WASTE MANAGEMENT

WASTE MANAGEMENT
1000 Parkwood Circle
Suite 700
Atlanta, GA 30339

May 23, 2012

NC Department of Environment and Natural Resources
Division of Waste Management – Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina 27699-1646
Attn: Ms. Jaclynne Drummond

RE: First Semiannual Groundwater Monitoring Report of 2012
Piedmont Landfill and Recycling Center, Kernersville, North Carolina
Permit Number 34-06

Dear Ms. Drummond:

Please find enclosed an electronic copy of the report documenting the First Semiannual Detection Groundwater Monitoring Event of 2012 for the above-referenced facility. The report package includes an Environmental Monitoring Reporting Form and a CD with the complete report and laboratory data in electronic format. Samples were collected by Professional Technical Support Services (ProTech) on March 14, 2011. All samples were transported to the Test America, Inc. laboratory in Arvada, Colorado for analysis.

The Piedmont Landfill and Recycling Center is a closed municipal solid waste facility that last received waste in 2004 and entered into post closure care in accordance with Rule .1627(d) of the North Carolina Solid Waste Management Regulations (NCSWMR) as of October 29, 2004. All points at the facility are currently being monitored under a Detection Monitoring Program under Rule .1633 of the NCSWMR.

There were no confirmed statistically significant increases (SSIs) of any NCSWMR Appendix I or II constituents detected for this site during the first semiannual sampling event of 2012, except for chromium in MW-03. An exceedance of NC2L groundwater standards for chromium was detected in well MW-03. An Alternate Source Demonstration for chromium in MW-03 was submitted on July 26, 2010 and was approved by DENR in a letter dated April 28, 2011.

A copy of this report will be placed into the site's operating record in accordance with Rule .1633(c)(1) of the NCSWMR. The next sampling event for the Piedmont Landfill and Recycling Center is scheduled for the third quarter of 2012. If you have any questions or concerns regarding this report, please call me at (770) 805-3366.

From everyday collection to environmental protection, Think Green.® Think Waste Management.

Printed on 100% post-consumer recycled paper.

Sincerely,
Waste Management of Carolinas, Inc.

Alexander Lacsamana, P.E.
District Manager, Closed Sites

Enclosure

Copy: March Smith, WMCI (w/o enclosure)
Van Burbach, Ph.D., P.G. – Joyce Engineering

PREPARED FOR:

PIEDMONT LANDFILL & RECYCLING CENTER
9900 FREEMAN ROAD
KERNERSVILLE, NORTH CAROLINA 27284
PERMIT NO. 34-06

PIEDMONT LANDFILL & RECYCLING CENTER
PERMIT # 34-06

FIRST SEMIANNUAL DETECTION GROUNDWATER MONITORING EVENT FOR 2012

APRIL 2012

PREPARED BY:

2211 WEST MEADOWVIEW ROAD, SUITE 101
GREENSBORO, NORTH CAROLINA 27407
NC LICENSE NUMBER C-0782
PHONE: (336) 323-0092
FAX: (336) 323-0093

JOYCE PROJECT NO. 00392.1201.12.01

DENR USE ONLY: ☐ Paper Report ☐ Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Waste Management of Carolinas, Inc.

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: G. Van Ness Burbach, Ph.D., P.G. Phone: (336) 323-0092

E-mail: vburbach@joyceengineering.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
Piedmont Landfill & Recycling Center	9900 Freeman Rd. Kernersville, NC	34-06	.1600	March 14, 2012

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☒ Detection Monitoring ☐ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☒ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☒ Leachate monitoring data
☒ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify) _____

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☒ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Alexander Lacsamana, PE — District Manager - Closed Sites — (770) 805-3366

Facility Representative Name (Print) — Title — (Area Code) Telephone Number

Alexander Lacsamana — 5/23/2012

Signature — Date

Affix NC Licensed/ Professional Geologist Seal

1000 Parkwood Circle, Suite 700 Atlanta, GA 30339

Facility Representative Address

NC PE Firm License Number (if applicable effective May 1, 2009)

Revised 6/2009

PIEDMONT LANDFILL & RECYCLING CENTER
PERMIT # 34-06

FIRST SEMIANNUAL DETECTION GROUNDWATER MONITORING EVENT FOR 2012

APRIL 2012

Prepared by:

