		mg/L		0.05	12-OCT-17
Rubidium (Rb)-Dissolved			<0.00020		mg/L		0.0002	12-OCT-17
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	12-OCT-17
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	12-OCT-17
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	12-OCT-17
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	12-OCT-17
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	12-OCT-17
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	12-OCT-17
Tellurium (Te)-Dissolved			<0.00020		mg/L		0.0002	12-OCT-17
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	12-OCT-17
Thorium (Th)-Dissolved			<0.00010		mg/L		0.0001	12-OCT-17
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	12-OCT-17
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	12-OCT-17
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	12-OCT-17
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	12-OCT-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	12-OCT-17
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	12-OCT-17
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	12-OCT-17
NO2-IC-WT	**Water**							

Quality Control Report

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-WT		**Water**							
Batch	**R3853963**								
WG2637481-9	**DUP**		**L2004753-2**						
Nitrite (as N)			<0.010	<0.010	RPD-NA	mg/L	N/A	25	12-OCT-17
WG2637481-7	**LCS**								
Nitrite (as N)				99.5		%		70-130	12-OCT-17
WG2637481-6	**MB**								
Nitrite (as N)				<0.010		mg/L		0.01	12-OCT-17
WG2637481-10	**MS**		**L2004753-2**						
Nitrite (as N)				100.9		%		70-130	12-OCT-17
NO3-IC-WT		**Water**							
Batch	**R3853963**								
WG2637481-9	**DUP**		**L2004753-2**						
Nitrate (as N)			1.83	1.81		mg/L	1.0	25	12-OCT-17
WG2637481-7	**LCS**								
Nitrate (as N)				100.2		%		70-130	12-OCT-17
WG2637481-6	**MB**								
Nitrate (as N)				<0.020		mg/L		0.02	12-OCT-17
WG2637481-10	**MS**		**L2004753-2**						
Nitrate (as N)				99.4		%		70-130	12-OCT-17
SO4-IC-N-WT		**Water**							
Batch	**R3853963**								
WG2637481-9	**DUP**		**L2004753-2**						
Sulfate (SO4)			20.6	20.6		mg/L	0.3	20	12-OCT-17
WG2637481-7	**LCS**								
Sulfate (SO4)				100.9		%		90-110	12-OCT-17
WG2637481-6	**MB**								
Sulfate (SO4)				<0.30		mg/L		0.3	12-OCT-17
WG2637481-10	**MS**		**L2004753-2**						
Sulfate (SO4)				100.2		%		75-125	12-OCT-17
SOLIDS-TDS-WT		**Water**							
Batch	**R3852662**								
WG2635778-2	**LCS**								
Total Dissolved Solids				95.9		%		85-115	11-OCT-17
WG2635778-1	**MB**								
Total Dissolved Solids				<10		mg/L		10	11-OCT-17
TKN-WT		**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	**Water**							
Batch R3856787								
WG2640062-10 LCS								
Total Kjeldahl Nitrogen			90.6		%		75-125	16-OCT-17
WG2640062-9 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	16-OCT-17

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

COC # M 81854

Lab Submitted to : ALS Waterloo
Lab Agreement no : Q58595
Lab Job ID:

Invoice to: Require Report: Y ✓ N

Company Name: MATRIX SOLUTIONS
Contact Name: Scott Miller
Address:
PC:
Phone / Fax#: Ph: Fax:
AFE #: 147164

Copy of Report to:
Matrix Solutions - Data Management
Suite 200, 150 - 13th Avenue SW
Calgary, Alberta, Canada
T2R 0V2
Ph: 403-237-0606 Fax: 403-263-2493
Fax draft copy of invoice to Matrix Solutions Inc.

Matrix Project # : 23089
Matrix Proj. Name: Clair Maltby CEIS
Location:
Sampler's Name(s): S.M / D.A.

REGULATORY REQUIREMENTS: (check)
- [ ] Alberta Tier 1
- [ ] SPIGEC
- [ ] Freshwater Aquatic Life (Low Level Metals)
- [ ] Canadian Drinking Water
- [ ] BC Regs
- [x] Other: ODWQS

SERVICE REQUESTED:
- [ ] RUSH (Please ensure you contact the lab) Due Date:
- [x] REGULAR Turnaround

REPORT DISTRIBUTION: always send to data_management@matrix-solutions.com
- [x] Additional Emails: smiller@matrix-solutions.com

Analysis Required: Q58595

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (cm)	Sample Type	Date/Time Sampled	Quantity # of Jars	Quantity # of Bags	Q58595	Lab Sample Number
1	23089171010001	MW-07	—	WATER	Oct 10/17 14:45	3	—	X	
2	23089171010002	MW-03-S	—	WATER	Oct 10/17 15:45	3	—	X	
3	23089171010003	MW03-D	—	WATER	Oct 10/17 16:57	3	—	X	
4									
5									
6									
7									
8	L2004753 ALS								
9									
10									
11									
12									
13									
14									
15									

L2004753-COFC

*For metals in water samples indicate if you want Total (T), Dissolved (D) or Extractable (E) as part of "Analysis Required"

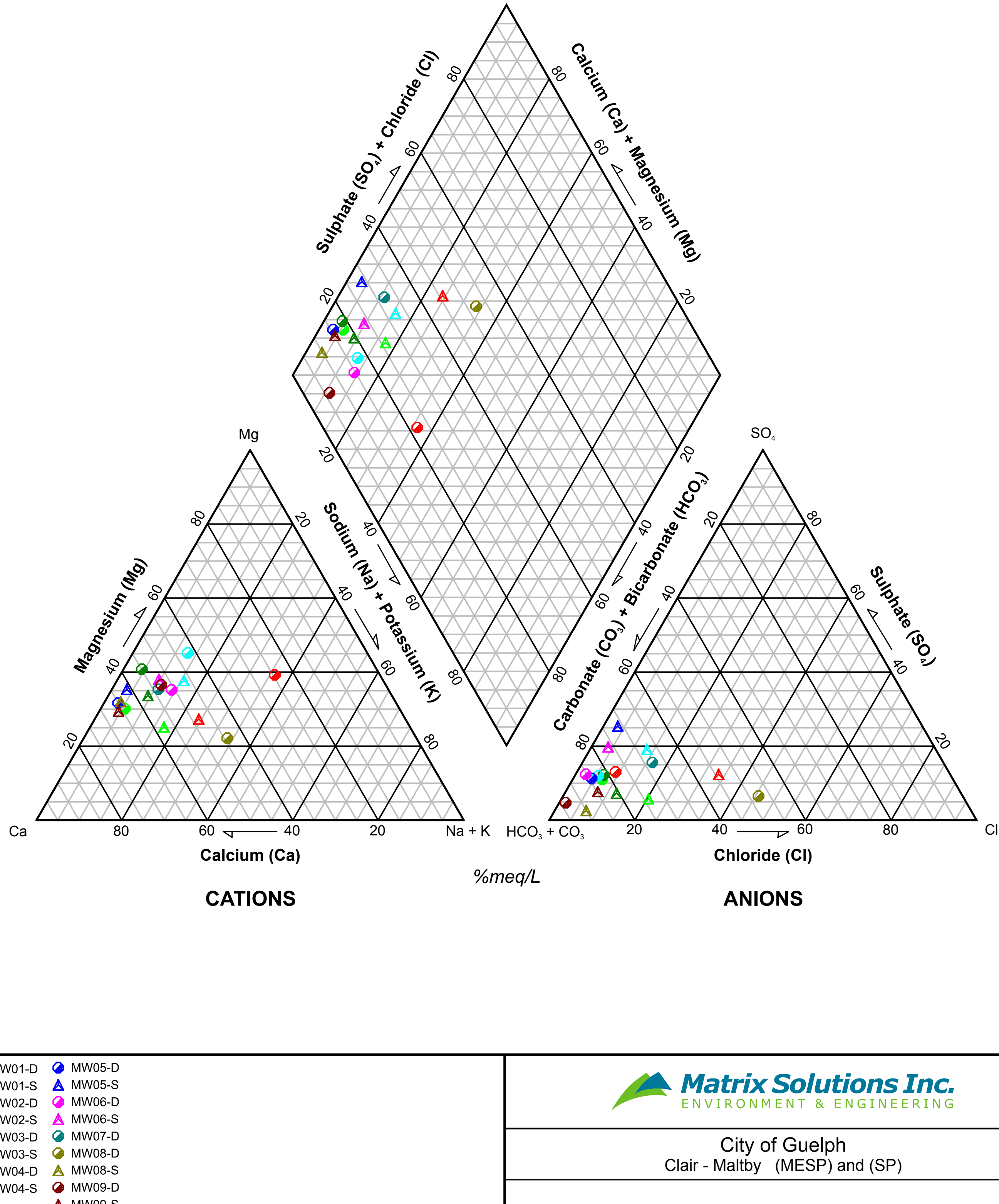
Preserved/Filtered

Relinquished by: Scott Miller Date/Time: Oct 11/17 9:10
Signature: [signature]

Received by: [initials] Date/Time: 11-Oct-17 9:10
Signature: T: 4.7°C

COMMENTS/SPECIAL INSTRUCTIONS: Dissolved metals were field filtered. Please see Q58595 for specific Analyses

Appendix GW-5:
Hydraulic Conductivity Test Results



Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

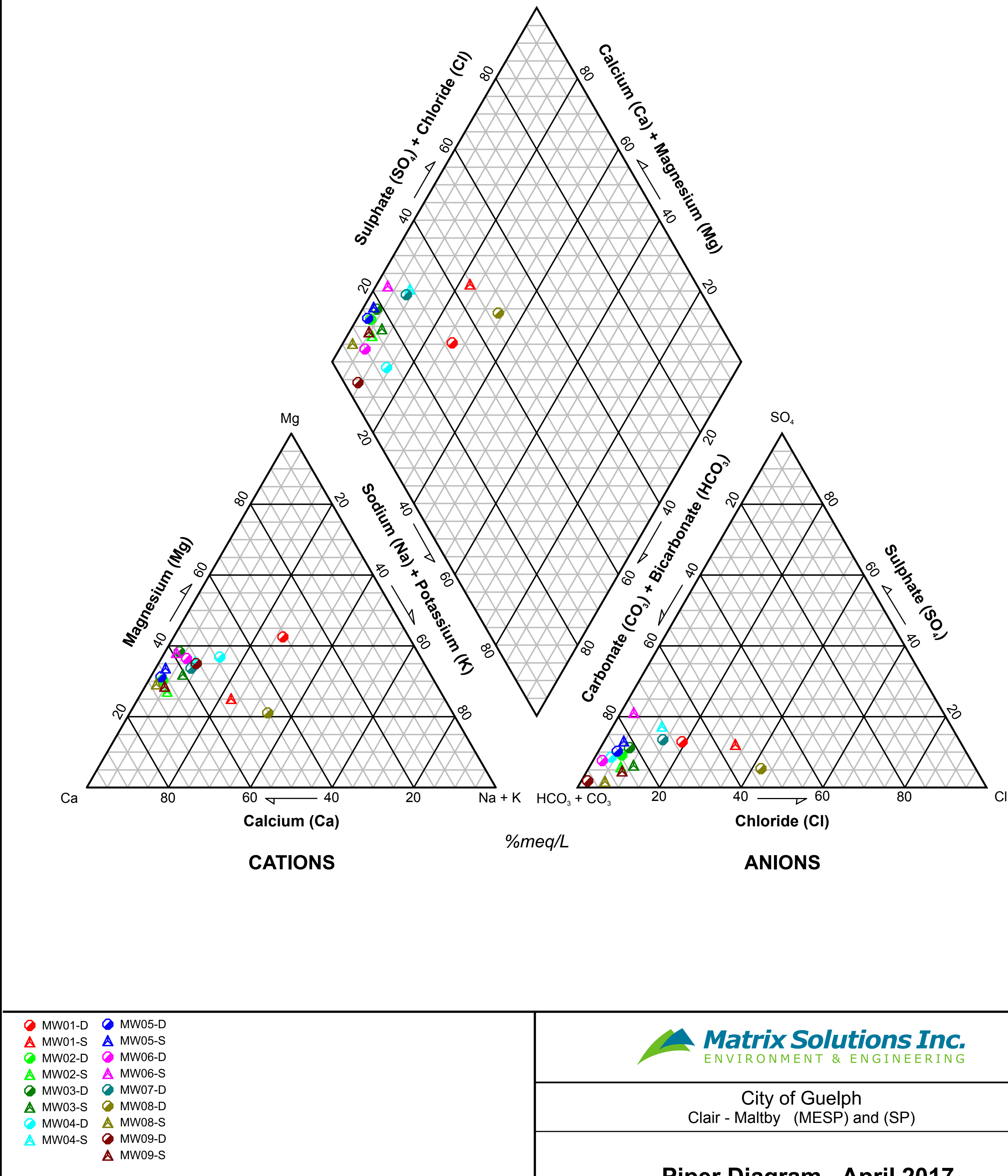
City of Guelph
Clair - Maltby (MESP) and (SP)

Piper Diagram - October 2016

Date: Jan 2018	Project: 23089-PD-18	Technical: S. Miller	Reviewer: D. Abbey

Figure GW5.1

F:\23089\06 Field\piper\pipers.cdr



Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

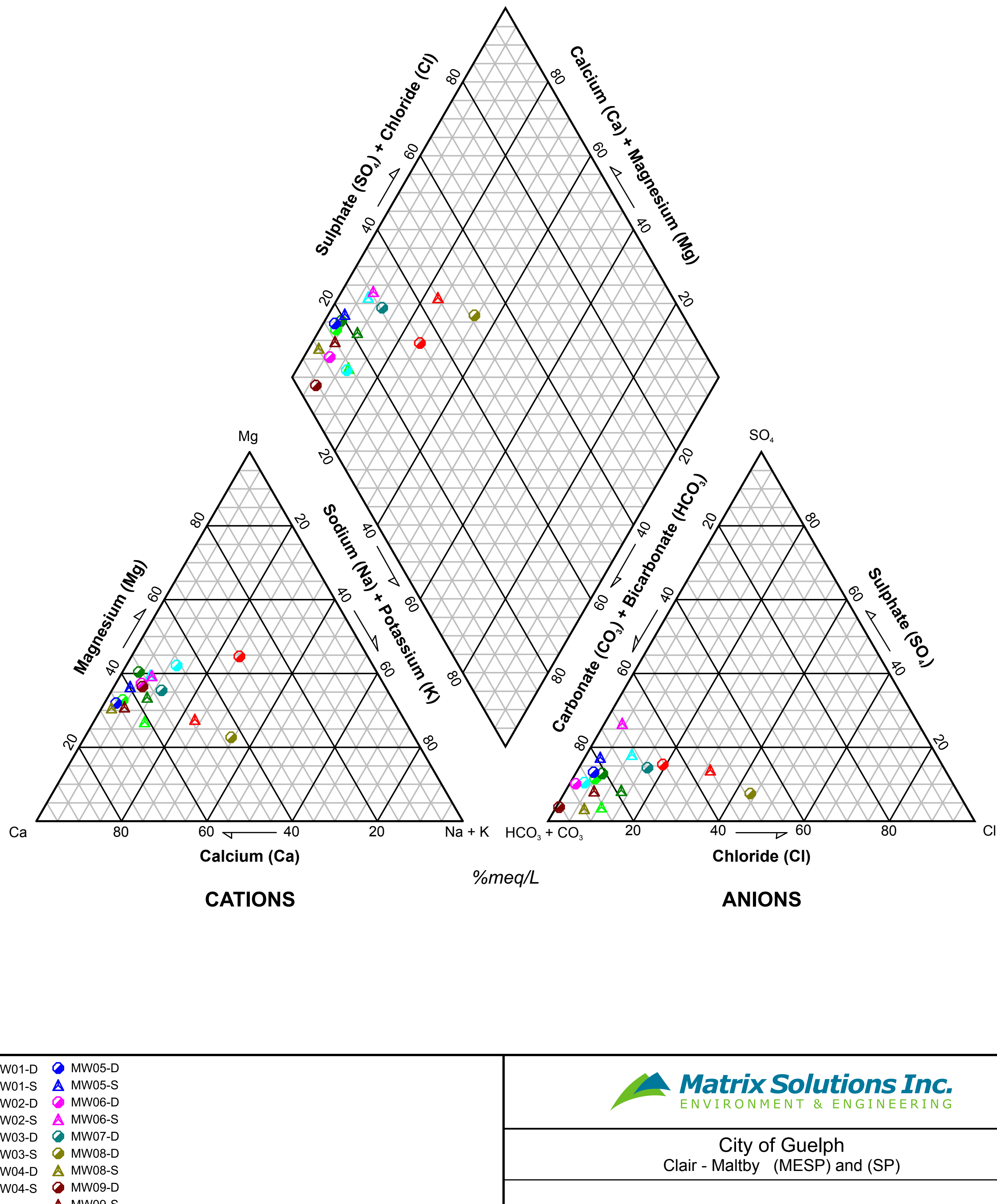
City of Guelph
Clair - Maltby (MESP) and (SP)

Piper Diagram - April 2017

Date:	Project:	Technical:	Reviewer:
Jan 2018	23089-PD-18	S. Miller	D. Abbey

Figure
GW5.2

F:\23089\06 Field\piper\pipers.cdr



Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

City of Guelph
Clair - Maltby (MESP) and (SP)

Piper Diagram - October 2017

Date: Jan 2018	Project: 23089-PD-18	Technical: S. Miller	Reviewer: D. Abbey

Figure GW5.3

F:\23089\06 Field\piper\pipers.cdr

Appendix NH-1:
List of Background Reports and Sources for Screened Data

Appendix NH-1

List of Background Reports and Sources Screened for Data

Appendix NH-1

List of Background Studies Screened

Studies that contributed data to the CEIS:

Aboud and Associates Inc. (2010).
1897 Gordon Street (Bird Property) - Environmental Impact Study and Tree Conservation Plan (2nd Submission). Prepared for Thomasfield Homes, September 3, 2010. 145 pp.

Aboud and Associates Inc. and GM BluePlan Engineering. (2010).
2013/2014 Monitoring Report, Bird Landing Subdivision, City of Guelph. Prepared for Bird Landing Subdivision, November 10, 2014. 109 pp.

Aboud and Associates Inc., Banks Groundwater Engineering Limited, and Gamsby and Mannerow Limited. (2013).
Environmental Implementation Report, Bird Landing Subdivision, Draft Plan of Subdivision 23T-08505 (1897 Gordon Street), City of Guelph. Prepared for Thomasfield Homes Limited, February 13, 2013. 995 pp.

Black, Shoemaker, Robinson and Donaldson, Hoyle, K. J., North-South Environmental Inc., Stantec Consulting. (2005).
West Minster Wood East, Phase 2, Environmental Implementation Report. First Draft. 33pp.

Coulson, D., Ertel, P. and Michalak, L. (1993).
Cranberry – Oil Well Bog Complex Wetland Evaluation.

Dance Environmental Inc. (2014).
Scoped E.I.S., 424 Maltby Road, Wellington County, Township of Puslinch. Prepared for Persian Investments Ltd., April 14, 2014. 94 pp.

Dougan & Associates. (2005).
Guelph Amphibian Survey Database.

LGL Limited. (2003).
Bird Property, Gordon Street, City of Guelph, Thomasfield Homes Re-Zoning Application, Environmental Overview and Impact Analysis. Received by Scott Hannah, January 20, 2003. 9 pp.

McCormick Rankin Corporation, and Gamsby and Mannerow Limited. (2003).
Victoria Road Class Environmental Assessment, Environmental Study Report. City of Guelph. 486 pp.

McEachren, J. (2012).
Maltby Road Reconstruction, Post Construction Monitoring 2012. City of Guelph. 8 pp.

Mitz, C. W. (2007).
Southgate Business Park Post-Development Water Balance: Wetland Impacts. Prepared for Joh Perks, December 4, 2007. 5 pp.

Natural Resource Solutions Inc. (2004).
Hanlon Creek Business Park, Consolidated Environmental Impact Study. Prepared for the City of Guelph, November 2004. 110 pp.

Natural Resource Solutions Inc. (2007).
Southgate Business Park, Draft Plan of Subdivision, Environmental Impact Study. Prepared for Industrial Equities Guelph Corporation, July 2007.164 pp.

Natural Resource Solutions Inc. (2009).
Hanlon Creek Business Park, Environmental Implementation Report. Prepared for the City of Guelph, February 2009. 433 pp.

Natural Resource Solutions Inc. (2010).
Maltby Road Wildlife Movement Surveys, 2009-2010 Summary Report. Prepared for the City of Guelph, July 2010. 24 pp.

Natural Resource Solutions Inc. (2011).
Maltby Road Wildlife Movement Surveys, 2009-2011 Summary Report. Prepared for the City of Guelph, June 2011. 26 pp.

Natural Resource Solutions Inc. (2012).
Species at Risk Habitat Screening - Results, 331 Clair Road, Guelph Ontario. Prepared for Acorn Developments, September 10, 2012. 12 pp.

