



August 2016

## REPORT ON

# Investigation of Groundwater Impacts Highway 401 and Boundary Road TDA Embankments Cornwall, Ontario

**Submitted to:**

Ministry of Transportation Ontario  
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REPORT

**Report Number:** 1413191-1030

**Distribution:**

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### 1.0 INTRODUCTION

This report presents the results of an investigation of groundwater impacts involving a geotechnical, geochemical and hydrogeological investigation carried out at the site of a pilot-scale application of Tire Derived Aggregate (TDA) as engineered fill for the Highway 401 Boundary Road bridge replacement in Cornwall, Ontario. The location of the bridge re-construction (referred to as the 'Site') is situated at the interchange of Boundary Road and Highway 401 in Eastern Ontario, on the municipal boundary between the City of Cornwall (west side) and the Township of South Glengarry (east side) (See Key Plan, Figure 1).

The Site is classified as a non-hazardous waste disposal site and operates under the Environmental Compliance Approval No. 5558-83WSFB (ECA). Refer to Appendix A for a copy of the ECA. Details pertaining to the design and specifications of the TDA are presented in the Tire Derived Aggregate Design Brief application to the Ministry of the Environment (MTO, 2009) and the Final Report (MTO, 2013) prepared by the Ministry of Transportation in accordance with Condition 41 of the ECA. The core of the approach embankments for the replacement bridge were constructed from TDA fill wrapped in geotextile and covered with low permeability soil according to the design specifications. Pursuant to Condition 21 of the ECA, TDA fill was placed greater than 2 metres above the groundwater table at the time of construction; a minimum of 20 metres from any surface water feature and greater than 100 metres away from any potable groundwater well. The licensed TDA fill area is 0.5 hectares within a total site area of 7.5 hectares. A Site Plan showing the location of the constructed TDA embankments is provided on Figure 2.

Golder Associates Ltd. (Golder) undertook the environmental monitoring program in accordance with Addendum No.1 of the MTO Contract 2010-4003, which included groundwater, surface water and/or TDA leachate quality monitoring during pre-construction, construction and post-construction of the TDA embankments from November 2010 to August 2015.

TDA leachate indicator parameters identified at the site include benzene, iron and manganese. At the request of the Ministry of the Environment and Climate Change (MOECC), alkalinity, hardness and sulphate were also added to the list of TDA leachate indicator parameters as part of the post-construction monitoring assessment. The available groundwater and surface water monitoring data suggests that elevated concentrations of manganese, hardness and/or sulphate at monitoring well MW 03 situated downgradient of the south TDA area may be related to the bridge embankments. However, the source of the elevated concentrations is undetermined and could be related to either the embankment soil or the TDA. Elevated groundwater concentrations of manganese and iron at MW 03 prior to the placement of TDA fill suggest that the groundwater impacts were present prior to construction of the new bridge embankments.





### 2.0 INVESTIGATION OBJECTIVES

The purpose of this investigation was to assess groundwater impacts which may or may not be caused by the TDA and/or the native fill materials used for construction of the bridge embankments and to address the following MOECC technical review comments (also included in Appendix A):

**March 13, 2015 technical comments from MOECC Hydrogeologist Frank Crossley:**

- “The pan lysimeters outside (control) the TDA area are typically reported as “dry” whereas the pan lysimeters within the TDA area have liquids (historical overflow reported). This suggest that the materials covering the TDA are not low permeable material or are insufficient to reduce the infiltration into the TDA area. This issue should be addressed.”

**June 10, 2015 technical comments from MOECC Senior Aquatic Specialist Victor Castro:**

- “Sampling results for stations SW 01, SW 02 and SW 07 show elevated levels of several TDA leachate indicator parameters: iron, manganese and zinc. The consultants do not attribute these elevated concentrations of indicator parameters to the TDA filled embankments, but instead they indicate there is limited evidence to suggest these stations are located downstream of the TDA area. The drainage patterns for the surface water stations is obviously an issue and needs to be confirmed in order to properly assess the surface water data. It may be quite possible for the elevated metals to be natural in origin, particularly in stagnant shallow surface water; however, there is a source of these contaminants in close proximity (i.e. TDA embankments) and therefore an understanding of drainage and flow patterns during wet periods is necessary to explain the elevated concentrations.”

General soil and groundwater conditions across the site were investigated by means of a limited number of test pits and geochemical testing of soil samples. A site drainage assessment was also completed to assess a possible hydrological connection between the TDA embankment and the nearby surface water features. Based on an interpretation of the information obtained from the investigation, along with the existing subsurface information available for the site, an assessment of the geotechnical, geochemical and hydrogeological conditions of the site was completed in order to develop a conceptual site model of the TDA embankments, with respect to groundwater flow and impacts to groundwater (and surface water) quality.



### 3.0 PROCEDURE

The procedures undertaken to complete the various components of the investigation are discussed in this section.

#### 3.1 Review of Available Information

Golder engineering staff reviewed the available drawings, borehole logs, photos and reports pertaining to the former bridge embankment and replacement bridge embankment designs. Coffey Geotechnics Inc. (Coffey) was retained by AECOM to carry out a foundation investigation at the site in 2008. Subsurface conditions and pre-construction groundwater levels presented in the Coffey report (Coffey, 2009) and Contract No. 2010-4003 Addendum No. 1 Design Drawing Sheet 54 were projected on design drawing Sheet 7A (refer to Figure 3), which in turn was used to select the approximate test pit locations.

#### 3.2 Test Pit Investigation

The test pit investigation was carried out in order to collect additional information regarding the thickness, the type, the distribution and environmental quality of the fill and/or native overburden materials vertically and horizontally across the site, including sufficient subsurface information from the north and south TDA fill areas. The test pit locations were selected following review of the design drawings and foundation reports and to include areas where concentrations of contaminants of interest ranged from low to high, in order to evaluate spatial variability of the soil leachability test results.

The test pit locations were picketed in the field by Golder personnel and coordinates and ground surface elevations were determined using a Trimble R8 GPS survey unit. The geodetic reference system used for the survey is the North American datum of 1983 (NAD83).

The field work for the test pit investigation was conducted on October 14, 2015. A total of twelve test pits were completed at the approximate locations shown on the Site Plan, Figure 2. Test pits TP15-01 to TP15-12 were excavated using a track-mounted hydraulic backhoe which was supplied and operated by Glen Wright Excavating Inc. of Ottawa, Ontario. The test pits were excavated on the accessible parts of the study area within the vicinity of north and south TDA areas.

- Test pits TP15-01, TP15-02, TP15-09 and TP15-12 were excavated near existing monitoring wells MW 01, MW 05, MW 03 and MW 04, respectively
- Test pits TP15-04, TP15-06, TP15-08 and TP15-11 were excavated on the side slope of the new embankment to sample the cover material
- Test pits TP15-03, TP15-05, TP15-07 and TP15-10 were excavated on the old embankment adjacent to the inside of the TDA material to confirm the subsurface conditions presented in the Coffey Geotechnics report

The test pits were excavated to depths varying from about 1.1 to 2.4 metres below the ground surface. The soils encountered within the test pits were classified by visual and tactile examination. Groundwater seepage conditions were observed in the test pits during the short time they remained open. The test pits were backfilled and compacted with the backhoe upon completion of the excavating and sampling.



The fieldwork was supervised by a member of our engineering staff who located the test pits, directed the test pitting operations, logged the test pits, and collected samples, and took custody of the samples retrieved.

Upon completion of the test pitting operations, samples of the soils encountered in the test pits were returned to our laboratory for further examination by the project engineer and for geotechnical laboratory testing completed by Golder and/or geochemical analytical testing completed by SGS Canada Inc. (SGS) in Lakefield, Ontario. The geotechnical laboratory testing was completed by Golder's facilities located in Ottawa and Mississauga, Ontario, and included natural water content determination, grain size distribution and constant head permeameter testing of select samples. Representative fill and native material soil samples were submitted to SGS for geochemical testing of total metals and soil leachate (Synthetic Precipitation Leaching Procedure, SPLP) for key leachate indicator parameters alkalinity, iron, hardness (calcium and magnesium), sulphate, zinc and as well as additional metals. The SPLP metal leaching testing (EPA 1312, USEPA, 1992) is used to assess potential chemical load likely to be released to the receiving environment under acid rain leaching conditions (ambient leaching conditions in the natural environment). Acid base accounting (ABA) testing was also undertaken. ABA testing is typically used to determine the potential for acid drainage generating conditions from sulphide bearing materials; however, for the purpose of this investigation ABA testing was conducted to determine the sulphur content of the soil constituents.

### 3.3 Surface Water Features

In response to technical review comments provided from Mr. Victor Castro of the MOECC Technical Support Section, Eastern Region dated June 10, 2015 (refer to Appendix A), Golder conducted a site drainage assessment on April 1, 2016, following consecutive daily precipitation events to confirm surface water drainage flow patterns. Photographs were taken and observations regarding the presence and/or absence of overland runoff, groundwater seeps and surface water flow and ponding were recorded.



## 4.0 SUBSURFACE CONDITIONS

### 4.1 Previous Investigation Findings

In 2008, Coffey Geotechnics completed a foundation investigation which involved drilling and sampling of a series of boreholes to characterize the subsurface conditions at the location of the proposed replacement bridge. Boreholes F1, F2, F3, BH-21, BH-23, BH-24, BH-25 and BH-26 were completed within the vicinity of the proposed south bridge embankment, while boreholes F6, F7, F8, BH-28, BH-31, BH-32A, BH-32B, BH-34 and BH-38 were completed within the proposed north bridge embankment (refer to Figure 2).

The subsurface conditions encountered during the foundations investigation are presented in Figure 3. Boreholes BH-23, BH-24, BH-25, BH-26, BH-28, BH-31, BH-38, F3 and F7 were drilled at the top of the former Boundary Road embankment prior to the construction of the TDA embankment. Granular pavement fill consisting of sand and gravel with some silt ranging between 0.8 and 2.6 metres thick (60.7 and 60.4 metres above sea level (masl) respectively) was encountered at boreholes BH-26, BH-28, BH-31, F3 and F7, situated nearest to the Highway 401 overpass. General embankment fill comprised of sandy silt to clayey silt was encountered from 1.2 to 6.9 metres depth (56.4 and 56.1 masl) at boreholes BH-25, BH-26, BH-28, BH-31, F3 and F7, and near surface at boreholes BH-23 and BH-38. Boreholes F3 and F7 were advanced through the native silty sand to sandy silt till encountered at 7.6 metres depth (55.4 and 55.7 masl). Limestone bedrock was encountered at 12.9 metres depth (50.4 masl) at borehole F3 and 13.6 metres depth (49.4 masl) at borehole F7 (not shown on Figure 3). Contract No. 2010-4003 Addendum No. 1 Design Drawing sheets 54 and 55 were projected on design drawing Sheet 7A (refer to Figure 3), which in turn was used to select the test pit locations.

Groundwater inflow was observed at 3.7 metres bgs (59.6 masl) at borehole F3 and 3.8 metres bgs (59.2 masl) at borehole F7 in the open boreholes and is assumed to originate from the underlying bedrock aquifer. Coffey reported the groundwater level across the site to range between 56 and 57 masl at the time of the investigation (Coffey, 2009). The groundwater level in the native silty sand to sandy silt overburden materials at the former embankment was inferred at approximately 55.8 masl at borehole F3 and 54.0 masl at borehole F7 based on saturated soil conditions observed during the drilling program. Inferred groundwater levels in the native overburden materials adjacent to and within the proposed TDA embankment areas ranged between 54.6 masl and 56.8 masl based on saturated soil conditions observed during the drilling program.

### 4.2 Test Pit Investigation

Twelve test pits (TP15-01 to TP15-12) were excavated on the site for geotechnical and/or environmental purposes in October 2015. The subsurface conditions encountered in the test pits TP15-01 through TP15-12 are shown on the Record of Test Pits provided in Appendix B. Photographs of the test pit locations are also provided in Appendix B. Cross-sections of the subsurface conditions encountered at the north and south embankments are shown on Figures 4 and 5, respectively. The following sections present a detailed overview of the subsurface conditions encountered in the test pits.

Soil samples were collected from each of the 12 test pits completed on the Site. The samples were retrieved directly from the excavator bucket using a clean, gloved hand from the fill (if observed), different soil layers, and/or from visually impacted soil layers (i.e. iron staining, if observed). Bedrock was not encountered at any of the test pit locations to a depth of 1.1 to 2.4 mbgs.



### 4.2.1 Monitoring Well Locations

Test pits TP15-01, TP15-02, TP15-09 and TP15-12 were completed adjacent to monitoring wells MW 01, MW 05, MW 03 and MW 04, respectively (refer to Figure 2) to evaluate the geochemical constituents of the shallow overburden materials. Test pits TP15-01, TP15-09 and TP15-12 were completed to assess the soil conditions downgradient of the TDA area where elevated groundwater concentrations of indicator parameters have previously been reported, while test pit TP15-02 is interpreted not to be under the influence by the TDA based on Golder's understanding of the local shallow overburden groundwater flow regime.

The subsurface conditions encountered at these locations primarily comprised of various fill materials. Test pit TP15-01 situated downgradient (north) of the north TDA area consist of 1.1 metres of peat (fill) underlain by at least 1.3 metres of silty clay with some sand and gravel fill materials. Silty clay fill materials approximately 1.1 metres thick overlay native overburden comprised of silty clay (weathered crust) to a depth of about 1.5 metres at test pit TP15-02, situated west and slightly downgradient of the north TDA area. The subsurface conditions encountered at test pit TP15-09 consist of 0.8 metres of topsoil underlain by at least 1.8 metres of silty clay with some gravel, cobbles and evidence of iron staining. Ground surface conditions at test pit TP15-12 are comprised of a thin layer of silty clay fill approximately 0.2 metres thick over rock fill, which in turn is underlain by black slag mixture (fill) 0.4 metres thick and sandy silt (fill) with some clay, gravel and cobbles to a depth of 2 metres. Groundwater inflow into the open excavations was observed at test pits TP15-01 and TP15-02 at 2.0 and 1.2 metres below ground surface (bgs), respectively (54.4 and 54.7 masl).

### 4.2.2 Former Embankment

Test pits TP15-03, TP15-05, TP15-07 and TP15-10 were completed between 1.2 and 1.5 metres from the edge of Boundary Road within the alignment of the former bridge embankment and at the top of the existing embankment (refer to Figure 2). Gravelly sand (Granular A) over sandy gravel (Granular B Type II) and sand and gravel fill were encountered at all test pit locations to a depth of about 0.6 to 0.9 metres. The embankment materials underlying the granular fill consist of modified earth borrow materials (fill) comprised of silty sand with some clay, gravel and cobbles at test pits TP15-03 and TP15-07 and sandy silt with some clay, gravel and cobbles at test pits TP15-05 and TP15-10. The former embankment fill materials were confirmed up to 2.2 metres depth (the extent of the test pit investigation) and to approximately 6 metres in the Coffey boreholes. All test pit locations were dry upon completion of the excavation, with the exception of test pit TP15-05, where groundwater inflow was observed at 1.4 metres bgs into the open excavation.

### 4.2.3 TDA Embankment

Test pits TP15-04, TP15-06, TP15-08 and TP15-11 were completed along the side slopes of the TDA embankment areas (Refer to Figure 2). The subsurface conditions at test pit locations TP15-04 and TP15-06 situated within the north TDA area are comprised of Granular A over Granular B Type II up to 0.65 metres thick overlying sandy silt (fill) with some clay, gravel and cobbles to a depths between 2.1 and 2.3 metres (the extent of the investigation). At test pit TP15-08, gravelly silty sand (fill) containing some clay, cobbles and boulders exists at the ground surface. A thin mixture of granular fill materials (Granular A and Granular B Type II) were encountered test pit TP15-11 overlying TDA cover materials comprised of silty clay with some gravel and cobbles. Geotextile material enveloping the south TDA fill area was encountered at test pit locations TP15-08 and TP15-11 at 1.1 and 1.2 metres depth. All test pits completed within the side slopes of the TDA embankment were dry upon completion of each excavation, with the exception of TP15-04 where groundwater inflow was observed at 1.2 metres.



### 4.3 Geotechnical Laboratory Testing

Geotechnical laboratory testing including water content determinations, grain size distribution testing and ex-situ hydraulic conductivity testing (constant head permeameter) was carried out on selected soil samples from the former embankment and TDA embankment modified earth borrow materials sampled to confirm the permeability of the materials used to cover the TDA. The results of the geotechnical laboratory testing are summarized in the following table below. The results of the laboratory analysis sheets are provided in Appendix C.

Location	Sample Depth (mbgs)	Sample Description	Water Content (%)	Grain Size Analysis	Hydraulic Conductivity (cm/s)
TP15-05	1.7	Sandy Silt (modified earth borrow)	6.3	~44% fines	-
TP15-06	1.8	Sandy Silt (cover material)	8.8	~34% fines	$5 \times 10^{-6}$
TP15-07	1.8	Silty Sand (modified earth borrow)	10.3	~39% fines	-
TP15-08	0.8	Sandy Silt (cover material)	8.6	~27% fines	$3 \times 10^{-5}$

### 4.4 Geochemical Analysis

A total of fourteen test pit soil samples were submitted to SGS for geochemical analysis of total metals, SPLP and ABA. The results of the total metals, SPLP and ABA testing are presented in Appendix D Tables D-1, D-2 and D-3, respectively and laboratory analytical certificates are included in Appendix E.

Figures D-1 through D-5 provide a graphical representation of concentrations of total metals or sulphate versus SPLP leachate for the relevant TDA leachate indicator parameters identified at the site: hardness (calcium and magnesium), iron, manganese and sulphate. SPLP leachate results were also compared to the applicable average historical post-construction groundwater and leachate concentrations as shown in Figures D-1 through D-5.

The lab results indicate that iron, manganese and sulphate are leached from the soil. Total and leachable concentrations of these parameters were generally similar between the native and fill materials with the exception of a few samples. Concentrations of total iron and manganese ranged between 110 and 680 µg/g and 12,000 and 39,000 µg/g, respectively. Concentrations of leachable iron, manganese and sulphate were reported between 0.637 and 30.2 mg/L, 0.00489 and 0.367 mg/L and 3 and 27 mg/L, respectively. The native silty clay materials tested from TP15-02 (TP15-02 SA-2) had the lowest reported concentrations of total iron and leachable sulphate. The slag fill (TP15-12 SA-1) reported the lowest total and leachable concentrations of manganese and leachable concentrations of iron, however total iron concentrations were generally still elevated compared to the other samples. Concentrations of TDA parameters iron and manganese leached from the soil samples retrieved at test pit locations TP15-05 and TP15-07 of the former embankment were greater than those measured in the TDA cover materials, and/or native materials.

Based on the observed subsurface conditions encountered, soil analytical results were compared to Provincial standards described in the document entitled "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*" dated April 15, 2011 (the Standard Document). The soil standards are typically used for the assessment of potentially contaminated sites in the context of Ontario Regulation ("O. Reg.") 153/04 as amended. For purpose of this assessment, soil results were compared to Table 1: Full Depth Background Site Conditions Standards, Residential/Parkland/Industrial/Commercial/Institutional Property Use (2011 MOE Table 1)





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and MOE Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, Commercial/Industrial Property Use, coarse texture soil (2011 MOE Table 2).

TDA leachate indicator parameters and additional metal constituents exceeding the referenced soil criteria are summarized in the following table:

Test Pit Location	Sample ID	Soil Description	Sample Depth (mbgs)	Parameters Exceeding Relevant Soil Criteria <sup>1,2</sup>
TP15-01	TP15-01 SA-1	Peat (Fill)	0.5	None
	TP15-01 SA-2	Silty Clay (Fill)	1.8	None
TP15-02	TP15-02 SA-1	Silty Clay (Fill)	0.6	None
	TP15-02 SA-2	Silty Clay	1.2	None
TP15-04	TP15-04 SA-1	Sandy Silt (Fill)	2.0	None
TP15-05	TP15-05 SA-1	Sandy Silt (Fill)	1.7	None
TP15-06	TP15-06 SA-1	Sandy Silt (Fill)	1.8	None
TP15-07	TP15-07 SA-1	Silty Sand (Fill)	1.6	None
TP15-08	TP15-08 SA-1	Sandy Silt (Fill)	0.8	None
TP15-09	TP15-09 SA-1	Topsoil (Fill)	0.6	None
	TP15-09 SA-2	Silty Clay (Fill)	1.7	None
TP15-11	TP15-11 SA-1	Silty Clay (Fill)	1.0	None
TP15-12	TP15-12 SA-1	Slag (Fill)	0.5	Arsenic <sup>1</sup> , Barium <sup>1</sup> , Molybdenum <sup>1</sup>
	TP15-12 SA-2	Sandy Silt	1.6	None

**Notes:** <sup>1</sup> MOE Table 1

<sup>2</sup> MOE Table 2

The soil analytical results indicated that of the fourteen soil samples submitted for metal analysis, only the soil sample comprised of slag fill (TP15-12 SA-1) exceeded MOE Table 1 for arsenic, barium and molybdenum which was collected at 0.5 metres depth adjacent to monitoring well MW 04, upgradient of the south TDA area. Note, arsenic, barium and molybdenum are not identified as TDA leachate indicator parameters. No soil standards exist for TDA leachate indicate parameters iron, manganese, and sulphate. All remaining soil samples collected from the topsoil, native soil or the fill layers within the vicinity of the other monitoring wells, former embankment and TDA embankment areas met the referenced soil standards.



### 5.0 SITE DRAINAGE ASSESSMENT

Golder conducted a site drainage assessment on April 1, 2016 to confirm surface water drainage flow patterns, following four consecutive daily precipitation events. Based on the available climatic data for the Environment Canada station situated in Cornwall, Ontario (6101874), a total of 29.6 mm of precipitation fell between March 28 and April 1, 2016. Photographs and a description of the drainage conditions observed at each of the seven surface water monitors (SW 01, SW 02, SW 03, SW 06, SW 07 and SW 09) and surrounding areas are included in Appendix G and summarized in the following table below.

Monitoring Location	Depth (m)	Width (m)	Flow (m <sup>3</sup> /s)	Description
SW 01	Ponded water, no visible flow			Highly vegetated wetland area situated downgradient of SW 02.
SW 02	Ponded water, no visible flow			Highly vegetated wetland area along roadside ditch north of Glen Road, situated downgradient of SW 03.
SW 03	0.04	0.35	0.002	Located south side of ditch of Glen Road. Surface water inputs originate from flooded area situated upgradient and to the southeast of SW 03 as well as roadside runoff. Water flows east along ditch and north through culvert underneath Glen Road and discharges to SW 02 area.
SW 04	0.06	0.26	Present	Located along ditch of former access road area. Flow present, could not be measure due to presence of vegetation. Water flowing in ditch westward contributes to flooded ponded area south of SW 03 and east of the north embankment.
SW 06	Ponded water, no visible flow			Situated in low lying area west of the north embankment of Boundary Road. Evidence of recent extended limits of the ponded water area based on disturbances to the surrounding vegetation.
SW 07	0.06	0.22	Present	Flow present, could not measure due to presence of vegetation. Water flowing north from Highway 401 ditch through culvert towards SW 06.
SW 08	0.03	0.26	0.001	Located in the ditch of the northbound lane of Boundary Road, upgradient of the south TDA embankment.

No overland flow or groundwater seeps were observed within the limits or adjacent to the north and south TDA embankments. Surface water flow was noted along the drainage courses where surface water monitors SW 03, SW 04, SW 07 and SW 08 are situated during the April 2016 site visit as shown in Figure 6. The surface water flow direction at monitor SW 06 has also occasionally been observed during previous site visits and is also shown on Figure 6. An area containing ponded water was observed southeast and upgradient of surface water monitor SW 03, which extends east and midway along the north TDA embankment before terminating just northeast of pan lysimeter PL2 (refer to Photo G-7 through G-9, Appendix G).





## 6.0 DISCUSSION

### 6.1 Geotechnical Assessment

This section of the report provides an assessment of the geotechnical and geochemical/hydrogeological design aspects of the construction of the TDA embankments based on the findings of the test pit investigation and our interpretation of the available project information (i.e., previous geotechnical studies, design drawings provided in Contract No. 2010-4003 Addendum No. 1, the Design Brief MTO TDA application to the Ministry of the Environment (MTO, 2009) and the Final Report (MTO, 2013)).

The MTO design brief states the following in regards to the construction of the TDA embankments:

- *Top and side slopes will be covered with a minimum 0.5 metre thick layer of low permeability soil with greater or equal to 30% fines in order to:*
  - *Minimize infiltration of water and air into the TDA.*
  - *Prevent direct contact between TDA and soil containing organic matter, such as topsoil.*
  - *Prevent contact between the public and the TDA, which may have exposed steel belts.*
- *The top of the cover soil will be sloped to drain water away from the TDA fill.*
- *The top TDA embankment fill will be covered with 1 metre to 2 meters of soil to limit deflections of overlying pavement caused by traffic loading.*

The TDA cover material was sourced from the Highway 401 replacement of the CNR mainline to the east of Boundary Road. A total of 23 grain size distribution tests were carried out on the glacial till samples collected at the site as part of the foundations investigation completed by Coffey. Of the 23 samples test, all had more than 30 percent fines with the exception of one sample. Two samples of the cover material brought to the site were tested by John D. Paterson and Associates Ltd. on May 24, 2012 for the MTO, which reported 32 and 34 percent fines. The top of the cover soil has an asphalt surface which is sloped to provide drainage. The side slope is at 2 horizontal to 1 vertical to shed the precipitation to the base of the embankment. The TDA fill is covered with 2 metres of soil consisting of 1 meter of cover material on the top and near 2 metres on the side slopes, more than the 0.5 metre minimum thickness. This cover material which when compacted above the TDA provided a flexible surface with poor rideability. One metre of sand and gravel fill plus an asphalt surface was provided in 2012 and the rideability for the trucks was then acceptable (see Figures 4 and 5). A second layer of asphalt was provided in 2014.

In general, fill materials encountered at test pits TP15-03 and TP15-05 (north embankment) and TP15-07 and TP15-10 (south embankment) differ with the shallow subsurface conditions encountered at boreholes F3 and F7 as part of the Coffey investigation (Coffey, 2009). The sandy silt and silty sand fill materials used for the construction of the former Boundary Road embankment identified during the Golder test pit investigation are characterized as low permeability soils with greater than 30% fine constituents (soil particles less than 0.06 mm in diameter). Boreholes F3 and F7 completed by Coffey behind the abutments encountered sand and gravel to 2.6-metres, part of the sand and gravel backfill required in the abutment design of the existing bridge. Test pits TP15-03, TP15-05, TP15-07 and TP15-10 within the old roadway encountered 0.65 to 0.90 metres of sand and gravel for the roadway design. The sand and gravel is underlain by sandy silt, earth burrow.



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Laboratory tests conducted by Golder on the earth borrow in the old embankment which forms the inner cover to the TDA reported 39 and 44 percent fines. The samples tested by Coffey had previously reported 44 and 52 percent fines. This earth borrow in the old embankment is considered to be low permeability.

The subsurface conditions encountered at test pits TP15-04, TP15-06, TP15-08 and TP15-11 indicate the amount of TDA cover soil (not including Granular A or B fill) used on the side slopes of the TDA embankments varied between 1.0 and 1.6 metres, which is in excess of the minimum 0.5 metre thick layer stated in the design brief.

The results of the grain size analysis completed on the two TDA cover soil samples recovered from test pits TP15-06 and TP15-08 (refer to Appendix C) indicate the gravelly sandy silt fill encountered at TP15-06 is comprised of 34% fines and the gravelly silty sand fill encountered at TP15-08 consists of 27% fines which is slightly below the description stated in the design brief (30%). The results of the laboratory testing estimate the hydraulic conductivity of the TDA cover fill to be  $3 \times 10^{-5}$  cm/s at TP15-08 in the vicinity of pan lysimeter PL3 and  $5 \times 10^{-6}$  cm/s at TP15-06 within the vicinity of PL2. Based on the results of this lab testing, the cover materials used for the construction of the embankments as tested at the Highway 401/CNR Site, after being received at the site and as tested from samples in the test pits could be considered to be generally “low permeability”. The periodic discharge observed at pan lysimeter PL3 during the quarterly monitoring sessions conducted on March 28, 2013, April 11, 2013 and October 4 and 21, 2013 may have been as a result of the absence of the final grading materials (completed in July 2014). Aecon (the contractor) also reported discharge from pan lysimeters PL2 and PL3 on various occasions in June 2013 during June 2013. In addition, drainage from the existing embankment was directed to the TDA embankment area during construction. Additional infiltration may also be occurring where the TDA abuts the bridge and the old embankment.

Discharge from pan lysimeter PL3 was also observed during a site inspection completed by the MOECC on June 3, 2016 following a short duration rain event as stated in the inspection report dated June 28, 2016 (refer to Appendix A). Golder personnel also noted evidence that some discharge from PL3 had likely recently occurred during a site visit conducted on August 15, 2016 following a period of several precipitation events (30.6 mm of precipitation between August 11 and 13, 2016 based on the Environment Canada Cornwall weather station 6101874). As discussed in Section 6.1, the hydraulic conductivity of the TDA cover fill near PL3 was an order of magnitude higher than that within the vicinity of PL2. The lower hydraulic conductivity cover materials should produce less leachate, although the quality of TDA leachate indicator parameters appears to be similar at PL2 and PL3.

Based on groundwater level monitoring completed at the site between November 2010 and August 2015 as part of the pre-construction, construction and post-construction monitoring periods, groundwater levels fluctuated between 0.5 and 1.6 metres at each location (refer to Table 1). Groundwater levels have generally been more variable and on average lower post-construction than during pre-construction. The groundwater flow direction within the shallow overburden materials (glacial till) is interpreted to be generally towards the north and northwest across the Site, with a more easterly component in the vicinity of the south TDA embankment, as shown on Figure 6 and appears to be controlled by local topography, including the TDA embankments. Post-construction groundwater elevations within the vicinity of the north TDA area at monitoring wells MW 01, MW 02 and MW 05 typically have varied between less than 55.0 and 55.8 masl, while groundwater elevations within the vicinity of the south TDA at monitoring wells MW 03, MW 04 and MW 06 varied between 56.6 and 58.1 masl. Based on the available design drawings of the north and south TDA embankments (refer to Figures 4 and 5), the lower limit of the TDA fill area extends to approximately 59.3 masl. Pursuant to Condition 21 of the ECA, TDA fill was placed greater than 2 metres above the groundwater table during construction (MTO, 2013). However, while the TDA fill



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areas are consistently above the water table, groundwater levels within the south TDA area may be less than 2 metres below the TDA fill during some times of the year (i.e., spring).

No groundwater inflow was observed into the open excavation at test pits completed along the side slopes of the TDA embankment, with the exception of TP15-04 completed at the within the northern TDA fill area. Test pit TP15-04 was excavated to a depth of 2.3 metres and groundwater inflow was observed at 1.2 metres bgs (refer to Figure 4). The groundwater inflow observed into the test pit was likely due to a perched water table or lower permeability fill materials (sandy silt or silt, refer to Figure 3), considering the lower groundwater elevations measured within the monitoring well network.

## 6.2 Geochemical Assessment

### 6.2.1 Previous TDA Studies

Iron, manganese and benzene have previously been identified as key leachate indicator parameters for TDA applications above the groundwater table (Humphrey & Swett, 2006). The results of TCLP testing of TDA selected parameters iron, manganese and zinc completed by Selbes (2009) on tire chip samples are summarized in the following table, along with the leachate results of field scale tests involving the application of TDA above the water table for TDA indicator parameters of interest iron, manganese, sulphate and zinc.

Select TDA Leachate Indicator		Iron	Manganese	Sulphate	Zinc
Selbes (2009)	TCLP	13.404 ± 4.493	0.093 ± 0.023	NA	0.589 ± 0.042
	Leaching Experiment	76.191	0.522	NA	0.818
Wisconsin	4" TDA	(0.71)	(1.129)	(115)	(0.093)
	2" TDA	(1.13)	(1.522)	(213)	(0.230)
North Yarmouth	Control	(0.0198)	(0.421)	(25.3) <sup>2</sup>	1.10
	TDA Section C	(0.0795)	(4.38)	(18.9) <sup>2</sup>	(0.0111)
	TDA Section D	(0.555)	(2.56)	(11.4) <sup>2</sup>	(0.0111)
Witter Farm Road		(0.158)	(2.53)	(3.51)	(0.082)
Ohio Monofills, Chyi (2000)	C&E Monofill	(0.19)	(2.72)	(468.5)	(0.492)
	American Monofill	(0.103)	(1.93)	(600.7)	(<0.005)
Binghampton, NY	Control TF2	(0.255)	(0.260)	NA	NA
	TDA TF1	(15.0)	(6.21)	NA	NA
Cornwall TDA Embankments	PL2, North TDA	0.04 – 63.3 (20.6)	0.09 – 4.5 (2.9)	209 – 2160 (653)	(<0.1)
	PL3, South TDA	0.45 – 84.8 (36)	0.28 – 3.5 (1.7)	103 – 2510 (752)	(<0.1)
	MW 03, South TDA (background)	13.9 – 21.5 (15.3)	2.42 – 6.8 (3.73)	9 – 98 (37)	(<0.1)
	MW 03, South TDA	0.55 – 19.9 (9.8)	2.6 – 13.6 (7.7)	9 – 337 (178)	(<0.1)

**Notes:** Units mg/L

NA = not available, parameter not tested for

References: Wisconsin (Eldin et al, 1993; Eldin & Secouci, 1992); North Yarmouth (Humphrey & Katz, 2000; Exponent Inc., 2003); Witter Farm Road (Humphrey, 1999); Ohio Monofills (Chyi, 2000); Binghampton, NY (Brophy & Graney, 2004)

( ) Mean concentration

<sup>1</sup> Concentrations measured during laboratory leaching test for 2"x2" scrap tire pieces in rainwater (at pH 3.0)

<sup>2</sup> Result for unfiltered sample



Our literature review of the groundwater quality impacts of TDA indicates that concentrations of sulphate were not affected by TDA application above the water table (Humphrey, 1999; Humphrey & Katz, 2000) and Sengupta & Miller (2004) reported only low levels of sulphate leaching from the tires. O'Shaughnessy and Garga (2000) reported that leaching of sulphate from tire chips in a column experiment was negligible. Eldin & Senouci (1992) concluded leaching of sulphate, calcium and magnesium (hardness) from tire chips may be heavily masked or overwhelmed by leaching of other materials used in the embankment construction, while increases in concentrations of alkalinity may be related to an increase in hydroxides of metal ions that have leached from the tires (Humphrey et al., 1996). Chyi (2000) also concluded that elevated levels of cations (calcium, magnesium, sodium and potassium) and anions (sulphate) in groundwater observed in leachate may be attributed to water leaking into the tire monofill. The monofill was constructed at the location of an abandoned coal mine, where acid mine drainage from the coal mines likely resulted in elevated sulphate concentrations.

Technical comments provided by Dana N. Humphrey, Ph.D (Consulting Engineer) dated August 3, 2016 following review of this draft report (included in Appendix H) confirm that past studies have not identified TDA as a significant contributor to sulphate and identified another potential source:

- *"In the pan lysimeters, concentrations of sulphate were reported at levels between about 1,700 and 2,500 mg/L on three sample dates during construction. Post construction, the concentrations have been near the aesthetic water quality standard of 500 mg/L. Past studies have not identified TDA as a significant contributor to sulphate. I was present only for a portion of two days during construction of the Boundary Road project. However, I observed that one load of TDA delivered to the south fill had a small amount fines that appeared to be residual construction demolition debris. This was observed near the bottom of the TDA load as it was being discharged from the walking floor trailer. It could be that the load carried by the truck prior to TDA was construction demolition debris. Construction demolition debris often contains drywall which is a source of calcium sulphate (CaSO<sub>4</sub>)."*

Elevated concentrations of sulphate ranging in concentrations as high as 1,700 mg/L have been reported in field-scale and laboratory leaching evaluations of construction and demolition debris containing gypsum drywall (Powell et al., 2015). The concentrations of sulphate observed in the pan lysimeter leachate are comparable to leachate impacted from construction debris. Therefore, sulphate is not likely leaching from the TDA, but, rather the elevated concentrations that have been detected in the leachate are likely attributed to the TDA materials being contaminated with a small amount of construction debris that may have been leftover in the same truck(s) that was used to transport the TDA.

### 6.2.2 Site Investigation Findings

The soil geochemical analyses results (lab testing) were compared to the available average groundwater and lysimeter quality data for TDA parameters calcium and magnesium (hardness), iron, manganese and sulphate at test pit locations TP15-01 (MW 01), TP15-02 (MW 05), TP15-06 (PL2), TP15-08 (PL3), TP15-09 (MW 03) and TP15-12 (MW 04) and are presented in Figures D-1 through D-5 provided in Appendix D. Concentrations of leachate indicator parameters were consistently at higher concentrations (one to two orders of magnitude) in groundwater than in the laboratory leachate from the fill and/or native overburden materials, with the exception of iron (refer to Figure D-3). The elevated iron results from the lab testing could be reflective of fine soil particles or colloid content in the leachate, based on the amount of fines present in the soils tested.



As shown in Figures D-1 through D-5, there is no correlation between total metal concentrations and SPLP for the 14 soil samples tested or the groundwater/lysimeter concentrations associated with the soil sample locations. However, concentrations of TDA parameters iron and manganese leached from the soil samples retrieved at test pit locations TP15-05 and TP15-07 of the former embankment were an order of magnitude greater than those measured in the TDA cover materials, and/or native materials.

Concentrations of TDA leachate indicator parameters benzene, iron, manganese, sulphate, alkalinity and hardness are plotted for groundwater monitors MW 03 and MW 04 and pan lysimeters PL2 and PL3 in Figures F-1 through F-6 (Appendix F) along with the relevant Ontario Drinking Water Quality Standard (MOE, 2006) health (maximum acceptable concentration, MAC) or aesthetic objective (AO). Historical pan lysimeter leachate and groundwater quality data are also provided in Appendix F. These plots indicate that concentrations of benzene in the leachate have declined over time and have generally stabilized at pan lysimeter PL2 (non-detect) and PL3 (below ODWQS). Manganese, iron and sulphate concentrations increased in the leachate pan lysimeters following the placement of TDA fill, but have decreased and remain slightly variable over time (Figure F-2, F-3 and F-4). Concentrations of hardness and alkalinity at the leachate monitors are elevated compared to the construction period, but remain somewhat variable. As discussed in Section 6.1, the hydraulic conductivity of the TDA cover fill near PL3 was measured to be an order of magnitude higher than that within the vicinity of PL2. The lower hydraulic conductivity cover materials should produce less leachate, although the quality of TDA leachate indicator parameters appears to be similar at PL2 and PL3. In general, the leachate quality was more variable at PL3 compared to PL2 as shown in Figures F-1 through F-7.

Concentrations of manganese observed at monitoring well MW 03, situated downgradient of pan lysimeter PL3 have consistently been higher than those observed at both the pan lysimeters, with the exception of the concentrations measured at PL3 during the post-construction monitoring session completed in August 2015. Concentrations of iron at MW 03 have been variable over time and lower than both pre-construction conditions and those measured at leachate monitor PL3, while concentrations of alkalinity remain stable. Note: increased concentrations of alkalinity and manganese have also been observed at groundwater monitor MW 04. Although this monitor is situated hydrogeologically upgradient of the south TDA area (refer to Figure 6), however transverse dispersion and diffusion may be resulting in impacts to MW 04.

Groundwater quality is influenced by hydrogeological, geochemical and biological processes occurring in the subsurface environment which are controlled by a number of factors such as the geological materials present in the subsurface environment and the length of time the groundwater is in contact with the materials. Chemical reactions involving the weathering, dissolution and/or precipitation of constituents, sorption and ion exchange, oxidation-reduction reactions, acid-base reactions and biodegradation occur in the subsurface and could result in higher groundwater concentrations of TDA leachate parameters than produced by laboratory/leach testing methods. The pH conditions in the lysimeter samples collected from PL2 and PL3 ranged between 7.2 and 8 indicating near neutral pH and a lesser ability to leach inorganic constituents (i.e., iron, manganese and zinc) from TDA. The results of the lab testing indicate that the soils used for the construction of the former embankments, TDA embankments and local native materials are capable of leaching TDA parameters iron and manganese which may contribute to the elevated concentrations observed in the groundwater. The results of the ABA testing indicate that the total sulphur content (sulphate and sulphide) of each sample tested was below 0.3% and the sulphur is primarily in the form sulphate (oxidized form of sulfur), which is more readily soluble in groundwater compared to sulphide.





The results of the ABA testing indicate that the leachable sulphate is present in the glacial till and soil fill, however the sulphate concentrations in the pan lysimeter samples taken during construction and site observations by Dana N. Humphrey, Ph.D (Consulting Engineer) indicate another potential source of sulphate (construction debris containing calcium sulphate).

### 6.3 Site Drainage Assessment

Previous site visits completed on a quarterly basis as part of the surface water monitoring program during the pre-construction, construction and post-construction of the TDA embankments indicated stagnant flow and/or limited intermittent low conditions at the locations of the nearby surface water features. A site drainage assessment was completed in spring 2016 during a wet period in order to confirm drainage and flow patterns at the site to assess potential hydrological connections between the TDA areas and the nearby surface water features. Review of site groundwater elevation data, the absence of groundwater seeps and/or overland flow along the TDA embankments indicates there is limited evidence to suggest any discharge from groundwater to the surface water (i.e. groundwater elevations are typically below the elevation of the surface water monitors).

The results of the site drainage assessment are generally consistent with the previous understanding of the hydrology at the site, in which surface water stations are assumed to be located upgradient of the TDA fill area (i.e. SW 04 and SW 08) or are not situated directly within the surface water drainage flow path from the TDA embankments (SW 06 and SW 07). Surface water monitor SW 03 is situated within the roadside ditch of Glen Road and is possibly hydrogeologically downgradient from the north TDA embankment. A surface water feature comprised of an area of ponded water southeast of Glen Road and east of the Boundary Road north TDA which discharges to SW 03 was identified during the April 2016 site visit. During wet periods, surface water from the ponded area and/or ditch along the south side of Glen Road flows north through the culvert and accumulates at surface water stations SW 02 and SW 01 under stagnant flow conditions.

Historical surface water quality data is presented in Appendix F. The results of the post-construction surface water monitoring program suggest that the surface water quality at surface water monitors SW 01, SW 02 or SW 03 have not been impacted as a result of the TDA emplacement. Based on the understanding of the hydrology at the site and the available surface water quality data, impacts to nearby surface water features as a result of the TDA leachate are not apparent and are not anticipated. Therefore, the risk of elevated concentrations of TDA parameters flowing beyond the Site via surface water features is low.



### 7.0 SITE CONCEPTUAL MODEL

Based on the results of the investigation, Golder has developed the following site conceptual model for the Cornwall TDA embankments:

- TDA fill materials used in the construction of the embankments are located above the water table;
- A minor amount of construction debris including drywall fines ( $\text{CaSO}_4$ ) was included with the TDA fill;
- A low permeability glacial till deposit underlies the TDA embankments;
- Generally low permeability fill materials used to cover the TDA fill and the side slopes of the embankments limit the amount of infiltration;
- Water that infiltrates the TDA abutments dissolves leachate indicator parameters from the soil cover and the TDA and sulphate from the drywall fines. The resultant leachate impacts the water table below the abutments;
- Groundwater is flowing slowly (metres per year) beneath the TDA embankments and contains elevated concentrations of iron, and manganese that originate in the native till deposits and from the historical bridge embankment (constructed of till derived fill from a nearby source);
- Sulphate leached from drywall fines increase below the TDA embankment. The peak concentrations occur soon after the TDA placement and quick reduces to levels that are close to the applicable drinking water standard;
- TDA leachate does not discharge to any of the nearby surface water features; and,
- Benzene is the only TDA leachate parameter that originates from the TDA only (not from soil fill).



### 8.0 PROPOSED MONITORING PROGRAM

The proposed monitoring program previously recommended in the Post-Construction Monitoring report prepared by Golder dated December 2015 has been revised based on the results of the groundwater impact investigation and is described below.

TDA leachate at the Boundary Road and Highway 401 site was characterized during the construction and post-construction monitoring program completed between June 2012 and August 2015 at pan lysimeters PL2 and PL3. Site specific leachate monitoring indicates that TDA leaches benzene, iron and manganese, while other parameters such as alkalinity, ammonia, sulphate and hardness may be elevated because the TDA was contaminated with construction debris. Leachate monitoring has indicated that concentrations of these parameters have generally declined or stabilized over time with the exception of concentrations of alkalinity and hardness which remain variable. Subject to the approval from the MOECC, it is recommended that pan lysimeter monitoring be discontinued as site specific TDA leachate has been sufficiently characterized. Subject to the approval from the MOECC, it is also recommended that the four on-site pan lysimeters be decommissioned as per Ontario Regulation 903. Background pan lysimeters PL1 and PL4 have consistently been dry, while PL2 and PL3 situated within the TDA fill areas have been used to characterize TDA leachate. The clean-outs of the pan lysimeters (specifically PL2 and PL3) can allow leachate to “short circuit” to the ground surface. Decommissioning of the pan lysimeters would eliminate the potential for any future release of leachate to enter surface water, wetland or otherwise cause an adverse effect.

Based on the understanding of the hydrology at the site and the available surface water quality data, impacts to nearby surface water features as a result of the TDA leachate are not apparent and are not anticipated, therefore the continuation of the surface water quality monitoring program is not recommended.

Based on the potential TDA leachate impact observed at monitoring well MW 03 (increasing trend in concentrations of key TDA leachate indicator parameter manganese in addition to sulphate), Golder recommends TDA groundwater quality monitoring continue at all six on-site monitoring wells twice per year. The results of the additional groundwater quality data will be evaluated in order to confirm groundwater impacts from the application of the TDA fill materials and the fate of the elevated concentrations of sulphate at MW 03 situated downgradient of pan lysimeter PL3. In accordance with Condition 30 of the ECA, the MTO received approval from the Director of the MOECC for the groundwater monitoring program described in Table 1 of Addendum No. 1 of the MTO Contract 2010-4003. Subject to approval from the MOECC, it is recommended that the groundwater monitoring program be revised to only include the following parameters for which an ODWQS health or aesthetic objective have been established: iron, manganese and sulphate. The groundwater monitoring program may be revised accordingly following interpretation of the additional 2016 groundwater quality data and future discussions with the MOECC.





### 9.0 RECOMMENDATIONS FOR FUTURE USE OF TDA FILL

Based on monitoring of groundwater and surface water quality at the existing network of monitoring locations, the Site is in compliance with the applicable MOE guideline B-7 (groundwater) and PWQO Policies 1 and 2 (surface water). Three years of TDA leachate quality data indicates that sulphate, iron, manganese and benzene are leaching from the TDA and the drywall fines that were included with the TDA. However, the results of the investigation also indicate that the soil also has the ability to contribute elevated concentrations of TDA parameters sulphate, iron and manganese.

TDA is a lightweight fill material (8 kN/m<sup>3</sup>) as compared to sand and gravel (20 kN/m<sup>3</sup>). There are many highways throughout Ontario which are being constructed over soft soils which require the use of lightweight fill to avoid overstressing the soil which could lead to slope instability and excessive settlement. The present lightweight fills used are expanded polystyrene or 'ESP' (1 kN/m<sup>3</sup>) which is effective but very expensive (~\$150/m<sup>3</sup>) as is cellular concrete (5 kN/m<sup>3</sup>). Slag has been used but with a unit weight of 14 kN/m<sup>3</sup>, however it is not very effective in lessening the embankment loading. The use for TDA as a lightweight fill within an embankment would provide technical and cost-effective solution over most soft soils. Scrap tires which are ending up in holding areas, which are subject to leachate runoff and in some cases devastating fires, could be safely used in select highway embankments. As such, an exemption of TDA used by MTO as lightweight fill from the designation under Ontario Regulation 347 would be beneficial for Ontario.

Golder recommends the following related to the future use of TDA fill materials:

- Pre-construction groundwater characterization should be undertaken, at all proposed TDA fill locations;
- Pre-construction leachate testing of potential fill materials should be undertaken.
- Fill leachate and TDA leachate results should be compared to pre-construction groundwater quality.
- If there is a potential for fill or TDA to impact groundwater quality, consider potential groundwater receptors (wells, surface water features) and develop an appropriate monitoring program.
- If there is limited potential for fill or TDA to impact groundwater, groundwater monitoring may not be warranted.
- The application of TDA fill materials may be considered following the completion of a site characterization study to determine the suitability of the site based on the stratigraphic soil and hydrogeological conditions, size of the property and identifying and evaluation of potential receptors. If no receptors are identified within 500 metres of a proposed TDA application, licensing of the site as a non-hazardous landfill may not be warranted.
- All TDA fill should be inspected to identify and remove potential other sources of groundwater impact (i.e., waste materials).
- Leachate monitoring (pan lysimeter) for benzene and other volatile organic compounds (VOCs) or semi-volatile VOCs could be considered during construction or early post-construction phases in order to confirm that concentrations do not exceed the applicable groundwater criteria.



### 10.0 LIMITATIONS AND USE OF REPORT

This report was prepared for the exclusive use of the Ontario Ministry of Transportation. The report, which specifically includes all tables, figures and appendices, is based on data and information collected by Golder Associates Ltd. and is based solely on the conditions of the properties at the time of the work, supplemented by historical information and data obtained by Golder Associates Ltd. provided by others as described in this report.

Golder Associates Ltd. has relied in good faith on all information provided and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the reports as a result of omissions, misinterpretation, or fraudulent acts of the persons contacted or errors or omissions in the reviewed documentation.

The assessment of the environmental and subsurface conditions at this Site has been made using the results of physical measurements and chemical analyses of soils and liquids from a number of locations. The Site conditions between sampling locations have been inferred based on conditions observed at test pits, surface water stations, borehole, groundwater and pan lysimeter monitoring locations. Subsurface conditions may vary from these sampled locations.

The services performed, as described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, Golder Associates Ltd. should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.



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### 11.0 CLOSURE

This report was prepared by Ms. Dale Holtze, M.Sc., P.Geo., and reviewed by Mr. Brian Byerley, Principal and Senior Hydrogeologist with Golder. Mr. Fin Heffernan, P.Eng., conducted an independent review of the report.

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## CORNWALL TDA EMBANKMENT PROJECT

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- Sengupta, S., and Miller, H. (2004). "An Evaluation of Recycled Tire Shreds as a Substitute for Gravel in Residential Soil Absorption Systems," Civil Engineering Practice – Journal of the Boston Society of Civil Engineers, Vol. 19, No. 1, pp. 33-52.
- Powell, J.T, Pradeep, J., Smith, J., Townsend, T.G., and Tolaymat, T.M. (2015), "Does Disposing of Construction and Demolition Debris in Unlined Landfills Impact Groundwater Quality? Evidence from 91 Landfill Sites in Florida".

**Table 1: Groundwater Elevation Data**

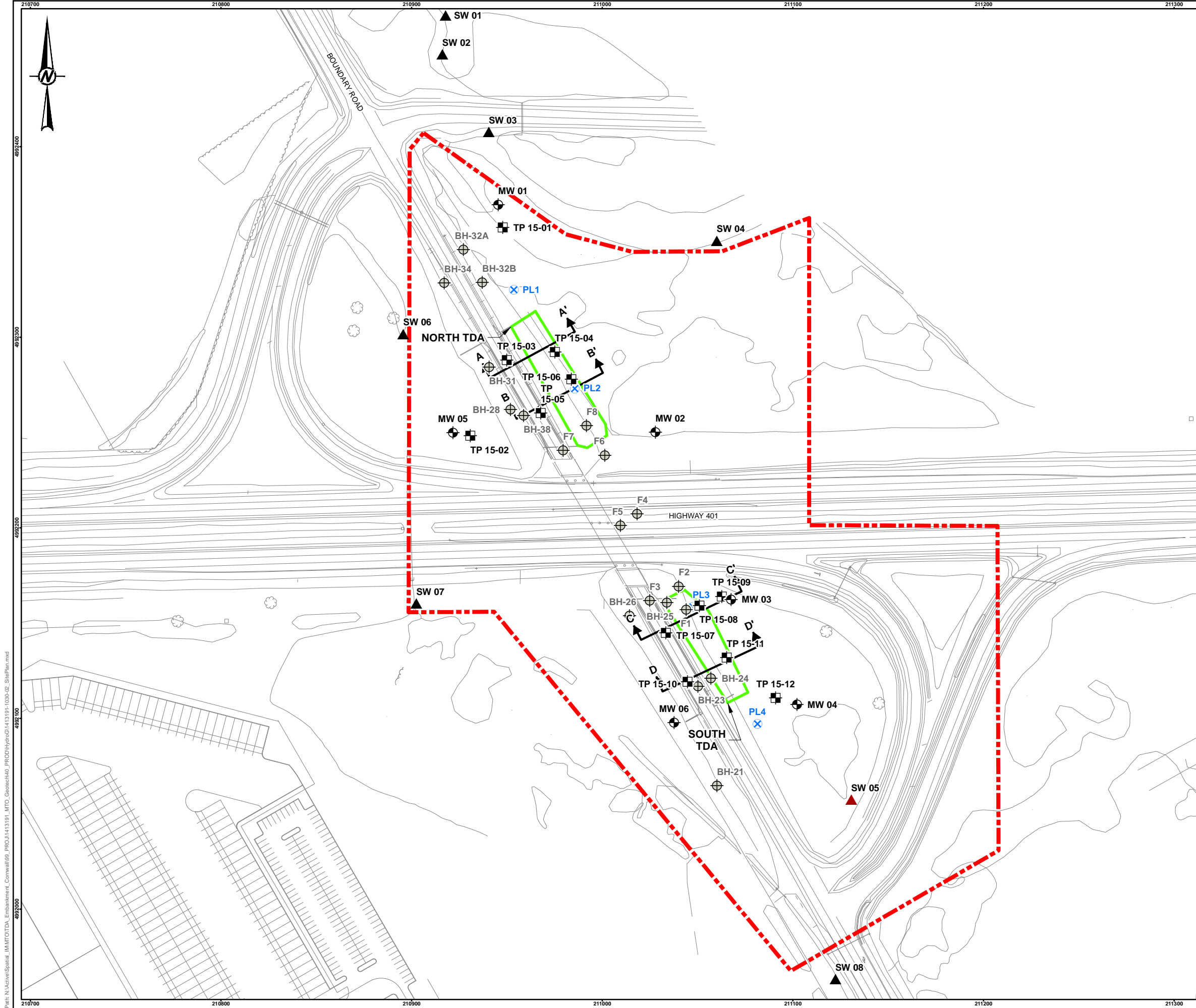
Groundwater Monitor	Ground Surface Elevation (mASL)	Well Casing Elevation (mASL)	Groundwater Elevation (mASL)															
			Pre-Construction				Construction								Post-Construction			
			26-Nov-10	28-Feb-11	7-Apr-11	10-May-12	14-Jun-12	17-Sep-12	18-Dec-12	11-Apr-13	5-Jul-13	21-Oct-13	3-Feb-14	25-May-14	9-Oct-14	24-Mar-15	17-Jun-15	27-Aug-15
<b>MW 01</b>	56.63	57.42	55.27	55.32	55.30	55.24	55.18	54.55	55.18	55.13	55.12	55.16	55.12	55.24	55.37	55.26	55.20	55.25
<b>MW 02</b>	56.95	57.79	56.06	56.05	56.10	56.11	56.03	55.40	55.93	56.37	55.53	55.55	55.51	55.59	55.80	55.62	55.54	55.60
<b>MW 03</b>	59.73	60.18	57.41	57.13	57.34	57.40	57.35	56.47	57.26	57.20	57.22	57.09	57.07	57.18	56.67	57.31	57.16	56.64
<b>MW 04</b>	60.64	60.68	57.00	57.60	58.12	57.96	<sup>1</sup>	56.93	57.86	57.74	57.73	57.50	57.47	57.59	56.80 <sup>4</sup>	57.60 <sup>4</sup>	57.57 <sup>4</sup>	56.62 <sup>5</sup>
<b>MW 05</b>	55.47	56.30	55.49	<sup>3</sup>	55.41	55.35	55.32	<sup>2</sup>	55.28	55.26	55.11	55.38	<sup>3</sup>	55.12	55.01	<sup>3</sup>	55.09	<sup>2</sup>
<b>MW 06</b>	59.46	60.32	58.67	58.31	58.41	58.37	58.33	<sup>2</sup>	58.31	58.24	58.16	58.03	58.00	58.11	<sup>2</sup>	58.06	58.10	<sup>2</sup>

**Notes:** Elevations are referred to geodetic datum established at the site by McIntosh Perry on May 19, 2011 (Pre-Construction), with the exception of MW 03 and MW 04 which were re-surveyed by McIntosh Perry on October 7, 2015 (Post-Construction).  
mASL – metres above sea level  
<sup>1</sup> Monitoring well MW 04 was buried/inaccessible on June 14, 2012  
<sup>2</sup> Monitoring well location was dry  
<sup>3</sup> Monitoring well location was frozen  
<sup>4</sup> MW 04 was damaged following completion of the final grading of the south embankment in July 2014  
<sup>5</sup> MW 04 well casing elevation revised following June 19, 2015 well repairs



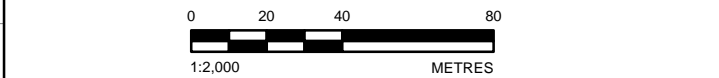






**LEGEND**

- APPROXIMATE GROUNDWATER MONITORING LOCATION
- APPROXIMATE TEST PIT LOCATION
- APPROXIMATE BOREHOLE LOCATION, PREVIOUS INVESTIGATION BY COFFEY GEOTECHNICS INC. (NOVEMBER 2008)
- APPROXIMATE SURFACE WATER MONITORING LOCATION
- APPROXIMATE SURFACE WATER MONITORING LOCATION (NOT ESTABLISHED)
- APPROXIMATE PAN LYSIMETER MONITORING LOCATION
- APPROXIMATE TDA AREA
- APPROXIMATE TDA SITE BOUNDARY
- CROSS-SECTION LOCATION



**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1413191-1030

**REFERENCE(S)**  
1. BASE PLAN PROVIDED IN ELECTRONIC FORMAT BY AECON  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: MTM ZONE 8 VERTICAL DATUM: CGVD28

**CLIENT**  
MINISTRY OF TRANSPORTATION ONTARIO

**PROJECT**  
TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

**TITLE**  
SITE PLAN

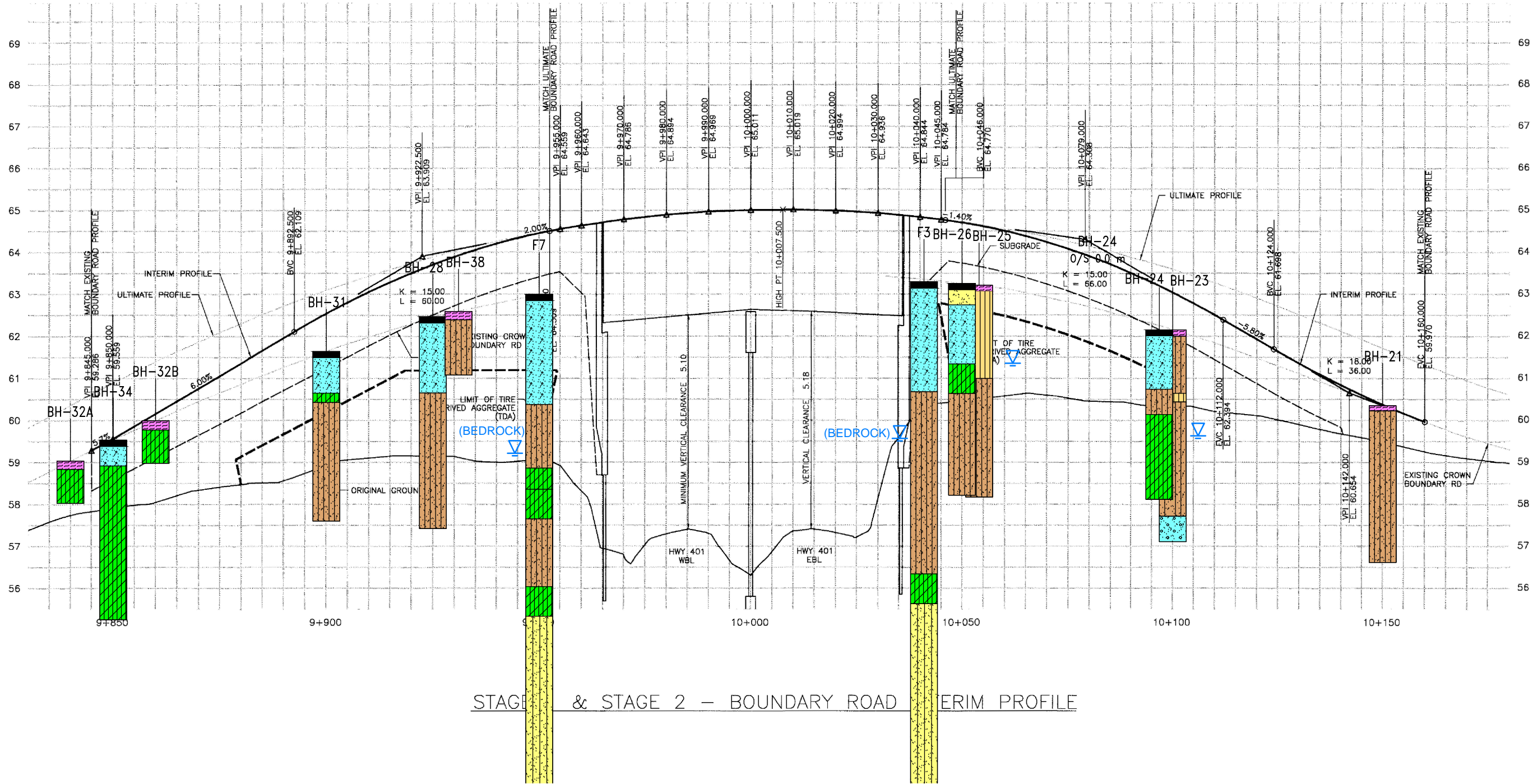
CONSULTANT	YYYY-MM-DD	2016-02-26
	DESIGNED	JEM
	PREPARED	JEM
	REVIEWED	DH
	APPROVED	BTB

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 28mm



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STAGE 1 & STAGE 2 - BOUNDARY ROAD EMBANKMENT SUBSURFACE CONDITIONS

LEGEND

- ASPHALT
- SAND and GRAVEL
- SAND
- CLAYEY SILT
- SANDY SILT
- ORGANICS/TOPSOIL
- SILT
- SANDY GRAVEL
- OBSERVED GROUNDWATER LEVEL



NOTE(S)

- THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 1413191-1030.
- STRATIGRAPHIC SEQUENCES INFERRED FROM BOREHOLE DRILLING INVESTIGATION PROGRAM COMPLETED BY COFFEY GEOTECHNICS INC. (COFFEY 2009)
- ORIGINAL STAGING PROFILE BY AECOM

CLIENT  
MINISTRY OF TRANSPORTATION ONTARIO

PROJECT  
TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE  
PRE-CONSTRUCTION BRIDGE EMBANKMENT SUBSURFACE  
CONDITIONS

