



CITY OF  
TUCSON  
ENVIRONMENTAL  
SERVICES

January 26, 2015

VIA U.S CERTIFIED MAIL

Michael N. Prigge, P.E.  
ADEQ Solid Waste Plan Review Unit  
1110 W. Washington Street  
Phoenix, AZ 85007



**Subject: Irvington Landfill, Tucson, AZ  
Annual Report for January – December 2014  
Aquifer Protection Permit (APP) No. 50044800.00**

Dear Mr. Prigge:

The City of Tucson, Environmental Services (COT-ES) prepared the attached report to document groundwater and landfill gas monitoring and post closure care activities at the Irvington Landfill as required by the APP No. 50044800.00.

During 2014, Irvington Landfill was in environmentally satisfactory condition for both in the field (including post closure inspections and landfill gas perimeter monitoring) and in laboratory analysis (groundwater and deep soil vapor parameter analysis), and thus meeting all APP requirements. The following are future tentatively scheduled routine APP events:

- Groundwater monitoring events shall be conducted on even numbered years (2016, 2018) with the next event to be conducted in 2016.
- Deep soil vapor monitoring for volatile organic compounds (VOCs) is not an APP requirement, but COT-ES intends to monitor the probes on a quadrennial (once every four years) to be synchronize with every other groundwater monitoring event. The next planned event planned shall be conducted in 2018.
- Monitoring for landfill gas in the shallow perimeter vapor probes and post-closure care inspections shall continue on a quarterly schedule in 2015.
- The next annual report will be submitted to ADEQ in January 2016.

If you have any questions concerning this report, please contact Mike Henrich at (520) 837-3713.

Sincerely,

Nancy Petersen  
Deputy Director

NP/LE/je

Enclosures: Irvington Landfill 2014 Annual Report, dated January 26, 2015

cc: Jeff Langejans, Tucson Fire Department (email link)  
Mike Henrich, City of Tucson Environmental Services (email link)  
Wally Wilson, Tucson Water (email link)  
Irvington Landfill File (full hardcopy)

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**2014 ANNUAL REPORT (JANUARY – DECEMBER 2014)  
IRVINGTON LANDFILL, TUCSON, ARIZONA**

Prepared for:

**THE ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY  
SOLID WASTE PLAN REVIEW UNIT  
AQUIFER PROTECTION PERMIT (APP) NO. 50044800.00**

**JANUARY 23, 2015**

**Prepared by:  
City of Tucson  
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Appendix B	Perimeter Landfill Gas Probes Field Data Sheet
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Appendix D	Post Closure Care Inspection Reports

## List of Acronyms

Alert Level	(AL)
Aquifer Protection Permit	(APP)
Aquifer Quality Limit	(AQL)
Aquifer Water Quality Standards	(AWQS)
Arizona Department of Environmental Quality	(ADEQ)
Below Ground Surface	(bgs)
Carbon Dioxide	(CO <sub>2</sub> )
City of Tucson Environmental Services	(COT-ES)
Feet	(ft)
Feet above mean sea level	(ft amsl)
Groundwater Protection Levels	(GPLs)
Non-detect	(ND)
Methane	(CH <sub>4</sub> )
Milligrams per liter	(mg/L)
Oxygen	(O <sub>2</sub> )
Quality Control/Quality Assurance	(QA/QC)
Reportable Detection Level	(RDL)
Volatile Organic Compounds	(VOCs)
Water Table Elevation	(WTE)

## 1.0 INTRODUCTION

The City of Tucson (COT) Environmental Services (ES) prepared this report to document groundwater and landfill gas monitoring, and post closure care activities at the Irvington Landfill collected during the calendar 2014 year as required by the Aquifer Protection Permit (APP) No. 50044800.00 approved by the Arizona Department of Environmental Quality (ADEQ) on May 28, 2009. The 30-year post closure care period began on August 27, 2010 with ADEQ approval of the landfill closure construction certification report. The Irvington Landfill is located on the east side of Tucson, Arizona at 10000 Irvington Road, near the intersection of Irvington and Houghton Roads (Figure 1). The Irvington Landfill operated from 1978 to 1988 and the waste boundary measures approximately 12.8 acres.

## 2.0 GROUNDWATER MONITORING

The annual February 2014 sampling event was completed in accordance with Section 2.5 of the APP. A site map is provided in Figure 2, and well completion data are presented in Table 1.

### 2.1 Water Level Monitoring

Depth to water was measured prior to semiannual well purging and sample collection. Table 2 contains water level data for February 24, 2014. A groundwater contour and flow direction map is provided in Figure 2.

The 2014 water table elevations at the landfill ranged from approximately 2,543.81 feet above mean sea level (ft amsl) to 2513.97 ft amsl in the four groundwater monitor wells. The water table elevations (WTE) indicate a horizontal hydraulic gradient toward the northwest of 0.017 ft/ft. The groundwater flow direction is northwest beneath the landfill (Figure 2). This is consistent with previous groundwater contour maps. From 1987 the average WTE beneath the site has decreased by approximately 1.50 foot/year (ft/yr) (Figure 3).

### 2.2 Sampling Results

COT-ES sampled the four groundwater monitor wells in February 2014. All samples were sent to the Tucson Water Quality Laboratory (TWQL) for analysis of parameters as listed in Section 4.0 of the APP. The field sampling sheets and groundwater monitoring laboratory reports are included as Appendix A.

