Lake Goodwin Landfill
2014 3rd Quarter Environmental Monitoring Report

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1.0 INTRODUCTION

The following report presents the third quarter ground water monitoring results for 2014 at the Lake Goodwin Landfill (*Lake Goodwin Landfill, Site*). The site is located immediately west of Frank Waters Road in northwestern Snohomish County, about one and one half (*1.5*) miles northwest of Lake Goodwin and about five-(*5*) miles south of Stanwood (*T31N, R4E, sections 17, 20 Willamette Meridian*). The landfill is located at 18520 Frank Waters Road, Stanwood, Washington, 98292. The location of the site relative to existing municipal improvements is shown on the **Vicinity Map** (*figure 1*).

This report has been prepared in compliance with the sites **Safety and Analysis Plan** (*SAP*) as approved by the **Snohomish Health District**, June, 2012.

1.1 BACKGROUND

The Lake Goodwin Landfill is sited within a former County gravel pit. Waste disposed at the landfill reportedly consisted of municipal waste, including garbage and demolition debris, and some industrial waste. Waste was placed in the landfill starting in the early 1960's under the direction of **Snohomish County's Road Maintenance Division**. The landfill was closed in September 1982. Upon closure a cover system was installed. The landfill is not lined nor does it have leachate or gas collection systems. The Lake Goodwin Landfill is currently permitted for post-closure monitoring by the **Snohomish Health District** (*SHD*) with a Solid Waste Facility Permit (*SW-085, 2014*). Monitoring results are reviewed by both the **SHD** and the **Department of Ecology**.

1.2 PERMIT INFORMATION

Monitoring activities at the landfill are governed by the Solid Waste Facility Permit SW-085 (*landfill permit, Snohomish Health District 2014*). This permit requires post-closure ground water monitoring on a quarterly basis until the facility has been shown to be stable and/or not harmful to human health or the environment. The **SHD** permits and evaluates post-closure conditions at the Lake Goodwin Landfill using the Snohomish Health District Sanitary Codes, *Chapter 3.1, Solid Waste Handling Regulations*; *Chapter 173-304 WAC Minimum Functional Standards for Solid Waste; Chapter 173-200 WAC Water Quality Standards for Ground Waters*; and *Chapter 246-290 WAC Drinking Water Regulations.* There is an approved **Sampling & Analysis Plan** (*SAP*) for this landfill.

1.3 SITE DESCRIPTION AND PHYSICAL CONDITIONS

The closed landfill is approximately 11.5 acres in size and is part of a larger County owned parcel of land. The Lake Goodwin Landfill is bounded by private residential property or commercial forest to the south, west and north. The Frank Waters Road is located along the eastern side of the site. Access into the site is from a partially paved and partially graveled driveway off of the Frank Waters Road. Existing site improvements are shown on the **Site Map** (*figure 2*).

The Lake Goodwin Landfill is located on a topographic feature known as the Tulalip Plateau, a rolling upland area bounded by the Stillaguamish River to the north, the Puget Sound to the west and south, and by a topographic low called the Marysville Trough to the east. The general topography in the immediate vicinity of the site is typical of glaciated areas within western Washington State – gently rolling landscapes bisected by seasonal and/or year round drainages, creeks and rivers. Several small to medium sized lakes are found in the immediate vicinity of the site. Lake Martha, Lake Howard and Lake Goodwin are all located within a few miles of the Landfill. There are no named drainages, creeks or rivers located in the immediate vicinity of the site. Elevations in the landfill range from approximately el. 320 to el. 380 feet above mean sea level. Relative to existing surrounding topography the landfill itself is approximately 60 ft high. It has been graded and slopes gently in a north to northeast direction. Site Topography is shown on the **Topographic Map** (*figure 3*). In most places the landfill cover is well vegetated with grass, clover and weeds. A few Douglas fir have naturally reseeded in the fill cover near the edge of the site. There are no stormwater detention ponds or leachate collection ponds located on the site.

1.4 LOCAL HYDROGEOLOGY

Surficial geology of the site area is shown on the **Geologic Map** (*figure 4*). Based on the Geologic Map and the site explorations, surficial geology at the landfill site consists of Advance Outwash (*Qva*) sands and gravels locally overlain by sandy silts to silty sands and gravels – Glacial Till (*Qvt*).

The Lake Goodwin Landfill is located on an upland area known as the Tulalip Plateau. Below the Tulalip Plateau the most productive aquifer is the Advance Outwash (*Qva*) aquifer which is underlain by Transitional Bed (*Qtb*) silts and clays. Where overlain by Glacial Till (*Qvt*), the aquifer is confined. In the vicinity of the Lake Goodwin Landfill where Glacial Till (*Qvt*) is absent, the aquifer is unconfined. With the exception of the surficial Glacial Till (*Qvt*) found overlying the Advance Outwash (*Qva*) sands and gravels along the southern edge of the landfill (*LG-02*), permeable soils were encountered from the surface down in all site explorations at the landfill. Ground water elevations below the landfill during the third quarter sampling event ranged from el. 151.93 to el. 155.62 with a north to northeast gradient in an unconfined condition within the Advance Outwash (*Qva*) aquifer.

1.5 EXISTING MONITORING NETWORK

As outlined in the Solid Waste Facility Permit SW-085, quarterly monitoring of ground water is required at the Lake Goodwin Landfill. There are currently four-(4) ground water monitoring wells (*LG-01, LG-02, LG-04, and LG-05*) at the Lake Goodwin Landfill site that are read on a quarterly basis. Well locations are shown on the **Network Monitoring Map** (*figure 5*). Of these wells, one-(*1*) is considered to be an up-gradient well monitoring background ground water conditions in the immediate vicinity of the site (*LG-02*). The remaining three-(3) wells are located down gradient of the landfill (*LG-01, and LG-04 and LG-05*) and monitor ground water conditions that may be impacted from the site. Third quarter monitoring results are discussed in section 2.0 below.

2.0 GROUND WATER MONITORING

Ground water quality within Snohomish County is generally good. Water types are typical of glacial originated soils. There are no wide spread areas of ground water contamination, however, salt water intrusion, agricultural and septic system impacts locally occur. According to the 1996 USGS ground water study, the most common and wide-spread water quality problems in Snohomish County are from natural causes. High iron and manganese concentrations are fairly common throughout the County. These minerals cause mostly nuisance issues because of objectionable odors and/or stained laundry and plumbing fixtures. Another naturally occurring water quality problem in Snohomish County is arsenic. Arsenic levels vary depending on the ground water aquifer and the proximity to bedrock units. Arsenic concentrations are the highest in areas located closest to surficial bedrock, such as in and around the Granite Falls area, where tested arsenic levels present health concerns. In most areas of the County, arsenic levels in ground water exceed current USEPA MCL reporting limits but are not high enough to present health concerns.

Third quarter 2014 monitoring of the ground water wells at the Lake Goodwin Landfill was performed by **Snohomish County** personnel. Depth to water was measured and ground water samples were collected following approved sampling protocol. The following sections describe field procedures used and analytical results derived from the sampling event.

2.1 Ground Water Level Measurements

The depth to ground water within each well was measured prior to ground water sampling activities. The depth to ground water was measured using an electronic water level indicator in increments to the nearest 0.01 ft. as taken from a marked survey point on the top of each well casing.

Third Quarter Ground Water Measurements are shown in *Table 1* below. **Hydrographs** of the third quarter 2014 monitoring well readings are contained in *Appendix A* of this report. Third quarter well readings show a general increase in water levels. Readings confirm that the aquifer is unconfined in the immediate vicinity of the site. The **Third Quarter Ground Water Contour Map** developed from the field data is shown in *Figure 6* of this report.

Measured precipitation at the Stanwood Weather Station (*WA-SN-11 http://www.cocorahs.org/state.aspx?state=wa*) during the third quarter monitoring period was 4.90". This is a decrease of 2.92" over the last quarter precipitation. For reference purposes, precipitation measured at station WA-SN-11 during the monitoring period has been included on the hydrographs.

Table 1 – 3rd Quarter Groundwater Measurements and Elevations

Well Numbers	Casing Elevation	3rd Quarter Delta/Elevation	
LG-01	239.18	+1.68	154.65
LG-02	268.67	+1.80	155.62
LG-04	206.93	+0.54	151.93
LG-05	235.00	+0.91	153.08

2.2 Third Quarter Ground Water Sampling Event

Purging and sampling of each of the four-(*4*) sampled monitoring wells was performed during the third quarter by Snohomish County personnel in accordance with the facilities closure permit. Approximately 1.9 to 3.2 gallons of water were purged from each well prior to sampling. Water samples were collected by slowly filling laboratory-supplied containers in such a manner as to reduce aeration. Sample containers were filled so that no headspace or air bubbles remained within the container. Samples were placed in coolers and packed in ice to keep samples at approximately 4C for delivery to the laboratory for testing. Samples were picked up by **Amtest** and taken to their Kirkland, WA laboratory for analysis of dissolved metals and conventional chemistry parameters. Analytical Data is included in *Appendix B*, Ground Water Analytical Data of this report. The analytical data was compared to the groundwater and secondary drinking water standards. A complete statistical analysis of the data was also performed utilizing **DUMPStat**. Results are discussed below.

2.3 Evaluation of Third Quarter Ground Water Analytical Results

Third Quarter Ground Water Test Results for each well are summarized in *Table 2* below. Comparison of results to regulatory criteria shows:

Third Quarter: Other than arsenic in all wells and pH in all downgradient wells, there were no measured exceedances of the standards in any well except LG-05. There were measured exceedances of the groundwater standards for conductivity, pH, sodium, total dissolved solids and arsenic in well LG-05. No other dissolved metals were observed exceeding WAC level groundwater drinking water standards during this sampling event.

Table 2 – 3rd Quarter Summary of Test Results

Well	3rd Quarter 2014 Groundwater Standard Exceedances
LG-01	pH, arsenic
LG-02	Arsenic
LG-04	pH, arsenic
LG-05	Conductivity, pH, sodium, TDS, arsenic

2.4 Statistical Evaluation

State health regulations under which the Lake Goodwin Landfill closure is permitted require that the landfill "...shall not cause exceedances of *Chapter 173-200 WAC*, **Water Quality Standards for Groundwater**, and *Chapter 246-290 WAC*, **Drinking Water Regulations**." The intent of these state regulations is to limit the impact that a landfill will have on the surrounding ground water resources. Collected ground water samples are tested for Primary and Secondary Drinking Water Standards, and Dissolved Metals – and compared to the standards listed in the above referenced WAC's. Where an exceedance to the standards occurs, a statistical analysis is provided to determine the significance of the change or exceedance. Each of these exceedances has been statistically analyzed using **DUMPStat Software** (*version 2.1.9 by Robert D. Gibbons Lt., 2000*) per the *Subtitle D* regulations and as specifically referenced in the **U.S. EPA** guidance manual. Mean, standard deviation, prediction limits, and confidence values were calculated by **DUMPStat**.

The Sens Trend analysis test was performed for the entire data set stretching back to 1988 and the results of that analysis – increasing or decreasing trends are recorded on the spreadsheet in Appendix B. The trend analysis in Appendix C is run between 2006 and current time. This allows us to place multiple constituents on a single graph to better see any potential correlation between the geochemistry and dissolved metals. Per Ecology and Snohomish Health District request, the prediction limit is updated in the first quarter of the year and subsequent data sets are compared against that prediction limit.

Based on the statistical analysis, exceedances to the prediction limits in down-gradient wells LG-01 and LG-05 were high for conventional chemistry parameters and minimal for the dissolved metals. Down-gradient well LG-04 was less impacted by leachate and had only one exceedance to the calculated prediction limits during the 3rd quarter sampling event. There were twenty three-(*23*) exceedances to the calculated prediction limits for all wells during this quarter, five fewer than last quarter. Calculated exceedances to the prediction limits in the third quarter are shown in *Table 3* below.

Table 3 – 3rd Quarter Statistical Summary Prediction Limit Exceedances

Well	3rd Quarter 2014 Exceedances
LG-01	Alkalinity, bicarbonate, conductivity, magnesium, potassium, sulfate
LG-02	None
LG-04	Barium
LG-05	Alkalinity, bicarbonate, calcium, chloride, conductivity, magnesium, nitrate, nitrite, potassium, sodium, sulfate, TDS, barium and iron

Stiff Diagrams, Trilinear Diagrams and **Statistically Significant Trends Analyses** results are included in *Appendix C* of this report.

3.0 GAS PROBE MEASUREMENTS

New probes were placed in three of the original nine locations at the Lake Goodwin Landfill November 15, 2013. Third quarter measurements were taken August 7, 2014.

Table 4 – 2nd Quarter Gas Probe Measurements

Probe / depth	Methane	Oxygen	CO2
LG-A1 / 44"	16	0	25
LG-B2 / 47"	19	0	18
LG-C2 / 46"	16	0	19

4.0 SUMMARY AND RECOMMENDATIONS

The ground water data collected during the 2014 third quarter sampling events indicates the following:

- Precipitation during the second quarter decreased compared to the second quarter, and water levels increased. The ground water elevation trend of all wells has been steadily rising since 2005.
- The conductivity level observed at well LG-05 was significantly higher than the surrounding wells during this sampling event.
- Statistical analysis did show significant impacts to well LG-05. Lesser impacts where indicated in wells LG-01 and minimal impacts were measured for LG-04. Time series plots based on the **DUMPStat** analysis indicates that there were fewer significant decreasing trends *(12)* than increasing trends (15*)* during this sampling event.
- There were very minimal impacts to the ground water from dissolved metals. Small exceedances to the calculated prediction limits for arsenic were found in all wells and for barium in wells LG-04 and LG-05.
- Every well exceeded the arsenic groundwater standard.