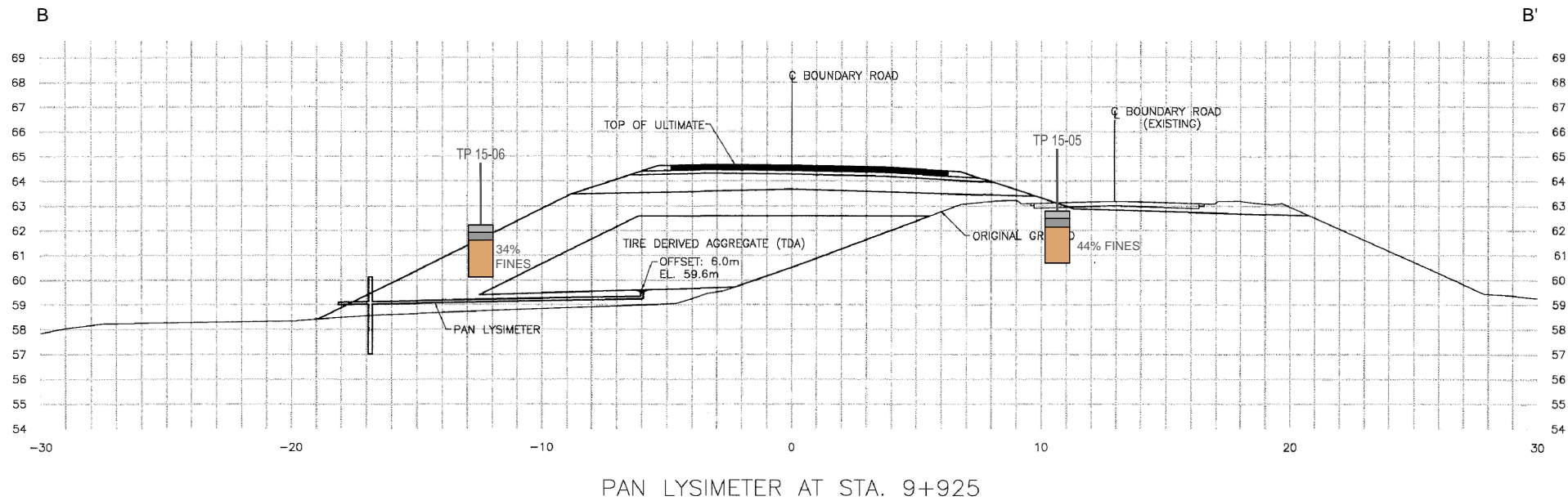
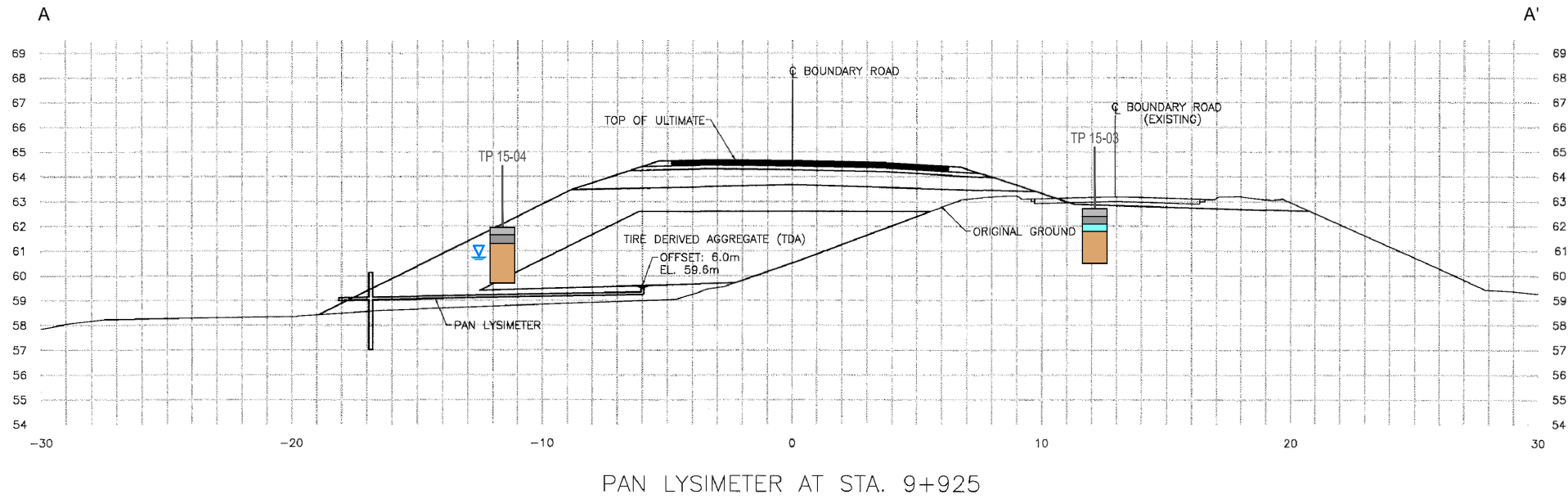
CONSULTANT	YYYY-MM-DD	2016-02-26
DESIGNED	JEM	
PREPARED	JEM	
REVIEWED	DH	
APPROVED	FJH	

PROJECT NO. 1413191 PHASE 1030 REV. 0 FIGURE 3



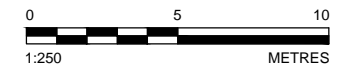
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

Path: \\golder-gds\gait\stms\Active\Spatial\_MMTO\TDA\_Embankment\_Cornwall\09\_PROJ\1413191\_MTO\_Geotech\40\_PROJ\Hydro\G1 | File Name: 1413191-1030-03-04\_05\_XS.dwg



LEGEND

- TOPSOIL
- GRANULAR A (FILL)
- GRANULAR B (FILL)
- SAND and GRAVEL (FILL)
- MODIFIED EARTH BURROW (SANDY SILT)
- MODIFIED EARTH BURROW (SILTY CLAY)
- APPROXIMATE GROUNDWATER ELEVATION



NOTE(S)

- THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 1413191-1030.
- TEST PIT LOCATIONS APPROXIMATE BASED ON SURVEY DATE AND DESIGN DRAWINGS PREPARED BY AECOM (2010)

CLIENT

MINISTRY OF TRANSPORTATION ONTARIO

PROJECT

TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE

CROSS-SECTIONS - NORTH TDA

CONSULTANT



YYYY-MM-DD 2016-02-26

DESIGNED JEM

PREPARED JEM

REVIEWED DH

APPROVED FJH

PROJECT NO.  
1413191

PHASE  
1030

REV.  
0

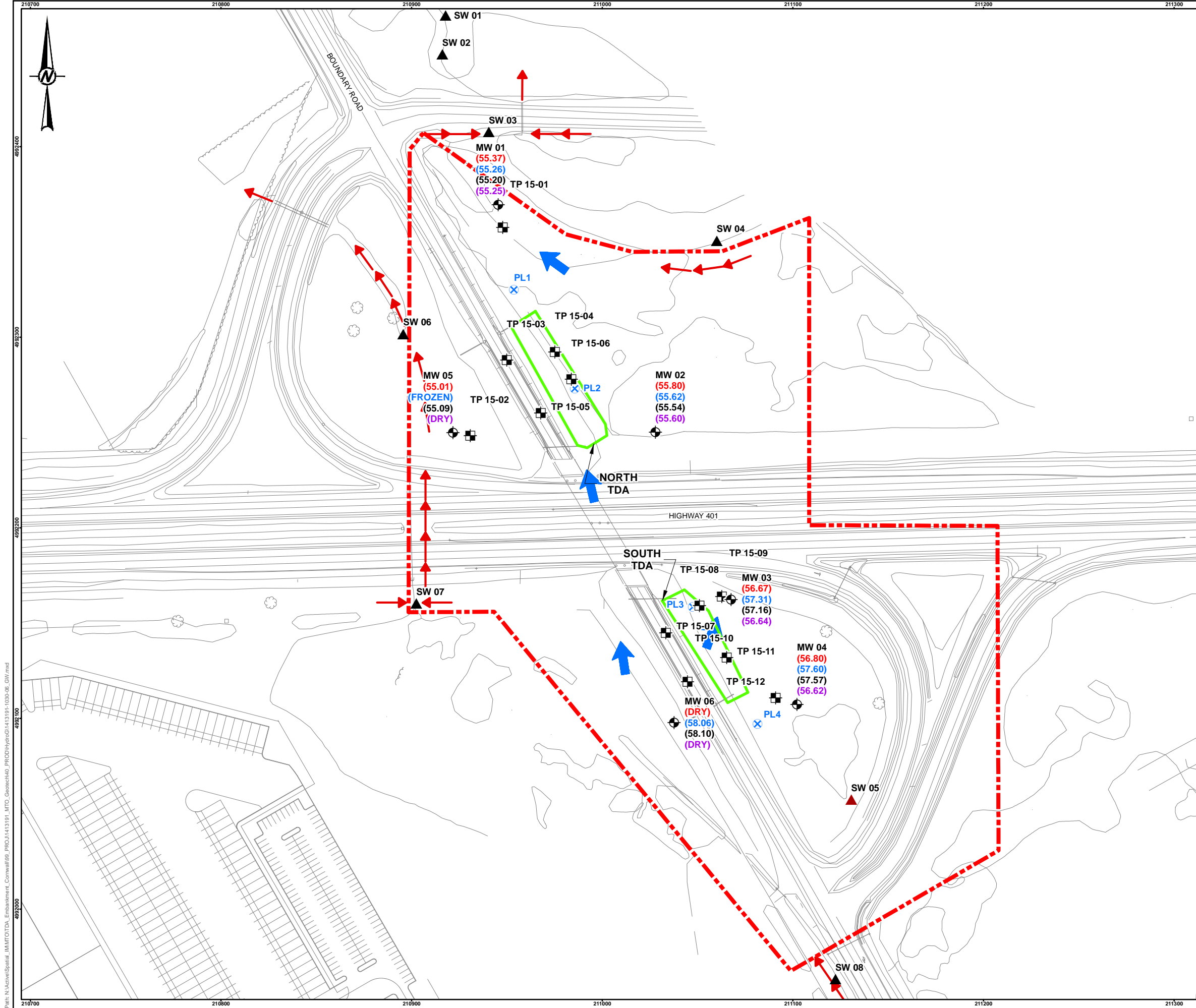
FIGURE  
4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25 mm







**LEGEND**

- APPROXIMATE GROUNDWATER MONITORING LOCATION
- APPROXIMATE TEST PIT LOCATION
- APPROXIMATE SURFACE WATER MONITORING LOCATION
- APPROXIMATE SURFACE WATER MONITORING LOCATION (NOT ESTABLISHED)
- APPROXIMATE PAN LYSIMETER MONITORING LOCATION
- APPROXIMATE TDA AREA
- APPROXIMATE TDA SITE BOUNDARY
- (55.27) GROUNDWATER ELEVATION, mASL, CONSTRUCTION V (OCTOBER 2014)
- (55.27) GROUNDWATER ELEVATION, mASL, CONSTRUCTION VI (MARCH 2015)
- (55.27) GROUNDWATER ELEVATION, mASL, CONSTRUCTION VII (JUNE 2015)
- (55.27) GROUNDWATER ELEVATION, mASL, CONSTRUCTION VIII (AUGUST 2015)
- INTERPRETED DIRECTION OF SHALLOW GROUNDWATER FLOW
- GENERAL SURFACE WATER FLOW DIRECTION (WHEN FLOW IS PRESENT)

**KEY MAP**

© OpenStreetMap (and contributors, CC-BY-SA)

0 20 40 80  
1:2,000 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1413191-1030

**REFERENCE(S)**

1. BASE PLAN PROVIDED IN ELECTRONIC FORMAT BY AECON  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: MTM ZONE 8 VERTICAL DATUM: CGVD28

**CLIENT**

MINISTRY OF TRANSPORTATION ONTARIO

**PROJECT**

TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

**TITLE**

**SITE PLAN WITH GROUNDWATER ELEVATION AND FLOW DIRECTION**

CONSULTANT	YYYY-MM-DD	2016-02-26
DESIGNED	JEM	
PREPARED	JEM	
REVIEWED	DH	
APPROVED	BTB	

PROJECT NO.	PHASE	REV.	FIGURE
1413191	1030	0	6

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 28mm



# **APPENDIX A**

## **Environmental Compliance Approval No. 5558-83WSFB and Comments from the MOECC**



Ministry of the Environment  
Ministère de l'Environnement

**PROVISIONAL CERTIFICATE OF APPROVAL**  
**WASTE DISPOSAL SITE**  
NUMBER 5558-83WSFB  
Issue Date: May 14, 2010

Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation  
1355 John Counter Blvd Postal Bag 4000  
Kingston, Ontario  
K7L 5A3

Site Location: Boundary Road & Highway 401 Interchange  
Cornwall, United Counties of Stormont, Dundas and Glengarry  
K6H 6M1

*You have applied in accordance with Section 27 of the Environmental Protection Act for approval of:*  
*the use and operation of a 0.50 hectare tire derived aggregate footprint for construction of embankments*  
*within a total site area of 7.5 hectares*

Note: Use of the site for any other type of waste is not approved under this Certificate, and requires obtaining a separate approval amending this Certificate.

*For the purpose of this Provisional Certificate of Approval and the terms and conditions specified below, the following definitions apply:*

"Crown " means Her Majesty the Queen in the Right of Ontario;

"Certificate " means this entire provisional Certificate of Approval document, issued in accordance with section 39 of the EPA , and includes any schedules to it, the application and the supporting documentation listed in schedule "A";

"Director " means any Ministry employee appointed in writing by the Minister pursuant to section 5 of the EPA as a Director for the purposes of Part V of the EPA;

"District Manager " means the District Manager of the local district office of the Ministry in which the Site is geographically located;

"*EPA* " means *Environmental Protection Act* , R.S.O. 1990, c. E. 19, as amended;

"*Ministry* " means the Ontario Ministry of the Environment;

"*Operator*" has the same meaning as ``operator`` as defined in Section 25 of the *EPA* and means the contractor retained by the Ministry of Transportation for construction of Tire Derived Aggregate embankments;

"*Owner* " means Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation and its successors and assigns;

"*Provincial Officer* " means any person designated in writing by the Minister as a provincial officer pursuant to section 5 of the *OWRA* or section 5 of the *EPA* or section 17 of *PA* .

"*Regional Director* " means the Regional Director of the local Regional Office of the Ministry in which the Site is located.

"*Regulation 347* " or "*Reg. 347* " means Regulation 347, R.R.O. 1990, made under the *EPA* , as amended from time to time;

"*Site* " means the entire TDA site , including the buffer lands located at Boundary Road and Highway 401 and legally described as Part of Lot D, Concession 2, City of Cornwall and Part of Lot 16, Concession 3, Township of South Glengarry, approved by this *Certificate* .

"*Tire Derived Aggregate* " or "*TDA* " means pieces of scrap tires (tire chips and tire shreds) that have a basic geometrical shape and are generally between 12 mm and 305 mm in size and are intended for use in civil engineering operations.

*You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:*

## TERMS AND CONDITIONS

### GENERAL

#### Compliance

1. The *Owner* shall ensure that any person authorized to carry out work on or operate any aspect of the *Site* is notified of the *Certificate* and the conditions herein and shall take all reasonable measures to ensure the person complies with the same.
2. Any person authorized to carry out work on or operate any aspect of the *Site* shall comply with the conditions of this *Certificate* .

#### In Accordance



3. Except as otherwise provided for in this *Certificate*, the *Site* shall be designed, developed, built, operated and maintained in accordance with the application for this *Certificate*, dated December 21, 2009, and the supporting documentation listed in Schedule "A".

#### Other Legal Obligations

4. The issuance of, and compliance with, this *Certificate* does not:
- relieve any person of any obligation to comply with any provision of the *EPA* or any other applicable statute, regulation or other legal requirement; or
  - limit in any way the authority of the *Ministry* to require certain steps be taken or to request that any further information related to compliance with this *Certificate* be provided to the *Ministry*;

unless a provision of this *Certificate* specifically refers to the other requirement or authority and clearly states that the other requirement or authority is to be replaced or limited by the this *Certificate*.

#### Adverse Effect

5. The *Owner* and *Operator* shall take all reasonable steps to minimize and ameliorate any adverse effect or impairment of water quality resulting from the operation of the *Site*, including such accelerated or additional monitoring as may be necessary to determine the nature of the effect or impairment.
6. The *Owner Operator* shall remain responsible for any contravention of any other condition of this *Certificate* or any applicable statute, regulation, or other legal requirement resulting from any act or omission that caused the adverse effect or impairment of water quality.

#### Furnish Information

7. Any information requested by the *Director* or a *Provincial Officer* concerning the *Site* and its operation under this *Certificate*, including but not limited to any records required to be kept by this *Certificate* shall be provided in a timely manner.
8. The receipt of any information by the *Ministry* or the failure of the *Ministry* to prosecute any person or to require any person to take any action, under this *Certificate* or under any statute, regulation or subordinate legal instrument, in relation to the information, shall not be construed as:
- an approval, waiver, or justification by the *Ministry* of any act or omission of any person that contravenes any condition of this *Certificate* or any statute, regulation or other subordinate legal requirement; or
  - acceptance by the *Ministry* of the information's completeness or accuracy.



## Freedom of Information Act

9. Any information related to this Certificate and contained in Ministry files may be made available to the public in accordance with the provisions of the Freedom of Information and Protection of Privacy Act, RSO 1990, CF-31.

## Interpretation

10. Where there is a conflict between a provision of any document, including the application, referred to in this *Certificate*, and the conditions of this *Certificate*, the conditions in this *Certificate* shall take precedence.
11. Where there is a conflict between the application and a provision in any documents listed in Schedule "A", the application shall take precedence, unless it is clear that the purpose of the document was to amend the application and that the *Ministry* approved the amendment.
12. Where there is a conflict between any two documents listed in Schedule "A", other than the application, the document bearing the most recent date shall take precedence.
13. The conditions of this *Certificate* are severable. If any condition of this *Certificate*, or the application of any condition of this *Certificate* to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this *Certificate* shall not be affected thereby.

## Inspections

14. No person shall hinder or obstruct a *Provincial Officer* from carrying out any and all inspections authorized by the *OWRA*, or the *EPA*, of any place to which this *Certificate* relates, and without limiting the foregoing:
  - to enter upon the premises where the approved works are located, or the location where the records required by the conditions of this *Certificate* are kept;
  - to have access to, inspect, and copy any records required to be kept by the conditions of this *Certificate*;
  - to inspect the *Site*, related equipment and appurtenances;
  - to inspect the practices, procedures, or operations required by the conditions of this *Certificate*; and
  - to sample and monitor for the purposes of assessing compliance with the terms and conditions of this *Certificate* or the *EPA*, the *OWRA* or the *PA*.

## Waste Type

15. Only the following types of waste shall be accepted at the *Site*:
  - Tire Derived Aggregate

16. Any waste type not listed in the previous condition shall not be accepted at the *Site*.

#### **Capacity**

17. The *Owner* shall only accept and deposit TDA at the site as long as there is available capacity as defined by the TDA limits for the *Site* approved by this *Certificate* as shown in Figure 18 of Item 2 in Schedule "A".
18. The amount of TDA deposited at the site shall not exceed the site capacity of 20,000 cubic metres.

#### **Service Area**

19. Only TDA that is generated **within the Province of Ontario** shall be accepted at the *Site*.

#### **Operation**

##### **Proper Operation**

20. The TDA embankments at the Site shall be properly constructed and maintained at all times. All TDA shall be managed in accordance with the requirements of this Certificate, the EPA and Regulation 347. At no time shall the discharge of a contaminant that causes or is likely to cause an adverse effect be permitted.

##### **Placement of TDA**

21. TDA shall be placed in accordance with the following requirements:
- A minimum of 2 metres above the groundwater table;
  - A minimum of 30 metres from any surface waterbody, watercourse, swamp or wetland; and
  - A minimum of 100 metres from any potable groundwater well.
22. TDA shall be placed in accordance with the procedures detailed in Item 2 of Schedule "A".

##### **TDA Limits**

23. TDA shall not be placed, compacted and covered outside the limits shown in Item 4 in Schedule "A" attached to this *Certificate*.

##### **Hours of Operation**

24. TDA may be accepted at the Site 24 hours per day, seven days per week.

##### **Site Security**

25. During non-operating hours, the TDA Site shall be secured against access by unauthorized

persons

### **TDA Inspection**

26. The *Operator* shall develop and implement a program to inspect TDA to ensure that the TDA is of a type approved for acceptance under this *Certificate* .

### **MONITORING, RECORDING NOTIFICATION**

#### **Monthly Inspections and Log Book**

27. An inspection of the TDA Site shall be conducted each month during construction to ensure compliance with this *Certificate*. Any deficiencies discovered as a result of the inspection shall be remedied immediately
28. A record of the inspections shall kept in a monthly log book *or a dedicated electronic file* that includes:
- the name and signature of person that conducted the inspection;
  - the date and time of the inspection;
  - the list of any deficiencies discovered;
  - the recommendations for remedial action; and
  - the date, time and description of actions taken.
29. A record shall be kept in the monthly log book of all refusal of TDA shipments, the reason(s) for refusal, and the origin of the TDA , if known.

#### **Monitoring Program**

30. Within sixty (60) days of issuance of this *Certificate*, the Owner shall submit a ground-water monitoring program to the Director for approval. The groundwater monitoring program shall include a parameter list, sampling frequency, the location of proposed on-site wells and the location of off-site domestic wells.
31. Placement and compaction of TDA may not occur until the monitoring program is approved by the Director.

#### **Record Retention**

32. Except as authorized in writing by the Director, all records required by this *Certificate* shall be retained at the Site for a minimum of two (2) years from their date of creation.
33. The Owner shall retain all documentation listed in Schedule "A" for as long as this *Certificate* is valid.

34. All monthly summary reports are to be kept at the site until they are included in the Final Report.
35. The Owner shall make all of the above documents available for inspection upon request of Ministry staff.

#### **Emergency Situations**

36. In the event of a fire or discharge of a contaminant to the environment, TDA site staff shall contact the MOE Spills Action Centre (1-800-268-6060) and the District Office of the MOE.
37. The Operator shall submit to the District Manager a written report within 3 days of the spill or incident, outlining the nature of the incident, remedial measures taken and measures taken to prevent future occurrences at the TDA Site.
38. The Operator shall prepare an Emergency Response Manual for the TDA site prior to receipt of TDA at this Site in consultation with local emergency response agencies. The Emergency Response Manual should indicate the responsibility of each of the stakeholders with respect to handling possible emergency situations.
39. The Emergency Response Manual shall be updated on a regular basis and be provided to the District Manager within one month of the revision date.
40. The Operator shall ensure that adequate fire fighting and contingency spill clean up equipment is available and that emergency response personnel are familiar with its use and location.

#### **Final Report**

41. A written report on the completion of TDA embankment construction and monitoring of the TDA Site, shall be completed (the "Final Report") and shall be submitted to the *District Manager* by March 31, 2013.
42. The Final Report shall include the following:
  - a. the results and an interpretive analysis of the results of all groundwater monitoring;
  - b. site plans showing the final TDA embankment construction;
  - c. a discussion of any operational problems encountered at the Site and corrective action taken;
  - d. a report on the status of all monitoring wells and a statement as to compliance with Ontario Regulation 903;
  - e. any other information with respect to the site which the District Manager or Regional Director may require from time to time;
  - f. a statement of compliance with all conditions of this Certificate of Approval and other relevant Ministry groundwater and surface water requirements;
  - g. Summary of inspections undertaken at the site; and,
  - h. interpretations, conclusions and recommendations for future use of TDA as a recycled engineered material in Ontario.

### SCHEDULE "A":

1. Application for a Provisional Certificate of Approval for a Waste Disposal Site for the Boundary Road/Highway 401 Interchange, signed and dated on December 21, 2009.
2. Document entitled "*Design Brief Tire Derived Aggregate Ministry of Transportation Application to Ministry of the Environment*" and Appendices A to D inclusive prepared by the Ministry of Transportation, dated December 2009.
3. Letter dated March 2, 2010 to Mr. David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation from Greg Washuta, Senior Waste Engineer, Waste Unit, EAAB, MOE.
4. Letter dated March 12, 2010 and attached figures entitled "TDA Site Boundary" and "MTO Property Limits" from Mr. David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation to Greg Washuta, Senior Waste Engineer, Waste Unit, EAAB, MOE.
5. Letter and attached draft Certificate of Approval dated April 8, 2010 from Greg Washuta, Senior Waste Engineer, Waste Unit, EAAB, MOE to David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation.
6. E-mail dated April 21, 2010 from Mr. David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation from Greg Washuta, Senior Waste Engineer, Waste Unit, EAAB, MOE.
7. Document entitled "MTO TDA Site - Boundary Road/Hwy 401 - Cornwall Comments on Draft C of A dated April 8/10 - REF #5447-7ZGRK2" created by Mr. David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation, dated April 21, 2010.
8. Letter and attached draft Certificate of Approval dated May 4, 2010 from Greg Washuta, Senior Waste Engineer, Waste Unit, EAAB, MOE to David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation.
9. E-mail dated May 5, 2010 from Mr. David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation from Greg Washuta, Senior Waste Engineer, Waste Unit, EAAB, MOE.
10. E-mail dated May 7, 2010 from Greg Washuta, Senior Waste Engineer, Waste Unit, EAAB, MOE to David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation.
11. E-mail dated May 7, 2010 from Mr. David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation from Greg Washuta, Senior Waste Engineer, Waste

Unit, EAAB, MOE.

*The reasons for the imposition of these terms and conditions are as follows:*

- 1. The reason for the definitions is to define the specific meaning of terms and simplify the wording of conditions in this Certificate of Approval.*
- 2. The reason for Condition 1 and 2 is to ensure that the Site is designed, operated, monitored and maintained in accordance with the application and supporting documentation submitted by the Owner, and not in a manner which the Director has not been asked to consider.*
- 3. The reason for Conditions 3 to 6 inclusive, 10-13 inclusive and 31-35 inclusive is to clarify the legal rights and responsibilities of the Owner under this Certificate of Approval.*
- 4. Conditions 7 and 8 are included to ensure that the appropriate Ministry staff have ready access to information and the operations of the Site, which are approved under this Certificate.*
- 5. Condition 9 is needed in order to clarify the Owner's responsibilities under the Freedom of Information Act.*
- 6. The reason for Condition 14 is to ensure that appropriate Ministry staff have ready access to the Site for inspection of facilities, equipment, practices and operations required by the conditions in this Certificate of Approval. This condition is supplementary to the powers of entry afforded a Provincial Officer pursuant to the EPA and OWRA.*
- 7. The reason for Conditions 15, 16 and 19 is to specify the approved areas from which TDA may be accepted at the Site and the types and amounts of TDA that may be accepted for disposal at the Site, based on the Owner's application and supporting documentation.*
- 8. The reason for Conditions 17 and 18 is to specify restrictions on the extent of landfilling at this Site based on the Owner's application and supporting documentation. These limits define the approved volumetric capacity of the site. Approval to landfill beyond these limits would require an application with supporting documentation submitted to the Director.*
- 9. The reasons for Condition 24 are to specify the normal hours of operation for the TDA Site and a mechanism for amendment of the hours of operation.*
- 10. The reasons for Condition 25 are to specify site access to/from the Site and to ensure the controlled access and integrity of the Site by preventing unauthorized access when the Site is closed and no site attendant is on duty.*
- 11. The reason for Conditions 23 is to ensure that placement of TDA is conducted in an environmentally acceptable manner.*

12. *The reasons for Conditions 20 to 22 inclusive, 26 and 27 are to ensure that the Site is operated, inspected and maintained in an environmentally acceptable manner and does not result in a hazard or nuisance to the natural environment or any person.*
13. *The reason for Condition 29 is to ensure that accurate TDA records are maintained to ensure compliance with the conditions in this Certificate of Approval (such as fill rate, site capacity, record keeping, annual reporting, and financial assurance requirements), the EPA and its regulations.*
14. *The reason for Condition 30 is to demonstrate that the TDA site is performing as designed and the impacts on the natural environment are acceptable. Regular monitoring allows for the analysis of trends over time and ensures that there is an early warning of potential problems so that any necessary remedial/contingency action can be taken.*
15. *The reasons for Condition 28 are to provide for the proper assessment of effectiveness and efficiency of site design and operation, their effect or relationship to any nuisance or environmental impacts, and the occurrence of any public complaints or concerns. Record keeping is necessary to determine compliance with this Certificate of Approval, the EPA and its regulations.*
16. *The reasons for Conditions 41 and 42 are to ensure that regular review of site development, operations and monitoring data is documented and any possible improvements to site design, operations or monitoring programs are identified. A final report is an important tool used in reviewing site activities and for determining the effectiveness of site design.*
17. *The reasons for Condition 36 are to ensure that the Ministry is informed of any spills or fires at the Site and to provide public health and safety and environmental protection.*
18. *Conditions 37-40 are contained in the Certificate to guarantee that appropriate measures are taken by the Owner to prevent future occurrences of spills or fires at the site and to protect public health and safety and the environment.*

*In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:*

1. *The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;*
2. *The grounds on which you intend to rely at the hearing in relation to each portion appealed.*

*The Notice should also include:*

3. *The name of the appellant;*
4. *The address of the appellant;*
5. *The Certificate of Approval number;*



6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

*And the Notice should be signed and dated by the appellant.*

*This Notice must be served upon:*

The Secretary\*  
Environmental Review Tribunal  
655 Bay Street, 15th Floor  
Toronto, Ontario  
M5G 1E5

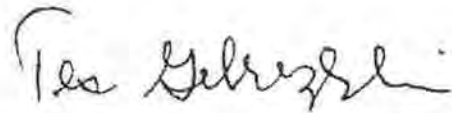
AND

The Director  
Section 39, *Environmental Protection Act*  
Ministry of the Environment  
2 St. Clair Avenue West, Floor 12A  
Toronto, Ontario  
M4V 1L5

\* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or [www.ert.gov.on.ca](http://www.ert.gov.on.ca)

*The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.*

DATED AT TORONTO this 14th day of May, 2010



Tesfaye Gebrezghi, P.Eng.  
Director  
Section 39, *Environmental Protection Act*

GW/

c: District Manager, MOE Cornwall  
David Staseff, Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation  
Lisa Chalmers, MOE, Cornwall



MEMORANDUM

13 March 2015

TO: L. Chalmers  
Sr. Environmental Officer  
Cornwall Area Office  
Eastern Region

FROM: F. Crossley  
Hydrogeologist  
Technical Support Section  
Eastern Region

RE: Annual Monitoring Report #2 - Tire Derived Aggregates  
Ministry of Transportation Ontario  
Highway 401 at Boundary Road, Cornwall, Ontario  
5558-83WSFB

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This Ministry issued (May, 2010) an Environmental Compliance Approval, 5558-83WSFB, to Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation for the use and operation of a 0.5 hectare tire derived aggregate (TDA) footprint for construction of embankments within a total site area of 7.5 hectares. The site is located at Boundary Road and Highway 41 interchange, Cornwall, Ontario.

TDA is derived from scrap tires. The scrap tires are mechanically processed, shredded. The tires are shredded to various sizes and based on their sizes are referred to as tire shreds (50-305 mms) or tire chips (12-60 mms). During the shredding process, some wire is removed from the tires, especially the tire chipping process. TDA consists of tire shreds and tire chips. TDA is used as an alternate to conventional fill materials (soils).

As part of the approval, a pre construction monitoring program was required. Golder Associates (Golder) conducted the pre construction monitoring program and summarized their results in "Pre Construction Baseline Study, TDA Embankment Boundary Road, Cornwall" dated June, 2012. The results in this report provide baseline conditions.

The TDA Embankments were installed in May, 2012. It is reported that approximately 400,000 used tires were used in the construction of the two embankments. The interchange was open to traffic in November, 2012.

Golder conducted monitoring in June, September, December, 2012 and April, 2013. Golder referred to these monitoring events as construction monitoring. Golder produced a summary report "Construction Monitoring Annual Report #1 TDA Embankment, Boundary Road, Cornwall" dated August, 2013 (received October, 2013). I reviewed this report to determine if the TDA is causing environmental impacts. I provided comments in a memorandum dated October 25, 2013. It was concluded that the TDA produces a leachate. The key leachate

indicator parameters are: benzene, iron and manganese. This was determined from the liquids (leachate) in the pan lysimeters. The results from the monitoring well network did not show leachate impacts (2012, 2013).

Golder conducted monitoring in July 2013, October 2013, February 2014 and May 2014. Golder produced a summary report "Construction Monitoring Report Annual Report #2, TDA Embankment, Boundary Road, Cornwall" dated August, 2014 (received October, 2014). I reviewed this report to determine if the TDA is causing environmental impacts.

Pan lysimeters were installed prior to the addition of TDA. In total, four pan lysimeters were installed: two north of Highway 401 (PL1 and PL2) and two south of Highway 401 (PL3 and PL4). The pan lysimeters are installed above the water table, thus the pan lysimeters collect leachate and/or infiltration. PL1 and PL4 are located outside the TDA area to provide control results (infiltration). PL2 and PL3 are located within the TDA area to collect leachate/infiltration. The purpose of the pan lysimeters is to provide a leachate characterization.

PL1 and PLS4, control lysimeters, were reported as "dry" throughout the monitoring program.

PL2 shows an increase in numerous chemical parameters compared to the pre construction results. PL3 shows an increase in numerous chemical parameters compared to the pre construction results.

Based on the results from the pan lysimeters, the key leachate indicator parameters are: iron; manganese; benzene; alkalinity; hardness and sulphates.

Groundwater monitoring wells were installed in November, 2010, prior to construction activities. In total, six boreholes/monitoring wells were installed: three monitoring wells north of Highway 401 (MW01, MW02 and MW05) and three monitoring wells south of Highway 401 (MW03, MW04 and MW06). The borehole logs generally show the geology to be: fill (structural fill); brown silty sand (Fort Covington); sand and gravel seam and grey sandy silt (Malone). The monitoring wells target the interface zone of the Fort Covington/sand and gravel seam/Malone units.

Golder determined the physical hydrogeological characteristics to be:

- The groundwater flow is to the northwest with a hydraulic gradient of 0.003 to 0.005 in the north TDA embankment. The depth to water in the north TDA embankment is 0.1 to 1.4 metres below ground surface.
- The groundwater flow is to the east with a horizontal hydraulic gradient of 0.01 in the south TDA embankment. The depth to water in the south embankment is 1.4 to 2.3 metres below ground surface.

The groundwater results are summarized in Appendix C-1. In comparing the results from the pre construction sampling events to the construction/post construction sampling events the following trends are noted at each monitoring well:

MW1 - No discernable trend.

MW2 - No discernable trend.

- MW3 - Increasing trend in hardness and sulphates and fluctuating trend in iron and manganese.
- MW4 - Slightly increasing trend in hardness and sulphates.
- MW5 - No discernable trend.
- MW6 - No discernable trend.

Since the site has an Environmental Compliance Approval, Guideline B-7 applies. Golder applied Guideline B-7 to the site. Exceedances of the Reasonable Use limits for iron and manganese occur at MW1 and MW3. MW1 is not interpreted to be impacted by leachate. MW3 is interpreted to be impacted by leachate.

As part of the pre construction and construction monitoring program, surface water samples were collected. The surface water results are not part of this review and will be reviewed separately by a Surface Water Evaluator.

I offer the following conclusions and recommendations:

- The Minister of Transportation was issued (May, 2010) an Environmental Compliance Approval, 5558-83WSFB, for the use and operation of a 0.5 hectare tire derived aggregates (TDA) footprint for construction of embankments within a total site area of 7.5 hectares located at the interchange of Boundary Road and Highway 401, Cornwall, Ontario.
- The Environmental Compliance Approval required pre construction sampling, construction sampling and post construction sampling.
- The pre construction sampling results provide baseline conditions.
- The pan lysimeter results provide a leachate characterization. The key leachate indicator parameters are: iron; manganese; benzene; alkalinity; hardness and sulphates.
- The pan lysimeters outside (control) the TDA area typically are reported as “dry” whereas the pan lysimeters within the TDA area have liquids (historical overflow reported). This suggests that the materials covering the TDA area are not a low permeable material or are insufficient to reduce infiltration into the TDA area. This issue should be addressed.
- The groundwater results show that the leachate is impacting MW3 and possibly MW4.
- The site is regulated (Environmental Compliance Approval), thus Guideline B-7 applies.
- The site is considered to be in compliance with Guideline B-7 as MW3 is within the site boundary. Ongoing monitoring will determine if further action is required.
- The monitoring program is to be continued.

- The Minister of Transportation Ontario is requesting the exemption of TDA from Regulation 347 and Part V of the Environmental Protection Act. TDA is not inert and generates a leachate best characterized by: iron; manganese; benzene; alkalinity; hardness and sulphates. Therefore it is recommended that TDA remain regulated and can be used in site specific cases where the leachate generation does not produce environmental impacts.



F. Crossley, P.Geo.  
/sh

ec: V. Castro  
M. Séguin  
G. Faaren (Acting Supervisor)  
P. Taylor

c: File GW ST CC 01 02 BO (TDA Boundary Road/Highway 401)  
FC/IDS #7120-9PFM7L



MEMORANDUM

June 10, 2015

TO: Lisa Chalmers  
Senior Environmental Officer  
Cornwall Area Office  
Eastern Region

FROM: Victor Castro  
Senior Aquatic Scientist  
Technical Support Section  
Eastern Region

RE: Tire Derived Aggregate (TDA) Annual Report #2  
Ministry of Transportation  
Environmental Compliance Approval No. 5558-83WSFB  
Highway #401 at Boundary Road, Cornwall, Ontario

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I have reviewed the report titled, "*Construction Monitoring Report, Annual Report #2 (PR #44), MTO Contract 2010-4003, TDA Embankment, WP-385-01-01, Boundary Road, Cornwall, Ontario*" dated August 2014 prepared by Golder Associates and offer the following comments for your consideration.

In Ontario, used tires that have not been refurbished for road use are a designated waste under Ontario Regulation 347 of the *Environmental Protection Act*. Land application of shredded or chipped tires as an engineered fill requires an approval under Part V of the Environmental Protection Act (EPA).

On May 14, 2010 Environmental Compliance (ECA) No. 5558-83WSFB was issued to the Ontario Ministry of Transportation (MTO) for the use and operation of a 0.50 hectare tire derived aggregate footprint for construction of embankments at the Boundary Road and Highway #401 interchange, in Cornwall, Ontario. The total site area is 7.5 hectares. Tire derived aggregate (TDA) is a recycled material processed from scrap tires into chips and shreds generally between 12 mm and 305 mm in size. Approximately 400,000 shredded tires were placed as fill within the approach embankments for the new bridge structure spanning Highway 401 at Boundary Road. The TDA embankments were installed in May 2012.

This is the second post-construction annual report submitted for this site spanning the period July 2013 to May 2014. I have previously provided comments dated February 13, 2014 on a March 2013 MTP Final Report, which included pre-construction sampling of baseline conditions in groundwater monitors, surface water stations and pan lysimeters.

The surface water sampling events took place on July 5, 2013, October 21, 2013, February 3, 2014 and May 25, 2014. During these periods numerous stations (SW03, SW04 and SW08) could not be sampled due to frozen or dry conditions. The remaining stations were reported as stagnant or with negligible flow. Sampling results for stations SW01, SW02 and SW07 show elevated levels of several TDA leachate indicator parameters: iron, manganese and zinc. The consultants do not attribute these elevated concentrations of indicator parameters to the TDA filled embankments, but instead they indicate there is limited evidence to suggest these stations are located downstream of the TDA area. The drainage patterns for the surface water stations is obviously an issue and needs to be confirmed in order to properly assess the surface water data. It may be quite possible for the elevated metals to be natural in origin, particularly in stagnant shallow surface water features; however, there is a source of these contaminants in close proximity (i.e. TDA embankments) and therefore an understanding of drainage and flow patterns during wet periods is necessary to explain the elevated concentrations.

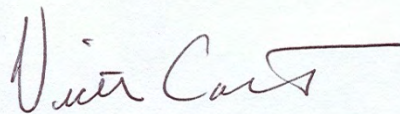
Pan lysimeters PL1 and PL4 are situated outside the TDA fills areas and were reported as dry throughout the monitoring period. This has been a common observation throughout the monitoring programs.

Pan lysimeters PL2 and PL3, which were installed directly in the TDA embankments above the water table, continue to show elevated levels of TDA leachate indicator parameters iron, manganese and benzene. Alkalinity, hardness and sulphates are also considered good leachate indicators for TDA.

During the sampling event on June 20, 2013 the consultants observed flow coming from the end cap of the horizontal drain pipe at PL3. Iron stained water was observed at the same location on October 21, 2013. These types of observations have been noted in past monitoring events and indicate higher than expected infiltration.

The consultants have recommended that surface water and groundwater monitoring continue at this site. I support this recommendation.

If you have any questions regarding these comments, please contact me at (613) 540-6862.



Victor Castro, B.Sc., M.Pl.  
VC/sh

ec: Greg Faaren

c: File SW ST CC 03 06 (MTO Boundary Road/401, TDA Site – Cornwall)





Ministry of the Environment and Climate Change  
Ministère de l'Environnement et de l'Action en  
matière de changement climatique

## Solid Non-Hazardous Waste Disposal Site Inspection Report

<b>Client:</b>	Her Majesty the Queen in Right of Canada as Represented by the Minister of Transportation, Business/Facility Name: Transport Canada Mailing Address: 4900 Yonge St, Toronto, Ontario, Canada, M2N 6A5 Physical Address: 4900 Yonge St, Toronto, City, Ontario, Canada Telephone: (416)952-0516 Client #: 7144-7UNHH6, Client Type: Federal Government		
<b>Inspection Site Address:</b>	Boundary Road/Hwy 401 Interchange Address: Tire Aggregate Site, Cornwall, City, United Counties of Stormont Dundas and Glengarry District Office: Cornwall Site #: 8479-869GAX		
<b>Contact Name:</b>	David Staseff	<b>Title:</b>	Sr. Foundations Engineer MTO
<b>Contact Telephone:</b>	416-235-4073 ext	<b>Contact Fax:</b>	
<b>Last Inspection Date:</b>			
<b>Inspection Start Date:</b>	2016/05/27	<b>Inspection Finish Date:</b>	2016/06/02
<b>Region:</b>	Eastern		

### 1.0 INTRODUCTION

Acronyms that may be included in this report include:

- ECA: Environmental Compliance Approval
- EPA: Environmental Protection Act
- ESDM Report: Emission Summary and Dispersion Modelling Report
- MOECC: Ontario Ministry of the Environment and Climate Change
- MTO: Ministry of Transportation
- NAICS: North American Industrial Classification System
- OWRA: Ontario Water resources Act
- O. Reg. 347 General Waste Management
- POI: Point of Impingement
- TDA: Tire Derived Aggregate
- WDS: Waste Disposal Site

The Ontario Ministry of the Environment and Climate Change (MOECC) conducts an inspection program to ensure that active and closed Waste Disposal Sites (WDS) are in compliance with ministry legislation, policies and guidelines and to ensure compliance with control documents issued for the site. Inspections also provide an opportunity to update files, ensure any outstanding requirements have been fulfilled, and provide an opportunity to identify potential concerns or impacts to the environment.

The Ontario Ministry of Transportation (MTO) presented to the Ministry of Environment and Climate Change (MOECC) that MTO wanted to utilize Tire Derived Aggregate (TDA) in road/embankment

construction rather than use natural aggregate. MTO presented in 2009 that *"reused and recycled materials such as TDA should not be designated as waste in MOE regulations, but should instead be considered as an engineered material for construction, subject to realistic pre-established environmental conditions"*. MTO also have advised that they will continue to liaise with stakeholders to develop policy or regulations to encourage the use of TDA in embankment construction.

Since TDA is not exempted as a waste at this time, individual TDA sites require an Environmental Compliance Approval (ECA) for Waste Disposal Site. In January 2010 MTO submitted an application for an approval to allow TDA to be used at the Highway 401 and Boundary Road interchange in Cornwall. The TDA material was deposited at the site in the summer of 2012. Final grading was completed July 2014.

This is the first Inspection conducted at the site, although the ministry has been active in reviewing reports and has responded to reported leachate emissions from the site. This Inspection included a review of ministry databases and files and two site visits, conducted May 27 and June 3, 2016. Photographs taken during site visits are provided (Appendix A).

The primary contact for ministry District staff throughout both the construction and post construction phase has been:

David Staseff, M.A.Sc., P. Eng.  
Senior Foundations Engineer  
Ministry of Transportation Ontario (MTO)  
145 Sir William Hearst Avenue, Room 223  
Downsview ON Canada  
M3M 0B6

## 2.0 INSPECTION OBSERVATIONS

### **Certificate of Approval Number(s):** ECA # 5558-83WSFB

Environmental Compliance Approval (ECA) #5558-83WSFB was issued on October 1, 2010. The application for the Approval, dated January 7, 2010, outlined the design for the TDA site. Considerations to requirements to meet engineering standards and best practices were incorporated into the site design. Some of the design considerations were aimed at ensuring construction standards would be met, while some were aimed at reducing potential environmental impacts based on lessons learned at other TDA sites.

In addition to the specific observations made in section 2.1 through 2.10, the Approval contained specific conditions that are addressed below.

Condition 20 requires that "at no time shall a discharge of a contaminant that causes or is likely to cause adverse effect be permitted". In the spring of 2013 there was a release of leachate from the site. The release was observed and sampled by Acon Construction and the contaminant levels for manganese and iron were reported to be 75 - 500% greater than the Provincial Water Quality Objectives (PWQO). The ministry's Regional Surface Water specialist advised that the levels of contaminants would impact surface water. MTO excavated sumps (holes) to capture the leachate to ensure that the leachate no longer discharged to adjacent surface water. As of June 2016 discharge continues from at least one of the Pan Lysimeter (PL3) stations. The release of leachate at PL#3 was ongoing despite extremely dry weather in 2016. MTO must conduct regular inspections to ensure that leachate does not leave the site and should ensure in particular that post-precipitation event inspections are conducted. Where release of leachate is likely to enter surface water, wetland, or otherwise has the potential to cause an adverse effect, MTO must take immediate action to contain the contaminant. The MOECC should be notified of any releases and Action Plan to address same.

Condition 26 requires MTO to develop an inspection program to assess TDA brought to the site. Information provided by MTO indicates that the inspection program developed required daily inspection of the TDA material and placement of the material. The responsibility for completing the inspection was given to the Contract Administrator (McIntosh Perry Consulting Engineers) for MTO. The inspections included review of equipment and operations, base preparation, TDA quantities received on site and clay seal placement over the TDA. The ECA was issued based on

the design brief provided by MTO. Once construction commenced there was difficulty with the tire shred supplier meeting the generic tire shred (type B) with too many smaller shreds in the TDA. To allow the project to continue TDA Design Expert (Dr. Dana Humphry) conducted a site visit and recommended that tire from truck and cars be blended to approach the Type B design material. Mr Staseff reported that Dr. Dana N. Humphrey visited the site on May 16 and May 18, 2012.

Condition 27 requires monthly inspection of the site during construction. The historic data (i.e., inspection records) were not reviewed.

Condition 42 required a final Report to be submitted to the ministry by March 31, 2013. MTO did submit the final report required in the ECA, although it was delayed because the construction of the site was itself delayed until 2012. The final report included all information required in the Approval. Note that while the ECA only required one post construction report, the Regional Technical Support staff requested reports be provided on an Annual Basis. MTO has also been submitting Annual Reports.

Condition 42(c) requires a discussion of any operational problems encountered at the Site and corrective action taken: Overall, there were very few issues with the construction of the TDA embankments. For the most part, the site operations were carried out as expected. One problem encountered during TDA construction was with the use of the rubber tire compactor. Due to tire punctures from exposed steel in the TDA, the Contractor switched to a double steel drum roller for TDA compaction.

## 2.1 FINANCIAL ASSURANCE:

### Specifics:

n/a

## 2.2 APPROVED AREA OF THE SITE:

### Specifics:

The approved area of the site is 0.5 hectares and is divided into two separate fill areas, each of approximately .25 hectares. The entire work site where the TDA is being used is approximately 7.5 hectares.

## 2.3 APPROVED CAPACITY:

### Specifics:

The total volume of tires approved for fill at this site is 20,000 cubic metres. In addition to the TDA fill, aggregate was used at the site along at the top and sides of the approved area. The approval application design indicated that .5 meters of soil would be used on top and sides. The design in the approval application required 1-2 meters of fill at the top of the embankment for construction purposes.

## 2.4 ACCESS CONTROL:

### Specifics:

Condition 25 of the ECA required that access be controlled during non-operating hours. During the construction phase the inspector passed by the site on numerous occasions and did not observe any restrictions to access.

At this time the TDA site is now covered and presents as any bridge embankment. The site is not overly accessible as it is bounded by busy road corridors and is located at a bridge crossing. It is noted however, that should people walk on the site they may encounter leachate from the PL seeps. Elimination of the leachate releases will alleviate any concerns about access at the site.

## 2.5 COVER MATERIAL:

### Specifics:

Cover was to be applied once the TDA waste was in place. Final cover was applied in 2012 once TDA areas were filled. The final grading of the site was completed in July 2014.

Comments on the project, provided during review of the pre-construction monitoring report included that a minimum of .6 meters of low permeable soil is to be placed on top of the TDA.

Leachate has been released from PL#3, and sometimes PL#2, since at least spring 2013. The need to assess the adequacy of the cover was presented to MTO as part of ministry reviews in the Fall of 2013 and again in Fall 2014. MTO advise that an assessment was conducted in 2015 but the report had not been completed until recently. Mr Staseff has advised that the report should be available July 2016.

Depending on the findings of the assessment of the cover, some maintenance or alteration to cover may be required,

## **2.6 WASTE BURNING:**

### **Specifics:**

There is no burning allowed at this road construction WDS.

The MTO Design and use of materials not only considered environmental impact potential but the suitability of the TDA as a construction aggregate replacement and concerns that might arise from its use. The ECA application information acknowledged that some sites using TDA in the United States did auto-ignite due to thermal properties. Temperature sensors are located within the TDA to ensure that the material does not overheat and self ignite. The post-construction report indicated that self-heating would not be a problem at this site: one brief period of temperatures elevated to "review status" occurred but it was when the TDA was exposed and during elevated ambient air temperature. MTO does not anticipate any temperature related issues now that the TDA is covered.

## **2.7 GROUNDWATER/SURFACEWATER IMPACT:**

### **Specifics:**

Monitoring for potential environmental impacts is required at this site. Condition 30 of the ECA required MTO to submit a monitoring plan within 60 days of issuance of the Approval. MTO submitted the plan May 2010, and submitted a revised and final monitoring program July 2010 following receipt of ministry comments. The monitoring program included locating all private wells within 500 metres of the site and sampling of those wells where possible. The monitoring program was to include a number of parameters, including all Regulation 347 "schedule 4" contaminants. In ministry comments, dated June 21, 2010, the ministry stated that pre-construction monitoring was imperative.

Some TDA was brought to the site before the monitoring was commenced. In November 2010 the Inspector observed TDA material on site and in response to ministry queries MTO advised approximately 100 tonnes was stockpiled on the inner loop of the ramp. MTO issued a stop order to ensure that the contractor did not bring any additional TDA to the site until the pre-construction monitoring report was completed. The pre-construction monitoring was completed in the spring of 2011

Ground Water and surface water sampling, as well as sampling of private wells has been done since the TDA project commenced. While the ECA required a "final Report" post construction, the District has required annual monitoring and reporting until such time that it is deemed unnecessary or to be modified. Currently three Annual Reports have been submitted.

### **Ground Water**

The Ground Water review Memorandum provided in November 2013 considered the final Report provided by MTO and a report submitted to the ministry by Aecon wherein data was provided on the seeps from the Pan Lysimeters and reported to the ministry in Spring 2013. The Memorandum's recommendations included that monitoring is to continue; that the analysis of semi-volatile organic compounds could be discontinued; and that there is evidence that the cap is not low permeable material given the ongoing seeps from PL2 and PL3. The Technical Memorandum also recommended that TDA remain regulated as

a waste. These comments were provided to MTO and are provided with this report (Appendix B)

Annual Report #2, dated August 2014, was submitted to the ministry September 2014. Ground Water comments were provided March 2015. Technical Support recommendations included, again, that the cover at the TDA site may not be appropriate given the leachate generation and seeping from some Pan Lysimeters and that MW3 and perhaps MW4 are being impacted by leachate. The Technical Reviewer continued to present that TDA should not be deregulated. The memorandum, provided previously to MTO, is provided in Appendix B.

Annual Report #3, dated December 2015, was submitted to the ministry upon request in May 2016. This report includes data to support that MWs continue to be impacted by leachate. The report hypothesises that MW4 is upgradient of the TDA area and that fill material may be contributing to the elevated parameters. There is no indication that additional work has been completed to verify possible contributors to the exceedances. The Annual Report #3 has not as yet been reviewed by the ministry Technical Support Section as the Inspector is waiting for a companion report, expected to have been submitted by MTO in January 2016. The companion report is to address the assessment of the cover used at the site. This companion report is now expected July 2016. Both the Annual Report #3 and the Cover Assessment Report will be reviewed together.

### **Surface Water**

MTO has submitted to the ministry one pre-construction Report and three post construction reports. The "Final Report, Tire Derived Aggregate (TDA), report dated March 2013, was reviewed by ministry. Technical Support comments provided in a Technical Memorandum dated February 13, 2014, provide recommendations regarding the potential for impact from TDA use and the need for long term monitoring. These comments were provided to MTO previously and are appended here (Appendix B) .

Annual Report #2, dated August 2014, was submitted to the ministry September 2014. Surface Water comments were provided in a Technical Memorandum dated June 10, 2015. Comments included that infiltration is occurring at higher than expected rate given ongoing observations of overflow at PL3; that monitoring must continue; and that the drainage patterns for surface water stations needs to be determined. The memorandum, provided previously to MTO, is provided here (Appendix B).

Annual Report #3, dated December 2015, was submitted to the ministry upon request in May 2016. The report includes some observations on the surface water drainage to identify upgradient and downstream sites. The Annual Report #3 has not been reviewed by Technical Support comments as the Inspector was waiting for a companion report that would address cover material at the site. This companion report is now expected July 2016. Both the Annual Report #3 and the Cover Assessment Report will be reviewed together. MTO should, in the meantime, ensure that the local Conservation Authority has been contacted to see if they, or the City, have any additional supporting data on surface water flows/direction.

## **2.8 LEACHATE CONTROL SYSTEM:**

### **Specifics:**

There is no leachate control system for this site. MTO has suggested, based on research and other (non-Ontario) sites, that there will be minimal leaching of contaminants from the site. Studies have shown that aesthetic parameters do have the potential of being released, namely iron and manganese.

The site did incorporate a capture system to collect leachate generated from within the TDA foot print to assist in determining leachate characteristics. The collection was done through installation of pan lysimeters (PL). Four were installed and the two that are located in the actual waste foot print have

captured sufficient leachate for collection and analysis. The two pan lysimeters located outside the waste footprint, which were intended to show background levels, have been dry since installation in 2012. Leachate from the pan lysimeter has been observed to be released to the surface of the TDA site. In 2013 sufficient leachate was released as to flow down the side of the embankment, leave the site, and enter the adjacent Surface water /wetland. In 2013 holes were excavated to act as collection sumps to retain the leachate within the TDA footprint. During this inspection leachate release continued to be observed at PL3 and indication is that it may also be occasionally released at PL2.

## 2.9 METHANE GAS CONTROL SYSTEM:

### Specifics:

n/a

## 2.10 OTHER WASTES:

### Specifics:

The only waste accepted at the site is tire shred.

## 3.0 REVIEW OF PREVIOUS NON-COMPLIANCE ISSUES

Condition 20 of the ECA states that *"at no time shall a discharge of a contaminants that causes or is likely to cause adverse effect be permitted"*. In addition, section 14(1) of the Environmental Protection Act (EPA) requires that "... a person shall not discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment, if the discharge causes or may cause an adverse effect."

In 2013 a report of release of a contaminants was received at the ministry. The ministry concluded that the leachate would be have an impact on the natural environment.

MTO took action to contain and capture the leachate on site. Since that time leachate has continued to be released but there have not been reports of off-site movement. Inspections of the site are conducted and any release must be contained. The underlying cause of the release has not yet been determined.

## 4.0 SUMMARY OF INSPECTION FINDINGS (HEALTH/ENVIRONMENTAL IMPACT)

**Was there any indication of a known or anticipated human health impact during the inspection and/or review of relevant material, related to this Ministry's mandate?**

No

### Specifics:

**Was there any indication of a known or anticipated environmental impact during the inspection and/or review of relevant material ?**

No

### Specifics:

**Was there any indication of a known or suspected violation of a legal requirement during the inspection and/or review of relevant material which could cause a human health impact or environmental impairment ?**

No

### Specifics:

**Was there any indication of a potential for environmental impairment during the inspection and/or the review of relevant material ?**

Yes

### Specifics:

Leachate continues to be released at least one Pan Lysimeter . In addition, MWs located outside of the



TDA fill area (but still inside of the approved WDS) are showing impacts from leachate.

**Was there any indication of minor administrative non-compliance?**

No

**Specifics:**


## 5.0 ACTION(S) REQUIRED

1. No later than August 1, 2016, provide the MOECC with an assessment of the cover that is in place at the Cornwall TDA Waste Disposal Site and include recommendations to address the ongoing leachate release from PL3 and (potentially) PL2. An Action Plan with time lines is to be included with the submission.
- No later than August 1, 2016, provide the MOECC with an assessment of the cover that is in place at the Cornwall TDA Waste Disposal Site and include recommendations to address the ongoing leachate release from PL3 and (potentially) PL2. An Action Plan with time lines is to be included with the submission.
  - MTO has also been submitting Annual Reports and conducting monitoring on an ongoing basis. MTO is required to continue with the monitoring as recommended by the ministry, and as may be altered from time to time by the ministry, and to continue to submit Annual Reports to the MOECC.
  - As of June 2016 discharge continues from at least one of the Pan Lysimeter (PL3) station. The release of leachate at PL3 was ongoing despite extremely dry weather in 2016. MTO must conduct regular inspections to ensure that leachate does not leave the site and should ensure in particular that inspections are conducted following any significant rain events. Where release of leachate is likely to enter surface water, wetland, or otherwise has the potential to cause an adverse effect, MTO must take immediate action to contain the contaminant. The MOECC should be notified of any releases and Action Plan to address same. MTO is requested to confirm to the Inspector that regular inspections will be conducted until such time that potential release of leachate at the PL stations has been resolved. The inspections program must incorporate site visits within a few days of any significant rain-fall events

## 6.0 OTHER INSPECTION FINDINGS

The Regional ministry Technical Support Section continues to recommend against deregulation of TDA from Regulation 347 and Part V of the EPA.

## 7.0 INCIDENT REPORT

Applicable  
1358-98DS9S 

## 8.0 ATTACHMENTS

Appendix B\_ Tech Support Comments \_Final Report 2013.pdf; Inspection Photos TDA Cornwall.pdf; ministry comments AMR#2 TDA site.pdf

**PREPARED BY:**

**Environmental Officer:**

**Name:**

**Lisa Chalmers**

**District Office:**

**Cornwall Area Office**

Date: 2016/06/28  
Signature



REVIEWED BY:  
District Supervisor:  
Name:  
District Office:  
Date:

Michael Seguin  
Cornwall Area Office  
2016/06/28

Signature:



File Storage Number: SI ST CC C3 610

**Note:**

"This inspection report does not in any way suggest that there is or has been compliance with applicable legislation and regulations as they may apply to this facility. It is, and remains, the responsibility of the owner and/or the operating authority to ensure compliance with all applicable legislative and regulatory requirements"



# **APPENDIX B**

**List of Abbreviations and Symbols, Record of Test Pits,  
Test Pit Photographs and Coffey Borehole Logs**

## RECORD OF TEST PITS

<u>Test Pit Number (Elevation)</u>	<u>Depth (metres)</u>	<u>Description</u>						
15-01 (56.4 m) Easting: 524366 Northing: 4990215	0.00 – 1.10	AMORPHOUS PEAT with wood debris (FILL) Dark brown to black						
	1.10 – 2.40	SILTY CLAY some sand and gravel (FILL) Grey-brown Moist to wet						
	2.40	END OF TEST PIT						
		Notes: Test pit located nearby groundwater monitor MW 01 that has elevated measured concentrations of iron and manganese  Water level at 2.0 m below ground surface upon completion of excavation.						
		<table><tr><th><u>Sample</u></th><th><u>Depth (m)</u></th></tr><tr><td>1</td><td>0.50</td></tr><tr><td>2</td><td>1.80</td></tr></table>	<u>Sample</u>	<u>Depth (m)</u>	1	0.50	2	1.80
<u>Sample</u>	<u>Depth (m)</u>							
1	0.50							
2	1.80							
15-02 (55.9 m) Easting: 524250 Northing: 4990105	0.00 – 1.10	SILTY CLAY some sand and gravel, contains boulders up to 900 mm diameter (FILL) Wet						
	1.10 – 1.50	SILTY CLAY, fissured, contains rootlets (WEATHERED CRUST) Stiff to very stiff Grey-brown						
	1.50	END OF TEST PIT						
		Notes: Test pit located nearby background groundwater monitor MW 05  Water level at 1.2 m below ground surface upon completion of excavation.						
		<table><tr><th><u>Sample</u></th><th><u>Depth (m)</u></th></tr><tr><td>1</td><td>0.60</td></tr><tr><td>2</td><td>1.20</td></tr></table>	<u>Sample</u>	<u>Depth (m)</u>	1	0.60	2	1.20
<u>Sample</u>	<u>Depth (m)</u>							
1	0.60							
2	1.20							

## RECORD OF TEST PITS

<u>Test Pit Number (Elevation)</u>	<u>Depth (metres)</u>	<u>Description</u>				
15-03	0.00 – 0.30	Granular A (FILL)				
(61.7 m)	0.30 – 0.60	Granular B (FILL)				
Easting: 524269	0.60 – 0.90	Sand and gravel (FILL)				
Northing: 4990146	0.90 – 2.20	SILTY SAND some clay and gravel, contains cobbles with less than 5 percent greater than 200 mm in diameter (FILL) Grey Moist				
	2.20	END OF TEST PIT				
		Notes: Test pit located in proximity to former bridge embankment, west of the north TDA area , approximately 1.5 metres from edge of asphalt  Test pit dry upon completion of excavation				
		<table><tr><th><u>Sample</u></th><th><u>Depth (m)</u></th></tr><tr><td>1</td><td>1.70</td></tr></table>	<u>Sample</u>	<u>Depth (m)</u>	1	1.70
<u>Sample</u>	<u>Depth (m)</u>					
1	1.70					

15-04	0.00 – 0.30	Granular A (FILL)				
(62.0 m)	0.30 – 0.65	Granular B (FILL)				
Easting: 524294	0.65 – 2.25	SANDY SILT some clay and gravel, contains cobbles and boulders with 15 percent greater than 200 mm in diameter (FILL) Brown with iron staining Moist				
Northing: 4990150	2.25	END OF TEST PIT				
		Notes: Test pit situated near replacement bridge embankment of north TDA area  Water level at 1.2 m below ground surface upon completion of excavation.				
		<table><tr><th><u>Sample</u></th><th><u>Depth (m)</u></th></tr><tr><td>1</td><td>2.00</td></tr></table>	<u>Sample</u>	<u>Depth (m)</u>	1	2.00
<u>Sample</u>	<u>Depth (m)</u>					
1	2.00					

## RECORD OF TEST PITS

<u>Test Pit Number (Elevation)</u>	<u>Depth (metres)</u>	<u>Description</u>
15-05	0.00 – 0.30	Granular A (FILL)
(62.8 m)	0.30 – 0.65	Granular B (FILL)
Easting: 524287	0.65 – 2.10	SANDY SILT some clay and gravel, contains cobbles with 3 to 5 percent greater than 200 mm in diameter (FILL) Brown with iron staining Moist
Northing: 4990118	2.10	END OF TEST PIT
Notes: Test pit situated near former bridge embankment, west of north TDA area, approximately 1.5 m from edge of Boundary Rd asphalt		
Water level at 1.4 m below ground surface upon completion of excavation		
	<u>Sample</u>	<u>Depth (m)</u> <u>Lab Testing</u>
	1	1.70 $w_n = 6\%$ , MH – Figure 2
15-06	0.00 – 0.30	Granular A (FILL)
(62.2 m)	0.30 – 0.60	Granular B (FILL)
Easting: 524303	0.60 – 2.10	Gravelly SANDY SILT, some clay contains cobbles with 10 percent larger than 200 mm in diameter (FILL) Brown Moist
Northing: 4990136	2.10	END OF TEST PIT
Notes: Test pit situated near replacement bridge embankment, east of north TDA area		
Test pit dry upon completion of excavation		
	<u>Sample</u>	<u>Depth (m)</u> <u>Lab Testing</u>
	1	1.80 $w_n = 9\%$ , MH – Figure 3

## RECORD OF TEST PITS

<u>Test Pit Number (Elevation)</u>	<u>Depth (metres)</u>	<u>Description</u>
15-07	0.00 – 0.30	Granular A (FILL)
(63.3 m)	0.30 – 0.65	Granular B (FILL)
Easting: 524355	0.65 – 0.90	Sand and Gravel (FILL)
Northing: 4990004	0.90 – 2.00	SILTY SAND some clay and gravel, contains cobbles and boulders with 2 to 3 percent greater than 200 mm in diameter (FILL) Grey Moist
	2.00	END OF TEST PIT
Notes: Test pit situated near former bridge embankment, west of south TDA area, approximately 1.2 m from edge of Boundary Rd asphalt		
Test pit dry upon completion of excavating		
<u>Sample</u>	<u>Depth (m)</u>	<u>Lab Testing</u>
1	1.60	w <sub>n</sub> = 10%, MH – Figure 2
15-08	0.00 – 1.10	Gravelly SANDY SILT some clay, contains cobbles with 3 to 5 percent greater than 200 mm in diameter (FILL) Grey Moist
(62.8 m)		
Easting: 524372		
Northing: 4990018	1.10	END OF TEST PIT
Notes: Test pit situated near replacement bridge embankment, east of south TDA area		
Geotextile fabric encountered at 1.1 metres below ground surface		
Test pit dry upon completion of excavation		
<u>Sample</u>	<u>Depth (m)</u>	<u>Lab Testing</u>
1	0.80	w <sub>n</sub> = 9%, MH – Figure 3



## RECORD OF TEST PITS

<u>Test Pit Number (Elevation)</u>	<u>Depth (metres)</u>	<u>Description</u>						
15-09 (59.1 m) Easting: 524384 Northing: 4990024	0.00 – 0.80	TOPSOIL (FILL) brown moist						
	0.80 – 2.00	SILTY CLAY, some gravel with cobbles brown with trace iron staining moist						
	2.00	END OF TEST PIT						
		Notes: Test pit situated near groundwater monitor MW 03 that has elevated measured concentrations of iron and manganese  Test pit dry upon completion						
		<table><tr><th><u>Sample</u></th><th><u>Depth (m)</u></th></tr><tr><td>1</td><td>0.60</td></tr><tr><td>2</td><td>1.70</td></tr></table>	<u>Sample</u>	<u>Depth (m)</u>	1	0.60	2	1.70
<u>Sample</u>	<u>Depth (m)</u>							
1	0.60							
2	1.70							

15-10 (62.7 m) Easting: 524366 Northing: 4989979	0.00 – 0.30	Granular A (FILL)				
	0.30 – 0.65	Granular B (FILL)				
	0.65 – 0.90	Sand and Gravel (FILL)				
	0.90 – 2.00	SANDY SILT some clay and gravel, contains cobbles with 2 to 3 percent greater than 200 mm in diameter (FILL) Grey Moist				
	2.00	END OF TEST PIT				
		Notes: Test pit situated near former bridge embankment, west of south TDA area, approximately 1.2 m from edge of Boundary Rd asphalt  Test pit dry upon completion				
		<table><tr><th><u>Sample</u></th><th><u>Depth (m)</u></th></tr><tr><td>1</td><td>1.60</td></tr></table>	<u>Sample</u>	<u>Depth (m)</u>	1	1.60
<u>Sample</u>	<u>Depth (m)</u>					
1	1.60					

## RECORD OF TEST PITS

<u>Test Pit Number (Elevation)</u>	<u>Depth (metres)</u>	<u>Description</u>
15-11 (62.6 m) Easting: 524387 Northing: 4989991	0.00 – 0.15	Mixture of Granular A and B (FILL)
	0.15 – 1.20	SILTY CLAY, some gravel, contains cobbles with 3 to 5 percent greater than 200 mm diameter (FILL) dark brown moist
	1.20	END OF TEST PIT
		Notes: Test pit situated near replacement bridge embankment, east of south TDA area
		Geotextile fabric encountered at 1.2 m below ground surface Test pit dry upon completion
	<u>Sample</u>	<u>Depth (m)</u>
	1	1.00
15-12 (59.5 m) Easting: 524413 Northing: 4989971	0.00 – 0.15	SILTY CLAY some gravel with cobbles (FILL)
	0.15 – 0.35	Rockfill (< 0.20 m diameter) (FILL)
	0.35 – 0.60	Slag mixture (FILL) black
	0.60 – 2.00	SANDY SILT, some clay and gravel, with cobbles (FILL)
	2.00	END OF TEST PIT
		Notes: Test pit situated near groundwater monitor MW 04 that has elevated measured concentrations of manganese
		Test pit dry upon completion
	<u>Sample</u>	<u>Depth (m)</u>
	1	0.50
	2	1.60



**Photo B-1:** View of TP15-01 near MW 01, located north of TDA area.



**Photo B-2:** View of amorphous peat fill materials recovered from TP15-01.





**Photo B-3:** View of TP15-02 situated near MW 05 and west of north TDA area.



**Photo B-4:** View of silty clay (fill) materials recovered from 15-02.





**Photo B-5:** General location of TP15-03 situated on the west side of Boundary Road.



**Photo B-6:** View of silty sand (fill) materials recovered from TP15-03, representative of former road embankment materials.