Groundwater analytical test results indicate no VOCs were detected above the laboratory method reportable detection levels (RDLs). Since no VOCs were detected, a table summarizing organic results has not been created. Inorganic analyses of groundwater samples met all APP Aquifer Quality Limits (AQLs) and alert level (AL). A summary of inorganic results is included as Table 3. As detailed under APP section 2.5.3 (1.) and approved by ADEQ<sup>1</sup> the frequency of post-

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<sup>1</sup> ADEQ, RE: Irvington Landfill, Aquifer Protection Permit (APP) No. 50044800.00, 2013 Annual Report for Groundwater and Methane Monitoring, Landfill Inspections, March 27, 2014

closure groundwater monitoring is being decreased from annual to biennial (once every two years). The next groundwater sampling event is scheduled for 2016.

### **2.2.1 Quality Assurance/Quality Control Results**

Quality assurance/quality control (QA/QC) analyses for the February 2014 sampling event included 1 duplicate sample and 1 trip blank. Analytical results for QA/QC samples are presented in the laboratory reports included in Appendix A, and duplicate comparisons are summarized in Table 3.

No analytes were detected in the trip blank.

The laboratory percent recoveries were within laboratory quality assurance objectives for accuracy, except for the data qualifiers listed in the laboratory case narratives. All were within acceptable quality.

If the relative percent difference (RPD) between original and duplicate samples is greater than 30%, laboratory precision and sampling protocols or sample crew field methodology may be evaluated. Total iron concentrations were above the 30% RPD (Table 3) for the R-126A duplicate and original samples. The iron concentrations of 10.4 mg/L in the original and 6.71 mg/L in the duplicate were also the highest observed concentrations for the sampling history at the site (Table 3). The 43% RPD between the original and duplicate samples and elevated concentrations are likely attributed from suspended solids present in the samples. The final turbidity reading prior to sample collection was 201 NTUs (field sampling sheets are included in Appendix A), and total suspended solids were 134 mg/L in the original and 140 mg/L in the duplicate (Table 3). COT-ES does not consider the discrepancy between the original and duplicate iron concentrations to represent a quality control issue associated with laboratory precision or field sampling protocol, but is an influence of particulates present in the well.

## **3.0 QUARTERLY LANDFILL GAS MONITORING**

COT- ES monitored the perimeter landfill gas probes (IRV-1 through IRV-14) quarterly in January, April, July and October 2014 for the presence of methane in the shallow subsurface (10 and 25 feet below the ground surface). These wells are located along the property boundary of the landfill (Figure 2). Methane concentrations in the perimeter landfill gas probes were below equipment detection limit (range is 0-100%, accuracy is  $\pm 0.3\%$ ) for the past year. The quarterly monitoring summary sheets are provided in Appendix B.

## **4.0 DEEP SOIL VAPOR MONITORING**

COT - ES voluntarily monitors VOCs in the deep nested soil-vapor probes at R-101A to assess deep vadose zone conditions at the Irvington Landfill site. There are no regulatory standards for this data and soil vapor VOCs monitoring is not a requirement of the APP. However, COT ES

uses historical trends and parameter concentrations to make a qualitative evaluation of risks to groundwater.

Prior to sampling for VOCs, the R-101A probes (80, 130, 180, and 230 ft) were purged and fixed gas concentrations were measured for methane, carbon dioxide, and oxygen using the Landtec Gas Analyzer and Extraction Monitor. A summary spreadsheet of the field measurements are included as Table 4, and the field sampling sheet with the laboratory analytical results are included in Appendix C.

Since site concentrations historically have been low, COT-ES monitors the soil vapor gas every three years (triennially) with a recent event being conducted during February 2014. All nested probes (80, 130, 180, and 230 feet below ground surface (ft bgs)) were non-detect for PCE, TCE, cis-1,2-DCE, and vinyl chloride. The laboratory reporting limits for these compounds had increased because of concentrations of dichlorodifluoromethane being 2 to 10 times higher than in 2011 (Table 5). The reporting limits for the primary constituents are adequate in comparison to the site specific Groundwater Protection Limits (GPLs).

Compound	GPLs	Results/ Reporting Limits
PCE	43	<0.0678
TCE	17	<0.0537
Cis-1,2-DCE	198	<0.0396
Vinyl Chloride	523	<0.0256

\*All concentrations are in mg/M<sup>3</sup>.

COT-ES retained HARGIS+Associates to provide estimates of vapor phase GPLs for the Irvington Landfill in 2008<sup>2</sup>. The reporting limits are significantly below the estimated GPL which indicates there is low potential risk of impacts to groundwater above AWQs using the method listed above. Although not a requirement of the APP, ADEQ<sup>1</sup> acknowledged the decreased soil vapor monitoring frequency from triennially to quadrennial (once every four years) to synchronize with every other groundwater monitoring sampling event. Deep soil vapor monitoring is not an APP requirement, and could be eliminated should the budget not be available at the time of monitoring. The next deep soil vapor monitoring event is scheduled for 2018.

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<sup>2</sup>, *Soil Vapor Assessment at Los Reales, Prudence, Vincent Mullins, Irvington, Cottonwood, and Ryan Landfills*; EEC and Hargis + Associates, Inc, April 10, 2008

## **5.0 POST CLOSURE CARE**

Tetra Tech BAS, Inc. conducted post-closure care inspections quarterly in accordance with the APP in March, June, and September of 2014. The final quarterly inspection was conducted by COT-ES staff in December 2014. The landfill met all APP criteria with all necessary and appropriate corrective actions being implemented. By the fourth quarter inspection, the landfill property was in satisfactory condition. Copies of inspection reports are included as Appendix D.

