DESIGN HYDROGEOLOGIC REPORT

WCA OF HIGH POINT CONSTRUCTION AND DEMOLITION LANDFILL
PHASE TWO
PERMIT NO. 41-16
GUILFORD COUNTY, NORTH CAROLINA

MARCH 2007

PREPARED FOR:

WCA OF HIGH POINT
5830 RIVERDALE DRIVE
JAMESTOWN, NORTH CAROLINA 27282

Carmen Johnson
Fac/Perm/Co ID # 41-16
Date 7/18/13
Doc ID#
DIN

PREPARED BY:

GOLDER ASSOCIATES NC, INC.
4900 KOGER BOULEVARD, SUITE 140
GREENSBORO, NC 27407
PROJECT NO. 063-6526.100

Golder Associates NC, Inc.

4900 Koger Boulevard, Suite 140
Greensboro, NC 27407
Telephone (336) 852-4903
Fax (336) 852-4904

April 18, 2007

Project No. 063-6526.100

Doc ID No. 4511

Department of Environment and Natural Resources
Division of Waste Management
Solid Waste Section
401 Oberlin Road, Suite 150
Raleigh, North Carolina 27605
919-508-8507

Attention: Mr. Brian Wootton
Hydrogeologist

Re: WCA of High Point C&D Landfill, Permit No. 41-16
Guilford County, North Carolina
Phase 2 Design Hydrogeologic Report and Water Quality Monitoring Plan

Dear Brian,

On behalf of WCA of High Point, LLC, Golder Associates NC, Inc. (Golder) is submitting the enclosed *Design Hydrogeologic Report for Phase 2 Expansion,* for the above-referenced facility. The *Water Quality Monitoring Plan* is included as an appendix to this report. If you have any questions, please contact the undersigned at 336-852-4903. We appreciate your assistance with this project.

Sincerely,
GOLDER ASSOCIATES NC, INC.

David "Dusty" Y. Reedy II, P.G.
Staff Hydrogeologist

Rachel P. Kirkman, P.G.
Senior Project Geologist

Enclosure

C: Mike McFeeley, Landfill Manager, WCA of High Point, 5830 Riverdale Drive, Jamestown, NC 27282, 336-886-3560
Vernon Smith, General Manager, WCA of North Carolina, 40 Estes Plant Road, Piedmont, SC 29673, 864-845-8355

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Facility Activity Tracker Report fo MRR SOUTHERN,LLC

Facility	MRR SOUTHERN,LLC	Permit #	4116	Type	MWP	Engr
Address	RIVERDALE DRIVE	County	Guilford	Status	Existing	Hydro

Doc ID #	X Ref #	Date	Phase	Function	Facility Notes
RCO2884		07/10/07	FCAR	General	Facility Compliance Audit Report; No New Violations. Compliance Order Issued 12/08/2006 in mitigation process.
RCO3177		12/19/06	GEN	Application	WCA Waste Corp. application for permit, Response to comments.
RCO827		11/16/06	ENF	General	Letter from Stephen R. Berlin in response to Paul Crissman's letter, dated August 15, 2006, in regards to the change in ownership of facilities permitted to MRR Southern, LLC and its subsudaries which facilities are owned and operated by WCA Waste Corporation, Inc.
RCO1103		11/08/06	FCAR	Inspection	Facility Compliance Audit Report; No Violations.
RCO3120		04/04/05	PTO	Modification	Cover letter for request for permit issuance. WCA of North Carolina, LP now owns MRR of High Point, LLC.

Facility	WCA OF HIGHPOINT, LLC	Permit #	4116	Type	CDLF	Engr
Address	RIVERDALE DR	County	Guilford	Status	Existing	Hydro

Doc ID #	X Ref #	Date	Phase	Function	Facility Notes
RCO3310		10/29/07	GWDM	GWDM Event	July 2007 sampling.
RCO3289	3286	10/25/07	PTO	General	Cover letter for PTO for Cells 4 & 5, and discussing ownership change.
RCO3286		10/23/07	PTO	Issuance	Permit to Operate issued for Cells 4 and 5. Also addresses ownership change, need to file certified copy of PTO with Register of Deeds under WCA of High Point, LLC, name.
RCO3246	3196	10/17/07	PTO	Review	Vernon Smith response to comments regarding property deeds.
RCO3196		10/10/07	PTO	Comments	DWM comments addressing PE certification, property discrepancies, purpose of deeds for tracts 1,2 and 3.
RCO2947		08/23/07	ENF	General	Letter to acknowledge that the penalty payment has been made and the conditions of compliance have been met to satisfy the Compliance Order With Administrative Penalty issued on 12/8/2006.
RCO2886		07/20/07	FCAR	Inspection	Facility Compliance Audit Report; No New Violations. Compliance Order Issued 12/08/2006 in mitigation process.
RCO2237		04/16/07	GWDM	GWDM Event	January 2007 sampling.
RCO927		01/04/07	FCAR	Inspection	Facility Compliance Audit Report; No New Violations. Compliance Order Issued 12/08/2006 unresolved.
RCO690		12/08/06	ENF	General	Compliance Order With Administrative Penalty of $2,250.00 issued pursuant to 15A NCAC 13B .0505(11)(a).
RCO826		11/16/06	ENF	General	Letter from Stephen R. Berlin in response to Paul Crissman's letter, dated August 15, 2006, in regards to the change in ownership of facilities permitted to MRR Southern, LLC and its subsudaries which facilities are owned and operated by WCA Waste Corporation, Inc.
RCO2115		09/13/06	GWM	GWDM Event	Second 2006 semiannual monitoring report. No inorganic or VOC constituents were reported above 2L.
RCO377		08/25/06	FCAR	General	Letter from Paul Crissman to Tom J. Fatjo, Jr. Of WCA Waste Corporations, Inc. requesting more information involving facilities permitted to MRR Southern, LLC and its subsidaries which facilities are owned and operated by WCA Waste Corporation, Inc.
RCO2114		03/15/06	GWM	GWAM Repor	1/06 sampling: No VOCs or metals detected in groundwater and surface water
RCO2113		10/13/05	GWM	GWDM Event	July 2005 Sampling. Data submitted on CD which has been loaded. No hits or exceedances.
RCO2112		04/15/05	GWM	GWDM Event	orginal db ID 206
RCO3599		07/21/03	PTC	Recordation	Deed recordation: Guilford County Book: 5836 Pages: 2154 to 2168.

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1.0 INTRODUCTION

In accordance with Title 15A of the North Carolina Administrative Code (NCAC) Subchapter 13B.0538(b), WCA of High Point, LLC (WCA) is submitting this Design Hydrogeologic Report for the Phase 2 lateral expansion of a construction and demolition debris (C&D) landfill. The WCA of High Point C&D Landfill operates under Permit No. 41-16 issued by the North Carolina Department of Environment and Natural Resources (NC DENR). The purpose of this report is to characterize the hydrogeologic conditions in and around the Phase 2 waste footprint and compliance boundary. The report will also provide the relationship of the site groundwater flow regime to local and regional hydrogeologic features, with emphasis on the relationship of C&D landfill units to potential groundwater receptors and groundwater discharge features.

2.0 SITE DESCRIPTION

The WCA of High Point C&D Landfill is located along Riverdale Drive in Guilford County, North Carolina (Figure 1). The site consists of approximately 154 acres, of which, approximately 12 acres is currently permitted as the Phase 1 waste unit. The proposed Phase 2 waste unit will be approximately 9.4 acres. The site location, property boundaries, and surrounding topography are shown on Figure 1. The site is located in the central portion of the Piedmont physiographic province on a group of knolls and valleys.

There are three small unnamed streams that traverse the site that flow into an unnamed tributary of Richland Creek, which forms the southern property boundary as shown on Drawing DH-1. The first unnamed tributary is a southwest trending stream that forms the northwestern property boundary. The second tributary is a southwest trending drainage in the center of the property and lies just east of the proposed Phase 2 waste unit. The third tributary is southwest trending drainage in the eastern portion of the site. A large man-made pond is located near the eastern property boundary. A small storm water basin was constructed in the northwest corner of the facility and a larger storm water basin was constructed along the southwestern part of the site during the construction of Phase 1.

The western portion of the site mainly consisted of trees and heavy brush before Phase 1 of the C&D landfill was constructed. Now, most of that area consists of landfill operations. The eastern portion of the site has historically been used for agricultural purposes. A reclamation facility is now located at the northernmost part of the site. A large portion of the surrounding properties are agricultural or owned by the City of High Point for operations associated with Kersey Valley Landfill.

3.0 FIELD INVESTIGATIONS

The following sections summarize the previous and current field investigation activities. Pertinent data from previous investigations are also summarized in select tables as described below.

3.1 Previous Investigations

The field activities associated with the Site Plan Application for the C&D landfill were performed in February through December 2002. That investigation consisted of the installation of 23 piezometers, a field survey of the new piezometers, the drilling of three geotechnical borings, the excavation and investigation of 20 test pits, well development and aquifer testing of selected piezometers, measurement of groundwater elevations, general site reconnaissance to locate outcrops, and performance of a magnetometer survey. Three piezometers (P-15S, P-12, and P-18) were later converted into monitoring wells (MW-4S, MW-5, and MW-6) and incorporated into the facility's compliance network. Three additional monitoring wells (MW-1, MW-2, and MW-3) were installed in September and October 2003, to be incorporated into the facility's compliance network. Piezometer P-2 was decommissioned on June 4, 2003, in order to begin construction of the reclamation facility. Ten piezometers (P-8, P-9, P-10, P-13S, P-13D, P-14, P-17, P-19, P-20, and P-21) were properly decommissioned on September 24-27, 2003, in order to begin construction of the Phase 1 waste cell. All piezometers that were within the proposed waste footprint were decommissioned by overdrilling to remove well construction materials, and then grouted with a cement-bentonite grout. The monitoring well and piezometer construction data are summarized in Table 1 and the locations are provided on Drawing DH-1. The Site Plan Application was approved by the Solid Waste Section in May 2003.

3.2 Current Investigation

The field activities for this investigation were performed from June through October 2006. The initial fieldwork consisted of the installation of 14 piezometers, a field survey of the new piezometers, well development and aquifer testing of selected piezometers, and measurement of groundwater elevations.