**Photo B-7:** General location of TP15-04 situated on east side of north TDA area.



**Photo B-8:** View of sandy silt (fill) materials recovered from TP15-04 used to cover north TDA area.





**Photo B-9:** General location of TP15-05 situated west of Boundary Road.



**Photo B-10:** View of sandy silt (fill) former road embankment materials recovered from TP15-05.





**Photo B-11:** General Location of Test Pit 15-06 situated east of Boundary Road.



**Photo B-12:** Open TP15-06 showing Granular A and B fill and sandy silt (fill) materials used to cover north TDA area.





**Photo B-13:** General location of TP15-07 (back) and TP15-10 (front) situated west of the south TDA area.



**Photo B-14:** View of silty sand (fill) materials recovered from TP15-07, representative of the former road embankment.





**Photo B-15:** General location of TP15-08 situated on the east side of the south TDA bridge embankment.



**Photo B-16:** View of gravelly sandy silt materials recovered at TP15-08 used to cover south TDA area.





**Photo B-17:** General location of 15-09 situated near MW 03.



**Photo B-18:** View of silty clay materials recovered from TP15-09.





**Photo B-19:** General location of TP15-10 situated west of Boundary Road.



**Photo B-20:** View of sandy silt (fill) materials recovered from TP15-10, representative of the former bridge embankment materials.





**Photo B-21:** General location of TP15-11 situated directly east of Boundary Road.



**Photo B-22:** View of silty clay (fill) materials recovered from TP15-11 used to cover the south TDA area.





**Photo B-23:** General location of TP15-12 situated near MW 04.



**Photo B-24:** View of open TP15-12 containing silty clay materials (fill).



SPT 1223

RECORD OF BOREHOLE No F1

1 OF 1

METRIC

GWP 385-01-01 LOCATION Sta: 10+054.5; 3.2 m Lt. C/L of Boundary Road (D = -0.6m) ORIGINATED BY SK  
DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
DATUM Geodetic DATE 11/18/2008 CHECKED BY ZSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
59.5 0.0	GROUND SURFACE													
	0.2 m TOPSOIL		1	SS	8		59							
	FILL: Clayey Silt to Sandy Silt with topsoil trace gravel, brown to dark grey, damp		2	SS	16		58							
58.0 1.5	TOPSOIL with silt pockets dark grey, damp, stiff (Possible Fill)		3	SS	14		57							
56.8 2.7	damp, stiff CLAYEY SILT with topsoil / organics grey to dark grey		4	SS	13		56							
55.7 3.8	very soft to soft brown, loose grey, dense SILTY SAND TO SANDY SILT TILL trace clay, wet		5	SS	2		55							spoon wet
			6	SS	9		54							8 48 33 11
			7	SS	35		53							
			8	SS	92		52							spoon bouncing
			9	SS	100 / 25 cm									
			10	SS	100 / 13 cm									
51.1 8.4	End of Borehole Auger refusal @ 8.4 m probably on bedrock Water level @ 1.9 m upon completion (not stabilized)* Hole caved in @ 3.8 m upon completion		11	SS	100 / 0.5 m									

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
10 (%) STRAIN AT FAILURE

coffey geotechnics  
309, CUMMERMAN RD, THE EARTH

SPT 1223

# RECORD OF BOREHOLE No F2

1 OF 1

METRIC

GWP 385-01-01 LOCATION Sta: 10+042: 5.5 m Li, C/L of Boundary Road (D = -1.2m) ORIGINATED BY SK  
DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers & NW Casing & NQ coring COMPILED BY SS  
DATUM Geodetic DATE 11/17/2008 CHECKED BY ZSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
58.3	GROUND SURFACE													
0.0	0.1 m TOPSOIL		1	SS	6		58							
	FILL: Clayey Silt to Sandy Silt mixed with topsoil, trace gravel, brown to dark grey, damp firm to stiff / loose to compact		2	SS	14		57							
56.8														
1.5			3	SS	9		56							15 40 31 14
	SILTY SAND TO SANDY SILT TILL some clay, brown, moist to wet		4	SS	54		55							26 45 22 7
			5	SS	20		54							
			6	SS	43		53							
			7	SS	35		52							
			8	SS	71		51							
			9	SS	78		50							
50.8			10	SS	100 / 5		49							
7.5			11	RCT CR=100% RQD=100%			48							auger refusal **UCS=173 MPa
	BEDROCK grey to dark grey argillaceous limestone, sound		12	RCT CR=100% RQD=81%										
47.8														
10.5	End of Borehole Water level @ 0.9 m upon completion (not stabilized) Hole caved in @ 4.5 m upon completion  Piezometer installed to 10.5 m water level in piezometer 1.2 m - Nov 20, 2008 1.2 m - Dec 12, 2008  **UCS=Unconfined Compressive Strength													

+<sup>3</sup>, x<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
(%) STRAIN AT FAILURE

SPT 1223

# RECORD OF BOREHOLE No F3

1 OF 2

METRIC

GWP 385-01-01 LOCATION Sta: 10+041; 11.0 m Rt. C/L of Boundary Road (D = +1.5m) ORIGINATED BY SK  
 DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers & NW Casing&NQ coring COMPILED BY SS  
 DATUM Geodetic DATE 11/6/2008 CHECKED BY ZSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					
								20 40 60 80 100					
								20 40 60 80 100					
63.3 0.0	GROUND SURFACE											GR SA SI CL	
	150 mm ASPHALT		1	SS	63								
	FILL: Sand & Gravel with trace to some silt brown, damp, very dense to compact		2	SS	38								
			3	SS	24								39 48 11 2
60.7 2.8			4	SS	22								
	FILL: Sandy Silt trace to some gravel, trace clay brown to greyish brown damp to moist		5	SS	22								
		dense	6	SS	34								11 37 37 15
		compact	7	SS	25								
			8	16	18								
		v. dense grey	9	SS	75								gravel @spoon tip
55.4 6.9	CLAYEY SILT trace to some organics / topsoil zones of sandy silt, brownish grey, moist, hard		10	SS	32								
55.7 7.6			11	SS	72								39 31 23 7 gravel @spoon tip
	SILTY SAND TO SANDY SILT TILL greyish brown, moist												spoon wet
		wet compact	12	SS	29								
		v. dense grey	13	SS 100 / 29 cm									11 21 54 14
			14	SS	73								
50.4 12.9			15	SS 100 / 10 cm									auger refusal
	BEDROCK grey to dark grey argillaceous limestone, sound		16	RC TCR=91% RQD=85%									
			17	RC TCR=100% RQD=100%									
48.3													

Continued Next Page

+ 3, X 3 Numbers refer to  
Sensitivity

20  
15 10 5  
10 (%) STRAIN AT FAILURE

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SPECIALISING IN MANAGING THE EARTH


SPT 1223

RECORD OF BOREHOLE No F3

2 OF 2

METRIC

GWP 385-01-01 LOCATION Sta: 10+041: 11.0 m Rt. C/L of Boundary Road (D = +1.5m) ORIGINATED BY SK  
DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers & NW Casing&NQ coring COMPILED BY SS  
DATUM Geodetic DATE 11/6/2008 CHECKED BY ZSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
48.3 15.0	BEDROCK gray to dark grey argillaceous limestone, fractured		18	RCTCR=100% RQD=42%			48							
47.3 16.0	End of Borehole Water level @ 3.7 m upon completion (not stabilized)* Hole caved in @ 7.5 m upon completion													

+<sup>3</sup> X<sup>3</sup> Numbers refer to  
Sensitivity

20  
15- $\phi$ -5  
10 (%) STRAIN AT FAILURE



SPT 1223

RECORD OF BOREHOLE No F4

1 OF 1

METRIC

GWP 385-01-01 LOCATION Sta: 9+998; 5.5 m Lt. C/L of Boundary Road (D = -0.3m) ORIGINATED BY SK  
DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers, Wash Boring & NW Casing&NQ coring COMPILED BY SS  
DATUM Geodetic DATE 11/19/2008 11/20/2008 CHECKED BY ZSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
56.4 0.0	GROUND SURFACE													
55.6 0.8	0.2 m TOPSOIL FILL: Clayey silt, trace gravel & rootlets brown, damp, soft		1	SS	3		56							
54.3 2.1	SILTY SAND some gravel, trace clay, trace rootlets brown, moist to wet, loose		2	SS	9		55							18 38 33 11
52.7 3.7	GRAVELLY SAND TO SANDY GRAVEL some silt, trace clay, compact, wet brown to grey		3	SS	11		54							spoon wet 46 39 (15)
49.6 6.8	SILTY SAND TO SANDY SILT TILL trace clay & gravel occ cobbles and boulders occasional sand pockets, wet brown to grey compact to v.dense		4	SS	22		53							30 43 19 8
			5	SS	15		52							spoon bouncing
			6	SS100 / 25 cm			51							
			7	RC TCR=70%			50							
			8	SS100 / 23 cm			49							
			9	SS	58		48							13 42 32 13
			10	SS100 / 25 cm			47							
			11	SS100 / 10 cm										auger refusal
			12	RCTCR=100% RQD=83%										
			13	RCTCR=100% RQD=87%										
			14	RCTCR=100% RQD=42%										
46.5 9.9	End of borehole Water level @ 0.3 m upon completion (not stabilized)* Hole caved in @ 2.3 m upon completion													

+<sup>3</sup>.x<sup>3</sup> Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

SPT 1223

# RECORD OF BOREHOLE No F5

1 OF 1

METRIC

GWP 385-01-01 LOCATION Sta: 9+999: 5.0 m Rt. C/L of Boundary Road (D = -0.15m) ORIGINATED BY SK  
 DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers, Wash Boring & NW Casing & NO coring COMPILED BY SS  
 DATUM Geodetic DATE 11/20/2008 CHECKED BY ZSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)				
56.6 0.0	GROUND SURFACE						20 40 60 80 100					
55.7 0.8	0.1 m TOPSOIL FILL: Silty Sand with some organics trace wooden pieces, brownish grey, wet, loose		1	SS	6							
54.2 2.3	FILL: Clayey Silt, trace organics with sand & gravel, brownish grey moist to wet, firm to soft		2	SS	6							
53.6 2.9	GRAVELLY SAND some silt, brown, wet		3	SS	2							
49.7 6.8	Boulder SILTY SAND TO SANDY SILT TILL trace clay, wet		4	SS	26							
46.5 10.0	compact very dense		5	SS	100 / 5 cm							
			6	RC	TCR=33%							
			7	SS	22							
			8	SS	100 / 25 cm							
			9	SS	58							
			10	SS	100 / 25 cm							
	highly fractured		11	RC	TCR=100% RQD=38%							
	BEDROCK grey to dark grey argillaceous limestone		12	RC	TCR=100% RQD=100%							
	sound		13	RC	TCR=100% RQD=62%							
	fractured											
End of borehole Water level @ surface upon completion (not stabilized)* Hole caved in @ 2.0 m upon completion **UCS=Unconfined Compressive Strength												

+ 3 . X 3 : Numbers refer to  
Sensitivity

20  
15 0.5  
10 (%) STRAIN AT FAILURE

SPT 1223

# RECORD OF BOREHOLE No F6

1 OF 1

METRIC

GWP 385-01-01 LOCATION Sta: 9+963; 6.5 m Lt. C/L of Boundary Road (D = -0.2m) ORIGINATED BY SK  
 DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers & NW Casing & NQ coring COMPILED BY SS  
 DATUM Geodetic DATE 11/13/2008 CHECKED BY ZSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)						
56.9 0.0	GROUND SURFACE							○ UNCONFINED + FIELD VANE						
	0.15 m TOPSOIL		1	SS	9			● POCKET PENETR. X LAB VANE						
	SILT TO CLAYEY SILT trace to some topsoil and organic, trace gravel brownish grey, damp to moist, stiff to v. stiff		2	SS	11									
			3	SS	13									
54.6 2.3	SANDY SILT some clay, trace gravel brown, wet, very loose		4	SS	1									
53.8 3.1			5	SS	17									
	SILTY SAND TO SANDY SILT TILL trace to some clay, sand pockets wet		6	SS	20									
			7	SS	22									
			8	SS	100 / 23									
			9	SS	100 / 23									
49.8 7.1	BEDROCK grey to dark grey argillaceous limestone		11	RCTCR=100% RQD=75%										
			12	RCTCR=100% RQD=65%										
46.7 10.2	End of borehole Water level @ 0.9 m upon completion (not stabilized)* Hole caved in @ 4.6 m upon completion  Piezometer installed to 10.2 m Water level in piezometer 0.7 m - Nov 20, 2008 0.7 m - Dec 12, 2008													

+ 3 . X 3 Numbers refer to  
Sensitivity

20  
15  
10 (%) STRAIN AT FAILURE



SPT 1223

# RECORD OF BOREHOLE No F7

1 OF 2

METRIC

GWP 385-01-01 LOCATION Sta: 9+950: 10.9 m Rt. C/L of Boundary Road (D = +1.5m) ORIGINATED BY SK  
 DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers & NW Casing & NO coring COMPILED BY SS  
 DATUM Geodetic DATE 11/5/2008 CHECKED BY ZSO


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)				
63.0	GROUND SURFACE						20 40 60 80 100					
0.0	150 mm ASPHALT		1	SS	39		63					
	FILL: Sand & Gravel some silt, brown to greyish brown damp, compact		2	SS	30		62					46 40 (14)
			3	SS	24		61					
60.4			4	SS	8		60					
2.6	FILL: Sandy Silt, trace gravel trace organics brown, damp to moist, loose to compact		5	SS	18		59					
58.9			6	SS	32		58					
4.1	FILL: Clayey Silt mixed with topsoil trace gravel, grey, damp, hard		7	SS	42		57					
58.4			8	SS	15		56					
4.6	FILL: Clayey Silt, gravel brown, damp, hard		9	SS	28		55					
57.7			10	SS	17		54					
5.3	FILL: Sandy Silt, trace clay trace to some gravel, brown to brownish grey compact		11	SS	11		53					
			12	SS	15		52					
56.1			13	SS	49		51					
6.9	CLAYEY SILT with topsoil dark grey to grey, damp, very stiff		14	SS 100 / 23 cm			50					
55.4			15	SS 100 / 5 cm			49					
7.6	SILTY SAND TO SANDY SILT TILL trace to some clay		16	RC TCR=78% RQD=18%			48					
			17	RC TCR=78%			47					
							46					
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Continued Next Page

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
(%) STRAIN AT FAILURE

SPT 1223

RECORD OF BOREHOLE No F7										2 OF 2		METRIC		
GWP 385-01-01		LOCATION Sta: 9+950; 10.9 m Rt. C/L of Boundary Road (D = +1.5m)				ORIGINATED BY SK								
DIST HWY Hwy 401		BOREHOLE TYPE Hollow Stem Augers & NW Casing&NQ coring				COMPILED BY SS								
DATUM Geodetic		DATE 11/5/2008				CHECKED BY ZSO								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
48.0 15.0	<b>BEDROCK</b> grey to dark grey argillaceous limestone fractured					RQD=44%	48							
46.2 16.8			18	RCTCR=100%			RQD=52%	47						
46.2 16.8	End of Borehole Water level @ 3.8 m upon completion (not stabilized)* Hole caved in @ 6.7 m upon completion													

+<sup>3</sup>, ×<sup>3</sup>; Numbers refer to  
Sensitivity

20  
15 0.5  
10 (%) STRAIN AT FAILURE

SPT 1223

RECORD OF BOREHOLE No F8

1 OF 1

METRIC

GWP 385-01-01 LOCATION Sta: 9+945; 6.0 m L.L. C/L of Boundary Road (D = -1.5m) ORIGINATED BY SK  
DIST HWY Hwy 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
DATUM Geodetic DATE 11/13/2008 11/14/2008 CHECKED BY ZSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
56.8 0.0	GROUND SURFACE													
56.0 0.8	0.1 m TOPSOIL CLAYEY SILT some topsoil, dark brown, damp, firm (possible fill)		1	SS	5									
	CLAYEY SILT trace to some topsoil brownish grey, moist, stiff		2	SS	10									
			3	SS	9									
54.5 2.3	SILTY SAND TO SANDY SILT TILL trace to some clay sand & clayey silt pockets, grey, wet		4	SS	12									
	compact		5	SS	16									
	loose		6	SS	4									
	v. dense		7	SS100 / 23 cm										
			8	SS100 / 20 cm										
			9	SS100 / 20 cm										
49.3 7.5	End of Borehole Auger refusal @ 7.5 m probably on bedrock Water level @ 1.0 m upon completion (not stabilized)* Hole caved in @ 4.5 m upon completion		10	SS100 / 05 cm										

+ 3, x 3, Numbers refer to  
Sensitivity

20  
15 10 5  
(%) STRAIN AT FAILURE



GEOTECHNICAL SURVEY DATA		Explanation of Terms Used Rt = Right (EBL) Sh = Shoulder Mid = Midlane EP = Edge of Pavement D - or D + = refers to position of the ground at the borehole location relative to datum. FMC = Field Moisture Content LSFH = Low Susceptibility to Frost Heaving MSFH = Moderate Susceptibility to Frost Heaving HSFH = High Susceptibility to Frost Heaving * = Hand-drilled borehole
G.W.P. 385-01-01		
SURVEY DATE	TYPE OF SURVEY	
August to November 2008	Power Auger Drilling Pavement Coring Visual Condition Survey	
NOTES		
1.Conditions (soil/pavement) and pavement depths apply only to the date of the survey.		
2.The boundaries between the strata have been established only at core and borehole locations. Between cores/boreholes the boundaries are assumed and may be subject to error.		
3.Soils are described according to the MTO Soil Classification System.		
4. Abbreviations for boring and test data conform to OPSD 100.08		

**Boundary Road at Hwy 401**

**Note:** Offset measured from centerline (C/L) of proposed alignment, unless otherwise noted.

<b>9+658, 2.8m Lt C/L (EP)</b>	<b>BH-52</b>
0 - 215 Asph	<u>Core 1</u>
215 - 480 Br Sa & Gr, Damp	
480 - 1.1 Br Sa Some Gr, Damp	
1.1 - 1.45 Tps	
1.45 - 2.0 Gry Si Cl Tr Gr, Moist to Wet	

<b>9+658, 3.0 m Rt C/L (EP)</b>	<b>BH-53</b>
0 - 220 Asph	
220 - 480 Br Sa & Gr, Damp	AS1
480 - 970 Br Sa Some Gr, Damp	AS2
970 - 1.2 Dk Gry to Blk Cl Si Tr Gr, Moist	AS3
1.2 - 1.4 Tps	AS4
1.4 - 1.5 Gry Si Cl Tr Gr, Moist to Wet	AS5

<b>9+658, 11 m Rt C/L (D- 0.5m)</b>	<b>BH-54</b>
0 - 120 Tps	
120 - 1.0 Br Si Tr Sa Tr Gr, Moist	

<b>9+700, 2.9m Lt C/L (EP)</b>	<b>BH-49</b>
0 - 225 Asph	
225 - 520 Br Sa & Gr, Damp	AS1
520 - 900 Br Sa Some Gr, Damp	AS2
900 - 1.2 Dk Gry Cl Si Tr Brick & Tps, Moist	AS3
1.2 - 1.4 Tps	AS4
1.4 - 2.0 Gry Si Cl Tr Gr, Moist to Wet	AS5

<b>9+700, 3.0m Rt C/L (EP)</b>	<b>BH-50</b>
0 - 230 Asph	
230 - 500 Br Sa & Gr, Damp	
500 - 980 Br Sa Some Gr, Damp	
980 - 1.2 Dk Gry to Blk Cl Si Tr Gr, Moist	
1.2 - 1.45 Tps	
1.45 - 2.0 Gry Si Cl Tr Gr, Moist to Wet	

<b>9+700, 10 m Lt C/L (D-0.8m)</b>	<b>BH-48</b>
0 - 320 Tps (Dk Br Cl Si Moist)	
320 - 1.0 Br Cl Si, Moist to Wet	

<b>9+700, 16 m Rt C/L (D-0.4m)</b>	<b>BH-51</b>
0 - 150 Tps	
150 - 1.0 Br Si Tr Sa Tr Gr, Moist	

<b>9+735, 3.0 Rt C/L (EP)</b>	<b>BH-47</b>
0 - 230 Asph	
230 - 510 Br Sa & Gr, Damp	
510 - 820 Br Sa Some Gr, Damp	
820 - 1.5 Gry Si Cl Tr Gr, Moist to Wet	

<b>9+738, 3.0m Lt C/L (EP)</b>	<b>BH-46</b>
0 - 220 Asph	
220 - 490 Dk Br Sa W Gr Tr Si, Damp	AS1
490 - 960 Br Sa W Gr Some Si, Damp	AS2
960 - 1.2 Gry Sa Si W Cl Tr Gr, Moist	AS3
1.2 - 1.5 Tps	AS4
1.5 - 2.0 Gry Si Cl Tr Gr, Moist to Wet	AS5

<b>Sample AS1</b>	
% Passing 4.75 mm	78.4
% Passing 75 µm	7.5
Lab Class: Not Acceptable as Granular A base material.	
Acceptable as Granular B Type I Subbase material.	

<b>Sample AS2</b>	
% Passing 4.75 mm	72.4
% Passing 75 µm	19.2
Lab Class: Not Acceptable as Granular B Type I subbase material.	

<b>Sample AS3</b>	
FMC	24.6%
% Passing 4.75 mm	97.7
% Passing 75 µm	68.0
% Passing 5 µm	27.4
Lab Class: MSFH (Atterberg Limits: ML)	

<b>9+740, 12 m Lt C/L (D-0.8m)</b>	<b>BH-45</b>
0 - 360 Tps (Dk Br Cl Si Moist)	
360 - 1.0 Br Cl Si, Moist to Wet	AS1

<b>9+740, 15 m Rt C/L (D-0.3m)</b>	<b>BH-73</b>
0 - 120 Tps (Dk Br Cl Si Moist)	
120 - 1.0 Br Si Tr Sa Tr Gr, Moist	AS1

<b>9+763, 16.0m Rt C/L (EP)</b>	<b>BH-44</b>
0 - 220 Asph	
220 - 480 Dk Br Sa & Gr, Damp	AS1
480 - 790 Br Sa Some Gr, Damp	AS2
790 - 1.5 Br Cl Si Tr Sa & Gr, Moist	AS3

<b>9+800, 18.0m Rt C/L (D-1.5 m)</b>	<b>BH-41</b>
0 - 250 Tps	
250 - 900 Br Cl Si Tr Gr, Moist	AS1
900 - 1.1 Tps	AS2
1.1 - 2.0 Gry Si Cl, Moist to Wet	AS3

<b>9+800, 12.0m Rt C/L (EP)</b>	<b>BH-40</b>
0 - 55 Asph	
55 - 200 Dk Gry 19 mm Crushed Stone, Damp	
200 - 820 Br Sa & Gr, Damp	
820 - 2.0 Br Cl Si Tr Sa, Moist	

<b>9+800, 7.0m Lt C/L (D-1.2 m)</b>	<b>BH-37</b>
0 - 100 Tps	
100 - 610 Br Si Tr Cl Some Tps Tr Rootlet	
Moist (N=2, Very L)	SS1
610 - 1.1 Blk Tps, Moist (N=3, Soft)	SS2
1.1 - 1.4 Gry Cl Si to Si Cl, Moist (N=3, Soft)	SS2
1.4 - 2.1 Gry Cl Si to Si Cl, Moist (N=7, Firm)	SS3

<b>9+800, 3.70m Rt C/L, (EP)</b>	<b>BH-39</b>
0 - 90 Asph	
90 - 320 Dk Gry 19 mm Crushed Stone, Damp	AS1
320 - 610 Br Sa & Gr, Damp	AS2
610 - 2.0 Br Cl Si Some Sa & Gr, Moist	AS3

<b>9+840, 10.0m Lt C/L (D-1.6 m)</b>	<b>BH-32A</b>
0 - 200 Tps	
200 - 1.0 Br Cl Si Tr Sa Tr Gr, Moist	

<b>9+850, 24.0m Rt C/L (D-1.8 m)</b>	<b>BH-36</b>
0 - 100 Tps	
100 - 610 Br Sa Si Tr Gr Tr Cl, Moist (N=14, Comp)	SS1
610 - 1.4 Br Cl Si Some Organic & Wood piece, Moist (N=3, Soft)	SS2
1.4 - 2.1 Gry Cl Si Some Sa & Gr, Moist (N=6, Firm)	SS3
2.1 - 2.9 Gry Si Some Cl Tr Sa & Gr Tr Rootlet, Moist (N=8, L)	SS4
2.9 - 3.66 Gry Cl Si to Si Cl, Wet (N=1, Very Soft)	SS5

<b>9+850, 7.4m Rt C/L (EP)</b>	<b>BH-34</b>
0 - 145 Asph	
145 - 610 Br Sa & Gr, Damp (N=37, D)	SS1
610 - 1.4 Br Cl Si Some Sa & Gr, Damp (N=23, Comp)	SS2
1.4 - 2.1 Gry Cl Si Some Sa & Gr, Damp (N=21, Comp)	SS3
2.1 - 2.9 Gry Cl Si Some Sa & Gr, Damp (N=16, Comp)	SS4
2.9 - 3.66 Gry Cl Si Some Sa & Gr, Moist (N=12, Comp)	SS5
3.66 - 4.03 Gry Cl Si Some Sa & Gr, Damp (N=100, V Dense)	SS6
4.03 - 4.24 Gry Cl Si Some Sa & Gr, Damp (N=100, V Dense)	SS7

<b>9+850, 13.80m Rt C/L (EP)</b>	<b>BH-35</b>
0 - 210 Asph	
210 - 410 Br Sa & Gr, Damp	SS1
410 - 630 Br Sa & Gr, Damp	
630 - 2.0 Br Cl Si Some Sa & Gr, Moist	SS2

<b>9+850, 8.0m Lt C/L (D-1.6m)</b>	<b>BH-32</b>
0 - 610 Blk Tps & Peat with Wood piece & Roolet, Moist (N=2, Very L)	SS1
610 - 910 Blk Tps & Peat with Wood piece & Rootlet, Moist (N=5, Very L)	SS1
910 - 1.4 Gry Cl Si Tr Sa & Gr, Moist (N=5, Firm)	SS2
1.4 - 2.1 Gry Cl Si Tr Sa & Gr, Moist (N=10, Stiff)	SS3

<b>9+850, 1.0m Lt C/L (D- 0.3 m)</b>	<b>BH-33</b>
0 - 200 Tps	
200 - 1.0 Br Cl Si Tr Sa Tr Gr, Moist	AS1

<b>9+860, 10.0m Lt C/L (D-1.6 m)</b>	<b>BH-32B</b>
0 - 220 Tps	
220 - 1.0 Br Cl Si Tr Sa Tr Gr, Moist	

<b>9+900, @ C/L (D- 0.0 m)</b>	<b>BH-30</b>
0 - 150 Tps	
150 - 1.0 Br Cl Si Tr Sa Tr Gr, Moist	AS1

**METRIC**

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN.

CONT No: 2010-4003

GWP: 385-01-01

**SOILS DATA**

SHEET  
54



<b>9+900, 9.0m Rt C/L (EP)</b>	<b>BH-31</b>
0 - 140 Asph	
140 - 480 Br Sa & Gr, Damp	
480 - 980 Br Sa & Gr, Damp	
980 - 1.2 Br Gry Cl Si, Moist	
1.2 - 4.0 Br Sa Si Some Cl & Gr, Moist	

<b>9+900, 7.0m Lt C/L</b>	<b>BH-29</b>
0 - 100 Tps	
100 - 610 Br Sa Si Tr Cl Tr Tps & Rootlet, Moist (N=12, Comp)	SS1
610 - 1.4 Br Sa Si Tr Cl Tr Tps & Rootlet, Moist (N=9, L)	SS2
1.4- 2.1 Gry Cl Si Tr Sa & Gr, Moist (N=23, Comp)	SS3
(N=10, L)	

<b>9+925, 10.5m Rt C/L (EP)</b>	<b>BH-28</b>
0 - 150 Asph	
150 - 580 Br Sa & Gr, Damp	
580 - 1.8 Br Sa & Gr, Damp	
1.8 - 5.0 Br Sa Si Some Cl & Gr, Damp to Moist	

<b>9+931, 6.0m Rt C/L</b>	<b>BH-38</b>
0 - 200 Tps	
200 - 1.5 Br Sa Si Some Cl Tr Gr, Moist	

<b>9+931, 6.0m Lt C/L (D- 2.5 m)</b>	<b>BH-27</b>
0 - 50 Tps	
50 - 1.5 Br Gry Cl Si Some Sa Tr Gr, Moist	

<b>10+050, 11.0m Rt C/L (EP)</b>	<b>BH-26</b>
0 - 150 Asph	
150 - 510 Br Gr Sa Some Si, Damp	AS1
510 - 1.9 Br Sa & Gr, Damp	AS2
1.9 - 2.6 Gry Br Cl Si, Moist	AS3
2.6 - 5.0 Br Sa Si Tr Cl & Gr, Moist	AS4

<b>Sample AS1</b>	
% Passing 4.75 mm	63.4
% Passing 75 µm	16.2
Lab Class: Not Acceptable as Granular A base material.	
Not Acceptable as Granular B Type I Subbase material.	

<b>10+054, 9.5m Lt C/L (EP)</b>	<b>BH-25</b>
0 - 150 Tps	
150 - 650 Br Org Si Tr Cl Sa & Gr, Moist	
650 - 2.2 Gry, Si Some Cl Tr Sa & Gr, Moist	
2.2 - 5.0 Br Sa Si Some Gr Tr Cl, Moist to Wet	
Fr Wat @ 1.8m	
Caved in @ 3.7m	

<b>10+100, 10.0m Lt C/L (D- 06 m)</b>	<b>BH-22</b>
0 - 75 Tps	
75 - 1.8 Gry Cl Si Tr Gr Tr Sa, Moist	AS1
1.8 - 3.0 Gry Sa Si Some Cl, Moist to Wet	AS2
3.0 - 5.0 Br Sa Si Some Gr, Wet	AS3
Fr Wat @ 1.5m	
Caved in @ 2.44m	



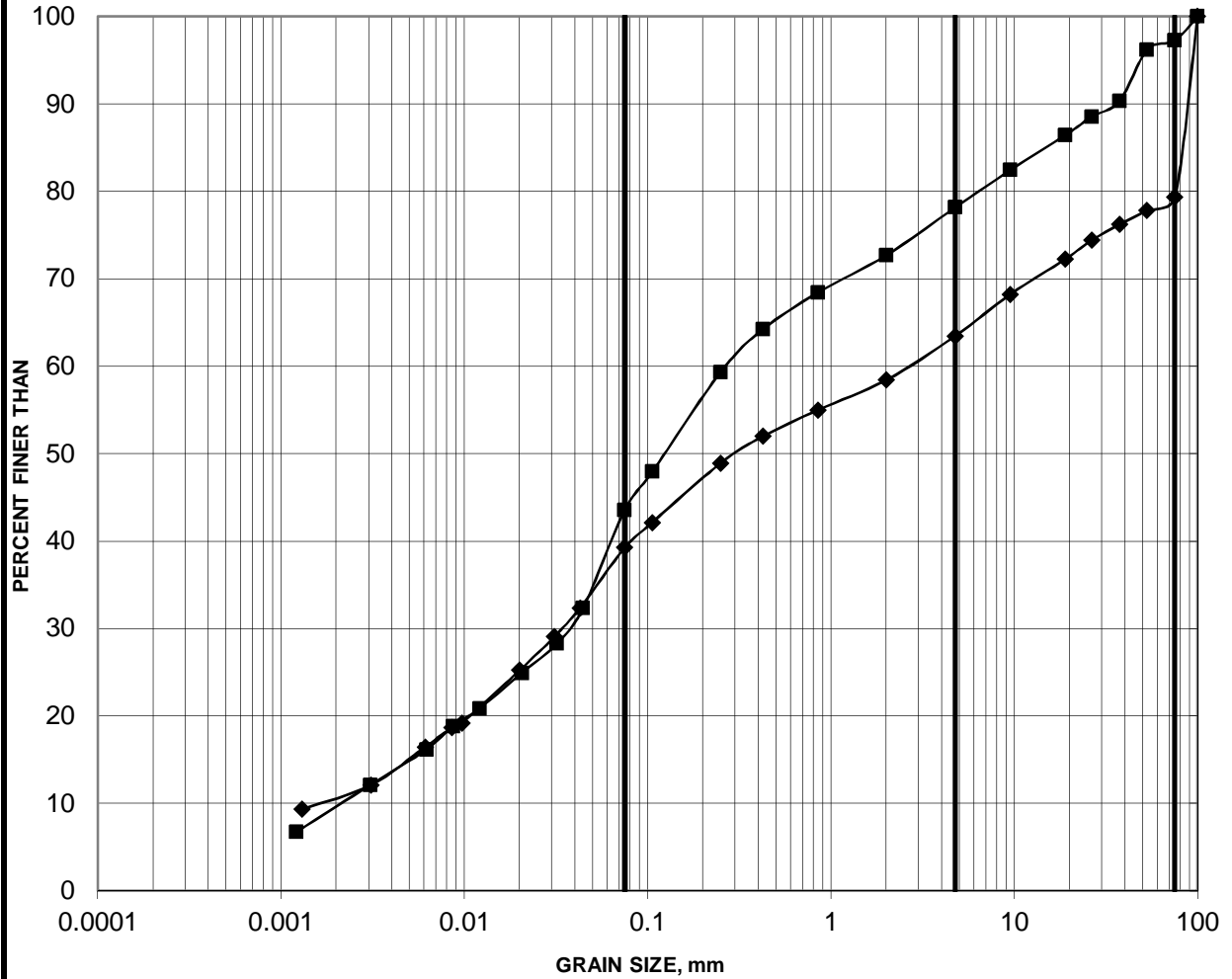
# **APPENDIX C**

## **Geotechnical Laboratory Testing Results**

# GRAIN SIZE DISTRIBUTION

FIGURE C-1

## FORMER EMBANKMENT



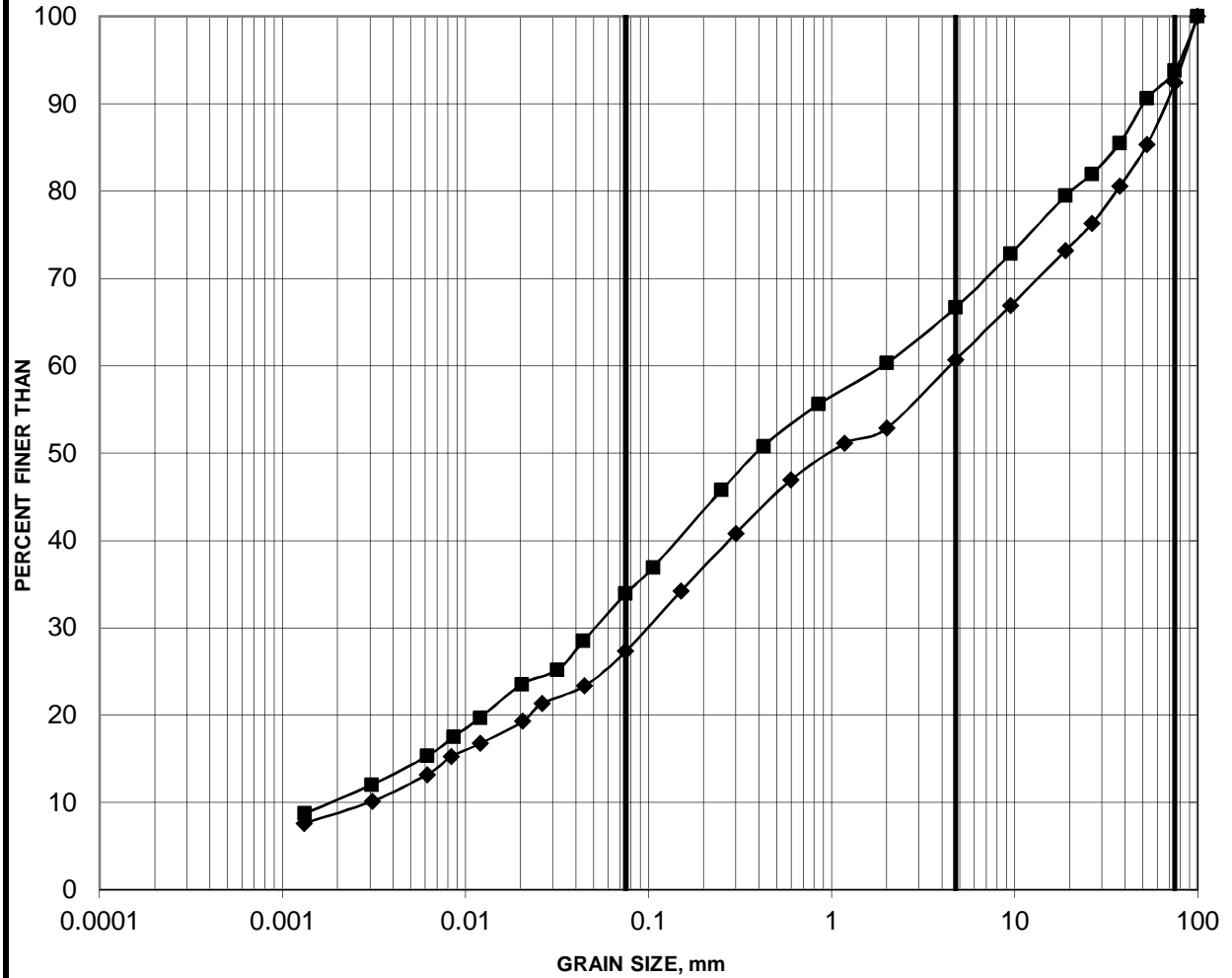
SILT AND CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
	SAND SIZE			GRAVEL SIZE		

Testpit	Sample	Depth (m)
■ 15-05	1	1.70
◆ 15-07	1	1.60

# GRAIN SIZE DISTRIBUTION

FIGURE C-2

## TDA EMBANKMENT SIDE SLOPE



SILT AND CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
	SAND SIZE			GRAVEL SIZE		

Testpit	Sample	Depth (m)
15-06	1	1.80
15-08	1	0.80



## HYDRAULIC CONDUCTIVITY TEST

## ASTM D 5084 (CONSTANT HEAD)

## SAMPLE IDENTIFICATION

PROJECT NUMBER	1413191/1030	SAMPLE	15-08
PROJECT TITLE	MTO/EOI-4014-E-0012&4014-E-0013	SAMPLE DEPTH, m	-
BOREHOLE NUMBER	-	DATE	12/25/2015

## SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	6.24	UNIT WEIGHT, kN/m <sup>3</sup>	20.18
SAMPLE DIAMETER, cm	6.95	DRY UNIT WEIGHT, kN/m <sup>3</sup>	18.06
SAMPLE AREA, cm <sup>2</sup>	37.94	SPECIFIC GRAVITY, assumed	2.70
SAMPLE VOLUME, cm <sup>3</sup>	236.72	VOLUME OF SOLIDS, cm <sup>3</sup>	161.47
TOTAL MASS, g	487.24	VOLUME OF VOIDS, cm <sup>3</sup>	75.25
DRY MASS, g	435.97	VOID RATIO	0.47
WATER CONTENT, %	11.8		

## SATURATION STAGE

CELL PRESSURE, kPa	420	EFFECTIVE CONSOLIDATION STRESS, kPa	5
HEAD PRESSURE, kPa	415	DURATION, min	6,600
BACK PRESSURE, kPa	415	B COEFFICIENT	0.90

## CONSOLIDATION STAGE

CELL PRESSURE, kPa	432	EFFECTIVE CONSOLIDATION STRESS, kPa	17
HEAD PRESSURE, kPa	415	DURATION, min	3,107
BACK PRESSURE, kPa	415	VOLUME CHANGE, cm <sup>3</sup>	6.0
		DRAINAGE	Top and Bottom

## SPECIMEN PROPERTIES AND DIMENSIONS (AFTER CONSOLIDATION)

SAMPLE HEIGHT, cm	6.19	SAMPLE AREA, cm <sup>2</sup>	37.29
SAMPLE DIAMETER, cm	6.89	SAMPLE VOLUME, cm <sup>3</sup>	230.74

## HYDRAULIC CONDUCTIVITY STAGE

CELL PRESSURE, kPa	438	EFFECTIVE CONSOLIDATION STRESS, kPa	17
HEAD PRESSURE, kPa	421	DURATION, min	240
BACK PRESSURE, kPa	415	HYDRAULIC GRADIENT, $i$	10

## SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	6.19	UNIT WEIGHT, kN/m <sup>3</sup>	21.55
SAMPLE DIAMETER, cm	6.89	DRY UNIT WEIGHT, kN/m <sup>3</sup>	18.53
SAMPLE AREA, cm <sup>2</sup>	37.29	SPECIFIC GRAVITY, assumed	2.70
SAMPLE VOLUME, cm <sup>3</sup>	230.74	VOLUME OF SOLIDS, cm <sup>3</sup>	161.47
TOTAL MASS, g	507.00	VOLUME OF VOIDS, cm <sup>3</sup>	69.27
DRY MASS, g	435.97	VOID RATIO	0.43
WATER CONTENT, %	16.3		

## TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)		0.0
DURATION OF STEADY STATE FLOW (min)	647-574-0989	240
INFLOW VOLUME UNDER STEADY STATE FLOW (cm <sup>3</sup> )		209.4
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm <sup>3</sup> )		187.3
INFLOW TO OUTFLOW RATIO		1.1
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)		3.94E-05
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)		3.53E-05
HYDRAULIC CONDUCTIVITY, K, cm/s		3.74E-05
HYDRAULIC CONDUCTIVITY AT STANDARD TEMPERATURE, K <sub>20</sub> , cm/s		3.48E-05

## NOTES:

Effective consolidation stress assigned by the client

PERMEANT FLUID

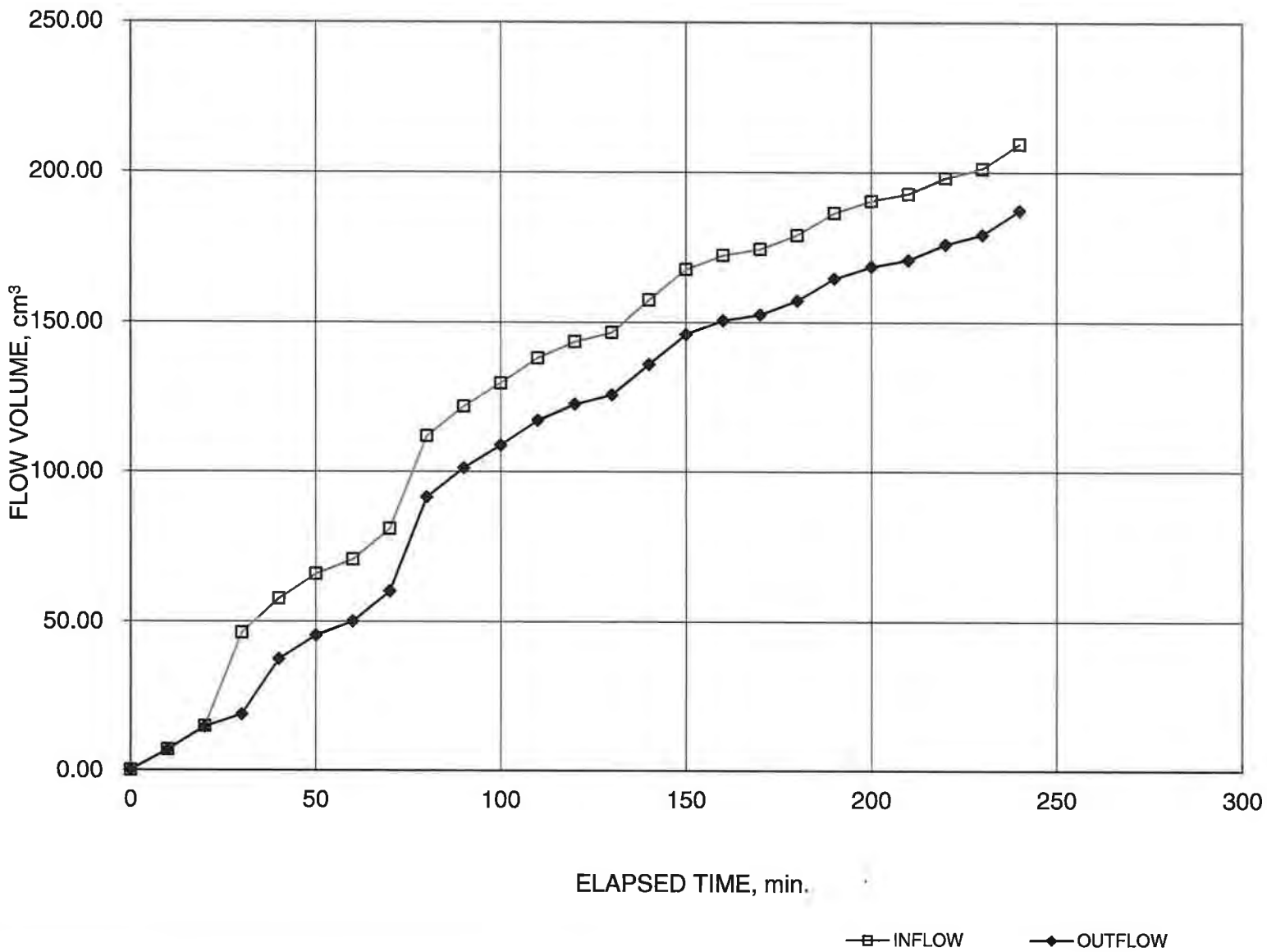
Deaired tap water

AVERAGE TEST TEMPERATURE

23.0 °C

# HYDRAULIC CONDUCTIVITY TEST

SA 15-08(i=10)



## HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 (CONSTANT HEAD)

## SAMPLE IDENTIFICATION

PROJECT NUMBER	1413191/1030	SAMPLE	15-06
PROJECT TITLE	MTO/EOI-4014-E-0012&4014-E-0013	SAMPLE DEPTH, m	-
BOREHOLE NUMBER	-	DATE	12/25/2015

## SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	7.12	UNIT WEIGHT, kN/m <sup>3</sup>	15.43
SAMPLE DIAMETER, cm	7.02	DRY UNIT WEIGHT, kN/m <sup>3</sup>	13.85
SAMPLE AREA, cm <sup>2</sup>	38.70	SPECIFIC GRAVITY, assumed	2.70
SAMPLE VOLUME, cm <sup>3</sup>	275.58	VOLUME OF SOLIDS, cm <sup>3</sup>	144.18
TOTAL MASS, g	433.64	VOLUME OF VOIDS, cm <sup>3</sup>	131.39
DRY MASS, g	389.30	VOID RATIO	0.91
WATER CONTENT, %	11.4		

## SATURATION STAGE

CELL PRESSURE, kPa	420	EFFECTIVE CONSOLIDATION STRESS, kPa	5
HEAD PRESSURE, kPa	415	DURATION, min	6,660
BACK PRESSURE, kPa	415	B COEFFICIENT	0.99

## CONSOLIDATION STAGE

CELL PRESSURE, kPa	453	EFFECTIVE CONSOLIDATION STRESS, kPa	38
HEAD PRESSURE, kPa	415	DURATION, min	1,478
BACK PRESSURE, kPa	415	VOLUME CHANGE, cm <sup>3</sup>	1.3
		DRAINAGE	Top and Bottom

## SPECIMEN PROPERTIES AND DIMENSIONS (AFTER CONSOLIDATION)

SAMPLE HEIGHT, cm	7.11	SAMPLE AREA, cm <sup>2</sup>	38.58
SAMPLE DIAMETER, cm	7.01	SAMPLE VOLUME, cm <sup>3</sup>	274.25

## HYDRAULIC CONDUCTIVITY STAGE

CELL PRESSURE, kPa	460	EFFECTIVE CONSOLIDATION STRESS, kPa	38
HEAD PRESSURE, kPa	422	DURATION, min	370
BACK PRESSURE, kPa	415	HYDRAULIC GRADIENT, $i$	10

## SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	7.11	UNIT WEIGHT, kN/m <sup>3</sup>	20.58
SAMPLE DIAMETER, cm	7.01	DRY UNIT WEIGHT, kN/m <sup>3</sup>	13.92
SAMPLE AREA, cm <sup>2</sup>	38.58	SPECIFIC GRAVITY, assumed	2.70
SAMPLE VOLUME, cm <sup>3</sup>	274.25	VOLUME OF SOLIDS, cm <sup>3</sup>	144.18
TOTAL MASS, g	575.60	VOLUME OF VOIDS, cm <sup>3</sup>	130.06
DRY MASS, g	389.30	VOID RATIO	0.90
WATER CONTENT, %	47.9		

## TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)		0.0
DURATION OF STEADY STATE FLOW (min)	647-574-0989	370
INFLOW VOLUME UNDER STEADY STATE FLOW (cm <sup>3</sup> )		43.5
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm <sup>3</sup> )		42.9
INFLOW TO OUTFLOW RATIO		1.0
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)		5.05E-06
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)		4.99E-06
HYDRAULIC CONDUCTIVITY, K, cm/s		5.02E-06
HYDRAULIC CONDUCTIVITY AT STANDARD TEMPERATURE, K <sub>20</sub> , cm/s		4.68E-06

## NOTES:

Effective consolidation stress assigned by the client

PERMEANT FLUID

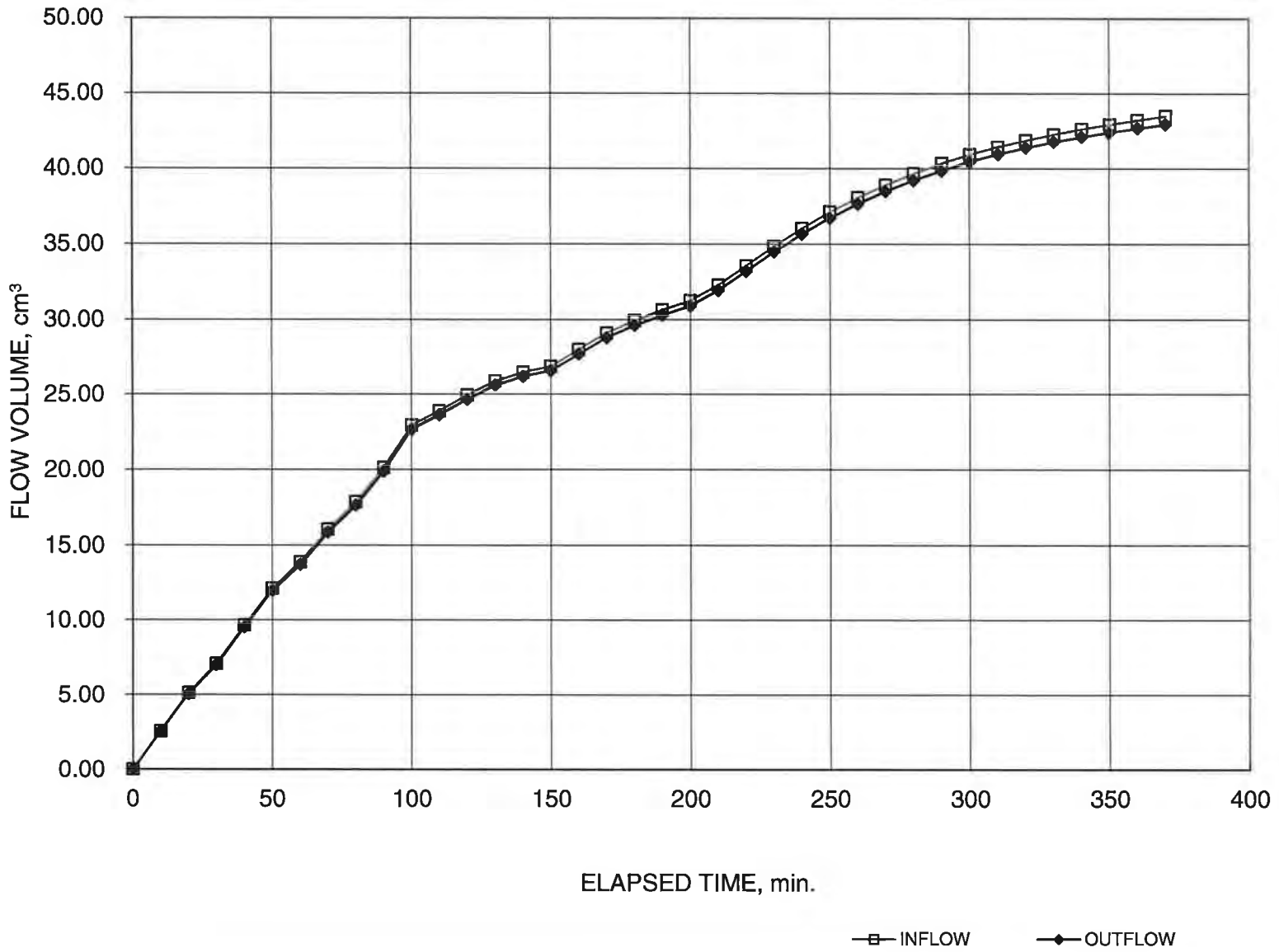
Deaired tap water

AVERAGE TEST TEMPERATURE

23.0 °C

# HYDRAULIC CONDUCTIVITY TEST

SA 15-06(i=10)





# **APPENDIX D**

## **Geochemical Analytical Testing Results**

Appendix D - Table D-1: Summary of Total Metals Lab Results

Parameter			Aluminum	Antimony	Arsenic	Barium	Calcium	Cobalt	Iron	Magnesium	Manganese	Molybdenum	Potassium	Sodium	Strontium	Sulphur	Zinc
Unit			µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
O.Reg 153 Table 1 Soil <sup>1,2</sup>			--	--	18	210	--	21	--	--	--	2	--	--	--	--	290
O.Reg 153 Table 2 Soil <sup>3,4</sup>			--	--	18	670	--	80	--	--	--	40	--	--	--	--	340
Sample ID	Sample Depth (m)	Sample Description															
TP15-01 SA-1	0.5	Peat (fill)	12000	< 0.8	2.6	110	46000	7.1	17000	9200	320	0.6	2000	470	110	1200	60
TP15-01 SA-2	1.8	Silty Clay (Fill)	23000	< 0.8	3.1	200	7400	14	33000	8000	240	0.3	3900	500	46	110	59
TP15-02 SA-1	0.6	Silty Clay (Fill)	8400	< 0.8	2.2	46	74000	6.4	16000	20000	490	0.3	1600	860	110	320	30
TP15-02 SA-2	1.2	Silty Clay	5000	< 0.8	1.7	28	89000	5.8	12000	20000	400	0.2	1500	440	150	180	21
TP15-04 SA-1	2.0	Sandy Silt (Fill)	6800	< 0.8	2.6	51	68000	6.0	13000	14000	420	0.3	1800	540	130	340	27
TP15-05 SA-1	1.7	Sandy Silt (Fill)	5000	< 0.8	2.0	51	61000	4.8	12000	16000	280	0.3	1400	700	97	400	22
TP15-06 SA-1	1.8	Sandy Silt (Fill)	9000	< 0.8	2.9	72	63000	7.2	16000	13000	490	0.3	2300	620	120	300	33
TP15-07 SA-1	1.6	Silty Sand (Fill)	6100	< 0.8	2.2	52	99000	5.1	14000	23000	490	0.4	1500	1300	150	480	24
TP15-08 SA-1	0.8	Sandy Silt (Fill)	8100	< 0.8	2.5	71	77000	7.0	15000	14000	510	0.3	2100	560	150	300	33
TP15-09 SA-1	0.6	Topsoil (Fill)	10000	< 0.8	2.5	87	77000	6.9	16000	13000	530	0.5	2100	270	210	600	37
TP15-09 SA-2	1.7	Silty Clay (Fill)	15000	< 0.8	2.7	130	34000	9.1	24000	8100	680	0.5	2300	310	120	260	43
TP15-11 SA-1	1.0	Silty Clay (Fill)	9200	< 0.8	2.6	80	75000	7.3	16000	14000	520	0.3	2400	580	150	330	33
TP15-12 SA-1	0.5	Slag (Fill)	11000	< 0.8	<b>61</b>	<b>240</b>	16000	10	39000	2300	110	<b>2.3</b>	770	410	300	820	22
TP15-12 SA-2	1.6	Sandy Silt	9800	< 0.8	3.8	100	60000	7.4	17000	15000	550	0.9	1900	490	120	410	41

**Footnotes:**

Tables should be read in conjunction with the accompanying document.

&lt; value = Indicates parameter not detected above laboratory method detection limit.

&gt; value = Indicates parameter detected above equipment analytical range.

-- Chemical not analyzed or criteria not defined.

Grey background indicates exceedances.

(1) Ontario Regulation 153 (2011) Table 1 Standards for Residential/Parkland/Institutional/Industrial/Commercial/Community Property use for soil in full depth background site condition

(2) Bold Font = Parameter concentration greater than O.Reg153 Table 1 - All Other Soil

(3) Ontario Regulation 153 (2011) Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, Commercial/Industrial Property Use, coarse texture soil

(4) Underline Font = Parameter concentration greater than O.Reg153 Table 2 - Industrial/Commercial/Community Property Use



Appendix D - Table D-2: Summary of SPLP Lab Results

Parameter Unit			Initial pH	pH	Alkalinity	Conductivity	Chloride	Sulphate	Arsenic	Barium	Calcium	Cobalt	Chromium	Iron	Magnesium	Manganese	Sodium	Nickel	Lead	Sulfur	Strontium	Zinc
			--	--	mg/L as CaCO3	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ODWQS - Health <sup>1,2</sup>			--	--	--	--	250	500	--	--	--	--	0.05	--	--	--	--	--	0.01	--	--	5
ODWQS - AO <sup>3,4</sup>			--	--	--	--	--	--	0.025	--	--	--	--	0.3	--	0.05	200	--	--	--	--	-
O.Reg 153 Table 1 GW <sup>5,6</sup>			--	--	--	--	790	--	0.013	0.61	--	0.0038	0.011	--	--	--	490	0.014	0.0019	--	--	0.16
O.Reg 153 Table 2 GW <sup>7,8</sup>			--	--	--	--	790	--	0.025	1	--	0.0038	0.05	--	--	--	--	0.1	0.01	--	--	1.1
Sample ID	Sample Depth (m)	Sample Description																				
TP15-01 SA-1	0.5	Peat (fill)	8.54	9.33	79	170	6	5	0.0018	0.0991	17.9	0.00247	0.0105	6.82	3.09	0.0524	20.5	0.0070	0.00625	1.5	0.0930	0.023
TP15-01 SA-2	1.8	Silty Clay (Fill)	7.16	9.78	30	76	5	27	0.0059	0.167	3.84	0.00726	0.0239	15.0	4.03	0.0993	16.1	0.0150	0.00501	1.1	0.0348	0.027
TP15-02 SA-1	0.6	Silty Clay (Fill)	8.89	9.19	77	262	33	11	0.0031	0.0582	10.5	0.00183	0.00800	5.25	2.39	0.0467	49.8	0.0057	0.00388	1.8	0.0332	0.014
TP15-02 SA-2	1.2	Silty Clay	9.43	9.69	57	123	9	3	0.0009	0.0115	7.50	0.000482	0.00214	1.32	0.944	0.00824	19.2	0.0013	0.00037	0.9	0.0167	0.004
TP15-04 SA-1	2.0	Sandy Silt (Fill)	9.38	9.93	61	173	14	11	0.0020	0.0582	10.5	0.00232	0.00865	6.09	2.10	0.0566	29.6	0.0062	0.00299	2.5	0.0363	0.014
TP15-05 SA-1	1.7	Sandy Silt (Fill)	9.75	10.2	130	195	8	9	0.0082	0.240	22.1	0.00934	0.0266	30.2	6.98	0.328	36.8	0.0302	0.0125	1.7	0.0768	0.072
TP15-06 SA-1	1.8	Sandy Silt (Fill)	9.38	9.52	56	144	10	9	0.0021	0.0678	9.83	0.00246	0.0106	6.62	2.41	0.0650	22.0	0.0070	0.00366	1.5	0.0486	0.016
TP15-07 SA-1	1.6	Silty Sand (Fill)	9.58	9.59	109	295	37	11	0.0025	0.171	15.8	0.00785	0.0225	21.2	4.86	0.367	60.1	0.0189	0.00967	2.7	0.0473	0.044
TP15-08 SA-1	0.8	Sandy Silt (Fill)	9.39	9.21	87	137	7	11	0.0023	0.0831	9.44	0.00270	0.0107	7.07	2.42	0.0718	22.9	0.0073	0.00470	1.5	0.0416	0.018
TP15-09 SA-1	0.6	Topsoil (Fill)	9.17	9.50	58	127	1	9	0.0008	0.0270	15.2	0.00173	0.00315	1.88	1.68	0.0181	12.5	0.0023	0.00102	2.3	0.223	0.005
TP15-09 SA-2	1.7	Silty Clay (Fill)	8.89	9.42	53	130	2	12	0.0005	0.0417	13.7	0.000668	0.00420	2.58	1.71	0.0188	15.0	0.0024	0.00087	3.1	0.0802	0.006
TP15-11 SA-1	1.0	Silty Clay (Fill)	9.33	9.68	82	142	8	10	0.0012	0.0538	9.53	0.00161	0.00731	4.71	1.93	0.0429	23.1	0.0047	0.00298	2.1	0.0467	0.012
TP15-12 SA-1	0.5	Slag (Fill)	8.97	9.55	45	114	2	9	0.0267	0.0205		0.000289	0.00132	0.637	1.17	0.00489	10.8	0.0009	0.00072	3.1	0.0903	0.004
TP15-12 SA-2	1.6	Sandy Silt	9.27	9.72	53	133	5	11	0.0021	0.0564		0.00148	0.00722	4.82	2.15	0.0577	19.7	0.0048	0.00549	2.0	0.115	0.015

**Footnotes:**

Tables should be read in conjunction with the accompanying document.

&lt; value = Indicates parameter not detected above laboratory method detection limit.

&gt; value = Indicates parameter detected above equipment analytical range.

-- Chemical not analyzed or criteria not defined.

Grey background indicates exceedances.

(1) Ontario Drinking Water Quality Standards - Health Based Standards (June 2003, revised June 2006).

(2) Bold Font = Parameter concentration greater than ODWQS(169/03)-Health

(3) Ontario Drinking Water Quality Standards - Aesthetic Objectives. Aesthetic Objectives are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices. For certain parameters, both aesthetic objectives and health-related MACs have been derived (June 2003, revised June 2006).