## **6.0 SUMMARY OF ACTIVITIES**

The following list summarizes activities at the Irvington Landfill site in 2014:

- No VOCs were detected above the laboratory method RDLs for the February 2014 event and all AQLs and ALs were met as specified by the APP for VOCs and inorganic analysis results.
- On March 27, 2014, ADEQ approved a decreased in monitoring frequency from annual to biennial. The next groundwater monitoring event is scheduled for 2016.
- All deep nested soil-vapor probes at R-101A were non-detect for PCE, TCE, cis-1,2-DCE, and vinyl chloride. The reporting limits are adequately below site specific groundwater protection limits, and are protective of potential impact to the groundwater. The next event is scheduled for 2018.
- No methane was detected in the perimeter landfill gas probes during quarterly monitoring. Landfill gas monitoring will continue to be collected quarterly in 2015.
- The landfill condition, including cap integrity, drainage systems, vegetation, and security, was inspected quarterly and was in satisfactory condition in December 2014. Post-closure care inspections shall continue to be conducted quarterly during 2015.

## FIGURES

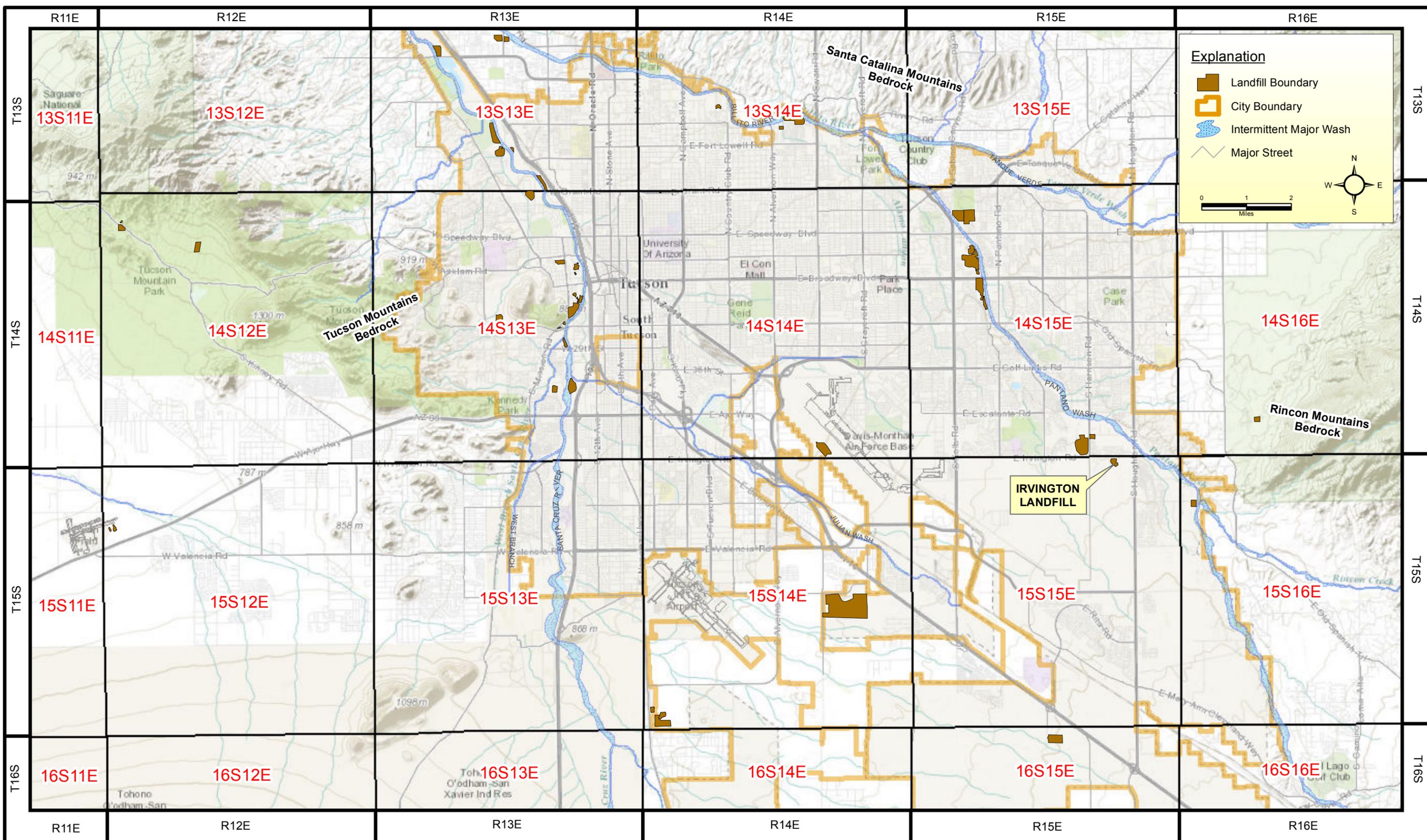
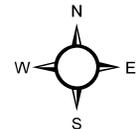


Figure 1  
Location Map  
Irvington Landfill



**Legend**

-  Perimeter Landfill Gas Probe
-  Soil Vapor Monitor Well
-  Groundwater Monitor Well
-  Direction of Groundwater Flow
-  Approx. Water Table Elevation (ft amsl)
-  Water Table Elevation (ft amsl)
-  Natural Drainage Areas (Washes)
-  Landfill Boundary



