VASHON ISLAND CLOSED LANDFILL

2017 ANNUAL GROUNDWATER DATA EVALUATION REPORT

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TABLE OF CONTENTS

1. PURPOSE 1-1

2. INTRODUCTION 2-1

2.1. REGIONAL SETTING 2-1
2.2. BACKGROUND AND PREVIOUS INVESTIGATIONS 2-2
2.3. LANDFILL HISTORY AND SITE IMPROVEMENTS 2-3
2.4. SITE GEOLOGY AND HYDROGEOLOGY 2-6

3. EVALUATION METHODS 3-1

3.1. DATA QUALITY 3-1

4. RESULTS 4-1

4.1. GROUND WATER ELEVATIONS AND FLOW DIRECTION 4-1
4.1.1. Groundwater in Channel Cc1 4-2
4.1.2. Groundwater in Channel Cc2 & Cc3 4-2
4.1.3. Groundwater in the Unit D Aquifer 4-3
4.2. GROUND WATER QUALITY 4-3
4.2.1. Groundwater Within or Adjacent to Channel Cc1 4-4
4.2.2. Groundwater in Channel Cc2 & Cc3 4-7
4.2.3. Groundwater in the Unit D Aquifer 4-13
4.3. WEIR AND SURFACE WATER QUALITY 4-17
4.4. OFFSITE DOMESTIC WELL MONITORING 4-19

5. LANDFILL GAS 5-20

6. CONCLUSIONS AND RECOMMENDATIONS 6-20

6.1. CONCLUSIONS 6-20
6.2. RECOMMENDATIONS/PROPOSED ACTIONS 6-21

7. REFERENCES 7-1

LIST OF FIGURES

Figure 1	Vashon Island Closed Landfill Vicinity Map
Figure 2	Vashon Island Water Table
Figure 3	Site Map
Figure 4	Site Stratographic Cross Section Locations
Figure 5	Site Stratographic Cross Section A-A’
Figure 6	Site Stratographic Cross Section B-B’
Figure 7	Site Stratographic Cross Section C-C’
Figure 8	Site Stratographic Cross Section D-D’
Figure 9	Site Stratographic Cross Section E-E’
Figure 10	Water Level Elevations for Groundwater in or Adjacent to Channel Cc1
Figure 11	Water Level Elevations in Channel Cc2
Figure 12	Water Level Elevations in Channel Cc3
Figure 13	Water Level Elevations in the Unit D Aquifer

LIST OF TABLES

Table 1-1	Regional and Vashon Island Landfill Hydrostratigraphy
Table 1-2	Vashon Island Landfill Groundwater Monitoring Well Completion Details
Table 1-3	2017 Site Maintenance Activities
Table 3-1	Statistical Summary for Groundwater
Table 3-2	Summary of Trend Analysis
Table 3-3	Groundwater Trends in Individual Wells
Table 3-4	Statistical Summary for Hillside Weirs

LIST OF APPENDICES

Appendix A	Groundwater Quality Standards
Appendix B	Exceedance Reports Regulatory Standards Exceedance Reports & Prediction Limit Exceedance Reports Seeps Exceedance Reports for Surface Water Criteria Seeps Exceedance Reports for Groundwater Criteria
Appendix C	Time Concentration Plots for groundwater within or adjacent to Channel Cc1
Appendix D	Time Concentration Plots for groundwater in Channel Cc2
Appendix E	Time Concentration Plots for groundwater in Channel Cc3
Appendix F	Time Concentration Plots for the Unit D Aquifer
Appendix G	Groundwater Velocity Calculations and Potentiometric Maps
Appendix H	Monitoring Well Keys
Appendix I	Groundwater Chemistry Data
Appendix J	Ion Balance Calculations & Trilinear Diagrams
Appendix K	Gas Monitoring Data
Appendix L	Inspection Survey Reports
Appendix M	Vashon Annual Financial Summary

EXECUTIVE SUMMARY

This Report presents the results of statistical analyses on the ground water monitoring data collected at the Vashon Island Closed Landfill from 1986 through December 2017.

In August 1999, landfilling was discontinued at the Vashon Landfill and a temporary plastic cover was placed over the refuse mound. A transfer/recycling station was constructed in the summer of 1999 to receive the waste generated on the island.

The final cover placement occurred in fall 2001. The landfill closure area is approximately 34 acres. The basic components of the cover system, from the top down, include: vegetative layer, upper drainage layer, impervious layer consists of high density polyethylene (HDPE), and lower gravel drainage layer.

The recent data reflects the natural variability in water quality present in the Cc2 background well MW-20. The relatively low and stable concentrations detected in MW-20 indicate that groundwater quality in this well is not impacted by the landfill. Chemical data from MW-20 represents natural aquifer conditions in the vicinity of the landfill. Wells in the groundwater perched in channel Cc2 displaying impacts from landfill activities include MW-2, MW-21, MW-5D. Stronger reducing conditions are identified in wells MW-5D and MW-21 than in MW-2, consistent with historical conditions. Most volatile compounds indicate decreasing or stable levels. Patterns observed for VOCs in wells MW-2 and MW-5D also, the wells indicate the possibility of a different mechanism of transport than for other water quality parameters. The observations indicate landfill gas as the most probable source of these groundwater impacts.

Three wells, MW-1, MW-5 (nested well) and MW-14 were decommissioned in April 2015 and one well, MW-27 in 2016. Also four new wells were drilled in 2015 and are being evaluated. Recommendations to add them or not to add them to the monitoring network will be evaluated for 2018.

We have continued to monitor the effectiveness of the landfill gas control system. One new gas well and three pairs of shallow/deep wells were installed in 2017 to further determine the presence of landfill gas on the South Slope area. There have been no methane detections at the compliance monitoring points since 2008.

A number of springs discharge on the hillslope on the Westside Highway SW. The water from these springs has been collected since 1991 at three weirs, SW-W1, SW-W2 and SW-W3. The only VOC detected with any frequency in the weirs is vinyl chloride. Vinyl chloride is rarely detected in SW-W1 and occasionally in SW-W2, but is routinely detected in SW-W3. A surface water site, SW-E was added to the sampling network in November of 2012 and results show that water quality is similar to SW-W1 with no volatile organic compound detections.

King County Solid Waste Division (KCSWD) currently monitors quarterly for groundwater, surface water and leachate at Vashon Island Closed Landfill, monthly for

landfill gas and bi-annually for offsite wells. Since the landfill was closed and capped, wells in the channel Cc2 have shown an overall reduction in volatile organic compounds. Wells screened in the Unit D Aquifer do not show impacts attributed to landfill activities. KCSWD is currently reviewing the need for additional monitoring wells and or improvements to the engineering control systems for the landfill.

The Financial Assurance information in this document (included in Appendix M) presents the authorized 2016 -2018 budget for the Vashon Island Closed Landfill. The financial information is presented in a format which responds to regulatory request for financial assurance.

1. PURPOSE

The purpose of this report is to meet or exceed the regulatory requirements of the WAC 173.351, Criteria for Municipal Solid Waste Landfills.

2. INTRODUCTION

This is the 2017 Annual Groundwater Data Evaluation Report that presents the results of statistical analyses on the ground water monitoring data collected at the Vashon Island Closed Landfill from 1986 through December 2017. This annual report describes the hydrogeologic conditions at the landfill and presents the evaluations on the groundwater quality data collected from upgradient and downgradient monitoring wells and on the water quality from seeps on the hillside to the west of the landfill. The data in this report are presented in compliance with Washington Department of Ecology "Criteria for Municipal Solid Waste Landfills" (WAC 173-351-415), and the Code of the King County Board of Health "King County Solid Waste Regulations" (Title 10, Rules and Regulations No. 8).

To meet the annual reporting requirement of WAC 173-351, this annual report includes a discussion of maintenance activities at the site in 2017, surface water data, landfill gas data and leachate data.

This report also provides a brief description of the partial closure and site improvements that were completed in 1989 and mentions the site investigations conducted at the landfill in 1995 and 1999 and the final closure construction completed in 2002. Groundwater quality trends are discussed in context of these site improvements. This report also includes: a summary of previous site investigations; a description of the location, topography, and regional geology and groundwater hydrology of the landfill; a history of the landfill; evaluation methods; data quality; site hydrogeology; and results and discussion of groundwater flow and chemistry at the landfill. Planned future activities at the site are presented in Section 4.

2.1. REGIONAL SETTING

The Vashon Landfill includes a 24-acre mixed municipal refuse fill area, located on a 145-acre parcel in the west central portion of Vashon Island (Figure 1). Groundwater monitoring at the landfill has occurred at various sampling locations (Figure 3) since 1986. Most of the property exists in sparsely to unwooded, gently rolling terrain at elevations of 300 to 400 feet. The western portion of the property (west of Westside Highway SW) is undeveloped, forested land that slopes steeply towards Colvos Passage.

The Vashon Landfill site is within the Judd Creek drainage area with surface water draining towards the south. The undeveloped portion of the property west of Westside Highway SW drains westward. Judd Creek discharges approximately three miles to the south east to Quartermaster Harbor. Judd Creek is one of Vashon Island's largest creeks. It flows through a drainage area of 3,149 acres with midsummer low flows of about 224 gpm (Carr, 1983).

Vashon Island hydrogeology has previously been characterized based on island well logs (Carr, 1983). The island is composed of glacially derived sediments that layered in three units. The most recent unit is glacial till which mantles the island with a thickness of 1 to greater than 50 feet. Beneath the till is a sand, and sand and gravel zone, which is 50 to 400 feet thick. In the landfill vicinity, this unit is estimated to be up to 300 feet thick. The deepest unit identified consists of silt and clay with sandy zones that extend to depths of about 600 feet below sea level.

The surface till has poor water-bearing characteristics and does not contain an aquifer. However, the till is important to island hydrology because groundwater recharge through the till is variable from location to location. The sand and gravel stratum contains the "Principal Aquifer" of the island, which services about 95 percent of island wells (Carr, 1983). In the landfill vicinity, the direction of regional groundwater flow within the Principal Aquifer is generally westward (Figure 2). Recharge of this Principal Aquifer occurs from infiltration of rainwater through the till. Island wide, the aquifer has generally good water quality, with local areas of elevated nitrate and iron levels. A "Deep Aquifer" exists about 100 to 300 feet below sea level, but is not penetrated by many wells, and none at the landfill site. See Table 1-1.

2.2. BACKGROUND AND PREVIOUS INVESTIGATIONS

Hydrogeology and water quality studies of the Vashon Landfill vicinity have been performed on behalf of the King County Solid Waste Division by R. W. Beck (1984), Harper-Owes (1986 and 1988), CH2M Hill (1995 and 1996), and Berryman & Henigar (2000). Central conclusions of the earlier reports were that groundwater beneath the landfill exists in two separate zones. The CH2M Hill report defined a third zone of groundwater. The 2000 report describes groundwater as occurring as both perched saturated zones and within a deeper, extensive saturated zone. This deeper zone is identified as the regional aquifer. The latest investigation included 3 additional groundwater wells in the regional aquifer, completed in 2003. The *Vashon Island Hydrogeologic Report Update* (Berryman & Henigar with UES) was finalized in December 2004. The 2004 Update identified geologic units beneath the landfill; identified as Units A through G. Table 1-1 in this report (Table 2-4 in the 2004 Update) describes the identified units. Unit C is a lacustrine silt incised by channel deposits. Three distinct channel deposits were identified and loosely correspond to zones identified in previous reports. Wells screened in channel Cc1, the uppermost channel, are described in previous reports as "screened above the lacustrine silt". Wells screened in channel Cc2, the middle channel, are described as "screened within the

lacustrine silt." Wells in the lower channel, Cc3, are described as "screened below the lacustrine silt". The regional aquifer is identified within the Unit D formation. The detailed description of the hydrogeology is found in the 2004 Hydrogeologic Update.

Channel Cc2 and the regional aquifer are the only water bearing units with sufficient information to produce potentiometric maps. Direction of groundwater flow within channel Cc2 was determined in the 2004 Update and subsequent quarterly potentiometric reports to be primarily westward. The direction of groundwater flow within the regional aquifer is indeterminate, with flow components potentially northward, westward and southward.

A steep slope drops down to the west of the landfill and cuts across a water-bearing silt/sand contact. As a result, some 400 to 500 feet to the west of the landfill, groundwater emerges and enters an unnamed creek before entering Puget Sound at Colvos Passage approximately 2/3 of a mile to the west. A hydrogeologic investigation of the hillslope was completed in 2011 that attempted to locate the outcroppings of the identified Unit C channels and provide water quality monitoring locations for the channels. The Vashon Landfill Western Hillslope Investigation Report presents the findings of this project.

The R. W. Beck (1984) and Harper-Owes (1986) reports indicated some evidence of leachate in the sand and gravel units beneath the till. Water quality conditions were re-evaluated in 1988 (letter report by Harper-Owes to Kevin Kiernan, King County Solid Waste Division) just prior to construction of the landfill closure and upgraded disposal area. Conclusions at that time were that the leachate was more dilute than typical of municipal landfills in the Pacific Northwest with no indication of elevated concentrations of organic compounds. Perimeter monitoring wells had some exceedances of primary and secondary drinking water criteria. The hillside weeps had only exceedances of secondary drinking water criteria.

2.3. LANDFILL HISTORY AND SITE IMPROVEMENTS

Solid waste disposal operations have been ongoing at the landfill since the early 1900s. Operation of the landfill was taken over by the Solid Waste Division by the late 1950's (R.W. Beck and Associates, 1983) and daily cover, record keeping, and other updated solid waste management practices were initiated. In 1983, the first four groundwater monitoring wells were installed at the landfill. Piezometers P-1 and P-2 (Figure 3), previously located in the fill area on the eastside, were abandoned in 1988 by overdrilling and then filling the borehole with bentonite in accordance with the Washington Administrative Code 173-160 as required at that time. An analysis of various leachate collection system alternatives was performed in order to meet King County Solid Waste Regulations (KCSWR - Regulation No. 8). The selected design consisted of installing an impermeable cap over the existing refuse area, a passive gas collection system under this cap, a leachate collection and conveyance system, an aerated pretreatment lagoon, storm water control facilities (ditches, culverts, and

siltation and detention ponds), and a venting and treatment system of flares. A liner for the future refuse area was installed. These improvements were completed in 1989. The northwest 2.3 acres of the landfill received final cover in 1988-1990. Two piezometers, MW-13 and MW-24 were installed in 1992. MW-13 is now being used as a monitoring well. MW-24 is monitored for groundwater levels.

The existing groundwater monitoring network was supplemented by the installation of eight groundwater monitoring wells during the summer of 1995. Figure 3 shows the location of new monitoring wells 7, 8, 9, 10, 11, 12, 14, and 19. Eight gas probes were installed around the perimeter of the refuse area to determine if gas migration was occurring at the landfill in 1995. Other improvements to the gas collection system included converting the system from passive to active and the conveyance and treatment system change from flares to activated carbon in 1996.

A detailed discussion of the depths and locations of the monitoring wells and gas probes installed in 1995 is provided in the Groundwater Monitoring Well Construction Work Plan (CH2M Hill, 1995).

During fall 1998, two more wells MW-20 and MW-21 were installed to provide supplementary monitoring of an extensive sand bed in the lacustrine silt. The most recent interpretation of the site hydrogeology is presented in the Vashon Island Landfill Hydrogeologic Report (Berryman & Henigar et. al., 2000). This report addresses the requirements in Chapter 173-351-490 of the Washington Administrative Code.

In August 1999, landfilling was discontinued at the Vashon Landfill and a temporary plastic cover was placed over the refuse mound. A transfer/recycling station was completed in the summer of 1999 to receive the waste generated on the island.

Storm water facility improvements were constructed during the summer and fall of 1999, including a detention pond in the southeast corner and an underground drain system around the perimeter of the landfill.

The final cover placement occurred in fall 2001. The landfill closure area is approximately 34 acres. The basic components of the cover system, from the top down, include: vegetative layer, upper drainage layer, impervious layer consists of high density polyethelene (HDPE), and lower gravel drainage layer (Berryman & Henigar et. al, 1999).

MW-11 was damaged in February 2001 during the Nisqually earthquake. No more samples have been collected from this well since then. MW-11 was decommissioned and the replacement well, MW-29, was installed in the summer of 2003. Additionally, MW-6S & D were damaged in the earthquake and were decommissioned as part of the drilling operations in 2003.

Drilling operations in 2003 also included installing 3 additional monitoring wells (MW-26, MW-27 and MW-28) and one piezometer (MW-25) to expand the monitoring network for

the regional aquifer. MW-28 has been dry since completion. The 2004 revision to the 2000 Hydrogeologic Report was finalized in December 2004, incorporating these new wells into the hydrogeologic interpretation of the site. Table 1-2 describes well details for all of the wells on the site.

Maintenance activities for the environmental control facilities are performed throughout the year. The Operations and Maintenance Plan was finalized at the end of 2005, which provides tables listing the specific O&M activities for each system. The new listings were incorporated into the SWD Operations tracking database in 2006. A summary of the maintenance activities completed in 2011 is included as Table 1-3.

In March 2006, three documents representing the environmental evaluation of the landfill site were submitted to Washington Department of Ecology (DOE) and to Seattle King County Department of Public Health (SKCDPH). The first report, “Environmental Evaluation”, provides evaluation of the landfill environmental control systems and their interaction with the hydrogeologic environment. The second document, “Potential Effects of Landfill Gas and Leachate on Vashon Landfill Groundwater and Springs”, addresses a chemistry based evaluation of the source of volatile organics seen in some of the wells. The third document, “VOC Sampling and Test Results”, reports the findings of the soil gas sampling performed at the site. In combination these documents address the requirements of Compliance Task 4 in the Vashon Closed Landfill Permit.

These reports provided recommendations for further actions. Some of these recommendations were completed in 2006. The task of the leachate lagoon liner testing was completed in 2007. The results were reported and concluded that the liner did not have any leaks.

Other recommendations in the reports require the procurement of consultant services, such as: Install wells as needed to better define Cc3 and extent of Cc2, evaluate and enhance the landfill gas extraction system and better define the geological contacts and springs on the West Hillslope (Table 5-1 Berryman & Henigar with UES, 2006). Some of these services are being performed by King County Water and Land Division (KCWLD). A consultant was hired to review all environmental investigations, monitoring and remediation performed at the landfill and to identify data gaps and identify enhancements to the existing engineering control systems.

As part of an ongoing investigation on the West Hillslope of the landfill, three shallow monitoring wells (MW-30, MW-31 and MW-32) were hand augured in December 2009. These three monitoring wells were sampled for one year and findings from this investigation are summarized in the Vashon Closed Landfill Western Hillslope Investigation March 2011.

In July 2015, the leachate lagoon was tested for leaks by Beyond Leak Detection. This is both a regulatory requirement and a condition of our Solid Waste Handling Permit. The leachate lagoon was found to have no leaks.

2.4. SITE GEOLOGY AND HYDROGEOLOGY

Surficial till, which corresponds to Vashon till, mantles the site. The weathered till has a thickness of 15-50 feet throughout most of the landfill site. No wells monitor the Vashon Till. The till is absent in southern portions of the site.

The outwash is underlain by a lacustrine silt layer that is interpreted to be laterally continuous beneath the site. This lacustrine silt is incised by fluvial sands and gravels. These sands and gravels are interpreted as channel deposits. Perched saturated zones identified beneath the Vashon Island Landfill site occur in channel deposits (Cc1 & Cc2) within the uppermost lacustrine silt (Unit C). Groundwater in the deeper saturated zone occurs in sands and gravels within the lowermost Unit C channel deposits (Cc3) and within Units D and F. This deeper saturated zone is apparently hydraulically continuous with the regional aquifer. Units D and F are generally separated by an aquitard (Unit E). However, this aquitard has likely been removed by erosion beneath at least some portions of the site (specifically, at MW-25 and MW-26, see Figure 7). A deeper aquitard, Unit G, was encountered in only one boring (MW-7, see Figures 6, 8, and 9). Due to its limited distribution, the hydrogeologic effect of the Unit G aquitard beneath the Vashon Island Landfill site is limited.

Groundwater perched in or adjacent to the upper Unit C channel deposits (Cc1) is evaluated using wells MW-1, MW-3, MW-4, MW-5S, MW-6S, MW-10, MW-13, and MW-24 (see Figures 6 through 9). All wells measure water levels within the Cc1 deposits, but not all wells produce sufficient water for sampling. Wells typically producing sufficient water include MW-10, MW-13, and periodically MW-1 and MW-3. Well MW-6S was also installed in these deposits; however, it was decommissioned after being damaged during the February 2001 Nisqually earthquake. Well MW-1 and MW-5S were decommissioned in April 2015.

Wells MW-2, MW-5D, MW-9, MW-20, and MW-21 are completed within the middle channel deposits (Cc2) (see Figures 5 and 9). Well MW-6D was also installed in these deposits; however, it was decommissioned after being damaged during the February 2001 Nisqually earthquake. Wells MW-8 and MW-14 are installed in silty sands that are beneath the middle channel deposits and are laterally equivalent with and adjacent to the lower channel deposits (Cc3) (see Figures 5 and 9). Hydrographs for wells MW-8, MW-14, and wells completed within perched saturated zones within the middle channel deposits are shown in Figure 3-9. Groundwater in wells MW-8 and MW-14 does not appear hydraulically connected with groundwater within either the middle channel deposits (Cc2) or the lower channel deposits (Cc3). Wells MW-5D and MW-14 were decommissioned in April 2015.

Four borings (MW-7, MW-11, MW-12, and MW-19) were advanced to elevations between 8 and 40 feet to evaluate site stratigraphy at depth (CH2M HILL, 1996). These borings were completed as wells screened to intercept groundwater in Unit D (see Figures 5 through 9). Well MW-11 was decommissioned after being damaged during the February 2001 Nisqually earthquake.

Five additional borings were advanced into Unit D and completed as monitoring wells during 2003 (B&H and UES, 2003a and 2003b). Of these, wells MW-25, MW-26, MW-29 were installed to screen groundwater in Unit D. Well MW-27 is constructed to screen the lower Unit C channel deposits (Cc3); the base of the well screen also penetrates the upper few feet of underlying Unit D deposits. As is discussed in Section 3.2.3, groundwater in MW-27 is interpreted as being equivalent with groundwater in saturated Unit D soils and therefore with the regional aquifer. Well MW-28 was installed to screen the contact between Unit D and Unit E; the elevation of this contact exceeds the water table elevation in Unit D at this location (see Figure 6). Well MW-27 was decommissioned in April 2016.

Geologic cross-sections of the landfill (Figures 4 to 9) show the relationship of the geologic units beneath the site and the identified water-bearing zones. Channel Cc2 and the regional aquifer are the only water bearing units with sufficient information to produce potentiometric maps. Direction of groundwater flow within channel Cc2 was determined in the 2004 Update and subsequent quarterly potentiometric reports to be primarily westward. The direction of groundwater flow within the regional aquifer is indeterminate, with flow components potentially northward, westward and southward.

3. Evaluation Methods

The site environmental evaluation was conducted in accordance with the Draft Data Evaluation Supplement to the Vashon Landfill Sampling and Analysis Plan. The evaluation tools include:

- Interwell Prediction Limits
- Intrawell Prediction Limits
- Mann Kendall Trend Test
- Time Concentration Plots
- Descriptive Statistics
- Exceedance Tables
- Trilinear Plots

The prediction limit exceedances, regulatory standard exceedances (Appendix B), ion balances and trilinear diagrams (Appendix J) are prepared for each quarterly report and compiled in this report. The data evaluated from wells screened within Cc3-Regional aquifer, will be calculated and compared to intrawell prediction limits and wells screened within channel Cc2 will be calculated and compared to interwell prediction limits (Appendix B).

The Mann Kendall trend test is recalculated based on the new data obtained in 2013. The trend test is evaluated for long term trends, including historical data up to the last eight samples, and for short term trends using the last eight samples. For wells with historical data beyond 50 samples, the most recent 50 samples are used in the long term trend test (Table 3-2). Wells with fewer than 20 samples and wells that have not produced sufficient water for eight samples in the last two years are compiled as a long term trend only.

Groundwater levels in individual wells have been plotted as a function of time. Changes in water levels before and after the 1989 closure are noted. Groundwater flow directions were estimated based on water elevations in monitoring wells screened in similar water-bearing zones. Upgradient and downgradient wells are determined by flow direction.

3.1. DATA QUALITY

Five analytical labs have performed laboratory services for water samples collected at the Vashon Landfill including Laucks from 1986 to March 1990, AmTest from March 1990 to April 1992, and Analytical Resources (ARI) from April 1992 to May 1995, Laucks again from May 1995 to April 2008 and Pace from April 2008 to March 2009 and the King County Environmental Laboratory from April 2009 to current. The State Manchester Laboratory accredited all five laboratories for the methods used at the time the samples were analyzed.

Contamination of blanks has important ramifications for data quality. However, some compounds have high blank contamination rates for compounds, such as methylene chloride. Although improvements have been made in reducing the rate of blank contamination in the lab, blank samples that have a longer residence time in the lab, such as volatile trip blanks and full set trip blanks, still show elevated rates. Since the common lab contaminants do not provide the only evidence of landfill impacts, other volatile compounds are used for this evaluation. Other compounds, such as, sulfate, zinc and iron have also been detected in blanks. These detections will be noted for the individual samples in which they have occurred. Some data, particularly concerning solvents, must be qualified based on blank contamination events and measures of precision and accuracy. All sample results qualified with a “B” have blank contamination associated with the analysis.

There are instances, particularly in the case of arsenic where the limit of detection, because of technological limitations, is above the State or Federal water quality levels. Because these concentrations are not quantifiable, they can be reported only qualitatively, as less than a reporting limit. Another issue involving limits arises when the limits of detection or analytical sensitivity changes over time. Especially noticeable for parameters such as chloride, where more recent samples show more fluctuations or definition on the graphs due to more significant figures (greater sensitivity) being reported. Other factors that may contribute to these changes may be due to dilution, or due to technical or contractual specifications such as technical advancements in instrumentation in the contractual laboratory industry. These changes must be kept in mind while reviewing data evaluation and conclusions.

A notable change in this annual report involves the methodology for the analytical testing covered by SW-846 (Test Methods for Evaluating Solid Waste). The previous Method Detection Limit (MDL) methodology has been updated in 2017 to use the Lower Limit of Quantitation (LLOQ).

The LLOQ is the lowest point on a calibration curve that can be used for quantification. It is a method that repeatedly tests and calibrates against known standards such as reagent water, method blanks, etc. Ultimately, the LLOQ’s ability to detect an analyte at a specific concentration is dependent upon factors such as instrument sensitivity and can, at times, be greater than the baseline curve concentration.

During the second quarter of 2017, the transition to using the LLOQ methodology resulted in revised reporting limits for a number of analytes. Quantitation limits for all trace metals (i.e. non-major cationic species metals), and a subset of the VOCs analyzed for regularly are lower than past analyses, while some VOCs have higher or the same limits as before. As a result of these changes, previously unobserved trace metals and VOCs in a number of wells are now reportable at concentrations below previous methodologies could quantify.

4. RESULTS

4.1. GROUND WATER ELEVATIONS AND FLOW DIRECTION

The Vashon Island Landfill Hydrogeologic Report Update (Berryman & Henigar with UES) presents the latest interpretation of the hydrogeology and was completed in December 2004. Starting in the fourth quarter of 2004, the interpretation has been used in the preparation of potentiometric surface maps and calculations of groundwater velocities.

Monitoring well locations are shown on Figure 3. These monitoring wells penetrate three water-bearing zones. Cross-sections illustrating site stratigraphy are presented in Figures 4 through 9.

The upper most unit over most of the property is till. This till unit is absent at the south end of the site. The upper most unit at the south end of the site consists of sands interbedded with silts. These sands interbedded with silt are directly beneath the till at the north end of the site. The silts act as partial aquitards as evidenced by different water levels in wells screened at different depths. Because of the presence of these silt barriers, groundwater has been subdivided for discussion purposes into 3 channels incised into the lacustrine silt and an extensive saturated zone. Groundwater in or adjacent to channel Cc1 is the perched saturated zone between the lacustrine silt (transitional beds) and the overlying advance outwash. Groundwater in channel Cc2 is the middle channel in Unit C and groundwater in channel Cc3 is the lowest channel. The regional aquifer is a saturated zone beneath the lacustrine silt.

The stratigraphy of the site identifies 7 geologic units, A through G. Unit A is the overlying Vashon till, B is outwash, C is lacustrine silt incised with channels of more permeable material and the regional aquifer is defined in Unit D. No wells are installed in the deeper units E through F; however some wells were over drilled and provide information about these units. A thorough discussion of the site is in the Hydrogeologic Report Update. Wells are installed in 3 channels incised in Unit C and are identified as Channels Cc1, Cc2 and Cc3 in vertical descending order. Wells in Cc1 have previously been identified as “perched above the lacustrine silt” and well in Cc2 as within the lacustrine silt (MW-27). The well in Cc3 was not previously installed.

In order to utilize the most current information, an elevation datum transition from NGVD29 to NAVD88 was implemented. Water level elevations from 2016 to present are adjusted by approximately 3 feet from previous reports. Figures 10 through 13 highlight this modification.

4.1.1. Groundwater in Channel Cc1

There are currently five wells screened in or adjacent to Cc1 deposits: MW-3, MW-4, MW-10, MW-13, and MW-24. Groundwater, when encountered in this zone, is encountered at elevations of 260 to 287 feet above mean sea level (MSL). MW-1 and MW-5S were decommissioned in April of 2015.

The saturated thickness of the channel Cc1 is generally less than 11 feet. The water levels in most of the wells (except for MW-10 and MW-13) have declined to the extent to make sample collection impracticable. There is an insufficient volume of water present to collect samples due to minimal recharge rates. The wells that have yielded sufficient groundwater for continuing analysis since 1993 are MW-10 and MW-13. In 1997, MW-4 started yielding sufficient groundwater for analysis again and stopped again in late 2000. In 2017, MW-4 yielded sufficient groundwater for three samples. MW-3 yielded sufficient water for one sample in 2017.

Water levels for most of the wells have fallen in elevation since 1991. The initial contributing factor was the periodic placement of temporary HDPE cover over the completed refuse fill area. This practice began in 1991. The final closure of the landfill in 2002 appears to have further reduced surface recharge to this sand zone.

Historically, water levels in the wells in the groundwater in and adjacent to channel Cc1 show a variation from less than one foot to almost five feet with no marked seasonality, except for MW-4 (see Figure 10). MW-4 is screened across a silt contact and the well can act as a sump. The 2004 Update recommends not sampling the well unless the water levels rise above the silt contact. There was sufficient groundwater for two samples in 2007 and three samples in 2017, but previously the water levels were not above the silt contact since November 2000. Water levels are measured and reported quarterly to confirm this.

Field permeability tests performed by Harper-Owes (1986) indicated that the average permeability of sand in channel Cc1 was approximately 4.3 feet per day (ft/day).

4.1.2. Groundwater in Channel Cc2 & Cc3

Monitoring wells MW-2, MW-20, MW-21, MW-5D, MW-6D, MW-14, MW-8, and MW-9 are screened at elevations between 200 and 234 feet MSL. MW-5D, MW-6D and MW-14, have been decommissioned.

Wells MW-9, MW-2, MW-20, and MW-21 are completed in channel Cc2. Well MW-8 is screened in silty sands beneath the Cc2 deposits and laterally equivalent with the Cc3 deposits. Groundwater levels in MW-8 do not appear to be hydraulically equivalent with groundwater within either Cc2 or Cc3. The water levels recorded for well MW-8 suggest these wells are along a flowpath from Cc2 to Cc3.

Annual water level fluctuations in the well MW-8 tended to be minor, with an annual range of about 1 foot. Water level fluctuations in MW-9 were about 1 foot. Annual water level fluctuations in MW-2, MW-20, and MW-21 were less than 1 foot. See Figures 11 and 12. This low or lack of response to the annual cycle of wet and dry seasons can be explained by the landfill not being located in an area where significant recharge to the aquifer occurs (Carr, 1983). Relatively low permeability surficial deposits (till) and partial closures in 1989 and 1999 contribute to the lack of significant recharge.

The general flow direction in the continuous thin sand, where MW-20, MW-21, and MW-2 are located in, is to the west or southwest. The potentiometric maps submitted quarterly and included in Appendix G generally agree with the flow directions reported by Carr (1983, see Figure 2).

The perched zone monitored by MW-2, MW-20, and MW-21 has a hydraulic gradient of 0.014 ft/ft. The hydraulic conductivity for this perched zone is estimated between 0.01 and 0.45 ft/day. The effective porosity ranges from 0.2 and 0.3. The estimated horizontal groundwater velocity for this zone in 2017 ranged from 0.0002 to 0.033 ft/day (see Appendix G). The calculated velocities are expected to be accurate only within one order of magnitude due to variability in permeability rates. Quarterly velocity calculations and potentiometric maps are attached in Appendix G.

4.1.3. Groundwater in the Unit D Aquifer

There are six wells screened within the Unit D Aquifer (MW-12, MW-7, MW-19, MW-25, MW-26 and MW-29). Groundwater is encountered at elevations of 154 to 195 feet MSL (see Figure 13).

The general flow direction in the regional aquifer is west to north away from MW-7. The water fluctuations for the regional wells are less than two feet and also without considerable seasonal trends, see Figure 13. This lack of response to the annual cycle of wet and dry seasons can be explained by the landfill not being located in an area where significant recharge to the aquifer occurs (Carr, 1983). Relatively low permeability surficial deposits (till) and site closures attributes to the lack of significant recharge. The potentiometric maps shown in Appendix G generally agree with the flow directions reported by Carr (1983, see Figure 2).

The groundwater velocity occurring in the Unit D Aquifer in 2017 is between 0.27 and 3.78 ft/day, with a hydraulic gradient ranging from 0.024 to 0.042 ft/ft and a hydraulic conductivity estimated between 3.0 and 28.0 ft/day. The estimated velocities are expected to be accurate only within one order of magnitude due to variability in permeability rates (see Appendix G).

4.2. GROUND WATER QUALITY

Results for the groundwater quality beneath the Vashon Landfill are presented according to two channels, Cc1 and Cc2; and the Unit D Aquifer. MW-8 (channel Cc3)

is discussed with the Channel Cc2 wells. Statistical summaries present data from two time periods, long and short. Emphasis is on the short term results, obtained from January 2016 to December 2017. All statistics and trend information discussed in the text is for this period unless otherwise identified. Tables 3-1 and 3-2 provide statistics and trends respectively for both this recent period and the previous samples. During this recent sampling period, the number of samples is eight for all wells. The quantity of data available for certain wells is limited. These wells have limited data due to a short monitoring history, are seasonally dry, have low production or are slow to recover and did not yield adequate data for comprehensive analyses. Therefore, only long term trend tests are available for these wells. Apparent trends in individual wells, long and short-term, are discussed where applicable. Hydraulically upgradient wells are presented first.

Due to the presence of volatile organic compounds in the downgradient wells within channel Cc2, MW-2, MW-21 and MW-5D were put into assessment monitoring. As the first step in assessment monitoring, these wells were tested with an expanded parameter list as defined by WAC 173-351 Appendix III. Results indicated that the single parameter detected in the downgradient wells not included in the lists defined by Appendix I and II was dichlorodifluoromethane. These test results led to an agreement that wells in assessment monitoring at the site should be tested for dichlorodifluoromethane in addition to the Appendix I and II lists. This addition was specifically required for MW-20, MW-2, MW-21, MW-5D, MW-4, MW-8 and MW-27. For site wide consistency, all wells on site are tested for Appendix I and II parameters and dichlorodifluoromethane. At the request of Ecology, wells MW-2, MW-5D, MW-20 and MW-21 were sampled again for Appendix III analytes. Except for dichlorodifluoromethane, there were no detections of Appendix III analytes. A demonstration was presented to Ecology in 2014 and based on the findings in the demonstration, it was agreed that, with the exception of dichlorodifluoromethane, KCSWD would cease sampling for Appendix III analytes for five years starting in 2013. The last year Appendix III analytes were sampled in 2013.

It is also important to note that several compounds, in particular acetone and methylene chloride, have been frequently detected in blanks and field samples at similar concentrations. The likely source of these compounds is laboratory contamination.

The pH field data for the period between late 1993 and early 1996 may not be reliable because of inconsistent field instrumentation.

The summary statistics are presented in Table 3-1. A summary of long and short-term trend evaluations for individual wells is presented in Table 3-2. Exceedances of water quality standards, prediction limit exceedances, time-concentration plots, potentiometric maps, groundwater velocities, and raw analytical data are presented as appendices.

4.2.1. Groundwater Within or Adjacent to Channel Cc1

As described in Section 3.1.1, MW-10, MW-3, MW-4 and MW-13 are the only monitoring wells in the groundwater within or adjacent to channel Cc1 silt for which water quality samples were taken in the most recent period (January 2016 to December 2017). There was sufficient water to collect one sample from MW-3 and three samples from MW-4 during this period.

For the Fourth Quarter 2017 arsenic results in samples from MW-10 and MW-13 exceeded the state groundwater quality standards. There were no volatile organic compounds detected for the quarter. The trilinear diagram shows the sample is within the same calcium-magnesium-bicarbonate hydrochemical facie. During this quarter, the ionic balance for the MW-10 and MW-13 is within ten percent (see Appendix J), which is sufficient for characterization.

MW-10

MW-10 was installed with eight additional groundwater monitoring wells during the summer of 1995. MW-10 is located in the northwest corner of the site. It is screened between 252.34 and 262.34 feet MSL. MW-10 is northwest to the placement of the refuse. MW-10 monitors a perched system distinct from other wells above the lacustrine silt. Water quality in MW-10 is discussed below.

The pH (field) is neutral (median 7.3). Specific conductance (field), median 151.0 μmhos/cm and total dissolved solids (median 106.0 mg/L) levels are low and stable. Sulfate (median 9.0 mg/L), chloride (median 3.3 mg/L) and nitrate (median 0.62 mg/L) are low and stable. See time concentration plots and statistical summaries. During the recent period, no conventional parameters exceed the water quality standards.

Iron had no detections in the last 8 samples for dissolved iron but detected twice for total iron, however iron is low and stable. Concentrations of common metals, calcium, and magnesium are low and stable. A short term statistically significant increasing trend for alkalinity and field specific conductance was seen in samples from MW-10. Arsenic exceeds the State Groundwater Quality Criteria in all eight samples. Arsenic is to some extent common, a naturally occurring element in groundwater throughout western Washington as identified by USGS and Washington State Department of Health. As we transition from dissolved to total metals, in most cases there is minimal differences, however in the case of iron, like in MW-10 we see higher total values compared to dissolved values. This can be from sediment in the well, or well chemistry conditions that can precipitate total iron from the dissolved state or the aquifer soils.

No volatile organic compounds (VOC) have been detected in MW-10 since 2001.

In general, the water quality in this well is good with no indications of landfill impact.

MW-13

MW-13 is screened above the lacustrine silt in sandy soils. It was installed in 1992. It was placed on the quarterly monitoring schedule in June of 1994. MW-13 is located in the southeast portion of the site. It is screened between 261.07 and 266.07 feet. MSL.

The pH is neutral (median 7.2). Specific conductance (field) (median 166 μmhos/cm), total dissolved solids (median 119 mg/L), nitrate (median 0.12 mg/L), and sulfate (median 14.0 mg/L) are low and stable. See time concentration plots, and statistical summaries.

Manganese (only 6 detections in the last two years) is low and stable. Concentrations of common metals sodium, potassium and magnesium are low and stable. There were no short term statistical trends in this well. Thallium and zinc are sporadically detected. Vanadium is detected regularly at low levels. Mercury has been detected twice and copper has been detected once in the entire monitoring history. Their use as indicators of landfill impacts is limited.

Arsenic exceeds the State Groundwater Quality Criteria of 0.05 μg/L in all eight recent samples. No other samples exceed State or Federal standards. Arsenic is to some extent common, a naturally occurring element in groundwater throughout western Washington.

No volatile organic compounds have been detected in this well since 1999.

In general, water in this well is of good quality with no indications of potential landfill impact.

MW-3, MW-4

MW-3 had sufficient water to provide one sample in 2017 and MW-4 had sufficient water to provide three samples in 2017. MW-1 was decommissioned in April 2015. MW-4 is monitored quarterly for water levels and will be sampled if possible. MW-3 shows similar or decreased values compared to previous years when samples were collected. Available chemical data is shown on time concentration plots and in the descriptive statistics table. MW-4 was placed in

assessment monitoring in 2003, but did not previously have sufficient water for sampling until 2007. MW-3 had one exceedance of water quality standards for pH and one for arsenic. Samples from MW-4 exceeded pH twice, arsenic four times, and dissolved iron once in 2017. There were three volatile organic compound detections for samples inMW-4 in 2017; cis-1,2 dichloromethane, acetone, and trichlorofluoromethane.

MW-24

MW-24 also monitors water in channel Cc1. Per Chapter 4 of the 2004 Hydrogeologic Update, MW-24 is screened within a silt and will not be monitored unless water levels rise above the silt sand contact, at 291.0 feet MSL. Water levels are measured quarterly at MW-24 and the elevation has remained below the specified elevation.

Groundwater Perched In and Adjacent to Channel Cc1 Summary

Water quality in MW-10 is good and is not considered impacted by landfilling activities. The absence of dissolved manganese in this well is notable. The conditions in this well in combination with low iron suggest a predominantly oxidizing environment.

MW-13 water quality is good and is not considered impacted by landfilling activities as well.

Reduced water volumes in the other shallow wells following installation of the cover at the site suggest the cover is adequately preventing recharge through the waste and is protecting the groundwater.

4.2.2. Groundwater in Channel Cc2 & Cc3

Wells MW-9, MW-2, MW-20, MW-21, and MW-5D monitor the groundwater perched within channel Cc2. MW-8 and MW-14 monitor water beneath channel Cc2 and laterally equivalent with channel Cc3. MW-5D and MW-14 were decommissioned in April 2015.

Wells MW-2, MW-20, and MW-21 are completed in continuous thin sand that correlates with the elevation and location of one of the seeps (seep 2 or SW-W2) on the west side of the landfill.

For the Fourth Quarter 2017, MW-21 exceeded the groundwater criteria for arsenic, iron, and manganese. Well MW-2 exceeded for arsenic and manganese. Well MW-9 exceeded the groundwater criteria for arsenic and iron. MW-20 exceeded the groundwater criteria for arsenic and manganese (see Appendix B, Table 7 for Cc2 exceedances).

The trilinear diagram shows all of the samples to be within the same calcium-magnesium-bicarbonate hydrochemical facie, as they have been in past samples for these wells. MW-21 and MW-2 continue to be characterized by more dominant bicarbonate-carbonate characteristics. The cation/anion balance during this quarter, for the wells in this zone, is within ten percent (see Appendix J). The reported results are sufficient for characterization.

Interwell prediction limits for the Fourth Quarter 2017 are tabulated in Appendix B (Table 8). The prediction limits in Cc2 are compared to well MW-20 and are similar to historic values with MW-2, and MW-21 exceeding the prediction limit for: specific conductance, alkalinity, and vinyl chloride. Wells MW-21 and MW-9 exceeded the prediction limit for nitrate. MW-21 exceeded the prediction limit for arsenic.

MW-20

MW-20 is located in the southeast portion of the site. It was installed in October 1998. It is screened between 233.2 and 237.5 feet MSL in a continuous sand bed within the lacustrine silt. It is upgradient of the landfilled area and used to calculate prediction limits and for upgradient comparison to wells MW-2, MW-21 and MW-5D.

The field pH results show a neutral pH (median 7.3). Measurements of specific conductance (median 225 μmhos/cm), chloride (median 3.2 mg/L), sulfate (median 16.7 mg/L) and total dissolved solids (median 145 mg/L) are stable.

Iron was detected in the past seven samples, calcium (median 13.4 mg/L) and magnesium (median 13.7 mg/L) both exhibit short term stability. During the 2017 reporting period, arsenic levels exceed the State Groundwater Quality Criteria in four of four quarterly samples.

In 2017, there was no volatile organic compounds detected in MW-20.

Groundwater from this well is believed to represent natural conditions. This well is not impacted by landfilling activities.

MW-9

MW-9 is located in the northwest portion of the site. It was also installed as part of the addition of eight groundwater monitoring wells during the summer of 1995. It is screened between 223.64 and 233.64 ft. MSL in sand and gravel.

The pH conditions in this well are fairly neutral with a median of 7.0. The specific conductance (median 194 μmhos/cm) is stable. The measurement of total dissolved solids (median 131 mg/L) fluctuates in a narrow range and exhibits no evident trend. Nitrate (median 0.41 mg/L), chloride (median 5.1 mg/L), and sulfate (median 12.6 mg/L) appear to be stable in recent samples.

Iron levels are low and stable with three detections in the past 8 samples. Sodium (median 5.9 mg/L) levels are stable. Arsenic exceeds the State Groundwater Quality Criteria of 0.05 μg/L in the eight recent samples. Arsenic is to some extent common, a naturally occurring element in groundwater throughout western Washington.

In 2017, there were no volatile organic compounds detected in MW-9.

The general water characteristics in this well represent good quality with no indications of landfill impact.

MW-2 and MW-21

These three wells are located downgradient and in the southwest portion of the site. MW-2 is located easterly from the other two. Wells MW-2 and MW-5D have been monitored quarterly since September 1986. MW-21 was installed in fall 1998 and has been monitored continuously since then. MW-5D was decommission in April 2015.

The screen elevations for these wells are: 227.58 ft. to 244.58 ft. MSL for MW-2; and 233.7 ft. to 243.1 ft. MSL for MW-21.

The pH measurements from these wells show conditions close to neutrality. The median values for the two wells range from 6.7 to 6.9 are stable in all three wells. Several indicator parameters and metals in recent sampling events from wells MW-21 and MW-2 are elevated relative to MW-20. MW-2 has the highest levels for total dissolved solids (median 190 mg/L), specific conductance (median 309 μmhos/cm), calcium (median 19.9 mg/L), and magnesium (median 22.8 mg/L). Samples results from MW-21 indicate levels elevated relative to MW-20 for specific conductance (median 267 μmhos/cm), total dissolved solids (median 173 mg/L), iron (median 0.43 mg/L), manganese (median 0.459), calcium (median 18.7 mg/L), and magnesium (median 16.5 mg/L). Chloride levels in both wells are lower than the level in the upgradient well MW-20.

The State and Federal groundwater quality criteria are exceeded consistently for manganese in wells, MW-2, MW-20 and MW-21. All recent samples from wells MW-9, MW-20 and MW-21 exceeded the State Ground Water Criterion for arsenic in 2017. MW-21 exceeded iron in all four samples, MW-20 had two exceedances in iron and MW-9 had one iron exceedance in 2017 (see Appendix B, Table 7 for Cc2 exceedances). As we transition from dissolved to total metals, in most cases there is minimal differences, however in the some cases we see higher total values compared to dissolved iron. For MW-21 we do see higher values of total iron and manganese. This can be from sediment in the well, or well chemistry conditions that can precipitate total iron from the dissolved state or the aquifer soils.

MW-21, MW-2 nor MW-5D showed no statistically significant short term trends for the past 8 samples except for one downward trend in MW-2 for trichlorofluoromethane. MW-20 showed a statistically significant decreasing short term trend for pH. Wells screened within CC2 continually show a long term stabilized of groundwater conditions.

Groundwater sampling results from MW-2, MW-21, and MW-5D continue to show detections of volatile organic compounds (VOCs). The detections for the past eight samples indicate overall stable levels for VOCs with minimal short term trends as listed above. All of these compounds are present in landfill gas as well as leachate and their distribution between phases (partitioning) is regulated by physical properties (Henry's constant, solubility, vapor pressure) where these phases are in contact.

Most of these detected compounds are likely components of the waste stream; however others are almost certainly degradation products of tetrachloroethene and/or trichloroethene by the process of reductive dechlorination. The detected VOCs, wells, median values or recent detection frequency for the last eight samples are:

- *Cis*-1,2 dichloroethene in MW-21 (7 out of 8 samples, median 0.935 μg/L), and MW-2 (4 out of 8 samples, median 0.1 μg/L);
- Vinyl chloride in MW-21 (7 out of 8 samples, median 0.077 μg/L), and MW-2 (8 out of 8 samples, median 0.078 μg/L);
- Trichlorofluoromethane in MW-21 (7 out of 8 samples, median 0.46 μg/L), and MW-2 (8 out of 8 samples, median 0.86 μg/L);
- Dichlorodifluoromethane in MW-21 (7 out of 8 samples, median 1.5 μg/L), and MW-2 (8 out of 8 samples, median 5.0 μg/L).

In 2017, MW-2 and MW-21 exceeded the State Groundwater Quality Criteria for vinyl chloride for all samples taken (see Appendix B, Table 7 for Cc2 exceedances).

Historically, MW-5D has displayed elevated concentrations of some indicator constituents, along with some exceedances. However, evaluation of recent data indicates in most cases short-term stability at considerably lower concentrations than historical data in this well. In 1992-1995, total dissolved solids, chloride, manganese, calcium, and magnesium levels went up while iron levels went down. In early 2002, manganese, total dissolved solids and chloride levels were slightly higher than previous quarters while iron levels were unusually low. Levels for total dissolved solids, chloride, manganese, calcium, and magnesium returned to previous levels and iron came back up. During 2001 – 2002 an event similar to the one observed between 1992 and 1995, might have occurred but to a much lesser extent.

The assessment monitoring program for Appendix III parameters detected dichlorodifluoromethane as the single Appendix III parameter not included on the Appendix I and II lists. This parameter is included in the current monitoring program for this site. At the request of Ecology, wells MW-2, MW-5D, MW-20 and MW-21 were sampled again for Appendix III analytes. With the exception of dichlorodifluoromethane, there continue to be no detections of Appendix III analytes. A demonstration was presented to Ecology in 2014 and based on the findings in the demonstration, it was agree that, with the exception of dichlorodifluoromethane, KCSWD would cease sampling for Appendix III analytes for five years starting in 2013. The last year Appendix III analytes were sampled in 2013.

There is an impact from landfill activities in wells MW-2, MW-5D, and MW-21. Closure activities have contributed to improvement of the water in MW-2, and MW-5D. MW-21 was installed following closure and exhibits similar characteristics to MW-2 and MW-5D. Improvement in water quality is characterized by decreases in specific conductance, chloride, nitrate and a reduction in the frequency and level of several VOCs.

The declines in concentration of general water quality indicators (specific conductance, dissolved solids, chlorides, metals, etc.) suggest that leachate impacts have been controlled as a result of closure activities. A different response for several volatile compounds strongly suggests that the source of these compounds has not been completely addressed by leachate control and most likely results from a landfill gas transport mechanism (although several show decreasing levels). The volatile compounds detected in groundwater are all present in significant amounts in landfill gas. Characterization of leachate indicates that the observed groundwater quality in impacted wells could not be achieved by leachate alone. Using the best available data, Vashon leachate does not contain adequate concentrations of VOCs or alkalinity to result in groundwater quality observed at MW-5D. Alkalinity and VOCs are two of the most likely contributions to groundwater by interaction with landfill gas.

Groundwater perched in Channel Cc2 Summary

The recent data reflects the natural variability in water quality present in MW-20. The relatively low and stable concentrations detected in MW-20 indicate that groundwater quality in this well is not impacted by the landfill. Chemical data from MW-20 represents natural aquifer conditions in the vicinity of the landfill.

Wells in the groundwater perched in channel Cc2 displaying impacts from landfill activities include MW-2and MW-21. Stronger reducing conditions are identified in wells MW-21 than in MW-2, which are consistent with historical conditions. Most volatile compounds indicate decreasing or stable levels.

Patterns observed for VOCs in wells MW-2, and the fact that the wells were constructed with screened intervals extending above the saturated zone, indicate the possibility of a different mechanism of transport than for other water quality parameters. As discussed in the 1992 Annual Report, the observations indicate landfill gas as the most probable source of these groundwater impacts.

Further investigations were conducted in 2003. Gas samples were taken from the airspace above the water table. Samples of landfill gas from probes and the active gas collection system were also taken to provide a comparison to typical landfill gas generated at the Vashon Landfill. The results from this sampling event were submitted to agency in 2006.

Further evaluation of the site continued in 2004. An environmental evaluation technical memorandum was submitted to agency in 2006. The technical memorandum made recommendations for further investigation and actions on the site. These recommendations are discussed in Section 1.3. These wells will continue to be monitored for response to any activities undertaken at the site.

Wells MW-8 and MW-14 monitor the groundwater perched beneath channel Cc2. MW-14 was decommissioned in April 2015.

Well MW-8 is screened lower than MW-9. Water levels in this well likely indicates vertical recharge to the underlying sand and gravel unit.

MW-8

MW-8 is located in the west portion of the site. It was also installed as part of the addition of eight groundwater monitoring wells during the summer of 1995. MW-8 is screened between 203.24 and 213.24 ft. MSL and is beneath the lacustrine silt. Water levels in MW-8 have averaged 206.92 ft with the highest elevation at 208.23 ft and the lowest at 205.57 ft, therefore the screened interval in MW-8 has intersected the potentiometric surface in all depth to water measurements.

MW-8 has nearly neutral pH values (median 6.9) with little variability and no apparent trends. Specific conductance (median 172 μmhos/cm), total dissolved solids (median 122 mg/L), nitrate (median 4.2 mg/L), sulfate (median 7.1 mg/L) and chloride (median 4.7 mg/L), these levels exhibit minor variability and no discernible trend.

Iron levels (only 1 detection in the past 8 samples) are low and stable. Other metals detected are barium, copper, manganese, vanadium and zinc. These detections are near or at the laboratory minimum detectable level. Magnesium (median 9.0 mg/L), sodium (median 6.0 mg/L), and potassium (median 1.1 mg/L) exhibits a short term increasing trend in field specific conductivity. Unlike other monitoring wells, there are no exceedances for arsenic State Groundwater Quality Criteria.

No volatile organics were detected at MW-8 in 2017.

General characteristics show this well to be of good quality except for nitrate. The source of the nitrate is uncertain due to the lack of any other impact indicators. Water in MW-8 is of good quality with low level of impact related to nitrate.

Groundwater Perched Beneath Channel Cc2 Summary

MW-8 is constructed with the screened interval extending above the saturated zone. Samples from this well show stable and decreasing trends.

4.2.3. Groundwater in the Unit D Aquifer

Wells MW-7, MW-11, MW-12, MW-19, MW-26 and MW-29 monitor the groundwater in the Unit D Aquifer. MW-27 is screened both in Channel Cc3 and the Unit D Aquifer and was decommissioned July 2016.

Construction differences make determination of groundwater gradients and flow direction difficult in the area monitored by these wells. Average screened depth below the water table in the wells ranges from near zero in MW-11, MW-26 and MW-29 to more than 30 ft in MW-12 and MW-7. These differences along with spatial variation over the site may well account for prediction limit exceedances using MW-7 as background data.

For the Fourth Quarter 2017, Arsenic exceeded the State Groundwater Quality Criteria in all wells. MW-29 exceeded the State Groundwater Quality Criteria for iron and wells MW-7, MW-19, MW-26 and MW-29 exceeded the groundwater criteria for manganese (see Appendix B, Table 3 for exceedances). Volatile organic compounds were detected for carbon disulfide and vinyl chloride this quarter. The trilinear diagram shows all samples are within the same calcium-magnesium-bicarbonate hydrochemical facie. During this quarter, the ionic balances for the wells in this zone are within ten percent (see Appendix J), which is sufficient for characterization.

MW-7

MW-7 is located in the southeast portion of the site. Historically, MW-7 has been interpreted to represent upgradient conditions. The interpretation provided in the 2004 Hydrogeologic Update, redefines MW-7 as downgradient of the site. This well was installed as part of the addition of eight groundwater monitoring wells during the summer of 1995. The screened elevations for this well are between 141.09 and 151.09 ft. MSL.

The pH conditions in MW-7 are slightly alkaline with a median of 7.7. Specific conductance (median 187 μmhos/cm), and ammonia (median 0.271 mg/L) is

consistently detected in this well. Nitrate (only 2 out of 8 detections), alkalinity (median 77 mg/L), total dissolved solids (median 132 mg/L), chloride (median 3.4 mg/L), and sulfate (median 10.8 mg/L), are stable.

Well MW-7 had iron for four detections in the past eight samples and manganese (median 0.182 mg/L) display no significant trends. Manganese exceeds water quality standards in three of four of the most recent samples. All eight recent samples exceed State Groundwater Quality Criteria for arsenic. Other metals detected occasionally in this period include selenium and zinc.

One volatile organic compound, carbon disulfide, was detected in 2017 at MW-7.

The results from MW-7 are considered to represent natural conditions and are not related to landfilling activities.

MW-11, MW-25 and MW-29

MW-11 was installed as part of the addition of eight groundwater monitoring wells during the summer of 1995. The screened elevations for these wells are between 152.28 and 162.28 ft. MSL. MW-11 was damaged during the Nisqually earthquake in February 2001. No more samples have been collected since then. The 2001 report contains the last assessment on well MW-11. The 2001 assessment indicated no impacts in this well from the landfill. MW-11 was decommissioned in 2003. MW-25 was installed to replace MW-11. However the screen failed during installation and the well cannot be developed. The well has been left in place for use as a piezometer. MW-29 was subsequently installed in 2003 as the replacement well for MW-11. The screened elevations for MW-29 are between 155.00 and 169.80 ft. MSL.

The water pH for MW-29 is slightly alkaline (median 7.5). Specific conductance is low (median 243), total dissolved solids (median 154 mg/L), alkalinity (median 102 mg/L), chloride (median 3.6 mg/L), sulfate (median 15.8 mg/L), are stable.

Iron (median 0.71 mg/L) and manganese (median 0.091 mg/L) are stable. Arsenic, Iron and manganese exceed water quality standards in all 2017 samples. All samples exceed State Groundwater Quality Criteria for arsenic. Other metals detected occasionally in this period include selenium and zinc.

No volatile organic compounds were detected in 2017 at MW-29.

The results from MW-29 resemble the historic MW-11 data and are considered to represent natural conditions and are not related to landfilling activities.

MW-12, MW-19, MW-26, MW-27 and MW-28

MW-12 and MW-19 were both installed in the summer of 1995. MW-12 is located to the south of the site. The screened elevations for MW-25 are between 129.62 and 139.62 ft. MSL. MW-19 is located to the northwest of the site. The screened elevations for MW-19 are between 131.10 and 141.10 ft. MSL.

MW-26 and MW-27 were both installed in 2003. MW-26 is located in the northwest corner of the site and the screened elevations are between 141.02 and 155.12 ft. MSL. MW-27 is screened both in channel Cc3 and the Unit D Aquifer. Water quality discussions for this well are included with the other regional wells. The screened elevations for MW-27 are between 180.07 and 194.27 ft. MSL. MW-27 was decommissioned in July 2016.

MW-28 has been dry since installation. The screened elevations for MW-28 are between 159.51 and 173.91 ft. MSL.

The pH for the Unit D Aquifer for monitoring wells MW-12 and MW-19 is slightly alkaline (medians 7.3 and 7.6). The pH for MW-27 was neutral (median 6.8) and for MW-26, more alkaline (median 8.0).

Typically parameter levels for MW-19 are higher than in MW-7 indicated by prediction limit (PL) exceedances, however there were no prediction limit exceedances in 2017 in MW-19. The highest concentrations of these parameters are low for groundwater in general and area groundwater specifically (see table on the next page). All parameters are currently stable.

Manganese and arsenic concentrations in MW-19 exceed the water quality standard criteria in all four samples last year but zero for iron (see Appendix B, Table 3 for the Unit D Aquifer exceedances).
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MW-12 and MW-27 historically are the only wells in this unit with infrequent detections of manganese, except for one detection in the entire monitoring history of MW-27 and two detections in MW-12 for the history of the well. MW-12 did not exhibit any short term trends.

Trends for MW-26 are stable for the past 8 samples with no short term trends. MW-29 exhibits a short term significant decreasing trend in pH, and a short term increasing trend in ammonia and total manganese. Manganese concentrations in MW-29 and MW-26 exceed the water quality standard criteria in all samples in 2017. Arsenic concentrations in MW-12, MW-19, MW-26 and MW-29 exceed the water quality standard criteria in all samples in 2017 (see Appendix B, Table 3 for the Unit D Aquifer exceedances).

One volatile organic compound, vinyl chloride, was detected in 2017 in a sample from MW-12 in the fourth quarter. This sample was qualified by the laboratory as an estimated value above the method detection limit but less than LLOQ quantitation limits. Comments made by the laboratory stated that a preceding

sample prior to MW-12 contained a vinyl chloride concentration. A reanalysis of the MW-12 sample was performed and found vinyl chloride to be nondetected.The initial analysis was performed on the last day of the 14 day holding time and the following day reanalysis was performed outside holding time requirements. Therefore, the 2017 fourth quarter sample was qualified as JLT to indicate a high bias. The first quarter sample of 2018 is a nondetect for vinyl chloride in MW-12. At this time, we do not believe the original vinyl chloride value to be valid.

In general, conditions in MW-12 appear to be at a higher redox potential than other wells in the regional aquifer. This environment is characterized by lower levels of iron and ammonia, absence of manganese, and higher levels of nitrate.

The redox conditions in the north portion of the site are more reducing, determined by lower levels of nitrate, and higher levels of iron, manganese and ammonia.

The following table presents a water quality comparison of background conditions and the regional aquifer characterized beneath the Vashon Landfill. VOCs are not summarized due to the absence of detections in these wells.

Comparison of Background Conditions and the Regional Aquifer

CONSTITUENT	Area Background Range*	Vashon Landfill Unit D Aquifer Jan 2016- Dec 2017
General Indicators		
pH	6.5 to 8.3	5.9 to 8.17
Conductivity (micromhos/cm)	80 to 545	93.6 to 332.6
Chloride	1.6 to 14	1.26 to 10.3
Sulfate	<0.50 to 41	5.22 to 20.7
Nitrate	<0.2 to 5.8	<0.01 to 5.53
Metals[a]		
Arsenic	<0.001 to 0.017	<0.001 to 0.0108
Iron	0.04 to 10	<0.005 to 10.5
Manganese	0.005 to 0.960	<0.001 to 1.1
Sodium	5.0 to 62	4.5 to 11.8

Notes: All values except pH and specific conductivity are reported in milligrams per liter (mg/L).
[a] = Total metals concentrations are reported for area background values.
*Background values are based on Carr (1983) and Vashon-Maury Island Groundwater Management Plan (1998)

Regional Aquifer Summary

Trend analyses for most wells in this unit show stable concentrations for many of the constituents in the short-term period. Exceptions include an increasing trend in dissolved magnesium for MW-7 and a decreasing trend for total manganese in MW-19. Conditions present in wells in the Unit D Aquifer show no indication of impacts attributable to landfill activities at the Vashon Island site. The water quality in this unit is good and is believed to represent natural conditions.

Groundwater flow is not well defined in the regional aquifer in the area monitored by these wells. The decommissioning of MW-27, screened across the channel Cc3 – Unit D Aquifer contact creates a more reasonable potentiometric map. Additional evaluations are scheduled to be completed in 2018 to evaluate the aquifer and update the potentiometric map.

4.3. WEIR and SURFACE WATER QUALITY

The weirs are located on the western ravine adjacent to the landfill (Figure 3). The elevations for the weirs are 239.33 ft for Weir 1; 224.78 ft for Weir 2; and 195.38 for Weir 3. The weir sampling locations SW-W1, SW-W2 and SW-W3 are located downstream of each weir. The elevations for the sampling locations are 230.59 ft for SW-W1; 189.89 ft for SW-W2; and 187.23 ft for SW-W3 (See Figure 3). The sampling stations consist of a v-notch weir.

Historically, the naming for these locations has on occasion been inadvertently switched. After a thorough review of the data, corrections have been made and the probable results from switching location names have been associated with the correct location name. However, single unusual results may be the result of the naming issues rather than true fluctuations in the data. As a result of this data issue, results reported previously may differ from the current conditions.

The weirs have been monitored since March 1991. Results for water from the weirs are presented in two periods similar to groundwater. Emphasis is on results obtained from the last eight samples, predominantly between 2016 and 2017. Four samples were collected from each of the three weirs in 2017.

The specific conductance ranges between 180 and 220 μmhos/cm for SW-W1; 515 to 648 μmhos/cm for SW-W2; and 240 to 320 μmhos/cm for SW-W3. Chloride levels range from 5 to 8 mg/L for SW-W1; 17 to 22 mg/L for SW-W2; and 5 to 9 mg/L for SW-W3. In general for specific conductance and chloride, SW-W1 has the lowest levels while SW-W2 displays the highest levels, and SW-W3 is midrange but tends closer to SW-W1. The maximum levels for both constituents have decreased compared to historical values for all three locations and in general the variability has decreased, as shown by decreases in standard deviation for short and long term periods at SW-W2 and SW-W3.

The medians for calcium concentrations are 15 mg/L for SW-W1, 50 mg/L for SW-W2, and 22 mg/L for SW-W3. The medians for magnesium concentrations are 12 mg/L for SW-W1, 43 mg/L for SW-W2, and 17 for SW-W3. The medians for potassium concentrations are 1.1 mg/L for SW-W1, 3.1 mg/L for SW-W2, and 2.2 mg/L for SW-W3. The medians for sodium concentrations are 7 mg/L for SW-W1, 15 mg/L for SW-W2, and 9 mg/L for SW-W3. As with specific conductance and chloride, SW-W1 and SW-W3 have lower levels for calcium, magnesium, potassium, and sodium, while SW-W2 has the higher levels. The levels of these metals are stable relative to long term values at all three locations. All medians above are equal to or lower than last year's values.

The only volatile organic compound (VOC) detected with any frequency in the weirs is vinyl chloride. Vinyl chloride is rarely detected in SW-W1 but there was one detection in 2016 and four in 2017. Vinyl chloride is occasionally detected in SW-W2, but is routinely detected in SW-W3. The median decreased in the recent samples for SW-W3 at 0.045 μg/L. SW-W2 had no vinyl chloride detections in the recent 8 samples.

Most of the exceedances of the Federal and State Surface Water Quality Standards are for metals. Historically the value of these exceedances in evaluating water impacts associated with municipal solid waste landfills is limited since the standards are based on dissolved metals and the weir results are based on total metals. In 2007, field procedures changed allowing samples collected to be field filtered and metals to be analyzed for both total and dissolved constituents. Dissolved metals were then

compared to groundwater criteria and total metals were compared to surface water criteria. Because water collected at the weirs is truly surface water, having been exposed to atmospheric conditions, it will no longer be compared to groundwater standards starting in 2011. Ammonia, Iron and one lead sample exceed the surface water quality standard in 2016 (see Table 13, Appendix B). All other exceedances are very inconsistent.

In November of 2011, a new surface water sampling location was established. SW-E is located approximately 1200 feet southwest of the weir locations on the east side of a culvert on Robinwood Road SW, approximately 200 feet south of the Robinwood Road SW-Sunset Road SW intersection (see Figure 1). For the first sample, we sampled for the same analytes as for the weirs but this analyte set will be paired down to a few analytes starting in the first quarter of 2015. As of 2015, SW-E will only be sampled for pH, specific conductance, total arsenic, total calcium, total iron, total magnesium, total manganese, total potassium, total sodium and vinyl chloride.

SW-E had a slightly alkaline pH of 7.8 and a specific conductivity of 180 umhos/cm. Specific conductivity and chloride are similar to weir SW-W1. For metals, arsenic is 0.002 mg/L. calcium is 14 mg/L, sodium is 7 mg/L, iron is 0.07 mg/L, magnesium is 12 mg/L and potassium is 2.0 mg/L. SW-E has lower metal values in all metals compared to SW-W1 with the exception of potassium which is only approximately 1 mg/L higher.

SW-E had no vinyl chloride detections.

Weir and Surface Water Summary

Conditions in SW-W1 represent the lowest levels of impact while SW-W2 displays somewhat higher low levels. SW-W3 exhibits a midrange impact on the basis of conventional parameters and metals, but has frequent detections of vinyl chloride. Water quality monitoring will continue at the weirs to provide water quality data for surface water flow leaving the site. The water quality is compared to surface water standards. The new down-stream surface water station has water quality values similar or better than SW-W1.

4.4. OFFSITE DOMESTIC WELL MONITORING

In 2002, Department of Natural Resources and Parks (DNRP) conducted sampling on Vashon-Maury Island in 11 domestic wells located around the landfill. No evidence of contamination originating from the landfill was found. The data was presented in the 2002 Annual Report. Data are included with the onsite well data, in the pdf files.

In 2005 SWD agreed to monitor 3 of these 11 wells. The first round of these samples was collected in October 2005. One of the three wells is no longer sampled as access is no longer available. Starting in 2010, samples will be collected from both of the offsite wells bi-annually. Four samples were collected in 2017 from the two off site

wells. No evidence of contamination originating from the landfill was found. The results are included in the .pdf files, in Appendix I.

5. Landfill Gas

Landfill gas migration is monitored by a network of compliance probes installed around the perimeter of the landfill and ambient air stations around the property boundary. The monitoring network comprises of nine ambient air stations, three monitoring wells and twenty-six gas probes. Probes are monitored monthly. The results can be found in Appendix K. There were no detections in 2017. The effects of landfill gas on current groundwater conditions are being reviewed to determine whether data gaps exist in the current analysis. In 2017, two sets (shallow and deep) temporary gas probes were installed to continue the determination of landfill gas on the south hillslope. Conclusions from the landfill gas review indication that gas well GW-9 is efficiently removing methane within a 100 feet radius of influence (KCSWD, 2017).

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

Conditions at the Vashon Landfill have continued the historic trend with some volatiles showing decreasing trends. Therefore most of the conclusions drawn from the previous Annual Reports hold true for this report as well. The following conclusions reiterate some from the previous Annual Reports.

1. The groundwater generally moves westward in the middle channel of the lacustrine silt, now designated channel Cc2, within Unit C.
2. The flow direction within the Unit D Aquifer is better defined and potentiometric maps show less radial flow after well MW-27 was decommissioned. The final review of the aquifer, due in 2018 as part of the remedial investigation will further define the potentiometric surface as previewed in the third and fourth quarter potentiometric maps..
3. The wells in the Unit D Aquifer showed low sensitivity to hydrologic activity, based on the observation of very small seasonal water level fluctuations, indicating limited groundwater recharge in the area of the landfill.
4. Landfilling impacts have been recognized in channel Cc2 at wells MW-21 and MW-2. Low levels of VOCs have been detected frequently in wells MW-2 and MW-21. Detections for most volatile compounds have declined significantly or are stable in the short term. Leachate is believed to have contributed to impacts

in the past. Recent data, specifically levels of VOCs in MW-21 and MW-2, suggest possible historic contaminant transport from landfill gas.

5. Previous expanded Appendix III analyte testing shows no new detections.
6. The landfill closure has been effective in improving the water quality condition of impacted wells, based on reductions in specific conductance, total dissolved solids, chloride and several VOCs.
7. Results obtained from wells in the regional aquifer do not show impacts attributable to landfill activities. The data reflects the natural variations in water quality that exist around the site.

6.2. Recommendations/Proposed Actions

1. The existing monitoring network shall continue to be monitored as described in the 2004 Vashon Island Landfill Hydrogeologic Report Update and following protocols from the Vashon Island Landfill Sampling and Analysis Plan.
2. Evaluation of the operating efficiency of the landfill gas collection system and probe network will continue in 2018 to determine if improvements to the collection and treatment system are needed.
3. Monitoring of the wells will continue for Appendix I and II parameters, with the addition of dichlorodifluoromethane. In 2018, KCSWD will perform the last of two samples for Appendix III for a minimum of once per year for two years.
4. The water bearing zone in channel Cc2 shall continue in assessment monitoring in accordance with WAC 173-351-430.
5. Surface Water sampling site SW-E will be sampled quarterly for pH, specific conductivity, turbidly, hardness, total metals and vinyl chloride.

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Vashon Island Closed Landfill Vicinity Map

King County
Department of
Natural Resources and Parks
Solid Waste Division

Figure 1

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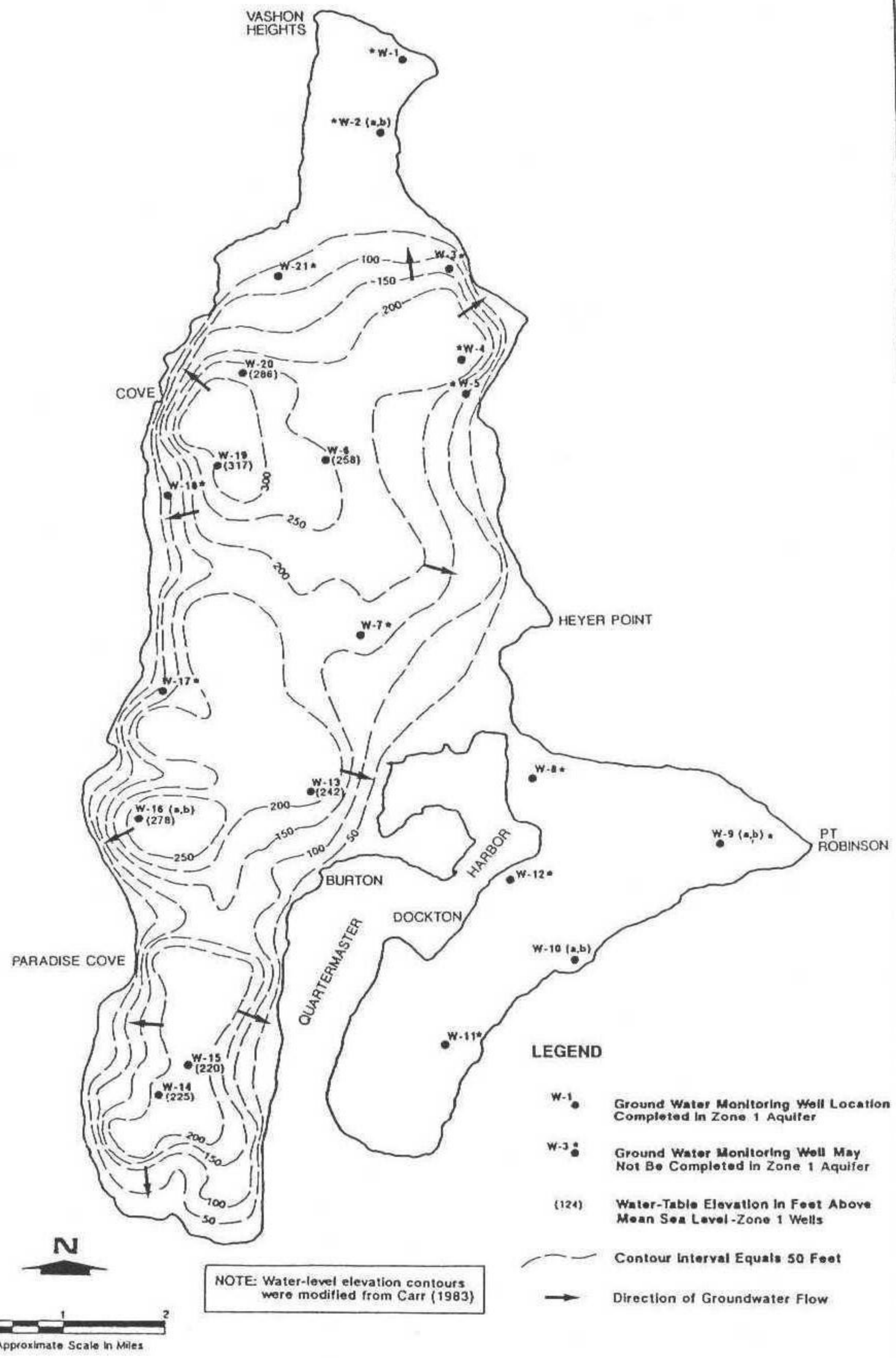
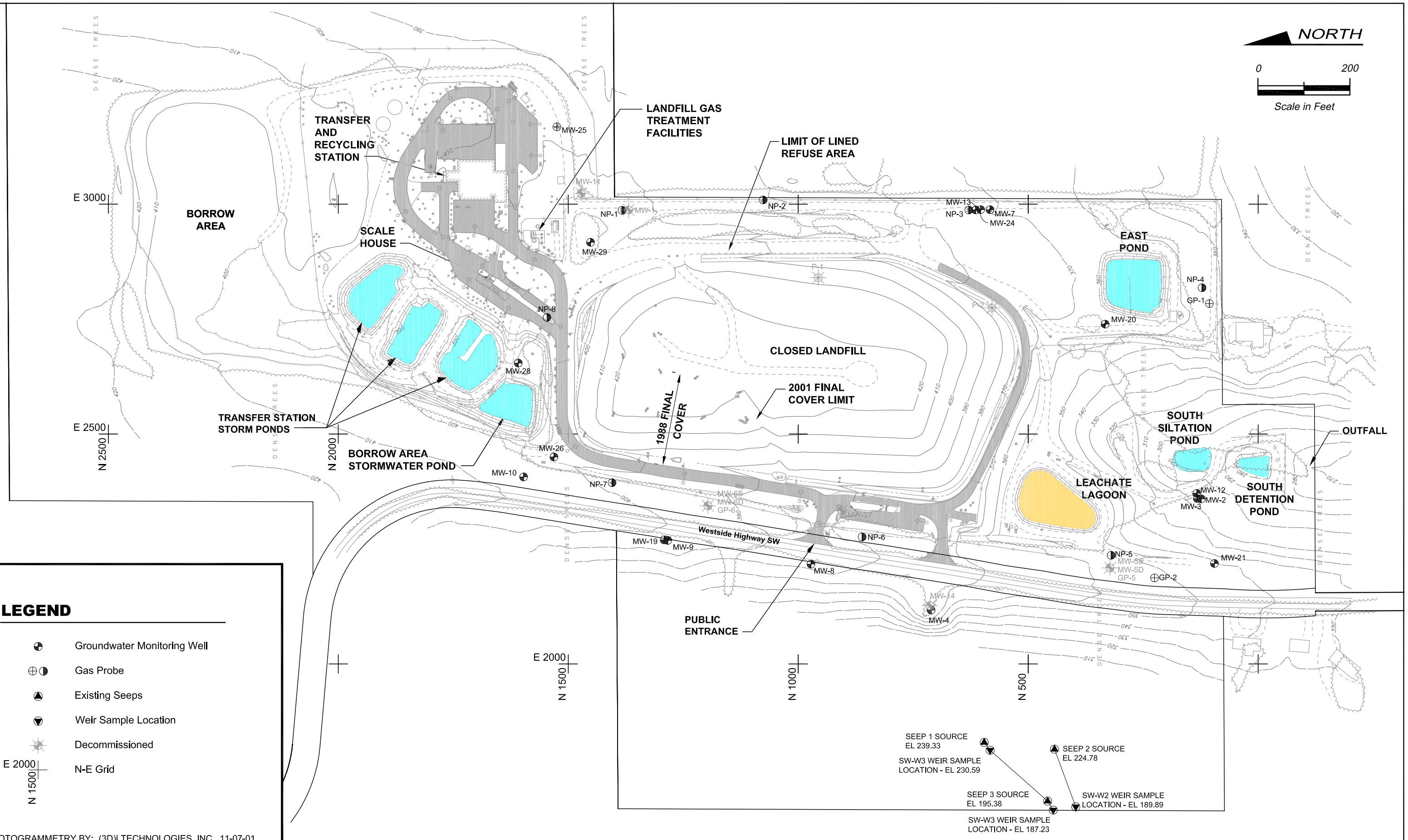


King County
Department of Natural Resources and Parks
Solid Waste Division

GENERALIZED WATER-TABLE ELEVATIONS FOR ZONE 1 AQUIFER
Source April 1991,
Vashon Groundwater Management Plan

FIGURE 2



King County

Department of Natural Resources and Parks

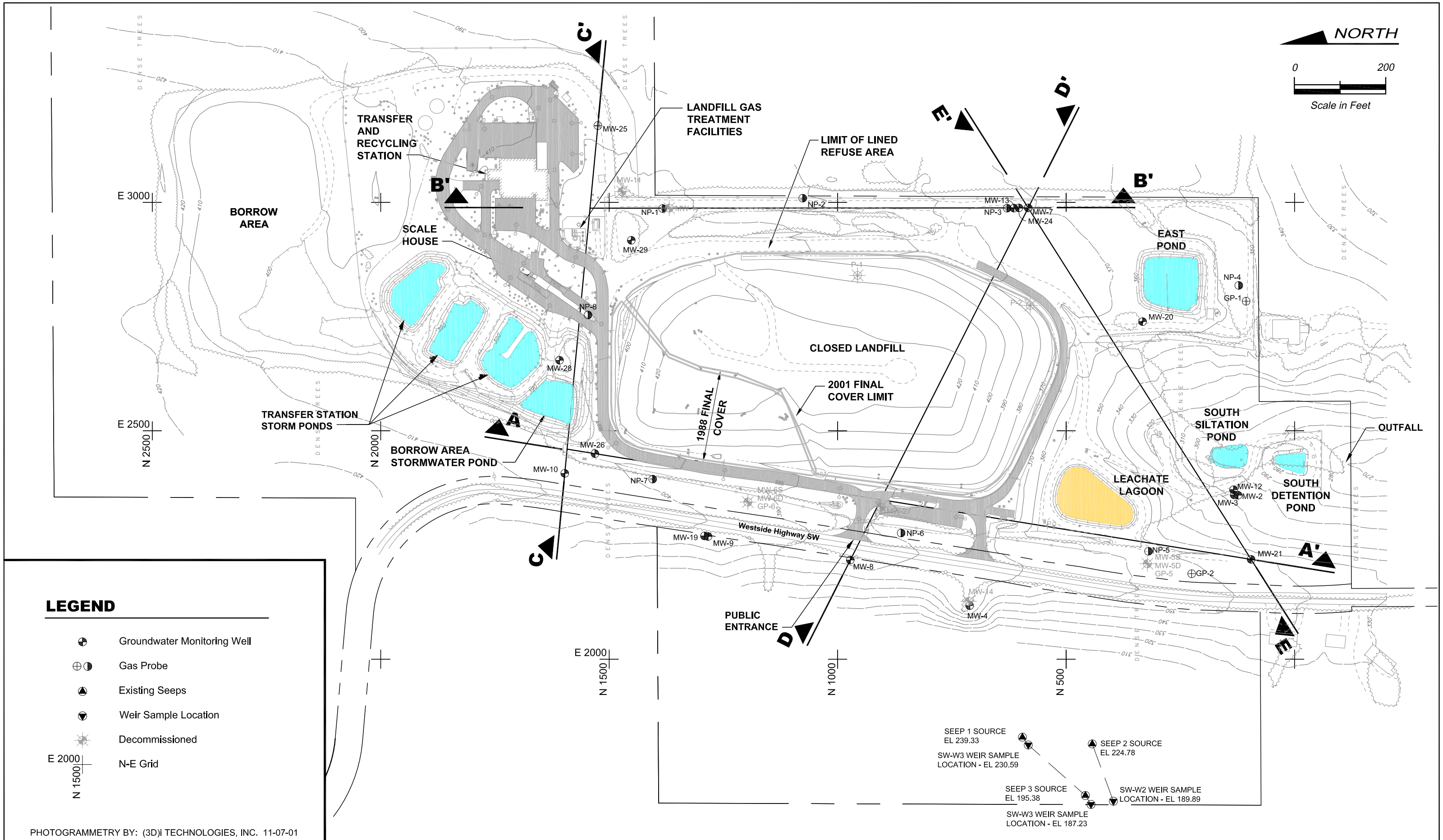
Solid Waste Division

Site Map

Source December 2004

Vashon Island Landfill Hydrogeologic Report Update

Figure **3**



King County

Department of Natural Resources and Parks

Solid Waste Division

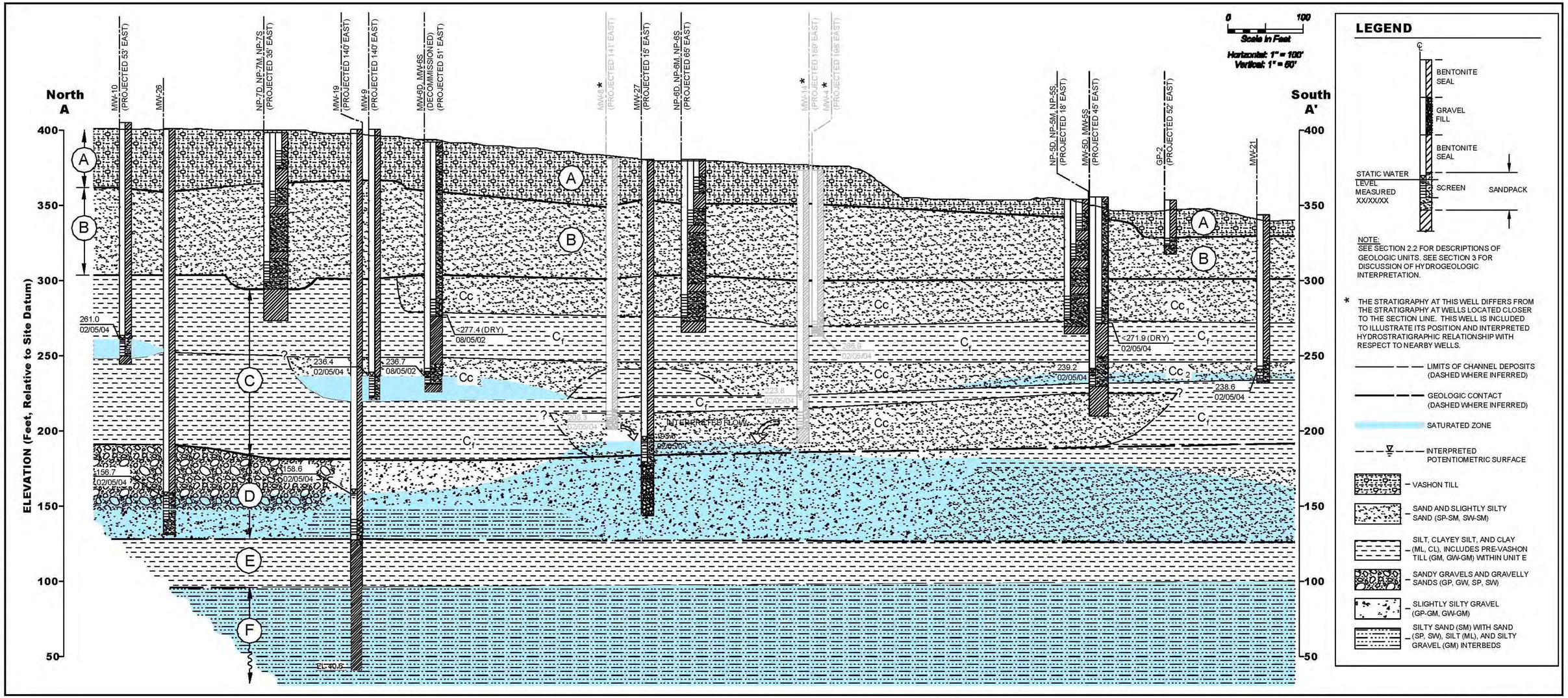
Hydrogeologic Cross Section Location Map

Source December 2004

Vashon Island Landfill Hydrogeologic Report Update

Prepared by Berryman & Henigar, with UES

Figure **4**



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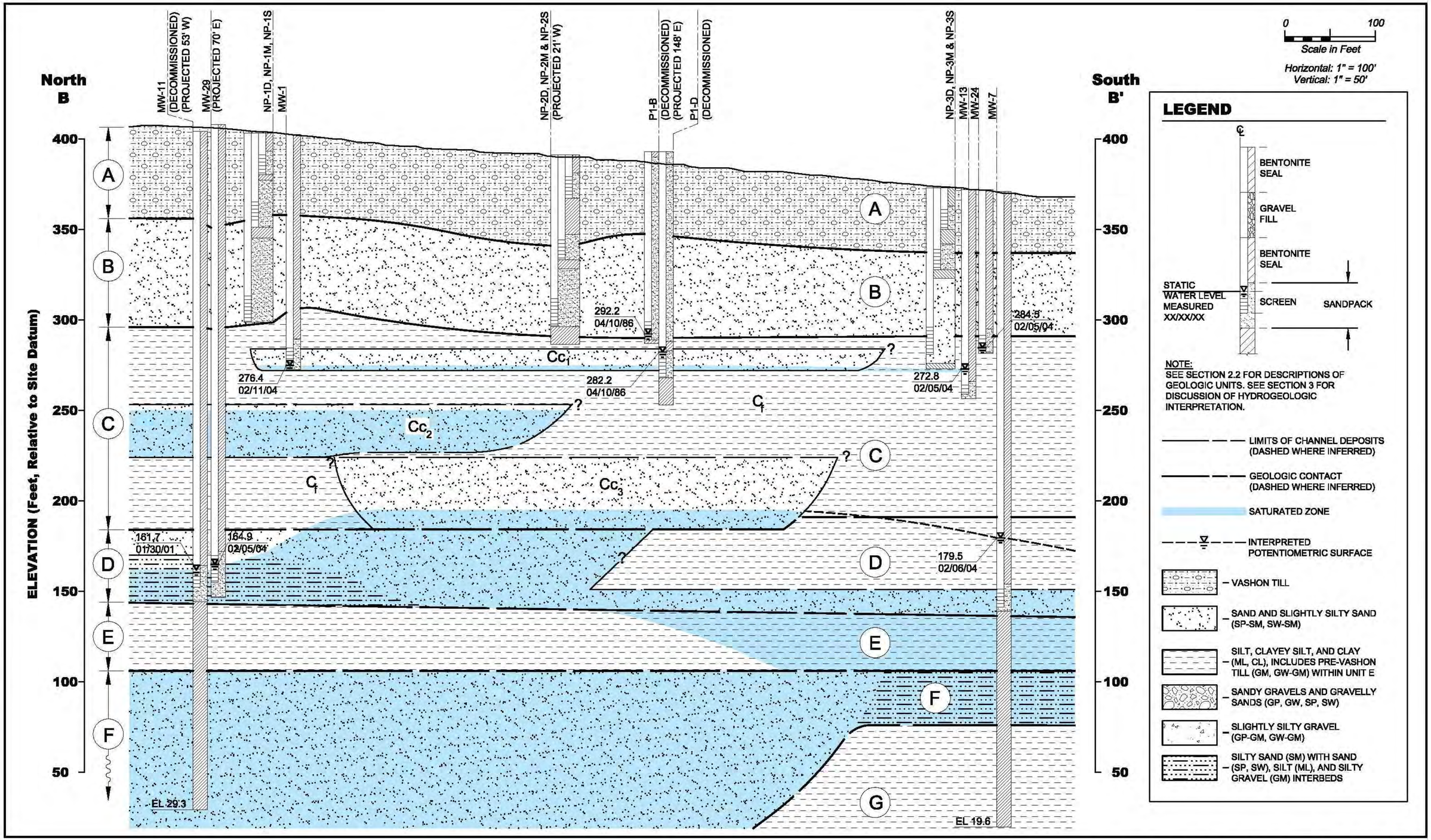
King County
Department of Natural Resources and Parks
Solid Waste Division

Hydrogeologic Cross Section A-A'

Source December 2004,
Vashon Island Landfill Hydrogeologic Report Update

Prepared by Berryman & Henigar with UES

Figure 5



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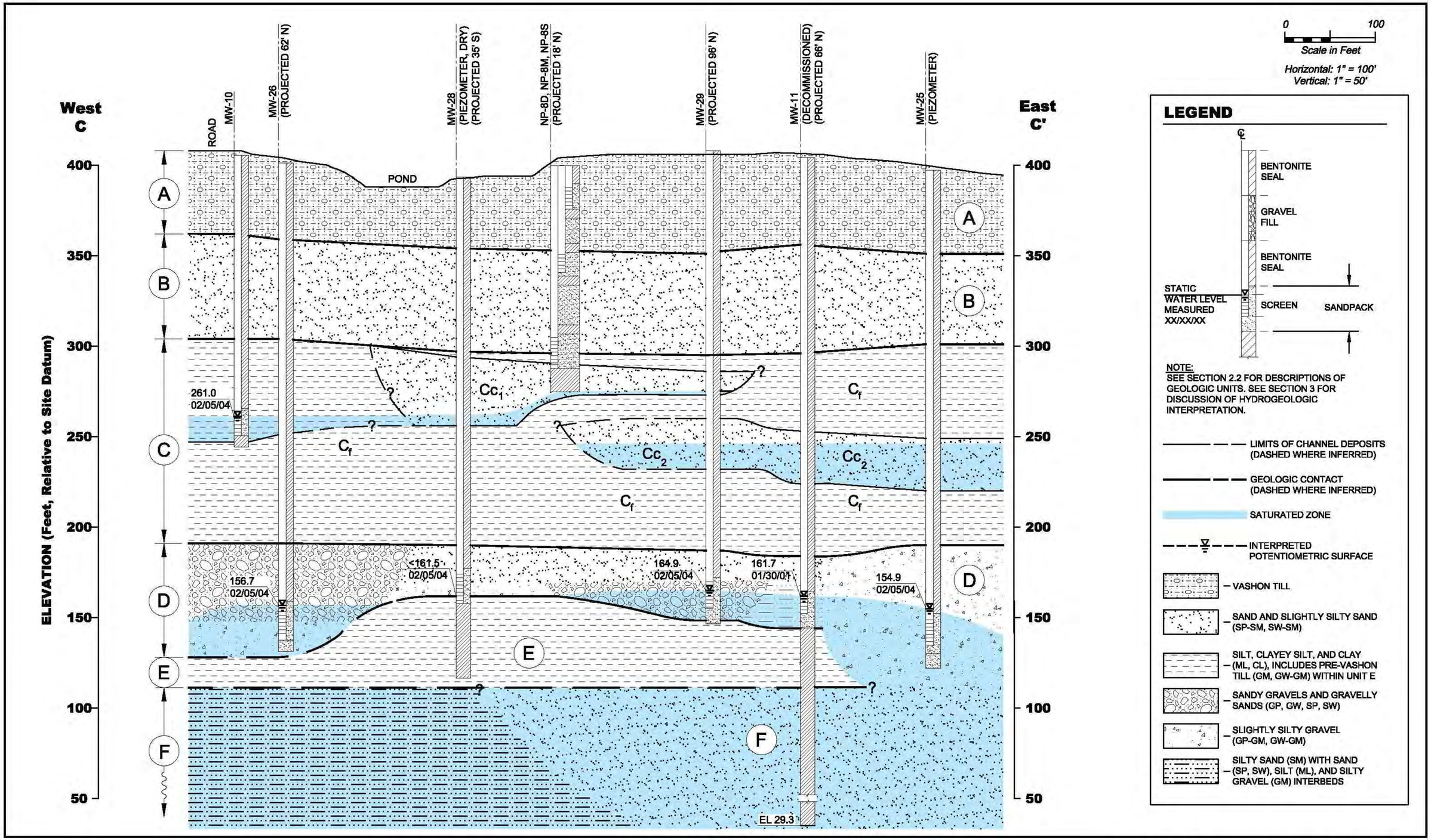
King County
Department of Natural Resources and Parks
Solid Waste Division

Hydrogeologic Cross Section B-B'

Source December 2004,
Vashon Island Landfill Hydrogeologic Report Update

Prepared by Berryman & Henigar with UES

Figure 6



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King County
Department of Natural Resources and Parks
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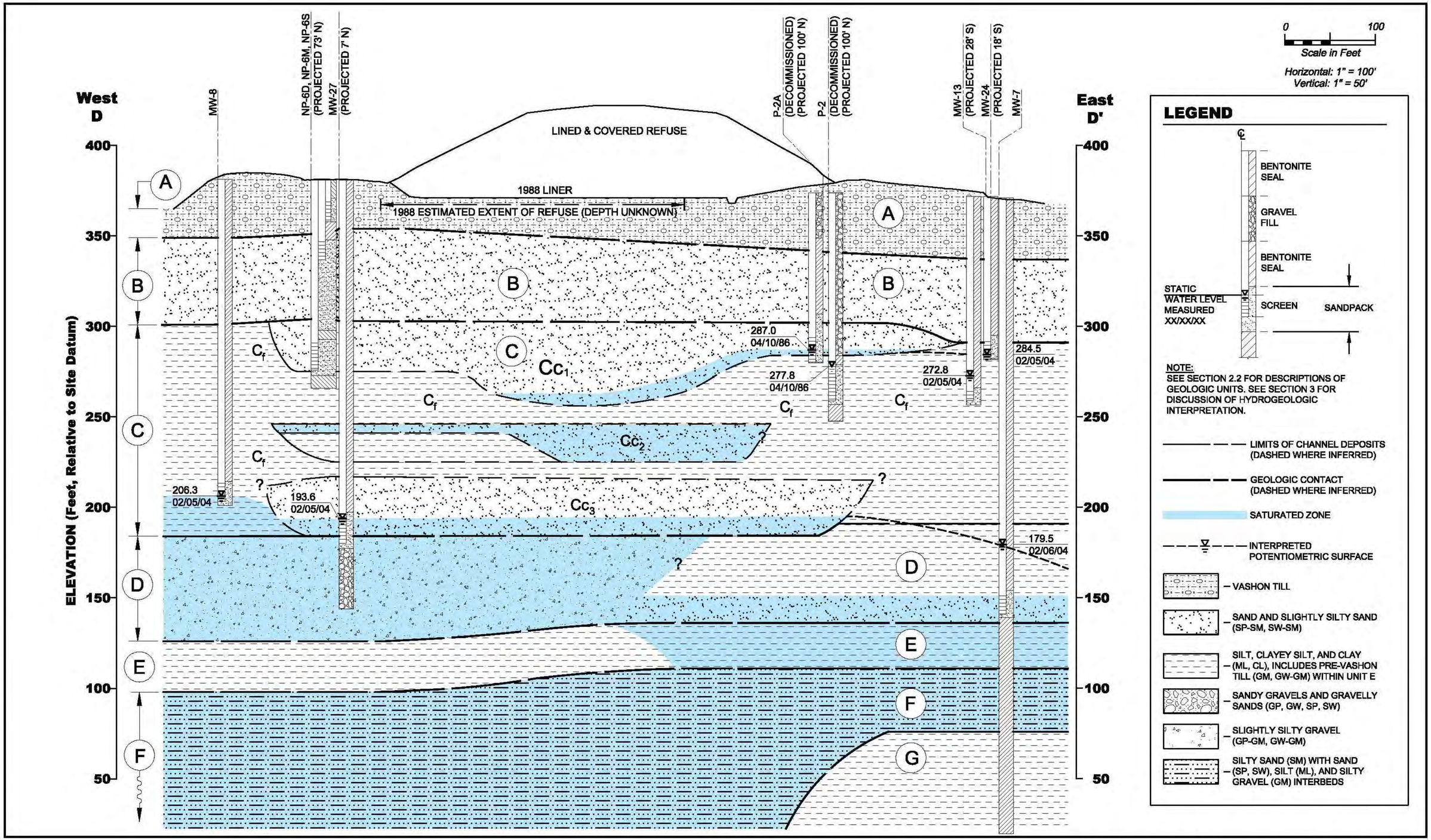
Hydrogeologic Cross Section C-C'

Source December 2004,
Vashon Island Landfill Hydrogeologic Report Update

Prepared by Berryman & Henigar with UES

Figure 7



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Solid Waste Division

Hydrogeologic Cross Section D-D'

Source December 2004,
Vashon Island Landfill Hydrogeologic Report Update

Prepared by Berryman & Henigar with UES

Figure 8

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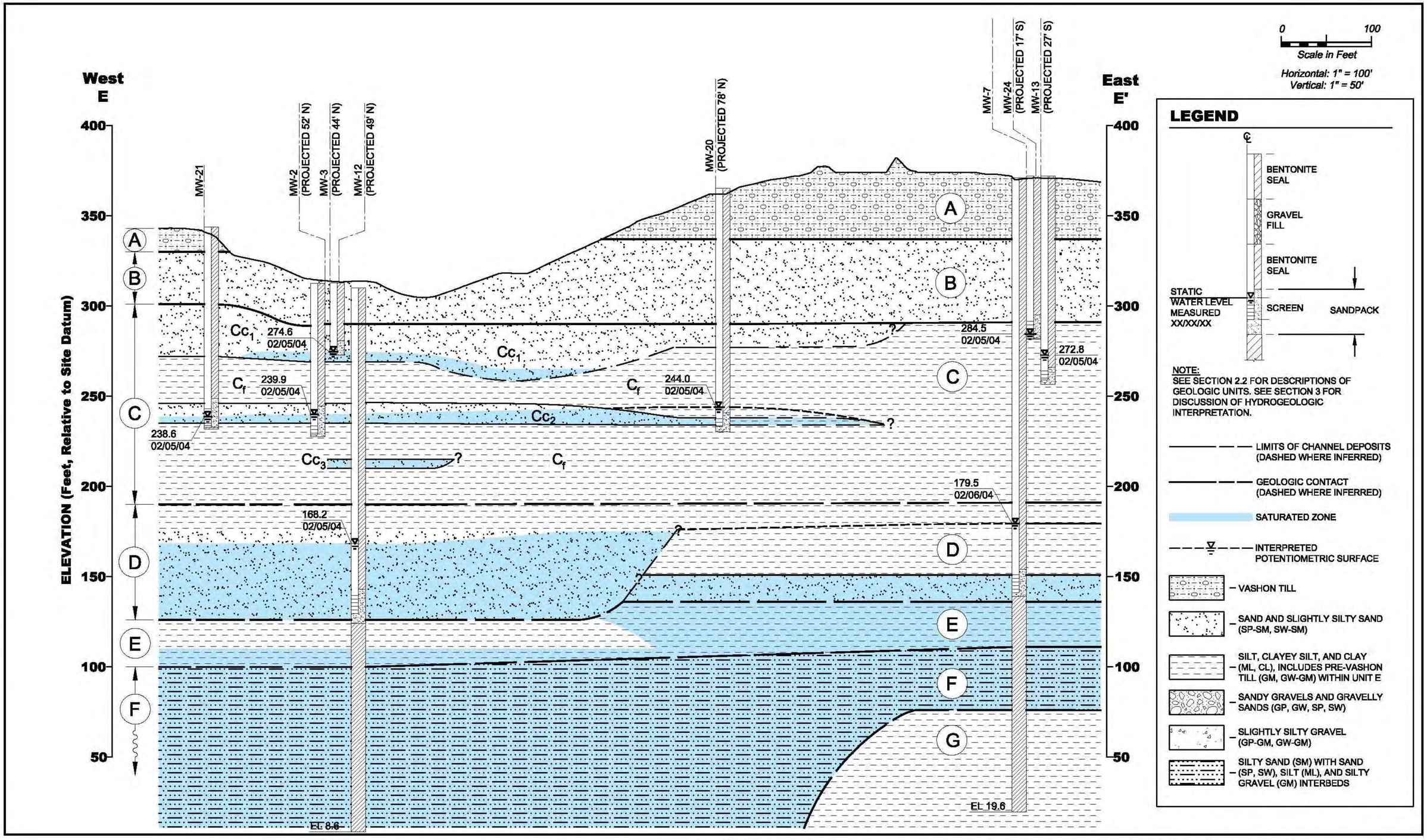

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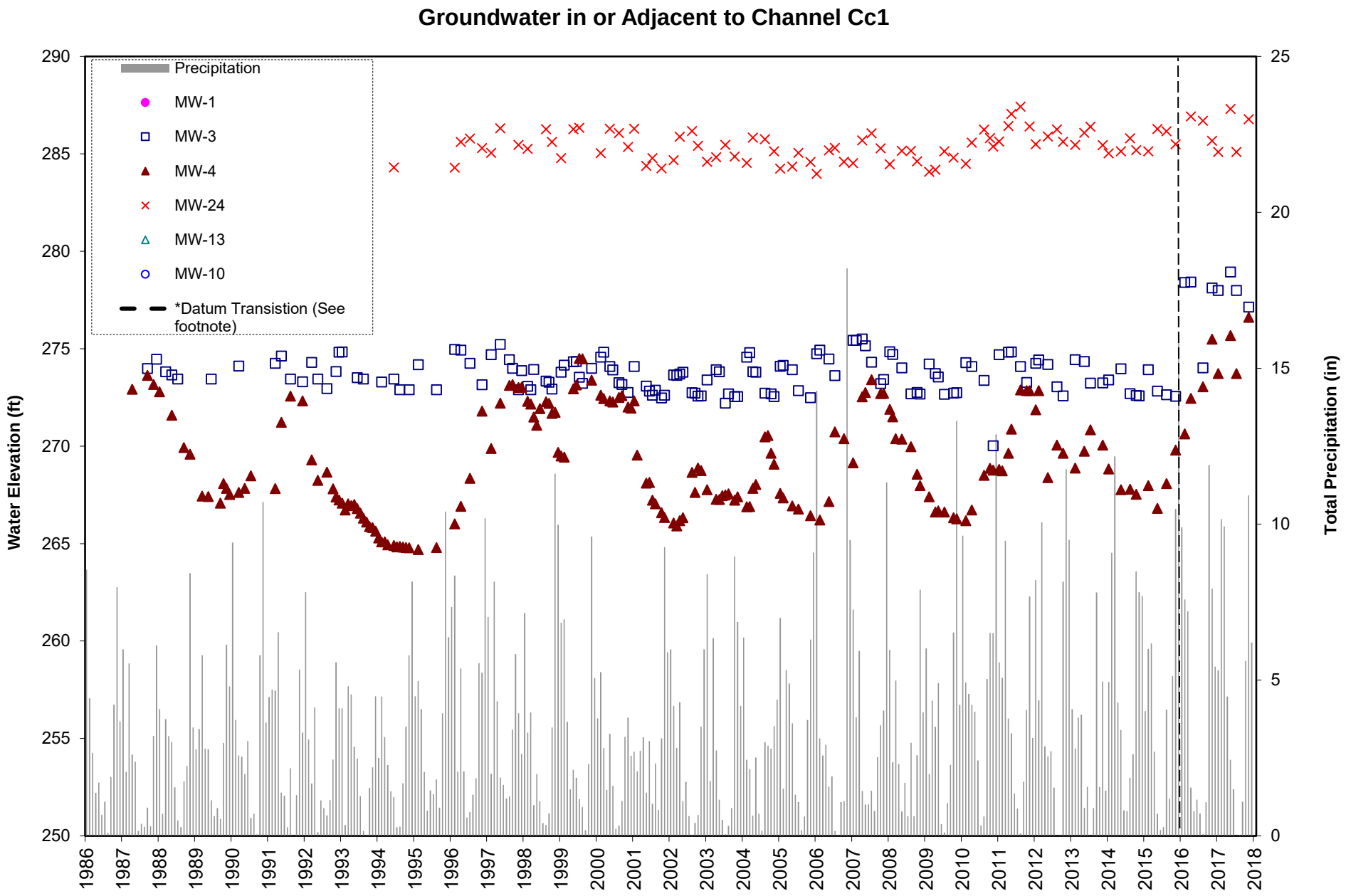
King County
Department of Natural Resources and Parks
Solid Waste Division

Hydrogeologic Cross Section E-E'

Source December 2004,
Vashon Island Landfill Hydrogeologic Report Update

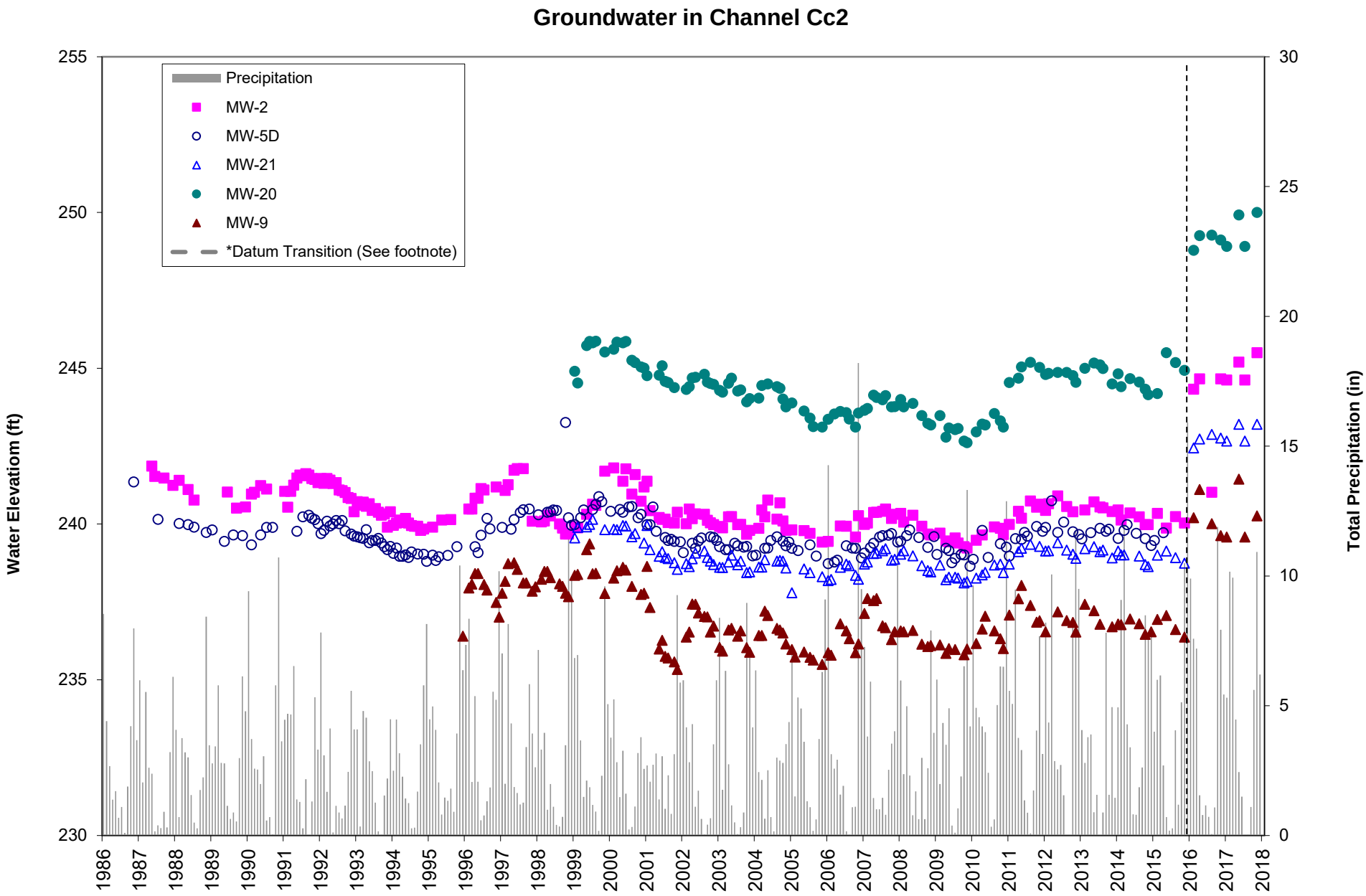
Prepared by Berryman & Henigar with UES

Figure 9



Precipitation Data Source:
Pre 2005: NOAA
Sea-Tac AP Station. Monthly Total Precipitation
Post 2005: KC DNRP. WLRD, Rain Gage, Vashon Landfill
*Datum transition from NGVD29 to NAVD88 beginning in 2016

Figure 10



Precipitation Data Source:
Pre 2005: NOAA
Sea-Tac AP Station. Monthly Total Precipitation
Post 2005: KC DNRP. WLRD, Rain Gage, Vashon Landfill
*Datum transition from NGVD29 to NAVD88 beginning 2016.

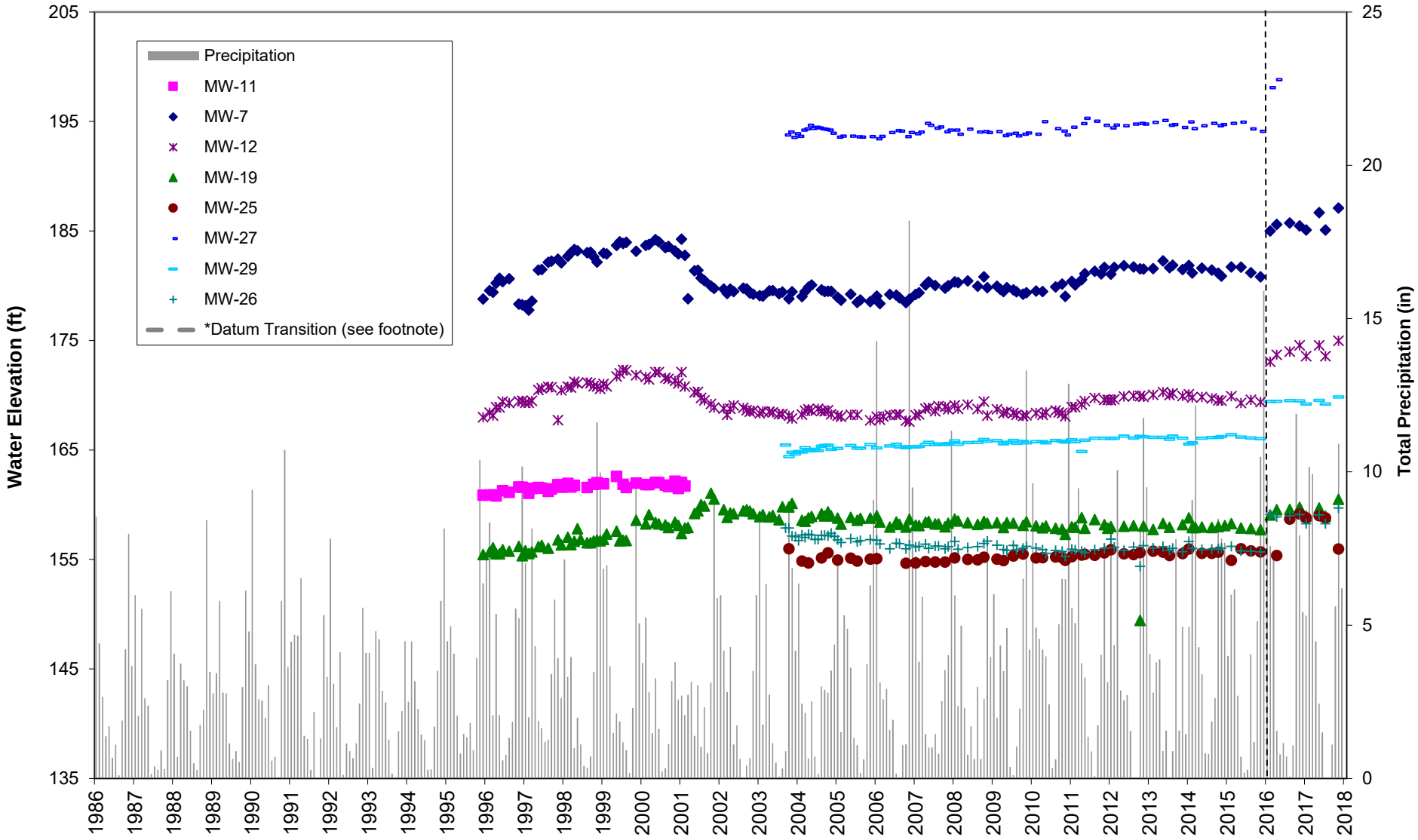
Figure 11

Groundwater Beneath Channel Cc3

Precipitation Data Source:
Pre 2005: NOAA
Sea-Tac AP Station. Monthly Total Precipitation
Post 2005: KC DNRP. WLRD, Rain Gage, Vashon Landfill
*Datum transition from NGVD29 to NAVD88 beginning 2016.