4.1 CONCLUSIONS/RECOMMENDATIONS

Third quarter 2014 data indicates a continued moderate leachate impact to the underlying Advance Outwash (*Qva*) aquifer below the Lake Goodwin Landfill. Statistical analysis indicates a number of significantly decreasing trends which would suggest that the leachate impact to the ground water below the landfill is decreasing at this time, however, increasing trends were calculated for down gradient well LG-01 during this sampling event. Interpretation of the data suggests that a leachate plume impacting ground water extends beyond the landfill boundaries following the ground water gradient to the north-northeast in the immediate vicinity of LG-05.

4.2 SIGNATURES and LICENSES

Kirk R. Bailey, LEG, LHG
SCPW – Engineering Services

Deanna Seaman
SCPW – Solid Waste Division
~~October 9, 2014~~
January 9, 2015

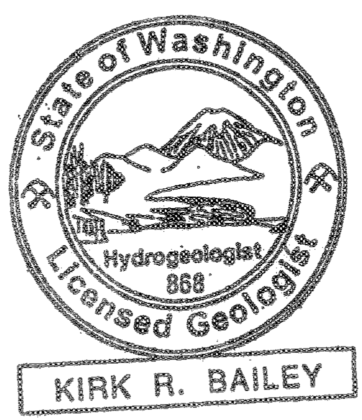


Figure 1

Lake Goodwin Landfill

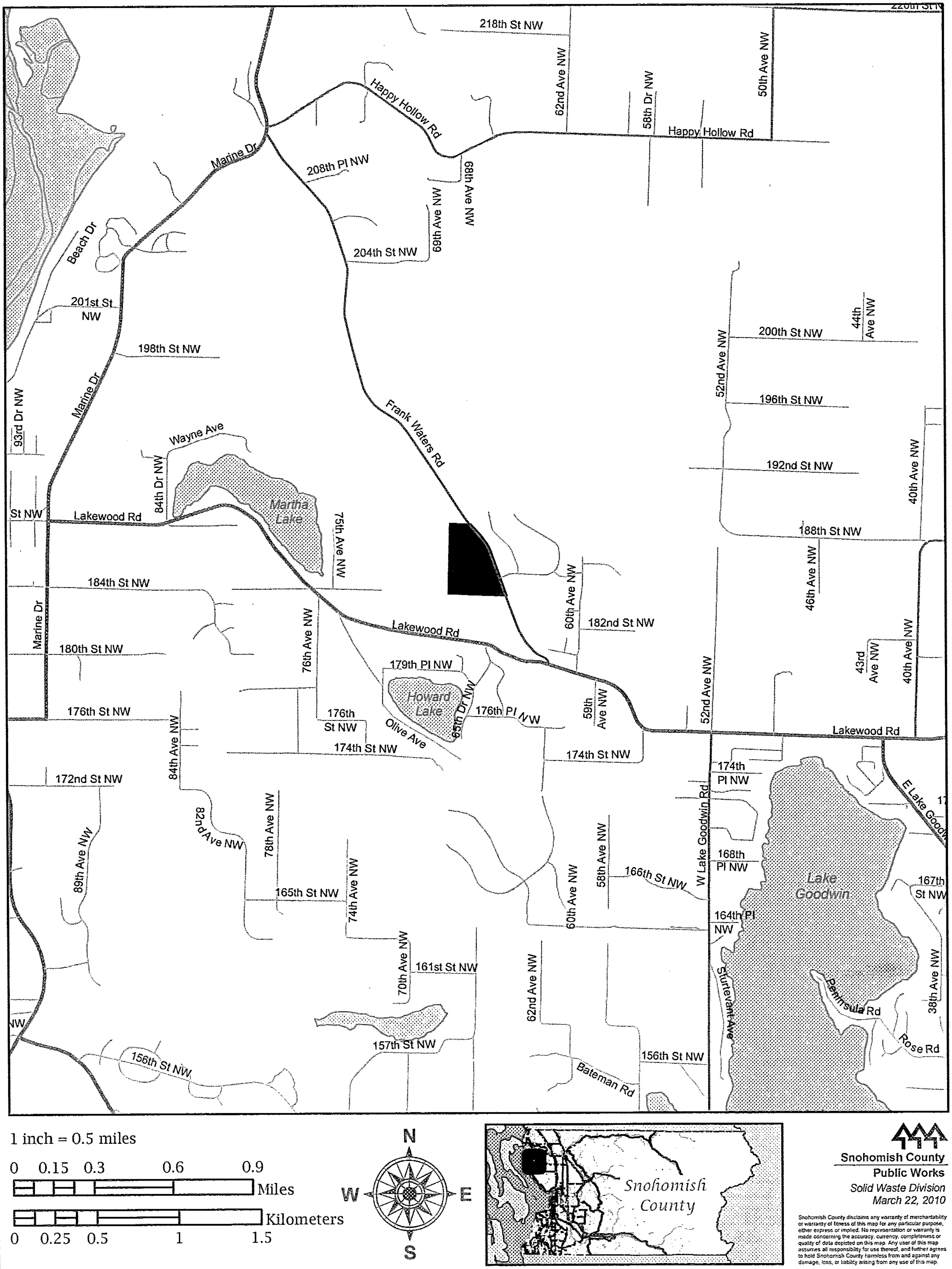
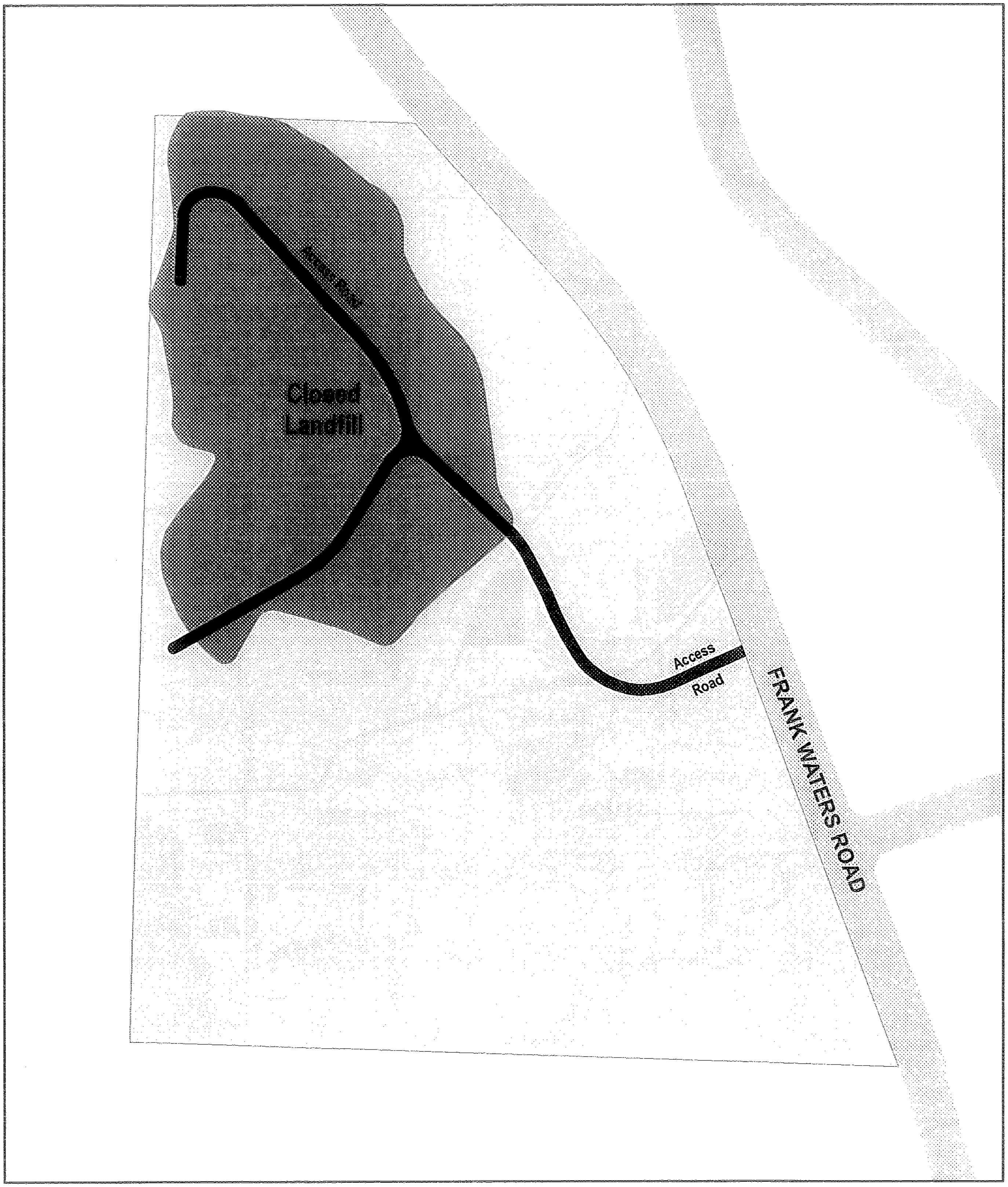
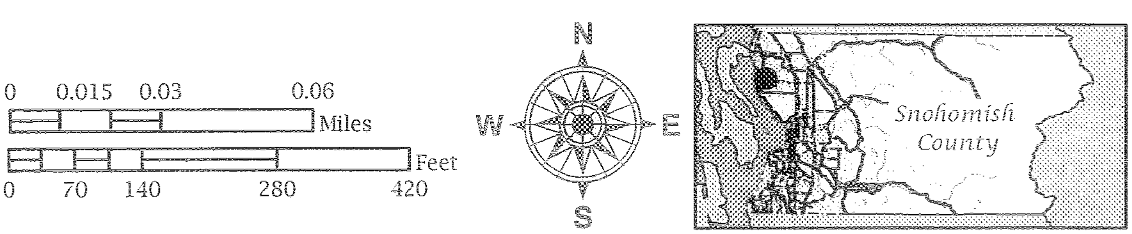


Figure 2

Lake Goodwin Landfill Site Map





Snohomish County
Public Works
Solid Waste Division
March 25, 2010

Figure 3

Lake Goodwin Landfill

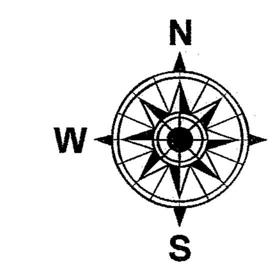
Topography

Map Features

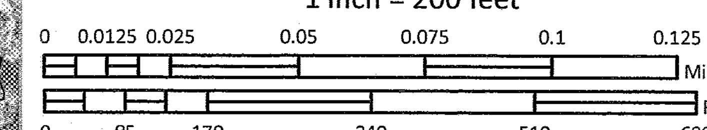
Parcel Boundary

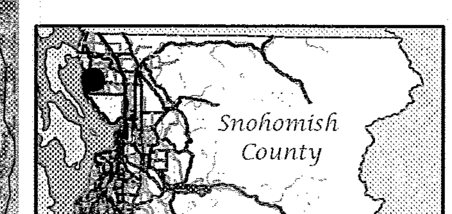
Subject Property Boundary

5 Foot Contours



1 inch = 200 feet





Snohomish County
Public Works
Solid Waste Division
March 23, 2010

Figure 4

Lake Goodwin Landfill

Geologic Map

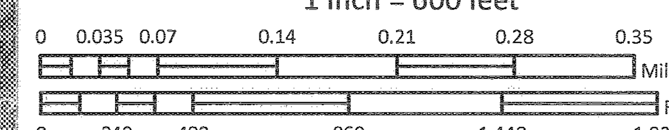
Map Features

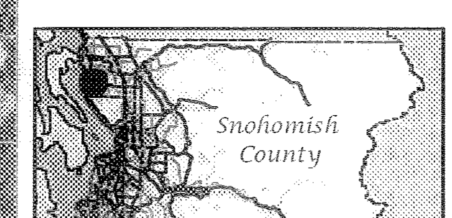
- Parcel Boundary
- Subject Property Boundary

Geologic Description

- Vashon advance outwash (Qva)
- Vashon recessional outwash
- Vashon till (Qvt)
- Water
- Modified Land

1 inch = 600 feet





Snohomish County
Public Works
Solid Waste Division
May 6, 2010

Figure 5

Lake Goodwin Landfill

Monitoring Network

Map Features

Parcel Boundary

Subject Property Boundary

Aquifer Unit (Active Wells)

Deep Aquifer

Additional Sampling Points

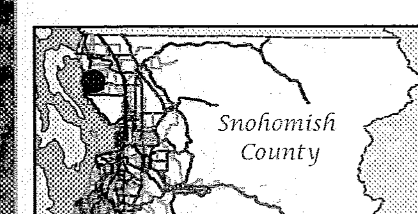
Bar Hole Punch Gas Probe

X = decommissioned

N W E S

0 0.015 0.03 0.06 0.09 0.12 Miles

0 80 160 320 480 640 Feet



Snohomish County
Public Works
Solid Waste Division
March 2, 2012

Figure 6

Lake Goodwin Landfill

Water Elevation Contours 3rd Quarter 2014

DIRECTION OF GROUNDWATER FLOW
1.93 ft / day
705 ft / year
77.73 degrees to the positive x - axis