(4) Underlined Font = Parameter concentration greater than ODWQS-AO

(5) Ontario Regulation 153 (2011) Table 1 full depth background site conditions

(6) Italic font = Parameter concentration greater than O.Reg 153 Table 1

(7) Ontario Regulation 153 (2011) Table 2 full depth generic site condition standards in a potable groundwater condition, all types of property use

(8) Double Border = Parameter concentration greater than O.Reg 153 Table 2

Appendix D - Table D-3: Summary of ABA Lab Test Results

Parameter			Sulphur (total)	Acid Leachable Sulphate	Sulphide	Total Inorganic Carbon	Acid Leachable Sulphate	AP	CaNP	CaNPR
Sample ID	Sample Depth (m)	Sample Description	%	%	%	%	ppm	t CaCO <sub>3</sub> /1000t	t CaCO <sub>3</sub> /1000t	dimensionless
TP15-01 SA-1	0.5	Peat (fill)	0.031	0.03	< 0.01	1.44	30	0.31	120	384
TP15-01 SA-2	1.8	Silty Clay (Fill)	<0.005	<0.01	< 0.01	0.038	<10	0.31	3	10
TP15-02 SA-1	0.6	Silty Clay (Fill)	0.009	<0.01	< 0.01	2.88	<10	0.31	240	768
TP15-02 SA-2	1.2	Silty Clay	0.007	<0.01	< 0.01	3.34	<10	0.31	278	891
TP15-04 SA-1	2.0	Sandy Silt (Fill)	0.019	0.02	< 0.01	2.46	20	0.31	205	656
TP15-05 SA-1	1.7	Sandy Silt (Fill)	0.026	0.02	0.01	2.45	20	0.31	204	653
TP15-06 SA-1	1.8	Sandy Silt (Fill)	0.019	0.02	< 0.01	2.31	20	0.31	193	616
TP15-07 SA-1	1.6	Silty Sand (Fill)	0.022	0.02	< 0.01	3.61	20	0.31	301	963
TP15-08 SA-1	0.8	Sandy Silt (Fill)	0.017	0.02	< 0.01	2.87	20	0.31	239	765
TP15-09 SA-1	0.6	Topsoil (Fill)	0.029	0.02	0.01	2.63	20	0.31	219	701
TP15-09 SA-2	1.7	Silty Clay (Fill)	0.009	<0.01	< 0.01	1.11	<10	0.31	93	296
TP15-11 SA-1	1.0	Silty Clay (Fill)	0.020	0.02	< 0.01	2.65	20	0.31	221	707
TP15-12 SA-1	0.5	Slag (Fill)	0.207	0.04	0.17	8.14	40	5.31	678	128
TP15-12 SA-2	1.6	Sandy Silt	0.026	0.03	< 0.01	2.48	30	0.31	207	661

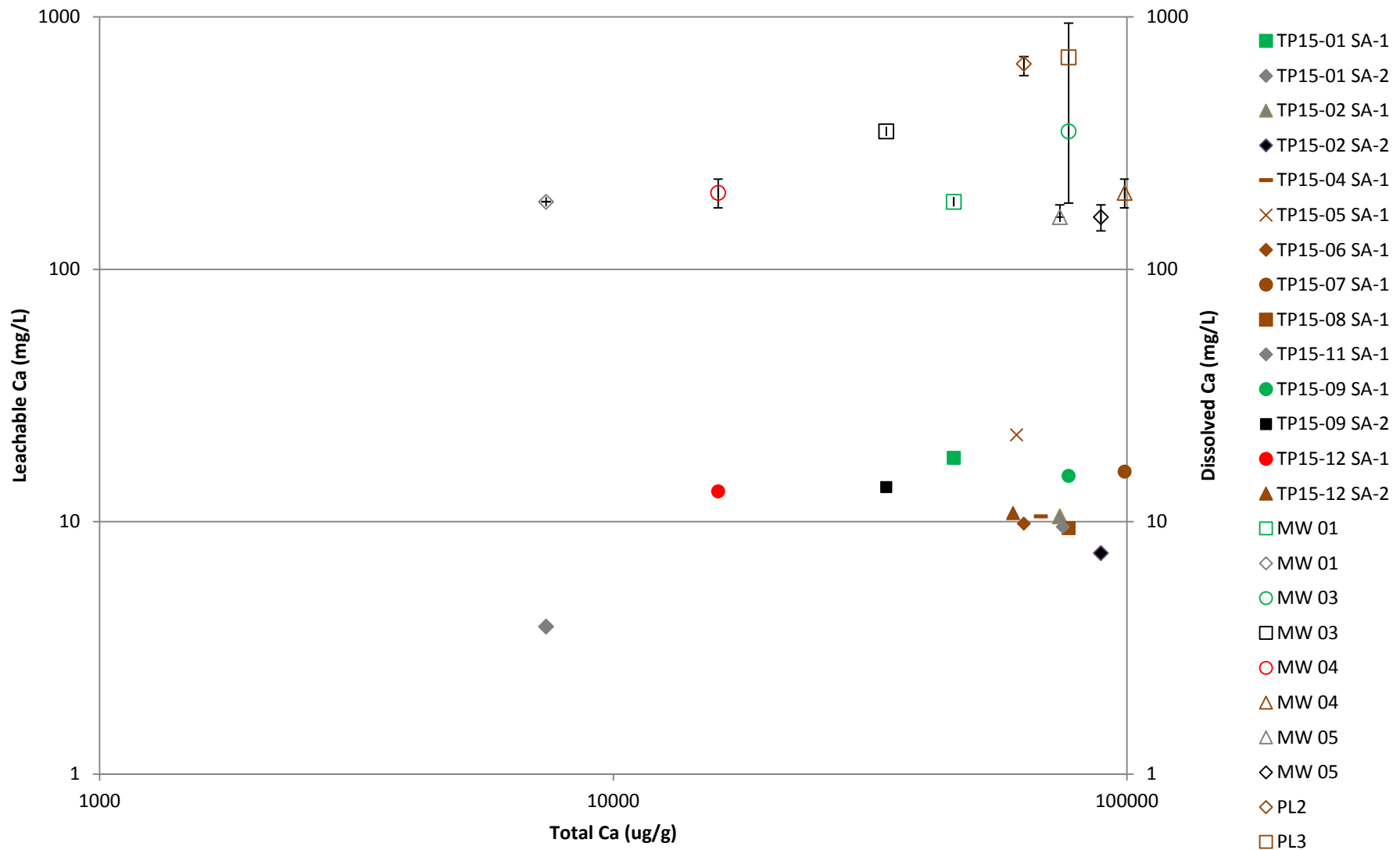
**Footnotes:**

AP - Acid Potential

CaNP - Carbonate Neutralization Potential

CaNPR - Carbonate Neutralization Potential Ratio

&lt; value = Indicates parameter not detected above laboratory method detection limit.



Notes: green (topsoil –fill); grey (silty clay – fill); brown (silty sand/sandy silt); black – native overburden; red (slag – fill), open symbol (groundwater or leachate monitor)



PROJECT No. 1413191-1030

Created by DH August 2016

Reviewed by BTB August 2016

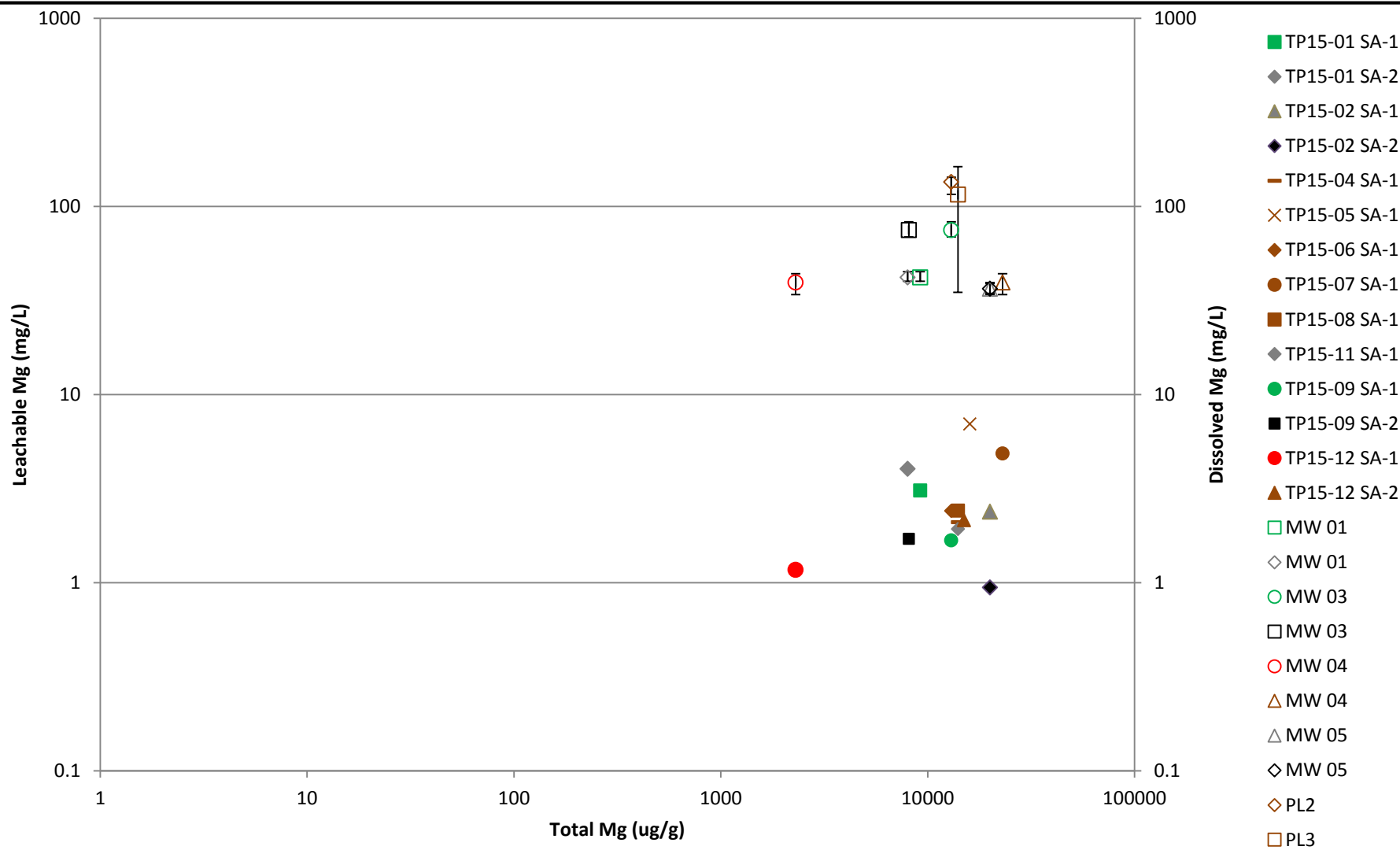
PROJECT

MTO TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO


TITLE

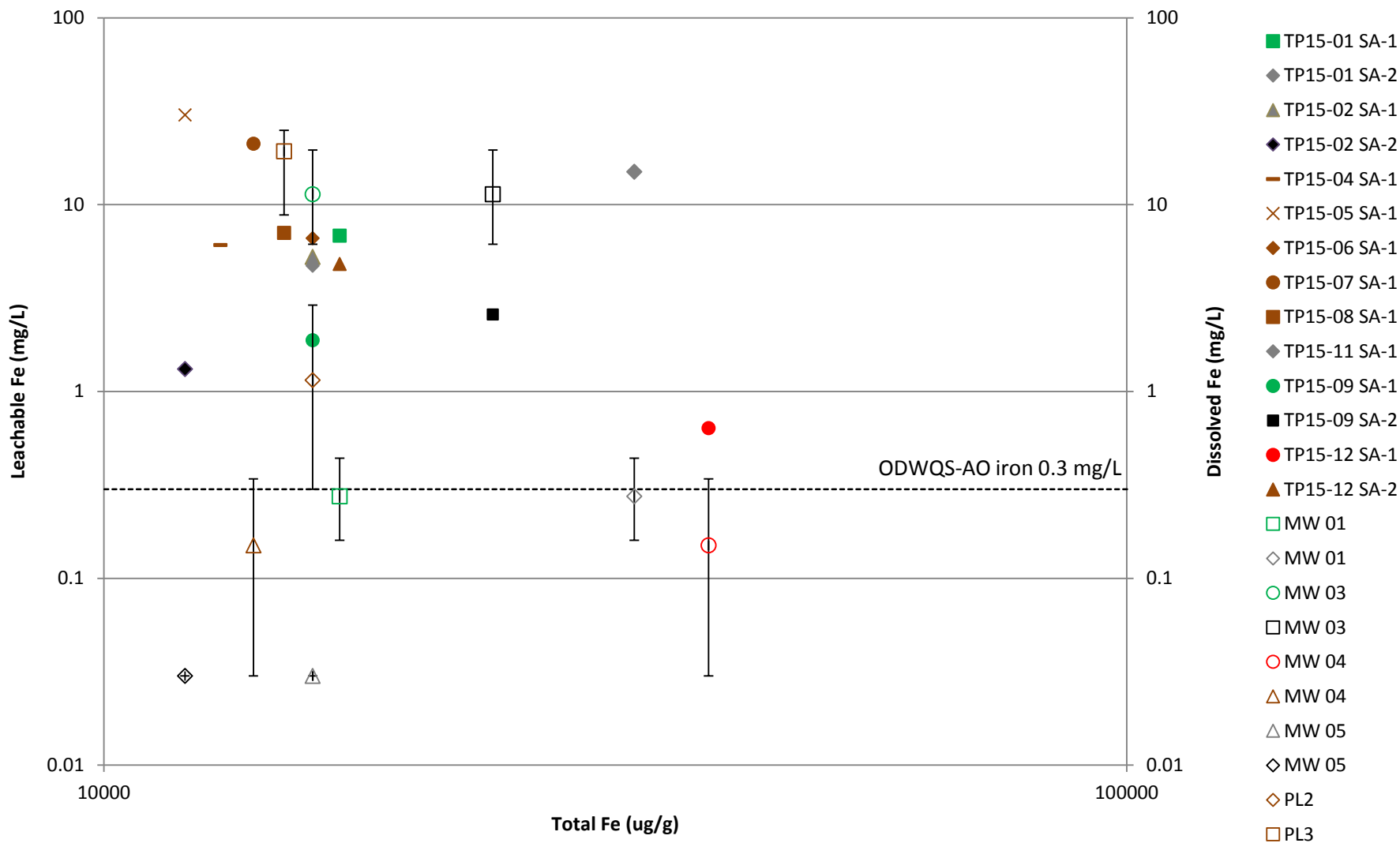
LAB LEACHABLE AND IN-SITU CALCIUM VERSUS TOTAL CALCIUM

FIGURE D-1



Notes: green (topsoil –fill); grey (silty clay – fill); brown (silty sand/sandy silt); black – native overburden; red (slag – fill), open symbol (groundwater or leachate monitor)

	PROJECT No. 1413191-1030			PROJECT	MTO TIRE DERIVED AGGREGATE EMBANKMENT CORNWALL, ONTARIO	FIGURE D-2
	Created by	DH	August 2016	TITLE	LAB LEACHABLE AND IN-SITU MAGNESIUM VERSUS TOTAL MAGNESIUM	
	Reviewed by	BTB	August 2016			



Notes: green (topsoil –fill); grey (silty clay – fill); brown (silty sand/sandy silt); black – native overburden; red (slag – fill), open symbol (groundwater or leachate monitor)



PROJECT No. 1413191-1030

Created by DH August 2016

Reviewed by BTB August 2016

PROJECT

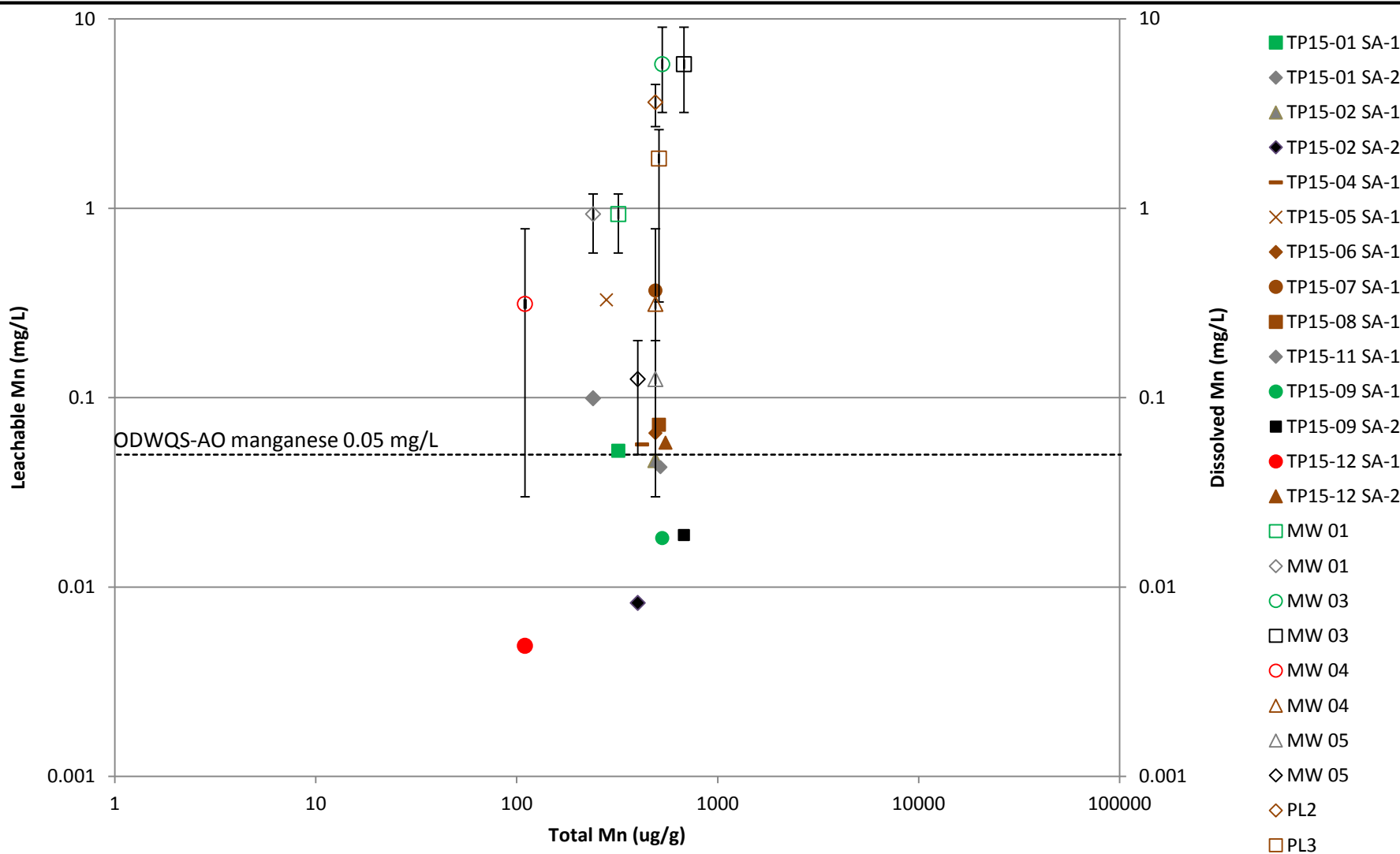
MTO TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE


LAB LEACHABLE AND IN-SITU IRON VERSUS TOTAL IRON

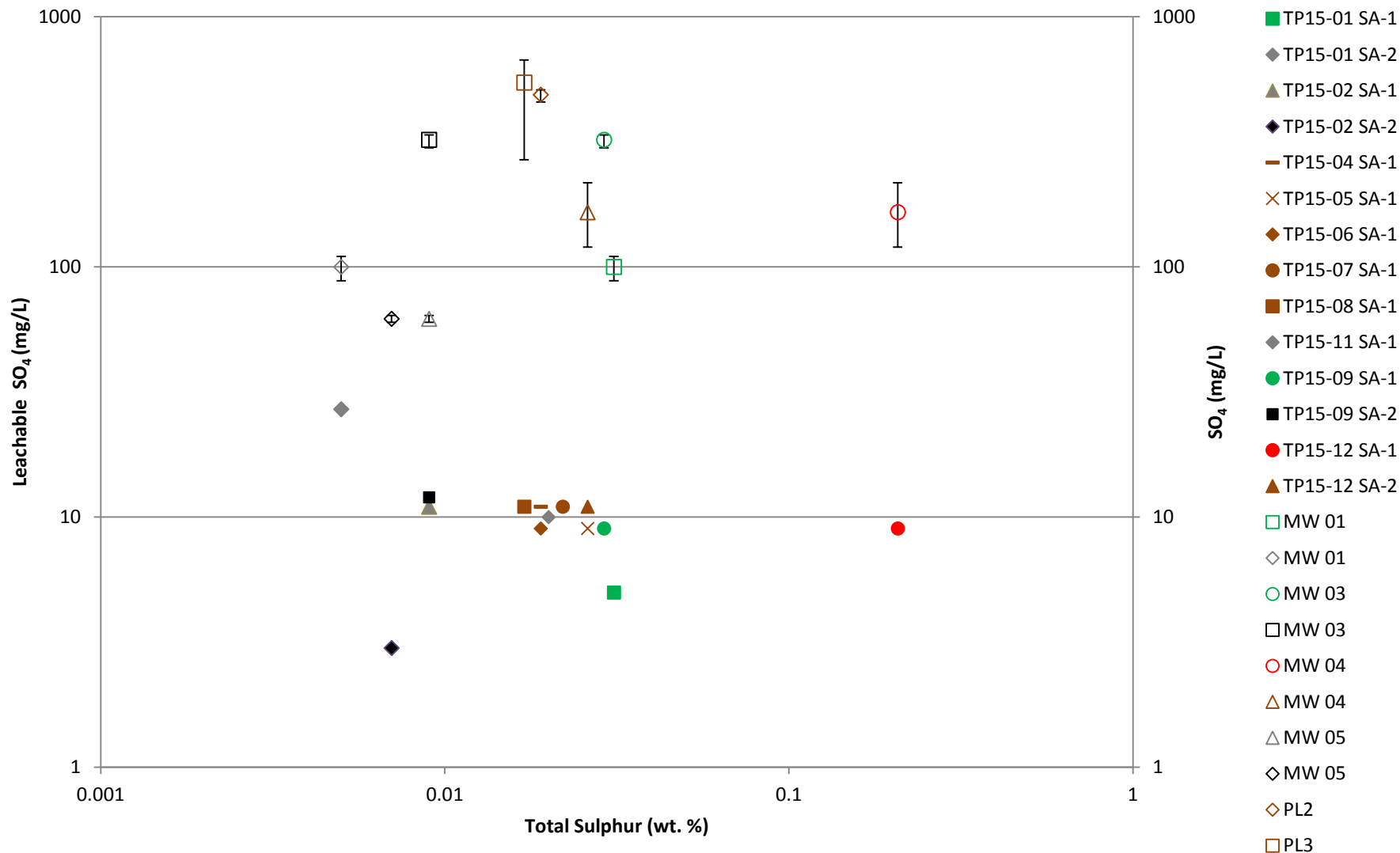
FIGURE D-3






Notes: green (topsoil -fill); grey (silty clay - fill); brown (silty sand/sandy silt); black - native overburden; red (slag - fill), open symbol (groundwater or leachate monitor)

	PROJECT No. 1413191-1030			PROJECT	MTO TIRE DERIVED AGGREGATE EMBANKMENT CORNWALL, ONTARIO	FIGURE D-4
	Created by	DH	August 2016			
	Reviewed by	BTB	August 2016	TITLE	LAB LEACHABLE AND IN-SITU MANGANESE VERSUS TOTAL MANGANESE	



Notes: green (topsoil –fill); grey (silty clay – fill); brown (silty sand/sandy silt); black – native overburden; red (slag – fill), open symbol (groundwater or leachate monitor)

	PROJECT No. 1413191-1030			PROJECT	MTO TIRE DERIVED AGGREGATE EMBANKMENT CORNWALL, ONTARIO	FIGURE D-5
	Created by	DH	August 2016			
	Reviewed by	BTB	August 2016	TITLE	LAB LEACHABLE AND IN-SITU SULPHATE VERSUS ACID LEACHATE SULPHATE	



# **APPENDIX E**

## **SGS Canada Inc. Laboratory Certificates of Analysis**

**SGS Canada Inc.**

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - K0L 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

**Golder Associates Limited**

Attn : Dale Holtze

1931 Robertson Rd  
Ottawa, ON  
K2H 5B7,

Phone: 613-592-9600  
Fax: 613-592-9601

17-November-2015


**Date Rec. :** 03 November 2015  
**LR Report:** CA15030-NOV15  
**Reference:** 1413191/1030

**Copy:** #1

## CERTIFICATE OF ANALYSIS

### Final Report

Sample ID	Sample Date & Time	Sulphur (total) %	Acid Leachable SO <sub>4</sub> -S %	Sulphide %	Total Inorganic Carbon %
3: Analysis Approval Date		12-Nov-15	12-Nov-15	12-Nov-15	12-Nov-15
4: Analysis Approval Time		14:00	13:59	13:59	13:59
5: TP15-01 SA-2	14-Oct-15	< 0.005	< 0.01	< 0.01	0.038
6: TP15-02 SA-1	14-Oct-15	0.009	< 0.01	< 0.01	2.88
7: TP15-02 SA-2	14-Oct-15	0.007	< 0.01	< 0.01	3.34
9: TP15-04 SA-1	14-Oct-15	0.019	0.02	< 0.01	2.46
10: TP15-05 SA-1	14-Oct-15	0.026	0.02	0.01	2.45
11: TP15-06 SA-1	14-Oct-15	0.019	0.02	< 0.01	2.31
12: TP15-08 SA-1	14-Oct-15	0.017	0.02	< 0.01	2.87
13: TP15-09 SA-1	14-Oct-15	0.029	0.02	0.01	2.63
14: TP15-09 SA-2	14-Oct-15	0.009	< 0.01	< 0.01	1.11
16: TP15-11 SA-1	14-Oct-15	0.020	0.02	< 0.01	2.65
17: TP15-12 SA-1	14-Oct-15	0.207	0.04	0.17	8.14
18: TP15-12 SA-2	14-Oct-15	0.026	0.03	< 0.01	2.48
19: TP15-01 SA-1	27-Oct-15	0.031	0.03	< 0.01	1.44
20: TP15-07 SA-1		0.022	0.02	< 0.01	3.61

  
\_\_\_\_\_  
**Brian Graham B.Sc.**  
**Project Specialist**  
**Environmental Services, Analytical**



**SGS Canada Inc.**

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17-November-2015

**Date Rec. :** 03 November 2015  
**LR Report:** CA15031-NOV15  
**Reference:** 1413191/1030

**Copy:** #1

# CERTIFICATE OF ANALYSIS

## Final Report

Analysis	3: Approval Date	4: Approval Time	5: TP15-01 SA-2	6: TP15-02 SA-1	7: TP15-02 SA-2	9: TP15-04 SA-1	10: TP15-05 SA-1	11: TP15-06 SA-1	12: TP15-08 SA-1	13: TP15-09 SA-1	14: TP15-09 SA-2	16: TP15-11 SA-1	17: TP15-12 SA-1	18: TP15-12 SA-2	19: TP15-01 SA-1
Sample Date & Time			14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	27-Oct-15
Silver [µg/g]	11-Nov-15	13:55	0.09	0.03	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.03	0.05	0.05	0.05
Aluminum [µg/g]	11-Nov-15	13:55	23000	8400	5000	6800	5000	9000	8100	10000	15000	9200	11000	9800	12000
Arsenic [µg/g]	11-Nov-15	13:55	3.1	2.2	1.7	2.6	2.0	2.9	2.5	2.5	2.7	2.6	61	3.8	2.6
Barium [µg/g]	11-Nov-15	13:55	200	46	28	51	51	72	71	87	130	80	240	100	110
Beryllium [µg/g]	11-Nov-15	13:55	0.68	0.31	0.20	0.31	0.22	0.37	0.35	0.39	0.58	0.39	0.95	0.43	0.41
Boron [µg/g]	11-Nov-15	13:55	5	6	6	6	4	7	6	7	6	7	22	6	5
Calcium [µg/g]	12-Nov-15	15:11	7400	74000	89000	68000	61000	63000	77000	77000	34000	75000	16000	60000	46000
Cadmium [µg/g]	11-Nov-15	13:55	0.14	0.08	0.05	0.07	0.05	0.08	0.09	0.13	0.14	0.09	0.15	0.16	0.26
Cobalt [µg/g]	11-Nov-15	13:55	14	6.4	5.8	6.0	4.8	7.2	7.0	6.9	9.1	7.3	10	7.4	7.1
Chromium [µg/g]	11-Nov-15	13:55	43	14	10	12	9.3	15	17	16	20	16	13	16	21
Copper [µg/g]	11-Nov-15	13:55	27	12	10	14	9.8	15	13	14	20	15	20	54	25
Iron [µg/g]	11-Nov-15	13:55	33000	16000	12000	13000	12000	16000	15000	16000	24000	16000	39000	17000	17000
Potassium [µg/g]	11-Nov-15	13:55	3900	1600	1500	1800	1400	2300	2100	2100	2300	2400	770	1900	2000
Lithium [µg/g]	11-Nov-15	13:55	13	2	< 1	1	< 1	2	2	2	5	2	4	3	5
Magnesium [µg/g]	12-Nov-15	15:11	8000	20000	20000	14000	16000	13000	14000	13000	8100	14000	2300	15000	9200
Manganese [µg/g]	11-Nov-15	13:56	240	490	400	420	280	490	510	530	680	520	110	550	320
Molybdenum [µg/g]	11-Nov-15	13:56	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.5	0.5	0.3	2.3	0.9	0.6
Nickel [µg/g]	11-Nov-15	13:56	28	14	12	13	10	16	16	15	19	16	20	15	16
Lead [µg/g]	11-Nov-15	13:56	9.1	8.0	4.0	6.6	4.0	9.9	13	10	9.4	11	10	26	21
Sulphur [µg/g]	11-Nov-15	14:50	110	320	180	340	400	300	300	600	260	330	820	410	1200





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LR Report :

CA15031-NOV15

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: TP15-01 SA-2	6: TP15-02 SA-1	7: TP15-02 SA-2	9: TP15-04 SA-1	10: TP15-05 SA-1	11: TP15-06 SA-1	12: TP15-08 SA-1	13: TP15-09 SA-1	14: TP15-09 SA-2	16: TP15-11 SA-1	17: TP15-12 SA-1	18: TP15-12 SA-2	19: TP15-01 SA-1
Selenium [µg/g]	11-Nov-15	13:56	< 0.7	0.8	0.9	0.8	0.7	< 0.7	0.8	0.9	< 0.7	< 0.7	< 0.7	0.9	1.0
Antimony [µg/g]	11-Nov-15	13:56	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Tin [µg/g]	11-Nov-15	13:56	0.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	3.3	1.2
Strontium [µg/g]	11-Nov-15	13:56	46	110	150	130	97	120	150	210	120	150	300	120	110
Thallium [µg/g]	11-Nov-15	13:56	0.21	0.07	0.05	0.07	0.07	0.10	0.09	0.10	0.15	0.10	0.59	0.12	0.12
Titanium [µg/g]	11-Nov-15	13:56	1100	240	190	230	240	320	280	310	460	330	400	350	420
Uranium [µg/g]	11-Nov-15	13:56	0.61	0.28	0.26	0.31	0.29	0.35	0.35	0.44	0.45	0.36	0.70	0.42	1.3
Vanadium [µg/g]	11-Nov-15	13:56	52	18	13	15	14	19	18	20	28	20	24	22	30
Yttrium [µg/g]	11-Nov-15	13:56	17	12	10	11	8.5	14	15	13	17	15	7.4	13	13
Zinc [µg/g]	11-Nov-15	13:56	59	30	21	27	22	33	33	37	43	33	22	41	60

*Brian Graham B.Sc.  
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Environmental Services, Analytical*



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SPLP1312-20:1 L/S 18hr

19-November-2015

**Date Rec. :** 03 November 2015  
**LR Report:** CA15032-NOV15  
**Reference:** 1413191/1030

**Copy:** #1

# CERTIFICATE OF ANALYSIS

## Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: TP15-01 SA-2	6: TP15-02 SA-1	7: TP15-02 SA-2	9: TP15-04 SA-1	10: TP15-05 SA-1	11: TP15-06 SA-1	12: TP15-08 SA-1	13: TP15-09 SA-1	14: TP15-09 SA-2
Sample Date & Time			14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15	14-Oct-15
Sample weight [g]	13-Nov-15	11:31	100	100	100	100	100	100	100	100	100
Ext Fluid [#1 or #2]	13-Nov-15	11:31	1	1	1	1	1	1	1	1	1
Ext Volume [mL]	13-Nov-15	11:31	2000	2000	2000	2000	2000	2000	2000	2000	2000
Initial pH	13-Nov-15	11:31	7.16	8.89	9.43	9.38	9.75	9.38	9.39	9.17	8.89
pH [no unit]	16-Nov-15	15:50	9.78	9.19	9.69	9.93	10.2	9.52	9.21	9.50	9.42
Alkalinity [mg/L as CaCO <sub>3</sub> ]	16-Nov-15	15:50	30	77	57	61	130	56	87	58	53
Conductivity [uS/cm]	16-Nov-15	15:50	76	262	123	173	195	144	137	127	130
Chloride [mg/L]	16-Nov-15	09:30	5	33	9	14	8	10	7	1	2
Sulphate [mg/L]	16-Nov-15	08:59	27	11	3	11	9	9	11	9	12
Bromide [mg/L]	18-Nov-15	08:43	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3
Mercury [mg/L]	13-Nov-15	10:45	0.00002	< 0.00001	< 0.00001	< 0.00001	0.00003	< 0.00001	0.00001	< 0.00001	0.00001
Silver [mg/L]	16-Nov-15	09:15	0.000053	0.000008	< 0.000002	0.000006	0.000037	0.000010	0.000008	0.000002	0.000003
Aluminum [mg/L]	16-Nov-15	09:15	14.8	4.96	1.73	5.43	20.5	5.83	6.45	2.64	3.70
Arsenic [mg/L]	16-Nov-15	09:15	0.0059	0.0031	0.0009	0.0020	0.0082	0.0021	0.0023	0.0008	0.0005
Barium [mg/L]	16-Nov-15	09:15	0.167	0.0582	0.0115	0.0582	0.240	0.0678	0.0831	0.0270	0.0417
Beryllium [mg/L]	16-Nov-15	09:15	0.000419	0.000172	0.000049	0.000210	0.000746	0.000219	0.000245	0.000064	0.000106
Boron [mg/L]	16-Nov-15	09:15	0.0474	0.0370	0.0200	0.0494	0.0662	0.0637	0.0572	0.0457	0.0385
Bismuth [mg/L]	16-Nov-15	09:15	0.000063	0.000032	0.000009	0.000030	0.000123	0.000030	0.000036	0.000011	0.000061
Calcium [mg/L]	16-Nov-15	09:15	3.84	10.5	7.50	10.5	22.1	9.83	9.44	15.2	13.7



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**SPLP1312-20:1 L/S 18hr**

**LR Report :**

**CA15032-NOV15**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: TP15-01 SA-2	6: TP15-02 SA-1	7: TP15-02 SA-2	9: TP15-04 SA-1	10: TP15-05 SA-1	11: TP15-06 SA-1	12: TP15-08 SA-1	13: TP15-09 SA-1	14: TP15-09 SA-2
Cadmium [mg/L]	16-Nov-15	09:15	0.000064	0.000020	< 0.000003	0.000031	0.000096	0.000018	0.000033	0.000011	0.000014
Cobalt [mg/L]	16-Nov-15	09:15	0.00726	0.00183	0.000482	0.00232	0.00934	0.00246	0.00270	0.00173	0.000668
Chromium [mg/L]	16-Nov-15	09:15	0.0239	0.00800	0.00214	0.00865	0.0266	0.0106	0.0107	0.00315	0.00420
Copper [mg/L]	16-Nov-15	09:15	0.0163	0.00635	0.00186	0.00791	0.0405	0.00763	0.00774	0.00261	0.00283
Iron [mg/L]	16-Nov-15	09:15	15.0	5.25	1.32	6.09	30.2	6.62	7.07	1.88	2.58
Potassium [mg/L]	16-Nov-15	09:15	4.40	2.21	0.924	3.12	7.09	4.01	3.74	1.15	1.39
Magnesium [mg/L]	16-Nov-15	09:15	4.03	2.39	0.944	2.10	6.98	2.41	2.42	1.68	1.71
Manganese [mg/L]	16-Nov-15	09:15	0.0993	0.0467	0.00824	0.0566	0.328	0.0650	0.0718	0.0181	0.0188
Sodium [mg/L]	16-Nov-15	09:15	16.1	49.8	19.2	29.6	36.8	22.0	22.9	12.5	15.0
Nickel [mg/L]	16-Nov-15	09:15	0.0150	0.0057	0.0013	0.0062	0.0302	0.0070	0.0073	0.0023	0.0024
Phosphorus [mg/L]	16-Nov-15	09:15	0.222	0.076	0.017	0.132	0.418	0.150	0.168	0.055	0.058
Lead [mg/L]	16-Nov-15	09:15	0.00501	0.00388	0.00037	0.00299	0.0125	0.00366	0.00470	0.00102	0.00087
Antimony [mg/L]	16-Nov-15	09:16	0.0003	0.0003	< 0.0002	0.0003	0.0003	0.0002	0.0002	0.0002	0.0003
Selenium [mg/L]	16-Nov-15	09:16	0.00020	0.00020	< 0.00004	0.00016	0.00017	0.00022	0.00031	0.00010	0.00008
Sulfur [mg/L]	16-Nov-15	09:16	1.1	1.8	0.9	2.5	1.7	1.5	1.5	2.3	3.1
Silicon [mg/L]	16-Nov-15	09:16	34.8	15.0	5.60	18.4	47.1	24.5	22.5	6.43	8.38
Tin [mg/L]	16-Nov-15	09:16	0.00052	0.00036	0.00007	0.00020	0.00028	0.00023	0.00023	0.00011	0.00019
Strontium [mg/L]	16-Nov-15	09:16	0.0348	0.0332	0.0167	0.0363	0.0768	0.0486	0.0416	0.223	0.0802
Titanium [mg/L]	16-Nov-15	09:16	0.658	0.249	0.0684	0.244	0.562	0.361	0.343	0.102	0.153
Thallium [mg/L]	16-Nov-15	09:16	0.000127	0.000065	0.000015	0.000065	0.000280	0.000074	0.000084	0.000026	0.000039
Uranium [mg/L]	16-Nov-15	09:16	0.000404	0.000396	0.000042	0.000189	0.000625	0.000251	0.000240	0.000208	0.000129
Zinc [mg/L]	16-Nov-15	09:16	0.027	0.014	0.004	0.014	0.072	0.016	0.018	0.005	0.006

Analysis	16: TP15-11 SA-1	17: TP15-12 SA-1	18: TP15-12 SA-2	19: TP15-01 SA-1	20: TP15-07 SA-1
Sample Date & Time	14-Oct-15	14-Oct-15	14-Oct-15	27-Oct-15	
Sample weight [g]	100	100	100	100	100
Ext Fluid [#1 or #2]	1	1	1	1	1
Ext Volume [mL]	2000	2000	2000	2000	2000
Initial pH	9.33	8.97	9.27	8.54	9.58
pH [no unit]	9.68	9.55	9.72	9.33	9.59
Alkalinity [mg/L as CaCO3]	82	45	53	79	109
Conductivity [uS/cm]	142	114	133	170	295
Chloride [mg/L]	8	2	5	6	37



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**SPLP1312-20:1 L/S 18hr**

**LR Report : CA15032-NOV15**

Analysis	16: TP15-11 SA-1	17: TP15-12 SA-1	18: TP15-12 SA-2	19: TP15-01 SA-1	20: TP15-07 SA-1
Sulphate [mg/L]	10	9	11	5	11
Bromide [mg/L]	< 3	< 3	< 3	< 3	< 3
Mercury [mg/L]	< 0.00001	< 0.00001	0.00002	0.00001	0.00003
Silver [mg/L]	0.000003	< 0.000002	0.000010	0.000007	0.000035
Aluminum [mg/L]	4.53	1.15	4.32	7.14	16.4
Arsenic [mg/L]	0.0012	0.0267	0.0021	0.0018	0.0025
Barium [mg/L]	0.0538	0.0205	0.0564	0.0991	0.171
Beryllium [mg/L]	0.000166	0.000025	0.000156	0.000198	0.000535
Boron [mg/L]	0.0399	0.0363	0.0403	0.0460	0.0437
Bismuth [mg/L]	0.000038	0.000018	0.000026	0.000033	0.000097
Calcium [mg/L]	9.53	13.2	10.8	17.9	15.8
Cadmium [mg/L]	0.000025	0.000010	0.000034	0.000023	0.000073
Cobalt [mg/L]	0.00161	0.000289	0.00148	0.00247	0.00785
Chromium [mg/L]	0.00731	0.00132	0.00722	0.0105	0.0225
Copper [mg/L]	0.00548	0.00141	0.0177	0.00888	0.0211
Iron [mg/L]	4.71	0.637	4.82	6.82	21.2
Potassium [mg/L]	2.71	0.477	2.25	2.47	5.09
Magnesium [mg/L]	1.93	1.17	2.15	3.09	4.86
Manganese [mg/L]	0.0429	0.00489	0.0577	0.0524	0.367
Sodium [mg/L]	23.1	10.8	19.7	20.5	60.1
Nickel [mg/L]	0.0047	0.0009	0.0048	0.0070	0.0189
Phosphorus [mg/L]	0.121	0.100	0.099	0.118	0.296
Lead [mg/L]	0.00298	0.00072	0.00549	0.00625	0.00967
Antimony [mg/L]	0.0002	0.0004	0.0003	0.0002	0.0002
Selenium [mg/L]	0.00024	0.00052	0.00041	0.00024	0.00037
Sulfur [mg/L]	2.1	3.1	2.0	1.5	2.7
Silicon [mg/L]	16.2	2.99	15.1	18.1	35.0
Tin [mg/L]	0.00018	0.00009	0.00076	0.00079	0.00027
Strontium [mg/L]	0.0467	0.0903	0.115	0.0930	0.0473
Titanium [mg/L]	0.216	0.0308	0.223	0.288	0.582
Thallium [mg/L]	0.000055	0.000045	0.000062	0.000075	0.000188
Uranium [mg/L]	0.000188	0.000205	0.000207	0.000680	0.000985
Zinc [mg/L]	0.012	0.004	0.015	0.023	0.044



**SGS Canada Inc.**

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Lakefield - Ontario - KOL 2H0

Phone: 705-652-2000 FAX: 705-652-6365

**SPLP1312-20:1 L/S 18hr**

**LR Report :**

**CA15032-NOV15**

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*Brian Graham B.Sc.  
Project Specialist  
Environmental Services, Analytical*





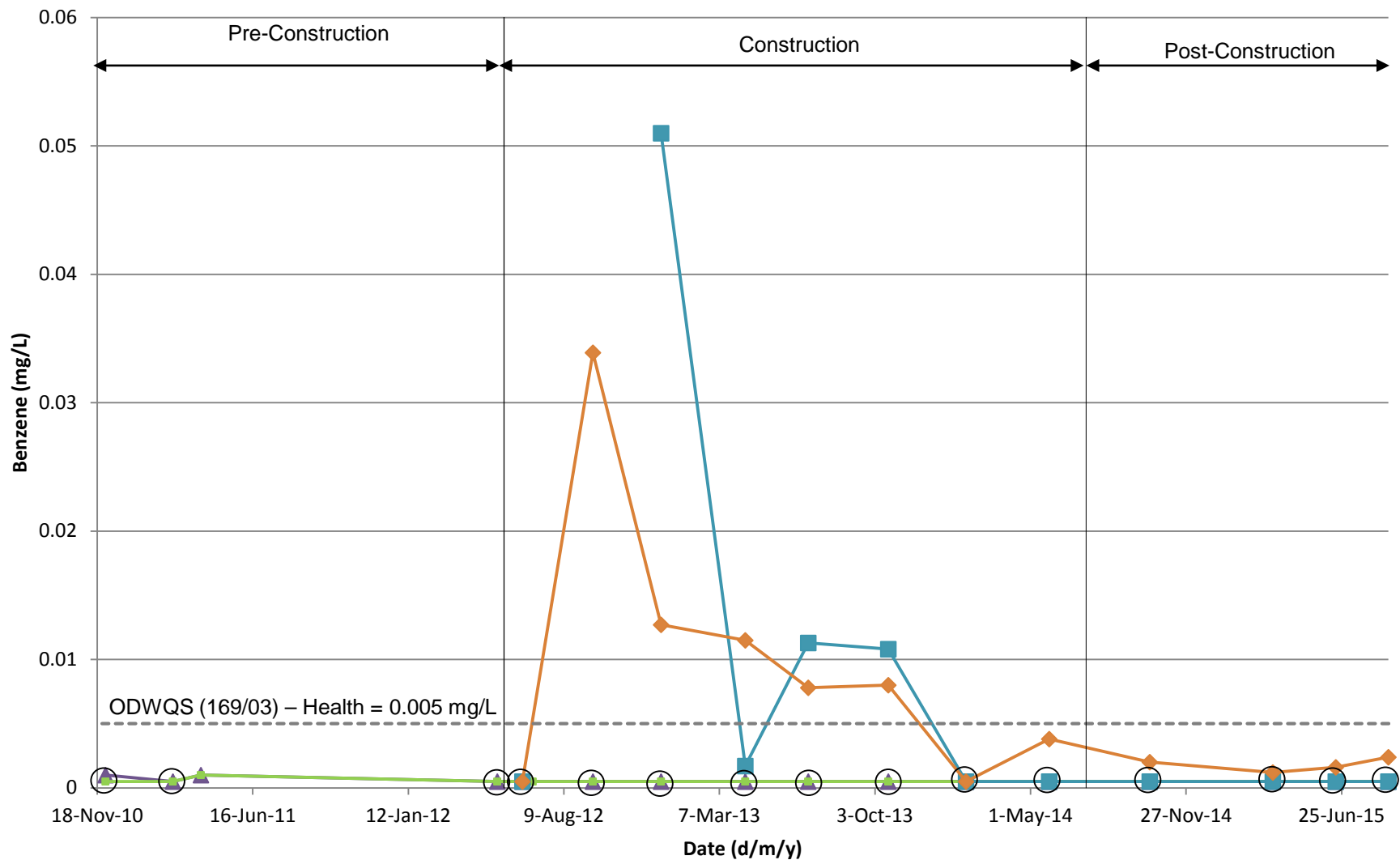
# APPENDIX F

## Historical Pan Lysimeter, Groundwater and Surface Water Quality Data, November 2010 to August 2015

Appendix F-I	–	Select Groundwater and Leachate Quality Trends
Appendix F-II	–	Pan Lysimeter Monitoring Locations
Appendix F-III	–	Groundwater Monitoring Locations
Appendix F-IV	–	Surface Water Monitoring Locations



## **Appendix F-I – Select Groundwater and Leachate Quality Trends**



Note: PL2 was dry on September 17, 2012

○ denotes concentration(s) below laboratory method detection limit



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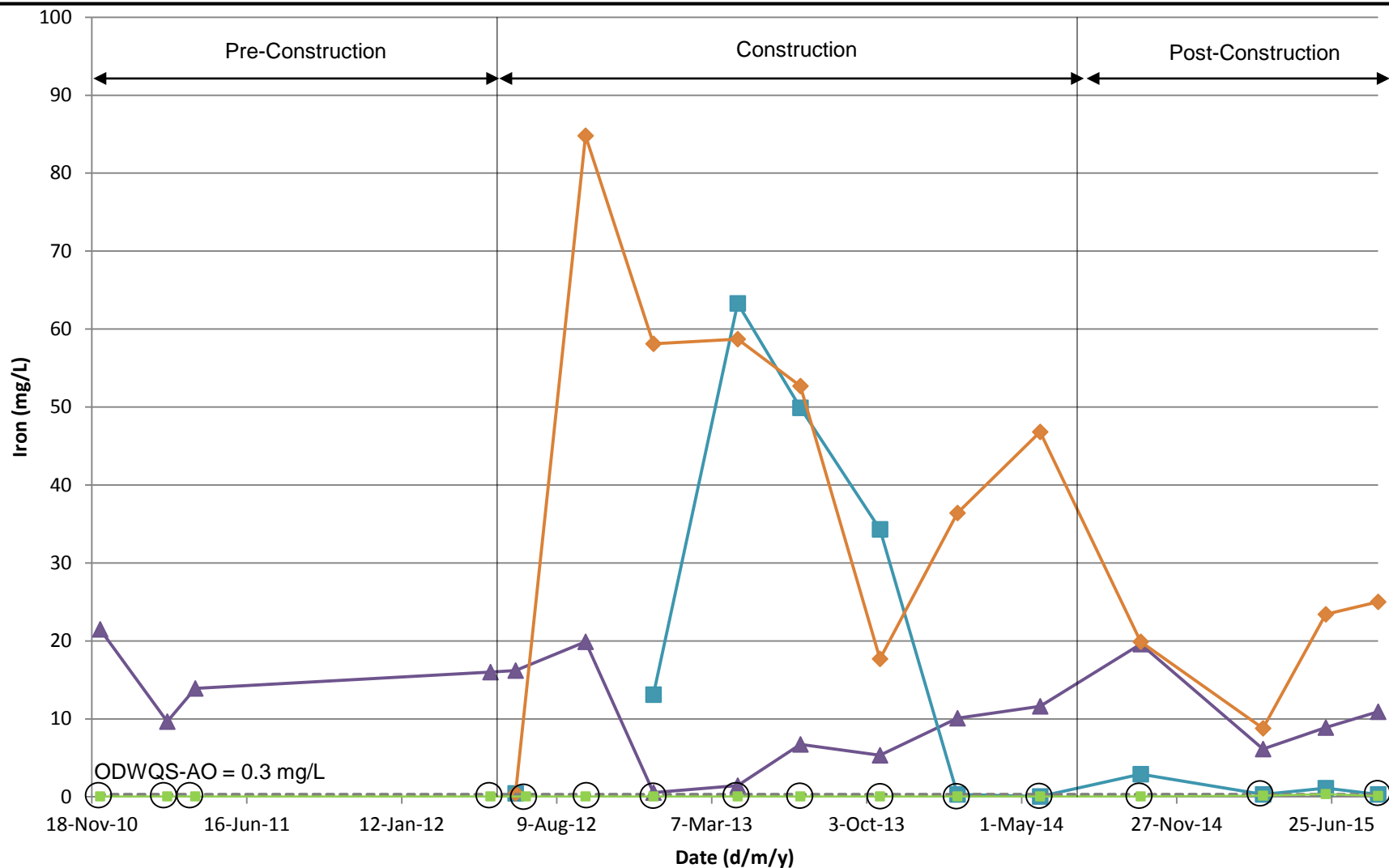
PROJECT

MTO TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE

BENZENE CONCENTRATIONS AT MW 03, MW 04, PL2 AND PL3  
NOVEMBER 2010 TO AUGUST 2015

FIGURE F-1



Notes: PL2 was dry on September 17, 2012

○ denotes concentration(s) below laboratory method detection limit



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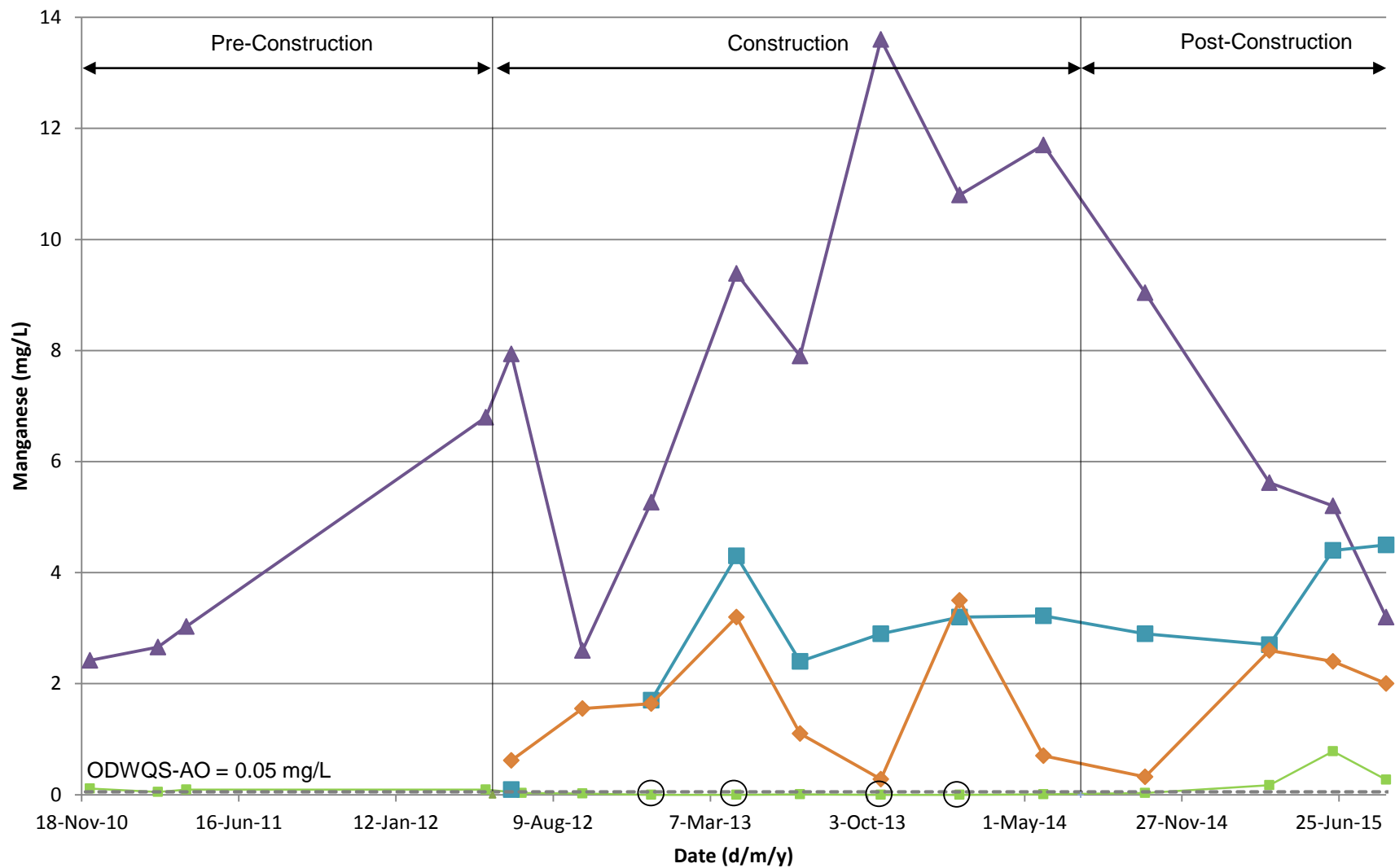
PROJECT

MTO TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE

IRON CONCENTRATIONS AT MW 03, MW 04, PL2 AND PL3  
NOVEMBER 2010 TO AUGUST 2015

FIGURE F-2



Notes: PL2 was dry on September 17, 2012

○ denotes concentration(s) below laboratory method detection limit



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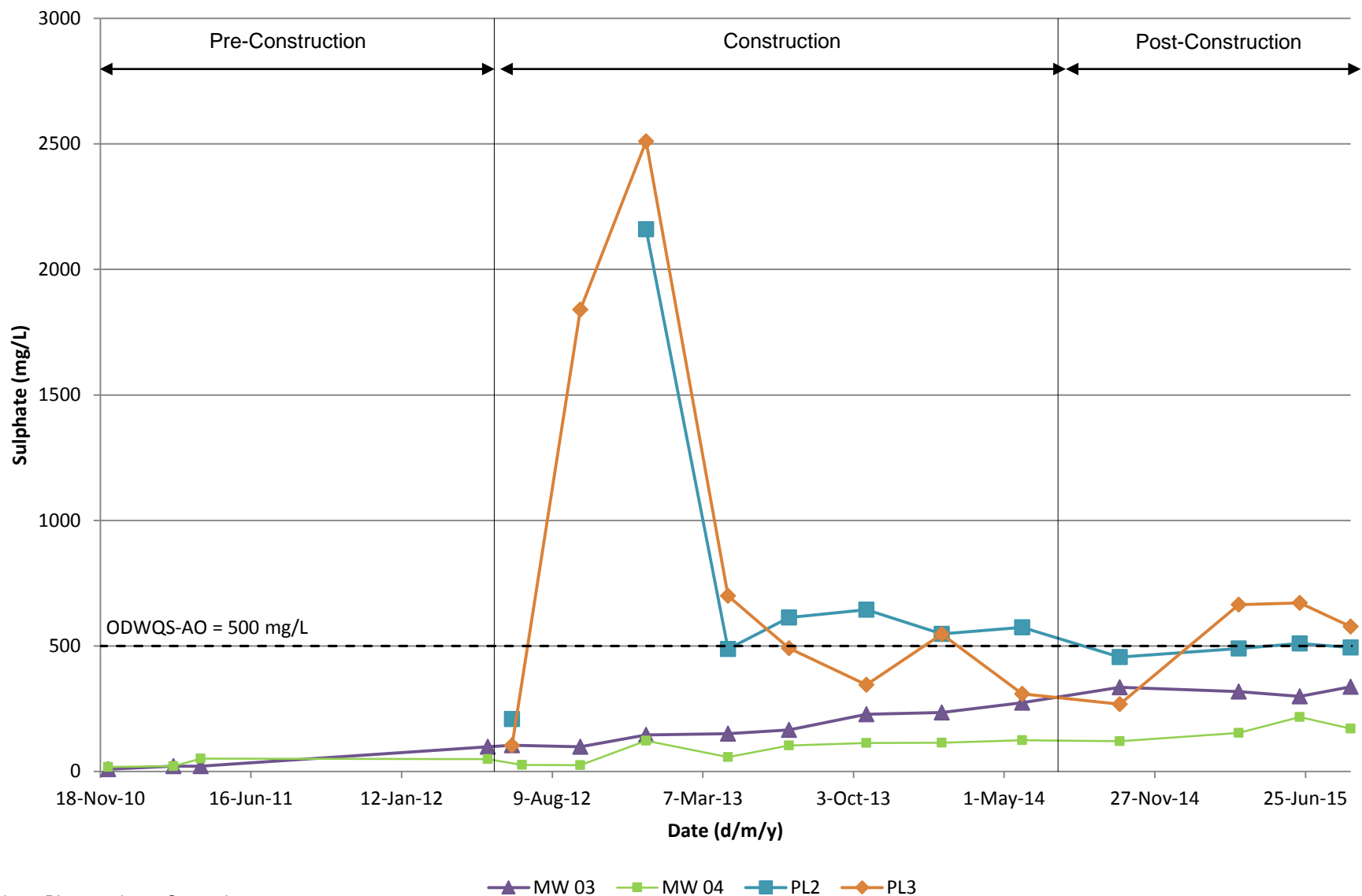
MTD TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE

MANGANESE CONCENTRATIONS AT MW 03, MW 04, PL2  
AND PL3 NOVEMBER 2010 TO AUGUST 2015

FIGURE F-3





Note: PL2 was dry on September 17, 2012



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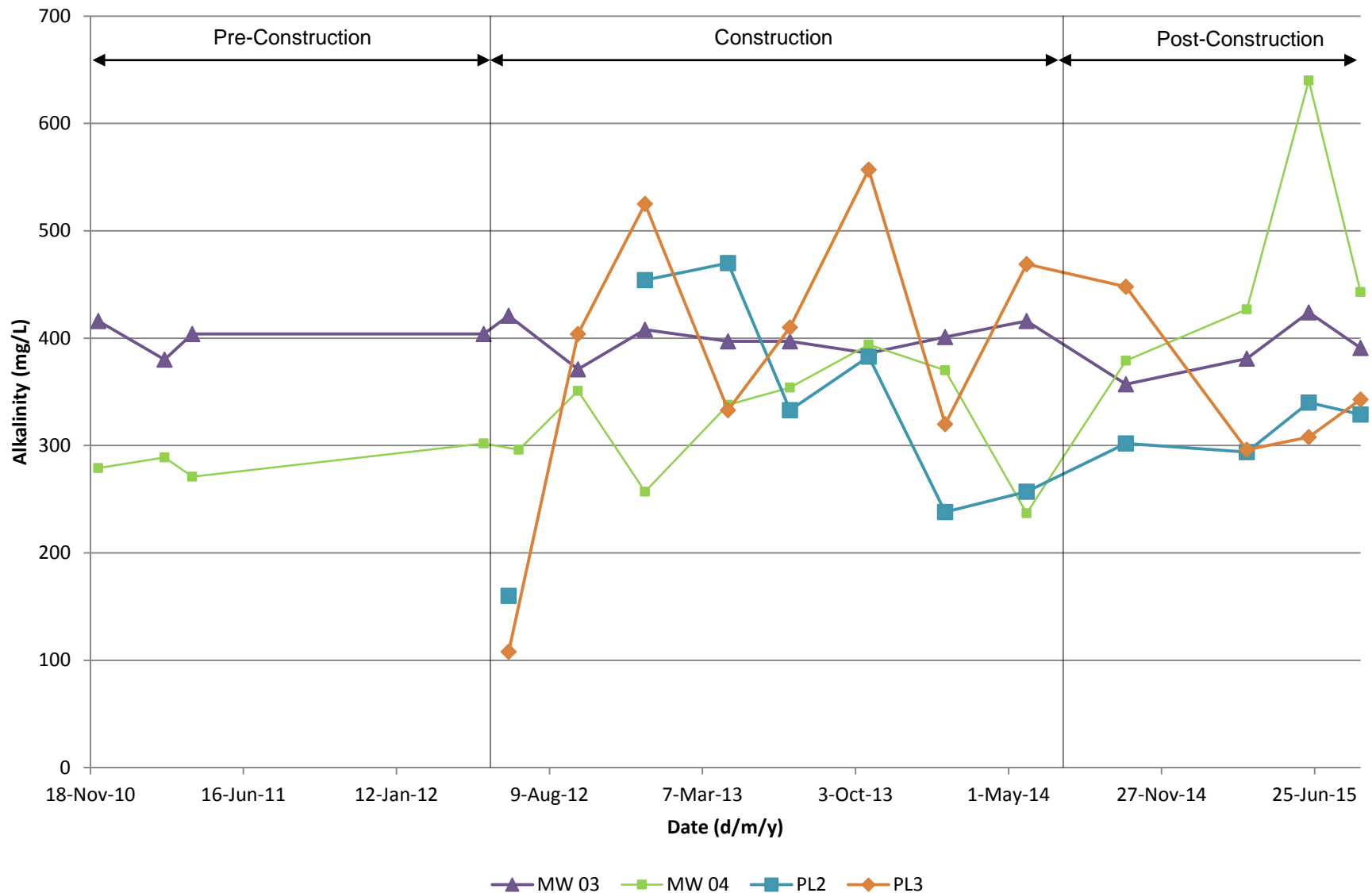
PROJECT

MTO TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE

SULPHATE CONCENTRATIONS AT MW 03, MW 04, PL2 AND PL3  
NOVEMBER 2010 TO AUGUST 2015

FIGURE F-4



Note: PL2 was dry on September 17, 2012

—▲— MW 03    —■— MW 04    —■— PL2    —◆— PL3



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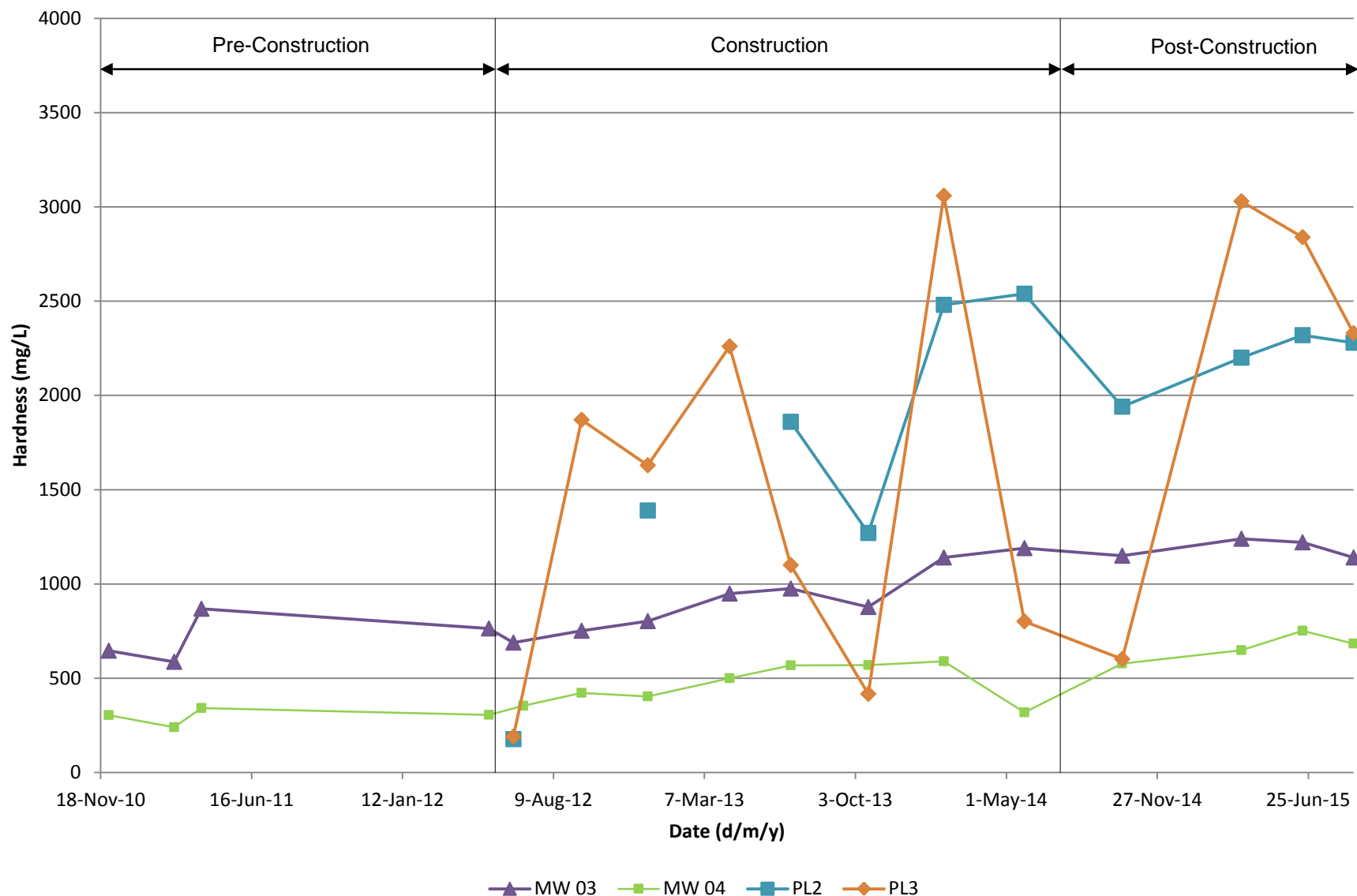
PROJECT

