REPORT

FALL 2017
SEMI-ANNUAL MONITORING REPORT

Waste Management of Canada
Richmond Landfill
Town of Greater Napanee, Ontario

Submitted to:

WASTE MANAGEMENT OF CANADA
1271 Beechwood Road
Napanee, ON K7R 3L1

Prepared by:

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4 Cataraqui Street
Kingston, ON K7K 1Z7

Project Number: 170194-02

January 2018

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1. INTRODUCTION

The purpose of this report is to present results and to provide an interpretation of the data that were collected during the summer and fall 2017 monitoring events at the Waste Management of Canada Corporation (WM) Richmond Landfill.

The WM Richmond Landfill is approved as a 16.2 hectare waste disposal (landfilling) facility within a total site area of 138 hectares, located on parts of Lots 1, 2 and 3, Concession IV of the former Township of Richmond, now in the Town of Greater Napanee, Ontario.

2. METHODOLOGY

2.1 Program Summary

The summer and fall 2017 monitoring events were conducted in accordance with the requirements outlined in the revised interim Environmental Monitoring Plan (EMP; Revision No. 05) dated April 15, 2016, as specified in the Environmental Compliance Approval (ECA) number A371203, issued by MOE January 9, 2012 and amended by Notice No. 1 dated May 3, 2013 and Environmental Review Tribunal (ERT) Order dated December 24, 2015.

The site layout and monitoring locations are shown on Figure 1. The monitoring programs for groundwater, surface water, leachate and landfill gas are summarized in Table 1.

The summer monitoring event was conducted between July 25 and August 1, 2017. The activities completed include the following:

- Groundwater monitoring wells installed in the shallow and intermediate bedrock flow zones (see Table 3) were monitored for water levels on August 1, 2017. No water level was measured at groundwater monitor M19 because it is damaged;
- Water levels were recorded at the staff gauges installed at the three ponds located on site between the landfill and Beechwood Road;
- Liquid levels were measured in landfill leachate wells on August 1, 2017; and
- Surface water sampling was conducted on July 25, 2017 from locations S2, S3, S5, S6, S7, S8R, S18, S19 and S20. No sample was collected from location S4R because it was dry. Surface water samples were analyzed for surface water inorganic and general parameters and for 1,4-dioxane, as listed in Table 2.

The fall monitoring event was conducted between October 13 and 19, 2017. The activities completed include the following:

- Groundwater monitoring wells installed in the shallow and intermediate bedrock flow zones (see Table 3) were monitored for water levels on October 13, 2017. No water levels were measured at groundwater monitors M15, M18, M58-4 because they were dry and M19 because it is damaged;
- Water levels were recorded at the staff gauges installed at the three ponds located on site between the landfill and Beechwood Road;
- Liquid levels were measured in landfill leachate wells on October 13, 2017;
- Groundwater monitoring wells listed in Table 1 were sampled between October 16 and 19, 2017. No samples were collected from monitoring wells M85 because it was dry and M192 since the property owner did not authorize access. Samples were analyzed for the suite of groundwater inorganic and general parameters and Volatile Organic Compounds (VOCs) listed in Table 2;
- Surface water sampling was conducted on October 16, 2017 from locations S2, S3, S5, S6, S7, S18, S19 and S20. No samples were collected from locations S4R and S8R because they were dry. Surface water samples were analyzed for surface water inorganic and general parameters and for 1,4-dioxane, as listed in Table 2;
- Landfill gas monitoring was conducted on October 19, 2017. Field measurements were made with a RKI Eagle probe calibrated to methane gas response at six gas monitors (GM1, GM3, GM4-1, GM4-2, GM5 and GM6); and
- A total of six Quality Assurance/Quality Control (QA/QC) samples were collected during the fall sampling event, including three field duplicate samples and three field blanks. De-ionised water for analysis of blank samples was supplied by the laboratory.

In addition to the aforementioned “routine” sampling requirements (Table 1), recently installed monitoring wells M178R-5, M188-2, M194-1, M194-2 and M195 were sampled as part of additional sampling events required by the EMP, as per amended ECA Condition No. 8.5(c)iv included in the ERT Order dated July 15, 2015. This condition requires that newly installed wells be tested a minimum of four times on a quarterly basis during the first year after being established.

2.2 Water Sample Collection and Laboratory Analysis

Groundwater and surface water samples were collected in accordance with accepted industry protocols. Groundwater samples were collected using dedicated Waterra inertial lift pumps connected to dedicated polyethylene tubing. Three casing volumes of water were purged from each monitoring well prior to the collection of groundwater samples. During purging, readings for pH, temperature, conductivity and oxidation-reduction potential were recorded on a regular basis. The stabilization of the parameters was used to assess when well purging was complete. Low producing wells were purged dry and allowed to recover prior to sampling.

If the monitoring well had not recovered sufficiently for sampling within 24 hours, the monitor was considered dry and a sample was not collected.

Surface water samples were collected using a clean bottle where water depth was sufficient; at sampling locations where water depth was an issue, a 50 cc syringe was used to carefully collect the surface water as not to disturb the bottom sediments. Surface water sampling locations were sampled from downstream to upstream to prevent any re-suspension of sediment impacting the downstream sampling locations. The pH, temperature, conductivity, dissolved oxygen and oxidation-reduction potential of the surface water were obtained in the field at all surface water sampling points while minimizing disturbance of the bottom sediment.

All water samples were placed in bottles supplied and prepared by the laboratory. The samples were packed in coolers with ice and shipped by courier to the laboratory. All samples were analysed by Maxxam Analytics Inc. of Mississauga, ON, which is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). Table 2 presents a summary of groundwater and surface water analytical parameters.

2.3 GROUNDWATER ELEVATIONS

Water levels were recorded to the nearest 0.005 m using an electronic water level meter for the groundwater monitoring wells listed in Table 3, grouped in relation to their location relative to the landfill footprint and groundwater flow zone monitored.

3. RESULTS AND DISCUSSION

Background information concerning the site geology and hydrogeology was described in detail in the Site Conceptual Model (SCM) report(1) and updated based on results from subsequent hydrogeological investigations(2,3,4,5), and is summarized here. The SCM report describes the groundwater flow conditions at the Richmond Landfill.

[1] *Site Conceptual Model Report, WM Richmond Landfill*, prepared by Dr. B.H. Kueper and WESA Inc., October 2009

[2] *Supporting Document, Application to Amend Environmental Compliance Approval No. A371203, Waste Management Richmond Landfill Site*, prepared by BluMetric Environmental Inc., March 2015

[3] *Site Conceptual Model Update and Contaminant Attenuation Zone Delineation, Waste Management Richmond Landfill Site*, prepared by BluMetric Environmental Inc., January 2016

[4] *Addendum to Site Conceptual Model Update and Contaminant Attenuation Zone Delineation, Waste Management Richmond Landfill Site*, prepared by BluMetric Environmental Inc., April 2016

[5] *Site Conceptual Model Update and Contaminant Attenuation Zone Delineation, Waste Management Richmond Landfill Site*, prepared by BluMetric Environmental Inc., July 2017

Based on the results from extensive studies conducted previously at the site, the basic hydrogeological framework for the facility has been defined as follows:

- the active groundwater flow zone at the site extends to a depth of approximately 30 m below the top of bedrock;
- the shallow groundwater flow zone is conceptualized as the overburden, the overburden-bedrock contact and the upper one to two metres of bedrock;
- the direction of groundwater flow in the shallow flow zone is strongly influenced by topography;
- the intermediate bedrock flow zone extends from one to two metres below top of bedrock to a depth of approximately 30 m below top of bedrock;
- groundwater flows through a network of fractures in the upper 30 m of bedrock;
- the dominant fracture orientation is horizontal to sub-horizontal; however, vertical to sub-vertical fractures are present providing hydraulic connection between horizontal fractures;
- hydraulic connections of fractures exist in the intermediate bedrock flow zone to the west, south and east of the site (horizontal and vertical connections);
- intermediate bedrock flownets show that groundwater flow directions are variable with season and generally flows to the west from the western edge of the landfill, to the southeast from the southern edge of the landfill, to the south along the eastern edge of the landfill, and north to northwest from the northern limit of the landfill;
- the hydraulic conductivity of the intermediate bedrock is lower to the north and east of the landfill compared to other areas of the site, implying that the rate of groundwater flow is lower than in areas immediately south, southeast and west of the landfill;
- south of the landfill, the intermediate bedrock flow zone has distinct areas of interacting hydrogeological zones which are not isolated from one another, but are distinct based on hydraulic conductivity, water level variations and the rate of response to recharge events; and,
- groundwater monitoring wells in the southern portion of the proposed CAZ have static groundwater elevations that are much deeper than wells further north in the CAZ; these deep groundwater elevations appear to be controlled by karst systems confirmed to exist in the southern portion of the proposed CAZ, as discussed in the latest update to the SCM[5].

3.1 Liquid Levels in Leachate Wells

Liquid levels were measured in the two landfill leachate wells on August 1 and October 13, 2017:

- The liquid level at LW-P1 was 147.01 and 146.76 meters above sea level (masl), respectively; and
- The liquid level at LW-P2 was 150.82 and 149.93 masl, respectively.

3.2 Groundwater Results

3.2.1 Groundwater Elevations

Groundwater elevations were measured on August 1 and October 13, 2017 from monitoring wells listed in Table 3, and are presented in Tables 4a and 4b, respectively. An inventory of all monitoring well locations is provided in Appendix A. Groundwater elevation contours within the shallow groundwater flow zone are shown on Figure 2a (summer) and Figure 2b (fall), while Figure 3a (summer) and Figure 3b (fall) show groundwater elevation contours for the intermediate bedrock flow zone. Groundwater flow directions were inferred by interpolating the water elevations from wells screened within the corresponding groundwater flow zone, and are consistent with historical results.

The summer and fall 2017 shallow groundwater contours (Figures 2a and 2b, respectively) show that the Empey Hill drumlin southwest from the landfill creates a flow divide, with shallow groundwater being directed both to the north and the south towards areas of lower hydraulic heads. The water level from shallow bedrock monitor M19 (damaged) and M85 (not static, believed to be influenced by recent sampling events at this slow recovery location) were not used to prepare the summer or fall 2017 groundwater contours. Additionally, monitors M15, M18 and M58-4 were dry during the fall 2017 monitoring event. North of the landfill, shallow groundwater converges towards Marysville Creek in the area immediately east of County Road 10 (Deseronto Road), while shallow groundwater flow in the southern portion of the site converges on Beechwood Ditch and the southern pond system. Shallow groundwater east of the landfill is influenced by a local zone of higher water levels in the vicinity of monitoring well M96; shallow groundwater north of M96 flows to the north-northwest and ultimately Marysville Creek, while groundwater south of M96 flows to the south-southwest, towards Beechwood Ditch and the ponds.

The summer and fall 2017 intermediate bedrock zone contours are presented on Figures 3a and 3b, respectively. On the landfill property, groundwater in this hydrostratigraphic unit generally flows to the north, west, and south-southeast relative to the landfill.

Groundwater flow for the intermediate bedrock in the area of well-connected fractures south of the landfill and east of the landfill access road can be distinguished by periods of higher groundwater levels and periods of lower groundwater levels. During periods of high groundwater levels, the groundwater generally flows south-southeast. During periods of lower water levels, as observed during the summer and fall 2016 monitoring events last year, groundwater flow is oriented toward the central portion of the well-connected area immediately south of the landfill, and continues toward the east-southeast as it moves further south of the landfill. Water levels from intermediate bedrock monitors M71 (damaged), as well as M70-2 and M191 (low permeability wells with water level interpreted as not being representative of static groundwater conditions) were not used to prepare the summer or fall 2017 groundwater contours. Additionally, intermediate bedrock zone monitoring wells located farther to the south (e.g., M173, M174, M181-1, M181-2, M182, M185-1, M187 and M189) were not considered in the groundwater contour interpolation because they exhibit much lower hydraulic heads, and appear to be part of a separate group of hydraulically responsive wells within the intermediate bedrock flow zone. This subset of wells appears to be influenced by karst systems that were identified in the southern part of the proposed CAZ. Additional details from the most recent hydrogeological investigation, including preliminary karst assessment, in the area south and southeast of the Site have been provided under separate cover[5].

3.2.2 Groundwater Analytical Results

Groundwater monitoring results from the wells sampled in fall 2017 as part of the EMP, as well as those from the additional sampling conducted in accordance with ECA Condition 8.5(c)iv, are presented in Table 5a. Groundwater quality data for the fall 2017 monitoring event are consistent with historical results.

3.2.2.1 Shallow Groundwater Flow Zone

As shown in Table 5a, slightly elevated concentrations of a number of water quality parameters (e.g., alkalinity, boron, chloride, conductivity, DOC, sodium and/or TDS) were observed in some shallow groundwater zone monitoring wells located in close proximity to the landfill footprint, north and northwest from the unlined portion of the landfill (e.g., M66-2, M86, M101, M103 and M104). 1,4-dioxane was detected at monitoring wells M101, M103 and M104, and 1,1-dichloroethane was detected at monitoring well M101. The approximate extents of leachate impacted shallow groundwater, consistent with those delineated from recent hydrogeological investigations[5], are shown on Figure 4.

Monitor M54-4, located approximately 200 m south of the landfill footprint, also exhibited slightly elevated alkalinity and conductivity, as well as low but detectable concentrations of chlorinated VOCs (e.g., 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, tetrachloroethylene and trichloroethylene. An assessment of the impacts at shallow monitoring well M54-4, attributed to surface contamination from historical local sources rather than from landfill leachate, was submitted recently under separate cover[6].

In other areas of the Site, there is no evidence of groundwater impacts away from the landfill footprint in the shallow groundwater flow zone. Isolated occurrences of elevated concentrations of water quality parameters (i.e., one or two parameters per sample) are seen elsewhere on the Site.

3.2.2.2 Intermediate Groundwater Flow Zone

Analytical results from intermediate bedrock groundwater monitors sampled in fall 2017 were generally consistent with historical results. North of the landfill, elevated concentrations of water quality parameters and detectable 1,4-dioxane concentrations were observed at monitors M6-3 and OW4, which are located in close proximity to the landfill footprint. These results indicate the presence of leachate impacts at these locations. However, despite moderate concentrations of some parameters (e.g., alkalinity at OW1, M5-3 and M75), no impacts from the landfill are apparent further north from the landfill footprint and near Marysville Creek (e.g., at OW1, M5-3, M75, M82-1 and M82-2).

South of the landfill, the presence of 1,4-dioxane and elevated concentrations of alkalinity (typically greater than 400 mg/L where 1,4-dioxane is present), DOC, chloride and TDS indicate groundwater impacts from the landfill at several monitoring well locations (e.g., M9-2, M9-3, M64-2, M108, M109-1, M110-1, M114-1, M121, M123, M167, M168, M170, M172, M178R-2, M178R-3 and M178R-4). Several monitoring wells downgradient of these impacted wells (e.g. M177, M179, M185-1, M185-2, M186, M187, M188-1 and M190) do not show impacts associated with landfill leachate (i.e. no 1,4-dioxane detected and alkalinity concentrations of 350 mg/L or lower) thus defining the limit of the groundwater plume. The approximate extents of leachate impacted groundwater in the intermediate bedrock flow zone, consistent with those delineated from recent hydrogeological investigations[5], are shown on Figure 5. Other locations south and southeast of the landfill with elevated concentrations of chloride, sodium, TDS, and/or BTEX compounds (e.g., M106, M185-1, M186, M70-2), are indicative of naturally poor quality connate (and often saline) groundwater. These pockets of naturally poor quality groundwater are isolated and do not reflect any widespread or significant upwelling of saline groundwater.

[6] *Assessment of Chlorinated VOC Impacts at Shallow Groundwater Monitoring Well M54-4, Waste Management Richmond Landfill, Town of Greater Napanee*, BluMetric Environmental Inc., July 2017

Wells sampled in the western part of the landfill site (e.g., M72, M74 and M82-1) exhibit concentrations of water quality parameters that are relatively low and continue to reflect background conditions.

Alkalinity and 1,4-dioxane results are shown for the Shallow and Intermediate Bedrock Flow Zones on Figures 4 and 5, respectively.

3.2.3 Guideline B-7 Reasonable Use Limits (RULs)

Constituent concentrations from selected monitoring wells located within the low-head areas of the WM Richmond Landfill in both the Shallow and Intermediate Bedrock Groundwater Flow Zones are compared to the RULs derived from laboratory analytical results (Table 5b). The RULs reported in Table 5b for leachate indicator parameters and trigger wells were presented in the interim EMP (Revision No. 05) dated April 2016, including 1,4-dioxane for which the site-specific RUL of 0.001 mg/L was set as required by the ERT Order dated December 24, 2015.

All results for 1,4-dioxane at trigger wells in the shallow and intermediate bedrock flow zones were below the RUL of 0.001 mg/L, with the exception of M178R-2, M178R-3 and M178R-4 with detectable concentrations that are consistent with historical data.

In the shallow groundwater zone, slightly elevated concentrations of a number of inorganic or general water quality parameters above their respective RUL (e.g., alkalinity, DOC, iron, manganese, and/or TDS) were observed in monitoring wells M54-4, M66-2, M67-2, M80-2 and OW37-s.

Slightly elevated concentrations of a number of water quality parameters above their respective RUL (e.g., alkalinity, chloride, DOC, iron, manganese, sodium, and/or TDS) were also observed in some intermediate groundwater flow zone monitoring wells (e.g., M82-1, M82-2, M106, M178R-2, M178R-3, M178R-4 M179, M185-1, and M186).

3.2.4 Status of Monitoring Wells and Compliance with Ontario Regulation 903

During the fall 2017 monitoring event, the condition of groundwater monitoring wells included in the EMP was inspected. Any repairs, such as new locks, labels or well caps, were made as necessary. Watertight casings and seals remain in place at all monitors to ensure that surface water or foreign materials cannot enter groundwater monitoring wells. All groundwater monitoring wells are fitted with a vermin proof cap to meet the requirements of Ontario Regulation 903 and are locked to provide protection against vandalism as per Waste Management standard operating procedure and in line with industry best practices.

Shallow groundwater monitoring wells M19, M58-4 and M68-4 are damaged and it is recommended that they be decommissioned when a revised EMP is approved as they cannot be repaired. These wells are considered unnecessary because flow in the shallow groundwater flow zone can be adequately assessed across the site without them.

Intermediate bedrock monitoring well M174 showed the presence of bentonite grout at the bottom and should be inspected in future monitoring events, and possibly be repaired, or replaced and decommissioned.

3.2.5 Off-Site Domestic Water Supply Well Results

The following off-site domestic water supply wells were sampled between October 16 and November 22, 2017:

Address	Well Type	Water Treatment Information
1441 County Road 1 West	Drilled	No water treatment
1499 County Road 1 West	Drilled	Sediment filter
1561 County Road 1 West	Dug	Not sampled
1614 County Road 1 West	Drilled	Sediment filter, UV and water softener; sample collected post-treatment
1654 County Road 1 West	Drilled	Water softener; sample collected pre-treatment
1680 County Road 1 West	Drilled	No water treatment
696 Belleville Road	Drilled	Water softener; sample collected pre-treatment

Letters were delivered by BluMetric staff in advance of the fall monitoring event to residents at all 13 addresses specified in the EMP (also listed in Table 1 of this report). Where no response had been received after two weeks, a second letter was again delivered by BluMetric staff. Despite attempts to obtain permission from the owners to sample their wells, the remaining domestic wells could not be sampled.

The domestic supply water well at 1561 County Road 1 West was confirmed as a dug well and was not sampled. It is recommended that this off-site domestic water supply well be removed from the EMP.

Results from off-site domestic water supply wells sampled in fall 2017 are presented in Table 6. All 1,4 dioxane concentrations were below the laboratory RDL of 0.001 mg/L.

3.2.6 Groundwater Chemistry Quality Assurance / Quality Control (QA/QC)

An evaluation of QA/QC data (from duplicate and blank samples) is included in Appendix B. A standard margin of error of 20% relative percent difference (RPD) between regular and duplicate samples was deemed acceptable for field duplicates. In general, the comparison between samples and duplicates shows very good correlation for the majority of analyzed constituents.

All parameters for groundwater duplicate QA/QC sampling were within the 20% margin of error, with the exception of nitrite (detected in the regular and duplicate samples at and slightly above the laboratory's reportable detection limit (RDL) of 0.01 mg/L, and therefore within the acceptable error margin established at 5 times the RDL). All parameters were near or below the RDL in the field blanks.

3.3 Surface Water Results

3.3.1 Pond Elevations

Staff gauges are installed in the three ponds on the south side of the landfill labeled SG1, SG2 and SG3 (Figure 1). Staff gauge locations and pond elevations measured on August 1 and October 13, 2017 are shown on Figures 2a and 2b.

3.3.2 Surface Water Monitoring Locations

The two water courses that may receive surface water/storm water runoff from the Richmond Landfill site are Marysville Creek to the north of the waste mound and Beechwood Ditch to the south (Figure 1). Beechwood Ditch is a man-made surface water course that flows from the east onto WM property. It then flows west across a portion of the site before again crossing Beechwood Road and travelling southwest to cross County Road 10, and joins Marysville Creek east of Highway 49 and north of Highway 401. Both Beechwood Ditch and Marysville Creek flow intermittently in the vicinity of the landfill. Marysville Creek has some base flow locally, and flows on a continuous basis west of County Road 10 (Deseronto Road). Marysville Creek eventually discharges into the Bay of Quinte at Hungry Bay.

An ephemeral unnamed local surface water course is present in the central portion of the proposed CAZ boundary, originating from a small man made pond located directly east of Quarry Road (see Figure 1). Surface water flows west from this pond over a distance of approximately 600 m along a topographically low area, to a second pond located near monitoring well M187 and finally to a local topographic depression located approximately 75 m farther west, where water, when flowing, enters into the ground into a near-surface karst feature.

Surface water monitoring locations are shown on Figure 1. Sampling locations S4R in July 2017 and S4R and S8R in October 2017 were not sampled because they were dry.

3.3.3 Surface Water Flow

Visual observations of surface water flow and general water characteristics for the summer and fall sampling programs are summarized in Tables 7a and 7b, respectively. Surface water flow velocities were not measured at any location because of insufficient flow conditions.

3.3.4 Surface Water Analytical Results

The analytical results from surface water locations sampled during the summer and fall 2017 sampling events are presented in Tables 8a and 8b, respectively.

Surface water quality results were compared to Provincial Water Quality Objectives (PWQO). Background surface water quality was monitored on site at upstream station S2 for Marysville Creek and station S5 for Beechwood Ditch. Background surface water quality was monitored at upstream station S18 for the unnamed local water course located in the central portion of the CAZ. Storm water runoff from the existing landfill area flows to one of three storm water sedimentation retention ponds, located to the northeast, northwest and south of the landfill footprint. Sampling location S3 is located near the downstream property boundary along Marysville Creek, while sampling location S8R is located along Beechwood Ditch near the downstream property boundary.

Constituents analysed in surface water samples collected during the summer 2017 sampling event were below their respective PWQO, with the exception of total phosphorous at all locations excluding S8R and S20, phenols at all locations excluding S19, boron at locations S3, S7, S8R, S19 and S20 and iron at locations S6, S18 and S19. Parameters analysed in surface water samples collected during the fall 2017 sampling event were all below PWQO, with the exception of total phosphorous at all locations, phenols at locations S2 and S19, cobalt at location S19 and iron at locations S2, S5, S6, S18, S19 and S20.

Results from summer and fall 2017 are consistent with historical results and indicate that the landfill is not causing adverse impacts to surface water quality.

3.3.5 Surface Water Quality Assurance / Quality Control (QA/QC)

An evaluation of QA/QC data (from duplicate and blank samples) is included in Appendix B. A standard margin of error of 20% was deemed acceptable for field duplicates. In general, the comparison between regular samples and duplicates shows very good correlation for the majority of analyzed constituents.