PARCEL BOUNDARY

SUBJECT PROPERTY BOUNDARY

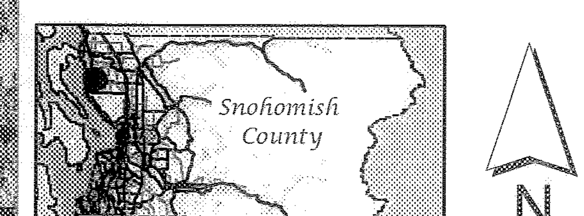
1 FT CONTOUR

WELL LOCATION

WELL_ID	SAMP_DATE	MEAS_HEAD
LG-01	7/22/2014	154.65
LG-02	7/22/2014	155.94
LG-04	7/22/2014	151.93
LG-05	7/22/2014	153.08

0 85 170 340 510 680 Feet

0 0.02 0.04 0.08 0.12 Miles

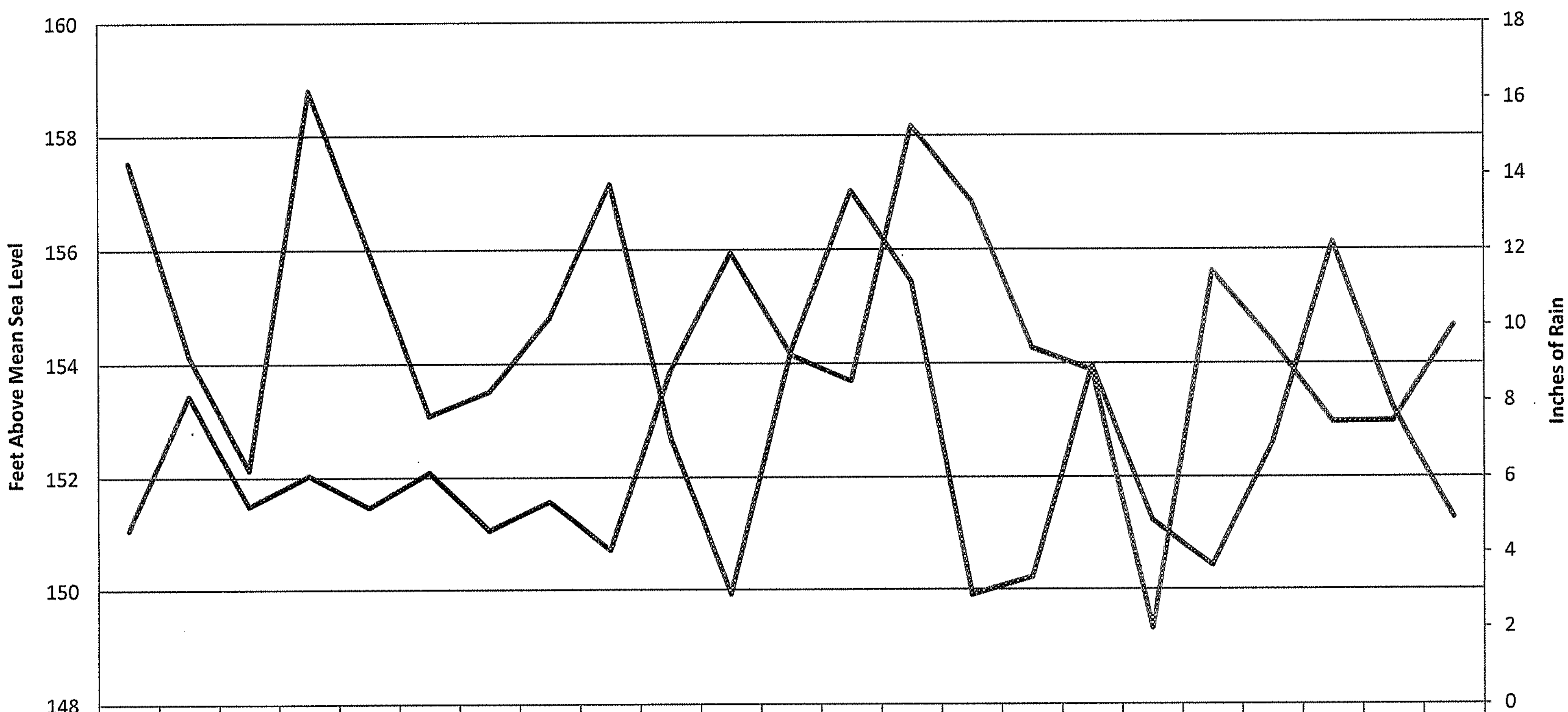


Snohomish County Public Works Solid Waste Division September 15, 2014

Appendix A

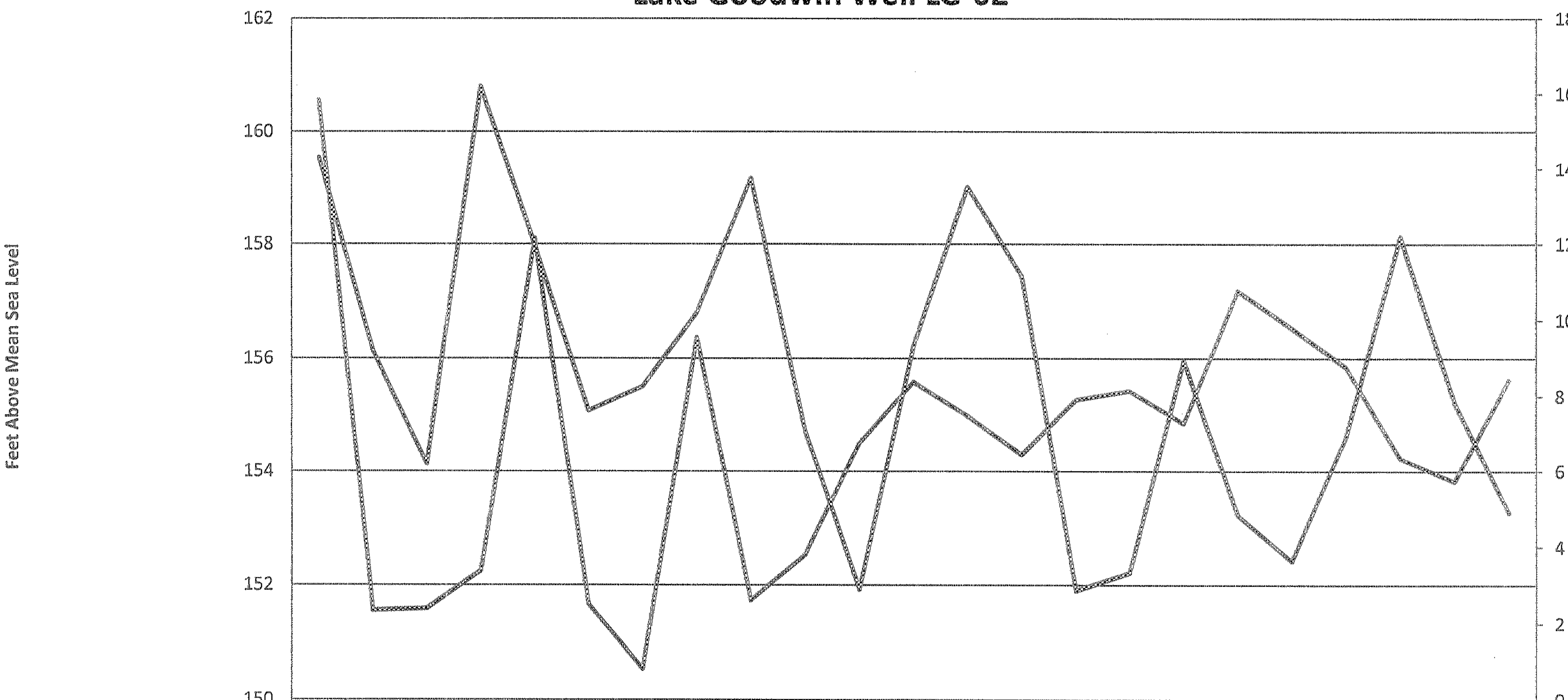
Hydrographs

Lake Goodwin Well LG-01



	Q-1 2009	Q-2 2009	Q-3 2009	Q-4 2009	Q-1 2010	Q-2 2010	Q-3 2010	Q-4 2010	Q-1 2011	Q-2 2011	Q-3 2011	Q-4 2011	Q-1 2012	Q-2 2012	Q-3 2012	Q-4 2012	Q-1 2013	Q-2 2013	Q-3 2013	Q-4 2013	Q-1 2014	Q-2 2014	Q-3 2014
Depth to Water	151.1	153.4	151.5	152	151.5	152.1	151.1	151.6	150.7	153.9	155.9	154.2	153.7	158.2	156.9	154.3	153.9	149.3	155.6	154.4	153	153	154.7
Precipitation	14.3	9.2	6.2	16.2	11.96	7.62	8.26	10.2	13.75	7.08	2.89	9.33	13.56	11.16	2.86	3.32	8.94	4.83	3.63	6.9	12.19	7.82	4.9

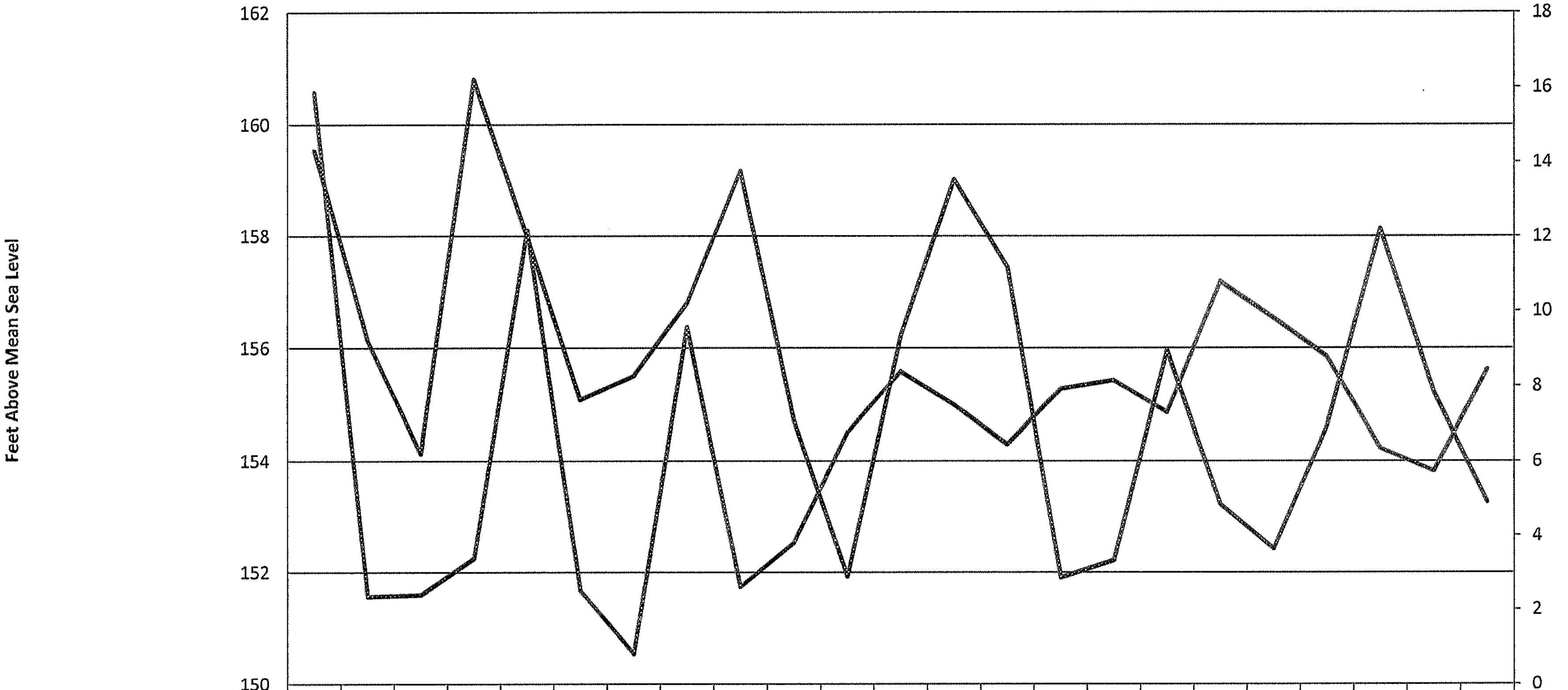
Lake Goodwin Well LG-02



	Q-1 2009	Q-2 2009	Q-3 2009	Q-4 2009	Q-1 2010	Q-2 2010	Q-3 2010	Q-4 2010	Q-1 2011	Q-2 2011	Q-3 2011	Q-4 2011
Groundwater Elevation	160.57	151.56	151.59	152.25	158.1	151.67	150.54	156.37	151.74	152.53	154.5	155.59
Precipitation	14.3	9.2	6.2	16.2	11.96	7.62	8.26	10.2	13.75	7.08	2.89	9.33