Figure 12

Groundwater in the Unit D Aquifer



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Sea-Tac AP Station. Monthly Total Precipitation
Post 2005: KC DNRP. WLRD, Rain Gage, Vashon Landfill
*Datum transition from NGVD29 to NAVD88 beginning 2016.

Figure 13

Table 1-1
Vashon Island Landfill Annual Groundwater Evaluation Report

Table 1-1 Summary of Vashon Island Landfill Site Stratigraphic Units			
Formation[a]	**Depositional Facies**	**Sediment Type**	**Approximate Elevations and Locations Beneath Vashon Island Landfill Site**
Unit A: Vashon till (Qvt)	Beneath continental glacier	Dense to very dense yellow-gray to gra y fine sandy silt or silty gravel with trace cobbles and boulders.	Occurs as surficial deposit in all portions of the site except where absent by erosion. The base of the till varies from elevations of about 362 feet in the northwest to about 330 feet in the south. In general, till is absent below about 330 feet.
Unconformity			
Unit B: pre-Vashon proglacial sand (Qva)	Fluvial, possibly glaciolacustrine	Approximately 40- to 60-foot-thick deposit of clean fine sands with minor well-graded gravelly sand. Includes laterally equivalent slightly silty fine sands and minor fine sandy silt. Typically yellow brown to brown, loose, gravels (where present) typically fine and subangular to subrounded.	Occurs beneath entire site directly beneath till or as surficial unit in areas where till is absent by erosion. Basal contact elevation ranges from 304 to 289 feet.
Unconformity			
Unit C: pre-Vashon glaciolacustrine deposits (Qpff and Qpfc?)	Glaciolacustrine incised by sand- and gravel-filled channels; the channels may reflect periodic rapid draining of the lake.	Approximately 100- to 120-foot-thick sequence, predominantly laminated floodplain or lacustrine silts, includes laterally equivalent sand, gravelly sand, and sandy gravel channel deposits incised into the lacustrine silts. At least three significant and laterally extensive channel deposits are present within this unit.	Occurs beneath entire site at elevations of about 304 to about 181 feet. Where fully penetrated, the basal contact elevation ranges from 181 to 191 feet.
Unconformity			
Unit D: pre-Vashon fluvial deposits (Qpfc?)	Meandering river channel and flood plain.	Fluvial channel and silt or clay overbank deposits. The channel deposits are typically coarser-grained than those of Unit C.	Occurs beneath the entire site at elevations of about 125 to 191 feet. Gravelly sand channel deposits extend beneath the northern, central, and western portions of the site; soils east of this are significantly finer-grained. Where fully penetrated, the basal contact elevation ranges from 125 to 134 feet.

Table 1-1
Vashon Island Landfill Annual Groundwater Evaluation Report

Table 1-1 Summary of Vashon Island Landfill Site Stratigraphic Units			
Formation[a]	**Depositional Facies**	**Sediment Type**	**Approximate Elevations and Locations Beneath Vashon Island Landfill Site**
Disconformity with least 40 feet of erosional relief.			
Unit E: pre-Vashon glacial till/ glaciolacustrine deposits (Qpff and/or Qpfc?)	Glaciolacustrine overlying basal till	Silty gravel and laterally equivalent silt, clay, and slightly silty fine sand.	Occurs at elevations of 96 to 134 feet, apparently beneath most of the site (only six borings penetrate this deposit). Apparently absent due to erosion at MW-25. The silty gravel facies is the basal unit at MW-7, MW-11, and MW-28 and generally occurs at elevations between 106 and 134 feet.
Possible Unconformity			
Unit F: pre-Vashon fluvial deposits (Qpfc?)	Meandering river channel and flood plain	Sequence of aggrading channel and overbank deposits. Predominantly fine sands and silty sands with laterally equivalent fine to medium sand channel deposits. Sediments contain white pumice and woody debris.	Occurs at elevations below about 100 to 111 feet beneath all portions of the site.
Disconformity with at least 68 feet of erosional relief			
Unit G: pre-Vashon lacustrine deposits (Qcso?)	Lacustrine	More than 50-foot-thick deposit of firm, dark gray clay and clayey silt with trace of fine sand and trace fine gravel.	Identified in MW-7 at elevations of 19.6 to 76 feet, not fully penetrated.
[a] Assignments to classifications derived from Booth (1991) are queried where tentative.			

Table 1-2
Vashon Island Groundwater Monitoring Well Completion Details

Well Number	Date Completed	Installed By	Top of PVC Casing Elevation (feet)[a]	Well Casing and Screen	Well Dia. (inches)	Screen slot (inches)	Top of Screen Elevation[b]	Bottom of Screen Elevation[b]	Top of Seal Elevation[b]	Bottom of Seal Elevation[b]	Seal Type	Top of Sand Pack (feet elev.)[b]	Bottom of Sand Pack (feet elev.)[b]	Sand Type	Reference[c]
MW-1[d]	9/8/1983	Sweet-Edwards	403.60	Sch 80 PVC	3	0.010	284.48	274.48	402.48	289.48	Bentonite	289.48	272.48	3/8 minus pea gravel	A
MW-2	9/9/1983	Sweet-Edwards	314.28	Sch 80 PVC	3	0.010	233.58	228.58	312.58	246.58	Bentonite	244.58	227.58	3/8 minus pea gravel	A
MW-3	9/12/1983	Sweet-Edwards	314.87	Sch 80 PVC	3	0.010	277.90	272.90	312.90	280.90	Bentonite	280.90	272.90	3/8 minus pea gravel	A
MW-4	9/14/1983	Sweet-Edwards	374.21	Sch 80 PVC	3	0.010	273.08	263.08	373.08	278.08	Bentonite	278.08	263.08	3/8 minus pea gravel	A
MW-5S[d]	3/6/1986	Golder	356.63	Sch 40 PVC[b]	2	0.020	281.86	271.86	355.86	352.86	Bentonite	352.86	271.36	#8 Monteray & Gravel	B
MW-5D[d]	3/6/1986	Golder	357.20	Sch 40 PVC[b]	2	0.020	240.86	229.86	255.36	249.86	Bentonite	253.86	229.86	#8 Monteray & Gravel	B
MW-6S[d]	3/19/1986	Golder	394.2	Sch 40 PVC[b]	2	0.020	287.42	277.42	392.42	389.42	Bentonite	389.42	276.42	#8 Aqua and Gravel	B
MW-6D[d]	3/19/1986	Golder	394.1	Sch 40 PVC[b]	2	0.020	241.92	231.92	256.42	250.42	Bentonite	244.42	231.42	#8 Aqua	B
MW-7	4/28/1995	CH2M HILL	373.25	Sch 40 PVC	2	0.010	151.09	141.09	371.09	154.09	Bentonite	154.09	139.09	#20 x 40	C
MW-8	6/30/1995	CH2M HILL	383.42	Sch 40 PVC	2	0.010	213.24	203.24	381.24	214.24	Bentonite	214.24	201.24	#20 x 40	C
MW-9	6/12/1995	CH2M HILL	402.57	Sch 40 PVC	2	0.010	233.64	223.64	400.64	236.64	Bentonite	236.64	220.64	#20 x 40	C
MW-10	7/1/1995	CH2M HILL	407.51	Sch 40 PVC	2	0.010	262.34	252.34	405.34	265.34	Bentonite	265.34	250.34	#20 x 40	C
MW-11[d]	5/15/1995	CH2M HILL	406.39	Sch 40 PVC	2	0.010	162.28	152.28	404.28	164.28	Bentonite	164.28	144.28	#20 x 40	C
MW-12	5/26/1995	CH2M HILL	312.39	Sch 40 PVC	2	0.010	139.62	129.62	310.12	143.12	Bentonite	143.12	124.12	#20 x 40	C
MW-13	4/22/1992	Terra	374.07	Sch 40 PVC	2	0.020	264.00	259.00	372.00	266.00	Bentonite	266.00	256.50	#8	D
MW-14[d]	6/21/1995	CH2M HILL	375.68	Sch 40 PVC	2	0.020	212.62	202.62	373.62	219.62	Bentonite	219.62	201.62	#20 x 40	C
MW-19	6/12/1995	CH2M HILL	403.83	Sch 40 PVC	2	0.020	141.10	131.10	400.60	140.60	Bentonite	140.60	124.60	#20 x 40	C
MW-20	10/21/1998	UES	367.21	Sch 40 PVC	2	0.020	237.57	233.27	365.27	240.87	Bentonite	240.87	231.27	#20 x 40	E
MW-21	10/21/1998	UES	345.66	Sch 40 PVC	2	0.020	243.17	233.77	343.77	248.77	Bentonite	248.77	232.77	#20 x 40	E
MW-24	4/27/1992	Terra	373.93	Sch 40 PVC	2	0.020	291.50	281.50	372.00	295.00	Bentonite	295.00	282.00	#8	D
MW-25	8/11/2003	UES	399.22	Sch 80 PVC	4	0.020	148.78	134.68	397.28	152.28	Bentonite	152.28	130.28	#16 x 30	F
MW-26	8/6/2003	UES	403.40	Sch 80 PVC	4	0.020	155.12	141.02	401.22	158.92	Bentonite	158.92	137.52	#16 x 30	F
MW-27[d]	8/15/2003	UES	383.06	Sch 80 PVC	4	0.020	194.27	180.07	380.77	197.27	Bentonite	197.27	177.27	#16 x 30	F
MW-28	8/29/2003	UES	395.59	Sch 80 PVC	4	0.020	173.91	159.51	393.51	177.01	Bentonite	177.01	157.71	#16 x 30	F
MW-29	8/29/2003	UES	410.57	Sch 80 PVC	4	0.020	169.80	155.00	408.00	172.00	Bentonite	172.00	147.00	#16 x 30	G
P-1S[d]	3/12/1986	Golder	No data	Sch 40 PVC	2	0.020	304.00	294.00	393.00	390.00	Bentonite	390.00	288.00	#8 Aqua and Gravel	B
P-1D[d]	3/12/1986	Golder	No data	Sch 40 PVC	2	0.020	278.50	268.50	288.00	283.00	Bentonite	283.00	268.00	#8 Aqua	B
P-1A[d]	3/25/1986	Golder	No data	Sch 40 PVC	2	0.020	280.02	270.02	354.02	286.02	Bentonite	286.02	269.02	#8 Monteray	B
P-1B[d]	3/29/1986	Golder	No data	Sch 40 PVC	2	0.020	299.08	289.08	380.08	304.08	Bentonite	304.08	289.08	10 x 20 silica	B
P-2[d]	3/19/1986	Golder	No data	Sch 40 PVC	2	0.020	273.73	258.73	283.73	278.73	Bentonite	278.73	256.73	#8 Aqua	B
P-2A[d]	3/24/1986	Golder	No data	Sch 40 PVC	2	0.020	293.60	281.60	348.60	306.60	Bentonite	306.60	280.10	#8 Aqua	B
P-4	2/29/1988	Golder	No data	Sch 80 PVC	1	0.020	374.90	372.90	407.40	376.90	Bentonite	376.90	371.90	#16 Monteray	H

[a] All survey data in feet are relative to site datum.
[b] Well installed as a dual-completion.
[c] A = R.W. Beck, 1984; B = Golder Associates, 1986; C = CH2M HILL, 1996; D = Terra Associates., 1992; E = B&H and UES, 1999b; F = B&H and UES, 2003b; G = B&H and UES, 2003a; H = Golder Associates, 1986.
[d] Well has been decommissioned.

Table 1-3 Vashon Landfill Signifigant Maintenance Activities Summary 2017

Maintenance Activity	Resolution
Geophysical investigation	Study performed to determine the extent of refuse in the northwest corner and south slope area of the closed landfill.
Drilling and well installation	Installation of additional temporary gas probes VTP-SS, VTP-5D, VTP-6S, and VTP-6D to continue to monitor landfill gases.
Influence Testing Study	The study concluded that MW-9 effectively reduces methane concentrations with the 100 feet radius of influence.

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in or adjacent to Cc1						
Well Location	MW-1	MW-3	MW-10		MW-13		MW-4
Gradient							
Time Interval	Long	Long	Long	Short	Long	Short	Long
pH field, Standard Units							
No. of Analyses	17	26	89	8	95	8	40
No. of Detections	17	26	89	8	95	8	40
Minimum	6.4	5.6	6.8	7.0	6.7	6.9	6.1
Maximum	8.2	6.8	8.4	7.4	8.0	7.6	8.0
Mean	7.21	6.14	7.38	7.25	7.22	7.24	6.55
Standard Deviation	0.43	0.32	0.28	0.13	0.23	0.20	0.33
Median	7.2	6.2	7.4	7.3	7.2	7.2	6.4
Specific Conductance field, micromhos/cm							
No. of Analyses	18	26	89	8	94	8	40
No. of Detections	18	26	89	8	94	8	40
Minimum	155	86	100	144	130	155	164
Maximum	250	200	159	159	195	177	860
Mean	190.0	115.7	130.5	151.0	160.8	166.5	535.4
Standard Deviation	27.2	26.7	11.6	4.8	15.0	7.5	180.0
Median	185	105	130	151	160	166	528
Total Dissolved Solids							
No. of Analyses	19	19	84	8	96	8	34
No. of Detections	19	19	84	8	96	8	34
Minimum	77	8	46	96	68	106	29
Maximum	170	90	130	117	150	124	500
Mean	125.6	67.8	96.5	104.9	116.0	117.5	353.1
Standard Deviation	26.5	17.8	13.0	6.9	14.7	6.1	107.1
Median	123	73	98	106	118	119	356
Alkalinity, mg/L							
No. of Analyses	5	17	85	8	92	8	16
No. of Detections	5	17	85	8	92	8	16
Minimum	98	21	52	56	30	62	58
Maximum	120	41	70	62	80	68	320
Mean	109.60	29.32	56.48	58.46	63.59	65.59	215.91
Standard Deviation	10.53	5.53	2.73	1.81	7.82	2.27	88.47
Median	110.0	30.5	56.0	58.4	63.8	65.8	235.0
Ammonia-N, mg/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	4	9	11	1	11	0	19
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.1	0.7	0.1	0.0	0.1	ND	0.3
Mean	-0.01	0.11	0.00	0.00	0.00	0.00	0.03
Standard Deviation	0.03	0.22	0.02	ID	0.02	ID	0.09
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate-N, mg/L							
No. of Analyses	29	24	85	8	97	8	49
No. of Detections	21	24	85	8	95	8	24
Minimum	ND	0.2	0.2	0.4	ND	0.1	ND
Maximum	0.3	5.5	0.8	0.7	0.3	0.2	6.3
Mean	0.13	1.90	0.39	0.59	0.10	0.12	1.10
Standard Deviation	0.14	1.42	0.10	0.09	0.05	0.05	1.95
Median	0.2	1.3	0.4	0.62	0.1	0.12	0.0
Sulfate, mg/L							
No. of Analyses	29	24	85	8	96	8	49
No. of Detections	29	24	85	8	96	8	49
Minimum	11.0	7.1	2.6	8.4	12.9	12.8	3.7
Maximum	21.0	19.0	11.0	9.9	26.8	16.6	46.0
Mean	16.91	11.17	9.56	8.92	18.94	14.28	17.80
Standard Deviation	2.08	3.42	0.93	0.52	2.27	1.36	9.60
Median	17.0	10.0	9.7	9.0	19.0	14.0	16.0

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in or adjacent to Cc1						
Well Location	MW-1	MW-3	MW-10		MW-13		MW-4
Gradient							
Time Interval	Long	Long	Long	Short	Long	Short	Long
Chloride, mg/L							
No. of Analyses	29	24	85	8	97	8	49
No. of Detections	29	24	84	8	97	8	47
Minimum	1.3	1.1	ND	3.1	2.5	2.8	ND
Maximum	6.3	11.0	30.9	3.5	10.6	3.3	19.0
Mean	4.27	2.98	3.39	3.30	3.56	2.96	8.85
Standard Deviation	0.87	2.37	3.06	0.14	1.06	0.15	4.55
Median	4.2	2.0	3.0	3.3	3.1	2.9	7.0
Dissolved Arsenic, mg/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	25	4	84	8	96	8	6
Minimum	ND	ND	ND	0.0015	ND	0.0016	ND
Maximum	0.0070	0.0070	0.0020	0.0016	0.0030	0.0021	0.0060
Mean	0.0040	-0.0006	0.0016	0.0016	0.0018	0.0018	-0.0009
Standard Deviation	0.0033	0.0018	0.0004	0.0000	0.0004	0.0002	0.0018
Median	0.0050	-0.0005	0.0017	0.0016	0.0019	0.0017	-0.0005
Total Arsenic, mg/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	25	4	84	8	96	8	6
Minimum	ND	ND	ND	0.0015	ND	0.0016	ND
Maximum	0.0070	0.0070	0.0020	0.0016	0.0030	0.0021	0.0060
Mean	0.0040	-0.0006	0.0016	0.0015	0.0018	0.0018	-0.0009
Standard Deviation	0.0033	0.0018	0.0004	0.0001	0.0004	0.0002	0.0018
Median	0.0050	-0.0005	0.0017	0.0016	0.0019	0.0017	-0.0005
Dissolved Iron, mg/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	14	19	56	0	62	5	40
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.3	8.6	0.3	ND	0.5	0.1	0.5
Mean	0.02	1.13	0.03	-0.01	0.03	0.02	0.08
Standard Deviation	0.07	2.50	0.05	ID	0.06	0.03	0.11
Median	0.0	0.0	0.0	-0.005	0.0	0.025	0.1
Total Iron, mg/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	14	19	56	2	62	6	40
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.3	8.6	0.3	0.0	0.5	0.1	0.5
Mean	0.02	1.13	0.03	0.00	0.03	0.03	0.08
Standard Deviation	0.07	2.50	0.05	ID	0.06	0.03	0.11
Median	0.0	0.0	0.0	-0.005	0.0	0.036	0.1

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in or adjacent to Cc1						
Well Location	MW-1	MW-3	MW-10		MW-13		MW-4
Gradient							
Time Interval	Long	Long	Long	Short	Long	Short	Long
Dissolved Manganese, mg/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	6	17	9	0	57	6	43
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.058	2.700	0.003	ND	0.027	0.014	0.970
Mean	0.00	0.39	0.00	0.00	0.00	0.01	0.18
Standard Deviation	0.01	0.90	0.00	ID	0.00	0.01	0.22
Median	-0.001	0.003	-0.001	-0.001	0.001	0.009	0.088
Total Manganese, mg/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	6	17	9	3	57	6	43
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.058	2.700	0.003	0.000	0.027	0.014	0.970
Mean	0.00	0.39	0.00	0.00	0.00	0.01	0.18
Standard Deviation	0.01	0.90	0.00	0.00	0.00	0.01	0.22
Median	-0.001	0.003	-0.001	-0.001	0.001	0.007	0.088
Dissolved Calcium, mg/L							
No. of Analyses	10	18	85	8	97	8	26
No. of Detections	10	18	85	8	97	8	26
Minimum	11.0	7.6	4.3	8.7	6.5	9.0	17.0
Maximum	14.0	11.0	13.0	10.7	11.5	10.7	73.6
Mean	12.24	9.17	8.89	9.51	9.36	9.67	52.06
Standard Deviation	1.16	1.01	1.02	0.64	0.90	0.60	17.81
Median	11.7	9.3	9.0	9.5	9.5	9.5	54.0
Total Calcium, mg/L							
No. of Analyses	10	18	85	8	97	8	26
No. of Detections	10	18	85	8	97	8	26
Minimum	11.0	7.6	4.3	8.7	6.5	9.2	17.0
Maximum	14.0	11.0	13.0	10.8	11.5	10.5	73.6
Mean	12.24	9.17	8.89	9.66	9.36	9.68	52.06
Standard Deviation	1.16	1.01	1.02	0.71	0.90	0.49	17.81
Median	11.7	9.3	9.0	9.5	9.5	9.6	54.0
Dissolved Magnesium, mg/L							
No. of Analyses	10	18	85	8	97	8	26
No. of Detections	10	18	85	8	97	8	26
Minimum	10.7	1.8	4.2	8.6	7.7	10.3	8.6
Maximum	16.0	3.1	12.0	10.5	14.0	12.9	56.8
Mean	12.46	2.37	8.19	9.31	10.58	11.28	39.59
Standard Deviation	1.74	0.29	0.89	0.59	1.20	0.82	13.73
Median	11.8	2.4	8.2	9.2	10.3	11.2	41.0
Total Magnesium, mg/L							
No. of Analyses	10	18	85	8	97	8	26
No. of Detections	10	18	85	8	97	8	26
Minimum	10.7	1.8	4.2	8.6	7.7	10.3	8.6
Maximum	16.0	3.1	12.0	10.8	14.0	12.7	56.8
Mean	12.46	2.37	8.19	9.52	10.58	11.30	39.59
Standard Deviation	1.74	0.29	0.89	0.77	1.20	0.74	13.73
Median	11.8	2.4	8.2	9.4	10.3	11.3	41.0

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in or adjacent to Cc1						
Well Location	MW-1	MW-3	MW-10		MW-13		MW-4
Gradient							
Time Interval	Long	Long	Long	Short	Long	Short	Long
Dissolved Sodium, mg/L							
No. of Analyses	10	18	85	8	97	8	26
No. of Detections	10	18	85	8	97	8	26
Minimum	7.3	3.7	2.3	4.6	4.9	5.4	5.4
Maximum	10.0	7.1	6.4	5.2	14.4	6.6	24.8
Mean	8.34	5.03	4.55	4.87	5.97	5.94	15.21
Standard Deviation	0.95	0.97	0.47	0.22	1.00	0.37	5.69
Median	8.0	4.8	4.5	4.8	5.8	5.9	13.5
Total Sodium, mg/L							
No. of Analyses	10	18	85	8	97	8	26
No. of Detections	10	18	85	8	97	8	26
Minimum	7.3	3.7	2.3	4.6	4.9	5.4	5.4
Maximum	10.0	7.1	6.4	5.6	14.4	6.5	24.8
Mean	8.34	5.03	4.55	5.00	5.97	5.98	15.21
Standard Deviation	0.95	0.97	0.47	0.33	1.00	0.33	5.69
Median	8.0	4.8	4.5	5.0	5.8	6.0	13.5
Dissolved Potassium, mg/L							
No. of Analyses	10	18	85	8	97	8	26
No. of Detections	10	18	85	8	97	8	26
Minimum	2.2	2.5	0.7	1.4	1.1	1.7	0.9
Maximum	3.0	4.1	2.0	1.6	2.2	2.0	2.7
Mean	2.51	3.23	1.35	1.45	1.69	1.81	1.89
Standard Deviation	0.25	0.53	0.15	0.08	0.17	0.08	0.43
Median	2.4	3.3	1.3	1.4	1.7	1.8	1.9
Total Potassium, mg/L							
No. of Analyses	10	18	85	8	97	8	26
No. of Detections	10	18	85	8	97	8	26
Minimum	2.2	2.5	0.7	1.4	1.1	1.7	0.9
Maximum	3.0	4.1	2.0	1.6	2.2	2.0	2.7
Mean	2.51	3.23	1.35	1.47	1.69	1.80	1.89
Standard Deviation	0.25	0.53	0.15	0.08	0.17	0.09	0.43
Median	2.4	3.3	1.3	1.5	1.7	1.8	1.9
Benzene, ug/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	1	0	1	0	1	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.3	ND	0.3	ND	0.2	ND	ND
Mean	-0.35	-0.20	-0.10	-0.08	-0.10	-0.08	-0.38
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	-0.5	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Chloroethane, ug/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	0	0	0	0	0	0	6
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	1.3
Mean	-1.52	-0.48	-0.10	-0.08	-0.10	-0.08	-1.08
Standard Deviation	ID	ID	ID	ID	ID	ID	1.47
Median	-2.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in or adjacent to Cc1						
Well Location	MW-1	MW-3	MW-10		MW-13		MW-4
Gradient							
Time Interval	Long	Long	Long	Short	Long	Short	Long
Toluene, ug/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	2	0	1	0	1	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.5	ND	0.4	ND	0.8	ND	ND
Mean	-1.08	-0.30	-0.09	-0.08	-0.09	-0.08	-0.79
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	-0.5	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Trichloroethene, ug/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	1	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	1.0	ND	ND	ND	ND	ND	ND
Mean	-0.32	-0.20	-0.10	-0.08	-0.10	-0.08	-0.38
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	-0.5	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Vinyl Chloride, ug/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	0	0	1	0	3	0	23
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	0.0	ND	0.0	ND	19.0
Mean	-0.57	-0.15	-0.01	-0.01	-0.01	-0.01	3.21
Standard Deviation	ID	ID	ID	ID	0.02	ID	5.49
Median	-0.5	0.0	0.0	0.0	0.0	0.0	0.0
Total Xylenes, ug/L							
No. of Analyses	29	24	85	8	97	8	49
No. of Detections	0	0	0	0	1	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	0.5	ND	ND
Mean	-0.40	-0.26	-0.17	-0.08	-0.16	-0.08	-0.53
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	-0.5	-0.2	-0.2	-0.1	-0.2	-0.1	-0.2
cis-1,2-Dichloroethene, ug/L							
No. of Analyses	17	21	85	8	97	8	36
No. of Detections	0	0	0	0	1	0	15
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	0.8	ND	16.0
Mean	-0.26	-0.15	-0.10	-0.08	-0.09	-0.08	0.72
Standard Deviation	ID	ID	ID	ID	ID	ID	2.95
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
trans-1,2-Dichloroethene, ug/L							
No. of Analyses	21	23	85	8	97	8	41
No. of Detections	0	0	0	0	0	0	1
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	0.3
Mean	-0.31	-0.18	-0.10	-0.08	-0.10	-0.08	-0.35
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	-0.5	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in or adjacent to Cc1						
Well Location	MW-1	MW-3	MW-10		MW-13		MW-4
Gradient							
Time Interval	Long	Long	Long	Short	Long	Short	Long
1,1 Dichloroethane, ug/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	0	0	0	0	0	0	17
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	1.0
Mean	-0.37	-0.20	-0.10	-0.08	-0.10	-0.08	-0.15
Standard Deviation	ID	ID	ID	ID	ID	ID	0.86
Median	-0.5	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
1,2-Dichloropropane, ug/L							
No. of Analyses	30	24	85	8	97	8	49
No. of Detections	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND
Mean	-0.37	-0.20	-0.10	-0.08	-0.10	-0.08	-0.38
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	-0.5	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Trichlorofluoromethane, ug/L							
No. of Analyses	10	18	85	8	97	8	27
No. of Detections	0	9	1	0	1	0	22
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	0.7	0.2	ND	1.0	ND	2.1
Mean	-0.10	0.15	-0.09	-0.07	-0.09	-0.08	0.80
Standard Deviation	ID	0.26	ID	ID	ID	ID	1.32
Median	-0.1	0.2	-0.1	-0.1	-0.1	-0.1	0.9
Dichlorodifluoromethane, ug/L							
No. of Analyses	5	17	85	8	92	8	17
No. of Detections	0	0	0	0	1	0	12
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	1.5	ND	4.2
Mean	-0.10	-0.09	-0.10	-0.07	-0.08	-0.07	1.06
Standard Deviation	ID	ID	ID	ID	ID	ID	1.99
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	1.3

NOTES:

ID	Insufficient Data. The number of detections is less than 3.
ND	Not Detected (at laboratory MDL).
mg/L	Milligram per liter.
ug/L	Microgram per liter.
Current	Reflects the most recent analysis data, up to eight analyses maximum.

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D		MW-14		MW-9		MW-8	
Gradient	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH field, Standard Units														
No. of Analyses	77	8	77	8	145	8	127	8	63	8	92	8	90	8
No. of Detections	77	8	77	8	145	8	127	8	63	8	92	8	90	8
Minimum	7.0	7.0	6.6	6.6	6.1	6.6	6.0	6.5	6.7	7.5	6.8	6.8	6.2	6.6
Maximum	8.6	7.3	8.2	7.9	7.8	7.0	8.0	6.9	8.5	7.8	8.0	7.3	8.0	7.0
Mean	7.85	7.22	6.89	6.97	6.87	6.88	6.70	6.69	7.70	7.71	7.36	7.06	6.86	6.83
Standard Deviation	0.39	0.12	0.24	0.39	0.24	0.13	0.28	0.13	0.31	0.12	0.22	0.21	0.32	0.12
Median	7.9	7.3	6.9	6.9	6.9	6.9	6.7	6.7	7.8	7.8	7.4	7.0	6.8	6.9
Specific Conductance field, micro														
No. of Analyses	78	8	77	8	144	8	126	8	63	8	92	8	90	8
No. of Detections	78	8	77	8	144	8	126	8	63	8	92	8	90	8
Minimum	140	203	200	247	230	257	110	170	140	150	110	185	130	158
Maximum	242	241	480	295	1024	394	1760	280	190	190	210	210	650	180
Mean	175.5	223.6	342.3	266.5	445.2	315.7	738.8	240.0	159.0	162.5	155.8	195.0	169.5	170.5
Standard Deviation	22.6	11.8	69.4	14.5	121.0	39.1	396.5	37.8	10.7	15.6	19.9	9.6	53.2	7.0
Median	170	225	339	267	427	309	550	240	160	158	150	194	165	172
Total Dissolved Solids														
No. of Analyses	72	8	72	8	135	8	126	8	63	8	87	8	86	8
No. of Detections	72	8	72	8	135	8	126	8	63	8	87	8	86	8
Minimum	50	138	157	157	34	174	188	204	71	110	58	116	54	113
Maximum	160	150	307	207	480	222	900	216	150	130	160	147	150	135
Mean	122.4	144.8	232.7	177.1	274.8	194.3	463.2	210.3	116.4	123.0	111.3	131.1	116.1	122.5
Standard Deviation	17.9	3.9	32.6	15.4	63.8	17.2	202.8	4.2	15.6	4.7	18.0	9.9	16.1	7.5
Median	120	145	230	173	270	190	360	209	120	125	110	131	120	122
Alkalinity, mg/L														
No. of Analyses	73	8	72	8	88	8	81	8	63	8	87	8	86	8
No. of Detections	73	8	72	8	88	8	81	8	63	8	87	8	86	8
Minimum	59	84	117	117	110	133	80	133	54	54	56	69	47	49
Maximum	95	90	290	162	500	177	724	155	84	76	100	81	78	56
Mean	72.78	86.54	198.1	127.8	222.1	149.9	293.7	141.1	71.9	72.7	66.5	75.3	59.9	51.7
Standard Deviation	5.47	1.82	45.3	14.9	53.8	15.4	120.6	7.2	3.9	3.7	6.2	4.8	5.7	2.4
Median	72.0	87.0	200	122	230	145	300	140	72	74	66	75	60	51
Ammonia-N, mg/L														
No. of Analyses	73	8	72	8	146	8	142	8	63	8	87	8	86	8
No. of Detections	41	8	37	7	18	1	117	7	11	1	11	0	8	1
Minimum	ND	0.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	0.1	0.0	0.1	0.0	0.0	0.0	0.4	0.1	0.3	0.0	0.1	ND	0.4	0.0
Mean	0.01	0.02	0.01	0.02	-0.01	0.00	0.06	0.04	0.00	-0.01	0.00	0.00	0.00	0.00
Standard Deviation	0.02	0.00	0.03	0.01	0.02	ID	0.07	0.02	0.04	ID	0.02	ID	0.05	ID
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate-N, mg/L														
No. of Analyses	73	8	72	8	146	8	142	8	63	8	88	8	86	8
No. of Detections	13	1	39	8	71	3	25	2	10	1	87	8	85	8
Minimum	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	0.2	ND	3.5
Maximum	0.1	0.0	0.6	0.3	1.3	1.3	0.3	0.0	0.1	0.0	1.6	1.0	8.1	4.8
Mean	-0.01	0.00	0.05	0.14	0.09	0.27	-0.03	0.00	-0.01	-0.01	0.24	0.49	3.91	4.22
Standard Deviation	0.02	ID	0.11	0.08	0.26	0.51	0.07	ID	0.02	ID	0.26	0.28	0.94	0.45
Median	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.41	3.8	4.2
Sulfate, mg/L														
No. of Analyses	73	8	72	8	146	8	142	8	63	8	87	8	86	8
No. of Detections	73	8	72	8	146	8	110	8	63	8	87	8	86	8
Minimum	14.0	16.1	10.0	12.1	1.5	14.4	ND	8.9	9.0	11.9	9.0	11.7	6.7	6.7
Maximum	18.0	17.3	19.0	16.1	18.8	17.2	81.8	10.0	13.0	13.0	18.0	14.3	11.0	8.4
Mean	16.03	16.64	14.15	13.86	12.40	15.79	5.15	9.50	11.28	12.48	12.93	12.84	8.59	7.18
Standard Deviation	1.17	0.47	2.82	1.34	2.77	1.08	7.49	0.40	1.03	0.39	1.33	0.94	0.77	0.54
Median	16.0	16.7	14.2	13.7	12.0	15.6	6.0	9.6	11.0	12.4	13.0	12.6	8.6	7.1

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D		MW-14		MW-9		MW-8	
Gradient	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Chloride, mg/L														
No. of Analyses	73	8	72	8	146	8	142	8	63	8	87	8	86	8
No. of Detections	73	8	72	8	143	8	137	8	63	8	87	8	85	8
Minimum	3.0	3.0	2.1	2.1	ND	2.7	ND	2.9	2.8	2.8	3.0	4.0	ND	4.2
Maximum	4.3	3.4	15.2	2.6	10.6	3.7	89.0	3.4	4.0	3.5	23.0	6.0	6.2	5.0
Mean	3.64	3.23	4.15	2.28	4.38	3.15	22.56	3.16	3.11	3.05	4.42	4.99	4.38	4.59
Standard Deviation	0.34	0.12	1.89	0.16	1.61	0.39	24.99	0.16	0.25	0.20	2.09	0.70	0.49	0.30
Median	3.6	3.2	4.0	2.3	4.0	3.0	7.0	3.2	3.0	3.0	4.0	5.1	4.3	4.7
Dissolved Arsenic, mg/L														
No. of Analyses	73	7	72	7	147	8	142	8	63	8	87	8	86	8
No. of Detections	72	7	70	7	95	8	141	8	63	8	86	8	1	3
Minimum	ND	0.0015	ND	0.0011	ND	0.0005	ND	0.0858	0.0020	0.0024	ND	0.0022	ND	ND
Maximum	0.0050	0.0017	0.0230	0.0019	0.0040	0.0011	0.3200	0.0960	0.0035	0.0031	0.0030	0.0024	0.0021	0.0005
Mean	0.0017	0.0016	0.0051	0.0015	0.0003	0.0003	0.1029	0.0930	0.0028	0.0029	0.0024	0.0023	-0.0005	-0.0001
Standard Deviation	0.0006	0.0001	0.0061	0.0004	0.0013	0.0008	0.0620	0.0034	0.0003	0.0001	0.0005	0.0001	ID	0.0005
Median	0.0016	0.0016	0.0030	0.0014	0.0010	0.0002	0.1080	0.0942	0.0030	0.0029	0.0024	0.0023	-0.0005	-0.0005
Total Arsenic, mg/L														
No. of Analyses	73	8	72	8	147	8	142	8	63	8	87	8	86	8
No. of Detections	72	8	70	8	95	7	141	8	63	8	86	8	1	3
Minimum	ND	0.0015	ND	0.0011	ND	ND	ND	0.0858	0.0020	0.0024	ND	0.0022	ND	ND
Maximum	0.0050	0.0024	0.0230	0.0042	0.0040	0.0010	0.3200	0.0960	0.0035	0.0031	0.0030	0.0024	0.0021	0.0005
Mean	0.0017	0.0019	0.0051	0.0026	0.0003	0.0001	0.1029	0.0930	0.0028	0.0029	0.0024	0.0023	-0.0005	-0.0001
Standard Deviation	0.0006	0.0004	0.0061	0.0013	0.0013	0.0008	0.0620	0.0034	0.0003	0.0001	0.0005	0.0001	ID	0.0005
Median	0.0016	0.0019	0.0030	0.0024	0.0010	-0.0005	0.1080	0.0942	0.0030	0.0029	0.0024	0.0023	-0.0005	-0.0005
Dissolved Iron, mg/L														
No. of Analyses	73	7	72	7	147	8	141	8	63	8	87	8	86	8
No. of Detections	52	7	72	7	107	0	141	8	53	2	50	1	53	0
Minimum	ND	0.2	0.1	0.2	ND	ND	1.5	7.9	ND	ND	ND	ND	ND	ND
Maximum	0.5	0.3	5.2	0.6	0.9	ND	59.0	9.1	0.2	0.1	0.3	0.0	0.2	ND
Mean	0.06	0.19	1.57	0.46	0.07	-0.01	20.91	8.40	0.04	-0.01	0.03	0.00	0.03	-0.01
Standard Deviation	0.08	0.08	1.28	0.25	0.11	ID	12.08	0.46	0.05	ID	0.06	ID	0.04	ID
Median	0.0	0.190	1.4	0.43	0.0	-0.005	17.5	8.4	0.0	-0.005	0.0	-0.005	0.0	-0.005
Total Iron, mg/L														
No. of Analyses	73	8	72	8	147	8	141	8	63	8	87	8	86	8
No. of Detections	52	8	72	8	107	4	141	8	53	2	50	3	53	1
Minimum	ND	0.1	0.1	0.2	ND	ND	1.5	7.9	ND	ND	ND	ND	ND	ND
Maximum	0.5	0.9	5.2	1.8	0.9	0.0	59.0	9.1	0.2	0.1	0.3	0.1	0.2	0.0
Mean	0.06	0.45	1.57	0.99	0.07	0.01	20.91	8.40	0.04	-0.01	0.03	0.01	0.03	0.00
Standard Deviation	0.08	0.35	1.28	0.63	0.11	0.01	12.08	0.46	0.05	ID	0.06	0.03	0.04	ID
Median	0.0	0.385	1.4	0.96	0.0	0.004	17.5	8.4	0.0	-0.005	0.0	-0.005	0.0	-0.005

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D		MW-14		MW-9		MW-8	
Gradient	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Dissolved Manganese, mg/L														
No. of Analyses	73	7	71	7	147	8	141	8	63	8	87	8	86	8
No. of Detections	73	7	71	7	146	8	140	8	63	8	8	2	5	0
Minimum	0.053	0.288	0.169	0.188	ND	0.079	ND	0.514	0.012	0.012	ND	ND	ND	ND
Maximum	0.548	0.342	1.600	0.812	0.590	0.112	11.500	0.660	0.061	0.056	0.540	0.000	0.003	ND
Mean	0.21	0.315	0.57	0.48	0.13	0.10	2.47	0.57	0.05	0.05	0.01	0.00	0.00	0.00
Standard Deviation	0.09	0.023	0.33	0.26	0.08	0.01	2.63	0.04	0.01	0.01	0.06	ID	0.00	ID
Median	0.210	0.315	0.484	0.459	0.110	0.093	1.500	0.565	0.051	0.049	-0.001	-0.001	-0.001	-0.001
Total Manganese, mg/L														
No. of Analyses	73	8	71	8	147	8	141	8	63	8	87	8	86	8
No. of Detections	73	8	71	8	146	8	140	8	63	8	8	3	5	1
Minimum	0.053	0.271	0.169	0.209	ND	0.084	ND	0.514	0.012	0.012	ND	ND	ND	ND
Maximum	0.548	0.344	1.600	1.050	0.590	0.112	11.500	0.660	0.061	0.056	0.540	0.003	0.003	0.002
Mean	0.21	0.314	0.57	0.56	0.13	0.10	2.47	0.57	0.05	0.05	0.01	0.00	0.00	0.00
Standard Deviation	0.09	0.024	0.33	0.30	0.08	0.01	2.63	0.04	0.01	0.01	0.06	0.00	0.00	ID
Median	0.210	0.310	0.484	0.541	0.110	0.099	1.500	0.565	0.051	0.049	-0.001	-0.001	-0.001	0.000
Dissolved Calcium, mg/L														
No. of Analyses	73	7	72	7	121	8	113	8	63	8	87	8	86	8
No. of Detections	73	7	72	7	121	8	113	8	63	8	87	8	86	8
Minimum	9.1	12.0	17.5	16.3	4.3	18.5	19.1	19.1	9.1	10.9	5.1	11.6	9.7	10.3
Maximum	18.0	13.9	40.0	19.7	47.9	23.2	149.0	25.1	18.0	14.2	15.2	15.8	15.9	11.8
Mean	12.23	13.19	26.27	18.70	32.45	20.31	64.87	21.30	12.37	12.53	11.62	13.93	11.98	11.19
Standard Deviation	1.62	0.61	6.00	1.51	9.40	1.62	35.90	1.91	1.47	1.28	1.53	1.50	1.21	0.43
Median	12.0	13.4	26.0	18.7	32.0	19.9	52.5	21.0	12.0	12.2	12.0	14.3	12.0	11.3
Total Calcium, mg/L														
No. of Analyses	73	8	72	8	121	8	113	8	63	8	87	8	86	8
No. of Detections	73	8	72	8	121	8	113	8	63	8	87	8	86	8
Minimum	9.1	12.2	17.5	16.1	4.3	18.4	19.1	19.1	9.1	10.9	5.1	12.0	9.7	10.2
Maximum	18.0	14.4	40.0	21.3	47.9	23.2	149.0	25.1	18.0	14.2	15.2	16.7	15.9	12.1
Mean	12.23	13.39	26.27	18.73	32.45	20.35	64.87	21.30	12.37	12.53	11.62	14.18	11.98	11.29
Standard Deviation	1.62	0.72	6.00	1.63	9.40	1.59	35.90	1.91	1.47	1.28	1.53	1.66	1.21	0.58
Median	12.0	13.6	26.0	18.5	32.0	19.8	52.5	21.0	12.0	12.2	12.0	14.4	12.0	11.3
Dissolved Magnesium, mg/L														
No. of Analyses	73	7	72	7	121	8	113	8	63	8	87	8	86	8
No. of Detections	73	7	72	7	121	8	113	8	63	8	87	8	86	8
Minimum	7.7	13.0	15.2	15.2	3.9	21.0	13.8	14.4	6.8	7.6	6.6	10.0	7.1	8.8
Maximum	14.0	14.4	43.2	17.7	53.9	26.5	102.0	17.8	12.0	10.3	13.0	12.7	11.9	9.4
Mean	10.10	13.70	26.53	17.16	36.40	23.18	48.41	15.70	8.62	9.29	9.18	11.34	9.27	9.02
Standard Deviation	1.45	0.49	7.63	2.52	10.51	1.95	27.98	1.16	0.89	0.85	1.26	0.94	0.80	0.21
Median	9.9	13.7	24.8	16.5	35.0	22.8	37.0	15.3	8.6	9.3	9.2	11.4	9.2	9.0
Total Magnesium, mg/L														
No. of Analyses	73	8	72	8	121	8	113	8	63	8	87	8	86	8
No. of Detections	73	8	72	8	121	8	113	8	63	8	87	8	86	8
Minimum	7.7	12.5	15.2	14.3	3.9	20.6	13.8	14.4	6.8	7.6	6.6	10.0	7.1	8.4
Maximum	14.0	15.0	43.2	23.0	53.9	26.5	102.0	17.8	12.0	10.3	13.0	14.0	11.9	9.8
Mean	10.10	13.74	26.53	16.99	36.40	22.99	48.41	15.70	8.62	9.29	9.18	11.52	9.27	9.05
Standard Deviation	1.45	0.79	7.63	2.70	10.51	2.02	27.98	1.16	0.89	0.85	1.26	1.32	0.80	0.43
Median	9.9	13.7	24.8	16.2	35.0	22.3	37.0	15.3	8.6	9.3	9.2	11.4	9.2	8.9

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D		MW-14		MW-9		MW-8	
Gradient	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Dissolved Sodium, mg/L														
No. of Analyses	73	7	72	7	121	8	114	8	63	8	87	8	86	8
No. of Detections	73	7	72	7	121	8	114	8	63	8	87	8	86	8
Minimum	4.2	6.0	8.8	10.3	2.2	8.1	11.5	11.5	4.9	4.9	4.5	5.3	4.5	5.8
Maximum	8.0	6.6	13.0	11.6	14.0	9.3	27.1	14.7	7.3	6.5	6.2	6.4	7.3	6.4
Mean	6.15	6.28	10.29	10.93	10.46	8.88	16.76	13.16	5.66	5.94	5.21	5.85	6.09	6.04
Standard Deviation	0.80	0.23	0.95	0.47	1.76	0.37	3.75	1.18	0.48	0.55	0.50	0.39	0.48	0.20
Median	6.1	6.2	10.0	10.9	10.0	9.0	16.0	13.5	5.6	5.93	5.2	5.9	6.1	6.0
Total Sodium, mg/L														
No. of Analyses	73	8	72	8	121	8	114	8	63	8	87	8	86	8
No. of Detections	73	8	72	8	121	8	114	8	63	8	87	8	86	8
Minimum	4.2	5.8	8.8	9.6	2.2	8.4	11.5	11.5	4.9	4.9	4.5	5.3	4.5	5.8
Maximum	8.0	6.9	13.0	11.8	14.0	9.1	27.1	14.7	7.3	6.5	6.2	6.8	7.3	6.6
Mean	6.15	6.29	10.29	10.79	10.46	8.79	16.76	13.16	5.66	5.94	5.21	5.95	6.09	6.10
Standard Deviation	0.80	0.37	0.95	0.66	1.76	0.29	3.75	1.18	0.48	0.55	0.50	0.51	0.48	0.30
Median	6.1	6.2	10.0	10.9	10.0	8.9	16.0	13.5	5.6	5.93	5.2	5.9	6.1	6.0
Dissolved Potassium, mg/L														
No. of Analyses	73	7	72	7	121	8	114	8	63	8	87	8	86	8
No. of Detections	73	7	72	7	121	8	114	8	63	8	87	8	86	8
Minimum	1.5	2.1	1.8	2.0	0.6	2.1	2.1	2.1	2.0	2.2	1.2	2.0	0.9	1.1
Maximum	2.9	2.3	3.3	2.1	3.7	2.3	5.3	2.4	3.4	2.6	2.4	2.4	1.5	1.2
Mean	2.06	2.12	2.41	2.04	2.54	2.17	3.47	2.26	2.43	2.53	1.92	2.21	1.09	1.11
Standard Deviation	0.22	0.12	0.35	0.07	0.40	0.09	0.92	0.08	0.22	0.11	0.19	0.12	0.11	0.07
Median	2.0	2.1	2.3	2.0	2.5	2.2	3.3	2.3	2.4	2.53	1.9	2.2	1.1	1.1
Total Potassium, mg/L														
No. of Analyses	73	8	72	8	121	8	114	8	63	8	87	8	86	8
No. of Detections	73	8	72	8	121	8	114	8	63	8	87	8	86	8
Minimum	1.5	1.9	1.8	2.0	0.6	2.1	2.1	2.1	2.0	2.2	1.2	1.9	0.9	1.0
Maximum	2.9	2.3	3.3	2.1	3.7	2.3	5.3	2.4	3.4	2.6	2.4	2.4	1.5	1.2
Mean	2.06	2.17	2.41	2.07	2.54	2.16	3.47	2.26	2.43	2.53	1.92	2.25	1.09	1.12
Standard Deviation	0.22	0.13	0.35	0.06	0.40	0.08	0.92	0.08	0.22	0.11	0.19	0.15	0.11	0.07
Median	2.0	2.2	2.3	2.1	2.5	2.1	3.3	2.3	2.4	2.53	1.9	2.3	1.1	1.1
Benzene, ug/L														
No. of Analyses	74	8	73	8	158	8	143	8	63	8	88	8	85	8
No. of Detections	0	0	3	0	0	0	113	8	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	0.3	ND	ND	ND	5.0	0.5	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.09	ND	-0.19	-0.08	0.93	0.45	-0.10	-0.10	-0.10	-0.08	-0.10	-0.08
Standard Deviation	ID	ID	0.06	ID	ID	ID	1.33	0.10	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	ND	-0.1	-0.1	0.6	0.49	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Chloroethane, ug/L														
No. of Analyses	74	8	73	8	158	8	143	8	63	8	88	8	85	8
No. of Detections	0	0	0	0	27	0	9	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	1.2	ND	0.9	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.08	-0.53	-0.08	-0.50	-0.10	-0.10	-0.10	-0.10	-0.08	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	1.22	ID	1.00	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D		MW-14		MW-9		MW-8	
Gradient	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Toluene, ug/L														
No. of Analyses	74	8	73	8	158	8	143	8	63	8	88	8	85	8
No. of Detections	1	0	0	0	2	0	49	0	0	0	0	0	1	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	0.2	ND	ND	ND	0.3	ND	2.9	ND	ND	ND	ND	ND	0.3	ND
Mean	-0.10	-0.08	-0.10	-0.08	-0.57	-0.08	0.08	-0.10	-0.10	-0.10	-0.10	-0.08	-0.09	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	1.30	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Trichloroethene, ug/L														
No. of Analyses	74	8	73	8	158	8	143	8	63	8	88	8	85	8
No. of Detections	0	0	0	0	0	0	35	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	1.8	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.08	-0.19	-0.08	0.06	-0.10	-0.10	-0.10	-0.10	-0.08	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	0.57	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Vinyl Chloride, ug/L														
No. of Analyses	74	8	73	8	158	8	143	8	63	8	88	8	85	8
No. of Detections	1	1	71	7	146	8	127	8	1	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	0.1	ND	2.9	ND	ND	ND	ND	ND	ND
Maximum	0.1	0.1	1.0	0.1	40.0	0.1	38.0	4.8	0.0	ND	ND	ND	ND	ND
Mean	-0.01	-0.01	0.37	0.08	6.53	0.08	13.47	3.57	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Standard Deviation	ID	ID	0.21	0.02	8.47	0.01	9.16	0.78	ID	ID	ID	ID	ID	ID
Median	0.0	0.0	0.4	0.077	0.9	0.078	13.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0
Total Xylenes, ug/L														
No. of Analyses	74	8	73	8	158	8	143	8	63	8	88	8	86	8
No. of Detections	0	0	0	0	0	0	19	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	2.3	ND	ND	ND	ND	ND	ND	ND
Mean	-0.16	-0.08	-0.16	-0.08	-0.25	-0.08	-0.01	-0.10	-0.19	-0.10	-0.17	-0.08	-0.17	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	0.65	ID	ID	ID	ID	ID	ID	ID
Median	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1
cis-1,2-Dichloroethene, ug/L														
No. of Analyses	74	8	73	8	131	8	126	8	63	8	88	8	85	8
No. of Detections	1	1	71	7	34	4	120	8	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	6.6	ND	ND	ND	ND	ND	ND
Maximum	1.0	1.0	8.7	1.0	0.6	0.3	22.0	9.4	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	2.26	0.93	-0.03	0.07	10.39	8.04	-0.10	-0.10	-0.10	-0.08	-0.10	-0.08
Standard Deviation	ID	ID	2.21	0.04	0.21	0.18	3.90	1.01	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	1.3	0.935	-0.1	0.1	10.0	7.915	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
trans-1,2-Dichloroethene, ug/L														
No. of Analyses	74	8	73	8	134	8	129	8	63	8	88	8	85	8
No. of Detections	0	0	9	3	0	0	101	8	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	0.4	0.1	ND	ND	0.9	0.4	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.05	-0.02	-0.14	-0.08	0.27	0.30	-0.10	-0.10	-0.10	-0.08	-0.10	-0.08
Standard Deviation	ID	ID	0.15	0.12	ID	ID	0.36	0.05	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.3	0.315	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D		MW-14		MW-9		MW-8	
Gradient	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1,1 Dichloroethane, ug/L														
No. of Analyses	74	8	73	8	158	8	143	8	63	8	88	8	85	8
No. of Detections	0	0	0	0	8	0	78	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	0.3	ND	1.2	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.08	-0.18	-0.08	0.16	-0.10	-0.10	-0.10	-0.10	-0.08	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	0.19	ID	0.54	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.100	0.2	-0.100	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
1,2-Dichloropropane, ug/L														
No. of Analyses	74	8	73	8	158	8	143	8	63	8	88	8	85	8
No. of Detections	0	0	0	0	0	0	70	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	2.8	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.08	-0.19	-0.08	0.27	-0.10	-0.10	-0.10	-0.10	-0.08	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	0.72	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.100	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Trichlorofluoromethane, ug/L														
No. of Analyses	74	8	73	8	121	8	114	8	63	8	88	8	85	8
No. of Detections	1	1	69	7	117	8	21	0	0	0	0	0	20	0
Minimum	ND	ND	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	0.6	0.6	9.0	1.0	23.0	3.3	1.5	ND	ND	ND	ND	ND	0.6	ND
Mean	-0.10	-0.08	2.39	0.48	6.97	1.33	0.04	-0.10	-0.10	-0.10	-0.10	-0.08	0.04	0.00
Standard Deviation	ID	ID	2.34	0.23	5.48	1.20	0.33	ID	ID	ID	ID	ID	0.19	ID
Median	-0.1	-0.1	1.4	0.46	4.6	0.86	-0.1	-0.100	-0.1	-0.1	-0.1	-0.1	-0.1	0.0
Dichlorodifluoromethane, ug/L														
No. of Analyses	74	8	72	8	87	8	80	8	63	8	88	8	85	8
No. of Detections	9	8	70	7	85	8	80	8	0	0	0	0	11	0
Minimum	ND	0.4	ND	ND	ND	4.0	0.6	1.1	ND	ND	ND	ND	ND	ND
Maximum	1.9	1.9	20.0	2.6	45.0	6.8	10.0	2.4	ND	ND	ND	ND	0.6	ND
Mean	-0.01	0.67	5.39	1.51	11.64	5.05	3.58	1.53	-0.10	-0.10	-0.10	-0.08	-0.01	-0.05
Standard Deviation	0.29	0.21	3.77	0.55	7.33	0.92	2.10	0.44	ID	ID	ID	ID	0.18	ID
Median	-0.1	0.6	4.2	1.5	9.5	5.0	3.5	1.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

NOTES:

ID	Insufficient Data. The number of detections is less than 3.
ND	Not Detected (at laboratory MDL).
mg/L	Milligram per liter.
ug/L	Microgram per liter.
Current	Reflects the most recent analysis data, up to eight analyses maximum.

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27		MW-29	
Gradient			a										
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH field, Standard Units													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	66	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	66	8
Minimum	6.8	7.4	6.9	6.8	7.1	6.8	7.4	7.4	7.5	6.5	6.5	7.0	7.3
Maximum	8.4	7.9	8.4	8.4	7.6	8.5	7.7	9.2	8.2	7.2	7.1	7.8	7.7
Mean	7.71	7.70	7.54	7.48	7.33	7.65	7.53	8.13	7.94	6.85	6.77	7.53	7.48
Standard Deviation	0.29	0.17	0.34	0.25	0.15	0.25	0.12	0.25	0.23	0.16	0.24	0.16	0.13
Median	7.8	7.7	7.6	7.5	7.3	7.7	7.6	8.1	8.0	6.9	6.8	7.6	7.5
Specific Conductance field, micro													
No. of Analyses	90	8	24	89	8	91	8	62	8	56	8	66	8
No. of Detections	90	8	24	89	8	91	8	62	8	56	8	66	8
Minimum	100	185	153	115	155	100	205	136	184	140	140	165	238
Maximum	194	194	220	185	167	230	227	200	197	199	199	265	247
Mean	159.6	188.0	179.8	140.0	161.2	194.6	220.4	170.0	190.3	172.0	181.1	215.3	243.3
Standard Deviation	15.5	2.8	14.1	12.4	3.9	24.0	7.1	13.5	3.8	13.4	21.2	21.0	2.5
Median	160	187	180	140	161	200	222	170	190	170	193	213	243
Total Dissolved Solids													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	63	125	36	53	105	80	130	90	131	57	124	90	145
Maximum	160	136	130	150	119	170	149	450	172	146	146	170	159
Mean	114.6	132.0	113.1	100.4	112.1	132.6	142.4	133.6	143.9	119.8	133.3	143.9	153.5
Standard Deviation	15.5	3.6	18.8	15.4	5.3	20.2	6.0	46.1	13.1	17.3	8.0	15.0	4.3
Median	120	132	120	100	112	130	142	130	140	123	132	147	154
Alkalinity, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	58	76	74	30	59	64	86	67	74	57	60	88	100
Maximum	100	79	100	66	64	110	89	86	85	78	71	140	103
Mean	73.40	77.5	81.9	57.3	61.0	83.9	87.6	74.4	76.2	67.2	65.7	98.8	101.9
Standard Deviation	5.05	0.9	5.2	4.3	1.5	12.7	1.1	3.6	3.7	4.2	4.3	7.7	1.0
Median	73.0	77	83	58	61	82	88	75	75	68	66	100	102
Ammonia-N, mg/L													
No. of Analyses	86	8	24	85	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	20	7	0	72	8	58	8	7	1	3	3
Minimum	0.1	0.2	ND	ND	ND	ND	0.0	0.0	0.2	ND	ND	ND	ND
Maximum	0.3	0.3	0.1	0.1	ND	0.2	0.0	0.3	0.3	0.5	0.0	0.0	0.0
Mean	0.20	0.27	0.03	-0.01	0.00	0.04	0.03	0.22	0.25	0.00	0.00	-0.01	0.00
Standard Deviation	0.05	0.01	0.03	0.01	ID	0.04	0.00	0.05	0.02	0.07	ID	0.01	0.00
Median	0.2	0.271	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0
Nitrate-N, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	33	2	6	86	8	34	1	25	2	55	8	1	0
Minimum	ND	ND	ND	0.6	0.7	ND	ND	ND	ND	ND	2.0	ND	ND
Maximum	0.3	0.014	0.0	1.9	0.8	0.8	0.0	0.2	0.0	10.3	10.3	0.1	ND
Mean	0.01	0.000	0.00	0.74	0.77	0.01	0.00	0.00	0.00	3.08	3.47	-0.01	-0.01
Standard Deviation	0.05	ID	0.01	0.15	0.04	0.09	ID	0.05	ID	1.56	2.83	ID	ID
Median	0.0	-0.005	0.0	0.7	0.8	0.0	0.0	0.0	0.0	2.9	2.3	0.0	0.0
Sulfate, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	8.7	10.1	13.0	9.0	9.8	12.0	15.1	11.0	11.5	7.8	8.1	15.0	14.9
Maximum	14.0	11.5	17.0	12.0	11.4	24.0	17.7	14.2	14.2	11.0	10.5	18.0	17.1
Mean	10.44	10.79	14.58	10.18	10.58	19.01	16.45	13.03	13.28	9.44	9.72	16.55	15.86
Standard Deviation	0.66	0.52	0.93	0.52	0.48	2.05	0.91	0.68	0.92	0.91	0.80	0.86	0.80
Median	10.3	10.8	14.5	10.0	10.6	19.0	16.5	13.0	13.6	9.4	9.9	16.6	15.8

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27		MW-29	
Gradient			a										
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Chloride, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	2.7	3.1	3.0	2.6	2.9	3.7	4.2	3.0	3.2	4.0	5.0	3.4	3.4
Maximum	5.0	3.5	6.0	5.0	3.3	37.6	4.9	9.1	4.0	6.1	5.5	5.6	3.8
Mean	3.19	3.34	3.63	3.08	3.11	5.57	4.55	3.97	3.70	4.87	5.31	3.93	3.63
Standard Deviation	0.34	0.14	0.69	0.37	0.13	3.53	0.24	0.86	0.26	0.50	0.18	0.32	0.16
Median	3.0	3.4	3.8	3.0	3.1	5.0	4.6	3.9	3.8	5.0	5.3	4.0	3.6
Dissolved Arsenic, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	16	8	58	8
Minimum	0.0021	0.0050	0.0030	0.0017	0.0020	0.0011	0.0011	0.0020	0.0028	ND	0.0005	0.0039	0.0038
Maximum	0.0220	0.0057	0.0070	0.0056	0.0024	0.0270	0.0012	0.0034	0.0031	0.0013	0.0005	0.0080	0.0042
Mean	0.0072	0.0052	0.0050	0.0021	0.0021	0.0039	0.0011	0.0029	0.0030	-0.0004	-0.0005	0.0047	0.0040
Standard Deviation	0.0032	0.0003	0.0011	0.0004	0.0001	0.0039	0.0001	0.0004	0.0001	0.0003	0.0000	0.0007	0.0001
Median	0.0063	0.0051	0.0050	0.0020	0.0021	0.0023	0.0011	0.0030	0.0030	-0.0005	-0.0005	0.0046	0.0040
Total Arsenic, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	16	8	58	8
Minimum	0.0021	0.0046	0.0030	0.0017	0.0019	0.0011	0.0011	0.0020	0.0029	ND	0.0005	0.0039	0.0035
Maximum	0.0220	0.0057	0.0070	0.0056	0.0024	0.0270	0.0013	0.0034	0.0046	0.0013	0.0005	0.0080	0.0045
Mean	0.0072	0.0051	0.0050	0.0021	0.0021	0.0039	0.0012	0.0029	0.0035	-0.0004	-0.0005	0.0047	0.0041
Standard Deviation	0.0032	0.0003	0.0011	0.0004	0.0002	0.0039	0.0001	0.0004	0.0007	0.0003	0.0000	0.0007	0.0003
Median	0.0063	0.0051	0.0050	0.0020	0.0021	0.0023	0.0012	0.0030	0.0033	-0.0005	-0.0005	0.0046	0.0041
Dissolved Iron, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	61	8	24	51	0	85	8	58	8	27	0	58	8
Minimum	ND	0.0	0.1	ND	ND	ND	0.0	0.0	0.1	ND	ND	0.290	0.687
Maximum	0.2	0.02	4.00	0.42	ND	0.19	0.06	0.23	0.13	0.30	ND	0.975	0.836
Mean	0.04	0.02	0.35	0.03	-0.01	0.06	0.04	0.10	0.10	0.03	-0.01	0.67	0.73
Standard Deviation	0.04	0.00	0.78	0.06	ID	0.04	0.01	0.04	0.02	0.05	ID	0.12	0.05
Median	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.71	0.71
Total Iron, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	61	8	24	51	4	85	8	58	8	27	0	58	8
Minimum	ND	0.0	0.1	ND	ND	ND	0.0	0.0	0.1	ND	ND	0.290	0.687
Maximum	0.2	0.02	4.00	0.42	0.03	0.19	0.21	0.23	2.47	0.30	ND	0.975	1.030
Mean	0.04	0.02	0.35	0.03	0.01	0.06	0.10	0.10	1.00	0.03	-0.01	0.67	0.83
Standard Deviation	0.04	0.00	0.78	0.06	0.01	0.04	0.07	0.04	1.05	0.05	ID	0.12	0.15
Median	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.1	0.7	0.0	0.0	0.71	0.75

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27		MW-29	
Gradient			a										
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Dissolved Manganese, mg/L													
No. of Analyses	86	8	24	86	8	86	8	58	8	56	8	58	8
No. of Detections	84	8	24	3	1	85	8	58	8	1	0	58	8
Minimum	ND	0.142	0.077	ND	ND	ND	0.430	0.042	0.060	ND	ND	0.068	0.082
Maximum	0.255	0.255	0.130	0.140	0.000	1.350	0.513	0.085	0.068	0.002	ND	0.123	0.095
Mean	0.14	0.18	0.10	0.00	0.00	0.43	0.48	0.06	0.06	0.00	0.00	0.092	0.090
Standard Deviation	0.03	0.03	0.01	0.02	ID	0.20	0.03	0.01	0.00	ID	ID	0.008	0.005
Median	0.140	0.172	0.094	-0.001	-0.001	0.470	0.476	0.064	0.063	-0.001	-0.001	0.092	0.091
Total Manganese, mg/L													
No. of Analyses	86	8	24	86	8	86	8	58	8	56	8	58	8
No. of Detections	84	8	24	3	3	85	8	58	8	1	0	58	8
Minimum	ND	0.142	0.077	ND	ND	ND	0.467	0.042	0.060	ND	ND	0.068	0.082
Maximum	0.255	0.255	0.130	0.140	0.001	1.350	0.549	0.085	0.086	0.002	ND	0.123	0.099
Mean	0.14	0.18	0.10	0.00	0.00	0.43	0.50	0.06	0.07	0.00	0.00	0.092	0.090
Standard Deviation	0.03	0.03	0.01	0.02	0.00	0.20	0.03	0.01	0.01	ID	ID	0.008	0.006
Median	0.140	0.170	0.094	-0.001	-0.001	0.470	0.500	0.064	0.069	-0.001	-0.001	0.092	0.091
Dissolved Calcium, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	9.2	13.4	12.0	7.7	9.7	9.2	13.2	11.2	14.7	10.1	11.9	13.6	17.5
Maximum	18.0	16.0	18.0	13.0	11.8	19.6	15.5	18.3	17.5	17.0	14.2	23.0	20.5
Mean	13.01	14.60	15.79	9.77	10.68	14.09	14.69	15.60	16.24	12.73	13.03	18.34	19.18
Standard Deviation	1.53	0.89	1.53	1.06	0.77	2.00	0.75	1.23	0.99	1.18	0.91	1.38	1.04
Median	13.0	14.5	16.0	9.8	10.6	14.0	14.8	15.7	16.2	12.7	12.9	18.2	19.3
Total Calcium, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	9.2	13.7	12.0	7.7	9.7	9.2	14.1	11.2	15.4	10.1	11.9	13.6	17.6
Maximum	18.0	16.0	18.0	13.0	11.5	19.6	15.7	18.3	19.1	17.0	14.2	23.0	22.2
Mean	13.01	14.89	15.79	9.77	10.63	14.09	14.95	15.60	16.74	12.73	13.03	18.34	19.53
Standard Deviation	1.53	0.92	1.53	1.06	0.70	2.00	0.64	1.23	1.39	1.18	0.91	1.38	1.53
Median	13.0	14.9	16.0	9.8	10.6	14.0	15.0	15.7	16.2	12.7	12.9	18.2	19.3
Dissolved Magnesium, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	6.3	8.6	8.4	6.2	7.6	8.4	13.1	5.4	6.9	8.5	9.2	10.0	12.8
Maximum	11.0	10.3	11.0	9.5	10.0	17.1	14.5	7.9	7.7	13.0	12.8	16.2	14.6
Mean	8.09	9.21	9.92	7.69	8.87	12.65	13.66	6.58	7.24	10.37	10.73	12.85	13.68
Standard Deviation	0.74	0.56	0.62	0.77	0.78	1.95	0.54	0.55	0.29	0.97	1.17	1.29	0.61
Median	8.2	9.0	9.9	7.8	8.8	12.0	13.5	6.6	7.2	10.0	10.4	13.0	13.8
Total Magnesium, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	6.3	8.6	8.4	6.2	7.6	8.4	13.1	5.4	6.9	8.5	9.2	10.0	12.8
Maximum	11.0	10.5	11.0	9.5	9.4	17.1	14.9	7.9	8.3	13.0	12.8	16.2	15.4
Mean	8.09	9.36	9.92	7.69	8.67	12.65	13.90	6.58	7.37	10.37	10.73	12.85	13.79
Standard Deviation	0.74	0.60	0.62	0.77	0.66	1.95	0.63	0.55	0.45	0.97	1.17	1.29	0.86
Median	8.2	9.3	9.9	7.8	8.8	12.0	13.9	6.6	7.3	10.0	10.4	13.0	13.8

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27		MW-29	
Gradient			a										
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Dissolved Sodium, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	4.8	5.4	4.9	4.3	5.3	4.8	6.2	6.5	7.3	5.2	5.5	5.1	5.7
Maximum	7.5	6.4	7.0	10.0	6.4	7.5	7.0	9.5	8.5	7.6	7.6	7.6	6.7
Mean	5.87	5.82	5.90	5.42	5.82	6.29	6.60	8.03	7.82	6.16	6.23	6.07	6.18
Standard Deviation	0.55	0.34	0.52	0.95	0.39	0.56	0.28	0.78	0.41	0.54	0.72	0.51	0.34
Median	5.8	5.8	5.9	5.3	5.9	6.3	6.6	8.0	7.8	6.1	6.0	6.0	6.3
Total Sodium, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	87	8	58	8	56	8	58	8
Minimum	4.8	5.4	4.9	4.3	5.3	4.8	6.2	6.5	7.3	5.2	5.5	5.1	5.7
Maximum	7.5	6.5	7.0	10.0	6.1	7.5	7.2	9.5	9.1	7.6	7.6	7.6	7.0
Mean	5.87	5.93	5.90	5.42	5.75	6.29	6.73	8.03	7.97	6.16	6.23	6.07	6.30
Standard Deviation	0.55	0.32	0.52	0.95	0.28	0.56	0.33	0.78	0.58	0.54	0.72	0.51	0.43
Median	5.8	5.9	5.9	5.3	5.8	6.3	6.7	8.0	7.8	6.1	6.0	6.0	6.3
Dissolved Potassium, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	86	8	58	8	56	8	58	8
Minimum	1.6	2.4	1.7	1.4	1.7	ND	2.3	2.1	2.7	1.0	1.3	1.6	2.0
Maximum	3.6	3.0	2.6	2.3	1.9	3.3	2.7	3.3	3.1	1.5	1.5	2.5	2.3
Mean	2.53	2.74	2.08	1.72	1.78	2.41	2.48	2.84	2.92	1.28	1.36	2.04	2.15
Standard Deviation	0.28	0.20	0.21	0.18	0.09	0.25	0.12	0.23	0.12	0.11	0.07	0.18	0.09
Median	2.5	2.7	2.1	1.7	1.8	2.4	2.4	2.9	2.9	1.3	1.4	2.1	2.2
Total Potassium, mg/L													
No. of Analyses	86	8	24	86	8	87	8	58	8	56	8	58	8
No. of Detections	86	8	24	86	8	86	8	58	8	56	8	58	8
Minimum	1.6	2.6	1.7	1.4	1.7	ND	2.3	2.1	2.7	1.0	1.3	1.6	2.1
Maximum	3.6	3.0	2.6	2.3	1.9	3.3	2.7	3.3	3.2	1.5	1.5	2.5	2.3
Mean	2.53	2.78	2.08	1.72	1.79	2.41	2.50	2.84	2.98	1.28	1.36	2.04	2.19
Standard Deviation	0.28	0.15	0.21	0.18	0.08	0.25	0.12	0.23	0.17	0.11	0.07	0.18	0.10
Median	2.5	2.7	2.1	1.7	1.8	2.4	2.5	2.9	3.0	1.3	1.4	2.1	2.2
Benzene, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.10	-0.08	-0.10	-0.08	-0.10	-0.08	-0.10	-0.10	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Chloroethane, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.10	-0.08	-0.10	-0.08	-0.10	-0.08	-0.10	-0.10	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27		MW-29	
Gradient			a										
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Toluene, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	1	0	0	1	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	0.2	ND	ND	0.9	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.09	-0.10	-0.08	-0.09	-0.08	-0.10	-0.08	-0.10	-0.10	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Trichloroethene, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	1	0	1	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	0.4	ND	0.3	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.09	-0.08	-0.10	-0.08	-0.10	-0.08	-0.10	-0.10	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Vinyl Chloride, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	1	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	0.0	ND	ND	ND	ND	ND	ND	ND	ND
Mean	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Xylenes, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	-0.17	-0.08	-0.20	-0.17	-0.08	-0.17	-0.08	-0.15	-0.08	-0.15	-0.10	-0.15	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.2	-0.1	-0.2	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1
cis-1,2-Dichloroethene, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.10	-0.08	-0.10	-0.08	-0.10	-0.08	-0.10	-0.10	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
trans-1,2-Dichloroethene, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.10	-0.08	-0.10	-0.08	-0.10	-0.08	-0.10	-0.10	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Table 3-1
Vashon Island Landfill
Summary of Statistical Analyses for Groundwater Well Samples
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27		MW-29	
Gradient			a										
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1,1 Dichloroethane, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.10	-0.08	-0.10	-0.08	-0.10	-0.08	-0.10	-0.10	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
1,2-Dichloropropane, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.10	-0.08	-0.10	-0.08	-0.10	-0.08	-0.10	-0.10	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Trichlorofluoromethane, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	1	0	0	1	0	0	0	1	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	0.7	ND	ND	0.2	ND	ND	ND	0.2	ND	ND	ND
Mean	-0.10	-0.08	-0.07	-0.10	-0.08	-0.10	-0.08	-0.10	-0.08	-0.05	0.05	-0.10	-0.08
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1
Dichlorodifluoromethane, ug/L													
No. of Analyses	86	8	24	87	8	87	8	58	8	56	8	58	8
No. of Detections	0	0	0	0	0	1	0	0	0	2	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	0.2	ND	ND	ND	0.3	ND	ND	ND
Mean	-0.10	-0.08	-0.10	-0.10	-0.08	-0.10	-0.08	-0.10	-0.08	-0.07	0.09	-0.08	-0.02
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.1	-0.1	-0.1

NOTES:

ID	Insufficient Data. The number of detections is less than 3.
ND	Not Detected (at laboratory MDL).
mg/L	Milligram per liter.
ug/L	Microgram per liter.
Current	Reflects the most recent analysis data, up to eight analyses maximum.
a	(Decommisioned 2003)

Table 3-2
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in or Adjacent to Cc1							Groundwater in Channel Cc2											
Well Location	MW-1[a]	MW-3	MW-10		MW-13		MW-4	MW-20		MW-21		MW-2		MW-5D[a]		MW-14[a]		MW-9	
Gradient Location								Up		Down		Down		Down					
Time Interval	Long	Long	Long	Short	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH field, Standard Units	--	--	D	D	--	--	--	D	D	I	--	--	--	--	--	I	--	D	--
Specific Conductance field,	I	D	--	--	--	--	--	--	--	D	--	D	--	D	--	--	--	--	--
Total Dissolved Solids	--	D	I	--	--	--	D	I	--	D	--	D	--	D	--	I	--	I	--
Alkalinity, mg/L	--	--	--	--	I	--	D	--	--	D	--	D	--	D	--	--	--	I	--
Ammonia-N, mg/L	--	D	D	--	D	--	--	--	--	--	--	D	--	--	--	--	--	D	--
Nitrate-N, mg/L	--	--	I	--	D	--	I	D	--	I	--	I	--	D	--	I	--	I	--
Sulfate, mg/L	--	D	D	--	D	--	I	I	--	I	--	I	--	I	--	I	--	I	--
Chloride, mg/L	--	D	I	--	--	--	--	D	--	D	--	--	--	D	--	I	--	I	--
Dissolved Iron, mg/L	--	--	--	--	--	--	--	D	--	--	--	--	--	--	--	I	--	--	--
Total Iron, mg/L	--	--	I	--	I	--	--	I	--	I	--	I	--	--	--	--	--	I	--
Dissolved Manganese, mg/L	D	D	--	--	--	--	I	I	--	--	--	--	--	D	--	--	--	--	--
Total Manganese, mg/L	--	D	I	--	I	--	--	I	--	I	--	I	--	D	--	--	--	I	--
Dissolved Calcium, mg/L	I	--	--	--	--	--	D	--	--	--	--	--	--	D	--	--	--	--	--
Total Calcium, mg/L	--	--	I	--	I	--	--	I	--	I	--	I	--	D	--	--	--	I	--
Dissolved Magnesium, mg/L	I	--	--	--	--	--	D	--	--	--	--	--	--	D	--	--	--	--	--
Total Magnesium, mg/L	--	--	I	--	I	--	--	I	--	I	--	I	--	D	--	--	--	I	--
Dissolved Sodium, mg/L	--	--	--	--	--	--	D	--	--	--	--	--	--	--	--	--	--	--	--
Total Sodium, mg/L	--	--	I	--	I	--	--	I	--	I	--	I	--	--	--	--	--	I	--
Dissolved Potassium, mg/L	--	D	--	--	--	--	D	--	--	--	--	--	--	D	--	--	--	--	--
Total Potassium, mg/L	--	D	I	--	I	--	--	I	--	I	--	I	--	D	--	--	--	I	--
Benzene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	D	--	--	--	--	--
Vinyl chloride, ug/L	--	--	--	--	--	--	D	--	--	D	--	D	--	D	--	--	--	--	--
cis 1,2-Dichloroethene, ug/L	--	--	--	--	--	--	I	--	--	D	--	--	--	D	--	--	--	--	--
trans 1,2-Dichloroethene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane, ug/L	--	--	--	--	--	--	D	--	--	--	--	--	--	D	--	--	--	--	--
1,2-Dichloropropane, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	D	--	--	--	--	--
Chloroethane, ug/L	--	--	--	--	--	--	D	--	--	--	--	--	--	--	--	--	--	--	--
Toluene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Xylenes, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane, ug/L	--	--	--	--	--	--	--	--	--	D	--	D	D	--	--	--	--	--	--
Dichlorodifluoromethane, ug/L	--	--	--	--	--	--	D	--	--	D	--	D	--	D	--	--	--	--	--

NOTES
D = decreasing trend.
I = increasing trend.
-- = no noticeable trend.
[a] Decommissioned in 2015
[b] Decommissioned in 2016

Table 3-2
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Cc3		Groundwater in D Aquifer												
Well Location	MW-8		MW-7		MW-11	MW-12		MW-19		MW-26		MW-27[b]		MW-29	
Gradient Location			Up		Side	Side		Down		(Installed 2003)		(Installed 2003)		(Installed 2003)	
Time Interval	Long	Short	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH field, Standard Units	D	--	D	--	--	--	--	D	--	D	--	D	I	--	D
Specific Conductance field,	D	D	D	--	--	--	--	I	--	--	--	D	--	I	--
Total Dissolved Solids	I	--	I	--	I	I	--	I	--	I	--	I	--	I	--
Alkalinity, mg/L	D	--	--	--	--	I	--	I	--	I	--	D	--	I	--
Ammonia-N, mg/L	D	--	I	--	D	D	--	--	--	--	--	--	--	--	I
Nitrate-N, mg/L	D	--	D	--	--	D	--	D	--	I	--	--	--	I	--
Sulfate, mg/L	D	--	I	--	--	I	--	D	--	--	--	D	--	I	--
Chloride, mg/L	I	--	I	--	--	I	--	--	--	D	--	I	--	D	--
Dissolved Iron, mg/L	--	--	--	--	--	--	--	--	--	D	--	D	--	I	--
Total Iron, mg/L	I	--	I	--	--	I	--	I	I	D	--	D	--	I	--
Dissolved Manganese, mg/L	--	--	--	--	D	--	--	--	--	D	--	--	--	--	--
Total Manganese, mg/L	I	--	I	--	--	I	--	I	--	D	--	--	--	--	--
Dissolved Calcium, mg/L	--	--	--	--	--	--	--	--	--	D	--	D	--	--	--
Total Calcium, mg/L	I	--	I	--	--	I	--	I	--	D	--	D	--	--	--
Dissolved Magnesium, mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	I	--
Total Magnesium, mg/L	I	--	I	--	--	I	--	I	--	--	--	--	--	I	I
Dissolved Sodium, mg/L	--	--	--	--	--	--	--	--	--	I	--	--	--	--	--
Total Sodium, mg/L	I	--	I	--	--	I	--	I	--	I	--	--	--	--	--
Dissolved Potassium, mg/L	--	--	--	--	D	--	--	--	--	I	--	--	--	I	--
Total Potassium, mg/L	I	--	I	--	--	I	--	I	--	I	--	--	--	I	--
Benzene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis 1,2-Dichloroethene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans 1,2-Dichloroethene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Xylenes, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane, ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES
D = decreasing trend.
I = increasing trend.
-- = no noticeable trend.
[a] Decommissioned in 2015
[b] Decommissioned in 2016

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in or Adjacent to Cc1						
Well Location	MW-1[a]	MW-3	MW-10		MW-13		MW-4
Gradient Location							
Time Interval	Long	Long	Long	Short	Long	Short	Long
pH field, Standard Units							
No. of Analyses	17	22	90	8	97	8	36
No. of Detections	17	22	90	8	97	8	36
Trend	--	--	D	D	--	--	--
S - value	12.0	-51.0	-389.0	-18.0	-128.0	-12	22.0
Probability	0.650	0.159	0.001	0.032	0.2881	0.178	0.775
Probability	0.650	0.159	0.001	0.032	0.288	0.178	0.775
Significant	NO	NO	YES	YES	NO	NO	NO
Specific Conductance field, micromhos/cm	18	22	90	8	96	8	36
No. of Analyses	18	22	90	8	96	8	36
No. of Detections	I	D	--	--	--	--	--
Trend	76.00	-113.00	106.00	14.00	164.00	5.00	-85.00
S - value	0.0	0.0	0.4	0.1	0.2	1	0.3
Probability	0.004	0.002	0.380	0.108	1.7E-01	0.634	0.253
Probability	YES	YES	NO	NO	NO	NO	NO
Significant							
Total Dissolved Solids							
No. of Analyses	19	20	88	8	96	8	37
No. of Detections	19	20	88	8	96	8	37
Trend	--	D	I	--	--	--	D
S - value	3	-45.0	343.0	13	175.0	10.0	-269.0
Probability	0.944	0.048	0.004	0	1.5E-01	0.276	3.3E-05
Probability	0.944	0.048	0.004	0	0.146	0.276	3.3E-05
Significant	NO	YES	YES	NO	NO	NO	YES
Alkalinity, mg/L							
No. of Analyses	5	18	89	8	92	8	19
No. of Detections	5	18	89	8	92	8	19
Trend	--	--	--	--	I	--	D
S - value	-1.0	-27.0	181.0	9.0	302.0	10.0	-63.0
Probability	1	0.155	0.132	0.337	1.2E-02	0.276	0.002
Probability	1	0.155	0.132	0.337	1.2E-02	0.276	0.002
Significant	NO	NO	NO	NO	YES	NO	YES
Ammonia-N, mg/L							
No. of Analyses	30	25	90	8	97	8	52
No. of Detections	4	9	12	1	11	0	21
Trend	--	D	D	--	D	--	--
S - value	-30.0	-71.0	-391.0	12	-573.0	6	-133.0
Probability	0.605	0.035	0.001	0	1.7E-06	1	0.241
Probability	0.605	0.035	0.001	--	1.7E-06	--	0.241
Significant	NO	YES	YES	--	YES	--	NO
Nitrate-N, mg/L							
No. of Analyses	29	25	89	8	97	8	52
No. of Detections	21	25	89	8	96	8	27
Trend	--	--	I	--	D	--	I
S - value	-8.0	54.0	697.0	9	-282.0	2	376.0
Probability	0.896	0.110	5.8E-09	0.337	0.0187	0.904	0.001
Probability	0.896	0.110	5.8E-09	0.337	0.019	0.904	0.001
Significant	NO	NO	YES	NO	YES	NO	YES

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in or Adjacent to Cc1						
Well Location	MW-1[a]	MW-3	MW-10		MW-13		MW-4
Gradient Location							
Time Interval	Long	Long	Long	Short	Long	Short	Long
Sulfate, mg/L							
No. of Analyses	29	25	89	8	96	8	52
No. of Detections	29	25	89	8	96	8	52
Trend	--	D	D	--	D	--	I
S - value	-57.0	-78.0	-477.0	-7.0	-445.0	4.0	416.0
Probability	0.294	0.020	0.000	0.473	2.0E-04	0.720	0.000
Probability	0.294	0.020	0.000	0.473	2.0E-04	0.720	0.000
Significant	NO	YES	YES	NO	YES	NO	YES
Chloride, mg/L							
No. of Analyses	29	25	89	8	97	8	52
No. of Detections	29	25	88	8	97	8	50
Trend	--	D	I	--	--	--	--
S - value	95.0	-69.0	442.0	0	-97.0	2	102.0
Probability	0.078	0.040	0.000	1	0.4220	0.904	0.369
Probability	0.078	0.040	0.000	1	0.422	0.904	0.369
Significant	NO	YES	YES	NO	NO	NO	NO
Dissolved Iron, mg/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	14	19	55	0	61	5	40
Trend	--	--	--	--	--	--	--
S - value	-96.0	-62.0	0.0	0	0.0	-4.0	176.0
Probability	0.090	0.065	9.9E-01	1	0.9933	0.720	0.120
Probability	0.090	0.065	9.9E-01	--	0.993	0.720	0.120
Significant	NO	NO	NO	--	NO	NO	NO
Total Iron, mg/L							
No. of Analyses	0	4	17	8	20	8	1
No. of Detections	0	4	15	2	20	6	1
Trend	--	--	I	--	I	--	--
S - value	-96.0	-62.0	339.0	4	424.0	-6.0	176.0
Probability	0.090	0.065	0.005	0.720	0.0004	0.548	0.120
Probability	--	0.065	0.005	--	0.000	0.548	--
Significant	--	NO	YES	--	YES	NO	--
Dissolved Manganese, mg/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	6	18	8	0	58	6	45
Trend	D	D	--	--	--	--	I
S - value	-134.0	-104.0	0.0	-12	0.0	0.0	306.0
Probability	0.018	0.002	0.993	0	0.9933	1.000	0.007
Probability	0.018	0.002	0.993	--	0.993	1.000	0.007
Significant	YES	YES	NO	--	NO	NO	YES
Total Manganese, mg/L							
No. of Analyses	0	4	17	8	20	8	1
No. of Detections	0	4	8	3	17	6	1
Trend	--	D	I	--	I	--	--
S - value	-134.0	-104.0	351.0	9	414.0	-2.0	306.0
Probability	0.018	0.002	0.003	0.337	0.0006	0.904	0.007
Probability	--	0.002	0.003	--	0.001	0.904	--
Significant	--	YES	YES	NO	YES	NO	--
Dissolved Calcium, mg/L							
No. of Analyses	10	19	89	8	97	8	29
No. of Detections	10	19	89	8	97	8	29
Trend	I	--	--	--	--	--	D
S - value	25.0	-13.0	0.0	9	0.0	10.0	-191.0
Probability	0.032	0.553	0.993	0.337	0.9933	0.276	9.1E-06
Probability	0.032	0.553	0.993	0.337	0.993	0.276	9.1E-06
Significant	YES	NO	NO	NO	NO	NO	YES

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in or Adjacent to Cc1						
Well Location	MW-1[a]	MW-3	MW-10		MW-13		MW-4
Gradient Location							
Time Interval	Long	Long	Long	Short	Long	Short	Long
Total Calcium, mg/L							
No. of Analyses	0	4	17	8	20	8	1
No. of Detections	0	4	17	8	20	8	1
Trend	--	--	I	--	I	--	--
S - value	25.0	-13.0	369.0	11	402.0	10	-191.0
Probability	0.032	0.553	0.002	0.227	0.0008	0.276	9.1E-06
Probability	--	0.553	0.002	0.227	0.001	0.276	--
Significant	--	NO	YES	NO	YES	NO	--
Dissolved Magnesium, mg/L							
No. of Analyses	10	19	89	8	97	8	29
No. of Detections	10	19	89	8	97	8	29
Trend	I	--	--	--	--	--	D
S - value	28.0	-5.0	0.0	2	0.0	8	-170.0
Probability	0.016	0.843	0.993	0.904	9.9E-01	0.398	7.9E-05
Probability	0.016	0.843	0.993	0.904	9.9E-01	0.398	7.9E-05
Significant	YES	NO	NO	NO	NO	NO	YES
Total Magnesium, mg/L							
No. of Analyses	0	4	17	8	20	8	1
No. of Detections	0	4	17	8	20	8	1
Trend	--	--	I	--	I	--	--
S - value	28.0	-5.0	367.0	2	394.0	8	-170.0
Probability	0.016	0.843	0.002	0.904	0.0010	0.398	7.9E-05
Probability	--	0.843	0.002	0.904	0.001	0.398	--
Significant	--	NO	YES	NO	YES	NO	--
Dissolved Sodium, mg/L							
No. of Analyses	10	19	89	8	97	8	29
No. of Detections	10	19	89	8	97	8	29
Trend	--	--	--	--	--	--	D
S - value	18.0	-8.0	0.0	11.0	0.0	4	-181.0
Probability	0.128	0.729	0.993	0.227	0.9933	0.720	2.6E-05
Probability	0.128	0.729	0.993	0.227	0.993	0.720	2.6E-05
Significant	NO	NO	NO	NO	NO	NO	YES
Total Sodium, mg/L							
No. of Analyses	0	4	17	8	20	8	1
No. of Detections	0	4	17	8	20	8	1
Trend	--	--	I	--	I	--	--
S - value	18.0	-8.0	361.0	12	398.0	4	-181.0
Probability	0.128	0.729	0.003	0.178	0.0009	0.720	2.6E-05
Probability	--	0.729	0.003	0.178	0.001	0.720	--
Significant	--	NO	YES	NO	YES	NO	--
Dissolved Potassium, mg/L							
No. of Analyses	10	19	89	8	97	8	29
No. of Detections	10	19	89	8	97	8	29
Trend	--	D	--	--	--	--	D
S - value	20.0	-50.0	0.0	7.0	0.0	9	-194.0
Probability	0.089	0.015	0.993	0.473	9.9E-01	0.337	6.6E-06
Probability	0.089	0.015	0.993	0.473	9.9E-01	0.337	6.6E-06
Significant	NO	YES	NO	NO	NO	NO	YES
Total Potassium, mg/L							
No. of Analyses	0	4	17	8	20	8	1
No. of Detections	0	4	17	8	20	8	1
Trend	--	D	I	--	I	--	--
S - value	20.0	-50.0	345.0	9	403.0	9	-194.0
Probability	0.089	0.015	0.004	0.337	0.0008	0.337	6.6E-06
Probability	--	0.015	0.004	0.337	0.001	0.337	--
Significant	--	YES	YES	NO	YES	NO	--

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in or Adjacent to Cc1						
Well Location	MW-1[a]	MW-3	MW-10		MW-13		MW-4
Gradient Location							
Time Interval	Long	Long	Long	Short	Long	Short	Long
Benzene, ug/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	1	0	1	0	1	0	0
Trend	--	--	--	--	--	--	--
S - value	-203.0	-72.0	0	15	0	0	-533.0
Probability	3.1E-04	0.032	0.993	0	0.9933	1	2.3E-06
Probability	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--
Vinyl chloride, ug/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	0	0	1	0	1	0	23
Trend	--	--	--	--	--	--	D
S - value	-134.0	-78.0	0	15	-17.0	0	-386.0
Probability	0.018	0.020	0.993	0	0.8935	1	0.001
Probability	--	--	--	--	--	--	0.001
Significant	--	--	--	--	--	--	YES
cis 1,2-Dichloroethene, ug/L							
No. of Analyses	17	22	89	8	97	8	39
No. of Detections	0	0	0	0	1	0	16
Trend	--	--	--	--	--	--	I
S - value	-70.0	-27.0	0	15	0	0	167.0
Probability	0.004	0.325	0.993	0	0.9933	1	0.018
Probability	--	--	--	--	--	--	0.018
Significant	--	--	--	--	--	--	YES
trans 1,2-Dichloroethene, ug/L							
No. of Analyses	21	24	89	8	97	8	44
No. of Detections	0	0	0	0	0	0	1
Trend	--	--	--	--	--	--	--
S - value	-77.0	-65.0	0	15	0	0	-319.0
Probability	0.022	0.038	0.993	0	0.9933	1	2.11E-04
Probability	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--
1,1-Dichloroethane, ug/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	0	0	0	0	0	0	17
Trend	--	--	--	--	--	--	D
S - value	-200.0	-72.0	0	15	0	0	-270.0
Probability	0	0.032	0.993	0	0.9933	1	0.017
Probability	--	--	--	--	--	--	0.017
Significant	--	--	--	--	--	--	YES
1,2-Dichloropropane, ug/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--
S - value	-200.0	-72.0	0	15	0	0	-533.0
Probability	0	0.032	0.993	0	0.9933	1	2.27E-06
Probability	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--
Chloroethane, ug/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	0	0	0	0	0	0	6
Trend	--	--	--	--	--	--	D
S - value	-77.0	-61.0	0	15	0	0	-461.0
Probability	0.175	0.070	0.993	0	0.9933	1	4.34E-05
Probability	--	--	--	--	--	--	4.34E-05
Significant	--	--	--	--	--	--	YES

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in or Adjacent to Cc1						
Well Location	MW-1[a]	MW-3	MW-10		MW-13		MW-4
Gradient Location							
Time Interval	Long	Long	Long	Short	Long	Short	Long
Toluene, ug/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	2	0	1	0	1	0	0
Trend	--	--	--	--	--	--	--
S - value	-88.0	-67.0	0	15	0	0	-421.0
Probability	0.121	0.046	0.993	0	0.9933	1	0.000
Probability	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--
Trichloroethene, ug/L							
No. of Analyses	30	25	89	8	97	8	52
No. of Detections	1	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--
S - value	-215.0	-72.0	0	15	0	0	-533.0
Probability	0	0.032	0.993	0	0.9933	1	2.27E-06
Probability	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--
Total Xylenes, ug/L							
No. of Analyses	29	25	89	8	97	8	52
No. of Detections	0	0	0	0	1	0	0
Trend	--	--	--	--	--	--	--
S - value	-190.0	-72.0	-399.0	15	-407.0	0	-533.0
Probability	3.92E-04	0.032	0.001	0	0.0007	1	2.27E-06
Probability	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--
Trichlorofluoromethane, ug/L							
No. of Analyses	10	19	89	8	97	8	30
No. of Detections	0	9	1	0	1	0	24
Trend	--	--	--	--	--	--	--
S - value	0	-1.0	0	11	0	0	-50.0
Probability	0.929	1	0.993	0	0.9933	1	0.280
Probability	--	1	--	--	--	--	0.280
Significant	--	NO	--	--	--	--	NO
Dichlorodifluoromethane, ug/L							
No. of Analyses	5	18	89	8	92	8	20
No. of Detections	0	0	0	0	1	0	12
Trend	--	--	--	--	--	--	D
S - value	0	0	0	11	0	0	-61.0
Probability	1	0.956	0.993	0	0.9933	1	0.007
Probability	--	--	--	--	--	--	0.007
Significant	--	--	--	--	--	--	YES

NOTES
D = decreasing trend.
I = increasing trend.
-- = no noticeable trend.
[a] **Decommissioned in 2015**
[b] **Decommissioned in 2016**

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D[a]		MW-14[a]		MW-9		MW-8	
Gradient Location	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH field, Standard Units														
No. of Analyses	77	8	78	8	147	8	120	8	64	8	76	8	90	8
No. of Detections	77	8	78	8	147	8	120	8	64	8	76	8	90	8
Trend	D	D	I	--	--	--	--	--	I	--	D	--	D	--
S - value	-552.0	-17.0	251.0	-14.0	30.0	-2	-155.0	-8.0	245.0	0	-451.0	-7.0	-469.0	-9.0
Probability	4.0E-06	0.047	0.037	0.108	0.808	0.904	0.171	0.398	0.041	1	1.7E-04	0.473	9.0E-05	0.337
Probability	4.0E-06	0.047	0.037	0.108	0.808	0.904	0.171	0.398	0.041	1	1.7E-04	0.473	9.0E-05	0.337
Significant	YES	YES	YES	NO	NO	NO	NO	NO	YES	NO	YES	NO	YES	NO
Specific Conductance field, micromhos/cm	78	8	78	8	146	8	119	8	64	8	76	8	90	8
No. of Analyses	78	8	78	8	146	8	119	8	64	8	76	8	90	8
No. of Detections	--	--	D	--	D	--	D	--	--	--	--	--	D	D
Trend	113.00	2.00	-533.00	-14.00	-513.00	-6.00	-557.00	-4.00	177.00	-5.00	28.00	8.00	-424.00	-18.00
S - value	0.3	1	0.0	0.1	0.0	0.5	0.0	0.7	0.1	0.6	0.8	0.4	0.0	0.0
Probability	0.349	0.904	0.000	0.108	1.8E-05	0.548	1.6E-06	0.720	0.141	0.634	0.821	0.398	4.0E-04	0.032
Probability	NO	NO	YES	NO	YES	NO	YES	NO	NO	NO	NO	NO	YES	YES
Significant														
Total Dissolved Solids														
No. of Analyses	76	8	76	8	139	8	126	8	63	8	91	8	90	8
No. of Detections	76	8	76	8	139	8	126	8	63	8	91	8	90	8
Trend	I	--	D	--	D	--	D	--	I	--	I	--	I	--
S - value	665.0	9.0	-450.0	-13.0	-456.0	-13.0	-827.0	-1.0	247.0	-5.0	400.0	-3	239.0	7.0
Probability	2.8E-08	0.337	0.000	0.143	0.000	0.143	4.9E-12	1	0.040	0.634	0.001	1	0.046	0.473
Probability	2.8E-08	0.337	0.000	0.143	0.000	0.143	4.9E-12	1	0.040	0.634	0.001	1	0.046	0.473
Significant	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
Alkalinity, mg/L														
No. of Analyses	77	8	76	8	92	8	81	8	63	8	91	8	90	8
No. of Detections	77	8	76	8	92	8	81	8	63	8	91	8	90	8
Trend	--	--	D	--	D	--	D	--	--	--	I	--	D	--
S - value	126.0	9	-544.0	-15.0	-655.0	-15.0	-913.0	-7.0	-45.0	3	256.0	-1.0	-515.0	-2.0
Probability	0.296	0.337	0.000	0.085	4.5E-08	0.085	2.4E-14	0.473	0.713	0.812	0.033	1	1.7E-05	0.904
Probability	0.296	0.337	0.000	0.085	4.5E-08	0.085	2.4E-14	0.473	0.713	0.812	0.033	1	1.7E-05	0.904
Significant	NO	NO	YES	NO	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO
Ammonia-N, mg/L														
No. of Analyses	77	8	76	8	150	8	142	8	63	8	91	8	90	8
No. of Detections	45	8	40	7	19	1	117	7	11	0	10	0	8	1
Trend	--	--	--	--	D	--	--	--	--	--	D	--	D	--
S - value	160.0	-11.0	-227.0	9.0	-422.0	11.0	62.0	0	198.0	0	-546.0	0	-472.0	12
Probability	0.184	0.227	0.059	0.337	0.000	0.227	0.610	1	0.099	1	5.14E-06	1	0.000	0.178
Probability	0.184	0.227	0.059	0.337	0.000	--	0.610	1	0.099	--	5.14E-06	--	0.000	--
Significant	NO	NO	NO	NO	YES	--	NO	NO	NO	--	YES	--	YES	--
Nitrate-N, mg/L														
No. of Analyses	77	8	76	8	150	8	142	8	63	8	92	8	90	8
No. of Detections	14	1	43	8	71	3	25	2	10	0	91	8	89	8
Trend	D	--	I	--	I	--	D	--	I	--	I	--	D	--
S - value	-385.0	11.0	492.0	1.0	491.0	-11.0	-300.0	-1	417.0	0	292.0	-3.0	-293.0	-7.0
Probability	0.001	0.227	4.0E-05	1.000	4.2E-05	0.227	0.012	1	0.001	1	0.015	0.812	0.015	0.473
Probability	0.001	--	4.0E-05	1.000	4.2E-05	--	0.012	--	0.001	--	0.015	0.812	0.015	0.473
Significant	YES	--	YES	NO	YES	NO	YES	--	YES	--	YES	NO	YES	NO

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D[a]		MW-14[a]		MW-9		MW-8	
Gradient Location	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Sulfate, mg/L														
No. of Analyses	77	8	76	8	150	8	142	8	63	8	91	8	90	8
No. of Detections	77	8	76	8	150	8	110	8	63	8	91	8	90	8
Trend	I	--	I	--	I	--	I	--	I	--	I	--	D	--
S - value	568.0	0	931.0	0	1056.0	0	704.0	0	607.0	-12.0	283.0	1.0	-487.0	-7.0
Probability	1.0E-06	1	1.1E-15	1	0	1	4.1E-09	1	4.0E-07	0.178	0.018	1.000	4.8E-05	0.473
Probability	1.0E-06	1	1.1E-15	1	0	1	4.1E-09	1	4.0E-07	0.178	0.018	1.000	4.8E-05	0.473
Significant	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
Chloride, mg/L														
No. of Analyses	77	8	76	8	150	8	142	8	63	8	91	8	90	8
No. of Detections	77	8	76	8	147	8	137	8	63	8	91	8	89	8
Trend	D	--	D	--	--	--	D	--	I	--	I	--	I	--
S - value	-641.0	-12.0	-380.0	-6.0	164.0	-3.0	-492.0	1	299.0	2	411.0	-3.0	552.0	-10.0
Probability	8.6E-08	0	0.002	0.548	0.173	0.812	4.0E-05	1	0.013	0.904	0.001	0.812	0.000	0.276
Probability	8.6E-08	0	0.002	0.548	0.173	0.812	4.0E-05	1	0.013	0.904	0.001	0.812	0.000	0.276
Significant	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO	YES	NO	YES	NO
Dissolved Iron, mg/L														
No. of Analyses	77	8	76	8	150	8	143	7	63	0	91	8	90	8
No. of Detections	56	8	76	8	105	0	142	7	53	0	49	1	52	0
Trend	D	--	--	--	--	--	--	--	I	--	--	--	--	--
S - value	-524.0	8	0.0	5.0	0.0	0	-212.0	2	381.0	0	0.0	6	0.0	0.0
Probability	1.2E-05	0.398	9.9E-01	0.634	9.9E-01	1	0.069	0.904	0.001	1	9.9E-01	1	9.9E-01	1.000
Probability	1.2E-05	0.398	9.9E-01	0.634	9.9E-01	--	0.069	0.904	0.001	--	9.9E-01	--	9.9E-01	--
Significant	YES	NO	NO	NO	NO	--	NO	NO	YES	--	NO	--	NO	--
Total Iron, mg/L														
No. of Analyses	19	8	15	8	20	8	7	7	0	0	19	8	18	8
No. of Detections	18	8	15	8	15	4	7	7	0	0	18	3	8	1
Trend	I	--	I	--	I	--	--	--	--	--	I	--	I	--
S - value	444.0	8	474.0	7	448.0	8.0	-212.0	2.0	381.0	0	399.0	7	417.0	0.0
Probability	0.000	0	0.000	0	0.000	0.398	0.069	0.904	0.001	1	0.001	0.473	0.001	1.000
Probability	0.000	0	0.000	0	0.000	0.398	0.069	0.904	--	--	0.001	--	0.001	--
Significant	YES	NO	YES	NO	YES	NO	NO	NO	--	--	YES	NO	YES	--
Dissolved Manganese, mg/L														
No. of Analyses	77	8	75	8	150	8	143	7	63	0	91	8	90	8
No. of Detections	77	8	75	8	149	8	142	7	63	0	9	2	4	0
Trend	I	--	--	--	--	--	D	--	--	--	--	--	--	--
S - value	400.0	-10.0	0.0	7.0	0.0	7.0	-615.0	-10.0	162.0	2	0.0	0	0.0	-12
Probability	0.001	0.276	9.9E-01	0.473	0.993	0.473	1.2E-07	0.276	0.178	0.904	0.993	1	0.993	0
Probability	0.001	0.276	9.9E-01	0.473	0.993	0.473	1.2E-07	0.276	0.178	--	0.993	--	0.993	--
Significant	YES	NO	NO	NO	NO	NO	YES	NO	NO	--	NO	--	NO	--
Total Manganese, mg/L														
No. of Analyses	19	8	15	8	20	8	7	7	0	0	19	8	18	8
No. of Detections	19	8	15	8	20	8	7	7	0	0	12	3	3	1
Trend	I	--	I	--	I	--	D	--	--	--	I	--	I	--
S - value	438.0	-10.0	456.0	11.0	430.0	6.0	-615.0	-10.0	162.0	2	391.0	0	416.0	9.0
Probability	0.000	0.276	0.000	0.227	0.000	0.548	1.2E-07	0.276	0.178	1	0.001	1	0.001	0.337
Probability	0.000	0.276	0.000	0.227	0.000	0.548	1.2E-07	0.276	--	--	0.001	--	--	--
Significant	YES	NO	YES	NO	YES	NO	YES	NO	--	--	YES	NO	YES	--
Dissolved Calcium, mg/L														
No. of Analyses	77	8	76	8	125	8	115	7	63	0	91	8	90	8
No. of Detections	77	8	76	8	125	8	114	7	63	0	90	8	90	8
Trend	--	--	--	--	--	--	D	--	--	--	--	--	--	--
S - value	-85.0	7	0.0	-4.0	0.0	-11.0	-663.0	-2.0	-64.0	-1.0	0.0	5.0	0.0	12.0
Probability	0.482	0	0.993	0.720	0.993	0.227	1.2E-08	0.904	0.598	1	0.993	0.634	9.9E-01	0.178
Probability	0.482	0	0.993	0.720	0.993	0.227	1.2E-08	0.904	0.598	--	0.993	0.634	9.9E-01	0.178
Significant	NO	NO	NO	NO	NO	NO	YES	NO	NO	--	NO	NO	NO	NO

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D[a]		MW-14[a]		MW-9		MW-8	
Gradient Location	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Total Calcium, mg/L														
No. of Analyses	19	8	15	8	19	8	7	7	0	0	19	8	18	8
No. of Detections	19	8	15	8	19	8	7	7	0	0	19	8	18	8
Trend	I	--	I	--	I	--	D	--	--	--	I	--	I	--
S - value	442.0	16	415.0	-3.0	403.0	-13.0	-663.0	-2	-64.0	-1	394.0	7.0	413.0	13.0
Probability	0.000	0.062	0.001	0.812	0.001	0.143	1.2E-08	0.904	0.598	1	0.001	0.473	0.001	0.143
Probability	0.000	0.062	0.001	0.812	0.001	0.143	1.2E-08	0.904	--	--	0.001	0.473	0.001	0.143
Significant	YES	NO	YES	NO	YES	NO	YES	NO	--	--	YES	NO	YES	NO
Dissolved Magnesium, mg/L														
No. of Analyses	77	8	76	8	125	8	115	7	63	0	91	8	90	8
No. of Detections	77	8	76	8	125	8	114	7	63	0	90	8	90	8
Trend	--	--	--	--	--	--	D	--	--	--	--	--	--	--
S - value	179.0	11	0.0	-8.0	0.0	-9.0	-615.0	4	140.0	-2.0	0.0	-1.0	0.0	4.0
Probability	0.137	0.227	0.993	0.398	0.993	0.337	1.2E-07	0.720	0.245	0.904	9.9E-01	1	0.993	0.720
Probability	0.137	0.227	0.993	0.398	0.993	0.337	1.2E-07	0.720	0.245	--	9.9E-01	1	0.993	0.720
Significant	NO	NO	NO	NO	NO	NO	YES	NO	NO	--	NO	NO	NO	NO
Total Magnesium, mg/L														
No. of Analyses	19	8	15	8	19	8	7	7	0	0	19	8	18	8
No. of Detections	19	8	15	8	19	8	7	7	0	0	19	8	18	8
Trend	I	--	I	--	I	--	D	--	--	--	I	--	I	--
S - value	448.0	9	436.0	-8.0	402.0	-11.0	-615.0	4	140.0	-2	384.0	-1	404.0	5.0
Probability	0.000	0.337	0.000	0.398	0.001	0.227	1.2E-07	0.720	0.245	1	0.001	1.000	0.001	1
Probability	0.000	0.337	0.000	0.398	0.001	0.227	1.2E-07	0.720	--	--	0.001	1.000	0.001	1
Significant	YES	NO	YES	NO	YES	NO	YES	NO	--	--	YES	NO	YES	NO
Dissolved Sodium, mg/L														
No. of Analyses	77	8	76	8	125	8	116	7	63	0	91	8	90	8
No. of Detections	77	8	76	8	125	8	115	7	63	0	90	8	90	8
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	-202.0	8	0.0	1	0.0	-1	-128.0	-3.0	-203.0	-1.0	0.0	-1.0	0.0	5
Probability	0.093	0.398	0.993	1.000	0.993	1.000	0.288	0.812	0.091	1	0.993	1.000	0.993	0.634
Probability	0.093	0.398	0.993	1.000	0.993	1.000	0.288	0.812	0.091	--	0.993	1.000	0.993	0.634
Significant	NO	NO	NO	NO	NO	NO	NO	NO	NO	--	NO	NO	NO	NO
Total Sodium, mg/L														
No. of Analyses	19	8	15	8	19	8	7	7	0	0	19	8	18	8
No. of Detections	19	8	15	8	19	8	7	7	0	0	19	8	18	8
Trend	I	--	I	--	I	--	--	--	--	--	I	--	I	--
S - value	432.0	10	416.0	1	407.0	-9	-128.0	-3.0	-203.0	-1	384.0	-1	399.0	3
Probability	0.000	0.276	0.001	1.000	0.001	0.337	0.288	0.812	0.091	1	0.001	1.000	0.001	1
Probability	0.000	0.276	0.001	1.000	0.001	0.337	0.288	0.812	--	--	0.001	1.000	0.001	1
Significant	YES	NO	YES	NO	YES	NO	NO	NO	--	--	YES	NO	YES	NO
Dissolved Potassium, mg/L														
No. of Analyses	77	8	76	8	125	8	116	7	63	0	91	8	90	8
No. of Detections	77	8	76	8	125	8	115	7	63	0	90	8	90	8
Trend	--	--	--	--	--	--	D	--	--	--	--	--	--	--
S - value	77.0	7.0	0.0	-7.0	0.0	-11	-469.0	-9.0	-169.0	6	0.0	1	0.0	0
Probability	0.525	0.473	0.993	0.473	0.993	0.227	9.0E-05	0.337	0.160	0.548	0.993	1	0.993	1
Probability	0.525	0.473	0.993	0.473	0.993	0.227	9.0E-05	0.337	0.160	--	0.993	1	0.993	1
Significant	NO	NO	NO	NO	NO	NO	YES	NO	NO	--	NO	NO	NO	NO
Total Potassium, mg/L														
No. of Analyses	19	8	15	8	19	8	7	7	0	0	19	8	18	8
No. of Detections	19	8	15	8	19	8	7	7	0	0	19	8	18	8
Trend	I	--	I	--	I	--	D	--	--	--	I	--	I	--
S - value	424.0	13	429.0	0	397.0	-13	-469.0	-9.0	-169.0	6	387.0	1.0	403.0	5
Probability	0.000	0.143	0.000	1	0.001	0.143	9.0E-05	0.337	0.160	1	0.001	1	0.001	0.634
Probability	0.000	0.143	0.000	1	0.001	0.143	9.0E-05	0.337	--	--	0.001	1	0.001	0.634
Significant	YES	NO	YES	NO	YES	NO	YES	NO	--	--	YES	NO	YES	NO

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D[a]		MW-14[a]		MW-9		MW-8	
Gradient Location	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Benzene, ug/L														
No. of Analyses	77	8	76	8	162	8	143	8	63	8	92	8	89	8
No. of Detections	0	0	3	0	0	0	113	8	0	0	0	0	0	0
Trend	--	--	--	--	--	--	D	--	--	--	--	--	--	--
S - value	0	-15	0	0	0	0	-636.0	-10.0	0	0	0	0	-72.0	0
Probability	0.993	0	0.993	1	0.993	1	0.000	0.276	0.993	1	0.993	1	0.553	1
Probability	--	--	--	--	--	--	0.000	0.276	--	--	--	--	--	--
Significant	--	--	NO	--	--	--	YES	NO	--	--	--	--	--	--
Vinyl chloride, ug/L														
No. of Analyses	77	8	76	8	162	8	143	8	63	8	92	8	89	8
No. of Detections	0	1	76	7	150	8	127	8	1	0	0	0	0	0
Trend	--	--	D	--	D	--	D	--	--	--	--	--	--	--
S - value	0	0	-745.0	-12.0	-837.0	-5.0	-789.0	4	39.0	0	0	0	-72.0	0
Probability	0.993	1	4.9E-10	0.178	2.7E-12	0.634	4.35E-11	0.720	0.751	1	0.993	1	0.553	1
Probability	--	--	4.9E-10	0.178	2.7E-12	0.634	4.35E-11	0.720	--	--	--	--	--	--
Significant	--	--	YES	NO	YES	NO	YES	NO	--	--	--	--	--	--
cis 1,2-Dichloroethene, ug/L														
No. of Analyses	77	8	76	8	135	8	126	8	63	8	92	8	89	8
No. of Detections	0	1	75	7	36	4	120	8	0	0	0	0	0	0
Trend	--	--	D	--	--	--	D	--	--	--	--	--	--	--
S - value	0	0	-301.0	-3.0	-13	8	-338.0	1	0	0	0	0	-72.0	-2
Probability	0.993	1	1.21E-02	0.812	0.920	0.398	0.005	1	0.993	1	0.993	1	0.553	1
Probability	--	--	1.21E-02	0.812	0.920	0.398	0.005	1	--	--	--	--	--	--
Significant	--	--	YES	NO	NO	NO	YES	NO	--	--	--	--	--	--
trans 1,2-Dichloroethene, ug/L														
No. of Analyses	77	8	76	8	138	8	129	8	63	8	92	8	89	8
No. of Detections	0	0	12	3	0	0	101	8	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0.0	0	0	0	-73.0	0	0	0	0	0	-72.0	0
Probability	0.993	1	0.993	1	0.993	1	0.547	1	0.993	1	0.993	1	0.553	1
Probability	--	--	0.993	--	--	--	0.547	1	--	--	--	--	--	--
Significant	--	--	NO	NO	--	--	NO	NO	--	--	--	--	--	--
1,1-Dichloroethane, ug/L														
No. of Analyses	77	8	76	8	162	8	143	8	63	8	92	8	89	8
No. of Detections	0	0	0	0	8	0	78	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	D	--	--	--	--	--	--	--
S - value	0	0	0	0	-106.0	0	-452.0	0	0	0	0	0	-72.0	0
Probability	0.993	1	0.993	1	0.380	1	1.62E-04	1	0.993	1	0.993	1	0.553	1
Probability	--	--	--	--	0.380	--	1.62E-04	--	--	--	--	--	--	--
Significant	--	--	--	--	NO	--	YES	--	--	--	--	--	--	--
1,2-Dichloropropane, ug/L														
No. of Analyses	77	8	76	8	162	8	143	8	63	8	92	8	89	8
No. of Detections	0	0	0	0	0	0	70	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	D	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	-449.0	0	0	0	0	0	-72.0	0
Probability	0.993	1	0.993	1	0.993	1	1.79E-04	1	0.993	1	0.993	1	0.553	1
Probability	--	--	--	--	--	--	1.79E-04	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	YES	--	--	--	--	--	--	--
Chloroethane, ug/L														
No. of Analyses	77	8	76	8	162	8	143	8	63	8	92	8	89	8
No. of Detections	0	0	0	0	27	0	9	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0.0	0	0	0	0	0	0	0	-72.0	0
Probability	0.993	1	0.993	1	0.993	1	0.993	1	0.993	1	0.993	1	0.553	1
Probability	--	--	--	--	0.993	--	0.993	--	--	--	--	--	--	--
Significant	--	--	--	--	NO	--	NO	--	--	--	--	--	--	--