0 250 500 1,000 Feet

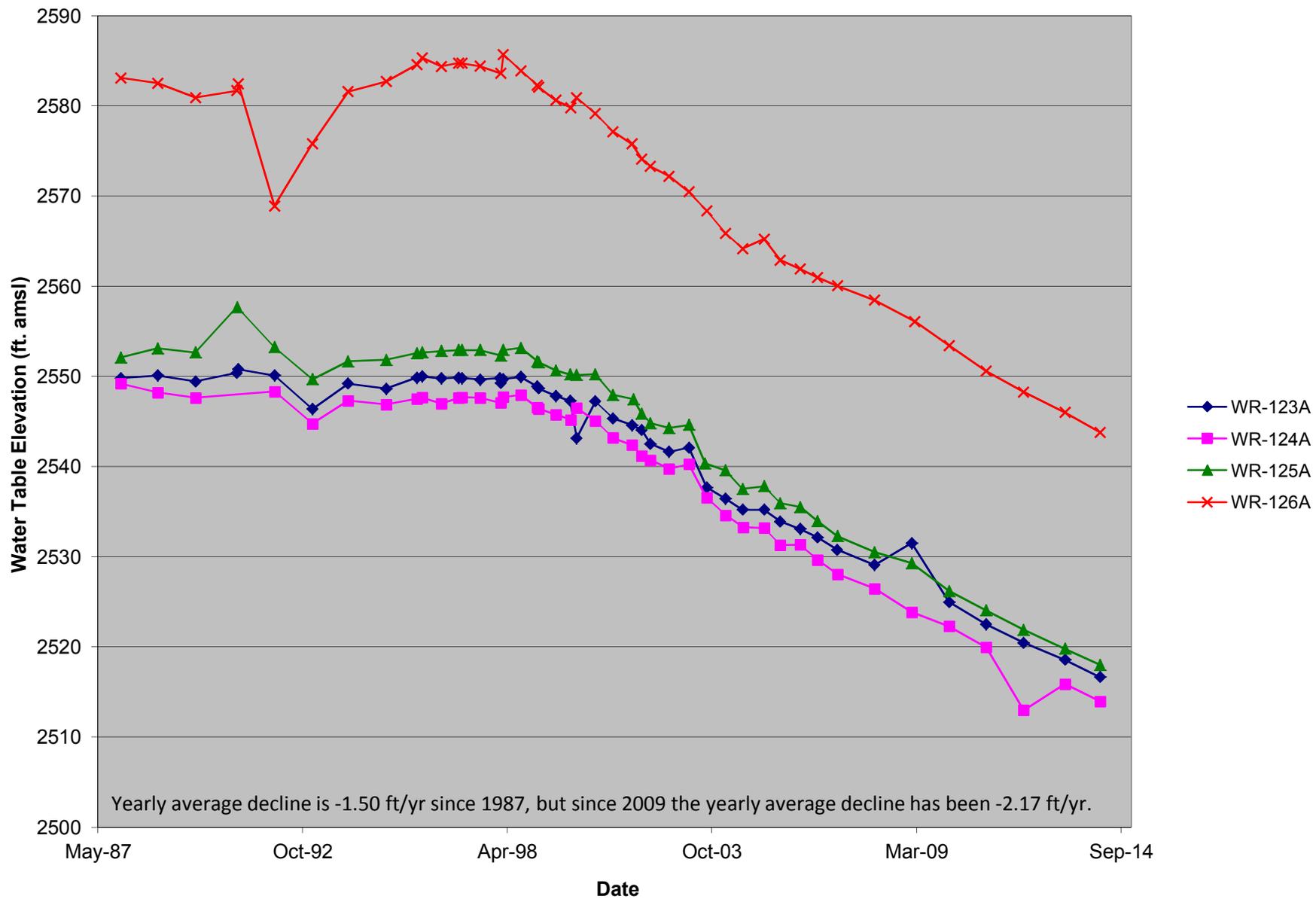


**Figure 2**  
 Site Map and 2014 Water Table Elevation Map  
 Irvington Landfill, Tucson, Az

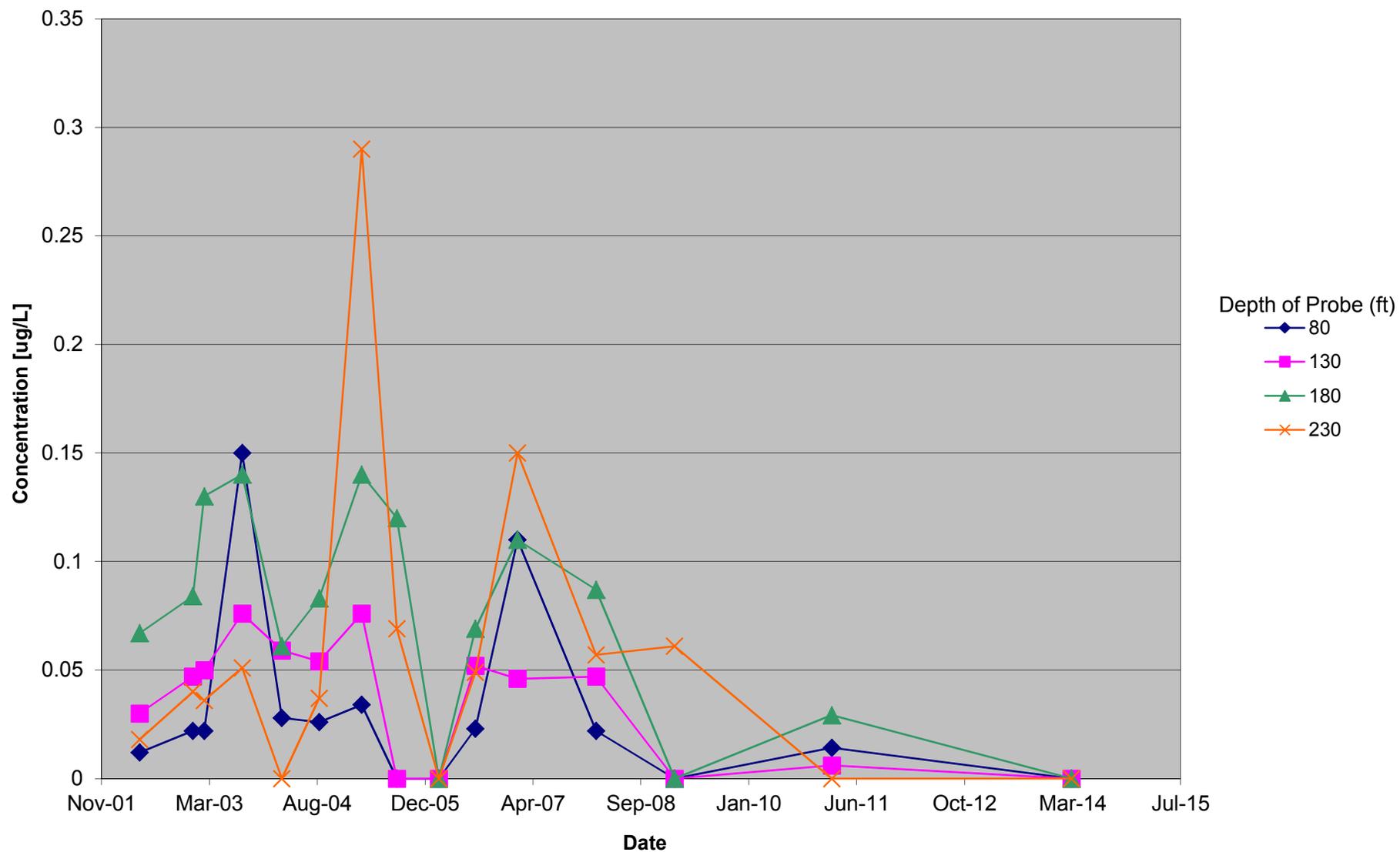
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Approved:	NP
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**Figure 3**  
**Hydrographs for Groundwater Monitor Wells**  
**Irvington Landfill**