MTO TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE

ALKALINITY CONCENTRATIONS AT MW 03, MW 04, PL2 AND PL3  
NOVEMBER 2010 TO AUGUST 2015

FIGURE F-5



Note: PL2 was dry on September 17, 2012



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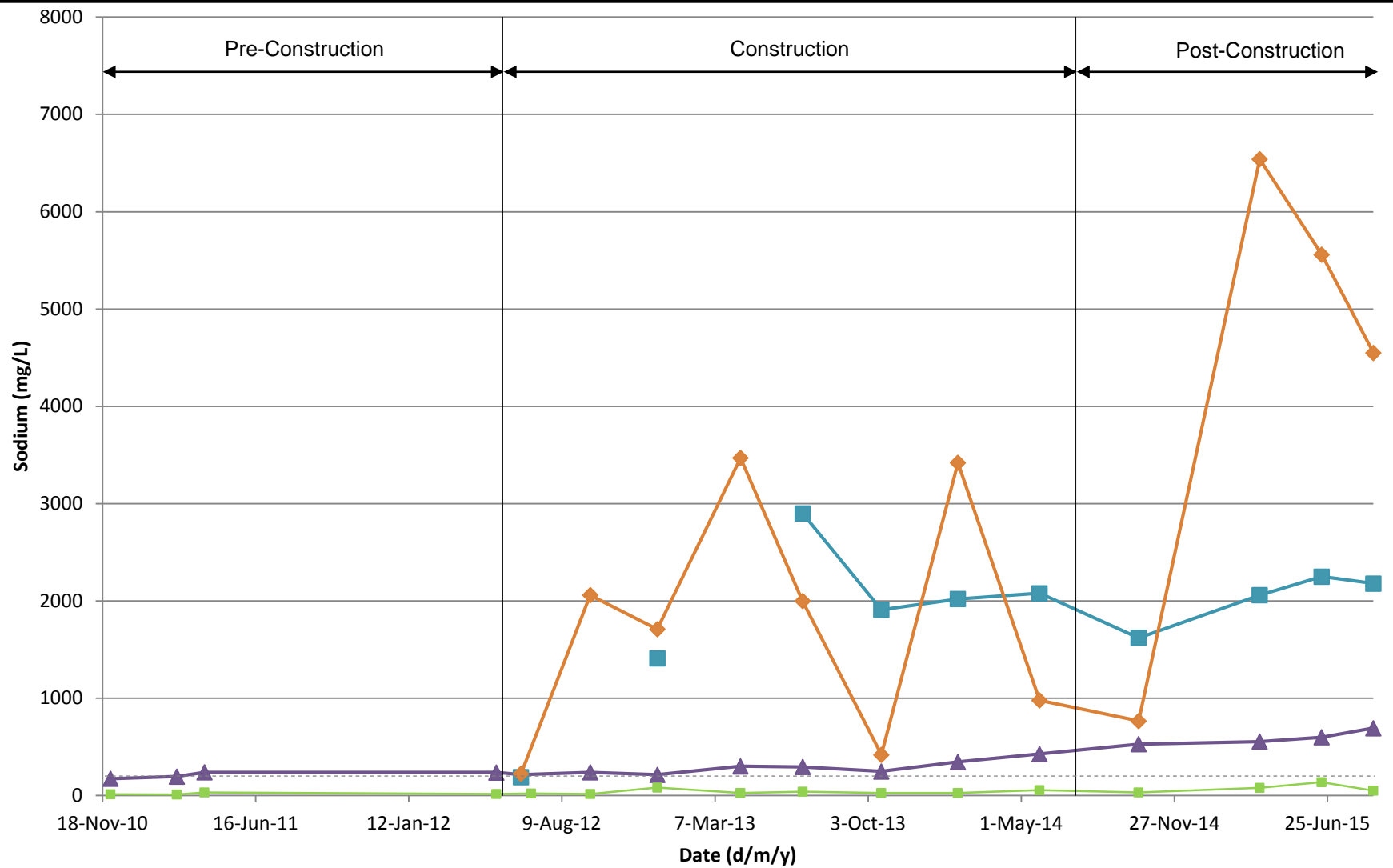
PROJECT

MTO TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE

HARDNESS CONCENTRATIONS AT MW 03, MW 04, PL2 AND PL3  
NOVEMBER 2010 TO AUGUST 2015

FIGURE F-6



Note: PL2 was dry on September 17, 2012

▲ MW 03   
 ■ MW 04   
 ■ PL2   
 ◆ PL3   
 - - - - - 200 mg/L ODWQS-AO



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PROJECT

MTO TIRE DERIVED AGGREGATE EMBANKMENT  
CORNWALL, ONTARIO

TITLE

SODIUM CONCENTRATIONS AT MW 03, MW 04, PL2 AND PL3  
NOVEMBER 2010 TO AUGUST 2015

**FIGURE F-7**



## **Appendix F-II – Pan Lysimeter Monitoring Locations**



Cornwall TDA Embankment - Report of Monitoring Results

1413191-1030

Parameter	Unit	(2) (1) ODWQS(169/ 03)-Health	(4) (3) ODWQS- AO	Construction PL1								Post-Construction PL1			
				14-Jun-2012 <sup>(6)</sup>	17-Sep-2012 <sup>(6)</sup>	18-Dec-2012 <sup>(6)</sup>	11-Apr-2013 <sup>(6)</sup>	05-Jul-2013 <sup>(6)</sup>	21-Oct-2013 <sup>(6)</sup>	03-Feb-2014 <sup>(6)</sup>	26-May-2014 <sup>(6)</sup>	09-Oct-2014 <sup>(6)</sup>	24-Mar-2015 <sup>(6)</sup>	17-Jun-2015 <sup>(6)</sup>	27-Aug-2015 <sup>(6)</sup>
				p-1	p1	1	p1	p1	p1	p1	p1	1	1	1	22
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ammonia, unionized	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ammonia Nitrogen	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ammonium	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bicarbonate	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromide	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbonate (CO3)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Color	color unit	--	5	--	--	--	--	--	--	--	--	--	--	--	--
Conductivity	uS/cm	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Conductivity (Field)	uS/cm	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoride	mg/l	1.5	--	--	--	--	--	--	--	--	--	--	--	--	--
Hardness, Calcium Carbonate	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate as N	mg/l	10	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite as N	mg/l	1	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH (Field)	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phosphorus	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/l	--	500 <sup>(8)</sup>	--	--	--	--	--	--	--	--	--	--	--	--
Temperature (Field)	deg c	--	15	--	--	--	--	--	--	--	--	--	--	--	--
Total Organic Carbon	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Turbidity	ntu	--	5 <sup>(9)</sup>	--	--	--	--	--	--	--	--	--	--	--	--
Turbidity (Field)	ntu	--	5 <sup>(9)</sup>	--	--	--	--	--	--	--	--	--	--	--	--
<b>Metals</b>															
Aluminum, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic, dissolved	mg/l	0.025	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium, dissolved	mg/l	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Boron, dissolved	mg/l	5	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium, dissolved	mg/l	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, dissolved	mg/l	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper, dissolved	mg/l	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Iron, dissolved	mg/l	--	0.3	--	--	--	--	--	--	--	--	--	--	--	--
Lead, dissolved	mg/l	0.01	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese, dissolved	mg/l	--	0.05	--	--	--	--	--	--	--	--	--	--	--	--
Molybdenum, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium, dissolved	mg/l	0.01	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sodium, dissolved	mg/l	--	200 <sup>(10)</sup>	--	--	--	--	--	--	--	--	--	--	--	--
Strontium, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Titanium, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium, dissolved	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc, dissolved	mg/l	--	5	--	--	--	--	--	--	--	--	--	--	--	--
<b>Petroleum Hydrocarbons</b>															
Benzene	mg/l	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	mg/l	--	0.0024	--	--	--	--	--	--	--	--	--	--	--	--
m,p-Xylenes	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	mg/l	--	0.024	--	--	--	--	--	--	--	--	--	--	--	--
Xylenes, Total	mg/l	--	0.3	--	--	--	--	--	--	--	--	--	--	--	--

Cornwall TDA Embankment - Report of Monitoring Results

1413191-1030

Parameter	Unit	(2) (1) ODWQS(169/ 03)-Health	(4) (3) ODWQS- AO	Construction PL1								Post-Construction PL1			
				14-Jun-2012 <sup>(6)</sup>	17-Sep-2012 <sup>(6)</sup>	18-Dec-2012 <sup>(6)</sup>	11-Apr-2013 <sup>(6)</sup>	05-Jul-2013 <sup>(6)</sup>	21-Oct-2013 <sup>(6)</sup>	03-Feb-2014 <sup>(6)</sup>	26-May-2014 <sup>(6)</sup>	09-Oct-2014 <sup>(6)</sup>	24-Mar-2015 <sup>(6)</sup>	17-Jun-2015 <sup>(6)</sup>	27-Aug-2015 <sup>(6)</sup>
				p-1	p1	1	p1	p1	p1	p1	p1	1	1	1	22
<b>Semi-VOCs</b>															
1-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	mg/l	0.014	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	mg/l	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	mg/l	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	mg/l	0.08	0.03	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloropropene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	mg/l	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	mg/l	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	mg/l	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	mg/l	0.002	--	--	--	--	--	--	--	--	--	--	--	--	--

Cornwall TDA Embankment - Report of Monitoring Results

1413191-1030

Parameter	Unit	(2) (1) ODWQS(169/ 03)-Health	(4) (3) ODWQS- AO	Construction PL2								Post-Construction PL2			
				14-Jun-2012 <sup>(12)</sup>	17-Sep-2012 <sup>(6)</sup>	18-Dec-2012 <sup>(13)</sup>	11-Apr-2013 <sup>(14)</sup>	05-Jul-2013 <sup>(15)</sup>	21-Oct-2013 <sup>(16)</sup>	03-Feb-2014 <sup>(16)</sup>	26-May-2014	09-Oct-2014 <sup>(17)</sup>	24-Mar-2015	17-Jun-2015 <sup>(18)</sup>	27-Aug-2015 <sup>(18)</sup>
				P-1	p12	P-3	PL-1	P-2	P - 3	P-1	PL - 2	PL - 2	PL-3	P-3	PL-3
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	--	--	160	--	454	470	333	383	238	257	302	294	340	329
Ammonia, unionized	mg/l	--	--	0.05	--	0.06	<0.02	0.02	0.03	<0.02	<0.02	0.05	<0.02	<0.05	<0.02
Ammonia Nitrogen	mg/l	--	--	1.28	--	5.31	1.83	1.87	2.40	1.21	1.09	1.27	1.41	0.79	0.862
Ammonium	mg/l	--	--	1.23	--	5.25	1.83	1.85	2.37	1.21	1.09	1.22	1.41	0.79	0.86
Bicarbonate	mg/l	--	--	160	--	454	470	333	383	238	257	302	294	340	329
Bromide	mg/l	--	--	10.2	--	12.0	<1.25	2.09	1.60	<2.50	3.56	<1.25	3.44	<1.25	<2.5
Carbonate (CO3)	mg/l	--	--	<1 <sup>(7)</sup>	--	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>	<1 <sup>(7)</sup>
Color	color unit	--	5	72	--	33	11	10	17	8	8	8	6	10	7
Conductivity	uS/cm	--	--	1480	--	8230	26800	15500	12600	13700	13600	11300	12700	14400	14100
Conductivity (Field)	uS/cm	--	--	1505	--	>5000	>4000	>3999	>4000	3140	>5000	>5000	>5000	>5000	>5000
Fluoride	mg/l	1.5	--	0.69	--	0.25	0.10	0.20	0.22	0.22	0.20	0.21	0.20	0.19	0.16
Hardness, Calcium Carbonate	mg/l	--	--	176	--	1390	2410	1860	1270	2480	2540	1940	2200	2320	2280
Nitrate as N	mg/l	10	--	0.90	--	<0.10	<0.10	<0.10	<0.10	<0.10	0.22	0.11	0.40	0.54	0.55
Nitrite as N	mg/l	1	--	<0.10	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH	-	--	--	7.78	--	7.71	7.07	7.65	7.54	7.29	7.74	7.83	7.40	7.47	7.95
pH (Field)	-	--	--	7.8	--	7.2	7.4	7.6	7.5	7.6	7.5	7.4	7.4	7.7	7.5
Phosphorus	mg/l	--	--	0.11	--	0.04	0.19	0.02	0.14	0.03	0.03	0.06	0.04	<0.05	<0.05
Sulfate	mg/l	--	500 <sup>(8)</sup>	209	--	2160	488	613	644	548	574	456	490	510	494
Temperature (Field)	deg c	--	15	15	--	6	3	17	14	8	11	9	8	13	15
Total Organic Carbon	mg/l	--	--	75	--	29.1	6.0	9.5	16.3	7.7	6.3	5.5	5.9	10.1	8.9
Total Suspended Solids	mg/l	--	--	26	--	63	464	147	237	209	17	97	75	21	40
Turbidity	ntu	--	5 <sup>(9)</sup>	10.6	--	>100	85.6	>100	>100	89.6	10.0	99.0	66.0	8.0	23.4
Turbidity (Field)	ntu	--	5 <sup>(9)</sup>	19.9	--	152	527	>100	>100	>100	>100	>100	>100	>100	>100
<b>Metals</b>															
Aluminum, dissolved	mg/l	--	--	0.02	--	<0.01	<0.1	<0.1	<0.1	<0.1	<0.01	<0.1	<0.1	<0.1	<0.1
Arsenic, dissolved	mg/l	0.025	--	<0.01	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01
Barium, dissolved	mg/l	1	--	0.07	--	0.06	0.5	0.2	0.2	0.3	0.16	0.1	0.2	0.2	0.2
Beryllium, dissolved	mg/l	--	--	<0.0005	--	<0.0005	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.005	<0.005	<0.005	<0.005
Boron, dissolved	mg/l	5	--	0.39	--	0.70	0.3	0.4	0.3	0.4	0.45	0.5	0.5	0.4	0.3
Cadmium, dissolved	mg/l	0.005	--	<0.0001	--	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001
Calcium, dissolved	mg/l	--	--	49	--	403	754	556	374	729	747	585	649	696	679
Chromium, dissolved	mg/l	0.05	--	0.001	--	0.008	<0.05	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01
Cobalt, dissolved	mg/l	--	--	0.0034	--	0.0051	0.005	0.002	0.006	0.004	0.0044	0.004	0.003	0.015	0.013
Copper, dissolved	mg/l	--	1	0.015	--	0.004	<0.01	<0.01	<0.01	<0.01	0.001	<0.01	<0.01	<0.01	<0.01
Iron, dissolved	mg/l	--	0.3	0.44	--	13.1	63.3	49.9	34.3	<0.3	0.04	2.9	<0.3	1.1	<0.3
Lead, dissolved	mg/l	0.01	--	0.001	--	<0.001	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01
Magnesium, dissolved	mg/l	--	--	13	--	94	128	114	81	159	165	116	140	141	143
Manganese, dissolved	mg/l	--	0.05	0.09	--	1.70	4.3	2.4	2.9	3.2	3.22	2.9	2.7	4.4	4.5
Molybdenum, dissolved	mg/l	--	--	0.019	--	0.007	<0.05	<0.05	<0.05	<0.05	<0.005	<0.05	<0.05	<0.05	<0.05
Nickel, dissolved	mg/l	--	--	0.022	--	0.016	<0.05	<0.05	<0.05	<0.05	0.014	<0.05	<0.05	<0.05	<0.05
Potassium, dissolved	mg/l	--	--	20	--	26	38	41	27	43	40	28	35	40	36
Selenium, dissolved	mg/l	0.01	--	<0.01	--	<0.1	<0.01	<0.01	<0.1	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01
Silver, dissolved	mg/l	--	--	<0.0001	--	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001
Sodium, dissolved	mg/l	--	200 <sup>(10)</sup>	191	--	1410	6560	2900	1910	2020	2080	1620	2060	2250	2180
Strontium, dissolved	mg/l	--	--	6.66	--	9.08	34.4	25.5	19.0	38.0	43.7	28.4	31.4	26.7	25.7
Thallium, dissolved	mg/l	--	--	<0.0001	--	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001
Titanium, dissolved	mg/l	--	--	<0.01	--	<0.01	<0.1	<0.1	<0.1	<0.1	<0.01	<0.1	<0.1	<0.1	<0.1
Vanadium, dissolved	mg/l	--	--	<0.001	--	0.002	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01
Zinc, dissolved	mg/l	--	5	0.12	--	<0.01	<0.1	<0.1	<0.1	<0.1	<0.01	<0.1	<0.1	<0.1	<0.1
<b>Petroleum Hydrocarbons</b>															
Benzene	mg/l	0.005	--	<0.0005	--	0.0510	0.0017	0.0113	0.0108	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/l	--	0.0024	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004
o-Xylene	mg/l	--	--	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	--	--	<0.1	--	--	--	<0.1	--	--	<0.02	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	<0.1	--	--	--	--	--	--	<0.1	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	--	--	--	<0.1	--	--	--	<0.1	--	--	0.03	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	--	--	--	0.3	--	--	--	<0.2	--	--	<0.05	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	--	--	--	<0.2	--	--	--	<0.2	--	--	<0.05	--
Toluene	mg/l	--	0.024	<0.0005	--	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--	<0.0005	<0.0005
Xylenes, Total	mg/l	--	0.3	<0.0010	--	--	<0.0010	--	--	--	<0.0010	--	--	<0.0010	--

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Parameter	Unit	(2) (1)	(4) (3)	Construction PL2								Post-Construction PL2			
		ODWQS(169/03)-Health	ODWQS-AO	14-Jun-2012 <sup>(12)</sup>	17-Sep-2012 <sup>(6)</sup>	18-Dec-2012 <sup>(13)</sup>	11-Apr-2013 <sup>(14)</sup>	05-Jul-2013 <sup>(15)</sup>	21-Oct-2013 <sup>(16)</sup>	03-Feb-2014 <sup>(16)</sup>	26-May-2014	09-Oct-2014 <sup>(17)</sup>	24-Mar-2015	17-Jun-2015 <sup>(18)</sup>	27-Aug-2015 <sup>(18)</sup>
				P-1	pl2	P-3	PL-1	P-2	P - 3	P-1	PL - 2	PL - 2	PL-3	P-3	PL-3
<b>Semi-VOCs</b>															
1-Methylnaphthalene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Acenaphthene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Acenaphthylene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Anthracene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	0.00001	--	--	--	--	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	<0.00005	--	--	--	--	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	<0.00005	--	--	--	--	--	--	--	--
Chrysene	mg/l	--	--	--	--	--	<0.00005	--	--	--	--	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Fluoranthene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Fluorene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Naphthalene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Phenanthrene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Pyrene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Styrene	mg/l	--	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,1-Dichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
1,2-Dibromoethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,2-Dichloroethane	mg/l	0.005	--	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
1,2-Dichloropropane	mg/l	--	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	--	--	<0.0003	--	--	--	<0.0003	--	--	<0.0003	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
Bromodichloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--	--	--	<0.0003	--	--	<0.0003	--
Bromoform	mg/l	--	--	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
Bromomethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
Carbon Tetrachloride	mg/l	0.005	--	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Chlorobenzene	mg/l	0.08	0.03	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Chloroethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Chloroform	mg/l	--	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
Chloromethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Dibromochloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--	--	--	<0.0003	--	--	<0.0003	--
Dichlorodifluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
Methylene Chloride	mg/l	0.05	--	<0.0040	--	--	<0.0040	--	--	--	<0.0040	--	--	<0.0040	--
Tetrachloroethylene	mg/l	0.03	--	<0.0003	--	--	<0.0003	--	--	--	<0.0003	--	--	0.0004	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Trichloroethene	mg/l	0.005	--	<0.0003	--	--	<0.0003	--	--	--	<0.0003	--	--	<0.0003	--
Trichlorofluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
Vinyl Chloride	mg/l	0.002	--	<0.0002	--	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--

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Parameter	Unit	(2) (1) ODWQS(169 /03)-Health	(4) (2) ODWQS- AO	Construction PL3								Post-Construction PL3			
				14-Jun-2012 (25)	17-Sep-2012 (21)	18-Dec-2012 (13)	11-Apr-2013 (14)	05-Jul-2013 (15)	21-Oct-2013 (21)	03-Feb-2014 (22)	26-May-2014	09-Oct-2014	24-Mar-2015	17-Jun-2015 (18)	27-Aug-2015 (18)
				P-2	P-1	P-1	PL-3	P-1	P-1	P-3	PL-1	PL-3	PL-2	P-1	PL-1
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	--	--	108	404	525	333	410	557	320	469	448	296	308	343
Ammonia, unionized	mg/l	--	--	0.03	0.04	0.08	<0.02	<0.02	0.08	<0.02	<0.02	0.04	<0.02	<0.05	<0.02
Ammonia Nitrogen	mg/l	--	--	0.84	9.55	6.95	2.48	0.94	1.99	1.21	0.62	0.97	1.82	1.79	1.53
Ammonium	mg/l	--	--	0.81	9.51	6.87	2.48	0.94	1.91	1.21	0.62	0.93	1.82	1.79	1.53
Bicarbonate	mg/l	--	--	108	404	525	333	410	557	320	469	448	296	308	343
Bromide	mg/l	--	--	4.15	16.6	13.0	<1.25	0.70	1.46	<2.50	1.30	<0.25	<1.25	<5	<5
Carbonate (CO3)	mg/l	--	--	<1 (7)	<1 (7)	<1 (7)	<1 (7)	<1 (7)	<1 (7)	<1 (7)	<1 (7)	<1 (7)	<1 (7)	<1 (7)	<1 (7)
Color	color unit	--	5	42	30	29	15	10	13	13	13	10	6	7	8
Conductivity	uS/cm	--	--	1660	11200	9910	16500	10600	3040	20300	5680	4640	30800	30100	21700
Conductivity (Field)	uS/cm	--	--	1595	1805	>5000	>4000	>3999	>4000	>5000	>5000	>5000	>5000	>5000	>5000
Fluoride	mg/l	1.5	--	0.24	0.17	0.20	0.20	0.19	0.23	0.11	0.37	0.31	<0.10	0.10	0.12
Hardness, Calcium Carbonate	mg/l	--	--	190	1870	1630	2260	1100	416	3060	801	601	3030	2840	2330
Nitrate as N	mg/l	10	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH	-	--	--	7.90	7.04	7.32	7.08	7.70	7.82	7.03	7.61	7.85	6.82	7.15	7.67
pH (Field)	-	--	--	7.9	8.0	7.3	7.5	7.6	7.5	7.7	7.4	7.3	7.3	7.6	7.4
Phosphorus	mg/l	--	--	2.66	0.52	0.47	0.03	0.24	0.35	0.27	0.10	0.13	0.04	0.96	0.30
Sulfate	mg/l	--	500 (8)	103	1840	2510	700	491	345	547	309	268	664	672	577
Temperature (Field)	deg c	--	15	15	16	5	3	15	12	8	11	8	8	13	16
Total Organic Carbon	mg/l	--	--	42.6	54.3	32.1	9.7	10.4	77.4	20.0	10.6	12.1	4.0	7.4	7.7
Total Suspended Solids	mg/l	--	--	1760	982	663	196	332	8600	1590	408	670	890	1350	1100
Turbidity	ntu	--	5 (9)	30.5	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100
Turbidity (Field)	ntu	--	5 (9)	45	62	128	450	>100	>100	>100	>100	>100	>100	>100	>100
<b>Metals</b>															
Aluminum, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.1	<0.1	<0.01	<0.1	<0.01	<0.01	<0.1	<0.1	<0.1
Arsenic, dissolved	mg/l	0.025	--	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001	<0.01	<0.01	<0.01
Barium, dissolved	mg/l	1	--	0.07	0.14	0.07	0.3	0.1	0.09	0.4	0.10	0.10	0.5	0.2	0.2
Beryllium, dissolved	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.005	<0.0005	<0.0005	<0.005	<0.005	<0.005
Boron, dissolved	mg/l	5	--	0.12	0.88	0.81	0.5	0.4	0.45	0.2	0.18	0.30	0.3	0.2	0.2
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001
Calcium, dissolved	mg/l	--	--	58	518	452	660	309	117	966	240	183	946	915	722
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.005	<0.005	<0.05	<0.01	<0.005	<0.01	<0.001	<0.001	<0.01	<0.01	<0.01
Cobalt, dissolved	mg/l	--	--	0.0027	0.0048	0.0026	0.003	<0.002	0.0003	0.003	0.0004	0.0002	<0.002	<0.002	<0.002
Copper, dissolved	mg/l	--	1	0.003	0.005	0.004	<0.01	<0.01	0.001	<0.01	<0.001	<0.001	<0.01	<0.01	<0.01
Iron, dissolved	mg/l	--	0.3	0.45	84.8	58.1	58.7	52.7	17.7	36.4	46.8	19.9	8.8	23.4	25.0
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.01	<0.001	<0.001	<0.01	<0.01	<0.01
Magnesium, dissolved	mg/l	--	--	11	139	121	148	79	30	158	49	35	163	135	129
Manganese, dissolved	mg/l	--	0.05	0.62	1.55	1.64	3.2	1.1	0.28	3.5	0.70	0.32	2.6	2.4	2.0
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.05	<0.05	<0.005	<0.05	<0.005	<0.005	<0.05	<0.05	<0.05
Nickel, dissolved	mg/l	--	--	0.010	0.019	0.009	<0.05	<0.05	<0.005	<0.05	<0.005	<0.005	<0.05	<0.05	<0.05
Potassium, dissolved	mg/l	--	--	10	26	30	48	19	10	36	8	9	38	41	32
Selenium, dissolved	mg/l	0.01	--	<0.01	<0.001	<0.1	<0.1	<0.01	<0.001	<0.01	<0.001	<0.001	<0.01	<0.01	<0.01
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001
Sodium, dissolved	mg/l	--	200 (10)	224	2060	1710	3470	2000	419	3420	978	767	6540	5560	4550
Strontium, dissolved	mg/l	--	--	3.02	8.20	8.71	32.1	13.7	5.19	37.6	5.93	4.94	33.3	31.3	21.2
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.0001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.1	<0.1	<0.01	<0.1	<0.01	<0.01	<0.1	<0.1	<0.1
Vanadium, dissolved	mg/l	--	--	<0.001	0.003	0.004	<0.01	<0.01	0.005	<0.01	<0.001	<0.001	<0.01	<0.01	<0.01
Zinc, dissolved	mg/l	--	5	0.03	<0.01	<0.01	<0.1	<0.1	<0.01	<0.1	<0.01	<0.01	<0.1	<0.1	<0.1
<b>Petroleum Hydrocarbons</b>															
Benzene	mg/l	0.005	--	<0.0005	0.0339	0.0127	0.0115	0.0078	0.0080	<0.0005	0.0038	0.0020	0.012	0.0016	0.0024
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	--	--	<0.1	--	--	<0.1	<0.1	--	--	<0.02	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	mg/l	--	--	<0.1	--	--	--	--	--	<0.1	<0.1	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	--	--	--	<0.1	--	--	--	<0.1	--	--	0.04	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	--	--	--	<0.2	--	--	--	<0.2	--	--	0.05	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	--	--	--	<0.2	--	--	--	<0.2	--	--	<0.05	--
Toluene	mg/l	--	0.024	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--	<0.0005	<0.0005
Xylenes, Total	mg/l	--	0.3	<0.0010	<0.0010	--	<0.0010	--	--	--	<0.0010	--	<0.0010	<0.0005	--



Parameter	Unit	(2) (1)	(4) (2)	Construction PL3								Post-Construction PL3			
		ODWQS(169 /03)-Health	ODWQS-AO	14-Jun-2012 <sup>(25)</sup>	17-Sep-2012 <sup>(21)</sup>	18-Dec-2012 <sup>(13)</sup>	11-Apr-2013 <sup>(14)</sup>	05-Jul-2013 <sup>(15)</sup>	21-Oct-2013 <sup>(21)</sup>	03-Feb-2014 <sup>(22)</sup>	26-May-2014	09-Oct-2014	24-Mar-2015	17-Jun-2015 <sup>(18)</sup>	27-Aug-2015 <sup>(18)</sup>
				P-2	P-1	P-1	PL-3	P-1	P - 1	P-3	PL - 1	PL - 3	PL-2	P-1	PL-1
<b>Semi-VOCs</b>															
1-Methylnaphthalene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Acenaphthene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Acenaphthylene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Anthracene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	<0.00001	--	--	--	--	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	<0.00005	--	--	--	--	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	<0.00005	--	--	--	--	--	--	--	--
Chrysene	mg/l	--	--	--	--	--	<0.00005	--	--	--	--	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Fluoranthene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Fluorene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Naphthalene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Phenanthrene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Pyrene	mg/l	--	--	--	--	--	<0.0001	--	--	--	--	--	--	--	--
Styrene	mg/l	--	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,1-Dichloroethane	mg/l	--	--	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
1,2-Dibromoethane	mg/l	--	--	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,2-Dichloroethane	mg/l	0.005	--	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
1,2-Dichloropropane	mg/l	--	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	<0.0003	--	<0.0003	--	--	--	<0.0003	--	--	<0.0003	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
Bromodichloromethane	mg/l	--	--	<0.0003	<0.0003	--	<0.0003	--	--	--	<0.0003	--	--	<0.0003	--
Bromoform	mg/l	--	--	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
Bromomethane	mg/l	--	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
Carbon Tetrachloride	mg/l	0.005	--	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Chlorobenzene	mg/l	0.08	0.03	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Chloroethane	mg/l	--	--	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Chloroform	mg/l	--	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
Chloromethane	mg/l	--	--	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Dibromochloromethane	mg/l	--	--	<0.0003	<0.0003	--	<0.0003	--	--	--	<0.0003	--	--	<0.0003	--
Dichlorodifluoromethane	mg/l	--	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
Methylene Chloride	mg/l	0.05	--	<0.0040	<0.0040	--	<0.0040	--	--	--	<0.0040	--	--	<0.0040	--
Tetrachloroethylene	mg/l	0.03	--	<0.0003	0.0006	--	0.0005	--	--	--	0.0006	--	--	<0.0003	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004	--	--	<0.0004	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--
Trichloroethene	mg/l	0.005	--	<0.0003	<0.0003	--	<0.0003	--	--	--	0.0005	--	--	0.0007	--
Trichlorofluoromethane	mg/l	--	--	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005	--	--	<0.0005	--
Vinyl Chloride	mg/l	0.002	--	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002	--	--	<0.0002	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (1) ODWQS(169 /03)-Health	(4) (3) ODWQS- AO	Construction PL4								Post-Construction PL4			
				14-Jun-2012 <sup>(2)</sup>	17-Sep-2012 <sup>(2)</sup>	18-Dec-2012 <sup>(2)</sup>	11-Apr-2013 <sup>(2)</sup>	05-Jul-2013 <sup>(2)</sup>	21-Oct-2013 <sup>(2)</sup>	03-Feb-2014 <sup>(2)</sup>	26-May-2014 <sup>(2)</sup>	09-Oct-2014 <sup>(2)</sup>	24-Mar-2015 <sup>(2)</sup>	17-Jun-2015 <sup>(2)</sup>	27-Aug-2015 <sup>(2)</sup>
				P-3	p3	4	p4	p4	p4	p4	p4	4	4	4	44
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	--	--	96	--	--	--	--	--	--	--	--	--	--	--
Ammonia, unionized	mg/l	--	--	0.02	--	--	--	--	--	--	--	--	--	--	--
Ammonia Nitrogen	mg/l	--	--	0.09	--	--	--	--	--	--	--	--	--	--	--
Ammonium	mg/l	--	--	0.07	--	--	--	--	--	--	--	--	--	--	--
Bicarbonate	mg/l	--	--	90	--	--	--	--	--	--	--	--	--	--	--
Bromide	mg/l	--	--	0.84	--	--	--	--	--	--	--	--	--	--	--
Carbonate (CO3)	mg/l	--	--	5	--	--	--	--	--	--	--	--	--	--	--
Color	color unit	--	5	34	--	--	--	--	--	--	--	--	--	--	--
Conductivity	uS/cm	--	--	1010	--	--	--	--	--	--	--	--	--	--	--
Conductivity (Field)	uS/cm	--	--	1080	--	--	--	--	--	--	--	--	--	--	--
Fluoride	mg/l	1.5	--	1.04	--	--	--	--	--	--	--	--	--	--	--
Hardness, Calcium Carbonate	mg/l	--	--	41	--	--	--	--	--	--	--	--	--	--	--
Nitrate as N	mg/l	10	--	2.97	--	--	--	--	--	--	--	--	--	--	--
Nitrite as N	mg/l	1	--	1.91	--	--	--	--	--	--	--	--	--	--	--
pH	-	--	--	8.79	--	--	--	--	--	--	--	--	--	--	--
pH (Field)	-	--	--	8.6	--	--	--	--	--	--	--	--	--	--	--
Phosphorus	mg/l	--	--	0.24	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/l	--	500 <sup>(2)</sup>	177	--	--	--	--	--	--	--	--	--	--	--
Temperature (Field)	deg c	--	15	14	--	--	--	--	--	--	--	--	--	--	--
Total Organic Carbon	mg/l	--	--	1.5	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids	mg/l	--	--	68	--	--	--	--	--	--	--	--	--	--	--
Turbidity	ntu	--	5 <sup>(2)</sup>	>100	--	--	--	--	--	--	--	--	--	--	--
Turbidity (Field)	ntu	--	5 <sup>(2)</sup>	99	--	--	--	--	--	--	--	--	--	--	--
<b>Metals</b>															
Aluminum, dissolved	mg/l	--	--	0.05	--	--	--	--	--	--	--	--	--	--	--
Arsenic, dissolved	mg/l	0.025	--	<0.01	--	--	--	--	--	--	--	--	--	--	--
Barium, dissolved	mg/l	1	--	0.03	--	--	--	--	--	--	--	--	--	--	--
Beryllium, dissolved	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
Boron, dissolved	mg/l	5	--	0.37	--	--	--	--	--	--	--	--	--	--	--
Cadmium, dissolved	mg/l	0.005	--	<0.0001	--	--	--	--	--	--	--	--	--	--	--
Calcium, dissolved	mg/l	--	--	8	--	--	--	--	--	--	--	--	--	--	--
Chromium, dissolved	mg/l	0.05	--	0.002	--	--	--	--	--	--	--	--	--	--	--
Cobalt, dissolved	mg/l	--	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--
Copper, dissolved	mg/l	--	1	0.001	--	--	--	--	--	--	--	--	--	--	--
Iron, dissolved	mg/l	--	0.3	<0.03	--	--	--	--	--	--	--	--	--	--	--
Lead, dissolved	mg/l	0.01	--	<0.001	--	--	--	--	--	--	--	--	--	--	--
Magnesium, dissolved	mg/l	--	--	5	--	--	--	--	--	--	--	--	--	--	--
Manganese, dissolved	mg/l	--	0.05	<0.01	--	--	--	--	--	--	--	--	--	--	--
Molybdenum, dissolved	mg/l	--	--	0.018	--	--	--	--	--	--	--	--	--	--	--
Nickel, dissolved	mg/l	--	--	<0.005	--	--	--	--	--	--	--	--	--	--	--
Potassium, dissolved	mg/l	--	--	13	--	--	--	--	--	--	--	--	--	--	--
Selenium, dissolved	mg/l	0.01	--	<0.01	--	--	--	--	--	--	--	--	--	--	--
Silver, dissolved	mg/l	--	--	<0.0001	--	--	--	--	--	--	--	--	--	--	--
Sodium, dissolved	mg/l	--	200 <sup>(2)</sup>	161	--	--	--	--	--	--	--	--	--	--	--
Strontium, dissolved	mg/l	--	--	2.80	--	--	--	--	--	--	--	--	--	--	--
Thallium, dissolved	mg/l	--	--	<0.0001	--	--	--	--	--	--	--	--	--	--	--
Titanium, dissolved	mg/l	--	--	<0.01	--	--	--	--	--	--	--	--	--	--	--
Vanadium, dissolved	mg/l	--	--	0.001	--	--	--	--	--	--	--	--	--	--	--
Zinc, dissolved	mg/l	--	5	<0.01	--	--	--	--	--	--	--	--	--	--	--
<b>Petroleum Hydrocarbons</b>															
Benzene	mg/l	0.005	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	mg/l	--	0.0024	<0.0005	--	--	--	--	--	--	--	--	--	--	--
m,p-Xylenes	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	mg/l	--	--	<0.1	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	mg/l	--	0.024	<0.0005	--	--	--	--	--	--	--	--	--	--	--
Xylenes, Total	mg/l	--	0.3	<0.0010	--	--	--	--	--	--	--	--	--	--	--

Parameter	Unit	(2) (1)	(4) (3)	Construction PL4								Post-Construction PL4			
		ODWQS(169 /03)-Health	ODWQS-AO	14-Jun-2012 <sup>(2)</sup>	17-Sep-2012 <sup>(2)</sup>	18-Dec-2012 <sup>(2)</sup>	11-Apr-2013 <sup>(2)</sup>	05-Jul-2013 <sup>(2)</sup>	21-Oct-2013 <sup>(2)</sup>	03-Feb-2014 <sup>(2)</sup>	26-May-2014 <sup>(2)</sup>	09-Oct-2014 <sup>(2)</sup>	24-Mar-2015 <sup>(2)</sup>	17-Jun-2015 <sup>(2)</sup>	27-Aug-2015 <sup>(2)</sup>
				P-3	p3	4	p4	p4	p4	p4	p4	4	4	4	44
<b>Semi-VOCs</b>															
1-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	mg/l	--	--	<0.0004	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	mg/l	--	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	mg/l	0.005	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	mg/l	--	--	<0.0003	--	--	--	--	--	--	--	--	--	--	--
Bromoform	mg/l	--	--	<0.0004	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	mg/l	0.005	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	mg/l	0.08	0.03	<0.0002	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	mg/l	--	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--
Chloroform	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	mg/l	--	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	mg/l	--	--	<0.0003	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	mg/l	0.05	--	<0.0040	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	mg/l	0.03	--	<0.0003	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	mg/l	0.005	--	<0.0003	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	mg/l	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	mg/l	0.002	--	<0.0002	--	--	--	--	--	--	--	--	--	--	--

**Footnotes:**

Tables should be read in conjunction with the accompanying document.

< value = Indicates parameter not detected above laboratory method detection limit.

> value = Indicates parameter detected above equipment analytical range.

-- Chemical not analyzed or criteria not defined.

Grey background indicates exceedances.

(1) Ontario Drinking Water Quality Standards - Health Based Standards (June 2003, revised June 2006).

(2) Bold Font = Parameter concentration greater than ODWQS(169/03)-Health

(3) Ontario Drinking Water Quality Standards - Aesthetic Objectives. Aesthetic Objectives are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices. For certain parameters, both aesthetic objectives and health-related MACs have been derived (June 2003, revised June 2006).

(4) Underlined Font = Parameter concentration greater than ODWQS-AO

(5) Metals MRL elevated due to matrix interference.

(6) Monitoring location was dry during this sampling event. No sample was collected.

(7) Not available - pH < 8.3

(8) There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L.

(9) Applicable for all waters at the point of consumption.

(10) The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

(11) Selenium MRL elevated due to matrix interference.

(12) Arsenic and Selenium MRL elevated due to matrix interference.

(13) Arsenic and Selenium MRL elevated due to matrix interference (dilution was done).

(14) Metals and Br MRL elevated due to matrix interference (dilution was done).

(15) Metals MRL elevated due to high conductivity (dilution was done).

(16) Metals MRL elevated due to high conductivity (dilution was done). Br MRL elevated due to matrix interference (dilution was done).

(17) Br MRL elevated due to matrix interference (dilution was done). Metals MRL elevated due to high conductivity (dilution was done).

(18) Metals MRLs elevated due to matrix interference (10x dilution was done). Bromide MRL elevated due to matrix interference (dilution was done).

(19) No result value available.

(20) TOC was not shaken prior to analysis due to sediment content. Arsenic and Selenium MRL elevated due to matrix interference.

(21) Arsenic MRL elevated due to matrix interference (dilution was done).

(22) Metals MRL elevated due to high conductivity (dilution was done). Br MRL elevated due to matrix interference (dilution was done).

(23) TOC was not shaken prior to analysis due to sediment content. Arsenic and Selenium MRL elevated due to matrix interference.



## **Appendix F-III – Groundwater Monitoring Locations**

Cornwall TDA Embankment - Report of Monitoring Results

1413191-1030

Parameter	Unit	(2) (1) ODWQS(169/03) Health	(4) (2) ODWQS- AO	MW 01 Pre-Construction				MW 01 Construction							
				26-Nov-2010	28-Feb-2011 <sup>(2)</sup>	07-Apr-2011 <sup>(2)</sup>	11-May-2012	14-Jun-2012 <sup>(7)</sup>	17-Sep-2012	18-Dec-2012	11-Apr-2013	05-Jul-2013	21-Oct-2013	03-Feb-2014 <sup>(2)</sup>	26-May-2014
				S-1	S-2	S-2	S-2	S-2	S-4	S-4	S-6	S-5	S-6	S-1	MW - 1
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	--	--	424	434	426	398	378	372	363	399	383	404	419	408
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Ammonia Nitrogen	mg/l	--	--	0.24	0.05	0.08	0.18	0.13	0.06	0.07	0.06	0.06	0.06	0.08	0.06
Ammonium	mg/l	--	--	0.24	0.05	0.08	0.18	0.13	0.06	0.07	0.06	0.06	0.06	0.08	0.06
Bicarbonate	mg/l	--	--	424	434	426	398	378	372	363	399	383	404	419	408
Bromide	mg/l	--	--	<0.25	<0.25	<0.25	0.48	<0.25	0.34	<0.25	<0.25	<0.25	<0.25	<0.50	0.32
Carbonate (CO3)	mg/l	--	--	<2 <sup>(10)</sup>	<2 <sup>(10)</sup>	<2 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>
Color	color unit	--	5	8	<2	7	4	11	12	10	6	8	7	4	12
Conductivity (Field)	uS/cm	--	--	2280	2410	2640	2760	1980	2005	2080	2505	2180	2005	2205	1970
Fluoride	mg/l	1.5	--	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.14	0.11	0.27
Hardness, Calcium Carbonate	mg/l	--	--	647	695	682	665	446	570	555	678	578	545	669	556
Nitrate as N	mg/l	10	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (Field)	-	--	--	6.66	7.25	7.26	7.25	7.7	7.6	7.8	7.4	7.8	7.6	7.8	7.5
Phosphorus	mg/l	--	--	5.51	1.83	3.97	1.06	1.77	0.88	3.80	2.30	1.08	1.97	6.71	1.54
Sulfate	mg/l	--	500 <sup>(11)</sup>	90	72	62	74	56	99	77	75	57	75	73	58
Temperature (Field)	deg c	--	15	8.2	6.2	7.0	9	13	13	6	4	12	8	5	8
Total Organic Carbon	mg/l	--	--	9.4	4.2	4.4	3.1	4.5	5.8	4.7	3.4	5.2	7.0	4.7	4.2
Total Suspended Solids	mg/l	--	--	5510	5430	5380	2500	969	988	1110	1290	587	1580	1050	691
Turbidity	ntu	--	5 <sup>(12)</sup>	>100	>100	--	<0.1	>100	>100	>100	17.1 <sup>(13)</sup>	>100	>100	>100	>100
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	--	--	--	239	140	162	204	-- <sup>(13)</sup>	>100	>100	>100	>100
<b>Metals</b>															
Aluminum, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, dissolved	mg/l	0.025	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	0.33	0.33	0.31	0.28	0.23	0.26	0.27	0.27	0.22	0.25	0.30	0.23
Beryllium, dissolved	mg/l	--	--	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron, dissolved	mg/l	5	--	0.03	0.02	0.02	0.03	0.03	0.06	0.03	0.03	0.04	0.04	0.03	0.05
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	185	204	207	189	129	169	163	194	167	154	192	160
Chromium, dissolved	mg/l	0.05	--	0.007	<0.005	<0.005	<0.005	0.003	<0.005	0.008	0.010	0.007	0.007	0.009	<0.001
Cobalt, dissolved	mg/l	--	--	0.0030	0.0019	0.0020	0.0020	0.0021	0.0032	0.0029	0.0011	0.0019	0.0027	0.0013	0.0016
Copper, dissolved	mg/l	--	1	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron, dissolved	mg/l	--	0.3	<0.03	0.05	0.04	0.10	0.11	0.25	0.35	<0.03	0.12	0.23	0.06	0.10
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	45	45	40	47	30	36	36	47	39	39	46	38
Manganese, dissolved	mg/l	--	0.05	1.75	1.18	1.12	1.05	0.95	1.38	1.27	0.56	0.87	0.97	0.59	0.80
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel, dissolved	mg/l	--	--	0.008	0.007	0.008	0.009	0.008	0.011	0.006	0.009	0.006	0.007	0.005	<0.005
Potassium, dissolved	mg/l	--	--	3	3	2	3	2	3	3	3	3	3	5	3
Selenium, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	291	297	328	281	178	178	196	329	238	238	248	242
Strontium, dissolved	mg/l	--	--	1.18	1.01	1.01	0.986	0.936	1.08	1.03	1.07	0.858	0.959	1.04	0.944
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium, dissolved	mg/l	--	--	0.004	0.004	0.003	0.004	0.001	0.005	0.005	0.003	0.003	0.002	0.004	<0.001
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<b>Petroleum Hydrocarbons</b>															
Benzene	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0010	<0.0010	<0.0020	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	--	<0.1	--	--	--	<0.1
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	--	<0.1	--	<0.1	<0.1	--	--	--	--	--	--	<0.1
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	--	--	--	<0.1	--	--	--	<0.1
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	<0.2	--	--	--	<0.2
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	<0.2	--	--	--	<0.2
Toluene	mg/l	--	0.024	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes, Total	mg/l	--	0.3	--	<0.0015	<0.003	<0.0010	<0.0010	<0.0010	<0.0010	--	--	--	--	<0.0010



Cornwall TDA Embankment - Report of Monitoring Results

1413191-1030

Parameter	Unit	(2) (1) ODWQS(169/03) Health	(4) (3) ODWQS- AO	MW 01 Pre-Construction				MW 01 Construction							
				26-Nov-2010	28-Feb-2011 <sup>(a)</sup>	07-Apr-2011 <sup>(a)</sup>	11-May-2012	14-Jun-2012 <sup>(7)</sup>	17-Sep-2012	18-Dec-2012	11-Apr-2013	05-Jul-2013	21-Oct-2013	03-Feb-2014 <sup>(8)</sup>	26-May-2014
				S-1	S - 2	S-2	S - 2	S-2	S-4	S-4	S-6	S-5	S - 6	S-1	MW - 1
Semi-VOCs															
1-Methylnaphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Acenaphthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Acenaphthylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Anthracene	mg/l	--	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.00001	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--	--
Chrysene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Fluorene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Naphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Phenanthrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Pyrene	mg/l	--	--	<0.00002	<0.00004	0.00010	<0.00002	--	--	--	<0.0001	--	--	--	--
Styrene	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
VOCs															
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	<0.0008	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	<0.0008	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
1,1-Dichloroethane	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
1,2-Dibromoethane	mg/l	--	--	<0.0010	<0.0010	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
1,2-Dichloroethane	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002
1,2-Dichloropropane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	<0.0003
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
Bromodichloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	<0.0003
Bromoform	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
Bromomethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
Carbon Tetrachloride	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002
Chlorobenzene	mg/l	0.08	0.03	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002
Chloroethane	mg/l	--	--	<0.0010	<0.0020	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002
Chloroform	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
Chloromethane	mg/l	--	--	<0.0010	<0.0020	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002
Dibromochloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	<0.0003
Dichlorodifluoromethane	mg/l	--	--	--	--	--	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
Methylene Chloride	mg/l	0.05	--	<0.0040	<0.0040	<0.0080	<0.0040	<0.0040	<0.0040	--	<0.0040	--	--	--	<0.0040
Tetrachloroethylene	mg/l	0.03	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	<0.0003
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	<0.0004
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002
Trichloroethene	mg/l	0.005	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	<0.0003
Trichlorofluoromethane	mg/l	--	--	<0.0005	<0.001	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	<0.0005
Vinyl Chloride	mg/l	0.002	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	<0.0002

Parameter	Unit	(2) (1) ODWQS(169/03) Health	(4) (2) ODWQS- AO	MW 01 Post-Construction			
				09-Oct-2014 MW1	24-Mar-2015 S-5	17-Jun-2015 S-7	27-Aug-2015 S-3
General Chemistry							
Alkalinity (Total as CaCO3)	mg/l	--	--	405	389	399	401
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	<0.05	<0.02
Ammonia Nitrogen	mg/l	--	--	0.12	0.02	0.07	0.073
Ammonium	mg/l	--	--	0.12	0.02	0.07	0.07
Bicarbonate	mg/l	--	--	405	389	399	401
Bromide	mg/l	--	--	<0.25	0.55	<0.25	<0.25
Carbonate (CO3)	mg/l	--	--	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>
Color	color unit	--	5	7	17	7	17
Conductivity (Field)	uS/cm	--	--	1880	1835	2310	2205
Fluoride	mg/l	1.5	--	0.20	0.15	0.24	0.24
Hardness, Calcium Carbonate	mg/l	--	--	665	655	599	623
Nitrate as N	mg/l	10	--	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10
pH (Field)	-	--	--	7.6	7.5	7.6	7.6
Phosphorus	mg/l	--	--	1.51	0.91	0.82	0.68
Sulfate	mg/l	--	500 <sup>(11)</sup>	96	88	110	106
Temperature (Field)	deg c	--	15	8	5	9	12
Total Organic Carbon	mg/l	--	--	4.2	3.3	2.5	2.8
Total Suspended Solids	mg/l	--	--	1800	839	330	890
Turbidity	ntu	--	5 <sup>(12)</sup>	>100	>100	>100	100
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	>100	76	81	>100
Metals							
Aluminum, dissolved	mg/l	--	--	<0.01	0.01	<0.01	<0.01
Arsenic, dissolved	mg/l	0.025	--	<0.001	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	0.24	0.29	0.25	0.21
Beryllium, dissolved	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
Boron, dissolved	mg/l	5	--	0.08	0.04	0.07	0.07
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	197	188	174	182
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	<0.001
Cobalt, dissolved	mg/l	--	--	0.0032	0.0011	0.0014	0.0029
Copper, dissolved	mg/l	--	1	<0.001	<0.001	<0.001	<0.001
Iron, dissolved	mg/l	--	0.3	0.34	0.16	0.16	0.44
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	42	45	40	41
Manganese, dissolved	mg/l	--	0.05	1.19	0.58	0.91	1.04
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005
Nickel, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005
Potassium, dissolved	mg/l	--	--	5	3	3	4
Selenium, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	249	249	225	224
Strontium, dissolved	mg/l	--	--	1.06	1.10	1.13	0.954
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01
Vanadium, dissolved	mg/l	--	--	<0.001	<0.001	<0.001	<0.001
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01
Petroleum Hydrocarbons							
Benzene	mg/l	0.005	--	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0005	<0.0005	<0.0004	<0.0004
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.0004	<0.0004
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	--	--	<0.02	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	--	--	<0.02	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	--	--	<0.05	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	--	--	<0.05	--
Toluene	mg/l	--	0.024	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes, Total	mg/l	--	0.3	--	<0.0010	<0.0005	--

Parameter	Unit	(2) (1)	(4) (3)	MW 01 Post-Construction			
		ODWQS(169/03) Health	ODWQS- AO	09-Oct-2014 MW1	24-Mar-2015 S-5	17-Jun-2015 S-7	27-Aug-2015 S-3
Semi-VOCs							
1-Methylnaphthalene	mg/l	--	--	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	--	--	--	--
Acenaphthene	mg/l	--	--	--	--	--	--
Acenaphthylene	mg/l	--	--	--	--	--	--
Anthracene	mg/l	--	--	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	--
Chrysene	mg/l	--	--	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	--
Fluoranthene	mg/l	--	--	--	--	--	--
Fluorene	mg/l	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	--
Naphthalene	mg/l	--	--	--	--	--	--
Phenanthrene	mg/l	--	--	--	--	--	--
Pyrene	mg/l	--	--	--	--	--	--
Styrene	mg/l	--	--	--	--	<0.0005	--
VOCs							
1,1,1,2-Tetrachloroethane	mg/l	--	--	--	--	<0.0005	--
1,1,1-Trichloroethane	mg/l	--	--	--	--	<0.0004	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	--	--	<0.0005	--
1,1,2-Trichloroethane	mg/l	--	--	--	--	<0.0004	--
1,1-Dichloroethane	mg/l	--	--	--	--	<0.0004	--
1,1-Dichloroethylene	mg/l	0.014	--	--	--	<0.0005	--
1,2-Dibromoethane	mg/l	--	--	--	--	<0.0002	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	--	--	<0.0004	--
1,2-Dichloroethane	mg/l	0.005	--	--	--	<0.0002	--
1,2-Dichloropropane	mg/l	--	--	--	--	<0.0005	--
1,3,5-Trimethylbenzene	mg/l	--	--	--	--	<0.0003	--
1,3-Dichlorobenzene	mg/l	--	--	--	--	<0.0004	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	--	--	<0.0004	--
Bromodichloromethane	mg/l	--	--	--	--	<0.0003	--
Bromoform	mg/l	--	--	--	--	<0.0004	--
Bromomethane	mg/l	--	--	--	--	<0.0005	--
Carbon Tetrachloride	mg/l	0.005	--	--	--	<0.0002	--
Chlorobenzene	mg/l	0.08	0.03	--	--	<0.0002	--
Chloroethane	mg/l	--	--	--	--	<0.0002	--
Chloroform	mg/l	--	--	--	--	<0.0005	--
Chloromethane	mg/l	--	--	--	--	<0.0002	--
cis-1,2-Dichloroethene	mg/l	--	--	--	--	<0.0004	--
cis-1,2-Dichloropropene	mg/l	--	--	--	--	<0.0002	--
Dibromochloromethane	mg/l	--	--	--	--	<0.0003	--
Dichlorodifluoromethane	mg/l	--	--	--	--	<0.0005	--
Methylene Chloride	mg/l	0.05	--	--	--	<0.0040	--
Tetrachloroethylene	mg/l	0.03	--	--	--	<0.0003	--
trans-1,2-Dichloroethene	mg/l	--	--	--	--	<0.0004	--
trans-1,3-Dichloropropene	mg/l	--	--	--	--	<0.0002	--
Trichloroethene	mg/l	0.005	--	--	--	<0.0003	--
Trichlorofluoromethane	mg/l	--	--	--	--	<0.0005	--
Vinyl Chloride	mg/l	0.002	--	--	--	<0.0002	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (3) ODWQS(169/03)- Health	(4) (3) ODWQS- AO	MW 02 Pre-Construction				MW 02 Construction						
				26-Nov-2010	28-Feb-2011 <sup>(12)</sup>	07-Apr-2011 <sup>(13)</sup>	11-May-2012	14-Jun-2012 <sup>(7)</sup>	17-Sep-2012	18-Dec-2012 <sup>(14)</sup>	11-Apr-2013	05-Jul-2013	21-Oct-2013	03-Feb-2014 <sup>(15)</sup>
				S-2	S-1	S-4	S-1	S-1	S-3	S-6	S-5	S-4	S-5	S-3
<b>General Chemistry</b>														
Alkalinity (Total as CaCO3)	mg/l	--	--	378	414	402	396	409	431	409	381	383	392	399
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Ammonia Nitrogen	mg/l	--	--	0.11	0.05	0.02	0.03	0.06	0.04	0.05	0.05	0.04	0.02	0.07
Ammonium	mg/l	--	--	0.11	0.05	0.02	0.03	0.06	0.04	0.05	0.05	<0.02	0.02	0.07
Bicarbonate	mg/l	--	--	378	414	402	396	409	431	409	381	383	392	399
Bromide	mg/l	--	--	<0.25	<0.25	<0.25	0.51	0.58	<0.25	<0.25	<0.25	<0.25	<0.25	<0.50
Carbonate (CO3)	mg/l	--	--	<2 <sup>(10)</sup>	<2 <sup>(10)</sup>	<2 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>
Color	color unit	--	5	8	<2	4	2	3	<2	5	9	3	2	4
Conductivity (Field)	uS/cm	--	--	2819	2500	2760	2360	2730	2905	2130	3060	3050	2940	3910
Fluoride	mg/l	1.5	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Hardness, Calcium Carbonate	mg/l	--	--	668	530	529	511	398	862	879	606	575	652	642
Nitrate as N	mg/l	10	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (Field)	-	--	--	6.79	7.36	7.7	7.2	7.7	7.6	7.3	7.2	7.7	7.6	7.6
Phosphorus	mg/l	--	--	0.06	0.02	0.03	3.60	0.52	6.13	5.95	5.62	5.54	2.94	1.72
Sulfate	mg/l	--	500 <sup>(11)</sup>	49	44	40	52	55	92	88	56	55	68	53
Temperature (Field)	deg c	--	15	8.3	5.6	5	13	12	13	7	5	12	8	6
Total Organic Carbon	mg/l	--	--	5.8	2.9	2.9	2.5	2.6	3.9	2.9	2.6	3.1	4.1	2.3
Total Suspended Solids	mg/l	--	--	132000	62500	57900	28000	15400	9030	7740	9370	6060	6460	1050
Turbidity	ntu	--	5 <sup>(12)</sup>	>100	>100	--	<0.1	>100	>100	>100	42.6 <sup>(13)</sup>	>100	>100	>100
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	--	--	--	208	195	145	220	-- <sup>(13)</sup>	>100	>100	>100
<b>Metals</b>														
Aluminum, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, dissolved	mg/l	0.025	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	0.28	0.24	0.19	0.12	0.17	0.33	0.28	0.17	0.20	0.24	0.21
Beryllium, dissolved	mg/l	--	--	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron, dissolved	mg/l	5	--	0.02	<0.01	<0.01	0.01	0.02	0.03	0.01	<0.01	<0.01	0.01	<0.01
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	190	153	154	142	115	256	258	175	166	187	188
Chromium, dissolved	mg/l	0.05	--	<0.005	<0.005	<0.005	<0.005	0.001	<0.005	<0.005	0.007	0.005	0.008	0.007
Cobalt, dissolved	mg/l	--	--	0.0032	0.0021	0.0018	0.0006	0.0011	0.0018	0.0011	0.0004	0.0023	0.0014	0.0002
Copper, dissolved	mg/l	--	1	0.001	0.001	0.001	<0.001	0.004	0.001	0.001	0.001	<0.001	<0.001	<0.001
Iron, dissolved	mg/l	--	0.3	<0.03	<0.03	<0.03	<0.03	<0.03	0.08	<0.03	<0.03	<0.03	0.09	<0.03
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	47	36	35	38	27	54	57	41	39	45	42
Manganese, dissolved	mg/l	--	0.05	0.43	0.33	0.25	0.07	0.12	0.14	0.13	0.03	0.24	0.17	0.02
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel, dissolved	mg/l	--	--	0.008	0.005	0.006	<0.005	<0.005	0.008	0.006	<0.005	<0.005	0.005	<0.005
Potassium, dissolved	mg/l	--	--	3	2	2	2	1	3	3	2	2	2	3
Selenium, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	446	355	358	351	297	711	608	473	438	425	462
Strontium, dissolved	mg/l	--	--	0.744	0.586	0.513	0.429	0.482	0.994	0.820	0.565	0.525	0.704	0.618
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium, dissolved	mg/l	--	--	0.004	0.004	0.003	0.004	<0.001	0.004	0.003	0.002	0.001	0.002	0.002
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<b>Petroleum Hydrocarbons</b>														
Benzene	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0010	<0.0010	<0.0020	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	--	<0.1	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	--	<0.1	--	<0.1	<0.1	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	--	--	--	<0.1	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	0.2	<0.2	<0.2	<0.2	--	--	--	<0.2	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	<0.2	--	--	--
Toluene	mg/l	--	0.024	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes, Total	mg/l	--	0.3	--	<0.0015	<0.003	<0.0010	<0.0010	<0.0010	<0.0010	--	--	--	--

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Parameter	Unit	(2) (1) ODWQS(169/03)- Health	(4) (3) ODWQS- AO	MW 02 Pre-Construction				MW 02 Construction						
				26-Nov-2010	28-Feb-2011 <sup>(15)</sup>	07-Apr-2011 <sup>(16)</sup>	11-May-2012	14-Jun-2012 <sup>(7)</sup>	17-Sep-2012	18-Dec-2012 <sup>(16)</sup>	11-Apr-2013	05-Jul-2013	21-Oct-2013	03-Feb-2014 <sup>(16)</sup>
				S-2	S - 1	S-4	S - 1	S-1	S-3	S-6	S-5	S-4	S - 5	S-3
Semi-VOCs														
1-Methylnaphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
2-Methylnaphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Acenaphthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Acenaphthylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Anthracene	mg/l	--	--	0.00032	<0.00002	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--
Benzo[a]anthracene	mg/l	--	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.00001	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Chrysene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Fluorene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Naphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Phenanthrene	mg/l	--	--	0.00046	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Pyrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Styrene	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
VOCs														
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	<0.0008	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	<0.0008	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
1,1-Dichloroethane	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
1,2-Dibromoethane	mg/l	--	--	<0.0010	<0.0010	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
1,2-Dichloroethane	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--
1,2-Dichloropropane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
Bromodichloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--
Bromoform	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
Bromomethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
Carbon Tetrachloride	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--
Chlorobenzene	mg/l	0.08	0.03	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--
Chloroethane	mg/l	--	--	<0.0010	<0.0020	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--
Chloroform	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
Chloromethane	mg/l	--	--	<0.0010	<0.0020	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--
Dibromochloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--
Dichlorodifluoromethane	mg/l	--	--	--	--	--	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
Methylene Chloride	mg/l	0.05	--	<0.0040	<0.0040	<0.0080	<0.0040	<0.0040	<0.0040	--	<0.0040	--	--	--
Tetrachloroethylene	mg/l	0.03	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--
Trichloroethene	mg/l	0.005	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--
Trichlorofluoromethane	mg/l	--	--	<0.0005	<0.001	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--
Vinyl Chloride	mg/l	0.002	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (1) ODWQS(169/03)- Health	(4) (3) ODWQS- AO	Construction MW 02	Post-Construction MW 02				
				26-May-2014	09-Oct-2014	24-Mar-2015	17-Jun-2015 <sup>(17)</sup>	27-Aug-2015 <sup>(18)</sup>	
				MW - 2	MW 2	S-4	S-5	S-5	
General Chemistry									
Alkalinity (Total as CaCO3)	mg/l	--	--	392	385	405	354	394	
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	<0.02	<0.05	<0.02	
Ammonia Nitrogen	mg/l	--	--	0.05	0.08	<0.02	<0.05	<0.025	
Ammonium	mg/l	--	--	0.05	0.08	<0.02	<0.05	<0.02	
Bicarbonate	mg/l	--	--	392	385	405	354	394	
Bromide	mg/l	--	--	0.53	<0.25	0.95	<0.50	<1.25	
Carbonate (CO3)	mg/l	--	--	<1 <sup>(19)</sup>	<1 <sup>(19)</sup>	<1 <sup>(19)</sup>	<1 <sup>(19)</sup>	<1 <sup>(19)</sup>	
Color	color unit	--	5	12	2	4	2	4	
Conductivity (Field)	uS/cm	--	--	3010	2895	3150	3410	1985	
Fluoride	mg/l	1.5	--	<0.10	<0.10	<0.10	<0.10	<0.10	
Hardness, Calcium Carbonate	mg/l	--	--	506	720	756	476	968	
Nitrate as N	mg/l	10	--	<0.10	<0.10	<0.10	<0.10	<0.10	
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	<0.10	
pH (Field)	-	--	--	7.3	7.4	7.4	7.7	7.6	
Phosphorus	mg/l	--	--	1.56	2.26	2.46	14.6	2.42	
Sulfate	mg/l	--	500 <sup>(11)</sup>	48	83	68	60	98	
Temperature (Field)	deg c	--	15	8	7	6	9	13	
Total Organic Carbon	mg/l	--	--	2.4	2.5	2.6	1.3	1.5	
Total Suspended Solids	mg/l	--	--	2180	713	2640	8220	1840	
Turbidity	ntu	--	5 <sup>(12)</sup>	≥100	≥100	≥100	≥100	100	
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	≥100	≥100	≥100	≥100	≥100	
Metals									
Aluminum, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.1	<0.01	
Arsenic, dissolved	mg/l	0.025	--	<0.001	<0.001	<0.001	<0.01	<0.001	
Barium, dissolved	mg/l	1	--	0.14	0.28	0.27	0.3	0.30	
Beryllium, dissolved	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.005	<0.0005	
Boron, dissolved	mg/l	5	--	<0.01	0.02	0.01	<0.1	0.01	
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	
Calcium, dissolved	mg/l	--	--	145	219	222	138	292	
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	<0.01	<0.001	
Cobalt, dissolved	mg/l	--	--	0.0005	0.0007	0.0005	<0.002	0.0027	
Copper, dissolved	mg/l	--	1	<0.001	<0.001	<0.001	<0.01	<0.001	
Iron, dissolved	mg/l	--	0.3	<0.03	0.09	<0.03	<0.3	0.24	
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.01	<0.001	
Magnesium, dissolved	mg/l	--	--	35	42	49	32	58	
Manganese, dissolved	mg/l	--	0.05	0.05	0.06	0.06	<0.1	0.19	
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.05	<0.005	
Nickel, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.05	<0.005	
Potassium, dissolved	mg/l	--	--	<1	3	2	2	3	
Selenium, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.01	<0.001	
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	430	548	596	522	697	
Strontium, dissolved	mg/l	--	--	0.454	0.870	0.794	1.13	0.961	
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.1	<0.01	
Vanadium, dissolved	mg/l	--	--	<0.001	<0.001	<0.001	<0.01	<0.001	
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.1	<0.01	
Petroleum Hydrocarbons									
Benzene	mg/l	0.005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
m,p-Xylenes	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004	
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004	
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	--	--	<0.02	--	
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	<0.1	--	--	--	--	
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	--	--	<0.02	--	
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	<0.2	--	--	<0.05	--	
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	--	--	<0.05	--	
Toluene	mg/l	--	0.024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Xylenes, Total	mg/l	--	0.3	<0.0010	--	<0.0010	<0.0005	--	