Natural Resource Solutions Inc. (2012).
Southgate Business Park 23T-06503 Environmental Implementation Report. Prepared for Industrial Equities Guelph Corporation, February 2012. 928 pp.

Natural Resource Solutions Inc. (2012).
Southgate Business Park 23T-06503 Environmental Implementation Report, Phase 2 Addendum. Prepared for Industrial Equities Guelph Corporation, November 2012. 331 pp.

Natural Resource Solutions Inc. (2014).
Southgate Business Park Environmental Implementation Report, Phase 2 Addendum Response Package (Final Submission). Prepared for the City of Guelph, January 9, 2014. 148 pp.

Natural Resource Solutions Inc., AECOM, and Banks Groundwater Engineering Limited. (2016).
Hanlon Creek Business Park, 2013 Consolidated Monitoring Report. Prepared for the City of Guelph, January 18, 2016. 125 pp.

North-South Environmental Inc. (2001).
Environmental Impact Study, Westminster Wood East (Adam’s Farm). Prepared for Westminster Woods Ltd., July 2001. 82 pp.

North-South Environmental Inc. (2002).
West Minster Wood East, Phase 1, Environmental Implementation Report (Including Tree Conservation Plan). Prepared for Westminster Woods, March 15, 2002. 26 pp.

North-South Environmental Inc. (2014).
161, 205 and 253 Clair Road East, Guelph - Environmental Implementation Report. Prepared for Victoria Wood (Dallan) GP Inc., February 2014. 189 pp.

North-South Environmental Inc. (2016)
161, 205 and 253 Clair Road East, Guelph - Year-End Report (2013-2015). Prepared for the City of Guelph and the Grand River Conservation Authority, August 2016. 61 pp.

North-South Environmental Inc. (2015).
132 Clair Road West, Guelph - Scoped Environmental Impact Study. Prepared for Mr. Jeff Neumann, August 28, 2015. 250 pp.

Paradigm Transportation Solutions Limited, ESG International Inc. and Braun Consulting Engineers. (2003).
Clair Road Class Environmental Assessment. City of Guelph. 265 pp.

Stantec Consulting Ltd. (2007).
Dallan Lands Environmental Impact Statement. Prepared for Victoria Wood, October 2007. 77 pp.

Stantec Consulting Ltd. (2009).
Dallan Lands EIS Addendum Report. Prepared for Victoria Wood, August 2009. 77 pp.

Stantec Consulting Ltd. (2014).
23T-03507 Former Pergola Lands Subdivision Phase II: Environmental Implementation Report. Prepared for Reid's Heritage Homes, February 4, 2014. 204 pp.

Tilt, N., Ferguson, M. S., McCracken, J. D., Coulson, D., Peluch, J. and Kempf, F. (1984).
Mill Creek Wetland Evaluation.

Timmerman, A., Adams, P., Marshall, J., Weeks, G., Ursic, K. and Ursic, M. (2010).
Hall's Pond Wetland Evaluation.

Totten Sims Hubicki Associates, Engineers, Architects, Planners. (2000).
Gordon Street, Wellington Road 46, Class Environmental Assessment, Environmental Study Report, Volume One: Main Report. City of Guelph and the County of Wellington. 122 pp.

TSH Engineers Architects Planners. (2007).
Hanlon Creek Business Park - SWM Design Report. Prepared for the City of Guelph, November 2007. 188 pp.

Background Studies that were screened but did not contribute data to the CEIS:

Aboud and Associates Inc. (2010).
1897 Gordon Street (Bird Property), Draft Plan of Subdivision 23T-08505, City of Guelph, Environmental Impact Study and Tree Conservation Plan." Received by Jessica McEachren, December 9, 2010.

Aboud and Associates Inc. and Gamsby and Mannerow Limited. (2013).
Environmental Implementation Report, Addendum No. 1, Bird Landing Subdivision, Draft Plan of Subdivision 23T-08505 (1897 Gordon Street), City of Guelph. Prepared for Thomasfield Homes Limited, October 23, 2013. 56 pp.

City of Guelph. (2005).
Westminster Woods East Subdivision – File No. 23T – 02502 -Environmental Implementation Report – Terms of Reference. Prepared for the Environmental Advisory Committee, October 12, 2005. 4 pp.

City of Guelph. (2005).
Westminster Woods East Subdivision – Phase 2 – File No. 23T – 02502 -Environmental Implementation Report – Terms of Reference. Prepared for the Environmental Advisory Committee, December 14, 2005. 8 pp.

Chung and Vander Doelen Engineering Ltd. (2012).
Geotechnical Investigation, Proposed Condominium Development, 331 Clair Road East, Guelph Ontario. Prepared for Acorn Developments, May 18, 2012. 25pp.

Gamsby and Mannerow Limited. (2010).
Preliminary Servicing Strategy for the Lands South of Clair Road, City of Guelph. 27 pp.

Gamsby and Mannerow Limited. (2010).
Site Servicing and Stormwater Management Report, 1897 Gordon Street, City of Guelph. 42 pp.

Gamsby and Mannerow Limited. (2010).
Stormwater Management Addendum No. 1, 1897 Gordon Street, City of Guelph. 18 pp.

Gamsby and Mannerow Limited. (2013).
Environmental Implementation Report, Addendum No. 2, Bird Landing Subdivision, 1897 Gordon Street, Draft Plan of Subdivision 23T-08505, City of Guelph. Prepared for Thomasfield Homes Limited, December 17, 2013. 324 pp.

Gamsby and Mannerow Limited. (2013).
Stormwater Management, Final Design Report, Bird Landing Subdivision, 1897 Gordon Street, Draft Plan of Subdivision 23T-08505, City of Guelph. Revised December 17, 2013. 342 pp.

Gamsby and Mannerow Limited. (2014).
Sanitary Sewer Flow Monitoring and Servicing Report, 1897 Gordon Street, City of Guelph. 156 pp.

Gamsby and Mannerow Limited. (2014).
Sanitary Sewer Oversizing, Design Brief, Bird Landing Subdivision, 1897 Gordon Street, City of Guelph. 13 pp.

Gamsby and Mannerow Limited. (2016).
Final Design Brief, Bird Landing Subdivision (1897 Gordon Street), Draft Plan of Subdivision 23T-08505, City of Guelph. Revised May 2, 2016. 10 pp.

IBI Group. (2011).
Southgate Business Park, List of Drawings. 25 pp.

Labbé, A. (2013).
Environmental Implementation Report (EIR) February 13, 2013. Received by Stephen Aboud and Marc Garon-Nielsen, Aboud and Associates, April 5, 2013.

Natural Resource Solutions Inc. (2007).
"Southgate Business Park – 'Old' Tree Inventory." Received by Carrie Musselman, November 22, 2007. 1 pp.

Paul F. J. Eagles Planning Limited. (1993).
An Assessment of Environmental Impacts of the Springfield Golf Course on the Property of the Foundation for the Support of International Medical Training (Canada). 17 pp.

Pickett, K.
"Species at Risk Habitat Screening- Results, 331 Clair Road, Guelph Ontario." Received by Jessica Linton, November 30, 2012.

Powers, H. (2005).
Environmental Planner's Report to the Environmental Advisory Committee – Westminster Wood Subdivision Revisions. January 10, 2005. 2 pp.

Powers, H. (2005).
Environmental Planner's Report to the Environmental Advisory Committee – Westminster Wood East. January 12, 2005. 3 pp.

North-South Environmental Inc. (2002).
Westminster Woods East – Phase 1: Environmental Implementation Report (including Tree Conservation Plan). March 15, 2002.

North-South Environmental Inc. (2002).
Westminster Woods East – Environmental Impact Study Addendum. May 14, 2002.

V. A. Wood (Guelph) Inc. (2003).
Geotechnical Investigation, Gosling Gardens extension, 1897 Gordon Street, Guelph Ontario. Prepared for Thomasfield Homes Limited & Fieldgate Commercial Property Ltd., January 2013. 24 pp.

V. A. Wood (Guelph) Inc. (2004).
Preliminary Geotechnical Investigation, Proposed Residential Development, Bird Property, City of Guelph Ontario. Prepared for Gamsby and Mannerow Limited, December 2004. 23 pp.

V. A. Wood (Guelph) Inc.
"Materials Testing, Bird Property, #1897 Gordon Street, Project No. S-284, City of Guelph, Ontario." Received by Gamsby and Mannerow Limited, September 28, 2006.

Appendix NH-2:
Terrestrial Monitoring Representative Photo Log (2016 - 2017)

Appendix NH-2

Terrestrial Monitoring Representative Photo Log (2016 – 2017)

Appendix NH-2

Terrestrial Monitoring Representative Photo Log (2016 – 2017)

Photo 1.
Winter Wildlife – Deer Tracks at 2162 Gordon St.
(March 17, 2017)

Photo 2.
Winter Wildlife – Wild Turkey at 2162 Gordon St.

Photo 3.
Amphibian Movement Survey – Wood Frog on Transect 2 (March 27, 2017)

Photo 4.
Amphibian Movement Survey – Blue-spotted Salamander on Transect 3 (March 27, 2017)

Photo 5.
Amphibian Movement Survey – Midland Painted Turtle on Transect 5 (April 27, 2017)

Photo 6.
Amphibian Movement Survey – Eastern Newt on Transect 3 (October 4, 2017)

Photo 7.
Turtle Survey – Ribbon Snake (April 27, 2017)

Photo 8.
Turtle Survey – Snapping Turtle (May 17, 2017)

Photo 9.
Deciduous Forest Community (FOD) near 128 Dallan (September 22, 2016)

Photo 10.
Graminoid Organic Shallow Marsh Ecosite (MAS3) at 24 Serena Lane (September 7, 2017)

Photo 11.
Duckweed Floating-leaved Shallow Aquatic Type (SAF1-3) at 2162 Gordon Street (July 21, 2017)

Photo 12.
Water Lily – Bullhead Lily Floating-leaved Shallow Aquatic Type (SAF1-1) at 2162 Gordon Street (August 17, 2016)

Photo 13.
East side of Submerged Shallow Aquatic (SAS) Community at 1992 Gordon Street (July 21, 2016)

Photo 14.
West side of Submerged Shallow Aquatic (SAS) Community at 1992 Gordon Street (September 22, 2016)

Photo 15.
Seep at 2162 Gordon Street (March 17, 2017)

Appendix NH-3:
ELC Data Cards

Appendix NH-3

ELC Data Cards

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 24 Serena		POLYGON: 1	
	SURVEYOR(S) DW	DATE Jun 28 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☑ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	Acextree
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	4	4	phamm??

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES: 0= NONE 1= 0% < CVR 10% 2= 10 < CVR 25% 3= 25 < CVR 60% 4= CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Marsh	CODE: MA
COMMUNITY SERIES: Meadow Marsh	CODE: MAM
ECOSITE: Mineral Meadow Marsh	CODE: MAM2
VEGETATION TYPE:	CODE:
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Acextree					
frapenn					
phaaru					
songhisp					
chelglab					
sun flower					
asclsyri					
alder					
impcape					
?					
?					
scirpus					
elevent.					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 24 Serena		POLYGON: 2	
SURVEYOR(S): DW	DATE: June 28		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☑ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☑ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	2	4	Acesasa Ulame Pinstro Prupenn
2 SUB-CANOPY	3	3	Prupenn Acesasa
3 UNDERSTOREY	4	3	Prupenn Lontata ...
4 GRD. LAYER	5	3	Cargrac astmacr parusi Carexsp

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	O < 10	A 10 - 24	A 25 - 50	R > 50
STANDING SNAGS:	O < 10	R 10 - 24	R 25 - 50	N > 50
DEADFALL / LOGS:	O < 10	O 10 - 24	R 25 - 50	N > 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	☑ MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Forest	CODE: FO
COMMUNITY SERIES: Deciduous Forest	CODE: FOD
ECOSITE: Fresh-Moist Sugar Maple DF	CODE: FOD6
VEGETATION TYPE: Fresh-Moist Sugar Maple-Hardwood	CODE: FOD6-5
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Betalle	R					mitelas					
Acesasa	A					cargrac					
Ulame	O					solglqi					
Pinstro	O					maiden					
Tsucan	R					Carex sp					
carcaro		R				parusi					
Fraam	R					dryand					
Acerub	R					astmacr					
Ostvir		R				smiherb					
Prusero	R					amecan					
Prupenn	O					solbrup					
						smihisp					
						mitdip					
						eripul					
						cilate					
						triaura					
Vibalni											
Lonvil											
Vibcas	A										
Rubid											
Tiacor											
Lontata											
Prunvir											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 24 Serena		POLYGON: 3	
SURVEYOR(S): DW	DATE: 28 Jun 17	UTME	
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL	☐ ORGANIC	☐ LACUSTRINE	☑ NATURAL	☐ PLANKTON	☐ LAKE
☐ WETLAND	☑ MINERAL SOIL	☐ RIVERINE	☐ CULTURAL	☐ SUBMERGED	☐ POND
☐ AQUATIC	☐ PARENT MIN.	☐ BOTTOMLAND		☐ FLOATING-LVD.	☐ RIVER
	☐ ACIDIC BEDRK.	☐ TERRACE		☐ GRAMINOID	☐ STREAM
	☐ BASIC BEDRK.	☐ VALLEY SLOPE		☐ FORB	☐ MARSH
	☐ CARB. BEDRK.	☐ TABLELAND		☐ LICHEN	☐ SWAMP
		☐ ROLL. UPLAND		☐ BRYOPHYTE	☐ FEN
		☐ CLIFF		☑ DECIDUOUS	☐ BOG
		☐ TALUS		☐ CONIFEROUS	☐ BARREN
		☐ CREVICE / CAVE		☐ MIXED	☐ MEADOW
		☐ ALVAR			☐ PRAIRIE
		☐ ROCKLAND			☐ THICKET
		☐ BEACH / BAR			☐ SAVANNAH
		☐ SAND DUNE			☐ WOODLAND
		☐ BLUFF			☑ FOREST
					☐ PLANTATION

SITE	COVER
☐ OPEN WATER	☐ OPEN
☐ SHALLOW WATER	☐ SHRUB
☐ SURFICIAL DEP.	☑ TREED
☐ BEDROCK	

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	2	4	Poptrem / Frapenn Prusero
2 SUB-CANOPY			
3 UNDERSTOREY	4	4	rhucath lonitata frapenn
4 GRD. LAYER	5	2	caragrac cvluta, fraffla lyssal

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	A < 10	A 10 - 24	R 25 - 50	N > 50
STANDING SNAGS:	R < 10	R 10 - 24	R 25 - 50	N > 50
DEADFALL / LOGS:	R < 10	R 10 - 24	R 25 - 50	N > 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	☑ MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Forest	CODE:	FO
COMMUNITY SERIES: Deciduous Forest	CODE:	FOD
ECOSITE: Fresh-Moist Poplar-Sassafras	CODE:	FOD8
VEGETATION TYPE: Fresh-Moist Poplar Deciduous Forest	CODE:	FOD8-1
INCLUSION	CODE:	
COMPLEX	CODE:	

Notes:

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Poptrem	A					onosens					
betpopu	R					lyscil					
Prusero	O					glycrg					
frapenn	O					fraffla					
						caragrac					
						parvins					
						vitrawaf					
						euvaria					
						circlut					
						arcmin					
						viola					
rhucath											
frapenn											
lonitata											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE		POLYGON:	
	SURVEYOR(S)	DATE		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE:	CODE:
VEGETATION TYPE:	CODE:
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.	SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Kilkenny		POLYGON: 1	
SURVEYOR(S): DW	DATE: 21 Jun 17	UTME	
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☑ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☑ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE ☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			**COVER** ☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY			
2 SUB-CANOPY			
3 UNDERSTOREY			
4 GRD. LAYER			phaarun >> soldule

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:								BA:
SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	A	25 - 50	R	> 50
STANDING SNAGS:	O	< 10	O	10 - 24	O	25 - 50	R	> 50
DEADFALL / LOGS:	A	< 10	A	10 - 24	O	25 - 50	R	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Marsh	CODE: MA
COMMUNITY SERIES: Shallow Marsh	CODE: MAS
ECOSITE: Mixed Organic Shallow Marsh	CODE: MAS3
VEGETATION TYPE: Reed Canary Organic Shallow Marsh	CODE: MAS3
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Solalba					
Sawcym					
Sdpeti					

SPECIES CODE	LAYER 1	2	3	4	COLL.
pharun					
pot. sp					
del pala					
Soldule					
lemmyo.					
Cicbulb					
~~[illegible]~~					
gertobe					
Solgig					
~~[illegible]~~					
dryocu					
carlugo					
~~[illegible]~~					
~~[illegible]~~					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 12 Kilkenny		POLYGON: 2	
	SURVEYOR(S) DW	DATE 21 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	5	4	grasses soltti arecana dutt

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE:	CODE:
VEGETATION TYPE:	CODE:
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Sal alba						Solalti					
Phrmi						arecana					
Polpbals						Festruf					
						Poaprat					
						Anthc					
						Cirarv					
						allpeti					
Rhodiv											
Vitrip											
Chrolf											
Conmac											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 12 Kilkenny		POLYGON: 3	
	SURVEYOR(S): DW	DATE: 21 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☑ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☑ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	4	Acexfre >> Fraxpen Popbal
2	SUB-CANOPY			Acefre
3	UNDERSTOREY	4	4	Rhacat Rhafran
4	GRD. LAYER	5	3	Glystri Carlac

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:								BA:
SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	A	25 - 50	R	> 50
STANDING SNAGS:	O	< 10	O	10 - 24	O	25 - 50	R	> 50
DEADFALL / LOGS:	A	< 10	A	10 - 24	O	25 - 50	R	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG		MID-AGE	✓	MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Swamp	CODE: SW
COMMUNITY SERIES: Deciduous Swamp	CODE: SWD
ECOSITE: Maple Mineral Deciduous Swamp	CODE: SWD3
VEGETATION TYPE: Swamp Maple Mineral Deciduous Swamp	CODE: SWD3-3
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Fraxpen						arecom					
Acefre						galobt					
Salalba						onosen					
Acerub						glystri					
Ulmame						cirlut					
Popbal						solalt					
						eupmac					
						fravir					
						solrug					
						oxastr					
						parqui					
						hydvir					
						allpet					
						cargra					
						carlupu					
						impcap					
						geucan					
						elycan					
						gerrob					
						solgig					
						aritri					
						drycli					
						lapcan					
						lyscil					
						equarv					
Rhacat						menarv					
Rhafran						schtab					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 12 Kilkenny		POLYGON: 4	
	SURVEYOR(S) DW	DATE 21 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☑ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			Poptrem > Prusero Ulmame Frapenn
2	SUB-CANOPY			
3	UNDERSTOREY	4	3	rhucath Loncatata Frapenn Crataeg
4	GRD. LAYER			Cirlute Fravirg Parinse Solalti

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:								BA:
SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	R	25 - 50	N	> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:	A	< 10	A	10 - 24	A	25 - 50	R	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Forest	CODE: FO
COMMUNITY SERIES: Deciduous Forest	CODE: FOD
ECOSITE: Fresh Moist Poplar - Sassafras	CODE: FOD8
VEGETATION TYPE: Fresh-Moist Poplar Deciduous Forest	CODE: FOD8-1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Poptrem						cirlute					
Pruser0						fravirg					
Frapenn						toxrydb					
Ulmame						Symnovi					
						Geucana					
						Parinse					
						Solalti					
						Pyrcoll					
						Friaura					
Pruvirg											
Frapenn											
Loncatat											
rhucath											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 12 Kilkenny		POLYGON: 5	
SURVEYOR(S): DW	DATE: 21 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☑ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	4	4	glysept > typlat scivali sususv

HT CODES: 1 = >25 m 2 = 10<HT ≤25 m 3 = 2<HT ≤10 m 4 = 1<HT ≤2 m 5 = 0.5<HT ≤1 m 6 = 0.2<HT ≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Marsh	CODE: MA
COMMUNITY SERIES: Shallow Marsh	CODE: MAS
ECOSITE: Mineral Shallow Marsh	CODE: MAS2
VEGETATION TYPE: Cattail Mineral Shallow Marsh	CODE: MAS2-1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
alisplan					
typlat					
poa sp					
glycstri					
lemmplenc					
rhuma					
typang					
iriveis					
Sldulc					
eqarv					
scival					
sususv					
ephir					
lycame					
sparg.					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 12 Kilkenny		POLYGON: 6	
	SURVEYOR(S): DW	DATE: 21 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL	☐ ORGANIC	☐ LACUSTRINE	☐ NATURAL	☐ PLANKTON	☐ LAKE
☐ WETLAND	☑ MINERAL SOIL	☐ RIVERINE	☑ CULTURAL	☐ SUBMERGED	☐ POND
☐ AQUATIC	☐ PARENT MIN	☐ BOTTOMLAND		☐ FLOATING-LVD	☐ RIVER
	☐ ACIDIC BEDRK	☐ TERRACE		☐ GRAMINOID	☐ STREAM
	☐ BASIC BEDRK	☐ VALLEY SLOPE		☑ FORB	☐ MARSH
	☐ CARB. BEDRK	☐ TABLELAND		☐ LICHEN	☐ SWAMP
		☐ ROLL. UPLAND		☐ BRYOPHYTE	☐ FEN
		☐ CLIFF		☐ DECIDUOUS	☐ BOG
		☐ TALUS		☐ CONIFEROUS	☐ BARREN
SITE		☐ CREVICE / CAVE	**COVER**	☐ MIXED	☑ MEADOW
☐ OPEN WATER		☐ ALVAR	☑ OPEN		☐ PRAIRIE
☐ SHALLOW WATER		☐ ROCKLAND	☐ SHRUB		☐ THICKET
☑ SURFICIAL DEP.		☐ BEACH / BAR	☐ TREED		☐ SAVANNAH
☐ BEDROCK		☐ SAND DUNE			☐ WOODLAND
		☐ BLUFF			☐ FOREST
					☐ PLANTATION