**Figure 4**  
**PCE Concentrations in Soil Vapor Probe R-101A**  
**Irvington Landfill**



Note: Reporting limits will vary depending per sampling event. Concentrations below laboratory reporting limits were plotted as zero.

## **TABLES**

**Table 1**  
**Monitoring Well Information**  
**Irvington Landfill**

<b>Well Name</b>	<b>Date Installed</b>	<b>Casing Diameter (inches)</b>	<b>Casing Material</b>	<b>Screened Interval (ft bls)</b>	<b>Total Depth (ft bls)</b>	<b>Benchmark Elevation (ft amsl)</b>	<b>Northing</b>	<b>Easting</b>
WR-123A	6/24/1987	6	ASTM A53B Steel	270-370	375	2791.20	424631.70	1051554.48
WR-124A	7/1/1987	6	ASTM A53B Steel	245-345	350	2794.38	424585.88	1051062.26
WR-125A	7/10/1987	6	ASTM A53B Steel	250-350	355	2797.95	423796.06	1051088.85
WR-126A	7/16/1987	6	ASTM A53B Steel	255-355	360	2822.95	423543.34	1052677.84

*ft bls = feet below land surface*

*ft amsl = feet above mean sea level*

*Geographic Coordinate System in State Plane, Central Arizona, NAD 83, NAVD88*

*Benchmark elevation is top of concrete well pad.*

**Table 2**  
**Groundwater Table Elevation Summary**  
**Irvington Landfill**

<b>Well Name</b>	<b>Date</b>	<b>Time</b>	<b>DTW (ft)</b>	<b>Correction Factor (ft)</b>	<b>Corrected DTW (ft)</b>	<b>Benchmark Elevation (ft - amsl)</b>	<b>WTE (ft)</b>
WR-123A	2/24/2014	956	275.12	-0.57	274.55	2791.20	2516.65
WR-124A	2/24/2014	1059	280.96	-0.55	280.41	2794.38	2513.97
WR-125A	2/24/2014	1148	280.59	-0.64	279.95	2797.95	2518.00
WR-126A	2/24/2014	848	279.73	-0.59	279.14	2822.95	2543.81