3.2.1 Drilling Program

Eleven piezometers (P-23, P-24, P-25, P-26S, P-26D, P-27, P-28, P-29, P-30S, P-30D, and P-31) were installed in and around the proposed Phase 2 footprint from June 29, 2006, to July 13, 2006. South Atlantic Environmental Drilling and Construction Company (SAEDACCO) of Fort Mill, South Carolina, performed drilling and well installation activities. The drilling equipment consisted of a Gus Pech GP-1100B drilling rig equipped with 4.25-inch and 6.25-inch inner diameter (ID) hollow-stem augers, HQ core barrel, 5.75-inch outer diameter (OD) tricone bit, and 6-inch OD downhole hammer. Continuous split-spoon samples were obtained and logged by the geologist for all of the boreholes, except in locations where nested piezometer pairs were installed. A licensed Golder geologist was present to observe the drilling and rock coring, log the boreholes and supervise the piezometer construction. An experienced Golder representative developed piezometers selected for aquifer testing. The boring logs, well and piezometer construction records, and well development forms for the newly installed piezometers are included in Appendix DH-A. The piezometer construction data are summarized in Table 1 and the locations are provided on Drawing DH-1. Well and piezometer construction was performed in accordance with the standards described in the *RCRA Technical Enforcement Guidance Document* (1986) and the *Draft North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities* (1995).

Two of the piezometer locations were chosen for rock coring. Rock core was taken at P-26D and P-30D. Approximately 8 feet of rock core were obtained from P-26D and approximately 20 feet of rock core were obtained from P-30D. Coring was performed using an HQ rock coring device. The rock core data are summarized in Table 2.

Three additional shallow piezometers (HA-3, HA-4, and HA-5) were installed on July 11, 2006, along the drainage east of the proposed Phase 2 footprint, which was inaccessible by the drilling rig. These piezometers were installed using a hand auger by an experienced Golder geologist.

Piezometers HA-3, HA-4, and HA-5 were installed in saprolite and range in depth from 2.5 to 5 feet with screens lengths that range from 1 to 4 feet. Piezometers P-26S, P-30S, and P-31 were installed at the partially weathered rock (PWR) and range in depth from 28 to 45 feet with screen lengths that range from 10 to 15 feet. Piezometers P-23, P-24, P-25, P-26D, P-27, P-28, P-29, and P-30D were installed in bedrock and range in depth from 25 to 74 feet with screen lengths that range from 10 to 15 feet in length.

Unless specified below, piezometers were grouted to the surface and lockable expansion caps installed in each casing. Piezometers P-23, P-30S, P-30D, and P-31 were covered by lockable anodized aluminum protective casings installed into 3x3x0.5-foot concrete aprons to protect their integrity. Any other piezometers that may be converted into monitoring wells will have lockable anodized aluminum protective casings and concrete aprons installed prior to the first sampling event.

On September 18, 2006, piezometers P-23, P-26S, P-30S, and P-30D were developed with a submersible pump to remove accumulated sediments resulting from the drilling and construction process, and to hydraulically connect the piezometers with the surrounding soils. On September 19, 2006, piezometer P-30S was further developed with a submersible pump. Also, piezometers P-25 and P-27 were developed with disposable bailers and P-26S was further developed with a disposable bailer. All piezometers were purged dry during development. Because of the small yields from each of the piezometers, approximately 7.5 to 17 gallons of water were purged from each piezometer during development. Any other piezometers that will be converted into permanent monitoring wells will be developed using similar procedures prior to the first sampling event.

The newly installed piezometers, MW-5, and a springhead in the drainage east of the proposed Phase 2 waste unit were surveyed in August 2006 by Fleming Engineering, Inc. of Greensboro, North Carolina. The height for well MW-5 had been modified during previous site activities. Elevations and horizontal locations were referenced to the N.C. Grid Coordinate System. The piezometer survey map and a sealed letter prepared by Fleming Engineering, Inc. are provided in Appendix DH-B.

A historical summary of the static groundwater elevations for all wells and piezometers is included in Table 3. When possible, static water level measurements were collected at the time of drilling, approximately 24 hours after construction, and on or about seven days after construction. Water levels were periodically measured for all existing site monitoring wells and Phase 2 investigation piezometers during additional site visits through October 2006.

3.2.2 Soil Testing

Soil samples were collected from each piezometer location during drilling activities. Standard penetration tests were performed at 5-foot intervals for each boring using a 2-foot long split spoon sampler, except where nested piezometer pairs were installed. Soil samples from the split spoons were collected so that select samples could be reviewed at a later date or sent to a soil testing laboratory. Undisturbed soil samples were collected using Shelby Tubes at select boring locations to be analyzed at a soil testing laboratory. Bulk samples were collected from drilling cuttings in materials too dense to be collected using Shelby Tubes at select piezometer locations to be analyzed by a soil testing laboratory.

Soil samples were sent to the Golder Associates Inc. Soil Testing Laboratory in Atlanta, Georgia. Soil samples sent to the laboratory consisted of two Shelby Tubes (P-24 (2'-4') and P-30D (3'-5')) and two bulk samples (P-26S (10'-13') and P-30D (16'-19')). Samples were analyzed for gradation, Atterberg limits, USCS classification, permeability, total porosity, total unit weight, and moisture content. The results of the soil analysis are summarized in Table 4 and the laboratory report is provided as Appendix DH-C.

3.2.3 Hydrogeologic Testing

The groundwater elevations of newly installed monitoring wells were measured at the time of well construction and approximately 24 hours and 7 days after well construction. The groundwater elevations of existing piezometers and newly installed piezometers were measured periodically and data are summarized in Table 3. The measurements were collected using a decontaminated electric water level indicator. The surveyed point on the top of the well casing was used as reference, and the measurements were recorded to within 0.01 foot. The groundwater elevation data collected on July 25, 2006, were used to construct a groundwater surface contour map and to infer groundwater flow directions at the site (Drawing DH-2).

Following rigorous development, six piezometers (P-23, P-25, P-26S, P-27, P-30S, and P-30D) were chosen for aquifer testing (slug tests) during the field investigation. The purpose of the testing was to assess the values of horizontal hydraulic conductivity at various hydrogeologic units within the aquifer at the site. In situ rising- and falling-head slug tests were chosen for the assessment due to the relatively low well yields noted during well installation and development.

Slug tests were conducted on September 20, 28, and 29, 2006, and October 12, 2006, by experienced Golder representatives. Rising- and falling-head tests were performed on piezometers P-23, P-25, P-26S, P-27, and P-30D. Prior to slug testing, the piezometers were opened and groundwater levels were allowed to equilibrate. Water level measurements were then collected using an electric water level indicator referenced to a point on the top of casing. A 15 pounds per square inch (psi) pressure transducer was then lowered inside the well casing and placed 10 to 15 feet below the top of the water table. A polyvinyl chloride (PVC) slug measuring 5 feet in length was then used to displace water inside the piezometers.

The first portion of the test was a falling-head test that measured the rate water levels fell back to static levels after the injection of the PVC slug. The transducer recorded water level data from the transducer at logarithmic time intervals. Data from the transducer were verified with hand

held water level measurements. Falling-head tests were terminated after water levels had recovered to within at least 99% of their pre-test level. A rising-head test was performed on each well after the falling-head test was completed. The rising-head test was performed with the same methodology as the rising-head test with the exception that the PVC slug was removed simultaneously with the start of the test.

In situ rising- and falling-head tests provide a quantitative estimate of horizontal hydraulic conductivity and a qualitative estimate of aquifer anisotropy in water-bearing units. The slug test data were analyzed using the Bouwer and Rice (1976 and 1989) equation, which is applicable to fully or partially penetrating wells in unconfined or confined aquifers. Piezometer specific aquifer thicknesses of 12.6 to 17.6 feet were assumed for the partially weathered rock (PWR) hydrogeologic unit based upon information available from the boring logs. Aquifer thicknesses of 25-50 feet were assumed for the bedrock hydrogeologic unit. A Computer software AQTESOLV, produced by HydroSOLVE, Inc., was utilized to assist in the analysis and plotting of data. The individual data points and computer plots of time versus groundwater displacement are presented in Appendix DH-D. A summary of aquifer testing performed at the site is included in Table 5. A geometric mean for hydraulic conductivity values for each of the hydrogeologic units was calculated as shown on Table 5.

4.0 REGIONAL AND LOCAL GEOLOGY

This section describes the geology in the region of the landfill and site specific geological conditions that may affect the performance of engineered features upon the land surface in the proposed cell area, the groundwater flow regime, and the ability to effectively monitor water quality at the site.

4.1 Regional Geology

The WCA of High Point C&D Landfill is located within the Carolina Slate Belt, which is in the Central Piedmont physiographic province. A portion of 1985 State Geologic Map produced by the North Carolina Geological Survey showing the area around the WCA of High Point C&D Landfill is provided as Figure 2. Geologic unit designations and descriptions used in this report are defined on the *Geologic Map of Region G, North Carolina* (P. Albert Carpenter, III, 1982) and in *The Central Piedmont* (Butler and Secor, 1991).

Generally, the regional geology of the Carolina Slate Belt consists of Late Proterozoic to Cambrian volcanic and greenschist-facies metasedimentary rocks intruded by plutonic suites (Butler and Secor, 1991). The site geology is characterized by a regional-scale felsic intrusive complex, which consists mainly of white to gray, fine to coarse grained, massive to foliated metamorphosed granitic rocks. In several areas granodiorite, quartz diorite, and quartz monzonite are also present. Local shearing is common within Guilford County. The region is characterized by regional and small scale Mesozoic diabase dikes, and may locally be the dominant rock type. Several small gold and copper mines are mapped within the area (P. Albert Carpenter, III, 1982). No evidence of mining activity has been found at the site.

4.2 Local Geology

During the field activities associated with the Site Plan Application performed in 2002, several exposures of massive granite were found on hillsides and in stream exposures. In general, the granite is phaneritic and contains biotite, feldspar, and quartz. A strong preferential foliation was noted in some rock core while only a slight preferential orientation was noted in others. Other outcrops of granite were massive in nature, with very little to no observed structure or foliation. Quartz veins of varying sizes were noted in severely weathered outcrops near the pond. One severely weathered outcrop of metamorphic phyllite was also noted near the pond.