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in Channel Cc2												Cc3	
Well Location	MW-20		MW-21		MW-2		MW-5D[a]		MW-14[a]		MW-9		MW-8	
Gradient Location	Up		Down		Down		Down							
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Toluene, ug/L														
No. of Analyses	77	8	76	8	162	8	143	8	63	8	92	8	89	8
No. of Detections	1	0	0	0	2	0	49	0	0	0	0	0	1	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	-1	0	0	0	0	0	0	0	0	0	0	0	-69.0	0
Probability	1.000	1	0.993	1	0.993	1	0.993	1	0.993	1	0.993	1	0.569	1
Probability	--	--	--	--	--	--	0.993	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	NO	--	--	--	--	--	--	--
Trichloroethene, ug/L														
No. of Analyses	77	8	76	8	162	8	143	8	63	8	92	8	89	8
No. of Detections	0	0	0	0	0	0	35	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	-10.0	0	0	0	0	0	-72.0	0
Probability	0.993	1	0.993	1	0.993	1	0.940	1	0.993	1	0.993	1	0.553	1
Probability	--	--	--	--	--	--	0.940	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	NO	--	--	--	--	--	--	--
Total Xylenes, ug/L														
No. of Analyses	77	8	76	8	162	8	143	8	63	8	92	8	89	8
No. of Detections	0	0	0	0	0	0	19	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	-511.0	6	-511.0	0	-511.0	0	-183.0	0	-183.0	0	-455.0	0	-422.0	0
Probability	1.99E-05	0.548	1.99E-05	1	1.99E-05	1	0.128	1	0.128	1	0.000	1	0.000	1
Probability	--	--	--	--	--	--	0.128	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	NO	--	--	--	--	--	--	--
Trichlorofluoromethane, ug/L														
No. of Analyses	77	8	76	8	125	8	114	8	63	8	92	8	89	8
No. of Detections	0	1	73	7	121	8	21	0	0	0	0	0	20	0
Trend	--	--	D	--	D	D	--	--	--	--	--	--	--	--
S - value	0	6	-430.0	-7.0	-505.0	-17.0	-165.0	0	0	0	0	0	-164.0	0
Probability	0.993	0.548	0.000	0.473	0.000	0.047	0.170	1	0.993	1	0.993	1	0.173	1
Probability	--	--	0.000	0.473	0.000	0.047	0.170	--	--	--	--	--	0.173	--
Significant	--	--	YES	NO	YES	YES	NO	--	--	--	--	--	NO	--
Dichlorodifluoromethane, ug/L														
No. of Analyses	77	8	75	8	91	8	80	8	63	8	92	8	89	8
No. of Detections	12	8	74	7	89	8	80	8	0	0	0	0	11	0
Trend	--	--	D	--	D	--	D	--	--	--	--	--	--	--
S - value	141	6	-506.0	-7.0	-381.0	-9.0	-636.0	10	0	0	0	0	-117.0	0
Probability	0.242	0.548	2.40E-05	0.473	1.48E-03	0.337	4.41E-08	0.276	0.993	1	0.993	1	0.332	1
Probability	0.242	0.548	2.40E-05	0.473	1.48E-03	0.337	4.41E-08	0.276	--	--	--	--	0.332	--
Significant	NO	NO	YES	NO	YES	NO	YES	NO	--	--	--	--	NO	--

NOTES
D = decreasing trend.
I = increasing trend.
-- = no noticeable trend.
[a] Decommissioned in 2015
[b] Decommissioned in 2016

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27[b]		MW-29	
Gradient Location	Up		Side	Side		Down		(Installed 2003)		(Installed 2003)		(Installed 2003)	
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH field, Standard Units													
No. of Analyses	75	8	25	90	8	92	8	62	8	56	8	56	8
No. of Detections	75	8	25	90	8	92	8	62	8	56	8	56	8
Trend	D	--	--	--	--	D	--	D	--	D	I	--	D
S - value	-282.0	-14	-17.0	-218.0	-8	-353.0	-8.0	-385.0	-2.0	-233.0	18.0	-151.0	-19.0
Probability	0.019	0.108	0.709	0.069	0	0.003	0	2.8E-04	0.904	0.028	0.032	0.156	0.023
Probability	0.019	0.108	0.709	0.069	0	0.003	0	2.8E-04	0.904	0.028	0.032	0.156	0.023
Significant	YES	NO	NO	NO	NO	YES	NO	YES	NO	YES	YES	NO	YES
Specific Conductance field, micromhos/cm	75	8	25	89	8	92	8	62	8	56	8	56	8
No. of Analyses	75	8	25	89	8	92	8	62	8	56	8	56	8
No. of Detections	D	--	--	--	--	I	--	--	--	D	--	I	--
Trend	-257.00	13.00	-16.00	35.00	4.00	798.00	-12.00	27.00	-10.00	-261.00	10.00	256.00	-13.00
S - value	0.0	0.1	0.7	0.8	0.7	0.0	0.2	0.8	0.3	0.0	0	0.0	0.1
Probability	0.032	0.143	0.726	0.776	0.720	2.6E-11	0.178	0.806	0.276	0.014	0.276	0.016	0.143
Probability	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO
Significant													
Total Dissolved Solids													
No. of Analyses	90	8	24	90	8	91	8	1	8	56	8	56	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	56	8
Trend	I	--	I	I	--	I	--	I	--	I	--	I	--
S - value	489.0	6	99.0	484.0	1	466.0	5.0	285.0	0.0	299.0	-1.0	501.0	9
Probability	4.5E-05	0.548	0.015	5.3E-05	1	0.00010	0.634	0.007	1.000	0.005	1	2.20E-06	0
Probability	4.5E-05	0.548	0.015	5.3E-05	1	0.00010	0.634	0.007	1.000	0.005	1	2.20E-06	0
Significant	YES	NO	YES	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
Alkalinity, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	56	8
Trend	--	--	--	I	--	I	--	I	--	D	--	I	--
S - value	220.0	13	8	536.0	1	397.0	-5.0	316.0	-1.0	-293.0	3	621.0	9
Probability	0.067	0.143	0.862	7.6E-06	1	9.2E-04	1	0.003	1.000	0.006	0.812	4.4E-09	0
Probability	0.067	0.143	0.862	7.6E-06	1	9.2E-04	1	0.003	1.000	0.006	0.812	4.4E-09	0
Significant	NO	NO	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
Ammonia-N, mg/L													
No. of Analyses	90	8	24	89	8	91	8	62	8	56	8	56	8
No. of Detections	90	8	20	7	0	76	8	62	8	7	1	7	3
Trend	I	--	D	D	--	--	--	--	--	--	--	--	I
S - value	605.0	-9.0	-152.0	-307.0	0	170.0	-1.0	148.0	-5	63.0	0	165.0	17
Probability	4.36E-07	0.337	1.80E-04	0.010	1	0.157	1.000	0.164	1	0.557	1	0.120	0
Probability	4.36E-07	0.337	1.80E-04	0.010	--	0.157	1.000	0.164	1	0.557	--	0.120	--
Significant	YES	NO	YES	YES	--	NO	NO	NO	NO	NO	--	NO	YES
Nitrate-N, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	35	2	6	90	8	34	1	27	2	55	8	55	0
Trend	D	--	--	D	--	D	--	I	--	--	--	I	--
S - value	-561.0	9.0	-49.0	-344.0	-1.0	-537.0	9.0	450.0	11	-66.0	-3.0	459.0	0
Probability	2.8E-06	0.337	0.234	4.1E-03	1.000	0.000	0.337	2.1E-05	0	0.538	0.812	1.4E-05	1
Probability	2.8E-06	--	0.234	4.1E-03	1.000	0.000	--	2.1E-05	--	0.538	0.812	1.4E-05	--
Significant	YES	--	NO	YES	NO	YES	--	YES	--	NO	NO	YES	--

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27[b]		MW-29	
Gradient Location	Up		Side	Side		Down		(Installed 2003)		(Installed 2003)		(Installed 2003)	
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Sulfate, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	56	8
Trend	I	--	--	I	--	D	--	--	--	D	--	I	--
S - value	283.0	0.0	-65.0	540.0	3	-576.0	1.0	148.0	-3.0	-267.0	-1.0	332.0	-10
Probability	0.018	1.000	0.112	0.000	1	1.5E-06	1.000	0.164	0.812	0.012	1	0.002	0
Probability	0.018	1.000	0.112	0.000	1	1.5E-06	1.000	0.164	0.812	0.012	1	0.002	0
Significant	YES	NO	NO	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO
Chloride, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	56	8
Trend	I	--	--	I	--	--	--	D	--	I	--	D	--
S - value	377.0	2.0	35.0	285.0	1	36.0	-1.0	-218.0	-8.0	240.0	6	-228.0	-8
Probability	0.002	0.904	0.399	0.018	1	0.770	1.000	0.008	0.398	0.024	0.548	0.032	0
Probability	0.002	0.904	0.399	0.018	1	0.770	1.000	0.008	0.398	0.024	0.548	0.032	0
Significant	YES	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	YES	NO
Dissolved Iron, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	64	8	24	51	0	89	8	62	8	27	0	27	8
Trend	--	--	--	--	--	--	--	D	--	D	--	I	--
S - value	0.0	-5.0	13.0	0.0	0	0.0	-1.0	-231.0	-7	-496.0	0	543.0	-2
Probability	9.9E-01	0.634	0.766	9.9E-01	1	0.993	1.000	0.029	0.473	2.8E-06	1	2.9E-07	1
Probability	9.9E-01	0.634	0.766	9.9E-01	--	0.993	1.000	0.029	0.473	2.8E-06	--	2.9E-07	1
Significant	NO	NO	NO	NO	--	NO	NO	YES	NO	YES	--	YES	NO
Total Iron, mg/L													
No. of Analyses	19	8	0	18	8	19	8	15	8	13	8	13	8
No. of Detections	18	8	0	12	4	19	8	15	8	3	1	3	8
Trend	I	--	--	I	--	I	I	D	--	D	--	I	--
S - value	448.0	7.0	13.0	380.0	0.0	460.0	17.0	-231.0	11	-496.0	0	543.0	-2
Probability	0.000	0.473	0.766	0.002	1	0.000	0.047	0.029	0.227	2.8E-06	1	2.9E-07	1
Probability	0.000	0.473	--	0.002	1	0.000	0.047	0.029	0.227	2.8E-06	--	2.9E-07	1
Significant	YES	NO	--	YES	NO	YES	YES	YES	NO	YES	--	YES	NO
Dissolved Manganese, mg/L													
No. of Analyses	90	8	24	90	8	90	8	62	8	56	8	56	8
No. of Detections	88	8	24	4	1	89	8	62	8	1	0	1	8
Trend	--	--	D	--	--	--	--	D	--	--	--	--	--
S - value	0.0	-5.0	-98.0	0.0	0.0	0.0	1.0	-407.0	3	9	0	-129.0	16
Probability	0.993	0.634	0.016	0.993	1.000	0.993	1.000	1.2E-04	0.812	0.940	1	0.226	0
Probability	0.993	0.634	0.016	0.993	--	0.993	1.000	1.2E-04	0.812	0.940	--	0.226	0
Significant	NO	NO	YES	NO	--	NO	NO	YES	NO	--	--	--	NO
Total Manganese, mg/L													
No. of Analyses	19	8	0	18	8	19	8	15	8	13	8	13	8
No. of Detections	19	8	0	7	3	19	8	15	8	0	0	0	8
Trend	I	--	--	I	--	I	--	D	--	--	--	--	--
S - value	422.0	-6	-98.0	367.0	0	342.0	9.0	-407.0	7	9	0	-129.0	14
Probability	0.000	1	0.016	0.002	1	0.004	0.337	1.2E-04	0	0.940	1	0.226	0
Probability	0.000	1	--	0.002	--	0.004	0.337	1.2E-04	0	0.940	--	0.226	0
Significant	YES	NO	--	YES	NO	YES	NO	YES	NO	--	--	--	NO
Dissolved Calcium, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	56	8
Trend	--	--	--	--	--	--	--	D	--	D	--	--	--
S - value	0	7	-41.0	0.0	-3	0.0	6	-235.0	5	-424.0	-3.0	128.0	2
Probability	1	0.473	0.321	0.993	0.812	0.993	0.548	0.027	0.634	6.2E-05	0.812	0.229	1
Probability	1	0.473	0.321	0.993	0.812	0.993	0.548	0.027	0.634	6.2E-05	0.812	0.229	1
Significant	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	NO

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27[b]		MW-29	
Gradient Location	Up		Side	Side		Down		(Installed 2003)		(Installed 2003)		(Installed 2003)	
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Total Calcium, mg/L													
No. of Analyses	19	8	0	18	8	19	8	15	8	13	8	13	8
No. of Detections	19	8	0	18	8	19	8	15	8	13	8	13	8
Trend	I	--	--	I	--	I	--	D	--	D	--	--	--
S - value	435.0	11	-41.0	356.0	-3.0	404.0	9	-235.0	7.0	-424.0	-3	128.0	2
Probability	0.000	0.227	0.321	0.003	1	0.001	0.337	0.027	0.473	6.2E-05	0.812	0.229	1
Probability	0.000	0.227	--	0.003	1	0.001	0.337	0.027	0.473	6.2E-05	0.812	0.229	1
Significant	YES	NO	--	YES	NO	YES	NO	YES	NO	YES	NO	NO	NO
Dissolved Magnesium, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	56	8
Trend	--	--	--	--	--	--	--	--	--	--	--	I	--
S - value	0.0	9.0	23.0	0.0	-3.0	0.0	7	6	6	-137.0	2	329.0	15
Probability	0.993	0.337	0.585	0.993	0.812	9.9E-01	0.473	0.962	0.548	0.198	0.904	0.002	0
Probability	0.993	0.337	0.585	0.993	0.812	9.9E-01	0.473	0.962	0.548	0.198	0.904	0.002	0
Significant	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
Total Magnesium, mg/L													
No. of Analyses	19	8	0	18	8	19	8	15	8	13	8	13	8
No. of Detections	19	8	0	18	8	19	8	15	8	13	8	13	8
Trend	I	--	--	I	--	I	--	--	--	--	--	I	I
S - value	424.0	11	23.0	342.0	-3.0	425.0	10	6	8.0	-137.0	2	329.0	18
Probability	0.000	0.227	0.585	0.004	1	0.000	0.276	0.962	0.398	0.198	0.904	0.002	0
Probability	0.000	0.227	--	0.004	1	0.000	0.276	0.962	0.398	0.198	0.904	0.002	0
Significant	YES	NO	--	YES	NO	YES	NO	NO	NO	NO	NO	YES	YES
Dissolved Sodium, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	56	8
Trend	--	--	--	--	--	--	--	I	--	--	--	--	--
S - value	0.0	5.0	-78.0	0.0	-3.0	0.0	7	267.0	9	-42.0	3	152.0	11
Probability	0.993	0.634	0.056	0.993	1	0.993	0.473	0.012	0.337	0.698	0.812	0.153	0
Probability	0.993	0.634	0.056	0.993	1	0.993	0.473	0.012	0.337	0.698	0.812	0.153	0
Significant	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO
Total Sodium, mg/L													
No. of Analyses	19	8	0	18	8	19	8	15	8	13	8	13	8
No. of Detections	19	8	0	18	8	19	8	15	8	13	8	13	8
Trend	I	--	--	I	--	I	--	I	--	--	--	--	--
S - value	422.0	9	-78.0	356.0	-3.0	432.0	11	267.0	9	-42.0	3.0	152.0	15
Probability	0.000	0	0.056	0.003	1	0.000	0	0.012	0	0.698	0.812	0.153	0
Probability	0.000	0	--	0.003	1	0.000	0	0.012	0	0.698	0.812	0.153	0
Significant	YES	NO	--	YES	NO	YES	NO	YES	NO	NO	NO	NO	NO
Dissolved Potassium, mg/L													
No. of Analyses	90	8	24	90	8	91	8	62	8	56	8	56	8
No. of Detections	90	8	24	90	8	91	8	62	8	56	8	56	8
Trend	--	--	D	--	--	--	--	I	--	--	--	I	--
S - value	0.0	-8.0	-134.0	0.0	1.0	0.0	-3.0	232.0	-4.0	99.0	2	275.0	4
Probability	0.993	0.398	0.001	0.993	1.000	0.993	0.812	0.029	0.720	0.353	0.904	0.009	1
Probability	0.993	0.398	0.001	0.993	1.000	0.993	0.812	0.029	0.720	0.353	0.904	0.009	1
Significant	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO
Total Potassium, mg/L													
No. of Analyses	19	8	0	18	8	19	8	15	8	13	8	13	8
No. of Detections	19	8	0	18	8	19	8	15	8	13	8	13	8
Trend	I	--	--	I	--	I	--	I	--	--	--	I	--
S - value	440.0	-3	-134.0	360.0	1	395.0	-1	232.0	10	99.0	2.0	275.0	7
Probability	0.000	0.812	0.001	0.003	1	0.001	1.000	0.029	0	0.353	1	0.009	0
Probability	0.000	0.812	--	0.003	1	0.001	1.000	0.029	0	0.353	1	0.009	0
Significant	YES	NO	--	YES	NO	YES	NO	YES	NO	NO	NO	YES	NO

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27[b]		MW-29	
Gradient Location	Up		Side	Side		Down		(Installed 2003)		(Installed 2003)		(Installed 2003)	
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Benzene, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	0	0	0	0	0	0	15
Probability	0.993	1	0.980	0.993	1	0.993	1	0.992	1	0.990	1	0.990	0
Probability	--	--	--	--	--	--	--	0.992	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	1	1	0	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	0	0	0	0	0	0	9
Probability	0.993	1	0.980	0.993	1	0.993	1	0.990	1	0.990	1	0.990	0
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
cis 1,2-Dichloroethene, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	0	0	0	0	0	0	0
Probability	0.993	1	0.980	0.993	1	0.993	1	0.990	1	0.990	1	0.990	1
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
trans 1,2-Dichloroethene, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	0	0	0	0	0	0	0
Probability	0.993	1	0.980	0.993	1	0.993	1	0.990	1	0.990	1	0.990	1
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	0	0	0	0	0	0	0
Probability	0.993	1	0.980	0.993	1	0.993	1	0.990	1	0.990	1	0.990	1
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	0	0	0	0	0	0	0
Probability	0.993	1	0.980	0.993	1	0.993	1	0.990	1	0.990	1	0.990	1
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	0	0	0	0	0	0	15
Probability	0.993	1	0.980	0.993	1	0.993	1	0.990	1	0.990	1	0.990	0
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 3-3
Vashon Island Landfill
Trends in Individual Wells
May 1987 through December 2017

	Groundwater in D Aquifer												
Well Location	MW-7		MW-11	MW-12		MW-19		MW-26		MW-27[b]		MW-29	
Gradient Location	Up		Side	Side		Down		(Installed 2003)		(Installed 2003)		(Installed 2003)	
Time Interval	Long	Short	Long	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Toluene, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	1	0	0	1	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	-9.0	0	0	9.0	0	0	0	0	0	0	0
Probability	0.993	1	0.843	0.993	1	0.947	1	0.990	1	0.990	1	0.990	1
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	1	0	1	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	-43.0	0	0.0	0	0	0	0	0	0	0
Probability	0.993	1	0.980	0.725	1	0.993	1	0.990	1	0.990	1	0.990	1
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Xylenes, ug/L													
No. of Analyses	90	8	24	91	8	90	8	62	8	56	8	62	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	-455.0	0	0	-428.0	0	-511.0	0	0	0	0	0	0	0
Probability	0.000	1	0.980	0.000	1	1.99E-05	1	0.990	1	0.990	1	0.990	1
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	1	0	0	1	0	0	0	1	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	-19.0	0	0	0	0	0	0	-33	0	0	0
Probability	0.993	1	0.655	0.993	1	0.993	1	0.990	1	0.762	1	0.990	1
Probability	--	--	--	--	--	--	--	--	--	0.762	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane, ug/L													
No. of Analyses	90	8	24	91	8	91	8	62	8	56	8	62	8
No. of Detections	0	0	0	0	0	1	0	0	0	2	0	0	0
Trend	--	--	--	--	--	--	--	--	--	--	--	--	--
S - value	0	0	0	0	0	0	0	0	0	-69	0	0	-13
Probability	0.993	1	0.980	0.993	1	0.993	1	0.990	1	0.520	1	0.990	0
Probability	--	--	--	--	--	--	--	--	--	--	--	--	--
Significant	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES
D = decreasing trend.
I = increasing trend.
-- = no noticeable trend.
[a] Decommissioned in 2015
[b] Decommissioned in 2016

Table 3-4
Vashon Island Landfill
Summary of Statistical Analyses for Seeps
1991 through 2017

	West Hillside Seeps							
Monitoring Location	SW-W1		SW-W2		SW-W3		SW-E	
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short
pH field, Standard Units								
No. of Analyses	65	8	96	8	97	8	13	8
No. of Detections	65	8	96	8	96	8	13	8
Minimum	6.5	7.4	6.9	6.9	ND	7.7	6.4	6.8
Maximum	8.8	7.9	8.9	8.3	10.7	7.9	10.2	8.5
Mean	7.6	7.6	8.0	7.9	7.8	7.8	7.6	7.7
Standard Deviation	0.5	0.1	0.4	0.5	0.6	0.1	0.9	0.5
Median	7.6	7.6	8.1	8.1	7.9	7.8	7.5	7.8
Specific Conductance field, micromhos/cm								
No. of Analyses	66	8	97	8	98	8	13	7
No. of Detections	66	8	97	8	98	8	13	7
Minimum	70	180	325	515	190	240	110	150
Maximum	860	220	1200	648	1034	320	370	235
Mean	333.6	200.0	761.2	591.3	467.6	279.9	184.2	183.0
Standard Deviation	170.6	14.6	184.2	42.9	168.3	27.5	62.5	30.3
Median	260	202	730	600	435	283	170	180
Chemical Oxygen Demand, mg/L								
No. of Analyses	66	8	98	8	98	8		
No. of Detections	58	8	97	8	86	8		
Minimum	ND	9.0	ND	14.0	ND	9.8		
Maximum	100.0	26.7	130.0	20.6	160.0	19.0		
Mean	20.32	16.99	21.28	17.24	17.13	14.10		
Standard Deviation	20.77	6.13	19.05	2.52	22.45	2.84		
Median	14.5	15.5	16.0	17.0	13.2	14.0		
Alkalinity, mg/L								
No. of Analyses	38	8	57	8	56	8		
No. of Detections	38	8	57	8	56	8		
Minimum	69	66	222	275	87	111		
Maximum	150	82	530	327	290	133		
Mean	94.9	73.5	408.5	300.8	182.7	120.4		
Standard Deviation	18.6	5.0	64.0	18.9	51.1	8.5		
Median	91	72	410	296	180	118		
Ammonia-N, mg/L								
No. of Analyses	66	8	99	8	99	8		
No. of Detections	39	8	43	4	35	3		
Minimum	ND	0.012	ND	ND	ND	ND		
Maximum	0.14	0.05	45	0.01	0.20	0.01		
Mean	0.015	0.022	0.458	0.002	0.002	0.001		
Standard Deviation	0.036	0.012	4.522	0.006	0.031	0.007		
Median	0.01	0.02	-0.01	0.01	-0.01	0.00		
Nitrate-N, mg/L								
No. of Analyses	66	8	99	8	99	8		
No. of Detections	58	8	70	8	90	8		
Minimum	ND	1.8	ND	0.187	ND	0.399		
Maximum	3.68	4.26	9.00	0.46	1.40	0.99		
Mean	1.421	2.538	0.200	0.337	0.326	0.638		
Standard Deviation	1.095	0.785	0.907	0.097	0.282	0.186		
Median	1.40	2.39	0.10	0.36	0.26	0.60		
Sulfate, mg/L								
No. of Analyses	66	8	99	8	99	8		
No. of Detections	65	8	99	8	99	8		
Minimum	ND	7	5	12	6	8		
Maximum	36	11	30	14	109	13		
Mean	11.9	8.2	8.5	12.7	12.2	10.8		
Standard Deviation	5.2	1.2	3.3	0.4	10.0	1.6		
Median	11	8	7	13	11	11		

Table 3-4
Vashon Island Landfill
Summary of Statistical Analyses for Seeps
1991 through 2017

	West Hillside Seeps							
Monitoring Location	SW-W1		SW-W2		SW-W3		SW-E	
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short
Chloride, mg/L								
No. of Analyses	66	8	97	8	98	8		
No. of Detections	66	8	95	8	96	8		
Minimum	3	5	ND	17	ND	5		
Maximum	15	8	79	22	48	9		
Mean	5.9	6.2	32.3	18.9	12.3	7.9		
Standard Deviation	1.9	0.9	11.3	1.9	6.4	1.2		
Median	5	6	32	18	10	8		
Dissolved Arsenic, mg/L								
No. of Analyses	34	8	36	8	36	8	12	8
No. of Detections	32	7	34	8	36	8	12	8
Minimum	ND	ND	ND	0.001	0.002	0.002	0.001	0.001
Maximum	0.009	0.003	0.002	0.016	0.004	0.004	0.002	0.002
Mean	0.0026	0.0021	0.0015	0.0033	0.0026	0.0031	0.0018	0.0018
Standard Deviation	0.0021	0.0009	0.0004	0.0051	0.0005	0.0004	0.0004	0.0004
Median	0.002	0.002	0.001	0.002	0.002	0.003	0.002	0.002
Total Arsenic, mg/L								
No. of Analyses	67	8	98	8	98	8	12	8
No. of Detections	67	8	98	8	97	8	12	8
Minimum	0.002	0.002	0.002	0.002	ND	0.004	0.002	0.001
Maximum	0.083	0.010	0.017	0.005	0.052	0.006	0.003	0.011
Mean	0.0122	0.0043	0.0048	0.0029	0.0061	0.0047	0.0022	0.0031
Standard Deviation	0.0122	0.0023	0.0029	0.0009	0.0064	0.0007	0.0004	0.0030
Median	0.008	0.003	0.004	0.003	0.005	0.005	0.002	0.002
Dissolved Iron, mg/L								
No. of Analyses	34	8	36	8	36	8	12	8
No. of Detections	33	8	36	8	36	8	12	8
Minimum	ND	0.0	0.012	0.019	0.018	0.027	0.039	0.033
Maximum	1.4	0.3	0.5	9.0	0.2	0.2	0.2	0.2
Mean	0.29	0.18	0.10	1.14	0.08	0.07	0.07	0.09
Standard Deviation	0.34	0.10	0.12	3.16	0.05	0.06	0.05	0.06
Median	0.15	0.19	0.03	0.03	0.06	0.05	0.05	0.07
Total Iron, mg/L								
No. of Analyses	67	8	98	8	98	8	12	8
No. of Detections	67	8	98	8	98	8	12	8
Minimum	0.7	0.7	0.4	0.7	0.5	0.6	0.2	0.3
Maximum	76.0	5.9	27.9	4.2	37.5	2.9	5.4	14.9
Mean	8.89	2.10	4.57	2.08	3.76	1.36	1.24	2.39
Standard Deviation	11.17	1.76	4.98	1.14	5.63	0.74	1.57	5.06
Median	5.0	1.5	2.9	2.0	2.0	1.2	0.6	0.7
Dissolved Manganese, mg/L								
No. of Analyses	34	8	36	8	36	8	12	8
No. of Detections	34	8	36	8	36	8	12	8
Minimum	0.01	0.01	0.02	0.04	0.11	0.24	0.01	0.01
Maximum	3.18	0.95	0.27	2.40	0.51	0.40	0.01	0.02
Mean	0.426	0.283	0.081	0.351	0.284	0.323	0.011	0.012
Standard Deviation	0.574	0.286	0.072	0.828	0.094	0.047	0.002	0.004
Median	0.28	0.22	0.06	0.06	0.27	0.32	0.01	0.01
Total Manganese, mg/L								
No. of Analyses	67	8	97	8	97	8	12	8
No. of Detections	67	8	97	8	97	8	12	8
Minimum	0.40	0.33	0.27	0.18	0.25	0.44	0.03	0.02
Maximum	18.00	2.10	17.90	1.04	8.56	0.90	0.18	1.14
Mean	2.678	0.739	2.158	0.419	1.262	0.625	0.076	0.192
Standard Deviation	2.944	0.579	2.594	0.266	1.534	0.149	0.044	0.384
Median	1.52	0.54	1.10	0.35	0.80	0.61	0.07	0.06

Table 3-4
Vashon Island Landfill
Summary of Statistical Analyses for Seeps
1991 through 2017

	West Hillside Seeps							
Monitoring Location	SW-W1		SW-W2		SW-W3		SW-E	
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short
Dissolved Calcium, mg/L								
No. of Analyses	34	8	36	8	36	8	12	8
No. of Detections	34	8	36	8	36	8	12	8
Minimum	12	12	35	42	17	18	8	9
Maximum	19	16	69	74	33	23	17	16
Mean	15.6	14.4	58.7	52.3	24.8	20.6	13.1	13.2
Standard Deviation	1.7	1.3	7.5	9.7	3.7	2.1	3.2	1.9
Median	16	15	59	51	25	21	15	14
Total Calcium, mg/L								
No. of Analyses	62	8	92	8	92	8	12	8
No. of Detections	62	8	92	8	92	8	12	8
Minimum	13	12	27	45	17	18	9	9
Maximum	85	17	127	57	93	25	18	19
Mean	31.5	14.8	76.8	50.7	43.8	21.7	13.9	14.7
Standard Deviation	20.7	1.3	20.1	3.9	19.4	2.0	3.2	2.8
Median	19	15	73	50	38	22	15	15
Dissolved Magnesium, mg/L								
No. of Analyses	34	8	36	8	36	8	12	8
No. of Detections	34	8	36	8	36	8	12	8
Minimum	10	11	29	37	13	12	6	9
Maximum	16	14	64	61	26	20	16	15
Mean	13.0	11.8	50.2	44.2	20.2	17.1	11.6	12.0
Standard Deviation	1.4	1.1	7.3	7.6	3.0	2.6	3.3	1.7
Median	13	12	51	43	20	17	12	12
Total Magnesium, mg/L								
No. of Analyses	62	8	92	8	93	8	12	8
No. of Detections	62	8	92	8	93	8	12	8
Minimum	11	10	20	37	15	15	7	9
Maximum	55	14	104	49	89	21	15	16
Mean	20.3	12.0	65.2	43.3	34.2	18.3	12.3	12.8
Standard Deviation	10.4	1.2	18.2	4.0	14.8	1.8	2.9	2.0
Median	15	12	60	43	31	18	14	13
Dissolved Sodium, mg/L								
No. of Analyses	34	8	36	8	36	8	12	8
No. of Detections	34	8	36	8	36	8	12	8
Minimum	5	6	10	12	6	7	4	5
Maximum	8	7	19	19	11	9	8	7
Mean	6.8	6.6	15.2	15.3	8.8	8.3	6.2	6.3
Standard Deviation	0.6	0.5	1.8	2.0	1.0	0.6	0.9	0.7
Median	7	7	15	15	9	8	6	7
Total Sodium, mg/L								
No. of Analyses	62	8	93	8	92	8	12	8
No. of Detections	62	8	93	8	92	8	12	8
Minimum	6	5	8	13	7	7	5	5
Maximum	17	7	25	17	19	9	7	7
Mean	9.0	6.7	16.1	15.2	11.4	8.5	6.4	6.5
Standard Deviation	3.1	0.6	2.5	1.3	3.0	0.8	0.9	0.7
Median	7	7	16	15	11	9	7	7
Dissolved Potassium, mg/L								
No. of Analyses	34	8	36	8	36	8	12	8
No. of Detections	33	8	36	8	35	8	12	8
Minimum	ND	0.8	1.2	2.7	ND	1.4	1.7	1.7
Maximum	1.5	1.2	4.1	3.8	2.8	2.3	2.3	2.8
Mean	1.09	1.05	3.18	3.15	2.13	2.02	1.98	2.04
Standard Deviation	0.23	0.14	0.45	0.33	0.42	0.33	0.16	0.34
Median	1.1	1.1	3.2	3.1	2.1	2.1	2.0	2.0

Table 3-4
Vashon Island Landfill
Summary of Statistical Analyses for Seeps
1991 through 2017

	West Hillside Seeps							
Monitoring Location	SW-W1		SW-W2		SW-W3		SW-E	
Time Interval	Long	Short	Long	Short	Long	Short	Long	Short
Total Potassium, mg/L								
No. of Analyses	62	8	93	8	93	8	12	8
No. of Detections	62	8	93	8	93	8	12	8
Minimum	0.8	0.9	1.8	3.0	1.7	2.0	1.8	1.7
Maximum	2.8	1.4	5.6	3.4	17.0	2.4	2.0	3.4
Mean	1.39	1.08	3.48	3.13	2.71	2.18	1.92	2.12
Standard Deviation	0.42	0.14	0.55	0.14	1.58	0.13	0.09	0.54
Median	1.2	1.0	3.4	3.1	2.5	2.2	1.9	2.0
Vinyl Chloride, ug/L								
No. of Analyses	64	8	94	8	96	8	12	8
No. of Detections	10	4	1	0	68	8	0	0
Minimum	ND	ND	ND	ND	ND	0.034	ND	ND
Maximum	0.05	0.03	0.02	ND	0.14	0.06	ND	ND
Mean	-0.06	0.0102	ID	ID	-0.01	0.05	ID	ID
Standard Deviation	0.21	0.02	ID	ID	0.19	0.01	ID	ID
Median	-0.010	0.015	ID	ID	0.04	0.045	ID	ID

NOTES:

ID	Insufficient Data. The number of detections is less than 3.
ND	Not Detected (at laboratory MDL).
mg/L	Milligram per liter.
ug/L	Microgram per liter.
Short	Reflects the most recent analysis data, up to eight analyses maximum.

Appendix A

Groundwater Quality Standards

Water Quality Standards

Analyte	CAS No.	Eff. Date	Federal Drinking Water Standards MCL		Ref.	Ground Water Quality Criteria Criterion*		Eff. Date	Ref.
Primary Standards									
A. Inorganics									
Antimony	7440-36-0	17-Jan-94	0.006	mg/L	FR v. 57 No.138	0.006	mg/L	17-Jan-94	WAC 173-200
Arsenic c	7440-38-2	23-Jan-06	0.01	mg/L	66 FR 28342	0.00005	mg/L	01-Dec-90	WAC 173-200
Asbestos	132207-33-1	30-Jul-92	7	mf/L	FR v. 56 No. 20	7	mf/L	30-Jul-92	WAC 173-200
Barium	7440-39-3	1-Jan-93	2.0	mg/L	FR v. 56 No. 126	1.0	mg/L	01-Dec-90	WAC 173-200
Beryllium	7440-41-7	17-Jan-94	0.004	mg/L	FR v. 57 No.138	0.004	mg/L	17-Jan-94	WAC 173-200
Cadmium	7440-43-9	30-Jul-92	0.005	mg/L	FR v. 56 No. 20	0.005	mg/L	01-Dec-90	WAC 173-200
Chromium	7440-47-3	30-Jul-92	0.1	mg/L	FR v. 56 No. 20	0.05	mg/L	01-Dec-90	WAC 173-200
Copper	7440-50-8	7-Dec-92	1.3**	mg/L	FR v. 57 No. 125	1.0	mg/L	01-Dec-90	WAC 173-200
Cyanide	57-12-5	17-Jan-94	0.2	mg/L	FR v. 57 No.138	0.2	mg/L	17-Jan-94	WAC 173-200
Fluoride	16984-48-8	2-Oct-87	4.0	mg/L	40 CFR 141	4.0	mg/L	01-Dec-90	WAC 173-200
Lead	7439-92-1	7-Dec-92	0.015**	mg/L	FR v. 57 No. 125	0.015	mg/L	01-Dec-90	WAC 173-200
Mercury	7439-97-6	2-Apr-86	0.002	mg/L	40 CFR 141	0.002	mg/L	01-Dec-90	WAC 173-200
Nickel	7440-02-0	17-Jan-94	0.1	mg/L	FR v. 57 No.138	0.1	mg/L	17-Jan-94	WAC 173-200
Nitrate	14797-55-8	2-Apr-86	10.0	mg/L	FR v. 56 No. 20	10.0	mg/L	01-Dec-90	WAC 173-200
Nitrate and Nitrite	14797-55-8+147	30-Jul-92	10.0	mg/L	FR v. 56 No. 20	10.0	mg/L	30-Jul-92	WAC 173-200
Nitrite	14797-65-0	30-Jul-92	1	mg/L	FR v. 56 No. 20	1.0	mg/L	30-Jul-92	WAC 173-200
Selenium	7782-49-2	30-Jul-92	0.05	mg/L	FR v. 56 No. 20	0.01	mg/L	01-Dec-90	WAC 173-200
Silver	7440-22-4		--			0.05	mg/L	01-Dec-90	WAC 173-200
Sodium	7440-23-5	20-Sep-04	20***	mg/L		20***	mg/L	03-Jul-04	WAC 246-290
Thallium	7440-28-0	17-Jan-94	0.002	mg/L	FR v. 57 No.138	0.002	mg/L	17-Jan-94	WAC 173-200
Total Coliforms		24-Dec-75	1/100	mL	40 CFR 141	1/100	mL	01-Dec-90	WAC 173-200
Turbidity		24-Dec-75	1	NTU	40 CFR 141	--	--	--	--
B. Organic Chemicals									
Alachlor	15972-60-8	30-Jul-92	2	ug/L	FR v. 56 No. 20	2	ug/L	30-Jul-92	WAC 173-200
Atrazine	1912-24-9	30-Jul-92	3	ug/L	FR v. 56 No. 20	3	ug/L	30-Jul-92	WAC 173-200
Benzene c	71-43-2	9-Jan-89	5	ug/L	40 CFR 141	1	ug/L	01-Dec-90	WAC 173-200
Bis(2-ethylhexyl)phthalate	117-81-7	17-Jan-94	6	ug/L	FR v. 57 No.138	6	ug/L	01-Dec-90	WAC 173-200
Bromodichloromethane c	75-27-4		--			0.3	ug/L	01-Dec-90	WAC 173-200
Bromoform c	75-25-2		--			5	ug/L	01-Dec-90	WAC 173-200
Carbofuran	1563-66-2	30-Jul-92	40	ug/L	FR v. 56 No. 20	40	ug/L	30-Jul-92	WAC 173-200
Carbon Tetrachloride c	56-23-5	9-Jan-89	5	ug/L	40 CFR 141	0.3	ug/L	01-Dec-90	WAC 173-200
Chlordane c	5103-71-9	30-Jul-92	2	ug/L	FR v. 56 No. 20	0.06	ug/L	01-Dec-90	WAC 173-200
Chlorobenzene	108-90-7	30-Jul-92	100	ug/L	FR v. 56 No. 20	100	ug/L	30-Jul-92	WAC 173-200
Chlorodibromomethane c	124-48-1		--			0.5	ug/L	01-Dec-90	WAC 173-200
Chloroform c	67-66-3		--			7	ug/L	01-Dec-90	WAC 173-200
2,4-D	94-75-7	30-Jul-92	70	ug/L	FR v. 56 No. 20	70	ug/L	01-Dec-90	WAC 173-200
Dalapon	75-99-0	17-Jan-94	200	ug/L	FR v. 57 No.138	200	ug/L	17-Jan-94	WAC 173-200
1,2-Dibromo-3-chloropropane	96-12-8	30-Jul-92	0.2	ug/L	FR v. 56 No. 20	0.2	ug/L	30-Jul-92	WAC 173-200
1,2-Dichlorobenzene	95-50-1	30-Jul-92	600	ug/L	FR v. 56 No. 20	600	ug/L	30-Jul-92	WAC 173-200
1,4-Dichlorobenzene c	106-46-7	9-Jan-89	75	ug/L	40 CFR 141	4	ug/L	01-Dec-90	WAC 173-200
1,1-Dichloroethane c	75-34-3		--			1	ug/L	01-Dec-90	WAC 173-200
1,2-Dichloroethane c	107-06-2	9-Jan-89	5	ug/L	40 CFR 141	0.5	ug/L	01-Dec-90	WAC 173-200
1,1-Dichloroethene	75-35-4	9-Jan-89	7	ug/L	40 CFR 141	7	ug/L	01-Dec-90	WAC 173-200
c-1,2-Dichloroethene	156-59-2	30-Jul-92	70	ug/L	FR v. 56 No. 20	70	ug/L	30-Jul-92	WAC 173-200
t-1,2-Dichloroethene	156-60-5	30-Jul-92	100	ug/L	FR v. 56 No. 20	100	ug/L	30-Jul-92	WAC 173-200
1,2-Dichloropropane c	78-87-5	30-Jul-92	5	ug/L	FR v. 56 No. 20	0.6	ug/L	01-Dec-90	WAC 173-200
1,3-Dichloropropene tot. c	542-75-6		--			0.2	ug/L	01-Dec-90	WAC 173-200
Di(ethylhexyl)adipate	103-23-1	17-Jan-94	400	ug/L	FR v. 57 No.138	400	ug/L	17-Jan-94	WAC 173-200
Dinoseb	88-85-7	17-Jan-94	7	ug/L	FR v. 57 No.138	7	ug/L	17-Jan-94	WAC 173-200
Diquat	231-36-7	17-Jan-94	20	ug/L	FR v. 57 No.138	20	ug/L	17-Jan-94	WAC 173-200
Endothall	145-73-3	17-Jan-94	100	ug/L	FR v. 57 No.138	100	ug/L	17-Jan-94	WAC 173-200
Endrin	72-20-8	17-Jan-94	2	ug/L	40 CFR 141	0.2	ug/L	01-Dec-90	WAC 173-200
Ethylbenzene	100-41-4	30-Jul-92	700	ug/L	FR v. 56 No. 20	700	ug/L	30-Jul-92	WAC 173-200
Ethylene dibromide c	106-93-4	30-Jul-92	0.05	ug/L	FR v. 56 No. 20	0.001	ug/L	01-Dec-90	WAC 173-200
Glyphosate	1071-83-6	17-Jan-94	70	ug/L	FR v. 57 No.138	70	ug/L	17-Jan-94	WAC 173-200
Heptachlor c	76-44-8	30-Jul-92	0.4	ug/L	FR v. 56 No. 20	0.02	ug/L	01-Dec-90	WAC 173-200
Heptachlor epoxide c	1024-57-3	30-Jul-92	0.2	ug/L	FR v. 56 No. 20	0.009	ug/L	01-Dec-90	WAC 173-200
Hexachlorobenzene	118-74-1	17-Jan-94	1	ug/L	FR v. 57 No.138	0.05	ug/L	01-Dec-90	WAC 173-200
Hexachlorocyclopentadiene (HEX)	77-47-4	17-Jan-94	50	ug/L	FR v. 57 No.138	50	ug/L	17-Jan-94	WAC 173-200
Lindane c	58-89-9	30-Jul-92	0.2	ug/L	FR v. 56 No. 20	0.06	ug/L	01-Dec-90	WAC 173-200

Water Quality Standards

Analyte	CAS No.	Eff. Date	Federal Drinking Water Standards MCL		Ref.	Ground Water Quality Criteria Criterion*		Eff. Date	Ref.
Methoxychlor	72-43-5	30-Jul-92	40	ug/L	FR v. 56 No. 20	40	ug/L	30-Jul-92	WAC 173-200
Methylene Chloride c	75-09-2	17-Jan-94	5	ug/L	FR v. 57 No.138	5	ug/L	17-Jan-94	WAC 173-200
Oxamyl (vydate)	23135-22-0	17-Jan-94	200	ug/L	FR v. 57 No.138	200	ug/L	17-Jan-94	WAC 173-200
PAHs [Benzo(a)pyrene]		17-Jan-94	0.2	ug/l	FR v. 57 No.138	0.01	ug/L	17-Jan-94	WAC 173-200
PCBs c	27323-18-8	30-Jul-92	0.5	ug/L	FR v. 56 No. 20	0.01	ug/L	01-Dec-90	WAC 173-200
Pentachlorophenol	87-86-5	1-Jan-93	1	ug/L	FR v. 56 No. 126	1	ug/L	01-Jan-93	WAC 173-200
Picloram	1918-02-1	17-Jan-94	500	ug/L	FR v. 57 No.138	500	ug/L	17-Jan-94	WAC 173-200
Simazine	122-34-9	17-Jan-94	4	ug/L	FR v. 57 No.138	4	ug/L	17-Jan-94	WAC 173-200
Styrene	100-42-5	30-Jul-92	100	ug/L	FR v. 56 No. 20	100	ug/L	30-Jul-92	WAC 173-200
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	17-Jan-94	3E-05	ug/L	FR v. 57 No.138	0.0000006	ug/L	01-Dec-90	WAC 173-200
Tetrachloroethylene c	127-18-4	30-Jul-92	5	ug/L	FR v. 56 No. 20	0.8	ug/L	30-Jul-92	WAC 173-200
Toluene	108-88-3	30-Jul-92	1000	ug/L	FR v. 56 No. 20	1000	ug/L	30-Jul-92	WAC 173-200
Total Trihalomethanes c	75-27-4, 75-25-2	29-Nov-79	100	ug/L	40 CFR 141	--	--	--	--
Toxaphene c	8001-35-2	30-Jul-92	3	ug/L	FR v. 56 No. 20	0.08	ug/L	01-Dec-90	WAC 173-200
2,4,5-TP	93-72-1	30-Jul-92	50	ug/L	FR v. 56 No. 20	100	ug/L	01-Dec-90	WAC 173-200
1,2,4-Trichlorobenzene	120-82-1	17-Jan-94	70	ug/L	FR v. 57 No.138	70	ug/L	17-Jan-94	WAC 173-200
1,1,1-Trichloroethane	71-55-6	9-Jan-89	200	ug/L	40 CFR 141	200	ug/L	01-Dec-90	WAC 173-200
1,1,2-Trichloroethane	79-00-5	17-Jan-94	5	ug/L	FR v. 57 No.138	5	ug/L	17-Jan-94	WAC 173-200
Trichloroethylene (TCE) c	79-01-6	9-Jan-89	5	ug/L	40 CFR 141	3	ug/L	01-Dec-90	WAC 173-200
Vinyl chloride c	75-01-4	9-Jan-89	2	ug/L	40 CFR 141	0.02	ug/L	01-Dec-90	WAC 173-200
Xylenes (total)	1330-20-7	30-Jul-92	10000	ug/L	FR v. 56 No. 20	10000	ug/L	30-Jul-92	WAC 173-200
C. Radionuclides and Radioactivity									
Radium 226 & Radium 228		9-Jul-76	5	pCi/L	FR v. 41 No. 133	5	pCi/L	01-Dec-90	WAC 173-200
Radium 226	13982-63-3		--			3	pCi/L	01-Dec-90	WAC 173-200
Radium 228	15262-20-1		--			5	pCi/L	01-Dec-90	WAC 173-200
Gross Alpha particle activity		9-Jul-76	15	pCi/L	FR v. 41 No. 133	15	pCi/L	01-Dec-90	WAC 173-200
Tritium	10028-17-8	9-Jul-76	20,000	pCi/L	FR v. 41 No. 133	20,000	pCi/L	01-Dec-90	WAC 173-200
Strontium	7440-24-6	9-Jul-76	8	pCi/L	FR v. 41 No. 133	8	pCi/L	01-Dec-90	WAC 173-200
Gross Beta particle activity		9-Jul-76	50	pCi/L	FR v. 41 No. 133	50	pCi/L	01-Dec-90	WAC 173-200
D. Additional Carcinogens Listed in Groundwater Criteria									
Acrylamide	79-06-1		--			0.02	ug/L	01-Dec-90	WAC 173-200
Acrylonitrile	107-13-1		--			0.07	ug/L	01-Dec-90	WAC 173-200
Aldrin	309-00-2		--			0.005	ug/L	01-Dec-90	WAC 173-200
Aniline	62-53-3		--			14	ug/L	01-Dec-90	WAC 173-200
Aramite	140-57-8		--			3	ug/L	01-Dec-90	WAC 173-200
Azobenzene	103-33-3		--			0.7	ug/L	01-Dec-90	WAC 173-200
Benzidine	92-87-5		--			0.0004	ug/L	01-Dec-90	WAC 173-200
Benzo(a)pyrene	50-32-8		--			0.008	ug/L	01-Dec-90	WAC 173-200
Benzotrichloride	98-07-7		--			0.007	ug/L	01-Dec-90	WAC 173-200
Benzyl chloride	100-44-7		--			0.5	ug/L	01-Dec-90	WAC 173-200
Bis(chloroethyl)ether	111-44-4		--			0.07	ug/L	01-Dec-90	WAC 173-200
Bis(chloromethyl)ether	542-88-1		--			0.0004	ug/L	01-Dec-90	WAC 173-200
Carbazole	86-74-8		--			5	ug/L	01-Dec-90	WAC 173-200
4-Chloro-2-methyl analine	95-69-2		--			0.1	ug/L	01-Dec-90	WAC 173-200
4-Chloro-2-methyl analine hydrochlo	3165-93-3		--			0.2	ug/L	01-Dec-90	WAC 173-200
o-Chloronitrobenzene	88-73-3		--			3	ug/L	01-Dec-90	WAC 173-200
p-Chloronitrobenzene	100-00-5		--			5	ug/L	01-Dec-90	WAC 173-200
Chlorthaloni	1897-45-6		--			30	ug/L	01-Dec-90	WAC 173-200
Diallate	2303-16-4		--			1	ug/L	01-Dec-90	WAC 173-200
DDT (includes DDE and DDD)	50-29-3, 72-55-9, 72-54-8		--			0.3	ug/L	01-Dec-90	WAC 173-200
1,2-Dibromomethane	106-93-4		--			0.001	ug/L	01-Dec-90	WAC 173-200
3,3'-Dichlorobenzidine	91-94-1		--			0.2	ug/L	01-Dec-90	WAC 173-200
Dichlorovos	62-73-7		--			0.3	ug/L	01-Dec-90	WAC 173-200
Dieldrin	60-57-1		--			0.005	ug/L	01-Dec-90	WAC 173-200
3,3'-Dimethoxybenzidine	119-90-4		--			6.0	ug/L	01-Dec-90	WAC 173-200
3,3-Dimethylbenzidine	119-93-7		--			0.007	ug/L	01-Dec-90	WAC 173-200
1,2-Dimethylhydrazine	540-73-8		--			60	ug/L	01-Dec-90	WAC 173-200
2,4-Dinitrotoluene	121-14-2		--			0.1	ug/L	01-Dec-90	WAC 173-200
2,6-Dinitrotoluene	606-20-2		--			0.1	ug/L	01-Dec-90	WAC 173-200
1,4-Dioxane	123-91-1		--			7	ug/L	01-Dec-90	WAC 173-200
1,2-Diphenylhydrazine	122-66-7		--			0.09	ug/L	01-Dec-90	WAC 173-200

Water Quality Standards

Analyte	CAS No.	Eff. Date	Federal Drinking Water Standards MCL		Ref.	Ground Water Quality Criteria Criterion*		Eff. Date	Ref.
Direct Black 38	1937-37-7		--			0.009	ug/L	01-Dec-90	WAC 173-200
Direct Blue 6	2602-46-2		--			0.009	ug/L	01-Dec-90	WAC 173-200
Direct Brown 95	16071-86-6		--			0.009	ug/L	01-Dec-90	WAC 173-200
Epichlorohydrin	106-89-8		--			8	ug/L	01-Dec-90	WAC 173-200
Ethyl acrylate	140-88-5		--			2	ug/L	01-Dec-90	WAC 173-200
Ethylene thiourea	96-45-7		--			2	ug/L	01-Dec-90	WAC 173-200
Folpet	133-07-3		--			20	ug/L	01-Dec-90	WAC 173-200
Furazolidone	67-45-8		--			0.02	ug/L	01-Dec-90	WAC 173-200
Furium	531-82-8		--			0.002	ug/L	01-Dec-90	WAC 173-200
Furmecyclox	60568-05-0		--			3	ug/L	01-Dec-90	WAC 173-200
Hexachlorocyclohexane (alpha)	319-84-6		--			0.001	ug/L	01-Dec-90	WAC 173-200
Hexachlorocyclohexane (technical)	608-73-1		--			0.05	ug/L	01-Dec-90	WAC 173-200
Hexachlorodibenzo-p-dioxin, mix	34465-46-8		--			0.00001	ug/L	01-Dec-90	WAC 173-200
Hydrazine/hydrazine sufate	302-01-2/10034-93-2		--			0.03	ug/L	01-Dec-90	WAC 173-200
2-Methoxy-5-nitroanaline	99-59-2		--			2.0	ug/L	01-Dec-90	WAC 173-200
2-Methylanaline	95-53-4		--			0.2	ug/L	01-Dec-90	WAC 173-200
2-Methylanaline hydrochloride	636-21-5		--			0.5	ug/L	01-Dec-90	WAC 173-200
4,4'-Methylene bis(N,N'-dimethyl) an	101-61-1		--			2.0	ug/L	01-Dec-90	WAC 173-200
Mirex	2385-85-5		--			0.05	ug/L	01-Dec-90	WAC 173-200
Nitrofurazone	59-87-0		--			0.06	ug/L	01-Dec-90	WAC 173-200
N-Nitrosodiethanolamine	1116-54-7		--			0.03	ug/L	01-Dec-90	WAC 173-200
N-Nitrosodiethylamine	55-18-5		--			0.0005	ug/L	01-Dec-90	WAC 173-200
N-Nitrosodimethylamine	62-75-9		--			0.002	ug/L	01-Dec-90	WAC 173-200
N-Nitrosodiphenylamine	86-30-6		--			17.0	ug/L	01-Dec-90	WAC 173-200
N-Nitroso-di-n-propylamine	621-64-7		--			0.01	ug/L	01-Dec-90	WAC 173-200
N-Nitrosopyrrolidine	930-55-2		--			0.04	ug/L	01-Dec-90	WAC 173-200
N-Nitroso-di-n-butylamine	924-16-3		--			0.02	ug/L	01-Dec-90	WAC 173-200
N-Nitroso-N-methylethylylamine	10595-95-6		--			0.004	ug/L	01-Dec-90	WAC 173-200
PBBs	59536-65-1		--			0.01	ug/L	01-Dec-90	WAC 173-200
o-Phenylenediamine	95-54-5		--			0.005	ug/L	01-Dec-90	WAC 173-200
Propylene oxide	75-56-9]		--			0.01	ug/L	01-Dec-90	WAC 173-200
p,a,a,a-Tetrachlorotoluene	5216-25-1		--			0.004	ug/L	01-Dec-90	WAC 173-200
2,4-Toluenediamine	95-80-7		--			0.002	ug/L	01-Dec-90	WAC 173-200
o-Toluidine	95-53-4		--			0.2	ug/L	01-Dec-90	WAC 173-200
2,4,6-Trichlorophenol	88-06-2		--			4.0	ug/L	01-Dec-90	WAC 173-200
Trimethyl phosphate	512-56-1		--			2.0	ug/L	01-Dec-90	WAC 173-200
Secondary Standards									
Aluminum	7429-90-5	30-Jul-92	0.05-0.2	mg/L	FR v. 56 No. 20	0.05-0.2	mg/L	30-Jul-92	WAC 173-200
Copper	7440-50-8	7-Dec-92	1.0	mg/L	FR v. 57 No. 125	1.0	mg/L	01-Dec-90	WAC 173-200
Iron	7439-89-6	2-Apr-86	0.3	mg/L	40 CFR 143	0.3	mg/L	01-Dec-90	WAC 173-200
Manganese	7439-96-5	2-Apr-86	0.05	mg/L	40 CFR 143	0.05	mg/L	01-Dec-90	WAC 173-200
Color		2-Apr-86	15	units	40 CFR 143	15	units	01-Dec-90	WAC 173-200
pH	12408-02-5	2-Apr-86	6.5-8.5	units	40 CFR 143	6.5-8.5	units	01-Dec-90	WAC 173-200
Specific Conductivity			--			700	uS/cm		WAC 246-290
Total Dissolved Solids		2-Apr-86	500	mg/L	40 CFR 143	500	mg/L	01-Dec-90	WAC 173-200
Chloride	16887-00-6	2-Apr-86	250	mg/L	40 CFR 143	250	mg/L	01-Dec-90	WAC 173-200
Fluoride	16984-48-8	2-Apr-86	2.0	mg/L	40 CFR 143	p			
Silver	7440-22-4	30-Jul-92	0.1	mg/L	FR v. 56 No. 20	p			
Sulfate	14808-79-8	2-Apr-86	250	mg/L	40 CFR 143	250	mg/L	01-Dec-90	WAC 173-200
Surfactants		2-Apr-86	0.5	mg/L	40 CFR 143	0.5	mg/L	01-Dec-90	WAC 173-200
Corrosivity		2-Apr-86	non-corrosive		40 CFR 143	non-corrosive		01-Dec-90	WAC 173-200
Odor-Threshold		2-Apr-86	3	units	40 CFR 143	3	units	01-Dec-90	WAC 173-200
Zinc	7440-66-6	2-Apr-86	5.0	mg/L	40 CFR 143	5.0	mg/L	01-Dec-90	WAC 173-200

NOTES: pCi/L=picocuries per liter
mg/L=milligrams per liter
mf/L=million fibers per liter
p=Listed as a Primary Standard
--'=no standard established
i=listed individually as groundwater criteria
c=Listed as a carcinogen in the Ground Water Criteria
MCL=Maximum Contaminant Level
*=Criteria shall be the most stringent concentration of the Federal MCLG, MCL; or State MCL
MCLG= Maximum Contaminant Level Goal
**=treatment technique in lieu of an MCL
***= A Drinking Water Advisory, not an enforceable standard.
Ground Water Quality Criteria=Water Quality Standards for Ground Waters of the State of Washington

Compiled by KCSWD 1/12/94. Revised 10/5/09

Appendix B

Exceedance Reports

Table 3

VASHON LANDFILL GW SUMMARY OF EXCEEDANCES
(January 1, 2017 to December 31, 2017)

D Aquifer

Parameter	Units	Site ID	Sample Date	Sample Value	Standard(s) Exceeded
Arsenic[1]	(mg/L)	MW-12	2/2/17	0.00185	SGW1
		MW-19	2/3/17	0.00108	SGW1
		MW-26	2/3/17	0.0034	SGW1
		MW-29	1/31/17	0.00354	SGW1
		MW-7	2/2/17	0.00455	SGW1
		MW-7	5/3/2017	0.00498	SGW1
		MW-12	5/17/2017	0.00204	SGW1
		MW-19	5/8/2017	0.0012	SGW1
		MW-26	5/25/2017	0.00463	SGW1
		MW-29	5/19/2017	0.00432	SGW1
		MW-7	8/4/2017	0.00514	SGW1
		MW-12	8/7/2017	0.002	SGW1
		MW-19	8/2/2017	0.00122	SGW1
		MW-26	8/11/2017	0.00365	SGW1
		MW-29	8/11/2017	0.0042	SGW1
		MW-7	11/13/2017	0.00493	SGW1
		MW-12	11/13/2017	0.00192	SGW1
		MW-19	11/17/2017	0.00125	SGW1
		MW-26	11/17/2017	0.00461	SGW1
		MW-29	11/17/2017	0.00447	SGW1
Iron[2]	(mg/L)	MW-26	2/3/2017	1.36	F2; SGW2
		MW-29	1/31/2017	0.754	F2; SGW2
		MW-29	5/19/2017	0.767	F2; SGW2
		MW-29	8/11/2017	0.836	F2; SGW2
		MW-29	11/17/2017	0.69	F2; SGW2
Manganese[2]	(mg/L)	MW-19	2/3/2017	0.496 D	F2; SGW2
		MW-26	2/3/2017	0.0723 D	F2; SGW2
		MW-29	1/31/2017	0.0849	F2; SGW2
		MW-7	2/2/2017	0.163 D	F2; SGW2
		MW-7	5/3/2017	0.165	F2; SGW2
		MW-19	5/8/2017	0.43	F2; SGW2
		MW-26	5/25/2017	0.0676	F2; SGW2
		MW-29	5/19/2017	0.0937	F2; SGW2
		MW-7	8/4/2017	0.174	F2; SGW2
		MW-19	8/2/2017	0.513	F2; SGW2
		MW-26	8/11/2017	0.0672	F2; SGW2
		MW-29	8/11/2017	0.0936	F2; SGW2
		MW-7	11/13/2017	0.17	F2; SGW2
		MW-19	11/17/2017	0.477	F2; SGW2
		MW-26	11/17/2017	0.0644	F2; SGW2
		MW-29	11/17/2017	0.0947	F2; SGW2

F1 = Primary Federal Drinking Water Quality Standard
F2 = Secondary Federal Drinking Water Quality Standard
SGW1 = State of Washington Primary Ground Water Quality Standard
SGW2 = State of Washington Secondary Ground Water Quality Standard
See Data Qualifiers Section for Qualifier Information.

See Analytical Data Qualifier Page for Data Qualifier Information.
[1] Total Metals
[2] Dissolved Metals

Table 4

VASHON LANDFILL GW SUMMARY OF PREDICTION LIMIT EXCEEDANCES
(January 1, 2017 to December 31, 2017)
Intrawell
D Aquifer

Parameter	Units	Site ID	Sample Date	Sample Value	Limit Value
Barium, Total	mg/L	MW-7	11/13/17	0.01	0.01
Calcium, Total	mg/L	MW-12	05/17/17	11.50	11.40
		MW-29	05/19/17	22.20	21.70
		MW-12	08/07/17	11.50	11.40
Magnesium, Total	mg/L	MW-7	08/04/17	10.50	10.21
Sulfate, Total	(mg/L)	MW-12	8/7/17	11.4	11.3

Table 5

VASHON LANDFILL GW VOLATILE ORGANIC COMPOUND DETECTIONS
(January 1, 2017 to December 31, 2017)

D Aquifer

Parameter	Units	Site ID	Date	Sample Value
Carbon Disulfide	(µg/L)	MW-7	11/13/2017	0.1 JT
Vinyl Chloride	(µg/L)	MW-12	11/13/2017	0.015 JLT

See Analytical Data Qualifier Page for Data Qualifier Information.

Groundwater Below Cc2 & Cc3

Parameter	Site ID	Sample Date	Sample Value	Standard(s) Exceeded
There were no exceedances in Cc2 for this period.				

See Analytical Data Qualifier Page for Data Qualifier Information.

SGW State of Washington Ground Water Quality Standard

[1] Total Metals

[2] Dissolved Metals

Table 7

VASHON LANDFILL GW SUMMARY OF EXCEEDANCES

(January 1, 2017 to December 31, 2017)

Groundwater Within Channel Cc2 & Cc3

Parameter	Units	Site ID	Sample Date	Sample Value	Standard(s) Exceeded
Arsenic[1]	(mg/L)	MW-20	2/14/17	0.00209	SGW1
		MW-21	2/14/17	0.00418	SGW1
		MW-9	2/3/17	0.0022	SGW1
		MW-2	5/17/17	0.000984	SGW1
		MW-20	5/8/17	0.00159	SGW1
		MW-21	5/25/17	0.0042	SGW1
		MW-8	5/4/17	0.000468	SGW1
		MW-9	5/19/17	0.00234	SGW1
		MW-2	8/7/17	0.000982	SGW1
		MW-8	8/3/2017	0.000472	SGW1
		MW-9	8/2/2017	0.00227	SGW1
		MW-20	8/7/2017	0.00243	SGW1
		MW-21	8/7/2017	0.00362	SGW1
		MW-2	11/13/2017	0.000945	SGW1
		MW-8	11/14/2017	0.000471	SGW1
		MW-9	11/17/2017	0.00217	SGW1
		MW-20	11/17/2017	0.00226	SGW1
		MW-21	11/14/2017	0.0026	SGW1
Iron[2]	(mg/L)	MW-20	2/14/17	0.587	F2; SGW2
		MW-21	2/14/17	1.74	F2; SGW2
		MW-20	5/8/17	0.22	F2; SGW2
		MW-21	5/25/17	0.384	F2; SGW2
		MW-20	8/7/2017	0.479	F2; SGW2
		MW-21	11/14/2017	0.586	F2; SGW2
		MW-9	11/17/2017	0.0383	F2; SGW2
Manganese[2]	(mg/L)	MW-2	2/2/17	0.0838 D	F2; SGW2
		MW-20	2/14/17	0.271	F2; SGW2
		MW-21	2/14/17	0.496	F2; SGW2
		MW-2	5/17/17	0.0945	F2; SGW2
		MW-20	5/8/17	0.291	F2; SGW2
		MW-21	5/25/17	0.812	F2; SGW2
		MW-2	8/7/17	0.106	F2; SGW2
		MW-20	8/7/17	0.295	F2; SGW2
		MW-21	8/7/17	0.736	F2; SGW2
		MW-2	11/13/2017	0.112	F2; SGW2
		MW-20	11/17/2017	0.288	F2; SGW2
		MW-21	11/14/2017	0.743	F2; SGW2
Vinyl Chloride	(µg/L)	MW-2	2/2/17	0.0746	SGW1
		MW-21	2/14/17	0.0667	SGW1
		MW-2	5/17/17	0.09	SGW1
		MW-21	5/25/17	0.0917	SGW1
		MW-2	8/7/17	0.0749	SGW1
		MW-21	8/7/17	0.0773	SGW1
		MW-2	11/13/17	0.0813	SGW1
		MW-21	11/14/2017	0.0556	SGW1

See Analytical Data Qualifier Page for Data Qualifier Information.

SGW State of Washington Ground Water Quality Standard

[1] Total Metals

[2] Dissolved Metals

Groundwater Below Cc2 & Cc3

Parameter	Site ID	Sample Date	Sample Value	Standard(s) Exceeded
There were no exceedances in Cc2 for this period.				

See Analytical Data Qualifier Page for Data Qualifier Information.

SGW State of Washington Ground Water Quality Standard

[1] Total Metals

[2] Dissolved Metals

Table 8

VASHON LANDFILL GW SUMMARY OF PREDICTION LIMIT EXCEEDANCES

(January 1, 2017 to December 31, 2017)

Interwell

Groundwater Within Channel Cc2 & Cc3

Parameter	Units	Site ID	Sample Date	Sample Value	Limit Value
pH	(Std. pH Units)	MW-2	02/02/17	6.85	< 7.24
		MW-20	02/14/17	7.18	< 7.24
		MW-21	02/14/17	6.93	< 7.24
		MW-2	05/17/17	6.92	< 7.24
		MW-21	05/25/17	6.65	< 7.24
		MW-9	05/19/17	7.1	< 7.24
		MW-2	08/07/17	6.99	< 7.24
		MW-20	08/07/17	6.95	< 7.24
		MW-21	08/07/17	6.89	< 7.24
		MW-9	08/02/17	6.77	< 7.24
		MW-2	11/13/17	6.77	< 7.24
		MW-20	11/17/17	7.21	< 7.24
		MW-21	11/14/17	6.63	< 7.24
		MW-9	11/17/17	6.95	< 7.24
Conductance	(umhos/cm)	MW-2	2/2/2017	332.6	242.1
		MW-21	2/14/2017	271.3	242.1
		MW-2	5/17/2017	311.3	242.1
		MW-21	5/25/2017	242.1	242.1
		MW-2	8/7/2017	301.3	242.1
		MW-21	8/7/2017	246.5	242.1
		MW-2	11/13/2017	294.9	242.1
		MW-21	11/14/2017	263.7	242.1
Alkalinity	(mg/L)	MW-2	2/2/2017	154	94.9
		MW-21	2/14/2017	121	94.9
		MW-2	5/17/2017	145	94.9
		MW-21	5/25/2017	125	94.9
		MW-2	8/7/2017	137	94.9
		MW-21	8/7/2017	120	94.9
		MW-2	11/13/2017	133	94.9
		MW-21	11/14/2017	120	94.9
Arsenic, Total	(mg/L)	MW-21	2/14/2017	0.00418	0.00232
		MW-20	5/8/2017	0.00244	0.00232
		MW-21	5/25/2017	0.00420	0.00232
		MW-20	8/7/2017	0.00243	0.00232
		MW-21	8/7/2017	0.00362	0.00232
		MW-21	11/14/2017	0.00260	0.00232

Table 8

VASHON LANDFILL GW SUMMARY OF PREDICTION LIMIT EXCEEDANCES

(January 1, 2017 to December 31, 2017)

Interwell

Groundwater Within Channel Cc2 & Cc3

Parameter	Units	Site ID	Sample Date	Sample Value	Limit Value
Calcium, Total	(mg/L)	MW-2	5/17/2017	21.1	15.7
		MW-21	5/25/2017	20.4	15.7
		MW-2	8/7/2017	19.2	15.7
		MW-21	8/7/2017	18.6	15.7
		MW-9	8/2/2017	16.7	15.7
		MW-2	11/13/2017	18.4	15.7
		MW-21	11/14/2017	18.4	15.7
Chloride	(mg/L)	MW-9	5/19/2017	5.6	4.10
		MW-9	8/2/2017	5.3	4.1
		MW-9	11/17/2017	4.6	4.1
Magnesium, Total	(mg/L)	MW-2	2/2/2017	22.6	16.86
		MW-2	5/17/2017	23.8	16.86
		MW-21	5/25/2017	18.2	16.86
		MW-2	8/7/2017	16.9	16.86
		MW-2	11/13/2017	20.6	16.86
Nitrate	(mg/L)	MW-21	2/14/2017	0.129	0.039
		MW-9	2/3/2017	0.21	0.039
		MW-21	5/25/2017	0.16	0.039
		MW-9	5/19/2017	0.82	0.039
		MW-21	8/7/2017	0.08	0.039
		MW-9	8/2/2017	0.44	0.039
		MW-9	11/18/2017	0.251	0.04
		MW-21	11/14/2017	0.130	0.04
		MW-9	11/17/2017	0.400	0.04
Sodium, Total	(mg/L)	MW-2	2/2/2017	8.35	7.39
		MW-21	2/14/2017	9.55	7.39
		MW-2	5/17/2017	9.10	7.39
		MW-21	5/25/2017	11.80	7.39
		MW-2	8/7/2017	8.60	7.39
		MW-21	8/7/2017	10.90	7.39
		MW-2	11/13/2017	8.50	7.39
		MW-21	11/14/2017	10.90	7.39

Table 8

VASHON LANDFILL GW SUMMARY OF PREDICTION LIMIT EXCEEDANCES

(January 1, 2017 to December 31, 2017)

Interwell

Groundwater Within Channel Cc2 & Cc3

Parameter	Units	Site ID	Sample Date	Sample Value	Limit Value
Total Dissolved Solids	(mg/L)	MW-2	2/2/2017	197	159
		MW-21	2/14/2017	170	159
		MW-2	5/17/2017	193	159
		MW-21	5/25/2017	181	159
		MW-2	8/7/2017	187	159
		MW-21	8/7/2017	169	159
		MW-2	11/13/2017	174	159
		MW-21	11/14/2017	168	159
Total Solids	(mg/L)	MW-2	2/2/2017	211	166
		MW-21	2/14/2017	193	166
		MW-2	5/17/2017	208	166
		MW-21	5/25/2017	197	166
		MW-2	8/7/2017	198	166
		MW-21	8/7/2017	182	166
		MW-2	11/13/2017	187	166
		MW-21	11/14/2017	174	166
Vanadium, Total	(mg/L)	MW-2	2/2/2017	0.00377	0.002
		MW-9	2/3/2017	0.00466	0.002
		MW-2	5/17/2017	0.00410	0.002
		MW-9	5/19/2017	0.00500	0.002
		MW-2	8/7/2017	0.00410	0.002
		MW-9	8/2/2017	0.00500	0.002
		MW-2	11/13/2017	0.00370	0.002
		MW-9	11/17/2017	0.00470	0.002
Vinyl Chloride	(ug/L)	MW-2	2/2/2017	0.0746	0.02
		MW-21	2/14/2017	0.0667	0.02
		MW-2	5/17/2017	0.09	0.02
		MW-21	5/25/2017	0.09	0.02
		MW-2	8/7/2017	0.07	0.02
		MW-21	8/7/2017	0.08	0.02
		MW-2	11/13/2017	0.0813	0.02
		MW-21	11/14/2017	0.0556	0.02

Table 9

VASHON LANDFILL GW VOLATILE ORGANIC COMPOUND DETECTIONS

(January 1, 2017 to December 31, 2017)

Groundwater Within & Below Channel Cc2 & Cc3

Parameter	Units	Site ID	Date	Sample Value
Carbon Disulfide	(µg/L)	MW-2	11/13/17	0.17 JT
	(µg/L)	MW-20	11/17/17	0.11 JT
Chloromethane	(µg/L)	MW-9	05/19/17	0.27 JT
cis-1,2-Dichloroethene	(ug/L)	MW-21	02/14/17	0.995
		MW-21	05/25/17	0.931
		MW-2	08/07/17	0.15 JT
		MW-21	08/07/17	0.956
		MW-2	11/13/17	0.214
		MW-21	11/14/17	0.875
Dichloroflouromethane	(ug/L)	MW-2	02/02/17	5.32
		MW-20	02/14/17	1.08
		MW-21	02/14/17	1.53
		MW-2	05/17/17	6.82
		MW-20	05/08/17	0.633
		MW-21	05/25/17	1.94
		MW-2	08/07/17	4.05
		MW-20	08/07/17	0.441
		MW-21	08/07/17	0.753
		MW-2	11/13/17	3.99
		MW-20	11/17/17	0.567
		MW-21	11/14/17	1
Trans-1,2-Dichloroethene	(ug/L)	MW-21	05/25/17	0.13 JT
		MW-21	08/07/17	0.13 JT
		MW-21	11/14/17	0.12 JT
Trichloroflouromethane	(ug/L)	MW-2	02/02/17	1.2
		MW-21	02/14/17	0.469
		MW-2	05/17/17	0.575
		MW-21	05/25/17	0.467
		MW-2	08/07/17	0.356
		MW-21	08/07/17	0.286
		MW-4	09/06/17	0.12 JT
		MW-2	11/13/17	0.335
		MW-21	11/14/17	0.303
Vinyl Chloride	(ug/L)	MW-2	02/02/17	0.0746
		MW-21	02/14/17	0.0667
		MW-2	05/17/17	0.09
		MW-21	05/25/17	0.0917
		MW-2	08/07/17	0.0749
		MW-21	08/07/17	0.0773
		MW-2	11/13/17	0.0813
		MW-21	11/14/17	0.0556

See Analytical Data Qualifier Page for Data Qualifier Information

Table 9

VASHON LANDFILL GW VOLATILE ORGANIC COMPOUND DETECTIONS
(January 1, 2017 to December 31, 2017)

Detections in Blanks

Parameter	Units	Site ID	Date	Sample Value
Acetone	(ug/L)	VOA TRIP BLANK	08/07/17	4.8 JT

See Analytical Data Qualifier Page for Data Qualifier Information

Table 11

VASHON LANDFILL GW SUMMARY OF EXCEEDANCES
(January 1, 2017 to December 31, 2017)

Groundwater Within & Adjacent to Channel Cc1

Parameter	Units	Site ID	Sample Date	Value	Exceeded
pH (Field)	(Std pH Units)	MW-3	5/17/17	5.9	F2; SGW2
		MW-4	9/6/2017	6.46	F2; SGW2
		MW-4	12/5/2017	6.4	F2; SGW2
Arsenic[1]	(mg/L)	MW-10	1/27/17	0.00148	SGW1
		MW-13	2/2/17	0.00162	SGW1
		MW-3	5/17/2017	0.000123	SGW1
		MW-4	6/5/2017	0.000359	SGW1
		MW-10	5/19/2017	0.00147	SGW1
		MW-13	5/8/2017	0.00179	SGW1
		MW-4	9/6/2017	0.000623	SGW1
		MW-10	8/3/2017	0.00153	SGW1
		MW-13	8/4/2017	0.00162	SGW1
		MW-4	12/5/2017	0.000366	SGW1
		MW-10	11/17/2017	0.00156	SGW1
		MW-13	11/13/2017	0.00196	SGW1
Iron[2]	(mg/L)	MW-4	9/6/2017	0.335	F2; SGW2

See Analytical Data Qualifier Page for Data Qualifier Information.

[1] Total Metals

[2] Dissolved Metals

Table 12

VASHON LANDFILL GW VOLATILE ORGANIC COMPOUND DETECTIONS
(January 1, 2017 to December 31, 2017)

Groundwater Within & Adjacent to Channel Cc1

Parameter	Units	Site ID	Date	Sample Value
Acetone	(µg/L)	MW-4	09/06/17	2.6 JT
cis-1,2-Dichloroethene	(ug/L)	MW-4	6/5/2017	0.273
Trichlorofluoromethane	(ug/L)	MW-4	6/5/2017	0.13 JT
		MW-4	9/6/2017	0.12 JT

See Analytical Data Qualifier Page for Data Qualifier Information

Table 13

VASHON ISLAND LANDFILL SEEPS/SURFACE WATER
(January 1, 2017 to December 31, 2017)

SUMMARY OF SURFACE WATER QUALITY CRITERIA EXCEEDANCES

Parameter	Units	Site ID	Sample Date	Sample Value	Reg. Limit	Standard(s) Exceeded
Ammonia	mg/L	SW-W1	02/01/17	0.02	0.0102; 0.0124	SSWC; FC
		SW-W1	05/11/17	0.123	0.0117	SSWC
		SW-W1	08/08/17	0.0162	0.0034; 0.0041	SSWC; FC
		SW-W2	08/08/17	0.0054	0.0034; 0.0041	SSWC; FC
Iron*	mg/L	SW-W1	02/01/17	3.25	1	FC
		SW-W2	02/01/17	3.12	1	FC
		SW-W1	05/11/17	1.72	1	FC
		SW-W2	05/11/17	2.16	1	FC
		SW-W3	05/11/17	2.86	1	FC
		SW-W2	08/08/17	1.89	1	FC
		SW-W1	12/05/17	1.27	1	FC
Lead*	mg/L	SW-W2	02/01/17	0.0017	0.0017	SSWC
Turbidity	NTU	SW-W2	5/11/17	27	10	SSWC, FA, FC
		SW-W3	5/11/17	65.9	10	SSWC, FA, FC

FC Federal Chronic Surface Water Criteria

FA Federal Acute Surface Water Criteria

SSWC State ChronicSurface Water Criteria

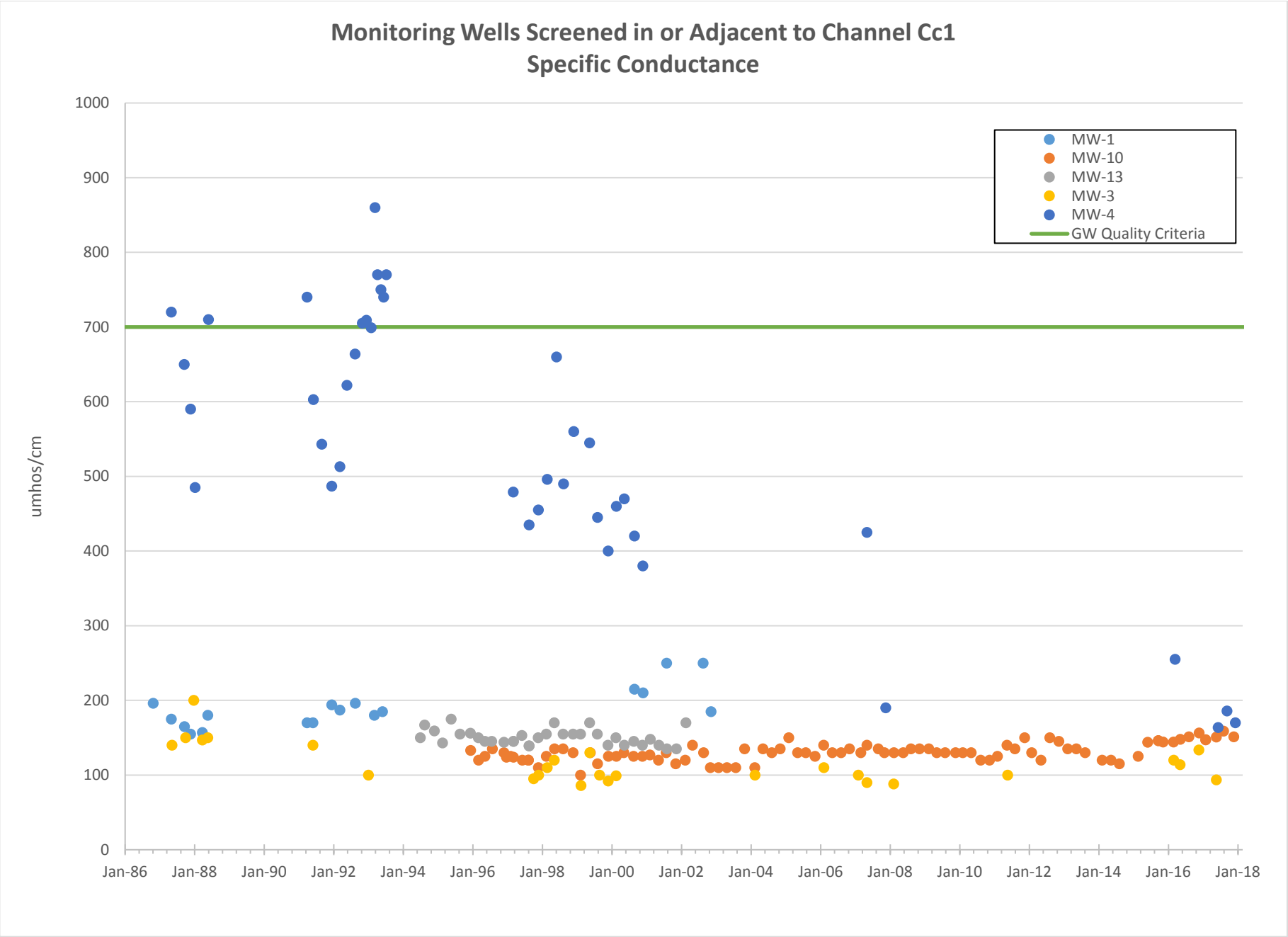
SSWA State Acute Surface Water Criteria

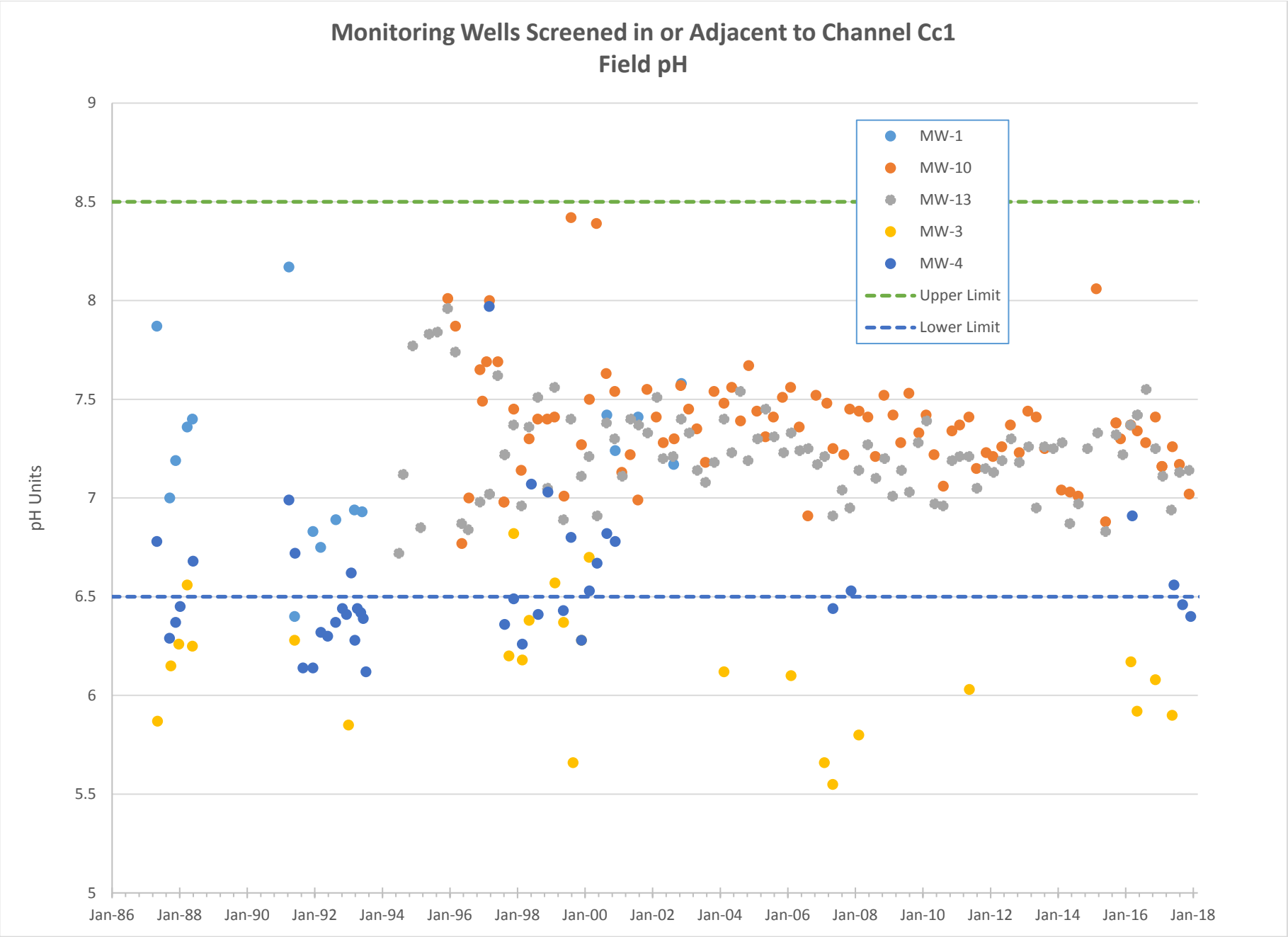
* Total Metals

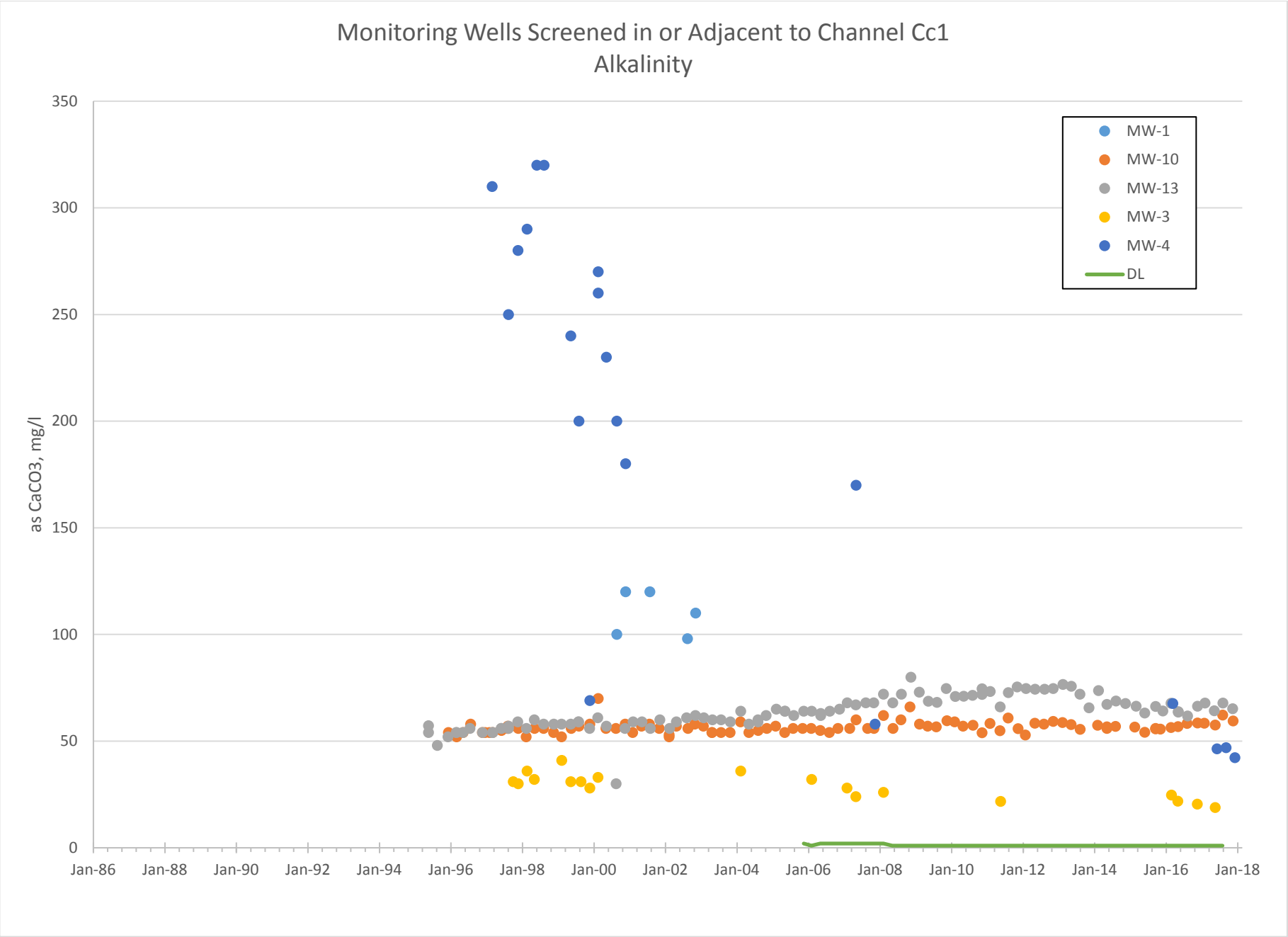
See Analytical Data Qualifier Page for Data Qualifier Information

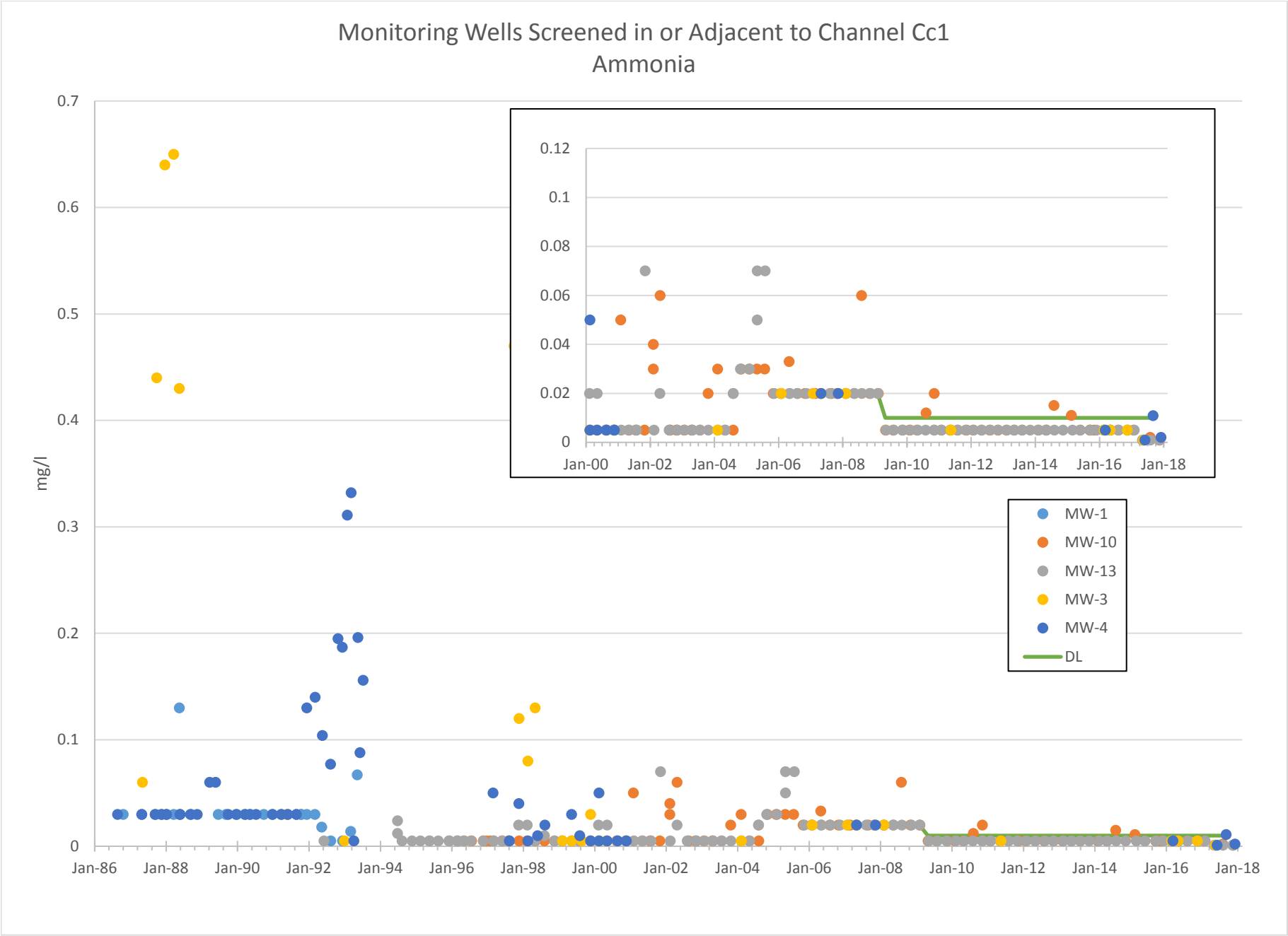
Appendix C

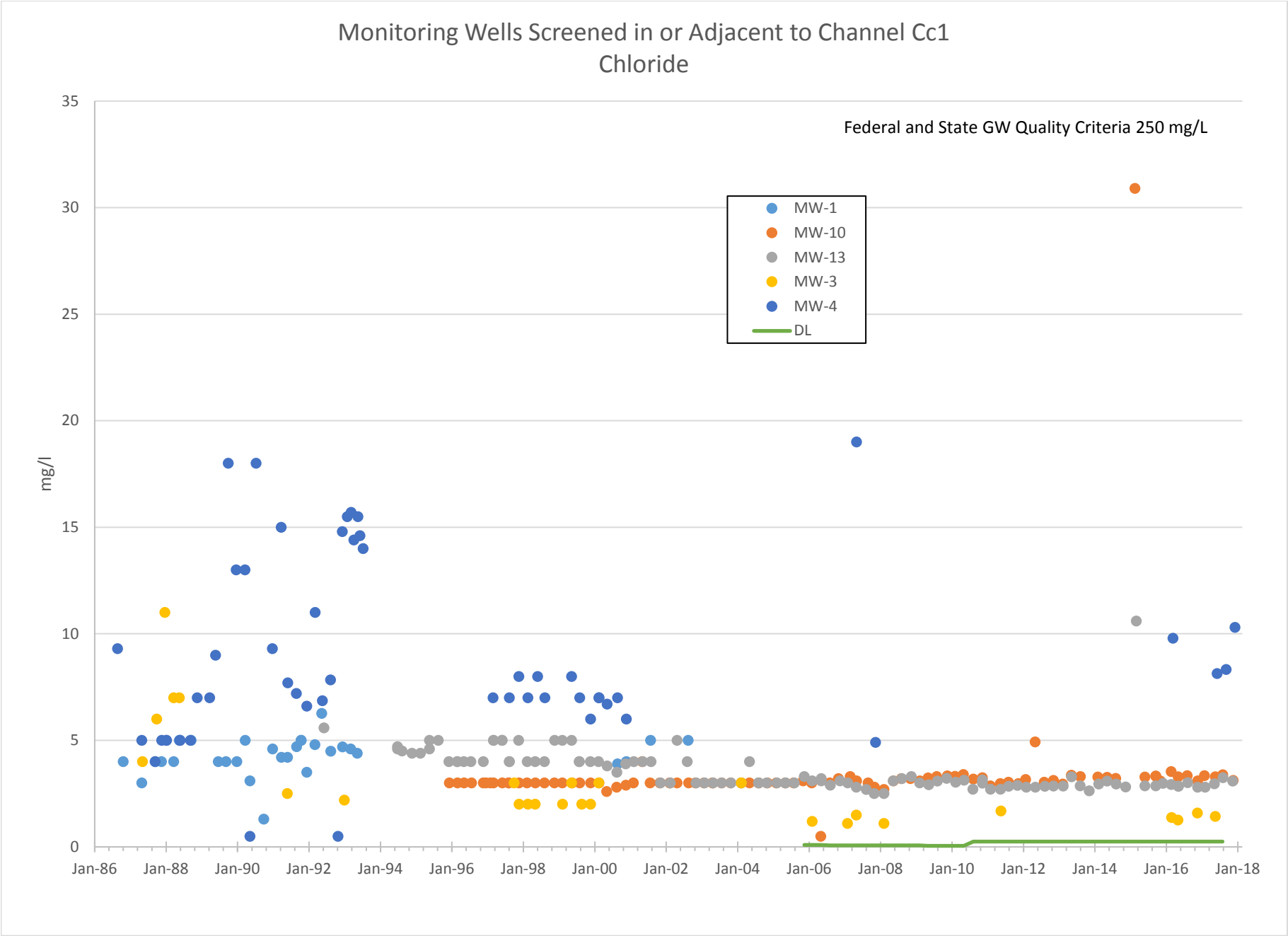
Time Concentration Plots for Groundwater in and Adjacent to Channel Cc1

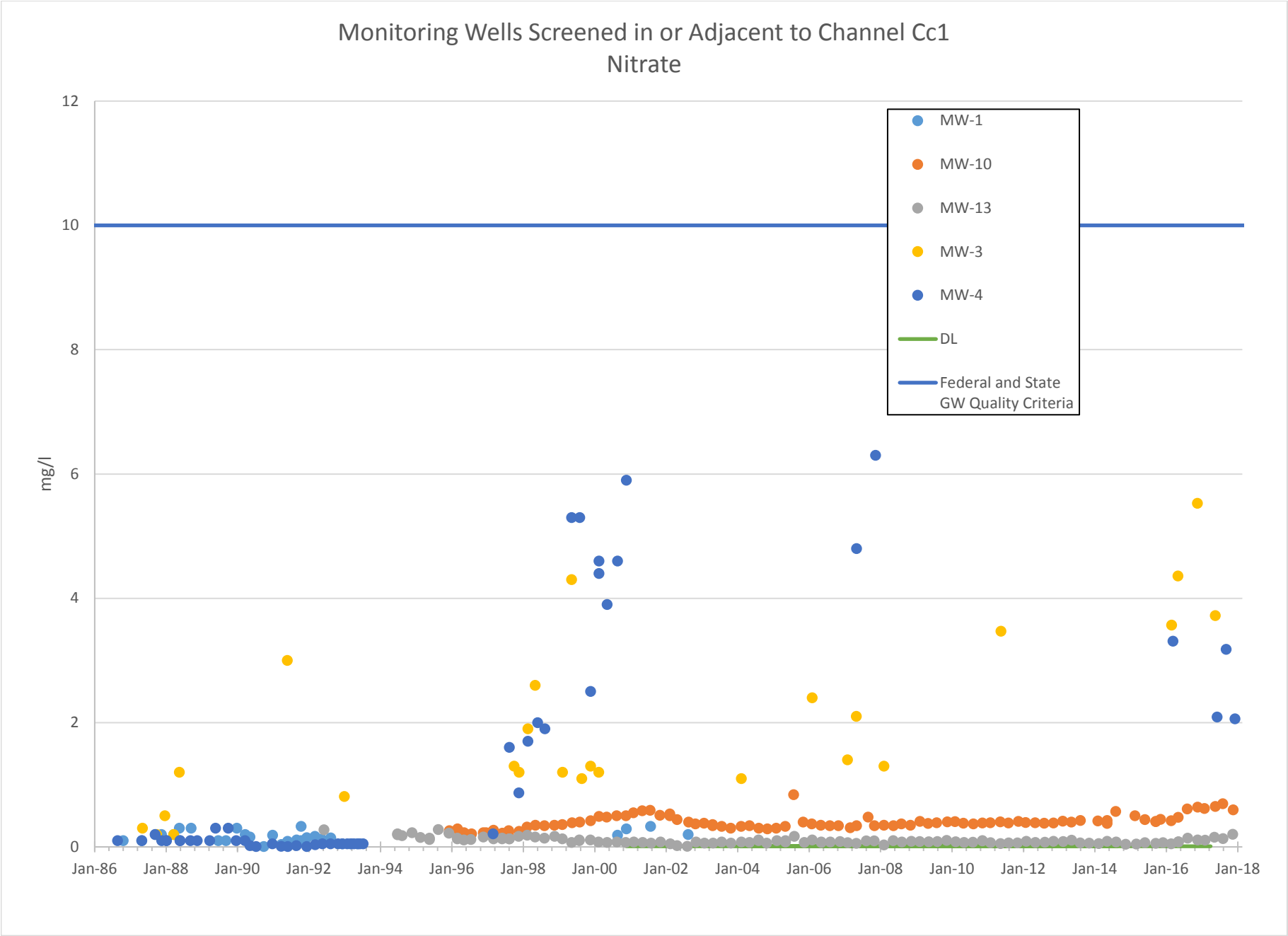

Monitoring Wells Screened in or Adjacent to Channel Cc1
Specific Conductance
umhos/cm
1000
900
800
700
600
500
400
300
200
100
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
GW Quality Criteria

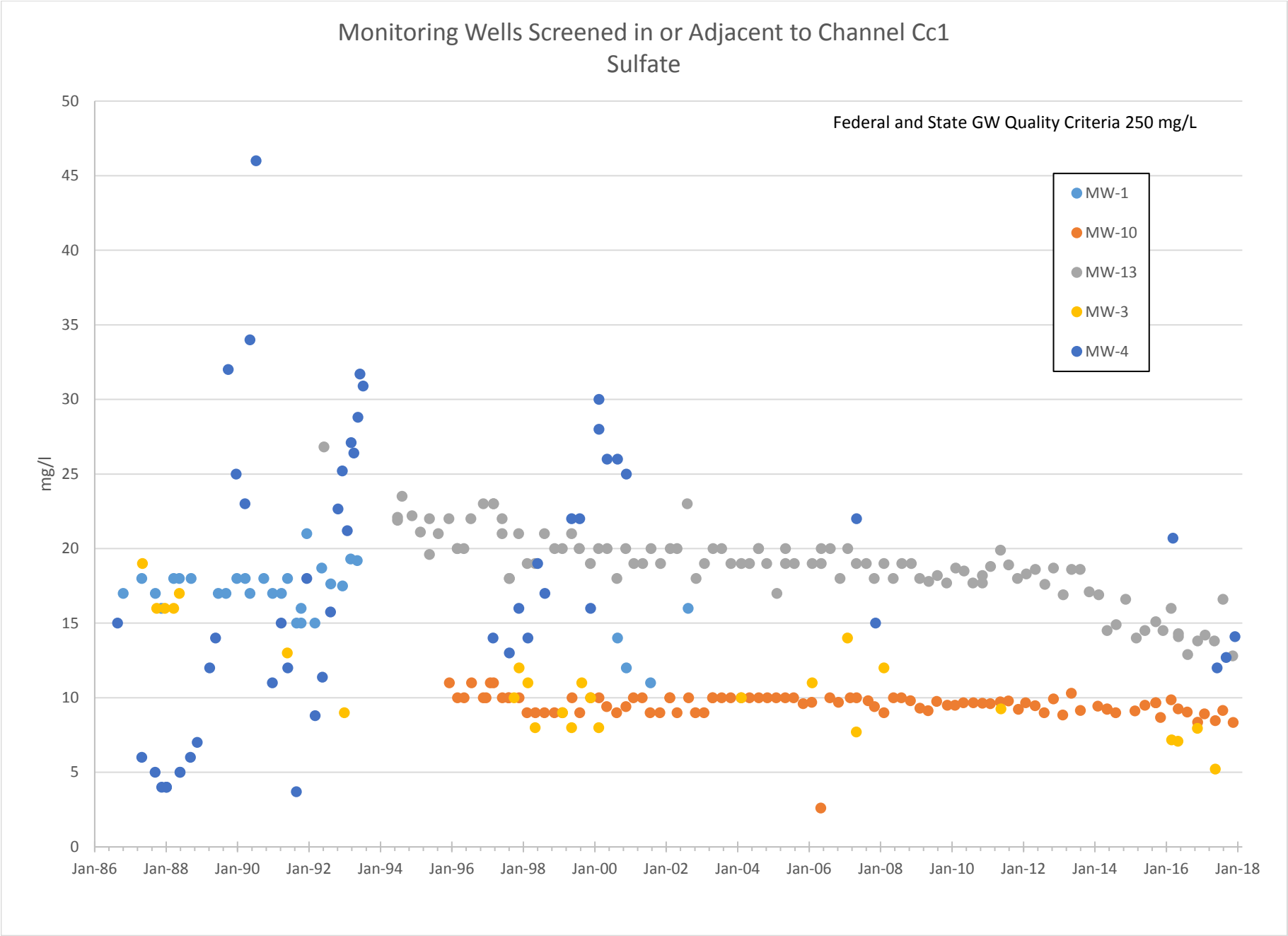

Monitoring Wells Screened in or Adjacent to Channel Cc1
Field pH
pH Units
9
8.5
8
7.5
7
6.5
6
5.5
5
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
Upper Limit
Lower Limit

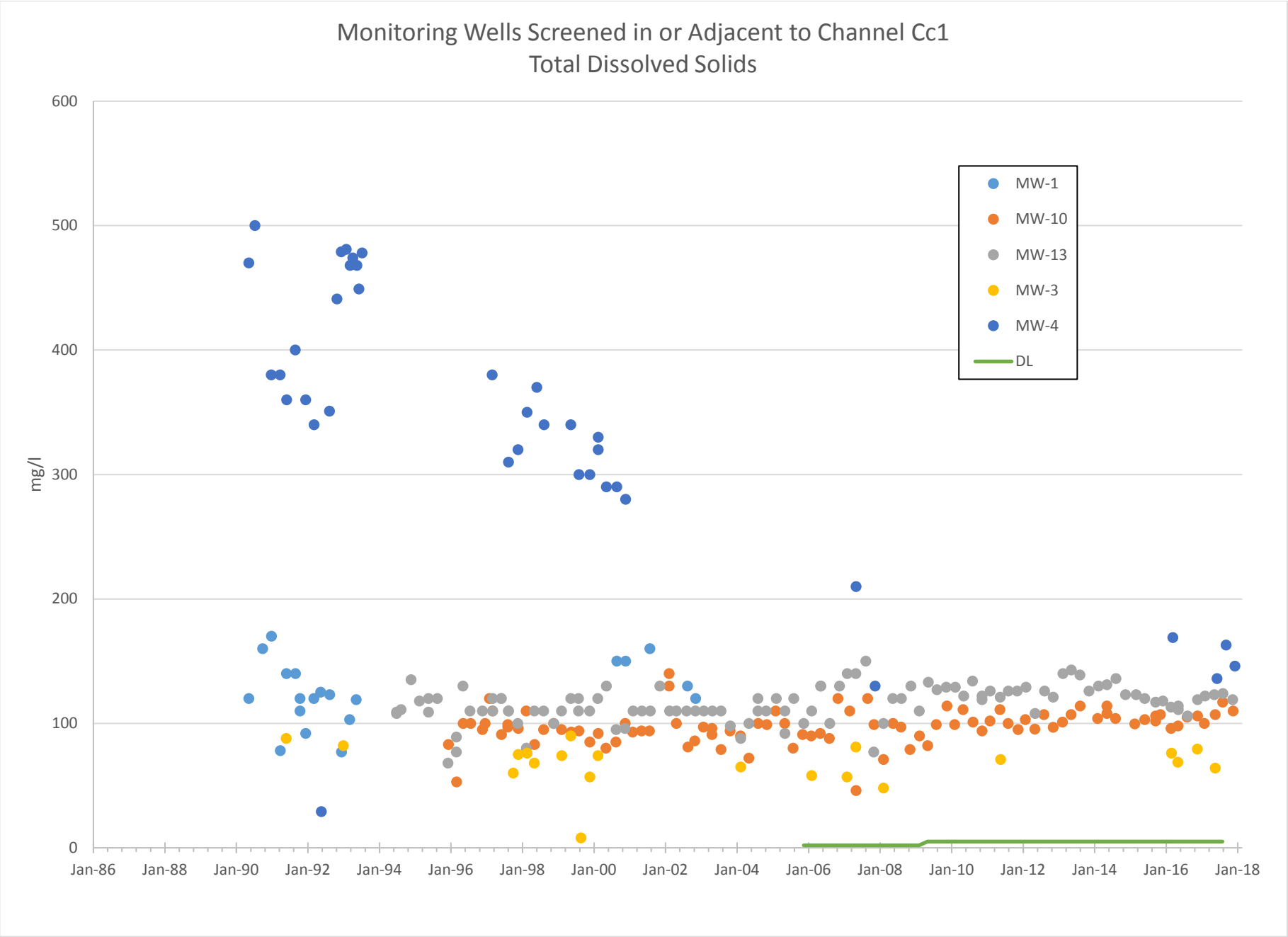

Monitoring Wells Screened in or Adjacent to Channel Cc1
Alkalinity
as CaCO3, mg/l
350
300
250
200
150
100
50
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
DL

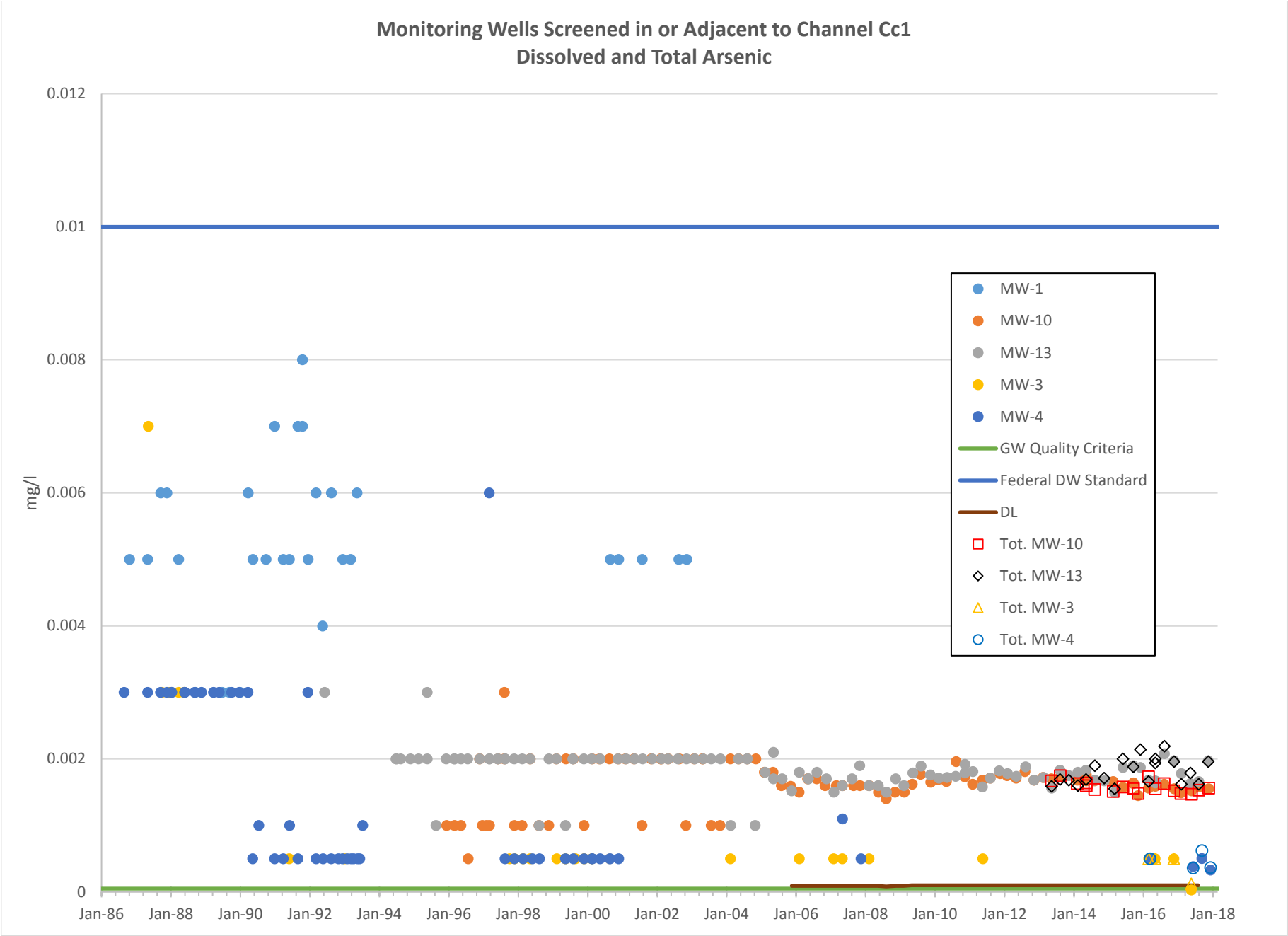

Monitoring Wells Screened in or Adjacent to Channel Cc1
Ammonia
mg/l
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
0.12
0.1
0.08
0.06
0.04
0.02
0
MW-1
MW-10
MW-13
MW-3
MW-4
DL

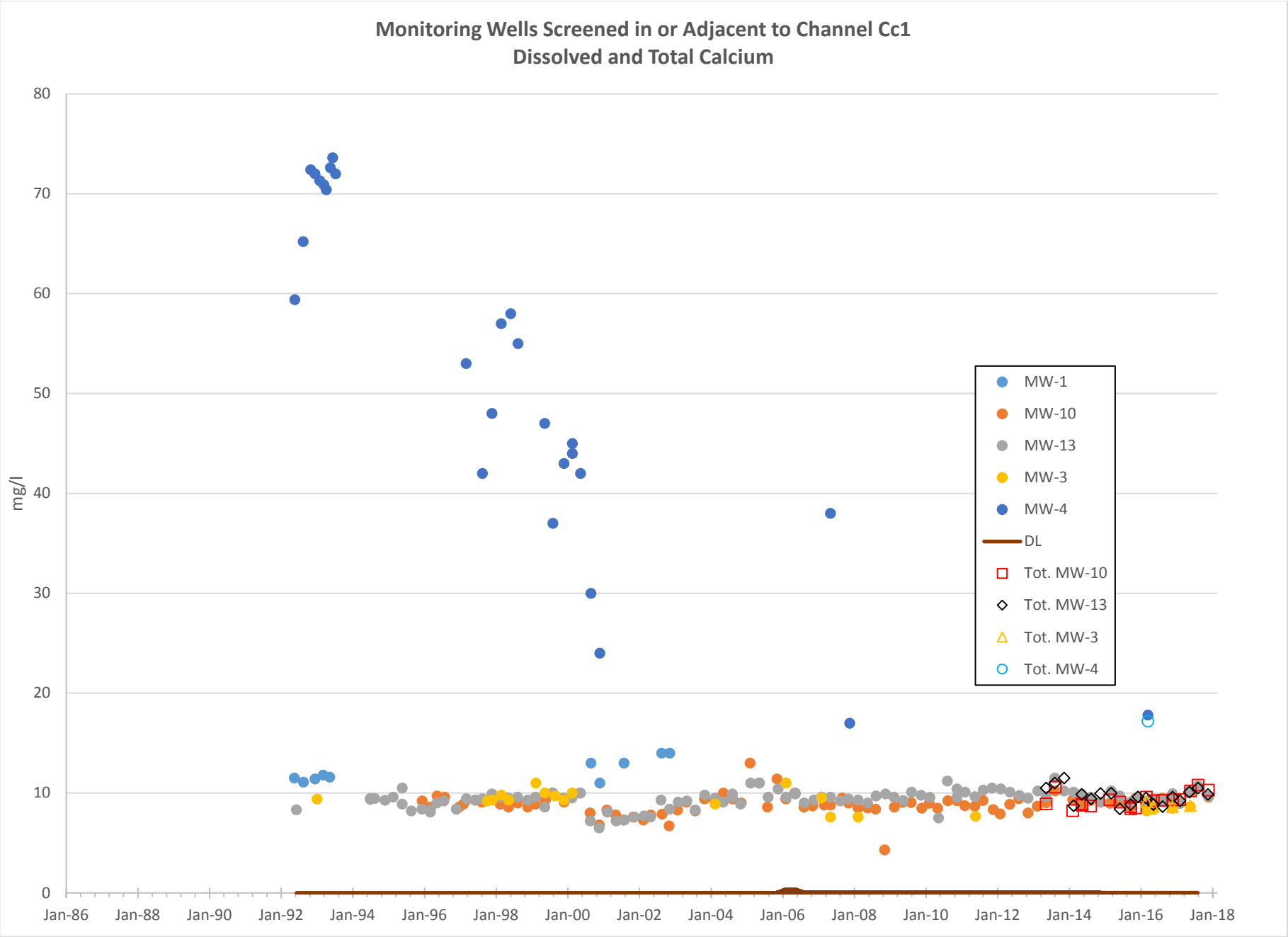

Monitoring Wells Screened in or Adjacent to Channel Cc1
Chloride
Federal and State GW Quality Criteria 250 mg/L
MW-1
MW-10
MW-13
MW-3
MW-4
DL
mg/l
35
30
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