All parameters for the summer sampling round surface water field duplicate sample (location S20) were within the 20% margin of error, with the exception of phenols (detected in the regular and duplicate samples slightly above the laboratory's reportable detection limit (RDL) of 0.001 mg/L, and therefore within the acceptable error margin established at 5 times the RDL). All parameters for the fall sampling round surface water field duplicate sample (location S2) were within the 20% margin of error.

3.4 SUBSURFACE GAS SAMPLING

On October 19, 2017, BluMetric inspected the subsurface gas monitoring probes and measured methane concentrations at all locations. The locations of the gas monitors are shown on Figure 1 and results are provided in Table 9. Measurements of gas wells were between 0 and 10 ppm, well below the LEL for methane of 5% by volume in air (or 50,000 ppm).

3.5 ANNUAL SUMMARY

A comparative review of groundwater quality results between this and previous sampling events indicates that constituent concentrations vary over time but for the most part have remained relatively consistent over the current calendar year and over the past five years or more. Depending on which monitoring point and more importantly the time scale considered, conflicting trends in concentrations can occur sporadically. However since implementing the revised EMP dated June 29, 2010, the majority of the patterns have been observed to be seasonally variable but relatively similar.

Where sufficient historical data are available, alkalinity, chloride, dissolved organic carbon (DOC), iron, manganese, sodium and total dissolved solids (TDS) concentration data were reviewed for all groundwater trigger wells listed in Table 12 of the EMP.

Time-concentration plots are provided in Appendix C. Over the past five years (from the spring of 2012 to the fall of 2017), the vast majority of the analytical results show stabilized and/or variable/oscillating concentrations for almost all parameters. Exceptions to this generalization include:

- For the shallow groundwater monitors:
  - M54-4 for alkalinity, DOC, sodium and TDS (increasing trend);
  - M66-2 for chloride, sodium and TDS (downward trend);
  - M67-2 for sodium and TDS (decreasing);
  - M80-2 for alkalinity, chloride, and TDS (increasing trend);
  - M86 for alkalinity (increasing trend) and chloride, iron, sodium and TDS (decreasing trend); and
  - OW37-s for alkalinity (increasing trend).
- For the intermediate bedrock groundwater monitors:
  - M106 for alkalinity, chloride, sodium and TDS (increasing trend);
  - M186 for manganese and TDS (decreasing trend).

The observed trends in groundwater geochemistry outlined here are not necessarily indicative of landfill leachate impacts, and should be interpreted with caution. 1,4-dioxane has recently been added to the environmental monitoring program as a primary leachate indicator parameter. Any changes over time for this and other parameters will be used in future environmental monitoring events in the comparative review of groundwater quality results and the evaluation of temporal trends that may be indicative of potential impacts to groundwater from landfill leachate.

3.6 Additional Investigations

Work outside of the scope of the EMP program was performed throughout the year at the Richmond Landfill Site. Table 10 describes activities performed in 2017.

The principal non-EMP investigations conducted in 2017 were related to the ongoing hydrogeological studies directed by the ERT Order dated December 24, 2015, and follow-up work under direction and oversight from the MOECC. These activities were aimed at confirming the spatial extents of the landfill leachate plume delineation in groundwater downgradient from the landfill. Hydrogeological field investigations initiated in 2016 were completed in the first half of 2017, and results were presented and discussed in the latest Site Conceptual Model Update and Contaminant Attenuation Zone Delineation report issued in July 2017[(5)].

Data loggers recording groundwater levels, temperature and electrical conductivity were installed in intermediate bedrock monitoring wells as recommended in the preliminary karst assessment report. Monitoring started in March 2017 (May 2017 at the newest wells) and will continue through 2018; results will be provided and discussed once at least one year of data have been recorded.

Additionally, an evaluation was conducted of the source of semi-volatile VOC impacts at shallow groundwater monitoring well M54-4, and results were reported to MOECC in July 2017[(6)].

Other activities conducted in 2017 were related to requirements from a separate ECA associated with the monitoring of on-site Ponds and Leachate, as well as from the Town of Napanee Waste Water Treatment Plant where landfill leachate is hauled and treated.

4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The summer and fall 2017 monitoring programs included the collection of groundwater and surface water samples, as well as landfill gas monitoring, in accordance with the site monitoring requirements outlined in the revised interim EMP (Revision No. 05) dated April 15, 2016, as specified in the Environmental Compliance Approval (ECA) number A371203, issued by MOE January 9, 2012 and amended by Notice No. 1 dated May 3, 2013 and Environmental Review Tribunal (ERT) Order dated December 24, 2015.

The following were completed as part of the summer and fall 2017 EMP monitoring events, between July 25 and August 1, 2017 and October 13 and 19, 2017, respectively:

- Water levels were recorded from groundwater monitoring wells installed in the Shallow groundwater and Intermediate Bedrock Flow Zones, as well as leachate monitoring wells;
- Groundwater monitors completed in the Shallow and Intermediate Bedrock Flow Zones were sampled for analytical testing;
- Surface water locations were sampled for analytical testing;
- Landfill gas monitoring wells were monitored for methane concentrations; and
- Quality Assurance/Quality Control (QA/QC) samples were collected, including field duplicate samples and field blanks.

In addition to the aforementioned "routine" sampling requirements (Table 1), recently installed monitoring wells M178R-5, M188-2, M194-1, M194-2 and M195 were sampled as part of additional sampling events as required by the EMP as per amended ECA Condition No. 8.5(c)iv included in the ERT Order dated July 15, 2015.

4.1 GROUNDWATER

- Groundwater flow directions interpreted from water elevations measured in monitors were consistent with historical flownets:
  - o Shallow groundwater flow on site is influenced by local topographic highs in the southwestern (Empey Hill Drumlin) and eastern (groundwater monitor M96 area) portions of the site, and is characterized by a flow divide with shallow groundwater being directed both to the north (toward Marysville Creek) and the south (toward Beechwood Ditch). South of Beechwood Road shallow groundwater flow converges

from local topographic highs to the north and south, and discharges to a local surface water course within a topographically low area running east-west in the central portion of the proposed CAZ;
    - o Groundwater in the intermediate bedrock flow zone generally flows to the north, west, and south-southeast relative to the landfill;
- Groundwater quality data from fall 2017 are generally consistent with historical results;
- Slightly elevated groundwater concentrations of a number of water quality parameters are seen in the Shallow Flow Zone within the property in the immediate vicinity of the landfill footprint to the south, north and northwest of the landfill footprint;
- The groundwater geochemical results for the Intermediate Bedrock Flow Zone indicate higher concentrations of water quality parameters associated with landfill leachate impacts to the south-southeast and immediately north of the landfill relative to concentrations west and east of the landfill;
- Recent investigations of the groundwater conditions south of the landfill within the proposed CAZ were completed to delineate the groundwater impacts from the landfill and to define the extent of a contaminant attenuation zone. Results from these investigations were submitted to MOECC in July 2017;
- Continued groundwater monitoring within the Shallow and Intermediate Bedrock groundwater flow zones between the landfill footprint and the low-head areas is warranted in order to further examine groundwater quality and any trends over time;
- Shallow groundwater monitoring wells M19, M58-4 and M68-4 are damaged and are considered unnecessary for the EMP monitoring program. Upon approval from MOECC, these wells will be decommissioned; and
- Intermediate bedrock monitoring well M174 showed the presence of bentonite grout at the bottom and should be inspected in future monitoring events, and possibly be repaired, or replaced and decommissioned.

4.2 SURFACE WATER

- The concentrations observed during summer and fall 2016 monitoring events are within the range of historical monitoring results and indicate that the landfill is not causing adverse impacts to surface water quality;
- The concentration of total phosphorous and phenols at most locations and various metals amongst locations exceeded PWQO; and
- All other measured parameters were consistent with natural surface water quality and below PWQO.

4.3 Subsurface Gas

Measurements for methane gas were between 0 and 10 ppm for the six monitoring locations, well below the LEL for methane of 5% by volume in air (or 50,000 ppm).

4.4 Leachate Generation

An estimate of the amount of leachate generated at the site is provided by the site records of the volume of leachate hauled off-site for treatment at the Town of Greater Napanee Waste Water Treatment Plant. For the 2017 calendar year, the site records show that 20,758 m^3 of leachate were generated and hauled for off-site treatment.

5. LIMITING CONDITIONS

The summer and fall 2017 monitoring program involved the collection of groundwater (from on-site and off-site monitoring wells), surface water and off site domestic supply wells for analyses. The data collected during this investigation represent the conditions at the sampled locations only.

The conclusions presented in this report represent our professional opinion and are based on the conditions observed on the dates set out in the report, the information available at the time this report was prepared, the scope of work, and any limiting conditions noted herein.

BluMetric Environmental Inc. provides no assurances regarding changes to conditions subsequent to the time of the assessment. BluMetric Environmental Inc. makes no warranty as to the accuracy or completeness of the information provided by others or of the conclusions and recommendations predicated on the accuracy of that information.

This report has been prepared for Waste Management of Canada. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric Environmental Inc. in writing. BluMetric Environmental Inc. accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

Respectfully submitted,
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TABLES

Table 1: Summary of Environmental Monitoring Program

Monitoring Locations		Parameter Suite	Monitoring Frequency
Shallow Groundwater Flow Zone Monitors			
M58-4, M68-4, M70-3, M96, M99-2		Groundwater Inorganic & General	Once each year, in spring
		VOCs	
M53-4, M54-4, M66-2, M67-2, M80-2, M81, M85, M86, M87-2, M101, M103, M104, M114-2, OW37-s		Groundwater Inorganic & General	Twice each year, in spring and fall
		VOCs	
Intermediate Bedrock Groundwater Flow Zone Monitors			
M56-2, M58-3, M59-2, M59-4, M91-1, M95-1		Groundwater Inorganic & General	Once each year, in spring
		VOCs	
M5-3, M6-3, M9-2, M9-3, M52-2, M64-2, M70-2, M72, M74, M75, M80-1, M82-1, M82-2, M106, M108, M109-1, M110-1, M114-1, M121, M123, M167, M168, M170, M172, M177, M178R-2, M178R-3, M178R-4, M179, M185-1, M185-2, M186, M187, M188-1, M190, M192, OW1, OW4		Groundwater Inorganic & General	Twice each year, in spring and fall
		VOCs	
Surface Water Sampling Locations			
Beechwood Ditch	S4R, S5 and S8R	Surface Water Inorganic and General	Three times each year, in spring, summer[1] and fall.
Marysville Creek	S2, S3, S6 and S7		
Unnamed water course in central portion of proposed CAZ	S18, S19 and S20		
Leachate Monitoring Locations			
North Chamber, South Chamber, LW-P1 and LW-P2		Leachate Inorganic & General	Once each year, in spring
		VOCs	
Landfill Gas Monitoring Wells			
GM1, GM3, GM4-1, GM4-2, GM5, GM6		% methane by volume	Twice each year, in spring and fall
Off-site Domestic Water Supply Wells			
1441 County Road 1 West 1483 County Road 1 West 1494 County Road 1 West (UNKN)[2] 1499 County Road 1 West 1556 County Road 1 West (UNKN)[2] 1561 County Road 1 West (UNKN)[2,3] 1614 County Road 1 West 1654 County Road 1 West 1680 County Road 1 West 1695 County Road 1 West 1866 County Road 1 West 614 Belleville Road 696 Belleville Road		1,4 dioxane	Once every two years, starting in 2015

[1] The summer monitoring event shall be scheduled after a rainfall of more than 25 mm

[2] The final list of domestic well locations will depend on confirmation of which addresses have drilled wells (locations where well construction is unknown are denoted UNKN). A residential survey will be completed in order to determine which of these locations are to be sampled. Only those residences with drilled bedrock wells that supply water for domestic use will be sampled; residences that use shallow dug wells or cisterns for water supplies are not included in the program.

[3] The well at 1561 Country Road 1 West was confirmed to be a dug well and should not be sampled

Table 2: Analytical Parameters for Water and Leachate Samples

Groundwater Inorganic and General Parameters		
Total dissolved solids	Magnesium	Manganese
Alkalinity	Sodium	Ammonia (total)
Conductivity	Potassium	Nitrate
Dissolved organic carbon	Boron	Nitrite
Calcium	Iron	Chloride
		Sulphate
Volatile Organic Compounds (VOCs)		
1,4 Dioxane	1,2-Dichlorobenzene	1,1,2-Trichloroethane
Benzene	1,3-Dichlorobenzene	1,1-Dichloroethane
Toluene	1,4-Dichlorobenzene	1,2-Dichloroethane
Ethylbenzene	Methylene chloride	1,1-Dichloroethylene
m&p-Xylene	Chloromethane	Cis-1,2-Dichloroethylene
o-Xylene	Chloroethane	Trans-1,2-Dichloroethylene
Styrene	1,1,2,2-Tetrachloroethane	Trichloroethylene
1,3,5-Trimethylbenzene	1,1,1,2-Tetrachloroethane	Tetrachloroethylene
Chlorobenzene	1,1,1-Trichloroethane	Vinyl chloride
Surface Water Inorganic and General Parameters		
1,4 Dioxane	Potassium	Nitrate
Total suspended solids	Boron	Nitrite
Total dissolved solids	Cadmium	Chloride
Biological oxygen demand	Chromium (Total, Cr6+, Cr3+)	Sulphate
Chemical oxygen demand	Cobalt	Phenols
Alkalinity	Copper	Total phosphorous
Conductivity	Iron	Naphthalene
Hardness	Lead	
Calcium	Nickel	*Field measurements:*
Magnesium	Zinc	*pH, temperature, conductivity, dissolved*
Sodium	Ammonia (total & un-ionized)	*oxygen, estimated flow rate*
Leachate Inorganic and General Parameters		
Total dissolved solids	Dissolved organic carbon	Ammonia (total)
Conductivity	Boron	Total Kjeldahl nitrogen
Alkalinity	Cadmium	Nitrate
pH	Chromium (total)	Nitrite
Hardness	Cobalt	Chloride
Calcium	Copper	Sulphate
Magnesium	Iron	Total phosphorous
Sodium	Lead	Phenols
Potassium	Manganese	Naphthalene
Biological oxygen demand	Nickel	N-nitrosodimethylamine (NDMA)
Chemical oxygen demand	Zinc	

Table 3: Groundwater Elevation Monitoring Locations

Location	Shallow Groundwater Flow Zone	Intermediate Groundwater Flow Zone
West of landfill footprint	M27, M58-4, M67-2, M84, M87-2, M88-2, M89-2, M97, M98, M99-2, M100, M101, M102, OW37-s	M3A-3, M56-2, M58-3, M59-2, M59-3, M59-4, M72, M73, M74, M82-1, M82-2, M91-1, M95-1
East of landfill footprint	M19, M23, M47-3, M68-4, M70-3, M77, M94-2, M96	M50-3, M52-2, M70-2, M108, M170
North of landfill footprint	M35, M60-4, M65-2, M66-2, M83, M85, M86, M103, M104	M46-2, M60-1, OW1
South of landfill footprint; north of Beechwood Road	M12, M14, M15, M18, M41, M53-4, M54-4, M80-2, M81	M9-2, M9-3, M10-1, M49-1, M53-2, M71, M80-1, M105, M106, M107, M109-1, M109-2, M110-1, M111-1, M112-1, M113-1, M192, M193
South of landfill footprint; south of Beechwood Road	M114-2, M115-2	M63-2, M64-2, M114-1, M116, M121, M122, M123, M125, M166, M167, M168, M173, M174, M176, M177, M178R-1, M178R-2, M178R-3, M178R-4, M179, M180, M181-1, M181-2, M182, M185-1, M185-2, M186, M187, M188, M189, M190, M191

Table 4a: Groundwater Elevations - August 1, 2017

Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)
Shallow Groundwater Flow Zone							
M12	125.38	M54-4	124.19	M83	123.64	M98	129.74
M14	126.52	M58-4	124.39	M84	122.06	M99-2	129.97
M15	124.89	M60-4	124.27	M85	120.10	M100	124.76
M18	126.85	M65-2	123.45	M86	121.01	M101	123.73
M19	NM	M66-2	123.02	M87-2	123.90	M102	123.77
M23	126.91	M67-2	122.71	M88-2	127.85	M103	123.36
M27	125.95	M68-4	124.22	M89-2	129.15	M104	123.22
M35	124.21	M70-3	127.15	M94-2	124.05	M114-2	123.64
M41	125.14	M77	126.18	M96	128.57	M115-2	124.56
M47-3	124.60	M80-2	123.49	M97	125.07	OW37-s	122.01
M53-4	124.75	M81	124.41				
Intermediate Bedrock Groundwater Flow Zone							
M3A-3	124.92	M71	124.09	M113-1	123.15	M178R-4	116.69
M9-2	121.81	M72	122.99	M114-1	121.33	M179	109.66
M9-3	122.35	M73	123.04	M116	121.34	M180	112.04
M10-1	121.41	M74	123.78	M121	121.27	M181-1	96.00
M46-2	122.96	M80-1	123.24	M122	121.03	M181-2	105.24
M49-1	121.43	M82-1	122.86	M123	120.72	M182	94.47
M50-3	124.21	M82-2	122.75	M125	121.38	M185-1	106.15
M52-2	122.50	M91-1	123.19	M166	120.72	M185-2	115.77
M53-2	121.17	M95-1	123.07	M167	> 120.68	M186	114.58
M56-2	123.18	M105	121.84	M168	120.73	M187	94.25
M58-3	123.19	M106	123.12	M170	121.77	M188-1	115.38
M59-2	123.25	M107	121.79	M173	100.62	M189	104.80
M59-3	123.21	M108	120.81	M174	94.35	M190	115.34
M59-4	123.22	M109-1	121.82	M176	109.68	M191	100.59
M60-1	122.91	M109-2	121.87	M177	115.23	M192	120.76
M63-2	121.54	M110-1	121.83	M178R-1	116.61	M193	122.27
M64-2	119.03	M111-1	123.13	M178R-2	> 120.52	OW1	122.97
M70-2	122.31	M112-1	123.15	M178R-3	> 120.42		

NM: Not Monitored (See text for details)

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Table 4b: Groundwater Elevations - October 13, 2017

Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)
Shallow Groundwater Flow Zone							
M12	125.12	M54-4	124.14	M83	123.59	M98	129.50
M14	125.94	M58-4	NM	M84	122.01	M99-2	129.53
M15	NM	M60-4	124.19	M85	120.35	M100	124.35
M18	NM	M65-2	123.17	M86	122.52	M101	123.47
M19	NM	M66-2	123.07	M87-2	123.53	M102	123.95
M23	125.82	M67-2	122.28	M88-2	127.00	M103	123.10
M27	126.07	M68-4	124.21	M89-2	128.65	M104	123.24
M35	124.26	M70-3	126.95	M94-2	124.28	M114-2	123.68
M41	124.91	M77	124.98	M96	127.66	M115-2	124.77
M47-3	124.55	M80-2	123.46	M97	124.19	OW37-s	121.93
M53-4	124.70	M81	124.42				
Intermediate Bedrock Groundwater Flow Zone							
M3A-3	124.42	M71	123.87	M113-1	122.86	M178R-4	116.47
M9-2	119.94	M72	122.71	M114-1	119.76	M179	109.32
M9-3	120.07	M73	122.77	M116	119.78	M180	111.89
M10-1	119.81	M74	123.34	M121	119.72	M181-1	95.88
M46-2	123.25	M80-1	122.98	M122	119.61	M181-2	105.13
M49-1	118.84	M82-1	122.82	M123	119.41	M182	95.20
M50-3	124.06	M82-2	122.51	M125	119.80	M185-1	111.81
M52-2	121.61	M91-1	122.89	M166	119.42	M185-2	115.55
M53-2	119.57	M95-1	122.81	M167	119.40	M186	114.30
M56-2	122.90	M105	119.96	M168	119.43	M187	94.51
M58-3	122.93	M106	122.85	M170	119.91	M188-1	115.42
M59-2	123.51	M107	119.94	M173	100.42	M189	104.80
M59-3	122.92	M108	119.44	M174	94.53	M190	115.22
M59-4	122.93	M109-1	119.94	M176	109.28	M191	102.40
M60-1	122.55	M109-2	119.96	M177	115.26	M192	NM
M63-2	121.12	M110-1	119.95	M178R-1	115.73	M193	NM
M64-2	118.59	M111-1	122.84	M178R-2	NM	OW1	122.55
M70-2	121.55	M112-1	122.87	M178R-3	NM		

NM: Not Monitored (See text for details)

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Table 5a: Groundwater Quality Results - October 16-19, 2017