The region is characterized by regional and small scale Mesozoic diabase dikes, although no large scale dikes are mapped within the area in and around the site. Most of the dikes are near vertical in dip and trend north-south to northeast-southwest and are characterized by plagioclase, augite and olivine (Ragland, 1991). The diabase found in site exposures is aphanitic and black to green depending on the degree of weathering.

Three hydrogeologic units have been identified on site. They consist of the saprolite, PWR, and bedrock. For the purpose of this investigation, the saprolite hydrogeologic unit consists of in-place media below the water table with standard penetration test (SPT) results of less than 50 blows per 6 inches with a split spoon sampler. The PWR hydrogeologic unit is media below the water table with SPT results of greater than 50 blows per 6 inches with a split spoon sampler, but above auger refusal. For this investigation, auger refusal defines the top of bedrock for the site. Therefore, the bedrock hydrogeologic unit is media below the water table and below the depth that auger refusal was encountered. Bedrock elevation contours were constructed based on auger refusal data from on site borings on Drawing DH-3. The hydrogeologic units are described in the sections below.

4.2.1 Saprolite Hydrogeologic Unit

As stated above, the saprolite hydrogeologic unit consists of in-place media below the water table with SPT results of less than 50 blows per 6 inches with a split spoon sampler. Though saprolite appears to be continuous across the proposed Phase 2 area, it appears to have limited extent as a hydrogeologic unit. The only piezometers that encountered the water table in saprolite at the time of drilling and piezometer installation in and around the proposed Phase 2 footprint were the hand-auger piezometers HA-1, HA-3, HA-4, and HA-5. All four of these piezometers are located in a drainage feature east of the proposed phase. The other 17 piezometers installed in and around the proposed Phase 2 area encountered the saprolite unit above the water table. One piezometer (P-23) has a stabilized groundwater elevation that intersects the saprolite hydrogeologic unit. The PWR hydrogeologic unit was not identified during the drilling of P-23. Based on the groundwater elevation collected on July 25, 2006, piezometer P-23, which is screened in the bedrock hydrogeologic unit, had a groundwater elevation that extended approximately 1.6 feet into the saprolite. This is likely the result of a potentiometric head generated from a semi-confined condition within the bedrock hydrogeologic unit and may not be representative of the true groundwater surface; however, the groundwater elevation for this well was included in the groundwater contour map included as Drawing DH-2.

Across the proposed Phase 2 area, saprolite ranges in thickness from 4 to 10.5 feet. The Unified Soil Classification System (USCS) particle-size classification of this media, based on field observations and laboratory testing, consists primarily of silty sand. Clayey sand was determined to be present, based on laboratory testing, near the eastern property boundary. The soil seems to be more developed in the eastern portion of the site with greater variability, but in the area of proposed Phase 2 waste unit the soil seems to be fairly uniform, lacking much vertical and horizontal variability.

During the Site Application investigation, the soils at piezometer P-16 were saturated above the true water table at the time of drilling and continue to have anomalous water level measurements. The groundwater elevation for this well was not included in the groundwater contour map included as Drawing DH-2. Though the boring log for P-16 only indicates silty sand and PWR consisting of silty sand, clay-rich horizons are believed to cause the vertical retention of percolating water as further discussed below in section 5.2. Piezometer P-16 is the only existing well in the proposed Phase 2 area that shows anomalous water level readings. Therefore, the clay-rich horizon is not expected to be continuous and is not considered a separate hydrogeologic unit. Also, it appears that the vertical retention of percolating water has little affect, if any on the overall groundwater flow regime.

During the Site Plan investigation, four samples from borings were analyzed by a soil testing laboratory and are summarized in Table 4. These samples were collected from the Phase 1 area and the eastern portion of the site. During the current investigation, two samples were collected from in or around the Phase 2 area and were analyzed by a soil testing laboratory and are summarized in Table 4 and included as Appendix DH-C. Laboratory soils classifications of two undisturbed (Shelby tube) samples from the current investigation were defined as silty sand utilizing the USCS. Effective porosity calculations were performed utilizing the soil testing results and the textural classification triangle (Johnson, 1967). The effective porosity calculations of 23 and 24 percent are similar to those typically assigned to Piedmont saprolite of approximately 0.20 (Harned and Daniel, 1989). Laboratory derived permeabilities for the samples were 4.5E-06 centimeters per second (cm/sec) and 2.3E-04 cm/sec.

Aquifer tests for one piezometer (P-2) screened in saprolite hydrogeologic unit were performed during the Site Plan investigation. Though this piezometer is not in the proposed Phase 2 area, the hydrogeologic properties are assumed to be similar. Hydraulic conductivities are expected to be on the order of E-05 to E-04 cm/sec, based on slug test data from P-2 that is summarized in Table 5. The geometric mean of P-2's rising- and falling-head tests is 4.8E-05 cm/sec.

Groundwater within the saprolite hydrogeologic unit in and around the Phase 2 footprint is expected to be stored and transmitted in pore spaces, and the material can be reasonably described as hydraulically isotropic. The saprolite hydrogeologic unit is considered to represent a limited hydrogeologic unit for the area in and around the proposed disposal area.

4.2.2 Partially Weathered Rock Hydrogeologic Unit

As stated above, the PWR hydrogeologic unit is media below the water table with SPT results of greater than 50 blows per 6 inches with a split spoon sampler, but above auger refusal. The

PWR hydrogeologic unit is highly variable across the proposed Phase 2 area. The unit was not identified in borings P-23 or P-29 and ranges in thickness across the Phase 2 area from 3 to 33.5 feet in piezometers that did encounter the unit. Only three borings (P-26S, P-30S, and P-31) encountered PWR below the water table during drilling and piezometer construction. These piezometers are located near the drainage feature east of the proposed phase and have thicker than average PWR zones. Two additional piezometers (P-25 and P-28) have stabilized groundwater elevations that intersect the PWR hydrogeologic unit. Based on the groundwater elevations collected on July 25, 2006, piezometers P-25 and P-28, which are screened in the bedrock hydrogeologic unit, had groundwater elevations that extended approximately 1.4 and 0.5 feet into the PWR, respectively. This could be the result of a potentiometric head generated from a semi-confined condition within the bedrock hydrogeologic unit and not representative of the true groundwater surface; however, the groundwater elevations for these wells were included in the groundwater contour map included as Drawing DH-2.

During the Site Plan investigation, four samples from borings were analyzed by a soil testing laboratory and are summarized in Table 4. Three of these samples were collected from outside of the Phase 2 area; the sample collected from the P-14 boring was collected from within the proposed waste unit. During the current investigation, two samples were collected from in or around the Phase 2 area and were analyzed by a soil testing laboratory and are summarized in Table 4 and included as Appendix DH-C. The two samples collected during the current investigation were collected as bulk samples because the material was too dense to collect undisturbed samples. The USCS particle-size classification of PWR, based on field observations and laboratory testing, consists mainly of silty sand with some locations classified as silty clay or clayey sand. Effective porosity calculations were performed utilizing the soil testing results and the textural classification triangle (Johnson, 1967). The effective porosity calculations for samples collected in and around the proposed Phase 2 footprint for the PWR hydrogeologic unit range from 13 and 28 percent. Laboratory derived permeabilities for those samples were 5.8E-05 cm/sec and 7.9E-04 cm/sec.

An aquifer test for one piezometer (P-7) screened in the PWR hydrogeologic unit was performed during the Site Plan investigation. Though this piezometer is not in the proposed Phase 2 area, the hydrogeologic properties are assumed to be similar based on proximity and similar soil types. During the current investigation, aquifer tests for two piezometers in and around the proposed Phase 2 footprint were performed. Hydraulic conductivities for the PWR hydrogeologic unit are expected to be on the order of E-05 cm/sec with a geometric mean of 2.1E-05 cm/sec (Table 5).

Based on field observations, laboratory soils testing, and aquifer tests, the composition of the PWR hydrogeologic unit is similar to the predominantly silty sands that overlay it in the saprolite hydrogeologic unit. Therefore, the PWR unit is difficult to distinguish from the saprolite unit based solely on its soil classifications and hydraulic properties. However, it is visually distinct from the saprolite unit due to the prominent granitic fabric and fresh feldspar, quartz, and biotite grains observed in drill cuttings and soil samples. Also, a significant increase in blow counts is associated with the transition into the PWR unit as seen in the boring logs in Appendix DH-A.

Groundwater within the PWR hydrogeologic unit in and around the Phase 2 footprint is expected to be stored and transmitted in pore spaces, and the material can be reasonably described as

hydraulically isotropic. The saprolite may have areas that exhibit relict foliation and these structures can result in locally anisotropic groundwater flow directions. Though the PWR hydrogeologic unit is limited in vertical and lateral extent across the proposed Phase 2 area, the unit is considered to represent an important hydrogeologic unit for the area in and around the proposed disposal area, especially at the compliance boundary.

4.2.3 Bedrock Hydrogeologic Unit

As stated in Section 4.2, the bedrock hydrogeologic unit is media below the water table and below the depth that auger refusal was encountered. The uppermost aquifer for much of the proposed Phase 2 area is in the bedrock hydrogeologic unit. Of the 21 piezometers installed in and around the proposed Phase 2 waste unit, 7 piezometers were screened in a hydrogeologic unit other than bedrock. Bedrock is shallow in the proposed Phase 2 footprint with top of bedrock depths ranging from 5 to 20 feet below ground surface. In the low lying drainage areas east and south of the proposed Phase 2 area, the depth to bedrock increases to 28 to 43 feet below ground surface as groundwater transitions to the saprolite and PWR hydrogeologic units, based on boring logs for P-26S/D and P-30S/D piezometer pairs.

During the field work associated with the Site Plan investigation, geologic mapping of the site did not reveal significant fracture patterns, fabrics, or joint patterns in rock outcrops that would cause preferential groundwater flow. Some horizontal fracture patterns were noted in outcrops, which is to be expected in massive plutonic complexes.

During the Site Plan investigation, bedrock was cored at five boring locations. One of these rock coring locations (P-10) is located in the proposed Phase 2 footprint. During the current investigation, rock coring was performed at two locations in the proposed Phase 2 area at piezometers P-26D and P-30D. Based on the data from the three rock core locations in and around the proposed Phase 2 footprint, the upper portion of the bedrock hydrogeologic unit is highly variable across the Phase 2 area. At piezometers P-10 and P-26D, the PWR unit transitions quickly to bedrock within 10 to 18 feet below where PWR was first encountered. At P-30D, the PWR unit is 33.5 feet thick based on auger refusal, but bedrock continues to be highly weathered through the 27 feet of bedrock that the boring was advanced through. This is supported by the rock quality designation (RQD) acquired from each core run performed in the borings. Core runs at piezometers P-10 and P-26D had RQDs that range from 89 to 100 percent. The RQDs at P-30D range from 31 to 82 percent. A summary of all rock core data collected at the site is provided on Table 2.