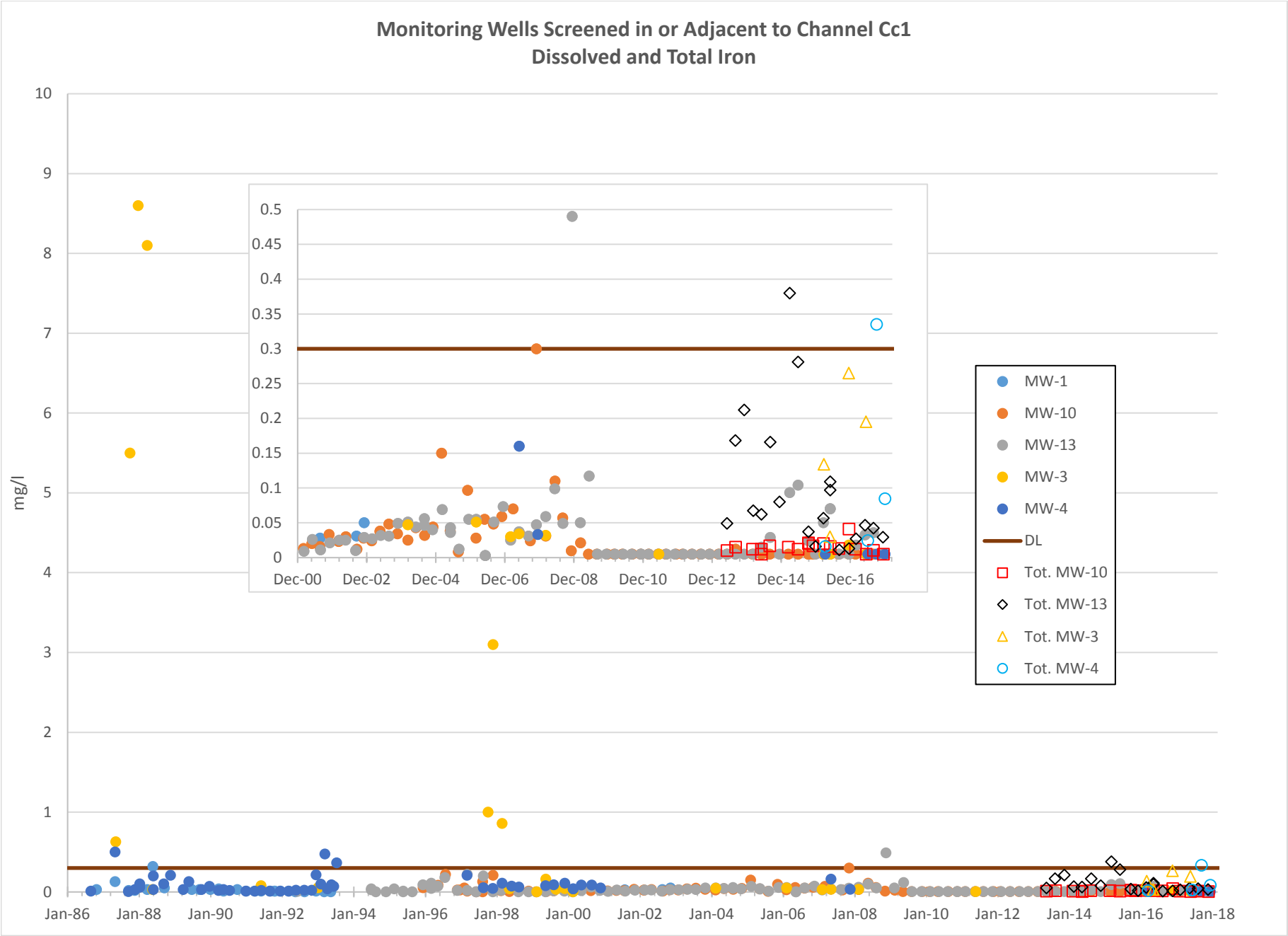

Monitoring Wells Screened in or Adjacent to Channel Cc1
Nitrate
mg/l
12
10
8
6
4
2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
DL
Federal and State GW Quality Criteria

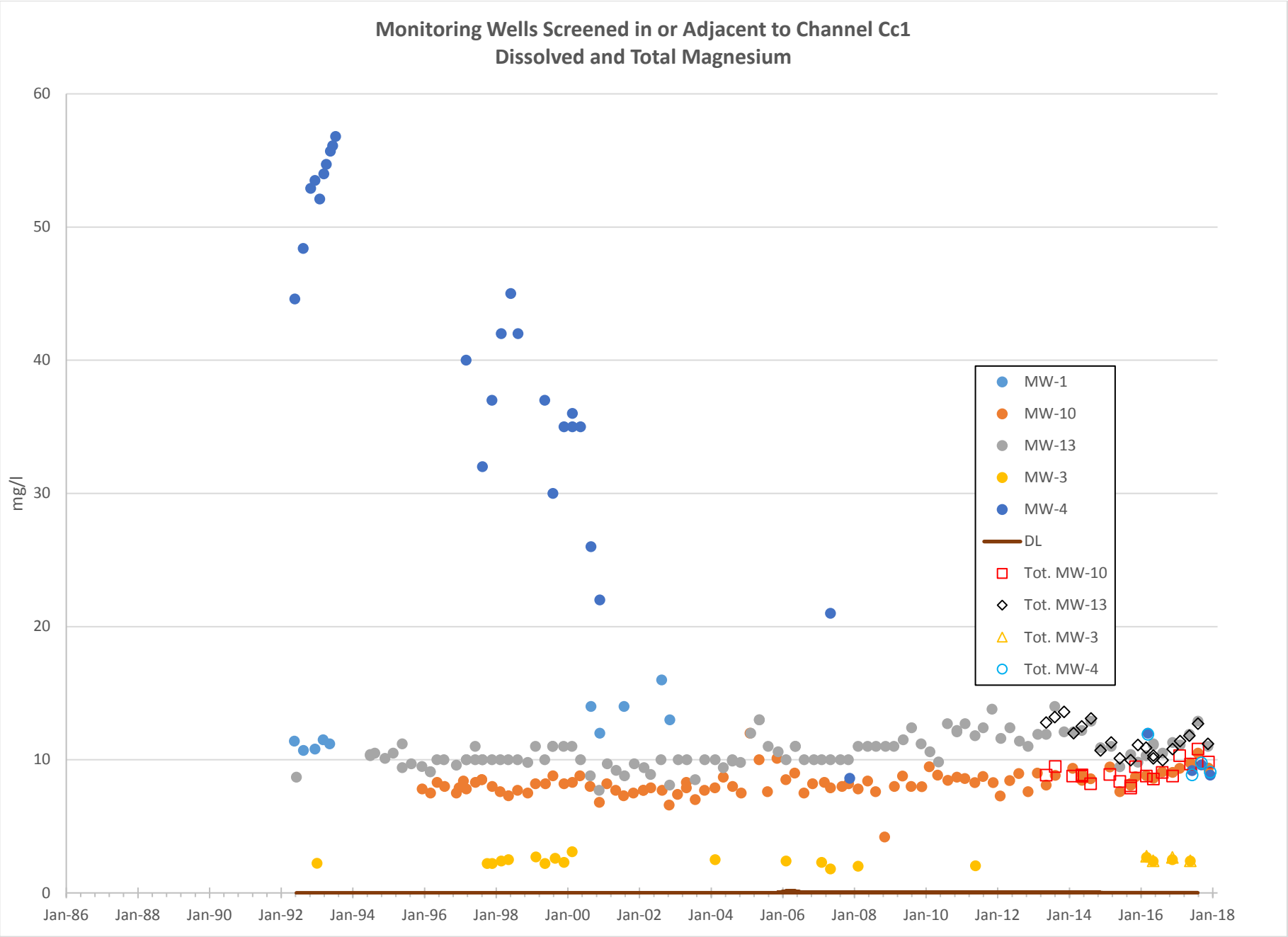

Monitoring Wells Screened in or Adjacent to Channel Cc1
Sulfate
Federal and State GW Quality Criteria 250 mg/L
MW-1
MW-10
MW-13
MW-3
MW-4
mg/l
50
45
40
35
30
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

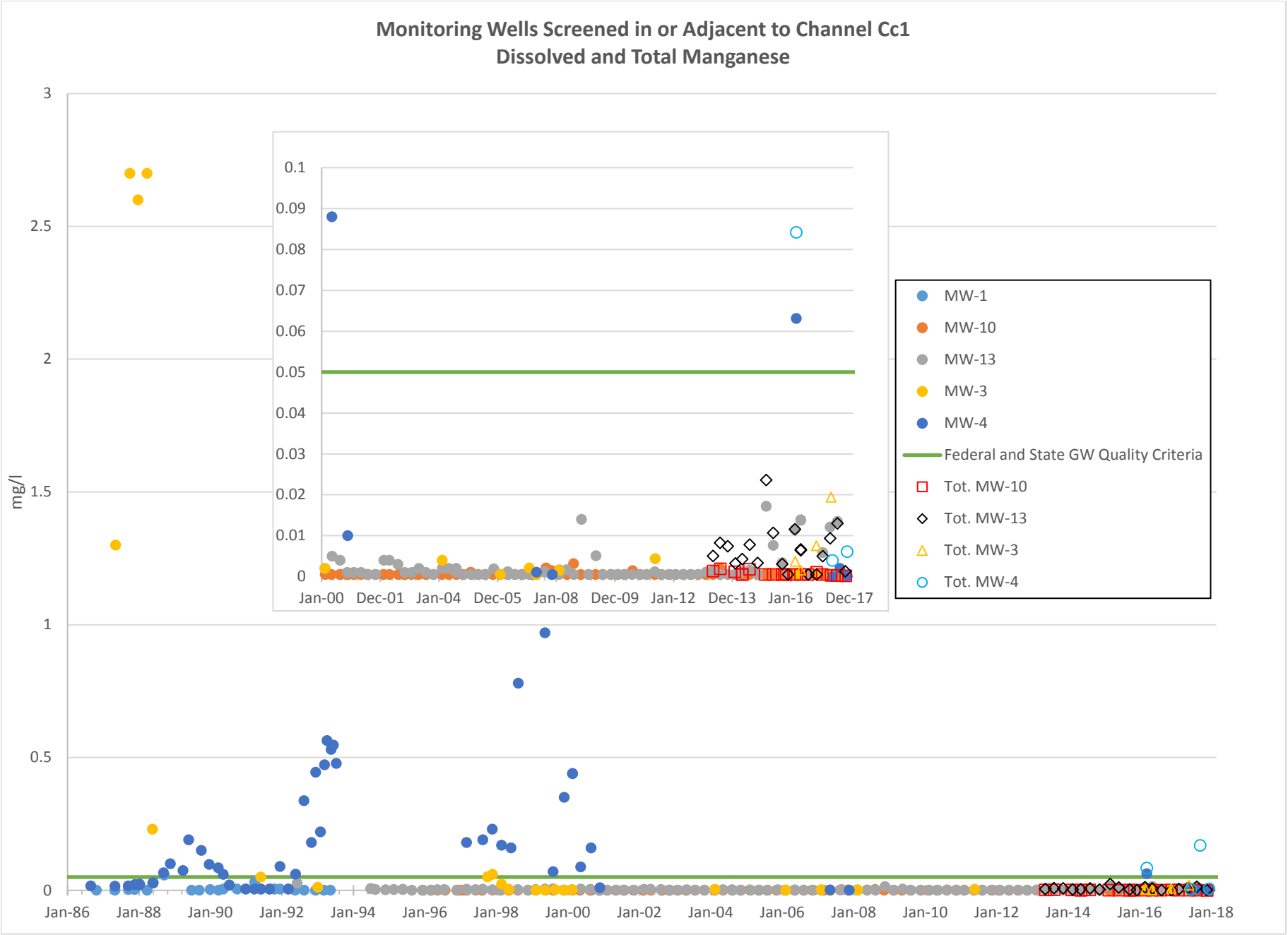

Monitoring Wells Screened in or Adjacent to Channel Cc1
Total Dissolved Solids
mg/l
600
500
400
300
200
100
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
DL

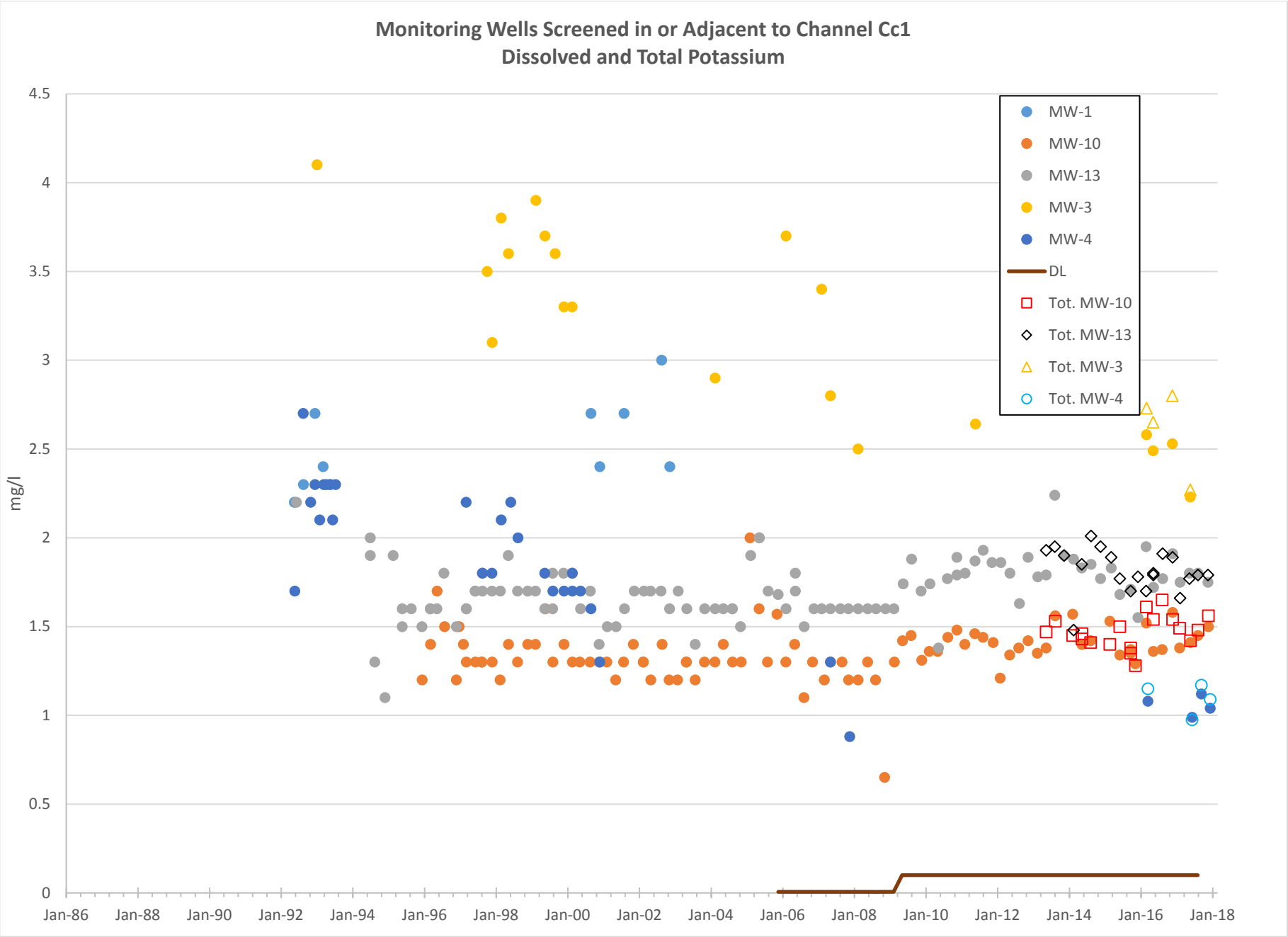

Monitoring Wells Screened in or Adjacent to Channel Cc1
Dissolved and Total Arsenic
mg/l
0.012
0.01
0.008
0.006
0.004
0.002
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
GW Quality Criteria
Federal DW Standard
DL
Tot. MW-10
Tot. MW-13
Tot. MW-3
Tot. MW-4

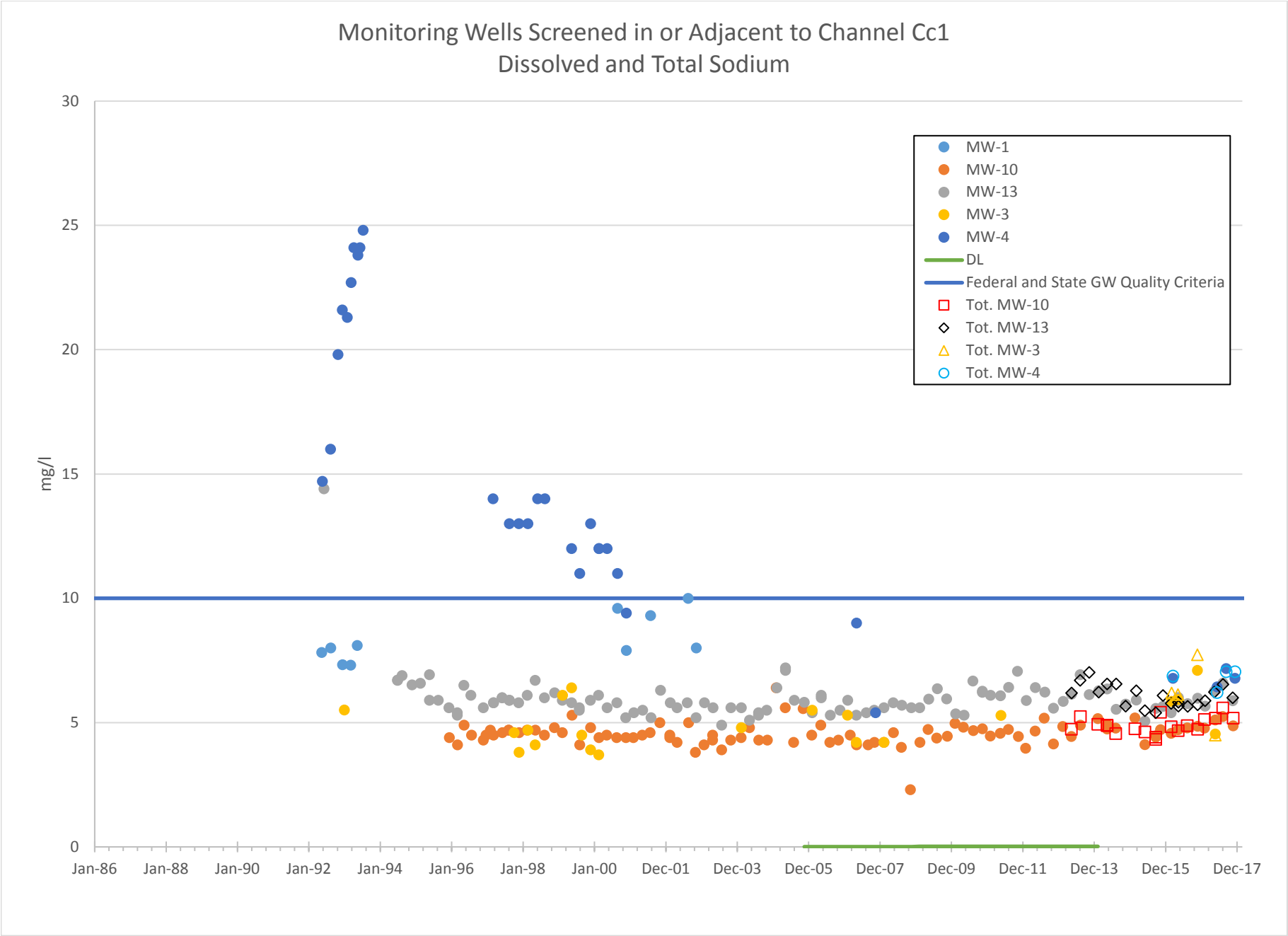

Monitoring Wells Screened in or Adjacent to Channel Cc1
Dissolved and Total Calcium
mg/l
80
70
60
50
40
30
20
10
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
DL
Tot. MW-10
Tot. MW-13
Tot. MW-3
Tot. MW-4


Monitoring Wells Screened in or Adjacent to Channel Cc1
Dissolved and Total Iron
mg/l
10
9
8
7
6
5
4
3
2
1
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Dec-00
Dec-02
Dec-04
Dec-06
Dec-08
Dec-10
Dec-12
Dec-14
Dec-16
MW-1
MW-10
MW-13
MW-3
MW-4
DL
Tot. MW-10
Tot. MW-13
Tot. MW-3
Tot. MW-4


Monitoring Wells Screened in or Adjacent to Channel Cc1
Dissolved and Total Magnesium
mg/l
60
50
40
30
20
10
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
DL
Tot. MW-10
Tot. MW-13
Tot. MW-3
Tot. MW-4

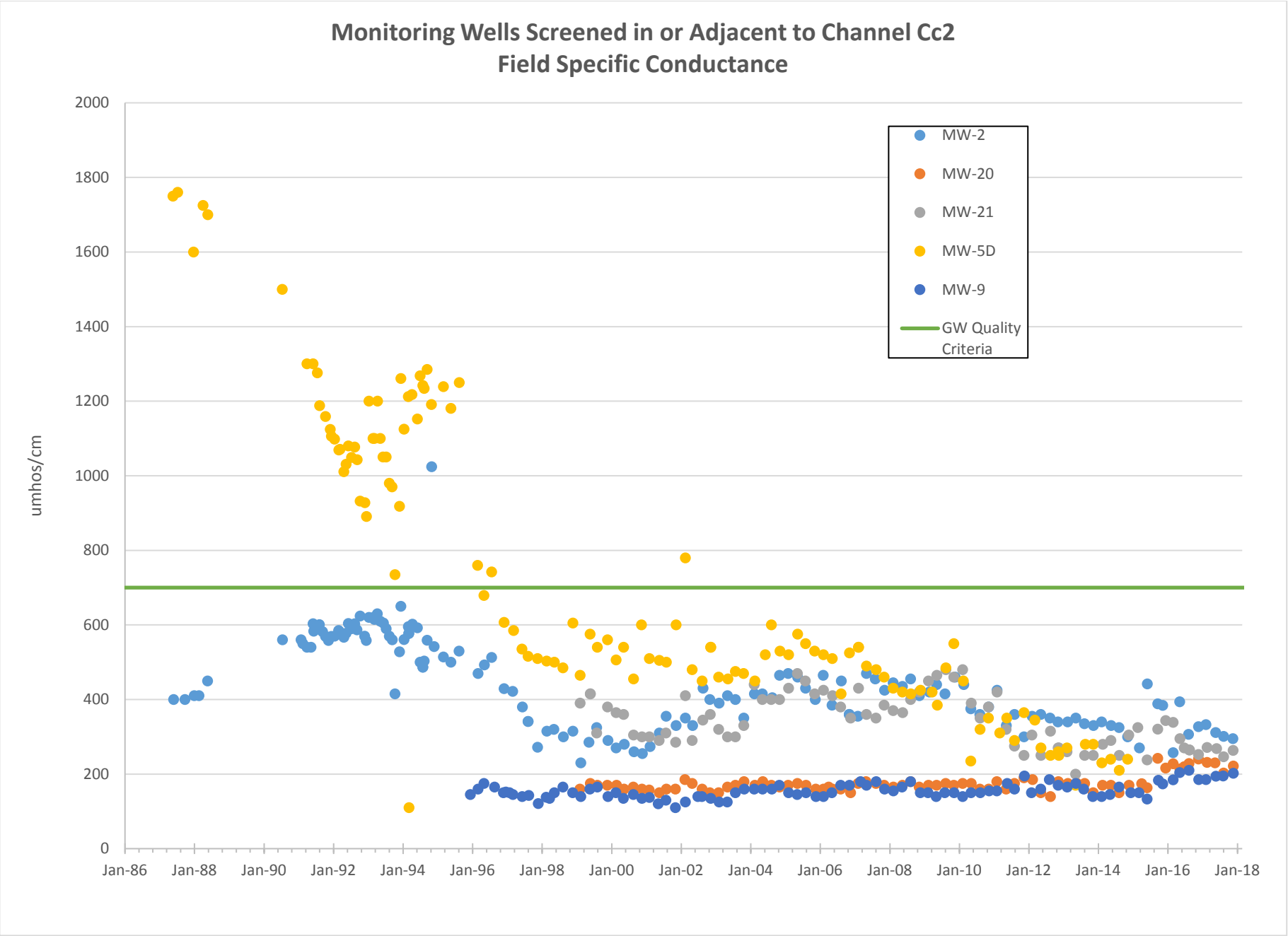

Monitoring Wells Screened in or Adjacent to Channel Cc1
Dissolved and Total Manganese
mg/l
3
2.5
2
1.5
1
0.5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Jan-00
Dec-01
Jan-04
Dec-05
Jan-08
Dec-09
Jan-12
Dec-13
Jan-16
Dec-17
MW-1
MW-10
MW-13
MW-3
MW-4
Federal and State GW Quality Criteria
Tot. MW-10
Tot. MW-13
Tot. MW-3
Tot. MW-4

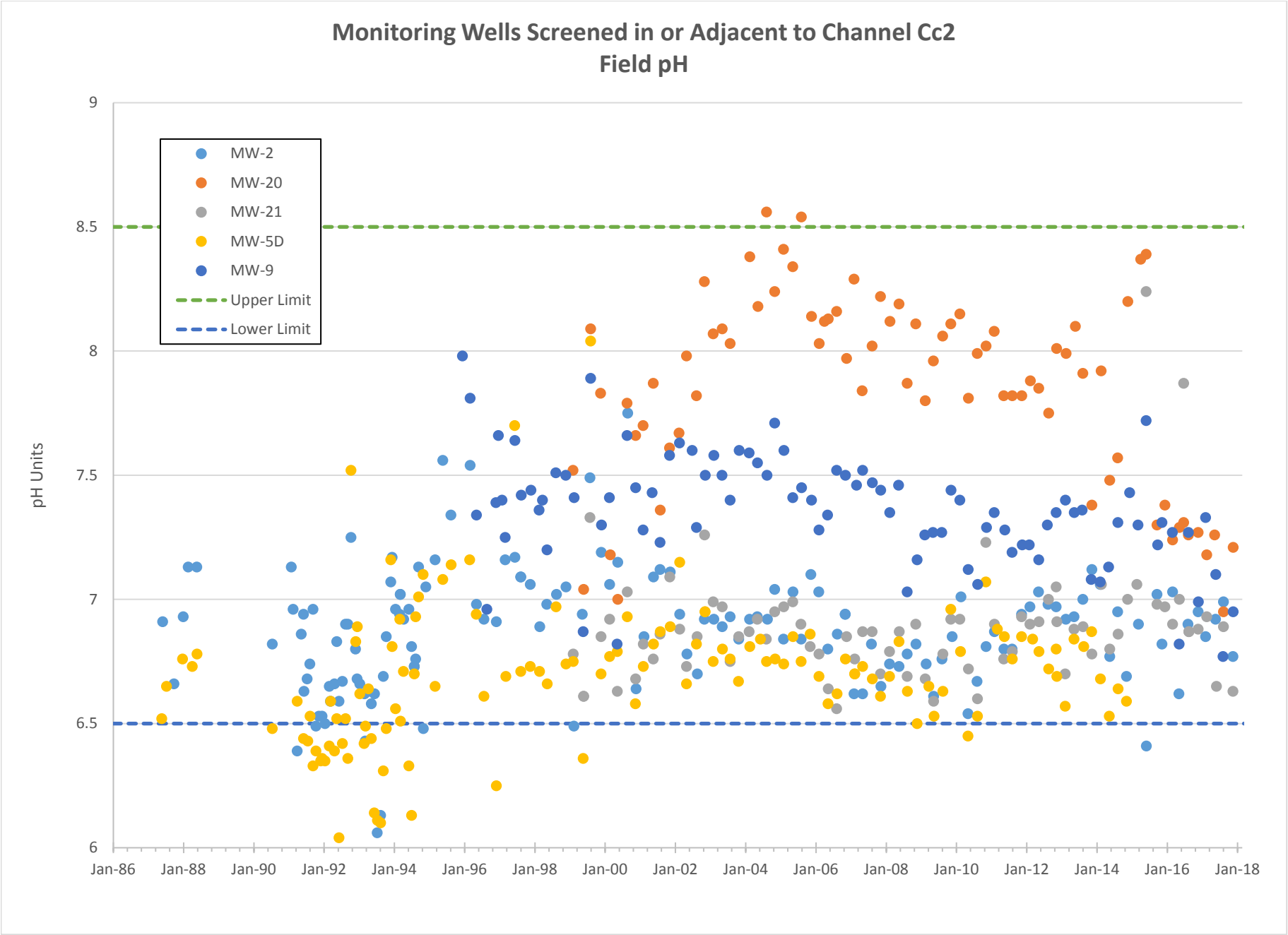

Monitoring Wells Screened in or Adjacent to Channel Cc1
Dissolved and Total Potassium
mg/l
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-1
MW-10
MW-13
MW-3
MW-4
DL
Tot. MW-10
Tot. MW-13
Tot. MW-3
Tot. MW-4

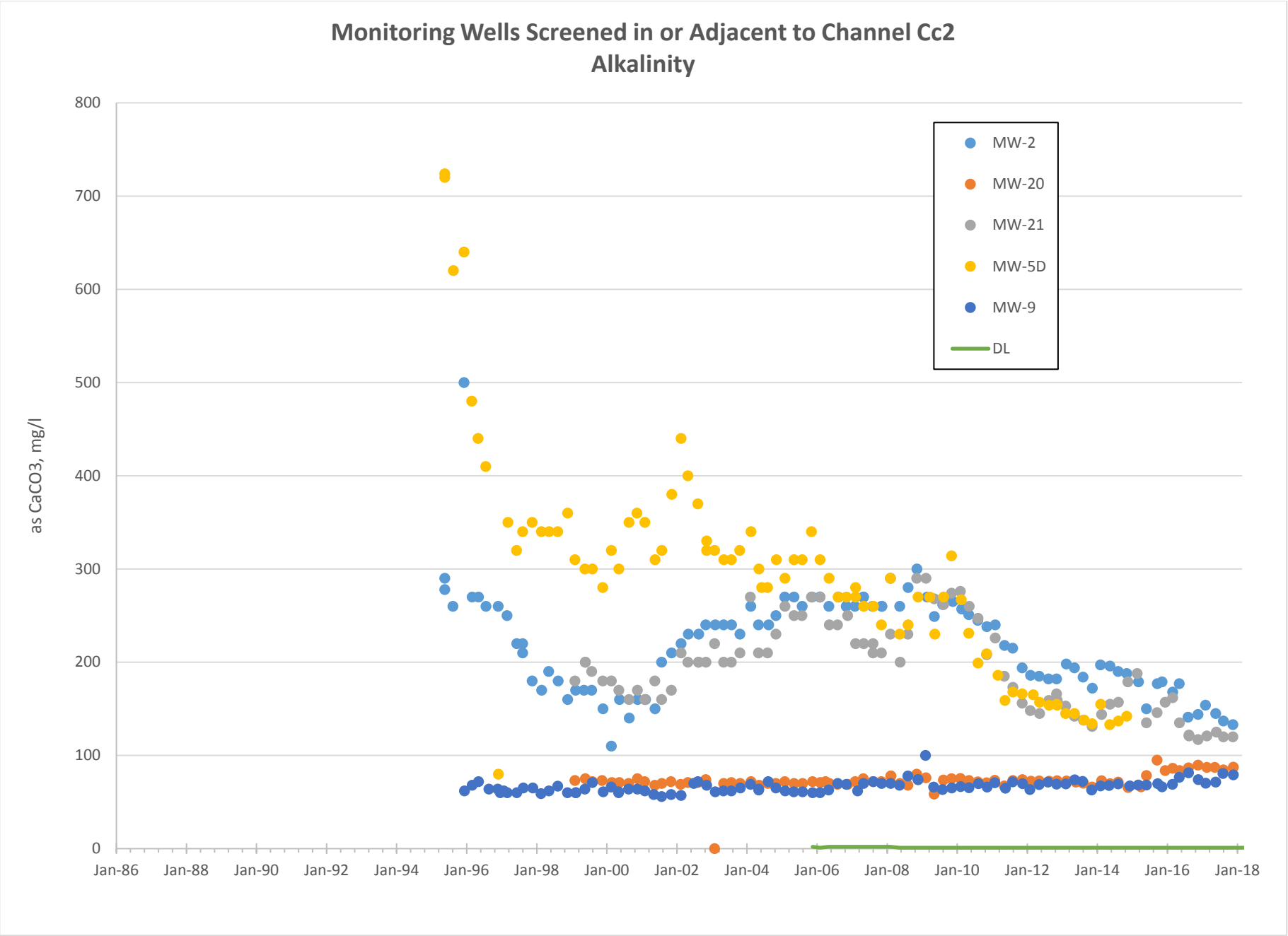

Monitoring Wells Screened in or Adjacent to Channel Cc1
Dissolved and Total Sodium
mg/l
30
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Dec-01
Dec-03
Dec-05
Dec-07
Dec-09
Dec-11
Dec-13
Dec-15
Dec-17
MW-1
MW-10
MW-13
MW-3
MW-4
DL
Federal and State GW Quality Criteria
Tot. MW-10
Tot. MW-13
Tot. MW-3
Tot. MW-4

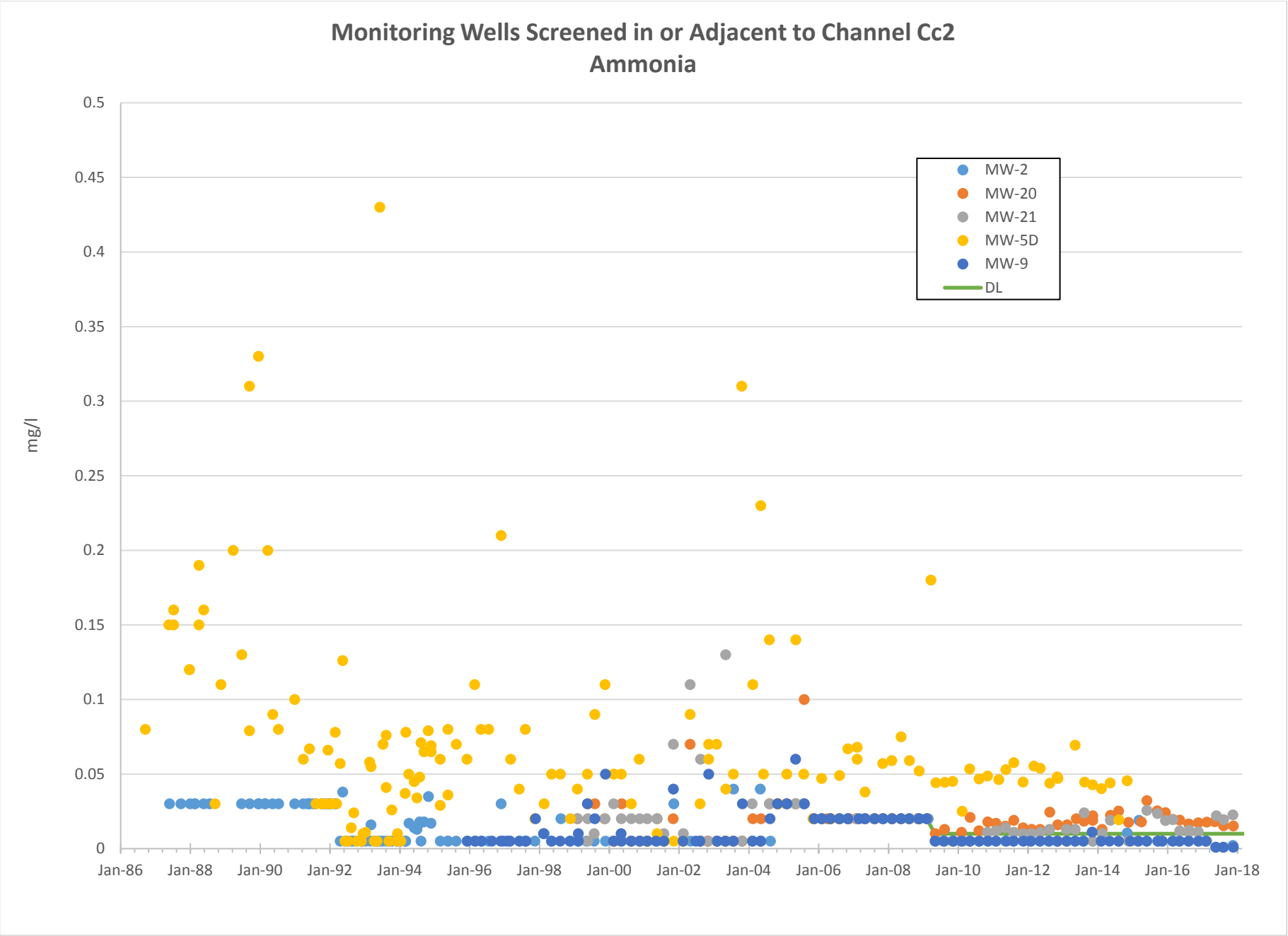
Appendix D

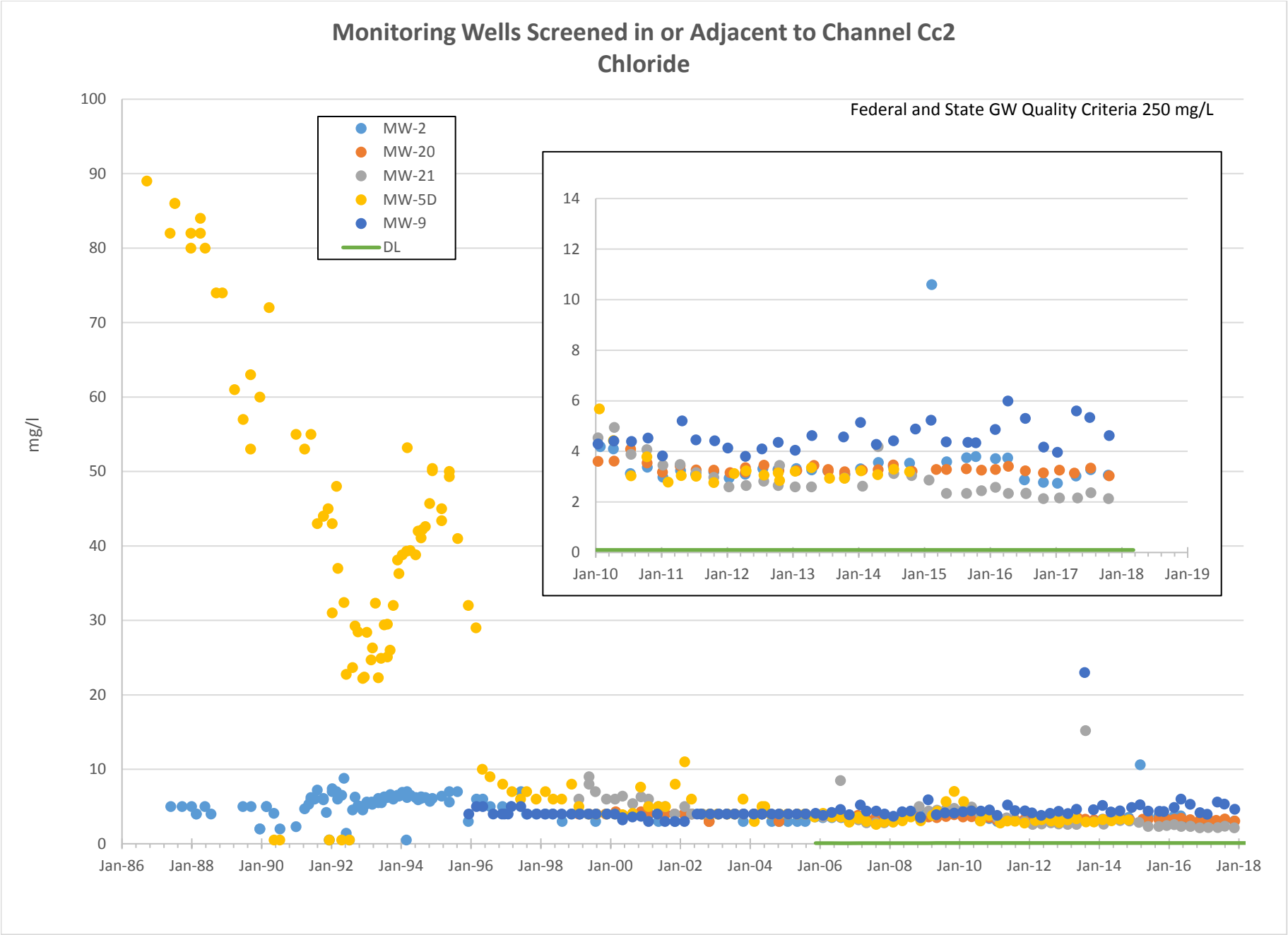
Time Concentration Plots for
Groundwater in Channel Cc2

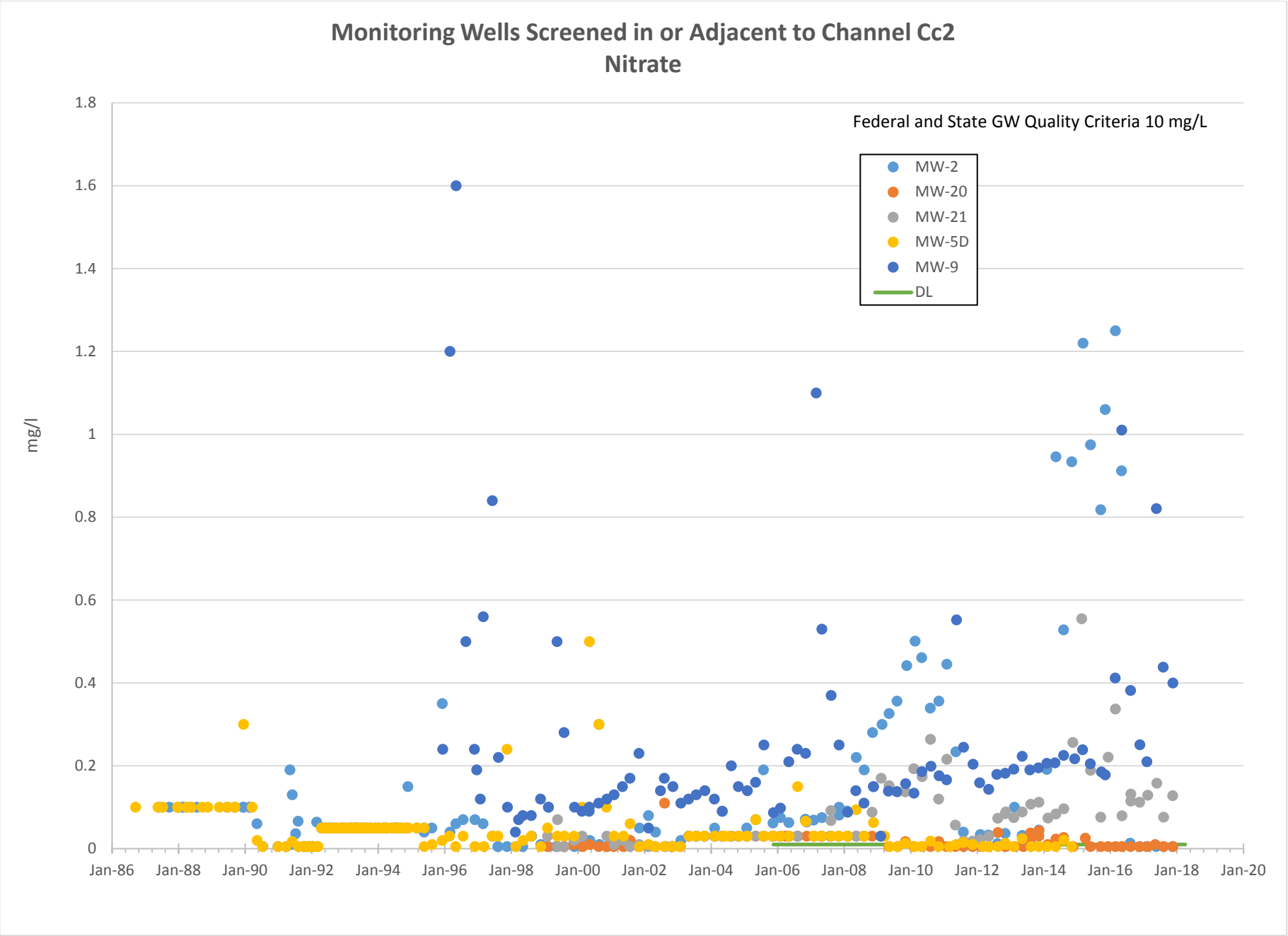

Monitoring Wells Screened in or Adjacent to Channel Cc2
Field Specific Conductance
umhos/cm
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
GW Quality Criteria

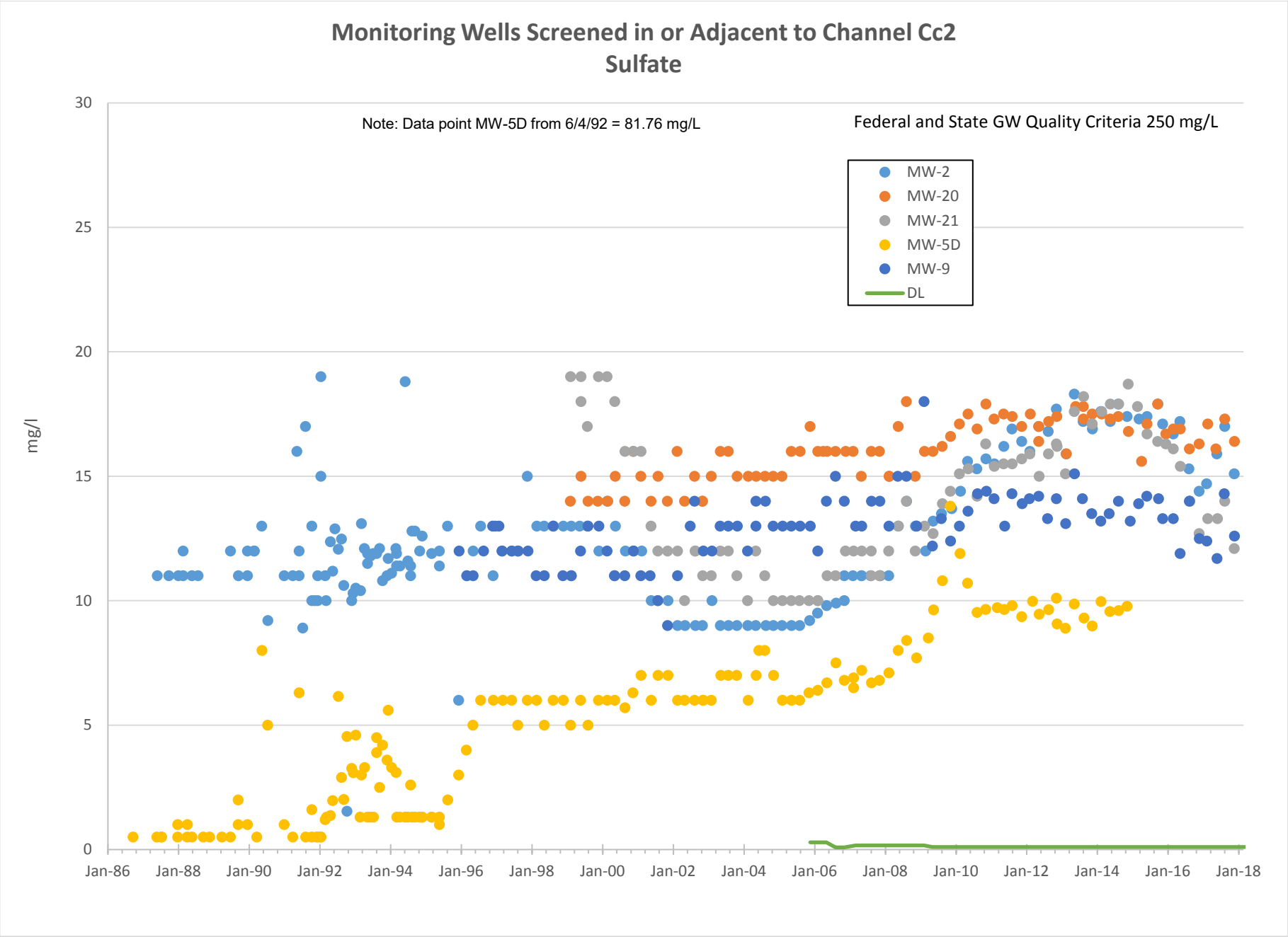

Monitoring Wells Screened in or Adjacent to Channel Cc2
Field pH
pH Units
9
8.5
8
7.5
7
6.5
6
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
Upper Limit
Lower Limit

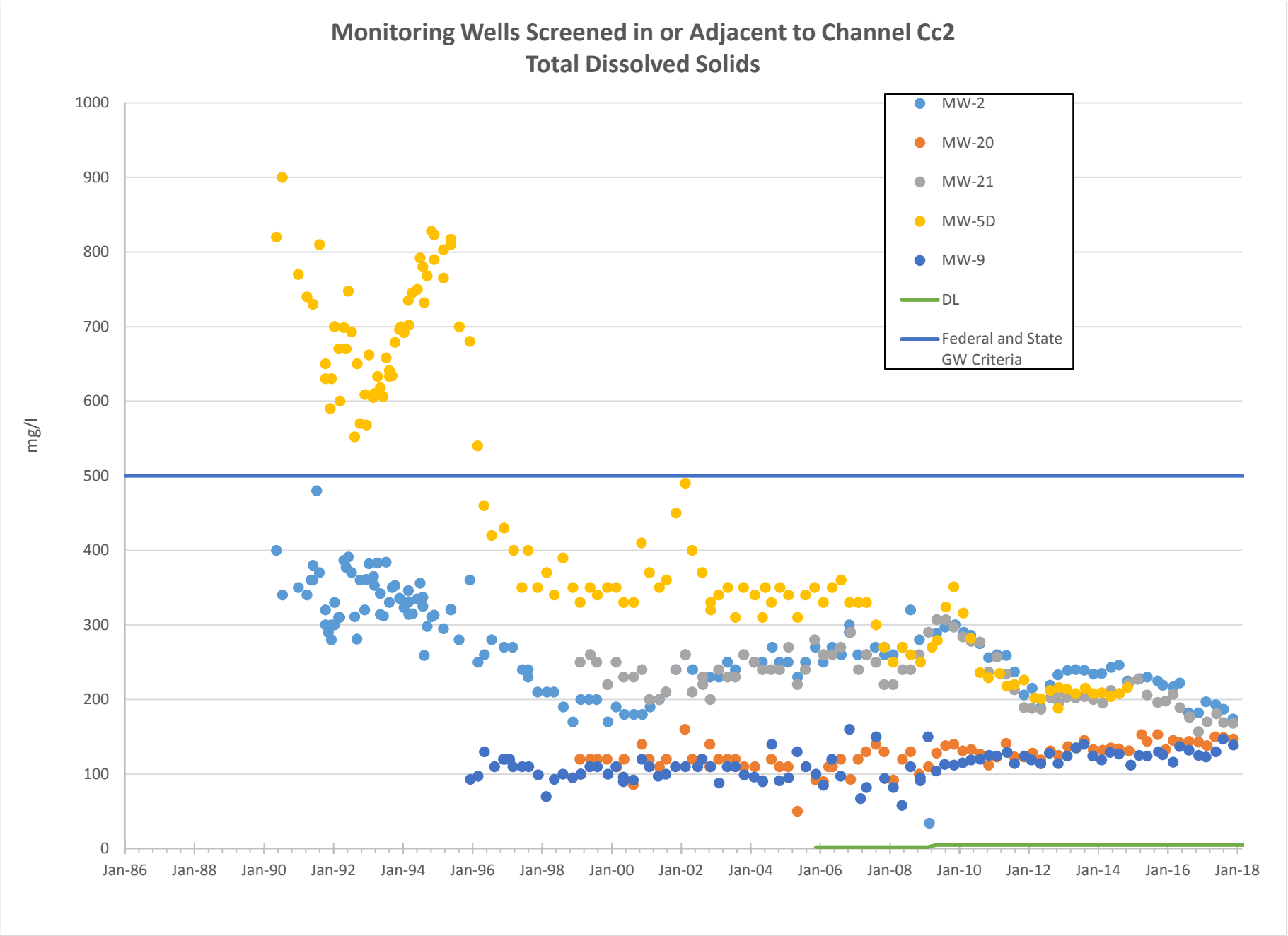

Monitoring Wells Screened in or Adjacent to Channel Cc2
Alkalinity
as CaCO3, mg/l
800
700
600
500
400
300
200
100
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

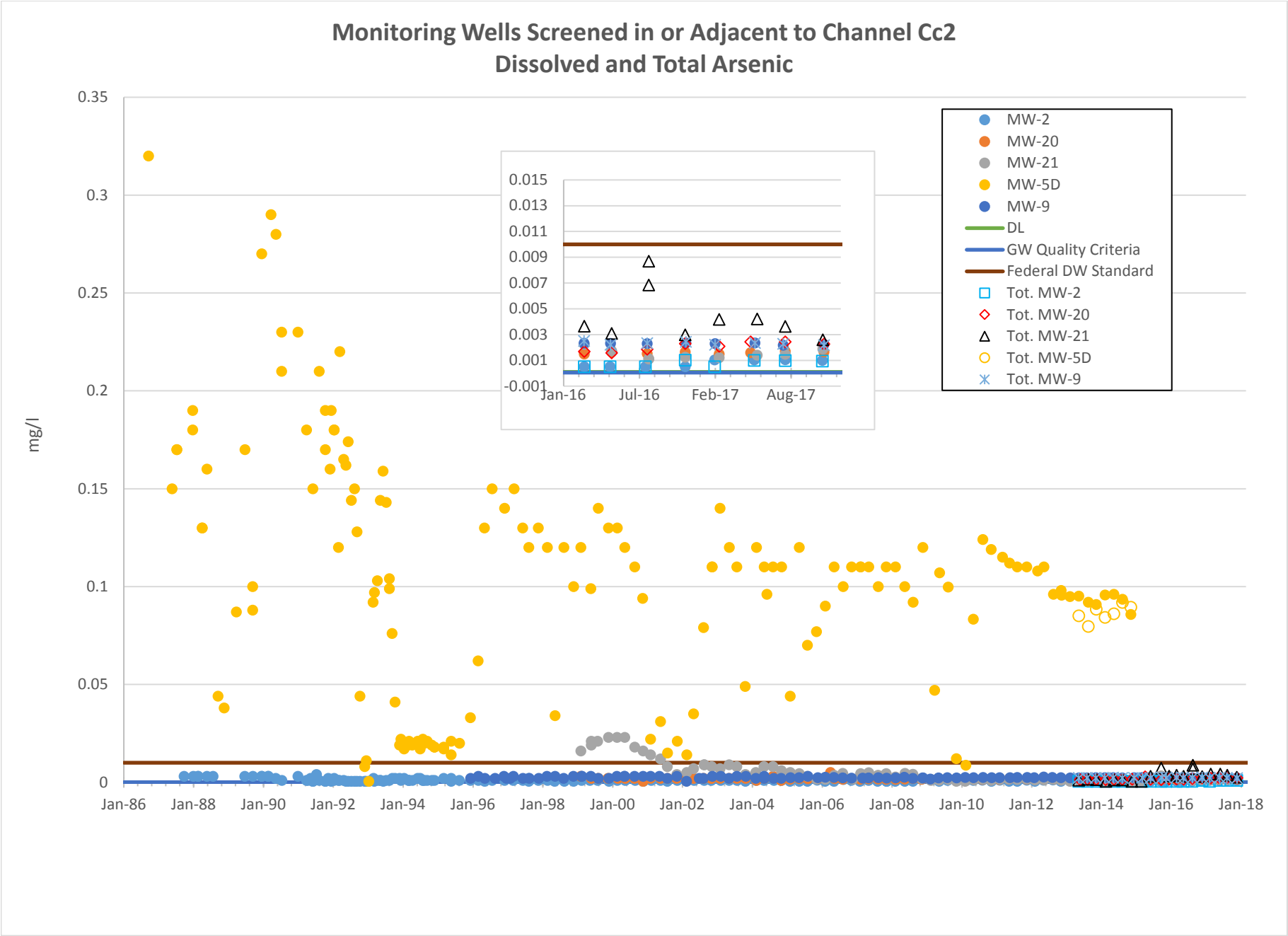

Monitoring Wells Screened in or Adjacent to Channel Cc2
Ammonia
mg/l
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

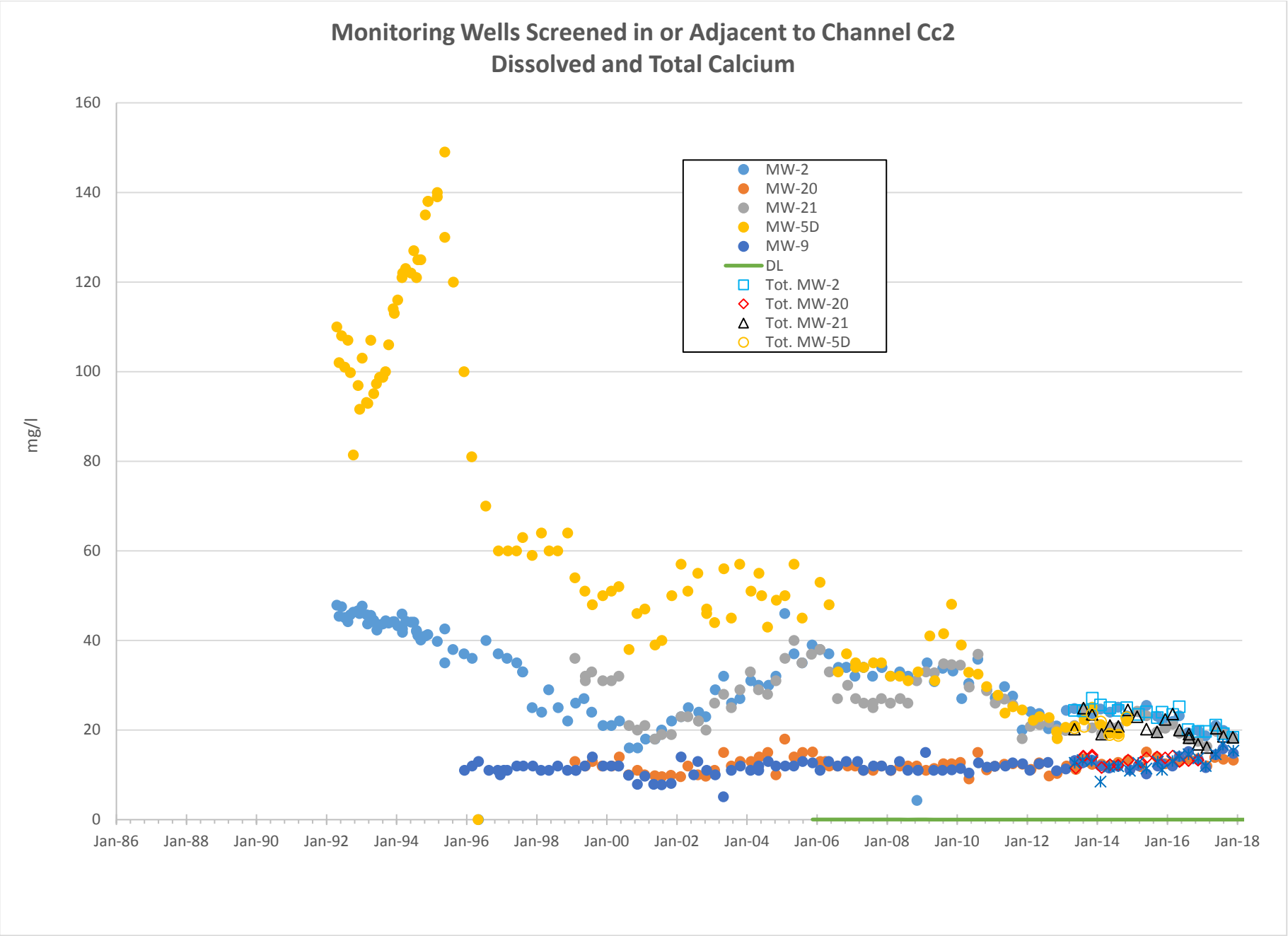

Monitoring Wells Screened in or Adjacent to Channel Cc2
Chloride
Federal and State GW Quality Criteria 250 mg/L
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
mg/l
100
90
80
70
60
50
40
30
20
10
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
14
12
10
8
6
4
2
0
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19

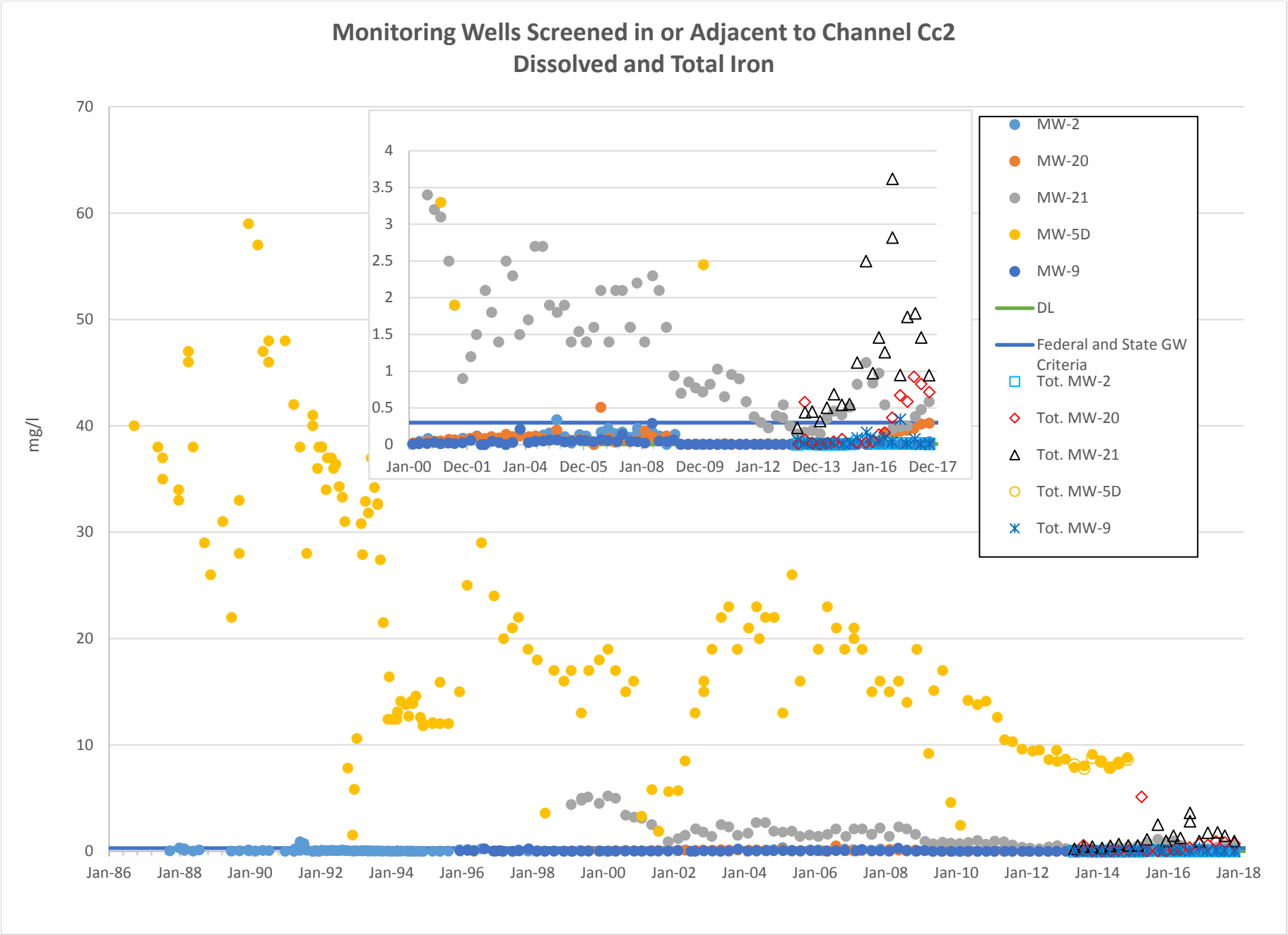

Monitoring Wells Screened in or Adjacent to Channel Cc2
Nitrate
Federal and State GW Quality Criteria 10 mg/L
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
mg/l
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Jan-20

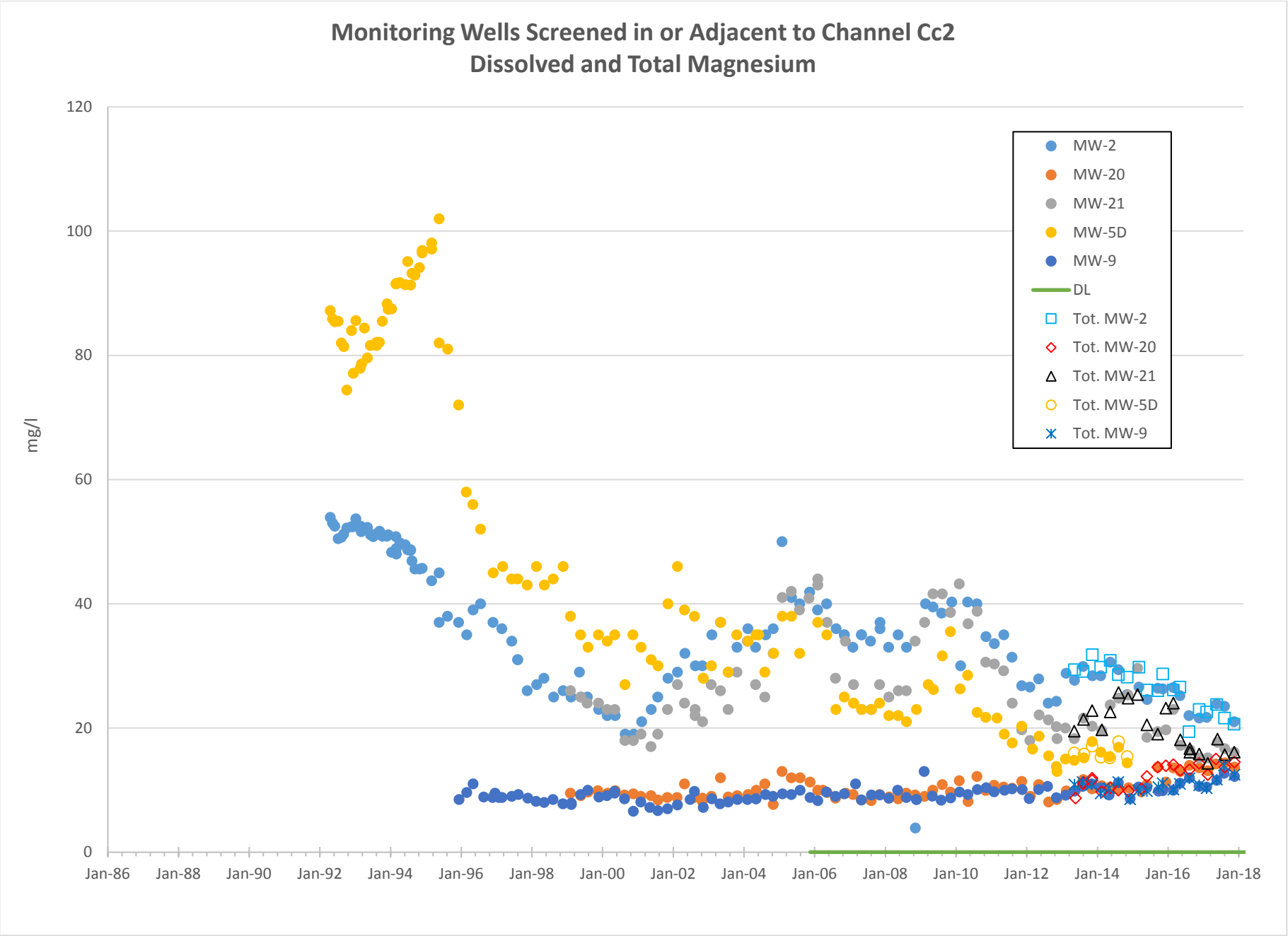

Monitoring Wells Screened in or Adjacent to Channel Cc2
Sulfate
Note: Data point MW-5D from 6/4/92 = 81.76 mg/L
Federal and State GW Quality Criteria 250 mg/L
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
mg/l
30
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

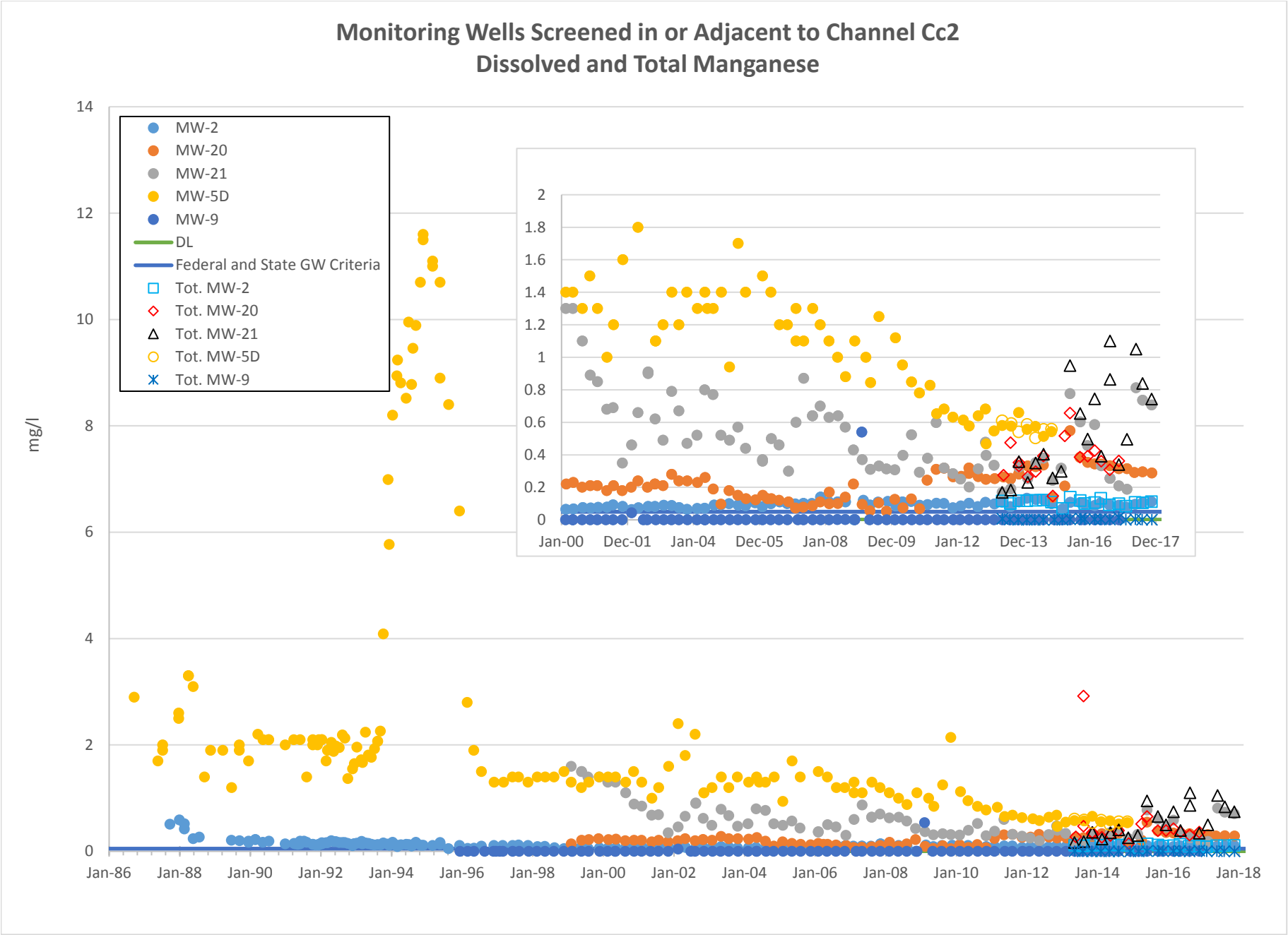

Monitoring Wells Screened in or Adjacent to Channel Cc2
Total Dissolved Solids
mg/l
1000
900
800
700
600
500
400
300
200
100
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
Federal and State GW Criteria

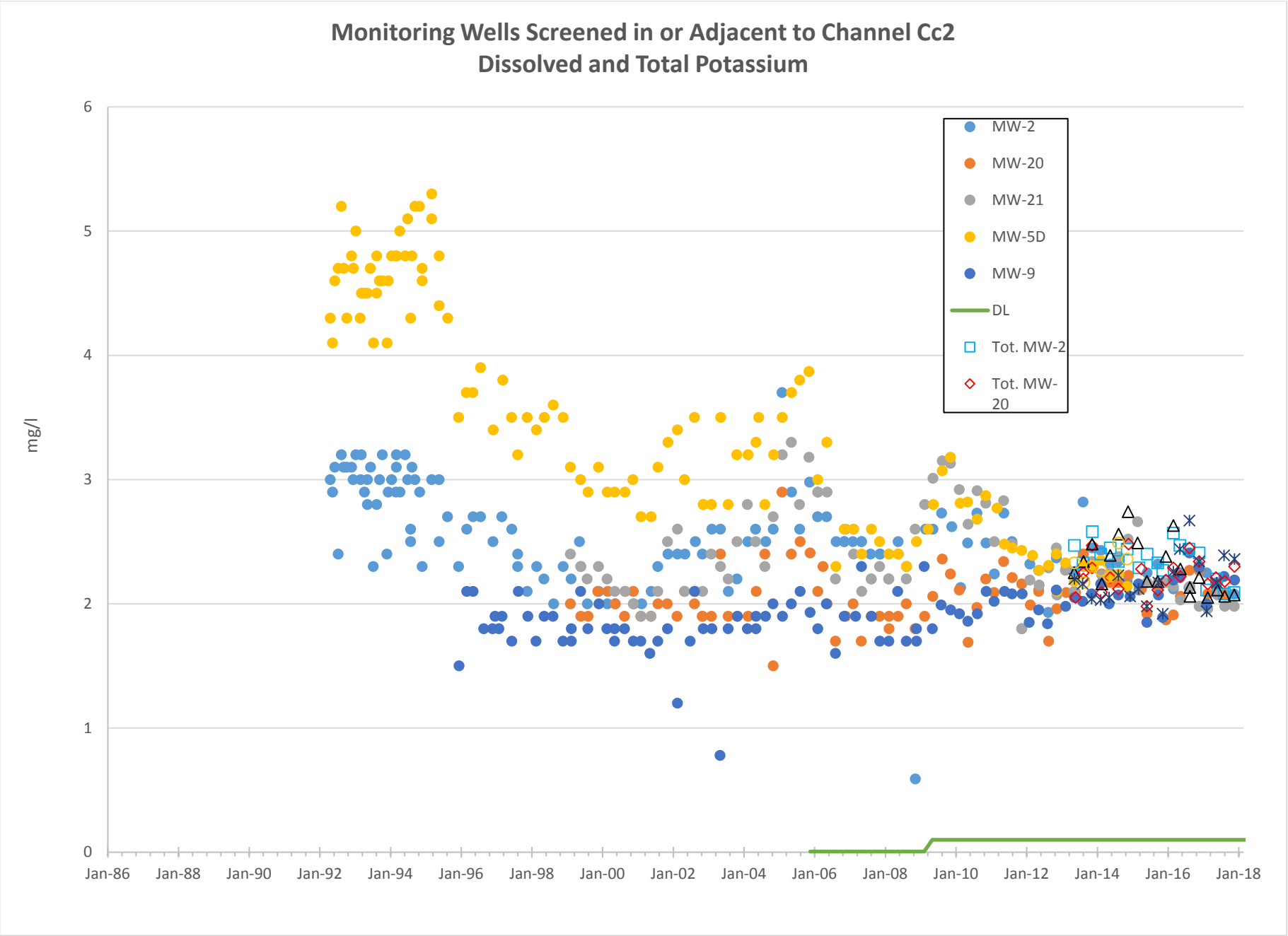

Monitoring Wells Screened in or Adjacent to Channel Cc2
Dissolved and Total Arsenic
mg/l
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
0.015
0.013
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
Jan-16
Jul-16
Feb-17
Aug-17
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
GW Quality Criteria
Federal DW Standard
Tot. MW-2
Tot. MW-20
Tot. MW-21
Tot. MW-5D
Tot. MW-9

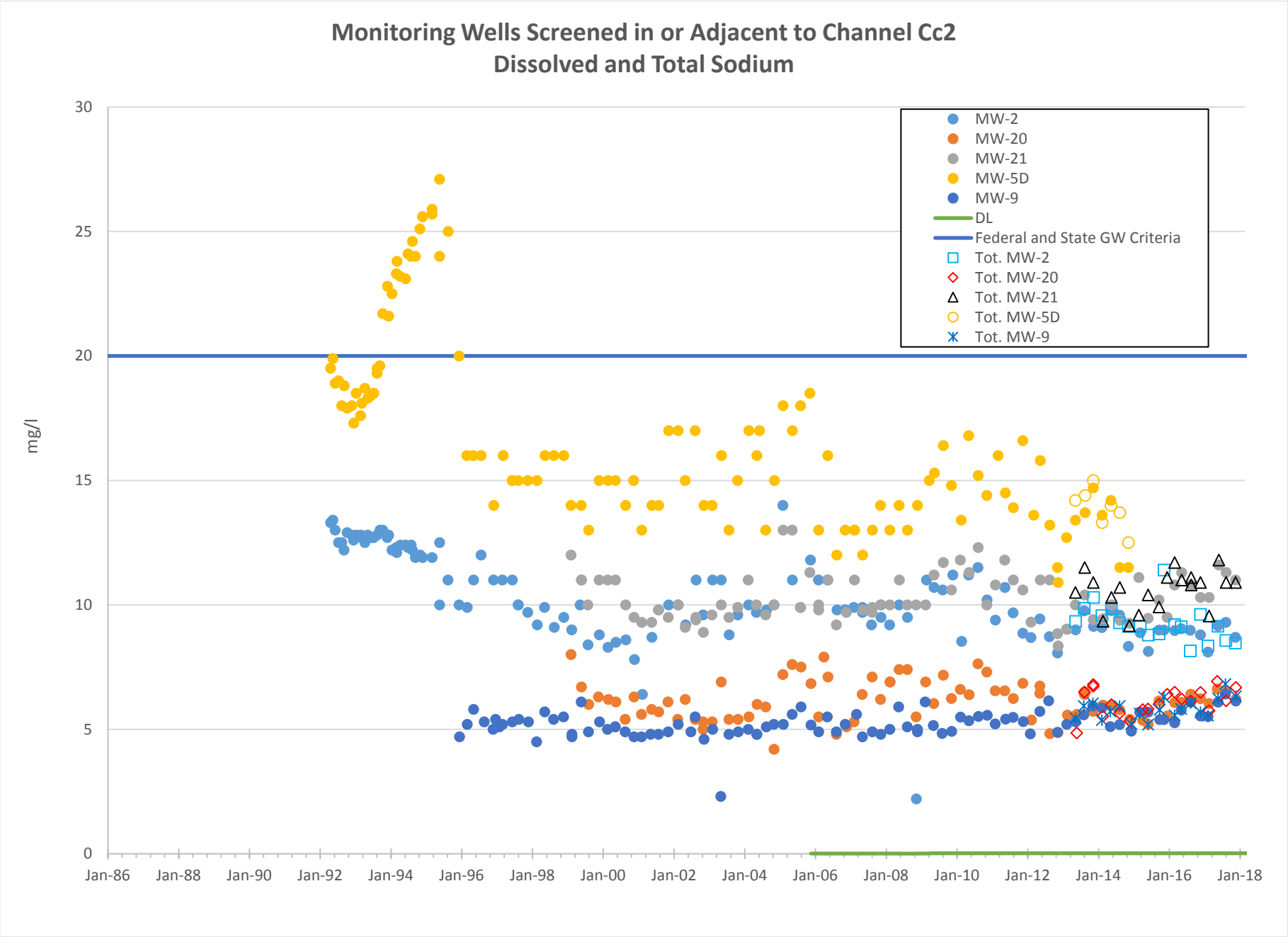

Monitoring Wells Screened in or Adjacent to Channel Cc2
Dissolved and Total Calcium
mg/l
160
140
120
100
80
60
40
20
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
Tot. MW-2
Tot. MW-20
Tot. MW-21
Tot. MW-5D

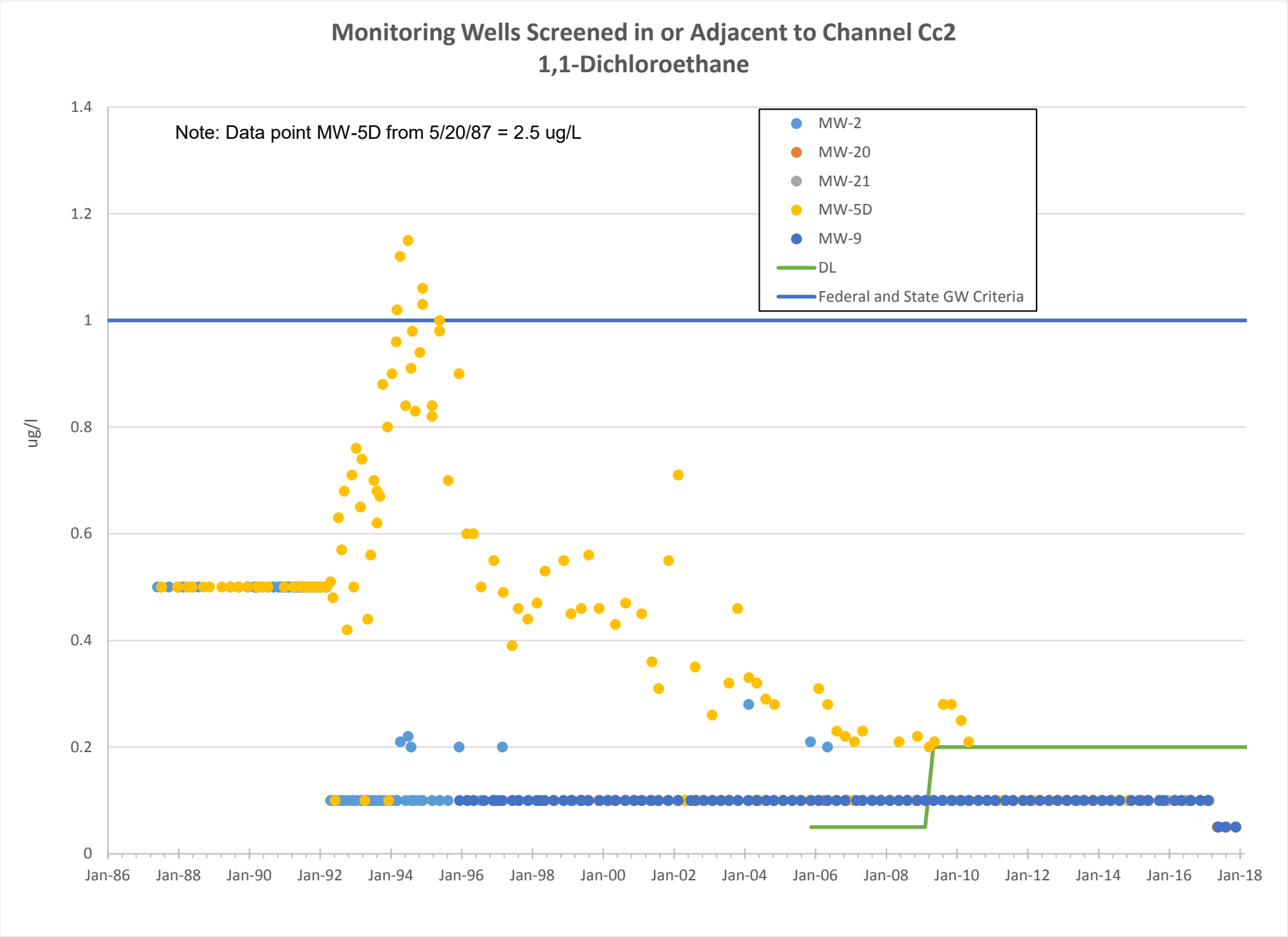

Monitoring Wells Screened in or Adjacent to Channel Cc2
Dissolved and Total Iron
mg/l
70
60
50
40
30
20
10
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
4
3.5
3
2.5
2
1.5
1
0.5
0
Jan-00
Dec-01
Jan-04
Dec-05
Jan-08
Dec-09
Jan-12
Dec-13
Jan-16
Dec-17
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
Federal and State GW Criteria
Tot. MW-2
Tot. MW-20
Tot. MW-21
Tot. MW-5D
Tot. MW-9

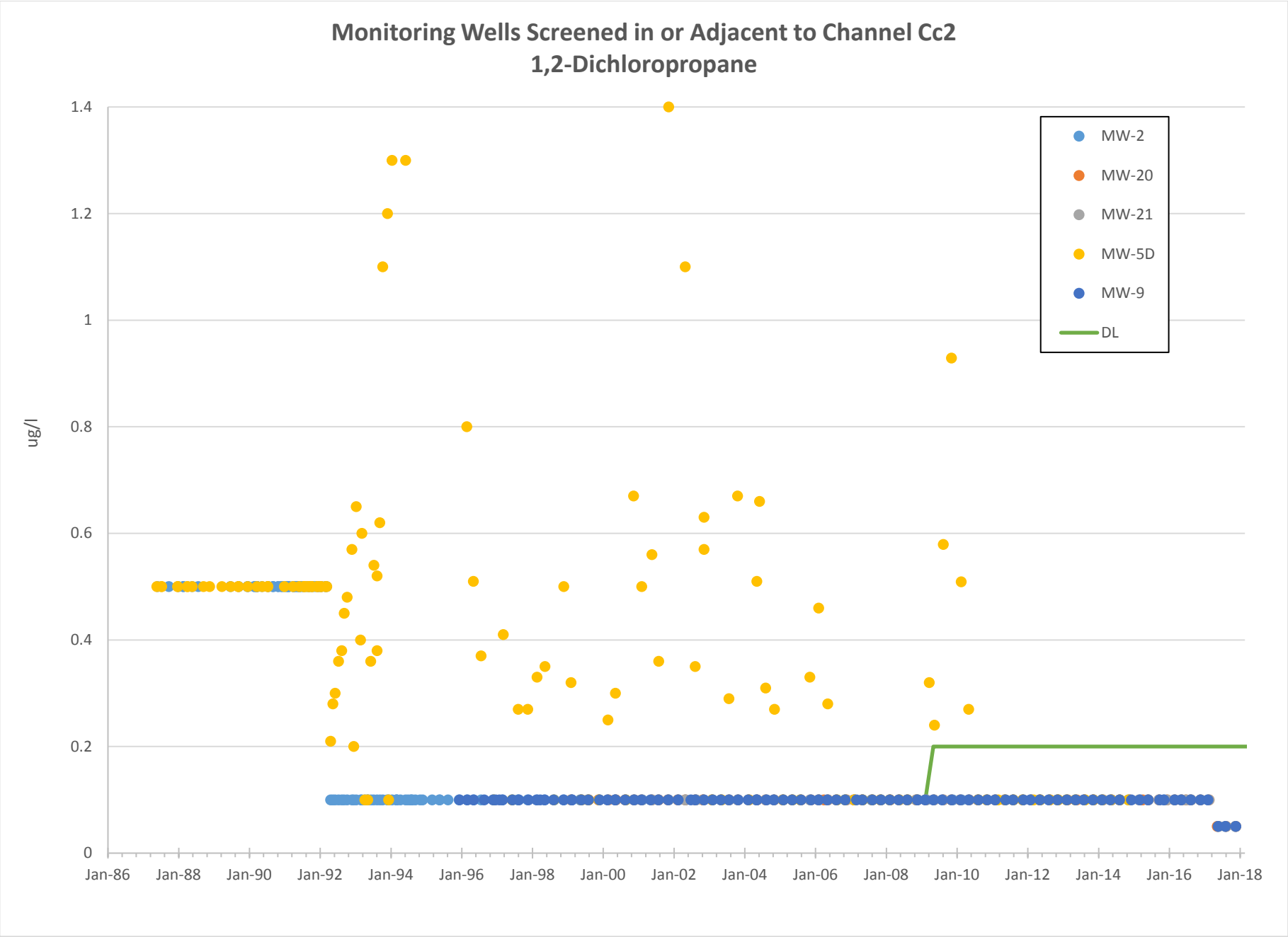

Monitoring Wells Screened in or Adjacent to Channel Cc2
Dissolved and Total Magnesium
mg/l
120
100
80
60
40
20
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
Tot. MW-2
Tot. MW-20
Tot. MW-21
Tot. MW-5D
Tot. MW-9

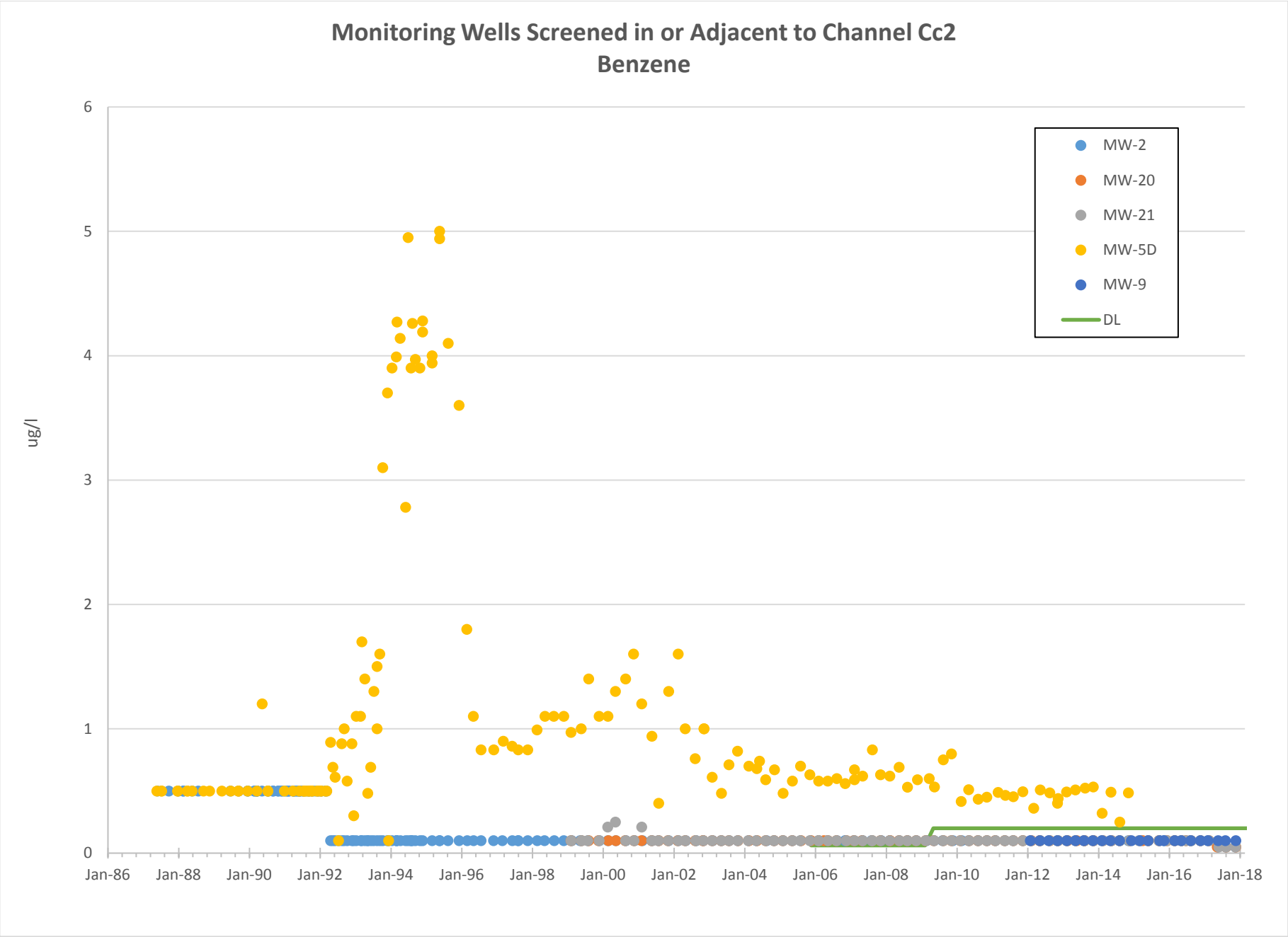

Monitoring Wells Screened in or Adjacent to Channel Cc2
Dissolved and Total Manganese
mg/l
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
Federal and State GW Criteria
Tot. MW-2
Tot. MW-20
Tot. MW-21
Tot. MW-5D
Tot. MW-9
0
2
4
6
8
10
12
14
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Jan-00
Dec-01
Jan-04
Dec-05
Jan-08
Dec-09
Jan-12
Dec-13
Jan-16
Dec-17

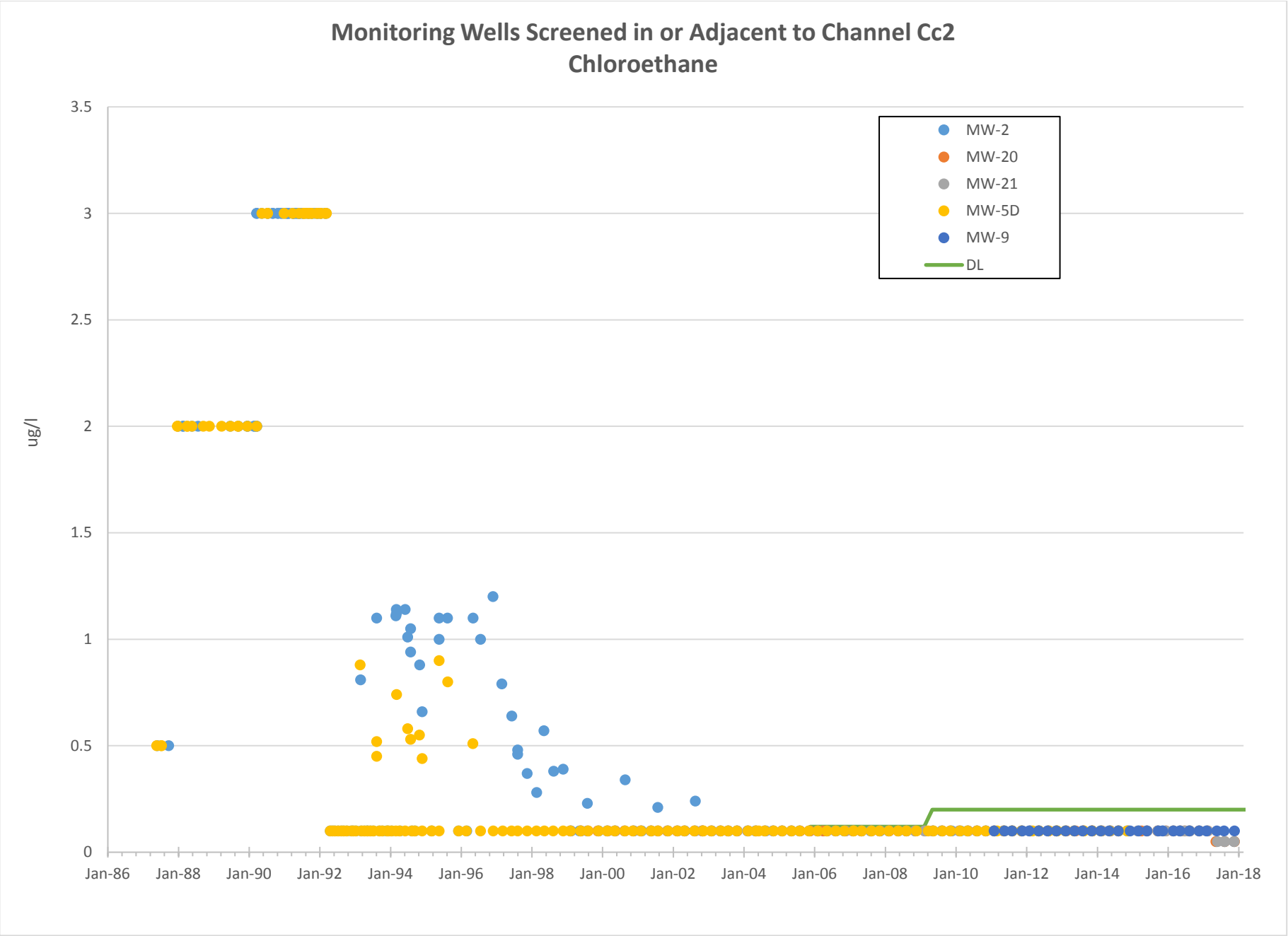

Monitoring Wells Screened in or Adjacent to Channel Cc2
Dissolved and Total Potassium
mg/l
6
5
4
3
2
1
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
Tot. MW-2
Tot. MW-20

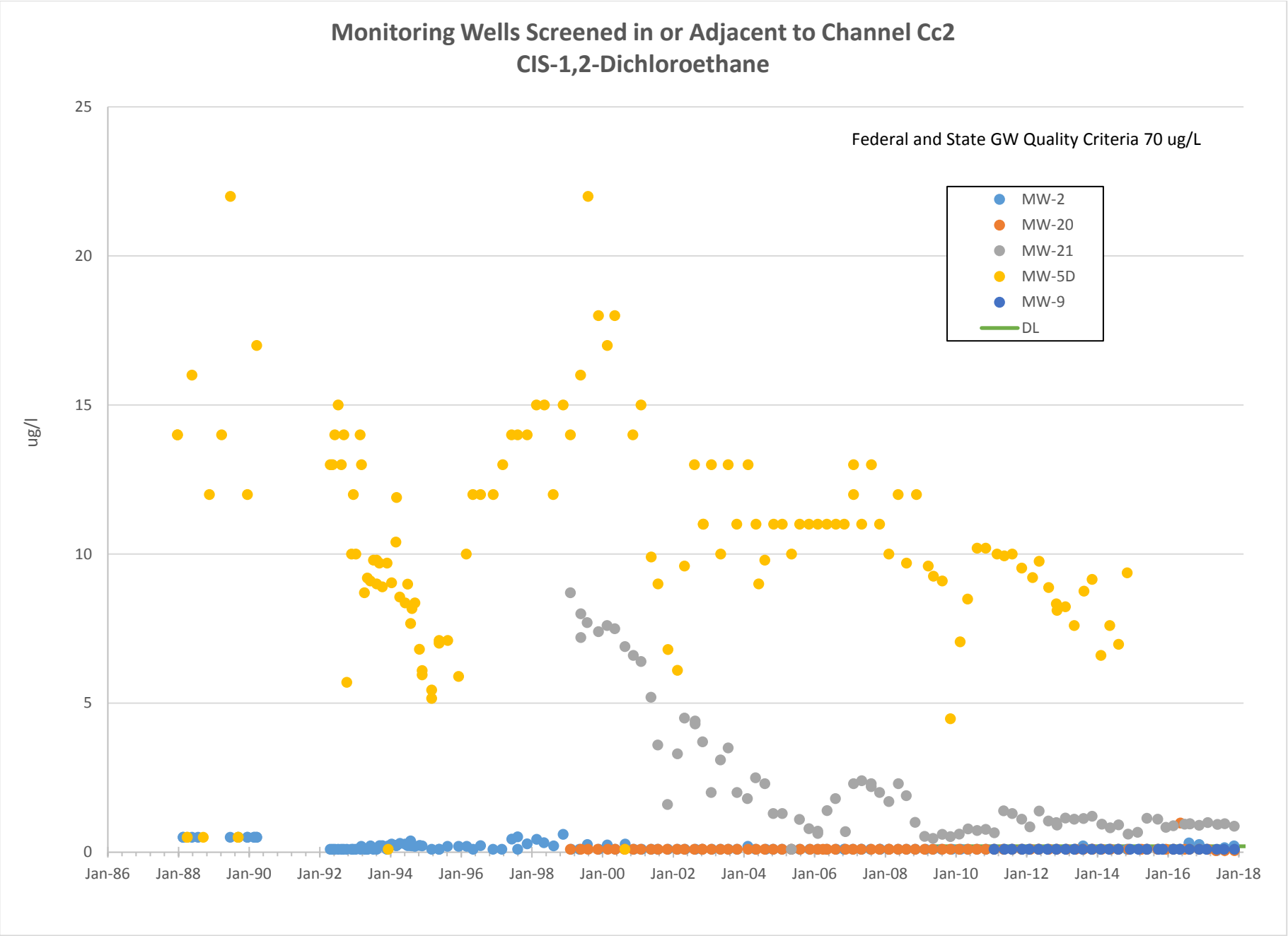

Monitoring Wells Screened in or Adjacent to Channel Cc2
Dissolved and Total Sodium
mg/l
30
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
Federal and State GW Criteria
Tot. MW-2
Tot. MW-20
Tot. MW-21
Tot. MW-5D
Tot. MW-9

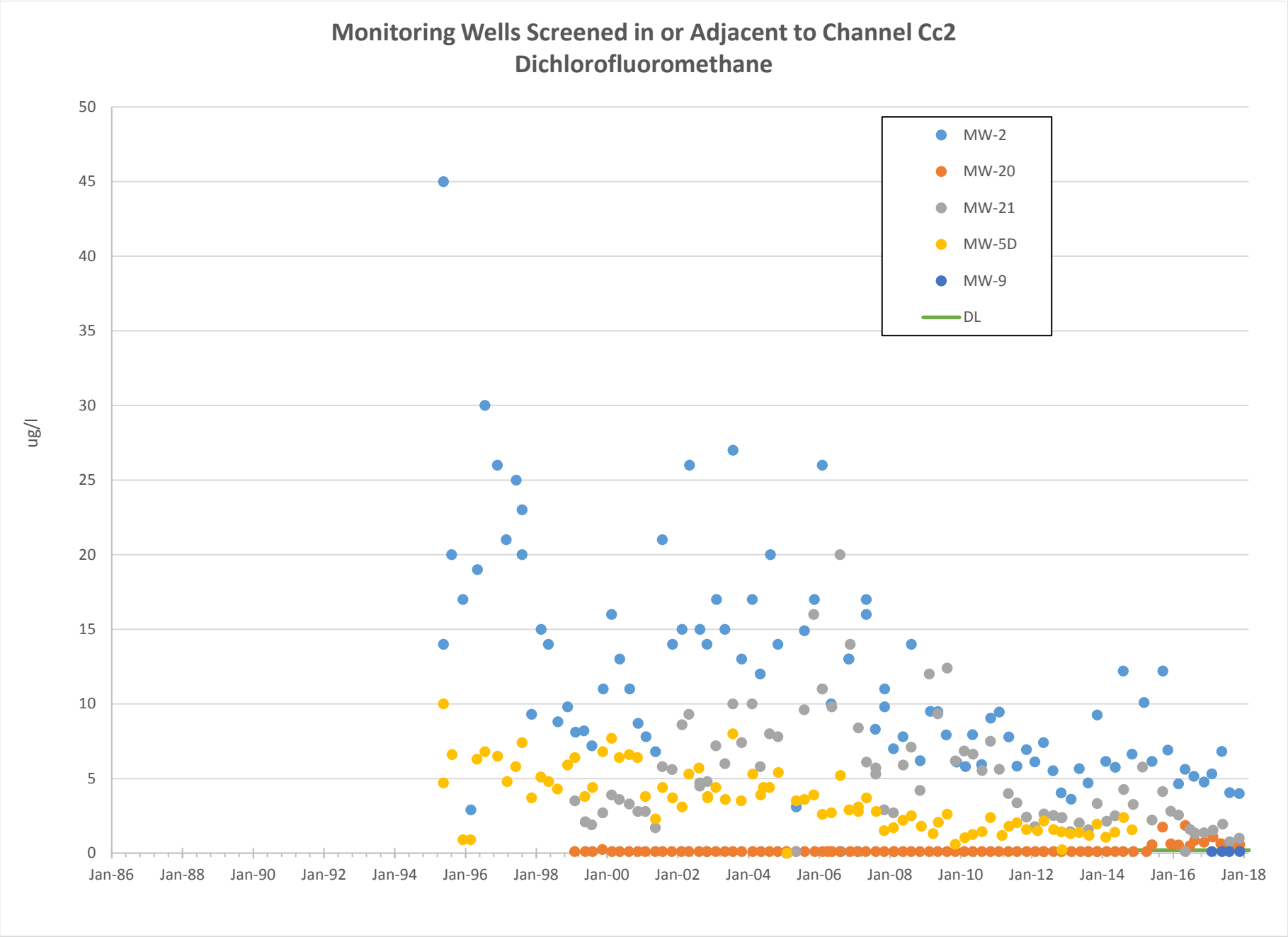

Monitoring Wells Screened in or Adjacent to Channel Cc2
1,1-Dichloroethane
Note: Data point MW-5D from 5/20/87 = 2.5 ug/L
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
Federal and State GW Criteria
ug/l
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

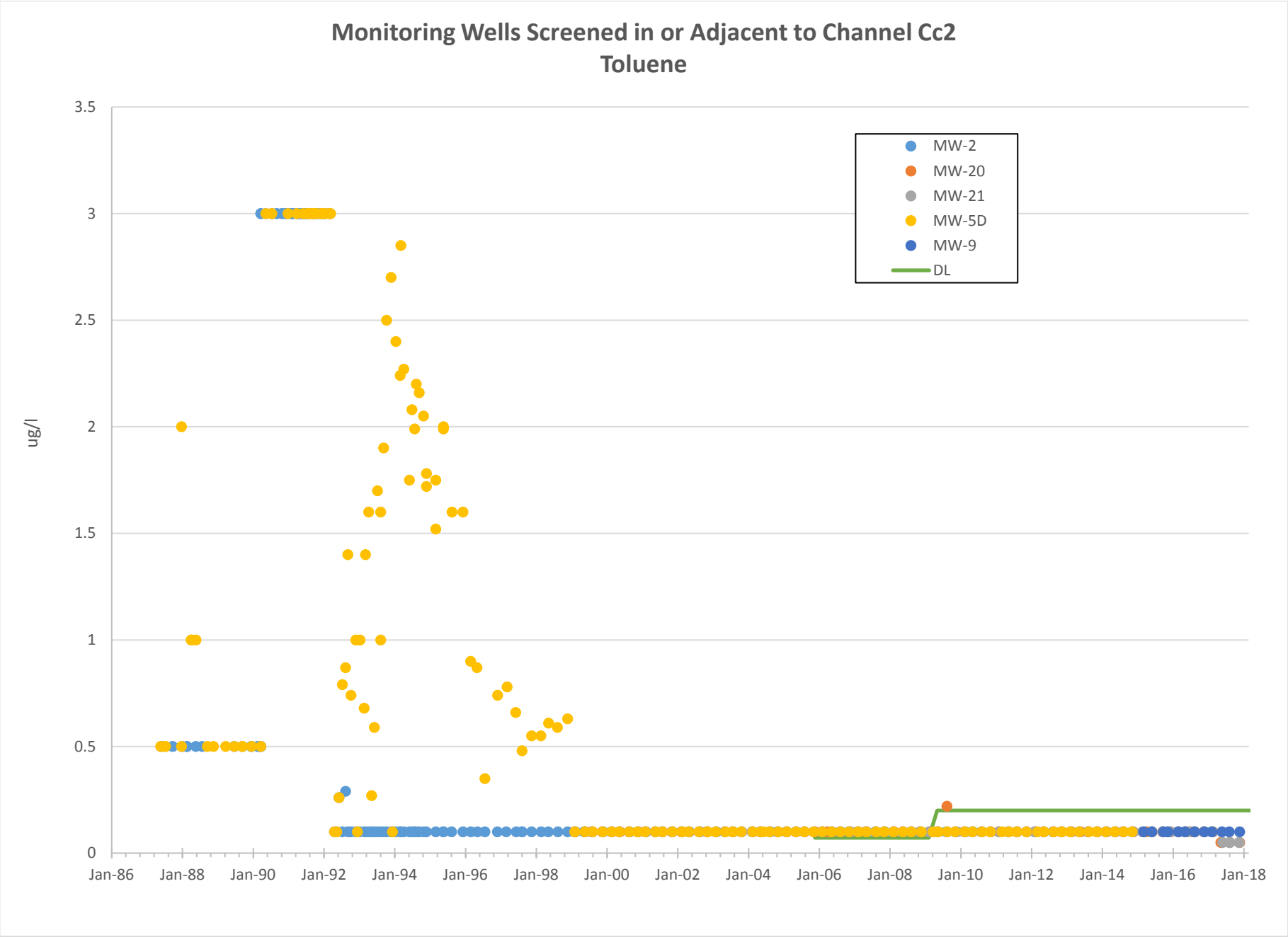

Monitoring Wells Screened in or Adjacent to Channel Cc2
1,2-Dichloropropane
ug/l
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

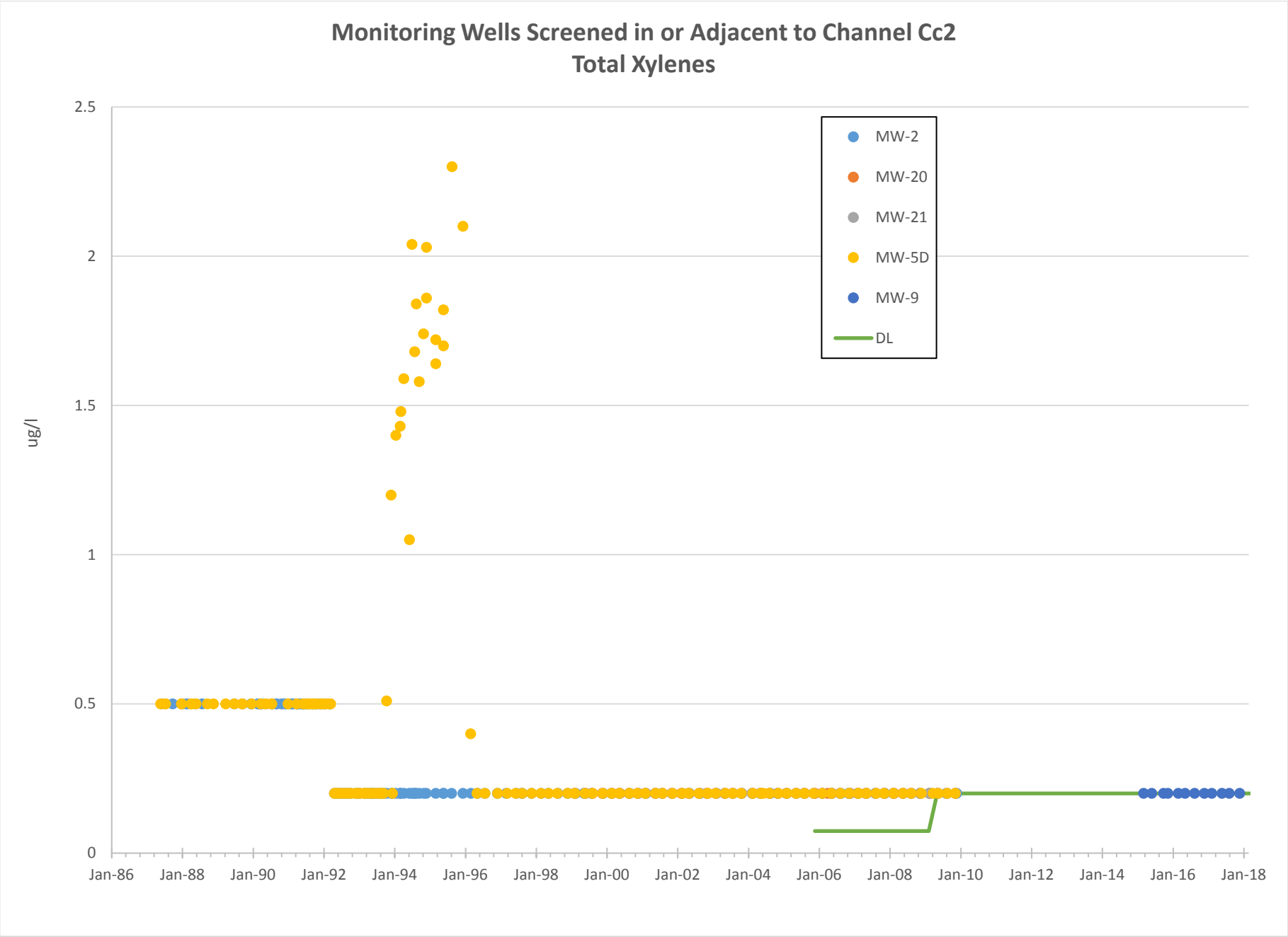

Monitoring Wells Screened in or Adjacent to Channel Cc2
Benzene
ug/l
6
5
4
3
2
1
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