		Alkalinity	Ammonia	Boron	Calcium	Chloride	Conductivity	Dissolved Organic Carbon	Iron	Magnesium	Manganese	Nitrate	Nitrite	Potassium	Sodium	Sulphate	Total Dissolved Solids	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethylene
Name	Date	mg/L	mg/L	mg/L	mg/L	mg/L	mS/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
Shallow Groundwater Flow Zone																							
M53-4	10/17/2017	400	< 0.15	< 0.02	120	2.6	840	2.4	< 0.1	27	< 0.002	< 0.1	< 0.01	0.53	41	100	560	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M54-4	10/16/2017	460	< 0.15	0.044	140	49	1000	2.6	< 0.1	28	0.019	< 0.1	< 0.01	1.5	58	64	620	< 0.0002	0.0016	< 0.0002	< 0.0002	0.0018	< 0.0001
M66-2	10/16/2017	340	< 0.15	0.42	110	100	1200	2.2	1.6	35	0.051	< 0.1	< 0.01	3.9	96	220	765	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M67-2	10/18/2017	320	0.45	0.83	46	4.3	580	1.9	0.65	27	0.024	< 0.1	< 0.01	8.6	47	9	385	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M80-2	10/17/2017	370	< 0.15	0.054	89	65	870	2	< 0.1	47	0.04	< 0.1	< 0.01	4.5	21	46	515	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M81	10/17/2017	350	< 0.15	0.036	96	83	910	1.5	< 0.1	50	0.035	< 0.1	< 0.01	2.4	10	40	550	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M86	10/17/2017	350	< 0.15	1.1	63	36	940	2.2	< 0.1	32	0.016	0.34	< 0.01	17	82	130	575	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M87-2	10/19/2017	240	< 0.15	0.036	52	27	590	1.3	< 0.1	34	0.009	< 0.1	< 0.01	2	12	50	295	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M101	10/18/2017	480	< 0.15	0.054	160	75	1100	2.6	< 0.1	48	0.013	< 0.1	< 0.01	3.4	16	63	780	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00076	< 0.0001
M103	10/17/2017	710	< 0.15	0.24	150	240	1900	4.7	< 0.1	89	0.002	0.1	< 0.01	5.6	130	68	1080	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M104	10/19/2017	1500	3.52	2.5	140	860	5000	71	< 0.1	130	0.49	1.9	0.074	13	780	71	2820	< 0.001	< 0.0005	< 0.001	< 0.001	< 0.0005	< 0.0005
M114-2	10/18/2017	310	< 0.15	0.021	100	69	840	1.9	< 0.1	16	< 0.002	1.62	< 0.01	0.94	58	39	490	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
OW37-s	10/18/2017	210	< 0.15	0.088	35	63	610	3.2	1.7	15	0.16	< 0.1	< 0.01	8.2	34	22	320	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M178R-5**	9/7/2017	510	0.21	0.19	100	44	840	3.6	0.16	22	0.031	< 0.1	< 0.01	4.7	49	15	492	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00052	< 0.0001
M188-2**	9/7/2017	280	< 0.15	0.67	67	2.2	650	2.2	< 0.1	25	0.076	0.58	< 0.01	7.2	39	66	362	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
Intermediate BedrockGroundwater Flow Zone																							
M5-3	10/17/2017	470	1.28	1.2	34	43	940	1.2	< 0.1	26	< 0.002	< 0.1	< 0.01	12	140	3.8	560	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M6-3	10/18/2017	600	5.2	0.69	450	1500	6800	42	< 0.1	1	< 0.002	< 0.1	< 0.01	37	630	54	4480	< 0.0005	< 0.00025	< 0.0005	< 0.0005	< 0.00025	< 0.00025
M9-2	10/19/2017	580	0.7	0.28	150	140	1400	7	13	41	0.41	< 0.1	< 0.01	5.9	86	< 1	720	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00039	< 0.0001
M9-3	10/19/2017	310	1.15	0.52	54	120	930	2.2	0.83	30	0.055	< 0.1	< 0.01	14	77	2.8	420	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00017	< 0.0001
M52-2	10/18/2017	430	1.48	1.2	25	310	1900	2	< 0.1	17	0.004	< 0.1	< 0.01	12	290	44	945	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M64-2	10/17/2017	320	1.04	0.97	49	120	900	1.5	< 0.1	29	0.007	< 0.1	< 0.01	9.5	88	1.7	445	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M70-2	10/18/2017	400	1.84	1.3	49	480	2200	1.9	0.86	34	0.014	< 0.1	< 0.01	14	370	22	1210	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M72	10/19/2017	280	0.53	0.4	53	31	630	1.7	< 0.1	32	0.002	< 0.1	< 0.01	7.2	16	24	290	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M74	10/19/2017	340	1.82	0.91	30	16	680	1.5	0.26	16	0.047	< 0.1	< 0.01	12	85	15	345	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M75	10/16/2017	440	1.3	0.99	40	65	960	1.9	< 0.1	22	0.075	< 0.1	< 0.01	12	130	25	485	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M80-1	10/17/2017	160	0.39	0.36	20	24	350	1	< 0.1	12	0.004	< 0.1	< 0.01	4.2	34	13	235	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M82-1	10/18/2017	330	0.81	1	50	43	860	2.7	< 0.1	27	0.004	< 0.1	< 0.01	10	90	67	535	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M82-2	10/18/2017	340	0.24	0.12	98	20	740	2.3	< 0.1	27	0.018	< 0.1	< 0.01	3.5	14	59	460	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M106	10/17/2017	380	2.44	1.9	110	1500	4800	1.3	< 0.1	72	< 0.002	< 0.1	< 0.01	22	890	< 1	2780	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.0019	0.00054
M108	10/16/2017	560	0.8	0.24	130	110	1200	5.8	1.7	40	0.11	< 0.1	0.01	7	70	< 1	655	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00045	< 0.0001
M109-1	10/16/2017	670	1.14	0.41	160	170	1500	8.6	12	52	0.33	< 0.1	< 0.01	7.4	110	< 1	825	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M110-1	10/16/2017	670	0.56	0.47	150	170	1600	8.6	0.11	51	0.013	< 0.1	< 0.01	6.8	120	< 1	865	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M114-1	10/18/2017	490	0.37	0.2	130	120	1200	4.8	7.9	32	0.4	< 0.1	< 0.01	5.5	74	5.7	640	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00015	0.00026
M121	10/17/2017	460	1.96	0.65	170	1000	3400	3.8	< 0.1	100	0.005	< 0.1	< 0.01	19	450	11	2150	< 0.002	< 0.001	< 0.002	< 0.002	< 0.001	< 0.001
M123	10/17/2017	400	0.27	0.15	100	42	810	3.8	< 0.1	22	0.011	< 0.1	< 0.01	3.6	46	6.8	460	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00011	< 0.0001
M167	10/18/2017	390	1.86	1.1	95	420	2100	2.9	< 0.1	61	0.003	< 0.1	< 0.01	19	220	1.7	1180	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M168	10/18/2017	420	1.39	0.54	130	320	1800	3.5	< 0.1	48	0.004	< 0.1	< 0.01	15	160	13	1070	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M170	10/18/2017	670	1.66	2.5	45	750	3500	4.2	< 0.1	34	< 0.002	< 0.1	< 0.01	16	640	3.2	1880	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M172	10/19/2017	570	0.74	0.16	160	120	1300	6.5	22	35	0.75	< 0.1	< 0.01	4.7	66	4.5	615	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.002	0.00018
M177	10/19/2017	250	0.52	0.35	71	8.3	530	1.7	< 0.1	15	0.006	< 0.1	< 0.01	6	9.1	28	230	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M178R-2	10/19/2017	380	0.24	0.15	99	40	830	3.7	2.1	21	0.058	< 0.1	< 0.01	4.4	39	14	390	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.001	0.0001
M178R-3	10/19/2017	400	0.29	0.18	99	43	860	3.9	0.85	22	0.041	< 0.1	< 0.01	4.8	46	12	415	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00091	< 0.0001
M178R-4	10/19/2017	390	0.27	0.18	96	42	850	3.6	< 0.1	21	0.018	< 0.1	< 0.01	4.4	45	14	395	< 0.0002	< 0.0001	< 0.0002	< 0.0002	0.00055	< 0.0001
M179	10/18/2017	350	0.3	0.26	92	47	820	3	0.43	14	0.028	< 0.1	0.012	4.6	44	23	485	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M185-1	10/19/2017	340	1.6	1.5	24	350	1900	1.7	< 0.1	7.3	0.037	< 0.1	< 0.01	10	360	50	950	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M185-2	10/19/2017	300	< 0.15	0.07	110	2	590	2.1	0.15	5.5	0.01	< 0.1	< 0.01	1.5	2.6	29	320	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M186	10/18/2017	370	2.2	2.1	71	1200	4300	2.1	0.52	47	0.12	< 0.1	< 0.01	21	650	8.5	2210	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M187	10/17/2017	270	< 0.15	0.091	100	25	610	3.5	< 0.1	7.7	0.004	0.28	< 0.01	2.3	18	39	350	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M188-1	10/19/2017	320	0.6	0.5	52	50	770	2.1	< 0.1	19	0.008	< 0.1	< 0.01	5.8	72	15	320	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M190	10/18/2017	330	< 0.15	0.082	110	36	740	3.3	< 0.1	11	0.007	< 0.1	< 0.01	3.4	21	31	415	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
OW1	10/17/2017	490	2.92	1.2	49	49	1100	4.9	< 0.1	31	0.15	< 0.1	< 0.01	14	140	39	605	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
OW4	10/17/2017	1000	1.14	0.92	160	550	3100	44	2.4	100	0.18	< 0.1	< 0.01	9.4	410	34	1920	< 0.002	< 0.001	< 0.002	< 0.002	< 0.001	< 0.001
M194-1**	9/7/2017	260	< 0.15	0.031	93	9.5	530	2.3	< 0.1	4.6	0.004	< 0.1	< 0.01	1	7	14	286	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M194-2**	9/7/2017	380	0.57	0.31	75	20	380	12	< 0.1	15	0.1	< 0.1	< 0.01	6.9	110	95	530	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001
M195**	9/7/2017	390	0.87	0.88	36	140	1400	2.5	0.26	13	0.012	< 0.1	< 0.01	7.9	220	75	728	< 0.0002	< 0.0001	< 0.0002	< 0.0002	< 0.0001	< 0.0001

* M85 Purged Dry - No Sample Collected

* M192 No access permission from property owner - No Sample Collected

** M178R-5, M188-2, M194-1, M194-2 and M195; are not included in the EMP; they were sampled as required by ECA Condition 8.5(c)iv

Table 5a: Groundwater Quality Results - October 16-19, 2017

Name	Date	1,2-Dichlorobenzene (o)	1,2-Dichloroethane	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene (m)	1,4-Dichlorobenzene (p)	1,4-Dioxane	Benzene	Chlorobenzene	Chloroethane	Chloromethane	Cis-1,2-Dichloroethylene	Dichloromethane	Ethylbenzene	m+p-Xylene	o-Xylene	Styrene	Tetrachloroethylene	Toluene	Trans-1,2-dichloroethylene	Trichloroethylene	Vinyl Chloride
		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	mg/L	mg/L	mg/L	mg/L	mg/L
Shallow Groundwater Flow Zone																						
M53-4	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M54-4	10/16/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	0.0015	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	0.0039	< 0.0002	< 0.0001	0.0017	< 0.0002
M66-2	10/16/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M67-2	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M80-2	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	0.00034	< 0.0001	< 0.0001	< 0.0002
M81	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M86	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M87-2	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M101	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0074	< 0.0001	< 0.0001	< 0.001	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M103	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.022	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M104	10/19/2017	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.15	< 0.0005	< 0.0005	< 0.001	< 0.0025	< 0.0005	< 0.0025	< 0.0005	< 0.0005	< 0.0005	< 0.001	< 0.0005	< 0.001	< 0.0005	< 0.0005	< 0.001
M114-2	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
OW37-s	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M178R-5**	9/7/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0058	< 0.0001	< 0.0001	0.00061	< 0.0005	< 0.0001	< 0.0005	< 0.0001	0.00011	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M188-2**	9/7/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
Intermediate BedrockGroundwater Flo																						
M5-3	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M6-3	10/18/2017	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.34	0.0013	< 0.00025	< 0.0005	< 0.0013	< 0.00025	< 0.0013	0.00028	0.0021	0.00065	< 0.0005	< 0.00025	0.0081	< 0.00025	< 0.00025	< 0.0005
M9-2	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.018	0.0002	< 0.0001	0.032	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	0.00054
M9-3	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.003	< 0.0001	< 0.0001	0.0058	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M52-2	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M64-2	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.003	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M70-2	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	0.0017	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M72	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M74	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M75	10/16/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M80-1	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	0.0008	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	0.0001	0.00046	0.00017	< 0.0002	< 0.0001	0.00034	< 0.0001	< 0.0001	< 0.0002
M82-1	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M82-2	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M106	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	0.0004	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M108	10/16/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.011	< 0.0001	< 0.0001	0.0058	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	0.00026
M109-1	10/16/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.026	0.0001	< 0.0001	0.015	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	0.00023
M110-1	10/16/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.032	0.0008	< 0.0001	0.015	< 0.0005	< 0.0001	< 0.0005	< 0.0001	0.0004	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	0.00025
M114-1	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0061	< 0.0001	< 0.0001	0.011	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	0.00023
M121	10/17/2017	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.0081	0.068	< 0.001	0.0059	< 0.005	< 0.001	< 0.005	0.0023	0.018	0.0015	< 0.002	< 0.001	< 0.002	< 0.001	< 0.001	< 0.002
M123	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0055	< 0.0001	< 0.0001	0.0044	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M167	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0022	0.0004	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M168	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0051	0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M170	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.009	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M172	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.00036	0.0096	< 0.0001	< 0.0001	0.0052	< 0.0005	0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	0.00027
M177	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M178R-2	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0037	< 0.0001	< 0.0001	0.0017	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M178R-3	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0056	< 0.0001	< 0.0001	0.0029	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M178R-4	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0051	< 0.0001	< 0.0001	0.0025	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M179	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M185-1	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	0.00019	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M185-2	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M186	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	0.001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	0.00026	0.00026	0.00051	< 0.0002	< 0.0001	0.00044	< 0.0001	< 0.0001	< 0.0002
M187	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
M188-1	10/19/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	0.00058	< 0.0001	< 0.0001	< 0.0002
M190	10/18/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0002	< 0.0001	< 0.0001	< 0.0002
OW1	10/17/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	0.002	0.00011	0.0002	< 0.0002	< 0.0001	0.00074	< 0.0001	< 0.0001	< 0.0002
OW4	10/17/2017	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.12	0.001	0.0021	< 0.002	< 0.005	< 0.001	< 0.005	0.0038	< 0.001	< 0.001	< 0.002	< 0.001	< 0.002	< 0.001	< 0.001	< 0.002
M194-1**	9/7/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	< 0.0001	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	0.00011	< 0.0001	< 0.0002	< 0.0001	0.00048	< 0.0001	< 0.0001	< 0.0002
M194-2**	9/7/2017	< 0.0002	< 0.0002	0.00033	< 0.0002	< 0.0002	< 0.001	0.0027	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	0.00039	0.0036	0.001	< 0.0002	< 0.0001	0.0073	< 0.0001	< 0.0001	< 0.0002
M195**	9/7/2017	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.001	0.0008	< 0.0001	< 0.0002	< 0.0005	< 0.0001	< 0.0005	< 0.0001	0.00029	0.0001	< 0.0002	< 0.0001	0.00042	< 0.0001	< 0.0001	< 0.0002

* M85 Purged Dry - No Sample Collected

* M192 No access permission from property owner - No Sample Collected

** M178R-5, M188-2, M194-1, M194-2 and M195; are not included in the EMP; they were sampled as required by ECA Condition 8.5(c)iv

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Table 5b: Groundwater Quality Results and Reasonable Use Limits - October 16-19, 2017

Name	Date	1,4-dioxane	Alkalinity	Chloride	Dissolved Organic Carbon	Iron	Manganese	Sodium	Total Dissolved Solids	1,1-dichloroethylene	Benzene	Ethylbenzene	Xylenes (Total)	Toluene
		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
Shallow Groundwater Flow Zone														
RUL		*0.001**	*390*	*130*	*3.6*	*0.18*	*0.034*	*109*	*452*	*0.0035*	*0.0014*	*0.0013*	*0.15*	*0.0121*
M54-4	10/16/2017	< 0.001	460	49	2.6	< 0.1	0.019	58	620	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M66-2	10/16/2017	< 0.001	340	100	2.2	1.6	0.051	96	765	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M67-2	10/18/2017	< 0.001	320	4.3	1.9	0.65	0.024	47	385	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
75% RUL†		*n/a*	*293*	*98*	*2.7*	*0.14*	*0.026*	*82*	*339*	*0.0026*	*0.0011*	*0.00098*	*0.11*	*0.0091*
M80-2	10/17/2017	< 0.001	370	65	2	< 0.1	0.04	21	515	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00034
M87-2	10/19/2017	< 0.001	240	27	1.3	< 0.1	0.009	12	295	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
OW37-s	10/18/2017	< 0.001	210	63	3.2	1.7	0.16	34	320	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
Intermediate BedrockGroundwater Flow Zone														
RUL		*0.001*	*400*	*132*	*3.5*	*0.18*	*0.032*	*106*	*465*	*0.0035*	*0.0014*	*0.0013*	*0.15*	*0.0121*
M177	10/19/2017	< 0.001	250	8.3	1.7	< 0.1	0.006	9.1	230	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M178R-2	10/19/2017	0.0037	380	40	3.7	2.1	0.058	39	390	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M178R-3	10/19/2017	0.0056	400	43	3.9	0.85	0.041	46	415	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M178R-4	10/19/2017	0.0051	390	42	3.6	< 0.1	0.018	45	395	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M179	10/18/2017	< 0.001	350	47	3.0	0.43	0.028	44	485	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M185-1	10/19/2017	< 0.001	340	350	1.7	< 0.1	0.037	360	950	< 0.0001	0.00012	< 0.0001	0.00019	< 0.0002
M185-2	10/19/2017	< 0.001	300	2.0	2.1	0.15	0.01	2.6	320	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M186	10/18/2017	< 0.001	370	1200	2.1	0.52	0.12	650	2210	< 0.0001	0.001	0.00026	0.00077	0.00044
M187	10/17/2017	< 0.001	270	25	3.5	< 0.1	0.004	18	350	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M188-1	10/19/2017	< 0.001	320	50	2.1	< 0.1	0.008	72	320	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00058
M190	10/18/2017	< 0.001	330	36	3.3	< 0.1	0.007	21	415	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
75% RUL†		*n/a*	*300*	*99*	*2.6*	*0.14*	*0.024*	*80*	*349*	*0.0026*	*0.0011*	*0.00098*	*0.11*	*0.0091*
M80-1	10/17/2017	< 0.001	160	24	1.0	< 0.1	0.004	34	235	< 0.0001	0.0008	0.0001	0.00063	0.00034
M82-1	10/18/2017	< 0.001	330	43	2.7	< 0.1	0.004	90	535	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M82-2	10/18/2017	< 0.001	340	20	2.3	< 0.1	0.018	14	460	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002
M106	10/17/2017	< 0.001	380	1500	1.3	< 0.1	< 0.002	890	2780	0.00054	0.0004	< 0.0001	0.0001	< 0.0002

* Site-specific RUL for 1,4 dioxane set by ERT Order dated December 24, 2015

† Wells located on the boundary of WM property, including the CAZ boundary, are compared to 75% of RUL concentrations

Groundwater results exceed Reasonable Use Limits (RUL) *0.05*

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Table 6: Water Quality Results from Off-Site Domestic Supply Wells - October 16 - November 22, 2017

Address	Date	1,4 dioxane (mg/L)
1441 County Road 1 West	10/17/2017	<0.001
1499 County Road 1 West	10/16/2017	<0.001
1614 County Road 1 West	11/2/2017	<0.001
1654 County Road 1 West	10/16/2017	<0.001
1680 County Road 1 West	11/22/2017	<0.001
696 Belleville Road	10/16/2017	<0.001

Table 7a: Surface Water Characteristics - July 25, 2017

Date	Parameter		Surface Water Station									
			S2	S3	S4R	S5	S6	S7	S8R	S18	S19	S20
7/25/2017	Velocity:	m/s	NM	NM	DRY	NM	NM	NM	NM	NM	NM	NM
	Depth:	m	0.40	NM		0.30	0.35	0.40	0.12	NM	NM	NM
	Width:	m	2.50	NM		2.00	3.00	4.00	1.25	NM	NM	NM
	Estimated Flow Rate:	m^3/s	NM	NM		NM	NM	NM	NM	NM	NM	NM

NM: Not Measured (Flow was insufficient, water was ponded, or unable to measure due to vegetation)

Table 7b: Surface Water Characteristics - October 16, 2017

Date	Parameter		Surface Water Station									
			S2	S3	S4R	S5	S6	S7	S8R	S18	S19	S20
10/16/2017	Velocity:	m/s	NM	NM	DRY	NM	NM	0.1	DRY	NM	NM	NM
	Depth:	m	NM	NM		NM	NM	0.12		NM	NM	NM
	Width:	m	NM	NM		NM	NM	0.50		NM	NM	NM
	Estimated Flow Rate:	m^3/s	NM	NM		NM	NM	0.01		NM	NM	NM

NM: Not Measured (Flow was insufficient, water was ponded, or unable to measure due to vegetation)

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Table 8a: Surface Water Quality Results - July 25, 2017

			Marysville Creek				Beechwood Ditch			South of Beechwood Road		
			S2	S3	S6	S7	S5	S4R	S8R	S18	S19	S20
			(upstream)	(downstream)	(downstream)	(downstream)	(upstream)	(downstream)	(downstream)	(upstream)	(downstream)	(downstream)
		Date	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017
Reading Name	Units	PWQO										
Inorganic and General Parameters												
Alkalinity	mg/L		170	170	160	160	170		130	130	290	220
Ammonia	mg/L		< 0.15	< 0.15	0.18	< 0.15	< 0.15		< 0.15	< 0.15	< 0.15	< 0.15
Ammonia (unionized)	mg/L	0.02	< 0.0014	< 0.0019	0.0021	< 0.0016	< 0.0018		< 0.005	< 0.0015	< 0.0026	< 0.0025
Biochemical Oxygen Demand	mg/L		< 2	< 2	< 2	< 2	< 2		< 2	< 2	< 2	< 2
Chemical Oxygen Demand	mg/L		53	38	39	37	28		23	29	25	31
Chloride	mg/L		11	10	8.9	9.2	1.1		8.9	4.2	19	15
Conductivity	µS/cm		340	340	320	330	310		280	270	580	450
Hardness	mg/L		160	160	150	160	160		110	140	260	210
Nitrate	mg/L		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	Dry	< 0.1	< 0.1	< 0.1	< 0.1
Nitrite	mg/L		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	< 0.01
Nitrate + Nitrite	mg/L											
Phenols	mg/L	0.001	*0.003*	*0.0022*	*0.0028*	*0.0024*	*0.0016*		*0.0016*	*0.0022*	0.001	*0.0022*
Phosphorus (total)	mg/L	0.03	*0.047*	*0.048*	*0.046*	*0.048*	*0.046*		< 0.03	*0.031*	*0.039*	< 0.03
Sulphate	mg/L		< 10	< 1	< 1	< 1	< 1		5.6	7.6	< 1	< 1
Total Dissolved Solids	mg/L		208	192	184	190	160		136	158	312	252
Total Suspended Solids	mg/L		< 10	< 10	< 10	< 10	< 10		< 10	< 10	< 10	< 10
Metals												
Boron	mg/L	0.2	< 0.02	*0.024*	< 0.02	*0.022*	< 0.02		*0.035*	< 0.02	*0.056*	*0.038*
Cadmium	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001		< 0.0001	< 0.0001	< 0.0001	< 0.0001
Calcium	mg/L		58	54	53	55	50		30	48	96	73
Chromium (III)	mg/L	0.0089	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005		< 0.005	< 0.005	< 0.005	< 0.005
Chromium (VI)	mg/L	0.001	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chromium (Total)	mg/L		< 0.005	< 0.005	< 0.005	< 0.005	< 0.005		< 0.005	< 0.005	< 0.005	< 0.005
Cobalt	mg/L	0.0009	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005		< 0.0005	< 0.0005	0.0006	< 0.0005
Copper	mg/L	0.005	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	Dry	< 0.002	< 0.002	< 0.002	< 0.002
Iron	mg/L	0.3	0.28	0.26	*0.33*	0.3	0.2		0.18	*0.31*	*2.7*	0.26
Lead	mg/L	0.005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Magnesium	mg/L		6.5	7.4	7	7.2	9.7		9	3.4	11	7.5
Nickel	mg/L	0.025	< 0.001	< 0.001	< 0.001	0.001	< 0.001		< 0.001	< 0.001	< 0.001	< 0.001
Potassium	mg/L		2	2	2	2.1	1.6		1.4	3.3	2.1	1.9
Sodium	mg/L		8.3	8.8	7.9	8.2	2.7		15	2.8	17	11
Zinc	mg/L	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	< 0.01
Volatile Organic Compounds (VOCs)												
1,4-dioxane	mg/L	0.02	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	Dry	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	mg/L	0.007	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005		< 0.00005	< 0.00005	< 0.00005	< 0.00005
Field Measurements												
pH (Field)	unitless	6.5-8.5	7.39	7.52	7.47	7.44	7.44		7.85	7.33	7.59	7.51
Conductivity (Field)	µS/cm		330	330	320	360	310	Dry	290	290	570	460
Dissoved Oxygen (Field)	mg/L		2.49	4.76	382	3.21	2.87		5.84	0.57	2.77	5.08
Temperature (Field)	°C		17.1	17.1	17.3	17.2	18.7		20	19.7	18.9	20.9

Exceeds PWQO

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Table 8b: Surface Water Quality Results - October 16, 2017