JOYCE ENGINEERING

2211 West Meadowview Road, Suite 101
Greensboro, North Carolina 27407

NORTH CAROLINA LICENSED SEAL 1349 GEOLOGIST G. VAN NESS BURBACH

Prepared by: G. Van Ness Burbach

G. Van Ness Burbach, Ph.D., P.G.
NC License # 1349

JOYCE Project # 392.1201.12, Task 01

JOYCE ENGINEERING

2211 West Meadowview Rd.
Boone Building, Suite 101
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tel: 336/323-0092
fax: 336/323-0093

www.JoyceEngineering.com

April 13, 2012

Mr. Alexander Lacsamana, P.E.
Project Manager, Closed Sites
Waste Management
2859 Paces Ferry Road, Suite 1600
Atlanta, Georgia 30339

RE: First Semiannual Groundwater Monitoring Report of 2012
Piedmont Landfill & Recycling Center, Permit No. 34-06
JOYCE Project No. 392.1201.12, Task 01

Dear Mr. Lacsamana,

The purpose of this report is to provide you with a complete submittal to satisfy the groundwater monitoring compliance requirements for the closed Piedmont Landfill and Recycling Center's first semiannual groundwater monitoring event of 2012. This report may also serve to fulfill the notification requirements of Rule .1634 (g) of the North Carolina Solid Waste Management Regulations (NCSWMR). An Environmental Monitoring Reporting Form (EMRF) for this event is attached.

Sampling for the event was performed on March 14, 2011 by Pro-Tech. During this semiannual event, the site compliance wells and surface water monitoring points were sampled and analyzed for the NC Appendix I list of constituents. The site leachate was also sampled during this event for the required list of parameters. The laboratory analytical reports, field data logs, and chains of custody are provided on CD as *Appendix A* of this report.

MONITORING PROGRAM HISTORY:

The site entered into an Assessment Monitoring Program for background wells MW-01 and MW-06 and downgradient well MW-09 after volatile organic constituents were detected in MW-09 during the second semiannual event of 1996. Two organic compounds (chloroethane and 1,1-dichloroethane) were historically detected in monitoring well MW-09. Chloroethane exhibited a declining trend to the point where chloroethane was reported at less than the laboratory reporting limit during the January 1998 sampling event. The concentration of 1,1-dichloroethane in MW-09 also decreased below the laboratory reporting limit during the July 1998 sampling event. Following receipt of approval from the North Carolina Department of Environment and Natural Resources (DENR), all wells at the site reverted to the Detection Monitoring Program as of the second semiannual event in 1999, as allowed by 15A NCAC 13B.1634 (b).

Monitoring well MW-09 was replaced by well MW-09R in November 1999. No chloroethane concentration above the laboratory reporting limit or SWSL has been detected in MW-09R since the well was installed; however, 1,1-dichloroethane was detected in MW-09R at a concentration of 23 µg/L during the initial sampling event conducted in January 2000. The concentration of 1,1-dichlorothane remained relatively consistent until recently, ranging in concentration from 7 µg/L to 28 µg/L; however, it has not been detected at quantifiable levels Since September 2009. The constituent cis-1,2-dichloroethene was detected in MW-09R above the laboratory reporting limit for the first time during the July 2002 event at a concentration of 6.5 µg/L, and has been detected at concentrations ranging from 5-28 µg/L; however, it has not been detected at quantifiable levels since September 2009. The presence of organic constituents in MW-09 and MW-09R is attributed to landfill gas (LFG). The LFG extraction network was expanded in this area in January 2003, and the recent decrease in concentrations of organic constituents in this well is attributed to the control of LFG.

Due to the detection of 1,1-dichloroethane in MW-09R during the first semiannual event in 2000, the site performed Assessment Monitoring on wells MW-01, MW-06, and MW-09R through the second semiannual event of 2001. Following NC DENR approval of an August 20, 2001 request by Waste Management, MW-01 and MW-06 again reverted to Detection Monitoring. Monitoring well MW-09R was sampled for the NC Appendix I list of constituents plus detected Appendix II constituents during the first semiannual event each year and NC Appendix II list of constituents during the second semiannual event until the DENR approved reverting back to detection monitoring on a letter dated March 15, 2012.