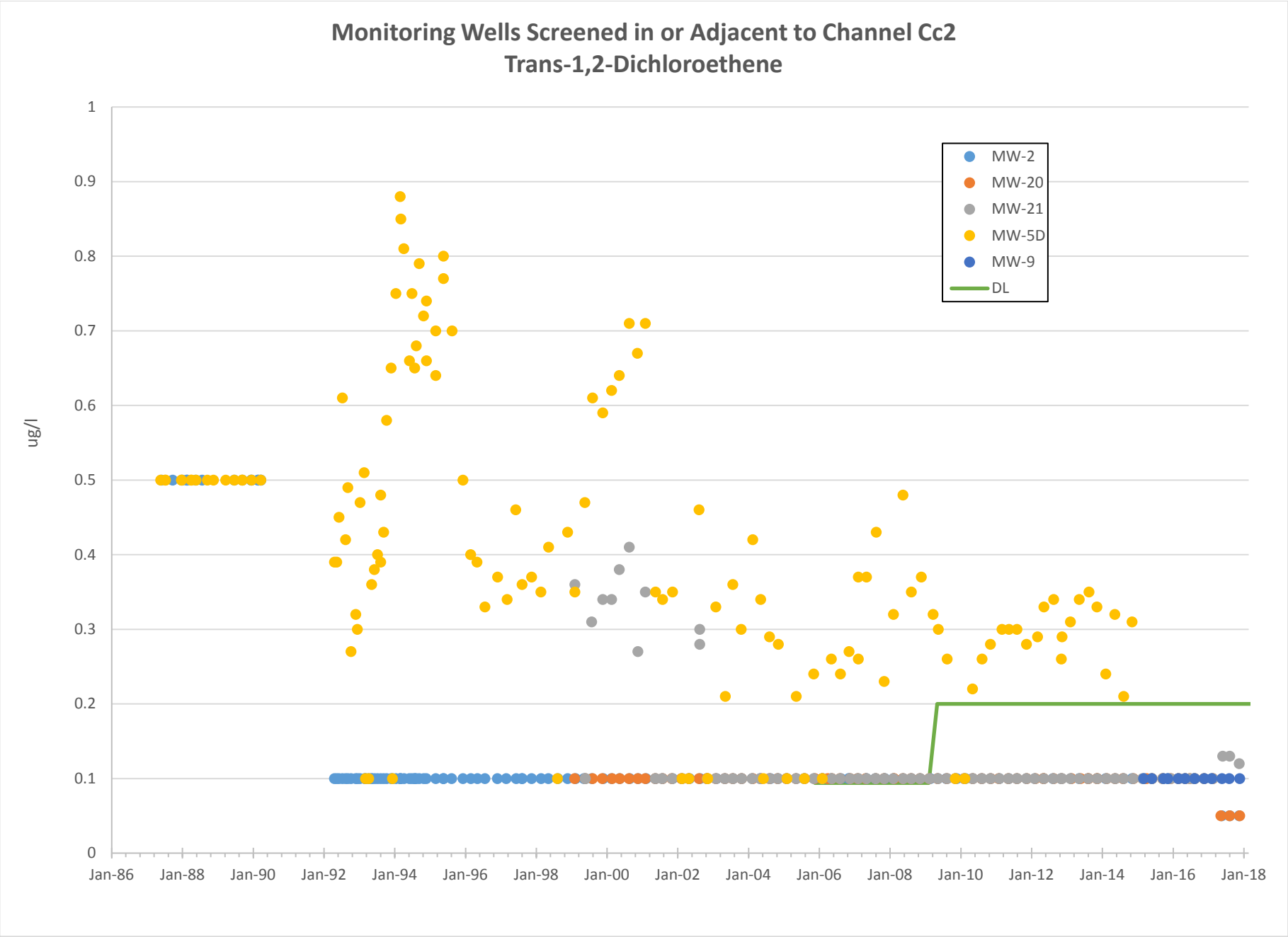

Monitoring Wells Screened in or Adjacent to Channel Cc2
Chloroethane
ug/l
3.5
3
2.5
2
1.5
1
0.5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

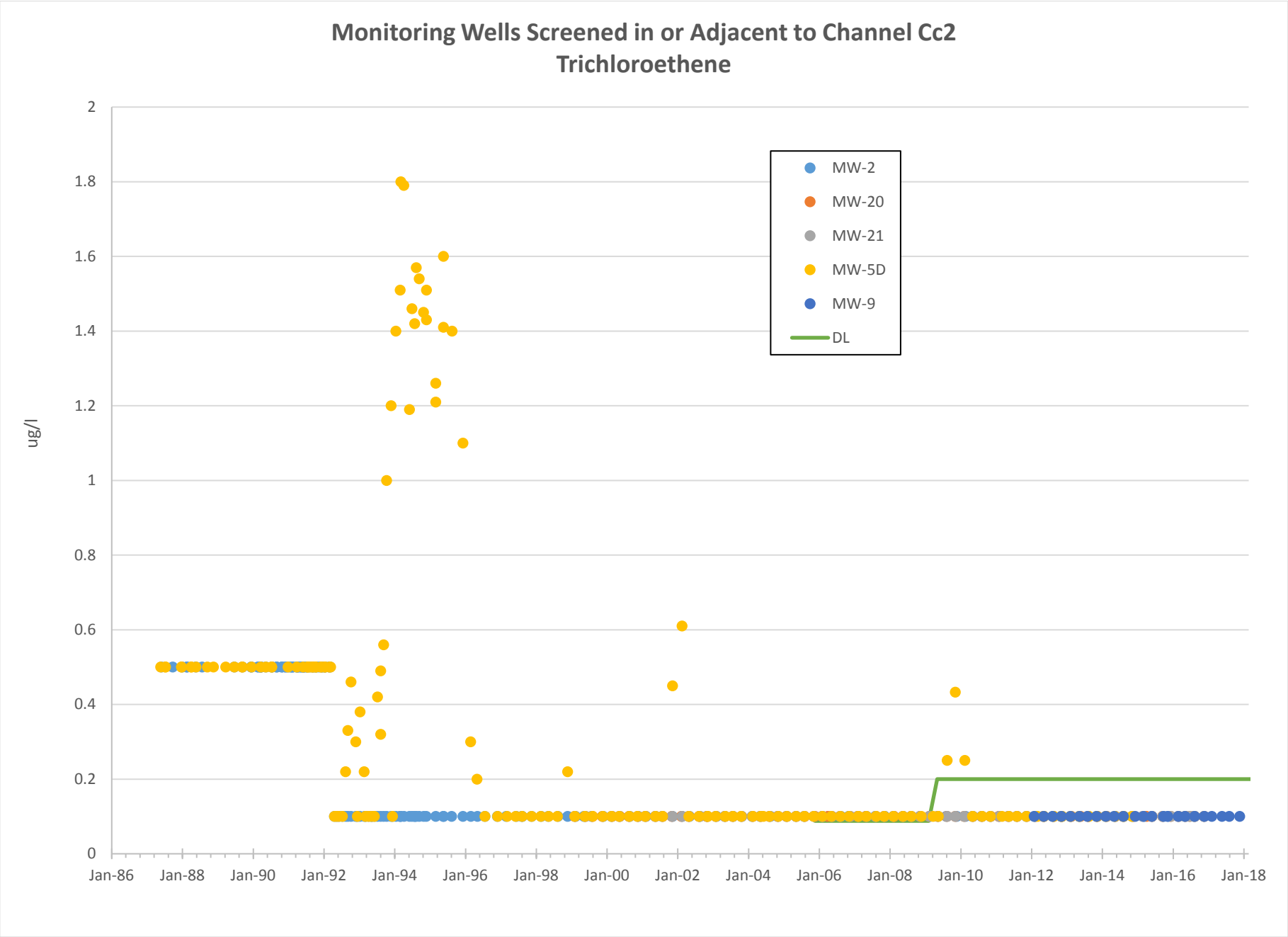

Monitoring Wells Screened in or Adjacent to Channel Cc2
CIS-1,2-Dichloroethane
Federal and State GW Quality Criteria 70 ug/L
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
ug/l
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

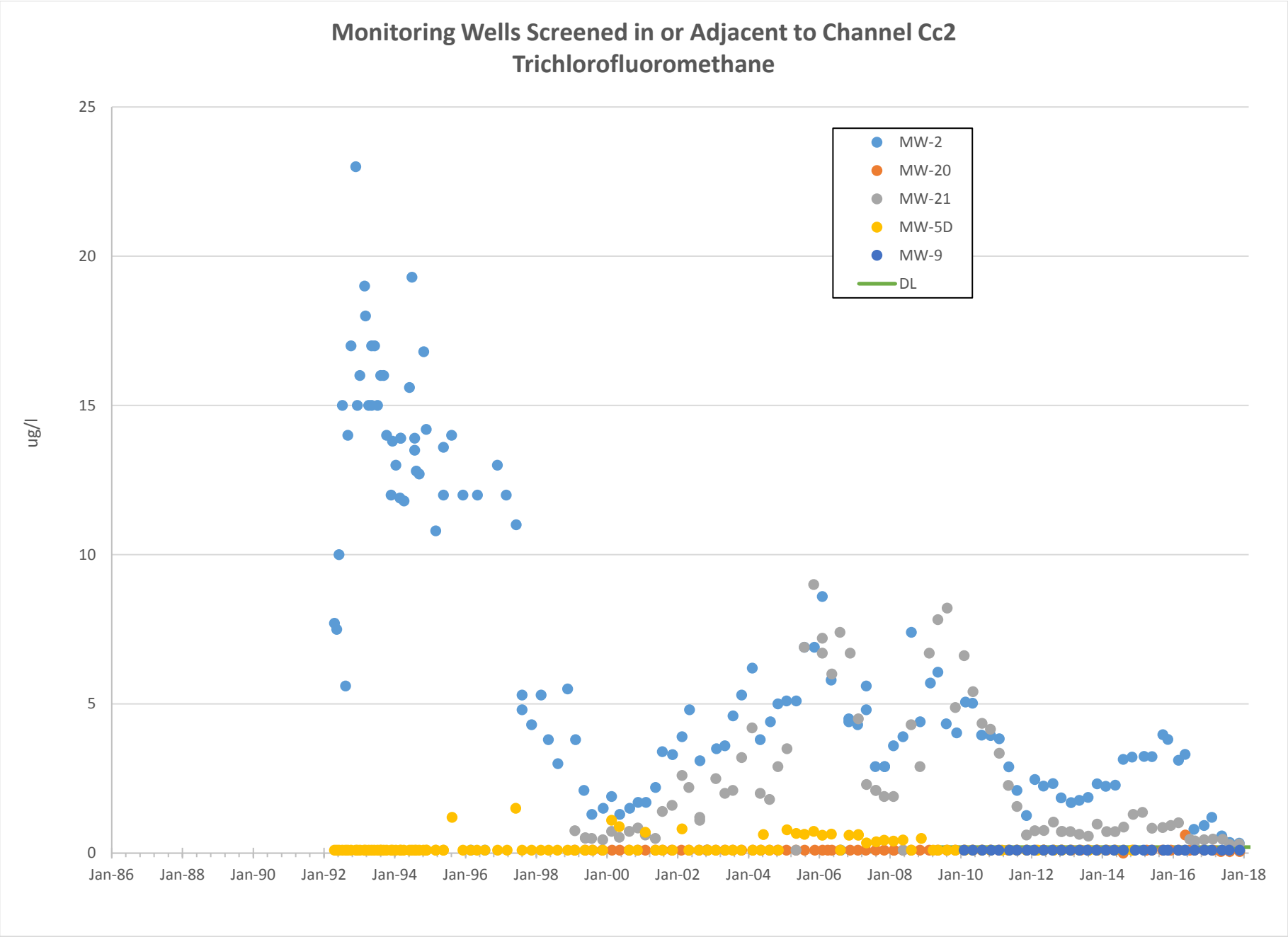

Monitoring Wells Screened in or Adjacent to Channel Cc2
Dichlorofluoromethane
ug/l
50
45
40
35
30
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

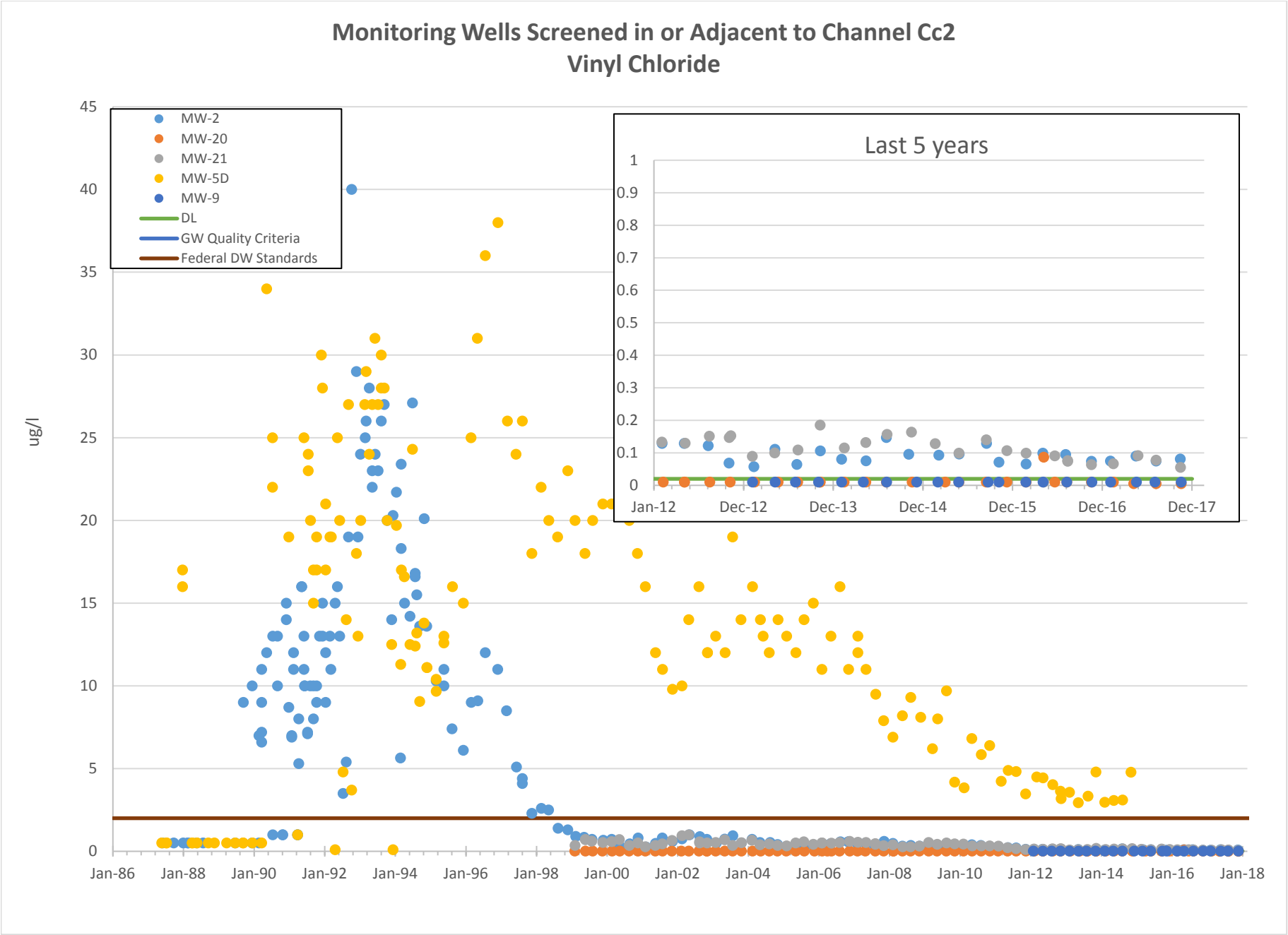

Monitoring Wells Screened in or Adjacent to Channel Cc2
Toluene
ug/l
3.5
3
2.5
2
1.5
1
0.5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL


Monitoring Wells Screened in or Adjacent to Channel Cc2
Total Xylenes
ug/l
2.5
2
1.5
1
0.5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL


Monitoring Wells Screened in or Adjacent to Channel Cc2
Trans-1,2-Dichloroethene
ug/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

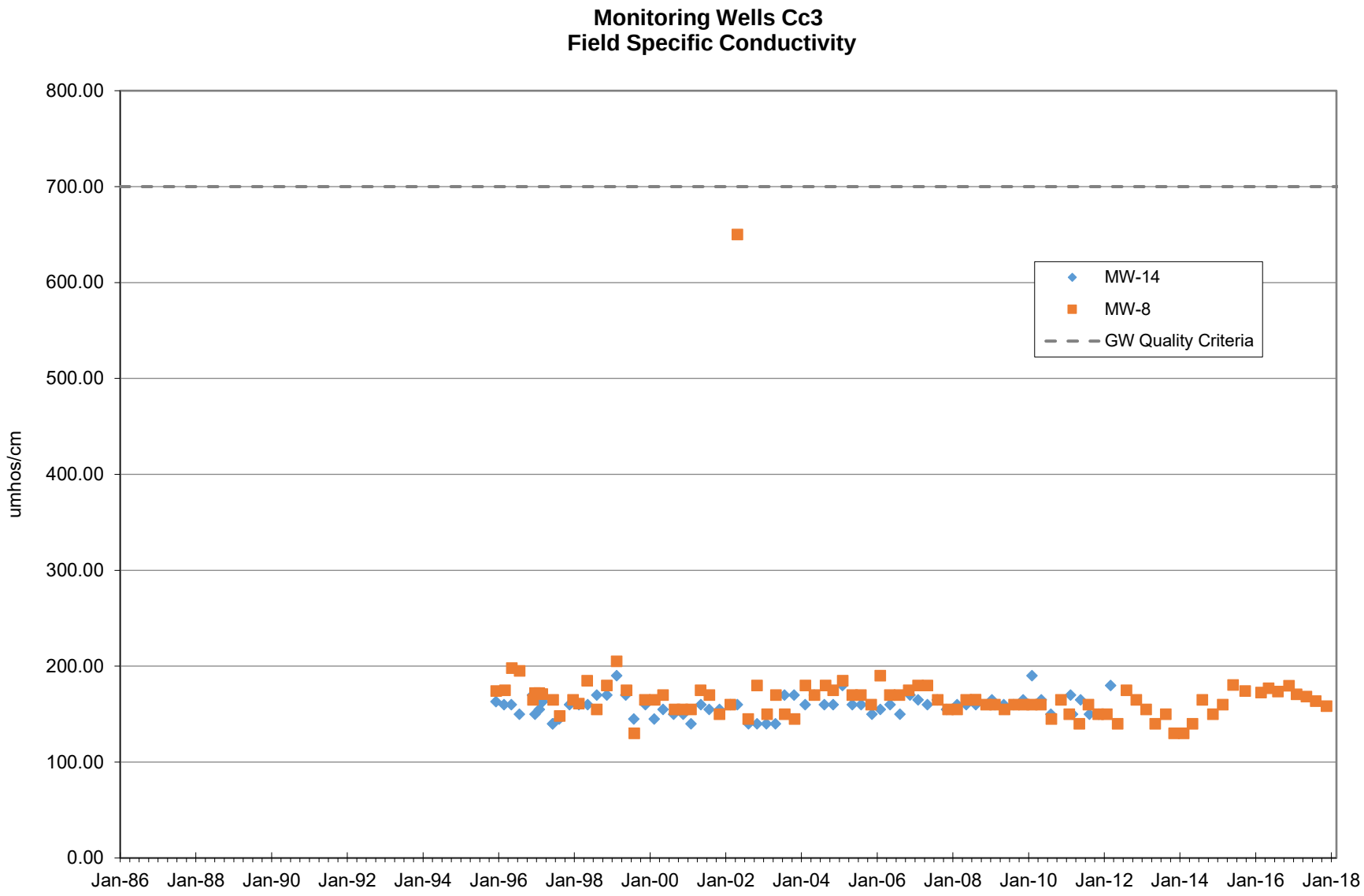

Monitoring Wells Screened in or Adjacent to Channel Cc2
Trichloroethene
ug/l
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

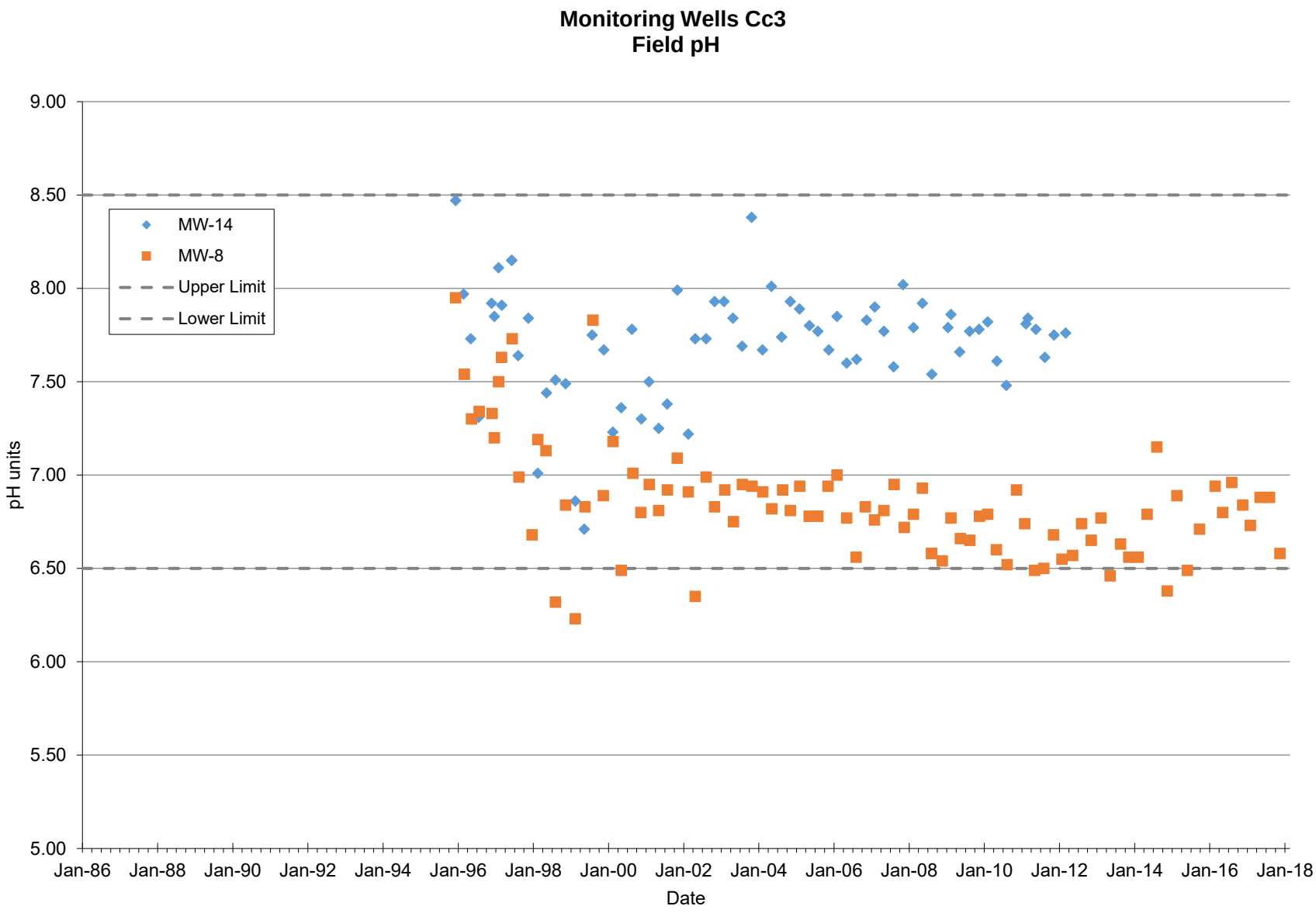

Monitoring Wells Screened in or Adjacent to Channel Cc2
Trichlorofluoromethane
ug/l
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-2
MW-20
MW-21
MW-5D
MW-9
DL

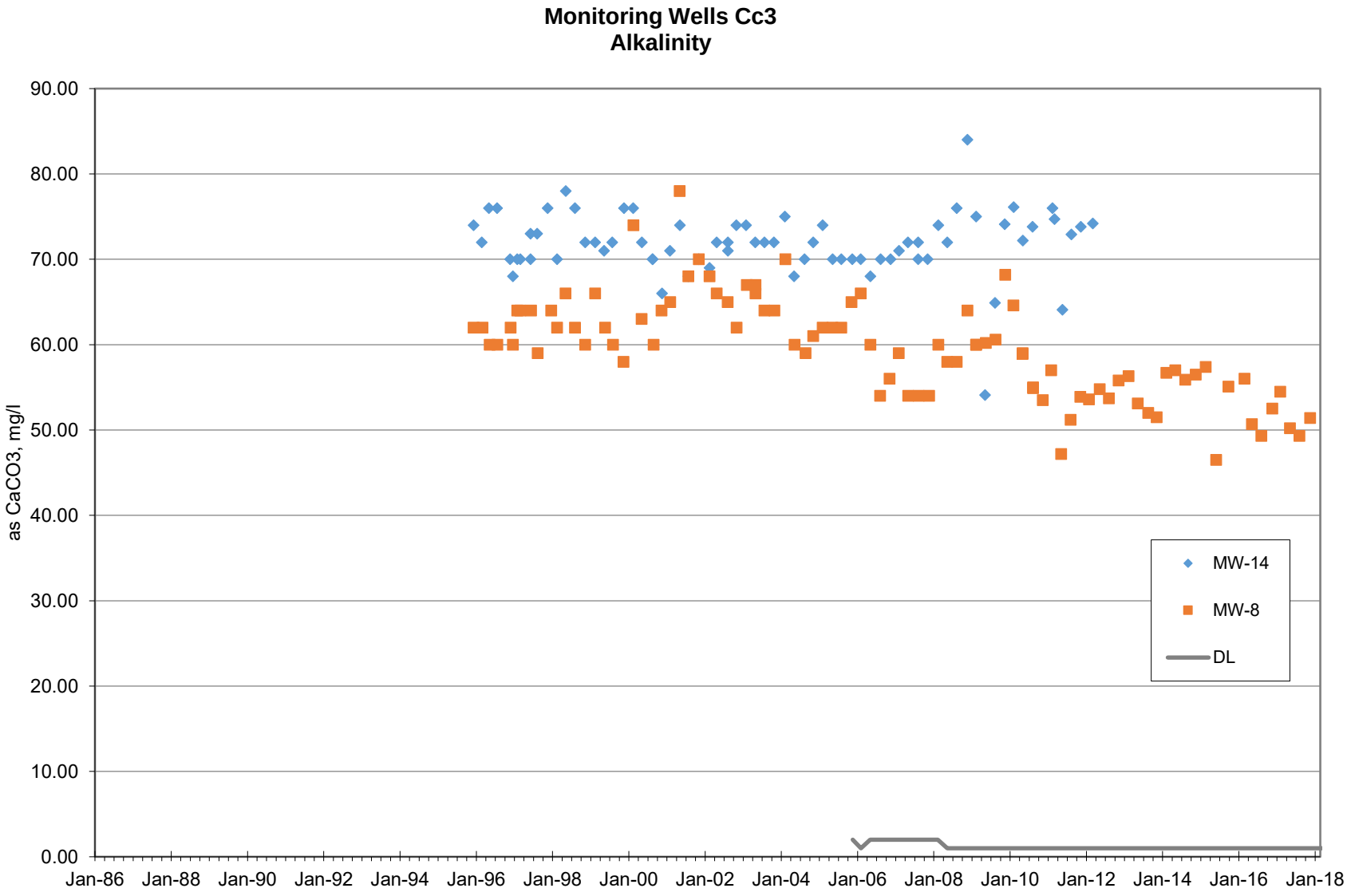

Monitoring Wells Screened in or Adjacent to Channel Cc2
Vinyl Chloride
ug/l
MW-2
MW-20
MW-21
MW-5D
MW-9
DL
GW Quality Criteria
Federal DW Standards
Last 5 years
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Jan-12
Dec-12
Dec-13
Dec-14
Dec-15
Dec-16
Dec-17

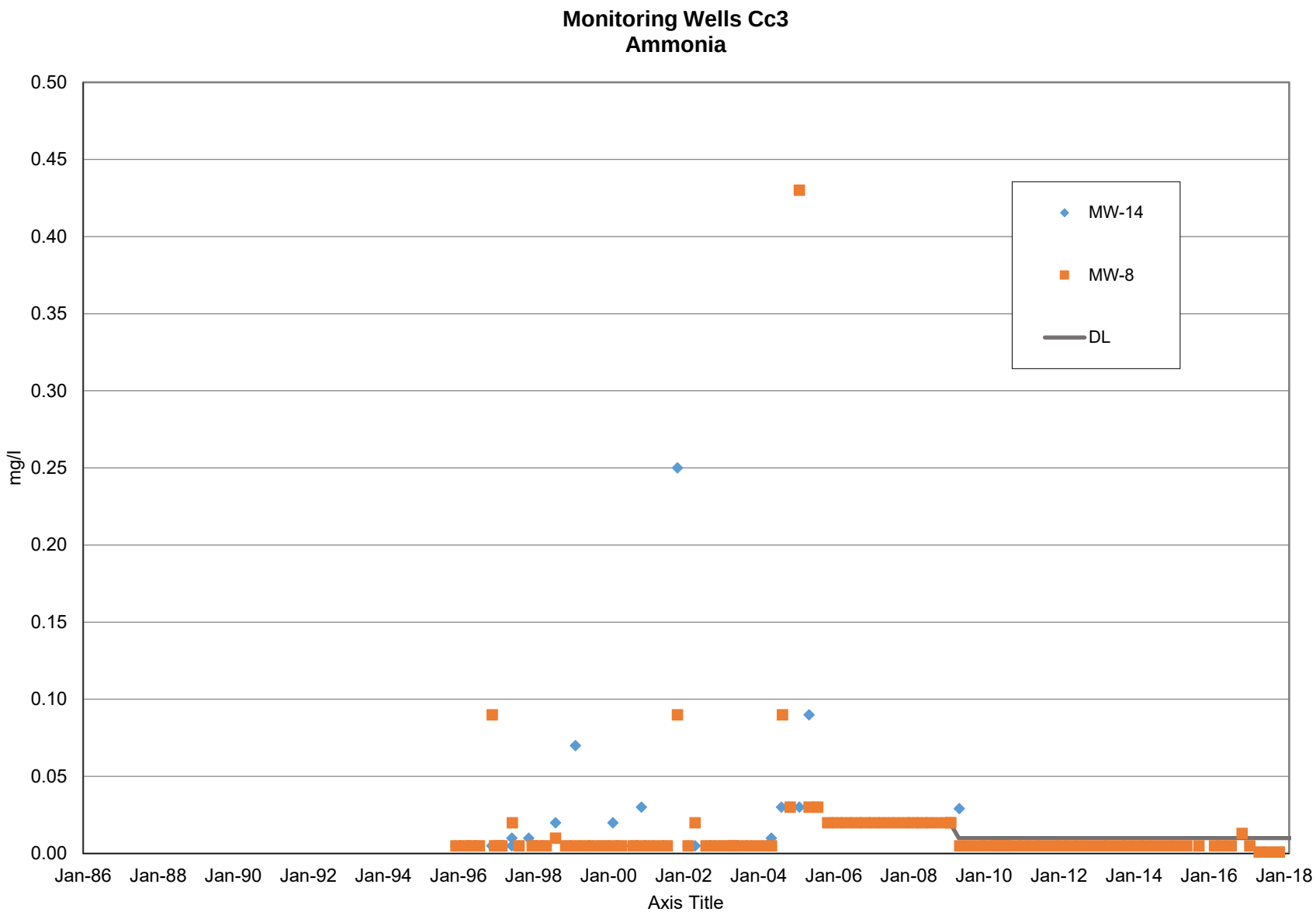
Appendix E

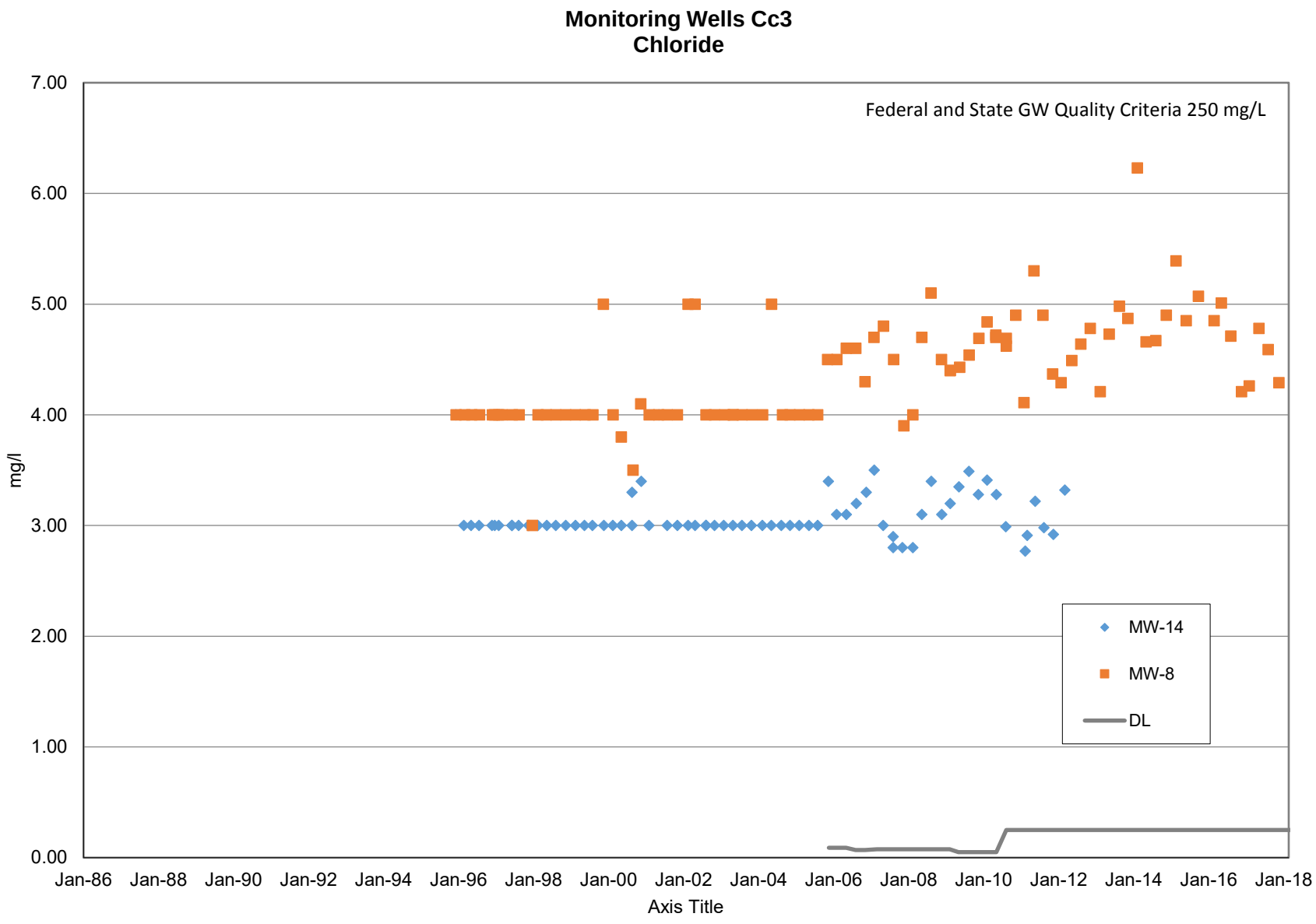
Time Concentration Plots for
Groundwater below Channel Cc2

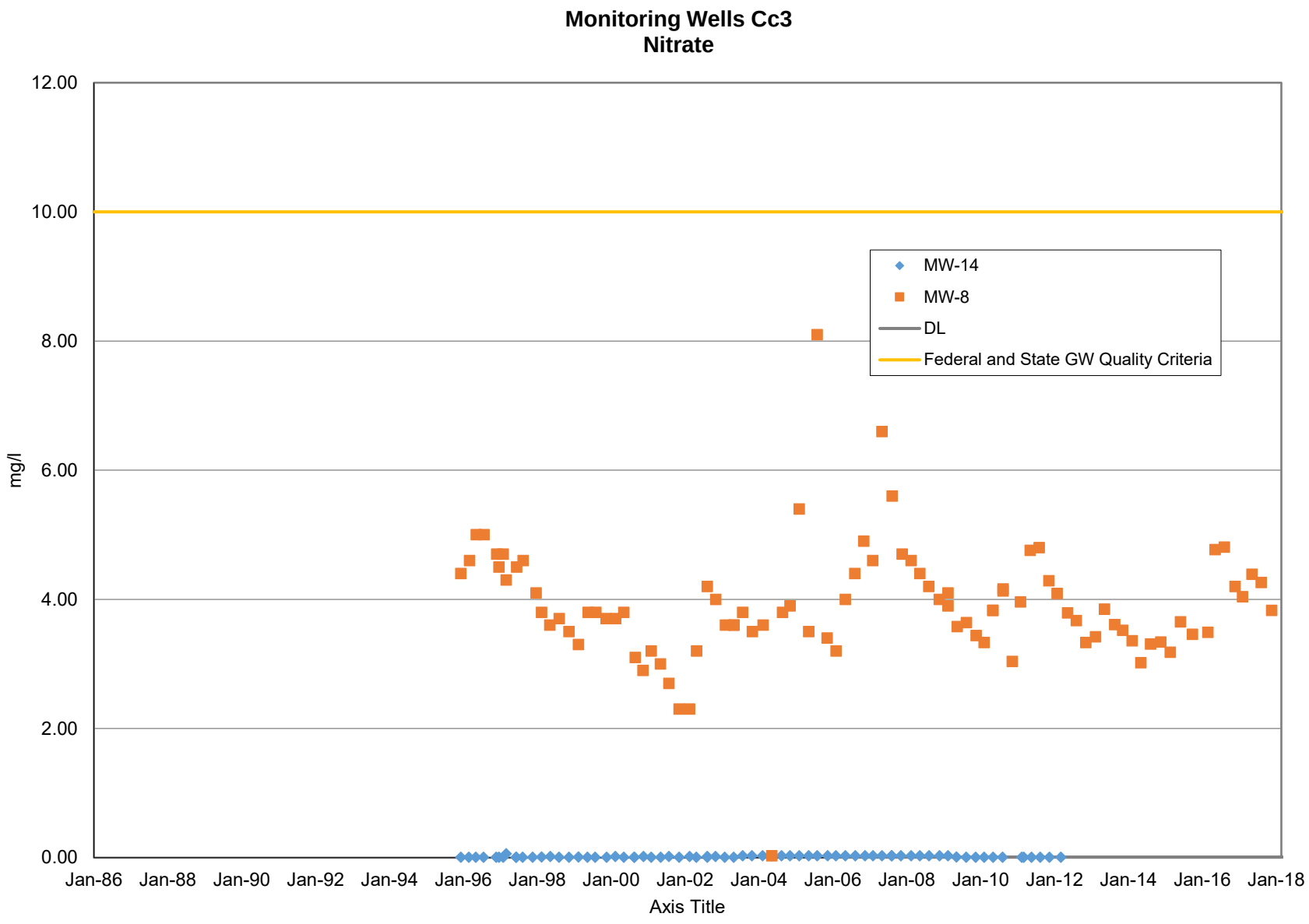

Monitoring Wells Cc3
Field Specific Conductivity
umhos/cm
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
GW Quality Criteria

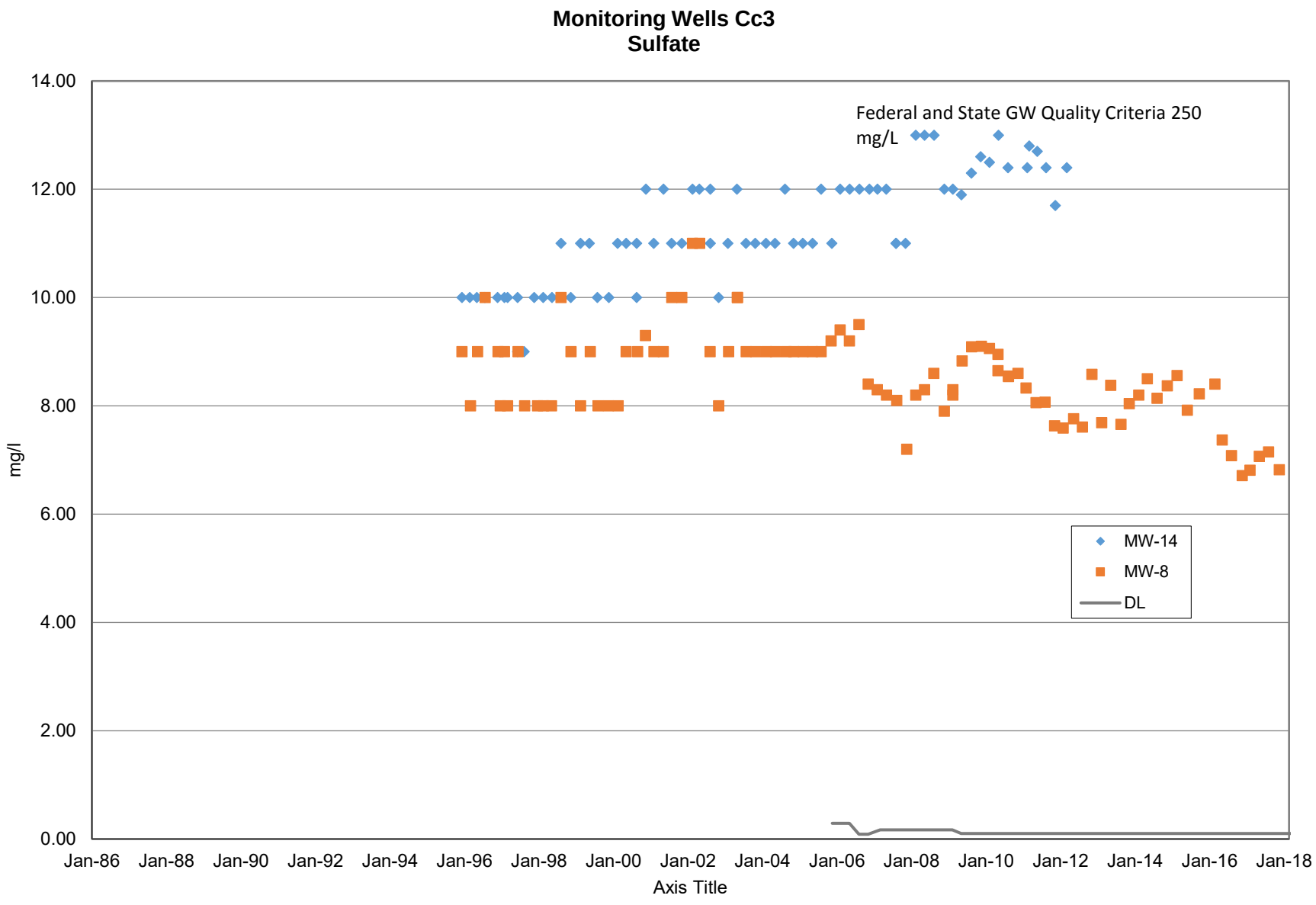

Monitoring Wells Cc3
Field pH
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
5.00
pH units
MW-14
MW-8
Upper Limit
Lower Limit
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Date

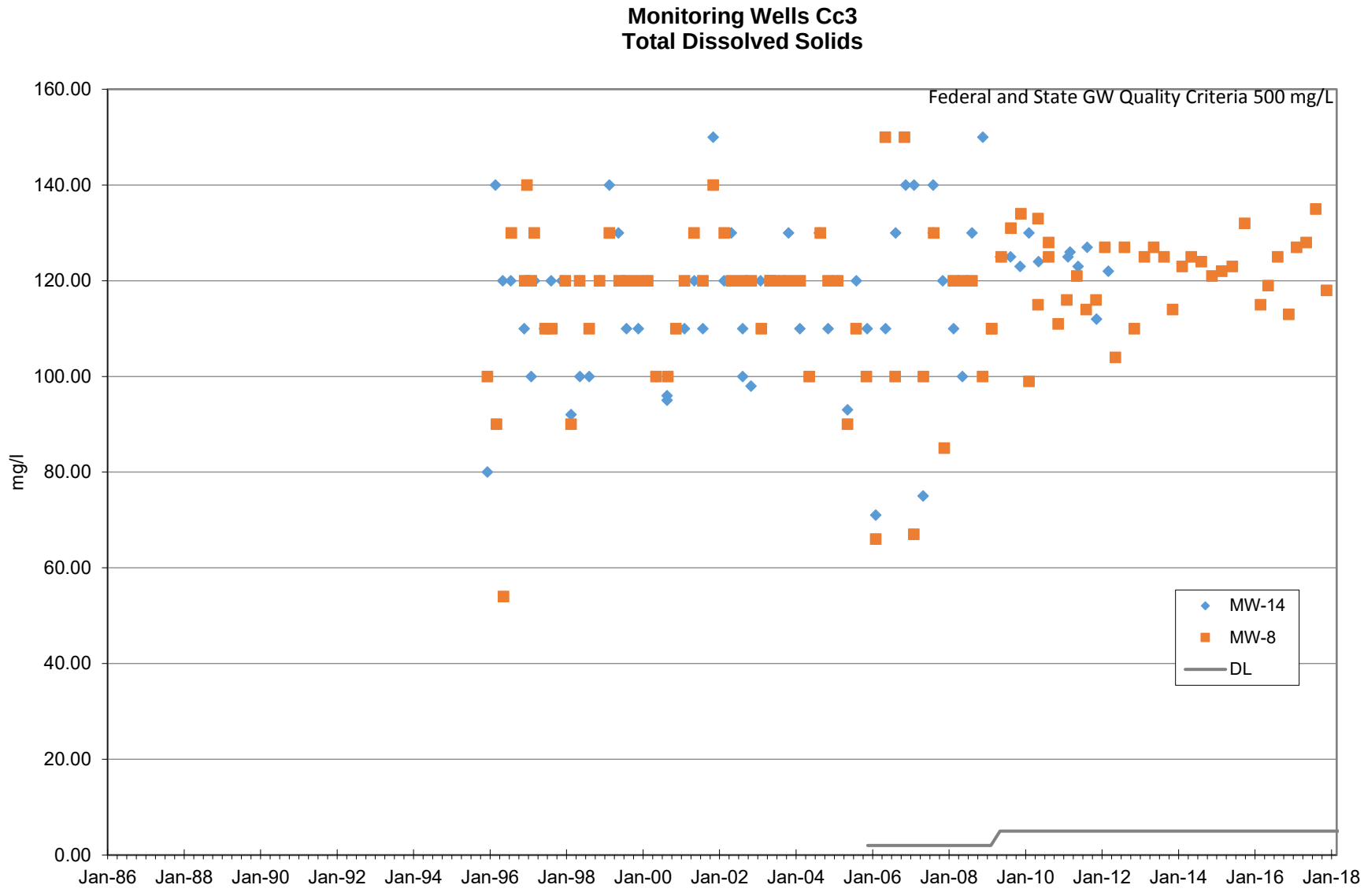

Monitoring Wells Cc3
Alkalinity
as CaCO3, mg/l
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
DL

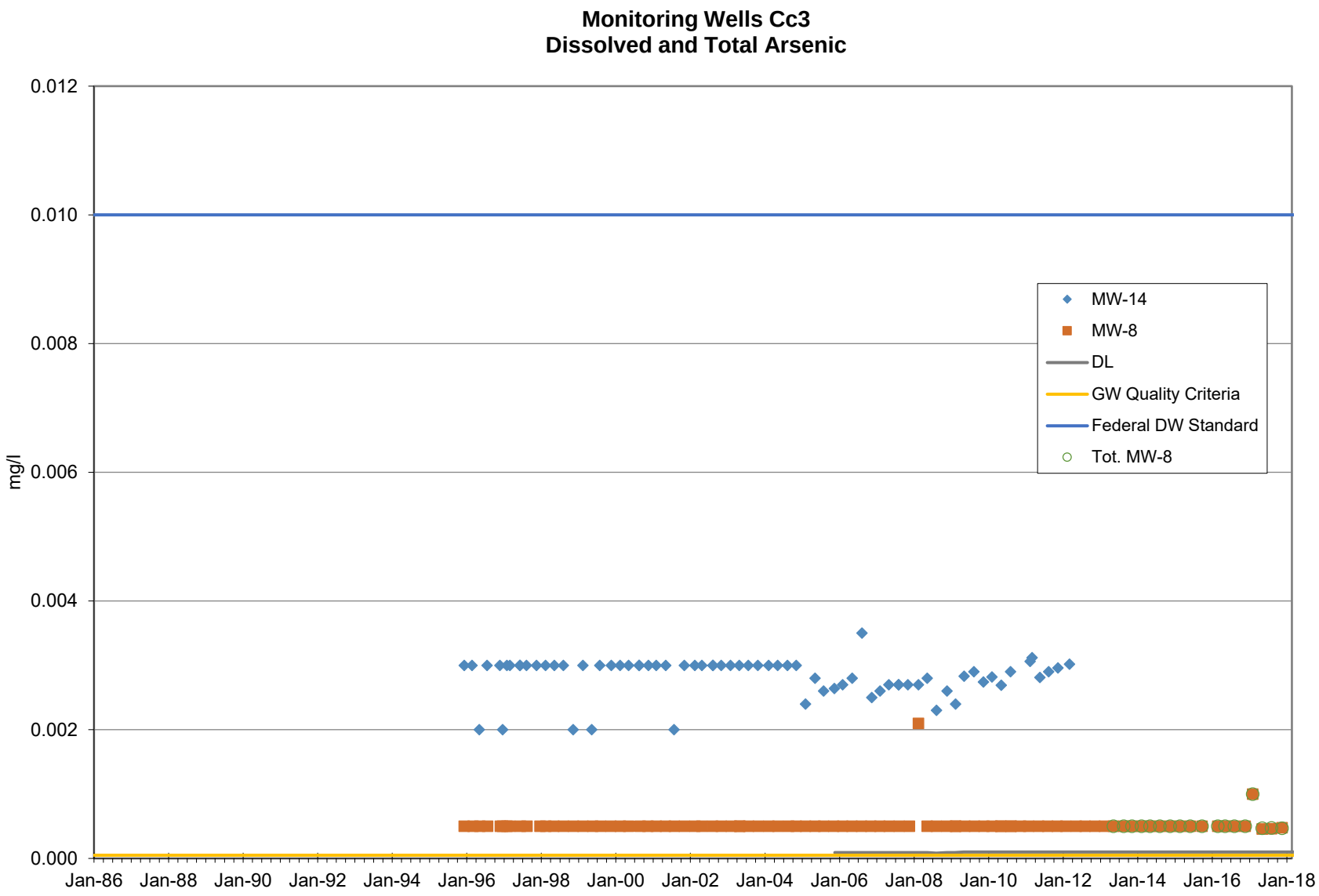

Monitoring Wells Cc3
Ammonia
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
mg/l
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Axis Title
MW-14
MW-8
DL

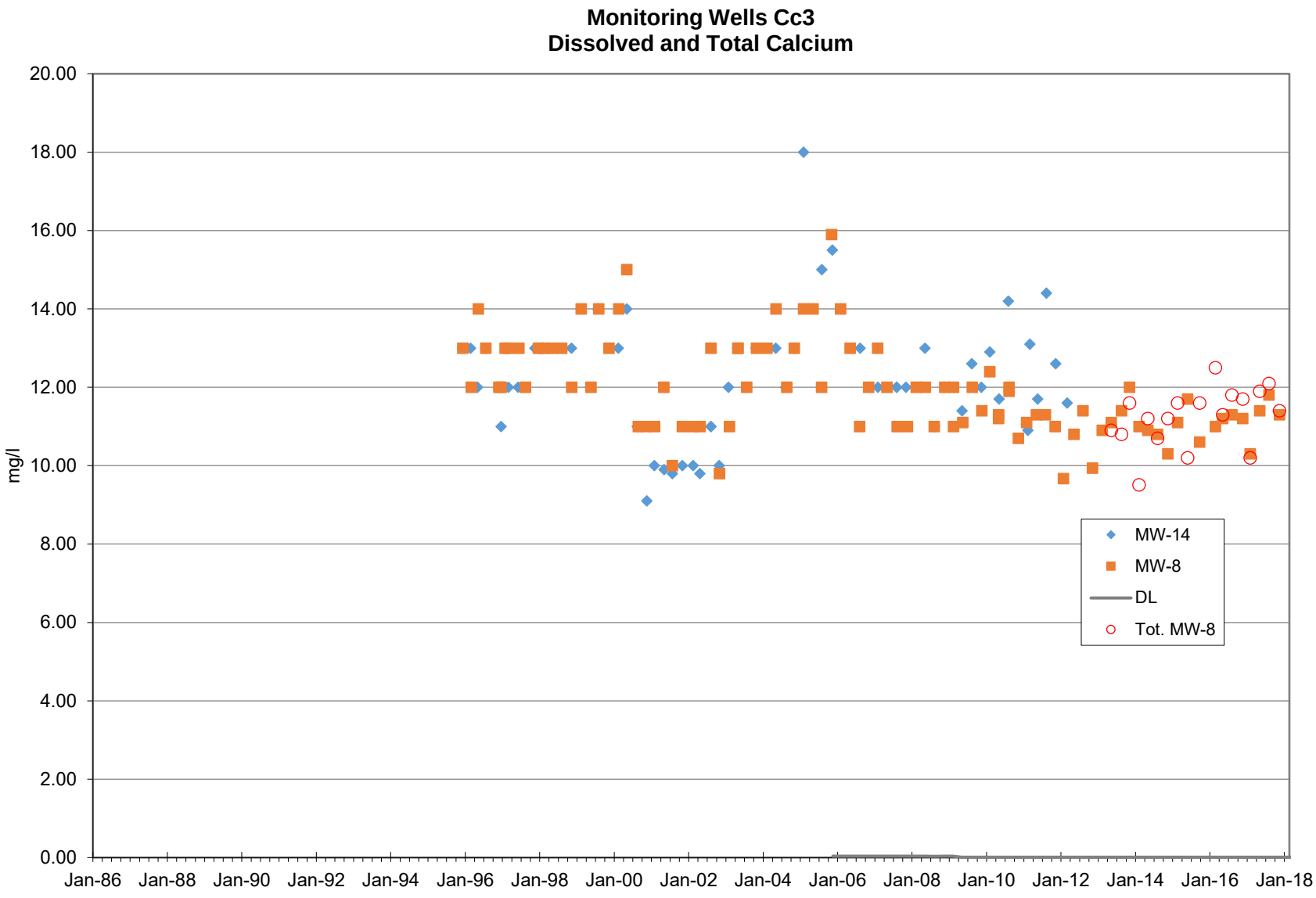

Monitoring Wells Cc3
Chloride
Federal and State GW Quality Criteria 250 mg/L
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
mg/l
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Axis Title
MW-14
MW-8
DL

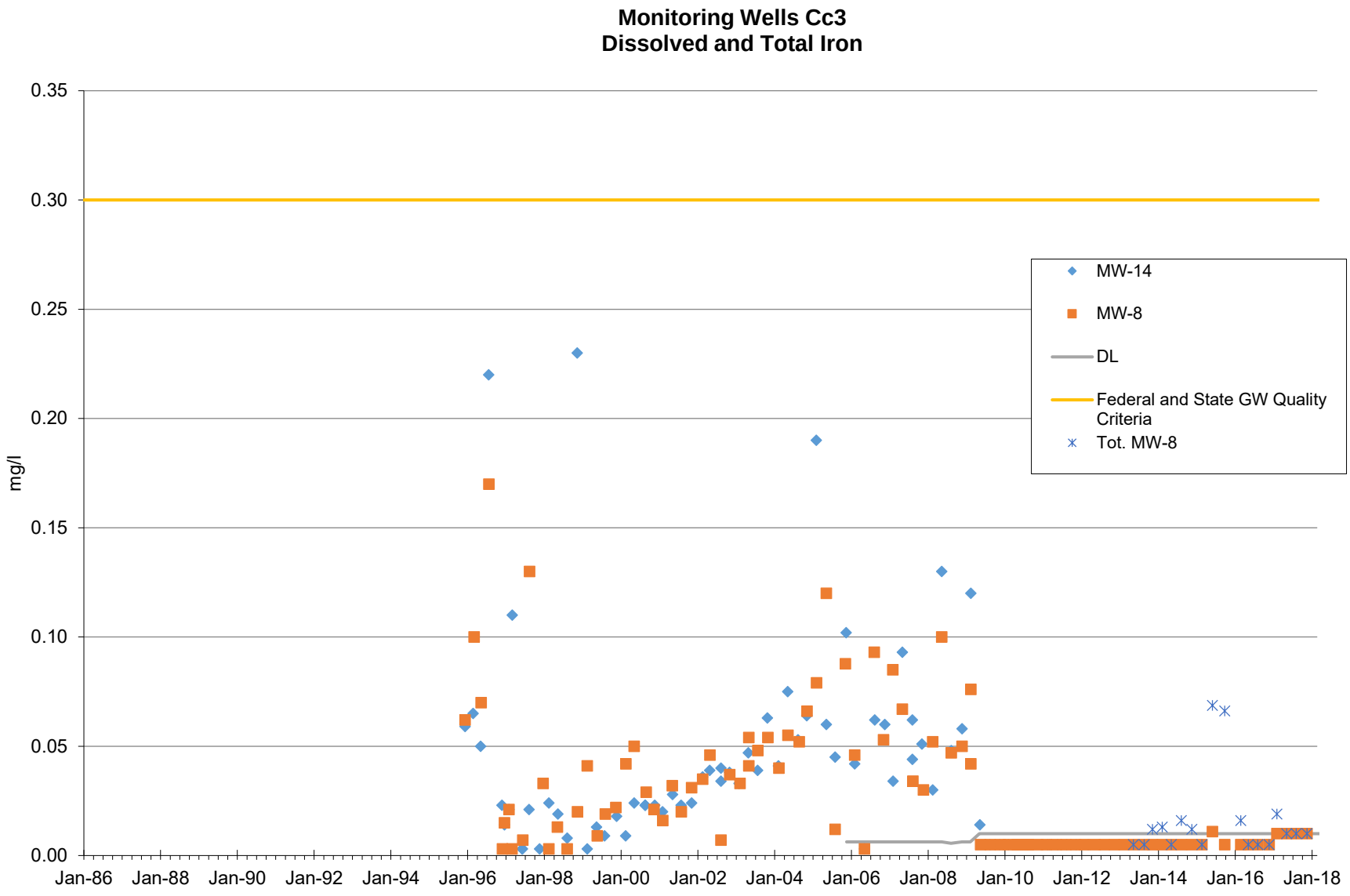

Monitoring Wells Cc3
Nitrate
12.00
10.00
8.00
6.00
4.00
2.00
0.00
mg/l
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Axis Title
MW-14
MW-8
DL
Federal and State GW Quality Criteria

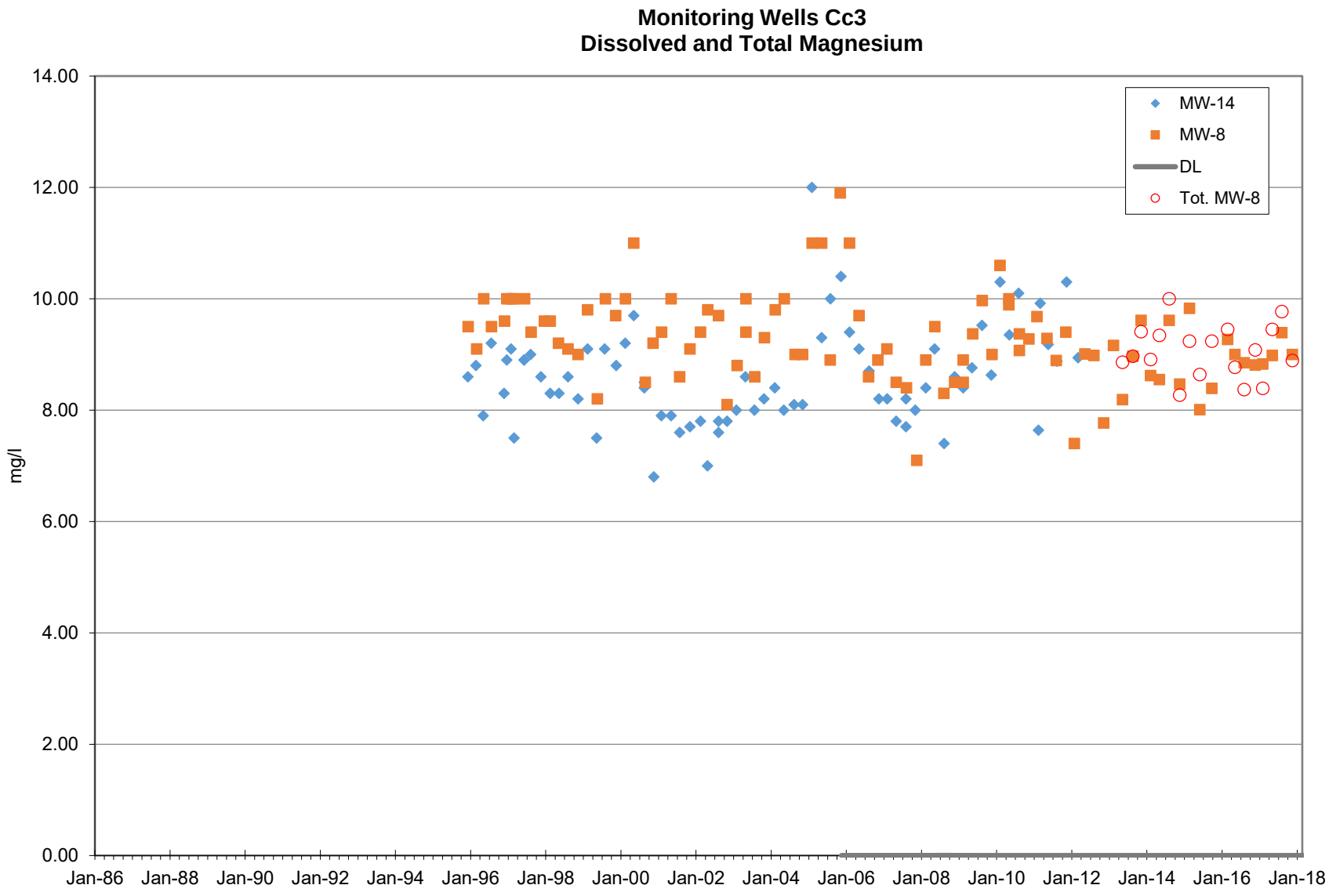

Monitoring Wells Cc3
Sulfate
Federal and State GW Quality Criteria 250 mg/L
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
mg/l
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Axis Title
MW-14
MW-8
DL

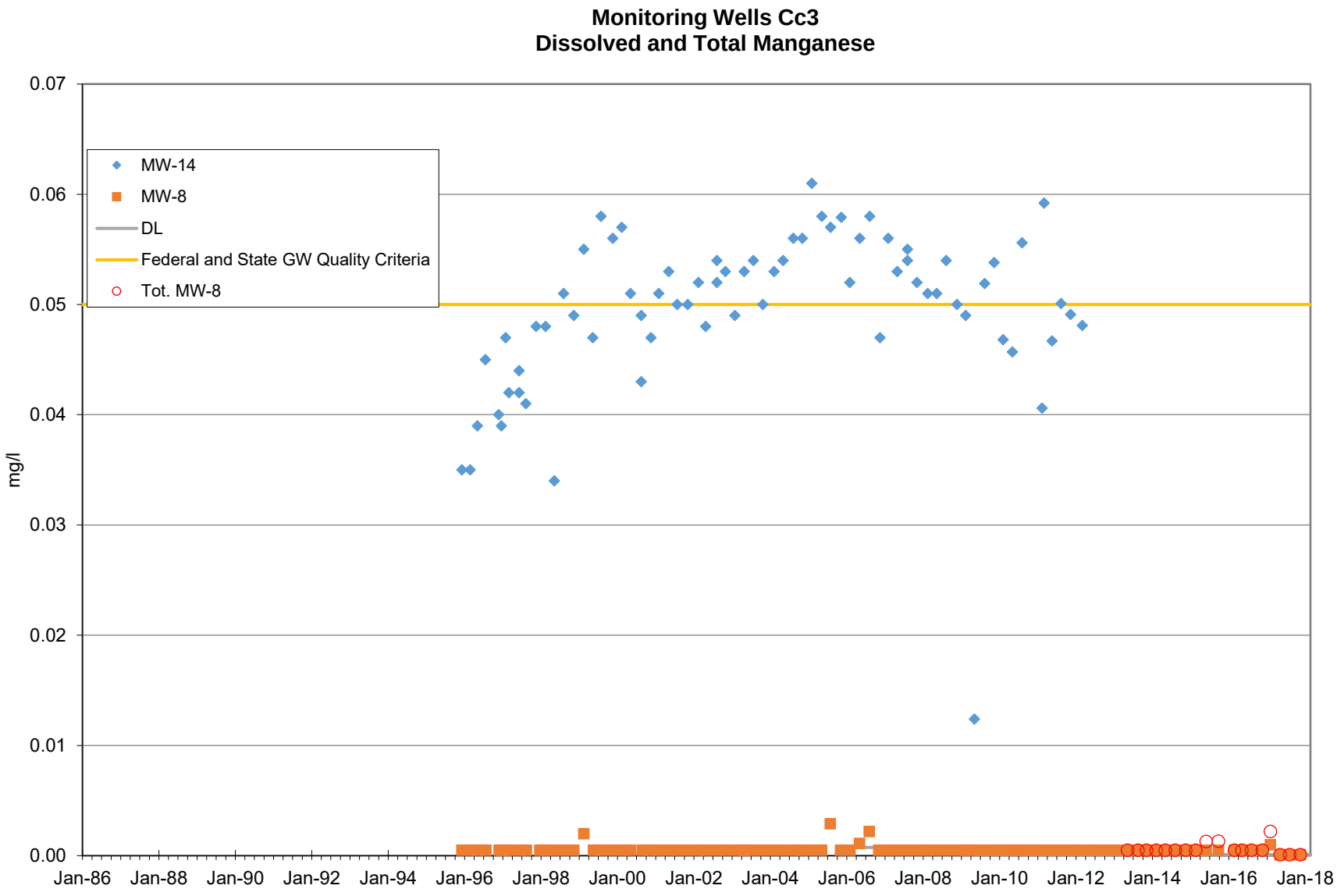

Monitoring Wells Cc3
Total Dissolved Solids
Federal and State GW Quality Criteria 500 mg/L
mg/l
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
DL

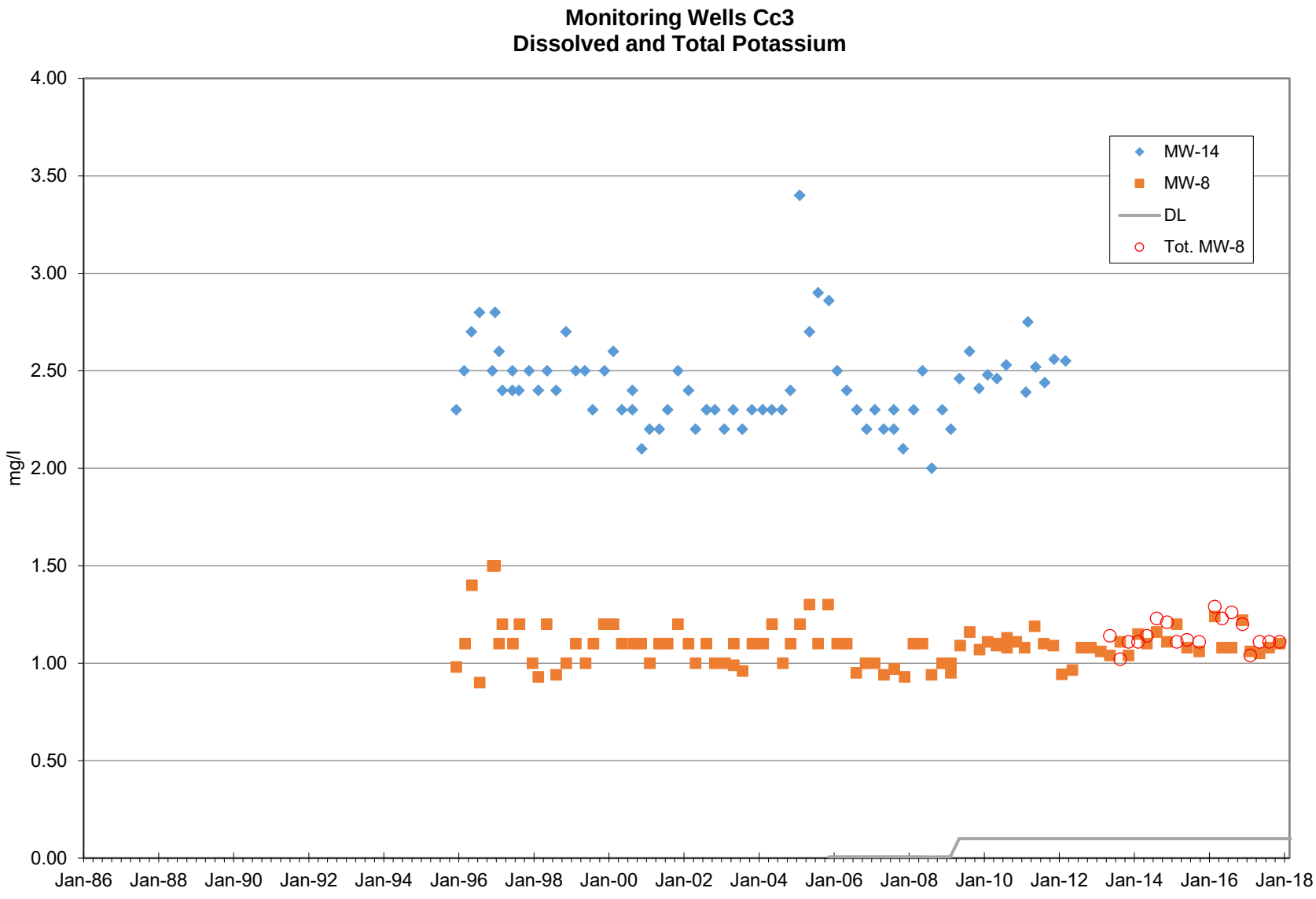

Monitoring Wells Cc3
Dissolved and Total Arsenic
mg/l
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
DL
GW Quality Criteria
Federal DW Standard
Tot. MW-8

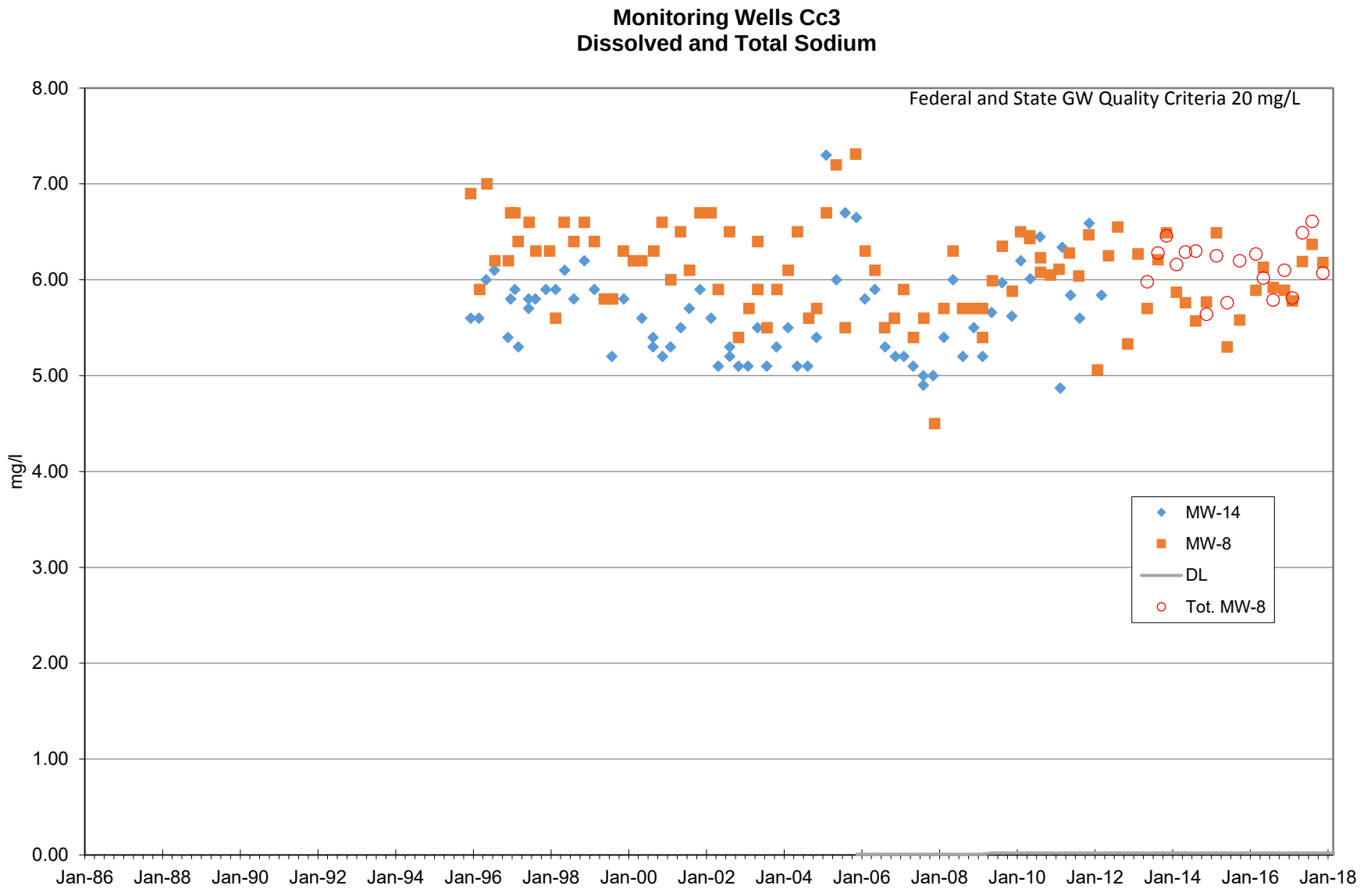

Monitoring Wells Cc3
Dissolved and Total Calcium
mg/l
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
DL
Tot. MW-8


Monitoring Wells Cc3
Dissolved and Total Iron
mg/l
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
DL
Federal and State GW Quality Criteria
Tot. MW-8


Monitoring Wells Cc3
Dissolved and Total Magnesium
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
mg/l
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
DL
Tot. MW-8

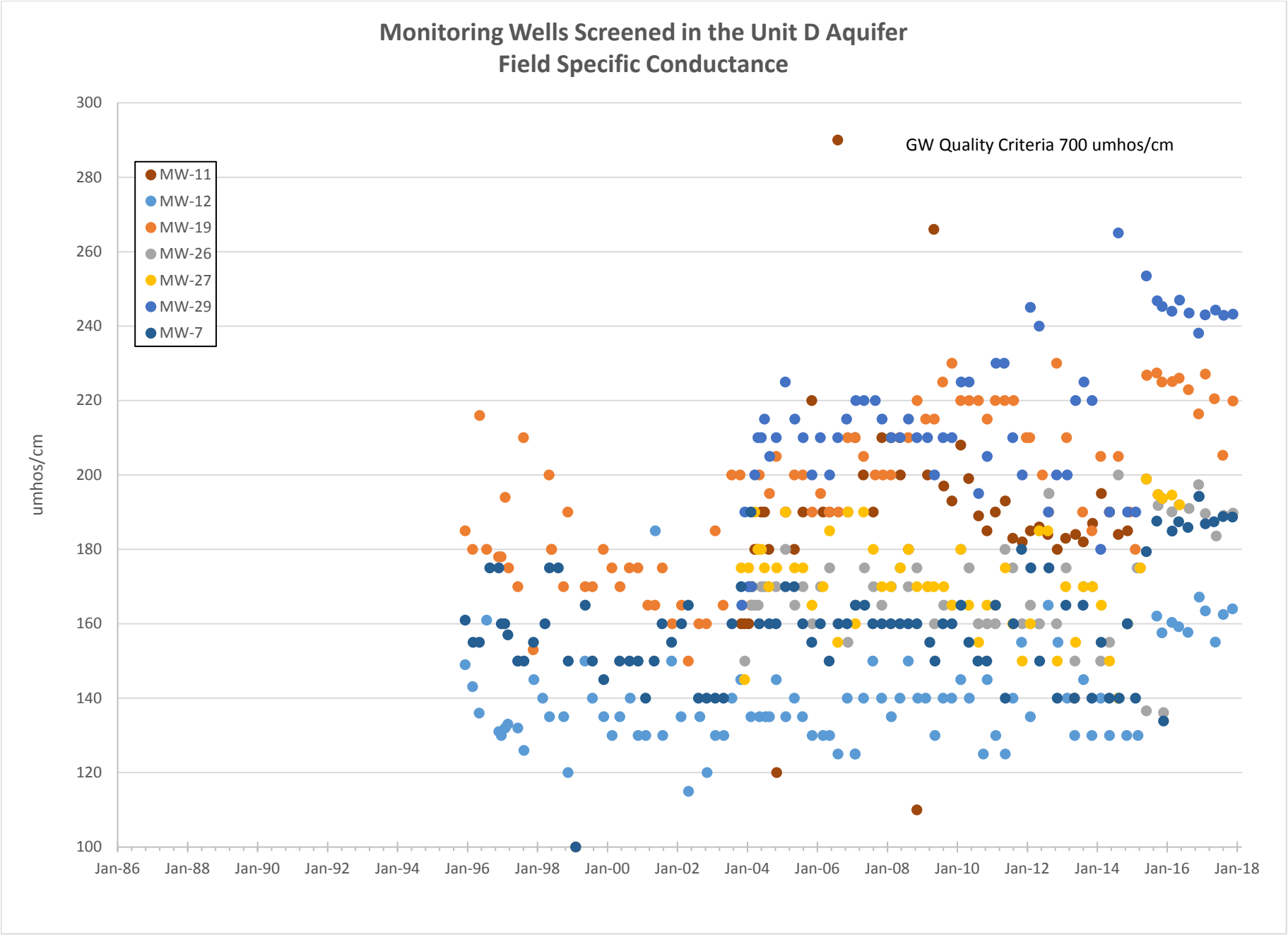

Monitoring Wells Cc3
Dissolved and Total Manganese
MW-14
MW-8
DL
Federal and State GW Quality Criteria
Tot. MW-8
mg/l
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

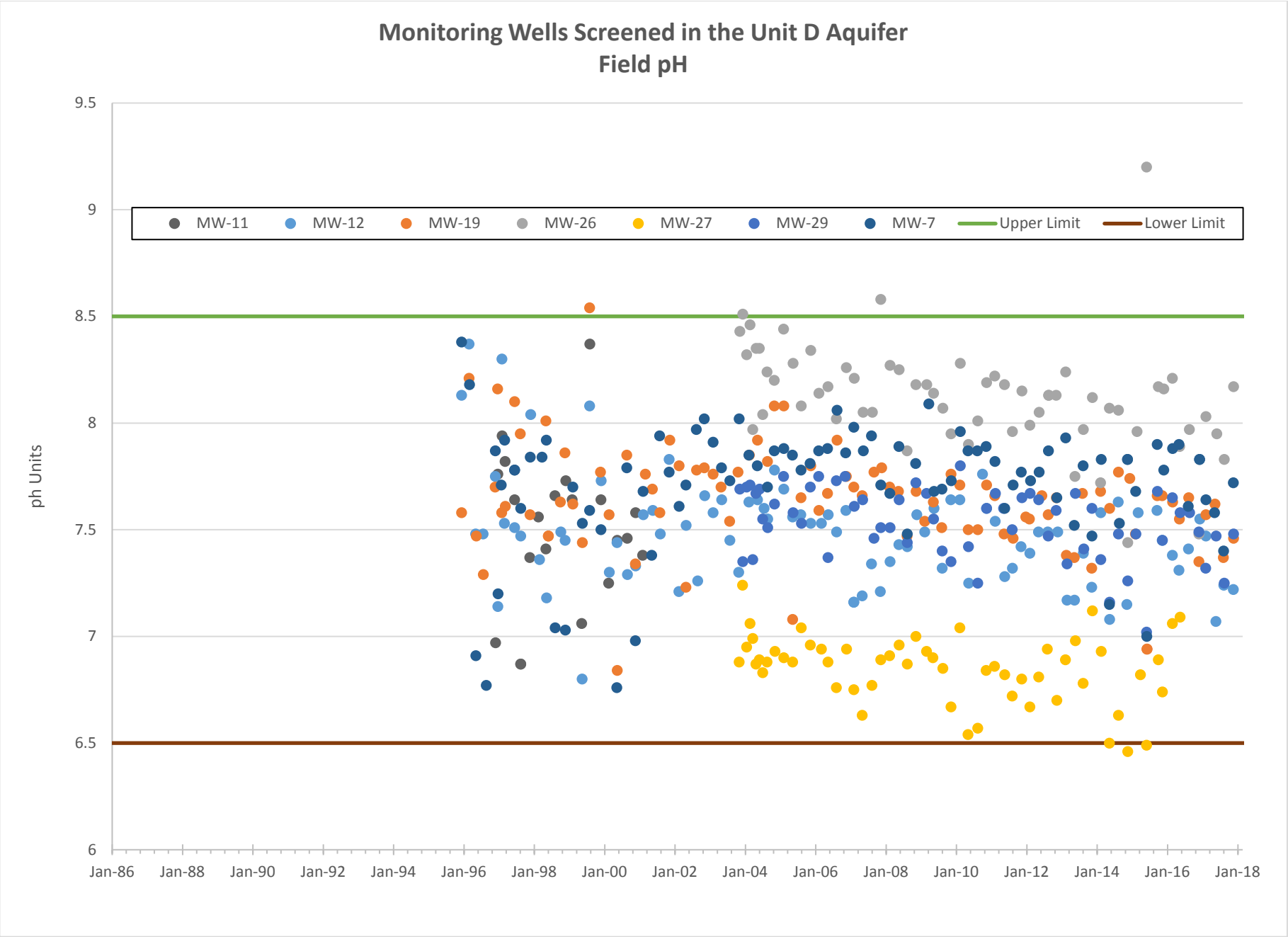

Monitoring Wells Cc3
Dissolved and Total Potassium
mg/l
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
DL
Tot. MW-8

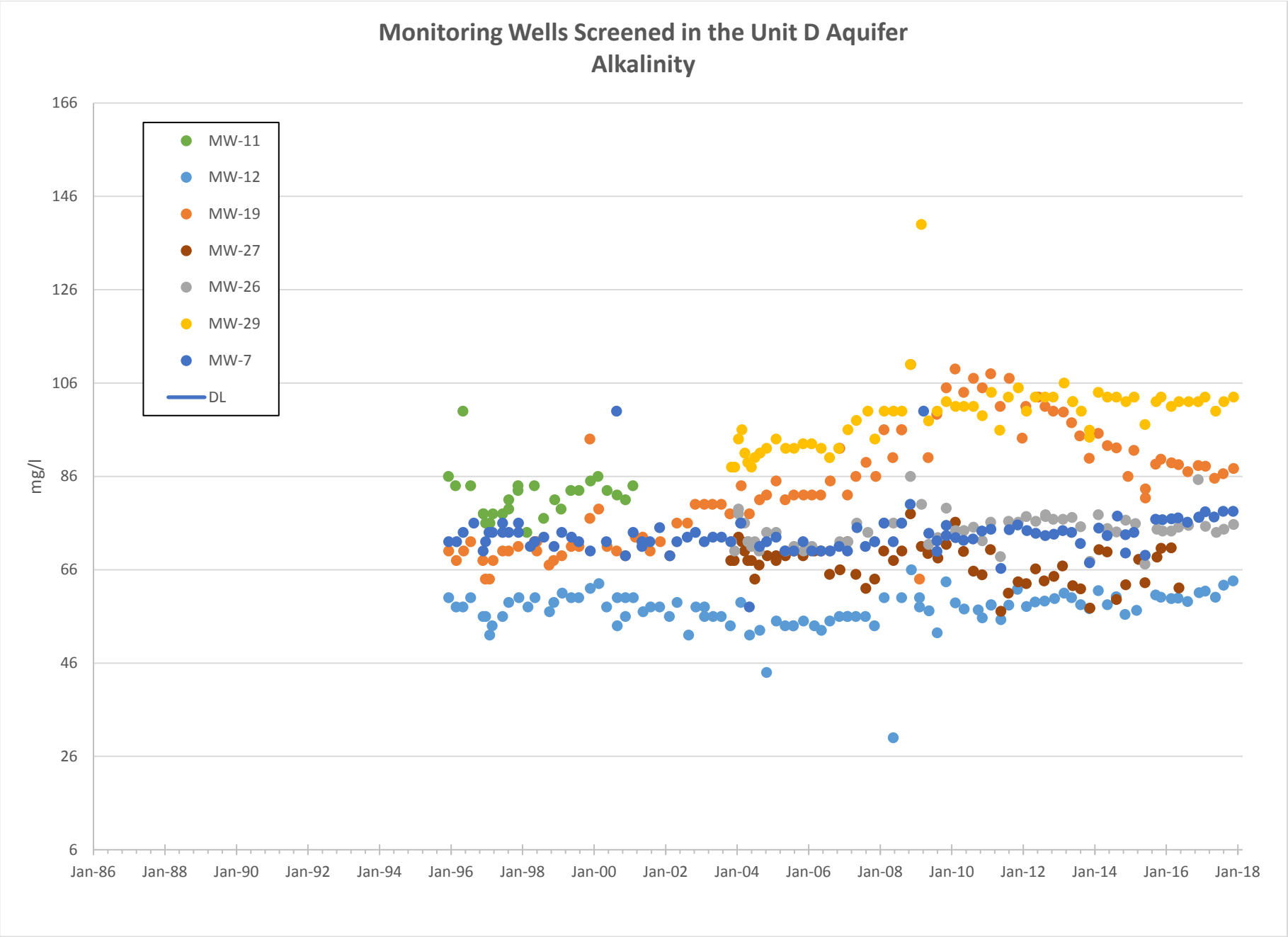

Monitoring Wells Cc3
Dissolved and Total Sodium
Federal and State GW Quality Criteria 20 mg/L
mg/l
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-14
MW-8
DL
Tot. MW-8

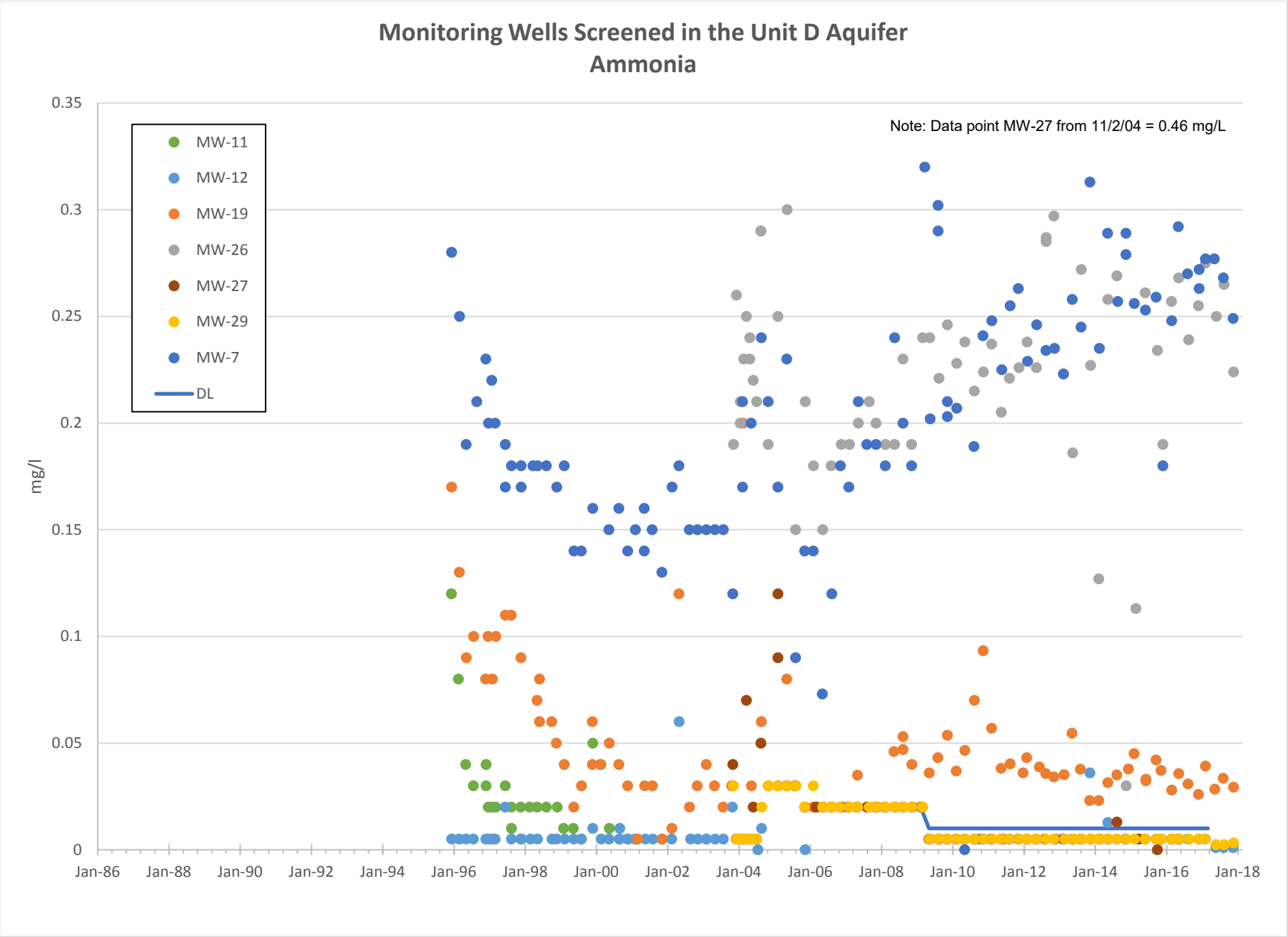
Appendix F

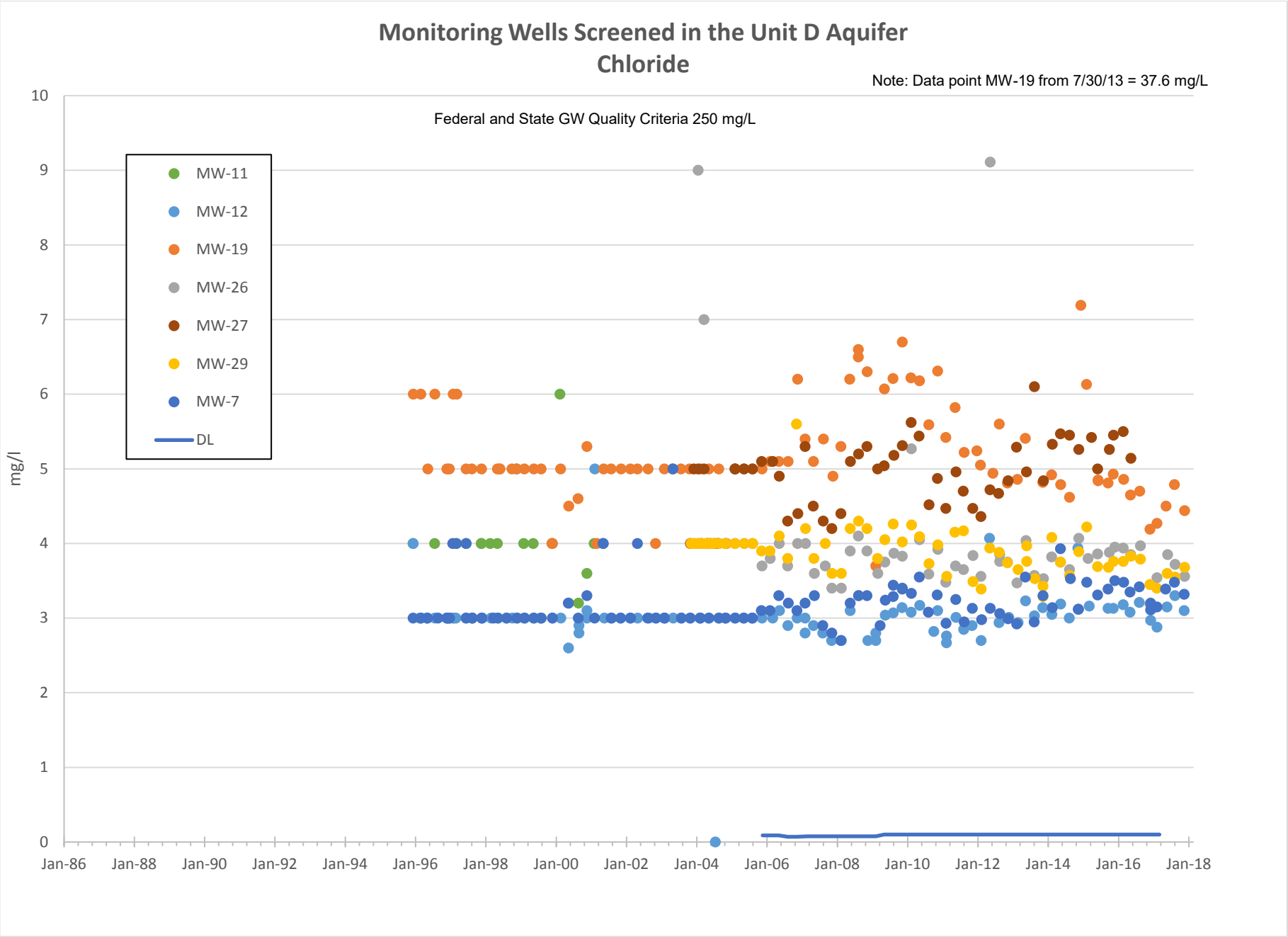
Time Concentration Plots for Regional Aquifer and Channel Cc3

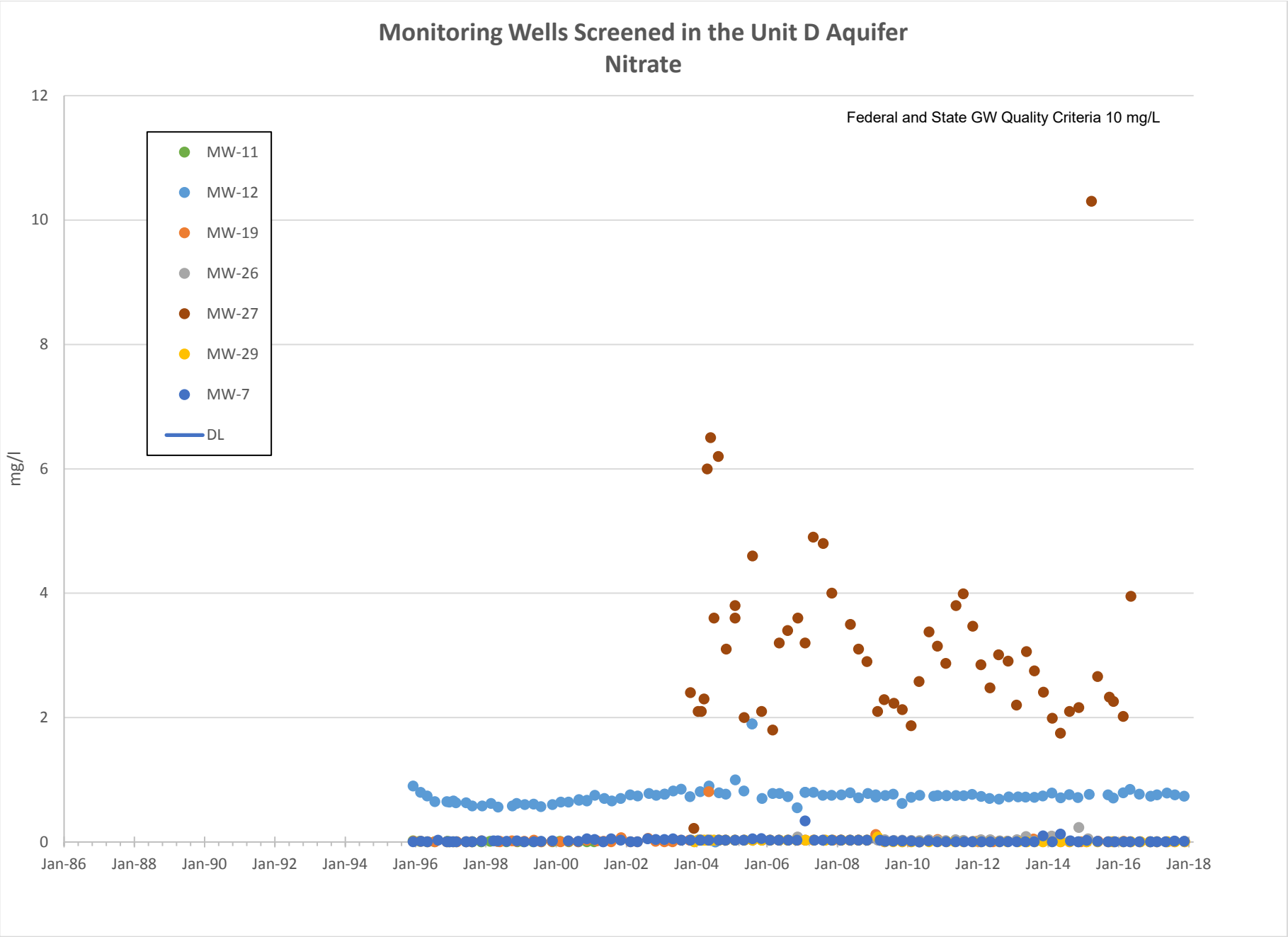

Monitoring Wells Screened in the Unit D Aquifer
Field Specific Conductance
GW Quality Criteria 700 umhos/cm
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
umhos/cm
300
280
260
240
220
200
180
160
140
120
100
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

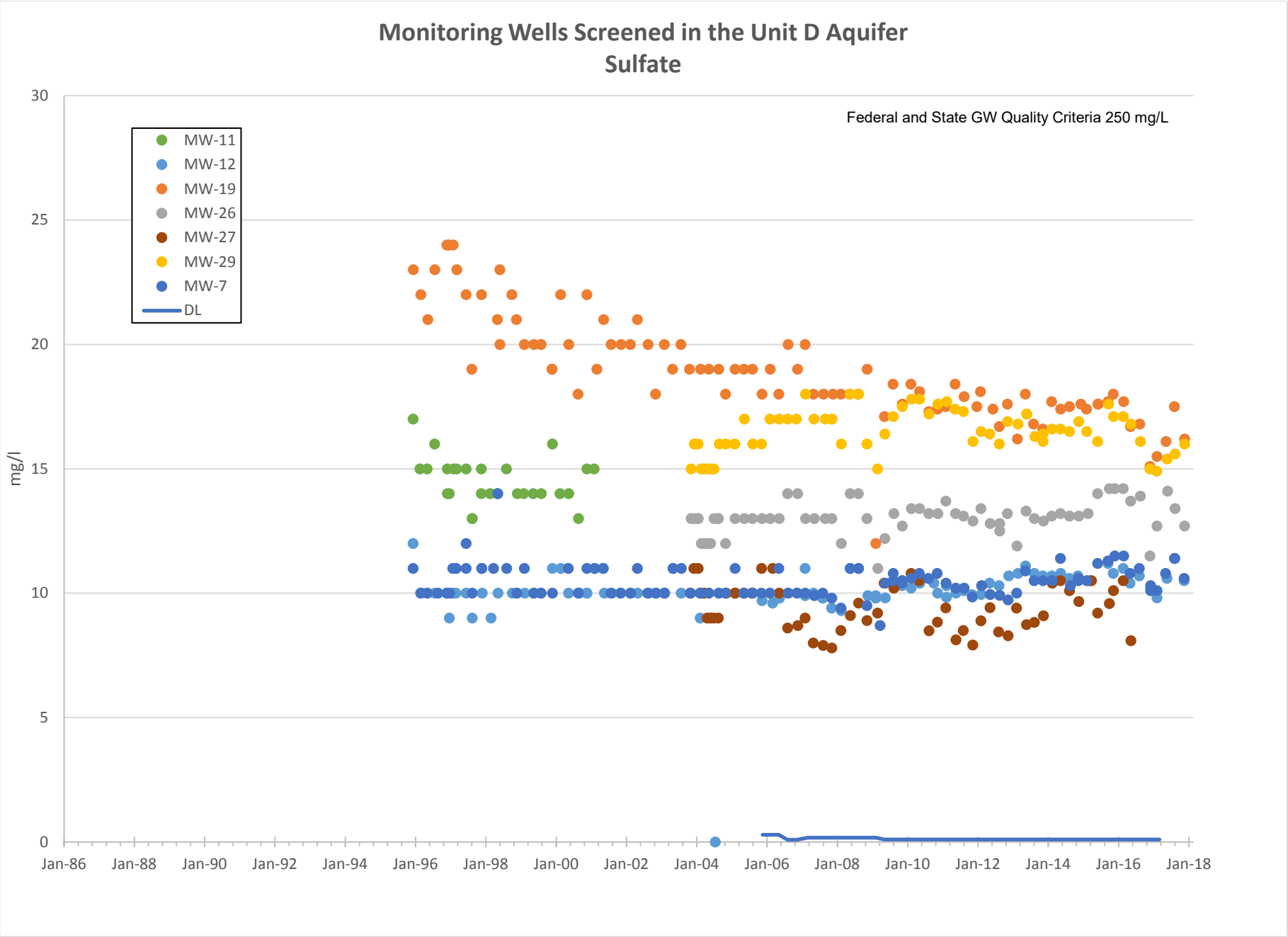

Monitoring Wells Screened in the Unit D Aquifer
Field pH
ph Units
9.5
9
8.5
8
7.5
7
6.5
6
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
Upper Limit
Lower Limit
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

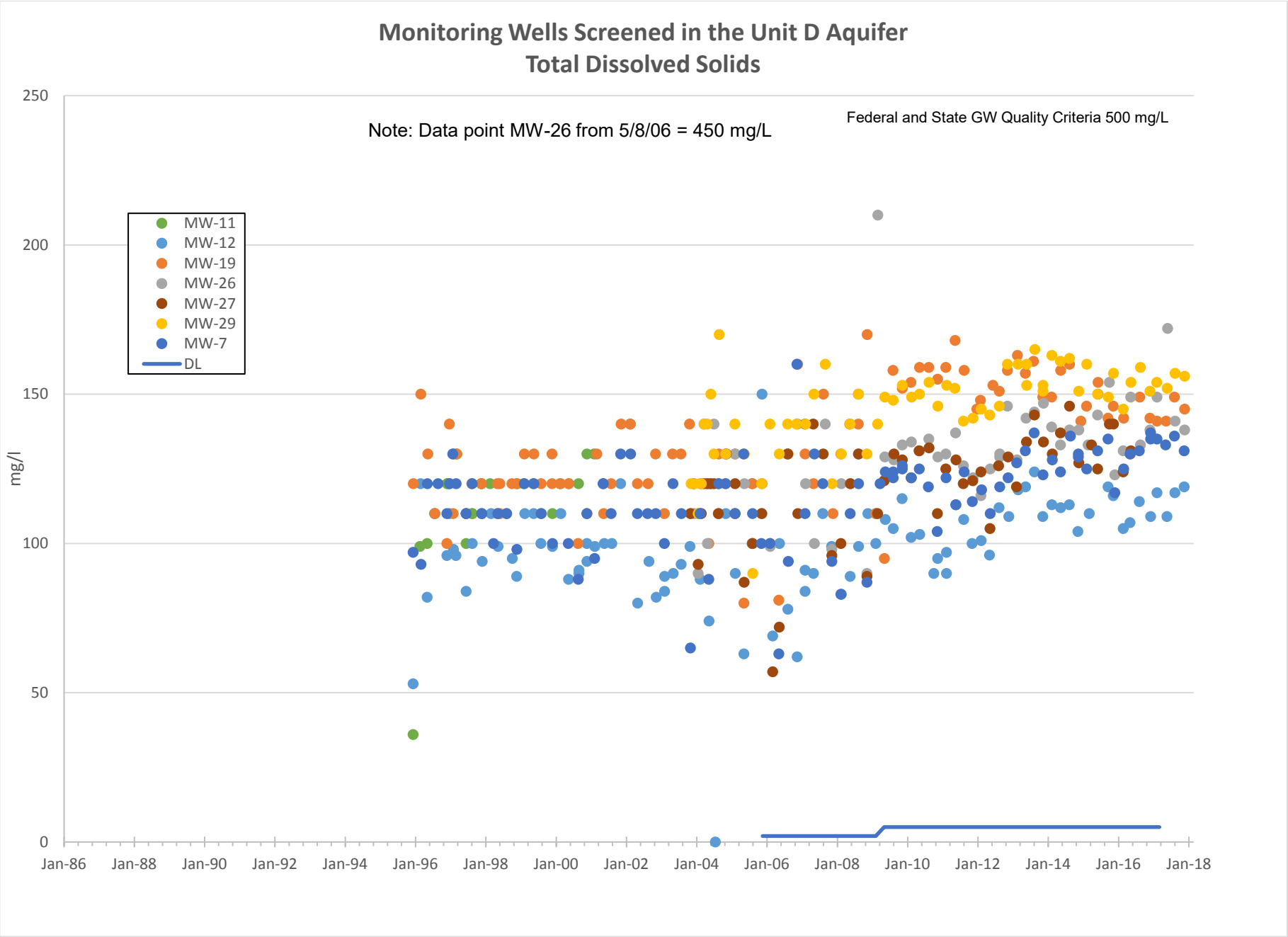

Monitoring Wells Screened in the Unit D Aquifer
Alkalinity
mg/l
166
146
126
106
86
66
46
26
6
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-11
MW-12
MW-19
MW-27
MW-26
MW-29
MW-7
DL

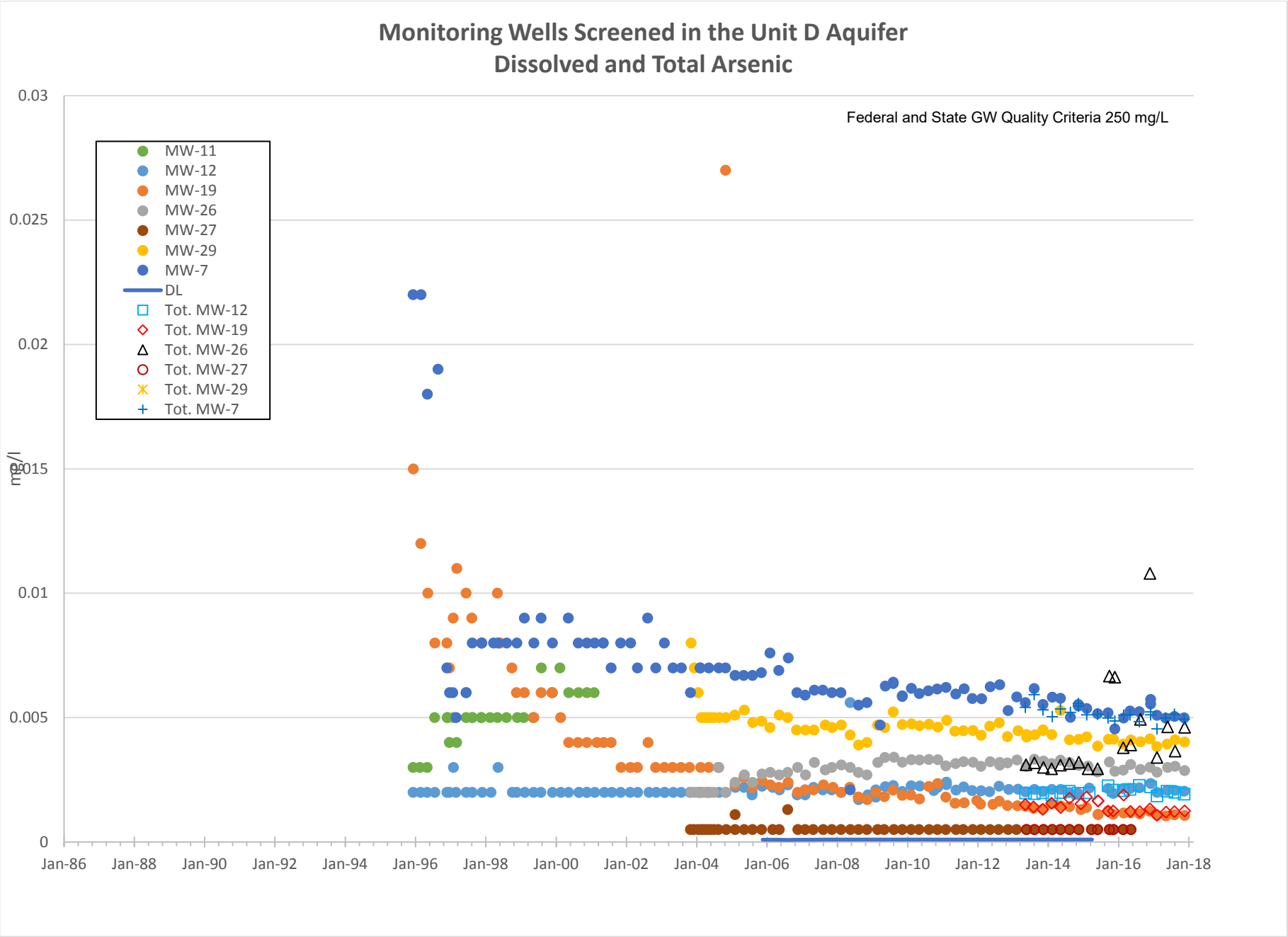

Monitoring Wells Screened in the Unit D Aquifer
Ammonia
Note: Data point MW-27 from 11/2/04 = 0.46 mg/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
mg/l
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

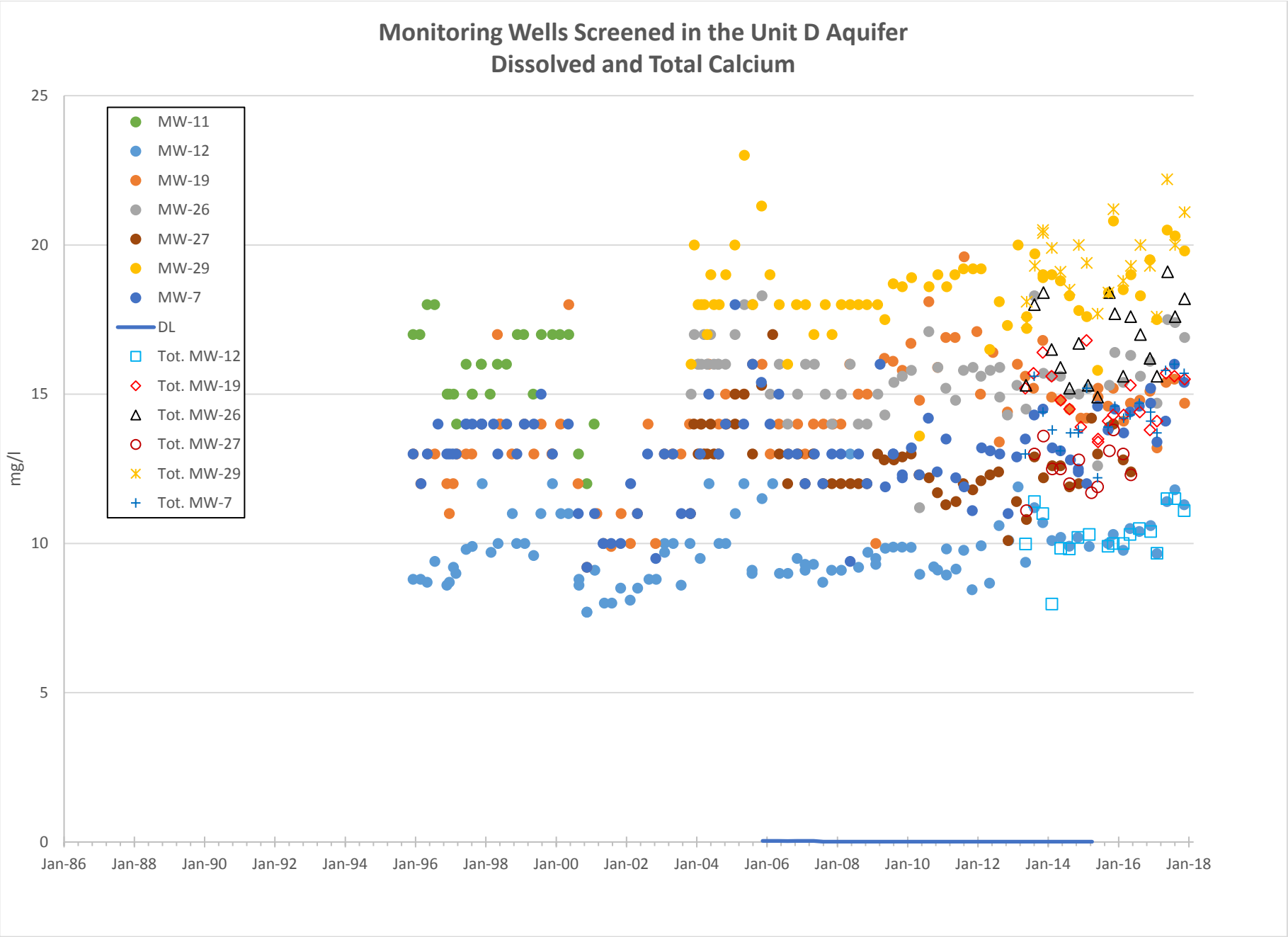

Monitoring Wells Screened in the Unit D Aquifer
Chloride
Note: Data point MW-19 from 7/30/13 = 37.6 mg/L
Federal and State GW Quality Criteria 250 mg/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
mg/l
0
1
2
3
4
5
6
7
8
9
10
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

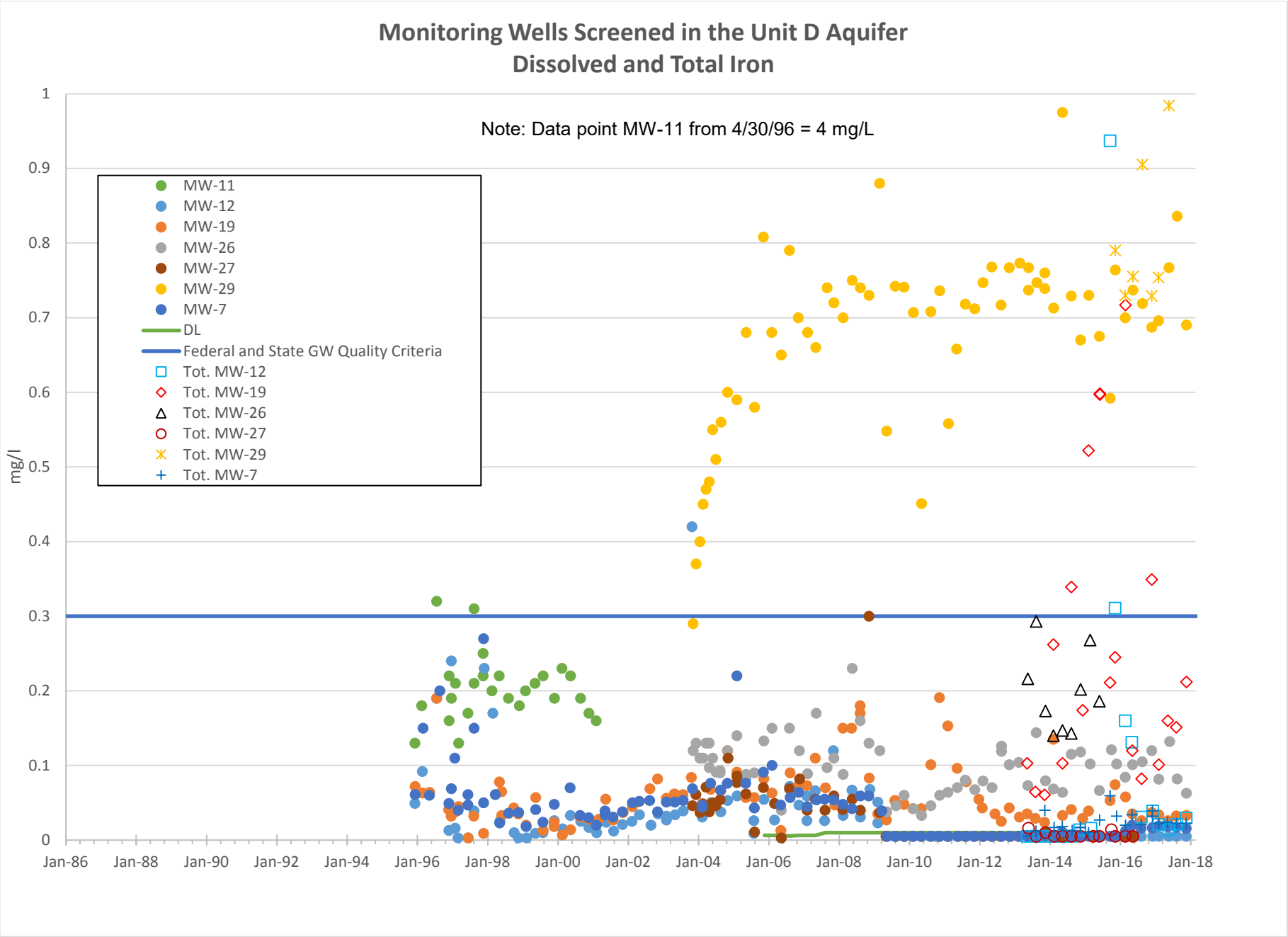

Monitoring Wells Screened in the Unit D Aquifer
Nitrate
Federal and State GW Quality Criteria 10 mg/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
mg/l
12
10
8
6
4
2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