The composition of the bedrock is very similar at the three rock core locations in and around the proposed Phase 2 footprint. The prominent rock type is granite composed of quartz, feldspar, and biotite. All three locations show a preferential orientation of biotite, which typically dips approximately 55 degrees. Photographs of the rock core are provided as Figure 3. Fractures commonly occur along this preferential orientation, especially in the more competent rock. In the highly weathered bedrock, fractures may sometimes cross the preferential orientation of biotite at a nearly perpendicular angle. As observed in rock cores, weathered bedrock is typically highly fractured, while competent bedrock has very few fractures, which is typical of bedrock in the Piedmont terrane.

An effective porosity of 9 percent is assumed for the bedrock hydrogeologic unit based on Heath, 1982. Aquifer tests of four piezometers screened in the bedrock hydrogeologic unit were performed during the Site Plan investigation. Only one of the piezometers is located in the proposed Phase 2 footprint, but the hydrogeologic properties of the other piezometers are assumed to be similar to those in the Phase 2 area based on proximity. During the current investigation, aquifer tests of four piezometers in and around the proposed Phase 2 footprint were performed. Hydraulic conductivities for the bedrock hydrogeologic unit are expected to be on the order of E-06 cm/sec and E-05 cm/sec with a geometric mean of 9.5E-06 cm/sec (Table 5). Hydraulic conductivities of the fractured bedrock unit are expected to fall within this range, and vary locally with fracture intensity. Hydraulic conductivities for the bedrock aquifer are expected to be low due to the generally highly competent nature of the granite that underlies the site, as described below.

Based on the data provided above, groundwater flow through the bedrock hydrogeologic unit is expected to be limited along the topographic highs were bedrock becomes competent relatively quickly below auger refusal, as seen at P-10 and P-26D. Groundwater flow is expected to increase along the slopes of drainage features where bedrock is highly weathered and the groundwater surface transitions to the overlying hydrogeologic units.

4.2.4 Diabase Dikes

In May 2002 during the Site Application field work, a magnetometer survey was performed at the site as part of the Site Plan investigation. This geophysical survey included the proposed Phase 2 area. A large area with magnetic anomalies was identified trending northeast through the center of the site. Though other magnetic anomalies were identified, this was the only one that transected the proposed Phase 2 waste unit, as seen on Drawing DH-3. These anomalies are interpreted as diabase dike swarms, as opposed to large-scale diabase dikes. This interpretation is based on field observation of diabase dike outcrops in the tributary of Richland Creek along the southern property boundary, which occurred in swarms. Also, granite outcrops were identified in areas with magnetic anomalies, showing the inconsistent nature of the features. The diabase dike swarm interpretation is supported by the shape of the anomalies. The magnetic anomalies shown on Drawing DH-3 have somewhat random shapes and do not appear linear.

Diabase was encountered in seven of the piezometer borings (P-10, P-11, P-23, P-26D, P-29, P-30S, and P-30D) during drilling in and around the proposed Phase 2 footprint. Only two of those borings (P-11 and P-29) are located in the area of the magnetic anomalies shown on Drawing DH-3. In each boring that encountered diabase, the utra-mafic rock appeared in relatively thin zones that range from 1 to 5 feet thick. Borings P-11, P-26D, and P-30D encountered multiple zones of diabase supporting the interpretation that the diabase dikes on site appear in swarms. Based on the rock cores, the diabase appears to weather at a similar rate as the country rock it intersects.

It is interpreted that diabase dikes occur across the Phase 2 area as small, discontinuous, swarms within the granite. Significant fractures associated with the diabase dikes is not expected, based on the small size of the dikes, and if present they are expected to have little impact on

groundwater flow. This is supported by the groundwater surface contour map (Drawing DH-2) and the cross-sections (Drawing DH-5), which do not show any mounding of groundwater that could result from impenetrable zones of diabase or preferential flow that could result from fracture zones in the granite formed during the intrusion of the dikes.

5.0 SITE HYDROGEOLOGY

The following section discusses the hydrogeologic aspects of the site, with emphasis on the proposed Phase 2 area. A significant amount of hydrogeologic investigation was performed in and around the proposed phase 2 footprint. During the original Site Plan investigation, 4 piezometers (P-9, P-10, P-14, and P-16) were installed in the proposed Phase 2 footprint. Two additional piezometers (P-8 and P-11) were installed in close proximity to the proposed footprint. Rock core was collected in 7 piezometer borings, including 1 in the proposed Phase 2 footprint. Also during that investigation, a geophysical survey for diabase dikes and test pits were dug across the site, which included the Phase 2 area. During the Phase 2 hydrogeologic investigation, 14 additional piezometers were installed in and around the proposed Phase 2 footprint and rock core was collected from 2 of these borings.

5.1 Hydrology and Discharge Features

As discussed in section 2.0, topography at the site consists of knolls and valleys that range from 700 to 820 feet above mean sea level as seen on Figure 1. Surface water and groundwater at the site flows south to southwest towards a tributary of Richland Creek. Richland Creek is approximately 1300 feet south of the site and flows to the Deep River, which is approximately 0.5 miles from the site. This tributary is approximately 1300 feet south of the property line and the Deep River is approximately 0.5 mile east of the site. Groundwater beneath the site flows in three distinguishable and vertically interconnected hydrogeologic units; saprolite, PWR, and bedrock.

5.2 Unsaturated Zone of Water Accumulation

During the 2002 field investigation, unusually high groundwater elevations were measured in several piezometers (P-4A, P-12, P-13S, P-16, and P-17). In order to explain these anomalous measurements, additional piezometers were installed and test pits were excavated adjacent to piezometers with anomalous groundwater measurements.

During the installation of the test pits, water seeped in from depths of approximately 3 to 5 feet below ground surface. The origin of the water often coincided with the occurrence of orange/gray mottled clayey sand or sandy clay horizons. In most of the test pits that encountered water, the water entered the excavations at depths above the anticipated stabilized water table. The water levels in many of the test pits and piezometers dropped significantly over time. The anomalous water levels are believed to be the result of the accumulation of water percolating through the unsaturated zone due to the low permeability of clay-rich saprolitic horizons.

Piezometer P-16, one of the wells with anomalous groundwater measurements, is located in the Phase 2 area. During the current investigation, groundwater measurements of P-16 are still

elevated compared to surrounding piezometers. During the drilling investigation in 2006, the shallow clayey horizons were not encountered and no anomalous water levels were recorded in the newly installed piezometers. Therefore, the clayey horizons do not appear to be continuous across the Phase 2 area. It is believed that much of the accumulated water was drained during the excavation of these soils during construction of the Phase 1 waste unit.

5.3 Groundwater Flow Regime

As previously discussed, shallow groundwater flow (upper 50 feet) occurs in 3 vertically interconnected hydrogeologic units: saprolite, PWR, and bedrock. The groundwater surface based on water level measurements taken on July 25, 2006, is shown on Drawing DH-2 and the historical groundwater surface elevations are summarized in Table 3. Groundwater flow arrows on Drawing DH-2 and site-specific data were used to determine groundwater flow velocities. Several hydrogeologic cross-sections are provided to illustrate the vertical component of groundwater flow on Drawings DH-4 and DH-5. Groundwater in all three hydrogeologic units beneath the proposed Phase 2 waste unit flows towards and discharges to streams along the western and southern property boundaries and discharge to the Deep River as seen on Figure 1.

Given the competence of the bedrock unit along the knolls, it is expected that a significant amount of *interflow* occurs in the unsaturated zone as discussed in Fetter, 1988. Based on site-specific hydrogeologic characteristics, groundwater is expected to move laterally more than vertically, thus limiting the amount of aquifer recharge occurring in the bedrock unit in and around the proposed Phase 2 footprint.

5.3.1 Saprolite Hydrogeologic Unit

As discussed in section 4.2.1, the saprolite hydrogeologic unit is limited in lateral extent in the proposed Phase 2 area. The only area identified where groundwater was located in saprolite is in the drainage feature east of the proposed waste unit. The saprolite hydrogeologic unit is expected to behave as a relatively isotropic, porous medium, where groundwater flow directions are expected to mimic topography. Locally, variation in soil type, clayey horizons, and hydrogeologic structures may cause an irregular groundwater surface and/or flow paths.

5.3.2 Partially Weathered Rock Hydrogeologic Unit

As discussed in section 4.2.2, the PWR hydrogeologic unit is limited in the proposed Phase 2 area. The unit was not identified in two borings (P-23 and P-29) in the Phase 2 investigation area, and only three borings (P-26S, P-30S, and P-31) encountered PWR below the water table during drilling and piezometer construction. These piezometers are located near the drainage feature east of the proposed phase and have thicker than average PWR zones. Two additional piezometers (P-25 and P-28) have stabilized groundwater elevations that intersect the PWR hydrogeologic unit, but this could be the result of a potentiometric head generated from a semi-confined condition within the bedrock hydrogeologic unit and may not be representative of the true groundwater surface as described above.

The upper part of the PWR hydrogeologic unit is expected to behave as a relatively isotropic, porous medium, where groundwater flow directions are expected to mimic topography. With increasing depth, groundwater flow within the PWR is expected to occur in fractures. Based on rock cores within the PWR unit and upper bedrock unit, the lower PWR is expected to be highly fractured with random orientations. The rock cores and split spoon samples do not indicate a prominent fabric or structure are not likely to control groundwater flow direction. Therefore, groundwater within the lower portion PWR unit is expected to mimic topography.

5.3.3 Bedrock Hydrogeologic Unit

As discussed in section 4.2.3, bedrock is the prominent hydrogeologic unit underneath the proposed Phase 2 footprint. Groundwater flow in the bedrock hydrogeologic unit occurs in fractures. Based on rock cores, the bedrock is expected to be highly fractured with random orientations on the side-slopes leading to drainage features, where the top of groundwater is transitioning from the bedrock to the overlying units. Groundwater in these highly weathered, highly fractures areas is expected to mimic topography.