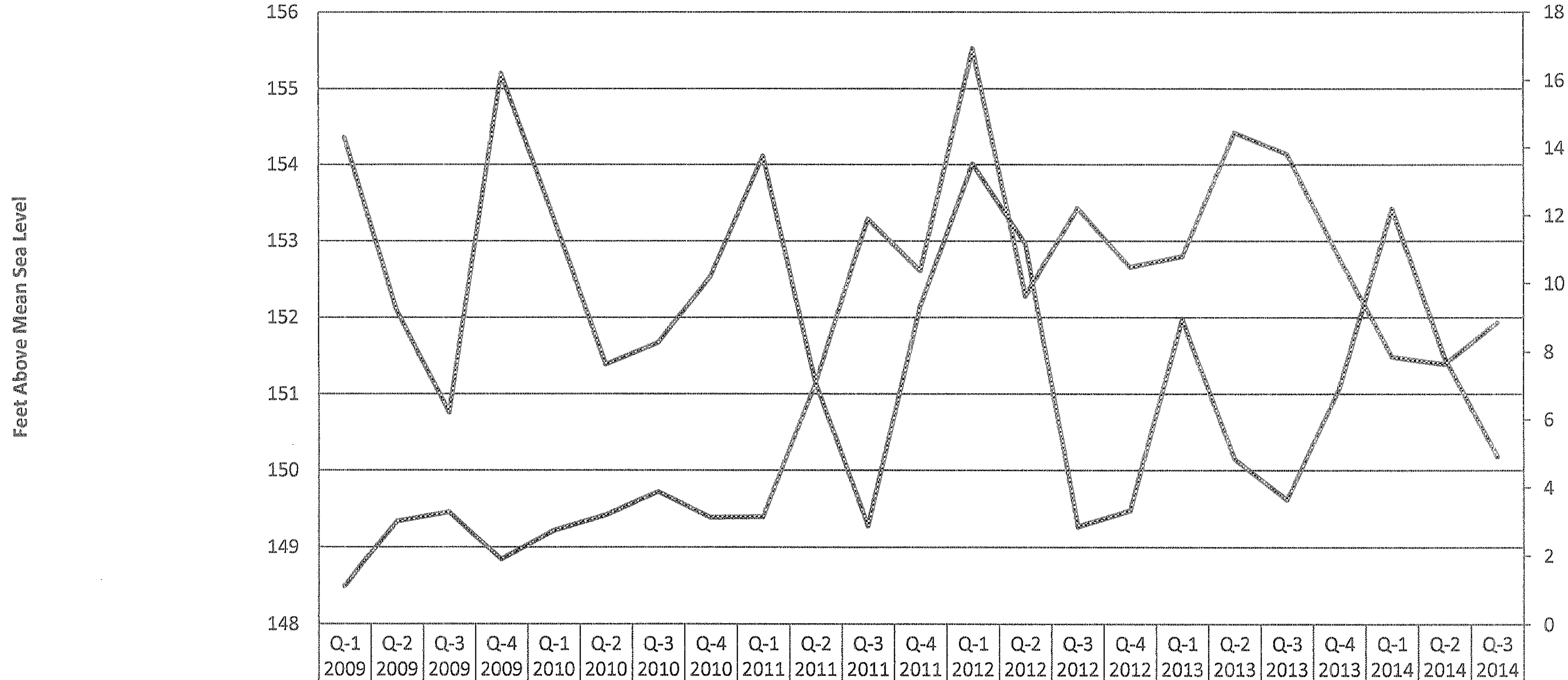
	Q-1 2012	Q-2 2012	Q-3 2012	Q-4 2012	Q-1 2013	Q-2 2013	Q-3 2013	Q-4 2013	Q-1 2014	Q-2 2014	Q-3 2014
Groundwater Elevation	154.99	154.30	155.27	155.43	154.85	157.18	156.53	155.85	154.23	153.82	155.62
Precipitation	13.52	11.16	2.86	3.32	8.94	4.83	3.63	6.9	12.19	7.82	4.9

Lake Goodwin Well LG-02



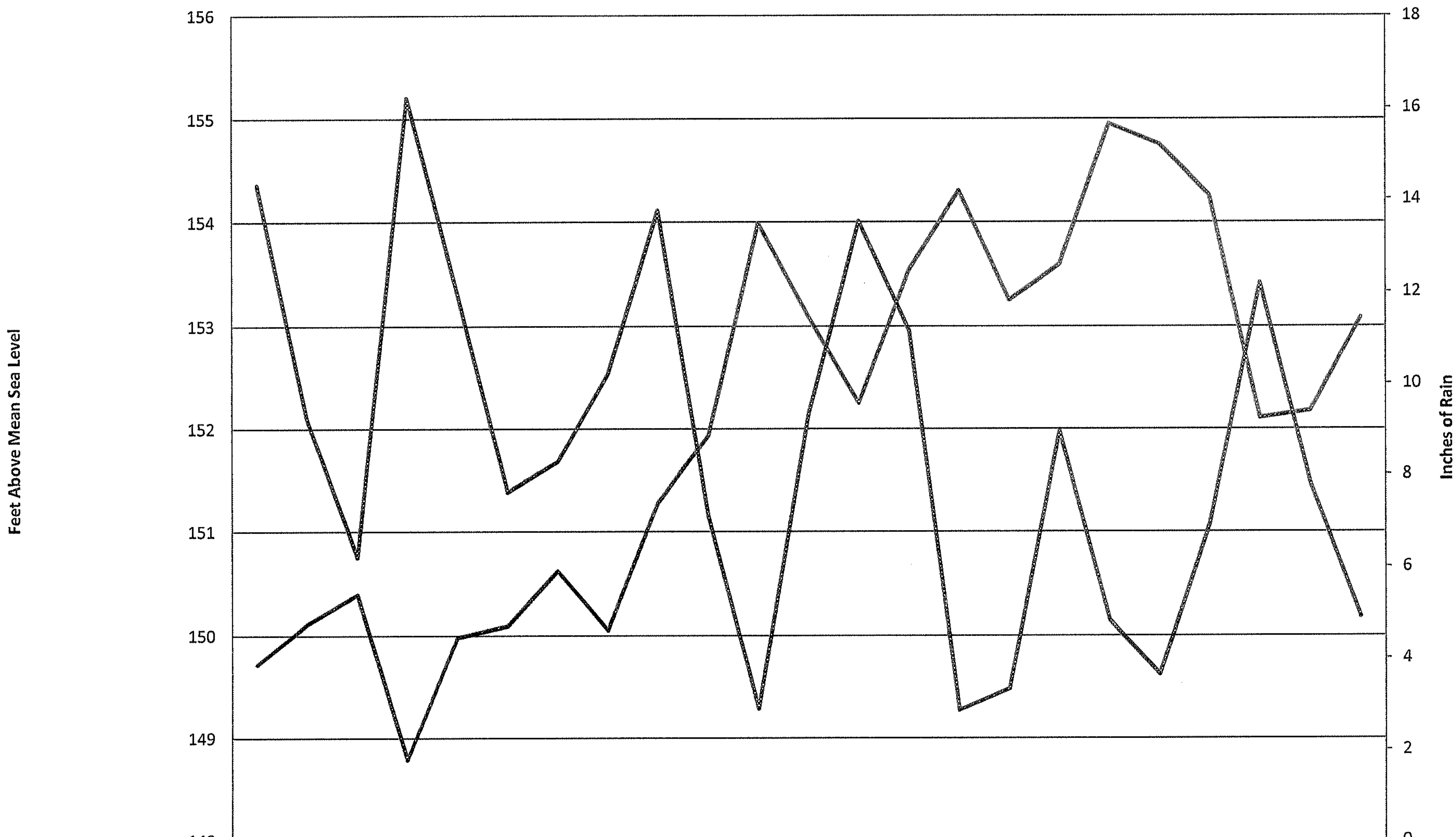
	Q-1 2009	Q-2 2009	Q-3 2009	Q-4 2009	Q-1 2010	Q-2 2010	Q-3 2010	Q-4 2010	Q-1 2011	Q-2 2011	Q-3 2011	Q-4 2011	Q-1 2012	Q-2 2012	Q-3 2012	Q-4 2012	Q-1 2013	Q-2 2013	Q-3 2013	Q-4 2013	Q-1 2014	Q-2 2014	Q-3 2014
Groundwater Elevation	160.57	151.56	151.59	152.25	158.1	151.67	150.54	156.37	151.74	152.53	154.5	155.59	154.99	154.30	155.27	155.43	154.85	157.18	156.53	155.85	154.23	153.82	155.62
Precipitation	14.3	9.2	6.2	16.2	11.96	7.62	8.26	10.2	13.75	7.08	2.89	9.33	13.52	11.16	2.86	3.32	8.94	4.83	3.63	6.9	12.19	7.82	4.9

Lake Goodwin Well LG-04



	Q-1 2009	Q-2 2009	Q-3 2009	Q-4 2009	Q-1 2010	Q-2 2010	Q-3 2010	Q-4 2010	Q-1 2011	Q-2 2011	Q-3 2011	Q-4 2011	Q-1 2012	Q-2 2012	Q-3 2012	Q-4 2012	Q-1 2013	Q-2 2013	Q-3 2013	Q-4 2013	Q-1 2014	Q-2 2014	Q-3 2014
Groundwater Elevation	148.5	149.3	149.5	148.8	149.2	149.4	149.7	149.4	149.4	151.1	153.3	152.6	155.5	152.3	153.4	152.7	152.8	154.4	154.1	152.8	151.5	151.4	151.9
Precipitation	14.3	9.2	6.2	16.2	11.96	7.62	8.26	10.2	13.75	7.08	2.89	9.33	13.52	11.16	2.86	3.32	8.94	4.83	3.63	6.9	12.19	7.82	4.9

Lake Goodwin Well LG-05



	Q-1 2009	Q-2 2009	Q-3 2009	Q-4 2009	Q-1 2010	Q-2 2010	Q-3 2010	Q-4 2010	Q-1 2011	Q-2 2011	Q-3 2011	Q-4- 2011	Q-1 2012	Q-2 2012	Q-3 2012	Q-4 2012	Q-1 2013	Q-2 2013	Q-3 2013	Q-4 2013	Q-1 2014	Q-2 2014	Q-3 2014
Groundwater Elevation	149.71	150.11	150.39	148.79	149.98	150.09	150.62	150.05	151.28	151.93	153.99	153.09	152.25	153.54	154.3	153.25	153.59	154.95	154.75	154.25	152.1	152.17	153.08
Precipitation	14.3	9.2	6.2	16.2	11.96	7.62	8.26	10.2	13.75	7.08	2.89	9.33	13.52	11.16	2.86	3.32	8.94	4.83	3.63	6.9	12.19	7.82	4.9

Appendix B

Analytical Data

Groundwater Statistical Summary: Third Quarter 2014 Lake Goodwin Landfill, Snohomish County, WA

	Statistical Method	No. of Samples	No. of Detects	Prediction Limit (a)	Secondary Drinking	Ground Water	Downgradient LG-01 7/22/14	D	V	T	C	Downgradient LG-04 7/22/14	D	V	T	C	Downgradient LG-05 7/22/14	D	V	T	C	Upgradient LG-02 7/22/14	D	V	T	C
CONVENTIONAL CHEMISTRY PARAMETERS																										
Alkalinity (as CaCO3)	normal	40	40	167.64	--	--	180		V	I	N	115					480		V	I	N	110			I	N
Ammonia Nitrogen	nonpar	36	9	0.069	--	--	0.01	U				0.01	U				0.01	U				0.01	U			
Bicarbonate	lognor	40	40	180	--	--	180		V			115			D	N	480		V			110				
Calcium, Dissolved	nonpar	40	40	31.2	--	--	23.1			I	N	22			D	N	53.7		V	I	N	18.2				
Chemical Oxygen Demand	nonpar	32	2	26	--	--	10	U				10	U				10					10	U			
Chloride	normal	40	40	9.88	250	250	5.88			I	N	8.04			I	N	21.4		V			6.08				
Conductivity (umhos/cm)	normal	40	40	365	--	700	430		V	I	N	310			D	N	1100		V	I	N	270				
Magnesium, Dissolved	nonpar	40	40	25.15	--	--	31.5		V	I	N	18.9					72.6		V			15.8				
Nitrate Nitrogen (mg-N/L)	nonpar	39	39	6	10	10	2			I	N	1.2					9.8		V			1.3				
Nitrite Nitrogen (mg-N/L)	nonpar	37	8	0.011	1	1	0.002	U				0.002	U				0.032		V			0.002	U			
pH (std units)	normal	40	40	6.28-7.89	6.5-8.5	6.5-8.5	6.31		V	D	N	5.75		V	D	N	6.28		P	D	N	6.73			D	N
Potassium, Dissolved	normal	40	40	3.67	--	--	3.76		V			3.14					7.69		V			2.75				
Sodium, Dissolved	nonpar	39	39	13.8	--	20	9.85			D	N	10.1			D	N	56.4		V	D	N	8.81				
Sulfate	nonpar	40	40	24	250	250	27.4		V			13.9			D	N	31.4		V			11.5				
Total Dissolved Solids	nonpar	40	40	550	500.0	500	300			I	N	230					640		V	I	N	200				
Total Organic Carbon	nonpar	40	18	19	--	--	0.5	U				0.5	U				5.4					0.5				
DISSOLVED METALS (mg/L)																										
Arsenic	nonpar	34	34	0.0078	0.01	0.00005	0.000788					0.000419					0.00149					0.00423				Y
Barium	nonpar	35	35	0.0193	2	2	0.0191		P	I	N	0.0202		V	D	N	0.0716		V			0.0106			I	N
Cadmium	nonpar	36	13	0.0002	0.005	0.005	0.000182		E			0.000025	U				0.000076					0.000027				
Chromium	normal	37	27	0.0089	0.1	0.1	0.001	U				0.001	U				0.001	U				0.0056				
Cobalt	nonpar	40	6	0.008	--	--	0.001	U				0.001	U				0.001	U				0.001	U			
Copper	nonpar	36	11	0.007	1	1.3	0.001	U				0.001	U				0.001	U	P			0.001	U			
Iron	nonpar	40	7	0.032	0.3	0.3	0.009					0.009	U				0.036					0.009	U			
Manganese	nonpar	37	16	0.0061	0.05	0.05	0.0005	U	P			0.0018					0.0005	U	P			0.0005	U			
Nickel	nonpar	40	0	0.005	--	0.1	0.005	U				0.005	U				0.01		V			0.005	U			