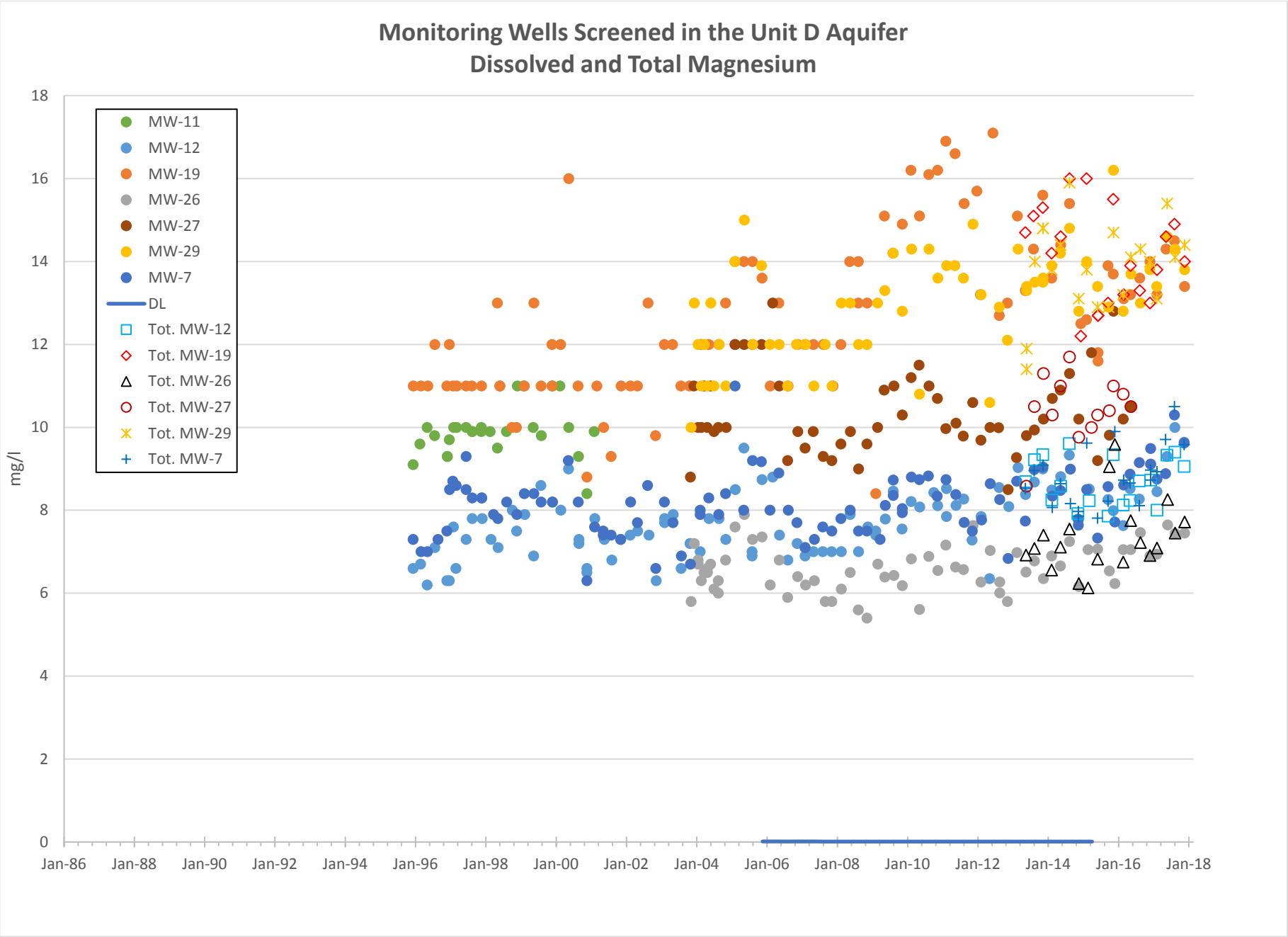

Monitoring Wells Screened in the Unit D Aquifer
Sulfate
Federal and State GW Quality Criteria 250 mg/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
mg/l
30
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

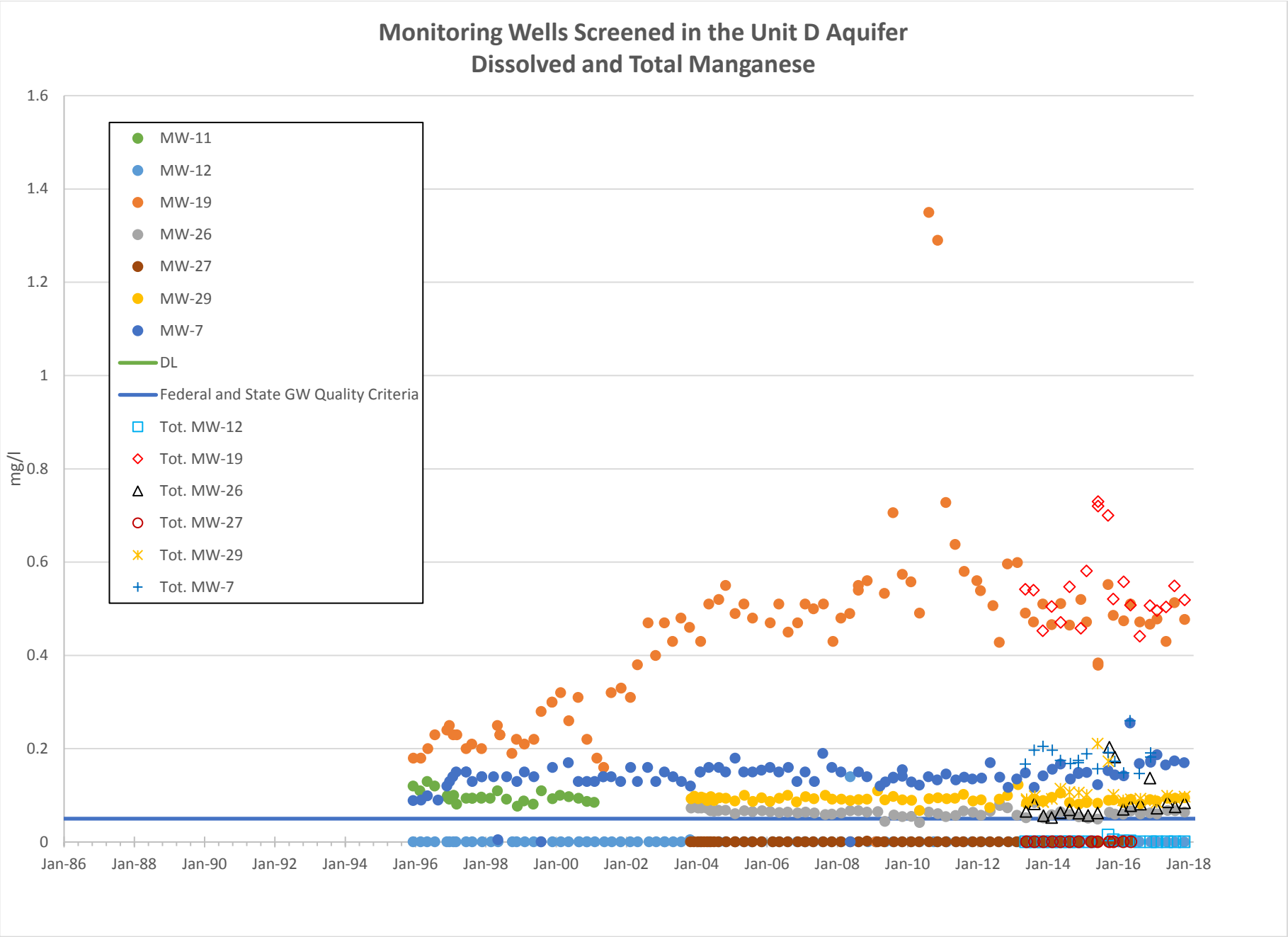

Monitoring Wells Screened in the Unit D Aquifer
Total Dissolved Solids
Note: Data point MW-26 from 5/8/06 = 450 mg/L
Federal and State GW Quality Criteria 500 mg/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
mg/l
250
200
150
100
50
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

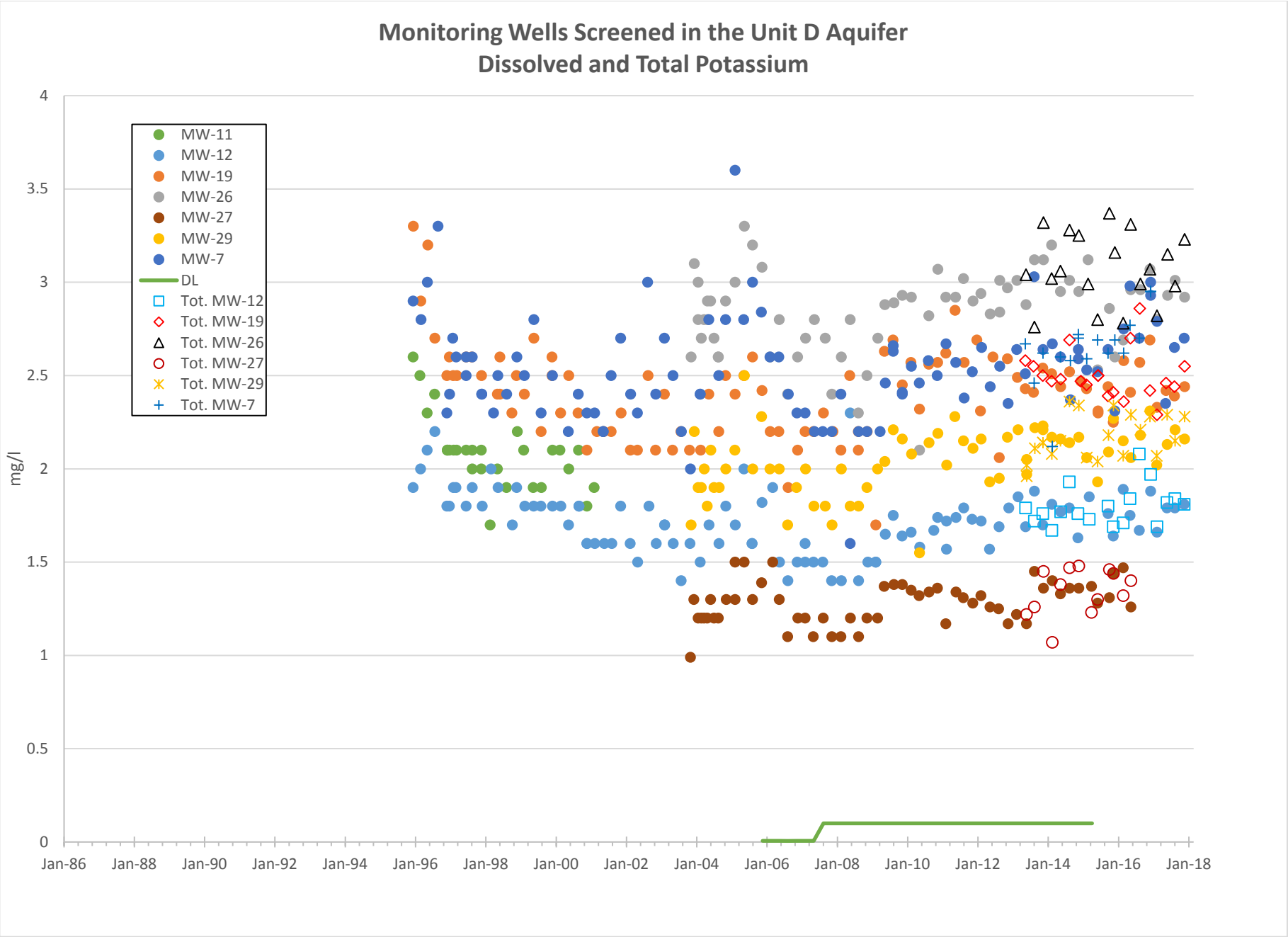

Monitoring Wells Screened in the Unit D Aquifer
Dissolved and Total Arsenic
Federal and State GW Quality Criteria 250 mg/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Tot. MW-12
Tot. MW-19
Tot. MW-26
Tot. MW-27
Tot. MW-29
Tot. MW-7
mg/l
0.03
0.025
0.02
0.015
0.01
0.005
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

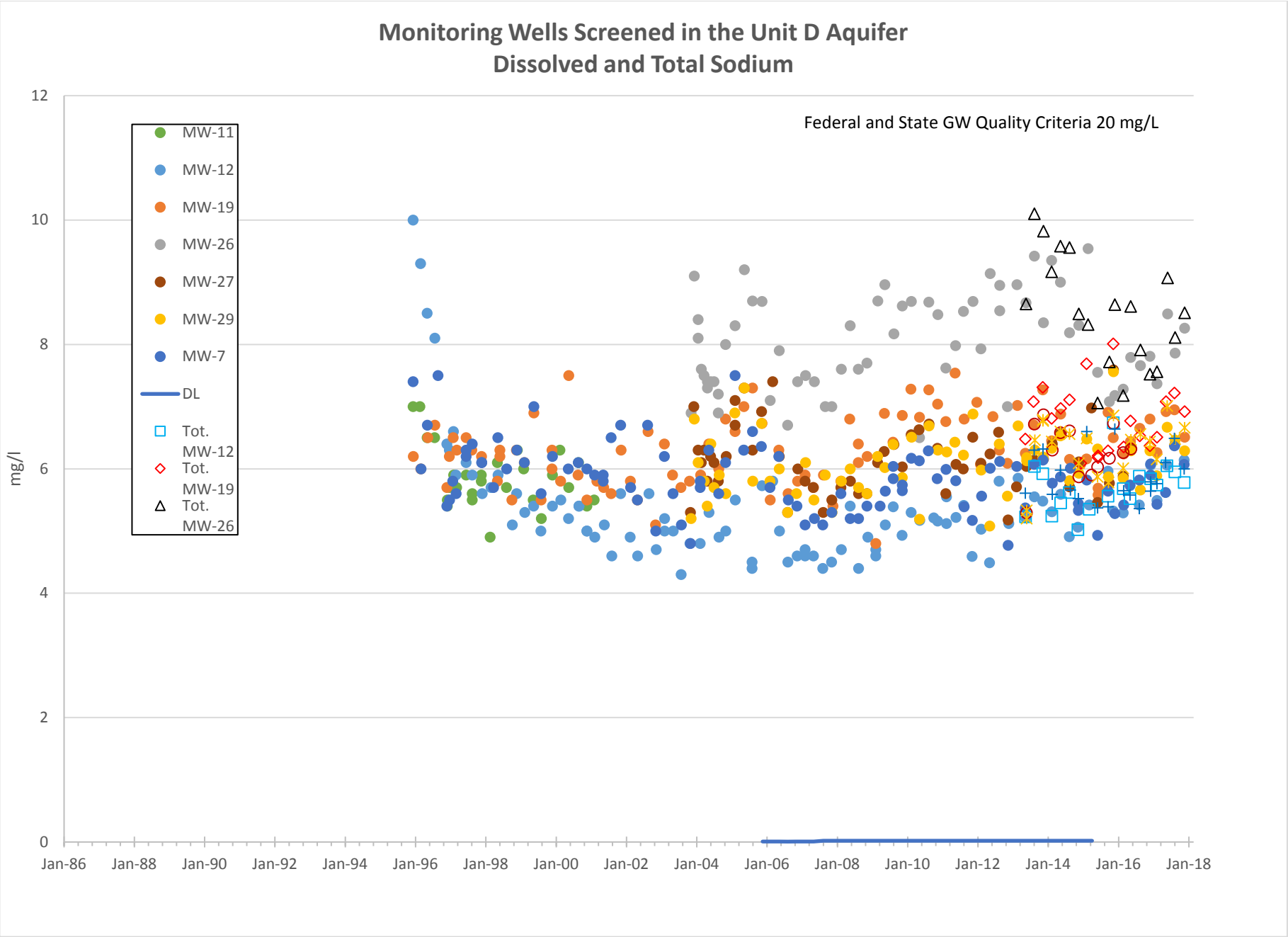

Monitoring Wells Screened in the Unit D Aquifer
Dissolved and Total Calcium
mg/l
25
20
15
10
5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Tot. MW-12
Tot. MW-19
Tot. MW-26
Tot. MW-27
Tot. MW-29
Tot. MW-7

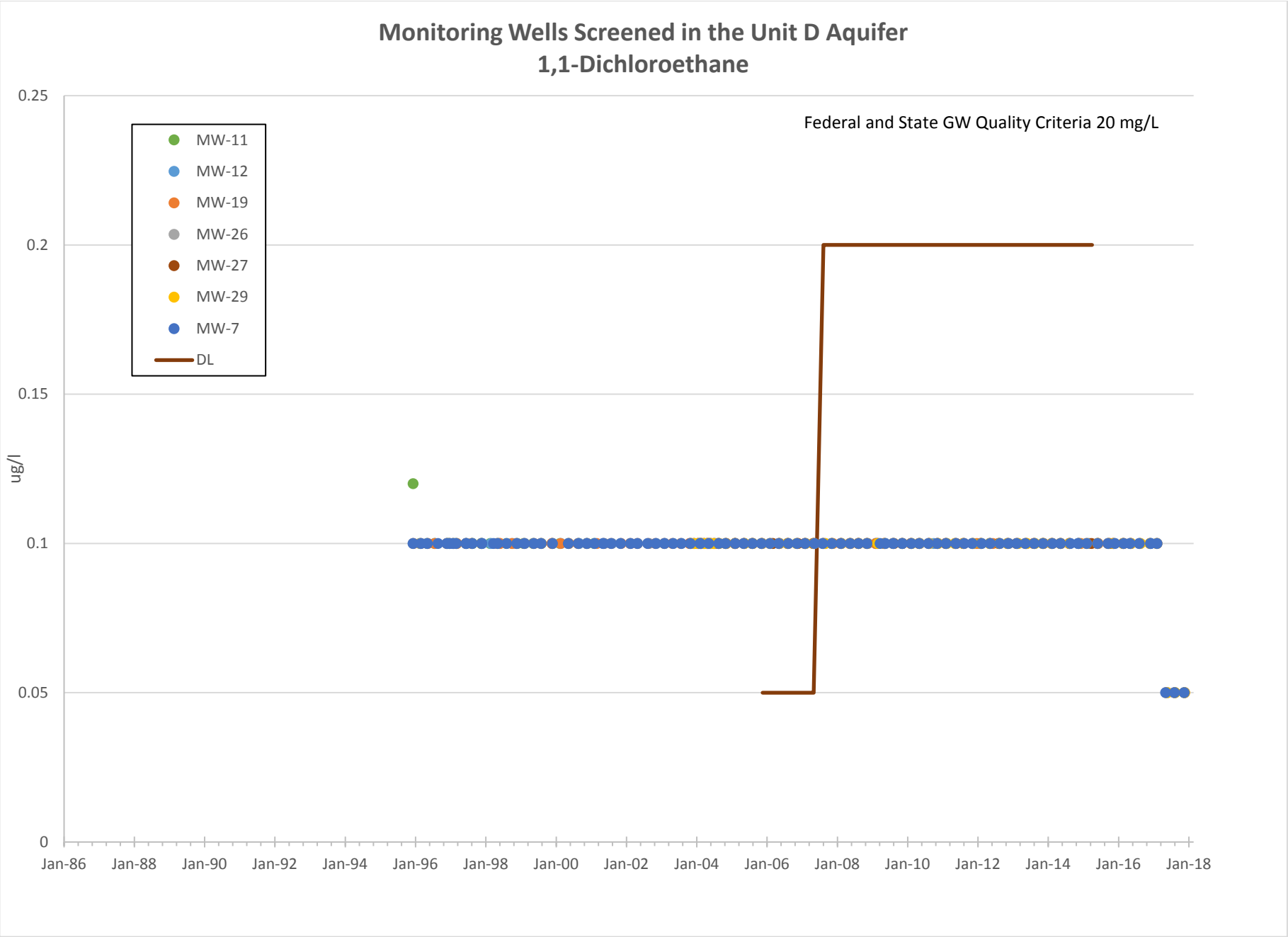

Monitoring Wells Screened in the Unit D Aquifer
Dissolved and Total Iron
Note: Data point MW-11 from 4/30/96 = 4 mg/L
mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Federal and State GW Quality Criteria
Tot. MW-12
Tot. MW-19
Tot. MW-26
Tot. MW-27
Tot. MW-29
Tot. MW-7

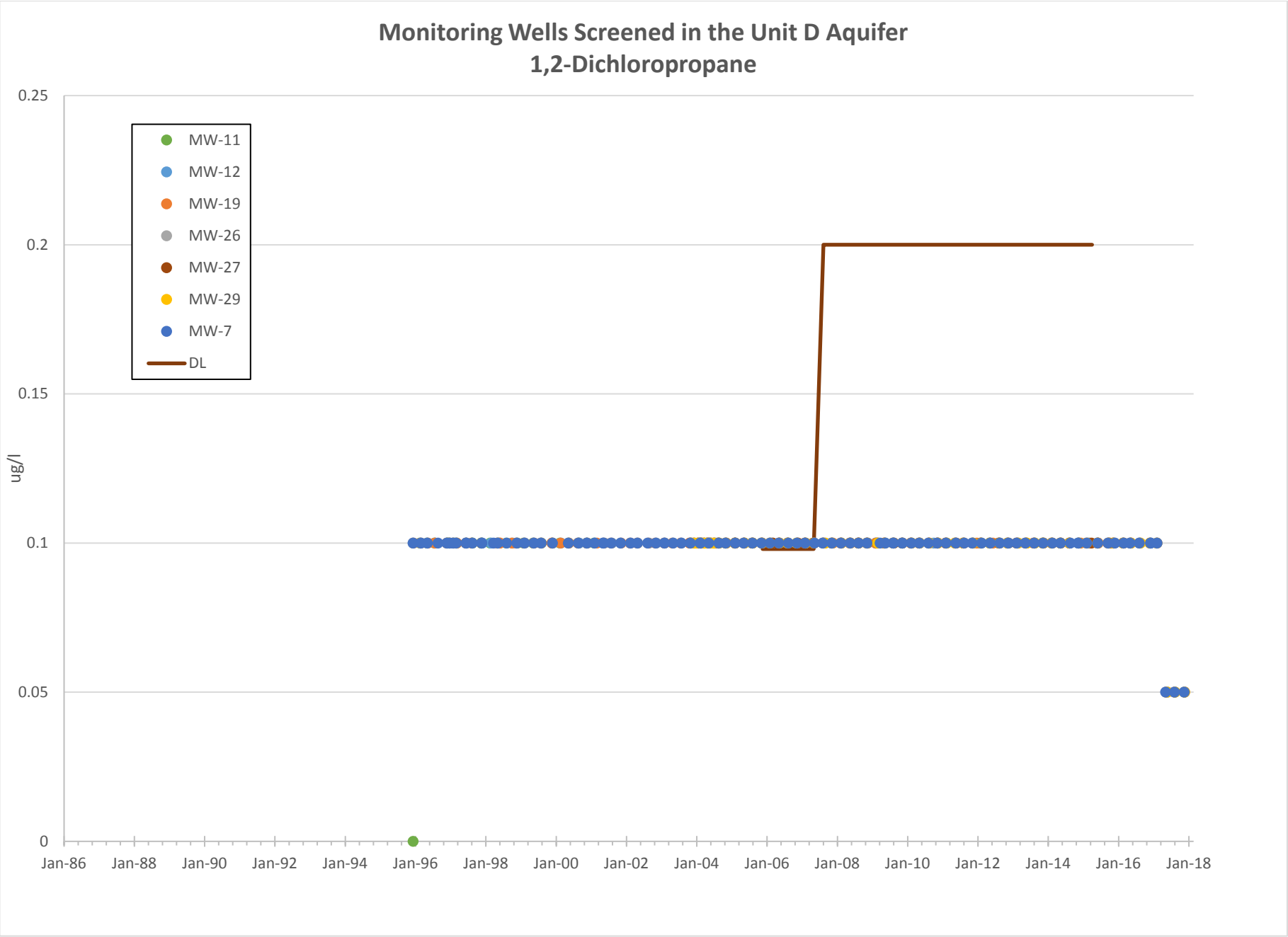

Monitoring Wells Screened in the Unit D Aquifer
Dissolved and Total Magnesium
mg/l
18
16
14
12
10
8
6
4
2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Tot. MW-12
Tot. MW-19
Tot. MW-26
Tot. MW-27
Tot. MW-29
Tot. MW-7

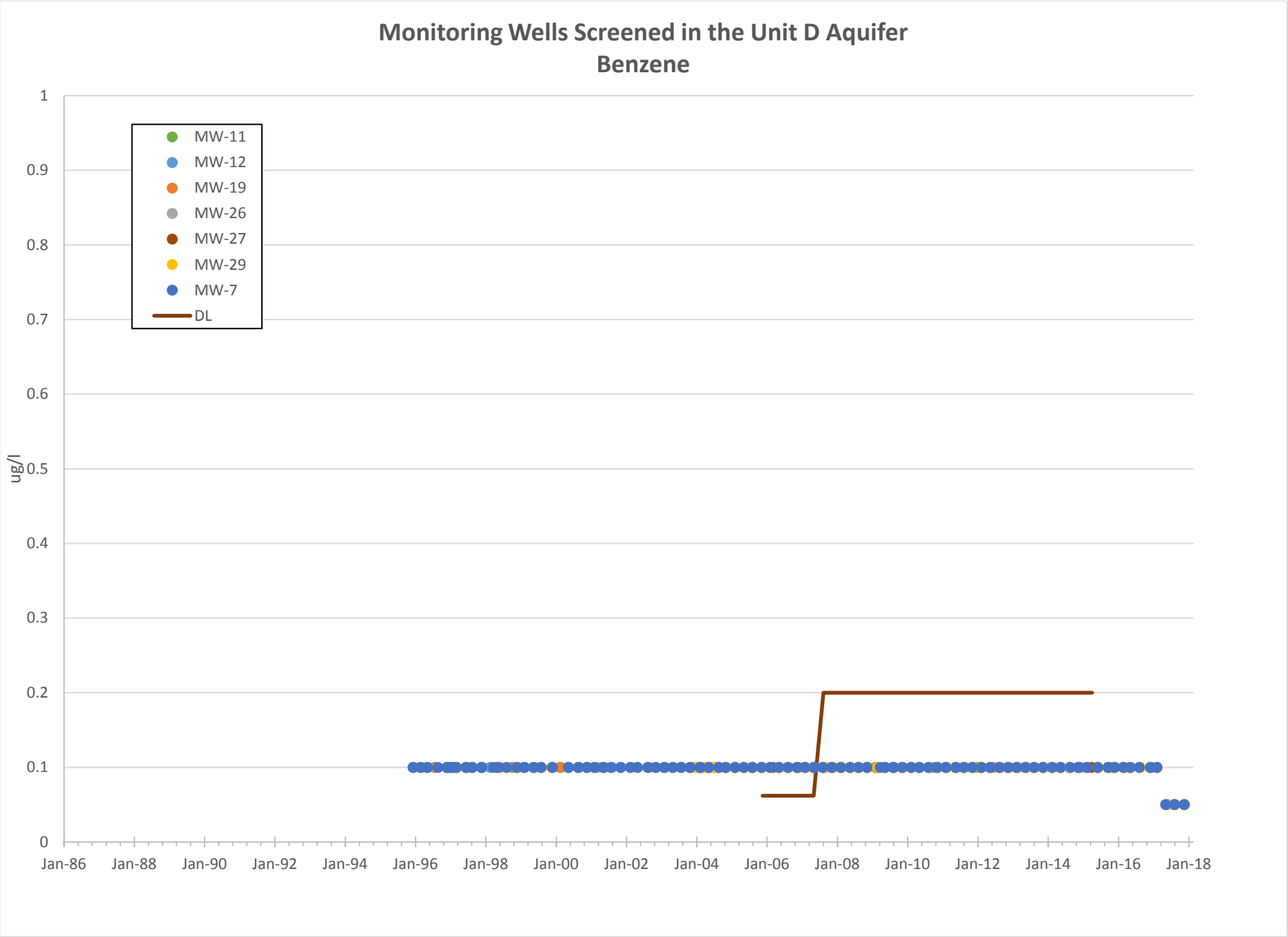

Monitoring Wells Screened in the Unit D Aquifer
Dissolved and Total Manganese
mg/l
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Federal and State GW Quality Criteria
Tot. MW-12
Tot. MW-19
Tot. MW-26
Tot. MW-27
Tot. MW-29
Tot. MW-7


Monitoring Wells Screened in the Unit D Aquifer
Dissolved and Total Potassium
mg/l
4
3.5
3
2.5
2
1.5
1
0.5
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Tot. MW-12
Tot. MW-19
Tot. MW-26
Tot. MW-27
Tot. MW-29
Tot. MW-7


Monitoring Wells Screened in the Unit D Aquifer
Dissolved and Total Sodium
Federal and State GW Quality Criteria 20 mg/L
mg/l
12
10
8
6
4
2
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Tot. MW-12
Tot. MW-19
Tot. MW-26


Monitoring Wells Screened in the Unit D Aquifer
1,1-Dichloroethane
Federal and State GW Quality Criteria 20 mg/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
ug/l
0.25
0.2
0.15
0.1
0.05
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
1,2-Dichloropropane
0.25
0.2
0.15
0.1
0.05
0
ug/l
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Benzene
ug/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
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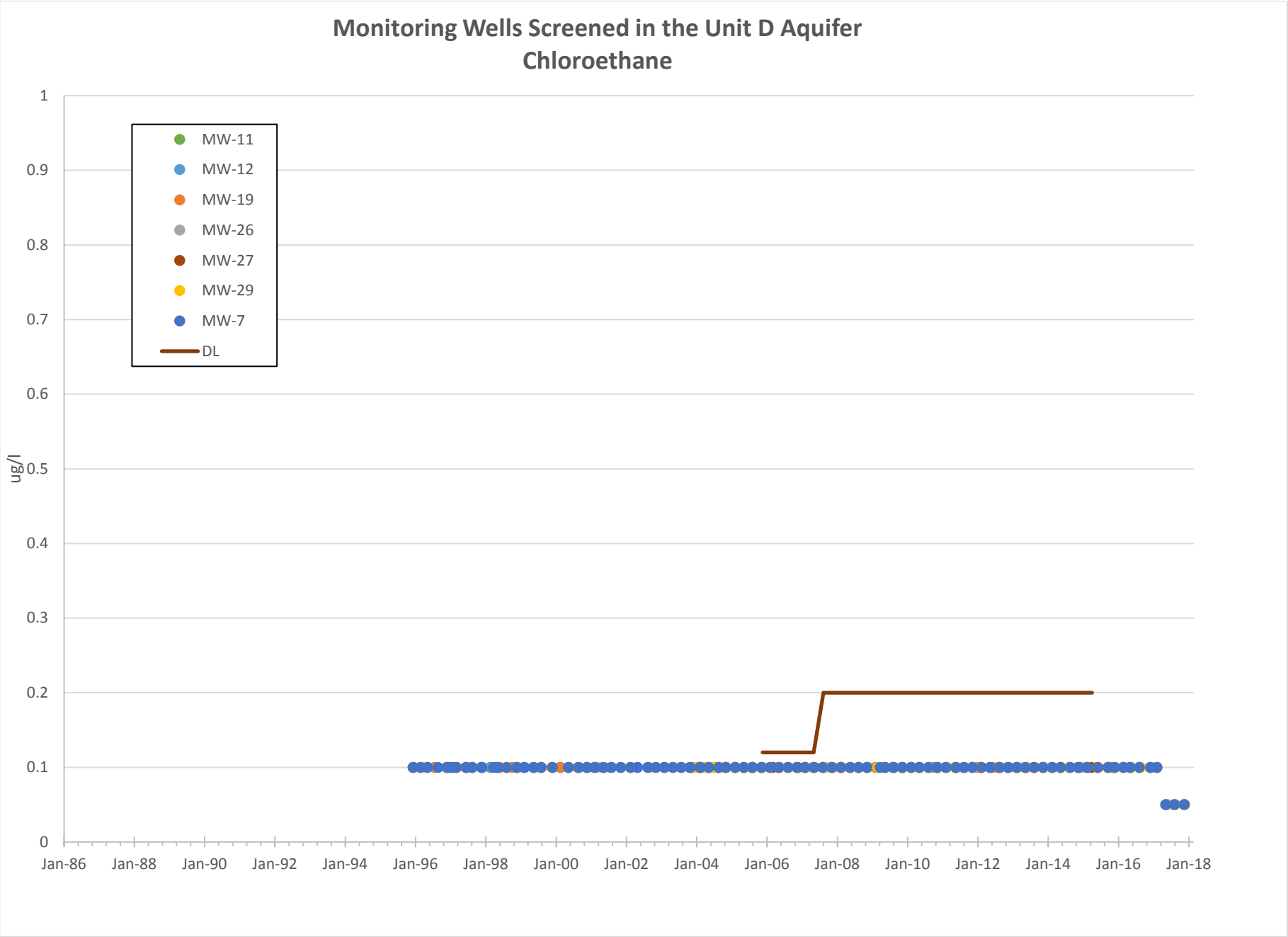
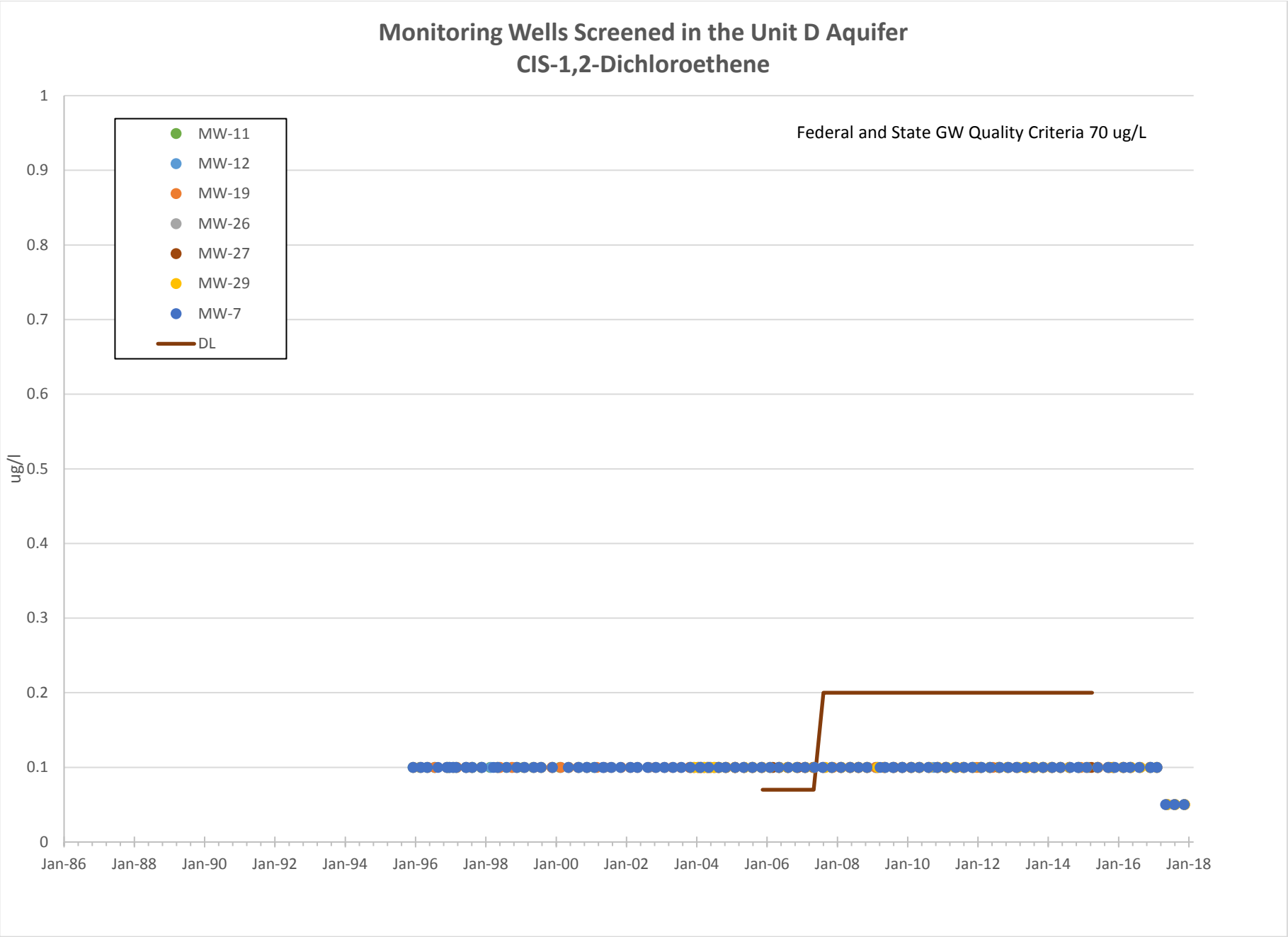
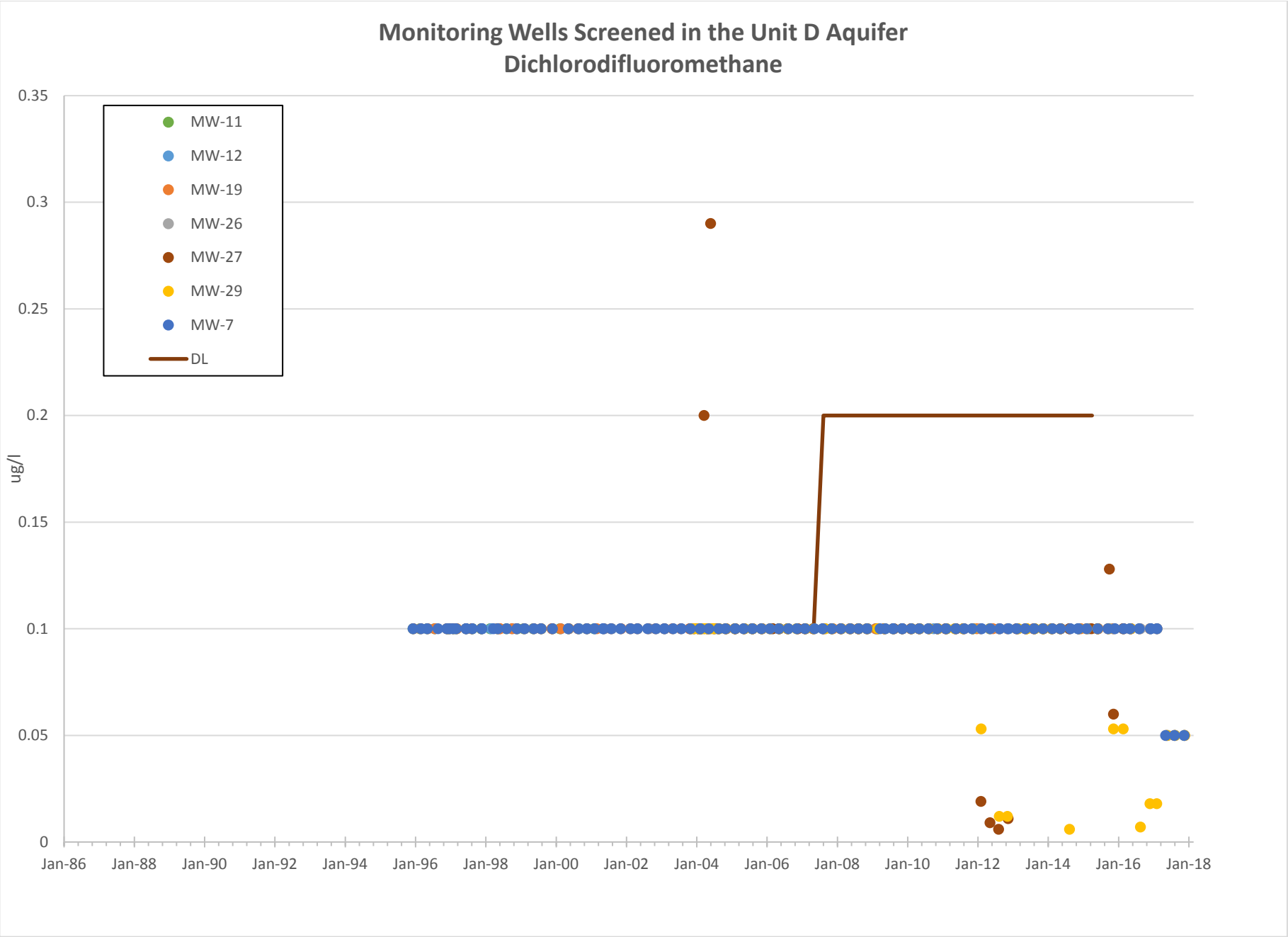
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Chloroethane
ug/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
CIS-1,2-Dichloroethene
Federal and State GW Quality Criteria 70 ug/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
ug/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Dichlorodifluoromethane
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
ug/l
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
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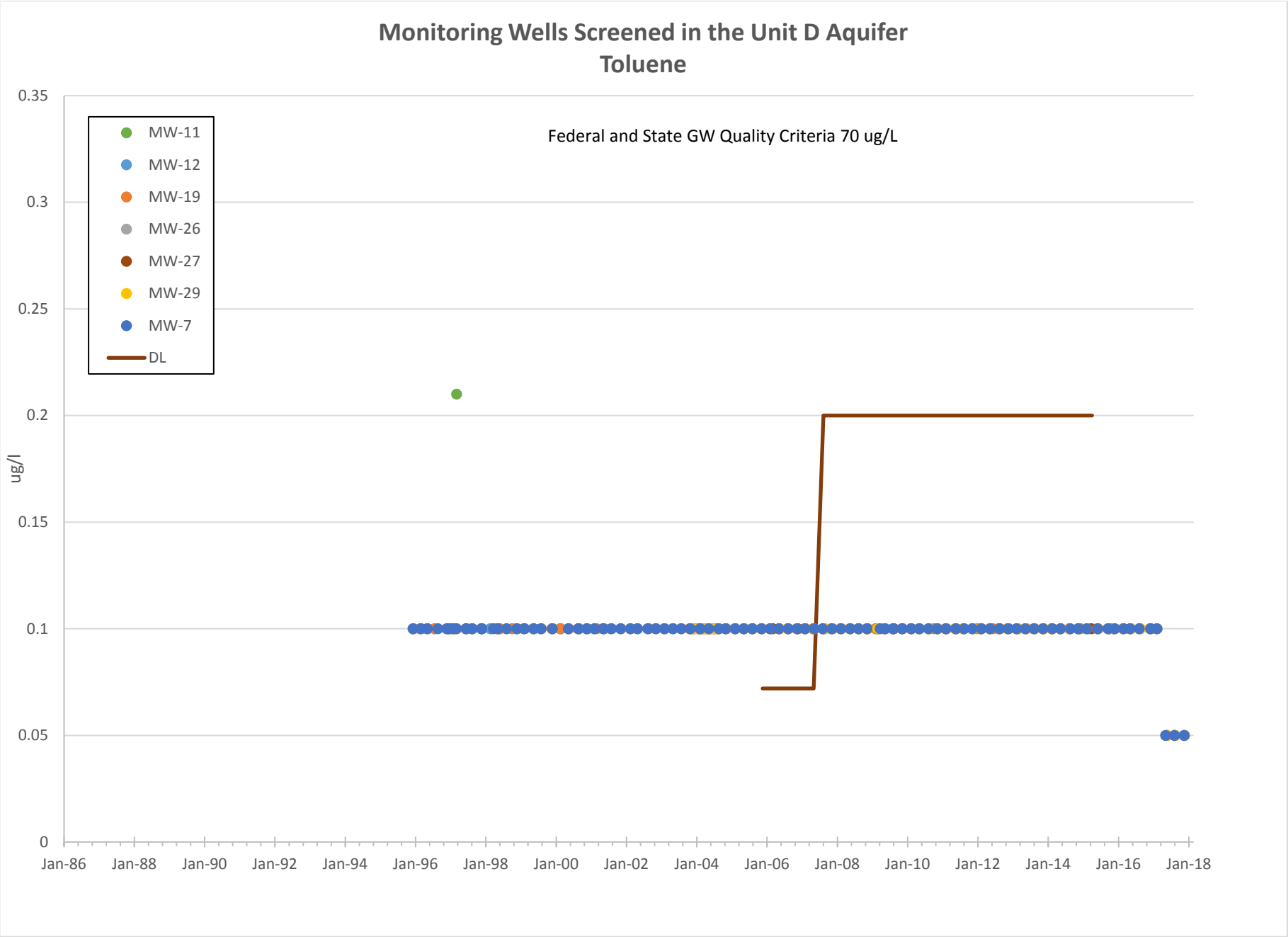
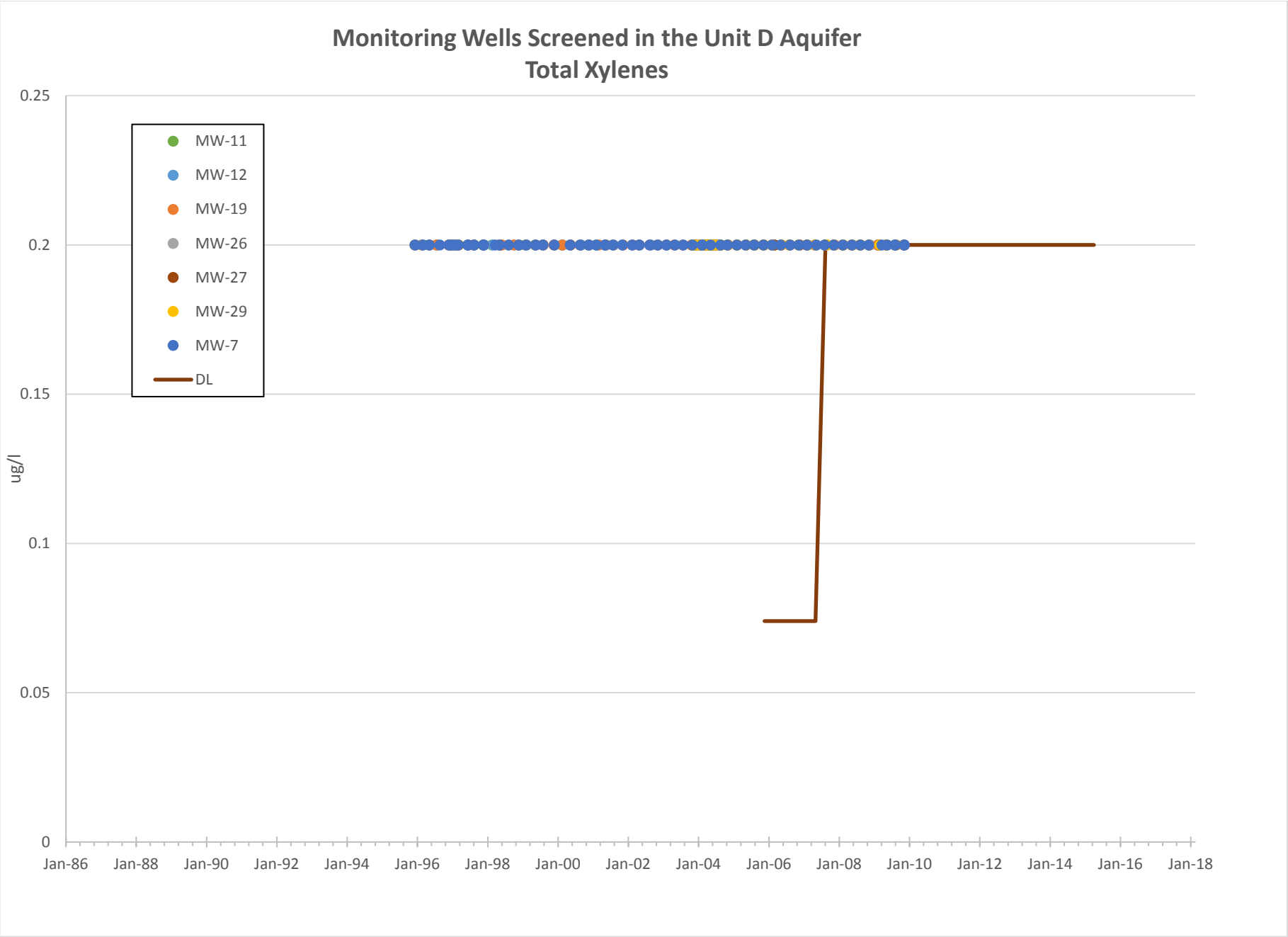
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Toluene
Federal and State GW Quality Criteria 70 ug/L
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
ug/l
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Total Xylenes
0.25
0.2
0.15
0.1
0.05
0
ug/l
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
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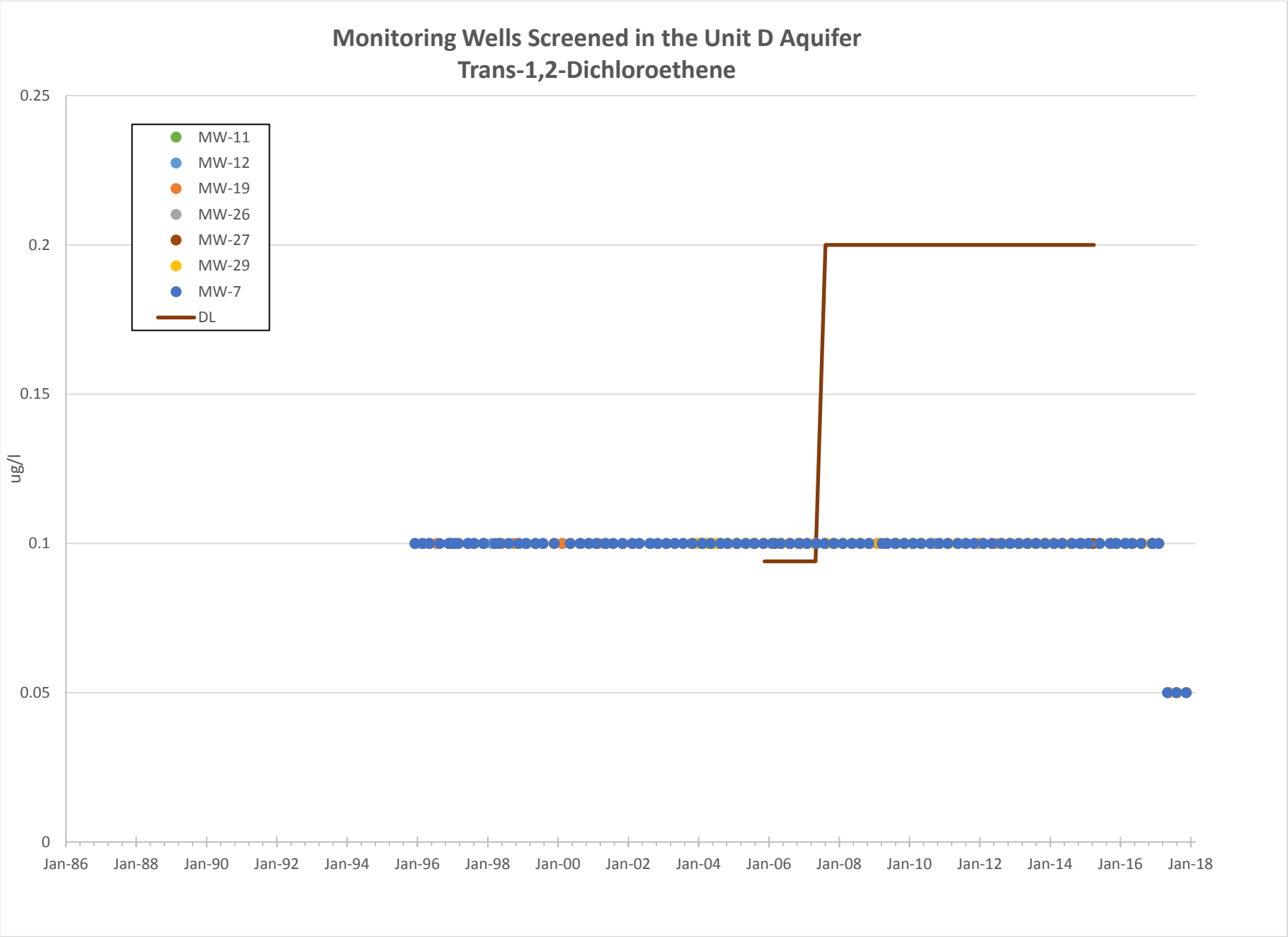
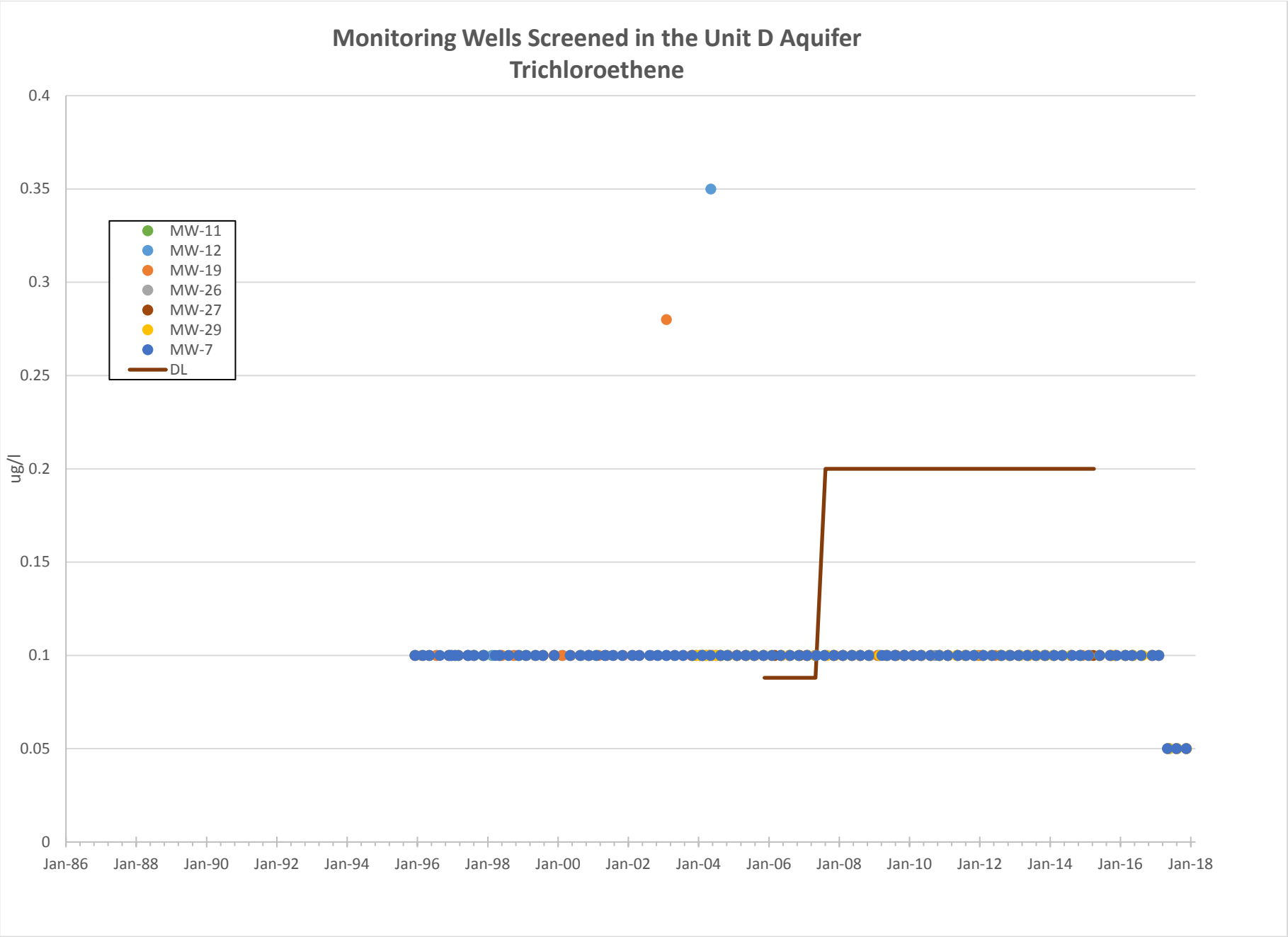
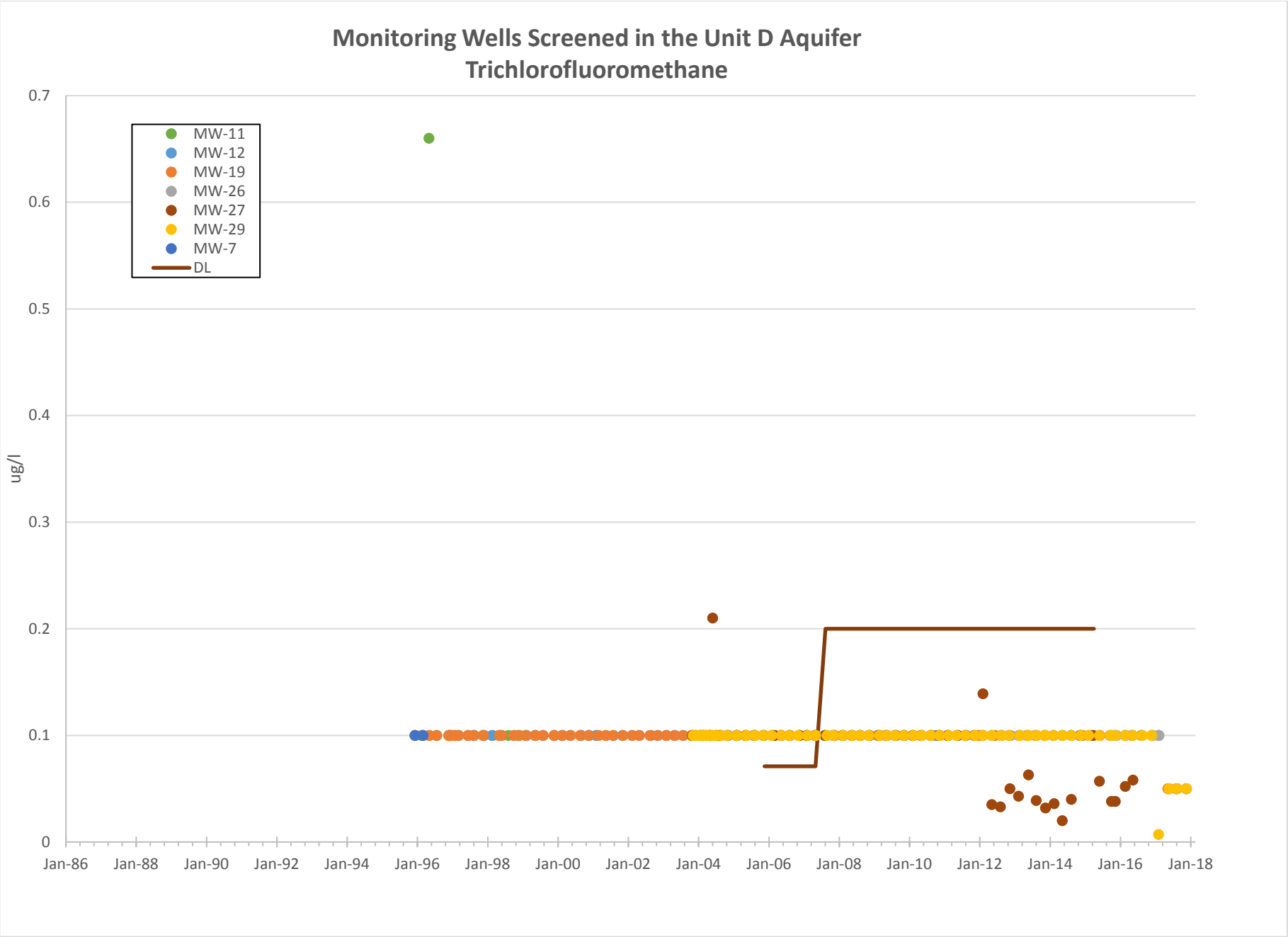
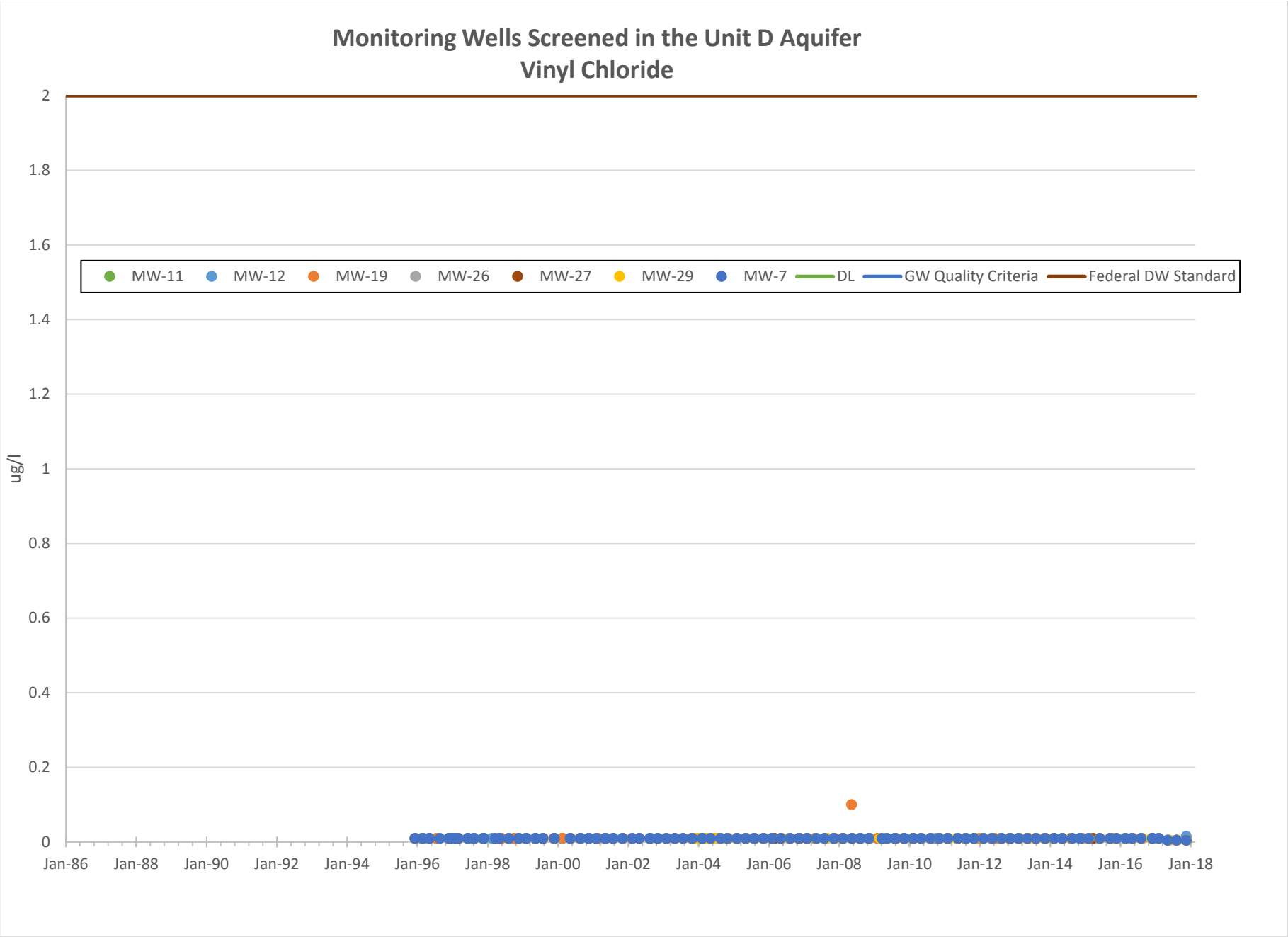
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Trans-1,2-Dichloroethene
ug/l
0.25
0.2
0.15
0.1
0.05
0
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Trichloroethene
ug/l
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Trichlorofluoromethane
ug/l
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18


Monitoring Wells Screened in the Unit D Aquifer
Vinyl Chloride
ug/l
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
MW-11
MW-12
MW-19
MW-26
MW-27
MW-29
MW-7
DL
GW Quality Criteria
Federal DW Standard
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18

Appendix G

Groundwater Velocity Calculations and Potentiometric Maps

King County
Water and Land Resources Division
Department of Natural Resources and Parks
King Street Center
201 South Jackson Street, Suite 600
Seattle, WA 98104-3855
206-477-4800 Fax 206-296-0192
TTY Relay: 711

May 18, 2017

TO: Dan Swope, Engineer II, Engineering Services Section, Solid Waste Division, Department of Natural Resources and Parks (DNRP)

FM: Sevin Bilir, Environmental Scientist IV, Science and Technical Support Section, Water and Land Resources Division, DNRP

RE: Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations
First Quarter 2017 Results
Vashon Island Landfill, King County, Washington
Project No. 1126980 – Task 25.106

King County Water and Land Resources Division (KCWLR Division) submits this report on groundwater conditions during the first quarter of 2017 for the Cc2 perched zone and the regional aquifer beneath the Vashon Island Landfill (landfill), in accordance with the *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations* (KCWLR Division, 2017). King County Solid Waste Division (KCSWD) personnel measured groundwater elevations at the landfill on January 27, 2017. These measurements were received by KCWLR Division on April 21, 2017 and were used to:

1. Evaluate the potentiometric groundwater surface elevation for the Cc2 perched zone and the regional aquifer;
2. Determine the groundwater flow direction and horizontal gradient for the Cc2 perched zone and the regional aquifer; and
3. Calculate the groundwater velocity of the Cc2 perched zone and the regional aquifer.

There have been no significant changes in the interpreted groundwater conditions since the report submitted for the fourth quarter of the 2017 monitoring event.

Groundwater Elevation Data

KCSWD measured groundwater level measurements at 21 monitoring wells during the first quarter of 2017. These wells were completed in the Cc2 perched zone, regional aquifer, and in other zones as referred to in *Vashon Island Landfill Hydrogeologic Report Update* (B&H/UES, 2004). Table 1 lists the well identifications, locations, well details, measured groundwater levels

and calculated groundwater elevations for the Cc2 perched zone, regional aquifer, and wells in other perched zones.

Cc2 Perched Zone

Three separate perching zones are identified in the *Vashon Island Landfill Hydrogeologic Report Update* (B&H/UES, 2004) within the Unit C deposits. Only the southern portion of the of the Cc2 middle channel deposit perched zone was identified as laterally extensive. Groundwater in this perched zone has been historically measured by wells MW-2, MW-5D, MW-9, MW-20, and MW-21. Since the report submitted for the first quarter of the 2015 monitoring event, monitoring well MW-5D was decommissioned. Two new wells, MW-33 and MW-35 were installed. Water level data from these wells will be included upon completion of a hydrogeologic characterization report.

Monitoring well MW-9 is hydraulically separated from the rest of the wells in the Cc2 perched zone, as described in the *Vashon Island Landfill Hydrogeologic Report Update* (B&H/UES, 2004). Due to removal of data from well MW-5D and timing of delivery of a hydrogeologic characterization report of the perched zone, a potentiometric surface was not created for this quarter. Figure 1 shows well locations and known groundwater elevations in the Cc2 perched zone for the January 27, 2017 measurement events.

Regional Aquifer

Wells MW-7, MW-12, MW-19, MW-25, MW-26, MW-27, MW-28, and MW-29 are reported to be in screened in or in hydraulic communication with the regional aquifer (B&H/UES, 2004). The regional aquifer includes the deepest channel deposit in Unit C (designated Cc3), and water-bearing Units D and F. Units D and F are separated by Unit E which is a semi-continuous, variably saturated aquitard (B&H/UES, 2004).

Wells MW-7, MW-12, and MW-19 measured water levels at least 15 feet above the top of the screen and may be influenced by vertical gradients in the regional aquifer. Well MW-27, completed in Unit Cc3, is identified in the Vashon Island Landfill Hydrogeologic Report Update (B&H/UES, 2004) to be measuring a groundwater mound in the regional aquifer water table. The mounding phenomenon is reported as likely due to local recharge from perched zones above.

The water level in monitoring well MW-28 was reported as “dry.” MW-28 is completed in the regional aquifer and has historically been dry. This well was not used for this analysis.
Figure 2 shows well locations, groundwater elevations, groundwater potentiometric surface contours, and interpreted groundwater flow direction in the regional aquifer for the January 27, 2017 measurement events.

Two new wells, MW-34 and MW-36, were recently installed. Water level data from these wells will be included upon completion of a hydrogeologic characterization report.

Direction of Groundwater Flow

Figure 1 shows groundwater elevations for the wells in the Cc2 perched zone, based on the January 27, 2017 measurements. Figure 2 shows the potentiometric surface contours and

interpreted groundwater flow directions in the regional aquifer, based on the January 27, 2017 measurements. Based on the current limited understanding of the regional aquifer, groundwater in the regional aquifer generally flowed radially away from MW-27 (Figure 2). Flow from MW-27 westward cannot be confirmed because there are no wells completed in the regional aquifer to the west of MW-27.

Groundwater Parameters

Horizontal groundwater velocity was calculated using the following formula:

where: $$v = \frac{1}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

v = Groundwater velocity [L/t]
n_{eff} = Effective porosity [dimensionless]
K = Hydraulic conductivity [L/t]
$\frac{\Delta H}{\Delta L}$ = Hydraulic gradient [L/L]

Horizontal groundwater velocity was calculated for the regional aquifer below the landfill. The hydraulic conductivity and effective porosity values were based on the ranges referred to in the *Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation – Vashon Island Landfill* (Aspect, 2010). The hydraulic gradient was determined from the potentiometric surface maps (Figure 2). The average hydraulic gradient was approximately 0.031 ft/ft within the Cc3 regional aquifer.

Table 2 presents a summary of the groundwater parameters used to calculate a groundwater velocity from the first quarter 2017 data. On January 27, 2017, the average horizontal groundwater velocity within the regional aquifer was 1.1 ft/d.

References

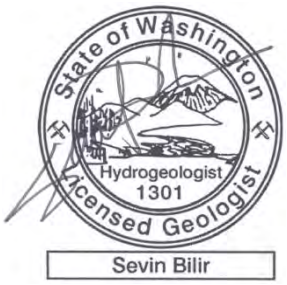
Aspect Consulting, LLC (Aspect). 2010. *Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation – Vashon Island Landfill*. Unpublished. January 10.

Berryman & Henigar in association with Udaloy Environmental Services (B&H/UES). 2004. *Vashon Island Landfill Hydrogeologic Report Update*. December.

King County Water and Land Resources Division (KCWLR Division). 2017. *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations*. Unpublished.

Thank you for the opportunity to provide hydrogeologic services to the KCSWD. If you have any questions, please feel free to contact met at 206-477-4646 or sevin.bilir@kingcounty.gov.

Sincerely,



Sevin Bilir, WA LHG
Environmental Scientist IV
King County Water and Land Resources Division

Enclosures:

Table 1: Groundwater Elevations – First Quarter 2017

Table 2: Groundwater Parameters – First Quarter 2017

Figure 1: Groundwater Potentiometric Surface Map – First Quarter 2017 - Cc2 Perched Zone

Figure 2: Groundwater Potentiometric Surface Map – First Quarter 2017 - Regional Aquifer

Table 1: Groundwater Elevations – First Quarter 2017

Vashon Island Landfill
King County, Washington

	Well Identification	Easting	Northing	Top of Casing Elevation (feet MSL)	Top of Screen Elevation (feet)	Screen length (feet)	Bottom of Screen Elevation (feet)	January 27, 2017 Measured Depth to Water (feet)	January 27, 2017 Groundwater Elevations (feet MSL)
Wells Completed in Cc2 Perched Zone	MW-2	1227788.52	162365.3	314.28	233.58	5.00	228.58	73.47	244.62
	MW-9	1227723.22	163526.88	402.57	233.64	10.00	223.64	165.74	239.58
	MW-20	1228173	162566.16	367.21	237.57	4.30	233.27	121.52	248.91
	MW-21	1227647.37	162339.91	345.66	243.17	9.40	233.77	106.29	242.66
	MW-33	1227883.14	162681.91	359.35	NI	NI	NI	112.15	247.09
	MW-35	1227651.21	162559.49	361.51	NI	NI	NI	118.1	243.38
Wells Completed in Cc3 Regional Aquifer	MW-7	1228427.31	162811.01	373.25	151.09	10.00	141.09	191.47	185.09
	MW-12	1227800.7	162374.89	312.39	139.62	10.00	129.62	142.11	173.56
	MW-19	1227724.63	163534.76	403.83	141.10	10.00	131.10	246.62	158.96
	MW-25	1228627.702	163748.5939	399.22	148.78	14.10	134.68	243.69	158.79
	MW-26	1227909.874	163770.4284	403.4	155.12	14.10	141.02	248.31	158.27
	MW-27	1227779.749	163147.519	383.06	194.27	14.20	180.07	NM	NM
	MW-28	1228115.81	163843.5839	395.59	173.91	14.40	159.51	236.81	161.91
	MW-29	1228375.064	163680.914	410.57	169.80	14.80	155.00	244.58	169.21
	MW-34	1227773.77	163134.6	385.90	NI	NI	NI	202.79	183.15
	MW-36	1227572.55	162951.34	378.28	NI	NI	NI	151.13	227.13
Wells Completed in Other Perched Zones	MW-3	1227789.56	162373.91	314.87	277.90	5.00	272.90	40.13	277.99
	MW-4	1227559.38	162957.79	374.21	273.08	10.00	263.08	103.58	273.72
	MW-8	1227664.94	163216.78	383.42	213.24	10.00	203.24	176.39	209.74
	MW-10	1227868.03	163837.42	407.51	262.34	10.00	252.34	145.41	264.80
	MW-13	1228427.45	162842.29	374.07	264.00	5.00	259.00	99.51	277.86
	MW-24	1228427.78	162831.38	373.93	291.50	10.00	281.50	88.83	285.10

Notes:
Water level measurements made by KCSWD personnel.
Northing & Easting coordinates are Washington North State Plane Coordinates in WGS84
Elevations reported in feet above Mean Sea Level based on the National Geodetic Vertical Datum, 1929.
NI, Not included. Newly installed wells.
NM, Not measured.

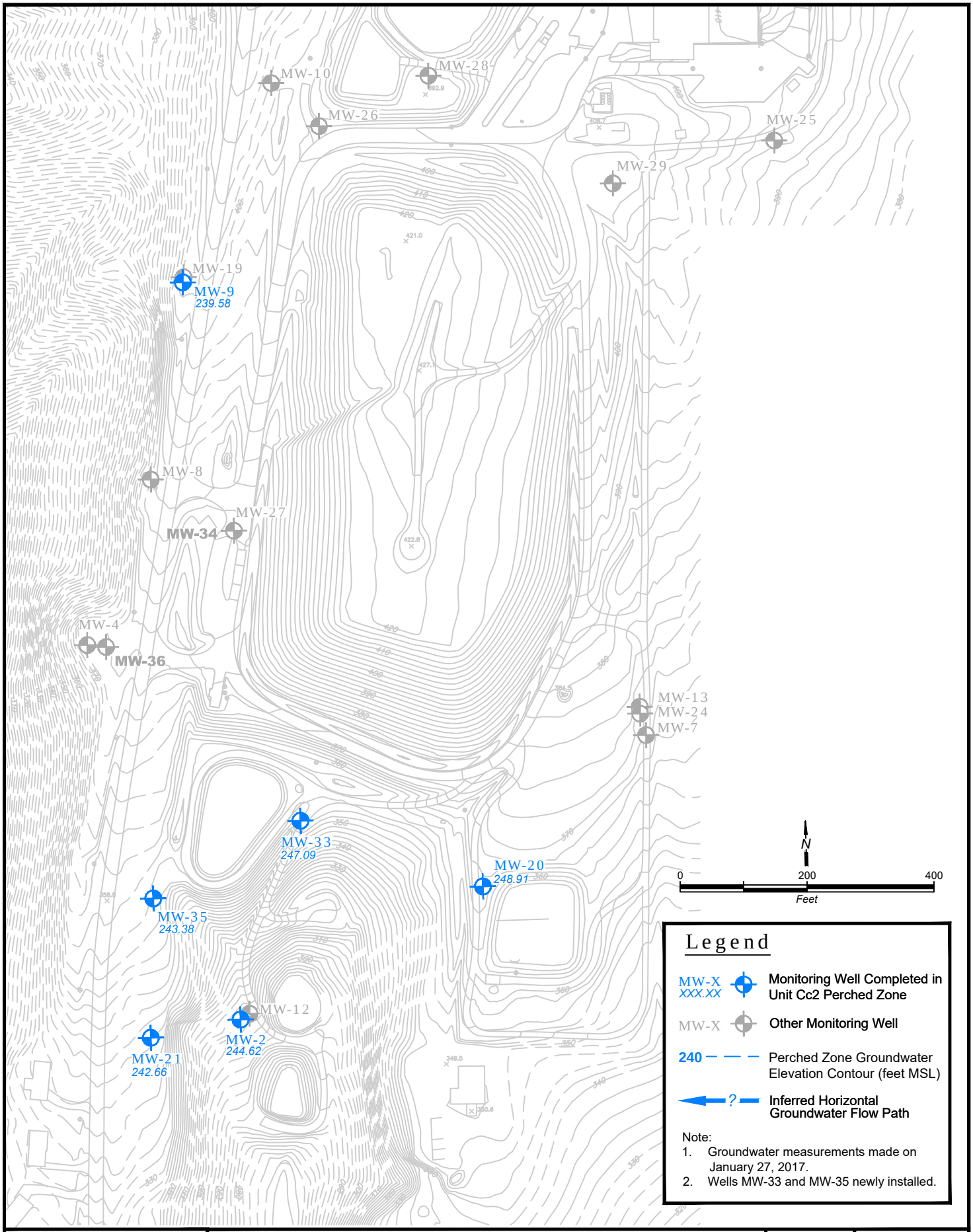
Table 2: Groundwater Parameters: First Quarter 2017

Vashon Island Landfill
King County, Washington

Water Bearing Zone Beneath the Landfill	Horizontal Hydraulic Conductivity (*K*)			Horizontal Hydraulic Gradient (DH/DL)	Effective Porosity (n_{eff})	Horizontal Groundwater Velocity (*v*)	General Groundwater Flow Direction
	Range	(cm/s)	(ft/d)	(ft/ft)		(ft/d)	
Southern Cc2 Perched Zone	Low	1.90E-06	0.01	0.009	30%	0.0003	Southwest
	High	1.60E-04	0.45	0.009	20%	0.020	
	Average	1.70E-05	0.05	0.009	25%	0.002	
Cc3 Regional Aquifer	Low	1.00E-03	3	0.031	30%	0.31	Radially away from MW-27
	High	1.00E-02	28	0.031	20%	4.3	
	Average	3.20E-03	9	0.031	25%	1.1	

Notes

1. Horizontal hydraulic conductivity values and effective porosity values from *Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation – Vashon Island Landfill (Aspect, 2010)*
2. Average hydraulic conductivity values are the geometric mean of the high and low values.
3. Horizontal hydraulic gradients based on average of gradients calculated between monitoring well with highest groundwater elevation and other monitoring wells shown on Figures 1 and 2.
4. Horizontal hydraulic gradients shown for Southern Cc2 Perched Zone are for time period before installation of MW-33 and MW-36 wells.



King County

Groundwater Potentiometric Surface Map

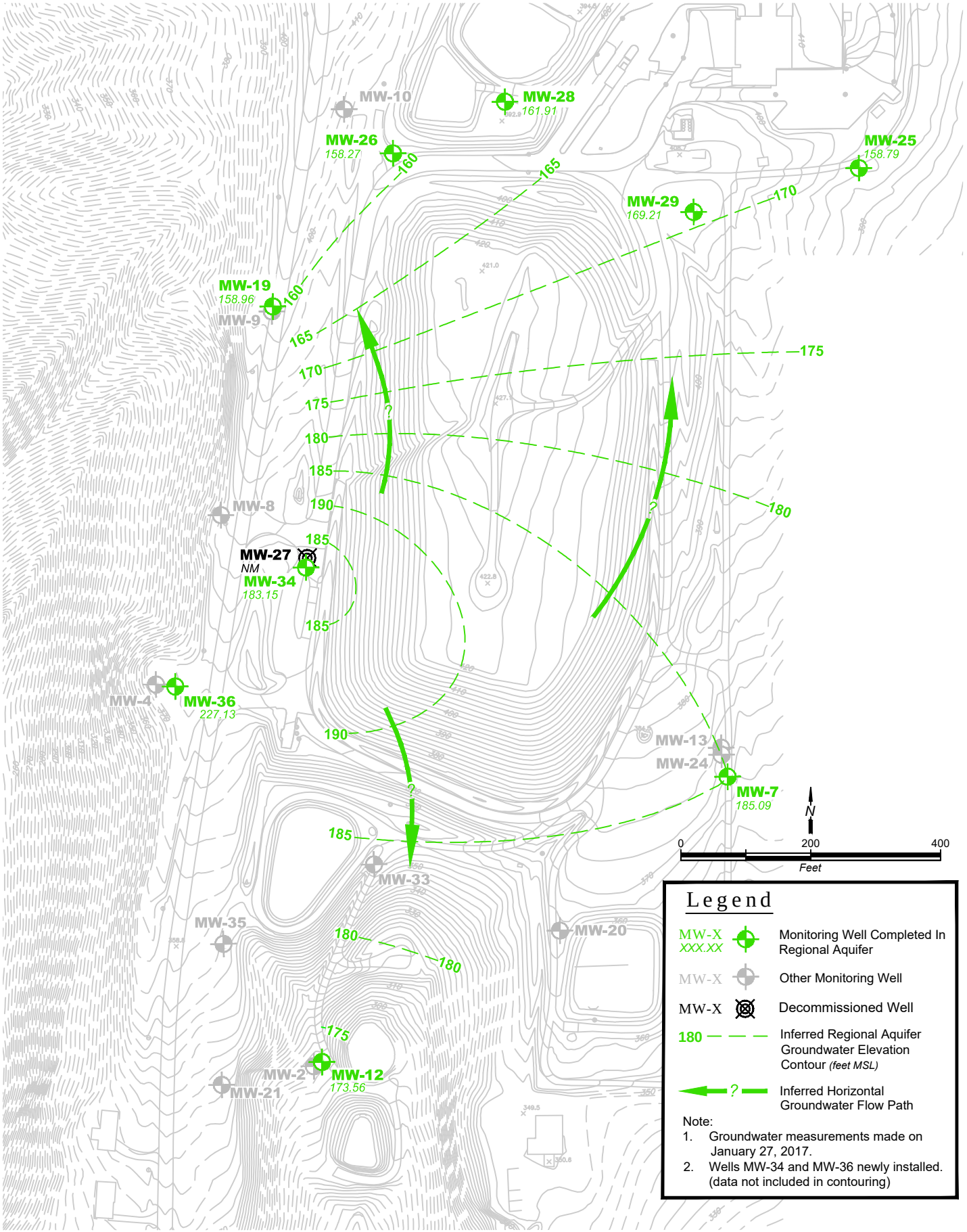
First Quarter 2017 - Cc2 Perched Zone

Vashon Island Landfill

King County, Washington

DATE: May 2017	PROJECT NO. 1033601
DESIGNED BY: SB	
DRAWN BY: LT	FIGURE NO. 1
REVISED BY: SB	

Vashon_1Q2017_Cc2Perched.dwg



King County

Groundwater Potentiometric Surface Map

First Quarter 2017 - Regional Aquifer

Vashon Island Landfill

King County, Washington

DATE: May 2017	PROJECT NO. 1033601
DESIGNED BY: SB	
DRAWN BY: LT	FIGURE NO. 2
REVISED BY: SB	

Vashon_1Q2017_regional.dwg

King County
Water and Land Resources Division
Department of Natural Resources and Parks
King Street Center
201 South Jackson Street, Suite 600
Seattle, WA 98104-3855
206-477-4800 Fax 206-296-0192
TTY Relay: 711

Memorandum

August 30, 2017

TO: Dan Swope, Engineer II, Engineering Services Section, Solid Waste Division, Department of Natural Resources and Parks (DNRP)

FM: Sevin Bilir, Environmental Scientist IV, Science and Technical Support Section, Water and Land Resources Division, DNRP

RE: Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations
Second Quarter 2017 Results
Vashon Island Landfill, King County, Washington
Project No. 1126980 – Task 25.106

King County Water and Land Resources Division (KCWLR Division) submits this memorandum report on groundwater conditions during the second quarter of 2017 for the Cc2 perched zone and the regional aquifer beneath the Vashon Island Landfill (landfill), in accordance with the *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations* (KCWLR Division, 2017). King County Solid Waste Division (KCSWD) personnel measured groundwater elevations at the landfill on May 3, 2017. These measurements were received by KCWLR Division on August 16, 2017 and were used to evaluate comparisons of groundwater elevations to the previous quarter (first quarter 2017) and the same quarter the year before (second quarter 2016).

Due to timing of delivery of a hydrogeologic characterization report of the perched zone and the regional aquifer, potentiometric surfaces were not created for this quarter.

There have been no significant changes in the groundwater elevations when compared to the reports submitted for the second quarter monitoring event in 2016 and the first quarter monitoring event in 2017.

Groundwater Elevation Data

KCSWD measured groundwater level measurements at 22 monitoring wells during the second quarter of 2017. These wells were completed in the Cc2 perched zone, regional aquifer, and in other zones as referred to in *Vashon Island Landfill Hydrogeologic Report Update* (B&H/UES,

2004). Table 1 lists the well identifications, locations, well details, measured groundwater levels and calculated groundwater elevations for the Cc2 perched zone, regional aquifer, and wells in other perched zones.

Cc2 Perched Zone

Three separate perching zones are identified in the *Vashon Island Landfill Hydrogeologic Report Update* (B&H/UES, 2004) within the Unit C deposits. Only the southern portion of the of the Cc2 middle channel deposit perched zone was identified as laterally extensive. Groundwater in this perched zone has been historically measured by wells MW-2, MW-5D, MW-9, MW-20, and MW-21. Since the report submitted for the first quarter of the 2015 monitoring event, monitoring well MW-5D was decommissioned.

Monitoring well MW-9 is hydraulically separated from the rest of the wells in the Cc2 perched zone, as described in the *Vashon Island Landfill Hydrogeologic Report Update* (B&H/UES, 2004). Due to removal of well MW-5D and timing of delivery of a hydrogeologic characterization report of the perched zone, a potentiometric surface was not created for this quarter.

Figure 1 shows well locations and known groundwater elevations in the Cc2 perched zone for the May 3, 2017 measurement events. A comparison of water level elevations in the wells screened within the Cc2 perched zone showed that water level elevations were higher by less than 0.7 feet (ft) than those reported during the second quarter 2016 monitoring event and higher by less than 1.8 ft than those reported in the first quarter 2017monitoring event.

Water level data from recently installed wells, MW-33 and MW-35, will be included upon completion of a hydrogeologic characterization report.

Regional Aquifer

Groundwater in the regional aquifer has been historically measured by wells MW-7, MW-12, MW-19, MW-25, MW-26, MW-27, MW-28, and MW-29 (B&H/UES, 2004). The regional aquifer includes the deepest channel deposit in Unit C (designated Cc3), and water-bearing Units D and F. Units D and F are separated by Unit E which is a semi-continuous, variably saturated aquitard (B&H/UES, 2004).

Well MW-27, reported to be completed in Unit Cc3, is identified in the Vashon Island Landfill Hydrogeologic Report Update (B&H/UES, 2004) to be measuring a groundwater mound in the regional aquifer water table. This well was decommissioned after the second quarter of 2016. A new well, MW-34 was installed.

Wells MW-7 and MW-12 measured water levels at least 15 feet above the top of the screen and may be influenced by vertical gradients in the regional aquifer.

The water level in monitoring well MW-28 was measured at about the screen bottom and is interpreted as “dry.” MW-28 is completed in the regional aquifer and has historically been dry.

Figure 2 shows well locations and groundwater elevations in the regional aquifer for the May 3, 2017 measurement event. A comparison of water level elevations in the wells in hydraulic communication with the regional aquifer showed that water level elevations were higher by less than 1.1 ft than those reported during the second quarter 2016 monitoring event and higher by less than 1.6 ft than those reported in the first quarter 2017monitoring event.

Water level data from recently installed wells, MW-34 and MW-36, will be included upon completion of a hydrogeologic characterization report.

Direction of Groundwater Flow

Figure 1 shows groundwater elevations for the wells in the Cc2 perched zone, based on the May 3, 2017 measurements. Figure 2 shows the groundwater elevations for the wells in the regional aquifer, based on the May 3, 2017 measurements.

Due to timing of delivery of a hydrogeologic characterization report for the landfill, direction of flow was not evaluated for this quarter. Based on previous reports the groundwater flow direction has historically been interpreted to the northeast in the perched zone and radially from decommissioned well MW-27 with a component to the northwest in the regional aquifer.

Groundwater Parameters

Due to timing of delivery of a hydrogeologic characterization report, horizontal groundwater velocities were not evaluated for this quarter. Based on a previous report for the same quarter in 2016, the groundwater velocities were calculated to be an average of 0.002 feet per day (ft/d) for the perched zone and an average of 1.5 ft/d for the regional aquifer (KCWLR Division, 2016).

References

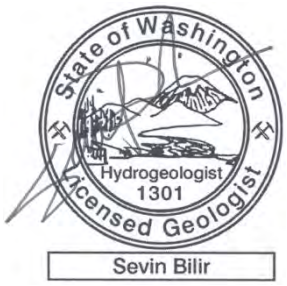
Berryman & Henigar in association with Udaloy Environmental Services (B&H/UES). 2004. *Vashon Island Landfill Hydrogeologic Report Update*. December.

King County Water and Land Resources Division (KCWLR Division). 2016. *Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations, Second Quarter 2016 Results, Vashon Island Landfill, King County, Washington; Project No. 1033601* – Task 29.14.137.45. June 20.

King County Water and Land Resources Division (KCWLR Division). 2017. *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations*. Unpublished.

Thank you for the opportunity to provide hydrogeologic services to the KCSWD. If you have any questions, please feel free to contact met at 206-477-4646 or sevin.bilir@kingcounty.gov.

Sincerely,



Sevin Bilir, WA LHG
Environmental Scientist IV
King County Water and Land Resources Division

Enclosures:

Table 1: Groundwater Elevations – Second Quarter 2017

Figure 1: Groundwater Potentiometric Surface Map – Second Quarter 2017 - Cc2 Perched Zone

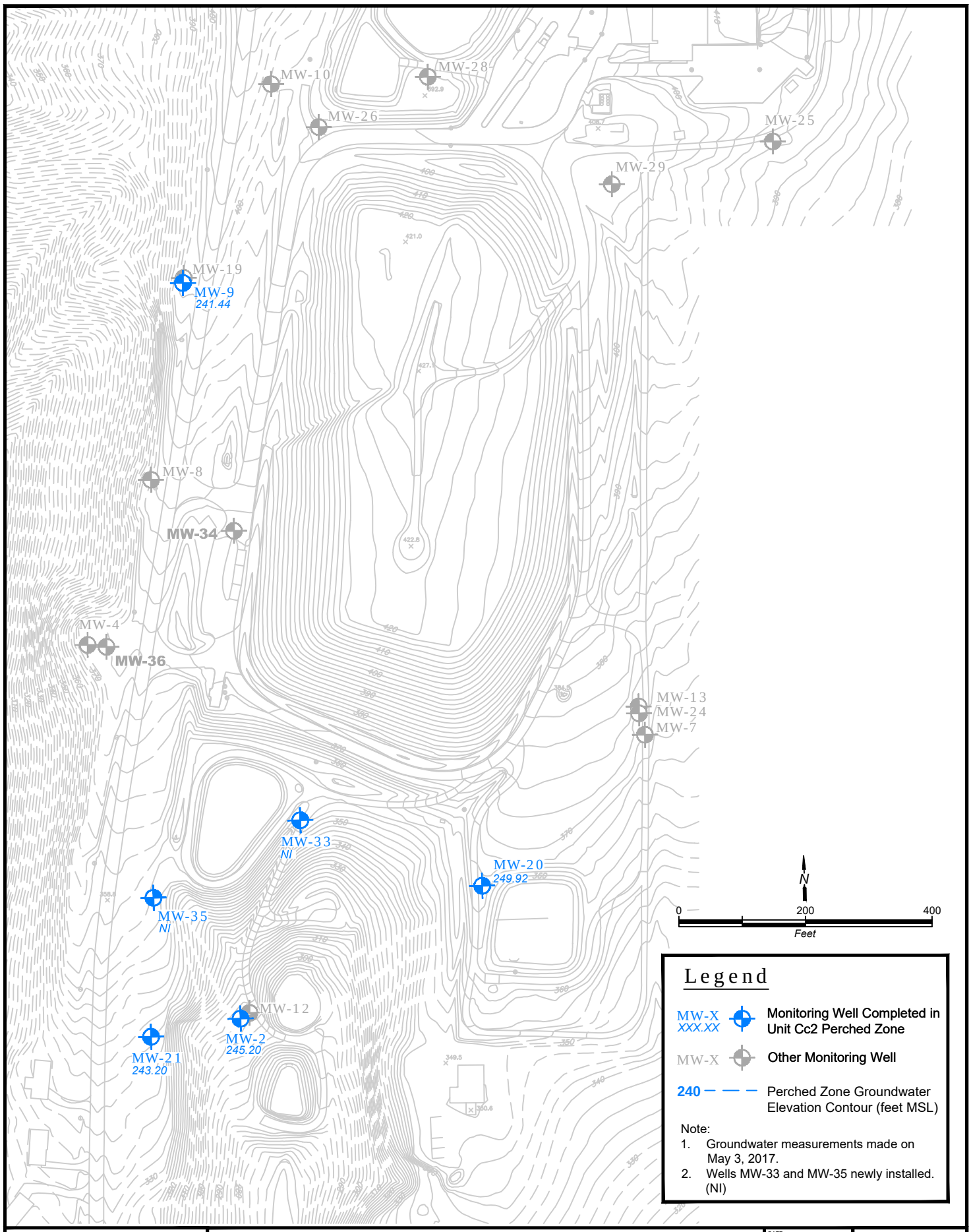
Figure 2: Groundwater Potentiometric Surface Map – Second Quarter 2017 - Regional Aquifer

Table 1: Groundwater Elevations – Second Quarter 2017

Vashon Island Landfill
King County, Washington

	Well Identification	Easting	Northing	Top of Casing Elevation (feet MSL)	Top of Screen Elevation (feet)	Bottom of Screen Elevation (feet)	May 3, 2017 Measured Depth to Water (feet)	May 3, 2017 Groundwater Elevations (feet MSL)
Wells Completed in Cc2 Perched Zone	MW-2	1227788.52	162365.3	318.09	239.09	234.09	72.89	245.20
	MW-9	1227723.22	163526.88	405.32	238.32	228.32	163.88	241.44
	MW-20	1228173	162566.16	370.43	242.43	237.43	120.51	249.92
	MW-21	1227647.37	162339.91	348.95	248.45	238.70	105.75	243.20
	MW-33	1227883.14	162681.91	NI	NI	NI	NI	NI
	MW-35	1227651.21	162559.49	NI	NI	NI	NI	NI
Wells Completed in Cc3 Regional Aquifer	MW-7	1228427.31	162811.01	376.56	156.56	146.56	189.89	186.67
	MW-12	1227800.7	162374.89	315.67	144.67	134.67	141.12	174.55
	MW-19	1227724.63	163534.76	405.58	145.58	135.58	245.88	159.70
	MW-25	1228627.702	163748.5939	402.48	153.98	139.88	243.48	159.00
	MW-26	1227909.874	163770.4284	406.58	160.48	146.38	247.51	159.07
	MW-28	1228115.81	163843.5839	398.72	177.03	162.63	DRY	DRY
	MW-29	1228375.064	163680.914	413.79	175.29	160.79	244.25	169.54
	MW-34	1227773.77	163134.6	NI	NI	NI	NI	NI
	MW-36	1227572.55	162951.34	NI	NI	NI	NI	NI
Wells Completed in Other Perched Zones	MW-3	1227789.56	162373.91	318.12	283.12	278.12	39.18	278.94
	MW-4	1227559.38	162957.79	377.30	277.30	267.30	101.62	275.68
	MW-8	1227664.94	163216.78	386.13	218.13	208.13	175.25	210.88
	MW-10	1227868.03	163837.42	410.21	267.21	257.21	145.75	264.46
	MW-13	1228427.45	162842.29	377.37	269.37	264.37	97.50	279.87
	MW-24	1228427.78	162831.38	377.39	294.96	284.96	86.62	287.31

Notes:
Water level measurements made by KCSWD personnel.
Northing & Easting coordinates are Washington North State Plane Coordinates in WGS84
Elevations reported in feet above Mean Sea Level based on the NAVD 88.
NI, Not included. Newly installed wells.
DRY, no water detected or water depth measured below base of screen.



King County

Groundwater Potentiometric Surface Map

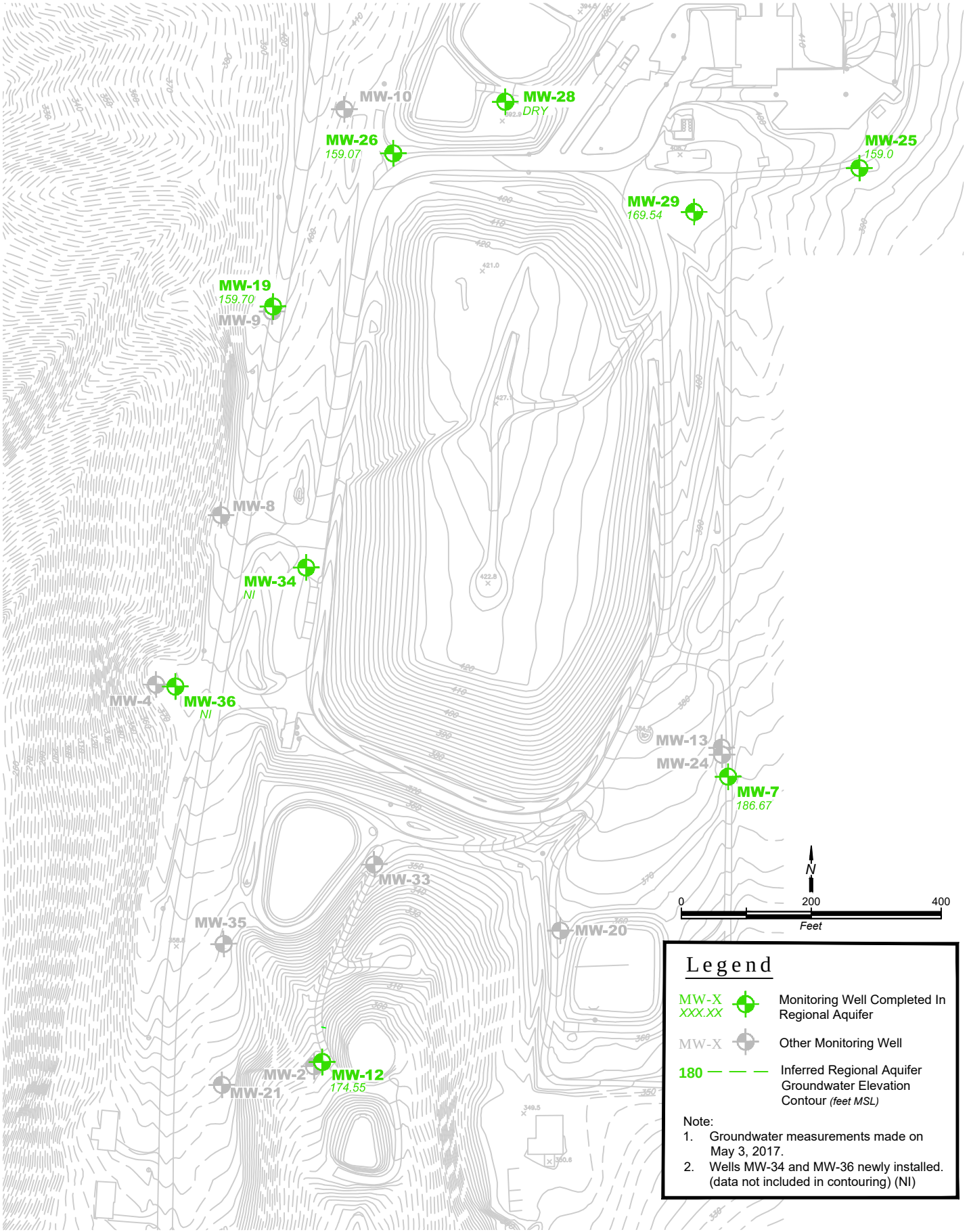
Second Quarter 2017 - Cc2 Perched Zone

Vashon Island Landfill

King County, Washington

DATE: August 2017	PROJECT NO. 1033601
DESIGNED BY: SB	
DRAWN BY: LT	FIGURE NO. 1
REVISED BY: SB	

Vashon_2Q2017_Cc2Perched.dwg



King County

Groundwater Potentiometric Surface Map

Second Quarter 2017 - Regional Aquifer

Vashon Island Landfill

King County, Washington

DATE: August 2017	PROJECT NO. 1033601
DESIGNED BY: SB	
DRAWN BY: LT	FIGURE NO. 2
REVISED BY: SB	

Vashon_2Q2017_regional.dwg

King County Department of Natural Resources and Parks

Solid Waste Division

Phase 1 – Vashon Island Closed Landfill

CONTRACT NO. E00102E08

Task No. 310 - D310.3.0

Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation

3rd Quarter Data Collected July 31, 2017

Prepared by
Aspect Consulting, LLC
401 Second Ave S, #201
Seattle, WA 98104
(206) 328-7443

King County
Department of
Natural Resources and Parks
Solid Waste Division

Waste **Prevention** • *Resource* **Recovery** • *Waste* **Disposal**

www.kingcounty.gov/solidwaste

November 9, 2017

FINAL

King County
Department of
Natural Resources and Parks
Solid Waste Division

November 9, 2017

Mr. Dan Swope
King County Solid Waste Division
King Street Center
201 South Jackson Street, Suite 701
Seattle, Washington 98104-3855

Re: Contract Number: E00102E08
Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation
3rd Quarter Data Collected July 31, 2017
Vashon Island Landfill
King County, Washington
Project No. 090057-310.3.0

Dear Mr. Swope:

Aspect Consulting, LLC (Aspect) submits this letter report on groundwater conditions measured during the 3rd Quarter of 2017 for the middle channel deposit in Unit C (designated Cc2) perched zone and the Unit D aquifer beneath the Vashon Island Landfill (Landfill), in accordance with King County Department of Natural Resources, Solid Waste Division (KCSWD) Contract Number E00102E08. KCSWD personnel measured groundwater elevations at the landfill on July 31, 2017. These measurements were received by Aspect and were used to:

1. Evaluate the potentiometric groundwater surface elevation for the Cc2 perched zone and the Unit D aquifer.
2. Determine the groundwater flow direction and horizontal gradient for the Cc2 perched zone and the Unit D aquifer.
3. Calculate the groundwater velocity of the Cc2 perched zone and the Unit D aquifer.

Unlike the previous report submitted for observations made during 2nd Quarter of 2017, this letter report includes data for four new wells (MW-33, MW-34, MW-35, and MW-36) installed across the Landfill.

Groundwater Elevation Data

KCSWD measured groundwater levels at 21 on-site wells completed at various depths near the landfill on July 31, 2017. Table 1 lists the well names, locations, reference point elevations, measured groundwater levels, calculated groundwater elevations, and hydrostratigraphic unit.

The water levels in wells MW-3 and MW-28 were reported as “dry.” MW-3 is completed in the Cc1 perched zone and was not used for this analysis. MW-28 is completed in the Unit D aquifer, but has historically been dry, and was not used to determine either potentiometric surface or groundwater velocity for this monitoring event.

Cc2 Perched Zone

Three separate perched zones are identified in the *Vashon Island Landfill Hydrogeologic Report Update* (Berryman & Henigar, December 2004) within the upper lacustrine silt deposits identified as Unit C. Only the southern portion of the Cc2 middle channel deposit perched zone was identified as laterally extensive. Groundwater in Cc2 is measured by wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-35. Figure 1 shows well locations, groundwater elevations, groundwater potentiometric surface contours, and interpreted groundwater flow directions in the Cc2 perched zone for the July 31, 2017, measurement event. Elevations of known spring locations where the Cc2 perched zone outcrops along the west hillslope were used in the drawing of potentiometric contours shown in Figure 1. For more information regarding the west slope spring and geologic conditions, see the *Vashon Island Landfill Hillslope Report for Scope of Work #1* (KCSWD, 2006).

Unit D Aquifer

Water levels at 7 of the 21 on-site wells measured the potentiometric surface in the Unit D aquifer. Wells MW-7, MW-12, MW-19, MW-25, MW-26, MW-27, MW-28, MW-29, and MW-34 are completed in the Unit D aquifer. Figure 2 shows well locations, groundwater elevations, groundwater potentiometric surface contours, and interpreted groundwater flow directions measured at wells completed in the Unit D aquifer for the July 31, 2017, measurement event.

Wells MW-7, MW-12, MW-19, MW-25, and MW-34 measured water levels were at least 20 feet above the top of the screen and may be influenced by vertical gradients or confining conditions in the Unit D aquifer.

Direction of Groundwater Flow

Groundwater elevations from measurements made on July 31, 2017, indicate that groundwater in the southern Cc2 perched zone generally flowed west towards the springs that discharge along the west hillslope (Figure 1).

Potentiometric mapping in the Unit D aquifer shows a “ridge” of high groundwater elevations trending generally west-northwest/east-southeast across the Landfill (Figure 2). Groundwater flows away from this ridge, to the north or the south-southwest.

Groundwater Velocity

Horizontal groundwater velocity was calculated using the following formula:

$$v = \frac{1}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

where:
v = Groundwater velocity [L/t]
K = Hydraulic conductivity [L/t]
$\Delta H/\Delta L$ = Hydraulic gradient [L/L]
n_{eff} = Effective porosity [dimensionless]

Horizontal groundwater velocity was calculated for the southern Cc2 perched zone and for the Unit D aquifer directly beneath the landfill. Table 2 presents a summary of the hydraulic parameters that were used to calculate a groundwater velocity from the 3rd Quarter 2017 data. On July 31, 2017, the

average horizontal groundwater velocity within the Cc2 perched zone was 0.003 feet per day (ft/d), and the average groundwater velocity in the Unit D aquifer was 1.1 ft/d. Note that the gradients used in the Cc2 perched zone are only in the areas under the landfill, and do not include the "inferred" contours west of the landfill boundary.

Thank you for the opportunity to provide hydrogeologic consulting services to the King County Solid Waste Division. Please call Aaron at (206) 838-6587 or John at (206) 780-7719, if you have any questions.

Sincerely,

Aspect consulting, LLC

State of Washington
3156
Licensed Geologist
11/9/17
AARON H. PRUITT

State of Washington
Hydrogeologist
1038
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11/9/17
John Jacob Strunk

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Attachments:
- Table 1: Measured Groundwater Elevations – 3rd Quarter 2017
- Table 2: Groundwater Velocity Calculations – 3rd Quarter 2017
- Figure 1: Groundwater Potentiometric Surface Map, Cc2 Perched Zone – July 2017
- Figure 2: Groundwater Potentiometric Surface Map, Unit D Aquifer – July 2017

V:\090057 ClosedLandfill\Deliverables\Vashon\Task 310\310.3.0 Potentiometric Mapping\VLF_PMaping_2017Q3.docx

TABLES

Table 1 - Measured Groundwater Elevations - 3rd Quarter 2017

Project No. 090057-310.3.0, Vashon Island Landfill, Vashon Island, WA

Hydrostratigraphic Unit	Location	Date	Top of Casing Elevation (feet)	Depth to Water (feet)	Water Level Elevation (feet)	Easting	Northing
Cc1	MW-3	7/31/2017	318.12	40.13	Dry	1227789.507	162374.0517
	MW-4	7/31/2017	377.3	103.58	273.72	1227559.402	162957.8726
	MW-10	7/31/2017	410.21	145.41	264.80	1227868.254	163837.4075
	MW-13	7/31/2017	377.37	99.51	277.86	1228427.508	162842.228
	MW-24	7/31/2017	377.39	88.83	285.10	1228427.78	162831.38
Cc2	MW-2	7/31/2017	318.09	73.47	244.62	1227788.192	162365.5107
	MW-9	7/31/2017	405.32	165.74	239.58	1227723.361	163526.7593
	MW-20	7/31/2017	370.43	121.52	248.91	1228173.098	162566.14
	MW-21	7/31/2017	348.95	106.29	242.66	1227647.721	162339.8555
	MW-33	7/31/2017	359.24	112.15	247.09	1227883.225	162681.958
	MW-35	7/31/2017	361.48	118.1	243.38	1227651.14	162559.4538
Cc3	MW-8	7/31/2017	386.13	176.39	209.74	1227664.843	163216.8853
	MW-36	7/31/2017	378.26	151.13	227.13	1227572.628	162951.3298
D	MW-7	7/31/2017	376.56	191.47	185.09	1228427.426	162810.969
	MW-12	7/31/2017	315.67	142.11	173.56	1227800.607	162374.9914
	MW-19	7/31/2017	405.58	246.62	158.96	1227724.722	163534.7053
	MW-25	7/31/2017	402.48	243.69	158.79	1228627.795	163748.581
	MW-26	7/31/2017	406.58	248.31	158.27	1227909.96	163770.324
	MW-28	7/31/2017	398.72	236.81	Dry	1228115.845	163843.491
	MW-29	7/31/2017	413.79	244.58	169.21	1228375.178	163680.916
	MW-34	7/31/2017	385.94	202.79	183.15	1227773.787	163135.4694

Notes:

Elevations are given in feet above North American Vertical Datum 1988 (NAVD88)

Northing and Easting coordinates are given in Washington North State Plane WGS84

Hydrostratigraphic unit based on interpretations of stratigraphy first presented in Berryman & Henigar, 2000 and hydrogeologic observations from installation of new wells MW-33, MW-34, MW-35, and MW-36

Table 2 - Groundwater Velocity Calculations - 3rd Quarter 2017

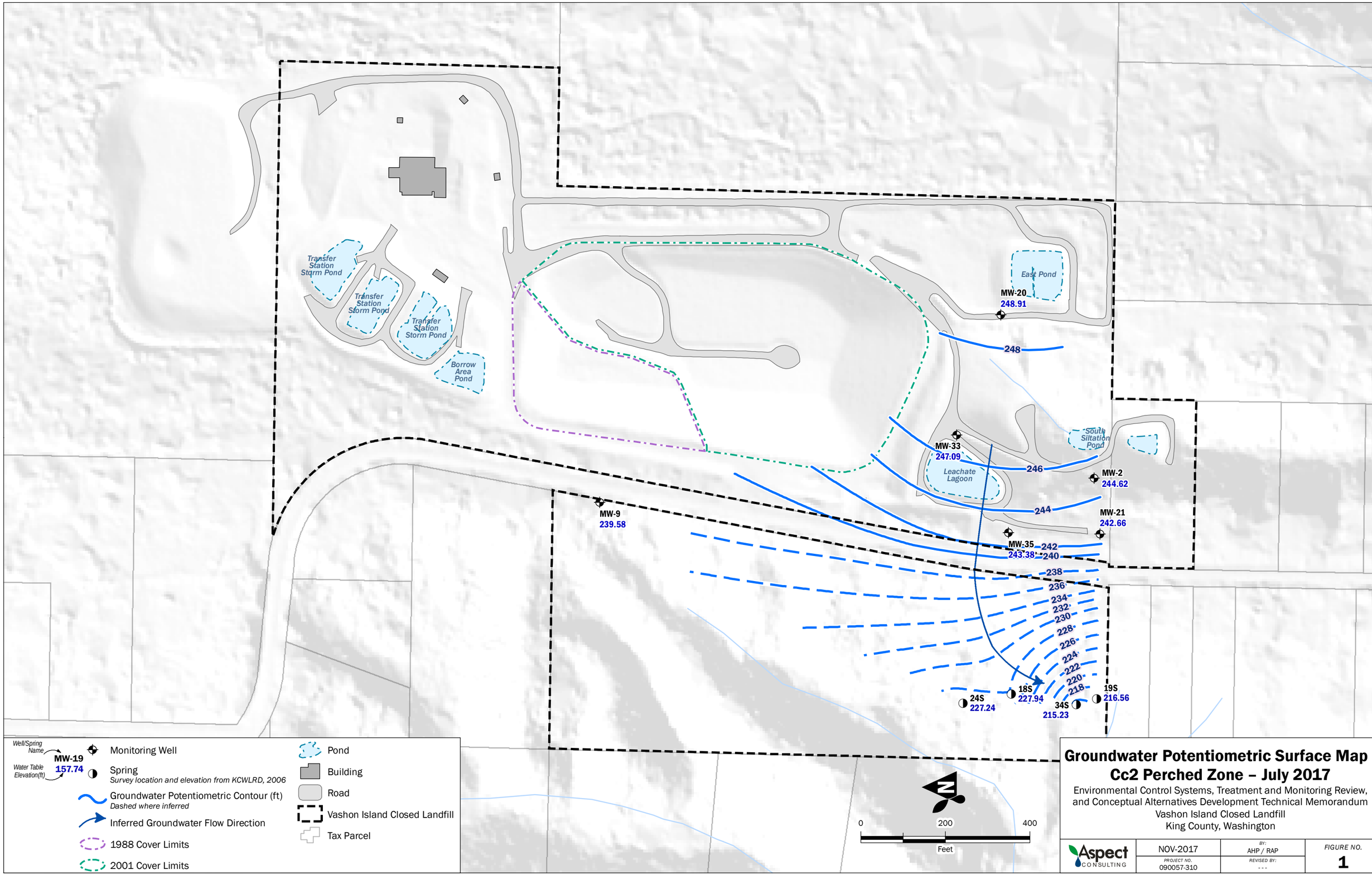
Project No. 090057-310.3.0, Vashon Island Landfill, Vashon Island, WA

Groundwater Zone Beneath Landfill	Horizontal Hydraulic Conductivity Range	(cm/s)	(ft/d)	Horizontal Hydraulic Gradient (ft/ft)	Effective Porosity	Horizontal Groundwater Velocity (ft/d)	General Direction of Groundwater Flow
Cc2 Aquifer	Low	1.9E-06	0.01	0.014	30%	0.0002	West
	High	1.6E-04	0.45	0.014	20%	0.03	
	Average	1.7E-05	0.05	0.014	25%	0.003	
D Aquifer	Low	1.0E-03	3	0.03	30%	0.3	North or South away from ridge
	High	1.0E-02	28	0.03	20%	4.3	
	Average	3.2E-03	9	0.03	25%	1.1	

Notes

1. The Cc2 Aquifer potentiometric surface is measured by wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-25. Well MW-9 is assumed not to be in hydraulic communication with the other
2. The Regional Aquifer potentiometric surface is measured by wells MW-7, MW-12, MW-19, MW-25, MW-26, MW-29 and MW-34.
3. Horizontal hydraulic conductivity values derived from Vashon Island Landfill Monitoring Well Construction Report, December 1996, King County Solid Waste Division. Average hydraulic conductivity values are the geometric mean of the high and low values.
4. Horizontal hydraulic gradients based on gradients measured at several points from the potentiometric maps shown in Figure 1 and Figure 2.
5. Effective porosity values were adopted from Potentiometric Surface Maps and Ground Water Velocity Estimates: 4th Quarter Ground Water Data Collected October 14, 2003 - Vashon Island Landfill, King County, Washington, January 6, 2004, HWA Geosciences, Inc.