On the knolls, competent bedrock occurs at relatively shallow depths with limited fractures. Fractures are typically aligned with preferential biotite orientations, which seem to vary laterally. As noted in section 4.2.2, the groundwater elevations measured from piezometers screened in the bedrock hydrogeologic unit may be slightly elevated, representing potentiometric heads rather than the groundwater surface. These effects are expected to be minimal with bedrock fractures interconnecting with the overlying units causing groundwater flow to mimic topography.

5.3.4 Horizontal Gradient Calculations

Horizontal hydraulic gradients for the proposed Phase 2 area were calculated using gradient segments from the July 25, 2006, groundwater surface contours shown on Drawing DH-2. Groundwater flow within the proposed Phase 2 area occurs predominantly in the bedrock hydrogeologic unit; groundwater flow in the monitoring zone downgradient of Phases 1 and 2 occurs predominantly above bedrock).

Hydraulic conductivity estimates were obtained from single well aquifer tests (slug tests), which are summarized on Table 5. Hydraulic conductivity values generated by slug test recovery data on individual wells are considered to be higher than actual conductivities for site-scale movement of groundwater. Curves generated during the analysis of slug test recovery data are typically impacted by near-field, or skin effects, and are reflective, in part, of the properties of the well screen filter pack judged to have greater hydraulic conductivity than the surrounding in-situ soils. The hydraulic conductivities for saprolite range from 1.9E-05 to 1.2E-04 cm/sec, with a geometric mean of 4.8E-05. The hydraulic conductivity for PWR ranges from 1.1E-05 to 4.7E-05 cm/sec, with a geometric mean of 2.1E-05. The hydraulic conductivity for bedrock ranges from 1.2E-06 to 4.8E-05 cm/sec, with a geometric mean of 9.5E-06. The geometric mean of the three hydrogeologic units combined is 1.4E-05 cm/sec.

The average horizontal gradients for gradient calculation segments along with the geometric mean for available hydraulic conductivity values were used to estimate linear groundwater flow

velocities. Average linear groundwater flow velocities were computed using the following modified Darcy equation:

$$V = Ki/n_e$$

where V = average linear velocity (feet per day), K = hydraulic conductivity (ft/day), i = horizontal hydraulic gradient, and n_e = effective porosity. Effective porosity values were calculated for each of the three hydrogeologic units, as described in sections 4.2.1 through 4.2.3 and shown on Table 4.

Horizontal gradients for the proposed Phase 2 area are presented in Table 6. The calculated horizontal gradients from the groundwater flow segments on Drawing DH-2 range from approximately 0.05 to 0.06 feet per feet. Groundwater velocities were calculated using a hydraulic conductivity of 1.4E-05, which is the geometric mean of the hydraulic conductivities for each of the hydrogeologic units. The mean hydraulic conductivity represents a conservative estimate of groundwater flow, given the amount of groundwater flow within bedrock in the Phase 2 area. An effective porosity of 9 percent was used in the calculations, which is the estimated effective porosity for bedrock. The bedrock effective porosity was used in order to obtain conservative velocity estimations. Calculated linear groundwater velocities are approximately 7.9 to 8.8 feet per year.

Though the average linear groundwater flow velocity was calculated assuming that the majority of groundwater occurs in the bedrock hydrogeologic unit, the values calculated utilizing the above equation are not considered valid for groundwater flow in fractured media (Parker et al., 1994). Groundwater flow velocities within the fractured bedrock are likely to be highly variable and may or may not be similar to the calculated values.

5.3.5 Vertical Gradient Calculations

Three nested well or piezometer pairs (MW-4S/D, P-26S/D, and P-30S/D) were utilized for purpose of measuring a vertical hydraulic gradient. Piezometer pair MW-4S/D is located downgradient of the Phase 1 waste unit near the confluence of the two main drainage features at the site. Piezometer pair P-26S/D is located upgradient of proposed Phase 2 less than 20 feet from the proposed waste boundary. Piezometer pair P-30S/D is located downgradient of Phase 2 footprint on a steep slope above a south trending drainage feature that bisects the southern portion of the facility. Calculations were performed using water levels measured on three different dates. Vertical gradients were calculated using the vertical distance between the screen midpoints of the pairs. If the water table intersected the well or piezometer screen, the screen midpoint for the shallow well was based on the portion of the screen that was below the water table for each given date. Vertical gradients calculated for MW-4S/D indicate a strong upward gradient and therefore suggest that groundwater discharge is taking place in this area, as would be anticipated given the size and flow of the adjacent drainages. The vertical gradients calculated for P-26S/D indicate a strong downward gradient and therefore suggest that groundwater recharge is occurring in this area as expected on the topographic high. The vertical gradients for P-30S/D indicate a slight downward gradient as would be expected as the aquifer transitions to an upward gradient at the drainage at the bottom of the slope. A summary of

vertical gradient data is presented in Table 7. Hydrogeologic cross-sections are provided to illustrate the vertical component of groundwater flow as shown on Drawings DH-4 and DH-5.

6.0 VERTICAL SEPARATION, RECEPTOR AND MONITORING CRITERIA

The following paragraphs discuss the vertical separation, receptor and monitoring criteria for the proposed Phase 2 C&D waste unit.

6.1 Relationship of Hydrogeology and the Proposed Phase 2 Waste Disposal Unit

A sufficient number of piezometers have been installed in and around the proposed Phase 2 footprint and soil samples and rock cores have been collected and evaluated to adequately characterize the hydrogeology of the area. The hydrogeologic characteristics of the site are typical of the Piedmont and no conditions were encountered that will require unusual monitoring requirements.

6.1.1 Vertical Separation from Bedrock

The top of bedrock elevations are based on the criteria described in section 4.2.3. Bedrock surface contours were generated from these elevations and are provided as Drawing DH-3. Proposed base grade contours of the Phase 2 waste unit are also provided on Drawing DH-3 in order to evaluate vertical separation from bedrock requirements. The proposed base grades were designed to have a minimum separation of 4 feet above the top of bedrock. Bedrock is generally above groundwater within the proposed Phase 2 footprint, except for areas described in section 4.2.2. The vertical separation of the proposed base grades for Phase 2 from bedrock is also shown on the hydrogeologic cross-sections provided as Drawings DH-4 and DH-5.

6.1.2 Vertical Separation from Seasonal High Groundwater Elevations

At the time design base grades for the proposed Phase 2 area were finalized, a limited amount of historical groundwater elevation data were available for the newly installed piezometers. Therefore, seasonal high groundwater elevations for these piezometers were be estimated using the historical groundwater elevations of existing site monitoring wells and piezometers with at least 3 years of groundwater elevation data. The potentiometric surface of on-site wells and piezometers has historically shown limited variability as shown on Figure 4. Precipitation data for the area was reviewed for trends and compared to the groundwater elevation data as described below.

The seasonal high groundwater calculations are based on historical groundwater elevations available from the site wells and piezometers with at least 3 years of groundwater elevation data (Table 3). The historical groundwater elevation data were examined and evaluated with respect to the average precipitation for Guilford County, North Carolina (Piedmont Triad International Airport), for the same time period (Table 8). A graphic representation of the precipitation data since 2002 is shown on Figure 5. A comparison of the precipitation data on Figure 5 with the groundwater elevation data on Figure 4 shows that periods of greater precipitation typically

result in minimal fluctuations of groundwater elevations. The average precipitation for 2002-2005 is slightly below the long-term average for Guilford County, based on data from 1931-2005, as shown on Table 8. Every month since June 2006, when the new piezometers were installed, has been above each month's historical average except for October, which was approximately equal to the average.

Each of the newly installed piezometers in and around the proposed Phase 2 footprint were compared to the wells installed in 2002, by grouping the wells and piezometers based on similar topographic settings and proximity to drainage features. The maximum groundwater elevation for each well or piezometer with at least 3 years of groundwater elevation data was subtracted from the July 25, 2006, groundwater elevation for each respective well or piezometer. The difference was rounded up to the nearest whole number as the seasonal high adjustment. The seasonal high adjustment values ranged from 1 to 5 feet. That number was added to the each respective well or piezometer's July 25, 2006, groundwater elevation. The seasonal high adjustment values were then added to the newly installed piezometers with similar topographic and hydrogeologic settings. The seasonal high groundwater elevation estimations are shown on Table 9.

The seasonal high groundwater elevations were then contoured and included as Drawing DH-6. Water levels from piezometer P-16 were not included in the seasonal high groundwater surface map because of anomalous groundwater elevations as described in section 5.2 above. Ground surface elevations were used as seasonal high groundwater elevations for the hand auger piezometers (HA-1, HA-3, HA-4, and HA-5). Proposed cell base grades are at least 4 feet above the estimated seasonal high groundwater elevations, as seen on Drawing DH-6 and in the hydrogeologic cross-sections on Drawing DH-5.

6.2 Potential Groundwater Receptors

One unoccupied house exists in the northeastern portion of the site property. The house has an associated water well that is not currently in use (identified as WW-1 on Drawing DH-1). Well WW-1 will be decommissioned prior to or during construction of disposal phases within a 500-foot radius of the well. The site is supplied water from the City of High Point. One residence located approximately 1,200 feet downgradient of the landfill is believed to be supplied by well water. Other nearby residences are located upgradient of the waste disposal area as described below.

Several residences are located on the north side of Riverdale Drive. Public water supply is available to these homes, but its use cannot be assumed. Some of these residences are known to be supplied by water from the City of High Point. The remaining residences must be considered potential receptors. These houses are located upgradient of the proposed Phase 2 footprint and are well outside of the 500-foot buffer zone.

A subdivision consisting of approximately 14 residential homes is located northwest of the proposed site. Each residence is supplied water from the City of High Point. Based on the groundwater flow paths on Drawing DH-2, it is not anticipated that groundwater would flow towards the subdivision. An agreement between the owner of the subdivision and WCA has

been made that the residences within 500 feet of the landfill's waste footprint will be demolished as required.

During the original Site Plan investigation, continuous water levels were taken from piezometer P-1. Based on the data collected, it was determined that the aquifers within the site are not affected by any significant local pumping from private potable wells or industrial pumping of groundwater from a nearby quarry. No appreciable decreases or increases in water levels were noted for this well other than precipitation-related changes.