In the September 2007 sampling event, benzene and vinyl chloride were detected in MW-02 at concentrations in exceedance of NC 2L groundwater standards. A resampling event confirmed the vinyl chloride, but not the benzene exceedance. An *Alternate Source Demonstration* (ASD) was submitted to DENR on March 14, 2008. The ASD demonstrated that the organic constituents detected in MW-02 are related to LFG impacts. In January 2008, improvements to the active LFG recovery system at the site were initiated to help mitigate these impacts. The ASD was accepted by DENR in a letter dated May 7, 2008 with the condition that if vinyl chloride and benzene concentrations in MW-02 are not sufficiently reduced by Spring 2009, MW-02 would enter Assessment Monitoring. Neither benzene nor vinyl chloride have had confirmed detections above the NC 2L standards in MW-02 since September 2008, so MW-02 remains in detection monitoring.

During the March 2010 sampling event, chromium was detected in MW-03 at a statistically significant concentration above the NC 2L groundwater standard. An ASD was submitted on July 26, 2010 for the chromium detected in MW-03 demonstrating that the chromium was naturally occurring in the soil and groundwater of the facility. DENR approved the ASD for chromium in MW-03 in a letter dated April 28, 2011.

STATISTICAL ANALYSIS:

The results of the statistical analysis of the March 2012 groundwater monitoring event are summarized below and in *Table 1*. The detailed statistical analyses for this event are provided on CD in *Appendix B*. The data for each inorganic parameter were statistically compared to historical data for each well using an intrawell approach, in accordance with the facility's statistical analysis plan,

EPA guidance document ("*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance*" July 1992), and ASTM standard D6312-98 ("*Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs*"). Statistical analyses for inorganic constituents were completed using the combined Shewhart-CUSUM control chart method. Organic constituents were directly compared to 15A NCAC 2L.0202 Groundwater Standards (NC 2L) or to the North Carolina Department of Environmental and Natural Resources (DENR) Solid Waste Section Limits (SWSL).

DETECTION MONITORING EVENT:

MW-01, MW-02, MW-03, MW-04, MW-04D, MW-05, MW-06, MW-07, MW-08, MW-9R, MW-10, MW-11, MW-11D, MW-12, MW-12D, and Surface Water Points: S-02, S-03, S-04, and S-05

During the first semiannual event of 2012, fifteen detection monitoring wells and four surface water points were sampled for the NC Appendix I list of constituents. The laboratory analytical reports, field data logs, and chains of custody for the March 2012 event are provided on CD in *Appendix A* of this report.

Organic Constituents

There were no quantified detections (above the SWSL) of any Appendix I organic constituents in any of these wells or surface water points during this event.

Inorganic Constituents

Inorganic constituents with quantified detections (above the SWSL) in one or more groundwater or surface water samples included barium in MW-02 and chromium in MW-03. Chromium was detected above the NC 2L in MW-03. The chromium results in MW-03 also appear as a statistically significant increase (SSI) above background. An ASD for chromium in MW-03 was approved by DENR in a letter dated April 28, 2011. No other Appendix I inorganic constituents were detected above the SWSL or the NC 2L groundwater standards or groundwater protection standards (GWPS) in any detection monitoring well or surface water sample during the March 2012 sampling event.

SUBMITTAL OF LEACHATE ANALYTICAL DATA:

Appendix A to this report contains the leachate monitoring results for March 2012 on CD as requested in the Solid Waste Section memo dated November 13, 1996. The leachate was analyzed for NC Appendix I constituents, alkalinity, carbonate alkalinity, bicarbonate alkalinity, TDS, TOC, chloride, ammonia, sulfate, nitrate, phosphorus, BOD, COD, TSS, mercury, indicator metals (calcium, iron, magnesium, manganese, sodium, and potassium), and the required field parameters.

SUBMITTAL OF GROUNDWATER MAP AND FLOW CALCULATIONS:

Appendix C to this report contains the groundwater surface contour map and groundwater flow rates for this event. In summary, the March 2012 sampling results and groundwater flow

assessment indicate that the site monitoring network is effective in monitoring for the release of solid waste constituents to the environment.

CONCLUSIONS/CLOSURE:

There were no organic constituents with quantified detections (above the SWSL) reported for any monitoring wells or surface water points during the March 2012 monitoring event. Two inorganic constituents had quantified detections in some monitoring wells, and chromium was detected above the NC 2L groundwater standard in MW-03. The only SSI was the chromium detection in MW-03.