FIGURES

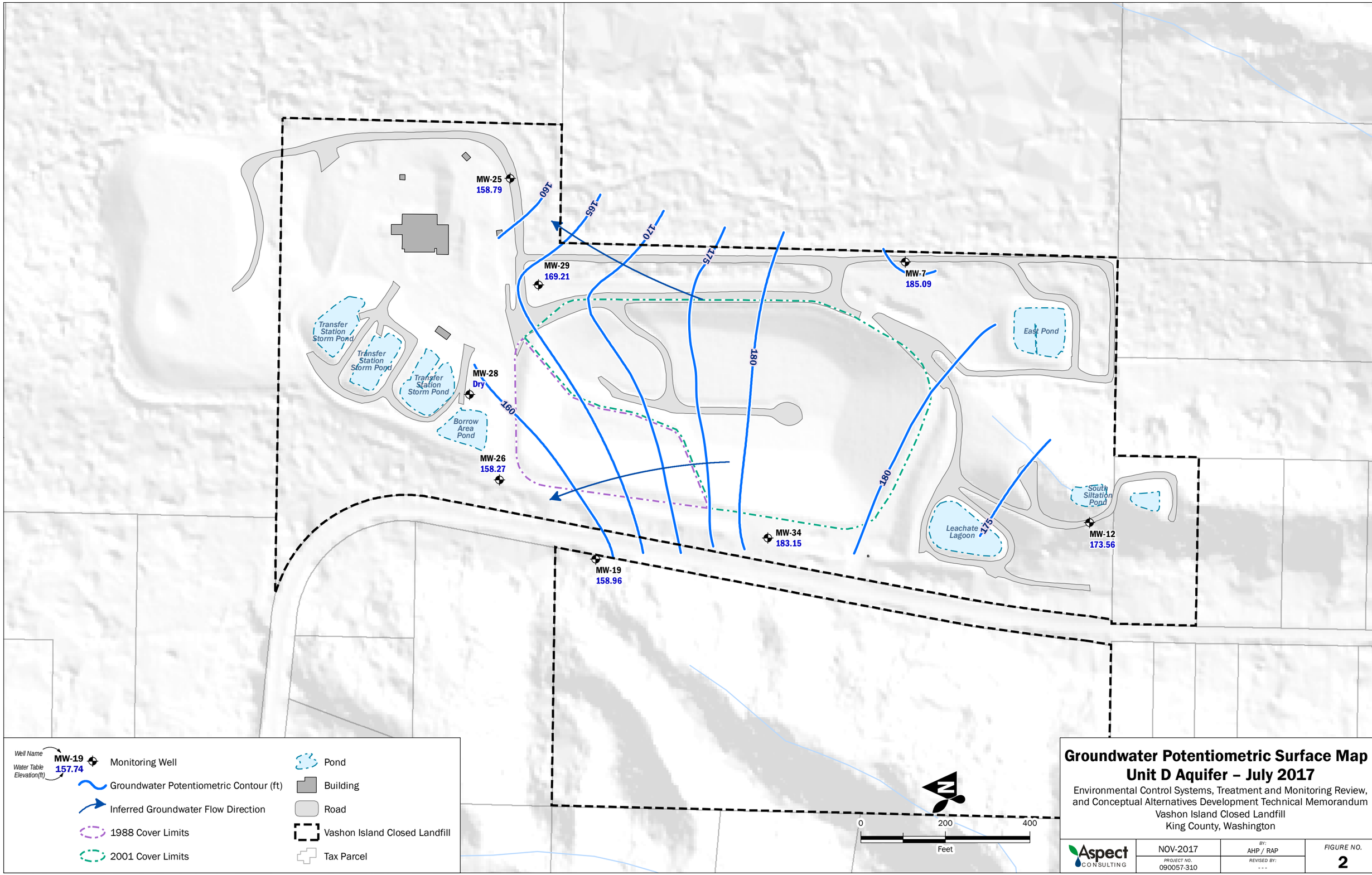


Groundwater Potentiometric Surface Map
Cc2 Perched Zone – July 2017

Environmental Control Systems, Treatment and Monitoring Review, and Conceptual Alternatives Development Technical Memorandum
Vashon Island Closed Landfill
King County, Washington

Aspect CONSULTING	NOV-2017	BY: AHP / RAP	FIGURE NO.
	PROJECT NO. 090057-310	REVISED BY: ---	1

GIS Path: T:\projects_8\KingCounty_SolidWaste\VashonIsland_landfill\Delivered\Environmental Monitoring and Conceptual Alt Memo\Aquifer\Cc2_Jul\2017.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/8/2017 || User: rnelin || Print Date: 11/8/2017



Groundwater Potentiometric Surface Map
Unit D Aquifer – July 2017

Environmental Control Systems, Treatment and Monitoring Review, and Conceptual Alternatives Development Technical Memorandum
Vashon Island Closed Landfill
King County, Washington

Aspect CONSULTING	NOV-2017	BY: AHP / RAP	FIGURE NO.
	PROJECT NO. 090057-310	REVISED BY: ---	2

GIS Path: T:\projects_8\KingCounty_SolidWaste\VashonIsland_landfill\Delivered\Environmental\Monitoring and Conceptual Alt Memo\AquiferD_July2017.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/8/2017 || User: rjeglin || Print Date: 11/8/2017

King County
Water and Land Resources Division
Department of Natural Resources and Parks
King Street Center
201 South Jackson Street, Suite 600
Seattle, WA 98104-3855
206-477-4800 Fax 206-296-0192
TTY Relay: 711

Memorandum

March 28, 2018

TO: Dan Swope, Engineer III, Engineering Services Section, Solid Waste Division, Department of Natural Resources and Parks (DNRP)

FM: Sevin Bilir, Environmental Scientist IV, Science and Technical Support Section, Water and Land Resources Division, DNRP

RE: Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations
Fourth Quarter 2017 Results
Vashon Island Landfill, King County, Washington
Project No. 1126980 – Task 25.106

King County Water and Land Resources Division (KCWLR Division) submits this memorandum report on groundwater conditions during the fourth quarter of 2017 for the middle channel deposit in the Cc2 perched zone and the Unit D aquifer beneath the Vashon Island Landfill (landfill), in accordance with the *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations* (KCWLR Division, 2017). King County Solid Waste Division (KCSWD) personnel measured groundwater elevations at the landfill on November 9, 2017. These measurements were received by KCWLR Division on December 26, 2017 and February 12, 2018 and were used to:

1. Evaluate the potentiometric groundwater surface elevation for the Cc2 perched zone and the Unit D aquifer;
2. Determine the groundwater flow direction and horizontal gradient for the Cc2 perched zone and the Unit D aquifer; and
3. Calculate the groundwater velocity of the Cc2 perched zone and the Unit D aquifer.

This report includes data from newly installed wells (MW-33, MW-34, MW-35, and MW-36) and their related designation to the hydrostratigraphic units underlying the landfill. The new designations are presented in Table 1 and discussed in *Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation, 3rd Quarter Data Collected July 31, 2017, Vashon Island Landfill, King County, Washington; Project No. 090057-310.3* (Aspect Consulting, 2017).

Groundwater Elevation Data

KCSWD measured groundwater levels at 21 monitoring wells during the fourth quarter of 2017. These wells were completed in the Cc2 perched zone, Unit D aquifer, and in other zones as referred to in *Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation, 3rd Quarter Data Collected July 31, 2017, Vashon Island Landfill, King County, Washington; Project No. 090057-310.3* (Aspect Consulting, 2017) and *Vashon Island Landfill Hydrogeologic Report Update.* (B&H/UES, 2004).

Table 1 lists groundwater well identifications, locations, details, measured depth to groundwater levels and calculated groundwater elevations for wells in the Cc2 perched zone, Unit D aquifer, and other water bearing zones.

Cc2 Perched Zone

Three separate perching zones are identified in the *Vashon Island Landfill Hydrogeologic Report Update* (B&H/UES, 2004) within the upper lacustrine silt deposits identified as Unit C. Only the southern portion of the of the Cc2 middle channel deposit perched zone was identified as laterally extensive. Groundwater in this perched zone is measured by wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-35.

According to *Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation: 3rd Quarter Data Collected July 31, 2017* (Aspect 2017), Well MW-9 is assumed not to be in hydraulic communication with the other wells in this zone. Based on this, MW-9 was not used to determine either potentiometric surface or groundwater velocity for this monitoring event.

Figure 1 shows well locations, groundwater elevations, groundwater potentiometric surface contours, and interpreted groundwater flow directions in the Cc2 perched zone for the November 9, 2017 measurement event.

Unit D Aquifer

Groundwater in the Unit D aquifer is measured by wells MW-7, MW-12, MW-19, MW-25, MW-26, MW-27, MW-28, MW-29, and MW-34 (B&H/UES, 2004).

The water level in monitoring well MW-28 was measured at about the screen bottom and is interpreted as “dry.” MW-28 has historically been dry and was not used to determine either potentiometric surface or groundwater velocity for this monitoring event.

Wells MW-7, MW-12, and MW-34 measured water levels were at least 20 feet above the top of the screen and may be influenced by vertical gradients or confining conditions in the Unit D aquifer.

Figure 2 shows well locations, groundwater elevations, groundwater potentiometric surface contours, and interpreted groundwater flow directions in the Unit D aquifer for the November 9, 2017 measurement event.

Direction of Groundwater Flow

Groundwater elevations from measurements made on November 9, 2017, indicate that groundwater in the Cc2 perched zone generally flowed towards the west (Figure 1). Groundwater elevations from measurements made on November 9, 2017, indicate that groundwater in the Unit D aquifer flows to the north-northwest, north-northeast, and to the southwest away from a "ridge" of higher groundwater elevations trending generally west-northwest/east-southeast across the southern end of the landfill (Figure 2).

Figures 1 and 2 show groundwater elevations, potentiometric surface contours and interpreted groundwater flow directions for the springs and wells in the Cc2 perched zone, and the wells in the Unit D aquifer, respectively, based on the November 9, 2017 measurements.

Groundwater Parameters

Horizontal groundwater velocity was calculated using the following formula:

where: $$v = \frac{1}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

v = Groundwater velocity [L/t]
n_{eff} = Effective porosity [dimensionless]
K = Hydraulic conductivity [L/t]
$\frac{\Delta H}{\Delta L}$ = Hydraulic gradient [L/L]

Horizontal groundwater velocity was calculated southern Cc2 perched zone and for the Unit D aquifer directly beneath the landfill. The hydraulic conductivity and effective porosity values were based on the ranges referred to in the *Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation – Vashon Island Landfill* (Aspect, 2010). Table 2 presents a summary of the groundwater parameters used to calculate groundwater velocities from fourth quarter 2017 data.

The hydraulic gradient was determined from the potentiometric surface maps (Figures 1 and 2). The average hydraulic gradient was approximately 0.015 ft/ft within the Cc2 perched zone and 0.027 ft/ft in the Unit D aquifer. Note that the gradients used in the Cc2 perched zone are only in the areas under the landfill.

On November 9, 2017, the average horizontal groundwater velocity within the Cc2 perched zone was 0.003 feet per day (ft/d), and the average groundwater velocity in the Unit D aquifer was 0.97 ft/d.

References

Aspect Consulting. 2017. *Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation, 3rd Quarter Data Collected July 31, 2017,*

Vashon Island Landfill, King County, Washington; Project No. 090057-310.3.0. October 27.

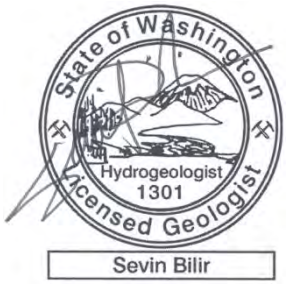
Berryman & Henigar in association with Udaloy Environmental Services (B&H/UES). 2004. *Vashon Island Landfill Hydrogeologic Report Update*. December.

King County Water and Land Resources Division. *Vashon Island Landfill Hillslope Report for Scope of Work #1* (KCSWD, 2006).

King County Water and Land Resources Division (KCWLR Division). 2017. *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations*. Unpublished.

Thank you for the opportunity to provide hydrogeologic services to the KCSWD. If you have any questions, please feel free to contact met at 206-477-4646 or sevin.bilir@kingcounty.gov.

Sincerely,



Sevin Bilir, WA LHG
Environmental Scientist IV
King County Water and Land Resources Division

Enclosures:

Table 1: Groundwater Elevations – Fourth Quarter 2017

Table 2: Groundwater Parameters – Fourth Quarter 2017

Figure 1: Groundwater Potentiometric Surface Map – Fourth Quarter 2017 - Cc2 Perched Zone

Figure 2: Groundwater Potentiometric Surface Map – Fourth Quarter 2017 - Unit D Aquifer

Table 1: Groundwater Elevations – Fourth Quarter 2017

Vashon Island Landfill
King County, Washington

Unit wells are completed in:	Well Identification	Easting	Northing	Top of Casing Elevation (feet MSL)	Top of Screen Elevation (feet)	Bottom of Screen Elevation (feet)	November 9, 2017 Measured Depth to Water (feet)	November 9, 2017 Groundwater Elevations (feet MSL)
Cc1	MW-3	1227789.56	162373.91	318.12	283.12	278.12	DRY	DRY
	MW-4	1227559.38	162957.79	377.30	277.30	267.30	100.69	276.61
	MW-10	1227868.03	163837.42	410.21	267.21	257.21	144.09	266.12
	MW-13	1228427.45	162842.29	377.37	269.37	264.37	97.47	279.90
	MW-24	1228427.78	162831.38	377.39	294.96	284.96	87.15	286.78
CC2 Perched Zone	MW-2	1227788.52	162365.3	318.09	239.09	234.09	72.59	245.50
	MW-9	1227723.22	163526.88	405.32	238.32	228.32	165.06	240.26
	MW-20	1228173	162566.16	370.43	242.43	237.43	120.43	250.00
	MW-21	1227647.37	162339.91	348.95	248.45	238.70	105.75	243.20
	MW-33	1227883.14	162681.91	359.35	229.57	219.57	111.33	247.91
	MW-35	1227651.21	162559.49	361.51	244.25	234.25	118.38	243.10
Cc3	MW-8	1227664.94	163216.78	386.13	218.13	208.13	175.74	210.39
	MW-36	1227572.55	162951.34	378.28	221.25	211.25	150.48	227.78
D	MW-7	1228427.31	162811.01	376.56	156.56	146.56	189.47	187.09
	MW-12	1227800.7	162374.89	315.67	144.67	134.67	140.69	174.98
	MW-19	1227724.63	163534.76	405.58	145.58	135.58	245.09	160.49
	MW-25	1228627.702	163748.5939	402.48	153.98	139.88	243.27	155.95
	MW-26	1227909.874	163770.4284	406.58	160.48	146.38	246.87	159.71
	MW-28	1228115.81	163843.5839	398.72	177.03	162.63	DRY	DRY
	MW-29	1228375.064	163680.914	413.79	175.29	160.79	243.96	169.83
	MW-34	1227773.77	163134.6	385.90	147.76	137.76	201.75	184.19

Notes:
Water level measurements made by KCSWD personnel.
Northing & Easting coordinates are Washington North State Plane Coordinates in WGS84
Elevations reported in feet above Mean Sea Level based on the NAVD 88.
DRY, no water detected or water depth measured below base of screen.

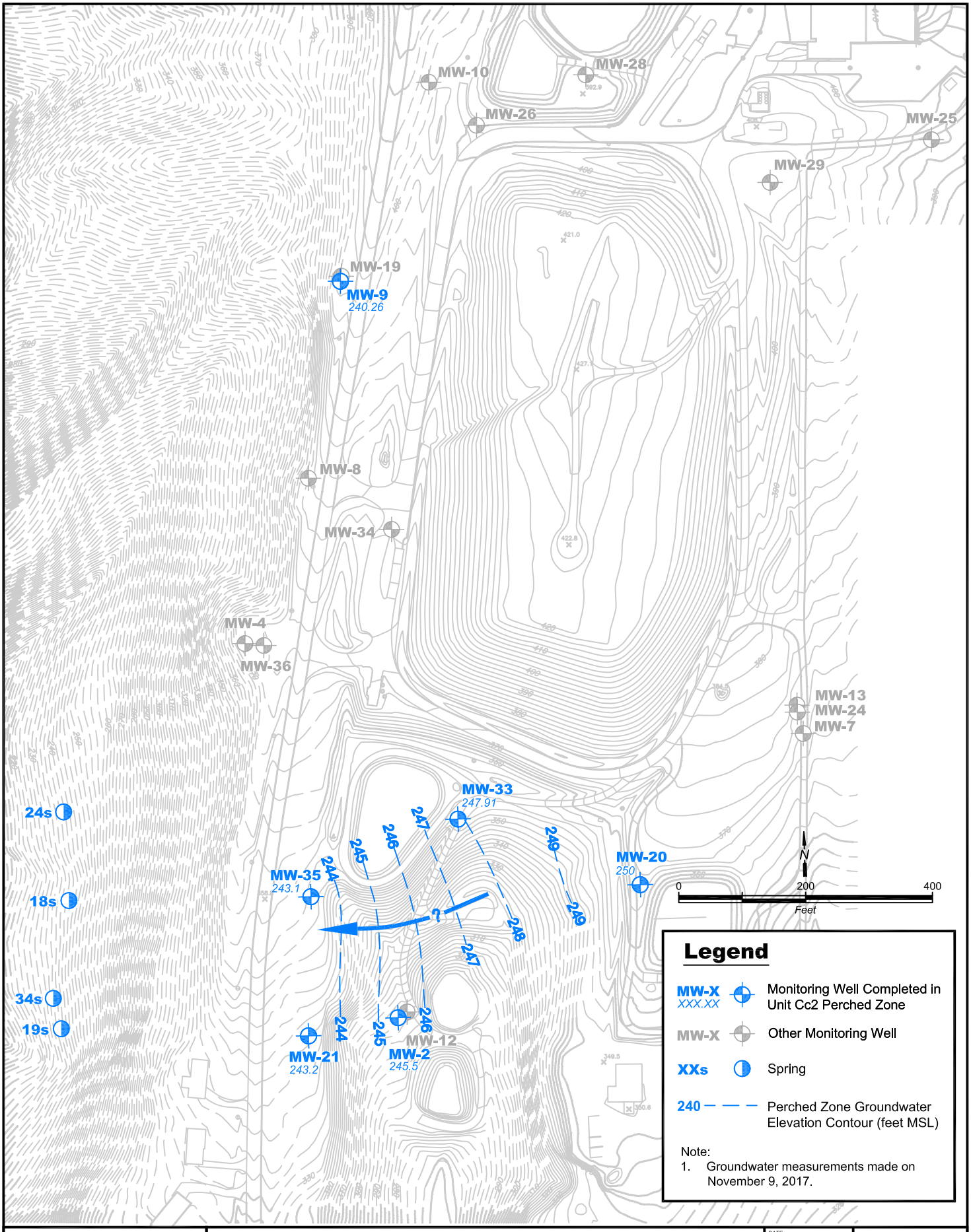
Table 2: Groundwater Parameters: Fourth Quarter 2017

Vashon Island Landfill
King County, Washington

Water Bearing Zone Beneath Landfill	Horizontal Hydraulic Conductivity (*K*)			Horizontal Hydraulic Gradient (DH/DL)	Effective Porosity (n_{eff})	Horizontal Groundwater Velocity (*v*)	General Groundwater Flow Direction
	Range	(cm/s)	(ft/d)	(ft/ft)		(ft/d)	
Cc2 Perched Zone	Low	1.90E-06	0.01	0.015	30%	0.0005	West
	High	1.60E-04	0.45	0.015	20%	0.033	
	Average	1.70E-05	0.05	0.015	25%	0.003	
D	Low	1.00E-03	3	0.027	30%	0.27	Southwest and north-northwest, north-northeast from a ridge
	High	1.00E-02	28	0.027	20%	3.78	
	Average	3.20E-03	9	0.027	25%	0.97	

Notes

1. Horizontal hydraulic conductivity values and effective porosity values from *Vashon Island Landfill Monitoring Well Construction Report, December 1996, King County Solid Waste Division.*
2. Average hydraulic conductivity values are the geometric mean of the high and low values.
3. Horizontal hydraulic gradients based on average of gradients measured at several points from the maps shown on Figures 1 and 2.
4. Effective porosity values were adopted from *Potentiometric Surface Maps and* Ground Water Velocity Estimates: *4th Quarter Ground Water Data Collected October 14, 2003 - Vashon Island Landfill, King County, Washington, January 6, 2004, HWA Geosciences, Inc.*
5. Cc2 Perched Zone gradient calculations did not incorporate hillslope or MW-9 locations.



King County

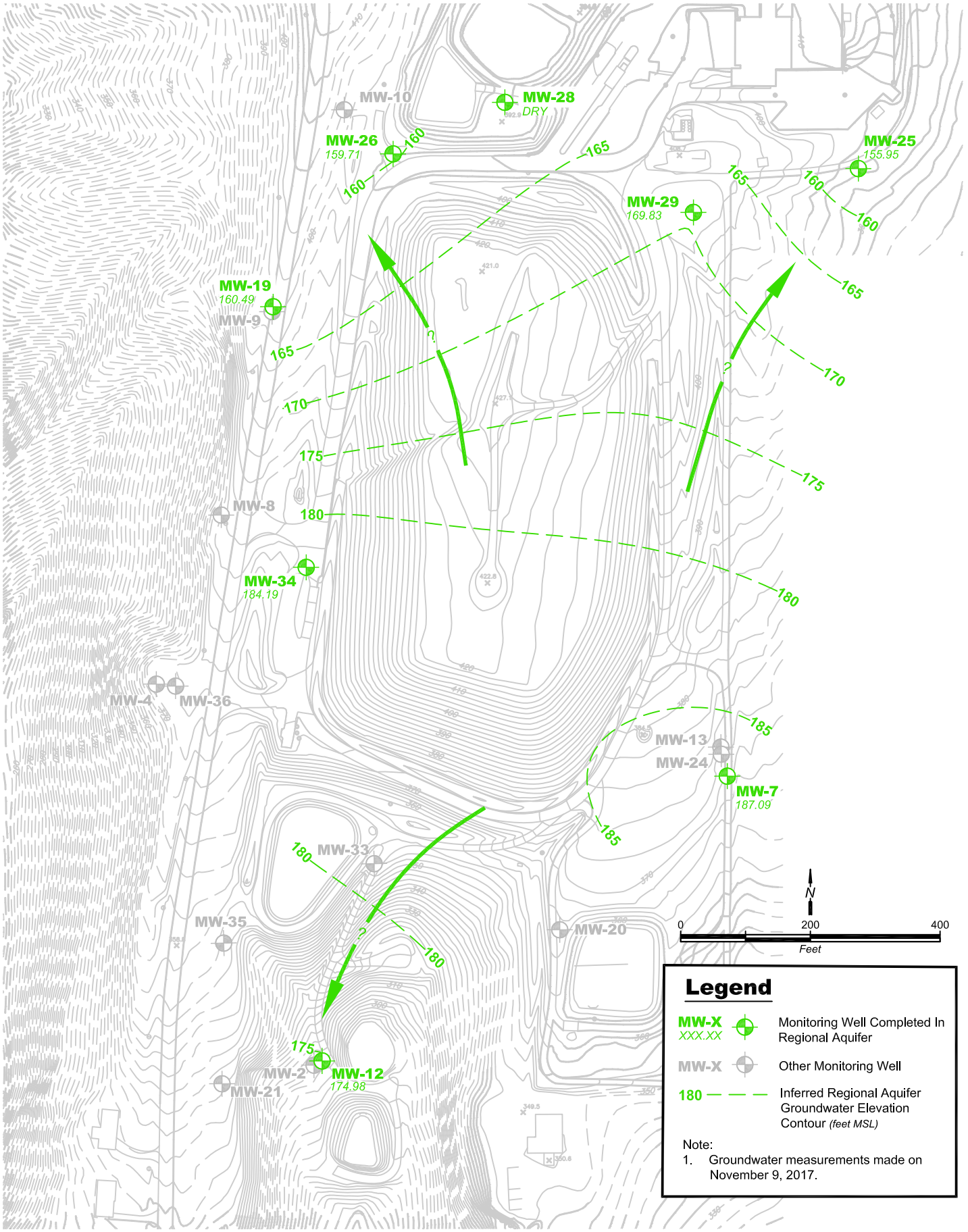
Groundwater Potentiometric Surface Map
Fourth Quarter 2017 - Cc2 Perched Zone

Vashon Island Landfill

King County, Washington

DATE: March 2018	PROJECT NO. 1033601
DESIGNED BY: SB	
DRAWN BY: KK	FIGURE NO. 1
REVISED BY: SB	

Vashon_4Q2017_Cc2Perched.dwg



King County

Groundwater Potentiometric Surface Map
Fourth Quarter 2017 - Unit D Aquifer
Vashon Island Landfill
King County, Washington

DATE: March 2018	PROJECT NO. 1033601
DESIGNED BY: SB	
DRAWN BY: KK	FIGURE NO. 2
REVISED BY: SB	

Vashon_4Q2017_UnitD.dwg

Appendix H

Monitoring Well Keys

VASHON MONITORING WELLS RENAMING SCHEME

New Name	Old Names		
MW-1	MW-1	MW-1A	Decommissioned
MW-2	MW-2	MW-2B	
MW-3	MW-3	MW-3A	
MW-4	MW-4	MW-4A	
MW-5S	MW-5S	MW-5A	Decommissioned
MW-5D	MW-5D	MW-5B	Decommissioned
MW-6S	MW-6S	MW-6A	Decommissioned
MW-6D	MW-6D	MW-6B	Decommissioned
MW-7	MW-7C		
MW-8	MW-8B		
MW-9	MW-9B		
MW-10	MW-10A	MW-10B	
MW-11	MW-1C		Decommissioned
MW-12	MW-2C		
MW-13	MW-P3		
MW-14	MW-4B		
MW-19	MW-9C		
MW-24	MW-P4		
MW-20	MW-11		Decommissioned
MW-21	MW-14		Decommissioned
MW-25	MW-27		Decommissioned
MW-26			
MW-27			
MW-28			
MW-29			

Appendix I

Groundwater Chemistry Data

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 296-4411

Static Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	**Measurement Date**	(feet)	(feet)	(feet above MSL)
MW-10	1/27/2017	410.21	145.41	264.8
MW-12	1/27/2017	315.67	142.11	173.56
MW-13	1/27/2017	377.37	99.51	277.86
MW-19	1/27/2017	405.58	246.62	158.96
MW-2	1/27/2017	318.09	73.47	244.62
MW-20	1/27/2017	370.43	121.52	248.91
MW-21	1/27/2017	348.95	106.29	242.66
MW-24	1/27/2017	373.93	88.83	285.1
MW-25	1/27/2017	402.48	243.69	158.79
MW-26	1/27/2017	406.58	248.31	158.27
MW-28	1/27/2017	398.72	236.81	161.91
MW-29	1/27/2017	413.79	244.58	169.21
MW-3	1/27/2017	318.12	40.13	277.99
MW-4	1/27/2017	377.3	103.58	273.72
MW-7	1/27/2017	376.56	191.47	185.09

Sampling Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	**Measurement Date**	(feet)	(feet)	(feet above MSL)
MW-10	1/27/2017	410.21	145.41	264.8
MW-29	1/31/2017	413.79	244.5	169.29
MW-8	1/31/2017	386.13	176.04	210.09
MW-13	2/2/2017	377.37	98.75	278.62
MW-2	2/2/2017	318.09	73.19	244.9
MW-12	2/2/2017	315.67	141.63	174.04
MW-7	2/2/2017	376.56	190.65	185.91
MW-19	2/3/2017	405.58	245.3	160.28
MW-9	2/3/2017	405.32	164.89	240.43
MW-20	2/14/2017	370.43	120.91	249.52
MW-21	2/14/2017	345.66	105.95	239.71
MW-3	2/16/2017	318.12	41.7	276.42

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 296-4411

Groundwater - Field Parameters			Specific Conductance (Field)	Dissolved Oxygen (DO) (Field)	Oxidation-Reduction Potential (ORP) (Field)	pH (Field)	Purge Volume	Temperature (Field)	Turbidity (Field)
Well #	**Sample Date**	**Sample ID**	(std. Units)	(mg/L)	(mV)	(µmhos/cm)	(gal)	(°C)	(NTU)
MW-10	1/27/2017	WV10170127-	147.3	5.71	399	7.16	3.1	10.51	4.93
MW-12	2/2/2017	WV12170202-	163.5	5.22	313.1	7.47	2	9.01	0.62
MW-13	2/2/2017	WV13170202-	172.8	4.98	434	7.11	3.5	9.86	0.45
MW-19	2/3/2017	WV19170203-	227.1	0.91	-13.8	7.57	2.9	9.56	0.49
MW-2	2/2/2017	WV2-170202-	332.6	0.71	304.1	6.85	1.5	9.32	0.74
MW-20	2/14/2017	WV20170214-	231.2	1.44	-15.1	7.18	2	10.36	4.91
MW-21	2/14/2017	WV21170214-	271.3	3.21	79.4	6.93	2.5	9.53	12
MW-26	2/3/2017	WV26170203-	189.6	0.56	142	8.03	5	9.66	4.37
MW-29	1/31/2017	WV29170131-	243	0.76	86	7.32	4.5	9.57	0.91
MW-7	2/2/2017	WV7-170202-	186.9	1.03	77	7.64	4.5	9.89	0.34
MW-8	1/31/2017	WV8-170131-	170.6	9.87	190	6.73	2	10.32	0.24
MW-9	2/3/2017	WV9-170203-	185.5	8.29	230.8	7.33	1.5	9.71	0.41

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 296-4411

Groundwater - Conventionals			Alkalinity, Total (as $CACO_3$)	Ammonia as N	Chloride	Nitrate	Specific Conductance (Lab)	Sulfate	Total Dissolved Solids	Total Organic Carbon	Total Solids	Total Suspended Solids
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(µmhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	1/27/2017	WV10170127-	58.4	< 0.01 U	3.34	0.619	145	8.92	100	< 1 U	101	< 1 U
MW-12	2/2/2017	WV12170202-	61.4	< 0.01 U	2.88	0.759	150	9.81	117	< 1 U	124	< 1 U
MW-13	2/2/2017	WV13170202-	67.9	< 0.01 U	2.8	0.108	164	14.2	122	< 1 U	131	< 1 U
MW-19	2/3/2017	WV19170203-	88.2	0.0392	4.27	< 0.01 U	233	15.5	141	< 1 U	170	< 1 U
MW-2	2/2/2017	WV2-170202-	154	< 0.01 U	2.74	< 0.01 U	308	14.7	197	< 1 U	211	1
MW-20	2/14/2017	WV20170214-	87.2	0.0178	3.26	< 0.01 U	225	17.1	138	< 1 U	157	4
MW-21	2/14/2017	WV21170214-	121	< 0.01 U	2.16	0.129	278	13.3	170	< 1 U	193	6
MW-26	2/3/2017	WV26170203-	75.3	0.275	3.54	< 0.01 U	199	12.7	149	< 1 U	180	11.2
MW-29	1/31/2017	WV29170131-	103	< 0.01 U	3.4	< 0.01 U	230	14.9	154	< 1 U	163	< 1 U
MW-7	2/2/2017	WV7-170202-	78.4	0.277	3.15	< 0.01 U	178	10.1	135	< 1 U	139	< 1 U
MW-8	1/31/2017	WV8-170131-	54.5	< 0.01 U	4.26	4.04	163	6.81	127	< 1 U	136	< 1 U
MW-9	2/3/2017	WV9-170203-	70.1	< 0.01 U	3.97	0.21	191	12.4	123	< 1 U	133	< 1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 296-4411

Groundwater - Metals (Dissolved & Total)			Antimony, Dissolved	Antimony, Total	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved	Barium, Total	Beryllium, Dissolved	Beryllium, Total	Cadmium, Dissolved	Cadmium, Total	Calcium, Dissolved
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	1/27/2017	WV10170127-	< 0.001 U	< 0.001 U	0.00149	0.00148	0.00324	0.00329	< 0.001 U	< 0.001 U	< 0.002 DU	< 0.002 U	9.04
MW-12	2/2/2017	WV12170202-	< 0.001 U	< 0.001 U	0.002	0.00185	0.00439	0.00461	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	9.66
MW-13	2/2/2017	WV13170202-	< 0.001 U	< 0.001 U	0.00178	0.00162	0.00357	0.00388 D	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	8.96
MW-19	2/3/2017	WV19170203-	< 0.001 U	< 0.001 U	0.00108	0.00108	0.0153	0.0171 D	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	13.2
MW-2	2/2/2017	WV2-170202-	< 0.001 U	< 0.001 U	0.00103	< 0.001 U	0.00688	0.00744 D	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	18.7
MW-20	2/14/2017	WV20170214-	< 0.001 U	< 0.001 U	0.00148	0.00209	0.00684	0.0072	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	12
MW-21	2/14/2017	WV21170214-	< 0.001 U	< 0.001 U	0.0012	0.00418	0.00687	0.00968	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	16.3
MW-26	2/3/2017	WV26170203-	< 0.001 U	< 0.001 U	0.00281	0.0034	0.0079	0.0119 D	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	14.7
MW-29	1/31/2017	WV29170131-	< 0.001 U	< 0.001 U	0.00384	0.00354	0.00917	0.00966	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	17.5
MW-7	2/2/2017	WV7-170202-	< 0.001 U	< 0.001 U	0.00509	0.00455	0.0127	0.0132 D	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	13.4
MW-8	1/31/2017	WV8-170131-	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U	0.00337	0.00349	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	10.3
MW-9	2/3/2017	WV9-170203-	< 0.001 U	< 0.001 U	0.00229	0.0022	0.00339	0.00358 D	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	11.6

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 296-4411

Groundwater - Metals (Dissolved & Total)			Calcium, Total	Chromium, Dissolved	Chromium, Total	Cobalt, Dissolved	Cobalt, Total	Copper, Dissolved	Copper, Total	Iron, Dissolved	Iron, Total	Lead, Dissolved	Lead, Total
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	1/27/2017	WV10170127-	9.34	< 0.005 U	< 0.005 U	< 0.003 DU	< 0.003 U	< 0.002 U	< 0.002 U	< 0.01 U	0.012 T	< 0.001 DU	< 0.001 U
MW-12	2/2/2017	WV12170202-	9.67	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	< 0.01 U	0.021 T	< 0.001 U	< 0.001 U
MW-13	2/2/2017	WV13170202-	9.22 D	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	0.018 T	0.027 T	< 0.001 U	< 0.001 DU
MW-19	2/3/2017	WV19170203-	14.1 D	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	0.034 T	0.101	< 0.001 U	< 0.001 DU
MW-2	2/2/2017	WV2-170202-	19.7 D	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	< 0.01 U	0.017 T	< 0.001 U	< 0.001 DU
MW-20	2/14/2017	WV20170214-	12.2	< 0.005 U	< 0.005 U	< 0.003 DU	< 0.003 U	< 0.002 U	< 0.002 U	0.196	0.587	< 0.001 DU	< 0.001 U
MW-21	2/14/2017	WV21170214-	16.1	< 0.005 U	< 0.005 U	< 0.003 DU	< 0.003 U	< 0.002 U	< 0.002 U	0.256	1.74	< 0.001 DU	< 0.001 U
MW-26	2/3/2017	WV26170203-	15.6 D	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	0.0815	1.36	< 0.001 U	< 0.001 DU
MW-29	1/31/2017	WV29170131-	17.6	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	0.696	0.754	< 0.001 U	< 0.001 U
MW-7	2/2/2017	WV7-170202-	13.7 D	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	0.019 T	0.022 T	< 0.001 U	< 0.001 DU
MW-8	1/31/2017	WV8-170131-	10.2	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	< 0.01 U	0.019 T	< 0.001 U	< 0.001 U
MW-9	2/3/2017	WV9-170203-	12 D	< 0.005 U	< 0.005 U	< 0.003 U	< 0.003 U	< 0.002 U	< 0.002 U	< 0.01 U	0.019 T	< 0.001 U	< 0.001 DU

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 296-4411

Groundwater - Metals (Dissolved & Total)			Magnesium, Dissolved	Magnesium, Total	Manganese, Dissolved	Manganese, Total	Mercury, Dissolved	Mercury, Total	Nickel, Dissolved	Nickel, Total	Potassium, Dissolved	Potassium, Total	Selenium, Dissolved
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	1/27/2017	WV10170127-	9.35	10.3	< 0.001 DU	< 0.001 U	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	1.38	1.49	< 0.001 U
MW-12	2/2/2017	WV12170202-	8.45	8	< 0.001 U	< 0.001 U	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	1.66	1.69	< 0.001 U
MW-13	2/2/2017	WV13170202-	11.1	11.4 D	0.00586 D	0.00501 D	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	1.75	1.66	< 0.001 U
MW-19	2/3/2017	WV19170203-	13.2	13.8 D	0.478	0.496 D	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	2.33	2.29	< 0.001 U
MW-2	2/2/2017	WV2-170202-	21.7	22.6 D	0.0787	0.0838 D	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	2.25	2.11	< 0.001 U
MW-20	2/14/2017	WV20170214-	13.1	12.5	0.314 D	0.271	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	2.08	2.16	< 0.001 U
MW-21	2/14/2017	WV21170214-	15.2	14.3	0.188 D	0.496	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	1.96	2.05	< 0.001 U
MW-26	2/3/2017	WV26170203-	6.94	7.09 D	0.0605	0.0723 D	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	2.8	2.82	< 0.001 U
MW-29	1/31/2017	WV29170131-	13.4	13.1	0.088	0.0849	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	2.02	2.07	< 0.001 U
MW-7	2/2/2017	WV7-170202-	8.75	8.93 D	0.187	0.163 D	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	2.79	2.59	< 0.001 U
MW-8	1/31/2017	WV8-170131-	8.83	8.39	< 0.001 U	0.0022	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	1.06	1.04	< 0.001 U
MW-9	2/3/2017	WV9-170203-	10.5	10.3 D	< 0.001 U	< 0.001 DU	< 0.0001 U	< 0.0001 U	< 0.01 U	< 0.01 U	2	1.94	< 0.001 U

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 296-4411

Groundwater - Metals (Dissolved & Total)			Selenium, Total	Silver, Dissolved	Silver, Total	Sodium, Dissolved	Sodium, Total	Thallium, Dissolved	Thallium, Total	Vanadium, Dissolved	Vanadium, Total	Zinc, Dissolved	Zinc, Total
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	1/27/2017	WV10170127-	< 0.001 U	< 0.003 DU	< 0.003 DU	4.78	5.12	< 0.001 U	< 0.001 U	0.00392	0.00414	< 0.004 U	< 0.004 U
MW-12	2/2/2017	WV12170202-	< 0.001 U	< 0.003 U	< 0.003 U	5.49	5.74	< 0.001 U	< 0.001 U	0.0049	0.00491	< 0.004 U	< 0.004 U
MW-13	2/2/2017	WV13170202-	< 0.001 U	< 0.003 U	< 0.003 DU	5.66	5.88	< 0.001 U	< 0.001 DU	0.00509	0.00501	< 0.004 U	< 0.004 U
MW-19	2/3/2017	WV19170203-	< 0.001 U	< 0.003 U	< 0.003 DU	6.26	6.51	< 0.001 U	< 0.001 DU	< 0.002 U	< 0.002 U	< 0.004 U	< 0.004 U
MW-2	2/2/2017	WV2-170202-	< 0.001 U	< 0.003 U	< 0.003 DU	8.1	8.35	< 0.001 U	< 0.001 DU	0.00403	0.00377	< 0.004 U	< 0.004 U
MW-20	2/14/2017	WV20170214-	< 0.001 U	< 0.003 DU	< 0.003 U	6.04	5.75	< 0.001 DU	< 0.001 DU	< 0.002 U	< 0.002 U	< 0.004 U	< 0.004 U
MW-21	2/14/2017	WV21170214-	< 0.001 U	< 0.003 DU	< 0.003 U	10.3	9.55	< 0.001 DU	< 0.001 DU	< 0.002 U	< 0.002 U	< 0.004 U	< 0.004 U
MW-26	2/3/2017	WV26170203-	< 0.001 U	< 0.003 U	< 0.003 DU	7.37	7.56	< 0.001 U	< 0.001 DU	< 0.002 U	< 0.002 U	< 0.004 U	0.00904
MW-29	1/31/2017	WV29170131-	< 0.001 U	< 0.003 U	< 0.003 U	5.89	6.15	< 0.001 U	< 0.001 U	< 0.002 U	< 0.002 U	< 0.004 U	< 0.004 U
MW-7	2/2/2017	WV7-170202-	< 0.001 U	< 0.003 U	< 0.003 DU	5.43	5.76	< 0.001 U	< 0.001 DU	< 0.002 U	< 0.002 U	< 0.004 U	< 0.004 U
MW-8	1/31/2017	WV8-170131-	< 0.001 U	< 0.003 U	< 0.003 U	5.78	5.81	< 0.001 U	< 0.001 U	0.00229	0.0022	< 0.004 U	< 0.004 U
MW-9	2/3/2017	WV9-170203-	< 0.001 U	< 0.003 U	< 0.003 DU	5.51	5.55	< 0.001 U	< 0.001 DU	0.00446	0.00466	< 0.004 U	< 0.004 U

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - VOAs			1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	1,2,3-Trichloropropane	1,2-Dibromo-3-Chloropropane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloropropane	1,4-Dichlorobenzene
		CAS #	630-20-6	71-55-6	79-34-5	79-00-5	75-34-3	75-35-4	96-18-4	96-12-8	106-93-4	95-50-1	107-06-2	78-87-5	106-46-7
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	1/27/2017	WV10170127-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-12	2/2/2017	WV12170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-13	2/2/2017	WV13170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-19	2/3/2017	WV19170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-2	2/2/2017	WV2-170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-20	2/14/2017	WV20170214-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-21	2/14/2017	WV21170214-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-26	2/3/2017	WV26170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-29	1/31/2017	WV29170131-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-7	2/2/2017	WV7-170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-8	1/31/2017	WV8-170131-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-9	2/3/2017	WV9-170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 1 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - VOAs			2-Butanone	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Acrylonitrile	Benzene	Bromochloromethane	Bromodichloromethane	Bromoform	Bromomethane	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene
		CAS #	78-93-3	591-78-6	108-10-1	67-64-1	107-13-1	71-43-2	74-97-5	75-27-4	75-25-2	74-83-9	75-15-0	56-23-5	108-90-7
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	1/27/2017	WV10170127-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-12	2/2/2017	WV12170202-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-13	2/2/2017	WV13170202-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-19	2/3/2017	WV19170203-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-2	2/2/2017	WV2-170202-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-20	2/14/2017	WV20170214-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-21	2/14/2017	WV21170214-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-26	2/3/2017	WV26170203-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-29	1/31/2017	WV29170131-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-7	2/2/2017	WV7-170202-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-8	1/31/2017	WV8-170131-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-9	2/3/2017	WV9-170203-	< 4 U	< 4 U	< 4 U	< 4 U	< 0.07 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 296-4411

Groundwater - VOAs			Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	Cis-1-2-Dichloroethene	Cis-1,3-Dichloropropene	Dibromomethane	Dichlorodifluoromethane	Ethylbenzene	M & P Xylene	Methyl Iodide	Methylene Chloride	O-Xylene
		CAS #	124-48-1	75-00-3	67-66-3	74-87-3	156-59-2	10061-01-5	74-95-3	75-71-8	100-41-4	MPX	74-88-4	75-09-2	95-47-6
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	1/27/2017	WV10170127-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-12	2/2/2017	WV12170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-13	2/2/2017	WV13170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-19	2/3/2017	WV19170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-2	2/2/2017	WV2-170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	5.32	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-20	2/14/2017	WV20170214-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	1.08	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-21	2/14/2017	WV21170214-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	0.995	< 0.2 U	< 0.2 U	1.53	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-26	2/3/2017	WV26170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-29	1/31/2017	WV29170131-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-7	2/2/2017	WV7-170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-8	1/31/2017	WV8-170131-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U
MW-9	2/3/2017	WV9-170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 GU	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U

King County Solid Waste Division
Environmental Field Data
Data Collected from January 1st, 2017 to March 31st, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - VOAs			Styrene	Tetrachloroethene	Toluene	Trans-1-2-Dichloroethene	Trans-1-3-Dichloropropene	Trans-1-4-Dichloro-2-Butene	Trichloroethene	Trichlorofluoromethane	Vinyl Acetate	Vinyl Chloride
		CAS #	100-42-5	127-18-4	108-88-3	156-60-5	10061-02-6	110-57-6	79-01-6	75-69-4	108-05-4	75-01-4
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	1/27/2017	WV10170127-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-12	2/2/2017	WV12170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-13	2/2/2017	WV13170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-19	2/3/2017	WV19170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-2	2/2/2017	WV2-170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	1.2	< 0.2 U	0.0746
MW-20	2/14/2017	WV20170214-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-21	2/14/2017	WV21170214-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	0.469	< 0.2 U	0.0667
MW-26	2/3/2017	WV26170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-29	1/31/2017	WV29170131-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-7	2/2/2017	WV7-170202-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-8	1/31/2017	WV8-170131-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U
MW-9	2/3/2017	WV9-170203-	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.2 U	< 100 U	< 0.2 U	< 0.2 U	< 0.2 U	< 0.02 U

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Static Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	**Measurement Date**	(feet)	(feet)	(feet above MSL)
MW-12	5/3/2017	315.67	141.12	174.55
MW-13	5/3/2017	377.37	97.5	279.87
MW-19	5/3/2017	405.58	245.88	159.7
MW-2	5/3/2017	318.09	72.89	245.2
MW-20	5/3/2017	370.43	120.51	249.92
MW-21	5/3/2017	348.95	105.75	243.2
MW-24	5/3/2017	373.93	86.62	287.31
MW-25	5/3/2017	402.48	243.48	159
MW-26	5/3/2017	406.58	247.51	159.07
MW-28	5/3/2017	398.72	236.68	162.04
MW-29	5/3/2017	413.79	244.25	169.54
MW-3	5/3/2017	318.12	39.18	278.94
MW-4	5/3/2017	377.3	101.62	275.68
MW-7	5/3/2017	376.56	189.89	186.67
MW-8	5/3/2017	386.13	175.25	210.88
MW-9	5/3/2017	405.32	163.88	241.44

Sampling Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	**Measurement Date**	(feet)	(feet)	(feet above MSL)
MW-8	5/4/2017	386.13	175.07	211.06
MW-36	5/4/2017	378.26	150.41	227.85
MW-13	5/8/2017	377.37	97.68	279.69
MW-19	5/8/2017	405.58	245.82	159.76
MW-12	5/17/2017	315.67	141.17	174.5
MW-34	5/17/2017	385.94	201.58	184.36
MW-35	5/17/2017	361.48	117.83	243.65
MW-2	5/17/2017	318.09	73	245.09
MW-3	5/17/2017	318.12	39.17	278.95
MW-9	5/19/2017	405.32	164.21	241.11
MW-10	5/19/2017	410.21	144.74	265.47
MW-29	5/19/2017	413.79	244.31	169.48
MW-21	5/25/2017	345.66	105.63	240.03
MW-26	5/25/2017	406.58	247.21	159.37
MW-4	6/2/2017	377.3	101.11	276.19
MW-4	6/5/2017	377.3	101.02	276.28

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Field Parameters			Specific Conductance (Field)	Dissolved Oxygen (DO) (Field)	Oxidation-Reduction Potential (ORP) (Field)	pH (Field)	Purge Volume	Temperature (Field)	Turbidity (Field)
Well #	**Sample Date**	**Sample ID**	(std. Units)	(mg/L)	(mV)	(µmhos/cm)	(gal)	(°C)	(NTU)
MW-10	5/19/2017	WV10170519-	150.9	6.54	321	7.26	2	10.63	0.41
MW-12	5/17/2017	WV12170517-	155.1	5.16	404.2	7.07	2	9.55	0.46
MW-13	5/8/2017	WV13170508-	164.4	8.69	299	6.94	1.5	10.54	0.57
MW-19	5/8/2017	WV19170508-	220.5	0.91	246	7.62	5	10.18	1.06
MW-2	5/17/2017	WV2-170517-	311.3	0.73	407	6.92	1.5	9.82	0.54
MW-20	5/8/2017	WV20170508-	230.2	2	26.1	7.26	1.5	10.84	7.06
MW-21	5/25/2017	WV21170525-	268.5	0.8	52.6	6.65	3	9.79	11.6
MW-26	5/25/2017	WV26170525-	183.6	1.02	-37.6	7.95	4	10.52	8.27
MW-29	5/19/2017	WV29170519-	244.3	0.48	95	7.47	7	11.73	1.44
MW-3	5/17/2017	WV3-170517-	93.6	7.84	442.9	5.9	2.5	10.3	3.4
MW-4	6/5/2017	WV4-170605-	163.8	9.94	461	6.56	0.8	11.4	0.67
MW-7	5/3/2017	WV7-170503-	187.4	1.02	172	7.58	3.6	10.8	0.34
MW-8	5/4/2017	WV8-170504-	168.2	9.99	255	6.88	1.75	10.68	0.49
MW-9	5/19/2017	WV9-170519-	194	7.84	308	7.1	3	10.15	3.68
DW-85	6/2/2017	WV85170602-	160	0.57	-112	7.1	41.25	11.1	0.39
DW-PA	6/2/2017	WVPA170602-	190	11.64	242	7.27	63	12	0.49
MW-12 DUP	5/17/2017	WV12170517D	155.1	5.16	404.2	7.07	2	9.55	0.46

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Conventionals			Alkalinity, Total (as $CACO_3$)	Ammonia as N	Chloride	Nitrate	Specific Conductance (Lab)	Sulfate	Total Dissolved Solids	Total Organic Carbon	Total Solids	Total Suspended Solids
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(µmhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	5/19/2017	WV10170519-	57.6	< 0.002 U	3.29	0.652	152	8.46	107	0.51 T	111	< 0.5 U
MW-12	5/17/2017	WV12170517-	60.1	< 0.002 U	3.15	0.789	162	10.6	109	< 0.5 U	119	< 0.5 U
MW-13	5/8/2017	WV13170508-	64.2	< 0.002 U	2.96	0.154	171	13.8	123	0.62 T	128	1.2
MW-19	5/8/2017	WV19170508-	85.6	0.0284	4.5	< 0.01 U	221	16.1	141	0.52 T	149	0.9 T
MW-2	5/17/2017	WV2-170517-	145	< 0.002 U	3.03	< 0.01 U	320	15.9	193	0.87 T	208	0.7 T
MW-20	5/8/2017	WV20170508-	87.1	0.0181	3.14	0.01 T	219	16.1	150	0.59 T	161	7.3
MW-21	5/25/2017	WV21170525-	125	0.0221	2.16	0.158	278	13.3	181	1.06	197	7
MW-26	5/25/2017	WV26170525-	74	0.25	3.85	< 0.01 U	188	14.1	172	0.72 T	169	27.2
MW-29	5/19/2017	WV29170519-	100	0.0024 T	3.6	< 0.01 U	243	15.4	152	0.53 T	161	< 1 U
MW-3	5/17/2017	WV3-170517-	18.9	< 0.002 U	1.43	3.72	96.9	5.22	64	0.75 T	78	4
MW-4	6/5/2017	WV4-170605-	46.4	< 0.002 HU	8.13	2.09 H	162	12	136	0.8 T	139	< 1 U
MW-7	5/3/2017	WV7-170503-	77.3	0.277	3.39	< 0.01 U	188	10.8	133	0.53 T	137	< 1 U
MW-8	5/4/2017	WV8-170504-	50.2	< 0.002 U	4.78	4.39	170	7.07	128	0.53 T	125	< 1 U
MW-9	5/19/2017	WV9-170519-	71.4	< 0.002 U	5.6	0.821	196	11.7	130	< 0.5 U	136	3.3
DW-85	6/2/2017	WV85170602-	67.7	0.303	2.88	< 0.01 U	151	2.78	107	0.68 T	113	< 0.5 U
DW-PA	6/2/2017	WVPA170602-	67.3	< 0.002 U	6.11	1.31	190	12.9	131	< 0.5 U	138	< 0.5 U
MW-12 DUP	5/17/2017	WV12170517D	59.9	< 0.002 U	3.11	0.786	161	10.5	115	0.57 T	120	< 0.5 U

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Antimony, Dissolved	Antimony, Total	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved	Barium, Total	Beryllium, Dissolved	Beryllium, Total	Cadmium, Dissolved	Cadmium, Total	Calcium, Dissolved
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	5/19/2017	WV10170519-	< 0.0003 U	< 0.0003 U	0.00152	0.00147	0.00344 D	0.00353	< 0.0001 DU	< 0.0001 U	< 0.00005 U	< 0.00005 U	10.1
MW-12	5/17/2017	WV12170517-	< 0.0003 U	< 0.0003 U	0.00207	0.00204	0.00481	0.00485	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	11.4
MW-13	5/8/2017	WV13170508-	< 0.0003 U	< 0.0003 U	0.00163	0.00179	0.00399	0.00399	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	10.3
MW-19	5/8/2017	WV19170508-	< 0.0003 U	< 0.0003 U	0.00105	0.0012	0.0162	0.0165	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	15.4
MW-2	5/17/2017	WV2-170517-	< 0.0003 U	< 0.0003 U	0.00102	0.000984	0.00749	0.00726	< 0.0001 U	< 0.0001 U	< 0.00005 U	0.0000582	21
MW-20	5/8/2017	WV20170508-	< 0.0003 U	< 0.0003 U	0.00159	0.00244	0.00706	0.00781	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	13.9
MW-21	5/25/2017	WV21170525-	< 0.0003 U	< 0.0003 U	0.00139	0.0042	0.00849 D	0.011	< 0.0001 DU	< 0.0001 U	< 0.00005 U	< 0.00005 U	19.7
MW-26	5/25/2017	WV26170525-	< 0.0003 U	< 0.0003 U	0.003	0.00463	0.00899 D	0.0156	< 0.0001 DU	< 0.0001 U	< 0.00005 U	< 0.00005 U	17.5
MW-29	5/19/2017	WV29170519-	< 0.0003 U	< 0.0003 U	0.00394	0.00432	0.0103 D	0.0115	< 0.0001 DU	< 0.0001 U	< 0.00005 U	< 0.00005 U	20.5
MW-3	5/17/2017	WV3-170517-	< 0.0003 U	< 0.0003 U	< 0.00005 U	0.000123	0.031	0.0325	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	8.64
MW-4	6/5/2017	WV4-170605-	< 0.0003 U	< 0.0003 U	0.000381	0.000359	0.00422	0.00423	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	11.4
MW-7	5/3/2017	WV7-170503-	< 0.0003 U	< 0.0003 U	0.00498	0.00498	0.0128	0.0138	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	14.1
MW-8	5/4/2017	WV8-170504-	< 0.0003 U	< 0.0003 U	0.000456	0.000468	0.00357	0.00354	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	11.4
MW-9	5/19/2017	WV9-170519-	< 0.0003 U	< 0.0003 U	0.00235	0.00234	0.00385 D	0.00427	< 0.0001 DU	< 0.0001 U	< 0.00005 U	< 0.00005 U	14.5
DW-85	6/2/2017	WV85170602-	< 0.0003 U	< 0.0003 U	0.00043	0.000425	0.00998	0.01	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	14.4
DW-PA	6/2/2017	WVPA170602-	< 0.0003 U	< 0.0003 U	0.00148	0.00144	0.00417	0.00417	< 0.0001 U	< 0.0001 U	< 0.00005 U	0.000178	13.8
MW-12 DUP	5/17/2017	WV12170517D	< 0.0003 U	< 0.0003 U	0.00208	0.00201	0.00484	0.00474	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	11.5

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - Metals (Dissolved & Total)			Calcium, Total	Chromium, Dissolved	Chromium, Total	Cobalt, Dissolved	Cobalt, Total	Copper, Dissolved	Copper, Total	Iron, Dissolved	Iron, Total	Lead, Dissolved	Lead, Total
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	5/19/2017	WV10170519-	10.2	0.00344	0.00352	< 0.00005 DL	< 0.00005 U	< 0.0002 U	< 0.0002 U	< 0.01 U	< 0.01 U	< 0.0001 DU	< 0.0001 U
MW-12	5/17/2017	WV12170517-	11.5	0.00345	0.00365	< 0.00005 U	< 0.00005 U	< 0.0002 U	< 0.0002 U	< 0.01 U	0.0138	< 0.0001 U	< 0.0001 U
MW-13	5/8/2017	WV13170508-	10.1	0.0023	0.00287	< 0.00005 U	< 0.00005 U	< 0.0002 U	0.000265	0.0325	0.0464	< 0.0001 U	< 0.0001 U
MW-19	5/8/2017	WV19170508-	15.7	< 0.0002 U	< 0.0002 U	< 0.00005 U	< 0.00005 U	< 0.0002 U	< 0.0002 U	0.0259	0.16	< 0.0001 U	< 0.0001 U
MW-2	5/17/2017	WV2-170517-	21.1	< 0.0002 U	0.000296	0.0000516	0.0000537	< 0.0002 U	0.0002	< 0.01 U	0.0156	< 0.0001 U	< 0.0001 U
MW-20	5/8/2017	WV20170508-	14.4	< 0.0002 U	< 0.0002 U	0.0000651	0.000104	< 0.0002 U	0.000411	0.22	0.926	< 0.0001 U	< 0.0001 U
MW-21	5/25/2017	WV21170525-	20.4	< 0.0002 U	0.000363	0.000241 D	0.00038	0.000242	0.000509	0.384	1.79	< 0.0001 DU	< 0.0001 U
MW-26	5/25/2017	WV26170525-	19.1	< 0.0002 U	0.000416	< 0.00005 DL	0.000159	< 0.0002 U	0.00053	0.132	2.47	< 0.0001 DU	0.000162
MW-29	5/19/2017	WV29170519-	22.2	< 0.0002 U	< 0.0002 U	< 0.00005 DL	< 0.00005 U	< 0.0002 U	< 0.0002 U	0.767	0.984	< 0.0001 DU	< 0.0001 U
MW-3	5/17/2017	WV3-170517-	8.73	< 0.0002 U	0.000467	< 0.00005 U	0.000118	< 0.0002 U	0.000457	< 0.01 U	0.195	< 0.0001 U	0.000391
MW-4	6/5/2017	WV4-170605-	11.3	0.00381	0.00397	< 0.00005 U	< 0.00005 U	< 0.0002 U	< 0.0002 U	< 0.01 U	0.0243	< 0.0001 U	< 0.0001 U
MW-7	5/3/2017	WV7-170503-	15.8	< 0.0002 U	< 0.0002 U	< 0.00005 U	< 0.00005 DU	< 0.0002 U	< 0.0002 U	0.0181	0.0238	< 0.0001 U	< 0.0001 U
MW-8	5/4/2017	WV8-170504-	11.9	0.00166	0.00173	< 0.00005 U	< 0.00005 U	< 0.0002 U	< 0.0002 U	< 0.01 U	< 0.01 U	< 0.0001 U	< 0.0001 U
MW-9	5/19/2017	WV9-170519-	14.6	0.00263	0.00295	< 0.00005 DL	< 0.00005 U	< 0.0002 U	< 0.0002 U	< 0.01 U	0.08	< 0.0001 DU	< 0.0001 U
DW-85	6/2/2017	WV85170602-	14.6	< 0.0002 U	< 0.0002 U	< 0.00005 U	< 0.00005 U	< 0.0002 U	0.017	0.0663	0.0868	0.000343	0.0185
DW-PA	6/2/2017	WVPA170602-	13.8	0.00179	0.00195	< 0.00005 U	< 0.00005 U	0.00951	0.0582	< 0.01 U	< 0.01 U	0.00182	0.00837
MW-12 DUP	5/17/2017	WV12170517D	11.4	0.00346	0.00363	< 0.00005 U	< 0.00005 U	< 0.0002 U	< 0.0002 U	< 0.01 U	0.0144	< 0.0001 U	< 0.0001 U

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Magnesium, Dissolved	Magnesium, Total	Manganese, Dissolved	Manganese, Total	Mercury, Dissolved	Mercury, Total	Nickel, Dissolved	Nickel, Total	Potassium, Dissolved	Potassium, Total	Selenium, Dissolved
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	5/19/2017	WV10170519-	9.74	9.68	< 0.0001 U	0.0003	< 0.00005 U	< 0.00005 U	0.000249	0.000231	1.41	1.42	< 0.0005 U
MW-12	5/17/2017	WV12170517-	9.3	9.33	< 0.0001 U	0.000366	< 0.00005 U	< 0.00005 U	0.000141	0.000189	1.79	1.82	< 0.0005 U
MW-13	5/8/2017	WV13170508-	11.9	11.8	0.0121	0.00935	< 0.00005 U	< 0.00005 U	0.00135	0.00132	1.8	1.77	< 0.0005 U
MW-19	5/8/2017	WV19170508-	14.3	14.6	0.43	0.504	< 0.00005 U	< 0.00005 U	< 0.0001 U	< 0.0001 U	2.42	2.46	< 0.0005 U
MW-2	5/17/2017	WV2-170517-	23.9	23.8	0.0945	0.108	< 0.00005 U	< 0.00005 U	0.00523	0.00607	2.17	2.2	< 0.0005 U
MW-20	5/8/2017	WV20170508-	14.2	15	0.291	0.304	< 0.00005 U	< 0.00005 U	0.000375	0.000543	2.14	2.21	< 0.0005 U
MW-21	5/25/2017	WV21170525-	17.7	18.2	0.812	1.05	< 0.00005 U	< 0.00005 U	0.00484	0.00592	2.07	2.11	< 0.0005 U
MW-26	5/25/2017	WV26170525-	7.65	8.26	0.0676	0.0858	< 0.00005 U	< 0.00005 U	< 0.0001 U	0.000621	2.93	3.15	< 0.0005 U
MW-29	5/19/2017	WV29170519-	14.6	15.4	0.0937	0.099	< 0.00005 U	< 0.00005 U	< 0.0001 U	0.000102	2.13	2.29	< 0.0005 U
MW-3	5/17/2017	WV3-170517-	2.4	2.42	0.000369	0.0194	< 0.00005 U	< 0.00005 U	0.000225	0.000506	2.23	2.27	< 0.0005 U
MW-4	6/5/2017	WV4-170605-	9.18	8.86	< 0.0001 U	0.00395	< 0.00005 U	< 0.00005 U	0.00117	0.00139 D	0.989	0.975	< 0.0005 U
MW-7	5/3/2017	WV7-170503-	8.88	9.71	0.165	0.182	< 0.00005 U	< 0.00005 U	0.000161	0.000202 D	2.35	2.66	< 0.0005 U
MW-8	5/4/2017	WV8-170504-	8.98	9.45	< 0.0001 U	< 0.0001 U	< 0.00005 U	< 0.00005 U	0.00057	0.000568	1.05	1.11	< 0.0005 U
MW-9	5/19/2017	WV9-170519-	11.6	11.7	0.000146	0.0028	< 0.00005 U	< 0.00005 U	0.000265	0.000461	2.16	2.17	< 0.0005 U
DW-85	6/2/2017	WV85170602-	6.68	6.7	0.0543	0.0552	< 0.00005 U	< 0.00005 U	< 0.0001 U	< 0.0001 DU	2.54	2.53	< 0.0005 U
DW-PA	6/2/2017	WVPA170602-	11.7	11.7	0.00021	0.000263	< 0.00005 U	< 0.00005 U	0.000571	0.000664 D	1.57	1.54	< 0.0005 U
MW-12 DUP	5/17/2017	WV12170517D	9.42	9.17	< 0.0001 U	0.000229	< 0.00005 U	< 0.00005 U	0.000152	0.000191	1.81	1.82	< 0.0005 U

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - Metals (Dissolved & Total)			Selenium, Total	Silver, Dissolved	Silver, Total	Sodium, Dissolved	Sodium, Total	Thallium, Dissolved	Thallium, Total	Vanadium, Dissolved	Vanadium, Total	Zinc, Dissolved	Zinc, Total
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	5/19/2017	WV10170519-	< 0.0005 U	< 0.00004 U	0.0000982	5.11	5.18	< 0.0001 U	< 0.0001 U	0.0043	0.00434	0.000779	< 0.0005 U
MW-12	5/17/2017	WV12170517-	< 0.0005 U	< 0.00004 U	0.0000436	6.06	6.05	< 0.0001 U	< 0.0001 U	0.00509	0.00509	< 0.0005 U	0.000671
MW-13	5/8/2017	WV13170508-	< 0.0005 U	< 0.00004 U	< 0.00004 U	6.26	6.23	< 0.0001 U	< 0.0001 U	0.00484	0.00554	< 0.0005 U	< 0.0005 U
MW-19	5/8/2017	WV19170508-	< 0.0005 U	< 0.00004 U	< 0.00004 U	6.92	7.08	< 0.0001 U	< 0.0001 U	< 0.000075 U	< 0.000375 U	< 0.0005 U	0.000506
MW-2	5/17/2017	WV2-170517-	< 0.0005 U	< 0.00004 U	< 0.00004 U	9.16	9.14	< 0.0001 U	< 0.0001 U	0.00413	0.00411	0.000813	0.000872
MW-20	5/8/2017	WV20170508-	< 0.0005 U	< 0.00004 U	< 0.00004 U	6.62	6.93	< 0.0001 U	< 0.0001 U	< 0.000075 U	< 0.000375 U	< 0.0005 U	0.000906
MW-21	5/25/2017	WV21170525-	< 0.0005 U	< 0.00004 U	< 0.00004 U	11.6	11.8	< 0.0001 U	< 0.0001 U	0.000448	0.000852	0.00182	0.00396
MW-26	5/25/2017	WV26170525-	< 0.0005 U	< 0.00004 U	< 0.00004 U	8.49	9.07	< 0.0001 U	< 0.0001 U	< 0.000075 U	0.000465	0.000771	0.0173
MW-29	5/19/2017	WV29170519-	< 0.0005 U	< 0.00004 U	< 0.00004 U	6.67	7.01	< 0.0001 U	< 0.0001 U	< 0.000075 U	< 0.000075 U	< 0.0005 U	0.000792
MW-3	5/17/2017	WV3-170517-	< 0.0005 U	< 0.00004 U	< 0.00004 U	4.54	4.5	< 0.0001 U	< 0.0001 U	< 0.000075 U	0.000423	< 0.0005 U	0.000812
MW-4	6/5/2017	WV4-170605-	< 0.0005 U	< 0.00004 U	< 0.00004 U	6.44	6.21	< 0.0001 U	< 0.0001 U	0.00243	0.00242	< 0.0005 U	< 0.0005 DU
MW-7	5/3/2017	WV7-170503-	< 0.0005 U	< 0.00004 DU	< 0.00004 U	5.62	6.1	< 0.0001 U	< 0.0001 U	0.0000913	< 0.000375 U	0.000535	0.000821
MW-8	5/4/2017	WV8-170504-	< 0.0005 U	< 0.00004 DU	< 0.00004 U	6.19	6.49	< 0.0001 U	< 0.0001 U	0.00225	0.00233	< 0.0005 U	< 0.0005 U
MW-9	5/19/2017	WV9-170519-	< 0.0005 U	< 0.00004 U	< 0.00004 U	6.09	6.24	< 0.0001 U	< 0.0001 U	0.00479	0.00502	< 0.0005 U	< 0.0005 U
DW-85	6/2/2017	WV85170602-	< 0.0005 U	< 0.00004 U	< 0.00004 U	6.08	5.97	< 0.0001 U	< 0.0001 U	0.0000792	0.0000811	0.00236	0.0283 D
DW-PA	6/2/2017	WVPA170602-	< 0.0005 U	< 0.00004 U	< 0.00004 U	6.75	6.66	< 0.0001 U	< 0.0001 U	0.00321	0.00326	0.00821	0.0207 D
MW-12 DUP	5/17/2017	WV12170517D	< 0.0005 U	< 0.00004 U	0.0000453	6	6.02	< 0.0001 U	< 0.0001 U	0.00514	0.00507	< 0.0005 U	0.00107

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - VOAs			1,1,1,2-Tetra-chloro-ethane	1,1,1-Trichloro-ethane	1,1,2,2-Tetrachloro-ethane	1,1,2-Trichloro-ethane	1,1-Dichloro-ethane	1,1-Dichloro-ethene	1,2,3-Trichloro-propane	1,2-Dibromo-3-Chloro-propane	1,2-Dibromo-ethane	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,2-Dichloro-propane	1,4-Dichloro-benzene
		CAS #	630-20-6	71-55-6	79-34-5	79-00-5	75-34-3	75-35-4	96-18-4	96-12-8	106-93-4	95-50-1	107-06-2	78-87-5	106-46-7
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	5/19/2017	WV10170519-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-12	5/17/2017	WV12170517-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-13	5/8/2017	WV13170508-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-19	5/8/2017	WV19170508-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-2	5/17/2017	WV2-170517-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-20	5/8/2017	WV20170508-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-21	5/25/2017	WV21170525-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-26	5/25/2017	WV26170525-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-29	5/19/2017	WV29170519-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-3	5/17/2017	WV3-170517-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-4	6/5/2017	WV4-170605-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-7	5/3/2017	WV7-170503-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-8	5/4/2017	WV8-170504-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-9	5/19/2017	WV9-170519-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
DW-85	6/2/2017	WV85170602-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
DW-PA	6/2/2017	WVPA170602-	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
MW-12 DUP	5/17/2017	WV12170517D	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - VOAs			2-Butanone	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Acrylo-nitrile	Benzene	Bromochloro-methane	Bromo-dichloro-methane	Bromoform	Bromo-methane	Carbon Disulfide	Carbon Tetra-chloride	Chloro-benzene
		CAS #	78-93-3	591-78-6	108-10-1	67-64-1	107-13-1	71-43-2	74-97-5	75-27-4	75-25-2	74-83-9	75-15-0	56-23-5	108-90-7
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	5/19/2017	WV10170519-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-12	5/17/2017	WV12170517-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-13	5/8/2017	WV13170508-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-19	5/8/2017	WV19170508-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-2	5/17/2017	WV2-170517-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-20	5/8/2017	WV20170508-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-21	5/25/2017	WV21170525-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-26	5/25/2017	WV26170525-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-29	5/19/2017	WV29170519-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-3	5/17/2017	WV3-170517-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-4	6/5/2017	WV4-170605-	< 0.25 GU	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-7	5/3/2017	WV7-170503-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-8	5/4/2017	WV8-170504-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-9	5/19/2017	WV9-170519-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
DW-85	6/2/2017	WV85170602-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
DW-PA	6/2/2017	WVPA170602-	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U
MW-12 DUP	5/17/2017	WV12170517D	< 0.25 U	< 0.5 U	< 2.5 U	< 2.5 U	< 0.035 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - VOAs			Chloro-dibromo-methane	Chloro-ethane	Chloroform	Chloro-methane	Cis-1,2-Dichloro-ethene	Cis-1,3-Dichloro-propene	Dibromo-methane	Dichloro-difluoro-methane	Ethyl-benzene	M & P Xylene	Methyl Iodide	Methylene Chloride	O-Xylene
		CAS #	124-48-1	75-00-3	67-66-3	74-87-3	156-59-2	10061-01-5	74-95-3	75-71-8	100-41-4	MPX	74-88-4	75-09-2	95-47-6
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	5/19/2017	WV10170519-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-12	5/17/2017	WV12170517-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-13	5/8/2017	WV13170508-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-19	5/8/2017	WV19170508-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-2	5/17/2017	WV2-170517-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	6.82	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-20	5/8/2017	WV20170508-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	0.633	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-21	5/25/2017	WV21170525-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	0.931	< 0.25 U	< 0.1 U	1.94	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-26	5/25/2017	WV26170525-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-29	5/19/2017	WV29170519-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-3	5/17/2017	WV3-170517-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-4	6/5/2017	WV4-170605-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	0.273	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-7	5/3/2017	WV7-170503-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-8	5/4/2017	WV8-170504-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-9	5/19/2017	WV9-170519-	< 0.5 U	< 0.1 U	< 0.1 U	0.27 JT	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
DW-85	6/2/2017	WV85170602-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
DW-PA	6/2/2017	WVPA170602-	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U
MW-12 DUP	5/17/2017	WV12170517D	< 0.5 U	< 0.1 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.25 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 2.5 U	< 0.1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from April 1st, 2017 to June 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - VOAs			Styrene	Tetra-chloro-ethene	Toluene	Trans-1,2-Dichloro-ethene	Trans-1,3-Dichloro-propene	Trans-1,4-Dichloro-2-Butene	Trichloro-ethene	Trichloro-fluoro-methane	Vinyl Acetate	Vinyl Chloride
		CAS #	100-42-5	127-18-4	108-88-3	156-60-5	10061-02-6	110-57-6	79-01-6	75-69-4	108-05-4	75-01-4
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	5/19/2017	WV10170519-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-12	5/17/2017	WV12170517-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-13	5/8/2017	WV13170508-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-19	5/8/2017	WV19170508-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-2	5/17/2017	WV2-170517-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	0.575	< 0.1 U	0.09
MW-20	5/8/2017	WV20170508-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-21	5/25/2017	WV21170525-	< 0.1 U	< 0.1 U	< 0.1 U	0.13 JT	< 0.5 U	< 0.5 U	< 0.1 U	0.467	< 0.1 U	0.0917
MW-26	5/25/2017	WV26170525-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-29	5/19/2017	WV29170519-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-3	5/17/2017	WV3-170517-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-4	6/5/2017	WV4-170605-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	0.13 JT	< 0.1 U	< 0.01 U
MW-7	5/3/2017	WV7-170503-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-8	5/4/2017	WV8-170504-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-9	5/19/2017	WV9-170519-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
DW-85	6/2/2017	WV85170602-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
DW-PA	6/2/2017	WVPA170602-	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U
MW-12 DUP	5/17/2017	WV12170517D	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.5 U	< 0.5 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.01 U

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Water Levels
Contact Person: Sendy Jimenez (206) 477-5224

Static Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	**Measurement Date**	(feet)	(feet)	(feet above MSL)
MW-10	7/31/2017	410.21	144.53	265.68
MW-12	7/31/2017	315.67	140.67	175
MW-13	7/31/2017	377.37	97.37	280
MW-19	7/31/2017	405.58	245.7	159.88
MW-2	7/31/2017	318.09	72.75	245.34
MW-20	7/31/2017	370.43	120.43	250
MW-21	7/31/2017	348.95	105.62	243.33
MW-24	7/31/2017	373.93	86.12	287.81
MW-26	7/31/2017	406.58	247.37	159.21
MW-28	7/31/2017	398.72	236.71	162.01
MW-29	7/31/2017	413.79	244.3	169.49
MW-3	7/31/2017	318.12	40	278.12
MW-4	7/31/2017	377.3	100.33	276.97
MW-7	7/31/2017	376.56	189.64	186.92
MW-8	7/31/2017	386.13	175.71	210.42
MW-9	7/31/2017	405.32	164.85	240.47

Sampling Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	**Measurement Date**	(feet)	(feet)	(feet above MSL)
MW-10	8/3/2017	410.21	144.35	265.86
MW-12	8/7/2017	315.67	140.71	174.96
MW-13	8/4/2017	377.37	97.28	280.09
MW-19	8/2/2017	405.58	245.47	160.11
MW-2	8/7/2017	318.09	72.74	245.35
MW-20	8/7/2017	370.43	120.43	250
MW-21	8/7/2017	345.66	105.6	240.06
MW-26	8/11/2017	406.58	159.47	247.11
MW-29	8/11/2017	413.79	169.65	244.14
MW-3	8/7/2017	318.12	40.06	278.06
MW-4	9/6/2017	377.3	100.12	277.18
MW-7	8/4/2017	376.56	189.32	187.24
MW-8	8/3/2017	386.143	175.6	210.53
MW-9	8/2/2017	405.32	164.74	240.58

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Field Parameters
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Field Parameters			Specific Conductance (Field)	Dissolved Oxygen (DO) (Field)	Oxidation-Reduction Potential (ORP) (Field)	pH (Field)	Purge Volume	Temperature (Field)	Turbidity (Field)
Well #	**Sample Date**	**Sample ID**	(std. Units)	(mg/L)	(mV)	(µmhos/cm)	(gal)	(°C)	(NTU)
MW-10	8/3/2017	WV10170803-	158.8	6.01	251	7.17	2.5	11.05	0.37
MW-12	8/7/2017	WV12170807-	162.5	4.8	223	7.24	3.5	10.27	0.44
MW-12	8/7/2017	WV12170807D	162.5	4.8	223	7.24	3.5	10.27	0.44
MW-13	8/4/2017	WV13170804-	176.7	4.67	114	7.13	4.1	11.12	0.23
MW-19	8/2/2017	WV19170802-	205.3	0.78	171.8	7.37	4.7	10.55	1.25
MW-2	8/7/2017	WV2-170807-	301.3	0.42	232	6.99	2.3	10.47	0.25
MW-20	8/7/2017	WV20170807-	202.5	1.09	125.7	6.95	2.75	11.84	4.72
MW-21	8/7/2017	WV21170807-	246.5	0.96	192.1	6.89	3	10.41	6.05
MW-26	8/11/2017	WV26170811-	189.1	0.37	126	7.83	5.75	10.91	3.21
MW-29	8/11/2017	WV29170811-	242.9	0.5	103	7.25	5.5	11.07	3.41
MW-4	9/6/2017	WV4-170906-	185.8	10.01	316.9	6.46	0.9	11.88	6.12
MW-7	8/4/2017	WV7-170804-	188.8	1.41	73	7.4	3	12.37	0.25
MW-8	8/3/2017	WV8-170803-	163.7	10.02	222	6.88	1.5	12.01	0.17
MW-9	8/2/2017	WV9-170802-	194.8	8.96	418.9	6.77	3	10.75	0.2
DW-85	9/7/2017	WV85170907-	156.6	0.2	-125.3	8.07	30	10.72	0.43
DW-PA	9/7/2017	WVPA170907-	196	8.76	224.6	7.1	31.5	11.51	0.26

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - Conventionals			Alkalinity, Total (as $CACO_3$)	Ammonia as N	Chloride	Nitrate	Specific Conductance (Lab)	Sulfate	Total Dissolved Solids	Total Organic Carbon	Total Solids	Total Suspended Solids
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(µmhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	8/3/2017	WV10170803-	62.2	0.0021 T	3.39	0.696	160	9.14	117	0.5 U	119	1 U
MW-12	8/7/2017	WV12170807-	62.7	0.002 U	3.3	0.759	165	11.4	117	0.5 U	123	0.5 U
MW-12	8/7/2017	WV12170807D	62.5	0.002 U	3.32	0.756	165	11.5	123	0.5 U	124	0.5 U
MW-13	8/4/2017	WV13170804-	67.9	0.002 U	3.25	0.133	180	16.6	124	0.5 U	132	0.7 T
MW-19	8/2/2017	WV19170802-	86.6	0.0335	4.79	0.01 U	222	17.5	149	0.5 U	161	1 U
MW-2	8/7/2017	WV2-170807-	137	0.002 U	3.28	0.01 U	306	17	187	0.61 T	198	0.6 T
MW-20	8/7/2017	WV20170807-	84.4	0.0154	3.34	0.01 U	213	17.3	149	0.5 U	166	6.4
MW-21	8/7/2017	WV21170807-	120	0.0194	2.37	0.076	266	14	169	1 T	182	5.1
MW-26	8/11/2017	WV26170811-	74.7	0.265	3.72	0.011 T	191	13.4	141	0.61 T	153	10.5
MW-29	8/11/2017	WV29170811-	102	0.0024 T	3.55	0.01 U	244	15.6	157	0.5 U	168	3.8
MW-4	9/6/2017	WV4-170906-	46.9	0.0109	8.33	3.18	178	12.7	163	0.5 U	179	8.9
MW-7	8/4/2017	WV7-170804-	78.5	0.268	3.48	0.014 T	191	11.4	136	0.73 T	140	0.5 U
MW-8	8/3/2017	WV8-170803-	49.3	0.002 U	4.59	4.26	166	7.15	135	0.5 U	139	0.5 U
MW-9	8/2/2017	WV9-170802-	80.6	0.002 U	5.34	0.438	210	14.3	147	0.5 U	157	0.5 U
DW-85	9/7/2017	WV85170907-	68.9	0.275	2.79	0.01 U	151	2.67	106	0.5 U	107	0.5 U
DW-PA	9/7/2017	WVPA170907-	72	0.002 U	5.77	1.36	196	11.5	127	0.5 U	131	0.5 U

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Antimony, Dissolved	Antimony, Total	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved	Barium, Total	Beryllium, Dissolved	Beryllium, Total	Cadmium, Dissolved	Cadmium, Total	Calcium, Dissolved
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	8/3/17 8:15	WV10170803-	0.0003 U	0.0003 U	0.00158	0.00153	0.00358	0.00375	0.0001 U	0.0001 U	0.00005 U	0.00005 U	10.7
MW-12	8/7/17 9:50	WV12170807-	0.0003 U	0.0003 U	0.00208	0.002	0.00477	0.00477	0.0001 U	0.0001 U	0.00005 U	0.00005 U	11.8
MW-12	8/7/17 9:50	WV12170807D	0.0003 U	0.0003 U	0.00211	0.00206	0.00458	0.00516	0.0001 U	0.0001 U	0.00005 U	0.00005 U	11.7
MW-13	8/4/2017	WV13170804-	0.0003 U	0.0003 U	0.00166	0.00162	0.00388	0.00405	0.0001 U	0.0001 U	0.00005 U	0.00005 U	10.7
MW-19	8/2/2017	WV19170802-	0.0003 U	0.0003 U	0.00109	0.00122	0.0169	0.0167	0.0001 U	0.0001 U	0.00005 U	0.00005 U	15.5
MW-2	8/7/2017	WV2-170807-	0.0003 U	0.0003 U	0.00105	0.000982	0.00674	0.00673	0.0001 U	0.0001 U	0.0000697	0.0000731	19.9
MW-20	8/7/2017	WV20170807-	0.0003 U	0.0003 U	0.0017	0.00243	0.00639	0.00783	0.0001 U	0.0001 U	0.00005 U	0.00005 U	13.5
MW-21	8/7/2017	WV21170807-	0.0003 U	0.0003 U	0.00147	0.00362	0.00807	0.0097	0.0001 U	0.0001 U	0.00005 U	0.00005 U	19.1
MW-26	8/11/2017	WV26170811-	0.0003 U	0.0003 U	0.00304	0.00365	0.00925	0.0118	0.0001 U	0.0001 U	0.00005 U	0.00005 U	17.4
MW-29	8/11/2017	WV29170811-	0.0003 U	0.0003 U	0.00411	0.0042	0.0108	0.0104	0.0001 U	0.0001 U	0.00005 U	0.00005 U	20.3
MW-4	9/6/2017	WV4-170906-	0.0003 U	0.0003 U	0.000503	0.000623	0.00443	0.00748	0.0001 U	0.0001 U	0.00005 U	0.000092	11.5
MW-7	8/4/2017	WV7-170804-	0.0003 U	0.0003 U	0.00505	0.00514	0.014	0.0139	0.0001 U	0.0001 U	0.00005 U	0.00005 U	16
MW-8	8/3/2017	WV8-170803-	0.0003 U	0.0003 U	**0.000462**	0.000472	0.00328	0.00348	0.0001 U	0.0001 U	0.00005 U	0.00005 U	11.8
MW-9	8/2/2017	WV9-170802-	0.0003 U	0.0003 U	0.00217	0.00227	0.00433	0.00446	0.0001 U	0.0001 U	0.00005 U	0.00005 U	15.8
DW-85	9/7/2017	WV85170907-	0.0003 U	0.0003 U	0.00043	0.000402	0.00969	0.00998	0.0001 U	0.0001 U	0.00005 U	0.00005 U	13.9
DW-PA	9/7/2017	WVPA170907-	0.0003 U	0.0003 U	0.00154	0.00152	0.00414	0.00413	0.0001 U	0.0001 U	0.00005 U	0.00005 U	13.5

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Calcium, Total	Chromium, Dissolved	Chromium, Total	Cobalt, Dissolved	Cobalt, Total	Copper, Dissolved	Copper, Total	Iron, Dissolved	Iron, Total	Lead, Dissolved	Lead, Total
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	8/3/17 8:15	WV10170803-	10.8	0.00339	0.00333	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.01 U	0.0104	0.0001 U	0.0001 U
MW-12	8/7/17 9:50	WV12170807-	11.5	0.00369	0.00367	0.00005 U	0.00005 U	0.000311	0.0002 U	0.01 U	0.0213	0.0001 U	0.0001 U
MW-12	8/7/17 9:50	WV12170807D	11.8	0.00366	0.00383	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.01 U	0.0226	0.0001 U	0.0001 U
MW-13	8/4/2017	WV13170804-	10.5	0.00222	0.00212	0.0000618	0.0000612	0.000202	0.000218	0.0357	0.0421	0.0001 U	0.0001 U
MW-19	8/2/2017	WV19170802-	15.6	0.0002 U	0.0002 U	0.00005 U	0.00005 U	0.0002 U	0.000237	0.0323	0.151	0.0001 U	0.0001 U
MW-2	8/7/2017	WV2-170807-	19.2	0.0002 U	0.00026	0.0000634	0.0000709	0.0002 U	0.000209	0.01 U	0.0166	0.0001 U	0.0001 U
MW-20	8/7/2017	WV20170807-	13.7	0.0002 U	0.000204	0.0000753	0.000102	0.0002 U	0.0002 U	0.282	0.827	0.0001 U	0.0001 U
MW-21	8/7/2017	WV21170807-	18.6	0.0002 U	0.0002 U	0.000237	0.00033	0.000211	0.000353	0.479	1.46	0.0001 U	0.0001 U
MW-26	8/11/2017	WV26170811-	17.6	0.0002 U	0.000308	0.00005 U	0.0000858	0.0002 U	0.000238	0.082	1.28	0.0001 U	0.0001 U
MW-29	8/11/2017	WV29170811-	20	0.0002 U	0.0002 U	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.836	1.03	0.0001 U	0.0001 U
MW-4	9/6/2017	WV4-170906-	11.7	0.00341	0.00386	0.00005 U	0.000356	0.0002 U	0.00119	0.01 U	0.335	0.0001 U	0.00113
MW-7	8/4/2017	WV7-170804-	16	0.0002 U	0.0002 U	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.0173	0.0223	0.0001 U	0.0001 U
MW-8	8/3/2017	WV8-170803-	12.1	0.00169	0.0017	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-9	8/2/2017	WV9-170802-	16.7	0.00405	0.00417	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
DW-85	9/7/2017	WV85170907-	14.2	0.0002 U	0.0002 U	0.00005 U	0.00005 U	0.0066	0.00025	0.071	0.0659	0.00331	0.0001 U
DW-PA	9/7/2017	WVPA170907-	13.7	0.00191	0.00193	0.00005 U	0.00005 U	0.00669	0.0153	0.01 U	0.01 U	0.000383	0.000578

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Magnesium, Dissolved	Magnesium, Total	Manganese, Dissolved	Manganese, Total	Mercury, Dissolved	Mercury, Total	Nickel, Dissolved	Nickel, Total	Potassium, Dissolved	Potassium, Total	Selenium, Dissolved
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	8/3/17 8:15	WV10170803-	10.5	10.8	0.0001 U	0.00026	0.00005 U	0.00005 U	0.000213	0.000271	1.45	1.48	0.0005 U
MW-12	8/7/17 9:50	WV12170807-	10	9.4	0.000142	0.000323	0.00005 U	0.00005 U	0.000177	0.000214	1.79	1.84	0.0005 U
MW-12	8/7/17 9:50	WV12170807D	9.84	9.37	0.0001 U	0.000601	0.00005 U	0.00005 U	0.000196	0.000235	1.79	1.87	0.0005 U
MW-13	8/4/2017	WV13170804-	12.9	12.7	0.0135	0.013	0.00005 U	0.00005 U	0.00125	0.00126	1.8	1.79	0.0005 U
MW-19	8/2/2017	WV19170802-	14.5	14.9	0.513	0.549	0.00005 U	0.00005 U	0.0001 U	0.0001 U	2.39	2.44	0.0005 U
MW-2	8/7/2017	WV2-170807-	23.5	21.6	0.106	0.105	0.00005 U	0.00005 U	0.00549	0.00549	2.08	2.08	0.0005 U
MW-20	8/7/2017	WV20170807-	14.4	13.7	0.295	0.302	0.00005 U	0.00005 U	0.000399	0.000636	2.07	2.18	0.0005 U
MW-21	8/7/2017	WV21170807-	16.7	15.7	0.736	0.839	0.00005 U	0.00005 U	0.00401	0.00429	1.98	2.06	0.0005 U
MW-26	8/11/2017	WV26170811-	7.44	7.45	0.0672	0.0753	0.00005 U	0.00005 U	0.000173	0.000452	3.01	2.98	0.0005 U
MW-29	8/11/2017	WV29170811-	14.3	14.1	0.0936	0.0932	0.00005 U	0.00005 U	0.0001 U	0.000175	2.21	2.15	0.0005 U
MW-4	9/6/2017	WV4-170906-	9.61	9.76	0.00203	0.169	0.00005 U	0.00005 U	0.00137	0.00814	1.12	1.17	0.0005 U
MW-7	8/4/2017	WV7-170804-	10.3	10.5	0.174	0.172	0.00005 U	0.00005 U	0.000197	0.00018	2.65	2.72	0.0005 U
MW-8	8/3/2017	WV8-170803-	9.39	9.77	0.0001 U	0.0001 U	0.00005 U	0.00005 U	0.000553	0.000557	1.08	1.11	0.0005 U
MW-9	8/2/2017	WV9-170802-	12.7	14	0.0001 U	0.000273	0.00005 U	0.00005 U	0.000138	0.000211	2.22	2.39	0.0005 U
DW-85	9/7/2017	WV85170907-	6.48	6.46	0.0533	0.0544	0.00005 U	0.00005 U	0.0001 U	0.0001 U	2.56	2.62	0.0005 U
DW-PA	9/7/2017	WVPA170907-	11.6	11.5	0.000116	0.000166	0.00005 U	0.00005 U	0.000552	0.000553	1.63	1.63	0.0005 U

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Selenium, Total	Silver, Dissolved	Silver, Total	Sodium, Dissolved	Sodium, Total	Thallium, Dissolved	Thallium, Total	Vanadium, Dissolved	Vanadium, Total	Zinc, Dissolved	Zinc, Total
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	8/3/17 8:15	WV10170803-	0.0005 U	0.00004 U	0.0000639	5.24	5.59	0.0001 U	0.0001 U	0.00437	0.00444	0.000515	0.00213 D
MW-12	8/7/17 9:50	WV12170807-	0.0005 U	0.00004 U	0.0000412	6.38	5.95	0.0001 U	0.0001 U	0.00522	0.00502	0.00258	0.0005 U
MW-12	8/7/17 9:50	WV12170807D	0.0005 U	0.00004 U	0.000043	6.14	5.94	0.0001 U	0.0001 U	0.0052	0.00521	0.0005 U	0.000524
MW-13	8/4/2017	WV13170804-	0.0005 U	0.00004 U	0.00004 U	6.59	6.54	0.0001 U	0.0001 U	0.00497	0.00491	0.0005 U	0.000531 D
MW-19	8/2/2017	WV19170802-	0.0005 U	0.00004 U	0.00004 U	6.95	7.22	0.0001 U	0.0001 U	0.000075 U	0.000075 U	0.0005 U	0.00137 D
MW-2	8/7/2017	WV2-170807-	0.0005 U	0.00004 U	0.00004 U	9.3	8.57	0.0001 U	0.0001 U	0.00426	0.00405	0.00124	0.00131
MW-20	8/7/2017	WV20170807-	0.0005 U	0.00004 U	0.00004 U	6.55	6.15	0.0001 U	0.0001 U	0.000075 U	0.000174	0.000723	0.00104
MW-21	8/7/2017	WV21170807-	0.0005 U	0.00004 U	0.00004 U	11.3	10.9	0.0001 U	0.0001 U	0.000433	0.000713	0.00221	0.0021
MW-26	8/11/2017	WV26170811-	0.0005 U	0.00004 U	0.00004 U	7.86	8.11	0.0001 U	0.0001 U	0.000075 U	0.000289	0.0005 U	0.00693
MW-29	8/11/2017	WV29170811-	0.0005 U	0.00004 U	0.00004 U	6.46	6.48	0.0001 U	0.0001 U	0.000075 U	0.000127	0.0005 U	0.000556
MW-4	9/6/2017	WV4-170906-	0.0005 U	0.00004 U	0.00004 U	7.17	7.05	0.0001 U	0.0001 U	0.00315	0.00404	0.00107	0.00254
MW-7	8/4/2017	WV7-170804-	0.0005 U	0.00004 U	0.00004 U	6.37	6.49	0.0001 U	0.0001 U	0.000103	0.000108	0.000672	0.00084 D
MW-8	8/3/2017	WV8-170803-	0.0005 U	0.00004 U	0.00004 U	6.37	6.61	0.0001 U	0.0001 U	0.00234	0.00239	0.000584	0.00139 D
MW-9	8/2/2017	WV9-170802-	0.0005 U	0.00004 U	0.00004 U	6.42	6.82	0.0001 U	0.0001 U	0.00465	0.00495	0.0005 U	0.000707 D
DW-85	9/7/2017	WV85170907-	0.0005 U	0.00004 U	0.00004 U	5.94	5.96	0.0001 U	0.0001 U	0.0000763	0.000082	0.00747	0.00153
DW-PA	9/7/2017	WVPA170907-	0.0005 U	0.00004 U	0.00004 U	6.65	6.7	0.0001 U	0.0001 U	0.00335	0.00333	0.00222	0.00247

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - VOAs			1,1,1,2-Tetrachloro-ethane	1,1,1-Trichloro-ethane	1,1,2,2-Tetrachloro-ethane	1,1,2-Trichloro-ethane	1,1-Dichloro-ethane	1,1-Dichloro-ethene	1,2,3-Trichloro-propane	1,2-Dibromo-3-Chloropro-pane	1,2-Dibromo-ethane	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,2-Dichloro-propane	1,4-Dichloro-benzene
		CAS #	630-20-6	71-55-6	79-34-5	79-00-5	75-34-3	75-35-4	96-18-4	96-12-8	106-93-4	95-50-1	107-06-2	78-87-5	106-46-7
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	8/3/2017	WV10170803-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-12	8/7/2017	WV12170807-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-12	8/7/2017	WV12170807D	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-13	8/4/2017	WV13170804-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-19	8/2/2017	WV19170802-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-2	8/7/2017	WV2-170807-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-20	8/7/2017	WV20170807-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-21	8/7/2017	WV21170807-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-26	8/11/2017	WV26170811-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-29	8/11/2017	WV29170811-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-4	9/6/2017	WV4-170906-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-7	8/4/2017	WV7-170804-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-8	8/3/2017	WV8-170803-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-9	8/2/2017	WV9-170802-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
DW-85	9/7/2017	WV85170907-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
DW-PA	9/7/2017	WVPA170907-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
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Groundwater - VOAs			2-Butanone	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Acrylo-nitrile	Benzene	Bromochloro-methane	Bromo-dichloro-methane	Bromoform	Bromo-methane	Carbon Disulfide	Carbon Tetra-chloride	Chloro-benzene
		CAS #	78-93-3	591-78-6	108-10-1	67-64-1	107-13-1	71-43-2	74-97-5	75-27-4	75-25-2	74-83-9	75-15-0	56-23-5	108-90-7
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	8/3/2017	WV10170803-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-12	8/7/2017	WV12170807-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-12	8/7/2017	WV12170807D	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-13	8/4/2017	WV13170804-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-19	8/2/2017	WV19170802-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-2	8/7/2017	WV2-170807-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-20	8/7/2017	WV20170807-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-21	8/7/2017	WV21170807-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-26	8/11/2017	WV26170811-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-29	8/11/2017	WV29170811-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-4	9/6/2017	WV4-170906-	0.25 U	0.5 U	2.5 U	2.6 JT	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-7	8/4/2017	WV7-170804-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-8	8/3/2017	WV8-170803-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-9	8/2/2017	WV9-170802-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
DW-85	9/7/2017	WV85170907-	0.25 U	0.5 U	2.5 U	4.4 JT	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
DW-PA	9/7/2017	WVPA170907-	0.25 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U

King County Solid Waste Division
Environmental Field Data
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Groundwater - VOAs			Chloro-dibromo-methane	Chloro-ethane	Chloroform	Chloro-methane	Cis-1-2-Dichloro-ethene	Cis-1,3-Dichloro-propene	Dibromo-methane	Dichloro-difluoro-methane	Ethyl-benzene	M & P Xylene	Methyl Iodide	Methylene Chloride	O-Xylene
		CAS #	124-48-1	75-00-3	67-66-3	74-87-3	156-59-2	10061-01-5	74-95-3	75-71-8	100-41-4	MPX	74-88-4	75-09-2	95-47-6
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	8/3/2017	WV10170803-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-12	8/7/2017	WV12170807-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-12	8/7/2017	WV12170807D	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-13	8/4/2017	WV13170804-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-19	8/2/2017	WV19170802-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-2	8/7/2017	WV2-170807-	0.5 U	0.1 U	0.1 U	0.25 U	0.15 JT	0.25 U	0.1 U	4.05	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-20	8/7/2017	WV20170807-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.441	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-21	8/7/2017	WV21170807-	0.5 U	0.1 U	0.1 U	0.25 U	0.956	0.25 U	0.1 U	0.753	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-26	8/11/2017	WV26170811-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-29	8/11/2017	WV29170811-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-4	9/6/2017	WV4-170906-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-7	8/4/2017	WV7-170804-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-8	8/3/2017	WV8-170803-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-9	8/2/2017	WV9-170802-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
DW-85	9/7/2017	WV85170907-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
DW-PA	9/7/2017	WVPA170907-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from July 1st, 2017 to September 30th, 2017
Vashon Closed Landfill --- Groundwater Analysis Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - VOAs			Styrene	Tetra-chloroethene	Toluene	Trans-1-2-Dichloro-ethene	Trans-1-3-Dichloro-propene	Trans-1-4-Dichloro-2-Butene	Trichloro-ethene	Trichloro-fluoro-methane	Vinyl Acetate	Vinyl Chloride
		CAS #	100-42-5	127-18-4	108-88-3	156-60-5	10061-02-6	110-57-6	79-01-6	75-69-4	108-05-4	75-01-4
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	8/3/2017	WV10170803-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-12	8/7/2017	WV12170807-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-12	8/7/2017	WV12170807D	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-13	8/4/2017	WV13170804-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-19	8/2/2017	WV19170802-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-2	8/7/2017	WV2-170807-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.356	0.1 U	0.0749
MW-20	8/7/2017	WV20170807-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-21	8/7/2017	WV21170807-	0.1 U	0.1 U	0.1 U	0.13 JT	0.5 U	0.5 U	0.1 U	0.286	0.1 U	0.0773
MW-26	8/11/2017	WV26170811-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-29	8/11/2017	WV29170811-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-4	9/6/2017	WV4-170906-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.12 JT	0.1 U	0.01 U
MW-7	8/4/2017	WV7-170804-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-8	8/3/2017	WV8-170803-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-9	8/2/2017	WV9-170802-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
DW-85	9/7/2017	WV85170907-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
DW-PA	9/7/2017	WVPA170907-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater Water Levels
Contact Person: Sendy Jimenez (206) 477-5224

Static Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	**Measurement Date**	(feet)	(feet)	(feet above MSL)
MW-10	11/9/2017	410.21	144.09	266.12
MW-12	11/9/2017	315.67	140.69	174.98
MW-13	11/9/2017	377.37	97.47	279.9
MW-19	11/9/2017	405.58	245.09	160.49
MW-2	11/9/2017	318.09	72.59	245.5
MW-20	11/9/2017	370.43	120.43	250
MW-21	11/9/2017	348.95	105.75	243.2
MW-24	11/9/2017	373.93	87.15	286.78
MW-25	11/9/2017	399.22	243.27	155.95
MW-26	11/9/2017	406.58	246.87	159.71
MW-28	11/9/2017	398.72	236.7	162.02
MW-29	11/9/2017	413.79	243.96	169.83
MW-3	11/9/2017	318.12	40.98	277.14
MW-4	11/9/2017	377.3	100.69	276.61
MW-7	11/9/2017	376.56	189.47	187.09
MW-8	11/9/2017	386.13	175.74	210.39
MW-9	11/9/2017	405.32	165.06	240.26

Sampling Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	**Measurement Date**	(feet)	(feet)	(feet above MSL)
MW-10	11/17/2017	410.21	144.56	265.65
MW-12	11/13/2017	315.67	140.88	174.79
MW-13	11/13/2017	377.37	97.67	279.7
MW-19	11/17/2017	405.58	247.6	157.98
MW-2	11/13/2017	318.09	73	245.09
MW-20	11/17/2017	370.43	120.91	249.52
MW-21	11/14/2017	345.66	105.96	239.7
MW-26	11/17/2017	406.58	247.24	159.34
MW-29	11/17/2017	413.79	244.18	169.61
MW-3	11/13/2017	318.12	40.44	277.68
MW-4	12/5/2017	377.3	101	276.3
MW-7	11/13/2017	376.56	189.65	186.91
MW-8	11/14/2017	386.13	175.97	210.16
MW-9	11/17/2017	405.32	165.5	239.82

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater Field Parameters
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Field Parameters			Specific Conductance (Field)	Dissolved Oxygen (DO) (Field)	Oxidation-Reduction Potential (ORP) (Field)	pH (Field)	Purge Volume	Temperature (Field)	Turbidity (Field)
Well #	**Sample Date**	**Sample ID**	(std. Units)	(mg/L)	(mV)	(µmhos/cm)	(gal)	(°C)	(NTU)
MW-10	11/17/2017	WV10171117-	151.3	5.54	224.7	7.02	3	10.01	0.67
MW-12	11/13/2017	WV12171113-	164	4.9	208.6	7.22	--	9.663	1.16
MW-13	11/13/2017	WV13171113-	166	7.6	182.4	7.14	1.75	10.728	0.77
MW-19	11/17/2017	WV19171117-	219.9	0.6	129.4	7.46	5.5	9.78	0.87
MW-2	11/13/2017	WV2-171113-	294.9	0.58	184.1	6.77	2.5	9.852	0.43
MW-20	11/17/2017	WV20171117-	221.6	1.2	-4.7	7.21	2	10.658	2.66
MW-21	11/14/2017	WV21171114-	263.7	0.62	26.8	6.63	4	9.77	4.47
MW-26	11/17/2017	WV26171117-	189.7	1.03	22.3	8.17	3.5	10.408	13.9
MW-29	11/17/2017	WV29171117-	243.2	4.45	193.5	7.48	1.9	10.56	3.18
MW-4	12/5/2017	WV4-171205-	170	10.68	273.5	6.4	0.5	10.28	1.08
MW-7	11/13/2017	WV7-171113-	188.7	1.4	90.9	7.72	2.75	10.558	0.63
MW-8	11/14/2017	WV8-171114-	158.3	10.16	199.7	6.58	2	10.51	0.42
MW-9	11/17/2017	WV9-171117-	202.1	9.14	257.3	6.95	2.4	9.92	0.91

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater Conventional Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Conventionals			Alkalinity, Total (as $CACO_3$)	Ammonia as N	Chloride	Nitrate	Specific Conductance (Lab)	Sulfate	Total Dissolved Solids	Total Organic Carbon	Total Solids	Total Suspended Solids
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(µmhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	11/17/2017	WV10171117-	59.5	0.002 U	3.12	0.597	152	8.35	110	0.5 U	106	0.5 U
MW-12	11/13/2017	WV12171113-	63.6	0.002 U	3.1	0.738	165	10.5	119	0.5 U	116	2.3
MW-13	11/13/2017	WV13171113-	65.2	0.002 U	3.09	0.204	167	12.8	119	1.7	124	1.1
MW-19	11/17/2017	WV19171117-	87.7	0.0293	4.44	0.01 U	222	16.2	145	0.5 U	147	0.5 T
MW-2	11/13/2017	WV2-171113-	133	0.0022 T	3.06	0.01 U	293	15.1	174	0.5 U	187	0.5 U
MW-20	11/17/2017	WV20171117-	87.4	0.0152	3.04	0.01 U	217	16.4	147	0.5 U	152	2.7
MW-21	11/14/2017	WV21171114-	120	0.0227	2.13	0.128	263	12.1	168	1 T	174	3.3
MW-26	11/17/2017	WV26171117-	75.7	0.224	3.56	0.012 T	190	12.7	138	0.5 U	158	18.6
MW-29	11/17/2017	WV29171117-	103	0.0032 T	3.68	0.01 U	244	16	156	0.77 T	160	2.8
MW-4	12/5/2017	WV4-171205-	42.3	0.0021 T	10.3	2.06	173	14.1	146	0.52 T	145	0.6 T
MW-7	11/13/2017	WV7-171113-	78.5	0.249	3.32	0.013 T	188	10.6	131	0.5 U	134	0.5 U
MW-8	11/14/2017	WV8-171114-	51.4	0.002 U	4.29	3.83	164	6.82	118	0.5 U	122	0.5 U
MW-9	11/17/2017	WV9-171117-	79.1	0.002 U	4.63	0.4	202	12.6	139	0.5 U	139	0.5 U

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater Metals Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Antimony, Dissolved	Antimony, Total	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved	Barium, Total	Beryllium, Dissolved	Beryllium, Total	Cadmium, Dissolved	Cadmium, Total	Calcium, Dissolved
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	11/17/2017	WV10171117-	0.0003 U	0.0003 U	0.00155	0.00156	0.00362	0.00368	0.0001 U	0.0001 U	0.00005 U	0.00005 U	9.6
MW-12	11/13/2017	WV12171113-	0.0003 U	0.0003 U	0.00204	0.00192	0.00451	0.00498	0.0001 U	0.0001 U	0.00005 U	0.00005 U	11.3
MW-13	11/13/2017	WV13171113-	0.0003 U	0.0003 U	0.00197	0.00196	0.00389	0.00402	0.0001 U	0.0001 U	0.00005 U	0.00005 U	9.69
MW-19	11/17/2017	WV19171117-	0.0003 U	0.0003 U	0.00107	0.00125	0.0168	0.0183	0.0001 U	0.0001 U	0.00005 U	0.00005 U	14.7
MW-2	11/13/2017	WV2-171113-	0.0003 U	0.0003 U	0.000994	0.000945	0.00636	0.00677	0.0001 U	0.0001 U	0.00005 U	0.00005 U	18.5
MW-20	11/17/2017	WV20171117-	0.0003 U	0.0003 U	0.00164	0.00226	0.00723	0.0079	0.0001 U	0.0001 U	0.00005 U	0.00005 U	13.3
MW-21	11/14/2017	WV21171114-	0.0003 U	0.0003 U	0.00187	0.0026	0.00743	0.00938	0.0001 U	0.0001 U	0.00005 U	0.00005 U	18.2
MW-26	11/17/2017	WV26171117-	0.0003 U	0.0003 U	0.00287	0.00461	0.00809	0.0155	0.0001 U	0.0001 U	0.00005 U	0.00005 U	16.9
MW-29	11/17/2017	WV29171117-	0.0003 U	0.0003 U	0.00402	0.00447	0.00965	0.0112	0.0001 U	0.0001 U	0.00005 U	0.00005 U	19.8
MW-4	12/5/2017	WV4-171205-	0.0003 U	0.0003 U	0.00033	0.000366	0.00441	0.00506	0.0001 U	0.0001 U	0.00005 U	0.00005 U	11.6
MW-7	11/13/2017	WV7-171113-	0.0003 U	0.0003 U	0.00499	0.00493	0.0129	0.0149	0.0001 U	0.0001 U	0.00005 U	0.00005 U	15.4
MW-8	11/14/2017	WV8-171114-	0.0003 U	0.0003 U	0.000479	0.000471	0.00329	0.00359	0.0001 U	0.0001 U	0.00005 U	0.00005 U	11.3
MW-9	11/17/2017	WV9-171117-	0.0003 U	0.0003 U	0.00224	0.00217	0.00383	0.00444	0.0001 U	0.0001 U	0.00005 U	0.00005 U	14.8

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater Metals Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Calcium, Total	Chromium, Dissolved	Chromium, Total	Cobalt, Dissolved	Cobalt, Total	Copper, Dissolved	Copper, Total	Iron, Dissolved	Iron, Total	Lead, Dissolved	Lead, Total
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	11/17/2017	WV10171117-	10.3	0.00312	0.00335	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-12	11/13/2017	WV12171113-	11.1	0.00364	0.00365	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.01 U	0.0297	0.0001 U	0.0001 U
MW-13	11/13/2017	WV13171113-	9.87	0.00306	0.00329	0.00005 U	0.00005 U	0.0002 U	0.000258	0.01 U	0.0294	0.0001 U	0.0001 U
MW-19	11/17/2017	WV19171117-	15.5	0.0002 U	0.0002 U	0.00005 U	0.00005 U	0.0002 U	0.000439	0.0331	0.212	0.0001 U	0.0001 U
MW-2	11/13/2017	WV2-171113-	18.4	0.0002 U	0.000222	0.0000646	0.0000783	0.0002 U	0.0002 U	0.01 U	0.0123	0.0001 U	0.0001 U
MW-20	11/17/2017	WV20171117-	14	0.0002 U	0.0002 U	0.0000725	0.0000845	0.0002 U	0.0002 U	0.293	0.716	0.0001 U	0.0001 U
MW-21	11/14/2017	WV21171114-	18.4	0.0002 U	0.0002 U	0.000237	0.000289	0.000201	0.000274	0.586	0.948	0.0001 U	0.0001 U
MW-26	11/17/2017	WV26171117-	18.2	0.0002 U	0.000351	0.00005 U	0.000129	0.0002 U	0.0004	0.0627	2.46	0.0001 U	0.000122
MW-29	11/17/2017	WV29171117-	21.1	0.0002 U	0.0002 U	0.00005 U	0.00005 U	0.000308	0.0002 U	0.69	1.01	0.0001 U	0.0001 U
MW-4	12/5/2017	WV4-171205-	12	0.00359	0.00378	0.00005 U	0.000067	0.0002 U	0.000295	0.01 U	0.0844	0.0001 U	0.000184
MW-7	11/13/2017	WV7-171113-	15.7	0.0002 U	0.0002 U	0.00005 U	0.00005 U	0.0002 U	0.000335	0.0157	0.0226	0.0001 U	0.0001 U
MW-8	11/14/2017	WV8-171114-	11.4	0.00179	0.00186	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-9	11/17/2017	WV9-171117-	15.4	0.004	0.00425	0.00005 U	0.00005 U	0.0002 U	0.0002 U	0.0383	0.011	0.0001 U	0.0001 U

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater Metals Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Magnesium, Dissolved	Magnesium, Total	Manganese, Dissolved	Manganese, Total	Mercury, Dissolved	Mercury, Total	Nickel, Dissolved	Nickel, Total	Potassium, Dissolved	Potassium, Total	Selenium, Dissolved
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	11/17/2017	WV10171117-	9.37	9.84	0.0001 U	0.000188	0.00005 U	0.00005 U	0.000273	0.000345	1.5	1.56	0.0005 U
MW-12	11/13/2017	WV12171113-	9.64	9.06	0.0001 U	0.000539	0.00005 U	0.00005 U	0.000279	0.000308	1.81	1.81	0.0005 U
MW-13	11/13/2017	WV13171113-	11	11.2	0.000335	0.00132	0.00005 U	0.00005 U	0.000969	0.00111	1.75	1.79	0.0005 U
MW-19	11/17/2017	WV19171117-	13.4	14	0.477	0.519	0.00005 U	0.00005 U	0.00036	0.000426	2.44	2.55	0.0005 U
MW-2	11/13/2017	WV2-171113-	21	20.6	0.112	0.112	0.00005 U	0.00005 U	0.00485	0.00468	2.08	2.09	0.0005 U
MW-20	11/17/2017	WV20171117-	13.7	14.5	0.288	0.305	0.00005 U	0.00005 U	0.00041	0.00048	2.19	2.3	0.0005 U
MW-21	11/14/2017	WV21171114-	16.1	16.1	0.707	0.743	0.00005 U	0.00005 U	0.0041	0.00418	1.98	2.07	0.0005 U
MW-26	11/17/2017	WV26171117-	7.45	7.72	0.0644	0.084	0.00005 U	0.00005 U	0.00011	0.00051	2.92	3.23	0.0005 U
MW-29	11/17/2017	WV29171117-	13.8	14.4	0.0947	0.0972	0.00005 U	0.00005 U	0.00014	0.000142	2.16	2.28	0.0005 U
MW-4	12/5/2017	WV4-171205-	8.85	9.07	0.000154	0.00612	0.00005 U	0.00005 U	0.00135	0.00175	1.04	1.09	0.0005 U
MW-7	11/13/2017	WV7-171113-	9.62	9.58	0.17	0.168	0.00005 U	0.00005 U	0.000248	0.000295	2.7	2.82	0.0005 U
MW-8	11/14/2017	WV8-171114-	9	8.89	0.0001 U	0.0001 U	0.00005 U	0.00005 U	0.000567	0.000562	1.1	1.11	0.0005 U
MW-9	11/17/2017	WV9-171117-	12.2	12.5	0.000129	0.000479	0.00005 U	0.00005 U	0.000187	0.000231	2.19	2.36	0.0005 U