6.3 Ability to Effectively Monitor Groundwater

No significant sources of potential contamination were identified within 2000 feet of the property boundary during the Site Plan investigation or during the current investigation. Groundwater downgradient of the existing and proposed disposal areas will be monitored by the well network described in the *Water Quality Monitoring Plan* included as Appendix DH-E.

No known physical or hydrogeologic conditions have been identified that effect the monitorability of the proposed Phase 2 waste unit. The discharge feature along the southern facility boundary serves as an effective groundwater flow boundary, as does the drainage feature east of the Phase 2 footprint. Surface water monitoring points are included in the current and proposed monitoring program, as well as additional groundwater monitoring points to detect a potential release from the waste unit.

7.0 CONCLUSIONS

The purpose of the Hydrogeologic Report is to present the assessment of geologic and hydrogeologic characteristics of the proposed Phase 2 footprint. Furthermore, the report must present data in support or non-support of the proposed Phase 2 expansion's use for C&D waste management activities. This report presents the current understanding of the groundwater flow regime and the relationship of the solid waste management units to groundwater receptors and groundwater discharge features.

The geologic and hydrogeologic data indicate that the site is located within typical Piedmont terrane. It appears that the amount of interflow inferred for this area relatively high, and will serve to reduce the infiltration of groundwater into bedrock. Depths to groundwater and bedrock are well defined in and around the site. Few site-specific preferential fractures were identified in the rock core or outcrops during this study. Diabase, where present, occurs in swarms, which will severely limit its affect on groundwater flow. The hydrogeologic conditions are well-defined and the report demonstrates that the waste unit can be effectively monitored for potential releases.

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TABLES

TABLE 1
Monitoring Well and Piezometer Completion Summary
WCA of High Point, LLC

WELL & PIEZOMETER NUMBER	DATE INSTALLED	CASING DIAMETER (inches)	WELL ELEVATIONS		TOTAL DEPTH DRILLED		TOP OF BEDROCK		SCREENED INTERVAL				LITHOLOGY OF SCREENED INTERVAL	STATUS
			GROUND SURFACE	T.O.C.	DEPTH (feet B.G.S.)	ELEV. (feet M.S.L.)	DEPTH (feet B.G.S.)	ELEV. (feet M.S.L.)	DEPTH (feet B.G.S.)		ELEVATION (feet M.S.L.)			
			feet above M.S.L.						from	to	from	to		
MW-1	09/29/03	2	809.79	813.17	30.0	779.79	4	805.79	15.0	30.0	794.79	779.79	Bedrock	Compliance Well
MW-2	09/30/03	2	752.30	754.85	16.5	735.80	8.5	743.80	6.5	16.5	745.80	735.80	PWR/Bedrock	Compliance Well
MW-3	10/02/03	2	752.65	755.48	27.0	725.65	13.5	739.15	12.0	27.0	740.65	725.65	PWR/Bedrock	Compliance Well
MW-4S	02/20/02	2	731.60	733.76	20.0	711.60	7	724.60	5.0	20.0	726.60	711.60	PWR/Bedrock	Compliance Well
MW-4D	02/19/02	2	731.88	734.23	80.0	651.88	7	724.88	60.0	80.0	671.88	651.88	Bedrock	Existing
MW-5	02/19/02	2	741.16	743.44	20.0	721.16	10	731.16	5.0	20.0	736.16	721.16	Saprolite/PWR/Bedrock	Compliance Well
MW-6	12/17/02	2	733.53	735.23	15.5	718.03	9	724.53	8.5	15.5	725.03	718.03	PWR/Bedrock	Compliance Well
P-1	02/21/02	2	817.64	820.04	50.5	767.14	6	811.64	30.5	50.5	787.14	767.14	Bedrock	Decommissioned
P-2	02/13/02	2	794.31	796.78	10.0	784.31	>10	<784.31	5.0	10.0	789.31	784.31	Saprolite	Decommissioned
P-3	02/12/02	2	787.62	790.06	25.0	762.62	>25	<762.62	10.0	25.0	777.62	762.62	Saprolite/PWR	Existing
P-4A	02/15/12	2	793.04	795.43	16.0	777.04	16	777.04	6.0	16.0	787.04	777.04	Saprolite/PWR	Existing
P-5	02/15/02	2	760.56	763.84	7.0	753.56	7.0	753.56	2.0	7.0	758.56	753.56	PWR	Existing
P-6	02/20/02	2	797.15	799.72	35.5	761.65	8.5	788.65	10.5	35.5	786.65	761.65	Bedrock	Existing
P-7	02/13/02	2	784.08	787.07	17.0	767.08	17.0	767.08	7.0	17.0	777.08	767.08	PWR	Existing
P-8	02/20/02	2	792.56	794.90	25.0	767.56	8.0	784.56	10.0	25.0	782.56	767.56	Bedrock	Decommissioned
P-9	02/20/02	2	808.11	810.92	40.0	768.11	11.0	797.11	20.0	40.0	788.11	768.11	Bedrock	Decommissioned
P-10	02/20/02	2	791.20	794.07	30.5	760.70	15.0	776.20	15.5	30.5	775.70	760.70	Bedrock	Decommissioned
P-11	02/20/02	2	778.21	780.29	40.0	738.21	10.0	768.21	25.0	40.0	753.21	738.21	Bedrock	Existing
P-13S	02/19/02	2	775.55	778.11	9.5	766.05	13.0	762.55	2.5	9.5	773.05	766.05	Saprolite/PWR	Decommissioned
P-13D	02/19/02	2	775.55	778.09	23.0	752.55	13.0	762.55	13.0	23.0	762.55	752.55	Bedrock	Decommissioned
P-14	02/19/02	2	782.80	785.11	50.0	732.80	12.0	770.80	15.0	50.0	767.80	732.80	Bedrock	Decommissioned
P-16	02/18/02	2	773.29	775.77	7.0	766.29	7.0	766.29	2.0	7.0	771.29	766.29	Saprolite/PWR	Existing
P-17	02/18/02	2	780.96	783.54	9.0	771.96	9.0	771.96	4.0	9.0	776.96	771.96	Saprolite/PWR	Decommissioned
P-19	12/17/02	2	749.41	751.78	15.5	733.91	6.0	743.41	7.5	15.5	741.91	733.91	Bedrock	Decommissioned
P-20	12/17/02	2	792.79	795.59	25.5	767.29	9.0	783.79	15.5	25.5	777.29	767.29	Bedrock	Decommissioned
P-21	12/17/02	2	764.47	766.51	15.5	748.97	13.0	751.47	13.0	15.5	751.47	748.97	Bedrock	Decommissioned
P-23	07/05/06	2	760.57	762.60	25.0	735.57	3.0	757.57	15.0	25.0	745.57	735.57	Bedrock	Existing
P-24	06/30/06	2	797.42	799.27	33.0	764.42	9.0	788.42	18.0	33.0	779.42	764.42	Bedrock	Existing
P-25	06/29/06	2	802.49	805.24	37.5	764.99	13.5	788.99	27.5	37.5	774.99	764.99	Bedrock	Existing
P-26S	07/10/06	2	806.46	808.71	28.0	778.46	>28.00	<778.46	18.0	28.0	788.46	778.46	PWR	Existing
P-26D	07/07/06	2	805.77	807.02	74.0	731.77	28.0	777.77	53.5	73.5	752.27	732.27	Bedrock	Existing
P-27	06/30/06	2	796.34	799.99	40.0	756.34	13.5	782.84	25.0	40.0	771.34	756.34	Bedrock	Existing
P-28	07/06/06	2	784.56	787.35	32.5	752.06	19.5	765.06	22.5	32.5	762.06	752.06	Bedrock	Existing
P-29	07/06/06	2	759.31	762.78	27.0	732.31	9.0	750.31	12.0	27.0	747.31	732.31	Bedrock	Existing
P-30S	07/13/06	2	761.20	763.52	45.0	716.20	45.0	716.20	30.0	45.0	731.20	716.20	PWR	Existing
P-30D	07/11/06	2	761.24	763.27	70.0	691.24	43.0	718.24	60.0	70.0	701.24	691.24	Bedrock	Existing
P-31	07/11/06	2	761.10	763.07	30.0	731.10	>30.0	<731.10	15.0	30.0	746.10	731.10	PWR	Existing
HA-1	02/22/02	2	770.71	773.08	4.5	766.21	>4.5	<766.21	2.0	4.5	768.71	766.21	Saprolite	Existing
HA-2	02/22/02	2	783.06	784.67	5.9	777.16	>5.9	<777.26	3.4	5.9	779.66	777.16	Saprolite	Existing
HA-3	07/11/06	2	748.55	753.23	5.0	743.55	>5.0	<743.55	1.0	5.0	747.55	743.55	Saprolite	Existing
HA-4	07/11/06	2	735.03	737.82	2.5	732.53	>2.5	<732.53	1.5	2.5	733.53	732.53	Saprolite	Existing
HA-5	07/11/06	2	725.93	728.17	4.0	721.93	>4.0	<721.93	2.0	4.0	723.93	721.93	Saprolite	Existing

NOTES:
1. All elevations are referenced to mean sea level (M.S.L.); depths are referenced to ground surface (G.S.).
2. na = not applicable
3. B.G.S. = below ground surface
4. M.S.L = mean sea level
5. T.O.C. = top of casing
6. PWR = partially weathered rock
7. Piezometers P-1 through P-21were installed by Joyce Engineering, Inc. on February 13-22, 2002 and December 17, 2002.
8. Monitoring wells MW-1 through MW-3 were installed by Joyce Engineering, Inc. between September 29, 2003 and October 2, 2003.
9. Piezometers P-23 through P-31 were installed by Golder Associates between June 29, 2006 and July 13, 2006.
10. Piezometers HA-1 through HA-5 were installed using a hand auger. HA-1 and HA-2 were installed by Joyce Engineering, Inc. in 2002 and HA-3, HA-4 and HA-5 were installed by Golder Associates in 2006.
11.Top of bedrock for P-10 and P-13 does not = auger refusal (of 5 and 10 feet B.G.S, respectively). Core data (%RQD and %Recovery) were used to determine depths of 15 and 13 feet B.G.S., respectively).
12. MW-4S and MW-4D were installed as piezometers P-15S and -15D, respectively, on February 19-20, 2002 by Joyce Engineering, Inc.
13. MW-5 was installed as piezometer P-12 by Joyce Engineering, Inc. on February 19, 2002.
14. MW-6 was installed as piezometer P-18 by Joyce Engineering, Inc. on December 17, 2002.