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY			
2 SUB-CANOPY			
3 UNDERSTOREY			
4 GRD. LAYER	4	4	solalti poapra ? = asoacan = brotnin

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR 10% 2 = 10 < CVR 25% 3 = 25 < CVR 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Meadow	CODE: CUM
ECOSITE: Mineral Cultural Meadow	CODE: CUM1
VEGETATION TYPE:	CODE: CUM1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
fraper						solalti					
poapratis						eqarvard					
junipean						asoacan					
						vikcrac					
						cirarvi					
						arcleppa					
						rushy?					
						scipendu					
						brotnin					
Cont'd											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 12 Kilkenny		POLYGON: 7	
	SURVEYOR(S) DW	DATE 21 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☑ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	4	Acesasa fraame fraggra prusero
2	SUB-CANOPY	3	3	Acesasa fraame Ostvirg
3	UNDERSTOREY	4	3	rhocath rhafran lonbarb
4	GRD. LAYER	5	3	parinse acesasa toxrydt moss arctlapp

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:								BA:
SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	R	25 - 50	N	> 50
STANDING SNAGS:	O	< 10	R	10 - 24	R	25 - 50	N	> 50
DEADFALL / LOGS:	O	< 10	R	10 - 24	R	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

	CODE:
COMMUNITY CLASS: Forest	FO
COMMUNITY SERIES: Deciduous Forest	FOD
ECOSITE: Dry-Fresh Sugar Maple DF	FOD5
VEGETATION TYPE: Dry-Fresh Sugar Maple-White Ash DF	FOD5-8
INCLUSION	
COMPLEX	

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Popgran						geulriv					
fraame						toxrydt					
Acesasa						carfoe					✓
Aceneg						carrda					
ostvirg						arctlapp					
Fraggra						solaltt					
prusero						geucan					
ulmame						parinse					
						eupmac					
						sancan					
						euphel					
						ostvirg					
parinse											
vitripa											
lonbarb											
fraame											
rhafran											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 12 Kilkenny		POLYGON 8	
	SURVEYOR(S)	DATE		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☑ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	4	Fraxinus, Prob...
2	SUB-CANOPY	3	3	Rhamnus, Fraxinus
3	UNDERSTOREY	4	3	Fraxinus, Rhamnus
4	GRD. LAYER	6	1	Lycopus, Carex sp, moss

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	✓ MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Swamp	CODE: SW
COMMUNITY SERIES: Deciduous Swamp	CODE: SWD
ECOSITE: Mineral Deciduous Swamp	CODE: SWD2
VEGETATION TYPE: Green Ash Mineral Deciduous Swamp	CODE: SWD2-2
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Fraxinus						Lycopus					
						Carex sp					
						moss					
Fraxinus											
Rhamnus											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 12 Kilheim		POLYGON: 97	
SURVEYOR(S): DW	DATE: 21 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☑ WOODLAND ☐ FOREST ☐ PLANTATION

SITE	COVER
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK	☐ OPEN ☑ SHRUB ☑ TREED

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	3	4	fraxpen > prunser poptrem ulmame
2 SUB-CANOPY			
3 UNDERSTOREY	2	3	fraxpen rhacat rhocath lonicera
4 GRD. LAYER	5	4	solalti cirvulata symnova poaprat

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	A	< 10	R	10 - 24	N	25 - 50	N	> 50
STANDING SNAGS:	R	< 10	R	10 - 24	N	25 - 50	N	> 50
DEADFALL / LOGS:	O	< 10	R	10 - 24	R	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER	✓	YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Woodland	CODE: CUW
ECOSITE: Mineral Cultural Woodland	CODE: CUW1
VEGETATION TYPE:	CODE: CUW1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
fraxpen						solalti					
prunser						prunvir					
poptrem						sol					
rhacath						cirvulata					
ulmame						symnova					
parthv						solgig					
						dactglom					
						echimurica					
						chalbum					
						asturvip					
rhacath											
rhamcath											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: VB-Kilkenny		POLYGON: 10	
	SURVEYOR(S): DW	DATE: 21 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☑ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	2	3	fraxpen >> acexfre
2 SUB-CANOPY	3	3	rhacath fraxpen
3 UNDERSTOREY	4	4	rhacath >> rhocath
4 GRD. LAYER	5	3	glysti arecana cvlute impcap

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	A < 10	A 10 - 24	O 25 - 50	R > 50
STANDING SNAGS:	O < 10	A 10 - 24	A 25 - 50	R > 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	☑ MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Swamp	CODE: SW
COMMUNITY SERIES: Deciduous Swamp	CODE: SWD
ECOSITE: Ash Mineral Deciduous Swamp	CODE: SWD2
VEGETATION TYPE: Green Ash Mineral Deciduous Swamp	CODE: SWD2-2
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
fraxpen						arecana					
acexfre						cvlute					
						cangran					
						equisarve					
						phlarun					
						eupmacu					
						glysti					
						glyscali					
						galpalu					
						lonobsc					
						carstip					
						phragm					
						solidula					
						impcap					
						allpeti					
vitrich											
rhacath											

EAB - tree DB

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 2162 Gordon			POLYGON:	
SURVEYOR(S): DW		DATE: 28 Jun 17		UTME
START	END		UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☑ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	4	Acexfre
2	SUB-CANOPY			
3	UNDERSTOREY	4	1	corstol rhafran rhacath soldisc
4	GRD. LAYER	5	4	impcap phaaru galpalu

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:							BA:	
SIZE CLASS ANALYSIS:	O	< 10	O	10 - 24	O	25 - 50	R	> 50
STANDING SNAGS:	N	< 10	N	10 - 24	N	25 - 50	N	> 50
DEADFALL / LOGS:	O	< 10	R	10 - 24	N	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Swamp	CODE: SW
COMMUNITY SERIES: Deciduous Swamp	CODE: SWD
ECOSITE: Mineral Deciduous Swamp	CODE: SWD3
VEGETATION TYPE: Swamp Maple Mineral Dec. Swamp	CODE: SWD3-3
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	1	2	3	4	COLL.	SPECIES CODE	1	2	3	4	COLL.
Acexfre						impcap					
Ulmpumi						astpuni					
						typangu					
						astlanc					
						phaaru					
						glystri					
						bidfron					
						soldulc					
						poapalu					
						galpalu					
						carretr					
						leeoryz					
						equarv					
						lycuni					
						calsep					
						cicbulb					
						polamph					
						carhyst					
						menarv					
soldisc											
rhafran											
vitripa											
corstol											
rhacath											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 2162 Gordon		POLYGON: 2	
	SURVEYOR(S) DW	DATE 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☒ WETLAND ☐ AQUATIC	☐ ORGANIC ☒ MINERAL SOIL ☐ PARENT MIN ☐ ACID C BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☒ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☒ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☒ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☒ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☒ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	3	Saldisc Salpeti Salpurp
2	SUB-CANOPY			
3	UNDERSTOREY	4	4	corstol
4	GRD. LAYER	5	4	unicope phrarun gal palu Scheltr

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Swamp	CODE: SW
COMMUNITY SERIES: Thicket Swamp	CODE: SWT
ECOSITE: Mineral Thicket Swamp	CODE: SWT
VEGETATION TYPE: Willow Mineral Thicket Swp	CODE: SWT2-2
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Saldisc						scheltr					
thnoccu						galpalu					
Salpurp						daucaro					
rhahar						dipfull					
						asthirc					
						ranpalu					
						impcapt					
						symoffi					
						phalaru					
						parvase					
						geuurba					
						anecana					
						fravirg					
						solcanad					
						lupcope					
Salpeti											
Corstol											
rhahar											
lonbelta											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 2162 Gordon		POLYGON: 3	
	SURVEYOR(S) DW	DATE 28 June 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	3	1	Ulpumi thuocci
2 SUB-CANOPY			
3 UNDERSTOREY	4	2	corstol, lonitatu
4 GRD. LAYER	5	4	Solidalto gramis chr leuc

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR 10% 2 = 10 < CVR 25% 3 = 25 < CVR 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural meadow	CODE: CUM
ECOSITE: Mineral Cultural meadow	CODE: CUM1
VEGETATION TYPE: Dry-Moist Old Field Meadow	CODE: CUM1-1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Ulpumi						Solialto				A	
thuocci						daucaro					
						chr leuc					
						euphorbia					
						dagful					
						phlprat					
						pueceiu					
						melyp					
						dusstr					
						Soldag					
						erigann					
						ellrepen					
						astlanc					
						mcssp					
lonitatu											
corstol											
viburdune											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE 2162 Gordon		POLYGON: 4	
SURVEYOR(S) DW	DATE 28 June 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☑ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	4	Ulmpumi Acesasa
2	SUB-CANOPY			Ulmpumi Thuocci
3	UNDERSTOREY	4	1	Lonbata Corstol
4	GRD. LAYER	5	4	Solalti bromin [illegible] Leucanth

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES: 0= NONE 1= 0% < CVR 10% 2= 10 < CVR 25% 3= 25 < CVR 60% 4= CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE:	CODE:
VEGETATION TYPE: Hedgerow	CODE: H
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Ulmpumi						allpetr					
Acesasa						[illegible]					
						parthen					
						[illegible]					
						leucant					
						Solalti					
						acesvir					
						daucaro					
						bromin					
						[illegible]					
						dracarg					
						[illegible]					
						[illegible]					
corstol			R								
lonbata			R								

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 2162 Gordon		POLYGON: 5	
	SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☑ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☑ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	Acefrc Salsp Acenegu
2	SUB-CANOPY	4	4	typang >> typlati
3	UNDERSTOREY	5	2	phrahun Soldule polamph galpalu
4	GRD. LAYER	7	2	lemminor

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Marsh	CODE: MA
COMMUNITY SERIES: Shallow Marsh	CODE: MAS
ECOSITE: Organic Shallow Marsh	CODE: MAS3
VEGETATION TYPE: Cattail Organic Shallow Marsh	CODE: MAS3-1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Acexfrei						typangu					
Acenegu						ohisin?					
Saldisc?						carlacu					
						polamph					
						cicbulb					
						lycame					
						typlati					
						eleplau?					
						phrarun					
						cuscre?					
						epilanc?					
						astlanc					
						eupmacu					
						galpalu					
						phoafr?					
						phytrin?					
						lysimachia (cultivar?)					
						cicbulb					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 2162 Gordon		POLYGON: 6	
	SURVEYOR(S): DW	DATE: 29 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☑ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☑ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN: > GREATER THAN: = ABOUT EQUAL TO)
1	CANOPY	3	4	corstol >> lontata soldisc
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	5	1	equarv broffi glyshi fraam

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m

CVR CODES 0 = NONE 1 = 0% < CVR 10% 2 = 10 < CVR 25% 3 = 25 < CVR 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Swamp	CODE: SW
COMMUNITY SERIES: Thicket Swamp	CODE: SWT
ECOSITE: Mineral Thicket Swamp	CODE: SWT2
VEGETATION TYPE: Red osier Mineral Thicket Swamp	CODE: SWT2-5
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
soldisc	R				
lontata	R				
corstol	D				

SPECIES CODE	LAYER 1	2	3	4	COLL.
broffi					
galpalu					
leilan					
panvir					
impcap					
solalt					
astlan					
glyshi					
dryaust					
astpuni					
viccra					
daucaro					
fraam					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: Gordon 2162		POLYGON: 7	
	SURVEYOR(S)	DATE: Jun 29 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL	☐ ORGANIC	☐ LACUSTRINE	☐ NATURAL	☐ PLANKTON	☐ LAKE
☐ WETLAND	☑ MINERAL SOIL	☐ RIVERINE	☑ CULTURAL	☐ SUBMERGED	☐ POND
☐ AQUATIC	☐ PARENT MIN.	☐ BOTTOMLAND		☐ FLOATING-LVD.	☐ RIVER
	☐ ACIDIC BEDRK.	☐ TERRACE		☐ GRAMINOID	☐ STREAM
	☐ BASIC BEDRK.	☐ VALLEY SLOPE		☐ FORB	☐ MARSH
	☐ CARB. BEDRK.	☐ TABLELAND		☐ LICHEN	☐ SWAMP
		☐ ROLL. UPLAND		☐ BRYOPHYTE	☐ FEN
		☐ CLIFF		☑ DECIDUOUS	☐ BOG
		☐ TALUS		☐ CONIFEROUS	☐ BARREN
		☐ CREVICE / CAVE		☐ MIXED	☐ MEADOW
		☐ ALVAR			☐ PRAIRIE
		☐ ROCKLAND			☐ THICKET
		☐ BEACH / BAR			☐ SAVANNAH
		☐ SAND DUNE			☑ WOODLAND
		☐ BLUFF			☐ FOREST
					☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER			☐ OPEN		
☐ SHALLOW WATER			☐ SHRUB		
☑ SURFICIAL DEP.			☑ TREED		
☐ BEDROCK					

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	3	3	Ulmpumi Lontata Acenegu juglnig
2 SUB-CANOPY			
3 UNDERSTOREY	4	2	Lontata
4 GRD. LAYER	5	4	brominn solalti ciscagn phrmm

HT CODES: 1 = >25 m 2 = 10<HT ≤25 m 3 = 2<HT ≤10 m 4 = 1<HT ≤2 m 5 = 0.5<HT ≤1 m 6 = 0.2<HT ≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	O < 10	O 10 - 24	O 25 - 50	N > 50
STANDING SNAGS:	R < 10	R 10 - 24	R 25 - 50	N > 50
DEADFALL / LOGS:	R < 10	R 10 - 24	R 25 - 50	N > 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Woodland	CODE: CUW
ECOSITE: Deciduous Cultural Woodland	CODE: CUW1
VEGETATION TYPE: Deciduous Cultural Woodland	CODE: CUW1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Ulmpumi						brominn					
Acenegu						ciscagn					
juglnig						daucaro					
						phragau					
						solalti					
						poaprat					
						asclsyr					
						dactglo					
						phlprat					
						chalbum					
parivie											
W/Sfzl											
vitripa											
Lontata											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 2162 Gordon		POLYGON: 8	
	SURVEYOR(S) DW	DATE 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☑ AQUATIC	☑ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☑ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☑ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY			
2 SUB-CANOPY			
3 UNDERSTOREY	5	4	phraomin ascerca riveis saglati
4 GRD. LAYER	7	4	lemmina >> nupvaw pot...

HT CODES: 1 = >25 m 2 = 10<HT ≤ 25 m 3 = 2<HT ≤ 10 m 4 = 1<HT ≤ 2 m 5 = 0.5<HT ≤ 1 m 6 = 0.2<HT ≤ 0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE: Floating leave shallow Aquatic	CODE: SAF1
VEGETATION TYPE: Duckweed Floating-leave Shallow Aquatic	CODE: SAF1-3
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
lemmi				A	
nupvari				O	
sagilati			R		
riveas			R		
asc inca			R		
potomoga				O	
phraaus			R		

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Gordon 2162		POLYGON: 9	
SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☑ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	2	4	AlexRFe Popdelt Salsx Frapenn
2 SUB-CANOPY			
3 UNDERSTOREY	4	1	Spialba
4 GRD. LAYER	5	4	impcape equarve onosens tusfarf

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR 10% 2 = 10 < CVR 25% 3 = 25 < CVR 60% 4 = CVR > 60%

STAND COMPOSITION:							BA:	
SIZE CLASS ANALYSIS:	O	< 10	O	10 - 24	O	25 - 50	R	> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Swamp	CODE: SW
COMMUNITY SERIES: Deciduous Swamp	CODE: SWD
ECOSITE: Mineral Deciduous Swamp	CODE: SWD3
VEGETATION TYPE: Swamp Maple Mineral Deciduous Swamp	CODE: SWD3-3
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Acerfre						phlarun					
Popdelt						impcape					
Sal sp						solalti					
Frapenn						anemcana					
						tusfarf					
						equarve					
						calcana					
						astlanc					
						calcana					
						galpalu					
						cirlute					
						parinse					
						onosens					
						erigphil					
Spialba											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 2162 Gordon		POLYGON 10
	SURVEYOR(S) DW	DATE 28 Jun 17	UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☑ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☑ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	Acesagn
2	SUB-CANOPY	3	4	Thuocci / Rhacath Loniata
3	UNDERSTOREY			
4	GRD. LAYER	5	2	solalti grasses arecana parsi

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	A < 10	A 10 - 24	R 25 - 50	N > 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG ✓	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Forest	CODE: FO
COMMUNITY SERIES: Coniferous Forest	CODE: FOC
ECOSITE: Fresh Moist White Cedar Con. For	CODE: FOC4
VEGETATION TYPE: F/M White Cedar Con. for.	CODE: FOC4-1
INCLUSION	CODE:
COMPLEX	CODE:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Acesagn	R					Solalti					
						Rosa					
						linbcan					
						lysculi					
						parinss					
Rhacath		O									
Vitripa											
Thuocci		D									
Loniata		R									

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: Gordon 2162		POLYGON: 11	
	SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☑ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☑ FOREST ☐ PLANTATION

SITE	COVER
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK	☐ OPEN ☐ SHRUB ☑ TREED

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	3	Thuocci, Pinstro, Quemacr, Thuocci [illegible]
2	SUB-CANOPY	3	4	Thuocci,
3	UNDERSTOREY	4	1	[illegible] prunvirg sampube -
4	GRD. LAYER	6	1	carpdu maican parrinse epihell

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:					BA:
SIZE CLASS ANALYSIS:	A	< 10	A 10 - 24	O 25 - 50	O > 50
STANDING SNAGS:	O	< 10	O 10 - 24	R 25 - 50	R > 50
DEADFALL / LOGS:	O	< 10	O 10 - 24	R 25 - 50	R > 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	✓ MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Forest	CODE: FO
COMMUNITY SERIES: Conifer Forest	CODE: FOC
ECOSITE: Fresh/Moist White Cedar Conifer	CODE: FOC4
VEGETATION TYPE: F/M White Cedar-Hemlock Conifer	CODE: FOC4-2
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Thuocci						epihell					
Pinstro						carpdu					
Pinusty						maican					
Ostvirg						prunvirg					
Quealba						viopube					
Tsucan											
Quemacr											
Sampube											
Prunvirg											
rhatrad											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 2162 Gordon		POLYGON: 12	
SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☑ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☑ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☑ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY			
2 SUB-CANOPY			
3 UNDERSTOREY			
4 GRD. LAYER	7	4	nup var > lem min

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR 10% 2 = 10 < CVR 25% 3 = 25 < CVR 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Shallow Aquatic	CODE: SA
COMMUNITY SERIES: Floating Leaved SA	CODE: SAF1
ECOSITE: W	CODE: W
VEGETATION TYPE: Water Lily / Bullhead Lily Floating Leaved	CODE: SAF1-1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
						nup var				A	
						lem min				D	

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: Gordon 2162		POLYGON: 13	
	SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☑ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☑ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☑ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	4	Tsucana Pinstro Ostvirg Acesosa
2	SUB-CANOPY	3	2	Tsucan Acesacs Ostvirg
3	UNDERSTOREY	4	2	Fagamy Sorn Acea Lonicab Mitcan
4	GRD. LAYER	5	2	Carpedu cirlut Maican Geurobe

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m

CVR CODES 0 = NONE 1 = 0% < CVR 10% 2 = 10 < CVR 25% 3 = 25 < CVR 60% 4 = CVR > 60%

STAND COMPOSITION:								BA:
SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	A	25 - 50	O	> 50
STANDING SNAGS:	O	< 10	O	10 - 24	O	25 - 50	O	> 50
DEADFALL / LOGS:	A	< 10	O	10 - 24	O	25 - 50	R	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG		MID-AGE	✓	MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	Forest	CODE:	FO
COMMUNITY SERIES:	Mixed Forest	CODE:	FOM
ECOSITE:	Dry Fresh Hemlock Mixed Forest	CODE:	FOM3
VEGETATION TYPE:	Dry/Fresh Hemlock-Sugar Maple MF	CODE:	FOM3-2
INCLUSION		CODE:	SAF1-3
COMPLEX		CODE:	

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Pinstro						cirlute					
Popten						epihell					
Pruser						thurarv					
Ulmame						carex					
Tsucan						maican					
Querru						dryart					
Faggran						aratriph					
Popgra						geurobe					
						fraame					
Ostvirg						anthyp					
Ulmame						oxastr					
Ulmame						carpedu					
						pren-sp					
						solcaes					
						sancana					
						polpube					
						lysdesp					
						cardiph					
						athfeli					
						cysbulb					
						solflex					
						allfrie					
						aqucan					
rhocath											
Pruvirg											
rhufrag											

Hieracium collected

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE 2162 Gordon	POLYGON: 17
	SURVEYOR(S)	DATE 28 Jun 17	UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☑ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION

SITE	COVER
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK	☑ OPEN ☐ SHRUB ☐ TREED

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	1	Sal peti
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	4	4	phaarun >> moses lysthyr

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR 10% 2 = 10 < CVR 25% 3 = 25 < CVR 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Marsh	CODE: MA
COMMUNITY SERIES: Shallow Marsh	CODE: MAS3
ECOSITE: Organic Shallow Marsh	CODE: MAS3
VEGETATION TYPE: Reed Canary Organic Shallow Marsh	CODE: MAS3
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Salpeti	R				

SPECIES CODE	LAYER 1	2	3	4	COLL.
phaarun				D	
Soldalt				O	
lysimach (lateral)				O	
onosens				O	
scirpus				O	
irivers				R	
Eupalin				O	
Glyglom				O	
juncus				R	
Junbuo				R	
sio sauv				R	
astlan				O	
asc inca				R	
menarve				R	
pol pum				R	

green frog

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Gordon 2162			POLYGON: 5	
SURVEYOR(S):		DATE: 28 Jun 17		UTME:
START:	END:		UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☑ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☑ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	4	Pinstro >> Jugnigr
2	SUB-CANOPY	3	1	Fraxamer Acesacn Tsucan
3	UNDERSTOREY	4	3	Fraxamer Lonitata
4	GRD. LAYER	5	1	grasses Taroffi Fraxamer Hiera.