An ASD was submitted on July 26, 2010 for the exceedance of chromium detected in MW-03 during the March 2010 sampling event. On April 28, 2011, DENR approved the ASD for chromium in MW-03. MW-03 will continue to be monitored in accordance with the Detection Monitoring Program.

All site wells will continue to be monitored in accordance with the Detection Monitoring Program and surface water points will continue to be monitored as required by the DENR. The next monitoring event for the closed Piedmont Landfill and Recycling Center is scheduled for the third quarter of 2012. If you have any questions, feel free to contact me or Steve Cowie at (336) 323-0092.

Sincerely,
JOYCE ENGINEERING

G. Van Ness Burbach, PhD, PG
Technical Consultant

Attachments: Environmental Monitoring Reporting Form
Table 1 – Summary of Detected Constituents – March 2012
Appendix A – Laboratory Analytical Reports (on CD)
Appendix B – Groundwater Statistical Analyses Report (on CD)
Appendix C – Groundwater Flow Regime Report

Copy: Steve Clarke, Waste Management

TABLES

TABLE 1
QUANTIFIED DETECTED APPENDIX I AND APPENDIX II CONSTITUENTS

WELL ID	PARAMETER	RESULT	UNITS	SWSL	NC2L	LIMIT	SSI
3406-MW02	Barium	140	µg/L	100	700	1,143.3	No
3406-MW03	Chromium	13	µg/L	10	10	18.2	Yes*

Notes:

1. SWSL = NC DENR Solid Waste Section Limits.
2. NC2L = 15A-NCAC-2L.0202 Groundwater Standards.
3. LIMIT = Background limit based on intra-well statististics.
4. SSI = Apparent statistically-significant increase above background.
5. Estimated and blank-qualified detections are excluded.
6. Shaded values are greater than the NC2L Standard.
7. * Chromium in MW-03 has been addressed in an ASD approved by DENR

APPENDICES ON CD:

Appendix A: Laboratory Analytical Reports

Including Field Data Logs and Chains of Custody

Appendix B: Groundwater Statistical Analyses Report

APPENDIX C

GROUNDWATER FLOW REGIME REPORT

Piedmont Landfill & Recycling Center – Permit No. 34-06
Groundwater Flow Regime Report – March 2012 Event

Prepared by:

JOYCE ENGINEERING

2211 West Meadowview Road, Suite 101
Greensboro, North Carolina 27407

Prepared by: G. Van Ness Burbach, Ph.D., P.G.

NORTH CAROLINA LICENSED SEAL 1349 GEOLOGIST G. VAN NESS BURBACH

Attachments: Drawing No. 1 – Groundwater Surface Map
Table 2 – Historical Groundwater Elevations
Table 3 – Groundwater Flow Rate Calculations

Piedmont Landfill & Recycling Center
Permit 34-06

APPENDIX C:
Groundwater Flow Regime Report – March 2012 Event

On behalf of Waste Management, Joyce Engineering has reviewed groundwater flow rates and flow directions at the Piedmont Landfill and Recycling Center for the first semiannual groundwater sampling event of 2012. The groundwater flow and direction calculations presented in this report are based on groundwater elevation data obtained by ProTech on March 14, 2012. The information provided in this report will satisfy, in part, the environmental reporting requirements of Piedmont Landfill's Municipal Solid Waste Permit.

The groundwater level measurements taken during the above referenced sampling event were used to construct the groundwater surface contour map attached to this report as *Drawing No. 1*. A summary of groundwater elevations obtained during this and previous sampling events is provided in *Table 2*. The potentiometric contours and the groundwater flow directions presented in *Drawing No. 1* were used to calculate hydraulic gradients for the site. The hydraulic gradient calculations are provided in *Table 3*. The hydraulic gradients (**i**) ranged from 0.012 ft/ft to 0.028 ft/ft. These gradients are generally consistent with past interpretations for the site.

An effective porosity value (**n**) of 41 percent was used in the equation based on an average of six laboratory-derived porosities as reported in the April 1994 *Design Hydrogeologic Study*, prepared by RUST Environment & Infrastructure. Hydraulic conductivities (**K**) were also taken from the *Design Hydrogeologic Study*, and were based on slug test data from piezometers located nearest the respective groundwater flow paths. Using the gradient (**i**) along each flow path, the linear flow velocity (**V**) was estimated using the modified Darcy equation: $\mathbf{V = i\,K/n}$. The flow rate calculations are presented in *Table 4*.