TABLE 2
Summary of Rock Core Data
WCA of High Point, LLC

BORING LOCATION	CORED INTERVAL (feet)	% RECOVERY	% RQD
P-10	5-15	0.02	0
	15-20	97	93
P-13S & P-13D	10-13	0.03	0
	13-18	66	55
	18-23	94	87
MW-4D	7-13	46	38
	13-17	98	66
P-19	7-15	100	100
P-20	10-15	75	69
	15-19	98	96
P-26D	33-38	100	100
	38-41.25	89	89
P-30D	45-50	99	82
	50-55	100	68
	55-60	48	40
	65-70	86	31

NOTES:

1. Locations P-10, P-13S/-13D and MW-4D were cored in February 2002 by Joyce Engineering, Inc., using an NQ wire-line rock coring device on an Acker Soil Max drilling rig.
2. Locations P-18 and P-20 were cored in December 2002 by Joyce Engineering, Inc., using an NQ rock coring device on a CME 75 drilling rig.
3. Locations P-26D and P-30D were cored in July 2006 by Golder Associates, using an HQ rock coring device on a Gus Pech GP-1100B drilling rig.
4. All rock core is granitic in composition except for P-30D from 57 to 61 feet, which is mafic rock.
5. RQD = Rock quality designation

TABLE 3
Summary of Bedrock and Water Level Elevations for Monitoring Wells and Piezometers
WCA of High Point, LLC

WELL & PIEZOMETER IDENTIFICATION	G.S. ELEV.	APPROXIMATE STICKUP (feet)	TOC ELEV.	DEPTH TO ROCK; G.S. (A.R.)	ROCK ELEV.	GROUNDWATER ELEVATIONS (feet AMSL)																				
						TOD ELEV.	24-HR ELEV.	02/21/02	02/22/02	02/25/02	02/27/02	02/28/02	03/04/02	03/06/02	03/08/02	03/11/02	03/14/02	03/15/02	03/19/02	03/21/02	03/26/02	03/28/02	04/01/02	04/02/02	04/05/02	04/08/02	04/11/02
MW-1	809.79	3.38	813.17	4.00	805.79	795.51	795.52	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-2	752.30	2.55	754.85	8.50	743.80	748.42	748.33	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-3	752.65	2.83	755.48	13.50	739.15	<725.65	734.60	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-4S	731.60	2.16	733.76	7.00	724.60	715.11	727.51	727.51	727.61	727.54	727.51	727.50	727.79	727.86	727.81	727.76	727.76	727.77	727.84	727.85	727.85	727.84	727.77	727.79	727.71	727.69	727.62
MW-4D	731.88	2.35	734.23	7.00	724.88	<651.88	652.95	654.16	656.18	660.94	664.07	665.51	670.83	676.69	683.11	691.99	699.43	701.65	710.15	713.82	720.65	722.57	726.05	726.57	728.13	729.45	730.48
MW-5	741.16	6.67	747.83	10.00	731.16	<721.16	738.13	738.05	737.58	737.43	737.40	737.32	737.56	737.63	737.70	737.66	737.79	737.58	737.53	737.69	737.72	737.66	737.71	737.67	737.62	737.64	737.63
MW-6	733.53	1.70	735.23	9.00	724.53	719.80	730.18	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-1	817.64	2.40	820.04	6.00	811.64	<767.14	767.59	na	767.59	768.95	769.89	770.36	772.07	772.88	773.75	775.04	776.29	776.65	778.16	778.94	780.74	na	782.76	783.06	783.96	784.88	785.81
P-2	794.31	2.47	796.78	>10	<784.31	<784.31	790.90	793.07	793.10	792.78	792.78	792.54	793.71	793.51	793.36	793.13	793.52	793.13	793.71	793.90	793.38	793.54	793.50	793.47	792.72	792.40	792.23
P-3	787.62	2.44	790.06	>25	<762.62	781.71	785.67	785.00	784.92	784.82	784.91	784.74	785.25	785.29	785.35	785.29	785.46	785.56	785.69	785.92	785.80	785.74	785.78	785.83	785.62	785.53	785.40
P-4A	793.04	2.39	795.43	16.00	777.04	777.60	790.38	790.47	790.39	790.11	790.04	789.91	790.69	790.42	790.35	790.19	790.89	790.68	791.09	791.40	790.44	790.38	789.01	788.89	788.59	788.41	788.18
P-5	760.56	3.28	763.84	7.00	753.56	<753.56	754.72	755.07	755.16	755.18	755.34	755.18	756.65	755.88	755.62	755.51	755.69	755.67	755.68	755.81	755.79	755.73	755.82	755.77	755.68	755.61	755.56
P-6	797.15	2.57	799.72	8.50	788.65	<761.65	779.46	779.42	779.00	778.94	779.08	778.95	779.01	778.99	779.11	779.18	779.25	779.26	779.30	779.46	779.57	779.49	779.56	779.56	779.47	779.52	779.45
P-7	784.08	2.99	787.07	17.00	767.08	<767.08	775.86	776.50	776.40	776.37	776.57	776.40	776.50	776.42	776.54	776.62	776.71	776.60	776.74	776.97	777.07	776.90	777.10	777.00	776.92	777.04	776.95
P-8	792.56	2.34	794.90	8.00	784.56	<767.56	768.42	768.25	769.32	772.05	773.65	774.11	775.45	775.79	775.91	775.78	775.90	775.97	776.17	776.38	776.78	776.59	776.48	776.46	776.35	776.10	775.87
P-9	808.11	2.81	810.92	11.00	797.11	773.66	784.75	784.72	784.60	784.80	784.79	784.80	784.69	784.74	784.72	784.70	784.69	784.47	784.59	784.62	784.58	784.53	784.56	784.55	784.56	784.57	784.57
P-10	791.20	2.87	794.07	15.00	776.20	<760.70	<760.70	<760.70	761.08	761.74	762.20	762.40	763.22	763.56	763.97	764.51	765.01	765.13	765.63	765.85	766.15	766.19	766.28	766.28	766.27	766.28	766.26
P-11	778.21	2.08	780.29	10.00	768.21	<738.21	738.44	738.29	738.47	738.69	738.83	738.89	739.10	739.21	739.31	739.47	739.66	739.77	739.86	739.94	740.18	740.17	740.34	740.36	740.43	740.54	740.62
P-13S	775.55	2.56	778.11	13.00	762.55	<766.05	767.99	768.42	769.92	772.15	772.41	772.31	774.30	773.81	773.60	773.38	774.16	773.81	773.87	774.36	773.44	773.51	773.71	773.54	773.09	773.03	772.80
P-13D	775.55	2.54	778.09	13.00	762.55	755.31	768.08	767.96	767.90	767.26	766.88	766.41	767.01	768.14	768.79	769.21	769.49	769.63	769.84	770.08	770.28	770.08	770.09	770.09	769.64	769.22	768.46
P-14	782.80	2.31	785.11	12.00	770.80	<732.80	752.28	756.56	758.83	759.80	760.11	760.10	760.35	760.54	760.87	761.22	761.54	761.59	761.93	762.23	762.77	762.88	763.13	763.10	763.10	763.22	763.28
P-16	773.20	2.59	775.79	7.00	766.20	<766.29	767.88	770.77	770.72	770.60	770.58	770.46	771.14	770.98	770.96	770.89	771.24	771.14	771.14	771.42	770.86	770.99	770.77	770.57	770.13	769.76	769.69
P-17	780.96	2.58	783.54	9.00	771.96	<773.96	<773.96	776.74	777.11	777.81	778.43	778.45	779.32	779.39	779.76	779.69	780.20	780.15	780.25	780.53	780.14	780.03	780.18	780.08	779.68	779.50	779.36
P-19	749.41	2.37	751.78	6.00	743.41	739.87	742.62	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-20	792.79	2.80	795.59	9.00	783.79	<767.29	774.49	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-21	764.47	2.04	766.51	13.00	751.47	759.80	758.11	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-23	760.57	2.03	762.60	3.00	757.57	<735.57	758.58	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-24	797.42	1.85	799.27	9.00	788.42	<764.42	780.10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-25	802.49	2.75	805.24	13.50	788.99	<764.49	781.49	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-26S	806.46	2.25	808.71	>28.00	<778.46	779.71	790.46	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-26D	805.77	1.25	807.02	28.00	777.77	<731.77	788.08	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-27	796.34	3.65	799.99	13.50	782.84	<756.34	777.86	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-28	784.56	2.79	787.35	19.50	765.06	<752.06	765.15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-29	759.31	3.47	762.78	9.00	750.31	<732.31	741.66	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-30S	761.20	2.32	763.52	45.00	716.20	719.12	731.52	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-30D	761.24	2.03	763.27	43.00	718.24	<691.24	730.57	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-31	761.10	1.97	763.07	>30.00	<731.10	<731.10	<731.10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
HA-1	770.71	2.37	773.08	>4.5	<766.21	768.56	768.56	---	768.56	768.56	768.58	768.56	768.75	768.61	768.60	768.59	768.71	768.66	768.70	768.98	768.60	768.59	768.61	768.51	768.49	768.51	768.46
HA-2	783.06	1.61	784.67	>5.9	<777.16	777.22	781.91	---	777.22	781.91	782.07	781.92	782.50	782.42	782.33	782.20	782.67	782.59	782.70	782.82	782.31	782.49	782.65	782.55	782.15	781.87	781.89
HA-3	748.55	4.68	753.23	>5.00	<743.55	749.05	749.10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
HA-4	735.03	2.79	737.82	>2.50	<732.53	733.05	733.77	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
HA-5	725.93	2.24	728.17	>4.00	<721.93	725.37	725.59	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 3
Summary of Bedrock and Water Level Elevations for Monitoring Wells and Piezometers
WCA of High Point, LLC