			Marysville Creek				Beechwood Ditch			South of Beechwood Road		
			S2	S3	S6	S7	S5	S4R	S8R	S18	S19	S20
			(upstream)	(downstream)	(downstream)	(downstream)	(upstream)	(downstream)	(downstream)	(upstream)	(downstream)	(downstream)
		Date	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017
Reading Name	Units	PWQO										
Inorganic and General Parameters												
Alkalinity	mg/L		200	250	250	250	200			200	320	230
Ammonia	mg/L		< 0.15	< 0.15	< 0.15	< 0.15	< 0.15			< 0.15	< 0.15	0.21
Ammonia (unionized)	mg/L	0.02	< 0.0006	< 0.00093	< 0.001	< 0.0012	< 0.0011			< 0.0053	< 0.001	0.0023
Biochemical Oxygen Demand	mg/L		< 2	< 2	< 2	< 2	< 2			4	< 2	< 2
Chemical Oxygen Demand	mg/L		59	24	27	29	29			34	28	29
Chloride	mg/L		16	19	18	19	2.7			5.4	28	23
Conductivity	µS/cm		420	500	500	490	360			390	660	530
Hardness	mg/L		210	260	250	260	230			200	320	240
Nitrate	mg/L		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	Dry	Dry	< 0.1	< 0.1	< 0.1
Nitrite	mg/L		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01			< 0.01	< 0.01	< 0.01
Nitrate + Nitrite	mg/L											
Phenols	mg/L	0.001	*0.0022*	< 0.001	< 0.001	< 0.001	< 0.001			< 0.001	*0.0014*	< 0.001
Phosphorus (total)	mg/L	0.03	*0.097*	*0.039*	*0.046*	*0.047*	*0.07*			*0.09*	*0.089*	*0.057*
Sulphate	mg/L		16	3.6	< 1	< 1	23			22	29	31
Total Dissolved Solids	mg/L		320	310	310	350	255			280	435	355
Total Suspended Solids	mg/L		< 10	62	< 10	< 10	16			24	22	11
Metals												
Boron	mg/L	0.2	0.022	0.049	0.047	0.049	< 0.02			0.023	0.063	0.046
Cadmium	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001			< 0.0001	< 0.0001	< 0.0001
Calcium	mg/L		67	76	77	80	63			76	120	82
Chromium (III)	mg/L	0.0089	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005			< 0.005	< 0.005	< 0.005
Chromium (VI)	mg/L	0.001	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005			< 0.0005	< 0.0005	< 0.0005
Chromium (Total)	mg/L		< 0.005	< 0.005	< 0.005	< 0.005	< 0.005			< 0.005	< 0.005	< 0.005
Cobalt	mg/L	0.0009	0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005			< 0.0005	*0.001*	< 0.0005
Copper	mg/L	0.005	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	Dry	Dry	< 0.002	< 0.002	< 0.002
Iron	mg/L	0.3	*0.64*	0.1	*0.46*	0.26	*0.4*			*0.74*	*2.1*	*0.52*
Lead	mg/L	0.005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005			< 0.0005	< 0.0005	< 0.0005
Magnesium	mg/L		9.5	11	12	12	12			5.6	12	9
Nickel	mg/L	0.025	0.001	0.001	0.001	0.001	0.001			0.001	0.001	< 0.001
Potassium	mg/L		5.2	3.3	3.1	3.4	2.1			4.7	4.4	5.5
Sodium	mg/L		9.7	15	15	16	4.5			4.3	22	15
Zinc	mg/L	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01			< 0.01	< 0.01	< 0.01
Volatile Organic Compounds (VOCs)												
1,4-dioxane	mg/L	0.02	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	Dry	Dry	< 0.001	< 0.001	< 0.001
Naphthalene	mg/L	0.007	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005			< 0.00005	< 0.00005	< 0.00005
Field Measurements												
pH (Field)	unitless	6.5-8.5	7.21	7.38	7.44	7.47	7.46			8.11	7.41	7.61
Conductivity (Field)	µS/cm		330	380	380	390	290	Dry	Dry	290	540	400
Dissoved Oxygen (Field)	mg/L		1.34	6.52	4.9	3.86	4.63			10.54	5.76	5.72
Temperature (Field)	°C		11.1	11.8	11.0	11.8	11.0			12.8	12.3	12.6

Exceeds PWQO

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Table 9: Subsurface Gas Monitoring Results - October 19, 2017

Gas Monitor	Location	Reading (ppm)
GM1	North of garage area, south of waste mound	5
GM3	Northeast corner of waste mound	5
GM4-1	Southeast corner of waste mound	10
GM4-2		0
GM5	Northwest corner of waste mound	0
GM6	North of waste mound	0

Table 10: Additional Investigations

Description of Activities in 2017	Reporting Completed in 2017	Anticipated / Planned Work in 2018
CAZ Investigation: · Complementary shallow groundwater investigation within the proposed CAZ (started in 2016) · Complementary intermediate bedrock groundwater investigation (started in 2016) · Complementary investigation within proposed CAZ as recommended by karst expert in 2016, including: · Drilling, testing, Monitoring Well installation of new Well between M187 and M64-2 · Installation of data loggers in 10 monitoring wells (water level, conductivity and temperature) · Supplementary stream survey	- Site Conceptual Model Update and Contaminant Attenuation Zone Delineation (July 2017) - Assessment of CVOC Impacts at Shallow Groundwater Monitoring Well M54-4 (July 2017)	- Preparation of application to amend ECA to include proposed CAZ - Preparation of revised EMP to reflect new wells and proposed CAZ - Compilation and interpretation of results from data loggers within CAZ (after first full year of data acquisition)
Town of Greater Napanee WWTP Requirements: · Monthly North/South Chambers combined leachate sampling (Jan-Dec)	- Monthly reports prepared for the Town of Greater Napanee	- Monitoring and reporting to continue in 2018
ECA Monitoring Requirements - Storm Water Ponds and Leachate: · Storm Water Ponds · Monthly sampling for inorganic and general chemistry parameter lists (March, April, May, October, November, December) · Quarterly Sampling of the ECA Storm water ponds for Toxicity (March, June, September, December) · Leachate (North Chamber) · Quarterly sampling list (March, August, October, December) · Annual sampling chemistry list (May)	- Monitoring results from the 2016 calendar year for the stormwater ponds and leachate locations were reported in the 2016 Annual Report, prepared by WSP Canada Inc. and dated March 2017	- Monitoring and reporting to continue in 2018
WMCC Wildlife Learning Centre: · Water supply (cistern) taken offline	n/a	n/a
Pipeline Investigation: · Decommissioning of three shallow piezometers (study completed in 2016)	n/a	n/a
Marysville Creek Conductivity Monitoring: · Monthly data download & compilation (one-year study completed in May 2017)	- Final data and interpretation reported in spring 2017 semi-annual monitoring report (July 2017)	n/a

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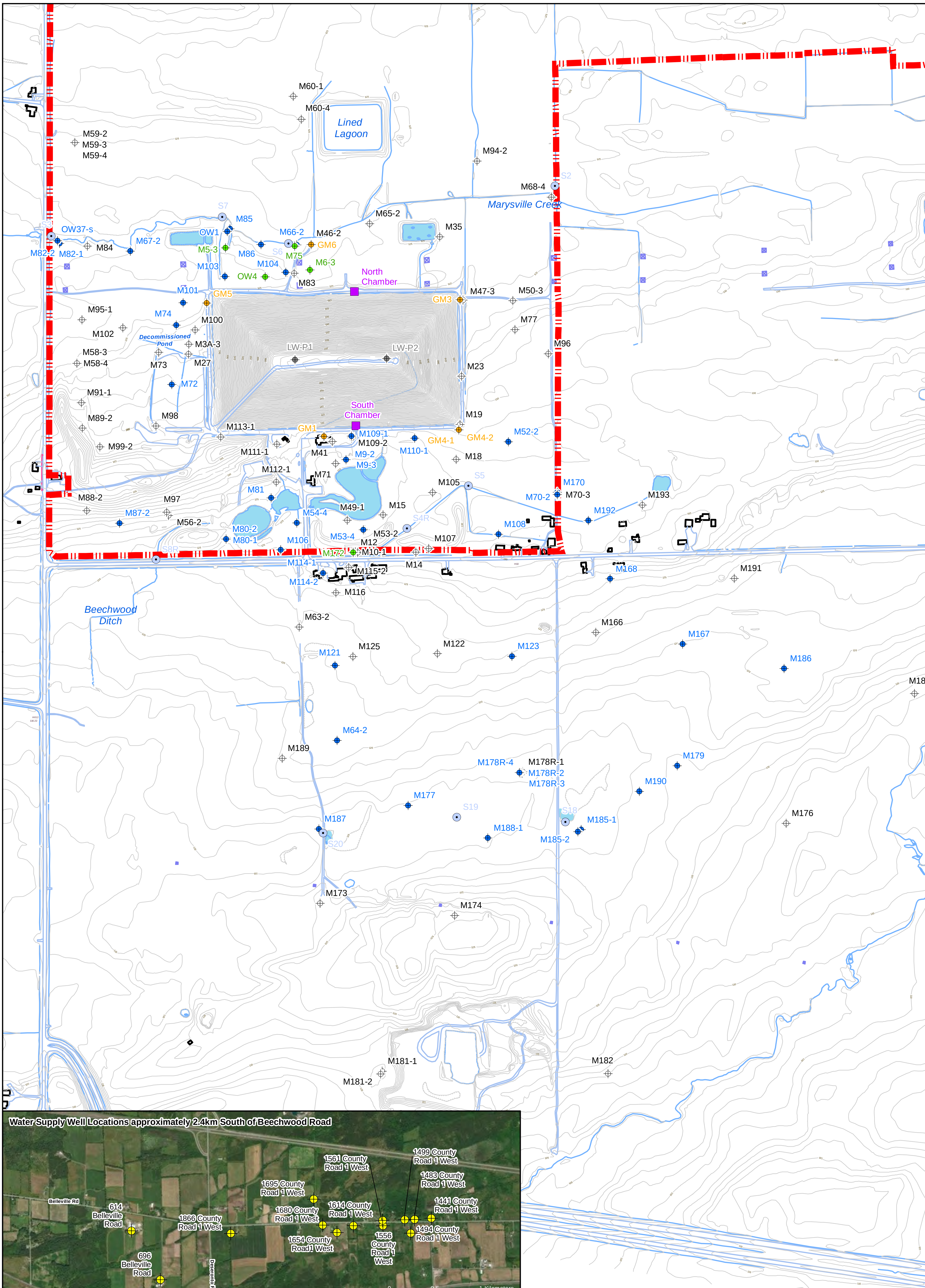
FIGURES



LEGEND

(grey line)	Topographic Contour Lines
(blue line)	Surface Water
(red dashed line)	Property Boundary
M35	Monitoring Well Used to Measure Water Level (Not Sampled)
M53-4	Monitoring Well Used to Measure Water Level and Sampled for Chemistry
M5-3	Monitoring Well Sampled for Chemistry (Not used for Water Levels)
1097 Beechwood	Domestic Water Supply Well Sampled for Chemistry
GM1	Gas Monitoring Well
(purple square)	Lechate Chambers
(well symbol)	Lechate Monitoring Well
S2	Surface Water Monitoring Location

REFERENCES

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-UNITS: METERS
-PROJECTION: UTM NAD83 ZONE 18
-DATA SOURCE: WM CANADA, BLUMETRIC, MNRO, NRCAN

0 80 160 Meters
1:8,000

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WM WASTE MANAGEMENT

PROJECT

WASTE MANAGEMENT RICHMOND LANDFILL
FALL 2017 SEMI-ANNUAL REPORT

TITLE

SITE PLAN AND
MONITORING LOCATIONS

PROJECT #		DATE	
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DRAWN	CHECKED	FIG NO.	REV
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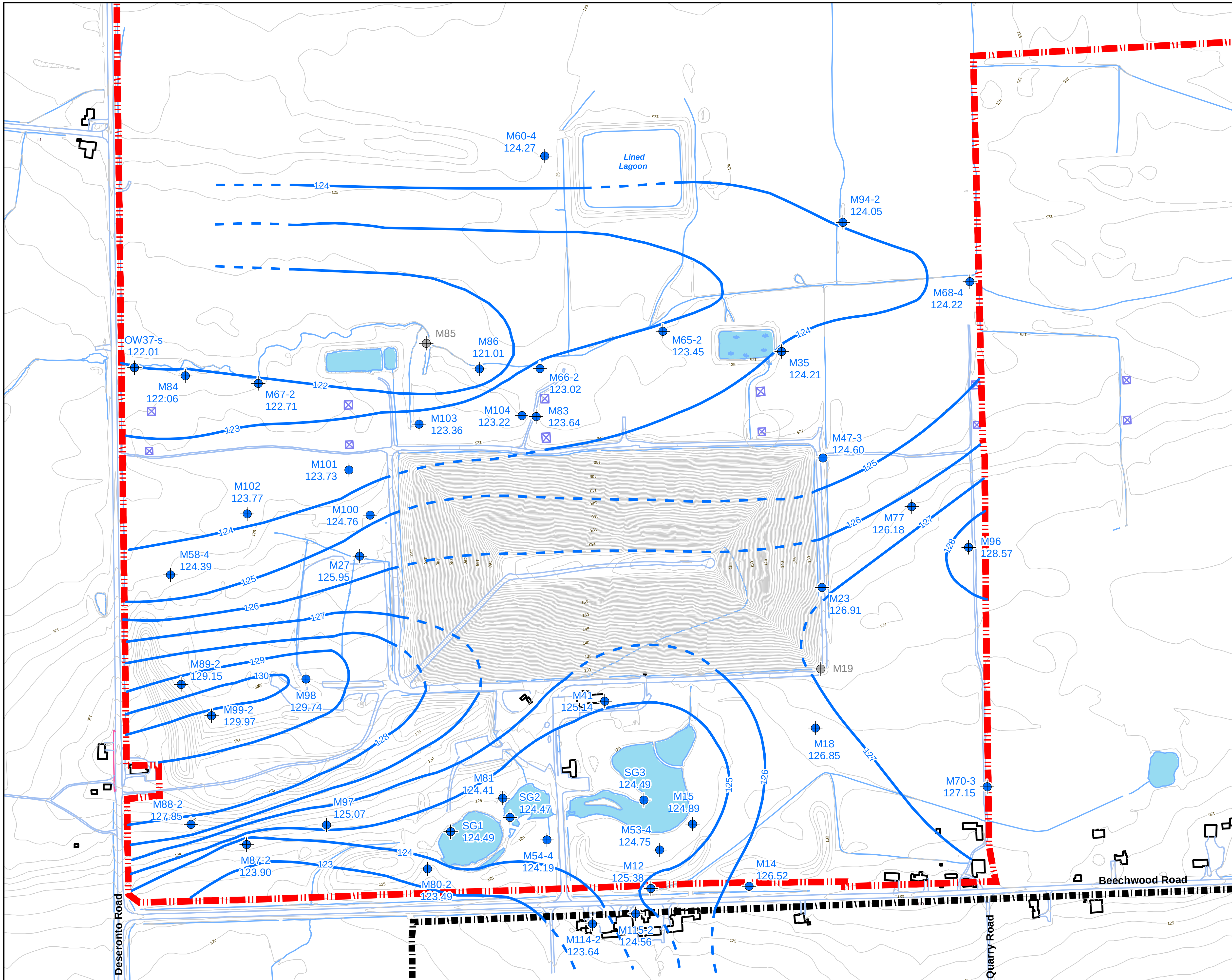

LEGEND

- Potentiometric Surface (masl)
- Topographic Contour Lines
- Surface Water
- Property Boundary
- Proposed CAZ Boundary
- M53-4 Shallow Groundwater Zone Elevation Monitor
- M5-3 Monitor Not Used in Contouring

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

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0 50 100 Metres

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WM WASTE MANAGEMENT

PROJECT

WASTE MANAGEMENT RICHMOND LANDFILL FALL 2017 SEMI-ANNUAL REPORT

TITLE

SHALLOW GROUNDWATER FLOW ZONE POTENTIOMETRIC SURFACE – AUGUST 1, 2017

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PROJECT #	DATE
170194-02	January, 2018

DRAWN	CHECKED	FIG NO.	REV
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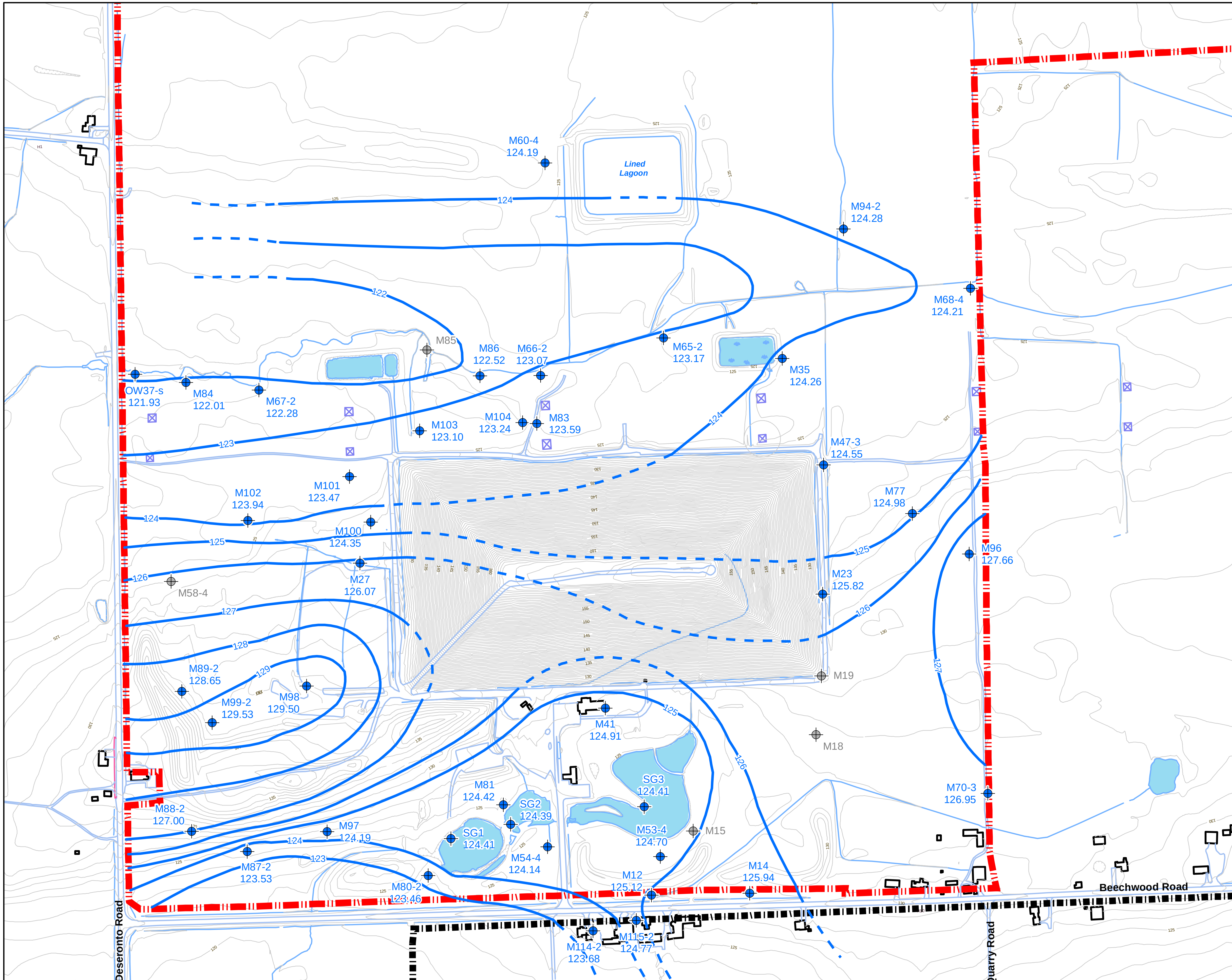

LEGEND

- Potentiometric Surface (masl)
- Topographic Contour Lines
- Surface Water
- Property Boundary
- Proposed CAZ Boundary
- M53-4 Shallow Groundwater Zone Elevation Monitor
- M5-3 Monitor Not Used in Contouring

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

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0 50 100 Metres

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WASTE MANAGEMENT

PROJECT

WASTE MANAGEMENT RICHMOND LANDFILL FALL 2017 SEMI-ANNUAL REPORT

TITLE

SHALLOW GROUNDWATER FLOW ZONE POTENTIOMETRIC SURFACE – OCTOBER 13, 2017

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PROJECT #	DATE
170194-02	January 04, 2018

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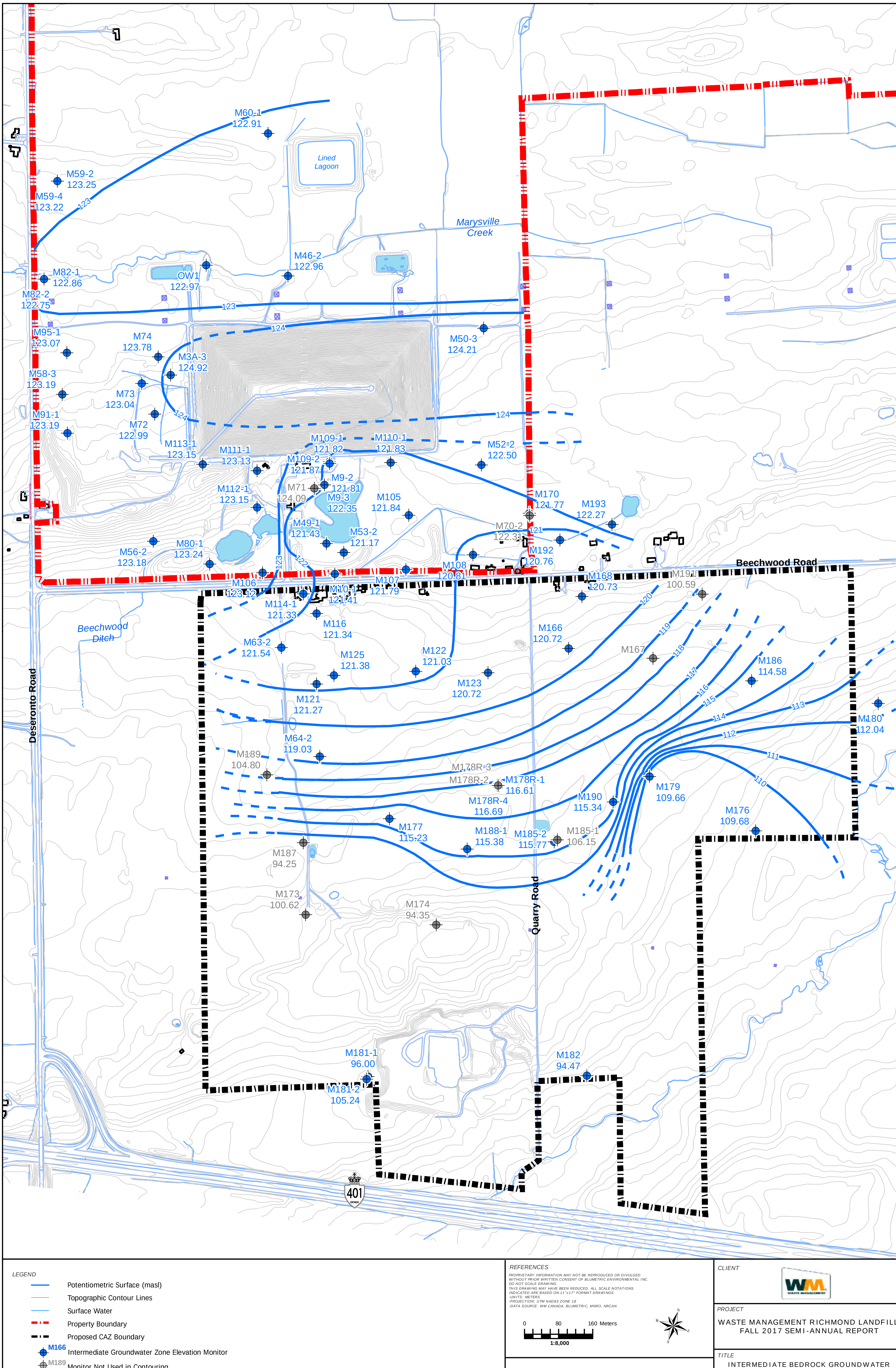

LEGEND

- Potentiometric Surface (masl)
- Topographic Contour Lines
- Surface Water
- Property Boundary
- Proposed CAZ Boundary
- M166 Intermediate Groundwater Zone Elevation Monitor
- M189 Monitor Not Used in Contouring