As shown on *Drawing 1*, groundwater flow at the site is generally west to northwest. Segment i_1 was 20.6 feet/year to the north-northwest; Segment i_2 was 5.3 feet/year to the northwest; Segment i_3 was 10.6 feet/year to the west. The average groundwater flow rate for March 2012 was approximately 12.2 feet/year. These groundwater flow directions and velocities are consistent with those calculated during other recent events.

In summary, the groundwater measurements obtained during the March 2012 event are generally consistent with those obtained during previous sampling events. Based on this information, it is our opinion that the groundwater monitoring system continues to be adequate for the detection of the release of solid waste constituents to the environment.

TABLE 2
HISTORICAL GROUNDWATER ELEVATIONS

DATA	MONITORING WELL WATER LEVEL ELEVATIONS															
Well ID:	**MW-01**	**MW-02**	**MW-03**	**MW-04**	**MW-04D**	**MW-05**	**MW-06**	**MW-07**	**MW-08**	**MW-09**	**MW-09R**	**MW-10**	**MW-11**	**MW-11D**	**MW-12**	**MW-12D**
TOC Elevation:	823.93	778.04	770.08	756.92	757.33	743.17	800.82	771.57	748.95	770.62	764.95	777.20	776.80	776.36	751.48	751.53
Well Depth:	49.0	25.5	38.0	27.0	62.0	20.5	29.6	31.3	18.8	35.0	43.0	38.0	35.0	93.5	18.0	43.3
30-Jan-1998	781.82	750.71	746.26	745.46	745.46	738.49	779.84	744.32	744.30	737.47	NA	744.42	749.08	747.66	746.58	747.05
21-Jul-1998	784.78	750.06	746.76	743.92	743.78	737.14	781.04	745.07	741.20	738.96	NA	744.35	748.95	748.58	745.88	746.11
14-Jan-1999	780.98	749.16	744.91	744.27	744.16	737.60	777.86	743.57	742.68	736.62	NA	743.63	748.09	747.74	745.93	746.11
27-Jul-1999	780.48	749.08	744.86	743.26	743.28	734.04	777.52	743.92	740.53	737.12	NA	743.62	748.05	747.75	745.53	745.68
20-Jan-2000	780.30	748.51	744.83	744.77	744.43	737.82	777.27	743.87	743.18	NA	737.14	743.90	748.36	747.97	746.28	746.53
12-Jul-2001	780.10	748.73	745.30	742.88	743.06	737.08	776.81	744.25	740.40	NA	738.12	743.66	747.77	747.44	745.45	745.71
24-Jan-2001	778.93	748.91	744.43	744.69	744.73	737.72	775.84	743.40	743.41	NA	737.35	743.49	747.85	747.54	746.06	746.54
17,18-Jul-2001	779.59	748.41	744.61	742.72	742.78	736.76	776.08	743.92	739.99	NA	737.77	743.35	749.45	747.09	745.45	745.40
30,31-Jan-2002	777.29	748.14	743.08	743.09	743.49	737.37	773.72	742.57	742.17	NA	736.40	742.74	747.35	747.03	745.14	742.42
17,18-Jul-2002	776.47	747.29	742.88	741.80	741.93	736.48	772.97	742.57	738.97	NA	735.86	742.30	746.54	746.21	744.27	744.44
20,21-Jan-2003	777.12	748.14	745.45	743.87	743.96	737.40	775.08	744.06	742.51	NA	738.06	743.60	748.05	746.57	745.50	745.92
23,24-Jul-2003	782.10	749.48	748.08	743.92	743.83	738.07	778.39	745.53	742.74	NA	741.80	744.60	748.40	748.16	745.83	746.08
21,22-Jan-2004	781.75	748.89	746.57	743.77	743.84	737.36	778.02	744.37	742.30	NA	739.10	743.91	747.86	747.47	745.87	746.07
27,28-Jul-2004	780.80	748.24	745.18	742.27	742.43	736.77	776.65	743.96	739.65	NA	738.45	743.37	747.26	746.96	745.03	745.31
19,20-Jan-2005	780.38	749.11	745.43	744.35	744.37	737.97	777.46	744.56	743.35	NA	739.05	744.95	748.39	747.75	746.02	746.39
11,12,13-Jul-2005	780.55	748.59	744.82	742.81	742.87	735.22	777.51	744.96	740.87	NA	739.20	744.51	747.60	747.26	745.21	745.43
16,17,18-Jan-2006	778.76	748.58	744.75	744.03	744.13	737.77	776.53	744.19	743.40	NA	737.95	744.21	747.70	747.36	745.73	746.09
10,11,12-Jul-2006	779.27	748.17	744.47	743.69	743.58	737.39	776.09	744.08	741.90	NA	738.07	744.00	747.05	746.76	745.51	745.77
22, 23, 24-Jan-2007	781.16	749.52	745.64	744.30	744.30	738.22	778.37	745.67	743.79	NA	739.33	745.14	748.40	747.94	745.95	746.33
12,13-Sep-2007	781.71	747.84	743.58	741.65	741.58	736.57	773.75	744.06	738.53	NA	737.60	743.15	746.70	746.26	744.48	744.44
19-Mar-2008	780.19	749.02	744.26	744.04	744.04	737.91	777.94	744.85	743.34	NA	737.35	744.87	747.99	747.62	745.42	746.05
11-Sep-2008	779.78	747.53	743.05	742.03	741.98	736.92	775.93	743.93	739.86	NA	736.89	743.55	746.55	746.14	744.54	744.65
11-Mar-2009	779.55	749.34	744.67	743.91	744.14	737.96	777.02	745.84	743.52	NA	738.35	747.67	748.13	747.76	745.37	746.01
16-Sep-2009	780.08	747.87	743.28	741.69	741.56	736.64	775.82	744.64	738.49	NA	737.13	743.37	746.84	746.36	744.41	744.38
10-Mar-2010	781.45	750.17	745.87	744.22	744.21	738.17	779.04	748.14	743.24	NA	741.16	748.24	749.06	748.61	745.33	746.23
16-Sep-2010	781.85	748.47	744.64	742.51	742.53	737.22	777.86	745.57	740.03	NA	737.90	744.90	747.42	747.07	744.86	745.08
15-Mar-2011	780.68	749.36	745.05	743.89	744.35	738.29	778.17	746.17	743.74	NA	738.35	745.14	748.42	747.47	744.91	745.63
14-Sep-2011	779.51	747.58	742.58	742.01	741.95	736.34	775.42	744.48	739.28	NA	736.20	742.70	746.64	746.26	744.35	744.66
14-Mar-2012	779.74	748.97	744.85	743.92	743.91	738.05	777.61	746.82	742.95	NA	738.28	746.07	748.02	747.48	745.37	745.72