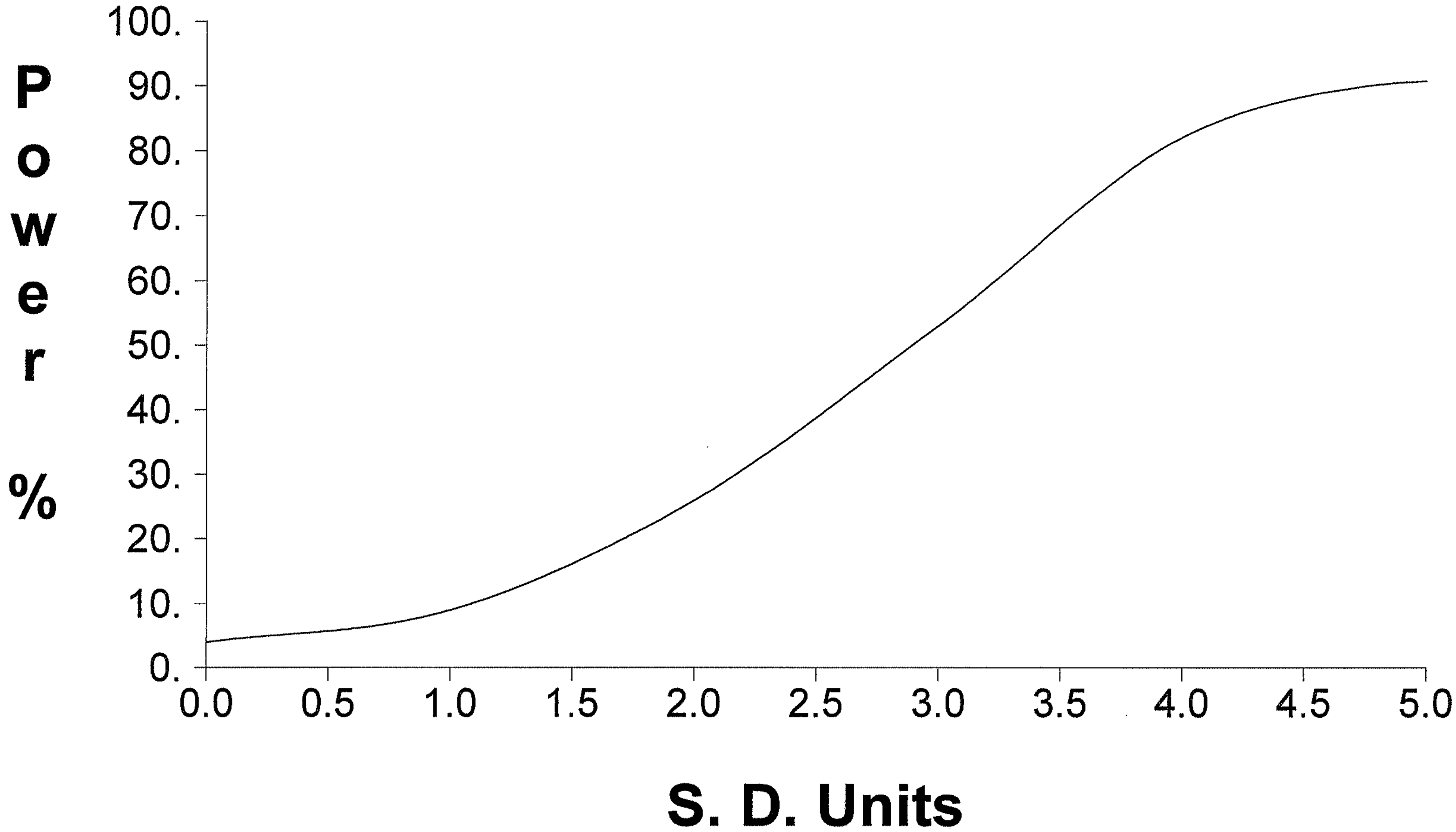
D Column: U = Compound not detected in any sample; V Column: V = verified hit, E = exceedance, waiting verification; P = Passed, exceedance not verified

I means increasing trend, D means decreasing trend via Mann-Kendall Analysis; Ch? = a change in the trend analysis, N is no, Y is yes. Compared to previous quarter.

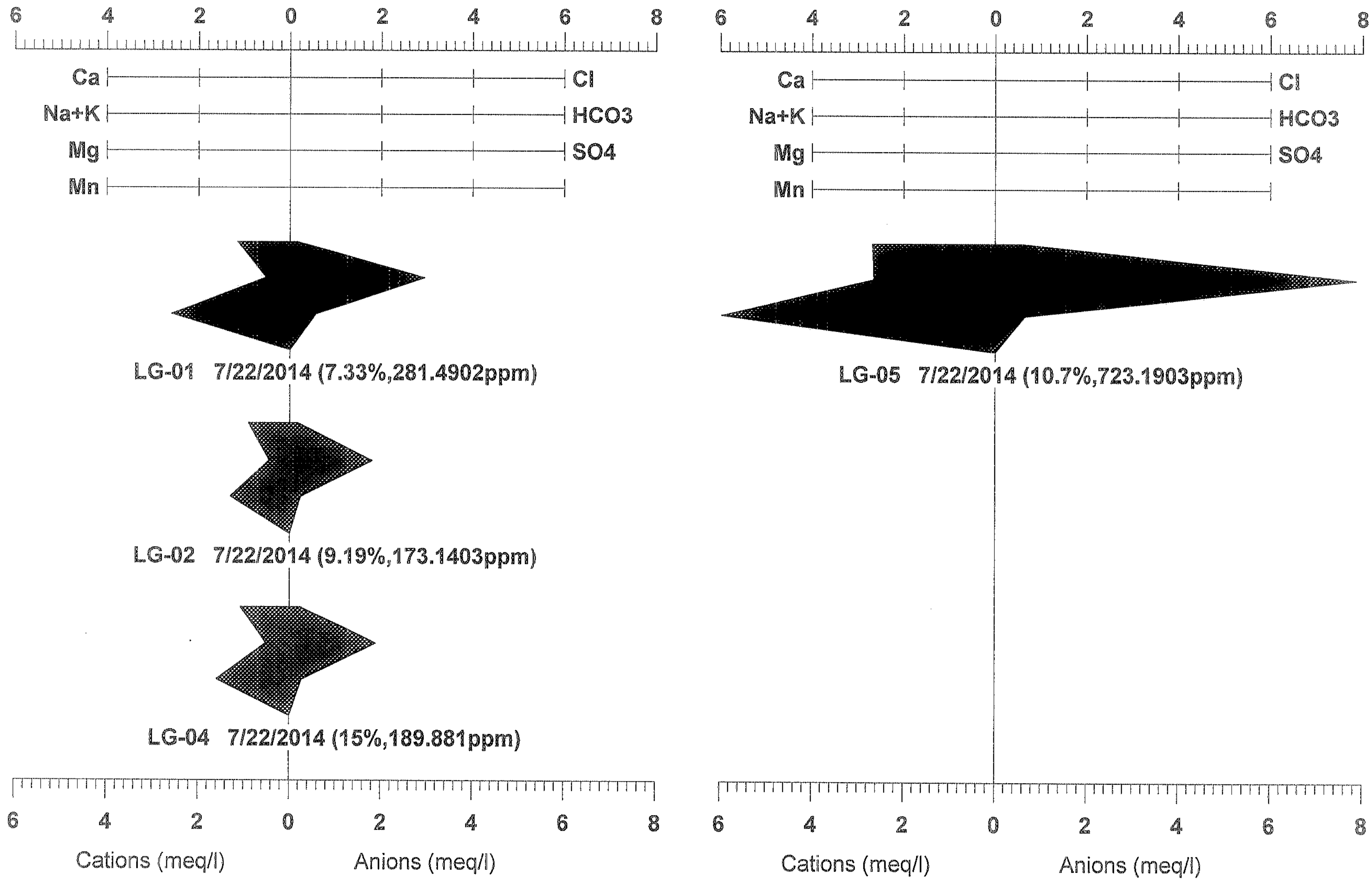
Appendix C

Stiff, Tri-linear and Trend Analysis

False Positive and False Negative Rates for Current Upgradient vs. Downgradient Monitoring Program



Q-3 2014 Goodwin Landfill



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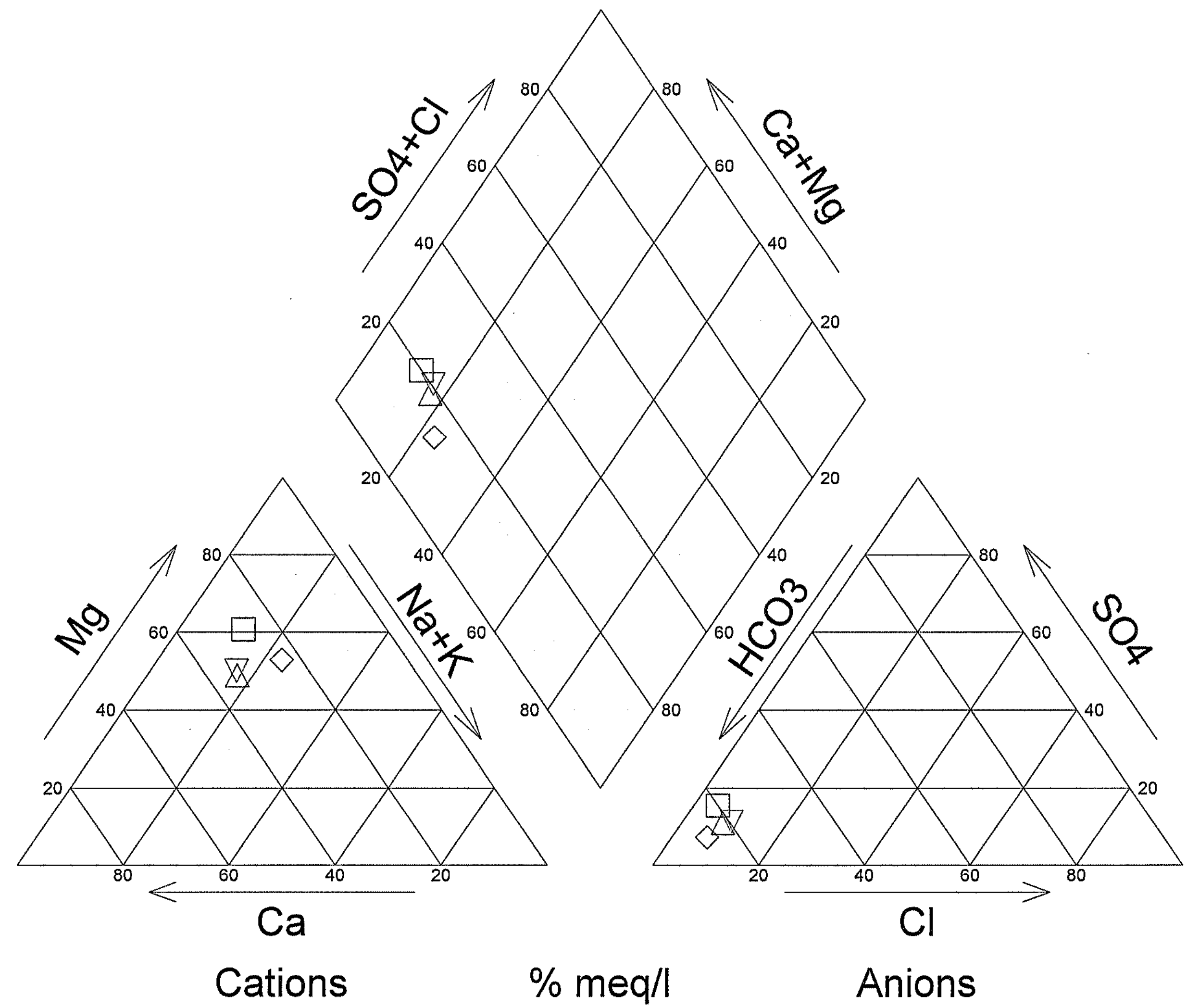
Q-3 2014 Goodwin Landfill