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Parameter	Unit	(2) (1)	(4) (3)	Construction MW 02	Post-Construction MW 02				
		ODWQS(169/03)- Health	ODWQS- AO	26-May-2014	09-Oct-2014	24-Mar-2015	17-Jun-2015 <sup>(17)</sup>	27-Aug-2015 <sup>(18)</sup>	
				MW - 2	MW 2	S-4	S-5	S-5	
Semi-VOCs									
1-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	
2-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	
Acenaphthene	mg/l	--	--	--	--	--	--	--	
Acenaphthylene	mg/l	--	--	--	--	--	--	--	
Anthracene	mg/l	--	--	--	--	--	--	--	
Benzo[a]anthracene	mg/l	--	--	--	--	--	--	--	
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	--	--	
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	--	--	
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	--	--	
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	--	--	
Chrysene	mg/l	--	--	--	--	--	--	--	
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	--	--	
Fluoranthene	mg/l	--	--	--	--	--	--	--	
Fluorene	mg/l	--	--	--	--	--	--	--	
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	--	--	
Naphthalene	mg/l	--	--	--	--	--	--	--	
Phenanthrene	mg/l	--	--	--	--	--	--	--	
Pyrene	mg/l	--	--	--	--	--	--	--	
Styrene	mg/l	--	--	<0.0005	--	--	<0.0005	--	
VOCs									
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1-Dichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	--	--	<0.0005	--	
1,2-Dibromoethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	--	--	<0.0004	--	
1,2-Dichloroethane	mg/l	0.005	--	<0.0002	--	--	<0.0002	--	
1,2-Dichloropropane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	--	--	<0.0003	--	
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	--	--	<0.0004	--	
Bromodichloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--	
Bromoform	mg/l	--	--	<0.0004	--	--	<0.0004	--	
Bromomethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Carbon Tetrachloride	mg/l	0.005	--	<0.0002	--	--	<0.0002	--	
Chlorobenzene	mg/l	0.08	0.03	<0.0002	--	--	<0.0002	--	
Chloroethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Chloroform	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Chloromethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Dibromochloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--	
Dichlorodifluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Methylene Chloride	mg/l	0.05	--	<0.0040	--	--	<0.0040	--	
Tetrachloroethylene	mg/l	0.03	--	<0.0003	--	--	<0.0003	--	
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Trichloroethene	mg/l	0.005	--	<0.0003	--	--	<0.0003	--	
Trichlorofluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Vinyl Chloride	mg/l	0.002	--	<0.0002	--	--	<0.0002	--	

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (1)	(4) (3)	MW 03 Pre-Construction				Construction MW 03						
		ODWQS(169/ 03)-Health	ODWQS- AO	29-Nov-2010 <sup>(16)</sup>	28-Feb-2011 <sup>(15)</sup>	07-Apr-2011 <sup>(20)</sup>	11-May-2012 <sup>(21)</sup>	14-Jun-2012 <sup>(22)</sup>	17-Sep-2012 <sup>(23)</sup>	18-Dec-2012 <sup>(24)</sup>	11-Apr-2013 <sup>(24)</sup>	05-Jul-2013 <sup>(24)</sup>	21-Oct-2013 <sup>(24)</sup>	03-Feb-2014 <sup>(16)</sup>
				S-1	S-4	S-5	S-5	S-4	S-1	S-1	S-3	S-2	S-3	S-4
<b>General Chemistry</b>														
Alkalinity (Total as CaCO3)	mg/l	--	--	416	380	404	404	421	371	408	397	397	386	401
Ammonia, unionized	mg/l	--	--	0.05	0.03	0.05	0.03	0.04	0.04	<0.02	<0.02	<0.02	<0.02	<0.02
Ammonia Nitrogen	mg/l	--	--	4.32	2.36	4.46	2.42	3.28	2.97	0.48	0.82	0.68	0.81	1.02
Ammonium	mg/l	--	--	4.27	2.33	4.41	2.39	3.24	2.93	0.48	0.82	0.68	0.81	1.02
Bicarbonate	mg/l	--	--	416	380	404	404	421	371	408	397	397	386	401
Bromide	mg/l	--	--	<0.25	1.01	1.00	1.35	1.77	0.86	1.41	3.98	1.99	0.80	0.84
Carbonate (CO3)	mg/l	--	--	<2 <sup>(10)</sup>	<2 <sup>(10)</sup>	<2 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>
Color	color unit	--	5	10	11	23	12	10	6	3	3	3	5	4
Conductivity (Field)	uS/cm	--	--	1960	2500	2740	2814	2590	2605	2650	2860	3100	3210	3180
Fluoride	mg/l	1.5	--	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10
Hardness, Calcium Carbonate	mg/l	--	--	646	587	868	764	689	752	803	948	975	877	1140
Nitrate as N	mg/l	10	--	<0.10	<0.10	<0.10	0.52	0.54	0.15	0.12	0.72	0.40	<0.10	0.75
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (Field)	-	--	--	6.98	7.1	7.35	6.92	7.8	7.7	7.4	6.9	7.4	7.5	7.4
Phosphorus	mg/l	--	--	12.1	3.27	2.86	2.55	1.74	1.25	1.25	2.73	2.34	3.18	6.89
Sulfate	mg/l	--	500 <sup>(11)</sup>	9	21	21	98	104	98	146	151	166	228	235
Temperature (Field)	deg c	--	15	8.2	6.7	6.6	8.8	12	14	7	6	11	8	6
Total Organic Carbon	mg/l	--	--	24.5	10.0	10.0	8.5	7.3	15.3	7.6	6.6	8.6	9.1	16.0
Total Suspended Solids	mg/l	--	--	8720	4380	7930	4920	3240	8660	1120	3330	1630	3460	4000
Turbidity	ntu	--	5 <sup>(12)</sup>	≥100	≥100	--	<0.1	≥100	≥100	<0.1	47.5	≥100	≥100	≥100
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	--	--	--	250	145	--	213	410	≥100	≥100	≥100
<b>Metals</b>														
Aluminum, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, dissolved	mg/l	0.025	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium, dissolved	mg/l	1	--	0.32	0.30	0.35	0.28	0.34	0.34	0.30	0.28	0.32	0.32	0.40
Beryllium, dissolved	mg/l	--	--	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron, dissolved	mg/l	5	--	0.03	0.02	0.02	0.02	0.02	0.16	0.06	0.02	0.03	0.03	0.02
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	183	174	270	222	200	194	236	279	280	249	333
Chromium, dissolved	mg/l	0.05	--	0.007	0.009	<0.005	<0.005	0.005	0.009	0.008	0.009	0.009	<0.005	0.008
Cobalt, dissolved	mg/l	--	--	0.0033	0.0043	0.0039	0.0068	0.0079	0.0043	0.0059	0.0073	0.0075	0.0130	0.0106
Copper, dissolved	mg/l	--	1	<0.001	0.001	0.001	<0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001
Iron, dissolved	mg/l	--	0.3	21.5	9.66	13.9	16.0	16.2	19.9	0.55	1.43	6.74	5.32	10.1
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	46	37	47	51	46	65	52	61	67	62	74
Manganese, dissolved	mg/l	--	0.05	2.42	2.66	3.03	6.80	7.94	2.60	5.27	9.39	7.90	13.6	10.8
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel, dissolved	mg/l	--	--	<0.005	0.006	0.008	0.010	0.012	0.006	0.008	0.015	0.010	0.015	0.016
Potassium, dissolved	mg/l	--	--	5	2	3	2	2	9	3	3	5	3	6
Selenium, dissolved	mg/l	0.01	--	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	173	196	239	238	215	239	214	301	294	249	346
Strontium, dissolved	mg/l	--	--	0.739	0.671	0.799	0.794	0.908	0.863	0.878	0.995	0.938	1.00	1.11
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium, dissolved	mg/l	--	--	0.006	0.005	0.004	0.006	0.002	0.006	0.006	0.005	0.004	0.005	0.004
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
<b>Petroleum Hydrocarbons</b>														
Benzene	mg/l	0.005	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/l	--	0.0024	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0020	<0.0010	<0.0020	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
o-Xylene	mg/l	--	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	--	<0.1	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	<0.1	<0.1	--	<0.1	<0.1	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	--	--	--	<0.1	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	<0.2	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	<0.2	--	--	--
Toluene	mg/l	--	0.024	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes, Total	mg/l	--	0.3	--	<0.0015	<0.003	<0.0010	<0.0010	<0.0010	--	<0.0010	--	--	--

Parameter	Unit	(2) (1) ODWQS(169/ 03)-Health	(4) (3) ODWQS- AO	MW 03 Pre-Construction				Construction MW 03							
				29-Nov-2010 <sup>(16)</sup>	28-Feb-2011 <sup>(19)</sup>	07-Apr-2011 <sup>(20)</sup>	11-May-2012 <sup>(21)</sup>	14-Jun-2012 <sup>(22)</sup>	17-Sep-2012 <sup>(23)</sup>	18-Dec-2012 <sup>(24)</sup>	11-Apr-2013 <sup>(25)</sup>	05-Jul-2013 <sup>(26)</sup>	21-Oct-2013 <sup>(26)</sup>	03-Feb-2014 <sup>(16)</sup>	
				S-1	S - 4	S-5	S - 5	S-4	S-1	S-1	S-3	S-2	S - 3	S-4	
Semi-VOCs															
1-Methylnaphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Acenaphthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Acenaphthylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Anthracene	mg/l	--	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.00001	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--	--
Chrysene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Fluorene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Naphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Phenanthrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Pyrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--	--
Styrene	mg/l	--	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
VOCs															
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0008	<0.0008	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0008	<0.0008	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
1,1-Dichloroethane	mg/l	--	--	<0.0008	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
1,2-Dibromoethane	mg/l	--	--	<0.0020	<0.0010	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0008	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
1,2-Dichloroethane	mg/l	0.005	--	<0.001	<0.0005	<0.001	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--
1,2-Dichloropropane	mg/l	--	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0006	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0008	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0008	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
Bromodichloromethane	mg/l	--	--	<0.0006	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	--
Bromoform	mg/l	--	--	<0.0008	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
Bromomethane	mg/l	--	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
Carbon Tetrachloride	mg/l	0.005	--	<0.001	<0.0005	<0.001	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--
Chlorobenzene	mg/l	0.08	0.03	<0.0004	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--
Chloroethane	mg/l	--	--	<0.0020	<0.0020	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--
Chloroform	mg/l	--	--	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
Chloromethane	mg/l	--	--	<0.0020	<0.0020	<0.0020	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0008	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0004	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--
Dibromochloromethane	mg/l	--	--	<0.0006	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	--
Dichlorodifluoromethane	mg/l	--	--	--	--	--	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
Methylene Chloride	mg/l	0.05	--	<0.0080	<0.0040	<0.0080	<0.0040	<0.0040	<0.0040	--	<0.0040	--	--	--	--
Tetrachloroethylene	mg/l	0.03	--	<0.0006	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0008	<0.0004	<0.0008	<0.0004	<0.0004	<0.0004	--	<0.0004	--	--	--	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0004	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--
Trichloroethene	mg/l	0.005	--	<0.0006	<0.0003	<0.0006	<0.0003	<0.0003	<0.0003	--	<0.0003	--	--	--	--
Trichlorofluoromethane	mg/l	--	--	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	--	--	--	--
Vinyl Chloride	mg/l	0.002	--	<0.0004	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	--	<0.0002	--	--	--	--

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Parameter	Unit	(2) (1)	(4) (3)	Construction MW 03	Post-Cosntruction MW 03				
		ODWQS(169/ 03)-Health	ODWQS- AO	26-May-2014	09-Oct-2014	24-Mar-2015	17-Jun-2015 <sup>(17)</sup>	27-Aug-2015 <sup>(17)</sup>	
				MW - 3	MW 3	S-1	S-2	S-1	
General Chemistry									
Alkalinity (Total as CaCO3)	mg/l	--	--	416	357	381	424	391	
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	<0.02	<0.05	0.06	
Ammonia Nitrogen	mg/l	--	--	1.48	1.39	0.88	1.05	1.48	
Ammonium	mg/l	--	--	1.48	1.39	0.88	1.04	1.42	
Bicarbonate	mg/l	--	--	416	357	381	424	391	
Bromide	mg/l	--	--	1.44	<0.25	1.33	<0.50	<1.25	
Carbonate (CO3)	mg/l	--	--	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	
Color	color unit	--	5	16	17	6	4	2	
Conductivity (Field)	uS/cm	--	--	3100	3210	3205	4250	--	
Fluoride	mg/l	1.5	--	<0.10	<0.10	<0.10	<0.10	<0.10	
Hardness, Calcium Carbonate	mg/l	--	--	1190	1150	1240	1220	1140	
Nitrate as N	mg/l	10	--	0.48	<0.10	<0.10	0.51	<0.10	
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	<0.10	
pH (Field)	-	--	--	7.3	7.4	7.3	7.3	--	
Phosphorus	mg/l	--	--	2.01	3.91	1.26	1.85	0.97	
Sulfate	mg/l	--	500 <sup>(11)</sup>	274	335	318	299	337	
Temperature (Field)	deg c	--	15	7	7	4	10	--	
Total Organic Carbon	mg/l	--	--	7.5	9.8	6.4	4.5	7.2	
Total Suspended Solids	mg/l	--	--	1330	7050	1240	694	6770	
Turbidity	ntu	--	5 <sup>(12)</sup>	≥100	≥100	≥100	≥100	100	
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	≥100	≥100	≥100	≥100	≥100	
Metals									
Aluminum, dissolved	mg/l	--	--	<0.01	0.02	<0.01	<0.1	<0.1	
Arsenic, dissolved	mg/l	0.025	--	<0.001	0.002	<0.001	<0.01	<0.01	
Barium, dissolved	mg/l	1	--	0.41	0.37	0.36	0.3	0.3	
Beryllium, dissolved	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.005	<0.005	
Boron, dissolved	mg/l	5	--	0.02	0.05	0.02	<0.1	<0.1	
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.001	<0.001	
Calcium, dissolved	mg/l	--	--	339	347	361	364	336	
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	<0.01	<0.01	
Cobalt, dissolved	mg/l	--	--	0.0085	0.0068	0.0042	0.004	0.003	
Copper, dissolved	mg/l	--	1	<0.001	<0.001	<0.001	<0.01	<0.01	
Iron, dissolved	mg/l	--	0.3	11.6	19.6	6.13	8.9	10.9	
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.01	<0.01	
Magnesium, dissolved	mg/l	--	--	83	69	83	76	72	
Manganese, dissolved	mg/l	--	0.05	11.7	9.04	5.62	5.2	3.2	
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.05	<0.05	
Nickel, dissolved	mg/l	--	--	0.011	<0.005	0.008	<0.05	<0.05	
Potassium, dissolved	mg/l	--	--	2	6	3	4	7	
Selenium, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.01	<0.01	
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.001	<0.001	
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	428	529	555	600	693	
Strontium, dissolved	mg/l	--	--	1.25	1.34	1.32	1.25	1.00	
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.001	<0.001	
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.1	<0.1	
Vanadium, dissolved	mg/l	--	--	<0.001	<0.001	<0.001	<0.01	<0.01	
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.1	<0.1	
Petroleum Hydrocarbons									
Benzene	mg/l	0.005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
m,p-Xylenes	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004	
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004	
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	--	--	<0.02	--	
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	<0.1	--	--	--	--	
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	--	--	<0.02	--	
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	<0.2	--	--	<0.05	--	
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	--	--	<0.05	--	
Toluene	mg/l	--	0.024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Xylenes, Total	mg/l	--	0.3	<0.0010	--	<0.0010	<0.0005	--	

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Parameter	Unit	(2) (1)	(4) (3)	Construction MW 03	Post-Cosntruction MW 03				
		ODWQS(169/ 03)-Health	ODWQS- AO	26-May-2014	09-Oct-2014	24-Mar-2015	17-Jun-2015 <sup>(17)</sup>	27-Aug-2015 <sup>(17)</sup>	
				MW - 3	MW 3	S-1	S-2	S-1	
Semi-VOCs									
1-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	
2-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	
Acenaphthene	mg/l	--	--	--	--	--	--	--	
Acenaphthylene	mg/l	--	--	--	--	--	--	--	
Anthracene	mg/l	--	--	--	--	--	--	--	
Benzo[a]anthracene	mg/l	--	--	--	--	--	--	--	
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	--	--	
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	--	--	
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	--	--	
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	--	--	
Chrysene	mg/l	--	--	--	--	--	--	--	
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	--	--	
Fluoranthene	mg/l	--	--	--	--	--	--	--	
Fluorene	mg/l	--	--	--	--	--	--	--	
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	--	--	
Naphthalene	mg/l	--	--	--	--	--	--	--	
Phenanthrene	mg/l	--	--	--	--	--	--	--	
Pyrene	mg/l	--	--	--	--	--	--	--	
Styrene	mg/l	--	--	<0.0005	--	--	<0.0005	--	
VOCs									
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1-Dichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	--	--	<0.0005	--	
1,2-Dibromoethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	--	--	<0.0004	--	
1,2-Dichloroethane	mg/l	0.005	--	<0.0002	--	--	<0.0002	--	
1,2-Dichloropropane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	--	--	<0.0003	--	
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	--	--	<0.0004	--	
Bromodichloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--	
Bromoform	mg/l	--	--	<0.0004	--	--	<0.0004	--	
Bromomethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Carbon Tetrachloride	mg/l	0.005	--	<0.0002	--	--	<0.0002	--	
Chlorobenzene	mg/l	0.08	0.03	<0.0002	--	--	<0.0002	--	
Chloroethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Chloroform	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Chloromethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Dibromochloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--	
Dichlorodifluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Methylene Chloride	mg/l	0.05	--	<0.0040	--	--	<0.0040	--	
Tetrachloroethylene	mg/l	0.03	--	<0.0003	--	--	<0.0003	--	
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Trichloroethene	mg/l	0.005	--	<0.0003	--	--	<0.0003	--	
Trichlorofluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Vinyl Chloride	mg/l	0.002	--	<0.0002	--	--	<0.0002	--	

Parameter	Unit	(2)	(3)	Pre-Construction MW 04				Construction MW 04							
		ODWQS(169/03)- Health	ODWQS- AO	26-Nov-2010	28-Feb-2011 (5)	07-Apr-2011 (25)	11-May-2012	14-Jun-2012 (26)	28-Jun-2012 (27)	17-Sep-2012 (28)	18-Dec-2012 (28)	11-Apr-2013 (28)	05-Jul-2013 (28)	21-Oct-2013 (28)	
General Chemistry															
Alkalinity (Total as CaCO3)	mg/l	--	--	279	289	271	302	--	296	351	257	338	354	394	
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	<0.02	<0.02	--	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Ammonia Nitrogen	mg/l	--	--	0.07	0.04	0.03	0.03	--	0.11	0.03	0.03	0.03	0.04	0.03	
Ammonium	mg/l	--	--	0.07	0.04	0.03	0.03	--	0.11	0.03	0.03	0.03	0.04	0.03	
Bicarbonate	mg/l	--	--	279	289	271	302	--	296	351	257	338	354	394	
Bromide	mg/l	--	--	<0.25	<0.25	0.75	0.31	--	0.40	1.42	0.61	0.82	0.69	0.99	
Carbonate (CO3)	mg/l	--	--	<2 (10)	<2 (10)	<2 (10)	<1 (10)	--	<1 (10)	<1 (10)	<1 (10)	<1 (10)	<1 (10)	<1 (10)	
Color	color unit	--	5	12	<2	3	<2	--	3	2	7	10	3	2	
Conductivity (Field)	uS/cm	--	--	532	1050	1390	764	--	740	1420	1080	1090	1114	1070	
Fluoride	mg/l	1.5	--	0.13	0.12	<0.10	0.10	--	0.11	0.10	0.15	0.10	0.11	<0.10	
Hardness, Calcium Carbonate	mg/l	--	--	304	240	342	305	--	353	422	403	500	568	569	
Nitrate as N	mg/l	10	--	0.14	0.13	0.50	0.34	--	0.22	0.15	2.45	0.37	0.35	0.11	
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
pH (Field)	-	--	--	7.29	7.9	7.8	7.6	--	7.9	7.36	7.7	7.0	7.5	7.4	
Phosphorus	mg/l	--	--	4.96	6.50	2.69	3.81	--	3.03	3.57	2.65	2.31	4.30	4.48	
Sulfate	mg/l	--	500 (11)	18	21	51	49	--	26	25	122	57	103	113	
Temperature (Field)	deg c	--	15	7.6	6.8	5.8	9	--	13.9	14	6	3	12	8	
Total Organic Carbon	mg/l	--	--	5.4	2.6	2.7	2.5	--	2.0	2.5	3.1	3.3	4.2	5.4	
Total Suspended Solids	mg/l	--	--	15300	29800	14700	12100	--	4700	6080	4010	11400	6660	6790	
Turbidity	ntu	--	5 (12)	≥100	≥100	--	<0.1	--	≥100	≥100	≥100	77.9 (13)	≥100	≥100	
Turbidity (Field)	ntu	--	5 (12)	--	--	--	180	--	142	98	145	-- (13)	≥100	≥100	
Metals															
Aluminum, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Arsenic, dissolved	mg/l	0.025	--	<0.001	<0.001	<0.001	<0.001	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Barium, dissolved	mg/l	1	--	0.05	0.04	0.06	0.05	--	0.05	0.06	0.06	0.05	0.08	0.08	
Beryllium, dissolved	mg/l	--	--	<0.001	<0.0005	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Boron, dissolved	mg/l	5	--	0.02	<0.01	0.04	0.03	--	<0.01	0.02	0.01	<0.01	0.02	0.01	
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Calcium, dissolved	mg/l	--	--	87	63	99	89	--	105	126	122	149	173	170	
Chromium, dissolved	mg/l	0.05	--	0.003	0.004	0.005	0.004	--	0.002	0.003	0.003	0.006	0.002	0.002	
Cobalt, dissolved	mg/l	--	--	0.0005	0.0003	0.0006	0.0005	--	0.0002	0.0002	<0.0002	<0.0002	0.0002	0.0002	
Copper, dissolved	mg/l	--	1	<0.001	<0.001	<0.001	<0.001	--	<0.001	0.009	<0.001	<0.001	<0.001	0.001	
Iron, dissolved	mg/l	--	0.3	<0.03	<0.03	<0.03	<0.03	--	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Magnesium, dissolved	mg/l	--	--	21	20	23	20	--	22	26	24	31	33	35	
Manganese, dissolved	mg/l	--	0.05	0.11	0.05	0.09	0.09	--	0.03	0.02	<0.01	<0.01	0.01	<0.01	
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Nickel, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Potassium, dissolved	mg/l	--	--	2	2	2	<1	--	1	1	2	1	2	1	
Selenium, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.01	<0.001	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Sodium, dissolved	mg/l	--	200 (14)	15	11	31	16	--	22	17	82	27	41	26	
Strontium, dissolved	mg/l	--	--	0.279	0.207	0.452	0.708	--	0.611	0.506	0.655	0.631	0.607	0.556	
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Vanadium, dissolved	mg/l	--	--	0.002	0.002	0.002	0.003	--	0.001	0.003	0.003	0.002	<0.001	0.003	
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	--	<0.01	0.03	<0.01	<0.01	<0.01	0.01	
Petroleum Hydrocarbons															
Benzene	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.001	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
m,p-Xylenes	mg/l	--	--	<0.0010	<0.0010	<0.0020	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	--	--	--	--	<0.1	--	--	
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	--	<0.1	--	<0.1	--	--	--	--	--	--	--	
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	--	--	--	--	<0.1	--	--	
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	--	<0.2	--	--	
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	--	<0.2	--	--	
Toluene	mg/l	--	0.024	<0.0005	<0.0005	<0.001	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Xylenes, Total	mg/l	--	0.3	--	<0.0015	<0.003	<0.0010	--	--	<0.0010	--	<0.0010	--	--	



Parameter	Unit	(2) (1) ODWQS(169/03)- Health	(4) (3) ODWQS- AO	Pre-Construction MW 04				Construction MW 04						
				26-Nov-2010	28-Feb-2011 <sup>(5)</sup>	07-Apr-2011 <sup>(25)</sup>	11-May-2012	14-Jun-2012 <sup>(26)</sup>	28-Jun-2012 <sup>(27)</sup>	17-Sep-2012 <sup>(28)</sup>	18-Dec-2012 <sup>(28)</sup>	11-Apr-2013 <sup>(28)</sup>	05-Jul-2013 <sup>(28)</sup>	21-Oct-2013 <sup>(28)</sup>
				S-4	S-5	S-6	S-4	S-4	S-1	S-2	S-2	S-4	S-1	S-1
<b>Semi-VOCs</b>														
1-Methylnaphthalene	mg/l	--	--	0.00004	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
2-Methylnaphthalene	mg/l	--	--	0.00004	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Acenaphthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Acenaphthylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Anthracene	mg/l	--	--	0.00044	<0.00002	<0.00001	<0.00001	--	--	--	--	<0.0001	--	--
Benzo[a]anthracene	mg/l	--	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	--	<0.0001	--	--
Benzo[a]pyrene	mg/l	0.00001	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	--	<0.00001	--	--
Benzo[b]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.00005	--	--
Benzo[g,h,i]perylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Benzo[k]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.00005	--	--
Chrysene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.00005	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Fluorene	mg/l	--	--	0.00023	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Naphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Phenanthrene	mg/l	--	--	0.00032	<0.00004	<0.00002	<0.00002	--	--	--	--	<0.0001	--	--
Pyrene	mg/l	--	--	0.00004	<0.00004	0.00009	<0.00002	--	--	--	--	<0.0001	--	--
Styrene	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	--	--	<0.0005	--	<0.0005	--	--
<b>VOCs</b>														
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	--	--	<0.0005	--	<0.0005	--	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	<0.0008	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	--	--	<0.0005	--	<0.0005	--	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	<0.0008	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
1,1-Dichloroethane	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	<0.0005	<0.001	<0.0005	--	--	<0.0005	--	<0.0005	--	--
1,2-Dibromoethane	mg/l	--	--	<0.0010	<0.0010	<0.0020	<0.0002	--	--	<0.0002	--	<0.0002	--	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	<0.0004	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
1,2-Dichloroethane	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0002	--	--	<0.0002	--	<0.0002	--	--
1,2-Dichloropropane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	--	--	<0.0005	--	<0.0005	--	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	--	--	<0.0003	--	<0.0003	--	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	<0.0004	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
Bromodichloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	--	--	<0.0003	--	<0.0003	--	--
Bromoform	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
Bromomethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	--	--	<0.0005	--	<0.0005	--	--
Carbon Tetrachloride	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0002	--	--	<0.0002	--	<0.0002	--	--
Chlorobenzene	mg/l	0.08	0.03	<0.0002	<0.0002	<0.0004	<0.0002	--	--	<0.0002	--	<0.0002	--	--
Chloroethane	mg/l	--	--	<0.0010	<0.0020	<0.0020	<0.0002	--	--	<0.0002	--	<0.0002	--	--
Chloroform	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	--	--	<0.0005	--	<0.0005	--	--
Chloromethane	mg/l	--	--	<0.0010	<0.0020	<0.0020	<0.0002	--	--	<0.0002	--	<0.0002	--	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	<0.0004	<0.0002	--	--	<0.0002	--	<0.0002	--	--
Dibromochloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	--	--	<0.0003	--	<0.0003	--	--
Dichlorodifluoromethane	mg/l	--	--	--	--	--	<0.0005	--	--	<0.0005	--	<0.0005	--	--
Methylene Chloride	mg/l	0.05	--	<0.0040	<0.0040	<0.0080	<0.0040	--	--	<0.0040	--	<0.0040	--	--
Tetrachloroethylene	mg/l	0.03	--	<0.0003	<0.0003	<0.0006	<0.0003	--	--	<0.0003	--	<0.0003	--	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	--	--	<0.0004	--	<0.0004	--	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	<0.0004	<0.0002	--	--	<0.0002	--	<0.0002	--	--
Trichloroethene	mg/l	0.005	--	<0.0003	<0.0003	<0.0006	<0.0003	--	--	<0.0003	--	<0.0003	--	--
Trichlorofluoromethane	mg/l	--	--	<0.0005	<0.001	<0.001	<0.0005	--	--	<0.0005	--	<0.0005	--	--
Vinyl Chloride	mg/l	0.002	--	<0.0002	<0.0002	<0.0004	<0.0002	--	--	<0.0002	--	<0.0002	--	--

**Cornwall TDA Embankment - Report of Monitoring Results**

1413191-1030

Parameter	Unit	(2) (1)	(4) (3)	Construction MW 04		Post-Construction MW 04			
		ODWQS(169/03)- Health	ODWQS- AO	03-Feb-2014 <sup>(26)</sup>	26-May-2014	09-Oct-2014	24-Mar-2015	17-Jun-2015	27-Aug-2015
				S-5	MW - 4	MW 4	S-2	S-1	S-2
General Chemistry									
Alkalinity (Total as CaCO3)	mg/l	--	--	370	237	379	427	640	443
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
Ammonia Nitrogen	mg/l	--	--	<0.02	0.09	0.10	0.11	0.10	0.045
Ammonium	mg/l	--	--	<0.02	0.09	0.10	0.11	0.10	0.04
Bicarbonate	mg/l	--	--	370	237	379	427	640	443
Bromide	mg/l	--	--	1.18	<0.25	0.36	0.56	<0.25	0.53
Carbonate (CO3)	mg/l	--	--	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>
Color	color unit	--	5	15	12	2	4	10	23
Conductivity (Field)	uS/cm	--	--	1290	1085	1105	1140	1280	1320
Fluoride	mg/l	1.5	--	<0.10	0.20	0.10	<0.10	<0.10	<0.10
Hardness, Calcium Carbonate	mg/l	--	--	590	319	577	648	751	683
Nitrate as N	mg/l	10	--	0.22	1.00	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (Field)	-	--	--	7.7	7.5	7.6	7.4	7.8	7.6
Phosphorus	mg/l	--	--	0.01	4.05	2.20	0.44	0.81	2.42
Sulfate	mg/l	--	500 <sup>(11)</sup>	114	124	120	154	217	171
Temperature (Field)	deg c	--	15	5	7	6	5	9	13
Total Organic Carbon	mg/l	--	--	4.7	3.9	3.8	5.3	6.8	2.9
Total Suspended Solids	mg/l	--	--	9200	3420	5040	1010	324	5560
Turbidity	ntu	--	5 <sup>(12)</sup>	≥100	≥100	≥100	≥100	≥100	100
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	≥100	≥100	≥100	≥100	≥100	≥100
Metals									
Aluminum, dissolved	mg/l	--	--	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
Arsenic, dissolved	mg/l	0.025	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	0.07	0.06	0.09	0.08	0.16	0.09
Beryllium, dissolved	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron, dissolved	mg/l	5	--	<0.01	0.10	0.02	0.03	0.16	0.01
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	177	98	175	195	228	206
Chromium, dissolved	mg/l	0.05	--	0.007	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt, dissolved	mg/l	--	--	<0.0002	<0.0002	0.0002	0.0018	0.0027	0.0026
Copper, dissolved	mg/l	--	1	0.002	0.001	0.001	0.002	<0.001	<0.001
Iron, dissolved	mg/l	--	0.3	<0.03	<0.03	<0.03	0.13	0.34	0.10
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	36	18	34	39	44	41
Manganese, dissolved	mg/l	--	0.05	<0.01	0.01	0.03	0.17	0.78	0.27
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel, dissolved	mg/l	--	--	<0.005	<0.005	<0.005	<0.005	0.007	<0.005
Potassium, dissolved	mg/l	--	--	2	2	2	2	3	2
Selenium, dissolved	mg/l	0.01	--	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	26	56	32	80	138	50
Strontium, dissolved	mg/l	--	--	0.421	1.33	0.542	1.30	5.61	0.676
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium, dissolved	mg/l	--	--	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Petroleum Hydrocarbons									
Benzene	mg/l	0.005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0004	<0.0004
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	--	<0.1	--	--	<0.02	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	--	<0.1	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	--	<0.1	--	--	<0.02	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	--	<0.2	--	--	<0.05	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	--	<0.2	--	--	<0.05	--
Toluene	mg/l	--	0.024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes, Total	mg/l	--	0.3	--	<0.0010	--	<0.0010	<0.0005	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (1)	(4) (3)	Construction MW 04		Post-Construction MW 04			
		ODWQS(169/03)- Health	ODWQS- AO	03-Feb-2014 <sup>(2b)</sup>	26-May-2014	09-Oct-2014	24-Mar-2015	17-Jun-2015	27-Aug-2015
Semi-VOCs									
1-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	--
Acenaphthene	mg/l	--	--	--	--	--	--	--	--
Acenaphthylene	mg/l	--	--	--	--	--	--	--	--
Anthracene	mg/l	--	--	--	--	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	--	--	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	--	--	--
Chrysene	mg/l	--	--	--	--	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	--	--	--
Fluoranthene	mg/l	--	--	--	--	--	--	--	--
Fluorene	mg/l	--	--	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	--	--	--
Naphthalene	mg/l	--	--	--	--	--	--	--	--
Phenanthrene	mg/l	--	--	--	--	--	--	--	--
Pyrene	mg/l	--	--	--	--	--	--	--	--
Styrene	mg/l	--	--	--	<0.0005	--	--	<0.0005	--
VOCs									
1,1,1,2-Tetrachloroethane	mg/l	--	--	--	<0.0005	--	--	<0.0005	--
1,1,1-Trichloroethane	mg/l	--	--	--	<0.0004	--	--	<0.0004	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	--	<0.0005	--	--	<0.0005	--
1,1,2-Trichloroethane	mg/l	--	--	--	<0.0004	--	--	<0.0004	--
1,1-Dichloroethane	mg/l	--	--	--	<0.0004	--	--	<0.0004	--
1,1-Dichloroethylene	mg/l	0.014	--	--	<0.0005	--	--	<0.0005	--
1,2-Dibromoethane	mg/l	--	--	--	<0.0002	--	--	<0.0002	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	--	<0.0004	--	--	<0.0004	--
1,2-Dichloroethane	mg/l	0.005	--	--	<0.0002	--	--	<0.0002	--
1,2-Dichloropropane	mg/l	--	--	--	<0.0005	--	--	<0.0005	--
1,3,5-Trimethylbenzene	mg/l	--	--	--	<0.0003	--	--	<0.0003	--
1,3-Dichlorobenzene	mg/l	--	--	--	<0.0004	--	--	<0.0004	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	--	<0.0004	--	--	<0.0004	--
Bromodichloromethane	mg/l	--	--	--	<0.0003	--	--	<0.0003	--
Bromoform	mg/l	--	--	--	<0.0004	--	--	<0.0004	--
Bromomethane	mg/l	--	--	--	<0.0005	--	--	<0.0005	--
Carbon Tetrachloride	mg/l	0.005	--	--	<0.0002	--	--	<0.0002	--
Chlorobenzene	mg/l	0.08	0.03	--	<0.0002	--	--	<0.0002	--
Chloroethane	mg/l	--	--	--	<0.0002	--	--	<0.0002	--
Chloroform	mg/l	--	--	--	<0.0005	--	--	<0.0005	--
Chloromethane	mg/l	--	--	--	<0.0002	--	--	<0.0002	--
cis-1,2-Dichloroethene	mg/l	--	--	--	<0.0004	--	--	<0.0004	--
cis-1,2-Dichloropropene	mg/l	--	--	--	<0.0002	--	--	<0.0002	--
Dibromochloromethane	mg/l	--	--	--	<0.0003	--	--	<0.0003	--
Dichlorodifluoromethane	mg/l	--	--	--	<0.0005	--	--	<0.0005	--
Methylene Chloride	mg/l	0.05	--	--	<0.0040	--	--	<0.0040	--
Tetrachloroethylene	mg/l	0.03	--	--	<0.0003	--	--	<0.0003	--
trans-1,2-Dichloroethene	mg/l	--	--	--	<0.0004	--	--	<0.0004	--
trans-1,3-Dichloropropene	mg/l	--	--	--	<0.0002	--	--	<0.0002	--
Trichloroethene	mg/l	0.005	--	--	<0.0003	--	--	<0.0003	--
Trichlorofluoromethane	mg/l	--	--	--	<0.0005	--	--	<0.0005	--
Vinyl Chloride	mg/l	0.002	--	--	<0.0002	--	--	<0.0002	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (1) ODWQS (169/ 03)-Health	(4) (3) ODWQS- AO	Pre-Construction MW 05				Construction MW 05						
				29-Nov-2010	28-Feb-2011 <sup>(30)</sup>	07-Apr-2011 <sup>(31)</sup>	11-May-2012	14-Jun-2012 <sup>(7)</sup>	17-Sep-2012 <sup>(32)</sup>	18-Dec-2012	11-Apr-2013 <sup>(33)</sup>	05-Jul-2013	21-Oct-2013	03-Feb-2014 <sup>(30)</sup>
				S-2	MW 05	S-1	S-7	S-6	sw5	S-7	S-1	S-7	S-7	m5
<b>General Chemistry</b>														
Alkalinity (Total as CaCO3)	mg/l	--	--	387	--	304	299	384	--	329	335	354	360	--
Ammonia, unionized	mg/l	--	--	<0.02	--	<0.02	<0.02	<0.02	--	<0.02	<0.02	<0.02	<0.02	--
Ammonia Nitrogen	mg/l	--	--	0.02	--	0.03	0.03	0.24	--	0.02	0.06	<0.02	0.02	--
Ammonium	mg/l	--	--	0.02	--	0.03	0.03	0.24	--	0.02	0.06	<0.02	0.02	--
Bicarbonate	mg/l	--	--	387	--	304	299	384	--	329	335	354	360	--
Bromide	mg/l	--	--	1.07	--	<0.25	0.66	1.10	--	<0.25	<0.50	0.41	0.35	--
Carbonate (CO3)	mg/l	--	--	<2 <sup>(10)</sup>	--	<2 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	--	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	--
Color	color unit	--	5	3	--	9	4	2	--	<2	5	2	<2	--
Conductivity (Field)	uS/cm	--	--	3250	--	2390	2405	4010	--	2880	3600	4400	>4000	--
Fluoride	mg/l	1.5	--	<0.10	--	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	--
Hardness, Calcium Carbonate	mg/l	--	--	508	--	1360	378	491	--	460	572	612	400	--
Nitrate as N	mg/l	10	--	<0.10	--	0.24	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	--
Nitrite as N	mg/l	1	--	<0.10	--	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	--
pH (Field)	-	--	--	7.5	--	7.7	7.5	7.9	--	7.8	7.66	8.0	7.8	--
Phosphorus	mg/l	--	--	2.86	--	1.73	2.24	0.74	--	1.94	5.43	1.66	1.32	--
Sulfate	mg/l	--	500 <sup>(11)</sup>	60	--	78	50	61	--	61	52	61	68	--
Temperature (Field)	deg c	--	15	7.9	--	5.8	12	13	--	7	5	13	9	--
Total Organic Carbon	mg/l	--	--	4.4	--	2.8	2.5	2.1	--	2.7	3.0	2.7	3.2	--
Total Suspended Solids	mg/l	--	--	3040	--	11200	2480	577	--	1810	22800	1980	3680	--
Turbidity	ntu	--	5 <sup>(12)</sup>	>100	--	--	<0.1	>100	--	>100	41.7 <sup>(13)</sup>	>100	>100	--
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	--	--	--	180	185	--	149	-- <sup>(13)</sup>	>100	>100	--
<b>Metals</b>														
Aluminum, dissolved	mg/l	--	--	<0.01	--	<0.1	<0.01	<0.01	--	<0.01	<0.01	<0.01	<0.01	--
Arsenic, dissolved	mg/l	0.025	--	<0.001	--	<0.01	<0.001	<0.001	--	<0.001	<0.001	<0.001	<0.001	--
Barium, dissolved	mg/l	1	--	0.20	--	0.2	0.14	0.22	--	0.19	0.18	0.27	0.22	--
Beryllium, dissolved	mg/l	--	--	<0.001	--	<0.005	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	--
Boron, dissolved	mg/l	5	--	0.06	--	<0.1	0.04	0.04	--	0.05	0.03	0.03	0.04	--
Cadmium, dissolved	mg/l	0.005	--	<0.0001	--	<0.001	<0.0001	<0.0001	--	<0.0001	<0.0001	<0.0001	<0.0001	--
Calcium, dissolved	mg/l	--	--	136	--	477	92	124	--	110	145	156	99	--
Chromium, dissolved	mg/l	0.05	--	<0.005	--	<0.01	0.005	0.002	--	0.005	0.006	0.007	0.007	--
Cobalt, dissolved	mg/l	--	--	0.0019	--	<0.002	<0.0002	0.0003	--	<0.0002	<0.0002	0.0004	0.0003	--
Copper, dissolved	mg/l	--	1	0.002	--	<0.01	0.002	0.001	--	<0.001	0.001	<0.001	<0.001	--
Iron, dissolved	mg/l	--	0.3	<0.03	--	<0.3	<0.03	<0.03	--	<0.03	<0.03	<0.03	<0.03	--
Lead, dissolved	mg/l	0.01	--	<0.001	--	<0.01	<0.001	<0.001	--	<0.001	<0.001	<0.001	<0.001	--
Magnesium, dissolved	mg/l	--	--	41	--	41	36	44	--	45	51	54	37	--
Manganese, dissolved	mg/l	--	0.05	0.33	--	0.2	<0.01	0.05	--	<0.01	0.02	0.22	0.05	--
Molybdenum, dissolved	mg/l	--	--	<0.005	--	<0.05	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Nickel, dissolved	mg/l	--	--	0.006	--	<0.05	<0.005	0.005	--	<0.005	<0.005	0.007	<0.005	--
Potassium, dissolved	mg/l	--	--	4	--	3	3	3	--	3	3	4	3	--
Selenium, dissolved	mg/l	0.01	--	<0.001	--	<0.01	<0.001	<0.001	--	<0.001	<0.001	<0.001	<0.001	--
Silver, dissolved	mg/l	--	--	<0.0001	--	<0.001	<0.0001	<0.0001	--	<0.0001	<0.0001	<0.0001	<0.0001	--
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	592	--	2420	531	523	--	607	604	706	582	--
Strontium, dissolved	mg/l	--	--	0.780	--	0.68	0.625	0.912	--	0.782	0.794	1.10	0.779	--
Thallium, dissolved	mg/l	--	--	<0.0001	--	<0.001	<0.0001	<0.0001	--	<0.0001	<0.0001	<0.0001	<0.0001	--
Titanium, dissolved	mg/l	--	--	<0.01	--	<0.1	<0.01	<0.01	--	<0.01	<0.01	<0.01	<0.01	--
Vanadium, dissolved	mg/l	--	--	0.004	--	<0.01	0.001	<0.001	--	0.001	0.002	0.002	0.002	--
Zinc, dissolved	mg/l	--	5	<0.01	--	<0.1	<0.01	<0.01	--	<0.01	<0.01	<0.01	<0.01	--
<b>Petroleum Hydrocarbons</b>														
Benzene	mg/l	0.005	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	--
Ethylbenzene	mg/l	--	0.0024	<0.0005	--	<0.001	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	--
m,p-Xylenes	mg/l	--	--	<0.0010	--	<0.0020	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	--
o-Xylene	mg/l	--	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	--
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	--	<0.1	<0.1	<0.1	--	--	<0.1	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	--	--	--	<0.1	<0.1	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	--	0.2	<0.1	--	--	--	<0.1	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	0.6	--	<0.2	<0.2	--	--	--	<0.2	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	--	<0.2	<0.2	--	--	--	<0.2	--	--	--
Toluene	mg/l	--	0.024	<0.0005	--	<0.001	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	--
Xylenes, Total	mg/l	--	0.3	--	--	<0.003	<0.0010	<0.0010	--	--	<0.0010	--	--	--

Parameter	Unit	(2) (1) ODWQS (169/ 03)-Health	(4) (3) ODWQS- AO	Pre-Construction MW 05				Construction MW 05						
				29-Nov-2010 S-2	28-Feb-2011 <sup>(30)</sup> MW 05	07-Apr-2011 <sup>(31)</sup> S-1	11-May-2012 S - 7	14-Jun-2012 <sup>(7)</sup> S-6	17-Sep-2012 <sup>(32)</sup> sw5	18-Dec-2012 S-7	11-Apr-2013 <sup>(33)</sup> S-1	05-Jul-2013 S-7	21-Oct-2013 S - 7	03-Feb-2014 <sup>(30)</sup> m5
Semi-VOCs														
1-Methylnaphthalene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
2-Methylnaphthalene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Acenaphthene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Acenaphthylene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Anthracene	mg/l	--	--	<0.00001	--	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--
Benzo[a]anthracene	mg/l	--	--	<0.00001	--	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	<0.00001	--	<0.00001	<0.00001	--	--	--	<0.00001	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Chrysene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Fluoranthene	mg/l	--	--	<0.00002	--	0.00005	<0.00002	--	--	--	<0.0001	--	--	--
Fluorene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Naphthalene	mg/l	--	--	<0.00002	--	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Phenanthrene	mg/l	--	--	<0.00002	--	<0.00002	0.00005	--	--	--	<0.0001	--	--	--
Pyrene	mg/l	--	--	<0.00002	--	0.00007	0.00002	--	--	--	<0.0001	--	--	--
Styrene	mg/l	--	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
VOCs														
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,1-Dichloroethane	mg/l	--	--	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
1,2-Dibromoethane	mg/l	--	--	<0.0010	--	<0.0020	<0.0002	<0.0002	--	--	<0.0002	--	--	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,2-Dichloroethane	mg/l	0.005	--	<0.0005	--	<0.001	<0.0002	<0.0002	--	--	<0.0002	--	--	--
1,2-Dichloropropane	mg/l	--	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	--	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
Bromodichloromethane	mg/l	--	--	<0.0003	--	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
Bromoform	mg/l	--	--	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
Bromomethane	mg/l	--	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
Carbon Tetrachloride	mg/l	0.005	--	<0.0005	--	<0.001	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Chlorobenzene	mg/l	0.08	0.03	<0.0002	--	<0.0004	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Chloroethane	mg/l	--	--	<0.0010	--	<0.0020	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Chloroform	mg/l	--	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
Chloromethane	mg/l	--	--	<0.0010	--	<0.0020	<0.0002	<0.0002	--	--	<0.0002	--	--	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	--	<0.0004	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Dibromochloromethane	mg/l	--	--	<0.0003	--	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
Dichlorodifluoromethane	mg/l	--	--	--	--	--	<0.0005	<0.0005	--	--	<0.0005	--	--	--
Methylene Chloride	mg/l	0.05	--	<0.0040	--	<0.0080	<0.0040	<0.0040	--	--	<0.0040	--	--	--
Tetrachloroethylene	mg/l	0.03	--	<0.0003	--	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	--	<0.0004	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Trichloroethene	mg/l	0.005	--	<0.0003	--	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
Trichlorofluoromethane	mg/l	--	--	<0.0005	--	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
Vinyl Chloride	mg/l	0.002	--	<0.0002	--	<0.0004	<0.0002	<0.0002	--	--	<0.0002	--	--	--

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Parameter	Unit	(2) (1)	(4) (3)	Construction MW 05	Post-Construction MW 05			
		ODWQS(169/ 03)-Health	ODWQS- AO	26-May-2014	09-Oct-2014	24-Mar-2015 <sup>(20)</sup>	17-Jun-2015 <sup>(17)</sup>	27-Aug-2015 <sup>(22)</sup>
				MW - 5	MW 5	5	S-6	55
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	409	368	--	419	--
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	--	<0.05	--
Ammonia Nitrogen	mg/l	--	--	0.07	0.05	--	<0.05	--
Ammonium	mg/l	--	--	0.07	0.05	--	<0.05	--
Bicarbonate	mg/l	--	--	409	368	--	419	--
Bromide	mg/l	--	--	0.94	<0.25	--	<0.50	--
Carbonate (CO3)	mg/l	--	--	<1 <sup>(16)</sup>	<1 <sup>(16)</sup>	--	<1 <sup>(16)</sup>	--
Color	color unit	--	5	13	2	--	4	--
Conductivity (Field)	uS/cm	--	--	4150	4210	--	3720	--
Fluoride	mg/l	1.5	--	<0.10	<0.10	--	<0.10	--
Hardness, Calcium Carbonate	mg/l	--	--	580	495	--	610	--
Nitrate as N	mg/l	10	--	<0.10	<0.10	--	<0.10	--
Nitrite as N	mg/l	1	--	<0.10	<0.10	--	<0.10	--
pH (Field)	-	--	--	7.6	7.4	--	7.7	--
Phosphorus	mg/l	--	--	4.01	2.39	--	1.61	--
Sulfate	mg/l	--	500 <sup>(11)</sup>	77	64	--	60	--
Temperature (Field)	deg c	--	15	8	7	--	10	--
Total Organic Carbon	mg/l	--	--	3.2	3.7	--	1.3	--
Total Suspended Solids	mg/l	--	--	3630	1730	--	1840	--
Turbidity	ntu	--	5 <sup>(12)</sup>	>100	>100	--	>100	--
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	≥100	≥100	--	≥100	--
Metals								
Aluminum, dissolved	mg/l	--	--	<0.01	<0.01	--	<0.1	--
Arsenic, dissolved	mg/l	0.025	--	<0.001	<0.001	--	<0.01	--
Barium, dissolved	mg/l	1	--	0.26	0.19	--	0.2	--
Beryllium, dissolved	mg/l	--	--	<0.0005	<0.0005	--	<0.005	--
Boron, dissolved	mg/l	5	--	0.04	0.03	--	<0.1	--
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	--	<0.001	--
Calcium, dissolved	mg/l	--	--	150	142	--	180	--
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	--	<0.01	--
Cobalt, dissolved	mg/l	--	--	<0.0002	<0.0002	--	<0.002	--
Copper, dissolved	mg/l	--	1	<0.001	<0.001	--	<0.01	--
Iron, dissolved	mg/l	--	0.3	<0.03	<0.03	--	<0.3	--
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	--	<0.01	--
Magnesium, dissolved	mg/l	--	--	50	34	--	39	--
Manganese, dissolved	mg/l	--	0.05	<0.01	0.05	--	0.2	--
Molybdenum, dissolved	mg/l	--	--	<0.005	<0.005	--	<0.05	--
Nickel, dissolved	mg/l	--	--	<0.005	<0.005	--	<0.05	--
Potassium, dissolved	mg/l	--	--	2	4	--	2	--
Selenium, dissolved	mg/l	0.01	--	<0.001	<0.001	--	<0.01	--
Silver, dissolved	mg/l	--	--	<0.0001	<0.0001	--	<0.001	--
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	715	603	--	499	--
Strontium, dissolved	mg/l	--	--	1.08	0.818	--	0.56	--
Thallium, dissolved	mg/l	--	--	<0.0001	<0.0001	--	<0.001	--
Titanium, dissolved	mg/l	--	--	<0.01	<0.01	--	<0.1	--
Vanadium, dissolved	mg/l	--	--	<0.001	<0.001	--	<0.01	--
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	--	<0.1	--
Petroleum Hydrocarbons								
Benzene	mg/l	0.005	--	<0.0005	<0.0005	--	<0.0005	--
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	--	<0.0005	--
m,p-Xylenes	mg/l	--	--	<0.0005	<0.0005	--	<0.0004	--
o-Xylene	mg/l	--	--	<0.0005	<0.0005	--	<0.0004	--
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	--	--	<0.02	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	<0.1	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	--	--	<0.02	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	<0.2	--	--	<0.05	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	--	--	<0.05	--
Toluene	mg/l	--	0.024	<0.0005	<0.0005	--	<0.0005	--
Xylenes, Total	mg/l	--	0.3	<0.0010	--	--	<0.0005	--



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Parameter	Unit	(2)(1)	(4)(3)	Construction MW 05	Post-Construction MW 05				
		ODWQS(169/ 03)-Health	ODWQS- AO	26-May-2014	09-Oct-2014	24-Mar-2015 <sup>(30)</sup>	17-Jun-2015 <sup>(17)</sup>	27-Aug-2015 <sup>(32)</sup>	
				MW - 5	MW 5	5	S-6	55	
Semi-VOCs									
1-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	
2-Methylnaphthalene	mg/l	--	--	--	--	--	--	--	
Acenaphthene	mg/l	--	--	--	--	--	--	--	
Acenaphthylene	mg/l	--	--	--	--	--	--	--	
Anthracene	mg/l	--	--	--	--	--	--	--	
Benzo[a]anthracene	mg/l	--	--	--	--	--	--	--	
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	--	--	
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	--	--	
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	--	--	
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	--	--	
Chrysene	mg/l	--	--	--	--	--	--	--	
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	--	--	
Fluoranthene	mg/l	--	--	--	--	--	--	--	
Fluorene	mg/l	--	--	--	--	--	--	--	
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	--	--	
Naphthalene	mg/l	--	--	--	--	--	--	--	
Phenanthrene	mg/l	--	--	--	--	--	--	--	
Pyrene	mg/l	--	--	--	--	--	--	--	
Styrene	mg/l	--	--	<0.0005	--	--	<0.0005	--	
VOCs									
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1-Dichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	--	--	<0.0005	--	
1,2-Dibromoethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	--	--	<0.0004	--	
1,2-Dichloroethane	mg/l	0.005	--	<0.0002	--	--	<0.0002	--	
1,2-Dichloropropane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	--	--	<0.0003	--	
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	--	--	<0.0004	--	
Bromodichloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--	
Bromoform	mg/l	--	--	<0.0004	--	--	<0.0004	--	
Bromomethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Carbon Tetrachloride	mg/l	0.005	--	<0.0002	--	--	<0.0002	--	
Chlorobenzene	mg/l	0.08	0.03	<0.0002	--	--	<0.0002	--	
Chloroethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Chloroform	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Chloromethane	mg/l	--	--	<0.0002	--	--	<0.0002	--	
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Dibromochloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--	
Dichlorodifluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Methylene Chloride	mg/l	0.05	--	<0.0040	--	--	<0.0040	--	
Tetrachloroethylene	mg/l	0.03	--	<0.0003	--	--	<0.0003	--	
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--	
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--	
Trichloroethene	mg/l	0.005	--	<0.0003	--	--	<0.0003	--	
Trichlorofluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--	
Vinyl Chloride	mg/l	0.002	--	<0.0002	--	--	<0.0002	--	

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (1) ODWQS (169/ 03)-Health	(4) (3) ODWQS- AO	Pre-Construction MW 06				Construction MW 06						
				26-Nov-2010 <sup>(34)</sup>	28-Feb-2011 <sup>(35)</sup>	07-Apr-2011 <sup>(36)</sup>	11-May-2012 <sup>(37)</sup>	14-Jun-2012 <sup>(38)</sup>	17-Sep-2012 <sup>(39)</sup>	18-Dec-2012	11-Apr-2013	05-Jul-2013	21-Oct-2013	03-Feb-2014
				S-6	S - 6	S-7	S - 6	S-5	sw6	S-3	S-2	S-3	S - 4	S-6
<b>General Chemistry</b>														
Alkalinity (Total as CaCO3)	mg/l	--	--	256	242	288	410	549	--	384	568	646	638	465
Ammonia, unionized	mg/l	--	--	<0.02	<0.02	<0.02	<0.02	<0.02	--	<0.02	<0.02	<0.02	<0.02	<0.02
Ammonia Nitrogen	mg/l	--	--	0.07	0.07	0.09	0.13	0.18	--	0.05	0.07	0.12	0.05	0.08
Ammonium	mg/l	--	--	--	--	--	0.13	0.18	--	0.05	0.07	0.12	0.05	0.08
Bicarbonate	mg/l	--	--	256	242	288	410	549	--	384	568	646	638	465
Bromide	mg/l	--	--	<0.25	<0.25	<0.25	<0.50	<0.50	--	<0.25	<0.25	<0.25	<0.25	<0.25
Carbonate (CO3)	mg/l	--	--	<2 <sup>(10)</sup>	<2 <sup>(10)</sup>	<2 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	--	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>
Color	color unit	--	5	9	4	14	34	119	--	73	72	81	79	31
Conductivity (Field)	uS/cm	--	--	>3995	>5000	2270	>5000	>4000	--	2000	3100	2400	2365	3090
Fluoride	mg/l	1.5	--	0.11	<0.10	<0.10	0.10	0.16	--	0.20	0.17	0.21	0.20	0.20
Hardness, Calcium Carbonate	mg/l	--	--	811	1680	1230	911	815	--	117	185	171	164	193
Nitrate as N	mg/l	10	--	0.15	0.37	0.27	<0.10	<0.10	--	0.37	0.19	<0.10	0.18	0.24
Nitrite as N	mg/l	1	--	<0.10	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	<0.10
pH (Field)	-	--	--	6.62	7.1	7.48	6.98	7.8	--	7.8	7.1	7.8	7.6	7.6
Phosphorus	mg/l	--	--	0.15	2.35	4.86	6.53	2.71	--	2.90	2.26	4.84	2.75	4.77
Sulfate	mg/l	--	500 <sup>(11)</sup>	24	92	81	93	65	--	78	160	231	437	160
Temperature (Field)	deg c	--	15	5.6	6.7	6.5	9	12	--	6	4	12	7	6
Total Organic Carbon	mg/l	--	--	6.5	4.7	6.0	9.2	15.8	--	10.8	12.5	19.6	30.6	14.3
Total Suspended Solids	mg/l	--	--	25000	18300	17300	11400	8420	--	4720	4250	6750	4570	13800
Turbidity	ntu	--	5 <sup>(12)</sup>	<u>&gt;100</u>	<u>&gt;100</u>	--	<0.1	<u>&gt;100</u>	--	<u>&gt;100</u>	<u>&gt;100</u>	<u>&gt;100</u>	<u>&gt;100</u>	<u>&gt;100</u>
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	--	--	--	169	165	--	182	438	>100	80.2	>100
<b>Metals</b>														
Aluminum, dissolved	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	0.02	0.02	0.03	0.04	0.01
Arsenic, dissolved	mg/l	0.025	--	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.001	<0.001	<0.01	<0.001	<0.001
Barium, dissolved	mg/l	1	--	0.4	0.7	0.4	0.3	0.4	--	0.02	0.04	0.04	0.05	0.03
Beryllium, dissolved	mg/l	--	--	<0.01	<0.005	<0.005	<0.005	<0.005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron, dissolved	mg/l	5	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	0.01	0.01	0.04	0.03	0.01
Cadmium, dissolved	mg/l	0.005	--	<0.001	<0.001	<0.001	<0.001	<0.001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	292	592	440	327	290	--	42	66	62	59	64
Chromium, dissolved	mg/l	0.05	--	<0.005	<0.005	<0.005	<0.05	<0.01	--	0.010	<0.005	0.006	0.010	0.010
Cobalt, dissolved	mg/l	--	--	<0.002	<0.002	<0.002	<0.002	<0.002	--	<0.0002	<0.0002	0.0017	0.0004	<0.0002
Copper, dissolved	mg/l	--	1	<0.01	<0.01	<0.01	<0.01	<0.01	--	0.004	0.005	0.004	0.007	0.003
Iron, dissolved	mg/l	--	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	--	0.06	0.04	0.44	0.10	<0.03
Lead, dissolved	mg/l	0.01	--	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	20	49	32	23	22	--	3	5	4	4	8
Manganese, dissolved	mg/l	--	0.05	0.2	0.3	<0.1	0.2	<0.1	--	0.01	<0.01	0.29	0.03	0.03
Molybdenum, dissolved	mg/l	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel, dissolved	mg/l	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.005	<0.005	<0.005	<0.005	<0.005
Potassium, dissolved	mg/l	--	--	4	3	3	<1	2	--	1	2	1	<1	8
Selenium, dissolved	mg/l	0.01	--	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Silver, dissolved	mg/l	--	--	<0.001	<0.001	<0.001	<0.001	<0.001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	1230	2910	2080	2390	2070	--	371	693	545	590	372
Strontium, dissolved	mg/l	--	--	2.39	4.91	3.20	2.44	2.59	--	0.232	0.421	0.391	0.389	0.435
Thallium, dissolved	mg/l	--	--	<0.001	<0.001	<0.001	<0.001	<0.001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium, dissolved	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	--	0.004	0.005	0.006	0.006	0.003
Zinc, dissolved	mg/l	--	5	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.01	<0.01	<0.01	<0.01	<0.01
<b>Petroleum Hydrocarbons</b>														
Benzene	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/l	--	0.0024	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0010	<0.0010	<0.0020	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
o-Xylene	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	--	<0.1	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	--	<0.1	--	<0.1	<0.1	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	<0.1	<0.1	<0.1	--	--	--	<0.1	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	<0.2	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	<0.2	<0.2	<0.2	--	--	--	<0.2	--	--	--
Toluene	mg/l	--	0.024	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes, Total	mg/l	--	0.3	--	<0.0015	<0.003	<0.0010	<0.0010	--	--	<0.0010	--	--	--