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater Metals Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - Metals (Dissolved & Total)			Selenium, Total	Silver, Dissolved	Silver, Total	Sodium, Dissolved	Sodium, Total	Thallium, Dissolved	Thallium, Total	Vanadium, Dissolved	Vanadium, Total	Zinc, Dissolved	Zinc, Total
Well #	**Sample Date**	**Sample ID**	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
MW-10	11/17/2017	WV10171117-	0.0005 U	0.00004 DU	0.0000527 D	4.87	5.18	0.0001 U	0.0001 U	0.0041	0.00431	0.0005 U	0.0005 U
MW-12	11/13/2017	WV12171113-	0.0005 U	0.00004 DU	0.0000413 D	6.14	5.78	0.0001 U	0.0001 U	0.00503	0.00487	0.0005 U	0.0005 U
MW-13	11/13/2017	WV13171113-	0.0005 U	0.00004 DU	0.00004 DU	5.88	6	0.0001 U	0.0001 U	0.00593	0.00611	0.0005 U	0.0005 U
MW-19	11/17/2017	WV19171117-	0.0005 U	0.00004 DU	0.00004 DU	6.51	6.92	0.0001 U	0.0001 U	0.000075 U	0.000075 U	0.0005 U	0.00153
MW-2	11/13/2017	WV2-171113-	0.0005 U	0.00004 DU	0.00004 DU	8.7	8.47	0.0001 U	0.0001 U	0.00376	0.00372	0.000819	0.000687
MW-20	11/17/2017	WV20171117-	0.0005 U	0.00004 DU	0.00004 DU	6.21	6.68	0.0001 U	0.0001 U	0.000075 U	0.0000797	0.0005 U	0.000665
MW-21	11/14/2017	WV21171114-	0.0005 U	0.00004 DU	0.00004 DU	11	10.9	0.0001 U	0.0001 U	0.000436	0.000621	0.000968	0.00122
MW-26	11/17/2017	WV26171117-	0.0005 U	0.00004 DU	0.00004 DU	8.26	8.51	0.0001 U	0.0001 U	0.000075 U	0.000374	0.0005 U	0.0128
MW-29	11/17/2017	WV29171117-	0.0005 U	0.00004 DU	0.00004 DU	6.29	6.66	0.0001 U	0.0001 U	0.000075 U	0.0000768	0.00114	0.000569
MW-4	12/5/2017	WV4-171205-	0.0005 U	0.00004 U	0.00004 U	6.78	7.05	0.0001 U	0.0001 U	0.00214	0.00245	0.0005 U	0.000539
MW-7	11/13/2017	WV7-171113-	0.0005 U	0.00004 DU	0.00004 DU	6.07	6	0.0001 U	0.0001 U	0.0000993	0.000108	0.000977	0.00169
MW-8	11/14/2017	WV8-171114-	0.0005 U	0.00004 DU	0.00004 DU	6.18	6.07	0.0001 U	0.0001 U	0.00231	0.00232	0.0005 U	0.0005 U
MW-9	11/17/2017	WV9-171117-	0.0005 U	0.00004 DU	0.00004 DU	6.14	6.33	0.0001 U	0.0001 U	0.00453	0.0047	0.00051	0.0005 U

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater VOA Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - VOAs			1,1,1,2-Tetrachloro-ethane	1,1,1-Trichloro-ethane	1,1,2,2-Tetrachloro-ethane	1,1,2-Trichloro-ethane	1,1-Dichloro-ethane	1,1-Dichloro-ethene	1,2,3-Trichloro-propane	1,2-Dibromo-3-Chloropro-pane	1,2-Dibromo-ethane	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,2-Dichloro-propane	1,4-Dichloro-benzene
		CAS #	630-20-6	71-55-6	79-34-5	79-00-5	75-34-3	75-35-4	96-18-4	96-12-8	106-93-4	95-50-1	107-06-2	78-87-5	106-46-7
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	11/17/2017	WV10171117-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-12	11/13/2017	WV12171113-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-13	11/13/2017	WV13171113-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-19	11/17/2017	WV19171117-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-2	11/13/2017	WV2-171113-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-20	11/17/2017	WV20171117-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-21	11/14/2017	WV21171114-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-26	11/17/2017	WV26171117-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-29	11/17/2017	WV29171117-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-4	12/5/2017	WV4-171205-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-7	11/13/2017	WV7-171113-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-8	11/14/2017	WV8-171114-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-9	11/17/2017	WV9-171117-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater VOA Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - VOAs			2-Butanone	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Acrylo-nitrile	Benzene	Bromochloro-methane	Bromo-dichloro-methane	Bromoform	Bromo-methane	Carbon Disulfide	Carbon Tetra-chloride	Chloro-benzene
		CAS #	78-93-3	591-78-6	108-10-1	67-64-1	107-13-1	71-43-2	74-97-5	75-27-4	75-25-2	74-83-9	75-15-0	56-23-5	108-90-7
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	11/17/2017	WV10171117-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-12	11/13/2017	WV12171113-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-13	11/13/2017	WV13171113-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-19	11/17/2017	WV19171117-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-2	11/13/2017	WV2-171113-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.17 JT	0.25 U	0.1 U
MW-20	11/17/2017	WV20171117-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.11 JT	0.25 U	0.1 U
MW-21	11/14/2017	WV21171114-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-26	11/17/2017	WV26171117-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-29	11/17/2017	WV29171117-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-4	12/5/2017	WV4-171205-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-7	11/13/2017	WV7-171113-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 JT	0.25 U	0.1 U
MW-8	11/14/2017	WV8-171114-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U
MW-9	11/17/2017	WV9-171117-	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater VOA Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - VOAs			Chloro-dibromo-methane	Chloro-ethane	Chloroform	Chloro-methane	Cis-1-2-Dichloro-ethene	Cis-1,3-Dichloro-propene	Dibromo-methane	Dichloro-difluoro-methane	Ethyl-benzene	M & P Xylene	Methyl Iodide	Methylene Chloride	O-Xylene
		CAS #	124-48-1	75-00-3	67-66-3	74-87-3	156-59-2	10061-01-5	74-95-3	75-71-8	100-41-4	MPX	74-88-4	75-09-2	95-47-6
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	11/17/2017	WV10171117-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-12	11/13/2017	WV12171113-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-13	11/13/2017	WV13171113-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-19	11/17/2017	WV19171117-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-2	11/13/2017	WV2-171113-	0.5 U	0.1 U	0.1 U	0.25 U	0.214	0.25 U	0.1 U	3.99	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-20	11/17/2017	WV20171117-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.567	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-21	11/14/2017	WV21171114-	0.5 U	0.1 U	0.1 U	0.25 U	0.875	0.25 U	0.1 U	1	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-26	11/17/2017	WV26171117-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-29	11/17/2017	WV29171117-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-4	12/5/2017	WV4-171205-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-7	11/13/2017	WV7-171113-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-8	11/14/2017	WV8-171114-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U
MW-9	11/17/2017	WV9-171117-	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U

King County Solid Waste Division
Environmental Field Data
Data Collected from October 1st, 2017 to December 31st, 2017
Vashon Closed Landfill --- Groundwater VOA Data
Contact Person: Sendy Jimenez (206) 477-5224

Groundwater - VOAs			Styrene	Tetra-chloroethene	Toluene	Trans-1-2-Dichloro-ethene	Trans-1-3-Dichloro-propene	Trans-1-4-Dichloro-2-Butene	Trichloro-ethene	Trichloro-fluoro-methane	Vinyl Acetate	Vinyl Chloride
		CAS #	100-42-5	127-18-4	108-88-3	156-60-5	10061-02-6	110-57-6	79-01-6	75-69-4	108-05-4	75-01-4
Well #	**Sample Date**	**Sample ID**	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-10	11/17/2017	WV10171117-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-12	11/13/2017	WV12171113-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.015 JLT
MW-13	11/13/2017	WV13171113-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-19	11/17/2017	WV19171117-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-2	11/13/2017	WV2-171113-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.335	0.1 U	0.0813
MW-20	11/17/2017	WV20171117-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-21	11/14/2017	WV21171114-	0.1 U	0.1 U	0.1 U	0.12 JT	0.5 U	5 U	0.1 U	0.303	0.1 U	0.0556
MW-26	11/17/2017	WV26171117-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-29	11/17/2017	WV29171117-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-4	12/5/2017	WV4-171205-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-7	11/13/2017	WV7-171113-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-8	11/14/2017	WV8-171114-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-9	11/17/2017	WV9-171117-	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U

Appendix J

Ion Balance Calculations and Trilinear Diagrams

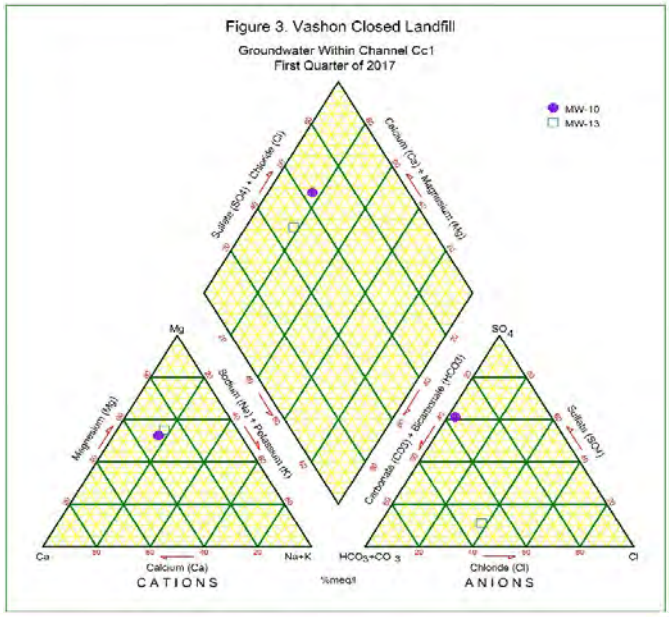
Figure 3. Vashon Closed Landfill
Groundwater Within Channel Cc1
First Quarter of 2017
MW-10
MW-13
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Mg
Magnesium (Mg)
Sodium (Na) + Potassium (K)
SO4
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Ca
Calcium (Ca)
Na+K
CATIONS
HCO3+CO 3
Chloride (Cl)
Cl
ANIONS
%meq/l

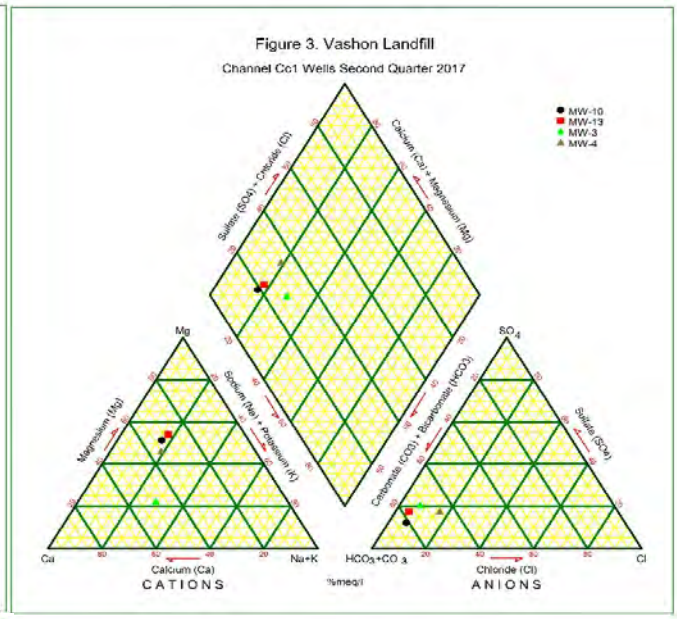
Figure 3. Vashon Landfill
Channel Cc1 Wells Second Quarter 2017
MW-10
MW-13
MW-3
MW-4
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Mg
Magnesium (Mg)
Sodium (Na) + Potassium (K)
SO4
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Ca
Calcium (Ca)
Na+K
CATIONS
HCO3+CO 3
Chloride (Cl)
Cl
ANIONS
%meq/l

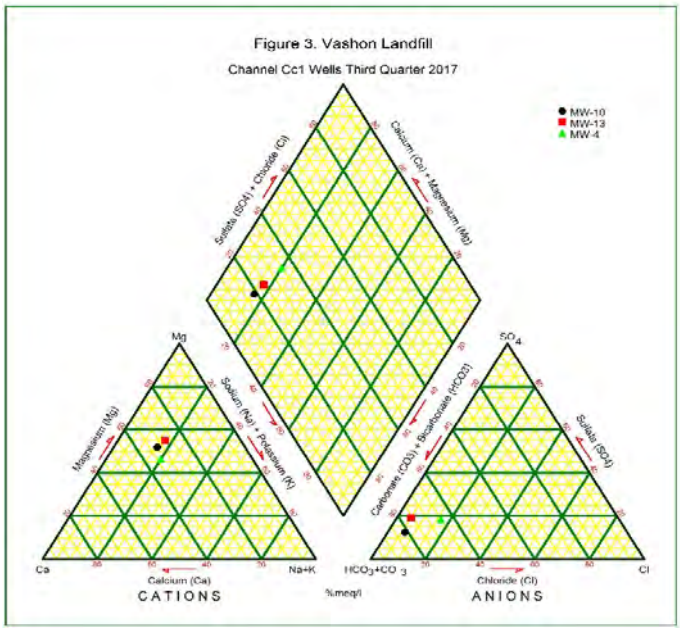
Figure 3. Vashon Landfill
Channel Cc1 Wells Third Quarter 2017
MW-10
MW-13
MW-4
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Mg
Magnesium (Mg)
Sodium (Na) + Potassium (K)
SO4
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Ca
Calcium (Ca)
Na+K
CATIONS
HCO3+CO 3
Chloride (Cl)
Cl
ANIONS
%meq/l

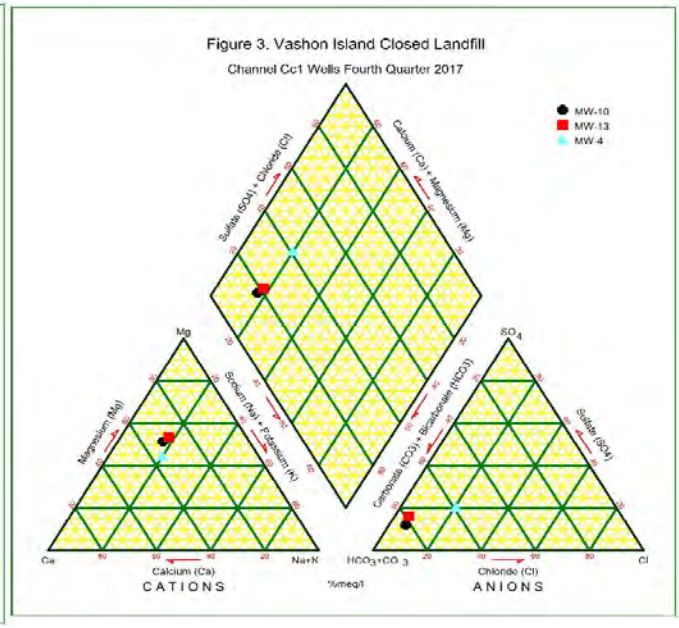
Figure 3. Vashon Island Closed Landfill
Channel Cc1 Wells Fourth Quarter 2017
MW-10
MW-13
MW-4
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Mg
Magnesium (Mg)
Sodium (Na) + Potassium (K)
SO4
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Ca
Calcium (Ca)
Na+K
CATIONS
HCO3+CO 3
Chloride (Cl)
Cl
ANIONS
%meq/l

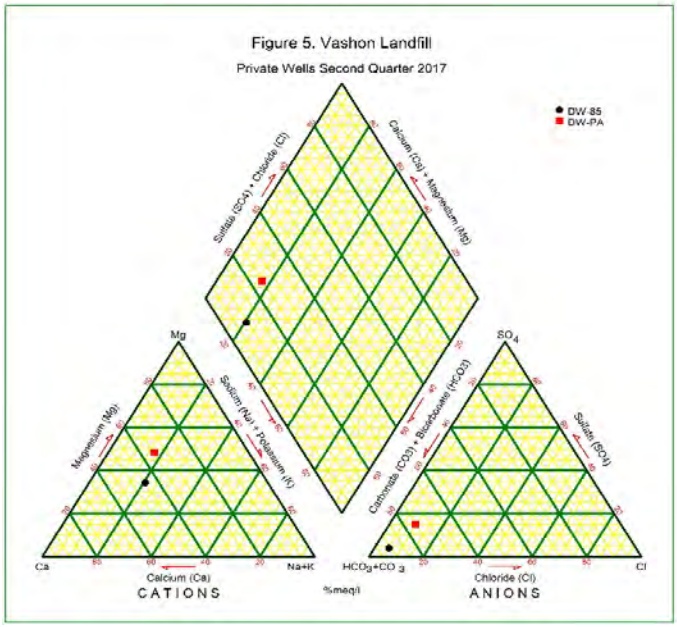
Figure 5. Vashon Landfill
Private Wells Second Quarter 2017
DW-85
DW-PA
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Mg
Magnesium (Mg)
Ca
Calcium (Ca)
Na+K
CATIONS
SO4
Sulfate (SO4)
HCO3+CO3
Chloride (Cl)
Cl
ANIONS
%meq/l

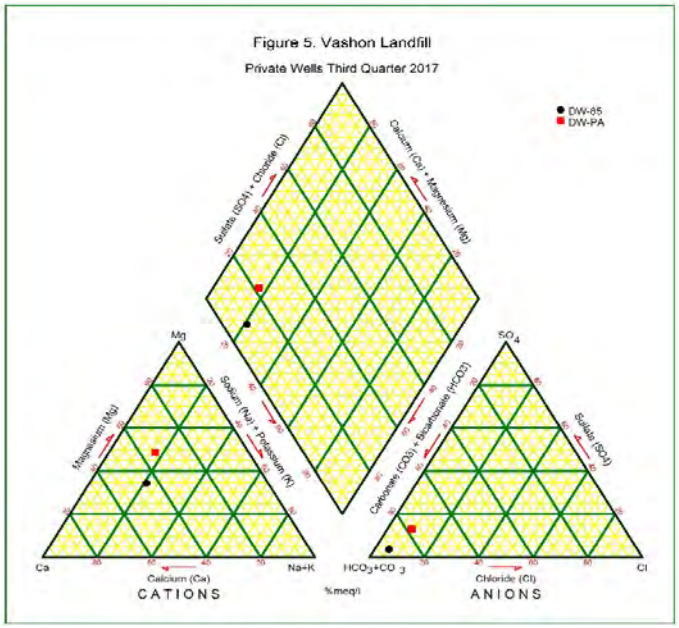
Figure 5. Vashon Landfill
Private Wells Third Quarter 2017
DW-85
DW-PA
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Mg
Magnesium (Mg)
Ca
Calcium (Ca)
Na+K
CATIONS
SO4
Sulfate (SO4)
HCO3+CO3
Chloride (Cl)
Cl
ANIONS
%meq/l

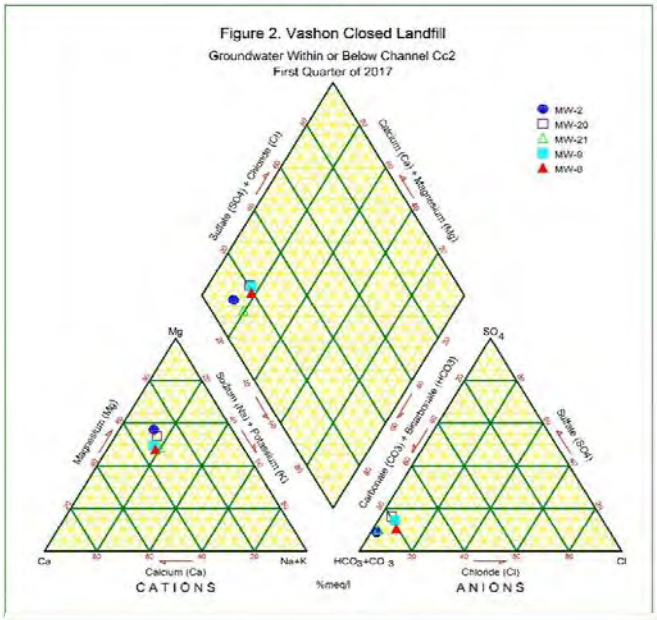
Figure 2. Vashon Closed Landfill
Groundwater Within or Below Channel Cc2
First Quarter of 2017
MW-2
MW-20
MW-21
MW-9
MW-8
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Magnesium (Mg)
Mg
SO4
Ca
Na+K
Calcium (Ca)
CATIONS
%meq/l
HCO3+CO3
Chloride (Cl)
Cl
ANIONS

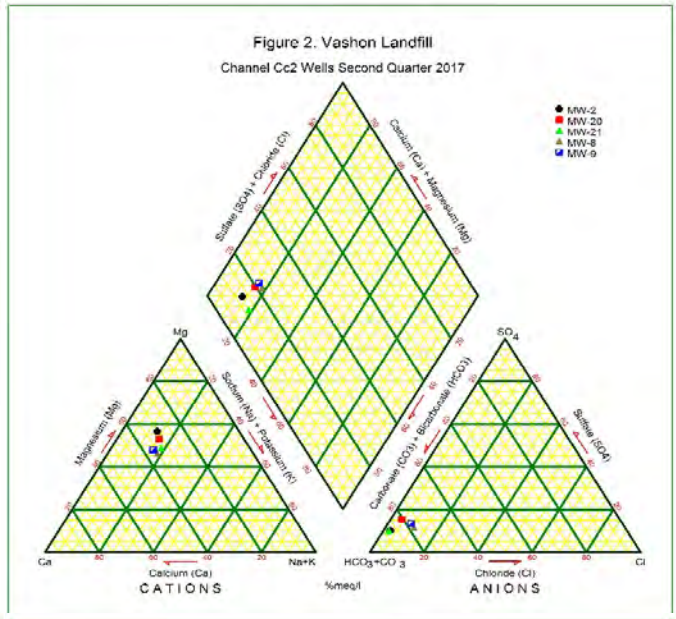
Figure 2. Vashon Landfill
Channel Cc2 Wells Second Quarter 2017
MW-2
MW-20
MW-21
MW-8
MW-9
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Magnesium (Mg)
Mg
SO4
Ca
Na+K
Calcium (Ca)
CATIONS
%meq/l
HCO3+CO3
Chloride (Cl)
Cl
ANIONS

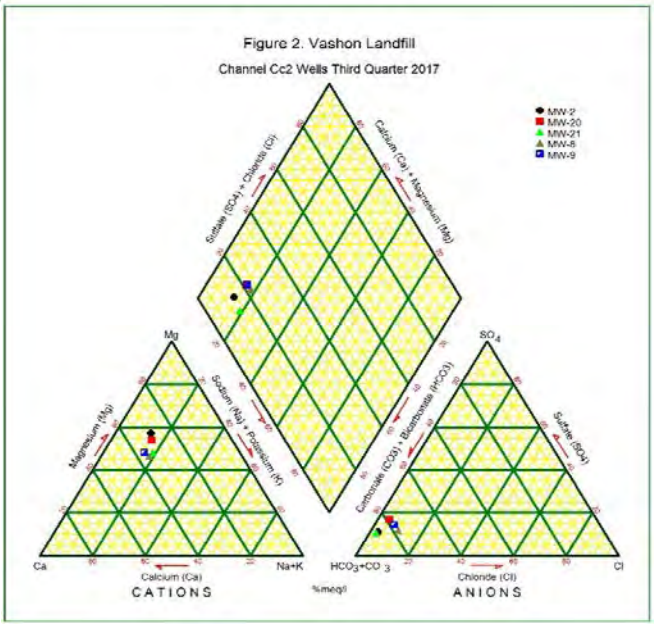
Figure 2. Vashon Landfill
Channel Cc2 Wells Third Quarter 2017
MW-2
MW-20
MW-21
MW-8
MW-9
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Magnesium (Mg)
Mg
SO4
Ca
Na+K
Calcium (Ca)
CATIONS
%meq/l
HCO3+CO3
Chloride (Cl)
Cl
ANIONS

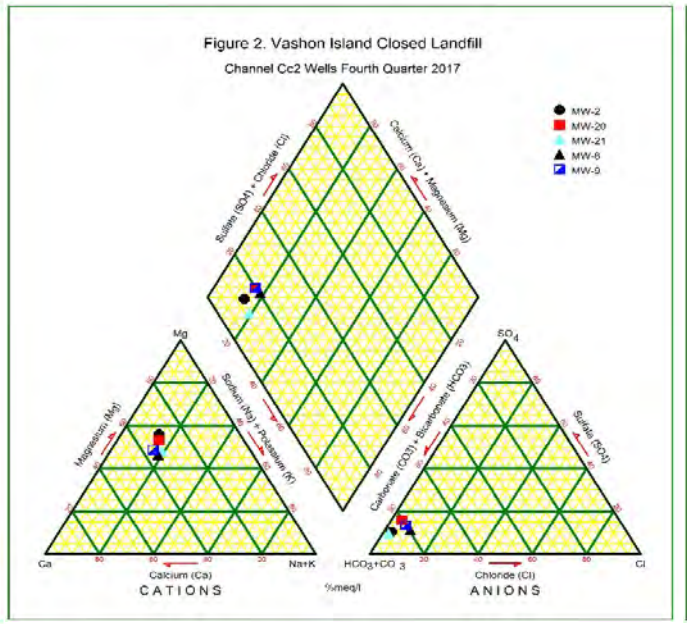
Figure 2. Vashon Island Closed Landfill
Channel Cc2 Wells Fourth Quarter 2017
MW-2
MW-20
MW-21
MW-8
MW-9
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Magnesium (Mg)
Mg
SO4
Ca
Na+K
Calcium (Ca)
CATIONS
%meq/l
HCO3+CO3
Chloride (Cl)
Cl
ANIONS

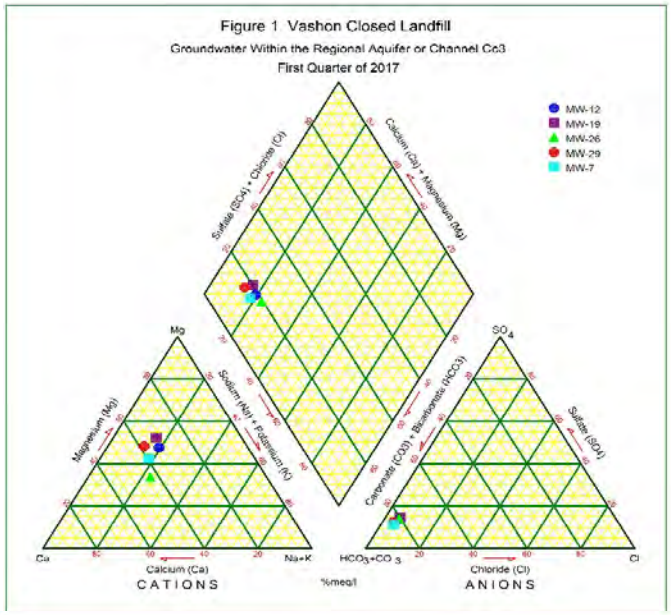
Figure 1. Vashon Closed Landfill
Groundwater Within the Regional Aquifer or Channel Cc3
First Quarter of 2017
MW-12
MW-19
MW-26
MW-29
MW-7
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Magnesium (Mg)
Mg
SO4
Ca
Na+K
HCO3+CO3
Cl
Calcium (Ca)
Chloride (Cl)
CATIONS
%meq/l
ANIONS

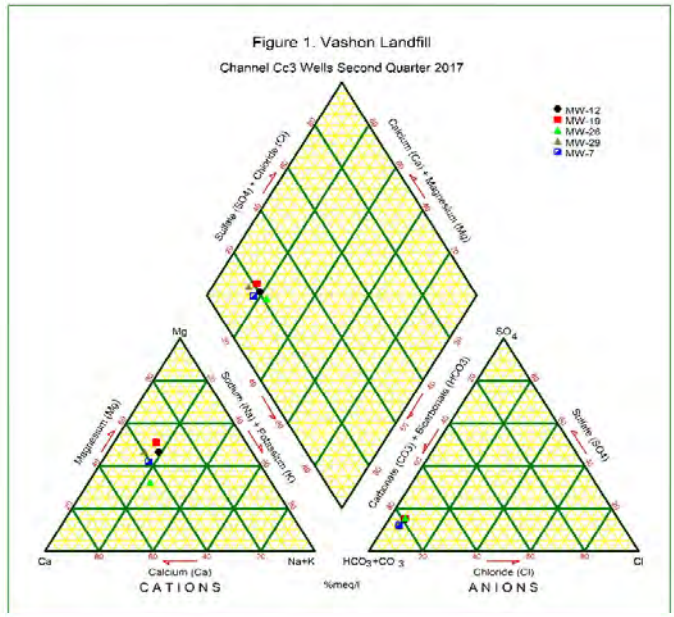
Figure 1. Vashon Landfill
Channel Cc3 Wells Second Quarter 2017
MW-12
MW-19
MW-26
MW-29
MW-7
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Magnesium (Mg)
Mg
SO4
Ca
Na+K
HCO3+CO3
Cl
Calcium (Ca)
Chloride (Cl)
CATIONS
%meq/l
ANIONS

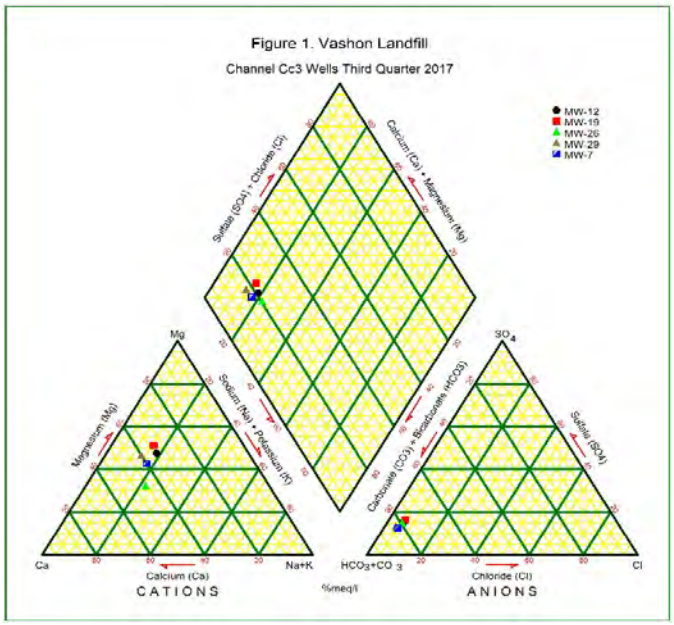
Figure 1. Vashon Landfill
Channel Cc3 Wells Third Quarter 2017
MW-12
MW-19
MW-26
MW-29
MW-7
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Magnesium (Mg)
Mg
SO4
Ca
Na+K
HCO3+CO3
Cl
Calcium (Ca)
Chloride (Cl)
CATIONS
%meq/l
ANIONS

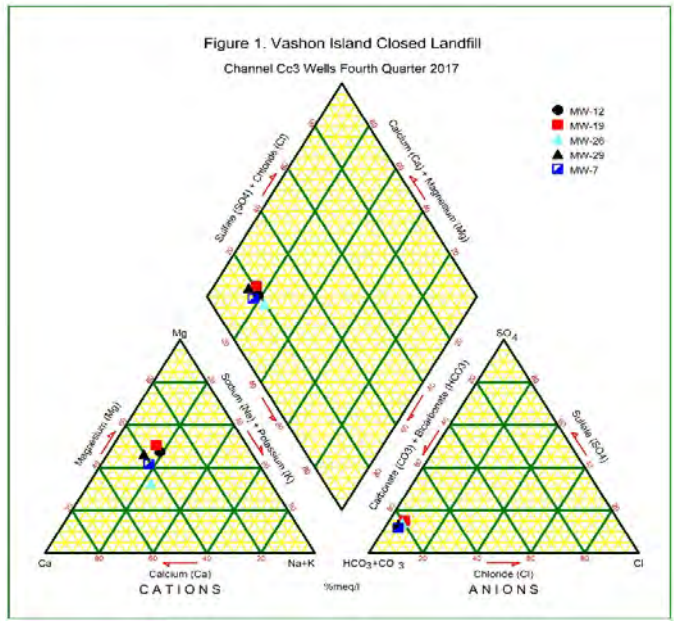
Figure 1. Vashon Island Closed Landfill
Channel Cc3 Wells Fourth Quarter 2017
MW-12
MW-19
MW-26
MW-29
MW-7
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Sulfate (SO4)
Magnesium (Mg)
Mg
SO4
Ca
Na+K
HCO3+CO3
Cl
Calcium (Ca)
Chloride (Cl)
CATIONS
%meq/l
ANIONS

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
1st Quarter 2017

Table 2

Ion Balance for Groundwater Wells Within Regional Aquifer & Channel Cc3

		Well #	**MW-12**			**MW-19**			**MW-26**			**MW-29**			**MW-7**		
		Sample Date	2/2/2017			2/3/2017			2/3/2017			1/31/2017			2/2/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.5			7.6			8.0			7.3			7.6		
Conductance	--		150			233			199			230			178		
TDS	--		117			141			149			154			135		
Calcium	40.1	2	9.7	0.4820	33.0	13.2	0.6587	31.4	14.7	0.7335	42.6	17.5	0.8733	37.8	13.4	0.6687	38.8
Magnesium	24.3	2	8.5	0.6953	47.6	13.2	1.0862	51.8	6.9	0.5711	33.2	13.4	1.1027	47.7	8.8	0.7200	41.8
Potassium	39.1	1	1.7	0.0425	2.9	2.3	0.0596	2.8	2.8	0.0716	4.2	2.0	0.0517	2.2	2.8	0.0714	4.1
Sodium	23.0	1	5.5	0.2388	16.4	6.3	0.2723	13.0	7.4	0.3206	18.6	5.9	0.2562	11.1	5.4	0.2362	13.7
Iron	55.8	2	0.010	0.0004	0.02	0.034	0.0012	0.06	0.082	0.0029	0.17	0.696	0.0249	1.08	0.019	0.0007	0.04
Manganese	54.9	2	0.001	0.0000	0.00	0.478	0.0174	0.83	0.061	0.0022	0.13	0.088	0.0032	0.14	0.187	0.0068	0.39
Ammonia-N	14.0	1	0.010	0.0007	0.05	0.039	0.0028	0.13	0.275	0.0196	1.14	0.010	0.0007	0.03	0.277	0.0198	1.15
		Total Cations (meq/L)		**1.5**			**2.1**			**1.7**			**2.3**			**1.7**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		61.4			88.2			75.3			103			78.4		
Carbonate	60.0	2	0.1087	0.0036	0.2311	0.1964	0.0065	0.2965	0.4801	0.0160	0.8555	0.1292	0.0043	0.1745	0.2049	0.0068	0.3658
Bicarbonate	61.0	1	74.69	1.2242	78.1	107.20	1.7572	79.6	90.89	1.4898	79.6	125.40	2.0554	83.3	95.23	1.5609	83.6
Chloride	35.5	1	2.9	0.0812	5.2	4.3	0.1204	5.5	3.5	0.0999	5.3	3.4	0.0959	3.9	3.2	0.0889	4.8
Nitrate-N	14.0	1	0.759	0.0542	3.457	0.010	0.0007	0.032	0.010	0.0007	0.038	0.010	0.0007	0.029	0.010	0.0007	0.038
Sulfate	96.1	2	9.8	0.2043	13.0	15.5	0.3227	14.6	12.7	0.2644	14.1	14.9	0.3102	12.6	10.1	0.2103	11.3
		Total Anions (meq/L)		**1.6**			**2.2**			**1.9**			**2.5**			**1.9**	
		Total Ions (meq/L)		**3.0**			**4.3**			**3.6**			**4.8**			**3.6**	
		Cation/Anion Ratio		**0.93**			**0.95**			**0.92**			**0.94**			**0.92**	
		Percent Difference		**-3.56**			**-2.54**			**-4.15**			**-3.22**			**-4.01**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
1st Quarter 2017

Table 6

Ion Balance for Groundwater Wells Within and Below Channel Cc2

		Well #	**MW-2**			**MW-20**			**MW-21**			**MW-8**			**MW-9**		
		Sample Date	2/2/2017			2/14/2017			2/14/2017			1/31/2017			2/3/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.9			7.2			6.9			7.3			6.7		
Conductance	--		308			225			278			191			163		
TDS	--		197			138			170			123			127		
Calcium	40.1	2	18.7	0.9331	29.8	12.0	0.5988	29.8	16.3	0.8134	31.5	11.6	0.5788	33.4	10.3	0.5140	33.8
Magnesium	24.3	2	21.7	1.7856	57.0	13.1	1.0780	53.6	15.2	1.2508	48.5	10.5	0.8640	49.8	8.8	0.7266	47.8
Potassium	39.1	1	2.3	0.0575	1.8	2.1	0.0532	2.6	2.0	0.0501	1.9	2.0	0.0512	2.9	1.1	0.0271	1.8
Sodium	23.0	1	8.1	0.3523	11.2	6.0	0.2627	13.1	10.3	0.4480	17.4	5.5	0.2397	13.8	5.8	0.2514	16.5
Iron	55.8	2	0.010	0.0004	0.01	0.196	0.0070	0.35	0.256	0.0092	0.36	0.010	0.0004	0.02	0.010	0.0004	0.02
Manganese	54.9	2	0.079	0.0029	0.09	0.314	0.0114	0.57	0.188	0.0068	0.27	0.001	0.0000	0.00	0.001	0.0000	0.00
Ammonia-N	14.0	1	0.010	0.0007	0.02	0.018	0.0013	0.06	0.010	0.0007	0.03	0.010	0.0007	0.04	0.010	0.0007	0.05
Total Cations (meq/L)				**3.1**			**2.0**			**2.6**			**1.7**			**1.5**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		154			87.2			121			70.1			54.5		
Carbonate	60.0	2	0.0655	0.0022	0.0631	0.0793	0.0026	0.1205	0.0619	0.0021	0.0746	0.0899	0.0030	0.1678	0.0176	0.0006	0.0358
Bicarbonate	61.0	1	187.75	3.0774	88.8	106.22	1.7411	79.4	147.49	2.4176	87.4	85.34	1.3988	78.3	66.45	1.0892	66.4
Chloride	35.5	1	2.7	0.0773	2.2	3.3	0.0920	4.2	2.2	0.0609	2.2	4.0	0.1120	6.3	4.3	0.1202	7.3
Nitrate-N	14.0	1	0.010	0.0007	0.021	0.010	0.0007	0.033	0.129	0.0092	0.333	0.210	0.0150	0.839	4.040	0.2884	17.585
Sulfate	96.1	2	14.7	0.3061	8.8	17.1	0.3560	16.2	13.3	0.2769	10.0	12.4	0.2582	14.4	6.8	0.1418	8.6
Total Anions (meq/L)				**3.5**			**2.2**			**2.8**			**1.8**			**1.6**	
Total Ions (meq/L)				**6.6**			**4.2**			**5.3**			**3.5**			**3.2**	
Cation/Anion Ratio				**0.90**			**0.92**			**0.93**			**0.97**			**0.93**	
Percent Difference				**-5.02**			**-4.28**			**-3.51**			**-1.48**			**-3.80**	

Table 10

Ion Balance for Groundwater Wells Within or Adjacent to Channel Cc1

		Well #	**MW-10**			**MW-13**		
		Sample Date	1/27/2017			2/2/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.2			7.1		
Conductance	--		145			164		
TDS	--		100			122		
Calcium	40.1	2	9.0	0.4511	30.8	9.0	0.4471	27.0
Magnesium	24.3	2	9.4	0.7694	52.5	11.1	0.9134	55.3
Potassium	39.1	1	1.4	0.0353	2.4	1.8	0.0448	2.7
Sodium	23.0	1	4.8	0.2079	14.2	5.7	0.2462	14.9
Iron	55.8	2	0.010	0.0004	0.02	0.018	0.0006	0.04
Manganese	54.9	2	0.001	0.0000	0.00	0.006	0.0002	0.01
Ammonia-N	14.0	1	0.010	0.0007	0.05	0.010	0.0007	0.04
	Total Cations (meq/L)			**1.5**			**1.7**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		58.4			67.9		
Carbonate	60.0	2	0.0507	0.0017	0.1133	0.0525	0.0018	0.1006
Bicarbonate	61.0	1	71.14	1.1661	78.2	82.73	1.3560	77.9
Chloride	35.5	1	3.3	0.0942	6.3	2.8	0.0790	4.5
Nitrate-N	14.0	1	0.619	0.0442	2.962	0.108	0.0077	0.443
Sulfate	96.1	2	8.9	0.1857	12.4	14.2	0.2957	17.0
	Total Anions (meq/L)			**1.5**			**1.7**	
	Total Ions (meq/L)			**3.0**			**3.4**	
	Cation/Anion Ratio			**0.98**			**0.95**	
	Percent Difference			**-0.92**			**-2.57**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
2nd Quarter 2017

Table 2

Ion Balance for Groundwater Wells Within Regional Aquifer & Channel Cc3

		Well #	**MW-12**			**MW-19**			**MW-26**			**MW-29**			**MW-7**		
		Sample Date	5/17/2017			5/8/2017			5/25/2017			5/19/2017			5/3/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.1			7.6			8.0			7.5			7.6		
Conductance	--		162			221			188			243			188		
TDS	--		109			141			172			152			133		
Calcium	40.1	2	11.4	0.5689	34.6	15.4	0.7685	33.0	17.5	0.8733	44.3	20.5	1.0230	39.3	14.1	0.7036	39.9
Magnesium	24.3	2	9.3	0.7653	46.5	14.3	1.1767	50.6	7.7	0.6295	31.9	14.6	1.2014	46.2	8.9	0.7307	41.4
Potassium	39.1	1	1.8	0.0458	2.8	2.4	0.0619	2.7	2.9	0.0749	3.8	2.1	0.0545	2.1	2.4	0.0601	3.4
Sodium	23.0	1	6.1	0.2636	16.0	6.9	0.3010	12.9	8.5	0.3693	18.7	6.7	0.2901	11.2	5.6	0.2445	13.8
Iron	55.8	2	0.010	0.0004	0.02	0.026	0.0009	0.04	0.132	0.0047	0.24	0.767	0.0275	1.06	0.018	0.0006	0.04
Manganese	54.9	2	0.000	0.0000	0.00	0.430	0.0157	0.67	0.068	0.0025	0.12	0.094	0.0034	0.13	0.165	0.0060	0.34
Ammonia-N	14.0	1	0.002	0.0001	0.01	0.028	0.0020	0.09	0.250	0.0178	0.91	0.002	0.0002	0.01	0.277	0.0198	1.12
Total Cations (meq/L)				**1.6**			**2.3**			**2.0**			**2.6**			**1.8**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		60.1			85.6			74			100			77.3		
Carbonate	60.0	2	0.0424	0.0014	0.0902	0.2137	0.0071	0.3276	0.3931	0.0131	0.6961	0.1770	0.0059	0.2435	0.1761	0.0059	0.3144
Bicarbonate	61.0	1	73.24	1.2004	76.6	104.00	1.7046	78.4	89.48	1.4667	77.9	121.64	1.9938	82.3	93.95	1.5399	82.5
Chloride	35.5	1	3.2	0.0889	5.7	4.5	0.1269	5.8	3.9	0.1086	5.8	3.6	0.1015	4.2	3.4	0.0956	5.1
Nitrate-N	14.0	1	0.789	0.0563	3.593	0.010	0.0007	0.033	0.010	0.0007	0.038	0.010	0.0007	0.029	0.010	0.0007	0.038
Sulfate	96.1	2	10.6	0.2207	14.1	16.1	0.3352	15.4	14.1	0.2936	15.6	15.4	0.3206	13.2	10.8	0.2249	12.0
Total Anions (meq/L)				**1.6**			**2.2**			**1.9**			**2.4**			**1.9**	
Total Ions (meq/L)				**3.2**			**4.5**			**3.9**			**5.0**			**3.6**	
Cation/Anion Ratio				**1.05**			**1.07**			**1.05**			**1.07**			**0.95**	
Percent Difference				**2.38**			**3.38**			**2.32**			**3.53**			**-2.80**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
2nd Quarter 2017

Table 6

Ion Balance for Groundwater Wells Within and Below Channel Cc2

	Well #		**MW-2**			**MW-20**			**MW-21**			**MW-8**			**MW-9**		
	Sample Date		5/17/2017			5/8/2017			5/25/2017			5/4/2017			5/19/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.9			7.3			6.7			6.9			7.1		
Conductance	--		320			219			278			170			196		
TDS	--		193			150			181			128			130		
Calcium	40.1	2	21.0	1.0479	30.2	13.9	0.6936	31.2	19.7	0.9830	32.3	11.4	0.5689	35.5	14.5	0.7236	36.2
Magnesium	24.3	2	23.9	1.9667	56.6	14.2	1.1685	52.5	17.7	1.4565	47.9	9.0	0.7389	46.1	11.6	0.9545	47.8
Potassium	39.1	1	2.2	0.0555	1.6	2.1	0.0547	2.5	2.1	0.0529	1.7	1.1	0.0269	1.7	2.2	0.0552	2.8
Sodium	23.0	1	9.2	0.3984	11.5	6.6	0.2880	12.9	11.6	0.5046	16.6	6.2	0.2693	16.8	6.1	0.2649	13.3
Iron	55.8	2	0.010	0.0004	0.01	0.220	0.0079	0.35	0.384	0.0138	0.45	0.010	0.0004	0.02	0.010	0.0004	0.02
Manganese	54.9	2	0.095	0.0034	0.10	0.291	0.0106	0.48	0.812	0.0296	0.97	0.000	0.0000	0.00	0.000	0.0000	0.00
Ammonia-N	14.0	1	0.002	0.0001	0.00	0.018	0.0013	0.06	0.022	0.0016	0.05	0.002	0.0001	0.01	0.002	0.0001	0.01
Total Cations (meq/L)				**3.5**			**2.2**			**3.0**			**1.6**			**2.0**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		145			87.1			125			50.2			71.4		
Carbonate	60.0	2	0.0725	0.0024	0.0728	0.0951	0.0032	0.1464	0.0336	0.0011	0.0393	0.0229	0.0008	0.0477	0.0540	0.0018	0.0953
Bicarbonate	61.0	1	176.75	2.8971	87.3	106.07	1.7386	80.3	152.43	2.4985	87.7	61.20	1.0031	62.7	87.00	1.4260	75.5
Chloride	35.5	1	3.0	0.0855	2.6	3.1	0.0886	4.1	2.2	0.0609	2.1	4.8	0.1348	8.4	5.6	0.1580	8.4
Nitrate-N	14.0	1	0.010	0.0007	0.022	0.010	0.0007	0.033	0.158	0.0113	0.396	4.390	0.3134	19.597	0.821	0.0586	3.105
Sulfate	96.1	2	15.9	0.3311	10.0	16.1	0.3352	15.5	13.3	0.2769	9.7	7.1	0.1472	9.2	11.7	0.2436	12.9
Total Anions (meq/L)				**3.3**			**2.2**			**2.8**			**1.6**			**1.9**	
Total Ions (meq/L)				**6.8**			**4.4**			**5.9**			**3.2**			**3.9**	
Cation/Anion Ratio				**1.05**			**1.03**			**1.07**			**1.00**			**1.06**	
Percent Difference				**2.29**			**1.33**			**3.28**			**0.16**			**2.85**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
2nd Quarter 2017

Table 10

Ion Balance for Groundwater Wells Within or Adjacent to Channel Cc1

		Well #	**MW-10**			**MW-13**			**MW-3**			**MW-4**		
		Sample Date	5/19/2017			5/8/2017			5/17/2017			6/5/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.3			6.9			5.9			6.6		
Conductance	--		152			171			97			162		
TDS	--		107			123			64			136		
Calcium	40.1	2	10.1	0.5040	32.2	10.3	0.5140	28.3	8.6	0.4311	48.8	11.4	0.5689	34.9
Magnesium	24.3	2	9.7	0.8015	51.2	11.9	0.9792	54.0	2.4	0.1975	22.3	9.2	0.7554	46.3
Potassium	39.1	1	1.4	0.0361	2.3	1.8	0.0460	2.5	2.2	0.0570	6.5	1.0	0.0253	1.6
Sodium	23.0	1	5.1	0.2223	14.2	6.3	0.2723	15.0	4.5	0.1975	22.3	6.4	0.2801	17.2
Iron	55.8	2	0.010	0.0004	0.02	0.033	0.0012	0.06	0.010	0.0004	0.04	0.010	0.0004	0.02
Manganese	54.9	2	0.000	0.0000	0.00	0.012	0.0004	0.02	0.000	0.0000	0.00	0.000	0.0000	0.00
Ammonia-N	14.0	1	0.002	0.0001	0.01	0.002	0.0001	0.01	0.002	0.0001	0.02	0.002	0.0001	0.01
Total Cations (meq/L)				**1.6**			**1.8**			**0.9**			**1.6**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		57.6			64.2			18.9			46.4		
Carbonate	60.0	2	0.0629	0.0021	0.1429	0.0336	0.0011	0.0672	0.0009	0.0000	0.0038	0.0101	0.0003	0.0217
Bicarbonate	61.0	1	70.14	1.1497	78.4	78.26	1.2827	77.0	23.06	0.3779	47.7	56.59	0.9275	59.6
Chloride	35.5	1	3.3	0.0928	6.3	3.0	0.0835	5.0	1.4	0.0403	5.1	8.1	0.2293	14.7
Nitrate-N	14.0	1	0.652	0.0465	3.172	0.154	0.0110	0.660	3.720	0.2656	33.510	2.090	0.1492	9.588
Sulfate	96.1	2	8.5	0.1761	12.0	13.8	0.2873	17.3	5.2	0.1087	13.7	12.0	0.2499	16.1
Total Anions (meq/L)				**1.5**			**1.7**			**0.8**			**1.6**	
Total Ions (meq/L)				**3.0**			**3.5**			**1.7**			**3.2**	
Cation/Anion Ratio				**1.07**			**1.09**			**1.11**			**1.05**	
Percent Difference				**3.20**			**4.24**			**5.44**			**2.32**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
2nd Quarter 2017

Table 14

Private Wells

	Well #		**DW-85**			**DW-PA**		
	Sample Date		6/2/2017			6/2/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.1			7.3		
Conductance	--		151			190		
TDS	--		107			131		
Calcium	40.1	2	14.4	0.7186	44.3	13.8	0.6886	34.7
Magnesium	24.3	2	6.7	0.5497	33.9	11.7	0.9628	48.5
Potassium	39.1	1	2.5	0.0650	4.0	1.6	0.0402	2.0
Sodium	23.0	1	6.1	0.2645	16.3	6.8	0.2936	14.8
Iron	55.8	2	0.066	0.0024	0.15	0.010	0.0004	0.02
Manganese	54.9	2	0.054	0.0020	0.12	0.000	0.0000	0.00
Ammonia-N	14.0	1	0.303	0.0216	1.33	0.002	0.0001	0.01
Total Cations (meq/L)				**1.6**			**2.0**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		67.7			67.3		
Carbonate	60.0	2	0.0512	0.0017	0.1143	0.0752	0.0025	0.1334
Bicarbonate	61.0	1	82.49	1.3521	90.5	81.95	1.3433	71.4
Chloride	35.5	1	2.9	0.0812	5.4	6.1	0.1723	9.2
Nitrate-N	14.0	1	0.010	0.0007	0.048	1.310	0.0935	4.974
Sulfate	96.1	2	2.8	0.0579	3.9	12.9	0.2686	14.3
Total Anions (meq/L)				**1.5**			**1.9**	
Total Ions (meq/L)				**3.1**			**3.9**	
Cation/Anion Ratio				**1.09**			**1.06**	
Percent Difference				**4.17**			**2.73**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
3rd Quarter 2017

Table 2

Ion Balance for Groundwater Wells Within Regional Aquifer & Channel Cc3

		Well #	**MW-12**			**MW-19**			**MW-26**			**MW-29**			**MW-7**		
		Sample Date	8/7/2017			8/2/2017			8/11/2017			8/11/2017			8/4/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.2			7.4			7.8			7.3			7.4		
Conductance	--		163			205			189			243			189		
TDS	--		117			149			141			157			136		
Calcium	40.1	2	11.8	0.5888	33.9	15.5	0.7735	32.9	17.4	0.8683	45.1	20.3	1.0130	39.6	16.0	0.7984	39.6
Magnesium	24.3	2	10.0	0.8229	47.4	14.5	1.1932	50.7	7.4	0.6122	31.8	14.3	1.1767	46.0	10.3	0.8476	42.0
Potassium	39.1	1	1.8	0.0458	2.6	2.4	0.0611	2.6	3.0	0.0770	4.0	2.2	0.0565	2.2	2.7	0.0678	3.4
Sodium	23.0	1	6.4	0.2775	16.0	7.0	0.3023	12.9	7.9	0.3419	17.8	6.5	0.2810	11.0	6.4	0.2771	13.7
Iron	55.8	2	0.005	0.0002	0.01	0.032	0.0012	0.05	0.082	0.0029	0.15	0.836	0.0299	1.17	0.017	0.0006	0.03
Manganese	54.9	2	0.000	0.0000	0.00	0.513	0.0187	0.79	0.067	0.0024	0.13	0.094	0.0034	0.13	0.174	0.0063	0.31
Ammonia-N	14.0	1	0.001	0.0001	0.00	0.034	0.0024	0.10	0.265	0.0189	0.98	0.002	0.0002	0.01	0.268	0.0191	0.95
Total Cations (meq/L)				**1.7**			**2.4**			**1.9**			**2.6**			**2.0**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		62.7			86.6			74.7			102			78.5		
Carbonate	60.0	2	0.0654	0.0022	0.1331	0.1218	0.0041	0.1820	0.3017	0.0101	0.5354	0.1089	0.0036	0.1473	0.1183	0.0039	0.2069
Bicarbonate	61.0	1	76.36	1.2516	76.4	105.40	1.7277	77.4	90.52	1.4837	79.0	124.22	2.0361	82.6	95.53	1.5658	82.1
Chloride	35.5	1	3.3	0.0931	5.7	4.8	0.1351	6.1	3.7	0.1049	5.6	3.6	0.1001	4.1	3.5	0.0982	5.1
Nitrate-N	14.0	1	0.759	0.0542	3.307	0.005	0.0004	0.016	0.011	0.0008	0.042	0.005	0.0004	0.014	0.014	0.0010	0.052
Sulfate	96.1	2	11.4	0.2374	14.5	17.5	0.3644	16.3	13.4	0.2790	14.9	15.6	0.3248	13.2	11.4	0.2374	12.5
Total Anions (meq/L)				**1.6**			**2.2**			**1.9**			**2.5**			**1.9**	
Total Ions (meq/L)				**3.4**			**4.6**			**3.8**			**5.0**			**3.9**	
Cation/Anion Ratio				**1.06**			**1.05**			**1.02**			**1.04**			**1.06**	
Percent Difference				**2.87**			**2.63**			**1.19**			**1.90**			**2.82**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
3rd Quarter 2017

Table 6

Ion Balance for Groundwater Wells Within and Below Channel Cc2

	Well #		**MW-2**			**MW-20**			**MW-21**			**MW-8**			**MW-9**		
	Sample Date		8/7/2017			8/7/2017			8/7/2017			8/3/2017			8/2/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.0			7.0			6.9			6.9			6.8		
Conductance	--		301			203			247			164			195		
TDS	--		187			149			169			135			147		
Calcium	40.1	2	19.9	0.9930	29.3	13.5	0.6737	30.4	19.1	0.9531	32.7	11.8	0.5888	35.3	15.8	0.7884	36.3
Magnesium	24.3	2	23.5	1.9338	57.1	14.4	1.1849	53.4	16.7	1.3742	47.1	9.4	0.7727	46.4	12.7	1.0451	48.2
Potassium	39.1	1	2.1	0.0532	1.6	2.1	0.0529	2.4	2.0	0.0506	1.7	1.1	0.0276	1.7	2.2	0.0568	2.6
Sodium	23.0	1	9.3	0.4045	11.9	6.6	0.2849	12.8	11.3	0.4915	16.9	6.4	0.2771	16.6	6.4	0.2793	12.9
Iron	55.8	2	0.005	0.0002	0.01	0.282	0.0101	0.46	0.479	0.0172	0.59	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2	0.106	0.0039	0.11	0.295	0.0107	0.48	0.736	0.0268	0.92	0.000	0.0000	0.00	0.000	0.0000	0.00
Ammonia-N	14.0	1	0.001	0.0001	0.00	0.015	0.0011	0.05	0.019	0.0014	0.05	0.001	0.0001	0.00	0.001	0.0001	0.00
Total Cations (meq/L)				**3.4**			**2.2**			**2.9**			**1.7**			**2.2**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		137			84.4			120			49.3			80.6		
Carbonate	60.0	2	0.0804	0.0027	0.0842	0.0452	0.0015	0.0703	0.0560	0.0019	0.0675	0.0225	0.0007	0.0478	0.0285	0.0010	0.0455
Bicarbonate	61.0	1	166.98	2.7369	85.9	102.88	1.6862	78.7	146.29	2.3978	86.8	60.10	0.9851	62.8	98.27	1.6108	77.0
Chloride	35.5	1	3.3	0.0925	2.9	3.3	0.0942	4.4	2.4	0.0668	2.4	4.6	0.1295	8.3	5.3	0.1506	7.2
Nitrate-N	14.0	1	0.005	0.0004	0.011	0.005	0.0004	0.017	0.076	0.0054	0.196	4.260	0.3041	19.392	0.438	0.0313	1.495
Sulfate	96.1	2	17.0	0.3540	11.1	17.3	0.3602	16.8	14.0	0.2915	10.5	7.2	0.1489	9.5	14.3	0.2977	14.2
Total Anions (meq/L)				**3.2**			**2.1**			**2.8**			**1.6**			**2.1**	
Total Ions (meq/L)				**6.6**			**4.4**			**5.7**			**3.2**			**4.3**	
Cation/Anion Ratio				**1.06**			**1.04**			**1.05**			**1.06**			**1.04**	
Percent Difference				**3.08**			**1.74**			**2.67**			**3.03**			**1.84**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
3rd Quarter 2017

Table 10

Ion Balance for Groundwater Wells Within or Adjacent to Channel Cc1

		Well #	**MW-10**			**MW-13**			**MW-4**		
		Sample Date	8/3/2017			8/4/2017			9/6/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.2			7.1			6.5		
Conductance	--		159			177			186		
TDS	--		117			124			163		
Calcium	40.1	2	10.7	0.5339	32.1	10.7	0.5339	27.7	11.5	0.5739	33.6
Magnesium	24.3	2	10.5	0.8640	51.9	12.9	1.0615	55.0	9.6	0.7908	46.3
Potassium	39.1	1	1.5	0.0371	2.2	1.8	0.0460	2.4	1.1	0.0286	1.7
Sodium	23.0	1	5.2	0.2279	13.7	6.6	0.2866	14.9	7.2	0.3119	18.3
Iron	55.8	2	0.005	0.0002	0.01	0.036	0.0013	0.07	0.005	0.0002	0.01
Manganese	54.9	2	0.000	0.0000	0.00	0.014	0.0005	0.03	0.002	0.0001	0.00
Ammonia-N	14.0	1	0.002	0.0001	0.01	0.001	0.0001	0.00	0.011	0.0008	0.05
Total Cations (meq/L)				**1.7**			**1.9**			**1.7**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		62.2			67.9			46.9		
Carbonate	60.0	2	0.0552	0.0018	0.1166	0.0550	0.0018	0.1016	0.0081	0.0003	0.0163
Bicarbonate	61.0	1	75.77	1.2420	78.6	82.73	1.3560	75.1	57.20	0.9376	56.3
Chloride	35.5	1	3.4	0.0956	6.1	3.3	0.0917	5.1	8.3	0.2350	14.1
Nitrate-N	14.0	1	0.696	0.0497	3.146	0.133	0.0095	0.526	3.180	0.2270	13.641
Sulfate	96.1	2	9.1	0.1903	12.0	16.6	0.3456	19.2	12.7	0.2644	15.9
Total Anions (meq/L)				**1.6**			**1.8**			**1.7**	
Total Ions (meq/L)				**3.2**			**3.7**			**3.4**	
Cation/Anion Ratio				**1.05**			**1.07**			**1.03**	
Percent Difference				**2.59**			**3.36**			**1.24**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
3rd Quarter 2017

Table 14

Private Wells

	Well #		**DW-85**			**DW-PA**		
	Sample Date		9/7/2017			9/7/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		8.1			7.1		
Conductance	--		157			196		
TDS	--		106			127		
Calcium	40.1	2	13.9	0.6936	44.0	13.5	0.6737	34.4
Magnesium	24.3	2	6.5	0.5332	33.9	11.6	0.9545	48.7
Potassium	39.1	1	2.6	0.0655	4.2	1.6	0.0417	2.1
Sodium	23.0	1	5.9	0.2584	16.4	6.7	0.2893	14.8
Iron	55.8	2	0.071	0.0025	0.16	0.005	0.0002	0.01
Manganese	54.9	2	0.053	0.0019	0.12	0.000	0.0000	0.00
Ammonia-N	14.0	1	0.275	0.0196	1.25	0.001	0.0001	0.00
Total Cations (meq/L)				**1.6**			**2.0**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		68.9			72		
Carbonate	60.0	2	0.4812	0.0160	1.0605	0.0544	0.0018	0.0936
Bicarbonate	61.0	1	83.08	1.3618	90.0	87.73	1.4380	74.2
Chloride	35.5	1	2.8	0.0787	5.2	5.8	0.1628	8.4
Nitrate-N	14.0	1	0.005	0.0004	0.024	1.360	0.0971	5.007
Sulfate	96.1	2	2.7	0.0556	3.7	11.5	0.2394	12.3
Total Anions (meq/L)				**1.5**			**1.9**	
Total Ions (meq/L)				**3.1**			**3.9**	
Cation/Anion Ratio				**1.04**			**1.01**	
Percent Difference				**2.02**			**0.52**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
4th Quarter 2017

Table 2

Ion Balance for Groundwater Wells Within Regional Aquifer & Channel Cc3

	Well #		**MW-12**			**MW-19**			**MW-26**			**MW-29**			**MW-7**		
	Sample Date		11/13/2017			11/17/2017			11/17/2017			11/17/2017			11/13/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.2			7.5			8.2			7.5			7.7		
Conductance	--		164			220			190			243			189		
TDS	--		119			145			138			156			131		
Calcium	40.1	2	11.3	0.5639	33.7	14.7	0.7335	33.3	16.9	0.8433	44.1	19.8	0.9880	39.8	15.4	0.7685	40.1
Magnesium	24.3	2	9.6	0.7933	47.5	13.4	1.1027	50.1	7.5	0.6130	32.1	13.8	1.1356	45.8	9.6	0.7916	41.3
Potassium	39.1	1	1.8	0.0463	2.8	2.4	0.0624	2.8	2.9	0.0747	3.9	2.2	0.0552	2.2	2.7	0.0691	3.6
Sodium	23.0	1	6.1	0.2671	16.0	6.5	0.2832	12.9	8.3	0.3593	18.8	6.3	0.2736	11.0	6.1	0.2640	13.8
Iron	55.8	2	0.010	0.0004	0.02	0.033	0.0012	0.05	0.063	0.0022	0.12	0.690	0.0247	1.00	0.016	0.0006	0.03
Manganese	54.9	2	0.000	0.0000	0.00	0.477	0.0174	0.79	0.064	0.0023	0.12	0.095	0.0034	0.14	0.170	0.0062	0.32
Ammonia-N	14.0	1	0.002	0.0001	0.01	0.029	0.0021	0.09	0.224	0.0160	0.84	0.003	0.0002	0.01	0.249	0.0178	0.93
Total Cations (meq/L)				**1.7**			**2.2**			**1.9**			**2.5**			**1.9**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		63.6			87.7			75.7			103			78.5		
Carbonate	60.0	2	0.0634	0.0021	0.1296	0.1517	0.0051	0.2281	0.6636	0.0221	1.1769	0.1865	0.0062	0.2490	0.2465	0.0082	0.4358
Bicarbonate	61.0	1	77.46	1.2697	77.9	106.69	1.7487	78.9	91.00	1.4917	79.4	125.28	2.0535	82.2	95.27	1.5615	82.8
Chloride	35.5	1	3.1	0.0874	5.4	4.4	0.1252	5.6	3.6	0.1004	5.3	3.7	0.1038	4.2	3.3	0.0936	5.0
Nitrate-N	14.0	1	0.738	0.0527	3.231	0.010	0.0007	0.032	0.012	0.0009	0.046	0.010	0.0007	0.029	0.013	0.0009	0.049
Sulfate	96.1	2	10.5	0.2186	13.4	16.2	0.3373	15.2	12.7	0.2644	14.1	16.0	0.3331	13.3	10.6	0.2207	11.7
Total Anions (meq/L)				**1.6**			**2.2**			**1.9**			**2.5**			**1.9**	
Total Ions (meq/L)				**3.3**			**4.4**			**3.8**			**5.0**			**3.8**	
Cation/Anion Ratio				**1.02**			**0.99**			**1.02**			**0.99**			**1.02**	
Percent Difference				**1.22**			**-0.33**			**0.83**			**-0.33**			**0.86**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
4th Quarter 2017

Table 6

Ion Balance for Groundwater Wells Within and Below Channel Cc2

		Well #	**MW-2**			**MW-20**			**MW-21**			**MW-8**			**MW-9**		
		Sample Date	11/13/2017			11/17/2017			11/14/2017			11/14/2017			11/17/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.8			7.2			6.6			6.6			7.0		
Conductance	--		295			222			264			158			202		
TDS	--		174			147			168			118			139		
Calcium	40.1	2	18.5	0.9232	29.9	13.3	0.6637	31.0	18.2	0.9082	32.3	11.3	0.5639	35.2	14.8	0.7385	35.7
Magnesium	24.3	2	21.0	1.7280	56.0	13.7	1.1273	52.7	16.1	1.3248	47.1	9.0	0.7406	46.2	12.2	1.0039	48.6
Potassium	39.1	1	2.1	0.0532	1.7	2.2	0.0560	2.6	2.0	0.0506	1.8	1.1	0.0281	1.8	2.2	0.0560	2.7
Sodium	23.0	1	8.7	0.3784	12.3	6.2	0.2701	12.6	11.0	0.4785	17.0	6.2	0.2688	16.8	6.1	0.2671	12.9
Iron	55.8	2	0.010	0.0004	0.01	0.293	0.0105	0.49	0.586	0.0210	0.75	0.010	0.0004	0.02	0.038	0.0014	0.07
Manganese	54.9	2	0.112	0.0041	0.13	0.288	0.0105	0.49	0.707	0.0257	0.92	0.000	0.0000	0.00	0.000	0.0000	0.00
Ammonia-N	14.0	1	0.002	0.0002	0.01	0.015	0.0011	0.05	0.023	0.0016	0.06	0.002	0.0001	0.01	0.002	0.0001	0.01
Total Cations (meq/L)				**3.1**			**2.1**			**2.8**			**1.6**			**2.1**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		133			87.4			120			51.4			79.1		
Carbonate	60.0	2	0.0471	0.0016	0.0513	0.0851	0.0028	0.1304	0.0308	0.0010	0.0377	0.0117	0.0004	0.0250	0.0424	0.0014	0.0705
Bicarbonate	61.0	1	162.16	2.6580	86.8	106.45	1.7449	80.2	146.34	2.3986	88.2	62.68	1.0275	65.7	96.42	1.5803	78.9
Chloride	35.5	1	3.1	0.0863	2.8	3.0	0.0857	3.9	2.1	0.0601	2.2	4.3	0.1210	7.7	4.6	0.1306	6.5
Nitrate-N	14.0	1	0.010	0.0007	0.023	0.010	0.0007	0.033	0.128	0.0091	0.336	3.830	0.2734	17.480	0.400	0.0286	1.426
Sulfate	96.1	2	15.1	0.3144	10.3	16.4	0.3415	15.7	12.1	0.2519	9.3	6.8	0.1420	9.1	12.6	0.2623	13.1
Total Anions (meq/L)				**3.1**			**2.2**			**2.7**			**1.6**			**2.0**	
Total Ions (meq/L)				**6.1**			**4.3**			**5.5**			**3.2**			**4.1**	
Cation/Anion Ratio				**1.01**			**0.98**			**1.03**			**1.02**			**1.03**	
Percent Difference				**0.43**			**-0.84**			**1.62**			**1.19**			**1.57**	

Ion Balance Calculations
Trilinear Data
Vashon Island Closed Landfill Groundwater
4th Quarter 2017

Table 10

Ion Balance for Groundwater Wells Within or Adjacent to Channel Cc1

		Well #	**MW-10**			**MW-13**			**MW-4**		
		Sample Date	11/17/2017			11/13/2017			12/5/2017		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.0			7.1			6.4		
Conductance	--		151			166			170		
TDS	--		110			119			146		
Calcium	40.1	2	9.6	0.4790	31.9	9.7	0.4835	28.6	11.6	0.5788	35.5
Magnesium	24.3	2	9.4	0.7710	51.4	11.0	0.9052	53.6	8.9	0.7282	44.7
Potassium	39.1	1	1.5	0.0384	2.6	1.8	0.0448	2.6	1.0	0.0266	1.6
Sodium	23.0	1	4.9	0.2118	14.1	5.9	0.2558	15.1	6.8	0.2949	18.1
Iron	55.8	2	0.010	0.0004	0.02	0.010	0.0004	0.02	0.010	0.0004	0.02
Manganese	54.9	2	0.000	0.0000	0.00	0.000	0.0000	0.00	0.000	0.0000	0.00
Ammonia-N	14.0	1	0.002	0.0001	0.01	0.002	0.0001	0.01	0.002	0.0001	0.01
Total Cations (meq/L)				**1.5**			**1.7**			**1.6**	
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		59.5			65.2			42.3		
Carbonate	60.0	2	0.0374	0.0012	0.0835	0.0541	0.0018	0.1078	0.0064	0.0002	0.0135
Bicarbonate	61.0	1	72.51	1.1886	79.5	79.43	1.3020	77.9	51.59	0.8457	53.6
Chloride	35.5	1	3.1	0.0880	5.9	3.1	0.0872	5.2	10.3	0.2905	18.4
Nitrate-N	14.0	1	0.597	0.0426	2.852	0.204	0.0146	0.871	2.060	0.1471	9.326
Sulfate	96.1	2	8.4	0.1739	11.6	12.8	0.2665	15.9	14.1	0.2936	18.6
Total Anions (meq/L)				**1.5**			**1.7**			**1.6**	
Total Ions (meq/L)				**3.0**			**3.4**			**3.2**	
Cation/Anion Ratio				**1.00**			**1.01**			**1.03**	
Percent Difference				**0.22**			**0.53**			**1.62**	

Appendix K

Gas Monitoring Data

King County Solid Waste Division

Environmental Monitoring Data

Data Collected January 2017

Vashon Closed Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH_4		CO_2	O_2	Relative Pressure
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(inches H_2O)
GP-01	1/9/17 13:47	0	0	1.9	19.5	-0.06
GP-02	1/9/17 14:48	0	0	2.2	19	-0.13
MWGP-13	1/9/17 13:33	0	0	0.1	21	0
MWGP-24	1/9/17 13:35	0	0	0.6	20.4	-0.03
GP-01D	1/9/17 13:13	0	0	0.4	18.2	1.38
GP-01I	1/9/17 13:12	0	0	0.4	19.4	0.74
GP-01S	1/9/17 13:10	0	0	0.3	21	-0.01
GP-02D	1/9/17 13:21	0	0	0.6	19.3	0.55
GP-02I	1/9/17 13:19	0	0	0.4	19.2	0.43
GP-02S	1/9/17 13:17	0	0	0.2	21	-0.06
GP-03D	1/9/17 13:31	0	0	1.9	17.8	-0.09
GP-03I	1/9/17 13:29	0	0	1.4	19.7	-0.12
GP-03S	1/9/17 13:28	0	0	0.2	21	-0.04
GP-04D	1/9/17 13:45	0	0	1.2	18.5	-0.22
GP-04I	1/9/17 13:43	0	0	0.9	20.5	-0.21
GP-04S	1/9/17 13:42	0	0	3	18.7	0.1
GP-05D	1/9/17 14:07	0	0	2.4	18.8	-0.32
GP-05I	1/9/17 14:05	0	0	1.7	19.9	-0.04
GP-05S	1/9/17 14:03	0	0	0.2	21	0.01
GP-06D	1/9/17 14:55	0	0	0.2	21	-0.47
GP-06I	1/9/17 14:53	0	0	0.3	21	-0.39
GP-06S	1/9/17 14:51	0	0	2.5	18.4	0.04
GP-07D	1/9/17 15:05	0	0	1.2	20.2	-0.27
GP-07I	1/9/17 15:04	0	0	0.8	21	-0.4
GP-07S	1/9/17 15:02	0	0	1	19.3	0.07
GP-08D	1/9/17 13:02	0	0	0.5	19.4	0.16
GP-08I	1/9/17 13:01	0	0	2.7	15.5	0.96
GP-08S	1/9/17 13:00	0	0	3.6	13.3	-4.37

King County Solid Waste Division

Environmental Monitoring Data

Data Collected Feburary 2017

Vashon Closed Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH_4		CO_2	O_2	Relative Pressure
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(inches H_2O)
GP-01	2/1/17 11:33	0	0	0.3	21	-0.1
GP-02	2/1/17 11:48	0	0	2.4	18.7	0.01
MWGP-13	2/1/17 11:17	0	0	0.2	19.9	0.01
MWGP-24	2/1/17 11:18	0	0	0.1	21	-0.51
GP-01D	2/1/17 11:05	0	0	0.1	21	-0.6
GP-01I	2/1/17 11:03	0	0	0.1	21	-0.06
GP-01S	2/1/17 11:02	0	0	0.3	20.7	0.03
GP-02D	2/1/17 11:10	0	0	0.1	21	-0.74
GP-02I	2/1/17 11:09	0	0	0.1	21	-0.75
GP-02S	2/1/17 11:07	0	0	0.2	21	0
GP-03D	2/1/17 11:16	0	0	1.7	18.7	-0.68
GP-03I	2/1/17 11:14	0	0	1.3	19.7	-0.71
GP-03S	2/1/17 11:13	0	0	0.6	20.8	0.03
GP-04D	2/1/17 11:25	0	0	1.3	18.6	-0.36
GP-04I	2/1/17 11:23	0	0	0.3	21	-0.32
GP-04S	2/1/17 11:22	0	0	2.9	18.5	0
GP-05D	2/1/17 11:43	0	0	2.7	19.2	-0.02
GP-05I	2/1/17 11:42	0	0	1.4	20.9	-0.02
GP-05S	2/1/17 11:40	0	0	0.2	21	0.25
GP-06D	2/1/17 11:54	0	0	0.2	21	-0.17
GP-06I	2/1/17 11:53	0	0	0.2	21	-0.3
GP-06S	2/1/17 11:51	0	0	2.3	18.6	0.02
GP-07D	2/1/17 12:00	0	0	0.4	21	-0.06
GP-07I	2/1/17 11:58	0	0	0.1	21	-0.58
GP-07S	2/1/17 11:57	0	0	0.2	21	-0.28
GP-08D	2/1/17 10:59	0	0	0.6	18.7	-0.62
GP-08I	2/1/17 10:57	0	0	2.7	16.3	-0.62
GP-08S	2/1/17 10:56	0	0	0.2	21	-7.25

King County Solid Waste Division

Environmental Monitoring Data

Data Collected March 2017

Vashon Closed Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH_4		CO_2	O_2	Relative Pressure
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(inches H_2O)
GP-01	3/21/17 11:59	0	0	3.4	17.8	0.98
GP-02	3/21/17 13:03	0	0	2.2	18.7	-0.05
MWGP-13	3/21/17 12:14	0	0	0.1	21	-0.03
MWGP-24	3/21/17 12:11	0	0	0.7	20.1	1.71
GP-01D	3/21/17 12:45	0	0	0.4	18.5	2.81
GP-01I	3/21/17 12:43	0	0	0.4	21	-0.05
GP-01S	3/21/17 12:41	0	0	0.2	21	-0.06
GP-02D	3/21/17 12:27	0	0	0.6	19.5	2.43
GP-02I	3/21/17 12:30	0	0	0.4	19.4	2.33
GP-02S	3/21/17 12:32	0	0	0.1	21	-0.03
GP-03D	3/21/17 12:17	0	0	2.1	18.3	1.93
GP-03I	3/21/17 12:20	0	0	1.4	19.7	1.86
GP-03S	3/21/17 12:22	0	0	0.2	21	-0.13
GP-04D	3/21/17 12:06	0	0	0.3	21	2.13
GP-04I	3/21/17 12:03	0	0	0.5	21	0.97
GP-04S	3/21/17 12:01	0	0	3.1	15.8	13.71
GP-05D	3/21/17 11:47	0	0	2.9	18.5	0.09
GP-05I	3/21/17 11:50	0	0	1.6	20.3	-0.01
GP-05S	3/21/17 11:52	0	0	3.9	16.9	-0.07
GP-06D	3/21/17 12:53	0	0	0.2	21	0.46
GP-06I	3/21/17 12:55	0	0	0.2	21	-0.09
GP-06S	3/21/17 12:58	0	0	2.6	18	-0.12
GP-07D	3/21/17 13:12	0	0	0.8	21	-0.04
GP-07I	3/21/17 13:10	0	0	0.2	21	0.89
GP-07S	3/21/17 13:07	0	0	1	19.6	1.56
GP-08D	3/21/17 11:37	0	0	0.7	15.6	3.06
GP-08I	3/21/17 11:35	0	0	1.8	15.9	2.86
GP-08S	3/21/17 11:32	0	0	3.6	4.5	6.91

King County Solid Waste Division
Environmental Monitoring Data
Data Collected April 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
AMB01	4/3/17 13:14	0	0	0.1	21	0
AMB02	4/3/17 11:19	0	0	0.2	21	0
AMB03	4/3/17 11:28	0	0	0.1	21	0
AMB04	4/3/17 11:42	0	0	0.1	21	0
AMB05	4/3/17 12:01	0	0	0.1	21	0
AMB06	4/3/17 12:13	0	0	0.1	21	0
AMB07	4/3/17 12:58	0	0	0.1	21	0
AMB08	4/3/17 13:43	0	0	0.1	21	0
AMBCB	4/3/17 11:25	0	0	0.1	21	0
GP-01	4/3/17 12:08	0	0	0.1	21	-0.14
GP-02	4/3/17 12:56	0	0	2.1	18.3	0.19
MWGP-13	4/3/17 11:48	0	0	0.1	21	0.04
MWGP-24	4/3/17 11:50	0	0	0.1	21	-0.73
GP-1D	4/3/17 11:32	0	0	0.1	21	-1
GP-1I	4/3/17 11:31	0	0	0.1	21	-0.25
GP-1S	4/3/17 11:30	0	0	0.2	21	0
GP-2D	4/3/17 11:38	0	0	0.1	21	-1.07
GP-2I	4/3/17 11:37	0	0	0.1	21	-1.12
GP-2S	4/3/17 11:36	0	0	0.1	21	0.02
GP-3D	4/3/17 11:46	0	0	2.2	17.9	-0.87
GP-3I	4/3/17 11:45	0	0	1.4	19.7	-0.87
GP-3S	4/3/17 11:44	0	0	0.2	21	0.01
GP-4D	4/3/17 12:06	0	0	1	19	-0.08
GP-4I	4/3/17 12:05	0	0	0.2	21	-0.31
GP-4S	4/3/17 12:04	0	0	3	15.2	9.39
GP-5D	4/3/17 12:26	0	0	2.7	18.4	0.11
GP-5I	4/3/17 12:25	0	0	1.4	20.3	0.03
GP-5S	4/3/17 12:24	0	0	0.1	21	0.03
GP-6D	4/3/17 12:53	0	0	0.2	21	-0.09
GP-6I	4/3/17 12:52	0	0	0.1	21	-0.27
GP-6S	4/3/17 12:50	0	0	2.3	17.5	0.06
GP-7D	4/3/17 13:03	0	0	0.5	21	0.13
GP-7I	4/3/17 13:02	0	0	0.1	21	-0.85
GP-7S	4/3/17 13:01	0	0	0.1	21	-0.48
GP-8D	4/3/17 11:23	0	0	0.1	21	-0.81
GP-8I	4/3/17 11:22	0	0	1.2	16.3	-0.95
GP-8S	4/3/17 11:21	0	0	3.4	2.7	4.95
TP-3D	4/3/17 12:40	0	0	0.1	21	0.01
TP-3S	4/3/17 12:38	0	0	0.1	21	-1.09
TP-4D	4/3/17 12:34	0	0	0.1	20.8	-0.13
TP-4S	4/3/17 12:35	0	0	0	0	0
TP-5D	4/3/17 12:29	0	0	0.1	21	-0.75
TP-5S	4/3/17 12:31	0	0	0.1	21	-0.73
TP-6D	4/3/17 12:15	0	0	0.1	21	-0.06
TP-6S	4/3/17 12:17	0	0	0.1	21	0.04

King County Solid Waste Division
Environmental Monitoring Data
Data Collected May 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
VaCOeast	5/10/2016 11:05	0.0	0	0.1	21.0	-0.11
GP-01	5/10/2016 11:48	0.0	0	0.0	20.6	-0.67
GP-02	5/10/2016 12:07	0.0	0	2.2	18.1	0.03
MWGP-13	5/10/2016 11:37	0.0	0	0.1	16.6	0.01
MWGP-24	5/10/2016 11:39	0.0	0	0.0	20.4	-1.25
GP-01D	5/10/2016 11:21	0.0	0	0.0	20.7	-2.52
GP-01I	5/10/2016 11:19	0.0	0	0.0	20.7	-0.77
GP-01S	5/10/2016 11:18	0.0	0	0.1	20.7	-0.08
GP-02D	5/10/2016 11:27	0.0	0	0.0	20.5	-2.21
GP-02I	5/10/2016 11:26	0.0	0	0.0	20.6	-2.16
GP-02S	5/10/2016 11:24	0.0	0	0.1	20.5	-0.02
GP-03D	5/10/2016 11:36	0.0	0	2.0	17.3	-1.73
GP-03I	5/10/2016 11:34	0.0	0	0.0	20.5	-1.38
GP-03S	5/10/2016 11:32	0.0	0	0.9	19.0	-0.06
GP-04D	5/10/2016 11:46	0.0	0	1.1	17.6	-1.42
GP-04I	5/10/2016 11:45	0.0	0	0.3	20.1	-0.82
GP-04S	5/10/2016 11:43	0.0	0	2.2	17.1	-0.31
GP-05D	5/10/2016 11:56	0.0	0	2.8	17.4	-0.05
GP-05I	5/10/2016 11:54	0.0	0	1.6	19.4	-0.01
GP-05S	5/10/2016 11:53	0.0	0	0.0	20.7	-0.01
GP-06D	5/10/2016 12:04	0.0	0	0.1	21.0	-0.47
GP-06I	5/10/2016 12:02	0.0	0	0.1	21.0	-0.24
GP-06S	5/10/2016 12:01	0.0	0	2.9	16.3	0
GP-07D	5/10/2016 12:16	0.0	0	0.0	21.0	-1.28
GP-07I	5/10/2016 12:15	0.0	0	0.1	21.0	-1.31
GP-07S	5/10/2016 12:13	0.0	0	1.8	17.0	0
GP-08D	5/10/2016 11:11	0.0	0	0.1	21.0	-2.46
GP-08I	5/10/2016 11:09	0.0	0	0.1	21.0	-2.38
GP-08S	5/10/2016 11:08	0.0	0	0.1	21.0	-0.14

King County Solid Waste Division
Environmental Monitoring Data
Data Collected June 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
NP-7I	6/6/2017 12:42	0.0	0.1	20.5	0	0.82
VaCoeast	6/6/2017 11:23	0.0	0.1	20.3	0	-0.04
GP-01	6/6/2017 12:02	0.0	0.1	19.7	0	0.69
GP-02	6/6/2017 12:32	0.0	1.8	17.3	0	0.13
MWGP-13	6/6/2017 11:53	0.0	0.2	18.2	0	0.04
MWGP-24	6/6/2017 11:54	0.0	0.2	19.2	0	1.04
GP-01D	6/6/2017 11:39	0.0	0.1	19.9	0	1.27
GP-01I	6/6/2017 11:38	0.0	0.1	19.9	0	0.22
GP-01S	6/6/2017 11:36	0.0	0.2	19.9	0	0.32
GP-02D	6/6/2017 11:46	0.0	0.1	19.9	0	1.17
GP-02I	6/6/2017 11:44	0.0	0.1	19.7	0	1.23
GP-02S	6/6/2017 11:43	0.0	0.1	19.9	0	0.11
GP-03D	6/6/2017 11:51	0.0	2	16.9	0	1.12
GP-03I	6/6/2017 11:50	0.0	1.5	17.7	0	1.05
GP-03S	6/6/2017 11:49	0.0	1	18.6	0	0.04
GP-04D	6/6/2017 12:00	0.0	0.9	17.8	0	1.45
GP-04I	6/6/2017 11:59	0.0	0.2	19.1	0	0.82
GP-04S	6/6/2017 11:57	0.0	1.9	16.4	0	0.43
GP-05D	6/6/2017 12:26	0.0	2.1	17.8	0	0.61
GP-05I	6/6/2017 12:25	0.0	1.2	19	0	0.31
GP-05S	6/6/2017 12:23	0.0	3.5	15.3	0	0.15
GP-06D	6/6/2017 12:38	0.0	0.1	20.4	0	1.08
GP-06I	6/6/2017 12:36	0.0	0.1	19.8	0	0.13
GP-06S	6/6/2017 12:35	0.0	1.9	16.3	0	0.05
GP-07D	6/6/2017 12:44	0.0	0.9	17.8	0	0.08
GP-07S	6/6/2017 12:41	0.0	0.1	20.5	0	1.25
GP-08D	6/6/2017 11:29	0.0	0.1	20	0	1.08
GP-08I	6/6/2017 11:27	0.0	2.3	16.3	0	1.1
GP-08S	6/6/2017 11:26	0.0	0.4	19.3	0	0.05
TP-3D	6/6/2017 12:59	0.4	9.1	0.9	8	0.09
TP-3S	6/6/2017 12:57	0.0	0.1	19.7	0	0.12
TP-4D	6/6/2017 12:55	0.0	6	12.4	0	0.11
TP-4S	6/6/2017 12:52	0.0	0	20.2	0	-0.11
TP-5D	6/6/2017 12:50	0.0	0	20.3	0	0.64
TP-5S	6/6/2017 12:49	0.0	0.1	20.1	0	0.58
TP-6D	6/6/2017 13:08	0.0	0.1	20	0	0.26
TP-6S	6/6/2017 13:07	0.0	0.1	19.6	0	0.08

King County Solid Waste Division
Environmental Monitoring Data
Data Collected July 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
GP-001	7/11/17 12:17	0	0	0.1	20.2	-0.25
GP-002	7/11/17 13:01	0	0	1.8	17.2	0.08
GP-MW13	7/11/17 12:06	0	0	0.1	20	0.07
GP-MW24	7/11/17 12:07	0	0	0.1	20.2	-0.52
GP-01D	7/11/17 11:50	0	0	0.1	20.4	-0.76
GP-01I	7/11/17 11:48	0	0	0.1	20.3	-0.13
GP-01S	7/11/17 11:46	0	0	0.4	19.7	-0.07
GP-02D	7/11/17 11:56	0	0	0.1	20.5	-0.7
GP-02I	7/11/17 11:55	0	0	0.1	20.4	-0.66
GP-02S	7/11/17 11:53	0	0	0.2	20.3	0.06
GP-03D	7/11/17 12:04	0	0	2.1	17.1	-0.65
GP-03I	7/11/17 12:03	0	0	1.9	17.8	-0.65
GP-03S	7/11/17 12:01	0	0	1.4	18.4	0.03
GP-04D	7/11/17 12:15	0	0	0.8	18.4	-0.45
GP-04I	7/11/17 12:14	0	0	0.4	19.6	-0.33
GP-04S	7/11/17 12:12	0	0	2.4	16.6	-0.1
GP-05D	7/11/17 12:51	0	0	2.3	17.4	0.07
GP-05I	7/11/17 12:49	0	0	1.4	18.9	0.04
GP-05S	7/11/17 12:48	0	0	0.1	20.1	0.01
GP-06D	7/11/17 12:59	0	0	0.1	20	-0.09
GP-06I	7/11/17 12:57	0	0	0.1	20	-0.06
GP-06S	7/11/17 12:56	0	0	2.8	15.8	0
GP-07D	7/11/17 13:18	0	0	1.5	16.7	0
GP-07I	7/11/17 13:16	0	0	0.1	20.4	-0.38
GP-07S	7/11/17 13:15	0	0	0.1	20.3	-0.23
GP-08D	7/11/17 11:39	0	0	0.1	20.2	-0.72
GP-08I	7/11/17 11:38	0	0	0.1	20.2	-0.7
GP-08S	7/11/17 11:36	0	0	0.1	20.3	-0.01

King County Solid Waste Division
Environmental Monitoring Data
Data Collected August 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
GP-01	8/8/2017 11:47	0.0	0	0.0	19.9	0.02
GP-02	8/8/2017 12:57	0.0	0	1.5	18.0	0
GP-MW13	8/8/2017 11:59	0.0	0	0.1	15.1	0.05
GP-MW24	8/8/2017 12:01	0.0	0	0.0	20.2	-0.19
GP-01D	8/8/2017 12:23	0.0	0	0.0	20.6	-0.19
GP-01I	8/8/2017 12:22	0.0	0	0.0	20.5	0
GP-01S	8/8/2017 12:20	0.0	0	0.9	18.5	0.09
GP-02D	8/8/2017 12:18	0.0	0	0.1	20.6	-0.25
GP-02I	8/8/2017 12:17	0.0	0	0.1	20.5	-0.19
GP-02S	8/8/2017 12:16	0.0	0	0.5	19.5	0.1
GP-03D	8/8/2017 11:57	0.0	0	2.0	17.1	-0.26
GP-03I	8/8/2017 11:56	0.0	0	1.8	17.5	-0.28
GP-03S	8/8/2017 11:55	0.0	0	1.2	18.2	0.06
GP-04D	8/8/2017 11:51	0.0	0	0.7	18.4	0.04
GP-04I	8/8/2017 11:50	0.0	0	0.5	19.3	-0.05
GP-04S	8/8/2017 11:49	0.0	0	2.3	17.3	0.01
GP-05D	8/8/2017 11:27	0.0	0	2.3	17.6	0.14
GP-05I	8/8/2017 11:26	0.0	0	1.4	19.1	0.08
GP-05S	8/8/2017 11:25	0.0	0	0.2	20.2	0.06
GP-06D	8/8/2017 12:54	0.0	0	0.1	20.8	0.08
GP-06I	8/8/2017 12:53	0.0	0	0.1	20.8	-0.02
GP-06S	8/8/2017 12:52	0.0	0	2.8	17.3	0.02
GP-07D	8/8/2017 13:04	0.0	0	1.4	17.4	0.01
GP-07S	8/8/2017 13:01	0.0	0	0.1	20.7	0.01
GP-08D	8/8/2017 12:29	0.0	0	0.0	20.4	-0.09
GP-08I	8/8/2017 12:27	0.0	0	0.0	20.5	0.02
GP-08S	8/8/2017 12:28	0.0	0	0.0	20.4	0.09

King County Solid Waste Division
Environmental Monitoring Data
Data Collected September 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
GP-001	9/11/2017 14:04	0.0	0	0	20.7	0.74
GP-002	9/11/2017 14:46	0.0	0	1.4	18.1	0.15
GP-MW13	9/11/2017 14:14	0.0	0	0.1	20.8	0.09
GP-MW24	9/11/2017 14:16	0.0	0	0.1	20.6	0.76
GP-01D	9/11/2017 14:30	0.0	0	0	20.8	0.69
GP-01I	9/11/2017 14:28	0.0	0	0	20.7	0.4
GP-01S	9/11/2017 14:27	0.0	0	1.2	18.1	0.12
GP-02D	9/11/2017 14:24	0.0	0	0.1	20.8	0.79
GP-02I	9/11/2017 14:22	0.0	0	0.1	20.8	0.7
GP-02S	9/11/2017 14:20	0.0	0	0.7	19.7	0.12
GP-03D	9/11/2017 14:11	0.0	0	2.2	18.6	0.79
GP-03I	9/11/2017 14:10	0.0	0	1.7	18.2	0.73
GP-03S	9/11/2017 14:08	0.0	0	1.4	19.4	0.16
GP-04D	9/11/2017 14:00	0.0	0	0.9	18.1	1.02
GP-04I	9/11/2017 13:58	0.0	0	0.3	20	0.61
GP-04S	9/11/2017 13:55	0.0	0	2.2	18.5	0.26
GP-05D	9/11/2017 13:29	0.0	0	2.2	17.8	0.52
GP-05I	9/11/2017 13:27	0.0	0	1.4	19.3	0.19
GP-05S	9/11/2017 13:25	0.0	0	2.2	19.1	0.12
GP-06D	9/11/2017 14:54	0.0	0	0.1	20.7	0.94
GP-06I	9/11/2017 14:52	0.0	0	0.1	20.6	0.24
GP-06S	9/11/2017 14:50	0.0	0	3.1	17.9	0.12
GP-07D	9/11/2017 15:01	0.0	0	1.4	18.1	0.26
GP-07I	9/11/2017 14:59	0.0	0	0	20.9	0.3
GP-07S	9/11/2017 14:57	0.0	0	0	20.9	0.83
GP-08D	9/11/2017 14:41	0.0	0	0	20.6	0.59
GP-08I	9/11/2017 14:39	0.0	0	1.2	17.5	0.64
GP-08S	9/11/2017 14:38	0.0	0	0.3	20	0.12

King County Solid Waste Division
Environmental Monitoring Data
Data Collected October 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
GP-001	10/3/17 11:33	0	0	0.1	20.7	-0.57
GP-002	10/3/17 12:14	0	0	1.7	18.8	0.03
GP-MW13	10/3/17 11:20	0	0	0.1	20.4	-0.02
GP-MW24	10/3/17 11:21	0	0	0.1	20.7	-1.25
GP-01D	10/3/17 11:05	0	0	0.1	20.3	-1.91
GP-01I	10/3/17 11:03	0	0	0.1	20	-1.59
GP-01S	10/3/17 11:02	0	0	1.2	18.5	-0.02
GP-02D	10/3/17 11:11	0	0	0.1	20.4	-1.64
GP-02I	10/3/17 11:10	0	0	0.1	20.3	-1.62
GP-02S	10/3/17 11:08	0	0	0.5	20	-0.02
GP-03D	10/3/17 11:18	0	0	2.1	18.7	-1.38
GP-03I	10/3/17 11:17	0	0	1.8	18.4	-1.36
GP-03S	10/3/17 11:15	0	0	1.1	19.9	-0.05
GP-04D	10/3/17 11:32	0	0	1.1	18.5	-1.14
GP-04I	10/3/17 11:30	0	0	0.3	20.6	-0.67
GP-04S	10/3/17 11:28	0	0	2.1	19.5	-0.34
GP-05D	10/3/17 11:42	0	0	2.1	18.9	-0.27
GP-05I	10/3/17 11:40	0	0	1.4	20.2	-0.19
GP-05S	10/3/17 11:39	0	0	0.1	21	-0.01
GP-06D	10/3/17 12:11	0	0	0.2	20.9	-0.47
GP-06I	10/3/17 12:09	0	0	0.2	20.7	-0.12
GP-06S	10/3/17 12:07	0	0	3	19	0.03
GP-07D	10/3/17 12:23	0	0	1.4	19.1	0.02
GP-07I	10/3/17 12:21	0	0	0.1	20.9	-0.97
GP-07S	10/3/17 12:20	0	0	0.1	20.9	-0.92
GP-08D	10/3/17 10:54	0	0	0.1	20.5	-1.82
GP-08I	10/3/17 10:53	0	0	0.1	20.5	-1.66
GP-08S	10/3/17 10:52	0	0	0.2	20.6	-0.04

King County Solid Waste Division
Environmental Monitoring Data
Data Collected November 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
GP-01	11/29/2017 10:43	0.0	0	0.1	20.7	-2.04
GP-02	11/29/2017 11:23	0.0	0	1.9	18.2	-0.24
GP-MW13	11/29/2017 10:55	0.0	0	0.2	19.1	0
GP-MW24	11/29/2017 10:57	0.0	0	0.1	20.7	-4.37
GP-01D	11/29/2017 11:14	0.0	0	0.1	20.8	-5.76
GP-01I	11/29/2017 11:12	0.0	0	0.1	20.7	-4.8
GP-01S	11/29/2017 11:11	0.0	0	2.4	17.2	1.08
GP-02D	11/29/2017 11:03	0.0	0	0.1	20.7	-5.27
GP-02I	11/29/2017 11:02	0.0	0	0.1	20.7	-5.25
GP-02S	11/29/2017 11:00	0.0	0	1.5	18.9	0.92
GP-03D	11/29/2017 10:54	0.0	0	1.3	19.1	-4.59
GP-03I	11/29/2017 10:53	0.0	0	1.6	19.0	-4.54
GP-03S	11/29/2017 10:51	0.0	0	0.1	20.6	-3.27
GP-04D	11/29/2017 10:48	0.0	0	0.3	20.2	-3.76
GP-04I	11/29/2017 10:47	0.0	0	0.1	20.6	-2.36
GP-04S	11/29/2017 10:45	0.0	0	1.1	19.7	-1.81
GP-05D	11/29/2017 10:21	0.0	0	2.2	18.5	-0.9
GP-05I	11/29/2017 10:20	0.0	0	1.1	19.7	-0.45
GP-05S	11/29/2017 10:18	0.0	0	0.2	20.6	-0.13
GP-06D	11/29/2017 11:20	0.0	0	0.1	20.7	-2.21
GP-06I	11/29/2017 11:19	0.0	0	0.2	20.7	-1.19
GP-06S	11/29/2017 11:17	0.0	0	2.6	18.3	-0.17
GP-07D	11/29/2017 11:30	0.0	0	1.0	19.8	-0.13
GP-07I	11/29/2017 11:28	0.0	0	0.1	20.8	-3.56
GP-07S	11/29/2017 11:27	0.0	0	0.1	20.7	-3.61
GP-08D	11/29/2017 10:11	0.0	0	0.2	21.0	-5.35
GP-08I	11/29/2017 10:10	0.0	0	0.9	19.2	-5.21

King County Solid Waste Division
Environmental Monitoring Data
Data Collected December 2017
Vashon Landfill--Gas Testing Results

Sample Location	Sample Date/Time	CH4		CO2	Vol O2	Relative Pressure
		%Vol	%LEL	%Vol	%Vol	in. H2O
GP-001	12/5/2017 10:37	0.0	0	0.1	21	-1.2
GP-002	12/5/2017 11:45	0.0	0	2.1	18.3	0.1
GP-MW13	12/5/2017 10:51	0.0	0	0.1	21	0.03
GP-MW24	12/5/2017 10:52	0.0	0	0.1	21	-2.72
GP-01D	12/5/2017 11:19	0.0	0	0.1	20.9	-4.2
GP-01I	12/5/2017 11:18	0.0	0	0.1	20.9	-3.45
GP-01S	12/5/2017 11:17	0.0	0	2.5	17.9	3.76
GP-02D	12/5/2017 11:14	0.0	0	0.1	20.9	-3.69
GP-02I	12/5/2017 11:13	0.0	0	0.1	20.9	-3.66
GP-02S	12/5/2017 11:11	0.0	0	1.5	19.1	0.89
GP-03D	12/5/2017 10:49	0.0	0	0.7	20.5	-2.89
GP-03I	12/5/2017 10:48	0.0	0	1.6	19.5	-2.89
GP-03S	12/5/2017 10:47	0.0	0	1.3	19.9	0.06
GP-04D	12/5/2017 10:41	0.0	0	0.2	21	-2.06
GP-04I	12/5/2017 10:40	0.0	0	0.2	21	-1.4
GP-04S	12/5/2017 10:39	0.0	0	1	20.5	-1.04
GP-05D	12/5/2017 11:55	0.0	0	2.3	18.8	-0.29
GP-05I	12/5/2017 11:53	0.0	0	1.3	20.1	-0.13
GP-05S	12/5/2017 11:52	0.0	0	0.1	21	0.03
GP-06D	12/5/2017 11:43	0.0	0	0.3	20.8	-1.02
GP-06I	12/5/2017 11:41	0.0	0	0.2	20.8	-0.51
GP-06S	12/5/2017 11:40	0.0	0	2.6	18.3	0.18
GP-07D	12/5/2017 11:37	0.0	0	1.7	19.1	0.21
GP-07S	12/5/2017 11:35	0.0	0	0.1	21	-2.44
GP-08D	12/5/2017 10:31	0.0	0	0.3	21	-4.19
GP-08I	12/5/2017 10:29	0.0	0	1.4	18.5	-4.05
GP-08S	12/5/2017 10:28	0.0	0	2.1	16.8	0.02

Appendix L
Inspection Survey Reports

SOLID WASTE INSPECTION REPORT

Public Health
Seattle & King County

PUBLIC HEALTH - SEATTLE & KING COUNTY	PURPOSE OF VISIT:
Downtown Office 401 - 5th Ave., Ste 1100 Seattle, WA 98104 206-263-9566	Routine Inspection/Field Review of a Closed Landfill - Permitted establishment (PE=1002)
ESTABLISHMENT INFORMATION:	**INSPECTION INFORMATION:**
VASHON LANDFILL VASHON LANDFILL 18900 SW WESTSIDE HWY SW VASHON ISLAND, WA 98070 206-296-4385 **Program Record:** PR0015723	**Date of Inspection:** Friday, March 3, 2017 **Time In:** 12:08 pm **Time Out:** 12:55 pm **Inspector:** Darshan Dhillon **Result: COMPLETE**

VIOLATIONS OBSERVED (if any)

OVERALL INSPECTION COMMENTS:

ACTIONS AND RECOMMENDATIONS:

1. Outlet pipe of the storm water pond located in the southeast corner of the landfill appeared to be blocked with debris needs cleaning

OBSERVATIONS:

1. Access to the facility is controlled with locked gates and no damage was found to the perimeter fencing.
2. All of the groundwater wells are secured with pad locks.
3. Couple of puddles of water were observed on top of the landfill but no bubbles were noticed.
4. Aeration pump was operating in the leachate pond.
5. No gas odors were detected.

Darshan Dhillon
H&EI III

Don Swope
Engineer II

PIC Phone #: 206-477-4623 **Email:** Don.Swope@KingCounty.Gov

INSPECTION CHECKLIST

The following items are evaluated during inspections.
Violations cited as out of compliance during this inspection are highlighted below.
Out=out of compliance

OUT

Abandoned Landfill Sites BOH 10.09.040

- [ ] 0888-Abandoned landfills maintained so as to not create a risk to the public health.

Closer Landfill Leachate Managment for surface impoundment WAC-173-350-330

- [ ] 0754-Records kept of weekly inspections and liner inspections at least every 5 years
- [ ] 0763-Liners, embankments, tank piping and secondary containment maintained and logs kept
- [ ] 0766-Surface impoundments not equipped with a leak detection layer must meet WAC 173-350-500
- [ ] 0767-Surface impoundments w/a leak detection layer are subject to WAC 173-350-040 (5),173-350-330(b)

Closure Performance Standard WAC-173-304-407 (3)

- [ ] 0870-Closure must be performed in a manner to minimize maintenance
- [ ] 0871-Closure must be performed to control and prevent threats to human health and the environment
- [ ] 0872-Facility must be prepared for post-closure period

Closure Plan and Amendments WAC-173-304-407 (4)

- [ ] 0873-Facility must provide a closure plan amendments as directed by JHD
- [ ] 0874-Facility must be closed in accordance with the approved closure plan amendments

Closure Procedure WAC 173-304-407 (4)

- [ ] 0875-Closure plan sheets signed by WS PE showing as-built changes in final constn per closure plan

Closure Requirements WAC-173-351-500

- [ ] 0856-Final cover installed to minimize, infiltration and erosion per design
- [ ] 0857-Closure plan followed for areas of the MSWLF unit within 30 days of final receipt of wa-stes
- [ ] 0858-For closed areas, closure activities must be completed within 180 days

Financial Assurance Criteria WAC-173-351-600

- [ ] 0864-Financial assurance for post closure care per WAC 173-351-600 (3)

Landfill requirements for landfill closed under WAC 173-304-460

- [ ] 0882-Must prevent groundwater contamination per WAC 173-304-100
- [ ] 0883-Operation shall not result in explosive gas generation in facility structures
- [ ] 0884-Operation shall not result in explosive gas generated by the landfill at property boundary
- [ ] 0885-Landfill shall not cause violation of ambient air quality standard at property boundary
- [ ] 0886-Landfill shall not cause water quality violations

Methane Monitoring BOH 10.09.050

- [ ] 0889-Methane monitoring must be conducted per BOH 10.09.050
- [ ] 0890-Structures within 1,000 ft of landfill must be protected from potential methane migration

Performance Standards

- [ ] 0290-Must not pose a threat to human health or environment
- [ ] 0291-Protects from ground water contamination
- [ ] 0292-The facility must conform to the approved local comprehensive solid waste management plan
- [ ] 0293-Complies with RCW 70.94 Emission or ambient air quality standards
- [ ] 0294-Complies with all other local/state/federal laws and regulations

Permit Requirements

- [ ] 0891-Permit Required for Landfills operating under WAC 173-351

Post Closure care WAC-173-351-500

OUT

- [ ] 0859-For closed areas post closure care must be conducted per post-closure plan and WAC
- [ ] 0860-Final cover for closed areas must be maintained (vegetation, settlement, erosion,# run on/off)
- [ ] 0861-Leachate collection systems maintained and operated per post-closure plan and WAC 173-351-300
- [ ] 0862-Gas monitoring systems maintained and operated per post-closure plan and WAC 173-351-200

Post Closure Performance Standards WAC 173-304-407 (6)

- [ ] 0876-Post-closure activities must provide maintenance & monitoring of air/land/ water for stability

Post Closure Plan WAC 173-304-407 (7)

- [ ] 0877-Facility must keep and abide by approved plan of post closure
- [ ] 0878-Facility must provide an approved financial assurance instrument for all post closure costs
- [ ] 0879-Post-closure activities must be completed per the closure plan and schedule
- [ ] 0880-Owner/operator must implement post closure activities w/ a valid post closure plan and any requ

Post Closure Procedure WAC 173-304-407 (8)

- [ ] 0881-WA PE certification must be to the JHD of why post-closure activities are no longer necessary

Requirements sf Landfills BOH 10.09: for landfills closed under WAC 173-351/304&pre WAC173-.04

- [ ] 0887-Necessary maintenance, site inspections, and reporting provided for closed landfills

SOLID WASTE INSPECTION REPORT

Public Health
Seattle & King County

PUBLIC HEALTH - SEATTLE & KING COUNTY	PURPOSE OF VISIT:
Downtown Office 401 - 5th Ave., Ste 1100 Seattle, WA 98104 206-263-9566	Routine Inspection/Field Review of a Closed Landfill - Permitted establishment (PE=1002)
ESTABLISHMENT INFORMATION:	**INSPECTION INFORMATION:**
VASHON LANDFILL VASHON LANDFILL 18900 SW WESTSIDE HWY SW VASHON ISLAND, WA 98070 206-296-4385 **Program Record:** PR0015723	**Date of Inspection:** Wednesday, June 7, 2017 **Time In:** 11:10 am **Time Out:** 11:55 am **Inspector:** Darshan Dhillon **Result: COMPLETE**

VIOLATIONS OBSERVED (if any)

OVERALL INSPECTION COMMENTS:

ACTIONS AND RECOMMENDATIONS:

1. Grass/weed is growing too tall needs to be mowed.
2. Ensure that aerators are functioning properly in the leachate pond.

OBSERVATIONS AND COMMENTS:

1. Access to the landfill has been controlled by a locking gate and fencing.
2. All of the GW wells are marked with identification numbers and kept locked.
3. Leachate collection ditches were found to be dry.
4. Perimeter fence was found to be in good repair.
5. Grass/weed is growing tall al over the landfill.
6. No fugitive dust was noticed.
7. No LFG smell was detected.

Anne Holmes
Supervising Engineer

Darshan Dhillon
HEI III

PIC Phone #: 206-477-5223 **Email:** Anne.holmes@kingcounty.gov

INSPECTION CHECKLIST

The following items are evaluated during inspections.
Violations cited as out of compliance during this inspection are highlighted below.
Out=out of compliance

OUT

Abandoned Landfill Sites BOH 10.09.040

- [ ] 0888-Abandoned landfills maintained so as to not create a risk to the public health.

Closer Landfill Leachate Managment for surface impoundment WAC-173-350-330

- [ ] 0754-Records kept of weekly inspections and liner inspections at least every 5 years
- [ ] 0763-Liners, embankments, tank piping and secondary containment maintained and logs kept
- [ ] 0766-Surface impoundments not equipped with a leak detection layer must meet WAC 173-350-500
- [ ] 0767-Surface impoundments w/a leak detection layer are subject to WAC 173-350-040 (5),173-350-330(b)

Closure Performance Standard WAC-173-304-407 (3)

- [ ] 0870-Closure must be performed in a manner to minimize maintenance
- [ ] 0871-Closure must be performed to control and prevent threats to human health and the environment
- [ ] 0872-Facility must be prepared for post-closure period

Closure Plan and Amendments WAC-173-304-407 (4)

- [ ] 0873-Facility must provide a closure plan amendments as directed by JHD
- [ ] 0874-Facility must be closed in accordance with the approved closure plan amendments

Closure Procedure WAC 173-304-407 (4)

- [ ] 0875-Closure plan sheets signed by WS PE showing as-built changes in final constn per closure plan

Closure Requirements WAC-173-351-500

- [ ] 0856-Final cover installed to minimize, infiltration and erosion per design
- [ ] 0857-Closure plan followed for areas of the MSWLF unit within 30 days of final receipt of wa-stes
- [ ] 0858-For closed areas, closure activities must be completed within 180 days

Financial Assurance Criteria WAC-173-351-600

- [ ] 0864-Financial assurance for post closure care per WAC 173-351-600 (3)

Landfill requirements for landfill closed under WAC 173-304-460

- [ ] 0882-Must prevent groundwater contamination per WAC 173-304-100
- [ ] 0883-Operation shall not result in explosive gas generation in facility structures
- [ ] 0884-Operation shall not result in explosive gas generated by the landfill at property boundary
- [ ] 0885-Landfill shall not cause violation of ambient air quality standard at property boundary
- [ ] 0886-Landfill shall not cause water quality violations

Methane Monitoring BOH 10.09.050

- [ ] 0889-Methane monitoring must be conducted per BOH 10.09.050
- [ ] 0890-Structures within 1,000 ft of landfill must be protected from potential methane migration

Performance Standards

- [ ] 0290-Must not pose a threat to human health or environment
- [ ] 0291-Protects from ground water contamination
- [ ] 0292-The facility must conform to the approved local comprehensive solid waste management plan
- [ ] 0293-Complies with RCW 70.94 Emission or ambient air quality standards
- [ ] 0294-Complies with all other local/state/federal laws and regulations

Permit Requirements

- [ ] 0891-Permit Required for Landfills operating under WAC 173-351

Post Closure care WAC-173-351-500

OUT

- [ ] 0859-For closed areas post closure care must be conducted per post-closure plan and WAC
- [ ] 0860-Final cover for closed areas must be maintained (vegetation, settlement, erosion,# run on/off)
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- [ ] 0862-Gas monitoring systems maintained and operated per post-closure plan and WAC 173-351-200

Post Closure Performance Standards WAC 173-304-407 (6)

- [ ] 0876-Post-closure activities must provide maintenance & monitoring of air/land/ water for stability

Post Closure Plan WAC 173-304-407 (7)

- [ ] 0877-Facility must keep and abide by approved plan of post closure
- [ ] 0878-Facility must provide an approved financial assurance instrument for all post closure costs
- [ ] 0879-Post-closure activities must be completed per the closure plan and schedule
- [ ] 0880-Owner/operator must implement post closure activities w/ a valid post closure plan and any requ

Post Closure Procedure WAC 173-304-407 (8)

- [ ] 0881-WA PE certification must be to the JHD of why post-closure activities are no longer necessary

Requirements sf Landfills BOH 10.09: for landfills closed under WAC 173-351/304&pre WAC173-.04

- [ ] 0887-Necessary maintenance, site inspections, and reporting provided for closed landfills

SOLID WASTE INSPECTION REPORT

Public Health
Seattle & King County

PUBLIC HEALTH - SEATTLE & KING COUNTY	PURPOSE OF VISIT:
Downtown Office 401 - 5th Ave., Ste 1100 Seattle, WA 98104 206-263-9566	Routine Inspection/Field Review of a Closed Landfill - Permitted establishment (PE=1002)
ESTABLISHMENT INFORMATION:	**INSPECTION INFORMATION:**
VASHON LANDFILL VASHON LANDFILL 18900 SW WESTSIDE HWY SW VASHON ISLAND, WA 98070 206-296-4385 **Program Record:** PR0015723	**Date of Inspection:** Monday, October 30, 2017 **Time In:** 2:20 pm **Time Out:** 3:05 pm **Inspector:** Darshan Dhillon **Result: COMPLETE**

VIOLATIONS OBSERVED (if any)

OVERALL INSPECTION COMMENTS:

1. ACTIONS AND RECOMMENDATIONS:

1.1 Ensure that leachate pond aeration blower system is in good working condition and it aerate leachate frequently. It prevents leachate from going anaerobic. Aerobic condition cause odors.

1. OBSERVATIONS:

1.1 Weed and grass on the landfill cover has been mowed and kept under control.
1.2 All of the monitoring wells have been secured by pad locks.
1.3 Perimeter fence is in good repair no damage was noticed.
1.4 Active LFG extraction and treatment system was operating.
1.5 Leachate pond aeration system was not operating.

Anne Holmes
Supervising Engineer

Darshan Dhillon
H&EI III

PIC Phone #: 206-477-4623 **Email:** Anne.Holmes@kingcounty.gov

INSPECTION CHECKLIST

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- [ ] 0888-Abandoned landfills maintained so as to not create a risk to the public health.

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- [ ] 0754-Records kept of weekly inspections and liner inspections at least every 5 years
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- [ ] 0290-Must not pose a threat to human health or environment
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- [ ] 0294-Complies with all other local/state/federal laws and regulations

Permit Requirements

- [ ] 0891-Permit Required for Landfills operating under WAC 173-351

Post Closure care WAC-173-351-500

OUT

- [ ] 0859-For closed areas post closure care must be conducted per post-closure plan and WAC
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Requirements sf Landfills BOH 10.09: for landfills closed under WAC 173-351/304&pre WAC173-.04

- [ ] 0887-Necessary maintenance, site inspections, and reporting provided for closed landfills

Appendix M
Vashon Annual Financial Summary

King County Solid Waste Division
Vashon Island Closed Landfill - 2017-2018 Financial Summary

King County Vashon Closed Landfill – Closed 2001 WAC 173-351

The minimum 30 year post closure required funding period is currently planned through 2031. Financial Assurance is derived from three sources: the established post-closure fund [WAC 173-351-600 (5) (a) (i), the recurring two-year operational and capital improvement program funds WAC 173-351-600 (5) (a) (ii)and the high security bonding options [WAC 173-351-600 (5) (a) (iii)] described in the April 18, 2014 letter from V. Okereke KCSWD to B. Lasby SKCDPH.

Landfill Systems being maintained during post-closure:
Geomembrane cover
Landfill gas collection with carbon treatment
Leachate/Wastewater control and management
Groundwater, surface water, leachate and landfill gas monitoring

Completion of the following projects will provide necessary information to reevaluate the current post-closure assumptions and financial assurance plans:
Enhancements to landfill gas control and treatment
Modifications to leachate and wastewater management
Groundwater monitoring of natural attenuation
Determination of remaining post-closure period

2017-18 King County Vashon Closed Landfill Adopted Budget

PCM Budget: Routine Maintenance, Operations, Compliance Reporting, Public Response

Item	2017	2018	2017-2018 Total
LOAN IN LABOR MANUAL	116,975	120,448	237,423
MISC OPERATING SUPPLIES	177	177	354
SMALL TOOLS NON CAP NON CONTR	11,675	11,675	23,350
UTILITIES SURFACE WATER UTILITY	12	12	24
DISPOSAL	16,524	16,524	33,048
LABORATORY ANALYSIS	87,224	87,224	174,448
VASHON Post-Closure Maintenance Budget Total	**$232,587**	**$236,060**	**$468,647**

CIP Budget: Env Investigation, Eng Control Systems Modifications, GW Montirong Network Evaluation and

VASHON Capitol Improvement Project Budget	**$3,606,011**