REFERENCES

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-PROJECTION: UTM NAD83 ZONE 18
-DATA SOURCE: WM CANADA, BLUMETRIC, MNRO, NRCAN

0 80 160 Meters
1:8,000

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PROJECT

WASTE MANAGEMENT RICHMOND LANDFILL
FALL 2017 SEMI-ANNUAL REPORT

TITLE

INTERMEDIATE BEDROCK GROUNDWATER FLOW ZONE POTENTIOMETRIC SURFACE - AUGUST 1, 2017

PROJECT #		DATE	
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DRAWN	CHECKED	FIG NO.	REV
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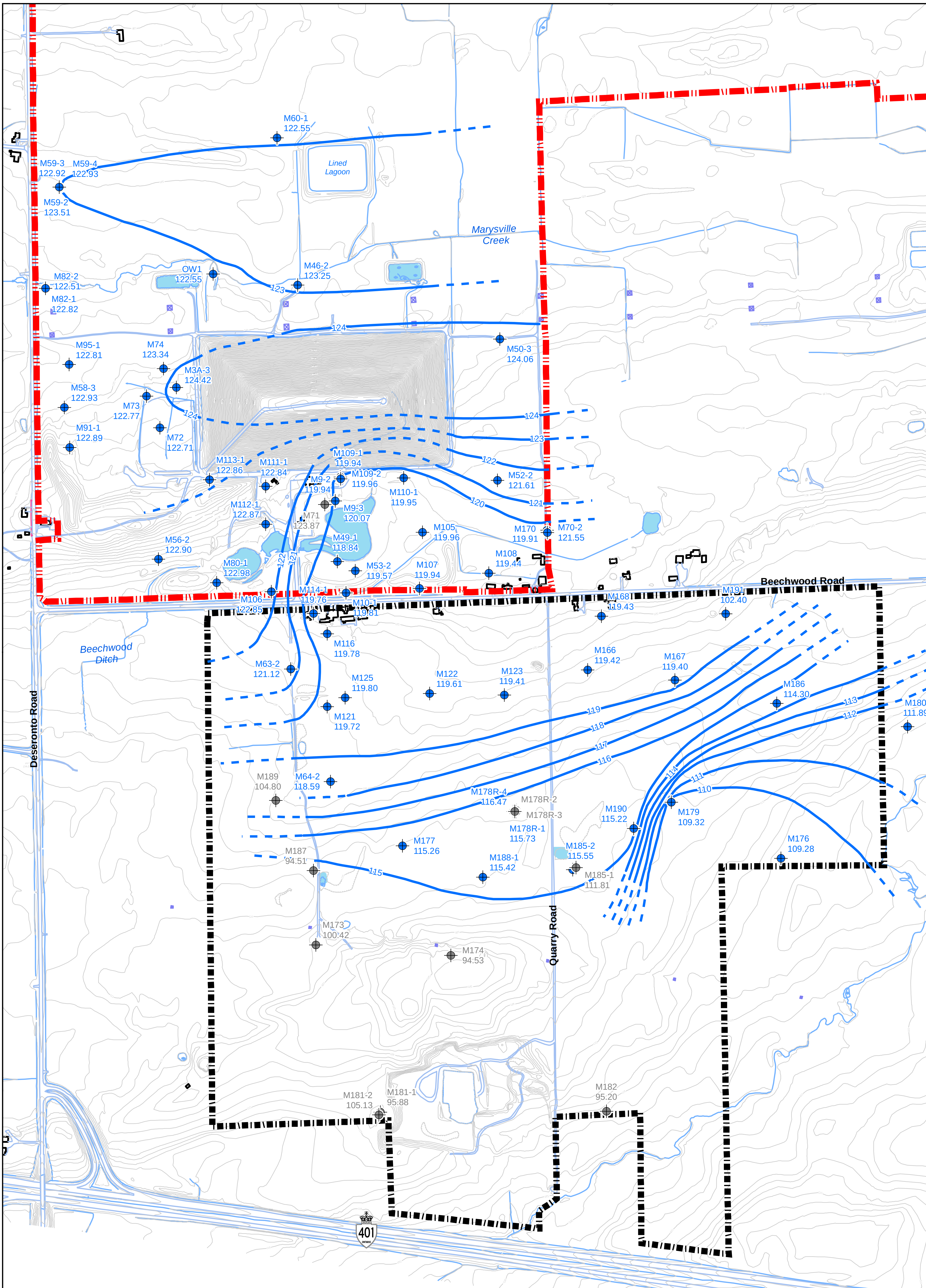

LEGEND

- Potentiometric Surface (masl)
- Topographic Contour Lines
- Surface Water
- Property Boundary
- Proposed CAZ Boundary
- M166 Intermediate Groundwater Zone Elevation Monitor
- M189 Monitor Not Used in Contouring

REFERENCES

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-PROJECTION: UTM NAD83 ZONE 18
-DATA SOURCE: WM CANADA, BLUMETRIC, MNRO, NRCAN

0 80 160 Meters
1:8,000

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PROJECT

WASTE MANAGEMENT RICHMOND LANDFILL
FALL 2017 SEMI-ANNUAL REPORT

TITLE

INTERMEDIATE BEDROCK GROUNDWATER FLOW ZONE POTENTIOMETRIC SURFACE - OCTOBER 13, 2017

PROJECT #	DATE		
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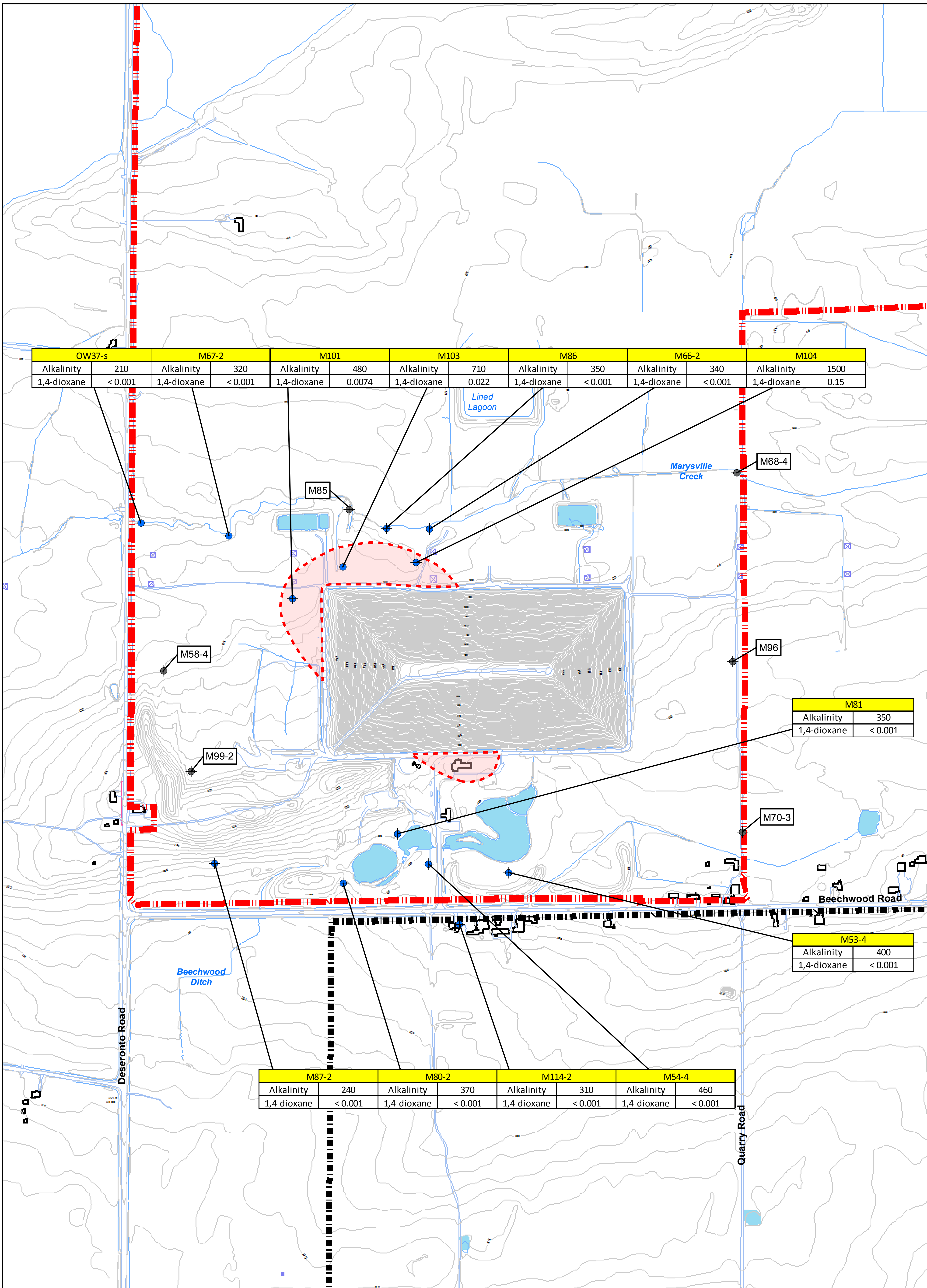

LEGEND

- Topographic Contour Lines
- Surface Water
- Property Boundary
- Proposed CAZ Boundary
- M99-2 Shallow Monitoring Well Sampled for Chemistry
- M99-2 Shallow Monitoring Well Not Sampled (see text for detailed)
- Approximate Extent of known 1,4 Dioxane Impacted Area

Parameter	Units
Alkalinity	mg/L CaCO3
1,4-dioxane	mg/L

REFERENCES

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-PROJECTION: UTM NAD83 ZONE 18
-DATA SOURCE: WM CANADA, BLUMETRIC, MNRO, NRCAN

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PROJECT
WASTE MANAGEMENT RICHMOND LANDFILL FALL 2017 SEMI-ANNUAL REPORT

TITLE
SHALLOW FLOW ZONE CONCENTRATIONS

PROJECT #	DATE
170194-02	January, 2018

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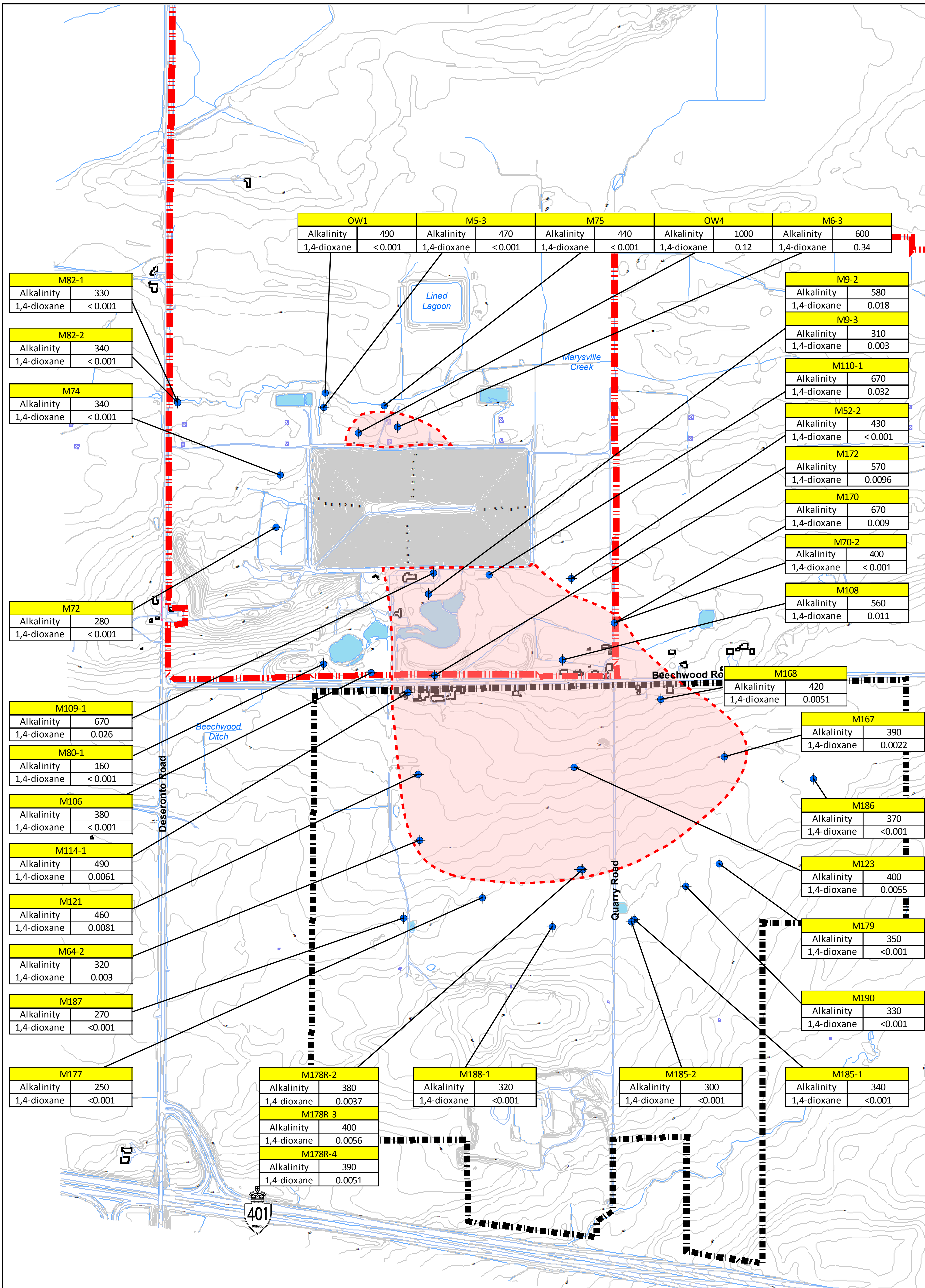

LEGEND

- Topographic Contour Lines
- Surface Water
- Property Boundary
- Proposed CAZ Boundary
- M9-2 Intermediate Monitoring Well Sampled for Chemistry
- Approximate Extent of known 1,4 Dioxane Impacted Area

Parameter	Units
Alkalinity	mg/L CaCO3
1,4-dioxane	mg/L

REFERENCES

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-PROJECTION: UTM NAD83 ZONE 18
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0 80 160 Meters
1:9,100

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WM WASTE MANAGEMENT

PROJECT
WASTE MANAGEMENT RICHMOND LANDFILL FALL 2017 SEMI-ANNUAL REPORT

TITLE
INTERMEDIATE BEDROCK FLOW ZONE CONCENTRATIONS

PROJECT #		DATE	
170194-02		January, 2018	
DRAWN	CHECKED	FIG NO.	REV
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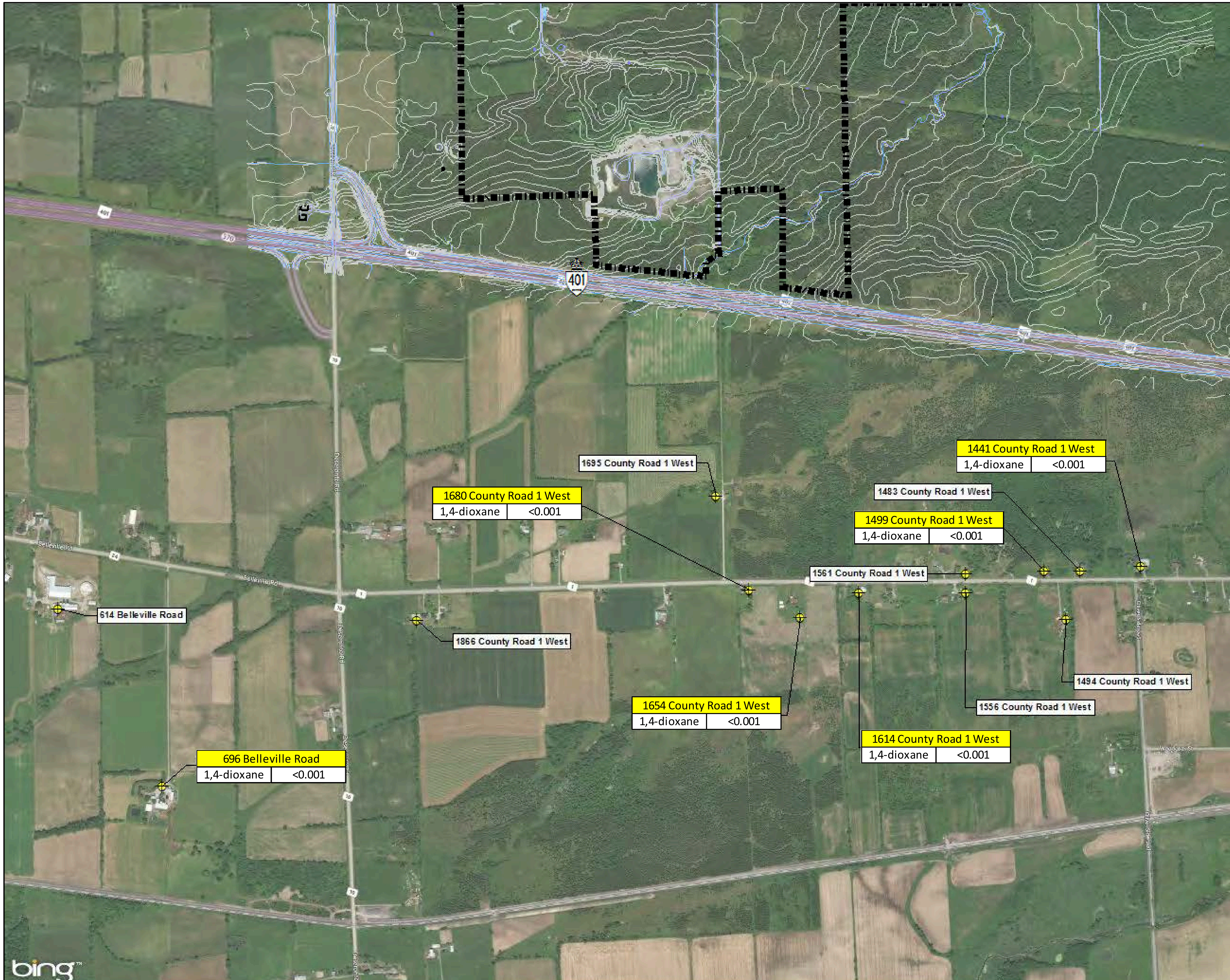

LEGEND

- Topographic Contour Lines
- Surface Water
- Property Boundary
- Proposed CAZ Boundary
- M53-4 Domestic Wells

Parameter	Units
Alkalinity	mg/L CaCO3
1,4-dioxane	mg/L

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

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WM WASTE MANAGEMENT

PROJECT

WASTE MANAGEMENT RICHMOND LANDFILL
FALL 2017 SEMI-ANNUAL REPORT

TITLE

DOMESTIC WELL CONCENTRATIONS

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PROJECT #	DATE
170194-02	January, 2018

DRAWN	CHECKED	FIG NO.	REV
WC	FR	06	0

APPENDIX A

Monitoring Well Inventory

Appendix A: Monitoring Well Inventory

Monitoring Well	Easting	Northing
2054	335293	4902797
2055	335402	4902782
M3A-1	334990	4902928
M3A-2	334990	4902930
M3A-3	334990	4902930
M4-1	335006	4903036
M4-2	335006	4903038
M4-3	335006	4903038
M5-1	335003	4903162
M5-2	335003	4903163
M5-3	335003	4903163
M6-1	335200	4903172
M6-2	335201	4903174
M6-3	335201	4903174
M9-1	335410	4902787
M9-2	335410	4902789
M9-3	335410	4902789
M9R-1	335400	4902787
M10-1	335494	4902596
M10-2	335494	4902596
M10-3	335494	4902594
M12	335500	4902596
M14	335625	4902637
M15	335528	4902695
M16	335447	4902710
M18	335648	4902866
M19	335632	4902944
M23	335602	4903049
M27	334997	4902908
M28	334897	4902853
M29	334924	4902983
M30	334999	4903033
M31	334857	4902977
M35	335458	4903336
M38	335006	4902978
M39	335299	4903310
M41	335368	4902818
M42-1	335006	4903006
M42-2	335007	4903008
M42-3	335007	4903008
M43-1	335475	4902588
M43-2	335476	4902590
M43-3	335476	4902590
M45-1	334790	4904582
M45-2	334790	4904582
M45-3	334790	4904582
M46-1	335185	4903230
M46-2	335185	4903232
M47-1	335552	4903214
M47-2	335552	4903215
M47-3	335552	4903215
M48-1	334838	4902564
M48-2	334839	4902565
M48-3	334839	4902565

Appendix A: Monitoring Well Inventory

Monitoring Well	Easting	Northing
M49-1	335454	4902658
M49-2	335455	4902660
M49-3	335455	4902660
M50-1	335660	4903247
M50-2	335660	4903248
M50-3	335660	4903248
M51-1	335714	4903073
M51-2	335714	4903075
M51-3	335714	4903075
M52-1	335748	4902939
M52-2	335748	4902940
M52-3	335748	4902940
M53-1	335501	4902651
M53-2	335499	4902650
M53-3	335498	4902650
M53-4	335496	4902649
M54-1	335346	4902623
M54-2	335347	4902622
M54-3	335347	4902620
M54-4	335348	4902618
M55-1	334961	4903151
M55-2	334962	4903149
M55-3	334962	4903148
M55-4	334963	4903146
M56-1	335066	4902508
M56-2	335065	4902545
M57	335418	4902623
M58-1	334760	4902816
M58-2	334760	4902814
M58-3	334761	4902812
M58-4	334761	4902811
M59-1	334609	4903287
M59-2	334607	4903287
M59-3	334606	4903287
M59-4	334604	4903287
M60-1	335044	4903538
M60-3	335079	4903494
M60-4	335077	4903494
M61-1	334457	4903750
M61-2	334456	4903749
M61-3	334455	4903748
M61-4	334454	4903747
M62-1	335166	4904438
M62-2	335168	4904441
M62-3	335166	4904441
M62-4	335165	4904440
M63-1	335424	4902393
M63-2	335425	4902394
M64-1	335585	4902174
M64-2	335585	4902176
M65-1	335297	4903314
M65-2	335298	4903316
M66-1	335154	4903218
M66-2	335155	4903219

Appendix A: Monitoring Well Inventory

Monitoring Well	Easting	Northing
M67-1	334799	4903089
M67-2	334799	4903090
M68-1	335670	4903504
M68-2	335671	4903502
M68-3	335671	4903500
M68-4	335672	4903499
M69-1	335062	4904299
M69-2	335063	4904298
M69-3	335063	4904296
M69-4	335064	4904295
M70-1	335890	4902862
M70-2	335891	4902860
M70-3	335891	4902858
M71	335390	4902773
M72	334981	4902831
M73	334931	4902891
M74	334950	4902962
M75	335151	4903215
M76	335675	4903217
M77	335685	4903188
M78	335391	4902776
M79	335673	4903215
M80-1	335207	4902532
M80-2	335206	4902534
M81	335275	4902654
M82-1	334640	4903060
M82-2	334641	4903058
M83	335169	4903156
M84	334702	4903072
M85	334999	4903208
M86	335077	4903195
M87-1	334959	4902493
M87-2	334965	4902495
M88-1	334883	4902497
M88-2	334885	4902499
M89-1	334815	4902673
M89-2	334818	4902674
M90-1	334520	4903845
M90-2	334522	4903843
M91-1	334798	4902729
M91-2	334792	4902734
M93	335006	4903908
M94-1	335497	4903519
M94-2	335486	4903526
M95-1	334743	4902908
M95-2	334740	4902917
M96	335774	4903158
M97	335059	4902551
M98	334976	4902730
M99-1	334869	4902646
M99-2	334869	4902646
M100	334994	4902965
M101	334949	4903015
M102	334836	4902919