HT CODES: 1 = >25 m 2 = 10<HT 25 m 3 = 2<HT 10 m 4 = 1<HT 2 m 5 = 0.5<HT 1 m 6 = 0.2<HT 0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR 10% 2 = 10 < CVR 25% 3 = 25 < CVR 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	O < 10	A 10 - 24	A 25 - 50	R > 50
STANDING SNAGS:	R < 10	R 10 - 24	R 25 - 50	N > 50
DEADFALL / LOGS:	O < 10	O 10 - 24	R 25 - 50	N > 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	✓ MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Plantation	CODE: CUP
ECOSITE: Coniferous Plantation	CODE: CUP3
VEGETATION TYPE: White Pine Coniferous Plantation	CODE: CUP3-2
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Pinstro	D				
Jugnigr	R				
Acesacn		R			
Tsucan		R			
Lonitata			O		
Rhacath			R		
Fraxamer		R	A	O	

SPECIES CODE	LAYER 1	2	3	4	COLL.
cirpedu					
hiera					
taroffi					
allpeti					
pruvulg					
carpens					
dacglom					
stellfu					
ornpalle					
spotcan					
[illegible]					
veroffi					
aruvelu					
geuurba					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 2162 Gordon		POLYGON: 16	
	SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☑ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	1	1	Acesasa Pinstro
2	SUB-CANOPY	3	4	Acesasa fraxamer junivir ulmamer
3	UNDERSTOREY	4	3	fraxamer rhacath lonitat
4	GRD. LAYER	5	4	grasses parinse circlute geucana

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:					BA:
SIZE CLASS ANALYSIS:	A < 10	A 10 - 24	O 25 - 50	R > 50	
STANDING SNAGS:	R < 10	R 10 - 24	N 25 - 50	N > 50	
DEADFALL / LOGS:	O < 10	R 10 - 24	R 25 - 50	N > 50	

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	☑ YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE:	CODE:
VEGETATION TYPE:	CODE:
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Acesasa						dacglo					
fraxamer						leer					
junivir						solalti					
ostvir						carebrun					
ulmamer						[illegible]					
pinsyl						ranevirg					
pinstro						solflex					
						parrose					
						geucana					
						viroffi					
						circlute					
						gerrobe					
						carlden					
						Samcana					
lo											
rhacath											
fraxamer											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 2162 Gordon		POLYGON: 17	
SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☑ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION

SITE	COVER
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK	☑ OPEN ☐ SHRUB ☐ TREED

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	2	Kraamei Pirsyiv Malus
2	SUB-CANOPY			
3	UNDERSTOREY	4	2	Kraamei lontata Pirsyiv
4	GRD. LAYER	5	4	grasses solalti lotcorn chrleuc

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE .		PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: cultural Meadow	CODE: CUM
ECOSITE: Mineral Cultural Meadow	CODE: CUM1
VEGETATION TYPE: Dry-Moist Old Field Meadow	CODE: CUM1-1
☐ INCLUSION	CODE:
☐ COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Pirsyiv	O				
Kraamei	O				
Malus	R				
lontata			O		
Kraamei			O		
Pirsyiv			O		

SPECIES CODE	LAYER 1	2	3	4	COLL.
bromin					
potrect					
lotcorn					
eshvulg					
chrleuc					
hyperf					
solalti					
hier sp					
phlprat					
viccrac					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 2162 Gordon		POLYGON: 18	
	SURVEYOR(S): RW	DATE: Jun 28 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☑ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE ☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			**COVER** ☐ OPEN ☑ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	2	2	fraamer prusero
2 SUB-CANOPY	3	4	lontata rhcath fraamer syvulg
3 UNDERSTOREY	4	3	lontata rhcath
4 GRD. LAYER	5	3	parinse geucana cirlute solalti

HT CODES: 1 = >25 m 2 = 10<HT<25 m 3 = 2<HT<10 m 4 = 1<HT<2 m 5 = 0.5<HT<1 m 6 = 0.2<HT<0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE.	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	Cultural	CODE:	CU
COMMUNITY SERIES:	Cultural Thicket	CODE:	CUT
ECOSITE:	Mineral Cultural Thicket	CODE:	CUT1
VEGETATION TYPE:	"	CODE:	CUT1
INCLUSION		CODE:	
COMPLEX		CODE:	

Notes:

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
fraamer	O	O			
prusero	O		A		
rhcath		A			
syvulg		R			
[illegible]		R			
lontata		A	A		

SPECIES CODE	LAYER 1	2	3	4	COLL.
geucana				O	
parinse				O	
geuurba				O	
solalti				D	
cirlute				D	
leovard				D	

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 2162 Gordon		POLYGON: 19	
	SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☑ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☑ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; ≥ GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	3	3	lonlata rhoath thuocc frauna
2 SUB-CANOPY			
3 UNDERSTOREY	4	3	lonlata rhoath frauna
4 GRD. LAYER	5	1	grasses apocanna hier-sp solalt

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE .	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Thicket	CODE: CUT
ECOSITE: Mineral Cultural Thicket	CODE: CUT1
VEGETATION TYPE: "	CODE: CUT1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
lonlata					
rhoath					
frauna					
thuocc					

SPECIES CODE	LAYER 1	2	3	4	COLL.
bromin					
dacglo					
solalti					
chrleuc					
hypperf					
phlprat					
poaprat					
apocanna					
hier-sp					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 2162 Gordon		POLYGON: 20	
	SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☑ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	3	1	Vrome
2 SUB-CANOPY			
3 UNDERSTOREY	4	1	[illegible] [illegible]
4 GRD. LAYER	5	4	bromin solalti chleuc phl prat

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE.	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Meadow	CODE: CUM
ECOSITE: Mineral Cultural Meadow	CODE: CUM1
VEGETATION TYPE: Dry-Moist Old Field Meadow	CODE: CUM1-1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 2162 Gordon		POLYGON: 2 1	
SURVEYOR(S): DW	DATE: 28 Jun 17		UTME:
START:	END:	UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM
- [x] TERRESTRIAL
- [ ] WETLAND
- [ ] AQUATIC

SUBSTRATE
- [ ] ORGANIC
- [x] MINERAL SOIL
- [ ] PARENT MIN
- [ ] ACIDIC BEDRK
- [ ] BASIC BEDRK
- [ ] CARB. BEDRK

TOPOGRAPHIC FEATURE
- [ ] LACUSTRINE
- [ ] RIVERINE
- [ ] BOTTOMLAND
- [ ] TERRACE
- [ ] VALLEY SLOPE
- [ ] TABLELAND
- [ ] ROLL. UPLAND
- [ ] CLIFF
- [ ] TALUS
- [ ] CREVICE / CAVE
- [ ] ALVAR
- [ ] ROCKLAND
- [ ] BEACH / BAR
- [ ] SAND DUNE
- [ ] BLUFF

HISTORY
- [ ] NATURAL
- [x] CULTURAL

PLANT FORM
- [ ] PLANKTON
- [ ] SUBMERGED
- [ ] FLOATING-LVD
- [ ] GRAMINOID
- [ ] FORB
- [ ] LICHEN
- [ ] BRYOPHYTE
- [x] DECIDUOUS
- [ ] CONIFEROUS
- [ ] MIXED

COMMUNITY
- [ ] LAKE
- [ ] POND
- [ ] RIVER
- [ ] STREAM
- [ ] MARSH
- [ ] SWAMP
- [ ] FEN
- [ ] BOG
- [ ] BARREN
- [ ] MEADOW
- [ ] PRAIRIE
- [x] THICKET
- [ ] SAVANNAH
- [ ] WOODLAND
- [ ] FOREST
- [ ] PLANTATION

SITE
- [ ] OPEN WATER
- [ ] SHALLOW WATER
- [x] SURFICIAL DEP.
- [ ] BEDROCK

COVER
- [ ] OPEN
- [x] SHRUB
- [ ] TREED

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	Fraxam Prusero Ulmpumi
2	SUB-CANOPY	3	3	Lontata vitripa Malus Rhacath
3	UNDERSTOREY	4	3	Lontata vitripa parinse
4	GRD. LAYER	5	4	grasses solalti vitripa

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE .	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE:	CU
COMMUNITY SERIES: Cultural Thicket	CODE:	CUT
ECOSITE: Mineral Cultural Thicket	CODE:	CUT1
VEGETATION TYPE: "	CODE:	CUT1
INCLUSION	CODE:	
COMPLEX	CODE:	

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Fraxam	R				
Prusero	R				
Ulmpumi	R				
Malus		O			
Morei		R			
Lontatar		AA			
Rhacath		O			
Moralba		R			
Malpum		R			
Parinse			O		
Vitripa		A	A		

SPECIES CODE	LAYER 1	2	3	4	COLL.
broinin					
agocana					
Solalti					
Chaleuc					
medlupu					
viccrac					
pangse					
vertham					
phlpratt					
vitripa					
silenae					

ELC
COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 2162 Gordon		POLYGON: 22	
SURVEYOR(S)	DATE 28 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☑ FOREST ☐ PLANTATION

SITE	COVER
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK	☐ OPEN ☐ SHRUB ☑ TREED

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; ≈ ABOUT EQUAL TO)
1	CANOPY	2	4	Acesasa Prusero Fraame Thuocc
2	SUB-CANOPY	3	2	Acesasa Prusero Thuocc Tilamer
3	UNDERSTOREY	4	3	pruvirg Loncanta rhacath
4	GRD. LAYER	5	2	geucana corlute fravirg equarve

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:	BA:

		< 10		10 - 24		25 - 50		> 50
SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	O	25 - 50	R	> 50
STANDING SNAGS:	R	< 10	R	10 - 24	N	25 - 50	N	> 50
DEADFALL / LOGS:	O	< 10	R	10 - 24	R	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE.		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Forest	CODE:	FO
COMMUNITY SERIES: Deciduous Forest	CODE:	FOD
ECOSITE: Dry-Fresh Sugar Maple DF	CODE:	FOD5
VEGETATION TYPE: "	CODE:	FOD5-1
INCLUSION	CODE:	
COMPLEX	CODE:	

Notes:

ELC
PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Acesasa	A	O			
Prusero	R	O			
Fraame	R				
Thuocc	R	R			
Tilamer	'	R			
rhacath			O		
Loncanta			O		
pruvirg			A		

SPECIES CODE	LAYER 1	2	3	4	COLL.
geucana				O	
Tarofti				O	
corlute				O	
parinsi				O	
Solalti				O	
arisphil				O	
fravirg				O	
equarve				O	

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 2162 Gordon		POLYGON: 23	
SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☑ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☑ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION

SITE	COVER
☐ OPEN WATER ☑ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK	☑ OPEN ☐ SHRUB ☐ TREED

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	4	4	typlati soldulc car-spp lysthyr

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:							BA:	
SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	Marsh	CODE:	MA
COMMUNITY SERIES:	Shallow Marsh	CODE:	MAS
ECOSITE:	Organic Shallow Marsh	CODE:	MAS3
VEGETATION TYPE:	Cattail Organic Shallow Marsh	CODE:	MAS3-1
INCLUSION		CODE:	
COMPLEX		CODE:	

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
siusuav					
impcape					
sagilati					
typlati					
carstipp.					
phaarun					
leeoryz					
ranaqu					
equiflav					
cicbulb					
glygrand					
aliplan					
aspinc					
sonkens					
galpalu					
conlacu					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 2162 Gordon			POLYGON: 24	
SURVEYOR(S): DW		DATE: 28 Jun 17		UTME
START	END		UTMZ	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☑ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☑ PLANTATION

SITE	COVER
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK	☐ OPEN ☐ SHRUB ☑ TREED

STAND DESCRIPTION:

LAYER		HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	4	Picabie Thuocci Tsucana Pinstro
2	SUB-CANOPY	3	2	Thuocci
3	UNDERSTOREY	4	2	pruvirg rhacath corialte
4	GRD. LAYER	5	1	toroffi parinsl cirlute arclapp

HT CODES: 1 = >25 m 2 = 10<HT<25 m 3 = 2<HT<10 m 4 = 1<HT<2 m 5 = 0.5<HT<1 m 6 = 0.2<HT<0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR < 10% 2 = 10 < CVR < 25% 3 = 25 < CVR < 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	O < 10	A 10 - 24	A 25 - 50	R > 50
STANDING SNAGS:	R < 10	R 10 - 24	R 25 - 50	N > 50
DEADFALL / LOGS:	O < 10	R 10 - 24	R 25 - 50	N > 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE.	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH
	☐	☐	☑	☐	☐

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Plantation	CODE: CUP
ECOSITE: Conifer Plantation	CODE: CUP3
VEGETATION TYPE: Norway Spruce Coniferous Plantation	CODE: CUP3
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Picabie	A				
Jugcine	R				
Thuocci	O	O			
Tsucana	O				
Pinstro	R				
Acesasa	R				
Solalba	R				
rhacath			O		
pruvirg			O		
corialte			R		
pruserot			R		
toroffi				R	
Dancare				R	
cirlute				R	
arclapp				R	
solalti				R	
epihell				R	
gchrobe				R	

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 2162 Gordon		POLYGON: 25	
	SURVEYOR(S): DW	DATE: 28 Jul 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☑ ORGANIC ☒ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☑ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☑ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	4	Salpeta Saldisa ||| Wet costal
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	4	4	Onaarum Cynlasu Soldute

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE.	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Swamp	CODE: SW
COMMUNITY SERIES: Thicket Swamp	CODE: SWT
ECOSITE: Organic Thicket Swamp	CODE: SWT3
VEGETATION TYPE: Willow Organic Thicket Swamp	CODE: SWT3-2
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 2162 Gordon		POLYGON: 26	
SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☑ WETLAND ☐ AQUATIC	☑ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☑ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	1	Corstol
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	4	4	phaarun conlacu solduhe glygran

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:								BA:
SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Marsh	CODE: MA
COMMUNITY SERIES: Shallow Marsh	CODE: MAS
ECOSITE: Organic Shallow Marsh	CODE: MAS3
VEGETATION TYPE: Reed Canary Organic SM	CODE: MAS3
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: S Kilterry		POLYGON: 1	
	SURVEYOR(S): [illegible]	DATE: June 21 2017		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☑ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	Acer [illegible] Quercus [illegible]
2	SUB-CANOPY	3	1	Fraxinus Pinus [illegible] Picea
3	UNDERSTOREY			
4	GRD. LAYER	5	4	bromus dactylis [illegible] [illegible] [illegible]

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	Cultural	CODE:	CU
COMMUNITY SERIES:	Cultural Meadow	CODE:	CUM
ECOSITE:	Mineral Cultural Meadow	CODE:	CUM1
VEGETATION TYPE:	Dry-Moist Old Field Meadow	CODE:	CUM1-1
INCLUSION		CODE:	
COMPLEX		CODE:	

Notes:

CUM1-1 w/ mostly planted trees

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
crat						brom in					
syzamna						sch vulg					
malus						chrleuc					
Acer [illegible]						lotcorn					
[illegible]						pla lanc					
[illegible]						cichint					
[illegible]						hiepra					
[illegible]						silene (svulg)					
[illegible]						dacglom					
						vic cracc					
						Solidago					
						her					
						circ [illegible]					
						vit [illegible]					
						cir van					
						ascyr					
						lolium					
						[illegible]					
						fra [illegible]					
						phl prat					
thuocc						sis [illegible]					
moralba						lil phil					
[illegible]											
[illegible]											
Physoc											
[illegible]											
quercus											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 5 Kilkenny		POLYGON: 2	
SURVEYOR(S): BW	DATE: 28 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☑ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☑ WOODLAND ☐ FOREST ☐ PLANTATION

SITE	COVER
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK	☐ OPEN ☐ SHRUB ☑ TREED

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	3	Pinstro Picea Pinsylv Fraxin
2	SUB-CANOPY			
3	UNDERSTOREY	4	1	brveu rhutyph ruballe
4	GRD. LAYER	5	4	grasses hes taruffi chrleuc

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	O	< 10	O	10 - 24	O	25 - 50	N	> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY g =	G=
MOISTURE:	DEPTH OF ORGANICS:	(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:	(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Woodland	CODE: CUW
ECOSITE: Mineral Cultural Woodland	CODE: CUW1
VEGETATION TYPE:	CODE: CUW1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Pinstro						Solcana					
Querrubr						dacglom					
Picabies						poapratt					
Fraxpenn						hes					
Malus						chrleuc					
Pinsylv						cirspic					
Acersacc						leoaut					
Ulmus						Solalt					
Acerplat						parquin					
Acerpsu						geocaigu					
Popxcan						poapratt					
Ulmus						taruffi					
						bromin					
						Corvari					
						vicccra					
						potrect					
						Juncus					
						medlupu					
						stram					
						sedacr					
~~Hawth~~ ruballe											
brveu											
rhutyph											

ELC

COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 8 [illegible]		POLYGON: 3	
SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☑ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☑ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☑ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	3	Pinsylv > Prusfrs Franer Larix
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	4	4	brown [illegible] hen [illegible]

HT CODES: 1 = >25 m 2 = 10<HT<25 m 3 = 2<HT<10 m 4 = 1<HT<2 m 5 = 0.5<HT<1 m 6 = 0.2<HT<0.5 m 7 = HT<0.2 m

CVR CODES: 0 = NONE 1 = 0% < CVR < 10% 2 = 10 < CVR < 25% 3 = 25 < CVR < 60% 4 = CVR > 60%

STAND COMPOSITION:							BA:	
SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Savanna	CODE: CUS
ECOSITE: Mineral Cultural Savanna	CODE: CUS1
VEGETATION TYPE: Scotch Pine Cultural Savanna	CODE: CUS1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC

PLANT SPECIES LIST

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.	SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 5 Kilkenny		POLYGON: 4	
	SURVEYOR(S): DW	DATE: 29 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☑ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☑ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY			
2 SUB-CANOPY	3	4	Rhutyph Salbebb
3 UNDERSTOREY	4	2	rhutyph
4 GRD. LAYER	5	3	Solalti brainin daeglm aucapp

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS: Cultural	CODE: CU
COMMUNITY SERIES: Cultural Thicket	CODE: CUT
ECOSITE: Mineral Cultural thicket	CODE: CUT1
VEGETATION TYPE: Sumac Cultural Thicket	CODE: CUT1-1
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
Rhutyph	D				
Malsps	R				
Salbebb	R				

SPECIES CODE	LAYER 1	2	3	4	COLL.
Solalti				A	
brainin				A	
Poapratt				8	
daeglm				8	
aucapp				O	
linadmu				O	

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: S Kilkenny		POLYGON: 5	
	SURVEYOR(S): DW	DATE: 28 Jun 17		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; ≈ ABOUT EQUAL TO)
1 CANOPY			Picpung
2 SUB-CANOPY			
3 UNDERSTOREY			
4 GRD. LAYER			grass Taroffi Junrepe plalanc

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:							BA:	
SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE		PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE:	CODE:
VEGETATION TYPE:	CODE:
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

[illegible]

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Picpung						Agrtrom					
Acenegu						Taroffi					
Aceplat						plalanc					
						Bromarve					
						Junrepe					
						Poaprat					
						Pruvulg					

Mng w/ 2

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: AMS Kilkenny		POLYGON: 2 con't
	SURVEYOR(S)	DATE	UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY			Pinstro Pinsylv Frame Piceg
2 SUB-CANOPY			
3 UNDERSTOREY			
4 GRD. LAYER			grasses hiera cirsleu