*DTW = Depth to water.*

*ft = feet*

*ft-amsl = feet above mean sea level.*

*WTE = water table elevation.*

**Table 3**  
**Selected Inorganic Groundwater Monitoring Results (mg/L)**  
**Irvington Landfill**

	Date	Ammonia As N	Arsenic, Total	Barium, Total	Bromide	Cadmium, Total	Calcium, Total	Chloride	Chromium, Total	Copper, Total	Fluoride	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Mercury, Total	Nitrate as N	Nitrite as N	Ortho Phosphate as P	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Sulfate	Total Kjeldahl Nitrogen as N	Total Suspended Solids	Zinc, Total
AQL →		--	0.05	2	--	0.005	--	--	0.1	--	4	--	0.05	--	--	0.002	10	1	--	--	0.05	--	--	--	--	--	--
AL →		--	0.04	1.6	--	0.004	--	--	0.08	--	3.2	--	0.04	--	--	0.0016	8	0.8	--	--	0.04	--	--	--	--	--	--
Well ID ↓																											
WR-123A	9/30/09	<.05	<.002	0.053	<.1	<.004	40	4.3	<.02	<.02	0.21	0.35	0.0046	3.7	<.02	<.0005	1.8	<.1	<.2	1.2	<.005	<.02	17	11	<.2	1.2	0.17
	2/10/10	<.05	<.002	0.05	<.1	<.0025	39	4.7	<.02	<.02	0.2	0.34	0.0027	3.5	<.02	<.0005	2.1	<.1	<.2	1.2	<.005	<.02	16	12	<.2	NA	0.15
	3/24/10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1	NA
	2/9/11	<.05	<.002	0.052	<.1	<.0025	41	4.3	<.02	<.02	0.14	0.38	0.0055	3.6	<.02	<.0005	1.7	<.1	<.2	1.2	<.005	<.02	17	11	<.2	1.0	0.16
	2/8/12	<.05	<.001	0.053	<.1	<.0025	40	4.4	<.02	<.02	0.2	0.56	0.0069	3.6	<.02	<.0005	1.8	<.1	<.2	1.2	<.001	<.02	17	11	<.2	1.0	0.19
	3/19/13	<.05	<.001	0.053	<.1	<.001	40	4.3	<.02	<.02	0.2	1.2	0.014	3.6	0.024	<.0005	1.8	<.1	<.2	1.2	<.001	<.02	17	11	<.2	5.3	0.31
	2/24/14	<.05	<.001	0.051	<.1	<.001	40.1	4.5	<.02	<.02	0.21	0.292	0.0055	3.6	<.02	<.0005	1.8	<.1	<.2	1.19	<.001	<.02	16.7	11.9	<.2	<1	0.14
WR-124A	9/30/09	<.05	<.002	0.085	<.1	<.004	45	5.0	<.02	<.02	0.22	2.3	0.009	5.9	0.13	<.0005	1.8	<.1	<.2	1.6	<.005	<.02	17	12	<.2	65.0	0.23
	2/10/10	<.05	<.002	0.071	<.1	<.0025	41	5.4	<.02	<.02	0.22	1.5	0.01	5.0	0.081	<.0005	2.1	<.1	<.2	1.3	<.005	<.02	16	14	<.2	13.8	0.34
	2/9/11	<.05	<.002	0.073	<.1	<.0025	43	4.7	<.02	<.02	0.15	1.7	0.018	5.2	0.088	<.0005	1.7	<.1	<.2	1.3	<.005	<.02	17	12	<.2	28.3	0.42
	2/8/12	<.05	0.0011	0.086	<.1	<.0025	42	4.7	<.02	<.02	0.2	4.5	0.02	5.5	0.27	<.0005	1.8	<.1	<.2	1.6	<.001	<.02	16	12	<.2	64.5	0.59
	3/19/13	<.05	<.001	0.074	0.1	<.001	42	4.5	<.02	<.02	0.21	2	0.017	5.0	0.12	<.0005	1.7	<.1	<.2	1.3	<.001	<.02	16	12	<.2	17.2	0.45
	2/24/14	<.05	<.001	0.072	<.1	<.001	42.6	4.6	<.02	<.02	0.23	1.7	0.0199	5.0	0.078	<.0005	1.8	<.1	<.2	1.23	<.001	<.02	16.1	12.3	<.4	6.6	0.44
WR-125A	9/30/09	<.05	<.002	0.073	<.1	<.004	42	4.3	<.02	<.02	0.22	2.7	0.01	5.7	0.088	<.0005	1.8	<.1	<.2	1.4	<.005	<.02	16	11	<.2	25.2	0.36
	2/10/10	<.05	<.002	0.063	<.1	<.0025	40	4.8	<.02	<.02	0.24	1.2	0.01	5.3	0.026	<.0005	2.1	<.1	<.2	1.2	<.005	<.02	15	13	<.2	8.5	0.48
	2/9/11	<.05	<.002	0.074	<.1	<.0025	42	4.4	<.02	<.02	0.15	3.8	0.019	5.8	0.2	<.0005	1.7	<.1	<.2	1.5	<.005	<.02	16	11	<.2	53.1	0.48
	2/8/12	<.05	<.001	0.073	<.1	<.0025	40	4.5	<.02	<.02	0.15	2.1	0.012	5.7	0.11	<.0005	1.7	<.1	<.2	1.4	<.001	<.02	16	12	<.2	76.0	0.35
	2/8/12	<.05	<.01	0.067	<.2	<.005	38.2	4.1	<.01	<.02	0.21	2.17	0.0126	5.4	0.114	<.0001	1.1	<.01	<.05	1.53	<.03	<.02	15.2	11.6	<.3	52.0	0.33
	3/19/13	<.05	<.001	0.064	<.1	<.001	40	4.3	<.02	<.02	0.22	2.1	0.013	5.4	0.067	<.0005	1.7	<.1	<.2	1.3	<.001	<.02	15	11	<.2	22.6	0.33
	3/19/13	<.05	<.001	0.087	<.1	<.001	42	4.3	<.02	<.02	0.21	5.7	<b>0.041</b>	5.2	0.38	<.0005	1.7	<.1	<.2	1.4	<.001	<.02	16	11	<.2	22.7	1.20
	6/6/13	NA	<.001	0.060	NA	<.001	40	NA	<.02	<.02	NA	0.24	0.0036	5.2	<.02	<.0005	NA	NA	NA	1.2	<.001	<.02	15	NA	NA	NA	0.19
	6/6/13	NA	<.001	0.059	NA	<.001	40	NA	<.02	<.02	NA	0.37	0.0036	5.2	<.02	<.0005	NA	NA	NA	1.2	<.001	<.02	15	NA	NA	NA	0.19
	7/12/13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/24/14	<.05	<.001	0.056	<.1	<.001	39.2	4.4	<.02	<.02	0.22	3.97	0.0092	5.21	0.111	<.0005	1.56	<.1	<.2	1.29	<.001	<.02	15.1	11.2	<.2	24.7	0.41
WR-126A	9/30/09	<.05	<.002	0.079	<.1	<.004	45	4.5	<.02	<.02	0.18	3.3	0.016	6.6	0.1	<.0005	2.0	<.1	<.2	1.6	<.005	<.02	16	14	<.2	54.4	0.42
	9/30/09	<.05	<.002	0.079	<.1	<.004	45	4.4	<.02	<.02	0.18	3.4	0.017	6.5	0.11	<.0005	2.0	<.1	<.2	1.6	<.005	<.02	16	14	<.2	54.2	0.42
	2/10/10	<.05	<.002	0.073	<.1	<.0025	42	5.0	<.02	<.02	0.16	2.1	0.012	6.0	0.052	<.0005	2.4	<.1	<.2	1.4	<.005	<.02	15	16	<.2	28.7	0.35
	2/10/10	<.05	<.002	0.074	<.1	<.0025	44	5.1	<.02	<.02	0.22	2.2	0.013	6.3	0.054	<.0005	2.4	<.1	<.2	1.5	<.005	<.02	15	16	0.47	28.7	0.38
	2/9/11	<.05	<.002	0.072	<.1	<.0025	45	4.5	<.02	<.02	0.11	1.3	0.011	6.4	0.029	<.0005	2.1	<.1	<.2	1.5	<.005	<.02	16	14	<.2	14.3	0.29
	2/9/11	<.05	<.002	0.072	<.1	<.0025	45	4.6	<.02	<.02	0.11	1.3	0.011	6.4	0.028	<.0005	2.1	<.1	<.2	1.5	<.005	<.02	16	14	<.2	12.1	0.29
	2/8/12	<.05	<.001	0.076	<.1	<.0025	45	4.7	<.02	<.02	0.15	2.8	0.019	6.3	0.054	<.0005	2.1	<.1	<.2	1.4	<.001	<.02	16	14	<.2	17.1	0.43
	3/19/13	<.05	0.0012	0.083	<.1	<.001	44	4.6	<.02	<.02	0.17	5.4	0.036	6.4	0.19	<.0005	2.1	<.1	<.2	1.5	<.001	<.02	15	14	<.2	64.0	0.76
	7/12/13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0164	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/24/14	0.05	0.0011	0.101	<.1	<.001	47.7	4.8	<.02	<.02	0.18	10.4	0.0175	7.76	0.255	<.0005	2.07	<.1	<.2	2.59	<.001	<.02	15.8	14.6	<.2	134	1.19
	2/24/14	0.05	<.001	0.091	<.1	<.001	48.3	4.7	<.02	<.02	0.17	6.71	0.0158	7.27	0.219	<.0005	2.06	<.1	<.2	2.05	<.001	<.02	15.7	14.6	<.2	140	1.13
	<b>RPD =</b>	<b>2%</b>		<b>10%</b>			<b>1%</b>	<b>1%</b>			<b>5%</b>	<b>43%</b>	<b>10%</b>	<b>7%</b>	<b>15%</b>				<b>23%</b>			<b>1%</b>	<b>0%</b>		<b>4%</b>	<b>5%</b>	