Appendix A: Monitoring Well Inventory

Monitoring Well	Easting	Northing
M103	335021	4903101
M104	335150	4903152
M105	335620	4902778
M106	335331	4902549
M107	335650	4902654
M108	335791	4902733
M109-1	335405	4902844
M109-2	335407	4902840
M110-1	335543	4902883
M110-2	335546	4902884
M111-1	335250	4902774
M111-2	335254	4902774
M112-1	335274	4902692
M112-2	335277	4902693
M113-1	335123	4902751
M113-2	335119	4902750
M114-1	335437	4902530
M114-2	335439	4902528
M115-1	335489	4902561
M115-2	335490	4902558
M116	335480	4902494
M117	335586	4902525
M121	335529	4902337
M122	335742	4902433
M123	335905	4902479
M125	335561	4902368
M166	336069	4902589
M167	336266	4902624
M168	336063	4902714
M170	335889	4902865
M171	335759	4903206
M172	335490	4902593
M173	335661	4901812
M174	335961	4901879
M176	336613	4902308
M177	335784	4902084
M178-1	336032	4902203
M178-2	336032	4902206
M178-3	336035	4902209
M178R-1	336008	4902236
M178R-2	336008	4902233
M178R-3	336005	4902233
M178R-4	336002	4902232
M178R-5	335997	4902232
M179	336338	4902357
M180	336801	4902677
M181-1	335912	4901492
M181-2	335912	4901492
M182	336402	4901643
M183	336953	4901770
M184	336176	4901998
M185-1	336170	4902151
M185-2	336170	4902151
M186	336509	4902627

Appendix A: Monitoring Well Inventory

Monitoring Well	Easting	Northing
M187	335607	4901972
M188-1	335979	4902069
M188-2	335978	4902068
M189	335479	4902099
M190	336274	4902275
M191	336332	4902802
M192	335976	4902826
M193	336082	4902896
M194-1	335564	4901886
M194-2	335568	4901889
M195	335592	4902084
OW1	334995	4903200
OW4	335108	4903128
OW5	335113	4903134
OW36	334799	4903100
OW37-d	334630	4903063
OW37-s	334634	4903062
OW54-d	335406	4902785
OW54-i	335406	4902785
OW54-s	335406	4902785
OW55-d	335376	4903186
OW55-i	335376	4903186
OW55-s	335376	4903184
OW56-d	335106	4903131
OW56-i	335106	4903131
OW56-s	335106	4903129
OW57	335117	4902762
PW1	335465	4902639
PW2	334988	4903095
PW3	335620	4902778
PW4	335626	4902775
PW5	335066	4902547

APPENDIX B

Results from Analytical Quality Assurance / Quality Control (QA/QC) Program

Appendix B

Summary of Results with Relative Percent Difference (RPD[1]) greater than 20%

Location	Parameter	Unit	Regular Sample	Field Duplicate	RPD (%)	MDL[2]	Comment
M108	Nitrite	mg/L	0.01	0.014	33.33	0.01	Less than 5x MDL
S20	Phenols	mg/L	0.0022	0.0031	33.96	0.001	Less than 5x MDL

[1] RPD (%) = 100 * ABS (Regular Sample - Duplicate Sample) / ([Regular Sample + Duplicate Sample] / 2)
[2] MDL = Laboratory Method Detection Limit

Detailed Results from Field Duplicate vs. Regular Samples

Reading Name	Units	M108 2017-10-16 Regular Sample	M108 2017-10-16 Field Duplicate	RPD (%)
General/Inorganic Parameters				
Alkalinity	mg/L	560	560	0.00
Ammonia	mg/L	0.8	0.82	2.47
Boron	mg/L	0.24	0.25	4.08
Calcium	mg/L	130	130	0.00
Chloride	mg/L	110	110	0.00
Conductivity	µS/cm	1200	1200	0.00
Dissolved Organic Carbon	mg/L	5.8	5.6	3.51
Iron	mg/L	1.7	1.7	0.00
Magnesium	mg/L	40	43	7.23
Manganese	mg/L	0.11	0.11	0.00
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	0.01	0.014	33.33
Potassium	mg/L	7	7.2	2.82
Sodium	mg/L	70	71	1.42
Sulphate	mg/L	< 1	< 1	0.00
Total Dissolved Solids	mg/L	655	675	3.01
Volatile Organic Compounds (VOCs)				
1,1,1,2-Tetrachloroethane	mg/L	< 0.0002	< 0.0002	0.00
1,1,1-Trichloroethane	mg/L	< 0.0001	< 0.0001	0.00
1,1,2,2-Tetrachloroethane	mg/L	< 0.0002	< 0.0002	0.00
1,1,2-Trichloroethane	mg/L	< 0.0002	< 0.0002	0.00
1,1-Dichloroethane	mg/L	0.00045	0.00045	0.00
1,1-Dichloroethylene	mg/L	< 0.0001	< 0.0001	0.00
1,2-Dichlorobenzene (o)	mg/L	< 0.0002	< 0.0002	0.00
1,2-Dichloroethane	mg/L	< 0.0002	< 0.0002	0.00
1,3,5-Trimethylbenzene	mg/L	< 0.0002	< 0.0002	0.00
1,3-Dichlorobenzene (m)	mg/L	< 0.0002	< 0.0002	0.00
1,4-Dichlorobenzene (p)	mg/L	< 0.0002	< 0.0002	0.00
1,4-Dioxane	mg/L	0.011	0.011	0.00
Benzene	mg/L	< 0.0001	< 0.0001	0.00
Chlorobenzene	mg/L	< 0.0001	< 0.0001	0.00
Chloroethane	mg/L	0.0058	0.0054	7.14
Chloromethane	mg/L	< 0.0005	< 0.0005	0.00
Cis-1,2-Dichloroethylene	mg/L	< 0.0001	< 0.0001	0.00
Dichloromethane	mg/L	< 0.0005	< 0.0005	0.00
Ethylbenzene	mg/L	< 0.0001	< 0.0001	0.00
m+p-Xylene	mg/L	< 0.0001	< 0.0001	0.00
o-Xylene	mg/L	< 0.0001	< 0.0001	0.00
Styrene	mg/L	< 0.0002	< 0.0002	0.00
Tetrachloroethylene	mg/L	< 0.0001	< 0.0001	0.00
Toluene	mg/L	< 0.0002	< 0.0002	0.00
Total Xylenes	mg/L	< 0.0001	< 0.0001	0.00
Trans-1,2-dichloroethylene	mg/L	< 0.0001	< 0.0001	0.00
Trichloroethylene	mg/L	< 0.0001	< 0.0001	0.00
Vinyl Chloride	mg/L	0.00026	0.00027	3.77

Detailed Results from Field Duplicate vs. Regular Samples

Reading Name	Units	M82-2 2017-10-18 Regular Sample	M82-2 2017-10-18 Field Duplicate	RPD (%)
General/Inorganic Parameters				
Alkalinity	mg/L	340	340	0.00
Ammonia	mg/L	0.24	0.23	4.26
Boron	mg/L	0.12	0.13	8.00
Calcium	mg/L	98	99	1.02
Chloride	mg/L	20	19	5.13
Conductivity	µS/cm	740	740	0.00
Dissolved Organic Carbon	mg/L	2.3	2.3	0.00
Iron	mg/L	< 0.1	< 0.1	0.00
Magnesium	mg/L	27	28	3.64
Manganese	mg/L	0.018	0.018	0.00
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	< 0.01	< 0.01	0.00
Potassium	mg/L	3.5	3.6	2.82
Sodium	mg/L	14	14	0.00
Sulphate	mg/L	59	58	1.71
Total Dissolved Solids	mg/L	460	455	1.09
Volatile Organic Compounds (VOCs)				
1,1,1,2-Tetrachloroethane	mg/L	< 0.0002	< 0.0002	0.00
1,1,1-Trichloroethane	mg/L	< 0.0001	< 0.0001	0.00
1,1,2,2-Tetrachloroethane	mg/L	< 0.0002	< 0.0002	0.00
1,1,2-Trichloroethane	mg/L	< 0.0002	< 0.0002	0.00
1,1-Dichloroethane	mg/L	< 0.0001	< 0.0001	0.00
1,1-Dichloroethylene	mg/L	< 0.0001	< 0.0001	0.00
1,2-Dichlorobenzene (o)	mg/L	< 0.0002	< 0.0002	0.00
1,2-Dichloroethane	mg/L	< 0.0002	< 0.0002	0.00
1,3,5-Trimethylbenzene	mg/L	< 0.0002	< 0.0002	0.00
1,3-Dichlorobenzene (m)	mg/L	< 0.0002	< 0.0002	0.00
1,4-Dichlorobenzene (p)	mg/L	< 0.0002	< 0.0002	0.00
1,4-Dioxane	mg/L	< 0.001	< 0.001	0.00
Benzene	mg/L	< 0.0001	< 0.0001	0.00
Chlorobenzene	mg/L	< 0.0001	< 0.0001	0.00
Chloroethane	mg/L	< 0.0002	< 0.0002	0.00
Chloromethane	mg/L	< 0.0005	< 0.0005	0.00
Cis-1,2-Dichloroethylene	mg/L	< 0.0001	< 0.0001	0.00
Dichloromethane	mg/L	< 0.0005	< 0.0005	0.00
Ethylbenzene	mg/L	< 0.0001	< 0.0001	0.00
m+p-Xylene	mg/L	< 0.0001	< 0.0001	0.00
o-Xylene	mg/L	< 0.0001	< 0.0001	0.00
Styrene	mg/L	< 0.0002	< 0.0002	0.00
Tetrachloroethylene	mg/L	< 0.0001	< 0.0001	0.00
Toluene	mg/L	< 0.0002	< 0.0002	0.00
Total Xylenes	mg/L	< 0.0001	< 0.0001	0.00
Trans-1,2-dichloroethylene	mg/L	< 0.0001	< 0.0001	0.00
Trichloroethylene	mg/L	< 0.0001	< 0.0001	0.00
Vinyl Chloride	mg/L	< 0.0002	< 0.0002	0.00

Detailed Results from Field Duplicate vs. Regular Samples

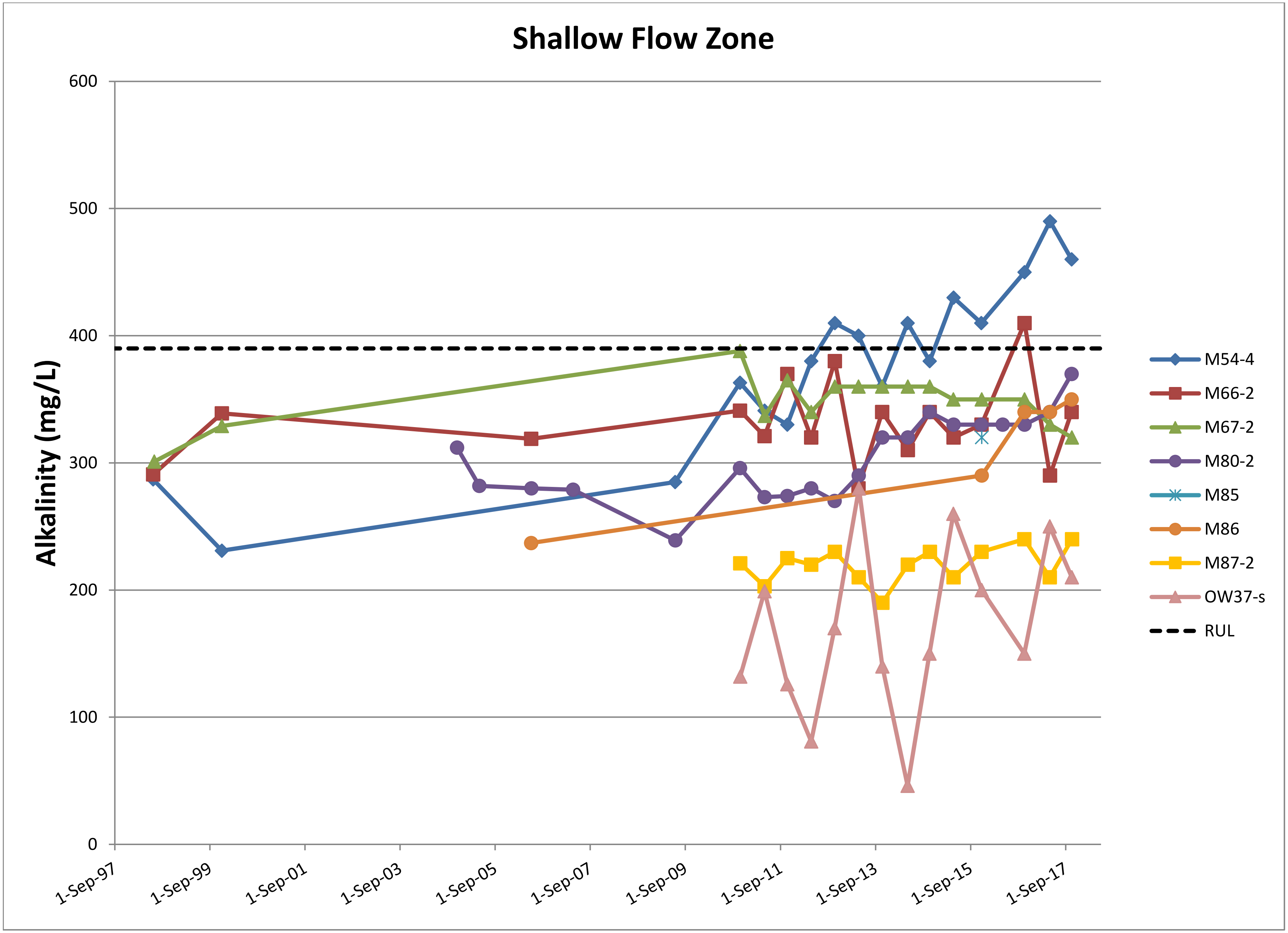
Reading Name	Units	S2 2017-10-16 Regular Sample	S2 2017-10-16 Field Duplicate	RPD (%)
1,4-Dioxane	mg/L	< 0.001	< 0.001	0.00
Alkalinity	mg/L	200	200	0.00
Ammonia	mg/L	< 0.15	< 0.15	0.00
Ammonia (unionized)	mg/L	< 0.0006	< 0.0006	0.00
Biochemical Oxygen Demand	mg/L	< 2	< 2	0.00
Boron	mg/L	0.022	0.022	0.00
Cadmium	mg/L	< 0.0001	< 0.0001	0.00
Calcium	mg/L	67	69	2.94
Chemical Oxygen Demand	mg/L	59	51	14.55
Chloride	mg/L	16	16	0.00
Chromium (III)	mg/L	< 0.005	< 0.005	0.00
Chromium (Total)	mg/L	< 0.005	< 0.005	0.00
Chromium (VI)	mg/L	< 0.0005	< 0.0005	0.00
Cobalt	mg/L	0.0006	0.0006	0.00
Conductivity	µS/cm	420	430	2.35
Copper	mg/L	< 0.002	< 0.002	0.00
Dissolved Oxygen	mg/L	1.34	1.34	0.00
Field Conductivity	µS/cm	330	330	0.00
Field Temperature	°C	11.12	11.12	0.00
Hardness	mg/L	210	210	0.00
Iron	mg/L	0.64	0.61	4.80
Lead	mg/L	< 0.0005	< 0.0005	0.00
Magnesium	mg/L	9.5	10	5.13
Naphthalene	mg/L	< 0.00005	< 0.00005	0.00
Nickel	mg/L	0.001	0.001	0.00
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	< 0.01	< 0.01	0.00
pH (Field)	unitless	7.21	7.21	0.00
Phenols	mg/L	0.0022	< 0.002	0.00
Phosphorus (total)	mg/L	0.097	0.11	12.56
Potassium	mg/L	5.2	5.4	3.77
Sodium	mg/L	9.7	10	3.05
Sulphate	mg/L	16	17	6.06
Total Dissolved Solids	mg/L	320	300	6.45
Total Suspended Solids	mg/L	< 10	< 10	0.00
Zinc	mg/L	< 0.01	< 0.01	0.00

Detailed Results from Field Duplicate vs. Regular Samples

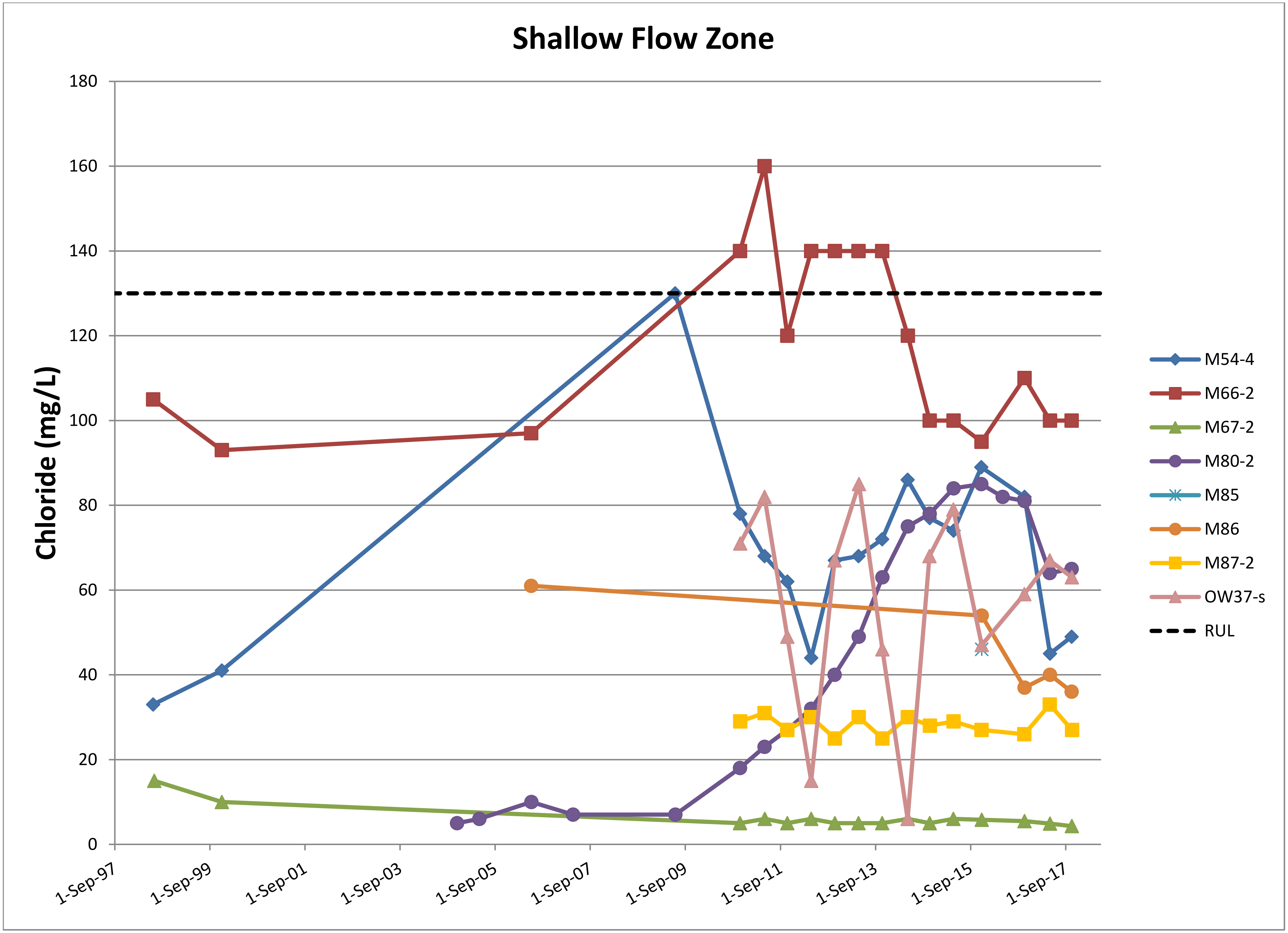
Reading Name	Units	S20 2017-07-25 Regular Sample	S20 2017-07-25 Field Duplicate	RPD (%)
1,4-Dioxane	mg/L	< 0.001	< 0.001	0.00
Alkalinity	mg/L	220	220	0.00
Ammonia	mg/L	< 0.15	< 0.15	0.00
Ammonia (unionized)	mg/L	< 0.0025	< 0.0025	0.00
Biochemical Oxygen Demand	mg/L	< 2	< 2	0.00
Boron	mg/L	0.038	0.039	2.60
Cadmium	mg/L	< 0.0001	< 0.0001	0.00
Calcium	mg/L	73	75	2.70
Chemical Oxygen Demand	mg/L	31	27	13.79
Chloride	mg/L	15	14	6.90
Chromium (III)	mg/L	< 0.005	< 0.005	0.00
Chromium (Total)	mg/L	< 0.005	< 0.005	0.00
Chromium (VI)	mg/L	< 0.0005	< 0.0005	0.00
Cobalt	mg/L	< 0.0005	< 0.0005	0.00
Conductivity	µS/cm	450	450	0.00
Copper	mg/L	< 0.002	< 0.002	0.00
Field Temperature	°C	20.9	20.9	0.00
Hardness	mg/L	210	210	0.00
Iron	mg/L	0.26	0.28	7.41
Lead	mg/L	< 0.0005	< 0.0005	0.00
Magnesium	mg/L	7.6	7.8	2.60
Magnesium	mg/L	7.5	7.6	1.32
Naphthalene	mg/L	< 0.00005	< 0.00005	0.00
Nickel	mg/L	< 0.001	< 0.001	0.00
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	< 0.01	< 0.01	0.00
pH (Field)	unitless	7.51	7.51	0.00
Phenols	mg/L	0.0022	0.0031	33.96
Phosphorus (total)	mg/L	< 0.03	< 0.03	0.00
Potassium	mg/L	1.9	2	5.13
Sodium	mg/L	11	12	8.70
Sulphate	mg/L	< 1	< 1	0.00
Total Dissolved Solids	mg/L	252	232	8.26
Total Suspended Solids	mg/L	< 10	< 10	0.00
Zinc	mg/L	< 0.01	< 0.01	0.00