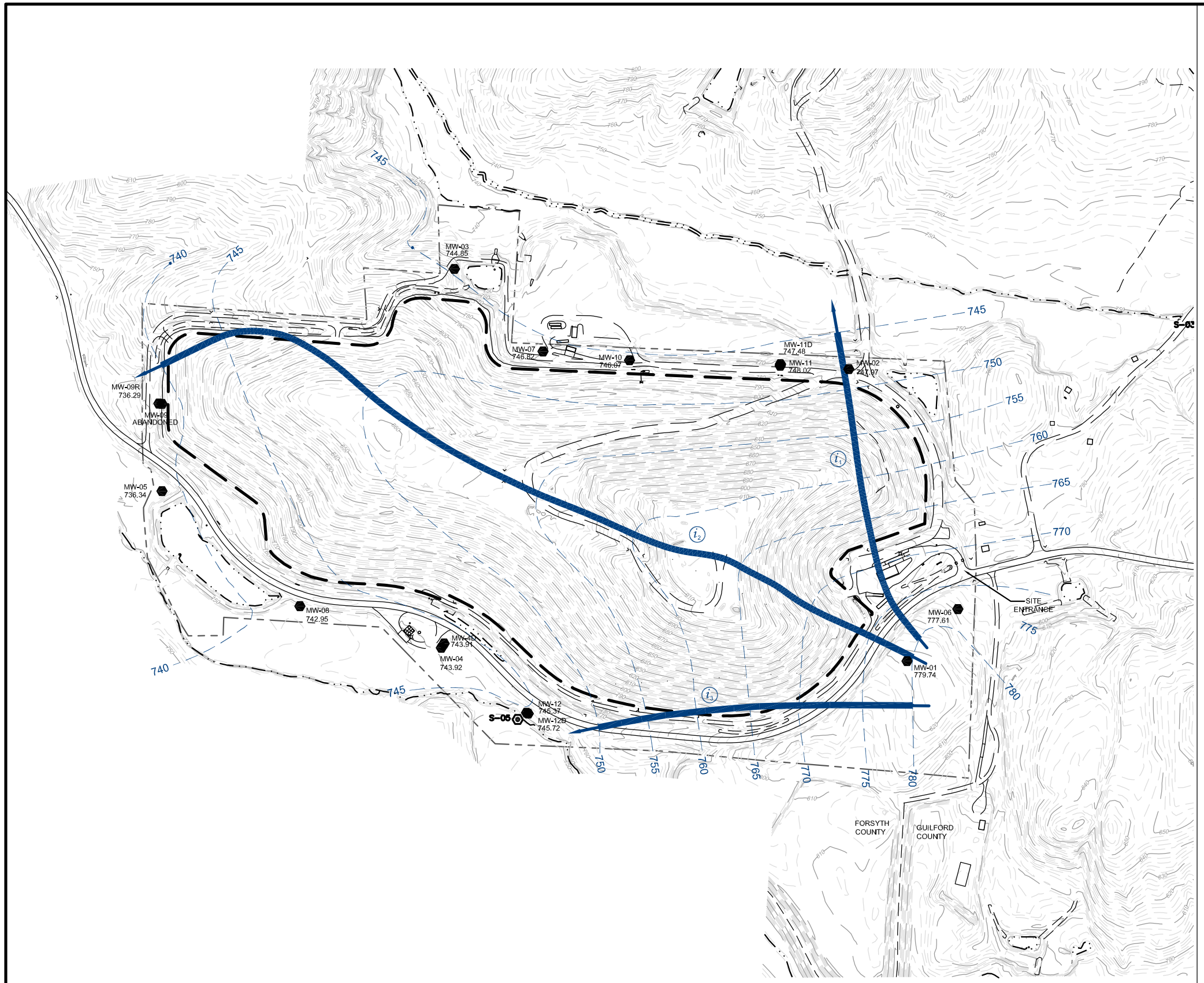
Notes:
TOC = Top of PVC casing.
All depths in feet measured from TOC.
TOC elevation for MW-02 is revised reflecting improvements were made to the well in July 2001 prior to sampling.
All water level elevations are reported in feet above mean sea level.
NA = data not available.