Parameter	Unit	(2) (1)	(4) (3)	Pre-Construction MW 06				Construction MW 06						
		ODWQS (169/ 03)-Health	ODWQS- AO	26-Nov-2010 <sup>(34)</sup>	28-Feb-2011 <sup>(35)</sup>	07-Apr-2011 <sup>(36)</sup>	11-May-2012 <sup>(37)</sup>	14-Jun-2012 <sup>(38)</sup>	17-Sep-2012 <sup>(39)</sup>	18-Dec-2012	11-Apr-2013	05-Jul-2013	21-Oct-2013	03-Feb-2014
				S-6	S - 6	S-7	S - 6	S-5	sw6	S-3	S-2	S-3	S - 4	S-6
<b>Semi-VOCs</b>														
1-Methylnaphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
2-Methylnaphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Acenaphthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Acenaphthylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Anthracene	mg/l	--	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--
Benzo[a]anthracene	mg/l	--	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.0001	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	<0.00001	<0.00002	<0.00001	<0.00001	--	--	--	<0.00001	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Chrysene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.00005	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Fluoranthene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Fluorene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Naphthalene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Phenanthrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Pyrene	mg/l	--	--	<0.00002	<0.00004	<0.00002	<0.00002	--	--	--	<0.0001	--	--	--
Styrene	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
<b>VOCs</b>														
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	<0.0008	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	<0.0008	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,1-Dichloroethane	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
1,2-Dibromoethane	mg/l	--	--	<0.0010	<0.0010	<0.0020	<0.0002	<0.0002	--	--	<0.0002	--	--	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,2-Dichloroethane	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0002	<0.0002	--	--	<0.0002	--	--	--
1,2-Dichloropropane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
Bromodichloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
Bromoform	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
Bromomethane	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
Carbon Tetrachloride	mg/l	0.005	--	<0.0005	<0.0005	<0.001	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Chlorobenzene	mg/l	0.08	0.03	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Chloroethane	mg/l	--	--	<0.0010	<0.0020	<0.0020	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Chloroform	mg/l	--	--	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
Chloromethane	mg/l	--	--	<0.0010	<0.0020	<0.0020	<0.0002	<0.0002	--	--	<0.0002	--	--	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Dibromochloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
Dichlorodifluoromethane	mg/l	--	--	--	--	--	<0.0005	<0.0005	--	--	<0.0005	--	--	--
Methylene Chloride	mg/l	0.05	--	<0.0040	<0.0040	<0.0080	<0.0040	<0.0040	--	--	<0.0040	--	--	--
Tetrachloroethylene	mg/l	0.03	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0008	<0.0004	<0.0004	--	--	<0.0004	--	--	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	--	--	<0.0002	--	--	--
Trichloroethene	mg/l	0.005	--	<0.0003	<0.0003	<0.0006	<0.0003	<0.0003	--	--	<0.0003	--	--	--
Trichlorofluoromethane	mg/l	--	--	<0.0005	<0.0001	<0.001	<0.0005	<0.0005	--	--	<0.0005	--	--	--
Vinyl Chloride	mg/l	0.002	--	<0.0002	<0.0002	<0.0004	<0.0002	<0.0002	--	--	<0.0002	--	--	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (1) ODWQS(169/ 03)-Health	(4) (3) ODWQS- AO	Construction MW 06	Post-Construction MW 06			
				26-May-2014	09-Oct-2014 <sup>(2)</sup>	24-Mar-2015	17-Jun-2015	27-Aug-2015 <sup>(3)</sup>
				MW - 6	6	S-3	S-4	66
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	480	--	262	388	--
Ammonia, unionized	mg/l	--	--	<0.02	--	<0.02	<0.05	--
Ammonia Nitrogen	mg/l	--	--	0.08	--	0.02	0.08	--
Ammonium	mg/l	--	--	0.08	--	0.02	0.08	--
Bicarbonate	mg/l	--	--	480	--	262	388	--
Bromide	mg/l	--	--	<0.25	--	<0.25	<0.25	--
Carbonate (CO3)	mg/l	--	--	<1 <sup>(10)</sup>	--	<1 <sup>(10)</sup>	<1 <sup>(10)</sup>	--
Color	color unit	--	5	35	--	134	33	--
Conductivity (Field)	uS/cm	--	--	2205	--	2180	1010	--
Fluoride	mg/l	1.5	--	0.23	--	0.16	0.18	--
Hardness, Calcium Carbonate	mg/l	--	--	179	--	162	234	--
Nitrate as N	mg/l	10	--	<0.10	--	0.80	0.10	--
Nitrite as N	mg/l	1	--	<0.10	--	<0.10	<0.10	--
pH (Field)	-	--	--	7.4	--	7.5	7.8	--
Phosphorus	mg/l	--	--	2.08	--	2.48	7.93	--
Sulfate	mg/l	--	500 <sup>(11)</sup>	136	--	56	226	--
Temperature (Field)	deg c	--	15	8	--	6	9	--
Total Organic Carbon	mg/l	--	--	8.9	--	6.5	11.5	--
Total Suspended Solids	mg/l	--	--	1920	--	3250	550	--
Turbidity	ntu	--	5 <sup>(12)</sup>	≥100	--	≥100	≥100	--
Turbidity (Field)	ntu	--	5 <sup>(12)</sup>	70	--	53.0	≥100	--
Metals								
Aluminum, dissolved	mg/l	--	--	0.02	--	0.02	<0.01	--
Arsenic, dissolved	mg/l	0.025	--	<0.001	--	<0.001	<0.001	--
Barium, dissolved	mg/l	1	--	0.03	--	0.02	0.03	--
Beryllium, dissolved	mg/l	--	--	<0.0005	--	<0.0005	<0.0005	--
Boron, dissolved	mg/l	5	--	0.06	--	0.03	0.12	--
Cadmium, dissolved	mg/l	0.005	--	<0.0001	--	<0.0001	<0.0001	--
Calcium, dissolved	mg/l	--	--	57	--	55	82	--
Chromium, dissolved	mg/l	0.05	--	<0.001	--	<0.001	<0.001	--
Cobalt, dissolved	mg/l	--	--	0.0004	--	<0.0002	<0.0002	--
Copper, dissolved	mg/l	--	1	0.004	--	0.003	0.006	--
Iron, dissolved	mg/l	--	0.3	0.03	--	<0.03	<0.03	--
Lead, dissolved	mg/l	0.01	--	<0.001	--	<0.001	<0.001	--
Magnesium, dissolved	mg/l	--	--	9	--	6	7	--
Manganese, dissolved	mg/l	--	0.05	0.08	--	<0.01	<0.01	--
Molybdenum, dissolved	mg/l	--	--	<0.005	--	<0.005	<0.005	--
Nickel, dissolved	mg/l	--	--	<0.005	--	<0.005	<0.005	--
Potassium, dissolved	mg/l	--	--	8	--	4	1	--
Selenium, dissolved	mg/l	0.01	--	<0.001	--	<0.001	<0.001	--
Silver, dissolved	mg/l	--	--	<0.0001	--	<0.0001	<0.0001	--
Sodium, dissolved	mg/l	--	200 <sup>(14)</sup>	327	--	161	230	--
Strontium, dissolved	mg/l	--	--	0.431	--	0.280	0.574	--
Thallium, dissolved	mg/l	--	--	<0.0001	--	<0.0001	<0.0001	--
Titanium, dissolved	mg/l	--	--	<0.01	--	<0.01	<0.01	--
Vanadium, dissolved	mg/l	--	--	<0.001	--	<0.001	<0.001	--
Zinc, dissolved	mg/l	--	5	<0.01	--	<0.01	<0.01	--
Petroleum Hydrocarbons								
Benzene	mg/l	0.005	--	<0.0005	--	<0.0005	<0.0005	--
Ethylbenzene	mg/l	--	0.0024	<0.0005	--	<0.0005	<0.0005	--
m,p-Xylenes	mg/l	--	--	<0.0005	--	<0.0005	<0.0004	--
o-Xylene	mg/l	--	--	<0.0005	--	<0.0005	<0.0004	--
Petroleum Hydrocarbons - F1 (C6-C10)	mg/l	--	--	<0.1	--	--	<0.02	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	mg/l	--	--	<0.1	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	mg/l	--	--	<0.1	--	--	<0.02	--
Petroleum Hydrocarbons - F3 (C16-C34)	mg/l	--	--	<0.2	--	--	<0.05	--
Petroleum Hydrocarbons - F4 (C34-C50)	mg/l	--	--	<0.2	--	--	<0.05	--
Toluene	mg/l	--	0.024	<0.0005	--	<0.0005	<0.0005	--
Xylenes, Total	mg/l	--	0.3	<0.0010	--	<0.0010	<0.0005	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(2) (1)	(4) (3)	Construction MW 06	Post-Construction MW 06			
		ODWQS(169/ 03)-Health	ODWQS- AO	26-May-2014	09-Oct-2014 <sup>(2)</sup>	24-Mar-2015	17-Jun-2015	27-Aug-2015 <sup>(2)</sup>
				MW - 6	6	S-3	S-4	66
Semi-VOCs								
1-Methylnaphthalene	mg/l	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/l	--	--	--	--	--	--	--
Acenaphthene	mg/l	--	--	--	--	--	--	--
Acenaphthylene	mg/l	--	--	--	--	--	--	--
Anthracene	mg/l	--	--	--	--	--	--	--
Benzo[a]anthracene	mg/l	--	--	--	--	--	--	--
Benzo[a]pyrene	mg/l	0.00001	--	--	--	--	--	--
Benzo[b]fluoranthene	mg/l	--	--	--	--	--	--	--
Benzo[g,h,i]perylene	mg/l	--	--	--	--	--	--	--
Benzo[k]fluoranthene	mg/l	--	--	--	--	--	--	--
Chrysene	mg/l	--	--	--	--	--	--	--
Dibenzo[a,h]anthracene	mg/l	--	--	--	--	--	--	--
Fluoranthene	mg/l	--	--	--	--	--	--	--
Fluorene	mg/l	--	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	mg/l	--	--	--	--	--	--	--
Naphthalene	mg/l	--	--	--	--	--	--	--
Phenanthrene	mg/l	--	--	--	--	--	--	--
Pyrene	mg/l	--	--	--	--	--	--	--
Styrene	mg/l	--	--	<0.0005	--	--	<0.0005	--
VOCs								
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	--	--	<0.0005	--
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--
1,1-Dichloroethane	mg/l	--	--	<0.0004	--	--	<0.0004	--
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	--	--	<0.0005	--
1,2-Dibromoethane	mg/l	--	--	<0.0002	--	--	<0.0002	--
1,2-Dichlorobenzene	mg/l	0.2	0.003	<0.0004	--	--	<0.0004	--
1,2-Dichloroethane	mg/l	0.005	--	<0.0002	--	--	<0.0002	--
1,2-Dichloropropane	mg/l	--	--	<0.0005	--	--	<0.0005	--
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	--	--	<0.0003	--
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	--	--	<0.0004	--
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	--	--	<0.0004	--
Bromodichloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--
Bromoform	mg/l	--	--	<0.0004	--	--	<0.0004	--
Bromomethane	mg/l	--	--	<0.0005	--	--	<0.0005	--
Carbon Tetrachloride	mg/l	0.005	--	<0.0002	--	--	<0.0002	--
Chlorobenzene	mg/l	0.08	0.03	<0.0002	--	--	<0.0002	--
Chloroethane	mg/l	--	--	<0.0002	--	--	<0.0002	--
Chloroform	mg/l	--	--	<0.0005	--	--	<0.0005	--
Chloromethane	mg/l	--	--	<0.0002	--	--	<0.0002	--
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--
cis-1,2-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--
Dibromochloromethane	mg/l	--	--	<0.0003	--	--	<0.0003	--
Dichlorodifluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--
Methylene Chloride	mg/l	0.05	--	<0.0040	--	--	<0.0040	--
Tetrachloroethylene	mg/l	0.03	--	<0.0003	--	--	<0.0003	--
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	--	--	<0.0004	--
trans-1,3-Dichloropropene	mg/l	--	--	<0.0002	--	--	<0.0002	--
Trichloroethene	mg/l	0.005	--	<0.0003	--	--	<0.0003	--
Trichlorofluoromethane	mg/l	--	--	<0.0005	--	--	<0.0005	--
Vinyl Chloride	mg/l	0.002	--	<0.0002	--	--	<0.0002	--

**Footnotes:**

Tables should be read in conjunction with the accompanying document.

< value = Indicates parameter not detected above laboratory method detection limit.

> value = Indicates parameter detected above equipment analytical range.

-- Chemical not analyzed or criteria not defined.

Grey background indicates exceedances.

(1) Ontario Drinking Water Quality Standards - Health Based Standards (June 2003, revised June 2006).

(2) Bold Font = Parameter concentration greater than ODWQS(169/03)-Health

(3) Ontario Drinking Water Quality Standards - Aesthetic Objectives. Aesthetic Objectives are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices. For certain parameters, both aesthetic objectives and health-related MACs have been derived (June 2003, revised June 2006).

(4) Underlined Font = Parameter concentration greater than ODWQS-AO

(5) PAH MRLs elevated due to insufficient sample volume.

(6) Due to matrix interference 2x dilution factor required for VOCs.

(7) TOC was not shaken prior to analysis due to sediment content.

(8) Br MRL elevated due to matrix interference (dilution was done).

(9) Bromide MRL elevated due to matrix interference (dilution was done).

(10) Not available - pH < 8.3

(11) There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L.

(12) Applicable for all waters at the point of consumption.

(13) No result value available.

(14) The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

(15) PAH MRL elevated due to insufficient sample volume.

(16) Arsenic MRL elevated due to matrix interference (dilution was done).

(17) Metals MRLs elevated due to matrix interference (10x dilution was done). Bromide MRL elevated due to matrix interference (dilution was done).

(18) Arsenic MRL elevated due to matrix interference. Due to matrix interference 2 X dilution factor required for VOCs.

(19) Arsenic and Selenium MRL elevated due to matrix interference. PAH MRLs elevated due to insufficient sample volume.

(20) Due to matrix interference 2x dilution factor required for VOCs. Arsenic and Selenium MRL elevated due to matrix interference.

(21) Arsenic and Selenium MRL elevated due to matrix interference.

(22) TOC was not shaken prior to analysis due to sediment content. Arsenic and Selenium MRL elevated due to matrix interference.

(23) Holding time for Turbidity analysis was exceeded for the entire report. Arsenic and Selenium MRL elevated due to matrix interference (dilution was done).

(24) Arsenic and Selenium MRL elevated due to matrix interference (dilution was done).

(25) Due to matrix interference 2x dilution factor required for VOCs. Selenium MRL elevated due to matrix interference.

(26) Monitoring location was not accessible.

(27) Selenium MRL elevated due to matrix interference.

(28) Selenium MRL elevated due to matrix interference (dilution was done).

(29) Selenium MRL elevated due to matrix interference (dilution was done). All samples were subcontracted for TOC analysis.

(30) Monitoring location was frozen during this sampling event. No sample was collected.

(31) Due to matrix interference 2x dilution factor required for VOCs. Metals MRL elevated due to matrix interference.

(32) Monitoring location was dry during this sampling event. No sample was collected.

(33) Br MRL elevated due to matrix interference (dilution was done).

(34) Metals MRL elevated due to matrix interference.

(35) Metals MRL elevated due to matrix interference. PAH MRLs elevated due to insufficient sample volume.

(36) Metals MRL elevated due to matrix interference. Due to matrix interference 2x dilution factor required for VOCs.

(37) Metals and Br MRL elevated due to matrix interference.

(38) Metals and Bromide MRL elevated due to matrix interference. TOC was not shaken prior to analysis due to sediment content.





## **Appendix F-IV – Surface Water Monitoring Locations**

Cornwall TDA Embankment - Report of Monitoring Results

1413191-1030

Parameter	Unit	(a) (i) PWQO	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1
			12-Nov-2010	28-Feb-2011 (a)	07-Apr-2011 (a)	10-May-2012	14-Jun-2012	17-Sep-2012 (a)	18-Dec-2012 (a)	11-Apr-2013	05-Jul-2013 (a)	21-Oct-2013	03-Feb-2014 (a)	26-May-2014	09-Oct-2014 (a)
			SW-7	SW-1	W-3	W-6	W-4	sw1	1	W-5	1	W - 3	1	SW - 1	s1
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	-- (a)	331	--	129	360	369	--	--	246	--	397	--	452	--
Ammonia, unionized	ug/l	20	--	--	<20	<20	<20	--	--	<20	--	<20	--	<20	--
Ammonia Nitrogen	ug/l	--	<20	--	40	<20	120	--	--	100	--	<20	--	40	--
Ammonium	ug/l	--	<20	--	40	<20	120	--	--	100	--	<20	--	40	--
Bicarbonate	ug/l	--	331000	--	129000	360000	369000	--	--	246000	--	397000	--	452000	--
Bromide	ug/l	--	<250	--	<250	280	<250	--	--	<250	--	<250	--	<250	--
Carbonate (CO3)	ug/l	--	<2000 (a)	--	<2000 (a)	<1000 (a)	<1000 (a)	--	--	<1000 (a)	--	<1000 (a)	--	<1000 (a)	--
Color	color unit	--	99	--	69	56	107	--	--	23	--	53	--	53	--
Conductivity	uS/cm	--	1640	--	885	1820	1180	--	--	1010	--	1350	--	2070	--
Conductivity (Field)	uS/cm	--	625	--	1405	1210	1095	--	--	1040	--	995	--	790	--
Dissolved Oxygen (Field)	mg/l	-- (a)	12.42	--	7.89	4.01	3.88	--	--	6.11	--	4.29	--	2.88	--
Fluoride	ug/l	--	110	--	<100	150	160	--	--	140	--	240	--	150	--
Hardness, Calcium Carbonate	ug/l	--	370000	--	216000	438000	345000	--	--	346000	--	389000	--	605000	--
Nitrate as N	ug/l	--	<100	--	<100	<100	<100	--	--	110	--	<100	--	<100	--
Nitrite as N	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	<100	--	<100	--
pH	-	8.5	7.79	--	7.76	7.74	7.98	--	--	7.87	--	7.94	--	7.99	--
pH (Field)	-	8.5	8.0	--	7.8	7.3	7.7	--	--	7.7	--	7.6	--	7.5	--
Phosphorus	ug/l	-- (a)	100	--	90	50	70	--	--	20	--	50	--	50	--
Sulfate	ug/l	--	16000	--	7000	42000	5000	--	--	44000	--	48000	--	46000	--
Temperature (Field)	deg c	-- (a)	3.4	--	1	13	20	--	--	4	--	5	--	15	--
Total Organic Carbon	ug/l	--	17900	--	11900	11600	19600	--	--	5100	--	14800	--	11300	--
Total Suspended Solids	ug/l	--	9000	--	3000	11000	17000	--	--	<2000	--	37000	--	5000	--
Turbidity	ntu	-- (a)	4.0	--	2.4	2.4	2.4	--	--	4.4	--	1.0	--	5.0	--
Turbidity (Field)	ntu	-- (a)	--	--	--	60	3.8	--	--	8.1	--	7.0	--	6.8	--
<b>Metals</b>															
Aluminum, dissolved	ug/l	-- (a)	<10	--	30	<10	<10	--	--	<10	--	10	--	<10	--
Arsenic	ug/l	100 (a)	<1	--	<1	<1	<1	--	--	<1	--	<1	--	<1	--
Barium	ug/l	--	80	--	40	60	60	--	--	50	--	60	--	110	--
Beryllium	ug/l	-- (a)	<1	--	<0.5	<0.5	<0.5	--	--	<0.5	--	<0.5	--	<0.5	--
Boron	ug/l	200 (a)	10	--	<10	10	20	--	--	10	--	50	--	40	--
Cadmium	ug/l	0.2 (a)	<0.1	--	<0.1	<0.1	<0.1	--	--	<0.1	--	<0.1	--	<0.1	--
Calcium	ug/l	--	112000	--	70000	139000	107000	--	--	109000	--	118000	--	191000	--
Chromium	ug/l	-- (a)	4	--	4	9	9	--	--	4	--	9	--	<1	--
Cobalt	ug/l	0.9	0.3	--	0.2	0.5	0.8	--	--	0.3	--	0.5	--	0.6	--
Copper	ug/l	5	1	--	2	1	<1	--	--	1	--	2	--	1	--
Iron	ug/l	300	350	--	240	1780	1030	--	--	140	--	170	--	700	--
Lead	ug/l	-- (a)	<1	--	<1	<1	<1	--	--	<1	--	<1	--	<1	--
Magnesium	ug/l	--	22000	--	10000	22000	19000	--	--	18000	--	23000	--	31000	--
Manganese	ug/l	--	410	--	250	260	420	--	--	80	--	130	--	880	--
Molybdenum	ug/l	40	<5	--	<5	<5	<5	--	--	<5	--	<5	--	<5	--
Nickel	ug/l	25	<5	--	<5	<5	<5	--	--	<5	--	6	--	<5	--
Potassium	ug/l	--	8000	--	2000	1000	2000	--	--	2000	--	2000	--	3000	--
Selenium	ug/l	100	<1	--	<1	<1	<1	--	--	<1	--	<1	--	<1	--
Silver	ug/l	0.1	<0.1	--	<0.1	<0.1	<0.1	--	--	<0.1	--	<0.1	--	<0.1	--
Sodium	ug/l	--	169000	--	127000	226000	82000	--	--	92000	--	103000	--	223000	--
Strontium	ug/l	--	840	--	412	866	732	--	--	1070	--	1250	--	1480	--
Thallium	ug/l	0.3 (a)	<0.1	--	<0.1	<0.1	<0.1	--	--	<0.1	--	<0.1	--	<0.1	--
Titanium	ug/l	--	<10	--	<10	<10	<10	--	--	<10	--	<10	--	<10	--
Vanadium	ug/l	6	3	--	2	4	4	--	--	2	--	4	--	2	--
Zinc	ug/l	30 (a)	<10	--	<10	<10	<10	--	--	60	--	260	--	<10	--
<b>Petroleum Hydrocarbons</b>															
Benzene	ug/l	100 (a)	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	<0.5	--	<0.5	--
Ethylbenzene	ug/l	8	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	<0.5	--	<0.5	--
m,p-Xylenes	ug/l	--	<1.0	--	<2.0	<0.5	<0.5	--	--	<0.5	--	<0.5	--	<0.5	--
o-Xylene	ug/l	40 (a)	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	<0.5	--	<0.5	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	--	--	<100	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	ug/l	--	<100	--	<100	<100	<100	--	--	--	--	--	--	<100	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	--	--	<100	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	<200	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	<200	--
Toluene	ug/l	0.8	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	<0.5	--	<0.5	--
Xylenes, Total	ug/l	--	--	--	<3	<1.0	<1.0	--	--	<1.0	--	--	--	<1.0	--

Parameter	Unit	(2) (i) PWQOG	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (4)	10-May-2012	14-Jun-2012	17-Sep-2012 (5)	18-Dec-2012 (5)	11-Apr-2013	05-Jul-2013 (5)	21-Oct-2013	03-Feb-2014 (5)	26-May-2014	09-Oct-2014 (5)
			SW-7	SW-1	W-3	W-6	W-4	sw1	1	W-5	1	W - 3	1	SW - 1	s1
<b>Semi-VOCs</b>															
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthylene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Anthracene	ug/l	0.0008 <sup>(15)</sup>	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]pyrene	ug/l	--	<0.01	--	<0.01	<0.01	--	--	--	<0.01	--	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Chrysene	ug/l	0.0001 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Pyrene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Styrene	ug/l	4 <sup>(18)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1-Dichloroethane	ug/l	200	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,2-Dichloroethane	ug/l	100	<0.5	--	<1	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Bromoform	ug/l	60 <sup>(15)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Carbon Tetrachloride	ug/l	--	<0.5	--	<1	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chloroethane	ug/l	--	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chloroform	ug/l	--	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Chloromethane	ug/l	700 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	--	--	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	<4.0	--	<8.0	<4.0	<4.0	--	--	<4.0	--	--	--	<4.0	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Trichloroethene	ug/l	20	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Trichlorofluoromethane	ug/l	--	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--

Parameter	Unit	(2) (1) PWQO	SW-1	SW-1	SW-1
			24-Mar-2015 (3)	17-Jun-2015	27-Aug-2015 (5)
			1	W-5	1
<b>General Chemistry</b>					
Alkalinity (Total as CaCO3)	mg/l	-- (6)	--	242	--
Ammonia, unionized	ug/l	20	--	<50	--
Ammonia Nitrogen	ug/l	--	--	60	--
Ammonium	ug/l	--	--	60	--
Bicarbonate	ug/l	--	--	242000	--
Bromide	ug/l	--	--	<250	--
Carbonate (CO3)	ug/l	--	--	<1000 (7)	--
Color	color unit	--	--	36	--
Conductivity	uS/cm	--	--	925	--
Conductivity (Field)	uS/cm	--	--	1680	--
Dissolved Oxygen (Field)	mg/l	-- (8)	--	1.98	--
Fluoride	ug/l	--	--	1510	--
Hardness, Calcium Carbonate	ug/l	--	--	314000	--
Nitrate as N	ug/l	--	--	<100	--
Nitrite as N	ug/l	--	--	<100	--
pH	-	8.5	--	8.01	--
pH (Field)	-	8.5	--	7.7	--
Phosphorus	ug/l	-- (9)	--	<50	--
Sulfate	ug/l	--	--	92000	--
Temperature (Field)	deg c	-- (10)	--	15	--
Total Organic Carbon	ug/l	--	--	6800	--
Total Suspended Solids	ug/l	--	--	<2000	--
Turbidity	ntu	-- (11)	--	6.6	--
Turbidity (Field)	ntu	-- (11)	--	5.8	--
<b>Metals</b>					
Aluminum, dissolved	ug/l	-- (12)	--	<10	--
Arsenic	ug/l	100 (13)	--	<1	--
Barium	ug/l	--	--	50	--
Beryllium	ug/l	-- (14)	--	<0.5	--
Boron	ug/l	200 (15)	--	130	--
Cadmium	ug/l	0.2 (13)	--	<0.1	--
Calcium	ug/l	--	--	101000	--
Chromium	ug/l	-- (16)	--	<1	--
Cobalt	ug/l	0.9	--	<0.2	--
Copper	ug/l	5	--	4	--
Iron	ug/l	300	--	250	--
Lead	ug/l	-- (17)	--	<1	--
Magnesium	ug/l	--	--	15000	--
Manganese	ug/l	--	--	30	--
Molybdenum	ug/l	40	--	<5	--
Nickel	ug/l	25	--	<5	--
Potassium	ug/l	--	--	4000	--
Selenium	ug/l	100	--	<1	--
Silver	ug/l	0.1	--	<0.1	--
Sodium	ug/l	--	--	80000	--
Strontium	ug/l	--	--	1450	--
Thallium	ug/l	0.3 (18)	--	<0.1	--
Titanium	ug/l	--	--	10	--
Vanadium	ug/l	6	--	3	--
Zinc	ug/l	30 (13)	--	30	--
<b>Petroleum Hydrocarbons</b>					
Benzene	ug/l	100 (18)	--	<0.5	--
Ethylbenzene	ug/l	8	--	<0.5	--
m,p-Xylenes	ug/l	--	--	<0.4	--
o-Xylene	ug/l	40 (18)	--	<0.4	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	ug/l	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	--	<50	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	--	<50	--
Toluene	ug/l	0.8	--	<0.5	--
Xylenes, Total	ug/l	--	--	<0.5	--

Parameter	Unit	(2) (1) PWQO	SW-1	SW-1	SW-1
			24-Mar-2015 (3)	17-Jun-2015	27-Aug-2015 (5)
			1	W-5	1
<b>Semi-VOCs</b>					
1-Methylnaphthalene	ug/l	2 (18)	--	--	--
2-Methylnaphthalene	ug/l	2 (18)	--	--	--
Acenaphthene	ug/l	--	--	--	--
Acenaphthylene	ug/l	--	--	--	--
Anthracene	ug/l	0.0008 (15)	--	--	--
Benzo[a]anthracene	ug/l	0.0004 (15)	--	--	--
Benzo[a]pyrene	ug/l	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 (15)	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 (15)	--	--	--
Chrysene	ug/l	0.0001 (15)	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 (15)	--	--	--
Fluoranthene	ug/l	0.0008 (15)	--	--	--
Fluorene	ug/l	0.2 (15)	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	--	--	--
Naphthalene	ug/l	7 (15)	--	--	--
Phenanthrene	ug/l	0.03 (15)	--	--	--
Pyrene	ug/l	--	--	--	--
Styrene	ug/l	4 (18)	--	<0.5	--
<b>VOCs</b>					
1,1,1,2-Tetrachloroethane	ug/l	20 (15)	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 (18)	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	--	<0.4	--
1,1-Dichloroethane	ug/l	200	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	--	<0.5	--
1,2-Dibromoethane	ug/l	5 (15)	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,2-Dichloroethane	ug/l	100	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 (15)	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	--	<0.4	--
Bromodichloromethane	ug/l	200 (15)	--	<0.3	--
Bromoform	ug/l	60 (15)	--	<0.4	--
Bromomethane	ug/l	0.9 (20)	--	<0.5	--
Carbon Tetrachloride	ug/l	--	--	<0.2	--
Chlorobenzene	ug/l	15 (21)	--	<0.2	--
Chloroethane	ug/l	--	--	<0.2	--
Chloroform	ug/l	--	--	<0.5	--
Chloromethane	ug/l	700 (15)	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 (22)	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	--	<0.2	--
Dibromochloromethane	ug/l	40 (15)	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	<0.5	--
Methylene Chloride	ug/l	100 (23)	--	<4	--
Tetrachloroethylene	ug/l	50 (24)	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 (22)	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 (15)	--	<0.2	--
Trichloroethene	ug/l	20	--	<0.3	--
Trichlorofluoromethane	ug/l	--	--	<0.5	--
Vinyl Chloride	ug/l	600 (15)	--	<0.2	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(a) (i) PWQO	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2
			12-Nov-2010	28-Feb-2011 (b)	07-Apr-2011 (c)	10-May-2012	14-Jun-2012 (d)	17-Sep-2012 (e)	18-Dec-2012	11-Apr-2013	05-Jul-2013	21-Oct-2013 (f)	03-Feb-2014 (g)	26-May-2014	09-Oct-2014 (h)
			SW-6	SW-2	W-2	W-4	W-3	SW2	W-4	W-6	W-2	W - 1	2	SW - 2	S2
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	-- (4)	362	--	339	309	365	--	202	241	355	479	--	480	--
Ammonia, unionized	ug/l	20	--	--	<20	<20	<20	--	<20	<20	<20	<20	--	<20	--
Ammonia Nitrogen	ug/l	--	<20	--	50	<20	100	--	40	80	60	<20	--	30	--
Ammonium	ug/l	--	<20	--	50	<20	100	--	40	80	60	<20	--	30	--
Bicarbonate	ug/l	--	362000	--	339000	309000	365000	--	202000	241000	355000	479000	--	480000	--
Bromide	ug/l	--	<250	--	<250	<250	420	--	<250	<250	<250	<250	--	<250	--
Carbonate (CO3)	ug/l	--	<2000 (i)	--	<2000 (i)	<1000 (i)	<1000 (i)	--	<1000 (i)	<1000 (i)	<1000 (i)	<1000 (i)	--	<1000 (i)	--
Color	color unit	--	61	--	28	8	66	--	37	24	53	55	--	55	--
Conductivity	uS/cm	--	1400	--	1790	907	1630	--	936	966	1300	2350	--	2080	--
Conductivity (Field)	uS/cm	--	705	--	1820	1505	1665	--	988	980	1408	1240	--	840	--
Dissolved Oxygen (Field)	mg/l	-- (4)	12.89	--	5.25	3.66	3.41	--	4.08	5.99	2.99	3.98	--	2.48	--
Fluoride	ug/l	--	130	--	100	180	130	--	130	140	390	150	--	230	--
Hardness, Calcium Carbonate	ug/l	--	392000	--	565000	291000	392000	--	286000	341000	413000	594000	--	605000	--
Nitrate as N	ug/l	--	<100	--	<100	<100	<100	--	220	130	<100	<100	--	<100	--
Nitrite as N	ug/l	--	<100	--	<100	<100	<100	--	<100	<100	<100	<100	--	<100	--
pH	-	8.5	7.92	--	7.89	8.10	7.82	--	7.86	7.87	8.09	7.71	--	8.04	--
pH (Field)	-	8.5	8.0	--	7.7	7.3	7.8	--	7.9	8.0	7.8	7.6	--	7.4	--
Phosphorus	ug/l	-- (4)	30	--	30	10	70	--	70	20	20	20	--	50	--
Sulfate	ug/l	--	26000	--	53000	50000	62000	--	67000	42000	42000	118000	--	45000	--
Temperature (Field)	deg c	-- (10)	3.2	--	3.7	14	20	--	2	3	24	6	--	13	--
Total Organic Carbon	ug/l	--	11800	--	6500	3800	12600	--	7700	5500	11300	15300	--	11100	--
Total Suspended Solids	ug/l	--	<2000	--	4000	14000	46000	--	17000	5000	3000	69000	--	2000	--
Turbidity	ntu	-- (11)	1.1	--	1.6	2.4	3.2	--	24.2	5.2	2.5	4.4	--	5.2	--
Turbidity (Field)	ntu	-- (11)	--	--	--	79	3.1	--	29	6.01	4.2	7.3	--	6.21	--
<b>Metals</b>															
Aluminum, dissolved	ug/l	-- (12)	<10	--	<10	20	<10	--	80	<10	<10	<10	--	<10	--
Arsenic	ug/l	100 (13)	<1	--	<1	<1	<10	--	<1	<1	<10	<10	--	<1	--
Barium	ug/l	--	60	--	80	60	70	--	40	50	60	90	--	110	--
Beryllium	ug/l	-- (14)	<1	--	<0.5	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Boron	ug/l	200 (15)	10	--	10	40	30	--	20	10	100	30	--	50	--
Cadmium	ug/l	0.2 (13)	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	<0.1	<0.1	--	<0.1	--
Calcium	ug/l	--	119000	--	180000	92000	119000	--	90000	107000	129000	182000	--	191000	--
Chromium	ug/l	-- (16)	3	--	7	4	9	--	5	5	5	7	--	<1	--
Cobalt	ug/l	0.9	0.2	--	0.3	0.2	0.6	--	0.4	0.4	1.0	0.8	--	0.7	--
Copper	ug/l	5	2	--	<1	2	2	--	2	2	2	1	--	2	--
Iron	ug/l	300	60	--	310	120	1300	--	250	160	270	340	--	700	--
Lead	ug/l	-- (17)	<1	--	<1	<1	<1	--	<1	<1	<1	<1	--	<1	--
Magnesium	ug/l	--	23000	--	28000	15000	23000	--	15000	18000	22000	34000	--	31000	--
Manganese	ug/l	--	170	--	210	20	270	--	70	80	570	800	--	860	--
Molybdenum	ug/l	40	<5	--	<5	<5	<5	--	<5	<5	<5	<5	--	<5	--
Nickel	ug/l	25	<5	--	<5	<5	<5	--	<5	<5	<5	<5	--	<5	--
Potassium	ug/l	--	4000	--	2000	2000	1000	--	3000	2000	3000	1000	--	3000	--
Selenium	ug/l	100	<1	--	<1	<1	<1	--	<1	<1	<1	<1	--	<1	--
Silver	ug/l	0.1	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	<0.1	<0.1	--	<0.1	--
Sodium	ug/l	--	127000	--	204000	52000	146000	--	81000	85000	136000	219000	--	222000	--
Strontium	ug/l	--	1030	--	1320	1870	1490	--	1010	1170	1570	1270	--	1460	--
Thallium	ug/l	0.3 (18)	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	<0.1	<0.1	--	<0.1	--
Titanium	ug/l	--	<10	--	<10	<10	<10	--	20	<10	<10	<10	--	<10	--
Vanadium	ug/l	6	2	--	2	3	4	--	4	2	4	4	--	2	--
Zinc	ug/l	30 (13)	<10	--	<10	10	10	--	40	60	130	<10	--	<10	--
<b>Petroleum Hydrocarbons</b>															
Benzene	ug/l	100 (18)	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Ethylbenzene	ug/l	8	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
m,p-Xylenes	ug/l	--	<1.0	--	<2.0	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
o-Xylene	ug/l	40 (18)	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	--	--	<100	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	ug/l	--	<100	--	<100	<100	<100	--	--	--	--	--	--	<100	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	--	--	<100	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	<200	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	<200	--
Toluene	ug/l	0.8	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Xylenes, Total	ug/l	--	--	--	<3	<1.0	<1.0	--	--	<1.0	<1.0	--	--	<1.0	--

Parameter	Unit	(2) (i) PWQO	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (4)	10-May-2012	14-Jun-2012 (25)	17-Sep-2012 (26)	18-Dec-2012	11-Apr-2013	05-Jul-2013	21-Oct-2013 (27)	03-Feb-2014 (3)	26-May-2014	09-Oct-2014 (6)
			SW-6	SW-2	W-2	W-4	W-3	sw2	W-4	W-6	W-2	W - 1	2	SW - 2	s2
<b>Semi-VOCs</b>															
1-Methylnaphthalene	ug/l	2 (18)	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
2-Methylnaphthalene	ug/l	2 (18)	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthylene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Anthracene	ug/l	0.0008 (16)	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]anthracene	ug/l	0.0004 (15)	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]pyrene	ug/l	--	<0.01	--	<0.01	<0.01	--	--	--	<0.01	--	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 (15)	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 (15)	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Chrysene	ug/l	0.0001 (16)	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 (15)	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluoranthene	ug/l	0.0008 (15)	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluorene	ug/l	0.2 (15)	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Naphthalene	ug/l	7 (16)	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Phenanthrene	ug/l	0.03 (15)	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Pyrene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Styrene	ug/l	4 (16)	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	ug/l	20 (15)	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 (18)	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1-Dichloroethane	ug/l	200	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,2-Dibromoethane	ug/l	5 (16)	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,2-Dichloroethane	ug/l	100	<0.5	--	<1	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 (15)	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
Bromodichloromethane	ug/l	200 (15)	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Bromoform	ug/l	60 (15)	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
Bromomethane	ug/l	0.9 (20)	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Carbon Tetrachloride	ug/l	--	<0.5	--	<1	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chlorobenzene	ug/l	15 (21)	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chloroethane	ug/l	--	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chloroform	ug/l	--	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Chloromethane	ug/l	700 (15)	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 (22)	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Dibromochloromethane	ug/l	40 (15)	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	--	--	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Methylene Chloride	ug/l	100 (23)	<4.0	--	<8.0	<4.0	<4.0	--	--	<4.0	--	--	--	<4.0	--
Tetrachloroethylene	ug/l	50 (24)	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 (22)	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 (15)	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Trichloroethene	ug/l	20	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Trichlorofluoromethane	ug/l	--	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Vinyl Chloride	ug/l	600 (15)	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--



Parameter	Unit	(2) (1) PWQO	SW-2	SW-2	SW-2
			24-Mar-2015 (2)	17-Jun-2015	27-Aug-2015 (2)
			2	W-3	2
<b>General Chemistry</b>					
Alkalinity (Total as CaCO3)	mg/l	-- (6)	--	269	--
Ammonia, unionized	ug/l	20	--	<50	--
Ammonia Nitrogen	ug/l	--	--	<50	--
Ammonium	ug/l	--	--	<50	--
Bicarbonate	ug/l	--	--	269000	--
Bromide	ug/l	--	--	<250	--
Carbonate (CO3)	ug/l	--	--	<1000 (7)	--
Color	color unit	--	--	43	--
Conductivity	uS/cm	--	--	1040	--
Conductivity (Field)	uS/cm	--	--	1840	--
Dissolved Oxygen (Field)	mg/l	-- (8)	--	1.96	--
Fluoride	ug/l	--	--	990	--
Hardness, Calcium Carbonate	ug/l	--	--	329000	--
Nitrate as N	ug/l	--	--	<100	--
Nitrite as N	ug/l	--	--	<100	--
pH	-	8.5	--	7.95	--
pH (Field)	-	8.5	--	7.8	--
Phosphorus	ug/l	-- (9)	--	<50	--
Sulfate	ug/l	--	--	71000	--
Temperature (Field)	deg c	-- (10)	--	14	--
Total Organic Carbon	ug/l	--	--	7600	--
Total Suspended Solids	ug/l	--	--	6000	--
Turbidity	ntu	-- (11)	--	7.8	--
Turbidity (Field)	ntu	-- (11)	--	6.1	--
<b>Metals</b>					
Aluminum, dissolved	ug/l	-- (12)	--	<10	--
Arsenic	ug/l	100 (13)	--	<1	--
Barium	ug/l	--	--	50	--
Beryllium	ug/l	-- (14)	--	<0.5	--
Boron	ug/l	200 (15)	--	140	--
Cadmium	ug/l	0.2 (13)	--	<0.1	--
Calcium	ug/l	--	--	107000	--
Chromium	ug/l	-- (16)	--	<1	--
Cobalt	ug/l	0.9	--	0.3	--
Copper	ug/l	5	--	3	--
Iron	ug/l	300	--	380	--
Lead	ug/l	-- (17)	--	<1	--
Magnesium	ug/l	--	--	15000	--
Manganese	ug/l	--	--	160	--
Molybdenum	ug/l	40	--	<5	--
Nickel	ug/l	25	--	<5	--
Potassium	ug/l	--	--	4000	--
Selenium	ug/l	100	--	<1	--
Silver	ug/l	0.1	--	<0.1	--
Sodium	ug/l	--	--	103000	--
Strontium	ug/l	--	--	1490	--
Thallium	ug/l	0.3 (18)	--	<0.1	--
Titanium	ug/l	--	--	10	--
Vanadium	ug/l	6	--	4	--
Zinc	ug/l	30 (13)	--	40	--
<b>Petroleum Hydrocarbons</b>					
Benzene	ug/l	100 (18)	--	<0.5	--
Ethylbenzene	ug/l	8	--	<0.5	--
m,p-Xylenes	ug/l	--	--	<0.4	--
o-Xylene	ug/l	40 (18)	--	<0.4	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	ug/l	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	--	<50	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	--	<50	--
Toluene	ug/l	0.8	--	<0.5	--
Xylenes, Total	ug/l	--	--	<0.5	--

Parameter	Unit	(2) (1) PWQO	SW-2	SW-2	SW-2
			24-Mar-2015 (3)	17-Jun-2015	27-Aug-2015 (5)
			2	W-3	2
<b>Semi-VOCs</b>					
1-Methylnaphthalene	ug/l	2 (18)	--	--	--
2-Methylnaphthalene	ug/l	2 (18)	--	--	--
Acenaphthene	ug/l	--	--	--	--
Acenaphthylene	ug/l	--	--	--	--
Anthracene	ug/l	0.0008 (15)	--	--	--
Benzo[a]anthracene	ug/l	0.0004 (15)	--	--	--
Benzo[a]pyrene	ug/l	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 (15)	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 (15)	--	--	--
Chrysene	ug/l	0.0001 (15)	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 (15)	--	--	--
Fluoranthene	ug/l	0.0008 (15)	--	--	--
Fluorene	ug/l	0.2 (15)	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	--	--	--
Naphthalene	ug/l	7 (15)	--	--	--
Phenanthrene	ug/l	0.03 (15)	--	--	--
Pyrene	ug/l	--	--	--	--
Styrene	ug/l	4 (18)	--	<0.5	--
<b>VOCs</b>					
1,1,1,2-Tetrachloroethane	ug/l	20 (15)	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 (18)	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	--	<0.4	--
1,1-Dichloroethane	ug/l	200	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	--	<0.5	--
1,2-Dibromoethane	ug/l	5 (15)	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,2-Dichloroethane	ug/l	100	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 (15)	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	--	<0.4	--
Bromodichloromethane	ug/l	200 (15)	--	<0.3	--
Bromoform	ug/l	60 (15)	--	<0.4	--
Bromomethane	ug/l	0.9 (20)	--	<0.5	--
Carbon Tetrachloride	ug/l	--	--	<0.2	--
Chlorobenzene	ug/l	15 (21)	--	<0.2	--
Chloroethane	ug/l	--	--	<0.2	--
Chloroform	ug/l	--	--	<0.5	--
Chloromethane	ug/l	700 (15)	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 (22)	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	--	<0.2	--
Dibromochloromethane	ug/l	40 (15)	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	<0.5	--
Methylene Chloride	ug/l	100 (23)	--	<4	--
Tetrachloroethylene	ug/l	50 (24)	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 (22)	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 (15)	--	<0.2	--
Trichloroethene	ug/l	20	--	<0.3	--
Trichlorofluoromethane	ug/l	--	--	<0.5	--
Vinyl Chloride	ug/l	600 (15)	--	<0.2	--

Cornwall TDA Embankment - Report of Monitoring Results

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Parameter	Unit	(a) (i) PWQO	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3
			12-Nov-2010	28-Feb-2011 (a)	07-Apr-2011 (a)	10-May-2012	14-Jun-2012	17-Sep-2012 (a)	18-Dec-2012 (a)	11-Apr-2013	05-Jul-2013 (a)	21-Oct-2013 (a)	03-Feb-2014 (a)	26-May-2014 (a)	09-Oct-2014 (a)
			SW-4	SW-3	W-1	W-3	W-1	SW3	W-3	W-3	3	W3	3	s3	s3
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	-- (a)	364	--	250	251	215	--	146	210	--	--	--	--	--
Ammonia, unionized	ug/l	20	--	--	<20	<20	<20	--	<20	<20	--	--	--	--	--
Ammonia Nitrogen	ug/l	--	<20	--	20	<20	70	--	70	60	--	--	--	--	--
Ammonium	ug/l	--	<20	--	20	<20	70	--	70	60	--	--	--	--	--
Bicarbonate	ug/l	--	364000	--	250000	251000	215000	--	146000	210000	--	--	--	--	--
Bromide	ug/l	--	450	--	<250	<250	540	--	<250	<250	--	--	--	--	--
Carbonate (CO3)	ug/l	--	<2000 (a)	--	<2000 (a)	<1000 (a)	<1000 (a)	--	<1000 (a)	<1000 (a)	--	--	--	--	--
Color	color unit	--	24	--	15	19	22	--	20	17	--	--	--	--	--
Conductivity	uS/cm	--	1540	--	901	1300	1680	--	860	726	--	--	--	--	--
Conductivity (Field)	uS/cm	--	949	--	908	800	1705	--	866	770	--	--	--	--	--
Dissolved Oxygen (Field)	mg/l	-- (a)	3.99	--	3.88	2.4	1.92	--	5.08	5.28	--	--	--	--	--
Fluoride	ug/l	--	150	--	120	240	380	--	110	140	--	--	--	--	--
Hardness, Calcium Carbonate	ug/l	--	424000	--	322000	335000	396000	--	207000	291000	--	--	--	--	--
Nitrate as N	ug/l	--	<100	--	<100	<100	<100	--	270	240	--	--	--	--	--
Nitrite as N	ug/l	--	<100	--	<100	<100	<100	--	<100	<100	--	--	--	--	--
pH	-	8.5	8.04	--	8.01	7.94	8.02	--	7.85	7.92	--	--	--	--	--
pH (Field)	-	8.5	7.81	--	7.6	7.4	7.9	--	7.8	8.0	--	--	--	--	--
Phosphorus	ug/l	-- (a)	30	--	20	<10	40	--	160	20	--	--	--	--	--
Sulfate	ug/l	--	51000	--	60000	111000	246000	--	38000	39000	--	--	--	--	--
Temperature (Field)	deg c	-- (a)	2.8	--	3	13	18	--	2	4	--	--	--	--	--
Total Organic Carbon	ug/l	--	8300	--	4800	4700	5700	--	5400	4400	--	--	--	--	--
Total Suspended Solids	ug/l	--	31000	--	<2000	9000	29000	--	62000	9000	--	--	--	--	--
Turbidity	ntu	-- (a)	12.7	--	2.0	3.5	2.7	--	<0.1	5.5	--	--	--	--	--
Turbidity (Field)	ntu	-- (a)	--	--	--	80	4.5	--	121	9.2	--	--	--	--	--
<b>Metals</b>															
Aluminum, dissolved	ug/l	-- (a)	<10	--	20	<10	<10	--	<10	<10	--	--	--	--	--
Arsenic	ug/l	100 (a)	<1	--	<1	<1	<1	--	<1	<1	--	--	--	--	--
Barium	ug/l	--	70	--	50	50	80	--	50	40	--	--	--	--	--
Beryllium	ug/l	-- (a)	<1	--	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--	--	--	--
Boron	ug/l	200 (a)	20	--	20	80	200	--	10	10	--	--	--	--	--
Cadmium	ug/l	0.2 (a)	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	--	--	--	--	--
Calcium	ug/l	--	135000	--	106000	103000	119000	--	68000	95000	--	--	--	--	--
Chromium	ug/l	-- (a)	4	--	1	5	5	--	6	4	--	--	--	--	--
Cobalt	ug/l	0.9	0.3	--	0.2	0.4	0.9	--	0.6	<0.2	--	--	--	--	--
Copper	ug/l	5	2	--	2	2	4	--	4	2	--	--	--	--	--
Iron	ug/l	300	160	--	130	70	400	--	680	100	--	--	--	--	--
Lead	ug/l	-- (a)	<1	--	<1	<1	1	--	3	<1	--	--	--	--	--
Magnesium	ug/l	--	21000	--	14000	19000	24000	--	9000	13000	--	--	--	--	--
Manganese	ug/l	--	20	--	30	20	80	--	50	<10	--	--	--	--	--
Molybdenum	ug/l	40	<5	--	<5	<5	11	--	<5	<5	--	--	--	--	--
Nickel	ug/l	25	<5	--	<5	<5	6	--	<5	<5	--	--	--	--	--
Potassium	ug/l	--	3000	--	2000	5000	7000	--	3000	3000	--	--	--	--	--
Selenium	ug/l	100	<1	--	<1	<1	<1	--	<1	<1	--	--	--	--	--
Silver	ug/l	0.1	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	--	--	--	--	--
Sodium	ug/l	--	149000	--	63000	133000	170000	--	88000	54000	--	--	--	--	--
Strontium	ug/l	--	1650	--	1730	3720	8100	--	958	1260	--	--	--	--	--
Thallium	ug/l	0.3 (a)	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	--	--	--	--	--
Titanium	ug/l	--	<10	--	<10	<10	10	--	40	<10	--	--	--	--	--
Vanadium	ug/l	6	3	--	2	2	3	--	4	1	--	--	--	--	--
Zinc	ug/l	30 (a)	<10	--	<10	<10	20	--	20	<10	--	--	--	--	--
<b>Petroleum Hydrocarbons</b>															
Benzene	ug/l	100 (a)	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	--	--	--	--	--
Ethylbenzene	ug/l	8	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	--	--	--	--	--
m,p-Xylenes	ug/l	--	<1.0	--	<2.0	<0.5	<0.5	--	<0.5	<0.5	--	--	--	--	--
o-Xylene	ug/l	40 (a)	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	ug/l	--	<100	--	<100	<100	<100	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	--	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	--	--
Toluene	ug/l	0.8	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	--	--	--	--	--
Xylenes, Total	ug/l	--	--	--	<3	<1.0	<1.0	--	--	<1.0	--	--	--	--	--

Parameter	Unit	(2) (i) PWQO	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (4)	10-May-2012	14-Jun-2012	17-Sep-2012 (26)	18-Dec-2012 (26)	11-Apr-2013	05-Jul-2013 (2)	21-Oct-2013 (2)	03-Feb-2014 (2)	26-May-2014 (2)	09-Oct-2014 (2)
			SW-4	SW-3	W-1	W-3	W-1	SW3	W-3	W-3	3	W3	3	s3	s3
<b>Semi-VOCs</b>															
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthylene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Anthracene	ug/l	0.0008 <sup>(15)</sup>	<0.01	--	<0.01	<b>0.01</b>	--	--	--	<0.1	--	--	--	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]pyrene	ug/l	--	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Chrysene	ug/l	0.0001 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	<0.02	--	<0.02	<b>0.10</b>	--	--	--	<0.1	--	--	--	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	<0.02	--	<0.02	<b>0.04</b>	--	--	--	<0.1	--	--	--	--	--
Pyrene	ug/l	--	0.02	--	<0.02	0.07	--	--	--	<0.1	--	--	--	--	--
Styrene	ug/l	4 <sup>(18)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	70	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
1,1,2-Trichloroethane	ug/l	800	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
1,1-Dichloroethane	ug/l	200	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
1,1-Dichloroethylene	ug/l	40	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
1,2-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
1,2-Dichloroethane	ug/l	100	<0.5	--	<1	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
1,3,5-Trimethylbenzene	ug/l	--	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	--	--
1,3-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
1,4-Dichlorobenzene	ug/l	4	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	--	--
Bromoform	ug/l	60 <sup>(15)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
Carbon Tetrachloride	ug/l	--	<0.5	--	<1	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
Chloroethane	ug/l	--	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
Chloroform	ug/l	--	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
Chloromethane	ug/l	700 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
cis-1,2-Dichloropropene	ug/l	--	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	--	--
Dichlorodifluoromethane	ug/l	--	--	--	--	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	<4.0	--	<8.0	<4.0	<4.0	--	--	<4.0	--	--	--	--	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	--	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	--	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
Trichloroethene	ug/l	20	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	--	--
Trichlorofluoromethane	ug/l	--	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	--	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	--	--

Parameter	Unit	(2) (1) PWQO	SW-3	SW-3
			17-Jun-2015	27-Aug-2015 (5)
			W-2	3
<b>General Chemistry</b>				
Alkalinity (Total as CaCO3)	mg/l	-- (6)	165	--
Ammonia, unionized	ug/l	20	<50	--
Ammonia Nitrogen	ug/l	--	<50	--
Ammonium	ug/l	--	<50	--
Bicarbonate	ug/l	--	165000	--
Bromide	ug/l	--	<250	--
Carbonate (CO3)	ug/l	--	<1000 (7)	--
Color	color unit	--	23	--
Conductivity	uS/cm	--	603	--
Conductivity (Field)	uS/cm	--	849	--
Dissolved Oxygen (Field)	mg/l	-- (8)	0.91	--
Fluoride	ug/l	--	2360	--
Hardness, Calcium Carbonate	ug/l	--	232000	--
Nitrate as N	ug/l	--	130	--
Nitrite as N	ug/l	--	<100	--
pH	-	8.5	7.99	--
pH (Field)	-	8.5	8	--
Phosphorus	ug/l	-- (9)	<50	--
Sulfate	ug/l	--	85000	--
Temperature (Field)	deg c	-- (10)	15	--
Total Organic Carbon	ug/l	--	4700	--
Total Suspended Solids	ug/l	--	7000	--
Turbidity	ntu	-- (11)	13.5	--
Turbidity (Field)	ntu	-- (11)	5.9	--
<b>Metals</b>				
Aluminum, dissolved	ug/l	-- (12)	10	--
Arsenic	ug/l	100 (13)	<1	--
Barium	ug/l	--	40	--
Beryllium	ug/l	-- (14)	<0.5	--
Boron	ug/l	200 (15)	170	--
Cadmium	ug/l	0.2 (13)	<0.1	--
Calcium	ug/l	--	78000	--
Chromium	ug/l	-- (16)	<1	--
Cobalt	ug/l	0.9	<0.2	--
Copper	ug/l	5	4	--
Iron	ug/l	300	250	--
Lead	ug/l	-- (17)	<1	--
Magnesium	ug/l	--	9000	--
Manganese	ug/l	--	20	--
Molybdenum	ug/l	40	<5	--
Nickel	ug/l	25	<5	--
Potassium	ug/l	--	4000	--
Selenium	ug/l	100	<1	--
Silver	ug/l	0.1	<0.1	--
Sodium	ug/l	--	42000	--
Strontium	ug/l	--	1500	--
Thallium	ug/l	0.3 (18)	<0.1	--
Titanium	ug/l	--	20	--
Vanadium	ug/l	6	7	--
Zinc	ug/l	30 (13)	<10	--
<b>Petroleum Hydrocarbons</b>				
Benzene	ug/l	100 (19)	<0.5	--
Ethylbenzene	ug/l	8	<0.5	--
m,p-Xylenes	ug/l	--	<0.4	--
o-Xylene	ug/l	40 (18)	<0.4	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	<20	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	ug/l	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	<20	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	<50	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	<50	--
Toluene	ug/l	0.8	<0.5	--
Xylenes, Total	ug/l	--	<0.5	--

Parameter	Unit	(2) (1) PWQO	SW-3	SW-3
			17-Jun-2015	27-Aug-2015 (5)
			W-2	3
<b>Semi-VOCs</b>				
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	--	--
Acenaphthene	ug/l	--	--	--
Acenaphthylene	ug/l	--	--	--
Anthracene	ug/l	0.0008 <sup>(15)</sup>	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	--	--
Benzo[a]pyrene	ug/l	--	--	--
Benzo[b]fluoranthene	ug/l	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	--	--
Chrysene	ug/l	0.0001 <sup>(15)</sup>	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	--	--
Pyrene	ug/l	--	--	--
Styrene	ug/l	4 <sup>(18)</sup>	<0.5	--
<b>VOCs</b>				
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	<0.5	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	<0.5	--
1,1,2-Trichloroethane	ug/l	800	<0.4	--
1,1-Dichloroethane	ug/l	200	<0.4	--
1,1-Dichloroethylene	ug/l	40	<0.5	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	<0.4	--
1,2-Dichloroethane	ug/l	100	<0.2	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	<0.4	--
1,4-Dichlorobenzene	ug/l	4	<0.4	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	<0.3	--
Bromoform	ug/l	60 <sup>(15)</sup>	<0.4	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	<0.5	--
Carbon Tetrachloride	ug/l	--	<0.2	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	<0.2	--
Chloroethane	ug/l	--	<0.2	--
Chloroform	ug/l	--	<0.5	--
Chloromethane	ug/l	700 <sup>(15)</sup>	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	<0.2	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	<0.3	--
Dichlorodifluoromethane	ug/l	--	<0.5	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	<4	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	<0.2	--
Trichloroethene	ug/l	20	<0.3	--
Trichlorofluoromethane	ug/l	--	<0.5	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	<0.2	--

Parameter	Unit	(2) (1) PWQO	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (4)	10-May-2012	14-Jun-2012 (5)	17-Sep-2012 (5)	18-Dec-2012	11-Apr-2013	05-Jul-2013 (5)	21-Oct-2013 (5)	03-Feb-2014 (3)	26-May-2014 (5)	09-Oct-2014 (3)
			SW-3	SW-4	W-5	W-2	w4	sw4	W-5	W-7	4	w4	4	s4	s4
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	-- (6)	335	--	259	286	--	--	187	248	--	--	--	--	--
Ammonia, unionized	ug/l	20	--	--	<20	<20	--	--	<20	<20	--	--	--	--	--
Ammonia Nitrogen	ug/l	--	<20	--	<20	<20	--	--	40	220	--	--	--	--	--
Ammonium	ug/l	--	<20	--	<20	<20	--	--	40	220	--	--	--	--	--
Bicarbonate	ug/l	--	335000	--	259000	286000	--	--	187000	248000	--	--	--	--	--
Bromide	ug/l	--	<250	--	<250	<250	--	--	<250	<250	--	--	--	--	--
Carbonate (CO3)	ug/l	--	<2000 (7)	--	<2000 (7)	<1000 (7)	--	--	<1000 (7)	<1000 (7)	--	--	--	--	--
Color	color unit	--	7	--	8	38	--	--	23	9	--	--	--	--	--
Conductivity	uS/cm	--	907	--	834	1310	--	--	685	824	--	--	--	--	--
Conductivity (Field)	uS/cm	--	902	--	830	895	--	--	730	940	--	--	--	--	--
Dissolved Oxygen (Field)	mg/l	-- (8)	4.88	--	5.18	2.7	--	--	3.01	5.11	--	--	--	--	--
Fluoride	ug/l	--	150	--	150	210	--	--	110	180	--	--	--	--	--
Hardness, Calcium Carbonate	ug/l	--	383000	--	319000	362000	--	--	231000	346000	--	--	--	--	--
Nitrate as N	ug/l	--	140	--	160	<100	--	--	290	480	--	--	--	--	--
Nitrite as N	ug/l	--	<100	--	<100	<100	--	--	<100	<100	--	--	--	--	--
pH	-	8.5	8.14	--	8.02	7.84	--	--	8.03	8.06	--	--	--	--	--
pH (Field)	-	8.5	7.82	--	8.0	7.5	--	--	8.2	8.2	--	--	--	--	--
Phosphorus	ug/l	-- (9)	10	--	20	10	--	--	40	50	--	--	--	--	--
Sulfate	ug/l	--	78000	--	62000	89000	--	--	30000	51000	--	--	--	--	--
Temperature (Field)	deg c	-- (10)	2.6	--	2	13	--	--	2	3	--	--	--	--	--
Total Organic Carbon	ug/l	--	3300	--	4200	7400	--	--	4800	3600	--	--	--	--	--
Total Suspended Solids	ug/l	--	14000	--	3000	3000	--	--	27000	7000	--	--	--	--	--
Turbidity	ntu	-- (11)	1.2	--	1.2	2.4	--	--	26.5	4.5	--	--	--	--	--
Turbidity (Field)	ntu	-- (11)	--	--	--	--	--	--	31	11.8	--	--	--	--	--
<b>Metals</b>															
Aluminum, dissolved	ug/l	-- (12)	<10	--	<10	<10	--	--	<10	<10	--	--	--	--	--
Arsenic	ug/l	100 (13)	<1	--	<1	<1	--	--	<1	<1	--	--	--	--	--
Barium	ug/l	--	50	--	40	50	--	--	40	40	--	--	--	--	--
Beryllium	ug/l	-- (14)	<1	--	<0.5	<0.5	--	--	<0.5	<0.5	--	--	--	--	--
Boron	ug/l	200 (15)	30	--	30	60	--	--	10	20	--	--	--	--	--
Cadmium	ug/l	0.2 (13)	<0.1	--	<0.1	<0.1	--	--	<0.1	<0.1	--	--	--	--	--
Calcium	ug/l	--	122000	--	103000	112000	--	--	76000	112000	--	--	--	--	--
Chromium	ug/l	-- (16)	2	--	2	6	--	--	4	3	--	--	--	--	--
Cobalt	ug/l	0.9	0.2	--	0.5	0.4	--	--	0.2	0.2	--	--	--	--	--
Copper	ug/l	5	1	--	1	1	--	--	2	2	--	--	--	--	--
Iron	ug/l	300	40	--	330	280	--	--	200	140	--	--	--	--	--
Lead	ug/l	-- (17)	<1	--	<1	<1	--	--	<1	<1	--	--	--	--	--
Magnesium	ug/l	--	19000	--	15000	20000	--	--	10000	16000	--	--	--	--	--
Manganese	ug/l	--	40	--	280	100	--	--	20	20	--	--	--	--	--
Molybdenum	ug/l	40	<5	--	<5	<5	--	--	<5	<5	--	--	--	--	--
Nickel	ug/l	25	<5	--	<5	<5	--	--	<5	<5	--	--	--	--	--
Potassium	ug/l	--	2000	--	2000	3000	--	--	3000	3000	--	--	--	--	--
Selenium	ug/l	100	<1	--	<1	<1	--	--	<1	<1	--	--	--	--	--
Silver	ug/l	0.1	<0.1	--	<0.1	<0.1	--	--	<0.1	<0.1	--	--	--	--	--
Sodium	ug/l	--	40000	--	43000	124000	--	--	49000	57000	--	--	--	--	--
Strontium	ug/l	--	1950	--	2080	2650	--	--	691	1800	--	--	--	--	--
Thallium	ug/l	0.3 (18)	<0.1	--	<0.1	<0.1	--	--	<0.1	<0.1	--	--	--	--	--
Titanium	ug/l	--	<10	--	<10	<10	--	--	20	<10	--	--	--	--	--
Vanadium	ug/l	6	2	--	3	3	--	--	3	1	--	--	--	--	--
Zinc	ug/l	30 (13)	10	--	30	<10	--	--	10	20	--	--	--	--	--
<b>Petroleum Hydrocarbons</b>															
Benzene	ug/l	100 (18)	<0.5	--	<1	<0.5	--	--	<0.5	<0.5	--	--	--	--	--
Ethylbenzene	ug/l	8	<0.5	--	<1	<0.5	--	--	<0.5	<0.5	--	--	--	--	--
m,p-Xylenes	ug/l	--	<1.0	--	<2.0	<0.5	--	--	<0.5	<0.5	--	--	--	--	--
o-Xylene	ug/l	40 (18)	<0.5	--	<1	<0.5	--	--	<0.5	<0.5	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	<100	--	<100	<100	--	--	--	<100	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	ug/l	--	<100	--	<100	<100	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	300	--	<100	<100	--	--	--	<100	--	--	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	--	--
Toluene	ug/l	0.8	<0.5	--	<1	<0.5	--	--	<0.5	<0.5	--	--	--	--	--
Xylenes, Total	ug/l	--	--	--	<3	<1.0	--	--	--	<1.0	--	--	--	--	--



Parameter	Unit	(2) (1) PWQO	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4	SW-4
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (4)	10-May-2012	14-Jun-2012 (5)	17-Sep-2012 (5)	18-Dec-2012	11-Apr-2013	05-Jul-2013 (5)	21-Oct-2013 (5)	03-Feb-2014 (3)	26-May-2014 (5)	09-Oct-2014 (3)
			SW-3	SW-4	W-5	W-2	w4	sw4	W-5	W-7	4	w4	4	s4	s4
<b>Semi-VOCs</b>															
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthylene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Anthracene	ug/l	0.0008 <sup>(15)</sup>	<0.01	--	<0.01	0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	<0.01	--	<0.01	0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]pyrene	ug/l	--	<0.01	--	<0.01	0.02	--	--	--	<0.01	--	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Chrysene	ug/l	0.0001 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	<0.02	--	<0.02	0.05	--	--	--	<0.1	--	--	--	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	<0.02	--	<0.02	0.06	--	--	--	<0.1	--	--	--	--	--
Pyrene	ug/l	--	<0.02	--	0.03	0.04	--	--	--	<0.1	--	--	--	--	--
Styrene	ug/l	4 <sup>(18)</sup>	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	--	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	--	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	70	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	--	--
1,1,2-Trichloroethane	ug/l	800	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
1,1-Dichloroethane	ug/l	200	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
1,1-Dichloroethylene	ug/l	40	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	--	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	--	--	--	<0.2	--	--	--	--	--
1,2-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
1,2-Dichloroethane	ug/l	100	<0.5	--	<1	<0.2	--	--	--	<0.2	--	--	--	--	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	--	--
1,3,5-Trimethylbenzene	ug/l	--	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	--	--
1,3-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
1,4-Dichlorobenzene	ug/l	4	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	--	--
Bromoform	ug/l	60 <sup>(15)</sup>	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	--	--
Carbon Tetrachloride	ug/l	--	<0.5	--	<1	<0.2	--	--	--	<0.2	--	--	--	--	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	<0.2	--	<0.4	<0.2	--	--	--	<0.2	--	--	--	--	--
Chloroethane	ug/l	--	<1.0	--	<2.0	<0.2	--	--	--	<0.2	--	--	--	--	--
Chloroform	ug/l	--	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	--	--
Chloromethane	ug/l	700 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	--	--	--	<0.2	--	--	--	--	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
cis-1,2-Dichloropropene	ug/l	--	<0.2	--	<0.4	<0.2	--	--	--	<0.2	--	--	--	--	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	--	--
Dichlorodifluoromethane	ug/l	--	--	--	--	<0.5	--	--	--	<0.5	--	--	--	--	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	<4.0	--	<8.0	<4.0	--	--	--	<4.0	--	--	--	--	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	--	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	--	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	--	--	--	<0.2	--	--	--	--	--
Trichloroethene	ug/l	20	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	--	--
Trichlorofluoromethane	ug/l	--	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	--	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	--	--	--	<0.2	--	--	--	--	--