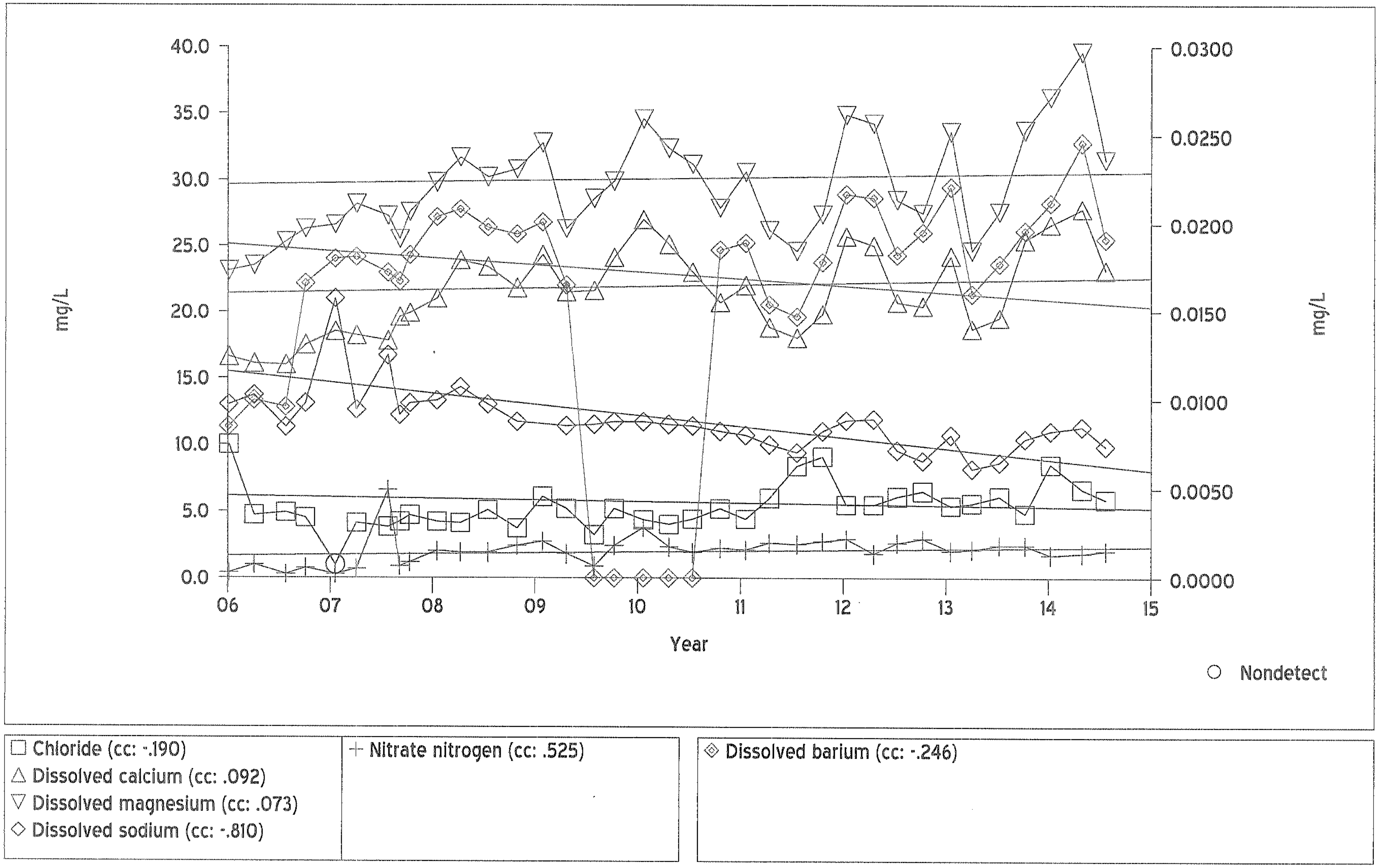
□	LG-01	7/22/2014 (7.33%,281.49ppm)
△	LG-02	7/22/2014 (9.19%,173.14ppm)
▽	LG-04	7/22/2014 (15%,189.88ppm)
◇	LG-05	7/22/2014 (10.7%,723.19ppm)



Prepared by: Snohomish County Solid Waste

Q-3 2014 Metals Goodwin Landfill

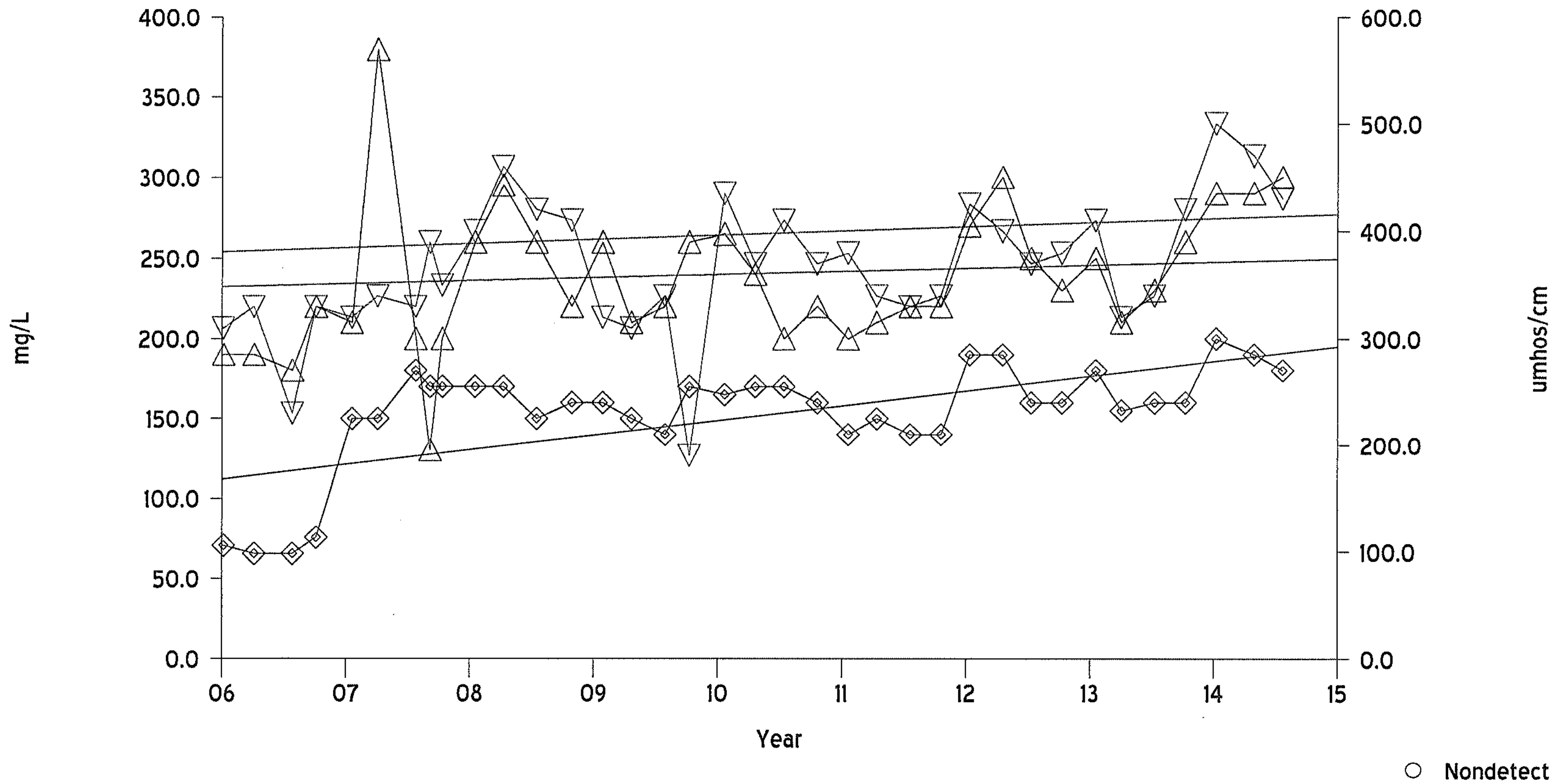
Time Series Plot for LG-01



Prepared by: Snohomish County Solid Waste

Q-3 2014 TDS Goodwin Landfill

Time Series Plot for LG-01



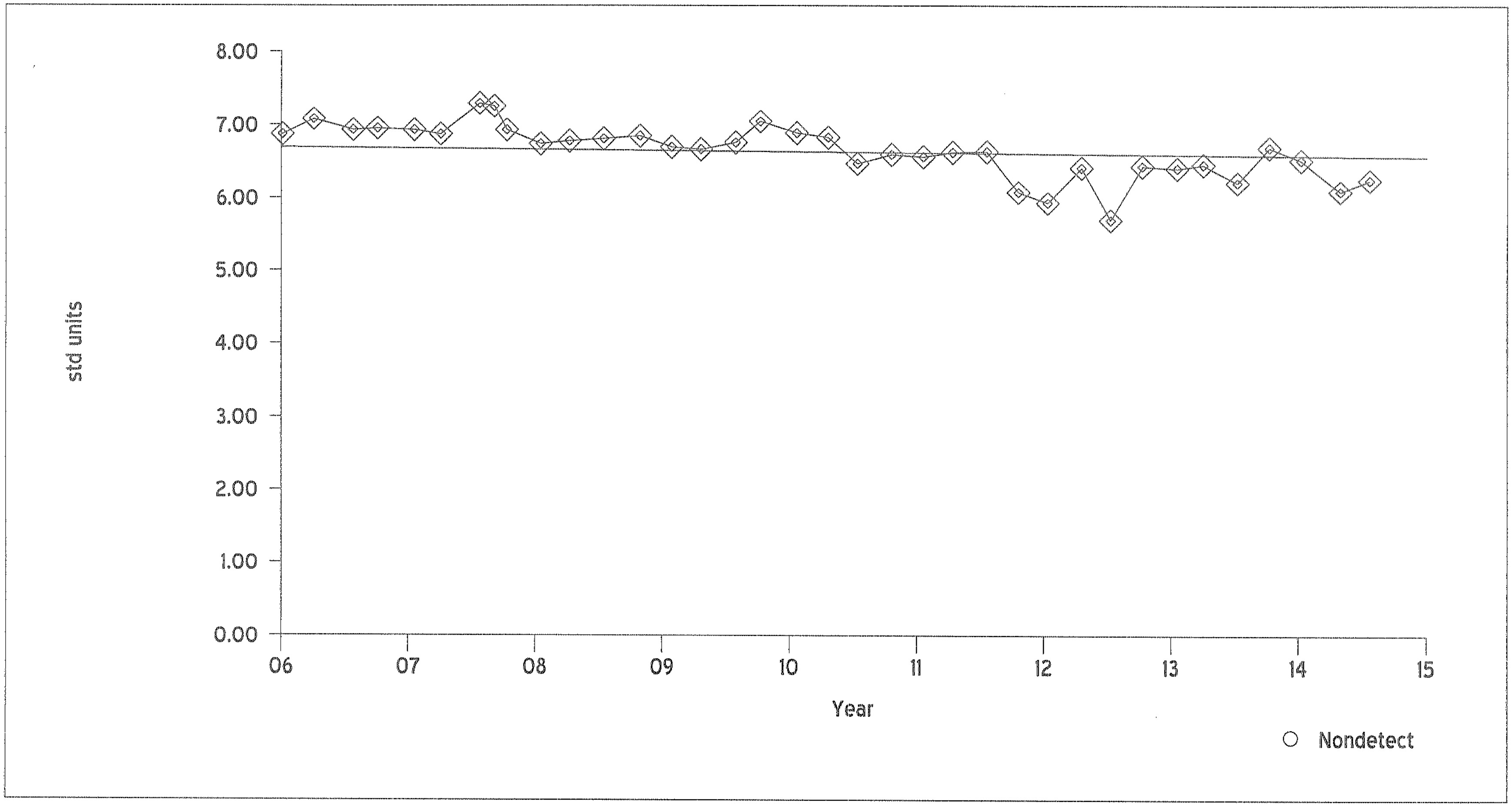
◇ Alkalinity (as caco3) (cc: .739)
△ Total dissolved solids (cc: .129)

▽ Conductivity (cc: .218)

Prepared by: Snohomish County Solid Waste

Q-3 2014 pH Goodwin Landfill

Time Series Plot for LG-01



pH (cc: -.358)