APPENDIX C

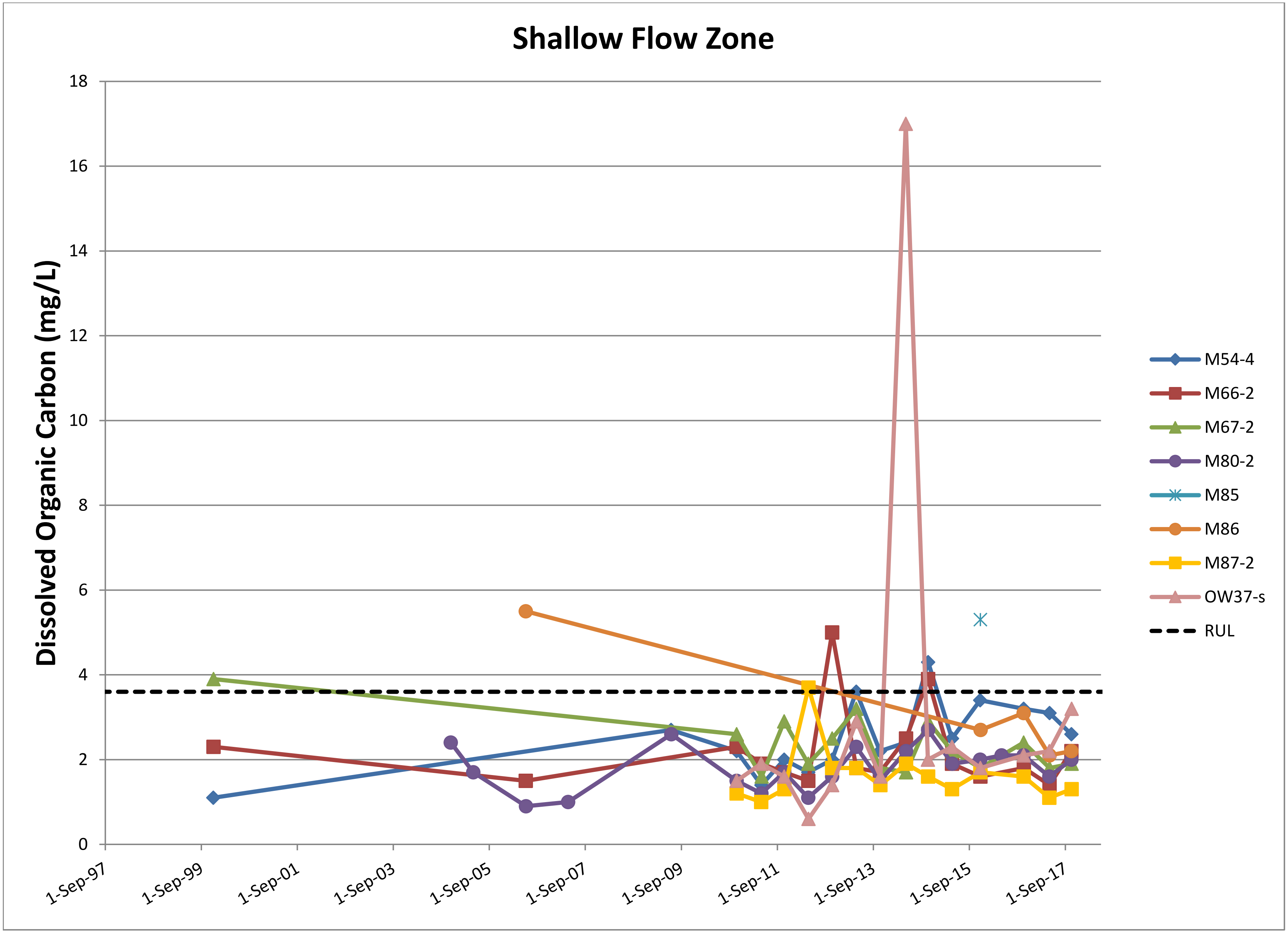
Time-Concentration Plots from Groundwater Trigger Wells



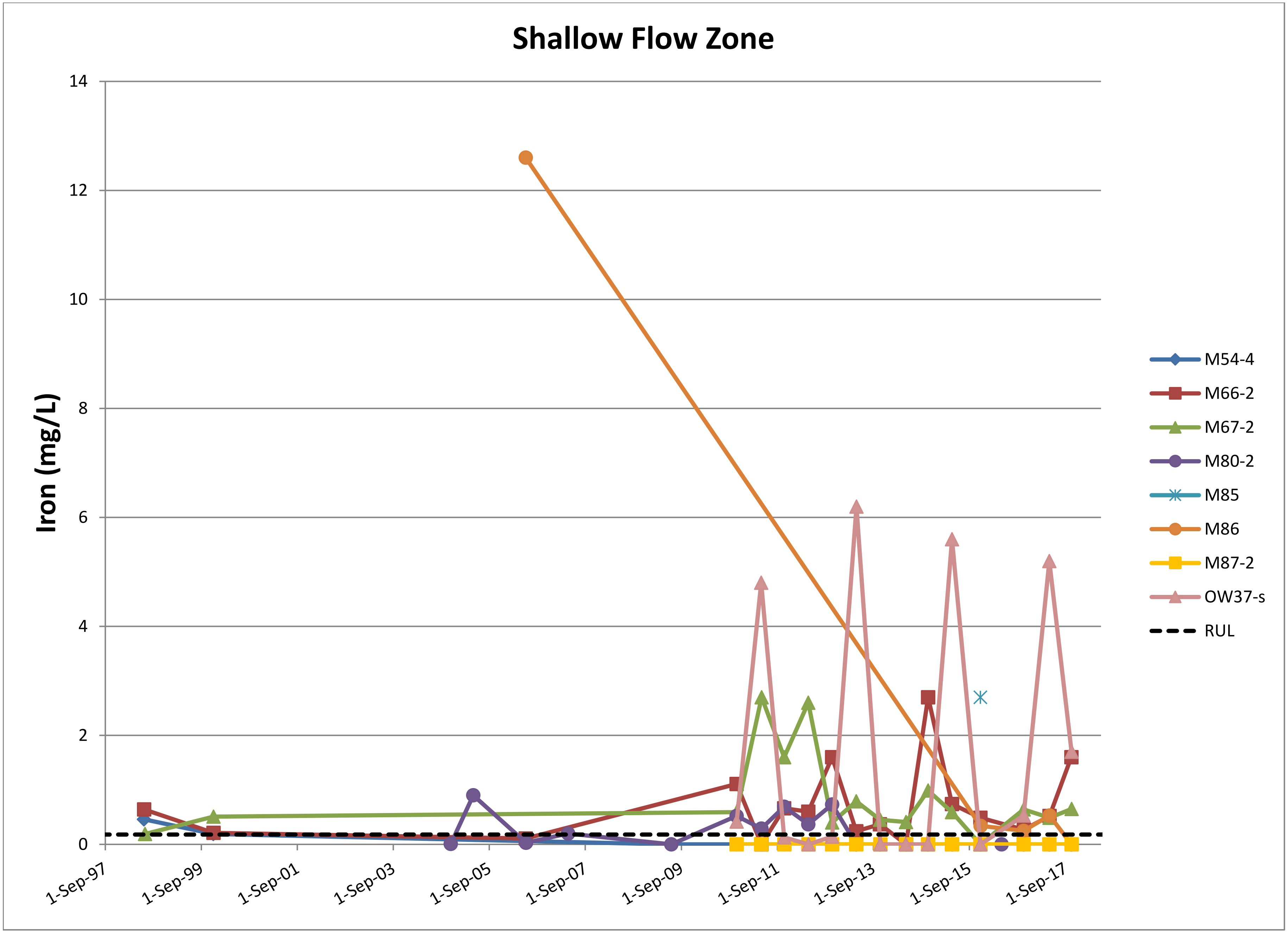
Shallow Flow Zone
Alkalinity (mg/L)
600
500
400
300
200
100
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M54-4
M66-2
M67-2
M80-2
M85
M86
M87-2
OW37-s
RUL

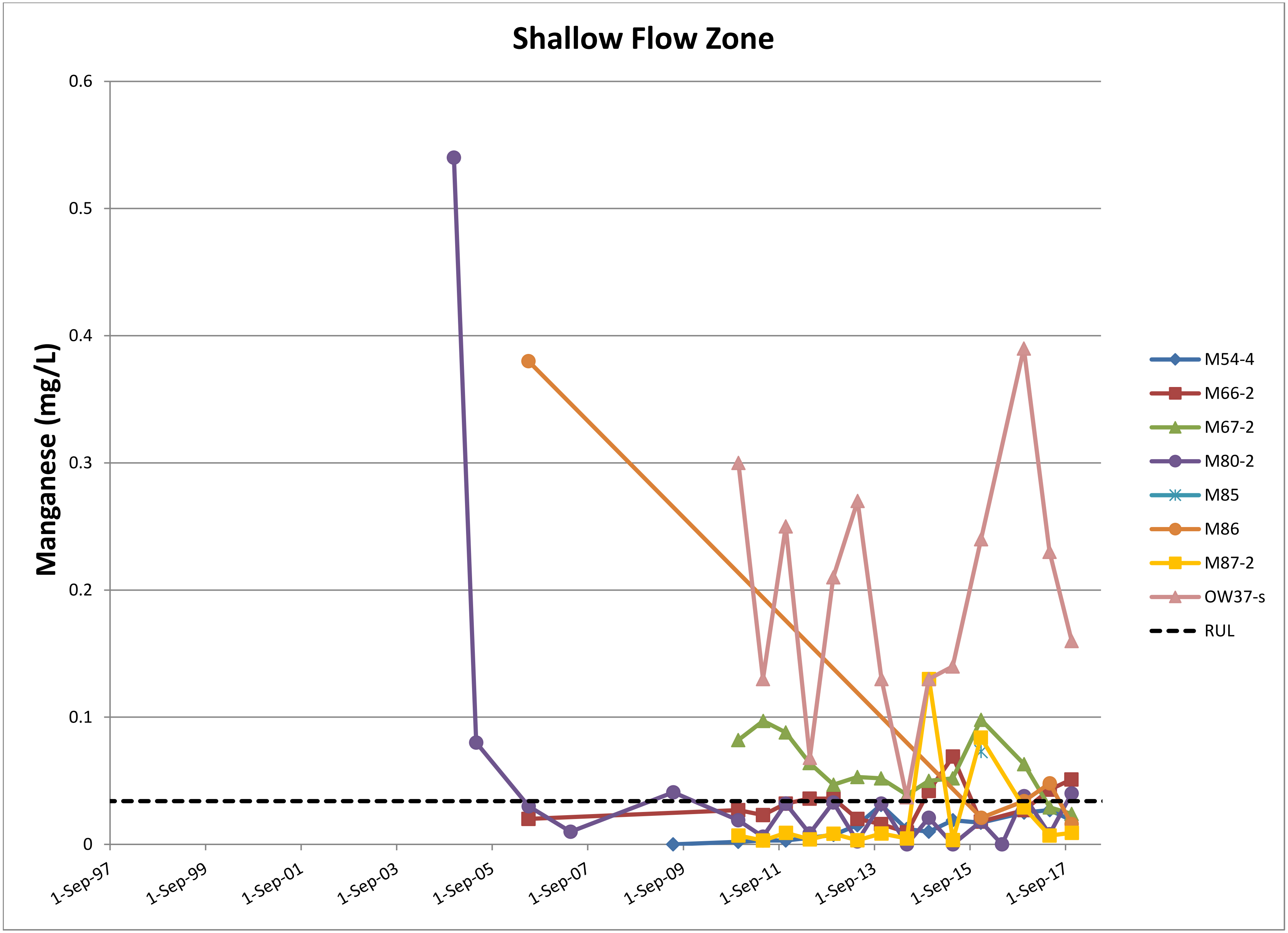


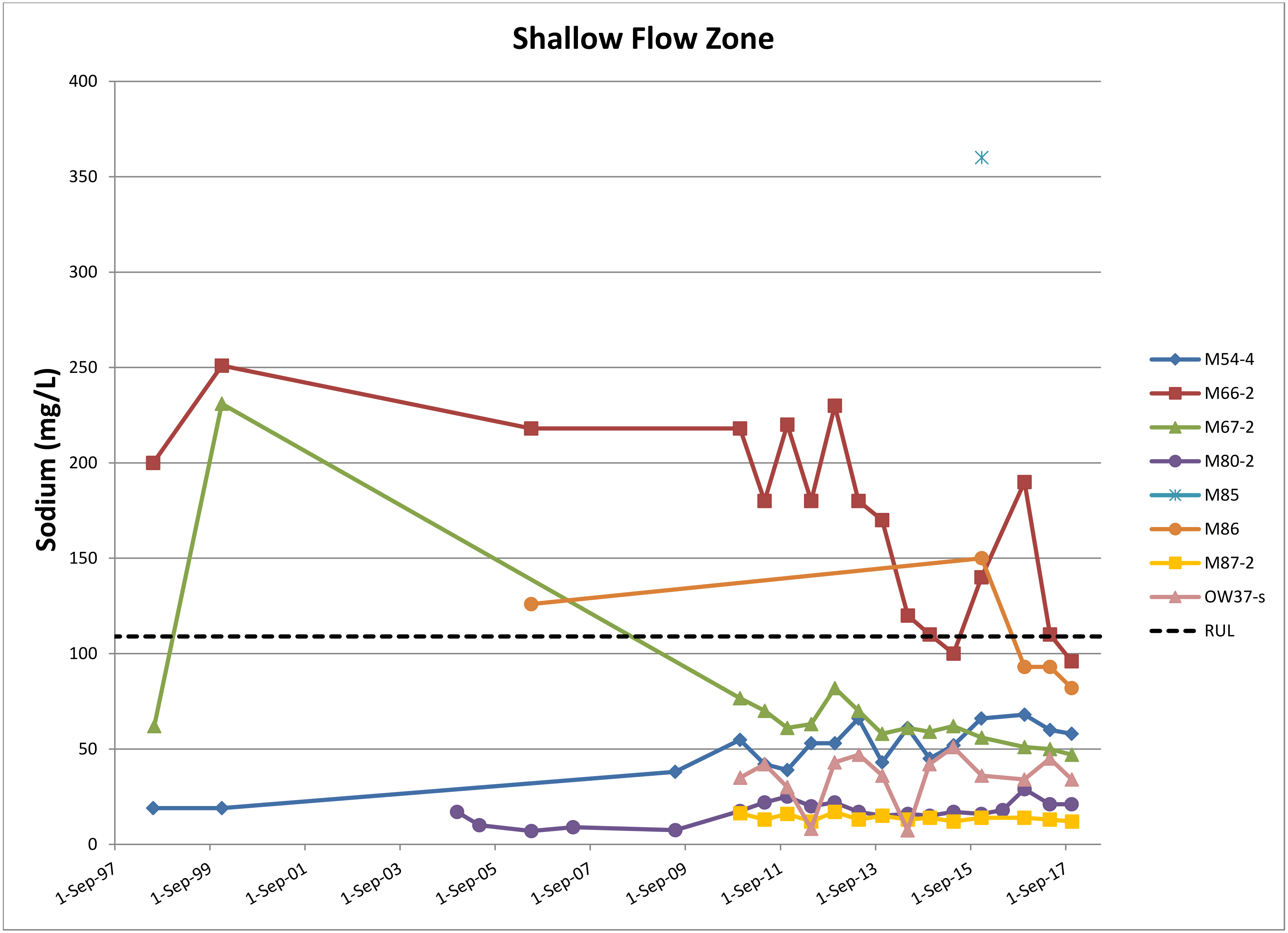
Shallow Flow Zone
Chloride (mg/L)
0
20
40
60
80
100
120
140
160
180
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M54-4
M66-2
M67-2
M80-2
M85
M86
M87-2
OW37-s
RUL



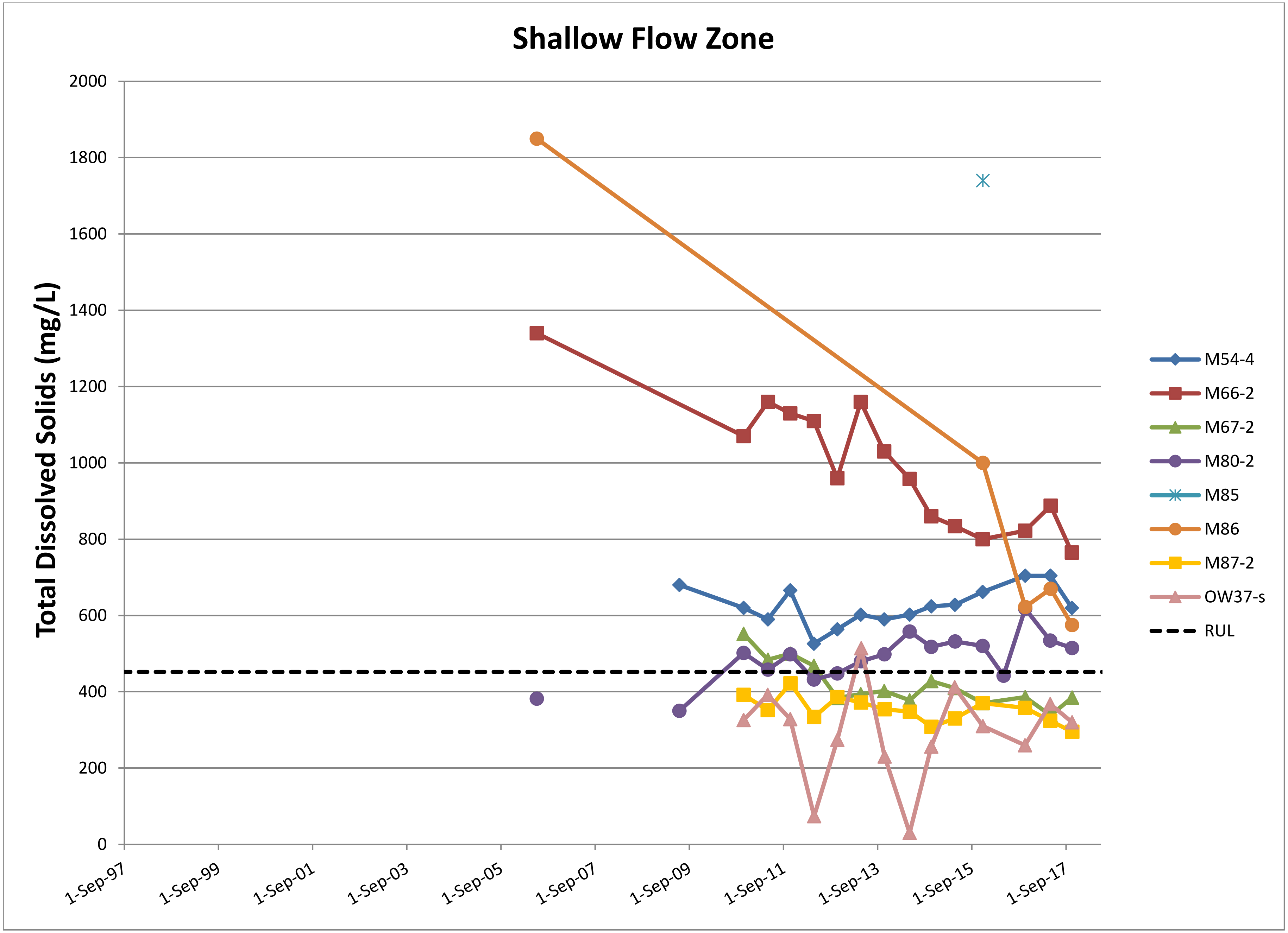
Shallow Flow Zone
Dissolved Organic Carbon (mg/L)
18
16
14
12
10
8
6
4
2
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M54-4
M66-2
M67-2
M80-2
M85
M86
M87-2
OW37-s
RUL

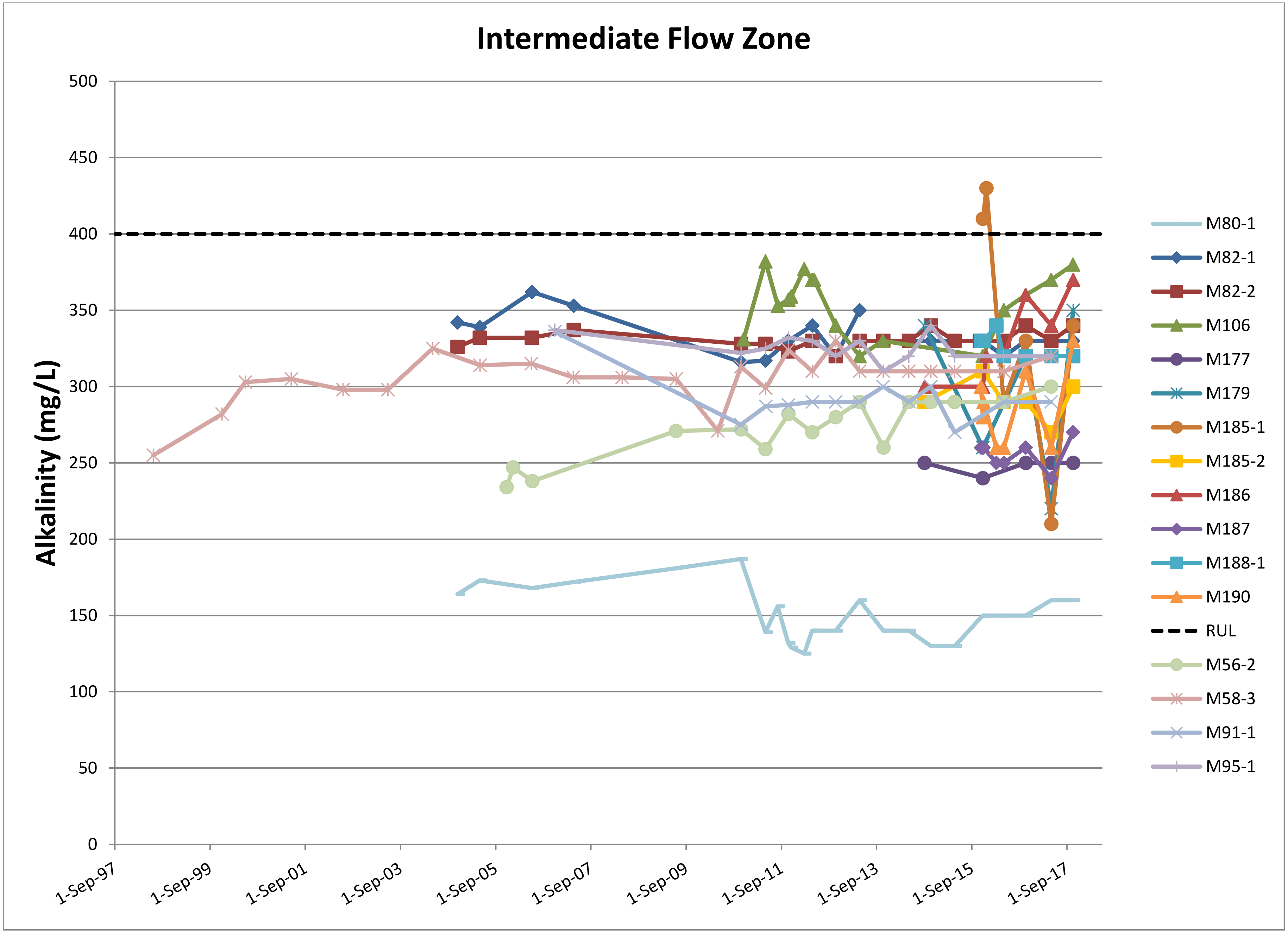

Shallow Flow Zone
Iron (mg/L)
0
2
4
6
8
10
12
14
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M54-4
M66-2
M67-2
M80-2
M85
M86
M87-2
OW37-s
RUL