TABLE 3
GROUNDWATER FLOW RATE CALCULATIONS

GRADIENT CALCULATION SEGMENT	HYDRAULIC CONDUCTIVITY (K, cm/s)	HYDRAULIC CONDUCTIVITY (K, ft/s)	EFFECTIVE POROSITY (**n**, unitless)	FLOW SEGMENT LENGTH (ft)	FLOW DIRECTION	March 14, 2012		
						Elevation (ft AMSL)	**Gradient** (**i**, ft/ft)	**Velocity** (**V**, ft/yr)
i_1	2.90E-04	9.51E-06	0.41	1243	NNW	780 745	0.028	20.6
i_2	1.70E-04	5.58E-06	0.41	3249	NW	780 740	0.012	5.3
i_3	1.70E-04	5.58E-06	0.41	1217	W	780 750	0.025	10.6
						AVERAGE:	0.022	12.2

Note:

1. An effective porosity (“n”) of 41% was based on average laboratory-derived porosity as reported in the April 1994 Design Hydrogeologic Study, prepared by RUST Environment & Infrastructure.
2. Hydraulic conductivities (“K”) were also taken from the Design Hydrogeologic Study, and were based on slug test data from piezometers originally located nearest the respective groundwater flow paths.
3. V = i K / n



LEGEND

EXISTING 10' TOPOGRAPHIC CONTOUR	850
EXISTING 2' TOPOGRAPHIC CONTOUR	
APPROXIMATE LIMITS OF WASTE	
GROUNDWATER SURFACE CONTOUR [FEET ABOVE MEAN SEA LEVEL (AMSL)]	740
GROUNDWATER FLOW DIRECTION	
EXISTING ROAD	
CENTERLINE OF STREAM	
PROPERTY LINE	
GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION WITH STATIC WATER LEVEL ELEVATION (FEET AMSL)	MW-9R 738.28
SURFACE WATER MONITORING POINTS	S-03
SEGMENT USED FOR GRADIENT CALCULATIONS	i_4