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE:	CODE:
VEGETATION TYPE:	CODE:
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Pinsylv						brominer					
Popxcan						corvari					
Rhocathr						solalt					
Frame						viccrac					
Pinresin						daucaro					
Malpum						solflexi					
Popbals						potrect					
Pinstro						phlprat					
Elaeang						linvulg					
Acepla						hiera					
Acesacch						prunvulg					
Aeschipp						medlupu					
						astnovae					
						sedacr					
chrleuc											
forvesca											
rubidae											
thyserp											

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 1 Kilkenny		POLYGON: 6
	SURVEYOR(S): DW	DATE: 21 Jun 17	UTME
	START	END	UTMZ / UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☑ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD ☑ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☑ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE ☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			**COVER** ☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1 CANOPY	2	1	Pic spp
2 SUB-CANOPY	3	1	Pic. spp
3 UNDERSTOREY			
4 GRD. LAYER	5	4	grasses soliditi vicavor dan leuc

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	Cultural	CODE: CU
COMMUNITY SERIES:	Cultural Meadow	CODE: CUM
ECOSITE:	Mineral Cultural Meadow	CODE: CUM1
VEGETATION TYPE:	Dry Mod	CODE: CUM1
INCLUSION		CODE:
COMPLEX		CODE:

Notes:

berm

ELC PLANT SPECIES LIST	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
Pic pungens						phleprat					
Acer?						poaprat					
Elaeag						dacglom					
						conmaful					
						chrleuc					
						viccrac					
						solalti					
						brinerm					
						bromerm					
						euphorbia					
						verthap					
						apocanda					
						ele vulg					
						hypperf					
						cirarv					
						solsagi					
						phlaru					

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE Kilkenny		POLYGON: 7	
	SURVEYOR(S) DW	DATE Jun 21 2017		UTME
	START	END	UTMZ	UTMN

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN ☐ ACIDIC BEDRK ☐ BASIC BEDRK ☐ CARB. BEDRK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	4	Picea
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	5	2	grasses arecam chalere traffi

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:				BA:
SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE:	CODE:
VEGETATION TYPE:	CODE:
INCLUSION	CODE:
COMPLEX	CODE:

Notes:

ELC PLANT SPECIES LIST	
SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
						arecam					
						bromin					
						daugla					
						Viola					
						Silene					
						traffi					
						solalti					
						verthi					
						chalere					

Appendix NH-4:
Clair-Maltby Secondary Plan Area Plant List

Appendix NH-4

Clair-Maltby Secondary Plan Plant List

Appendix NH-4

Clair-Maltby Secondary Plan Plant List

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Aceraceae	*Acer negundo*	Manitoba Maple			S5	
Aceraceae	*Acer nigrum*	Black Maple			S4?	LS
Aceraceae	*Acer platanoides*	Norway Maple			SNA	
Aceraceae	*Acer pseudoplatanus*	Sycamore Maple			SNA	
Aceraceae	*Acer rubrum*	Red Maple			S5	
Aceraceae	*Acer saccharinum*	Silver Maple			S5	
Aceraceae	*Acer* x *freemanii*	Freeman's Maple			S5	
Alismataceae	*Alisma plantago-aquatica*	Broad-leaved Water-plantain			S5	
Alismataceae	*Alisma subcordatum*	Southern Water-plantain			S4?	
Alismataceae	*Sagittaria cuneata*	Wapatum Arrowhead			S4?	
Alismataceae	*Sagittaria latifolia*	Broadleaf Arrowhead			S5	
Amaranthaceae	*Amaranthus retroflexus*	Red-root Amaranth			SNA	
Anacardiaceae	*Rhus hirta*	Staghorn Sumac			S5	
Anacardiaceae	*Toxicodendron rydbergii*	Western Poison Ivy			S5	
Apiaceae	*Cicuta bulbifera*	Bulb-bearing Water-hemlock			S5	
Apiaceae	*Cicuta maculata*	Spotted Water-hemlock			S5	
Apiaceae	*Daucus carota*	Queen Anne's Lace			SNA	
Apiaceae	*Sium suave*	Hemlock Water-parsnip			S5	
Apocynaceae	*Apocynum androsaemifolium* ssp. *androsaemifolium*	Spreading Dogbane			S5	
Apocynaceae	*Apocynum cannabinum*	Clasping-leaved Indian Hemp			S5	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Apocynaceae	*Vinca minor*	Periwinkle			SNA	
Aquifoliaceae	*Ilex verticillata*	Winterberry			S5	
Araceae	*Arisaema triphyllum* ssp. *triphyllum*	Jack-in-the-pulpit			S5	
Araceae	*Calla palustris*	Wild Calla			S5	
Araliaceae	*Aralia nudicaulis*	Wild Sarsaparilla			S5	
Aristolochiaceae	*Asarum canadense*	Wild Ginger			S5	
Asclepiadaceae	*Asclepias incarnata* ssp. *incarnata*	Swamp Milkweed			S5	
Asclepiadaceae	*Asclepias syriaca*	Common Milkweed			S5	
Asteraceae	*Achillea millefolium* var. *millefolium*	Common Yarrow			SNA	
Asteraceae	*Achillea millefolium* var. *occidentalis*	Wooly Yarrow			S5	
Asteraceae	*Ambrosia artemisiifolia*	Annual Ragweed			S5	
Asteraceae	*Antennaria neglecta*	Field Pussytoes			S5	
Asteraceae	*Arctium lappa*	Greater Burdock			SNA	
Asteraceae	*Arctium minus*	Lesser Burdock			SNA	
Asteraceae	*Bidens cernua*	Nodding Beggar's Ticks			S5	
Asteraceae	*Bidens connata*	Purple-stemmed Beggars Tick			S4?	
Asteraceae	*Bidens frondosa*	Devil's Beggar's Ticks			S5	
Asteraceae	*Bidens* sp.	Beggar's Ticks Species				
Asteraceae	*Bidens tripartita*	European Beggar's Ticks			S5	
Asteraceae	*Carduus nutans* ssp. *leiophyllus*	Musk Thistle			SNA	
Asteraceae	*Centaurea biebersteinii*	Spotted Knapweed			SNA	
Asteraceae	*Centaurea jacea*	Brown Knapweed			SNA	
Asteraceae	*Centaurea* sp.	Knapweed Species				
Asteraceae	*Cichorium intybus*	Chicory			SNA	
Asteraceae	*Cirsium arvense*	Creeping Thistle			SNA	
Asteraceae	*Cirsium vulgare*	Bull Thistle			SNA	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Asteraceae	*Conyza canadensis*	Fleabane			S5	
Asteraceae	*Erigeron annuus*	White-top Fleabane			S5	
Asteraceae	*Erigeron philadelphicus* var. *philadelphicus*	Philadelphia Fleabane			S5	
Asteraceae	*Erigeron pulchellus*	Robin's Plantain			S5	
Asteraceae	*Eupatorium perfoliatum*	Common Boneset			S5	
Asteraceae	*Eurybia macrophylla*	Large-leaved Aster			S5	
Asteraceae	*Euthamia graminifolia*	Grass-leaved Goldenrod			S5	
Asteraceae	*Eutrochium maculatum* var. *maculatum*	Spotted Joe-pye Weed			S5	
Asteraceae	*Hieracium caespitosum*	Field Hawkweed			SNA	
Asteraceae	*Hieracium lachenalii*	Common Hawkweed			SNA	
Asteraceae	*Hieracium piloselloides*	Tall Hawkweed			SNA	
Asteraceae	*Hieracium* sp.	Hawkweed Species				
Asteraceae	*Inula helenium*	Elecampane			SNA	
Asteraceae	*Leucanthemum vulgare*	Oxeye Daisy			SNA	
Asteraceae	*Matricaria discoidea*	Pineapple-weed			SNA	
Asteraceae	*Oclemena acuminatus*	Whorled Aster			S4	
Asteraceae	*Onopordum acanthium*	Scotch Thistle			SNA	
Asteraceae	*Prenanthes altissima*	Tall Rattlesnake-root			S5	
Asteraceae	*Rudbeckia hirta*	Black-eyed Susan			S5	
Asteraceae	*Senecio jacobaea*	Tansy Ragwort			SNA	
Asteraceae	*Solidago altissima var. altissima*	Tall Goldenrod			S5	
Asteraceae	*Solidago caesia*	Bluestem Goldenrod			S5	
Asteraceae	*Solidago canadensis*	Canada Goldenrod			S5	
Asteraceae	*Solidago flexicaulis*	Broad-leaved Goldenrod			S5	
Asteraceae	*Solidago gigantea*	Smooth Goldenrod			S5	
Asteraceae	*Solidago juncea*	Early Goldenrod			S5	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Asteraceae	*Solidago nemoralis* var. *nemoralis*	Field Goldenrod			S5	
Asteraceae	*Solidago patula*	Rough-leaved Goldenrod			S5	LS
Asteraceae	*Solidago rugosa* ssp. *rugosa*	Rough Goldenrod			S5	
Asteraceae	*Solidago* sp.	Goldenrod Species				
Asteraceae	*Sonchus arvensis* ssp. *arvensis*	Field Sowthistle			SNA	
Asteraceae	*Sonchus asper* ssp. *asper*	Spiny-leaf Sowthistle			SNA	
Asteraceae	*Sonchus oleraceus*	Common Sowthistle			SNA	
Asteraceae	*Symphyotrichum cordifolium*	Heart-leaved Aster			S5	LS
Asteraceae	*Symphyotrichum ericoides* var. *ericoides*	Heath Aster			S5	
Asteraceae	*Symphyotrichum lanceolatum* ssp. *lanceolatum*	Panicled Aster			S5	
Asteraceae	*Symphyotrichum lateriflorum* var. *hirsuticaule*	Hairy Calico Aster			S4?	
Asteraceae	*Symphyotrichum lateriflorum* var. *lateriflorum*	Calico Aster			S5	
Asteraceae	*Symphyotrichum novae-angliae*	New England Aster			S5	
Asteraceae	*Symphyotrichum pilosum* var. *pilosum*	Hairy Aster			S5	
Asteraceae	*Symphyotrichum puniceum* var. *puniceum*	Purple-stemmed Aster			S5	
Asteraceae	*Symphyotrichum urophyllum*	Arrow-leaved Aster			S4	
Asteraceae	*Tanacetum vulgare*	Common Tansy			SNA	
Asteraceae	*Taraxacum officinale*	Common Dandelion			SNA	
Asteraceae	*Tragopogon dubius*	Meadow Goat's-beard			SNA	
Asteraceae	*Tragopogon pratensis* ssp. *pratensis*	Meadow Goat's-beard			SNA	
Asteraceae	*Tripleurospermum maritima* ssp. *phaeocephala*	Scentless Chamomile			S3?	
Asteraceae	*Tussilago farfara*	Colt's Foot			SNA	
Balsaminaceae	*Impatiens capensis*	Spotted Jewel-weed			S5	
Berberidaceae	*Berberis vulgaris*	European Barberry			SNA	
Berberidaceae	*Caulophyllum thalictroides*	Blue Cohosh			S5	
Berberidaceae	*Podophyllum peltatum*	May Apple			S5	

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Betulaceae	*Alnus incana* ssp. *rugosa*	Speckled Alder			S5	
Betulaceae	*Betula alleghaniensis*	Yellow Birch			S5	
Betulaceae	*Betula papyrifera*	Paper Birch			S5	
Betulaceae	*Carpinus caroliniana* ssp. *virginiana*	American Hornbeam			S5	
Betulaceae	*Ostrya virginiana*	Eastern Hop-hornbeam			S5	
Boraginaceae	*Echium vulgare*	Common Viper's-bugloss			SNA	
Boraginaceae	*Hackelia virginiana*	Virginia Stickseed			S5	
Brassicaceae	*Alliaria petiolata*	Garlic Mustard			SNA	
Brassicaceae	*Barbarea vulgaris*	Yellow Rocket			SNA	
Brassicaceae	*Cardamine concatenata*	Cutleaf Toothwort			S5	
Brassicaceae	*Cardamine diphylla*	Broad-leaved Toothwort			S5	
Brassicaceae	*Cardamine pensylvanica*	Pennsylvania Bitter-cress			S5	
Brassicaceae	*Erysimum cheiranthoides* ssp. *cheiranthoides*	Woormseed Mustard			SNA	
Brassicaceae	*Hesperis matronalis*	Dame's Rocket			SNA	
Brassicaceae	*Lepidium densiflorum*	Dense-flower Pepper-grass			SNA	
Brassicaceae	*Rorippa palustris* ssp. *hispida*	Hispid Yellow-cress			S5	
Brassicaceae	*Sinapis arvensis*	Charlock			SNA	
Brassicaceae	*Thlaspi arvense*	Field Penny-cress			SNA	
Cannabaceae	*Humulus japonicus*	Japanese Hop			SNA	
Caprifoliaceae	*Lonicera dioica*	Glaucous Honeysuckle			S5	
Caprifoliaceae	*Lonicera morrowii*	Morrow's Honeysuckle			SNA	
Caprifoliaceae	*Lonicera tatarica*	Tartarian Honeysuckle			SNA	
Caprifoliaceae	*Sambucus nigra* ssp. *canadensis*	Common Elderberry			S5	
Caprifoliaceae	*Sambucus racemosa* var. *racemosa*	Red-berried Elder			S5	
Caprifoliaceae	*Symphoricarpos albus*	Snowberry			S5	
Caprifoliaceae	*Triosteum aurantiacum*	Horse Gentian			S5	

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Caprifoliaceae	*Viburnum acerifolium*	Maple-leaf Viburnum			S5	
Caprifoliaceae	*Viburnum lantana*	Wayfaring-tree			SNA	
Caprifoliaceae	*Viburnum lentago*	Nannyberry			S5	
Caprifoliaceae	*Viburnum opulus*	Guelder-rose Viburnum			SNA	
Caprifoliaceae	*Viburnum opulus* var. *americanum*	Highbush Cranberry			S5	
Caryophyllaceae	*Cerastium arvense* ssp. *arvense*	Field Chickweed			SNA	
Caryophyllaceae	*Cerastium fontanum*	Common Mouse-ear Chickweed			SNA	
Caryophyllaceae	*Dianthus armeria*	Deptford-pink			SNA	
Caryophyllaceae	*Saponaria officinalis*	Bouncing-bet			SNA	
Caryophyllaceae	*Silene latifolia*	Bladder Campion			SNA	
Caryophyllaceae	*Silene noctiflora*	Night-flowering Catchfly			SNA	
Caryophyllaceae	*Silene vulgaris*	Maiden's Tears			SNA	
Caryophyllaceae	*Stellaria graminea*	Little Starwort			SNA	
Celastraceae	*Euonymus obovata*	Running Strawberry-bush			S5	
Ceratophyllaceae	*Ceratophyllum demersum*	Common Hornwort			S5	
Chenopodiaceae	*Atriplex patula*	Halberd-leaf Saltbush			S5	
Chenopodiaceae	*Atriplex rosea*	Tumbling Orach			SNA	
Chenopodiaceae	*Chenopodium album* var. *album*	White Goosefoot			SNA	
Chenopodiaceae	*Chenopodium simplex*	Giant-seed Goosefoot			S5	
Clusiaceae	*Hypericum perforatum*	St. John's-wort			SNA	
Convolvulaceae	*Convolvulus arvensis*	Field Bindweed			SNA	
Convolvulaceae	*Cuscuta gronovii*	Gronovius Dodder			S5	
Cornaceae	*Cornus alternifolia*	Alternate-leaf Dogwood			S5	
Cornaceae	*Cornus racemosa*	Gray Dogwood			S5	
Cornaceae	*Cornus sericea* ssp. *sericea*	Red-osier Dogwood			S5	
Crassulaceae	*Sedum acre*	Mossy Stonecrop			SNA	

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Cucurbitaceae	*Echinocystis lobata*	Wild Mock-cucumber			S5	
Cupressaceae	*Juniperus virginiana*	Eastern Red Cedar			S5	
Cupressaceae	*Thuja occidentalis*	Northern White Cedar			S5	
Cyperaceae	*Carex atherodes*	Awned Sedge			S4S5	LS
Cyperaceae	*Carex bebbii*	Bebb's Sedge			S5	
Cyperaceae	*Carex cristatella*	Crested Sedge			S5	
Cyperaceae	*Carex disperma*	Softleaf Sedge			S5	
Cyperaceae	*Carex eburnea*	Ebony Sedge			S5	
Cyperaceae	*Carex foenea* var. *foenea*	Hay Sedge			S5	
Cyperaceae	*Carex gracillima*	Graceful Sedge			S5	
Cyperaceae	*Carex hystericina*	Porcupine Sedge			S5	
Cyperaceae	*Carex intumescens*	Bladder Sedge			S5	
Cyperaceae	*Carex lacustris*	Lake-bank Sedge			S5	
Cyperaceae	*Carex lasiocarpa*	Slender Sedge			S5	
Cyperaceae	*Carex lupulina*	Hop Sedge			S5	LS
Cyperaceae	*Carex molesta*	Troublesome Sedge			S4?	
Cyperaceae	*Carex pedunculata*	Longstalk Sedge			S5	
Cyperaceae	*Carex pellita*	Woolly Sedge			S5	
Cyperaceae	*Carex pensylvanica*	Pennsylvania Sedge			S5	
Cyperaceae	*Carex pseudo-cyperus*	Cyperus-like Sedge			S5	
Cyperaceae	*Carex radiata*	Stellate Sedge			S5	
Cyperaceae	*Carex retrorsa*	Retrorse Sedge			S5	
Cyperaceae	*Carex rosea*	Rosy Sedge			S5	
Cyperaceae	*Carex spicata*	Spiked Sedge			SNA	
Cyperaceae	*Carex stipata*	Stalk-grain Sedge			S5	
Cyperaceae	*Carex stricta*	Tussock Sedge			S5	

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Cyperaceae	*Carex utriculata*	Beaked Sedge			S5	
Cyperaceae	*Carex vulpinoidea*	Fox Sedge			S5	
Cyperaceae	*Eleocharis erythropoda*	Bald Spikerush			S5	
Cyperaceae	*Eleocharis obtusa*	Blunt Spikerush			S5	
Cyperaceae	*Eleocharis ovata*	Ovate Spikerush			S5	
Cyperaceae	*Eleocharis palustris*	Creeping Spikerush			S5	
Cyperaceae	*Schoenoplectus pungens* var. *pungens*	Three-square Bulrush			S5	
Cyperaceae	*Schoenoplectus tabernaemontani*	Soft-stemmed Bulrush			S5	
Cyperaceae	*Scirpus atrovirens*	Woolgrass Bulrush			S5	
Cyperaceae	*Scirpus pendulus*	Pendulous Bulrush			S5	
Dipsacaceae	*Dipsacus fullonum* ssp. *sylvestris*	Common Teasel			SNA	
Dryopteridaceae	*Athyrium filix-femina* var. *angustum*	Lady-fern			S5	
Dryopteridaceae	*Cystopteris bulbifera*	Bulblet Fern			S5	
Dryopteridaceae	*Dryopteris carthusiana*	Spinulose Wood Fern			S5	
Dryopteridaceae	*Dryopteris cristata*	Crested Wood Fern			S5	
Dryopteridaceae	*Dryopteris marginalis*	Marginal Wood Fern			S5	
Dryopteridaceae	*Dryopteris* x *uliginosa*	Braun's Wood Fern			SNA	
Dryopteridaceae	*Matteuccia struthiopteris* var. *pensylvanica*	Ostrich Fern			S5	
Dryopteridaceae	*Onoclea sensibilis*	Sensitive Fern			S5	
Dryopteridaceae	*Polystichum acrostichoides*	Christmas Fern			S5	
Elaeagnaceae	*Elaeagnus angustifolia*	Russian Olive			SNA	
Elaeagnaceae	*Elaeagnus umbellata*	Autum Olive			SNA	
Elatinaceae	*Elatine triandra*	Long-stemmed Waterwort			S3	
Equisetaceae	*Equisetum arvense*	Field Horsetail			S5	
Equisetaceae	*Equisetum fluviatile*	Water Horsetail			S5	
Equisetaceae	*Equisetum palustre*	Marsh Horsetail			S5	LS