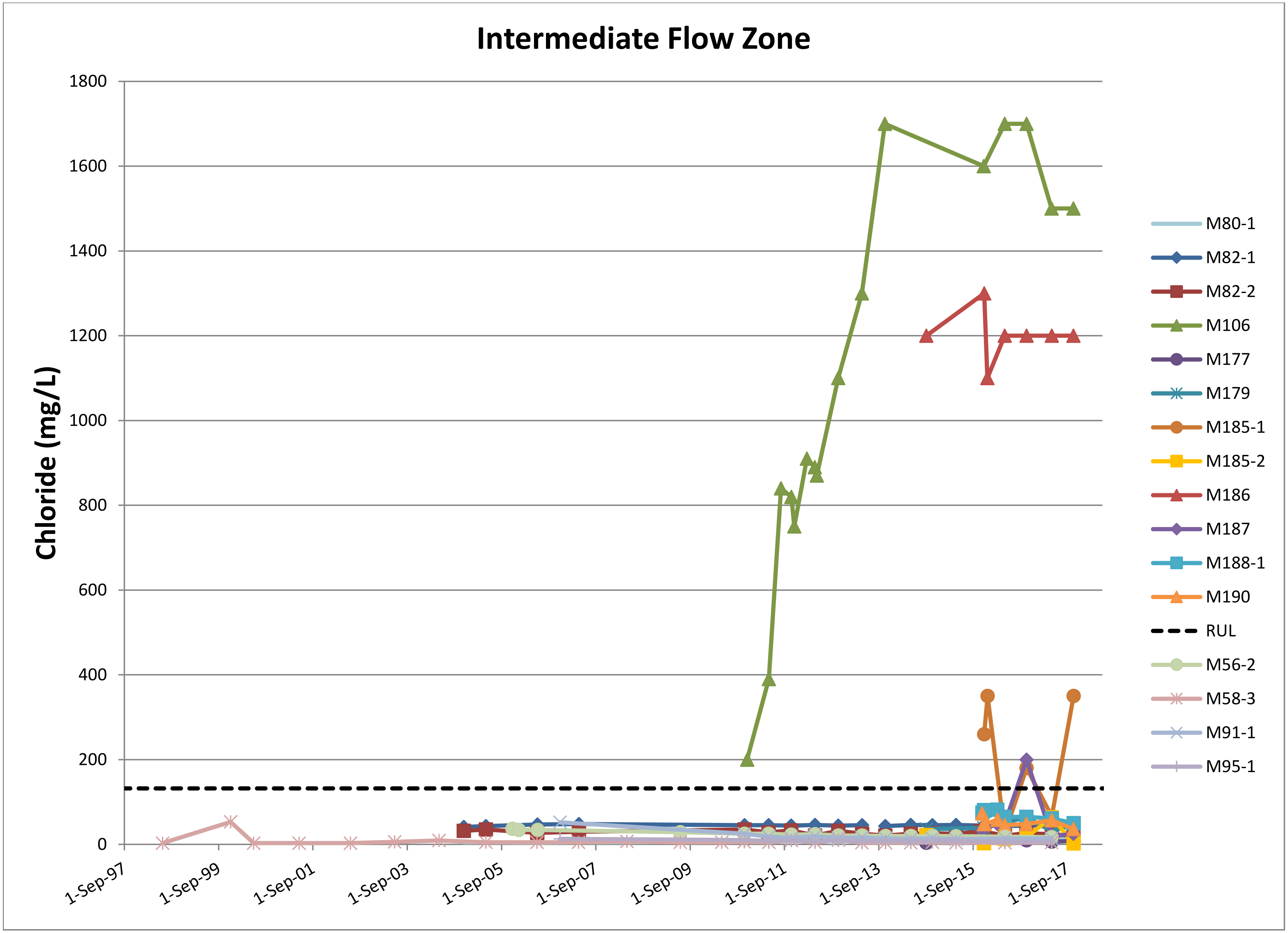

Shallow Flow Zone
Manganese (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M54-4
M66-2
M67-2
M80-2
M85
M86
M87-2
OW37-s
RUL



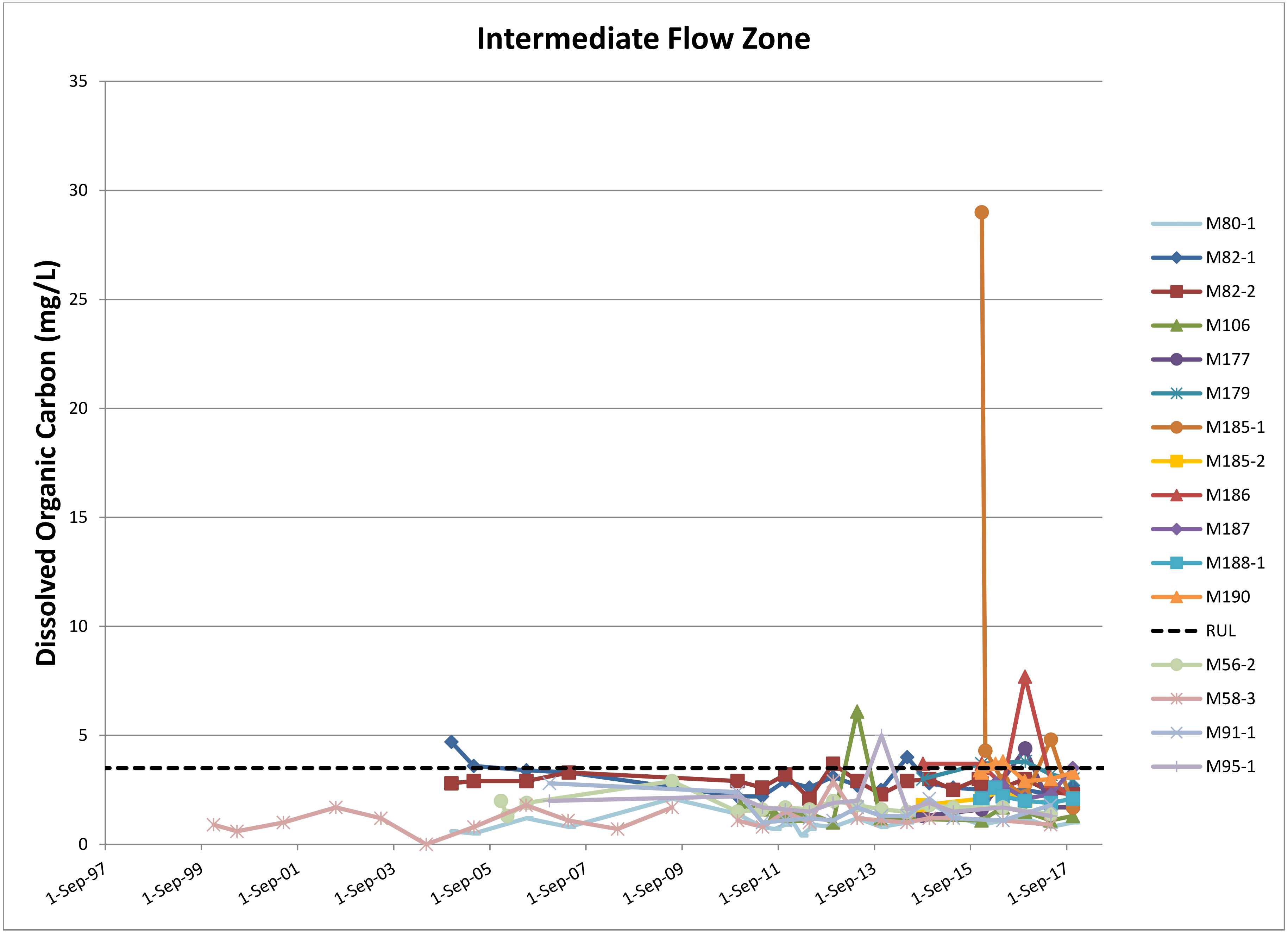
Shallow Flow Zone
Sodium (mg/L)
400
350
300
250
200
150
100
50
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M54-4
M66-2
M67-2
M80-2
M85
M86
M87-2
OW37-s
RUL

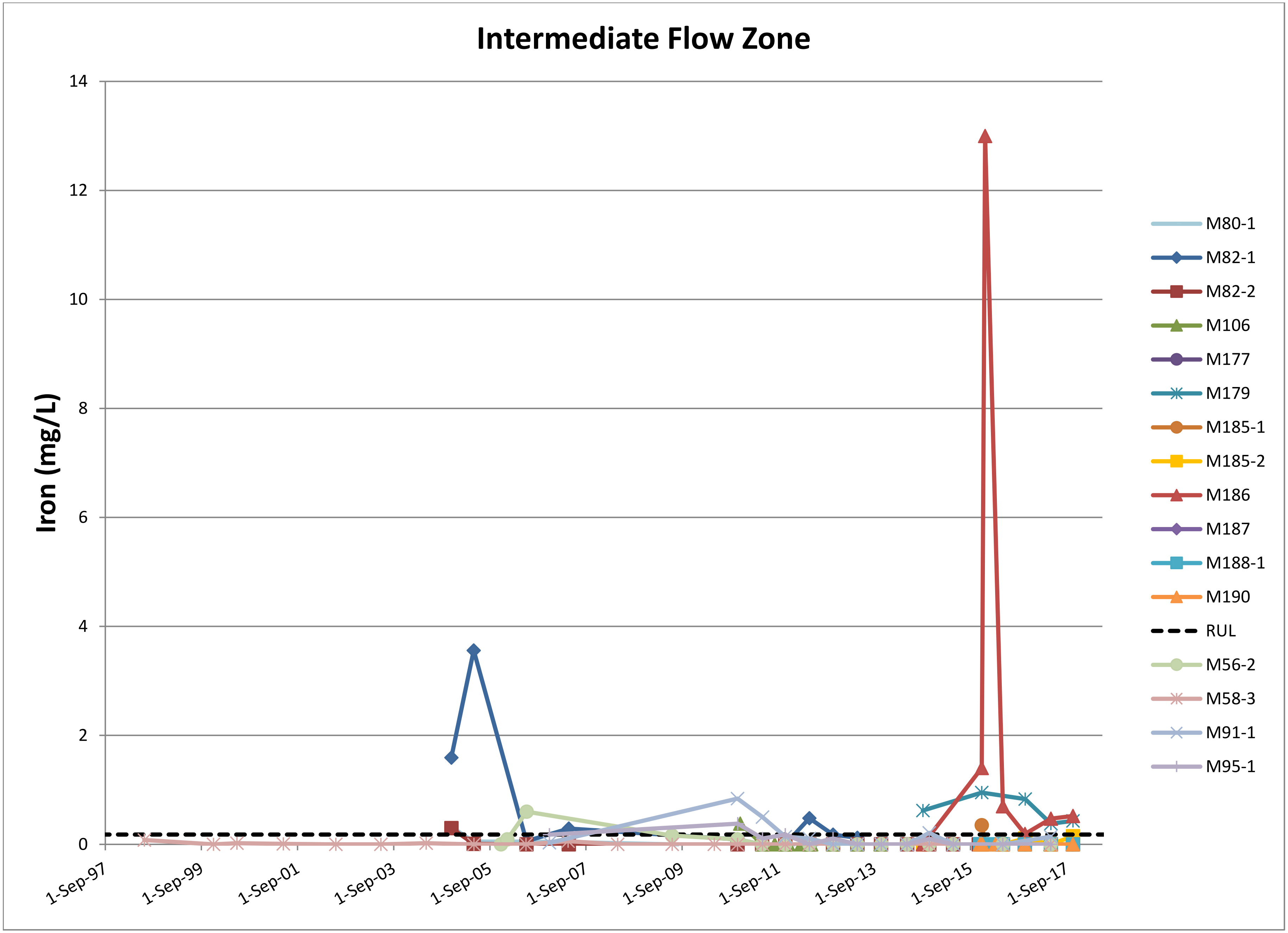

Shallow Flow Zone
Total Dissolved Solids (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M54-4
M66-2
M67-2
M80-2
M85
M86
M87-2
OW37-s
RUL


Intermediate Flow Zone
Alkalinity (mg/L)
500
450
400
350
300
250
200
150
100
50
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M80-1
M82-1
M82-2
M106
M177
M179
M185-1
M185-2
M186
M187
M188-1
M190
RUL
M56-2
M58-3
M91-1
M95-1

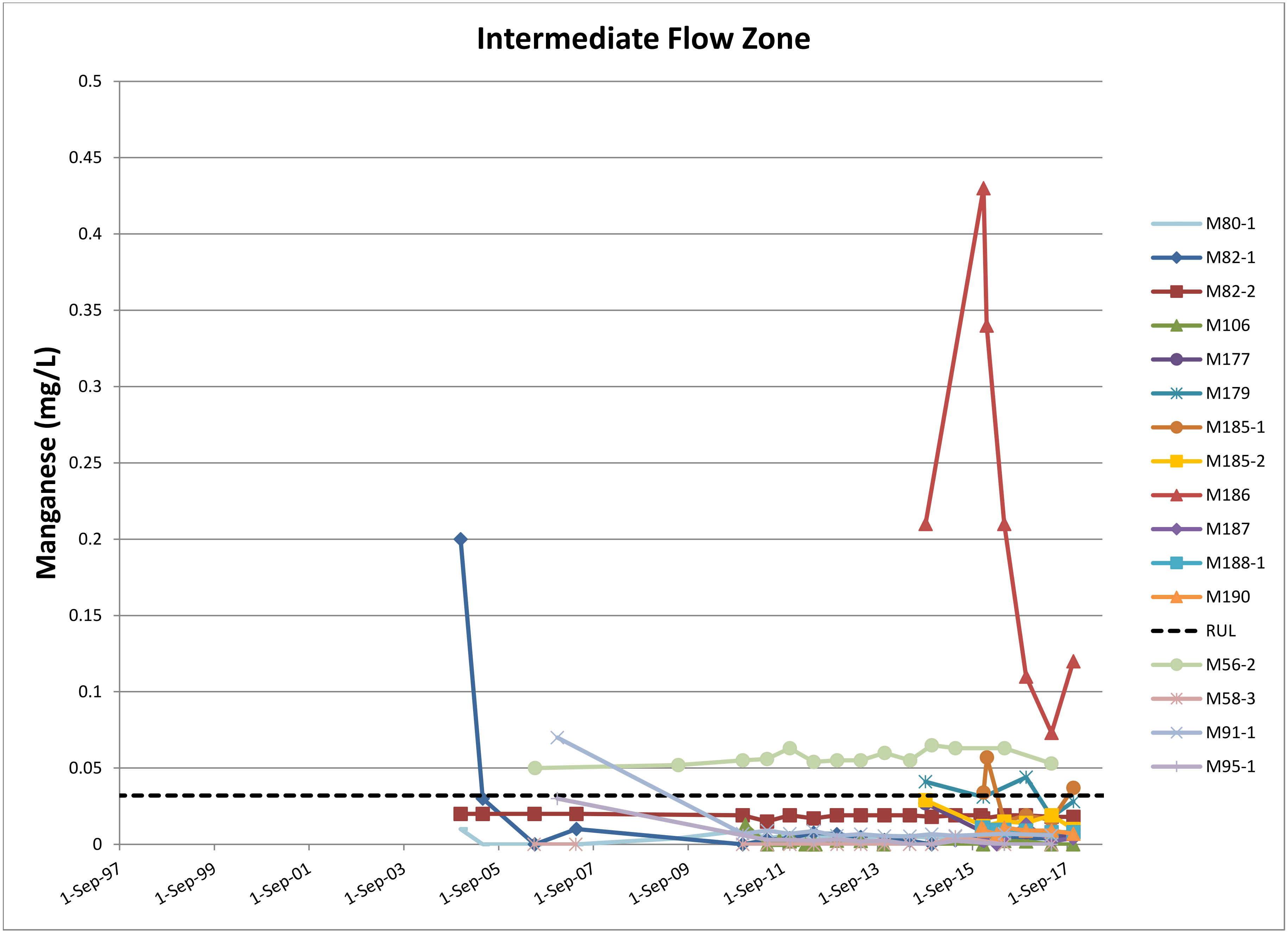


Intermediate Flow Zone
Chloride (mg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M80-1
M82-1
M82-2
M106
M177
M179
M185-1
M185-2
M186
M187
M188-1
M190
RUL
M56-2
M58-3
M91-1
M95-1

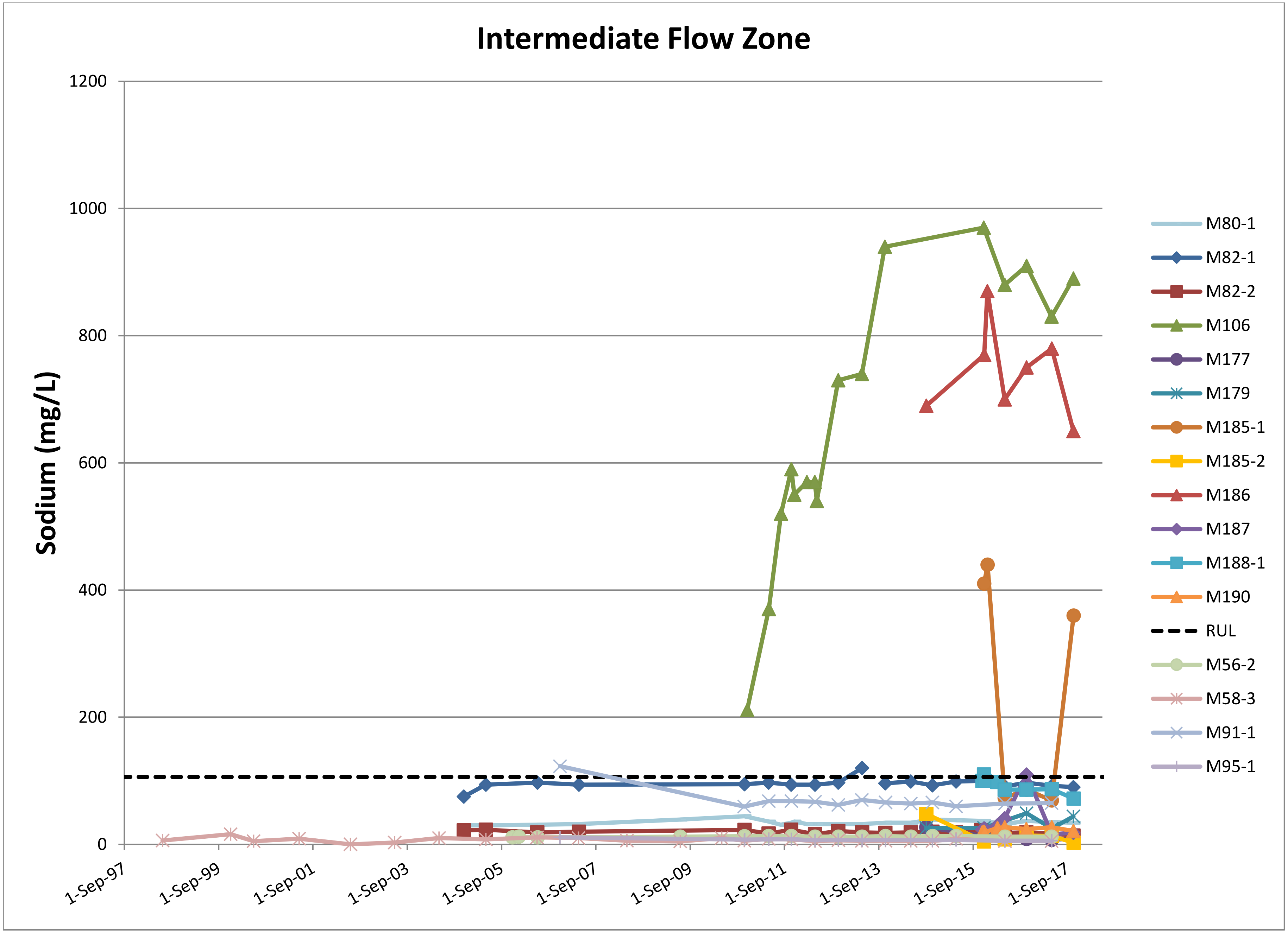

Intermediate Flow Zone
Dissolved Organic Carbon (mg/L)
35
30
25
20
15
10
5
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M80-1
M82-1
M82-2
M106
M177
M179
M185-1
M185-2
M186
M187
M188-1
M190
RUL
M56-2
M58-3
M91-1
M95-1

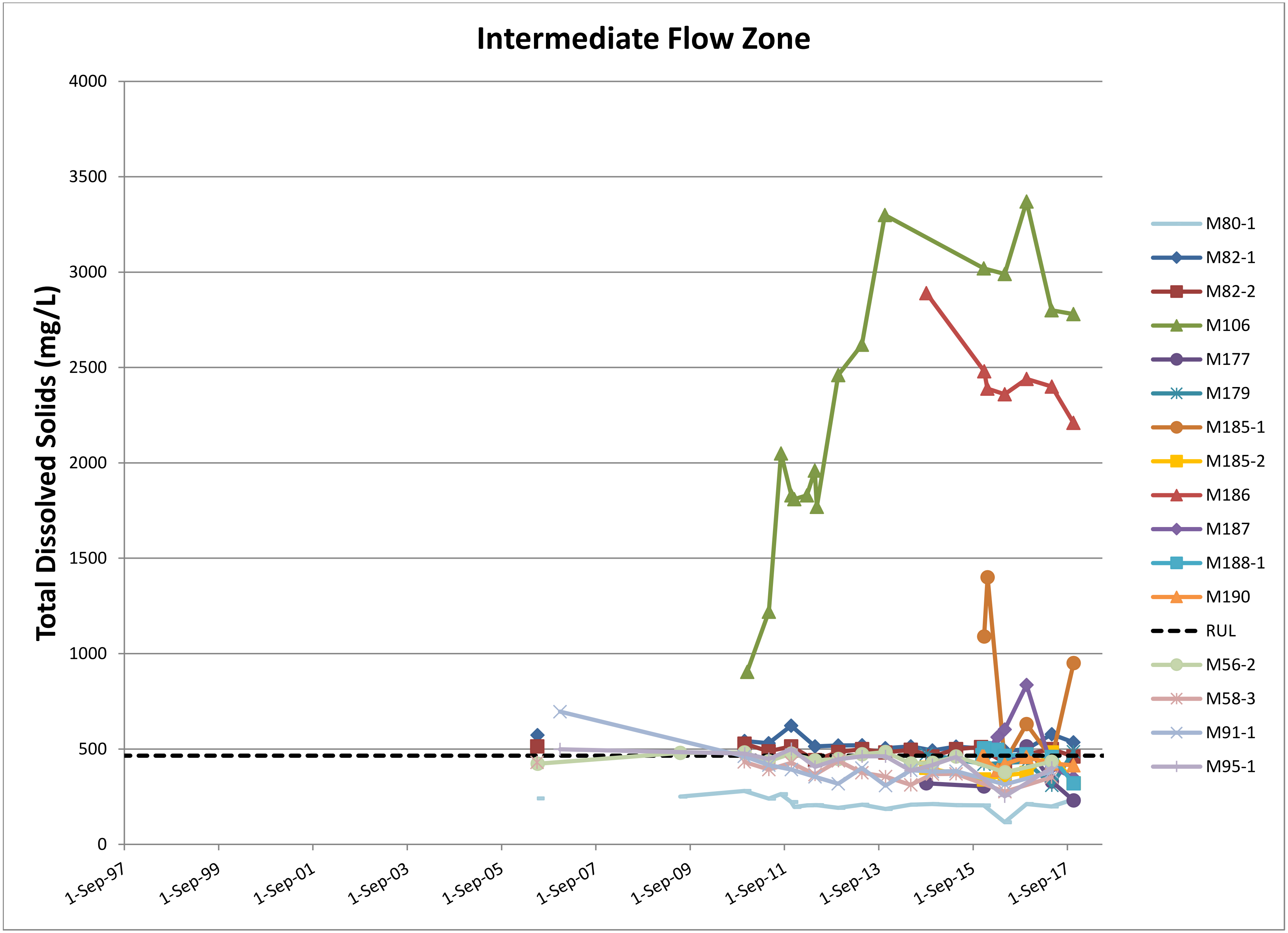


Intermediate Flow Zone
Iron (mg/L)
14
12
10
8
6
4
2
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M80-1
M82-1
M82-2
M106
M177
M179
M185-1
M185-2
M186
M187
M188-1
M190
RUL
M56-2
M58-3
M91-1
M95-1



Intermediate Flow Zone
Manganese (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M80-1
M82-1
M82-2
M106
M177
M179
M185-1
M185-2
M186
M187
M188-1
M190
RUL
M56-2
M58-3
M91-1
M95-1


Intermediate Flow Zone
Sodium (mg/L)
1200
1000
800
600
400
200
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M80-1
M82-1
M82-2
M106
M177
M179
M185-1
M185-2
M186
M187
M188-1
M190
RUL
M56-2
M58-3
M91-1
M95-1


Intermediate Flow Zone
Total Dissolved Solids (mg/L)
4000
3500
3000
2500
2000
1500
1000
500
0
1-Sep-97
1-Sep-99
1-Sep-01
1-Sep-03
1-Sep-05
1-Sep-07
1-Sep-09
1-Sep-11
1-Sep-13
1-Sep-15
1-Sep-17
M80-1
M82-1
M82-2
M106
M177
M179
M185-1
M185-2
M186
M187
M188-1
M190
RUL
M56-2
M58-3
M91-1
M95-1

BluMetric Environmental Inc.

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