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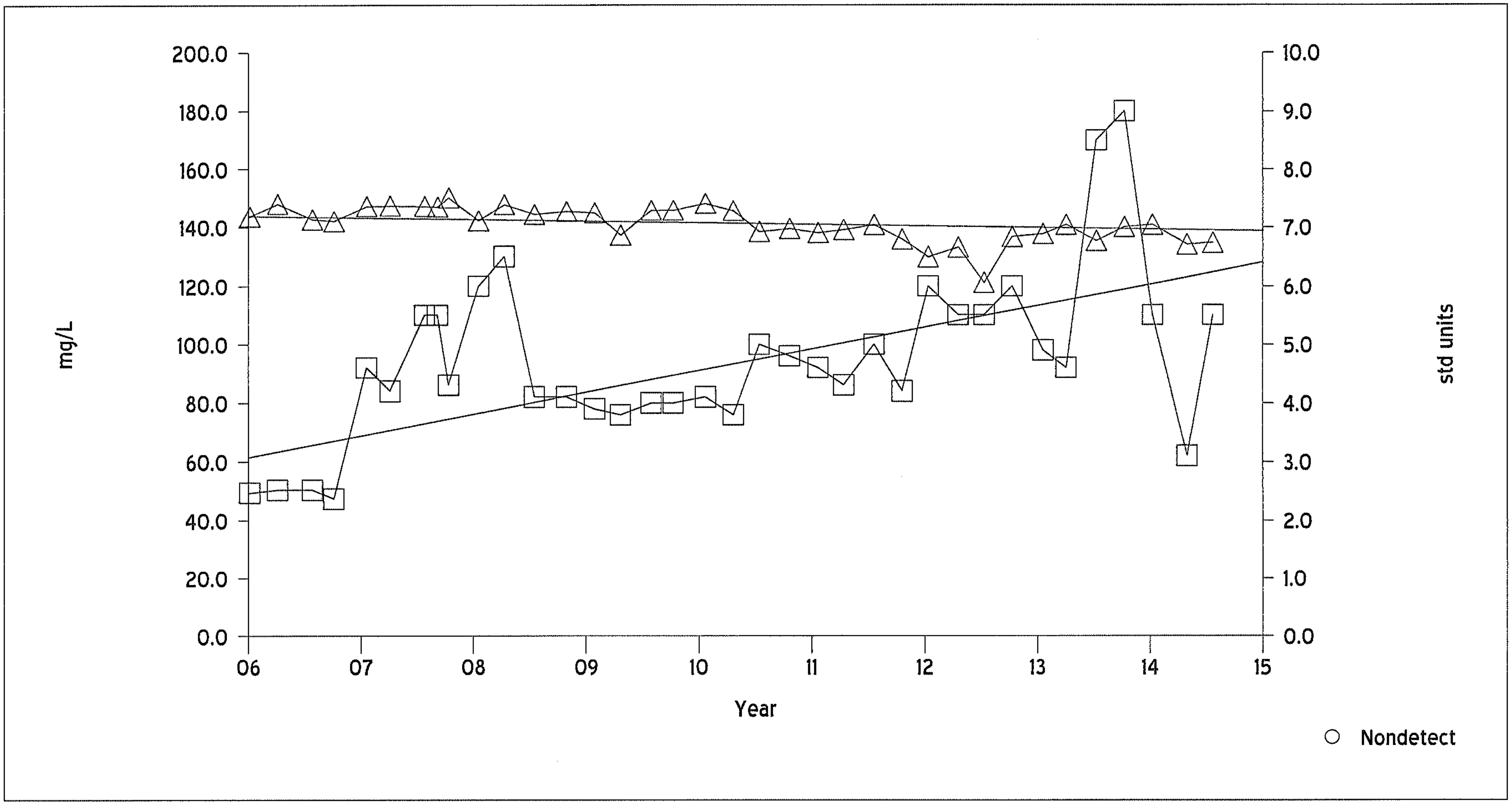
Q-3 2014 Alk. v. pH Goodwin Landfill

Time Series Plot for LG-02



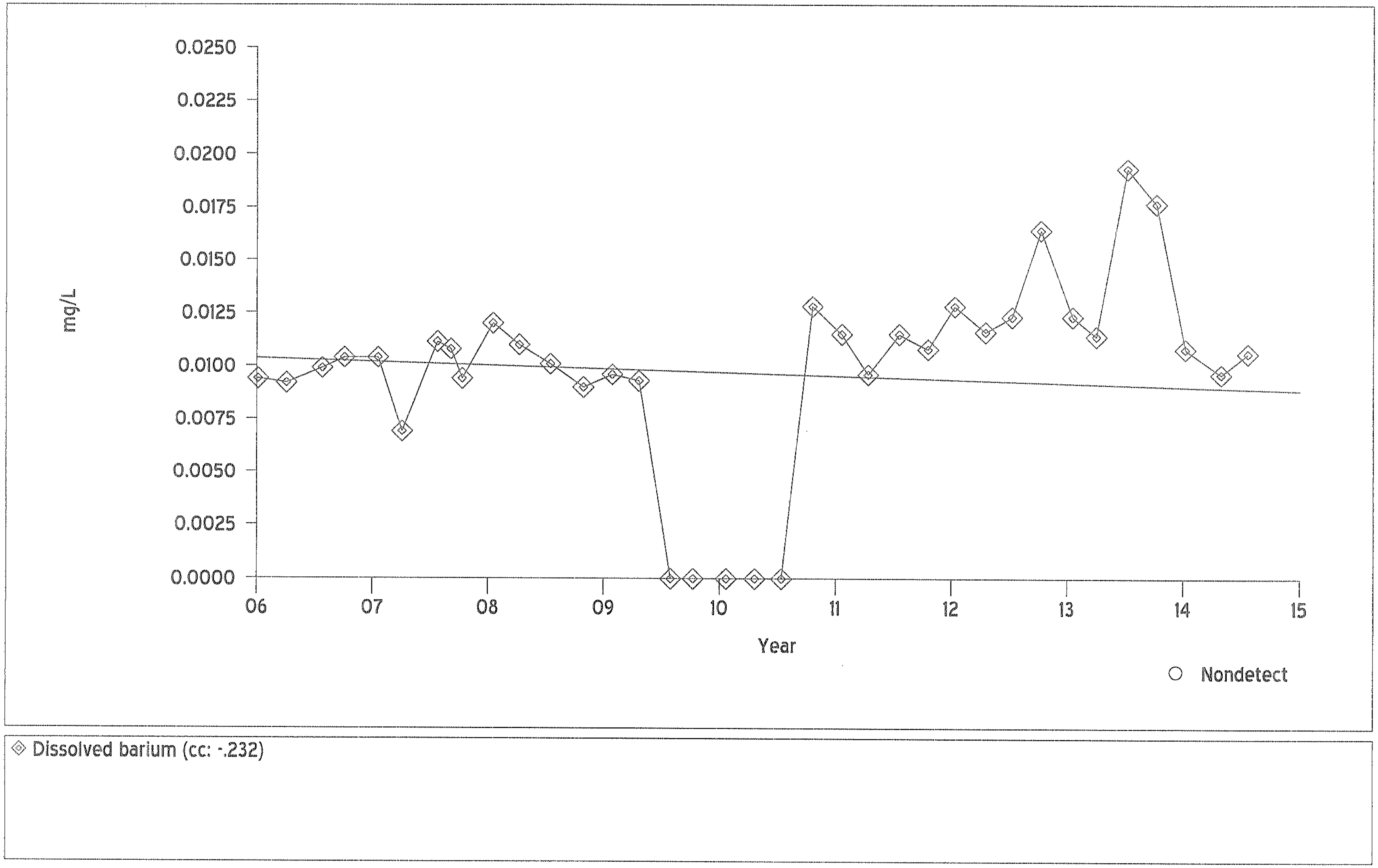
□ Alkalinity (as caco3) (cc: .743)

△ pH (cc: -.535)

Prepared by: Snohomish County Solid Waste

Q-3 2014 Ba Goodwin Landfill

Time Series Plot for LG-02



1

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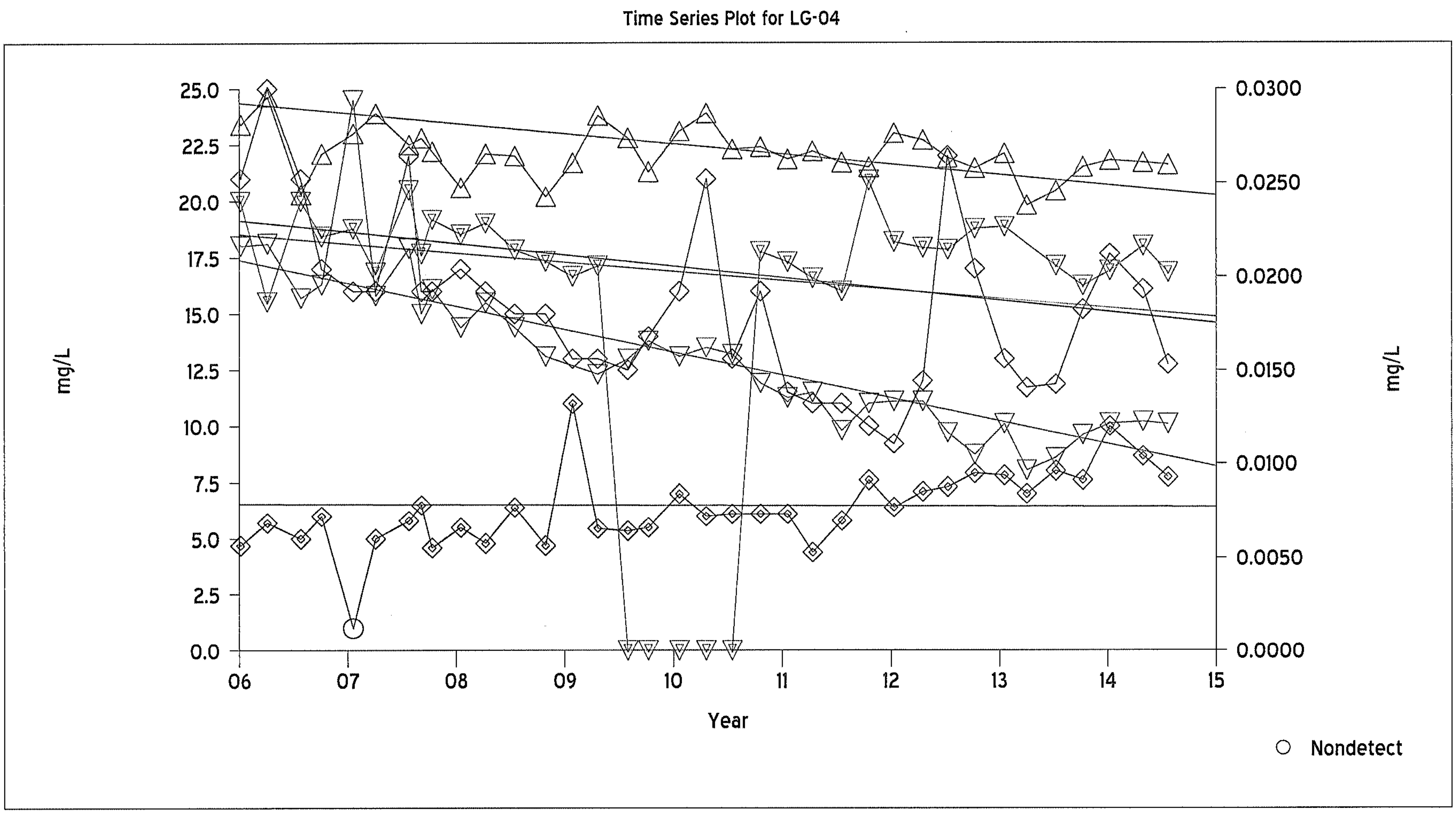
Q-3 2014 Metals Goodwin Landfill

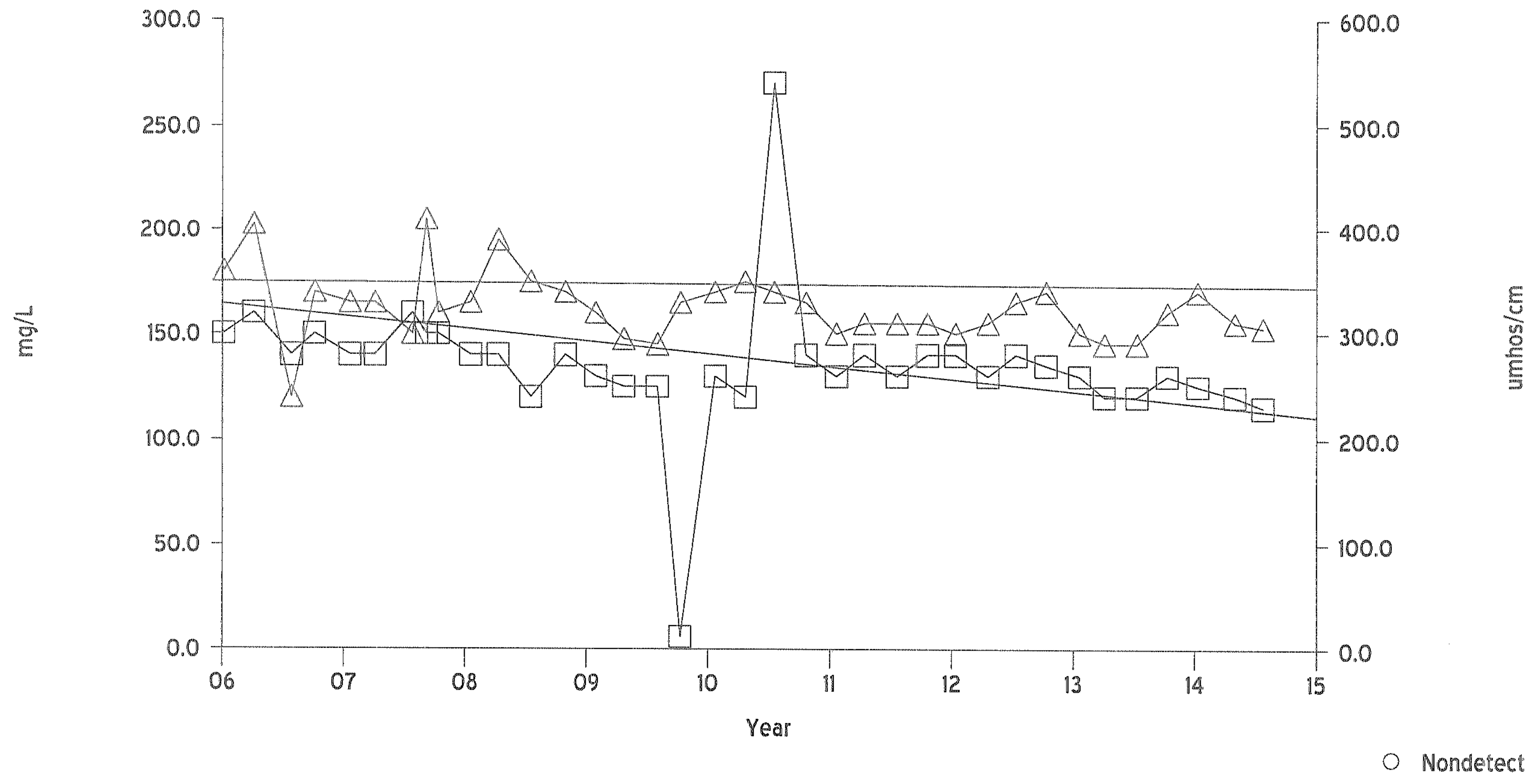


Chloride (cc: -.068)
Dissolved calcium (cc: -.466)
Dissolved sodium (cc: -.824)
Sulfate (cc: -.323)
Dissolved barium (cc: -.387)