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Equisetaceae	*Equisetum pratense*	Meadow Horsetail			S5	LS
Ericaceae	*Vaccinium corymbosum*	Highbush Blueberry			S4	LS
Fabaceae	*Coronilla varia*	Crown-vetch			SNA	
Fabaceae	*Desmodium canadense*	Showy Tick-trefoil			S4	
Fabaceae	*Gleditsia triacanthos*	Honey Locust			S2	
Fabaceae	*Lotus corniculatus*	Bird's-foot Trefoil			SNA	
Fabaceae	*Medicago lupulina*	Black Medic			SNA	
Fabaceae	*Medicago sativa* ssp. *falcata*	Alfalfa			SNA	
Fabaceae	*Medicago sativa* ssp. *sativa*	Alfalfa			SNA	
Fabaceae	*Melilotus alba*	White Sweet Clover			SNA	
Fabaceae	*Robinia pseudo-acacia*	Black Locust			SNA	
Fabaceae	*Trifolium aureum*	Yellow Clover			SNA	
Fabaceae	*Trifolium hybridum* ssp. *elegans*	Alsike Clover			SNA	
Fabaceae	*Trifolium pratense*	Red Clover			SNA	
Fabaceae	*Trifolium repens*	White Clover			SNA	
Fabaceae	*Vicia cracca*	Tufted Vetch			SNA	
Fagaceae	*Fagus grandifolia*	American Beech			S5	
Fagaceae	*Quercus alba*	White Oak			S5	
Fagaceae	*Quercus macrocarpa*	Bur Oak			S5	
Fagaceae	*Quercus rubra*	Northern Red Oak			S5	
Gentianaceae	*Gentiana andrewsii*	Closed Gentian			S4	
Geraniaceae	*Geranium maculatum*	Wild Geranium			S5	
Geraniaceae	*Geranium robertianum*	Herb-robert			S5	
Grossulariaceae	*Ribes americanum*	Wild Black Currant			S5	
Grossulariaceae	*Ribes cynosbati*	Prickly Gooseberry			S5	
Grossulariaceae	*Ribes rubrum*	Northern Red Currant			SNA	

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Haloragaceae	*Myriophyllum* sp.	Water-milfoil Species				
Hippocastanaceae	*Aesculus hippocastanum*	Horse Chestnut			SNA	
Hydrocharitaceae	*Vallisneria americana*	Eel-grass			S5	
Iridaceae	*Iris pseudacorus*	Yellow Iris			SNA	
Iridaceae	*Iris* sp.	Iris Species				
Iridaceae	*Iris versicolor*	Blueflag			S5	
Iridaceae	*Sisyrinchium montanum*	Strict Blue-eyed-grass			S5	
Juglandaceae	*Carya cordiformis*	Bitternut Hickory			S5	
Juglandaceae	*Juglans cinerea*	Butternut	END	END	S2?	LS
Juglandaceae	*Juglans nigra*	Black Walnut			S4?	
Juncaceae	*Juncus articulatus*	Jointed Rush			S5	
Juncaceae	*Juncus dudleyi*	Dudley's Rush			S5	
Juncaceae	*Juncus effusus* ssp. *solutus*	Soft Rush			S5	
Juncaceae	*Juncus pylaei*	Rush			S5?	
Juncaceae	*Juncus tenuis*	Slender Rush			S5	
Lamiaceae	*Clinopodium vulgare*	Field Basil			S5	
Lamiaceae	*Leonurus cardiaca* ssp. *cardiaca*	Common Motherwort			SNA	
Lamiaceae	*Lycopus americanus*	American Bugleweed			S5	
Lamiaceae	*Lycopus uniflorus*	Northern Bugleweed			S5	
Lamiaceae	*Mentha arvensis*	Corn Mint			S5	
Lamiaceae	*Nepeta cataria*	Catnip			SNA	
Lamiaceae	*Prunella vulgaris* ssp. *lanceolata*	Self-heal			S5	
Lamiaceae	*Prunella vulgaris* ssp. *vulgaris*	Common Heal-all			SNA	
Lamiaceae	*Scutellaria galericulata*	Hooded Skullcap			S5	
Lamiaceae	*Scutellaria lateriflora*	Mad Dog Skullcap			S5	
Lemnaceae	*Lemna minor*	Lesser Duckweed			S5	

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Lemnaceae	*Lemna trisulca*	Star Duckweed			S5	
Lemnaceae	*Spirodela polyrhiza*	Common Water-flaxseed			S5	
Liliaceae	*Allium tricoccum*	Wild Leek			S5	
Liliaceae	*Asparagus officinalis*	Asparagus			SNA	
Liliaceae	*Clintonia borealis*	Blue Bead Lily			S5	
Liliaceae	*Convallaria majalis*	European Lily-of-the-valley			SNA	
Liliaceae	*Erythronium americanum* ssp. *americanum*	Yellow Trout-lily			S5	
Liliaceae	*Hemerocallis fulva*	Orange Daylily			SNA	
Liliaceae	*Lilium philadelphicum*	Wood Lily			S5	LS
Liliaceae	*Maianthemum canadense*	Wild-lily-of-the-valley			S5	
Liliaceae	*Maianthemum racemosum* ssp. *racemosum*	False Solomon's Seal			S5	
Liliaceae	*Narcissus pseudonarcissus*	Daffodil			SNA	
Liliaceae	*Polygonatum pubescens*	Downy Solomon's Seal			S5	
Liliaceae	*Trillium grandiflorum*	White Trillium			S5	
Lythraceae	*Decodon verticillatus*	Hairy Swamp Loosestrife			S5	LS
Lythraceae	*Lythrum salicaria*	Slender-spike Loosestrife			SNA	
Malvaceae	*Malva neglecta*	Cheeses			SNA	
Monotropaceae	*Monotropa hypopithys*	Pinesap			S4	
Moraceae	*Morus alba*	White Mulberry			SNA	
Nymphaeaceae	*Nuphar variegata*	Bullhead Pond-lily			S5	
Oleaceae	*Forsythia viridissima*	Golden-bells			SNA	
Oleaceae	*Fraxinus americana*	White Ash			S5	
Oleaceae	*Fraxinus nigra*	Black Ash			S5	
Oleaceae	*Fraxinus pennsylvanica*	Green Ash			S5	
Oleaceae	*Ligustrum vulgare*	European Privet			SNA	
Oleaceae	*Syringa vulgaris*	Common Lilac			SNA	

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Onagraceae	*Chamerion angustifolium* ssp. *angustifolium*	Fireweed			S5	LS
Onagraceae	*Circaea lutetiana* ssp. *canadensis*	Enchanter's Nightshade			S5	
Onagraceae	*Epilobium ciliatum* ssp. *ciliatum*	Hairy Willow-herb			S5	
Onagraceae	*Epilobium coloratum*	Purple-leaf Willow-herb			S5	
Onagraceae	*Epilobium hirsutum*	Great-hairy Willow-herb			SNA	
Onagraceae	*Epilobium leptophyllum*	Linear-leaved Willow-herb			S5	
Onagraceae	*Epilobium parviflorum*	Small-flower Willow-herb			SNA	
Onagraceae	*Epilobium strictum*	Downy Willow-herb			S5	LS
Onagraceae	*Oenothera biennis*	Common Evening-primrose			S5	
Orchidaceae	*Cypripedium pubescens* var. *pubescens*	Large Yellow Lady's-slipper			S5	
Orchidaceae	*Epipactis helleborine*	Eastern Helleborine			SNA	
Osmundaceae	*Osmunda cinnamomea*	Cinnamon Fern			S5	
Osmundaceae	*Osmunda claytoniana*	Interrupted Fern			S5	LS
Osmundaceae	*Osmunda regalis* var. *spectabilis*	Royal Fern			S5	
Oxalidaceae	*Oxalis stricta*	Upright Yellow Wood Sorrel			S5	
Paeoniaceae	*Paeonia officinalis*	Common Peony			SNA	
Papaveraceae	*Chelidonium majus*	Greater Celadine			SNA	
Papaveraceae	*Sanguinaria canadensis*	Bloodroot			S5	
Pinaceae	*Abies balsamea*	Balsam Fir			S5	
Pinaceae	*Larix decidua*	European Larch			SNA	
Pinaceae	*Larix laricina*	American Larch			S5	
Pinaceae	*Picea abies*	Norway Spruce			SNA	
Pinaceae	*Picea glauca*	White Spruce			S5	
Pinaceae	*Picea pungens*	Colorado Spruce			SNA	
Pinaceae	*Pinus banksiana*	Jack Pine			S5	
Pinaceae	*Pinus nigra*	Black Pine			SNA	

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Pinaceae	*Pinus resinosa*	Red Pine			S5	
Pinaceae	*Pinus strobus*	Eastern White Pine			S5	
Pinaceae	*Pinus sylvestris*	Scotch Pine			SNA	
Pinaceae	*Tsuga canadensis*	Eastern Hemlock			S5	
Plantaginaceae	*Plantago lanceolata*	English Plantain			SNA	
Plantaginaceae	*Plantago major*	Nipple-seed Plantain			SNA	
Poaceae	*Agrostis gigantea*	Redtop			SNA	
Poaceae	*Agrostis scabra*	Rough Bentgrass			S5	
Poaceae	*Agrostis stolonifera*	Spreading Bentgrass			S5	
Poaceae	*Bromus inermis* ssp. *inermis*	Smooth Brome			SNA	
Poaceae	*Calamagrostis canadensis*	Blue-joint Reedgrass			S5	
Poaceae	*Dactylis glomerata*	Orchard Grass			SNA	
Poaceae	*Dichanthelium acuminatum* ssp. *implicatum*	Mat Panic Grass			S5	
Poaceae	*Digitaria sanguinalis*	Hairy Crabgrass			SNA	
Poaceae	*Echinochloa crusgalli*	Barnyard Grass			SNA	
Poaceae	*Elymus repens*	Quack Grass			SNA	
Poaceae	*Festuca rubra* ssp. *rubra*	Red Fescue			S5	
Poaceae	*Glyceria borealis*	Northern Manna Grass			S5	
Poaceae	*Glyceria grandis*	American Manna Grass			S4S5	
Poaceae	*Glyceria septentrionalis*	Floating Manna Grass			S4	
Poaceae	*Glyceria striata*	Fowl Manna Grass			S5	
Poaceae	*Leersia oryzoides*	Rice Cutgrass			S5	
Poaceae	*Lolium pratense*	Meadow Fescue			SNA	
Poaceae	*Panicum capillare*	Old Panic Grass			S5	
Poaceae	*Phalaris arundinacea*	Reed Canary Grass			S5	
Poaceae	*Phleum pratense*	Timothy			SNA	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Poaceae	*Poa compressa*	Canada Bluegrass			S5	
Poaceae	*Poa palustris*	Fowl Bluegrass			S5	
Poaceae	*Poa pratensis* ssp. *pratensis*	Kentucky Bluegrass			SNA	
Poaceae	*Secale cereale*	Cultivated Rye			SNA	
Poaceae	*Setaria viridis*	Green Bristle Grass			SNA	
Poaceae	*Spartina pectinata*	Fresh Water Cordgrass			S4	LS
Polygalaceae	*Persicaria amphibia*	Water Smartweed			S5	
Polygonaceae	*Polygonum hydropiperoides*	Mild Water-pepper			S5	
Polygonaceae	*Polygonum persicaria*	Lady's Thumb			SNA	
Polygonaceae	*Polygonum punctatum*	Dotted Smartweed			S5	
Polygonaceae	*Rumex crispus*	Curly Dock			SNA	
Polygonaceae	*Rumex obtusifolius* ssp. *obtusifolius*	Bitter Dock			SNA	
Portulacaceae	*Portulaca oleracea*	Common Purslane			SNA	
Potamogetonaceae	*Stuckenia pectinatus*	Sago Pondweed			S5	
Primulaceae	*Lysimachia ciliata*	Fringed Loosestrife			S5	
Primulaceae	*Lysimachia nummularia*	Moneywort			SNA	
Primulaceae	*Lysimachia quadrifolia*	Whorled Loosestrife			S4	
Primulaceae	*Lysimachia thyrsiflora*	Water Loosestrife			S5	
Primulaceae	*Trientalis borealis* ssp. *borealis*	Northern Starflower			S5	
Ranunculaceae	*Actaea pachypoda*	White Baneberry			S5	
Ranunculaceae	*Anemone americana*	Round-lobed Hepatica			S5	
Ranunculaceae	*Anemone canadensis*	Canada Anemone			S5	
Ranunculaceae	*Aquilegia canadensis*	Wild Columbine			S5	
Ranunculaceae	*Caltha palustris*	Marsh Marigold			S5	
Ranunculaceae	*Coptis trifolia*	Goldthread			S5	
Ranunculaceae	*Ranunculus abortivus*	Kidney-leaved Buttercup			S5	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Ranunculaceae	*Ranunculus acris*	Tall Buttercup			SNA	
Ranunculaceae	*Ranunculus flabellaris*	Yellow Water-crowfoot			S4?	LS
Ranunculaceae	*Ranunculus gmelinii*	Small Yellow Water Buttercup			S5	LS
Ranunculaceae	*Ranunculus hispidus* var. *caricetorum*	Swamp Buttercup			S5	
Ranunculaceae	*Ranunculus hispidus* var. *hispidus*	Bristly Buttercup			S3	
Ranunculaceae	*Ranunculus pensylvanicus*	Bristly Crowfoot			S5	
Ranunculaceae	*Ranunculus recurvatus* var. *recurvatus*	Hooked Crowfoot			S5	
Ranunculaceae	*Ranunculus repens*	Creeping Buttercup			SNA	
Ranunculaceae	*Ranunculus sceleratus* var. *sceleratus*	Cursed Crowfoot			S5	
Ranunculaceae	*Thalictrum dioicum*	Early Meadowrue			S5	
Ranunculaceae	*Thalictrum pubescens*	Tall Meadowrue			S5	
Rhamnaceae	*Frangula alnus*	Glossy Buckthorn			SNA	
Rhamnaceae	*Rhamnus cathartica*	Buckthorn			SNA	
Rosaceae	*Agrimonia gryposepala*	Tall Hairy Agrimony			S5	
Rosaceae	*Crataegus macrosperma*	Variable Hawthorn			S5	
Rosaceae	*Crataegus mollis*	Downy Hawthorn			S5	
Rosaceae	*Crataegus monogyna*	English Hawthorn			SNA	
Rosaceae	*Crataegus punctata*	Dotted Hawthorn			S5	
Rosaceae	*Crataegus* sp.	Hawthorn Species				
Rosaceae	*Crataegus succulenta*	Fleshy Hawthorn			S4S5	
Rosaceae	*Fragaria vesca* ssp. *americana*	Woodland Strawberry			S5	
Rosaceae	*Fragaria virginiana*	Wild Stawberry			S5	
Rosaceae	*Geum aleppicum*	Yellow Avens			S5	
Rosaceae	*Geum canadense*	White Avens			S5	
Rosaceae	*Geum laciniatum*	Rough Avens			S4	LS
Rosaceae	*Geum rivale*	Purple Avens			S5	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Rosaceae	*Geum urbanum*	Clover-root			SNA	
Rosaceae	*Malus pumila*	Common Apple			SNA	
Rosaceae	*Malus* sp.	Apple Species				
Rosaceae	*Potentilla argentea*	Silvery Cinquefoil			SNA	
Rosaceae	*Potentilla norvegica* ssp. *monspeliensis*	Norwegian Cinquefoil			S5	
Rosaceae	*Potentilla recta*	Sulphur Cinquefoil			SNA	
Rosaceae	*Prunus avium*	Sweet Cherry			SNA	
Rosaceae	*Prunus mahaleb*	Perfumed Cherry			SNA	
Rosaceae	*Prunus nigra*	Canada Plum			S4	
Rosaceae	*Prunus pensylvanica*	Fire Cherry			S5	
Rosaceae	*Prunus serotina*	Wild Black Cherry			S5	
Rosaceae	*Prunus virginiana* var. *virginiana*	Choke Cherry			S5	
Rosaceae	*Pyrus communis*	Common Pear			SNA	
Rosaceae	*Rosa multiflora*	Rambler Rose			SNA	
Rosaceae	*Rubus allegheniensis*	Allegheny Blackberry			S5	
Rosaceae	*Rubus idaeus* ssp. *strigosus*	Wild Red Raspberry			S5	
Rosaceae	*Rubus occidentalis*	Black Raspberry			S5	
Rosaceae	*Rubus pubescens*	Dwarf Raspberry			S5	
Rosaceae	*Sorbus aucuparia*	European Mountain-ash			SNA	
Rosaceae	*Spiraea alba*	Narrow-leaved Meadow-sweet			S5	
Rosaceae	*Waldsteinia fragarioides*	Barren Strawberry			S5	
Rubiaceae	*Cephalanthus occidentalis*	Buttonbush			S5	LS
Rubiaceae	*Galium asprellum*	Rough Bedstraw			S5	
Rubiaceae	*Galium mollugo*	White Bedstraw			SNA	
Rubiaceae	*Galium palustre*	Marsh Bedstraw			S5	
Rubiaceae	*Galium trifidum* ssp. *trifidum*	Small Bedstraw			S5	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Rubiaceae	*Galium triflorum*	Sweet-scent Bedstraw			S5	
Rubiaceae	*Galium verum*	Yellow Bedstraw			SNA	
Rutaceae	*Zanthoxylum americanum*	Northern Prickly Ash			S5	
Salicaceae	*Populus alba*	White Poplar			SNA	
Salicaceae	*Populus balsamifera* ssp. *balsamifera*	Balsam Poplar			S5	
Salicaceae	*Populus deltoides* ssp. *deltoides*	Eastern Cottonwood			S5	
Salicaceae	*Populus grandidentata*	Large-tooth Aspen			S5	
Salicaceae	*Populus tremuloides*	Quaking Aspen			S5	
Salicaceae	*Salix alba*	White Willow			SNA	
Salicaceae	*Salix amygdaloides*	Peach-leaved Willow			S5	
Salicaceae	*Salix bebbiana*	Bebb's Willow			S5	
Salicaceae	*Salix candida*	Hoary Willow			S5	
Salicaceae	*Salix discolor*	Pussy Willow			S5	
Salicaceae	*Salix eriocephala*	Heart-leaved Willow			S5	
Salicaceae	*Salix exigua*	Sandbar Willow			S5	
Salicaceae	*Salix fragilis*	Crack Willow			SNA	
Salicaceae	*Salix lucida*	Shining Willow			S5	
Salicaceae	*Salix nigra*	Black Willow			S4?	
Salicaceae	*Salix petiolaris*	Meadow Willow			S5	
Salicaceae	*Salix purpurea*	Basket Willow			SNA	
Salicaceae	*Salix serissima*	Autumn Willow			S5	
Salicaceae	*Salix* x *rubens*	Reddish Willow			SNA	
Saxifragaceae	*Penthorum sedoides*	Ditch-stonecrop			S5	
Scrophulariaceae	*Chelone glabra*	Turtlehead			S5	
Scrophulariaceae	*Linaria vulgaris*	Butter-and-eggs			SNA	
Scrophulariaceae	*Mimulus ringens*	Square-stem Monkey-flower			S5	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Scrophulariaceae	*Penstemon digitalis*	Foxglove Beardtongue			S4S5	
Scrophulariaceae	*Verbascum thapsus*	Common Mullein			SNA	
Scrophulariaceae	*Veronica americana*	American Speedwell			S5	
Scrophulariaceae	*Veronica anagallis-aquatica*	Brook-pimpernell			SNA	
Scrophulariaceae	*Veronica officinalis*	Common Speedwell			SNA	
Scrophulariaceae	*Veronica scutellata*	Marsh Speedwell			S5	
Smilacaceae	*Smilax tamnoides*	Hispid Greenbrier			S4	
Solanaceae	*Solanum dulcamara*	Climbing Nightshade			SNA	
Solanaceae	*Solanum ptychanthum*	Eastern Black Nightshade			S5	
Sparganiaceae	*Sparganium americanum*	American Bur-reed			S4?	
Sparganiaceae	*Sparganium eurycarpum*	Large Bur-reed			S5	
Thelypteridaceae	*Thelypteris palustris* var. *pubescens*	Marsh Fern			S5	
Thymelaeaceae	*Dirca palustris*	Eastern Leatherwood			S4?	
Tiliaceae	*Tilia americana*	American Basswood			S5	
Typhaceae	*Typha angustifolia*	Narrow-leaved Cattail			S5	
Typhaceae	*Typha latifolia*	Broad-leaf Cattail			S5	
Ulmaceae	*Ulmus americana*	American Elm			S5	
Ulmaceae	*Ulmus pumila*	Siberian Elm			SNA	
Ulmaceae	*Ulmus rubra*	Slippery Elm			S5	
Urticaceae	*Boehmeria cylindrica*	False Nettle			S5	
Urticaceae	*Laportea canadensis*	Wood Nettle			S5	
Urticaceae	*Pilea pumila*	Canada Clearweed			S5	LS
Urticaceae	*Urtica dioica* ssp. *gracilis*	Slender Stinging Nettle			S5	
Violaceae	*Viola affinis*	Lecontes Violet			S4?	
Violaceae	*Viola conspersa*	American Bog Violet			S5	
Violaceae	*Viola macloskeyi* ssp. *pallens*	Smooth White Violet			S5	

Family Name	Scientific Name	Common Name	COSEWIC	COSSARO	S-RANK	Guelph 2012
Violaceae	*Viola pubescens*	Downy Yellow Violet			S5	
Violaceae	*Viola sororia*	Woolly Blue Violet			S5	
Violaceae	*Viola* sp.	Violet Species				
Vitaceae	*Parthenocissus vitacea*	Thicket Creeper			S5	
Vitaceae	*Vitis riparia*	Riverbank Grape			S5	

*SOURCE: City of Guelph. 2012. Locally Significant Plant List. First published in the City of Guelph Natural Heritage Strategy Phase 2: Terrestrial Inventory & Natural Heritage System (Volume 2, Appendices). Updated with current species stauses by the City in June 2012.
LS = Locally Significant in Wellington County