AQL = Aquifer Quality Limit as specified in site APP permit.  
AL = Alert Level as specified in site APP permit.  
NA = not analyzed.

RPD = Relative Percent Difference used for sample duplicate quality control comparisons.  
Highlighted yellow and bold numbers exceed AL and/or AQL.

**Table 4**  
**R-101A Vapor Probe Field Measurements of Methane, Carbon Dioxide, and Oxygen**  
**Irvington Landfill**

Date	Depth (ft bls)	CH <sub>4</sub> %	CO <sub>2</sub> %	O <sub>2</sub> %
5/1/2002	80	0.0	4.6	12.9
	130	0.1	5.0	12.2
	180	0.1	6.2	6.9
	230	0.0	1.3	11.1
1/3/2003	80	0.0	8.0	8.2
	130	0.0	7.0	8.0
	180	0.0	7.4	6.3
	230	0.0	0.4	14.9
2/25/2003	80	0.0	7.9	7.7
	130	0.0	8.1	6.8
	180	0.0	7.4	5.5
	230	0.0	2.1	6.2
8/20/2003	80	0.0	6.0	8.2
	130	0.0	8.5	6.1
	180	0.0	9.4	3.9
	230	0.0	2.4	5.5
2/19/2004	80	0.1	8.8	8.1
	130	0.1	9.3	6.2
	180	0.0	6.6	6.8
	230	0.0	2.4	6.4
8/10/2004	80	0.0	8.7	8.6
	130	0.0	8.3	6.7
	180	0.0	7.7	5.5
	230	0.0	2.0	15.0
2/23/2005	80	0.0	8.9	8.2
	130	0.0	10.3	5.0
	180	0.0	9.3	4.0
	230	0.0	2.8	5.7
8/5/2005	80	0.0	8.4	8.3
	130	0.0	9.9	5.4
	180	0.0	9.5	4.0
	230	0.0	2.9	5.7
2/16/2006	80	0.0	8.7	8.6
	130	0.0	9.5	7.4
	180	0.0	7.2	7.4
	230	0.0	2.8	5.7
8/4/2006	80	0.0	0.6	8.5
	130	0.0	10.2	9.2
	180	0.0	9.8	3.7
	230	0.0	3.0	5.5

**Table 4**  
**R-101A Vapor Probe Field Measurements of Methane, Carbon Dioxide, and Oxygen**  
**Irvington Landfill**

Date	Depth (ft bls)	CH <sub>4</sub> %	CO <sub>2</sub> %	O <sub>2</sub> %
2/15/2007	80	0.0	0.9	7.7
	130	0.0	9.9	5.5
	180	0.0	10.0	4.1
	230	0.0	3.2	6.1
2/14/2008	80	0.0	8.9	8.2
	130	0.0	11.3	4.5
	180	0.0	9.9	3.4
	230	0.0	3.4	4.9
2/12/2009	80	0.0	7.3	9.1
	130	0.0	9.9	4.1
	180	0.0	8.7	2.9
	230	0.0	2.9	5.0
2/10/2011	80	0.0	9.6	8.0
	130	0.0	11.5	4.6
	180	0.0	11.4	2.6
	230	0.0	4.5	4.6
2/25/2014	80	0.0	7.9	6.1
	130	0.0	10.3	6.4
	180	0.0	9.9	3.1
	230	0.0	4.1	6.3