Parameter	Unit	(2) (1) PWQO	SW-4	SW-4	SW-4
			24-Mar-2015 (3)	17-Jun-2015	27-Aug-2015 (5)
			3	W-6	4
<b>General Chemistry</b>					
Alkalinity (Total as CaCO3)	mg/l	-- (6)	--	341	--
Ammonia, unionized	ug/l	20	--	<50	--
Ammonia Nitrogen	ug/l	--	--	<50	--
Ammonium	ug/l	--	--	<50	--
Bicarbonate	ug/l	--	--	341000	--
Bromide	ug/l	--	--	<250	--
Carbonate (CO3)	ug/l	--	--	<1000 (7)	--
Color	color unit	--	--	82	--
Conductivity	uS/cm	--	--	1520	--
Conductivity (Field)	uS/cm	--	--	860	--
Dissolved Oxygen (Field)	mg/l	-- (8)	--	1.23	--
Fluoride	ug/l	--	--	200	--
Hardness, Calcium Carbonate	ug/l	--	--	288000	--
Nitrate as N	ug/l	--	--	<100	--
Nitrite as N	ug/l	--	--	<100	--
pH	-	8.5	--	8.09	--
pH (Field)	-	8.5	--	7.9	--
Phosphorus	ug/l	-- (9)	--	<50	--
Sulfate	ug/l	--	--	53000	--
Temperature (Field)	deg c	-- (10)	--	17	--
Total Organic Carbon	ug/l	--	--	11400	--
Total Suspended Solids	ug/l	--	--	4000	--
Turbidity	ntu	-- (11)	--	9.9	--
Turbidity (Field)	ntu	-- (11)	--	5.1	--
<b>Metals</b>					
Aluminum, dissolved	ug/l	-- (12)	--	10	--
Arsenic	ug/l	100 (13)	--	<1	--
Barium	ug/l	--	--	60	--
Beryllium	ug/l	-- (14)	--	<0.5	--
Boron	ug/l	200 (15)	--	30	--
Cadmium	ug/l	0.2 (13)	--	<0.1	--
Calcium	ug/l	--	--	89000	--
Chromium	ug/l	-- (16)	--	1	--
Cobalt	ug/l	0.9	--	0.3	--
Copper	ug/l	5	--	5	--
Iron	ug/l	300	--	460	--
Lead	ug/l	-- (17)	--	<1	--
Magnesium	ug/l	--	--	16000	--
Manganese	ug/l	--	--	30	--
Molybdenum	ug/l	40	--	<5	--
Nickel	ug/l	25	--	<5	--
Potassium	ug/l	--	--	3000	--
Selenium	ug/l	100	--	<1	--
Silver	ug/l	0.1	--	<0.1	--
Sodium	ug/l	--	--	224000	--
Strontium	ug/l	--	--	966	--
Thallium	ug/l	0.3 (18)	--	<0.1	--
Titanium	ug/l	--	--	30	--
Vanadium	ug/l	6	--	1	--
Zinc	ug/l	30 (13)	--	<10	--
<b>Petroleum Hydrocarbons</b>					
Benzene	ug/l	100 (18)	--	<0.5	--
Ethylbenzene	ug/l	8	--	<0.5	--
m,p-Xylenes	ug/l	--	--	<0.4	--
o-Xylene	ug/l	40 (18)	--	<0.4	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	ug/l	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	--	<50	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	--	<50	--
Toluene	ug/l	0.8	--	<0.5	--
Xylenes, Total	ug/l	--	--	<0.5	--

Parameter	Unit	(2) (1) PWQO	SW-4	SW-4	SW-4
			24-Mar-2015 (3)	17-Jun-2015	27-Aug-2015 (5)
			3	W-6	4
<b>Semi-VOCs</b>					
1-Methylnaphthalene	ug/l	2 (18)	--	--	--
2-Methylnaphthalene	ug/l	2 (18)	--	--	--
Acenaphthene	ug/l	--	--	--	--
Acenaphthylene	ug/l	--	--	--	--
Anthracene	ug/l	0.0008 (15)	--	--	--
Benzo[a]anthracene	ug/l	0.0004 (15)	--	--	--
Benzo[a]pyrene	ug/l	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 (15)	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 (15)	--	--	--
Chrysene	ug/l	0.0001 (15)	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 (15)	--	--	--
Fluoranthene	ug/l	0.0008 (15)	--	--	--
Fluorene	ug/l	0.2 (15)	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	--	--	--
Naphthalene	ug/l	7 (15)	--	--	--
Phenanthrene	ug/l	0.03 (15)	--	--	--
Pyrene	ug/l	--	--	--	--
Styrene	ug/l	4 (18)	--	<0.5	--
<b>VOCs</b>					
1,1,1,2-Tetrachloroethane	ug/l	20 (15)	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 (18)	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	--	<0.4	--
1,1-Dichloroethane	ug/l	200	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	--	<0.5	--
1,2-Dibromoethane	ug/l	5 (15)	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,2-Dichloroethane	ug/l	100	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 (15)	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	--	<0.4	--
Bromodichloromethane	ug/l	200 (15)	--	<0.3	--
Bromoform	ug/l	60 (15)	--	<0.4	--
Bromomethane	ug/l	0.9 (20)	--	<0.5	--
Carbon Tetrachloride	ug/l	--	--	<0.2	--
Chlorobenzene	ug/l	15 (21)	--	<0.2	--
Chloroethane	ug/l	--	--	<0.2	--
Chloroform	ug/l	--	--	<0.5	--
Chloromethane	ug/l	700 (15)	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 (22)	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	--	<0.2	--
Dibromochloromethane	ug/l	40 (15)	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	<0.5	--
Methylene Chloride	ug/l	100 (23)	--	<4	--
Tetrachloroethylene	ug/l	50 (24)	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 (22)	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 (15)	--	<0.2	--
Trichloroethene	ug/l	20	--	<0.3	--
Trichlorofluoromethane	ug/l	--	--	<0.5	--
Vinyl Chloride	ug/l	600 (15)	--	<0.2	--

Cornwall TDA Embankment - Report of Monitoring Results

1413191-1030

Parameter	Unit	(2) (1) PWQO	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (4)	10-May-2012	14-Jun-2012	17-Sep-2012 (2)	18-Dec-2012	11-Apr-2013	05-Jul-2013 (2)	21-Oct-2013	03-Feb-2014 (2)	26-May-2014	09-Oct-2014
			SW-2	SW-6	W-6	W-7	W-5	s6	W-6	W-1	6	W - 4	6	SW - 6	SW 6
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	-- (6)	417	--	232	366	437	--	85	215	--	398	--	371	327
Ammonia, unionized	ug/l	20	--	--	<20	<20	<20	--	<20	<20	--	<20	--	<20	<20
Ammonia Nitrogen	ug/l	--	40	--	<20	<20	120	--	50	70	--	30	--	30	110
Ammonium	ug/l	--	40	--	<20	<20	120	--	50	70	--	30	--	30	110
Bicarbonate	ug/l	--	417000	--	232000	366000	437000	--	85000	215000	--	398000	--	371000	320000
Bromide	ug/l	--	<250	--	570	<250	490	--	<250	<250	--	<250	--	<250	<250
Carbonate (CO3)	ug/l	--	<2000 (7)	--	<2000 (7)	<1000 (7)	<1000 (7)	--	<1000 (7)	<1000 (7)	--	<1000 (7)	--	<1000 (7)	6000
Color	color unit	--	41	--	24	16	127	--	40	20	--	31	--	46	38
Conductivity	uS/cm	--	1840	--	1280	1490	2500	--	1020	1010	--	1980	--	1300	1960
Conductivity (Field)	uS/cm	--	1862	--	1936	1740	2460	--	1056	720	--	1010	--	1095	885
Dissolved Oxygen (Field)	mg/l	-- (6)	8.84	--	7.69	2.88	4.91	--	4.22	6.10	--	9.3	--	5.11	4.11
Fluoride	ug/l	--	120	--	<100	100	180	--	120	110	--	140	--	150	210
Hardness, Calcium Carbonate	ug/l	--	482000	--	340000	371000	311000	--	109000	288000	--	373000	--	342000	293000
Nitrate as N	ug/l	--	<100	--	<100	<100	<100	--	190	<100	--	<100	--	<100	160
Nitrite as N	ug/l	--	<100	--	<100	<100	<100	--	<100	<100	--	<100	--	<100	<100
pH	-	8.5	7.94	--	7.89	8.11	7.82	--	7.33	7.91	--	8.08	--	8.05	8.33
pH (Field)	-	8.5	7.41	--	7.5	7.4	7.8	--	7.4	8.0	--	7.7	--	7.5	7.6
Phosphorus	ug/l	-- (6)	60	--	30	<10	130	--	140	30	--	150	--	50	80
Sulfate	ug/l	--	84000	--	35000	23000	43000	--	37000	40000	--	93000	--	57000	102000
Temperature (Field)	deg c	-- (10)	2.1	--	3	14	21	--	1	1	--	5	--	12	5
Total Organic Carbon	ug/l	--	8800	--	5300	4400	20600	--	7300	5000	--	10800	--	8300	8500
Total Suspended Solids	ug/l	--	11000	--	5000	4000	17000	--	18000	18000	--	32000	--	5000	4000
Turbidity	ntu	-- (11)	3.6	--	1.9	0.3	1.7	--	15.2	1.7	--	1.8	--	5.9	5.0
Turbidity (Field)	ntu	-- (11)	--	--	--	71	3.2	--	20	14.2	--	4.34	--	19	16.6
<b>Metals</b>															
Aluminum, dissolved	ug/l	-- (12)	<10	--	<10	<10	10	--	<10	<10	--	<10	--	<10	<10
Arsenic	ug/l	100 (13)	<1	--	<1	<1	<1	--	<1	<1	--	<1	--	<1	<1
Barium	ug/l	--	60	--	40	60	70	--	30	40	--	60	--	50	70
Beryllium	ug/l	-- (14)	<1	--	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	<0.5	--	<0.5	<0.5
Boron	ug/l	200 (15)	10	--	<10	<10	30	--	10	<10	--	20	--	20	40
Cadmium	ug/l	0.2 (13)	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	--	<0.1	--	<0.1	<0.1
Calcium	ug/l	--	147000	--	108000	114000	98000	--	37000	89000	--	113000	--	104000	91000
Chromium	ug/l	-- (16)	4	--	4	7	8	--	4	4	--	9	--	<1	<1
Cobalt	ug/l	0.9	0.3	--	<0.2	0.6	0.4	--	0.2	<0.2	--	0.2	--	0.3	0.3
Copper	ug/l	5	1	--	3	1	3	--	3	1	--	1	--	1	2
Iron	ug/l	300	390	--	270	420	360	--	290	50	--	140	--	160	250
Lead	ug/l	-- (17)	<1	--	<1	<1	<1	--	1	<1	--	<1	--	<1	<1
Magnesium	ug/l	--	28000	--	17000	21000	16000	--	4000	16000	--	22000	--	20000	16000
Manganese	ug/l	--	130	--	40	260	390	--	40	50	--	30	--	100	240
Molybdenum	ug/l	40	<5	--	<5	<5	<5	--	<5	<5	--	<5	--	<5	<5
Nickel	ug/l	25	<5	--	<5	<5	<5	--	<5	<5	--	<5	--	<5	<5
Potassium	ug/l	--	2000	--	2000	<1000	1000	--	4000	2000	--	2000	--	2000	3000
Selenium	ug/l	100	<1	--	<1	<1	<1	--	<1	<1	--	<1	--	<1	<1
Silver	ug/l	0.1	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	--	<0.1	--	<0.1	<0.1
Sodium	ug/l	--	213000	--	177000	149000	305000	--	145000	117000	--	222000	--	158000	246000
Strontium	ug/l	--	977	--	987	802	1140	--	421	774	--	1200	--	872	1280
Thallium	ug/l	0.3 (18)	<0.1	--	<0.1	<0.1	<0.1	--	<0.1	<0.1	--	<0.1	--	<0.1	<0.1
Titanium	ug/l	--	<10	--	<10	<10	<10	--	20	<10	--	<10	--	<10	<10
Vanadium	ug/l	6	4	--	2	3	4	--	2	2	--	3	--	<1	<1
Zinc	ug/l	30 (13)	<10	--	10	<10	<10	--	30	<10	--	<10	--	<10	<10
<b>Petroleum Hydrocarbons</b>															
Benzene	ug/l	100 (18)	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	--	<0.5	--	<0.5	<0.5
Ethylbenzene	ug/l	8	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	--	<0.5	--	<0.5	<0.5
m,p-Xylenes	ug/l	--	<1.0	--	<2.0	<0.5	<0.5	--	<0.5	<0.5	--	<0.5	--	<0.5	<0.5
o-Xylene	ug/l	40 (18)	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	--	<0.5	--	<0.5	<0.5
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	--	--	<100	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	ug/l	--	<100	--	<100	<100	<100	--	--	--	--	--	--	<100	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	<100	--	<100	<100	<100	--	--	<100	--	--	--	<100	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	<200	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	<200	--
Toluene	ug/l	0.8	<0.5	--	<1	<0.5	<0.5	--	<0.5	<0.5	--	<0.5	--	<0.5	<0.5
Xylenes, Total	ug/l	--	--	--	<3	<1.0	<1.0	--	--	<1.0	--	--	--	<1.0	--

Parameter	Unit	(2)(1) PWQO	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6	SW-6
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (4)	10-May-2012	14-Jun-2012	17-Sep-2012 (3)	18-Dec-2012	11-Apr-2013	05-Jul-2013 (3)	21-Oct-2013	03-Feb-2014 (3)	26-May-2014	09-Oct-2014
			SW-2	SW-6	W-6	W-7	W-5	S6	W-6	W-1	6	W-4	6	SW-6	SW-6
<b>Semi-VOCs</b>															
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	0.03	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthylene	ug/l	--	0.03	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Anthracene	ug/l	0.0008 <sup>(16)</sup>	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]pyrene	ug/l	--	<0.01	--	<0.01	<0.01	--	--	--	<0.01	--	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Chrysene	ug/l	0.0001 <sup>(16)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	<b>0.09</b>	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Pyrene	ug/l	--	0.11	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Styrene	ug/l	4 <sup>(16)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1-Dichloroethane	ug/l	200	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,2-Dichloroethane	ug/l	100	<0.5	--	<1	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Bromoform	ug/l	60 <sup>(15)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Carbon Tetrachloride	ug/l	--	<0.5	--	<1	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chloroethane	ug/l	--	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Chloroform	ug/l	--	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Chloromethane	ug/l	700 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	--	--	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	<4.0	--	<8.0	<4.0	<4.0	--	--	<4.0	--	--	--	<4.0	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	<0.4	--	--	<0.4	--	--	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--
Trichloroethene	ug/l	20	<0.3	--	<0.6	<0.3	<0.3	--	--	<0.3	--	--	--	<0.3	--
Trichlorofluoromethane	ug/l	--	<0.5	--	<1	<0.5	<0.5	--	--	<0.5	--	--	--	<0.5	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	<0.2	--	--	<0.2	--	--	--	<0.2	--

Parameter	Unit	(2) (1) PWQO	SW-6	SW-6	SW-6
			24-Mar-2015 (6)	17-Jun-2015	27-Aug-2015 (6)
			6	W-7	6
<b>General Chemistry</b>					
Alkalinity (Total as CaCO <sub>3</sub> )	mg/l	-- (6)	--	279	--
Ammonia, unionized	ug/l	20	--	<50	--
Ammonia Nitrogen	ug/l	--	--	<50	--
Ammonium	ug/l	--	--	<50	--
Bicarbonate	ug/l	--	--	279000	--
Bromide	ug/l	--	--	<250	--
Carbonate (CO <sub>3</sub> )	ug/l	--	--	<1000 (7)	--
Color	color unit	--	--	10	--
Conductivity	uS/cm	--	--	1100	--
Conductivity (Field)	uS/cm	--	--	1040	--
Dissolved Oxygen (Field)	mg/l	-- (8)	--	1.09	--
Fluoride	ug/l	--	--	2150	--
Hardness, Calcium Carbonate	ug/l	--	--	491000	--
Nitrate as N	ug/l	--	--	220	--
Nitrite as N	ug/l	--	--	<100	--
pH	-	8.5	--	8.09	--
pH (Field)	-	8.5	--	7.82	--
Phosphorus	ug/l	-- (9)	--	<50	--
Sulfate	ug/l	--	--	238000	--
Temperature (Field)	deg c	-- (10)	--	16	--
Total Organic Carbon	ug/l	--	--	3400	--
Total Suspended Solids	ug/l	--	--	3000	--
Turbidity	ntu	-- (11)	--	5.2	--
Turbidity (Field)	ntu	-- (11)	--	12.2	--
<b>Metals</b>					
Aluminum, dissolved	ug/l	-- (12)	--	10	--
Arsenic	ug/l	100 (13)	--	<1	--
Barium	ug/l	--	--	70	--
Beryllium	ug/l	-- (14)	--	<0.5	--
Boron	ug/l	200 (15)	--	350	--
Cadmium	ug/l	0.2 (13)	--	<0.1	--
Calcium	ug/l	--	--	162000	--
Chromium	ug/l	-- (16)	--	<1	--
Cobalt	ug/l	0.9	--	<0.2	--
Copper	ug/l	5	--	3	--
Iron	ug/l	300	--	150	--
Lead	ug/l	-- (17)	--	<1	--
Magnesium	ug/l	--	--	21000	--
Manganese	ug/l	--	--	50	--
Molybdenum	ug/l	40	--	<5	--
Nickel	ug/l	25	--	<5	--
Potassium	ug/l	--	--	7000	--
Selenium	ug/l	100	--	<1	--
Silver	ug/l	0.1	--	<0.1	--
Sodium	ug/l	--	--	61000	--
Strontium	ug/l	--	--	3730	--
Thallium	ug/l	0.3 (18)	--	<0.1	--
Titanium	ug/l	--	--	<10	--
Vanadium	ug/l	6	--	3	--
Zinc	ug/l	30 (13)	--	20	--
<b>Petroleum Hydrocarbons</b>					
Benzene	ug/l	100 (18)	--	<0.5	--
Ethylbenzene	ug/l	8	--	<0.5	--
m,p-Xylenes	ug/l	--	--	<0.4	--
o-Xylene	ug/l	40 (18)	--	<0.4	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	ug/l	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	--	<50	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	--	<50	--
Toluene	ug/l	0.8	--	<0.5	--
Xylenes, Total	ug/l	--	--	<0.5	--

Parameter	Unit	(2) (1) PWQO	SW-6	SW-6	SW-6
			24-Mar-2015 (5)	17-Jun-2015	27-Aug-2015 (5)
			6	W-7	6
<b>Semi-VOCs</b>					
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	--	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	--	--	--
Acenaphthene	ug/l	--	--	--	--
Acenaphthylene	ug/l	--	--	--	--
Anthracene	ug/l	0.0008 <sup>(15)</sup>	--	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	--	--	--
Benzo[a]pyrene	ug/l	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	--	--	--
Chrysene	ug/l	0.0001 <sup>(15)</sup>	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	--	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	--	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	--	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	--	--	--
Pyrene	ug/l	--	--	--	--
Styrene	ug/l	4 <sup>(18)</sup>	--	<0.5	--
<b>VOCs</b>					
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	--	<0.4	--
1,1-Dichloroethane	ug/l	200	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	--	<0.5	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,2-Dichloroethane	ug/l	100	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	--	<0.4	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	--	<0.3	--
Bromoform	ug/l	60 <sup>(15)</sup>	--	<0.4	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	--	<0.5	--
Carbon Tetrachloride	ug/l	--	--	<0.2	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	--	<0.2	--
Chloroethane	ug/l	--	--	<0.2	--
Chloroform	ug/l	--	--	<0.5	--
Chloromethane	ug/l	700 <sup>(15)</sup>	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	--	<0.2	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	<0.5	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	--	<4	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	--	<0.2	--
Trichloroethene	ug/l	20	--	<0.3	--
Trichlorofluoromethane	ug/l	--	--	<0.5	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	--	<0.2	--



Cornwall TDA Embankment - Report of Monitoring Results

1413191-1030

Parameter	Unit	(2) (1) PWQO	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (2)	10-May-2012	14-Jun-2012 (2)	17-Sep-2012 (2)	18-Dec-2012	11-Apr-2013	05-Jul-2013	21-Oct-2013 (2)	03-Feb-2014 (2)	26-May-2014	09-Oct-2014
			SW-1	SW-7	W-7	W-1	w7	s7	W-1	W-2	W-1	w7	7	SW - 7	SW 7
<b>General Chemistry</b>															
Alkalinity (Total as CaCO3)	mg/l	-- (6)	371	--	326	294	--	--	255	315	396	--	--	372	314
Ammonia, unionized	ug/l	20	--	--	<20	<20	--	--	<20	<20	<20	--	--	<20	<20
Ammonia Nitrogen	ug/l	--	<20	--	20	<20	--	--	<20	40	<20	--	--	<20	70
Ammonium	ug/l	--	<20	--	20	<20	--	--	<20	40	<20	--	--	<20	70
Bicarbonate	ug/l	--	371000	--	326000	294000	--	--	255000	315000	396000	--	--	372000	314000
Bromide	ug/l	--	<250	--	<250	<250	--	--	<250	<250	330	--	--	<250	<250
Carbonate (CO3)	ug/l	--	<2000 (7)	--	<2000 (7)	<1000 (7)	--	--	<1000 (7)	<1000 (7)	<1000 (7)	--	--	<1000 (7)	<1000 (7)
Color	color unit	--	8	--	17	35	--	--	28	11	27	--	--	20	19
Conductivity	uS/cm	--	1540	--	1560	1360	--	--	1270	1360	1290	--	--	1070	1600
Conductivity (Field)	uS/cm	--	1467	--	1795	1466	--	--	1280	960	1250	--	--	890	810
Dissolved Oxygen (Field)	mg/l	-- (6)	6.88	--	5.34	2.98	--	--	3.11	5.88	2.60	--	--	3.91	3.70
Fluoride	ug/l	--	<100	--	<100	200	--	--	120	100	140	--	--	130	110
Hardness, Calcium Carbonate	ug/l	--	383000	--	420000	352000	--	--	315000	433000	411000	--	--	364000	520000
Nitrate as N	ug/l	--	<100	--	<100	<100	--	--	<100	<100	<100	--	--	<100	<100
Nitrite as N	ug/l	--	<100	--	<100	<100	--	--	<100	<100	<100	--	--	<100	<100
pH	-	8.5	8.14	--	8.09	7.84	--	--	8.17	8.00	8.15	--	--	8.13	8.13
pH (Field)	-	8.5	7.71	--	7.6	7.2	--	--	8.1	7.6	7.9	--	--	7.4	7.5
Phosphorus	ug/l	-- (6)	10	--	20	40	--	--	10	20	20	--	--	20	20
Sulfate	ug/l	--	46000	--	29000	88000	--	--	28000	36000	10000	--	--	28000	201000
Temperature (Field)	deg c	-- (10)	3.0	--	2	10	--	--	1	2	26	--	--	14	6
Total Organic Carbon	ug/l	--	3900	--	4200	7000	--	--	5800	3900	8700	--	--	5800	7600
Total Suspended Solids	ug/l	--	5000	--	7000	28000	--	--	<2000	13000	5000	--	--	4000	2000
Turbidity	ntu	-- (11)	0.4	--	1.0	3.6	--	--	1.3	0.9	2.0	--	--	3.4	1.3
Turbidity (Field)	ntu	-- (11)	--	--	--	64	--	--	4.8	13.8	3.8	--	--	5.40	11.8
<b>Metals</b>															
Aluminum, dissolved	ug/l	-- (12)	10	--	<10	20	--	--	<10	<10	<10	--	--	<10	<10
Arsenic	ug/l	100 (13)	<1	--	<1	<1	--	--	<1	<1	<1	--	--	<1	<1
Barium	ug/l	--	50	--	60	60	--	--	30	50	40	--	--	40	60
Beryllium	ug/l	-- (14)	<1	--	<0.5	<0.5	--	--	<0.5	<0.5	<0.5	--	--	<0.5	<0.5
Boron	ug/l	200 (15)	<10	--	<10	50	--	--	<10	<10	20	--	--	<10	20
Cadmium	ug/l	0.2 (13)	<0.1	--	<0.1	<0.1	--	--	<0.1	<0.1	<0.1	--	--	<0.1	0.1
Calcium	ug/l	--	112000	--	132000	108000	--	--	98000	134000	125000	--	--	111000	162000
Chromium	ug/l	-- (16)	3	--	6	5	--	--	4	6	6	--	--	<1	<1
Cobalt	ug/l	0.9	0.3	--	0.2	0.5	--	--	<0.2	0.3	0.8	--	--	0.3	0.5
Copper	ug/l	5	1	--	2	2	--	--	2	1	2	--	--	<1	3
Iron	ug/l	300	70	--	<30	540	--	--	<30	100	660	--	--	160	600
Lead	ug/l	-- (17)	<1	--	<1	<1	--	--	<1	<1	<1	--	--	<1	<1
Magnesium	ug/l	--	25000	--	22000	20000	--	--	17000	24000	24000	--	--	21000	28000
Manganese	ug/l	--	70	--	30	130	--	--	<10	90	990	--	--	330	520
Molybdenum	ug/l	40	<5	--	<5	<5	--	--	<5	<5	<5	--	--	<5	<5
Nickel	ug/l	25	<5	--	<5	<5	--	--	<5	<5	<5	--	--	<5	<5
Potassium	ug/l	--	<1000	--	1000	3000	--	--	2000	2000	<1000	--	--	<1000	<1000
Selenium	ug/l	100	<1	--	<1	<1	--	--	<1	<1	<1	--	--	<1	<1
Silver	ug/l	0.1	<0.1	--	<0.1	<0.1	--	--	<0.1	<0.1	<0.1	--	--	<0.1	<0.1
Sodium	ug/l	--	124000	--	166000	127000	--	--	136000	144000	137000	--	--	102000	143000
Strontium	ug/l	--	707	--	1050	2490	--	--	456	814	676	--	--	671	925
Thallium	ug/l	0.3 (18)	<0.1	--	<0.1	<0.1	--	--	<0.1	<0.1	<0.1	--	--	<0.1	<0.1
Titanium	ug/l	--	<10	--	<10	<10	--	--	<10	<10	<10	--	--	<10	<10
Vanadium	ug/l	6	3	--	3	3	--	--	3	3	3	--	--	<1	<1
Zinc	ug/l	30 (13)	<10	--	<10	10	--	--	<10	<10	20	--	--	<10	<10
<b>Petroleum Hydrocarbons</b>															
Benzene	ug/l	100 (18)	<0.5	--	<1	<0.5	--	--	<0.5	<0.5	<0.5	--	--	<0.5	<0.5
Ethylbenzene	ug/l	8	<0.5	--	<1	<0.5	--	--	<0.5	<0.5	<0.5	--	--	<0.5	<0.5
m,p-Xylenes	ug/l	--	<1.0	--	<2.0	<0.5	--	--	<0.5	<0.5	<0.5	--	--	<0.5	<0.5
o-Xylene	ug/l	40 (18)	<0.5	--	<1	<0.5	--	--	<0.5	<0.5	<0.5	--	--	<0.5	<0.5
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	<100	--	<100	<100	--	--	--	<100	--	--	--	<100	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	ug/l	--	<100	--	<100	<100	--	--	--	--	--	--	--	<100	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	<100	--	<100	<100	--	--	--	<100	--	--	--	<100	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	<200	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	<200	--	<200	<200	--	--	--	<200	--	--	--	<200	--
Toluene	ug/l	0.8	<0.5	--	<1	<0.5	--	--	<0.5	<0.5	<0.5	--	--	<0.5	<0.5
Xylenes, Total	ug/l	--	--	--	<3	<1.0	--	--	--	<1.0	<1.0	--	--	<1.0	--

Parameter	Unit	(2)(1) PWQO	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7	SW-7
			12-Nov-2010	28-Feb-2011 (2)	07-Apr-2011 (29)	10-May-2012	14-Jun-2012 (3)	17-Sep-2012 (3)	18-Dec-2012	11-Apr-2013	05-Jul-2013	21-Oct-2013 (3)	03-Feb-2014 (3)	26-May-2014	09-Oct-2014
			SW-1	SW-7	W-7	W-1	w7	s7	W-1	W-2	W-1	w7	7	SW-7	SW-7
<b>Semi-VOCs</b>															
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Acenaphthylene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Anthracene	ug/l	0.0008 <sup>(16)</sup>	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	<0.01	--	<0.01	<0.01	--	--	--	<0.1	--	--	--	--	--
Benzo[a]pyrene	ug/l	--	<0.01	--	<0.01	<0.01	--	--	--	<0.01	--	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Chrysene	ug/l	0.0001 <sup>(16)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.05	--	--	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	0.12	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	<0.02	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Pyrene	ug/l	--	0.16	--	<0.02	<0.02	--	--	--	<0.1	--	--	--	--	--
Styrene	ug/l	4 <sup>(16)</sup>	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
<b>VOCs</b>															
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
1,1-Dichloroethane	ug/l	200	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	--	--	--	<0.2	--	--	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
1,2-Dichloroethane	ug/l	100	<0.5	--	<1	<0.2	--	--	--	<0.2	--	--	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	<0.3	--
Bromoform	ug/l	60 <sup>(15)</sup>	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
Carbon Tetrachloride	ug/l	--	<0.5	--	<1	<0.2	--	--	--	<0.2	--	--	--	<0.2	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	<0.2	--	<0.4	<0.2	--	--	--	<0.2	--	--	--	<0.2	--
Chloroethane	ug/l	--	<1.0	--	<2.0	<0.2	--	--	--	<0.2	--	--	--	<0.2	--
Chloroform	ug/l	--	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
Chloromethane	ug/l	700 <sup>(15)</sup>	<1.0	--	<2.0	<0.2	--	--	--	<0.2	--	--	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	<0.2	--	<0.4	<0.2	--	--	--	<0.2	--	--	--	<0.2	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	--	--	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	<4.0	--	<8.0	<4.0	--	--	--	<4.0	--	--	--	<4.0	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	<0.4	--	<0.8	<0.4	--	--	--	<0.4	--	--	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	--	--	--	<0.2	--	--	--	<0.2	--
Trichloroethene	ug/l	20	<0.3	--	<0.6	<0.3	--	--	--	<0.3	--	--	--	<0.3	--
Trichlorofluoromethane	ug/l	--	<0.5	--	<1	<0.5	--	--	--	<0.5	--	--	--	<0.5	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	<0.2	--	<0.4	<0.2	--	--	--	<0.2	--	--	--	<0.2	--

Parameter	Unit	(2) (1) PWQO	SW-7	SW-7	SW-7
			24-Mar-2015 <sup>(6)</sup>	17-Jun-2015	27-Aug-2015 <sup>(6)</sup>
			7	W-1	7
<b>General Chemistry</b>					
Alkalinity (Total as CaCO <sub>3</sub> )	mg/l	-- <sup>(6)</sup>	--	400	--
Ammonia, unionized	ug/l	20	--	<50	--
Ammonia Nitrogen	ug/l	--	--	50	--
Ammonium	ug/l	--	--	50	--
Bicarbonate	ug/l	--	--	400000	--
Bromide	ug/l	--	--	<250	--
Carbonate (CO <sub>3</sub> )	ug/l	--	--	<1000 <sup>(7)</sup>	--
Color	color unit	--	--	34	--
Conductivity	uS/cm	--	--	1550	--
Conductivity (Field)	uS/cm	--	--	1750	--
Dissolved Oxygen (Field)	mg/l	-- <sup>(8)</sup>	--	2.04	--
Fluoride	ug/l	--	--	150	--
Hardness, Calcium Carbonate	ug/l	--	--	389000	--
Nitrate as N	ug/l	--	--	<100	--
Nitrite as N	ug/l	--	--	<100	--
pH	-	8.5	--	8.12	--
pH (Field)	-	8.5	--	7.8	--
Phosphorus	ug/l	-- <sup>(9)</sup>	--	<50	--
Sulfate	ug/l	--	--	40000	--
Temperature (Field)	deg c	-- <sup>(10)</sup>	--	14	--
Total Organic Carbon	ug/l	--	--	7200	--
Total Suspended Solids	ug/l	--	--	16000	--
Turbidity	ntu	-- <sup>(11)</sup>	--	4.9	--
Turbidity (Field)	ntu	-- <sup>(11)</sup>	--	6.6	--
<b>Metals</b>					
Aluminum, dissolved	ug/l	-- <sup>(12)</sup>	--	<10	--
Arsenic	ug/l	100 <sup>(13)</sup>	--	<1	--
Barium	ug/l	--	--	60	--
Beryllium	ug/l	-- <sup>(14)</sup>	--	<0.5	--
Boron	ug/l	200 <sup>(15)</sup>	--	20	--
Cadmium	ug/l	0.2 <sup>(13)</sup>	--	<0.1	--
Calcium	ug/l	--	--	123000	--
Chromium	ug/l	-- <sup>(16)</sup>	--	<1	--
Cobalt	ug/l	0.9	--	0.3	--
Copper	ug/l	5	--	2	--
Iron	ug/l	300	--	550	--
Lead	ug/l	-- <sup>(17)</sup>	--	<1	--
Magnesium	ug/l	--	--	20000	--
Manganese	ug/l	--	--	280	--
Molybdenum	ug/l	40	--	<5	--
Nickel	ug/l	25	--	<5	--
Potassium	ug/l	--	--	1000	--
Selenium	ug/l	100	--	<1	--
Silver	ug/l	0.1	--	<0.1	--
Sodium	ug/l	--	--	193000	--
Strontium	ug/l	--	--	1040	--
Thallium	ug/l	0.3 <sup>(18)</sup>	--	<0.1	--
Titanium	ug/l	--	--	<10	--
Vanadium	ug/l	6	--	<1	--
Zinc	ug/l	30 <sup>(13)</sup>	--	<10	--
<b>Petroleum Hydrocarbons</b>					
Benzene	ug/l	100 <sup>(18)</sup>	--	<0.5	--
Ethylbenzene	ug/l	8	--	<0.5	--
m,p-Xylenes	ug/l	--	--	<0.4	--
o-Xylene	ug/l	40 <sup>(18)</sup>	--	<0.4	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTEX	ug/l	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	--	<20	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	--	<50	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	--	<50	--
Toluene	ug/l	0.8	--	<0.5	--
Xylenes, Total	ug/l	--	--	<0.5	--

Parameter	Unit	(2) (1) PWQO	SW-7	SW-7	SW-7
			24-Mar-2015 (5)	17-Jun-2015	27-Aug-2015 (5)
			7	W-1	7
<b>Semi-VOCs</b>					
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	--	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	--	--	--
Acenaphthene	ug/l	--	--	--	--
Acenaphthylene	ug/l	--	--	--	--
Anthracene	ug/l	0.0008 <sup>(15)</sup>	--	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	--	--	--
Benzo[a]pyrene	ug/l	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	--	--	--
Chrysene	ug/l	0.0001 <sup>(15)</sup>	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	--	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	--	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	--	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	--	--	--
Pyrene	ug/l	--	--	--	--
Styrene	ug/l	4 <sup>(18)</sup>	--	<0.5	--
<b>VOCs</b>					
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	--	<0.5	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	--	<0.4	--
1,1,2,2-Tetrachloroethane	ug/l	70	--	<0.5	--
1,1,2-Trichloroethane	ug/l	800	--	<0.4	--
1,1-Dichloroethane	ug/l	200	--	<0.4	--
1,1-Dichloroethylene	ug/l	40	--	<0.5	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	--	<0.2	--
1,2-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,2-Dichloroethane	ug/l	100	--	<0.2	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	--	<0.5	--
1,3,5-Trimethylbenzene	ug/l	--	--	<0.3	--
1,3-Dichlorobenzene	ug/l	2.5	--	<0.4	--
1,4-Dichlorobenzene	ug/l	4	--	<0.4	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	--	<0.3	--
Bromoform	ug/l	60 <sup>(15)</sup>	--	<0.4	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	--	<0.5	--
Carbon Tetrachloride	ug/l	--	--	<0.2	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	--	<0.2	--
Chloroethane	ug/l	--	--	<0.2	--
Chloroform	ug/l	--	--	<0.5	--
Chloromethane	ug/l	700 <sup>(15)</sup>	--	<0.2	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	--	<0.4	--
cis-1,2-Dichloropropene	ug/l	--	--	<0.2	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	--	<0.3	--
Dichlorodifluoromethane	ug/l	--	--	<0.5	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	--	<4	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	--	<0.3	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	--	<0.4	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	--	<0.2	--
Trichloroethene	ug/l	20	--	<0.3	--
Trichlorofluoromethane	ug/l	--	--	<0.5	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	--	<0.2	--

Parameter	Unit	(2) (1) PWQO	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8
			12-Nov-2010	28-Feb-2011 (2)	10-Jun-2012 (2)	14-Jun-2012 (2)	17-Sep-2012 (2)	18-Dec-2012 (2)	11-Apr-2013 (2)	05-Jul-2013 (2)	21-Oct-2013 (2)	03-Feb-2014 (2)	26-May-2014 (2)	09-Oct-2014 (2)
			SW-5	SW-6	W-8	w8	s8	8	w8	8	w8	8	s8	s8
<b>General Chemistry</b>														
Alkalinity (Total as CaCO3)	mg/l	-- (6)	347	--	--	--	--	--	--	--	--	--	--	--
Ammonia, unionized	ug/l	20	--	--	--	--	--	--	--	--	--	--	--	--
Ammonia Nitrogen	ug/l	--	<20	--	--	--	--	--	--	--	--	--	--	--
Ammonium	ug/l	--	<20	--	--	--	--	--	--	--	--	--	--	--
Bicarbonate	ug/l	--	347000	--	--	--	--	--	--	--	--	--	--	--
Bromide	ug/l	--	<250	--	--	--	--	--	--	--	--	--	--	--
Carbonate (CO3)	ug/l	--	<2000 (7)	--	--	--	--	--	--	--	--	--	--	--
Color	color unit	--	16	--	--	--	--	--	--	--	--	--	--	--
Conductivity	uS/cm	--	1040	--	--	--	--	--	--	--	--	--	--	--
Conductivity (Field)	uS/cm	--	1210	--	--	--	--	--	--	--	--	--	--	--
Dissolved Oxygen (Field)	mg/l	-- (6)	2.11	--	--	--	--	--	--	--	--	--	--	--
Fluoride	ug/l	--	120	--	--	--	--	--	--	--	--	--	--	--
Hardness, Calcium Carbonate	ug/l	--	350000	--	--	--	--	--	--	--	--	--	--	--
Nitrate as N	ug/l	--	<100	--	--	--	--	--	--	--	--	--	--	--
Nitrite as N	ug/l	--	<100	--	--	--	--	--	--	--	--	--	--	--
pH	-	8.5	8.27	--	--	--	--	--	--	--	--	--	--	--
pH (Field)	-	8.5	7.90	--	--	--	--	--	--	--	--	--	--	--
Phosphorus	ug/l	-- (6)	40	--	--	--	--	--	--	--	--	--	--	--
Sulfate	ug/l	--	58000	--	--	--	--	--	--	--	--	--	--	--
Temperature (Field)	deg c	-- (10)	2.0	--	--	--	--	--	--	--	--	--	--	--
Total Organic Carbon	ug/l	--	4300	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids	ug/l	--	14000	--	--	--	--	--	--	--	--	--	--	--
Turbidity	ntu	-- (11)	2.5	--	--	--	--	--	--	--	--	--	--	--
Turbidity (Field)	NTU	-- (11)	--	--	--	--	--	--	--	--	--	--	--	--
<b>Metals</b>														
Aluminum, dissolved	ug/l	-- (12)	<10	--	--	--	--	--	--	--	--	--	--	--
Arsenic	ug/l	100 (13)	<1	--	--	--	--	--	--	--	--	--	--	--
Barium	ug/l	--	50	--	--	--	--	--	--	--	--	--	--	--
Beryllium	ug/l	-- (14)	<1	--	--	--	--	--	--	--	--	--	--	--
Boron	ug/l	200 (15)	10	--	--	--	--	--	--	--	--	--	--	--
Cadmium	ug/l	0.2 (13)	<0.1	--	--	--	--	--	--	--	--	--	--	--
Calcium	ug/l	--	109000	--	--	--	--	--	--	--	--	--	--	--
Chromium	ug/l	-- (16)	2	--	--	--	--	--	--	--	--	--	--	--
Cobalt	ug/l	0.9	0.3	--	--	--	--	--	--	--	--	--	--	--
Copper	ug/l	5	4	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l	300	230	--	--	--	--	--	--	--	--	--	--	--
Lead	ug/l	-- (17)	3	--	--	--	--	--	--	--	--	--	--	--
Magnesium	ug/l	--	19000	--	--	--	--	--	--	--	--	--	--	--
Manganese	ug/l	--	20	--	--	--	--	--	--	--	--	--	--	--
Molybdenum	ug/l	40	<5	--	--	--	--	--	--	--	--	--	--	--
Nickel	ug/l	25	<5	--	--	--	--	--	--	--	--	--	--	--
Potassium	ug/l	--	1000	--	--	--	--	--	--	--	--	--	--	--
Selenium	ug/l	100	<1	--	--	--	--	--	--	--	--	--	--	--
Silver	ug/l	0.1	<0.1	--	--	--	--	--	--	--	--	--	--	--
Sodium	ug/l	--	86000	--	--	--	--	--	--	--	--	--	--	--
Strontium	ug/l	--	1560	--	--	--	--	--	--	--	--	--	--	--
Thallium	ug/l	0.3 (18)	<0.1	--	--	--	--	--	--	--	--	--	--	--
Titanium	ug/l	--	<10	--	--	--	--	--	--	--	--	--	--	--
Vanadium	ug/l	6	3	--	--	--	--	--	--	--	--	--	--	--
Zinc	ug/l	30 (13)	50	--	--	--	--	--	--	--	--	--	--	--
<b>Petroleum Hydrocarbons</b>														
Benzene	ug/l	100 (19)	<0.5	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	ug/l	8	<0.5	--	--	--	--	--	--	--	--	--	--	--
m,p-Xylenes	ug/l	--	<1.0	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	ug/l	40 (18)	<0.5	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	<100	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	ug/l	--	<100	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	<100	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	<200	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	<200	--	--	--	--	--	--	--	--	--	--	--
Toluene	ug/l	0.8	<0.5	--	--	--	--	--	--	--	--	--	--	--
Xylenes, Total	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--

Parameter	Unit	(2) (1) PWQO	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8	SW-8
			12-Nov-2010	28-Feb-2011 (2)	10-Jun-2012 (2)	14-Jun-2012 (2)	17-Sep-2012 (2)	18-Dec-2012 (2)	11-Apr-2013 (2)	05-Jul-2013 (2)	21-Oct-2013 (2)	03-Feb-2014 (2)	26-May-2014 (2)	09-Oct-2014 (2)
			SW-5	SW-8	W-8	w8	s8	8	w8	8	w8	8	s8	s8
<b>Semi-VOCs</b>														
1-Methylnaphthalene	ug/l	2 (18)	<0.02	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	ug/l	2 (18)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	ug/l	--	<0.02	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	ug/l	--	<0.02	--	--	--	--	--	--	--	--	--	--	--
Anthracene	ug/l	0.0008 (15)	<0.01	--	--	--	--	--	--	--	--	--	--	--
Benzo[a]anthracene	ug/l	0.0004 (15)	<0.01	--	--	--	--	--	--	--	--	--	--	--
Benzo[a]pyrene	ug/l	--	<0.01	--	--	--	--	--	--	--	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	<0.02	--	--	--	--	--	--	--	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 (15)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 (15)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Chrysene	ug/l	0.0001 (15)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 (15)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	ug/l	0.0008 (15)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Fluorene	ug/l	0.2 (15)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	<0.02	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	ug/l	7 (15)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	ug/l	0.03 (15)	<0.02	--	--	--	--	--	--	--	--	--	--	--
Pyrene	ug/l	--	<0.02	--	--	--	--	--	--	--	--	--	--	--
Styrene	ug/l	4 (18)	<0.5	--	--	--	--	--	--	--	--	--	--	--
<b>VOCs</b>														
1,1,1,2-Tetrachloroethane	ug/l	20 (15)	<0.5	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	ug/l	10 (18)	<0.4	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	70	<0.5	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	ug/l	800	<0.4	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/l	200	<0.4	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	ug/l	40	<0.5	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	ug/l	5 (15)	<1.0	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	ug/l	2.5	<0.4	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/l	100	<0.5	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/l	0.7 (15)	<0.5	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	ug/l	--	<0.3	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/l	2.5	<0.4	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/l	4	<0.4	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	ug/l	200 (15)	<0.3	--	--	--	--	--	--	--	--	--	--	--
Bromoform	ug/l	60 (15)	<0.4	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	ug/l	0.9 (20)	<0.5	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	ug/l	--	<0.5	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	ug/l	15 (21)	<0.2	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	ug/l	--	<1.0	--	--	--	--	--	--	--	--	--	--	--
Chloroform	ug/l	--	<0.5	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	ug/l	700 (15)	<1.0	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	ug/l	200 (22)	<0.4	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloropropene	ug/l	--	<0.2	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	ug/l	40 (15)	<0.3	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	ug/l	100 (23)	<4.0	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	ug/l	50 (24)	<0.3	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	ug/l	200 (22)	<0.4	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	ug/l	7 (15)	<0.2	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	ug/l	20	<0.3	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	ug/l	--	<0.5	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	ug/l	600 (15)	<0.2	--	--	--	--	--	--	--	--	--	--	--

Parameter	Unit	(2) (1) PWQO	SW-8	SW-8	SW-8
			24-Mar-2015 <sup>(6)</sup>	17-Jun-2015 <sup>(6)</sup>	27-Aug-2015 <sup>(6)</sup>
			8	8	8
<b>General Chemistry</b>					
Alkalinity (Total as CaCO <sub>3</sub> )	mg/l	-- <sup>(6)</sup>	--	--	--
Ammonia, unionized	ug/l	20	--	--	--
Ammonia Nitrogen	ug/l	--	--	--	--
Ammonium	ug/l	--	--	--	--
Bicarbonate	ug/l	--	--	--	--
Bromide	ug/l	--	--	--	--
Carbonate (CO <sub>3</sub> )	ug/l	--	--	--	--
Color	color unit	--	--	--	--
Conductivity	uS/cm	--	--	--	--
Conductivity (Field)	uS/cm	--	--	--	--
Dissolved Oxygen (Field)	mg/l	-- <sup>(6)</sup>	--	--	--
Fluoride	ug/l	--	--	--	--
Hardness, Calcium Carbonate	ug/l	--	--	--	--
Nitrate as N	ug/l	--	--	--	--
Nitrite as N	ug/l	--	--	--	--
pH	-	8.5	--	--	--
pH (Field)	-	8.5	--	--	--
Phosphorus	ug/l	-- <sup>(6)</sup>	--	--	--
Sulfate	ug/l	--	--	--	--
Temperature (Field)	deg c	-- <sup>(10)</sup>	--	--	--
Total Organic Carbon	ug/l	--	--	--	--
Total Suspended Solids	ug/l	--	--	--	--
Turbidity	ntu	-- <sup>(11)</sup>	--	--	--
Turbidity (Field)	NTU	-- <sup>(11)</sup>	--	--	--
<b>Metals</b>					
Aluminum, dissolved	ug/l	-- <sup>(12)</sup>	--	--	--
Arsenic	ug/l	100 <sup>(13)</sup>	--	--	--
Barium	ug/l	--	--	--	--
Beryllium	ug/l	-- <sup>(14)</sup>	--	--	--
Boron	ug/l	200 <sup>(15)</sup>	--	--	--
Cadmium	ug/l	0.2 <sup>(13)</sup>	--	--	--
Calcium	ug/l	--	--	--	--
Chromium	ug/l	-- <sup>(16)</sup>	--	--	--
Cobalt	ug/l	0.9	--	--	--
Copper	ug/l	5	--	--	--
Iron	ug/l	300	--	--	--
Lead	ug/l	-- <sup>(17)</sup>	--	--	--
Magnesium	ug/l	--	--	--	--
Manganese	ug/l	--	--	--	--
Molybdenum	ug/l	40	--	--	--
Nickel	ug/l	25	--	--	--
Potassium	ug/l	--	--	--	--
Selenium	ug/l	100	--	--	--
Silver	ug/l	0.1	--	--	--
Sodium	ug/l	--	--	--	--
Strontium	ug/l	--	--	--	--
Thallium	ug/l	0.3 <sup>(18)</sup>	--	--	--
Titanium	ug/l	--	--	--	--
Vanadium	ug/l	6	--	--	--
Zinc	ug/l	30 <sup>(13)</sup>	--	--	--
<b>Petroleum Hydrocarbons</b>					
Benzene	ug/l	100 <sup>(19)</sup>	--	--	--
Ethylbenzene	ug/l	8	--	--	--
m,p-Xylenes	ug/l	--	--	--	--
o-Xylene	ug/l	40 <sup>(18)</sup>	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)	ug/l	--	--	--	--
Petroleum Hydrocarbons - F1 (C6-C10)-BTX	ug/l	--	--	--	--
Petroleum Hydrocarbons - F2 (C10-C16)	ug/l	--	--	--	--
Petroleum Hydrocarbons - F3 (C16-C34)	ug/l	--	--	--	--
Petroleum Hydrocarbons - F4 (C34-C50)	ug/l	--	--	--	--
Toluene	ug/l	0.8	--	--	--
Xylenes, Total	ug/l	--	--	--	--



Parameter	Unit	(2) (1) PWQO	SW-8	SW-8	SW-8
			24-Mar-2015 <sup>(5)</sup>	17-Jun-2015 <sup>(5)</sup>	27-Aug-2015 <sup>(5)</sup>
			g	g	g
<b>Semi-VOCs</b>					
1-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	--	--	--
2-Methylnaphthalene	ug/l	2 <sup>(18)</sup>	--	--	--
Acenaphthene	ug/l	--	--	--	--
Acenaphthylene	ug/l	--	--	--	--
Anthracene	ug/l	0.0008 <sup>(15)</sup>	--	--	--
Benzo[a]anthracene	ug/l	0.0004 <sup>(15)</sup>	--	--	--
Benzo[a]pyrene	ug/l	--	--	--	--
Benzo[b]fluoranthene	ug/l	--	--	--	--
Benzo[g,h,i]perylene	ug/l	0.00002 <sup>(15)</sup>	--	--	--
Benzo[k]fluoranthene	ug/l	0.0002 <sup>(15)</sup>	--	--	--
Chrysene	ug/l	0.0001 <sup>(15)</sup>	--	--	--
Dibenzo[a,h]anthracene	ug/l	0.002 <sup>(15)</sup>	--	--	--
Fluoranthene	ug/l	0.0008 <sup>(15)</sup>	--	--	--
Fluorene	ug/l	0.2 <sup>(15)</sup>	--	--	--
Indeno[1,2,3-cd]pyrene	ug/l	--	--	--	--
Naphthalene	ug/l	7 <sup>(15)</sup>	--	--	--
Phenanthrene	ug/l	0.03 <sup>(15)</sup>	--	--	--
Pyrene	ug/l	--	--	--	--
Styrene	ug/l	4 <sup>(18)</sup>	--	--	--
<b>VOCs</b>					
1,1,1,2-Tetrachloroethane	ug/l	20 <sup>(15)</sup>	--	--	--
1,1,1-Trichloroethane	ug/l	10 <sup>(18)</sup>	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	70	--	--	--
1,1,2-Trichloroethane	ug/l	800	--	--	--
1,1-Dichloroethane	ug/l	200	--	--	--
1,1-Dichloroethylene	ug/l	40	--	--	--
1,2-Dibromoethane	ug/l	5 <sup>(15)</sup>	--	--	--
1,2-Dichlorobenzene	ug/l	2.5	--	--	--
1,2-Dichloroethane	ug/l	100	--	--	--
1,2-Dichloropropane	ug/l	0.7 <sup>(15)</sup>	--	--	--
1,3,5-Trimethylbenzene	ug/l	--	--	--	--
1,3-Dichlorobenzene	ug/l	2.5	--	--	--
1,4-Dichlorobenzene	ug/l	4	--	--	--
Bromodichloromethane	ug/l	200 <sup>(15)</sup>	--	--	--
Bromoform	ug/l	60 <sup>(15)</sup>	--	--	--
Bromomethane	ug/l	0.9 <sup>(20)</sup>	--	--	--
Carbon Tetrachloride	ug/l	--	--	--	--
Chlorobenzene	ug/l	15 <sup>(21)</sup>	--	--	--
Chloroethane	ug/l	--	--	--	--
Chloroform	ug/l	--	--	--	--
Chloromethane	ug/l	700 <sup>(15)</sup>	--	--	--
cis-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	--	--	--
cis-1,2-Dichloropropene	ug/l	--	--	--	--
Dibromochloromethane	ug/l	40 <sup>(15)</sup>	--	--	--
Dichlorodifluoromethane	ug/l	--	--	--	--
Methylene Chloride	ug/l	100 <sup>(23)</sup>	--	--	--
Tetrachloroethylene	ug/l	50 <sup>(24)</sup>	--	--	--
trans-1,2-Dichloroethene	ug/l	200 <sup>(22)</sup>	--	--	--
trans-1,3-Dichloropropene	ug/l	7 <sup>(15)</sup>	--	--	--
Trichloroethene	ug/l	20	--	--	--
Trichlorofluoromethane	ug/l	--	--	--	--
Vinyl Chloride	ug/l	600 <sup>(15)</sup>	--	--	--

**Footnotes:**

Tables should be read in conjunction with the accompanying document.

< value = Indicates parameter not detected above laboratory method detection limit.

> value = Indicates parameter detected above equipment analytical range.

-- Chemical not analyzed or criteria not defined.

Grey background indicates exceedances.

(1) Provincial Water Quality Objectives (July 1994, reprinted February 1999)

(2) Bold Font = Parameter concentration greater than PWQO

(3) Monitoring location was frozen during this sampling event. No sample was collected.

(4) Due to matrix interference 2x dilution factor required for VOCs.

(5) Monitoring location was dry during this sampling event. No sample was collected.

(6) Alkalinity should not be decreased by more than 25% of the natural concentration.

(7) Not available - pH < 8.3

(8) Objective depends on water temperature and biota. Dissolved oxygen concentrations should not be less than the values specified in the PWQO document for cold water biota (e.g. salmonid fish communities) and warm water biota (e.g. centrarchid fish communities).

(9) Current scientific evidence is insufficient to develop a firm Objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines which should be supplemented by site-specific studies: To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L; A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 µg/L or less. This should apply to all lakes naturally below this value; Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 µg/L.

(10) (1) General: The natural thermal regime of any body of water shall not be altered so as to impair the quality of the natural environment. In particular, the diversity, distribution and abundance of plant and animal life shall not be significantly changed. (2) Waste Heat Discharge: (a) Ambient Temperature Changes: The temperature at the edge of a mixing zone shall not exceed the natural ambient water temperature at a representative control location by more than 10°C (18°F). However, in special circumstances, local conditions may require a significantly lower temperature difference than 10°C (18°F).

Potential dischargers are to apply to the MOEE for guidance as to the allowable temperature rise for each thermal discharge. This ministry will also specify the nature of the mixing zone and the procedure for the establishment of a representative control location for temperature recording on a case-by-case basis. (b) Discharge Temperature Permitted: The maximum temperature of the receiving body of water, at any point in the thermal plume outside a mixing zone, shall not exceed 30°C (86°F) or the temperature of a representative control location plus 10°C (18°F) or the allowed temperature difference, whichever is the lesser temperature. These maximum temperatures are to be measured on a mean daily basis from continuous records. (c) Taking and Discharging of Cooling Water: Users of cooling water shall meet both the Objectives for temperature outlined above and the "Procedures for the Taking and Discharge of Cooling Water" as outlined in the MOEE publication Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters(1994).

(11) Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than 10 percent.

(12) At pH 4.5 to 5.5 the Interim PWQO is 15 µg/L based on inorganic monomeric aluminum measure in clay-free samples; At pH > 5.5 to 6.5, no condition should be permitted which would increase the acid soluble inorganic aluminum concentration in clay-free samples to more than 10% above natural background concentrations for waters representative of that geological area of the Province that are unaffected by man-made inputs. At pH > 6.5 to 9.0, the Interim PWQO is 75 µg/L based on total aluminum measured in clay-free samples. If natural background aluminum concentrations in water bodies unaffected by man-made inputs are greater than the numerical Interim PWQO (above), no condition is permitted that would increase the aluminum concentration in clay-free samples by more than 10% of the natural background level. Note: pH values of < 6.5 and > 8.5 are outside the range considered acceptable by the PWQO for pH. See the Scientific Criteria Document for Development of Provincial Water Quality Objectives and Guidelines - Aluminum for a discussion of analytical procedures.

(13) An Interim PWQO also exists for this parameter. See Section 1.10 of the PWQO - Where both a PWQO and an Interim PWQO exist.

(14) If hardness as CaCO<sub>3</sub> < 75 mg/L, PWQO = 11 µg/L; if hardness as CaCO<sub>3</sub> > 75 mg/L, PWQO = 1100 µg/L.

(15) See Section 1.2.3. of PWQO. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

(16) PWQO values exist for Cr(III) and Cr(VI)

(17) If alkalinity as CaCO<sub>3</sub> < 20 mg/L, PWQO = 5 µg/L; if alkalinity as CaCO<sub>3</sub> from 20 to 40 mg/L, PWQO = 10 µg/L; if alkalinity as CaCO<sub>3</sub> from 40 to 80 mg/L, PWQO = 20 µg/L; if alkalinity as CaCO<sub>3</sub> > 80 mg/L, PWQO = 25 µg/L. An Interim PWQO also exists for this parameter. See Section 1.10 of the PWQO - Where both a PWQO and an Interim PWQO exist.

(18) See Section 1.2.2. of PWQO. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

(19) See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

(20) synonym - methyl bromide. See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

(21) Common synonym - monochlorobenzene.

(22) Interim PWQO applies to both the cis & trans 1,2-dichloroethylene.

(23) Common synonym - dichloromethane. See Section 1.2.3. of PWQO. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

(24) Synonym-perchloroethylene or perc.

(25) Arsenic MRL elevated due to matrix interference.

(26) Monitoring location was damaged and could not be sampled.

(27) Arsenic MRL elevated due to matrix interference (dilution was done). All samples were subcontracted for DOC analysis. Holding time for DOC analysis was exceeded for the entire report.

(28) TP MRL elevated due to sample turbidity.

(29) Holding time for turbidity analysis was exceeded. Due to matrix interference 2x dilution factor required for VOCs.



# **APPENDIX G**

## **Photographs of Site Drainage Assessment**



**Photo G-1:** General location of surface water station SW 01.



**Photo G-2:** View of ponded water at surface water station SW 01.





**Photo G-3:** View of culvert discharging to north side of Glen Road near SW 02.



**Photo G-4:** View of surface water station SW 02.





**Photo G-5:** View of surface water station SW 03 situated in the southern ditch along Glen Road.



**Photo G-6:** View looking towards the south of the north TDA embankment, upgradient of SW 03.





**Photo G-7:** View from Boundary Road looking east towards monitor MW 01 and flooded area situated southeast and upgradient of SW 03.



**Photo G-8:** View of ponded water situated east of the Boundary Road north TDA embankment and southeast of Glen Road, which discharges to SW 03.





**Photo G-9:** Looking towards pan lysimeter PL2. The limit of the flooded area which discharges to SW 03 is situated northeast of PL2.



**Photo G-10:** View of ponded water upstream of SW 03 along roadside ditch of Glen Road, looking west towards Boundary Road.





**Photo G-11:** View of culvert downstream of SW 03 on south side of Glen Road which discharges water to SW 02.



**Photo G-12:** View of culvert downstream of SW 03 on south side of Glen Road which discharges water to SW 02





**Photo G-13:** View of Glen Road looking towards the east at SW 04



**Photo G-14:** Westward flow in ditch at SW 04.



**Photo G-15:** View of SW 06 looking west from Boundary Road. Evidence of recent flooding is apparent in



**Photo G-16:** View of general location of SW 06 looking west.





**Photo G-17:** Looking towards the east at SW 07.



**Photo G-18:** View of SW 07 with water flowing towards north towards the culvert at Highway 401.





**Photo G-19:** View looking north from SW 08. Roadside ditch along Boundary Road is dry between SW 08 and the south bridge embankment.



**Photo G-20:** View of SW 08 looking towards the south.



# **APPENDIX H**

**Technical review comments provided by  
Dana N. Humphrey, Ph.D (Consulting Engineer)  
dated August 3, 2016**



**Dana N. Humphrey, Ph.D.**  
*Consulting Engineer*

August 3, 2016

Mr. Tony Sangiuliano, P. Eng.  
Ontario Ministry of Transportation  
1201 Wilson Avenue, Building C, Room 232  
Downsview, Ontario M3M 1J8

RE: Review of Draft Report “Investigation of Groundwater Impacts Highway 401 and Boundary Road, TDA Embankments, Cornwall, Ontario,” dated June 2016

Dear Mr. Sangiuliano:

At your request, I had review the draft report titled, ““Investigation of Groundwater Impacts Highway 401 and Boundary Road, TDA Embankments, Cornwall, Ontario,” prepared by Golder Associates, dated June 2016. I am in general agreement with Section 6.0 Discussion and Section 7.0 Site Conceptual Model. In the following I offer some comments that may add additional clarity to some aspects of these sections. I will conclude this review by offering comments on Section 8.0 Recommendations for Use of TDA Fill.

**Comments on Sections 6.0 and 7.0**

During the construction period benzene was above the ODWQS (169/03) – Health Standard of 0.005 mg/L for several samples from the pan lysimeters immediately beneath the TDA. Since completion of the construction, the results have been below the standard. However, benzene was not detected in monitoring well MW 03 immediately downgradient of the south TDA fill. This is consistent with a study of TDA below the groundwater table summarized by Humphrey and Swett (2006) which detected benzene in water in direct contact with TDA, but that benzene was not detected in downgradient wells.

TDA likely contributes iron to the leachate and the likely TDA source is the steel belts exposed at the cut edges of the TDA. The concentrations in lysimeter samples were generally higher during the construction period than the post construction period. This is consistent with the results from the North Yarmouth Field Site where TDA was placed above the water table. For the Boundary Road project, post construction concentrations of iron from lysimeter samples are in the range for groundwater at the site.

TDA likely contributes manganese to the leachate. The likely source is the steel belts as manganese used as an alloy in the belts. In the pan lysimeters, the concentrations during and post construction are similar. This is consistent with the results from the North Yarmouth Field Site.

In the pan lysimeters, concentrations of sulphate were reported at levels between about 1700 and 2500 mg/L on three sample dates during construction. Post construction, the concentrations have been near the aesthetic water quality standard of 500 mg/L. Past studies have not identified TDA as a significant contributor to sulphate. I was present only for a portion of two days during construction of the Boundary Road project. However, I observed that one load of TDA delivered

to the south fill had a small amount fines that appeared to be residual construction demolition debris. This was observed near the bottom of the TDA load as it was being discharged from the walking floor trailer. It could be that the load carried by the truck prior to TDA was construction demolition debris. Construction demolition debris often contains drywall which is a source of calcium sulphate ( $\text{CaSO}_4$ ).

It is noted that with the exception of benzene, the parameters discussed in the report have aesthetic rather than health based standards. Moreover, there is no evidence that TDA impacted groundwater quality down gradient from the TDA fill or surface water that flows across the site. The report notes that conventional earth used as fill for embankment construction may impact water quality.

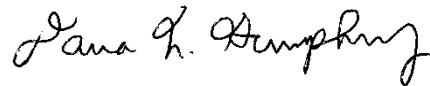
### **Comments on Section 8.0**

Prior work combined with the water quality monitoring results from the Boundary Road Project shows that TDA used as embankment fill above the water table has a negligible effect on groundwater quality beyond the footprint of the embankment. Based on this, I recommend that water quality monitoring is not needed for future TDA embankment fills placed above the water table unless there is a shallow public or private drinking water well that is located in very close proximity to the fill.

### **Closure**

Thank you for the opportunity to assist with this project. Please let me know if you have any additional questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Dana N. Humphrey". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Dana N. Humphrey, Ph.D.  
Consulting Engineer

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