Appendix NH-5:
Clair-Maltby Secondary Plan Area Wildlife List

Appendix NH-5

Clair-Maltby Secondary Plan Area
Wildlife List

Appendix NH-5

Clair-Maltby Secondary Plan Area Wildlife List

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	Sources (e)
BIRDS								x
Pied-billed Grebe	*Podilymbus podiceps*			S4	S,R	B	B	1,19
Great Blue Heron**	*Ardea herodias*			S4	S,R	x	x	1,2,9,22
Tundra Swan	*Cygnus columbianus*			S4			B	5
Canada Goose	*Branta canadensis*			S5		B	B	1,2,5,9,17,18,19,20
Wood Duck	*Aix sponsa*			S5			B	5,19,20
Mallard	*Anas platyrhynchos*			S5		B	B	1,2,5,9,18,19,20,22
Ring-necked Duck	*Aythya collaris*			S5	S,R	x	x	1,19
Bufflehead	*Bucephala albeola*			S4			x	19
Common Merganser	*Mergus merganser*			S5	S,R	x		1
Turkey Vulture	*Cathartes aura*			S5	S,R		x	1,5,9,13,14,19,20,22
Osprey	*Pandion haliaetus*			S5	S,R	B	B	1,19
Northern Harrier	*Circus cyaneus*			S4	S		B	13,14,19
Sharp-shinned Hawk	*Accipiter striatus*			S5	S		B	19
Cooper's Hawk	*Accipiter cooperi*			S4	S	x	B	1,5
Red-shouldered Hawk	*Buteo lineatus*			S4	S,R		x	13,14
Broad-winged Hawk	*Buteo platypterus*			S5	S,R		B	13,14,19
Red-tailed Hawk	*Buteo jamaicensis*			S5		x	B	1,5,13,14,19,20,22
Wild Turkey	*Meleagris gallopavo*			S5		B	x	1,10,11,12,20
Ruffed Grouse	*Bonasa umbellus*			S4			B	5,13,14,20
Sora	*Porzana carolina*			S4	S,R		B	4,19

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	Sources (e)
Killdeer	*Charadrius vociferus*			S5		B	B	1,2,5,7,9,13,14,17,19,20,22
Spotted Sandpiper	*Actitis macularia*			S5		B		1
American Woodcock	*Scolopax minor*			S4			B	1,7,13,14,19,22
Ring-billed Gull**	*Larus delawarensis*			S5	S,R	x	x	2,5,19,20
Herring Gull**	*Larus argentatus*			S5	S,R		x	20
Tern sp.	*Sternidae sp*			n/a		x	x	1
Rock Pigeon	*Columba livia*			SNA			B	5,9,13,14,19,22
Mourning Dove	*Zenaida macroura*			S5		B	B	1,2,5,9,13,14,19,20,22
Black-billed Cuckoo	*Coccyzus erythropthalmus*			S5	S		B	19
Yellow-billed Cuckoo	*Coccyzus americanus*			S4	S,R		B	7
Great Horned Owl	*Bubo virginianus*			S4			B	13,14,20
Ruby-throated Hummingbird	*Archilochus colubris*			S5			B	19
Belted Kingfisher	*Ceryle alcyon*			S4		x		1
Yellow-bellied Sapsucker	*Sphyrapicus varius*			S5	S		B	19,20
Red-bellied Woodpecker	*Melanerpes carolinus*			S4			B	20
Downy Woodpecker	*Picoides pubescens*			S5		B	B	1,5,9,13,14,19,20,22
Hairy Woodpecker	*Picoides villosus*			S5	S	x	B	1,5,19,20
Northern Flicker	*Colaptes auratus*			S4	S	B	B	1,5,19,20,22
Pileated Woodpecker	*Dryocopus pileatus*			S5	S	B	B	1,19,20
Eastern Wood-Pewee	*Contopus virens*	SC	SC	S4	S	B	B	1,4,5,7,19
Alder Flycatcher	*Empidonax alnorum*			S5			B	13,14,19
Willow Flycatcher	*Empidonax traillii*			S5	S	B	B	1,2,19
Least Flycatcher	*Empidonax minimus*			S4	S	B	B	1,5,19
Eastern Phoebe	*Sayornis phoebe*			S5		B	B	1,9,19,20
Great Crested Flycatcher	*Myiarchus crinitus*			S4		B	B	1,5,7,9,19
Eastern Kingbird	*Tyrannus tyrannus*			S4	S	B	B	1,2,5,7,9,13,14,19,22

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	Sources (e)
Horned Lark	*Eremophila alpestris*			S5		B	B	1,13,14
Tree Swallow	*Tachycineta bicolor*			S4		B	B	1,2,5,7,9,19,22
N. Rough-winged Swallow	*Stelgidopteryx serripennis*			S4			B	5
Cliff Swallow**	*Petrochelidon pyrrhonota*			S4	S	B	B	5,6,7
Barn Swallow	*Hirundo rustica*	THR	THR	S4		B	B	1,2,5,6,9,19,20,22
Blue Jay	*Cyanocitta cristata*			S5		B	B	1,5,7,9,13,14,17,19,20,22
American Crow	*Corvus brachyrhynchos*			S5		B	B	1,2,5,7,9,13,14,19,20,22
Common Raven	*Corvus corax*			S5	S,R		B	19
Black-capped Chickadee	*Poecile atricapillus*			S5		B	B	1,2,5,7,9,13,14,17,19,20,22
Red-breasted Nuthatch	*Sitta canadensis*			S5	S		B	20
White-breasted Nuthatch	*Sitta carolinensis*			S5			B	1,5,13,14,19,20
Brown Creeper	*Certhia americana*			S5	S		B	20
House Wren	*Troglodytes aedon*			S5		B	B	1,2,5,7,9,13,14,19,22
Winter Wren	*Troglodytes hiemalis*			S5	S		B	20
Golden-crowned Kinglet	*Regulus satrapa*			S5			B	20
Ruby-crowned Kinglet	*Regulus calendula*			S4	S,R		x	1,13,14,20
Eastern Bluebird	*Sialia sialis*			S5			B	7
Hermit Thrush	*Catharus guttatus*			S5			x	20
Wood Thrush	*Hylocichla mustelina*	THR	SC	S4	S		B	4,7
American Robin	*Turdus migratorius*			S5		B	B	1,2,5,6,7,9,13,14,19,20,22
Gray Catbird	*Dumetella carolinensis*			S4		B	B	1,2,5,7,9,13,14,17,19,22
Brown Thrasher	*Toxostoma rufum*			S4	S	B	B	1,5,13,14,19
Cedar Waxwing	*Bombycilla cedrorum*			S5		B	B	1,2,5,13,14,19,22
European Starling	*Sturnus vulgaris*			SE		B	B	1,2,5,13,14,19,20,22

Common Name	**Latin Name**	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	**Sources (e)**
Warbling Vireo	*Vireo gilvus*			S5		B	B	1,2,5,7,19,22
Red-eyed Vireo	*Vireo olivaceus*			S5		B	B	1,5,13,14,19
Yellow Warbler	*Setophaga petechia*			S5		B	B	1,2,5,9,13,14,19
Chestnut-sided Warbler	*Setophaga pensylvanica*			S5			B	7,19
Magnolia Warbler	*Setophaga magnolia*			S5	S,R		B	13,14
Yellow-rumped Warbler	*Setophaga coronata*			S5			B	19,20
Black-throated Green Warbler	*Setophaga virens*			S5	S,R		B	1,13,14,19
Pine Warbler	*Setophaga pinus*			S5	S	B	B	1,13,14,19,20
Black-and-white Warbler	*Mniotilta varia*			S5	S		B	13,14
American Redstart	*Setophaga ruticilla*			S5	S	B	B	1,2,5
Ovenbird	*Seiurus aurocapillus*			S4			B	19
Northern Waterthrush	*Parkesia noveboracensis*			S5			B	1
Mourning Warbler	*Geothlypis philadelphia*			S4			B	13,14
Common Yellowthroat	*Geothlyphis trichas*			S5		B	B	1,5,13,14,19,22
Yellow-breasted Chat	*Icteria virens*	END	END	S2	S,R		B	19,20,21
Scarlet Tanager	*Piranga olivacea*			S4	S,R	B		1
Northern Cardinal	*Cardinalis cardinalis*			S5		B	B	1,2,5,7,9,13,14,19,20
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			S4	S	B	B	1,5,13,14,19
Indigo Bunting	*Passerina cyanea*			S4		B	B	1,2,5,7,13,14,17,19
Eastern Towhee	*Pipilio erythrophthalmus*			S4	S	B	B	1,5,19
American Tree Sparrow	*Spizelloides arborea*			S4			B	19
Chipping Sparrow	*Spizella passerina*			S5		B	B	1,2,5,7,9,13,14,19
Field Sparrow	*Spizella pusilla*			S4	S	B	B	1,2,5,7,19,22
Vesper Sparrow	*Pooecetes gramineus*			S4	S	B	B	1,13,14,19
Savannah Sparrow	*Passerculus sandwichensis*			S4	S	B	B	1,2,7,9,13,14
Grasshopper Sparrow	*Ammodramus savannarum*			S4	S,R		B	1

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	Sources (e)
Song Sparrow	*Melospiza melodia*			S5		B	B	1,2,5,7,9,13,14,17,19,20,22
Swamp Sparrow	*Melospiza georgiana*			S5			B	1,13,14,19
White-throated Sparrow	*Zonotrichia albicollis*			S5			B	19
Dark-eyed Junco	*Junco hyemalis*			S5	S,R		B	13,14,19,20
Bobolink	*Dolichonyx oryzivorus*	THR	THR	S4	S	B	B	2,8,22
Red-winged Blackbird	*Agelaius phoeniceus*			S4		B	B	1,2,5,7,9,13,14,17,19,20,22
Eastern Meadowlark	*Sturnella magna*	THR	THR	S4	S		B	1,2,19,20,22
Brewer's Blackbird	*Euphagus cyanocephalus*			S4	S,R		x	20
Common Grackle	*Quiscalus quiscula*			S5		B	B	1,2,5,7,9,19,20
Brown-headed Cowbird	*Molothrus ater*			S4		B	B	1,5,9,13,14,19,20,22
Baltimore Oriole	*Icterus galbula*			S4	S	B	B	1,5,7,9,13,14,19,22
House Finch	*Haemorhous mexicanus*			SNA		B	x	2,13,14
Purple Finch	*Haemorhous purpureus*			S4			B	20
Pine Siskin	*Spinus pinus*			S4			B	20
American Goldfinch	*Spinus tristis*			S5		B	B	1,2,5,7,9,13,14,17,19,20,22
House Sparrow	*Passer domesticus*			SNA		B		2
AMPHIBIANS								x
American Toad	*Bufo americanus americanus*			S5		B	B	1,3,4,5,7,9,10,11,12,19,23
Tetraploid Gray Treefrog	*Hyla versicolor*			S5		B	B	1,2,3,4,5,7,8,9,10,11,12,13,14,19,20,22,23
Western Chorus Frog	*Pseudacris triseriata*	THR		S3	S,R	B	B	1,4,7,8,19,21,23
Spring Peeper	*Pseudacris crucifer crucifer*			S5		B	B	1,2,3,4,5,7,8,9,10,11,12,19,20,22,23
Bullfrog	*Rana catesbeiana*			S4	S,R	B	B	1,3,4,19,20,21
Green Frog	*Rana clamitans*			S5		B	B	1,2,3,4,5,7,8,9,10,11,12,19,20,22

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	Sources (e)
Pickerel Frog	*Rana palustris*			S4	S,R	B	x	3,23
Northern Leopard Frog	*Rana pipiens*			S5		B	B	1,2,3,4,5,8,9,10,11,12,18,19,20,22,23
Wood Frog	*Rana sylvatica*			S5		B	B	1,3,4,5,7,8,9,10,11,12,18,19,20,23
Blue-spotted Salamander	*Ambystoma laterale*			S4	S,R		B	19,20
Blue-spotted dominated polyploid Salamander	*Ambystoma (2) laterale - jeffersonianum*			S4	S,R		B	3,5,10,11,12,20
Blue-spotted/Blue-spotted dominated polyploid Salamander	*Ambystoma laterale or Ambystoma (2) laterale - jeffersonianum*			S4	S,R		x	1,11,12,23
Yellow (Spotted) Salamander	*Ambystoma maculatum*			S4	S,R	B	B	18,19,20
Salamander sp.	*n/a*			n/a			x	1
Eastern Newt	*Notophtalmus viridescens*			S5			x	1,3,5,20
Red-spotted Newt	*Notophtalmus viridescens viridescens*			S5	S,R	B	B	20,23
REPTILES								x
Snapping Turtle	*Chelydra serpentina*	SC	SC	S3	S,R	B	B	1,2,3,4,7,18,21
Midland Painted Turtle	*Chrysemys picta marginata*			S5		B	x	1,2,3,5,7,10,11,12,19
Red-eared Slider	*Trachemys scripta elegans*			SE			x	1
Northern Water Snake	*Nerodia sipedon sipedon*			S5	S,R		x	1
Brown Snake	*Storeria dekayi dekayi*			S5	S,R		x	1,5,10,11,12
Redbelly Snake	*Storeria o. occipitomaculata*			S5	S,R	x	x	2,3,4,5,10,11,12,20
Ribbon Snake	*Thamnophis sauritus septentrionalis*	SC	SC	S4		x	x	1,19,20,21
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*			S5		x	x	1,2,3,4,5,10,11,12,13,14,19,20
MAMMALS								x
Northern Short-tailed Shrew	*Blarina brevicauda*			S5			x	5
Shrew Sp.	*Sorex Sp.*			n/a			x	3

Common Name	**Latin Name**	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	**Sources (e)**
Star-nosed Mole	*Condylura cristata*			S5			x	3,4
Small-footed Bat	*Myotis leibii*		END	S2S3	S,R		x	5
Silver-haired Bat	*Lasionycteris noctivagans*			S4			x	5
Big Brown Bat	*Epesicus fuscus*			S4			x	5
Eastern Red Bat	*Lasiurus borealis*			S4			x	5
Hoary Bat	*Lasiurus cinereus*			S4			x	5
Bat Sp.	*n/a*			n/a			x	9
Eastern Cottontail	*Sylvilagus floridanus*			S5		x	x	1,3,5,7,9,19
Eastern Chipmunk	*Tamias striatus*			S5		x	x	1,3,5,10,11,12,13,14, 19
Woodchuck	*Marmota monax*			S5			x	21,22
Gray Squirrel	*Sciurus carolinensis*			S5		x	x	1,2,5,9,13,14,19,20
Red Squirrel	*Tamiasciurus hudsonicus*			S5		x	x	1,5,9,18,20
Mouse Sp.	*Peromyscus sp.*			n/a			x	3
Meadow Vole	*Microtus pennsylvanicus*			S5			x	3,19
Norway Rat	*Rattus norvegicus*			SNA			x	5
Muskrat	*Ondatra zibethicus*			S5		x	x	2,3,18,19
Meadow Jumping Mouse	*Zapus hudsonius*			S5			x	22
Porcupine	*Erethizon dorsatum*			S5			x	19
Coyote	*Canis latrans*			S5		x	x	1,5,7,10,11,12,21
Red Fox	*Vulpes vulpes*			S5		x	x	1,18,19
Raccoon	*Procyon lotor*			S5		x	x	1,2,5,7,10,11,12,13,1 4,18,20,22
Long-tailed Weasel	*Mustela frenata*			S4	S,R		x	19
Mink	*Mustela vison*			S5			x	3,19
Striped Skunk	*Mephitis mephitis*			S5			x	7
White-tailed Deer	*Odocoileus virginianus*			S5		x	x	1,2,5,7,9,10,11,12,13, 14,19,20,21,22

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	Sources (e)
Domestic Dog	*Canis sp.*			n/a		x		1
DRAGONFLIES AND DAMSELFLIES (ODONATES)								x
Sweetflag Spreadwing	*Lestes forcipatus*			S4	S,R		x	5
Slender Spreadwing	*Lestes rectangularis*			S5			x	5
Lyre-tipped Spreadwing	*Lestes unguiculatus*			S5			x	5
Spreadwing Sp.	*Lestes sp.*			n/a			x	19
Citrine Forktail	*Ischnura hastata*			SNA	S,R		x	5
Familiar Bluet	*Enallagma civile*			S5			x	5
Eastern Forktail	*Ischnura verticalis*			S5			x	5
Darner sp.	*Aeshna sp.*			n/a		x	x	1
Common Green Darner	*Anax junius*			S5			x	5,19
Eastern Pondhawk	*Erythemis simplicicollis*			S5			x	5
Widow Skimmer	*Libellula luctuosa*			S5			x	5
Common Whitetail	*Libellula lydia*			S5			x	5,19
Twelve-spotted Skimmer	*Libellula pulchella*			S5			x	5,9,19
Cherry-faced Meadowfly	*Sympetrum internum*			S5			x	5
White-faced Meadowfly	*Sympetrum obtrusum*			S5			x	5,19
Ruby Meadowfly	*Sympetrum rubicundulum*			S5			x	5
Meadowfly sp.	*Sympetrum sp.*			n/a			x	1
Black Saddlebags	*Tramea lacerata*			S4			x	5
BUTTERFLIES								x
Least Skipper	*Ancyloxypha numitor*			S5			x	19
Black Swallowtail	*Papilio polyxenes*			S5		x	x	2,5,7,13,14,22
Eastern Tiger Swallowtail	*Papilio glaucus glaucus*			S5			x	5,7,19
Giant Swallowtail	*Papilio cresphontes*			S4	S,R		x	7
Mustard White	*Pieris oleracea*			S4			x	13,14
Cabbage White	*Pieris rapae*			SNA		x	x	1,2,5,7,13,14,17,19

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Wellington County (d)	Secondary Plan Area	Primary Study Area	Sources (e)
Clouded (Common) Sulphur	*Colias philodice*			S5			x	5,13,14,17
Sulphur Sp.	*Colias sp.*			n/a			x	19
Spring Azure	*Celastrina ladon*			SU			x	5,7,19
Summer Azure	*Celastrina neglecta*			S5			x	5
Great Spangled Fritillary	*Speyeria cybele*			S5			x	13,14
Pearl Crescent	*Phyciodes tharos*			S4			x	5,7,13,14
Northern Crescent	*Phyciodes cocyta*			S5			x	19
Eastern Comma	*Polygonia comma*			S5			x	7
Comma Sp.	*Polygonia Sp.*			n/a			x	5
Mourning Cloak	*Nymphalis antiopa*			S5			x	5,7,19
Viceroy	*Limenitis archippus*			S5			x	5
Little Wood-Satyr	*Megisto cymela*			S5			x	5,19
Common Ringlet	*Coenonympha tullia*			S5			x	7,13,14
Common Wood-Nymph	*Cercyonis pegala*			S5			x	5,7,19,22
Monarch	*Danaus plexippus*	SC	SC	S2	S	x	B	1,2,4,5,7,13,14,17,19,22

LEGEND

x= species not breeding or not specified if breeding
B = species observed breeding
** = Only habitats that support or have recently supported active nests should be considered significant

a COSEWIC = Committee on the Status of Endangered Wildlife in Canada
Staus on shown if: END = Endangered, THR = Threatened, SC = Special Concern

b Species at Risk in Ontario List (as applies to ESA) as designated by COSSARO (Committee on the Status of Species at Risk in Ontario)
Staus on shown if: END = Endangered, THR = Threatened, SC = Special Concern

c SRANK (from Natural Heritage Information Centre) for breeding status if:
S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), S4 (Apparently Secure), S5 (Secure)
SNA (Not applicable…'because the species is not a suitable target for conservation activities'; includes non-native species)

SE (exotic, i.e. non-native), SU (unrankable)

c Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide (Appendix G). 151 p plus appendices.

d Significant Wildlife List for Wellington County from the City of Guelph Natural Heritage Strategy, Volume 2 (Dougan & Associates with Snell and Cecile 2009), last updated by the City of Guelph 2012.
Status only shown if: S = Significant, R = Rare
Note that the following designations were excluded from this list:
† = Bank Swallow: Significant only when found nesting in colonies equal to or greater than 100. However, recent OBBA data for Wellington County should be reviewed to see if this is appropriate.
† = Cliff Swallow: Significant only when found nesting in colonies equal to or greater than 8. However, recent OBBA data for Wellington County should be reviewed to see if this is appropriate.
‡ = Being small and secretive, these species are often overlooked. When more information is collected, it is possible that they may not merit significant species status in the future.
o= Habitat protection should be considered only when larval habitat is present at or in close proximity to where adults were documented.
Δ = Considered significant at present, but may prove to be too common to be so regarded in the future.