Prepared by: Snohomish County Solid Waste

Q-3 2014 Bicarb Goodwin Landfill

Time Series Plot for LG-04



□ Bicarbonate (cc: -.530)

△ Conductivity (cc: -.074)

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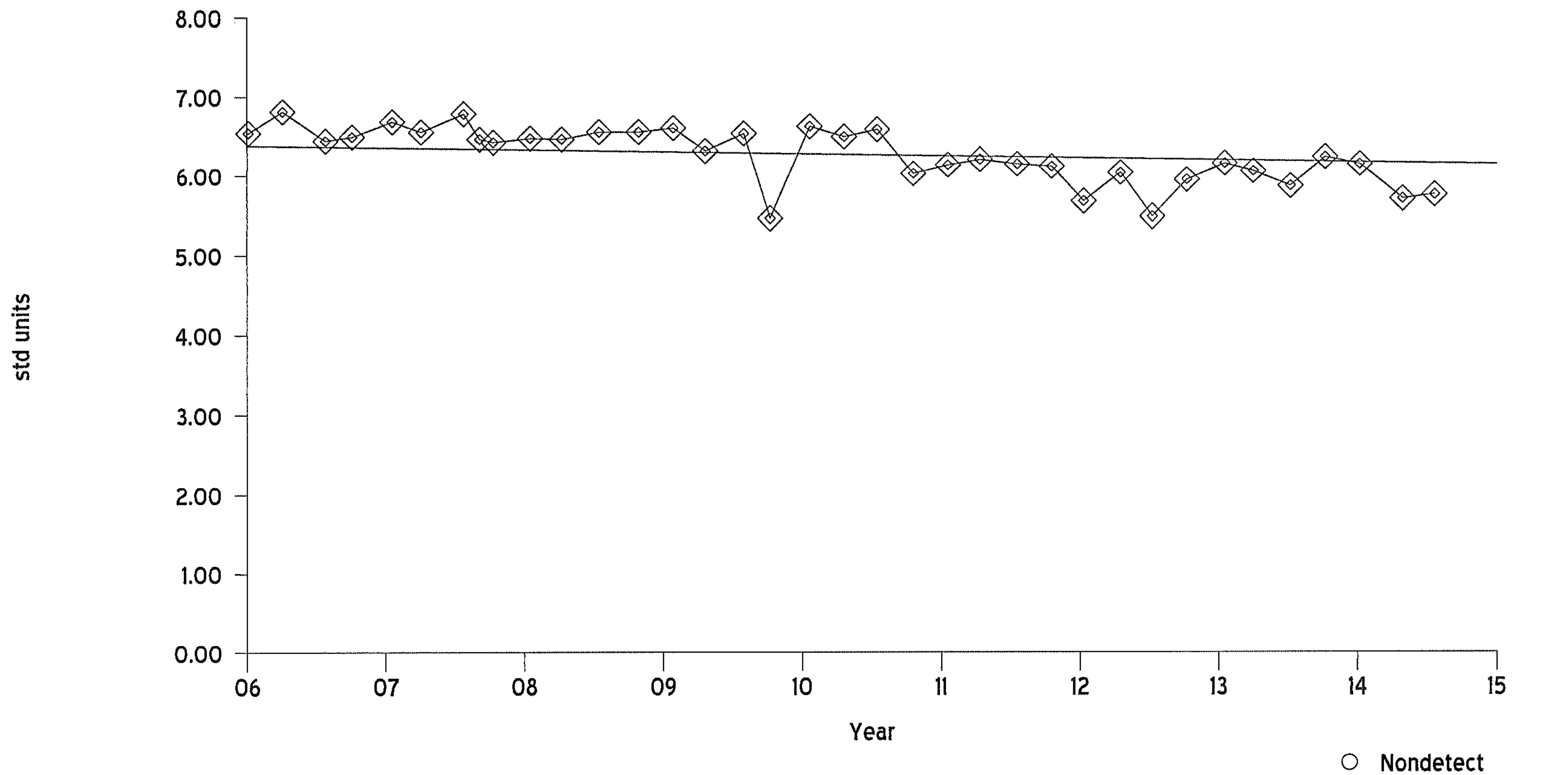
Q-3 pH Goodwin Landfill

Time Series Plot for LG-04



pH (cc: -.593)

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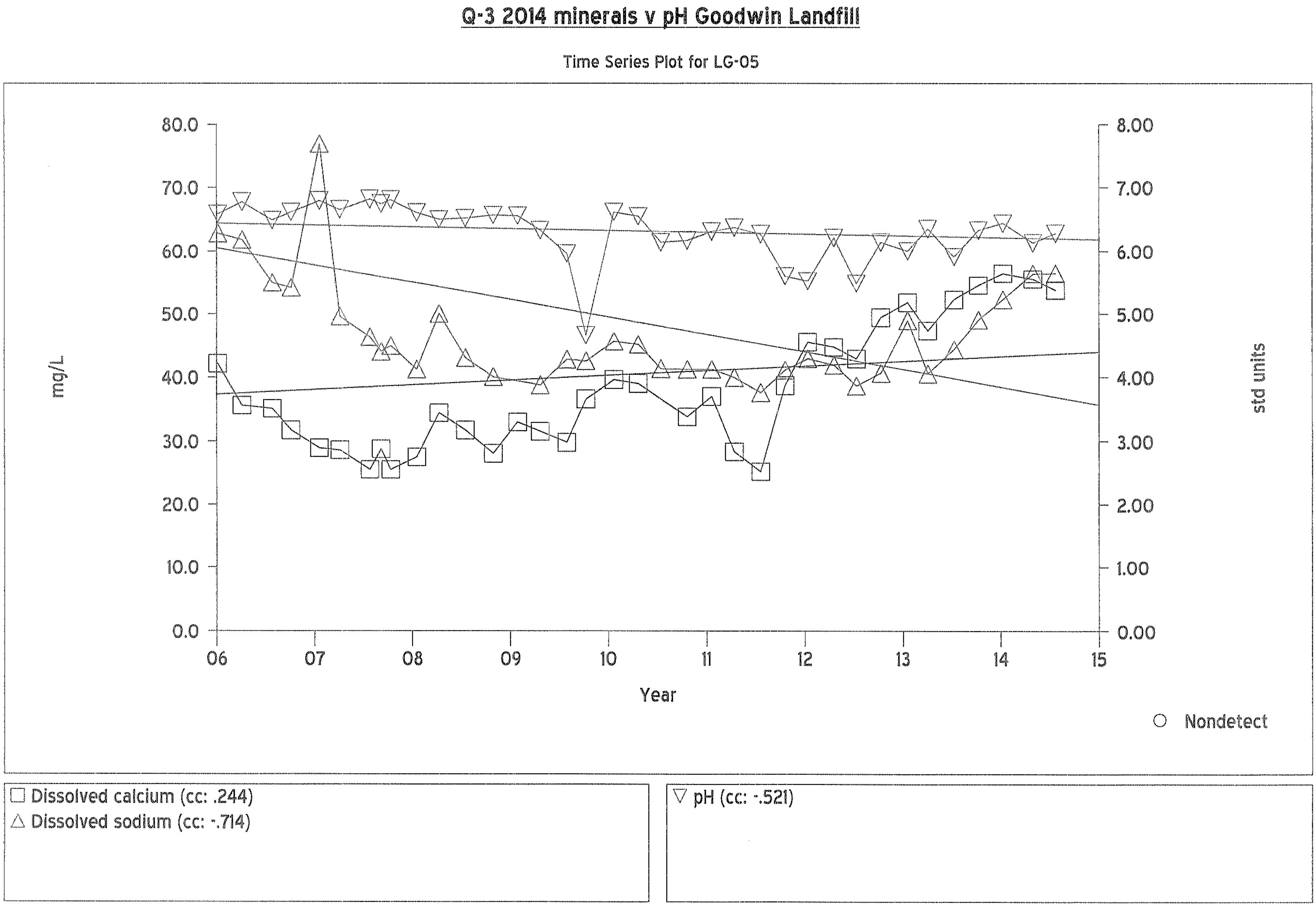
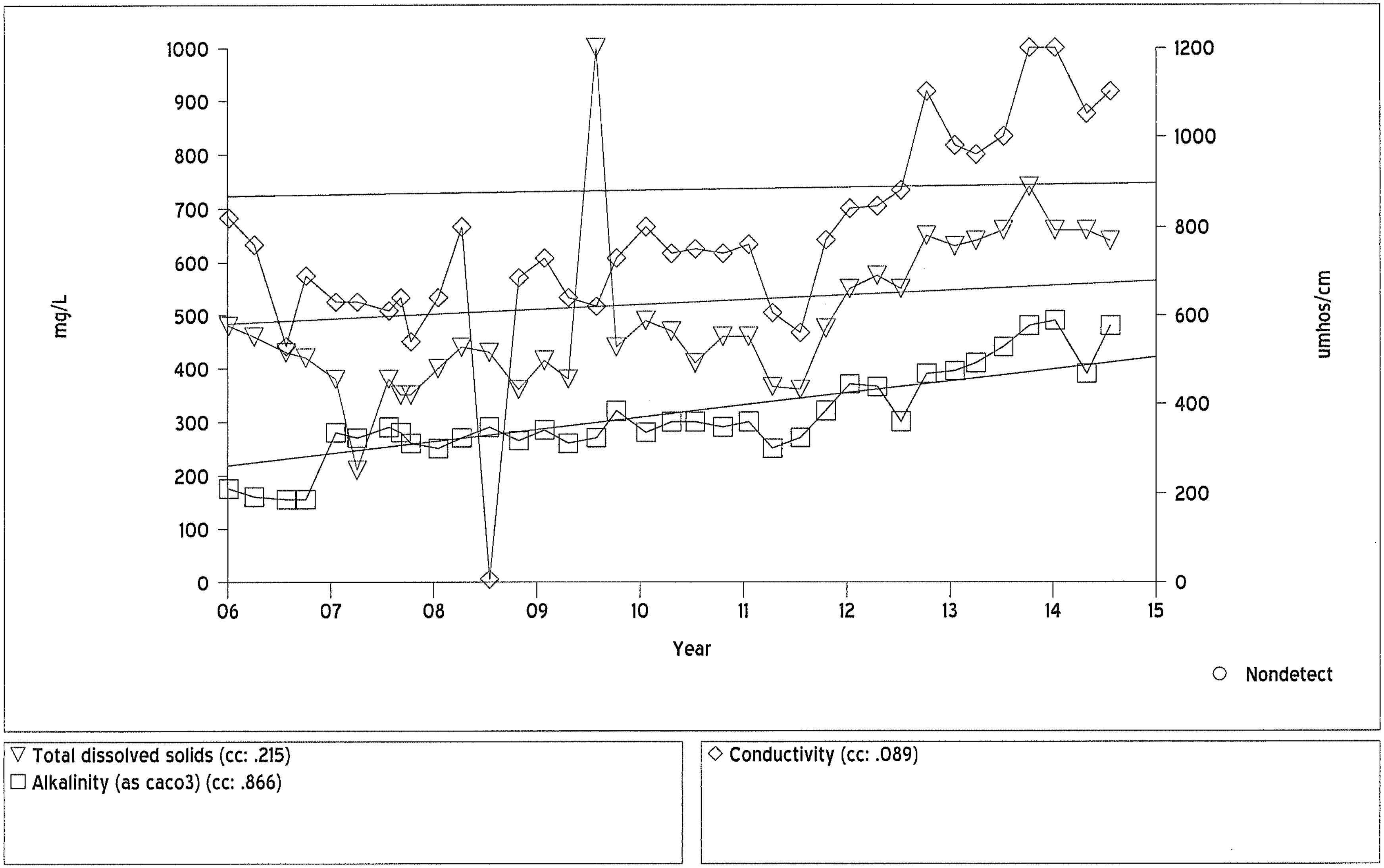


1

Prepared by: Snohomish County Solid Waste

Q-3 TDS Goodwin Landfill

Time Series Plot for LG-05



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