*ft bls = feet below land surface*

*CH<sub>4</sub> = methane*

*CO<sub>2</sub> = carbon dioxide*

*O<sub>2</sub> = oxygen*

**Table 5**  
**R-101A Vapor Probe Results - Selected VOCs**  
**Irvington Landfill**

Date	Depth (ft)	PCE	TCE	cis-1,2-DCE	VC	TCFM	DCFM
5/1/2002	80	0.012	ND	ND	ND	0.34	NA
1/3/2003	80	0.022	0.0015	ND	ND	0.63	NA
2/25/03	80	0.022	ND	ND	ND	0.72	NA
8/20/03	80	0.15	ND	ND	ND	0.52	0.47
2/19/04	80	0.028	ND	ND	ND	0.8	0.48
8/10/04	80	0.026	ND	ND	ND	0.8	0.65
2/23/05	80	0.034	ND	ND	ND	0.8	0.75
8/5/05	80	ND	ND	ND	ND	0.63	0.45
2/16/06	80	ND	ND	ND	ND	0.63	0.55
8/4/06	80	0.023	ND	ND	ND	0.63	0.55
2/15/07	80	0.11	1.4	ND	ND	0.68	0.31
2/14/08	80	0.022	ND	ND	ND	0.56	0.53
2/12/09	80	ND	ND	ND	ND	ND	ND
2/10/11	80	0.0142	ND	ND	ND	0.422	0.302
2/25/14	80	ND	ND	ND	ND	0.3484	0.9445
5/1/2002	130	0.03	ND	ND	ND	0.77	NA
1/3/2003	130	0.047	0.0031	ND	ND	1.1	NA
2/25/03	130	0.05	ND	ND	ND	1.2	NA
8/20/03	130	0.076	ND	ND	ND	0.91	0.86
2/19/04	130	0.059	0.18	ND	ND	1.1	1.2
8/10/04	130	0.054	ND	ND	ND	1.4	1.3
2/23/05	130	0.076	ND	ND	ND	1.3	1.2
8/5/05	130	ND	ND	ND	ND	1.1	0.86
2/16/06	130	ND	ND	ND	ND	0.0028	0.0041
8/4/06	130	0.052	ND	ND	ND	1	0.86
2/15/07	130	0.046	ND	ND	ND	0.91	0.28
2/14/08	130	0.047	ND	ND	ND	0.87	0.91
2/12/09	130	ND	ND	ND	ND	ND	ND
2/10/11	130	0.0061	ND	ND	ND	0.163	0.119
2/25/14	130	ND	ND	ND	ND	0.5957	1.1781
5/1/2002	180	0.067	ND	ND	ND	2.2	NA
1/3/2003	180	0.084	ND	ND	0.0025	2	NA
2/25/03	180	0.13	ND	ND	ND	3.2	NA
8/20/03	180	0.14	ND	ND	ND	1.7	1.4
2/19/04	180	0.061	ND	ND	0.23	1.9	1.8
8/10/04	180	0.083	0.033	ND	0.23	2.6	2.2
2/23/05	180	0.14	ND	ND	0.013	2.5	2.1
8/5/05	180	0.12	ND	ND	ND	2.5	1.7
2/16/06	180	ND	ND	ND	0.081	1.6	1.3
8/4/06	180	0.069	ND	ND	ND	1.7	1.2
2/15/07	180	0.11	0.033	ND	ND	2	0.44
2/14/08	180	0.087	ND	ND	ND	1.2	1.1
2/12/09	180	ND	ND	ND	ND	ND	ND
2/10/11	180	0.0292	ND	ND	ND	0.787	0.545
2/25/14	180	ND	ND	ND	ND	0.7857	1.0751
5/1/2002	230	0.018	ND	ND	0.0028	1.6	NA
1/3/2003	230	0.04	ND	ND	0.012	1.9	NA
2/25/03	230	0.036	ND	ND	ND	2.8	NA
8/20/03	230	0.051	ND	ND	0.012	3	2.3
2/19/04	230	ND	ND	ND	ND	4.3	3.7
8/10/04	230	0.037	ND	ND	0.042	1	0.75
2/23/05	230	0.29	0.083	ND	ND	3.6	3.3
8/5/05	230	0.069	ND	ND	ND	3.9	2.3
2/16/06	230	ND	ND	ND	ND	3.9	2.8
8/4/06	230	0.049	ND	ND	ND	2.8	1.9
2/15/07	230	0.15	ND	ND	ND	2.6	2
2/14/08	230	0.057	ND	ND	ND	2.7	2.1

**Table 5**  
**R-101A Vapor Probe Results - Selected VOCs**  
**Irvington Landfill**

<b>Date</b>	<b>Depth (ft)</b>	<b>PCE</b>	<b>TCE</b>	<b>cis-1,2-DCE</b>	<b>VC</b>	<b>TCFM</b>	<b>DCFM</b>
2/12/09	230	0.061	ND	ND	ND	2.2	1.7
2/10/11	230	ND	ND	ND	ND	0.399	0.257
2/25/14	230	ND	ND	ND	ND	2.232	2.228

NA = Not Analyzed

ND = Not Detect

PCE = Tetrachloroethene

TCE = Trichloroethene

cis-1,2-DCE = cis-1,2-Dichloroethene

VC = Vinyl Chloride

TCFM = Trichlorofluoromethane

DCFM = Dichlorodifluoromethane

All concentrations reported in ug/L.

All samples analyzed using Method TO-15

**APPENDIX A**  
Groundwater Field Sampling Sheets  
And  
Laboratory Analytical Reports