NOTES:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. GROUNDWATER SURFACE CONTOUR INTERVAL = 5 FEET.
3. STATIC WATER LEVELS MEASURED ON 03/14/12.
4. GROUNDWATER CONTOURS BASED ON LINEAR INTERPOLATION BETWEEN AND EXTRAPOLATION FROM KNOWN DATA, TOPOGRAPHIC CONTOURS, AND KNOWN FIELD CONDITIONS. THEREFORE, GROUNDWATER CONTOURS MAY NOT REFLECT ACTUAL GROUNDWATER CONDITIONS.
5. TOPOGRAPHIC MAP AND SURVEYED WELL LOCATIONS PROVIDED TO JOYCE ENGINEERING, INC. BY PIEDMONT LANDFILL.
6. GROUNDWATER CONTOUR LINES SHOW THE WATER TABLE SHAPE AND ELEVATION. THESE CONTOURS ARE INFERRED LINES FOLLOWING THE GROUNDWATER SURFACE AT A CONSTANT ELEVATION ABOVE SEA LEVEL. THE GROUNDWATER FLOW DIRECTION IS GENERALLY PERPENDICULAR TO THE GROUNDWATER SURFACE CONTOURS, SIMILAR TO THE RELATIONSHIP BETWEEN SURFACE WATER FLOW AND TOPOGRAPHIC CONTOURS.
7. THE LOCATIONS OF SURFACE WATER MONITORING POINTS ARE APPROXIMATE AS SHOWN.

Well ID	Installation Date	Location Relative to Waste	Screened Interval (feet BGS)	Lithology of Screened Interval	Monitoring Program *
MW-01	07/13/89	Upgradient	44.0 - 49.0	WEATHERED GNEISS BEDROCK	Detection
MW-02	08/05/89	Downgradient	20.2 - 25.2	SILTY SAND	Detection
MW-03	08/06/89	Downgradient	32.5 - 37.5	SILTY SAND	Detection
MW-04	07/14/89	Downgradient	20.0 - 25.0	SILTY SAND	Detection
MW-04D	02/18/94	Downgradient	53.25-58.25	SAPROLITE/BEDROCK	Detection
MW-05	08/02/89	Downgradient	14.45 - 19.45	SILTY SAND	Detection
MW-06	08/09/93	Upgradient	20.9 - 25.9	SILTY SAND	Detection
MW-07	08/25/94	Downgradient	17.0 - 32.4	SILTY SAND	Detection
MW-08	08/31/94	Downgradient	5.0 - 20.0	SILTY SAND	Detection
MW-09	08/30/94	Downgradient	19.81 - 34.22	SAND/SAPROLITE BEDROCK	Abandoned
MW-09R	11/09/99	Downgradient	32.0 - 42.5	BEDROCK	Detection
MW-10	10/24/94	Downgradient	20.0 - 36.99	CLAYEY SILT/SILT	Detection
MW-11	11/17/94	Downgradient	19.01 - 34.22	SILT/SANDY SILT	Detection
MW-11D	11/15/94	Downgradient	81.82 - 91.79	SANDY SILT/GRAVELY SILT	Detection
MW-12	10/21/94	Downgradient	3.33 - 17.22	SILTY CLAY/SILTY SAND/SANDY SILT	Detection
MW-12D	10/27/94	Downgradient	31.98 - 42.2	SILTY GRAVEL	Detection

BGS = below ground surface

* Monitoring Program = status as of April 2012

GRAPHIC SCALE

0 100 200 400

(FEET)

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

DESIGNED RLW
DRAWN RWH
CHECKED RLW
APPROVED GVB
DATE 4-6/12

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PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

GROUNDWATER SURFACE MAP
MARCH 14,2012
PERMIT NO. 34-06

PROJECT NO.
392.1201.12.01

SCALE
AS NOTED

DRAWING NO.
1

N:\Dwgs\Drawings-Current\WM\Piedmont\GW EVENT MAPS\GW EVENT 04-12.dwg Layout=Layout1