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Appendix NH-6:
Clair-Maltby Secondary Plan Area Provincially Endangered and Threatened Species at Risk Screening

Appendix NH-6

Clair-Maltby Secondary Plan
Provincially Endangered and Threatened Species at Risk Screening

Appendix NH-6

Clair-Maltby Secondary Plan Provincially Endangered and Threatened Species at Risk Screening

Taxonomy	Column1	ESA Status	SARA Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Presence in PSA	Species Confirmed Present in the PSA or SPA (See Figure # for confirmed species' locations)
Plants	Butternut *Juglans cinerea*	END	END Schedule 1	In Ontario, Butternut usually grows alone or in small groups in deciduous forests. It prefers moist, well-drained soil and is often found along streams. It is also found on well-drained gravel sites and rarely on dry rocky soil. This species does not do well in the shade, and often grows in sunny openings and near forest edges.	Butternut can be found throughout central and eastern North America. In Canada, Butternut occurs in Ontario, Quebec and New Brunswick. In Ontario, this species is found throughout the southwest, north to the Bruce Peninsula, and south of the Canadian Shield.	**Yes** Suitable habitat is present within the PSA and SPA	**No** Butternut not confirmed present in PSA or SPA
Amphibians	Jefferson Salamander *Ambystoma jeffersonianum*	END	THR Schedule 1	Adults live in moist, loose soil, under logs or in leaf litter. Your best chance of spotting a Jefferson salamander is in early spring when they travel to woodland ponds to breed. They lay their eggs in clumps attached to underwater vegetation. By midsummer, the larvae lose their gills and leave the pond and head into the surrounding forest. Once in the forest, Jefferson salamanders spend much of their time underground in rodent burrows, and under rocks and stumps. They feed primarily on insects and worms.	In Canada, it is found only in southern Ontario, mainly along the Niagara Escarpment.	**Yes** Suitable habitat is present within the PSA and SPA within woodlands and woodland ponds	**No** Jefferson Salamander not confirmed present in PSA or SPA
Reptiles	Blanding's Turtle *Emydoidea blandingii*	THR	THR Schedule 1	Blanding's Turtles live in shallow water, usually in large wetlands and shallow lakes with lots of water plants. It is not unusual, though, to find them hundreds of metres from the nearest water body, especially while they are searching for a mate or traveling to a nesting site. Blanding's Turtles hibernate in the mud at the bottom of permanent water bodies from late October until the end of April.	The Blanding's Turtle is found in and around the Great Lakes Basin, with isolated populations elsewhere in the United States and Canada. In Canada, the Blanding's Turtle is separated into the Great Lakes-St. Lawrence population and the Nova Scotia population. Blanding's Turtles can be found throughout southern, central and eastern Ontario.	**Yes** Suitable habitat is present within the PSA and SPA within larger wetlands or ponds with lots of water vegetation	**No** Blanding's Turtle not confirmed present in PSA or SPA
Birds	Yellow-breasted Chat *Icteria virens*	END	END Schedule 1	The Yellow-breasted Chat lives in thickets and scrub, especially locations where clearings have become overgrown. These birds spend their winters in coastal marshes.	In Canada, it lives in southern British Columbia, the Prairies, and southwestern Ontario, where it is concentrated in Point Pelee National Park and Pelee Island in Lake Erie.	**Yes** Suitable habitat is present within the PSA and SPA within thicket habitat	**Yes** Yellow-breasted Chat confirmed in the south-western section of the PSA within thicket habitat
Birds	Barn Swallow *Hirundo rustica*	THR	THR Schedule 1	Barn Swallows often live in close association with humans, building their cup-shaped mud nests almost exclusively on human-made structures such as open barns, under bridges and in culverts. The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood, since the mud does not adhere as well to smooth surfaces.	The Barn Swallow may be found throughout southern Ontario and can range as far north as Hudson Bay, wherever suitable locations for nests exist.	**Yes** Suitable habitat is present within the PSA and SPA within human-made structures such as barns	**Yes** Barn Swallow confirmed nesting in barns within the PSA and SPA

Taxonomy	Column1	ESA Status	SARA Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Presence in PSA	Species Confirmed Present in the PSA or SPA (See Figure # for confirmed species' locations)
Birds	Bobolink *Dolichonyx oryzivorus*	THR	THR Schedule 1	Historically, Bobolinks lived in North American tallgrass prairie and other open meadows. With the clearing of native prairies, Bobolinks moved to living in hayfields. Bobolinks often build their small nests on the ground in dense grasses. Both parents usually tend to their young, sometimes with a third Bobolink helping.	The Bobolink breeds across North America. In Ontario, it is widely distributed throughout most of the province south of the boreal forest, although it may be found in the north where suitable habitat exists.	**Yes** Suitable habitat is present within the PSA and SPA within grassland habitat	**Yes** Bobolink confirmed in the northern section of the PSA and SPA within grassland habitat
Birds	Chimney Swift *Chaetura pelagica*	THR	THR Schedule 1	Before European settlement Chimney Swifts mainly nested on cave walls and in hollow trees or tree cavities in old growth forests. Today, they are more likely to be found in and around urban settlements where they nest and roost (rest or sleep) in chimneys and other manmade structures. They also tend to stay close to water as this is where the flying insects they eat congregate.	The Chimney Swift breeds in eastern North America, possibly as far north as southern Newfoundland. In Ontario, it is most widely distributed in the Carolinian zone in the south and southwest of the province, but has been detected throughout most of the province south of the 49th parallel. It winters in northwestern South America.	**Yes** Suitable habitat is present within the PSA and SPA within human-made structures	**No** Chimney Swift not confirmed present in PSA or SPA
Birds	Eastern Meadowlark *Sturnella magna*	THR	THR Schedule 1	Eastern Meadowlarks breed primarily in moderately tall grasslands, such as pastures and hayfields, but are also found in alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields, or other open areas. Small trees, shrubs or fence posts are used as elevated song perches.	In Ontario, the Eastern Meadowlark is primarily found south of the Canadian Shield but it also inhabits the Lake Nipissing, Timiskaming and Lake of the Woods areas.	**Yes** Suitable habitat is present within the PSA and SPA within grassland habitat	**Yes** Eastern Meadowlark confirmed in the PSA and SPA within various grassland habitats
Mammals	Eastern Small-footed Myotis (Bat) *Myotis leibii*	END	No Status	In the spring and summer, eastern small-footed bats 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. They seem to choose colder and drier sites than similar bats and will return to the same spot each year.	The eastern small-footed bat has been found from south of Georgian Bay to Lake Erie and east to the Pembroke area. There are also records from the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park. Most documented sightings are of bats in their winter hibernation sites.	**Yes** Suitable habitat is present within the PSA and SPA within treed areas or in buildings	**Yes** Eastern Small-footed Bat confirmed in the south-western section PSA within treed habitats
Mammals	Little Brown Myotis (Bat) *Myotis lucifugus*	END	END Schedule 1	Bats are nocturnal. During the day they roost in trees and buildings. They often select attics, abandoned buildings and barns for summer colonies where they can raise their young. Bats can squeeze through very tiny spaces (as small as six millimetres across) and this is how they access many roosting areas. 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. This species can typically be associated with any community where suitable roosting (i.e. caviety trees, houses, abandoned buildings, barns, etc.) habitat is available.	The little brown bat is widespread in southern Ontario and found as far north as Moose Factory and Favourable Lake. Outside Ontario, this bat is found across Canada (except in Nunavut) and most of the United States.	**Yes** Suitable habitat is present within the PSA and SPA within treed areas or in buildings	**n/a** Field surveys for Little Brown Bat not completed
Mammals	Northern Myotis *(Bat)* *Myotis septentrionalis*	END	END Schedule 1	Northern Myotis bats are associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. These bats hibernate from October or November to March or April, most often in caves or abandoned mines.	The Northern Myotis is found throughout forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon.	**Yes** Suitable habitat is present within the PSA and SPA within treed areas	**n/a** Field surveys for Tri-coloured Bat not completed

Taxonomy	Column1	ESA Status	SARA Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Presence in PSA	Species Confirmed Present in the PSA or SPA (See Figure # for confirmed species' locations)
Mammals	Tri-coloured Bat *Perimyotis subflavus*	END	END Schedule 1	Tri-coloured Bat overwinters in caves and mines. Summer maternity colonies are sometimes in buildings, but mostly in large-diameter trees. Foraging occurs over water, along waterways and forest edges. Large open fields or clearcuts are generally avoided.	Tri-coloured Bat ranges Nova Scotia, New Brunswick, Quebec, Ontario, and the eastern half of the United States.	**Yes** Suitable habitat is present within the PSA and SPA within treed areas and buildings	**n/a** Field surveys for Tri-coloured Bat not completed
Insects	Rusty-patched Bumble Bee *Bombus affinis*	END	END Schedule 1	This species, like other bumble bees, can be found in open habitat such as mixed farmland, urban settings, savannah, open woods and sand dunes. The most recent sightings have been in oak savannah, which contains both woodland and grassland flora and fauna.	The Rusty-patched Bumble Bee was once widespread and common in eastern North America, found from southern Ontario south to Georgia and west to the Dakotas. The species has suffered rapid, severe decline throughout its entire range since the 1970s with only a handful of specimens collected in recent years in Ontario. The only sightings of this bee in Canada since 2002 have been at The Pinery Provincial Park on Lake Huron.	**Yes** Suitable habitat is present within the PSA and SPA within the agricultural lands, urban areas and open woodlands	**No** Rusty-patched Bumble Bee not confirmed present in PSA or SPA

Glossary

EXP	ESA - Extripated - a species that no longer exists in the wild in Ontario but still occurs elsewhere.
	SARA - Extripated - a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
END	ESA - Endangered - a species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's Endangered Species Act.
	SARA - Endangered - a wildlife species that is facing imminent extirpation or extinction.
THR	ESA - Threatened - a species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
	SARA - 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	ESA - Special Concern (formerly Vulnerable) - a species with characteristics that make it sensitive to human activities or natural events.
	SARA - Special Concern - a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
MNRF	Ontario Ministry of Natural Resources and Forestry
ESA	Endangered Species Act
SARA	Species at Risk Act (Federal)
Schedule 1	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.
COSEWIC	Committee on the Stauts of Endangerd Wildlife in Canada - a committee of experts that assesses and designates which wild species are in some danger of disappearing from Canada.

References

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2 - Species at Risk Status Reports. Committed on the Status of Endangered Wildlife in Canada. Ottawa. http://www.sararegistry.gc.ca/search/advSearchResults_e.cfm?stype=doc&docID=18.

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Appendix NH-7:
Clair-Maltby Secondary Plan Area Non-Provincially Endangered and Threatened Species at Risk Screening

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Clair-Maltby Secondary Plan Non-Provincially Endangered and Threatened Species at Risk Screening

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Clair-Maltby Secondary Plan Non-Provincially Endangered and Threatened Species at Risk Screening

Taxonomy	Species	ESA Status	SARA Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Presence in PSA	Species Confirmed Present in the PSA or SPA (See Figure # for confirmed species' locations)
Amphibians	Western Chorus Frog (Great Lakes / St. Lawrence - Canadian Shield population) *Pseudacris maculata*	No Status	THR Schedule 1	Western Chorus Frog is a lowland terrestrial species, and is found on the ground, low shrubs or grass within marshes to wooded wetland areas. For breeding and tadpole development, it requires seasonally dry, temporary ponds without predators (such as fish), and rarely inhabits permanent pond. The Western Chorus Frog is very rarely found in permanent ponds.	In Canada, the Western Chorus Frog is present in southern Ontario and southwestern Quebec. In southern Ontario, its range is bounded by the United States border in the south, Georgian Bay in the northwest, south of Algonquin Park, and up the Ottawa River valley to the vicinity of Eganville in the east. It is also found in the central and northeastern United States.	**Yes** Suitable habitat is present within the PSA and SPA within marshes and woodland ponds	**Yes** Western Chorus Frog confirmed in western portion PSA and SPA within woodlands and marshes
Reptiles	Eastern Ribbonsnake *Thamnophis sauritus*	SC	SC Schedule 1	The Eastern Ribbonsnake is usually found close to water, especially in marshes, where it hunts for frogs and small fish. A good swimmer, it will dive in shallow water, especially if it is fleeing from a potential predator. At the onset of cold weather, these snakes congregate in underground burrows or rock crevices to hibernate together.	In Ontario the eastern Ribbonsnake occurs throughout southern and eastern Ontario and is locally common in parts of the Bruce Peninsula, Georgian Bay and eastern Ontario.	**Yes** Suitable habitat is present within the PSA and SPA within habitats close to water	**Yes** Eastern Ribbon Snake confirmed in PSA within pond behind baseball diamond
Reptiles	Snapping turtle *Chelydra serpentina*	SC	SC Schedule 1	Snapping Turtles spend most of their lives in water. They prefer shallow waters so they can hide under the soft mud and leaf litter, with only their noses exposed to the surface to breathe. During the nesting season, from early to mid-summer, females travel overland in search of a suitable nesting site, usually gravelly or sandy areas along streams. Snapping Turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.	The Snapping Turtle's range extends from Ecuador to Canada. In Canada this turtle can be found from Saskatchewan to Nova Scotia. It is primarily limited to the southern part of Ontario. The Snapping Turtle's range is contracting.	**Yes** Suitable habitat is present within the PSA and SPA within ponds/wetlands or on roads	**Yes** Snapping Turtle confirmed in PSA and SPA within various ponds/wetlands and on road sides
Birds	Bald Eagle *Haliaeetus leucocephalus*	SC	No Status	Bald Eagles nest in a variety of habitats and forest types, almost always near a major lake or river where they do most of their hunting. While fish are their main source of food, Bald Eagles can easily catch prey up to the size of ducks, and frequently feed on dead animals, including White-tailed Deer. They usually nest in large trees such as pine and poplar. During the winter, Bald Eagles sometimes congregate near open water such as the St. Lawrence River, or in places with a high deer population where carcasses might be found.	Bald Eagles are widely distributed throughout North America. In Ontario, they nest throughout the north, with the highest density in the northwest near Lake of the Woods. Historically they were also relatively common in southern Ontario, especially along the shore of Lake Erie, but this population was all but wiped out 50 years ago. After an intensive re-introduction program and environmental clean-up efforts, the species has rebounded and can once again be seen in much of its former southern Ontario range.	**Yes** Suitable habitat is present within the PSA and SPA within woodlands	**No** Bald Eagle not confirmed present in PSA or SPA

Taxonomy	Species	ESA Status	SARA Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Presence in PSA	Species Confirmed Present in the PSA or SPA (See Figure # for confirmed species' locations)
Birds	Canada Warbler *Wilsonia canadensis*	SC	THR Schedule 1	The Canada Warbler breeds in a range of deciduous and coniferous, usually wet forest types, all with a well- developed, dense shrub layer. Dense shrub and understory vegetation help conceal Canada Warbler nests that are usually located on or near the ground on mossy logs or roots, along stream banks or on hummocks.	The Canada Warbler only breeds in North America and 80 per cent of its known breeding range is in Canada. Its primary breeding range is in the Boreal Shield, extending north into the Hudson Plains and south into the Mixedwood Plains. Although the Canada Warbler breeds at low densities across its range, in Ontario, it is most abundant along the Southern Shield.	**Yes** Suitable habitat is present within the PSA and SPA in wet woodlands with dense shrub layer	**No** Canada Warbler not confirmed present in PSA or SPA
Birds	Common Nighthawk *Chordeiles minor*	SC	THR Schedule 1	Traditional Common Nighthawk habitat consists of open areas with little to no ground vegetation, such as logged or burned-over areas, forest clearings, rock barrens, peat bogs, lakeshores, and mine tailings. Although the species also nests in cultivated fields, orchards, urban parks, mine tailings and along gravel roads and railways, they tend to occupy natural sites.	The range of the Common Nighthawk spans most of North and Central America. In Canada, the species is found in all provinces and territories except Nunavut. In Ontario, the Common Nighthawk occurs throughout the province except for the coastal regions of James Bay and Hudson Bay.	**Yes** Suitable habitat is present within the PSA and SPA within forest clearings, urban parks and cultivated fields	**No** Common Nighthawk not confirmed present in PSA or SPA
Birds	Golden-winged Warbler *Vermivora chrysoptera*	SC	THR Schedule 1	Golden-winged Warblers prefer to nest in areas with young shrubs surrounded by mature forest – locations that have recently been disturbed, such as field edges, hydro or utility right-of-ways, or logged areas.	In Ontario the Golden-winged Warbler breed in central-eastern Ontario, as far south as Lake Ontario and the St. Lawrence River, and as far north as the northern edge of Georgian Bay. Golden-winged Warblers have also been found in the Lake of the Woods area near the Manitoba border, and around Long Point on Lake Erie.	**Yes** Suitable habitat is present within the PSA and SPA near mature forests and field edges	**No** Golden-winged Warbler not confirmed present in PSA or SPA
Birds	Red-headed Woodpecker *Melanerpes erythrocephalus*	SC	THR Schedule 1	The Red-headed Woodpecker lives in open woodland and woodland edges, and is often found in parks, golf courses and cemeteries. These areas typically have many dead trees, which the bird uses for nesting and perching. This woodpecker regularly winters in the United States, moving to locations where it can find sufficient acorns and beechnuts to eat. A few of these birds will stay the winter in woodlands in southern Ontario if there are adequate supplies of nuts.	The Red-headed Woodpecker is found across southern Ontario, where it is widespread but rare. Outside Ontario, it lives in Alberta, Saskatchewan, Manitoba and Quebec, and is relatively common in the United States.	**Yes** Suitable habitat is present within the PSA and SPA within woodlands and woodland edges, parks and golf courses	**No** Red-headed Woodpecker not confirmed present in PSA or SPA
Birds	Wood Thrush *Hylocichla mustelina*	SC	THR Schedule 1	The Wood Thrush lives in mature deciduous and mixed (conifer-deciduous) forests. They seek moist stands of trees with well-developed undergrowth and tall trees for singing perches. These birds prefer large forests, but will also use smaller stands of trees. They build their nests in living saplings, trees or shrubs, usually in sugar maple or American beech.	The wood thrush is found all across southern Ontario. It is also found, but less common, along the north shore of Lake Huron, as far west as the southeastern tip of Lake Superior. There is a very small population near Lake of the Woods in northwestern Ontario, and there have been scattered sightings in the mixed forest of northern Ontario.	**Yes** Suitable habitat is present within the PSA and SPA in mature deciduous or mixed forests	**Yes** Wood Thrush confirmed in the mid-northern section of the PSA within forested habitat
Birds	Eastern Wood-Pewee *Contopus virens*	SC	SC Schedule 1	The Eastern Wood-pewee lives in the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in intermediate-age mature forest stands with little understory vegetation.	The eastern wood-pewee is found across most of southern and central Ontario, and in northern Ontario as far north as Red Lake, Lake Nipigon and Timmins.	**Yes** Suitable habitat is present within the PSA and SPA within woodlands	**Yes** Eastern Wood-pewee confirmed in the PSA and SPA within various forested habitats

Taxonomy	Species	ESA Status	SARA Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Presence in PSA	Species Confirmed Present in the PSA or SPA (See Figure # for confirmed species' locations)
Insects	Monarch *Danaus plexippus*	SC	SC Schedule 1	Throughout their life cycle, Monarchs use three different types of habitat. Only the caterpillars feed on milkweed plants and are confined to meadows and open areas where milkweed grows. Adult butterflies can be found in more diverse habitats where they feed on nectar from a variety of wildflowers.	The Monarch's range extends from Central America to southern Canada. In Canada, Monarchs are most abundant in southern Ontario and Quebec where milkweed plants and breeding habitat are widespread. During late summer and fall, Monarchs from Ontario migrate to central Mexico where they spend the winter months. During migration, groups of Monarchs numbering in the thousands can be seen along the north shores of Lake Ontario and Lake Erie.	**Yes** Suitable habitat is present within the PSA and SPA within meadows	**Yes** Monarch confirmed in the PSA and SPA close to or within various meadow habitats
Insects	West Virginia White *Pieris virginiensis*	SC	No Status	The West Virginia White is a small – three to four centimetre wingspan – dingy white butterfly. Its wings appear translucent and on the underside of the hind wing, the veins have grey-brown scaling. As a caterpillar, it is yellow-green with a green stripe along each side. The West Virginia White lives in moist, deciduous woodlots. This butterfly requires a supply of toothwort, a small, spring-blooming plant that is a member of the mustard family, since it is the only food source for larvae.	The majority of sites in the province are in central and southern Ontario, but it also extends north to Manitoulin and St. Joseph islands. The largest populations are in the western Lake Ontario region.	**Yes** Suitable habitat is present within the PSA and SPA within deciduous woodlands	**No** West Virginia White not confirmed present in PSA or SPA

Glossary

EXP ESA - Extirpated - a species that no longer exists in the wild in Ontario but still occurs elsewhere.
SARA - Extirpated - a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
END ESA - Endangered - a species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's Endangered Species Act.
SARA - Endangered - a wildlife species that is facing imminent extirpation or extinction.
THR ESA - Threatened - a species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SARA - 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 ESA - Special Concern (formerly Vulnerable) - a species with characteristics that make it sensitive to human activities or natural events.
SARA - Special Concern - a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
MNRF Ontario Ministry of Natural Resources and Forestry
ESA Endangered Species Act
SARA Species at Risk Act (Federal)
Schedule 1 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.

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