WELL & PIEZOMETER IDENTIFICATION	GROUNDWATER ELEVATIONS (feet AMSL)																							
	04/16/02	04/19/02	04/23/02	05/01/02	05/09/02	05/17/02	05/23/02	05/31/02	06/07/02	06/12/02	11/12/02	12/18/02	12/23/02	12/30/02	2/7/2003	10/08/03	01/23/04	07/08/04	01/25/05	07/06/05	01/09/06	07/12/06	07/25/06	09/18/06	10/24/06
MW-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	795.37	794.77	794.08	793.29	793.98	789.97	793.37	793.43	793.54	793.53
MW-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	748.43	747.88	748.05	748.15	746.84	748.75	748.80	749.37	748.43	748.07
MW-3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	739.48	738.90	736.77	738.53	736.57	737.23	737.13	737.41	737.37	737.25
MW-4S	727.59	727.52	727.44	727.20	727.13	726.86	726.56	725.91	725.43	725.16	728.73	729.36	729.33	729.41	729.00	728.29	727.76	727.60	727.91	726.11	728.24	727.85	728.59	728.40	728.14
MW-4D	731.51	731.74	731.81	732.64	731.91	732.51	732.19	731.92	731.66	731.93	734.23	732.05	732.75	733.98	734.18	---	---	---	---	---	734.13	734.13	734.16	734.15	734.23
MW-5	737.55	737.58	737.38	737.35	736.93	736.58	736.22	735.90	735.48	735.32	738.62	739.64	739.73	739.70	739.38	740.31	734.88	735.44	736.18	734.73	735.94	735.39	735.59	735.57	735.49
MW-6	---	---	---	---	---	---	---	---	---	---	---	732.83	727.90	732.75	729.26	726.66	724.26	724.33	724.23	724.26	725.70	724.37	727.84	727.16	725.83
P-1	787.37	789.60	791.57	793.81	794.64	794.99	795.00	795.07	794.97	794.93	794.89	796.47	796.72	796.98	797.78	---	---	---	---	---	---	---	---	---	---
P-2	792.11	791.93	791.43	791.21	790.88	790.65	790.29	790.02	789.87	789.70	793.44	793.78	794.18	794.27	794.35	---	---	---	---	---	---	---	---	---	---
P-3	785.41	785.33	785.06	784.90	784.59	784.38	784.11	783.94	783.65	783.58	785.71	786.47	786.73	786.79	786.94	---	---	---	---	---	---	---	785.26	785.88	785.87
P-4A	787.99	787.85	787.66	787.33	786.97	786.68	786.36	786.07	785.82	785.62	789.38	789.12	789.18	789.09	789.56	---	---	---	---	---	---	---	---	---	---
P-5	755.64	755.59	755.49	755.23	754.88	754.67	754.46	754.45	<753.56	<753.56	755.48	756.07	756.21	756.22	756.27	---	---	---	---	---	---	---	---	---	---
P-6	779.52	779.50	779.32	779.34	779.16	778.99	778.81	778.70	778.44	778.41	779.66	780.21	780.33	780.49	780.31	---	---	---	---	---	---	---	778.64	778.95	779.18
P-7	777.17	777.23	777.12	777.30	777.22	777.13	776.96	776.95	776.87	776.77	776.69	777.09	777.33	777.54	777.97	---	---	---	---	---	---	---	776.00	775.99	775.80
P-8	775.68	775.51	775.29	775.12	774.90	774.77	774.64	774.59	774.47	774.44	779.53	786.58	786.90	786.99	785.15	---	---	---	---	---	---	---	---	---	---
P-9	784.62	784.62	784.62	784.67	784.69	784.71	784.68	784.66	784.55	784.52	783.73	784.32	784.51	785.01	789.31	---	---	---	---	---	---	---	---	---	---
P-10	766.30	766.29	766.29	766.31	766.32	771.37	766.39	766.43	766.37	766.37	765.89	766.07	766.18	766.18	766.37	---	---	---	---	---	---	---	---	---	---
P-11	740.76	740.81	740.89	740.99	741.09	741.14	741.18	741.23	741.24	741.24	740.88	744.97	740.99	742.06	742.45	---	---	---	---	---	---	746.25	746.18	746.03	746.06
P-13S	772.63	772.51	772.26	771.68	771.59	771.94	771.95	771.18	772.65	772.27	775.37	774.80	774.83	774.86	775.29	---	---	---	---	---	---	---	---	---	---
P-13D	767.30	766.71	765.65	764.65	763.71	763.17	762.70	762.52	762.16	762.14	771.57	771.80	771.93	771.93	771.89	---	---	---	---	---	---	---	---	---	---
P-14	763.46	763.54	763.41	763.39	763.11	762.84	762.54	762.29	761.84	761.66	767.42	779.11	778.84	779.26	775.65	---	---	---	---	---	---	---	---	---	---
P-16	769.54	769.23	768.46	767.26	766.39	<766.29	<766.29	<766.29	<766.29	<766.29	771.47	770.86	770.81	770.78	770.38	---	---	---	---	---	---	768.87	769.75	770.76	---
P-17	779.27	778.99	778.39	777.55	776.99	775.84	775.12	774.42	773.87	773.33	780.33	780.19	780.54	780.54	780.48	---	---	---	---	---	---	---	---	---	---
P-19	---	---	---	---	---	---	---	---	---	---	---	742.93	742.39	742.79	740.99	---	---	---	---	---	---	---	---	---	---
P-20	---	---	---	---	---	---	---	---	---	---	---	774.65	772.92	774.84	779.52	---	---	---	---	---	---	---	---	---	---
P-21	---	---	---	---	---	---	---	---	---	---	---	758.11	758.49	758.75	758.21	---	---	---	---	---	---	---	---	---	---
P-23	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	758.44	759.20	759.17	759.33
P-24	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	784.76	784.90	785.27	785.37
P-25	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	790.49	790.43	790.46	790.53
P-26S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	793.51	795.18	796.76	797.82
P-26D	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	789.29	790.09	790.41	790.47
P-27	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	777.85	777.99	777.70	778.29
P-28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	765.55	765.60	765.97	766.05
P-29	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	743.19	742.94	742.25	742.14
P-30S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	731.52	731.32	731.08
P-30D	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	730.57	730.77	730.65	730.44
P-31	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<731.10	731.42	731.13	731.01
HA-1	768.44	768.33	768.28	768.13	767.97	767.89	767.68	767.57	767.50	767.27	769.34	768.73	768.75	768.73	768.43	---	---	---	---	---	---	---	768.46	768.13	768.27
HA-2	781.74	781.42	781.10	780.75	780.67	780.67	780.34	780.10	780.19	779.97	782.74	782.47	782.50	782.48	782.80	---	---	---	---	---	---	---	---	---	---
HA-3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	749.10	750.19	750.11	749.87
HA-4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	733.77	734.14	733.94	734.30
HA-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	725.59	725.59	725.89	726.06

NOTES:

1. G.S. = ground surface
2. TOC = top of casing
3. A.R. = auger refusal
4. ELEV. = elevation
5. AMSL = above mean sea level
6. TOD = time of drilling
7. 24-HR = 24 hours after construction
8. --- = no data available
9. Rock Elevations for P-10 and P-13 do not equal A.R. (of 5 feet and 10 feet below ground surface, respectively). Core data (%RQD and %Recovery) were used to determine depths to bedrock of 15 feet and 13 feet below ground surface, respectively, as described in the approved Site Plan Application.
10. 24-Hour water elevations for HA-1, HA-2, P-4A, P-5, P-24, and P-27 were taken after approximately 72 hours.
11. 24-Hour water elevations for P-26S and P-26D were measured after approximately 96 hours.
12. 24-Hour water elevations for P-30S were measured after approximately 288 hours.
13. MW-4S and -4D were installed as piezometers P-15S and -15D, respectively, on February 19-20, 2002.
14. MW-5 was installed as piezometer P-12 on February 19, 2002.
15. MW-6 was installed as piezometer P-18 on December 17, 2002.
16. Elevations measured on October 31, 2006 (shown in blue) were used in the construction of potentiometric surface contours shown on Drawing 2.

TABLE 4
Summary of Laboratory Soils Test Data
WCA of High Point, LLC

HYDRO-GEOLOGIC UNIT	BORING NUMBER	SAMPLE DEPTH (feet)	SAMPLE TYPE	USCS CLASSIFICATION	USCS SYMBOL	NATURAL MOISTURE CONTENT (%)	UNIT WEIGHT (pcf)		GRADATION RESULTS (% passing)										USDA SOIL CLASSIFICATION SYSTEM			ASTM SOIL CLASSIFICATION SYSTEM			WENTWORTH SOIL CLASSIFICATION SYSTEM			ATTERBERG LIMITS			POROSITY (%)	EFFECTIVE POROSITY (%)	PERMEABILITY (cm/sec)
							WET	DRY	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200	% SAND	% SILT	% CLAY	% SAND	% SILT	% CLAY	% SAND	% SILT	% CLAY	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX			
SAPROLITE	P-1	0 - 2	Split Spoon	Sandy Clay	SC-SM	---	---	---	100	100	100	100	100	98.0	---	73.6	---	45.4	35.5	---	---	---	---	---	---	---	---	---	19	13	6	---	---	---
	P-2	7 - 9	Undisturbed	Sandy Clay	SC	25.2	---	---	100	100	100	100	100	97.5	---	70.9	---	43.0	35.7	---	---	---	---	---	---	---	---	---	37	22	15	38.5	---	9.58E-08
	P-3	0 - 10	Bulk	Sandy Clay	SC	---	120.2	12.0	100	100	100	100	98.8	95.1	---	67.3	---	45.4	37.0	---	---	---	---	---	---	---	---	---	36	23	13	32.4	---	8.76E-08
	P-3	4.5 - 6.5	Split Spoon	Sandy Clay	SC	---	---	---	100	100	100	100	100	95.3	---	67.5	---	44.9	36.6	---	---	---	---	---	---	---	---	---	35	24	11	---	---	---
	P-13	0 - 2	Bulk	Silty Sand	SM	---	---	---	100	100	100	100	100	97.9	---	64.9	---	48.1	32.2	69	16	14	68	17	16	67	16	15	---	---	---	---	15	---
	P-24	2 - 4	Undisturbed	Silty Sand	SM	9.5	---	109.6	100	100	100	100	100	94.5	77.3	57.0	41.4	30.6	22.5	75	11	9	78	13	10	73	13	9	NP	NP	NP	35	24	2.3E-04
	P-30D	3 - 5	Undisturbed	Silty Sand	SM	10.0	---	115.3	100	100	100	100	100	97.5	87.4	69.3	51.1	36.3	24.8	74	15	9	75	15	10	74	15	10	NP	NP	NP	32	23	4.5E-06
PARTIALLY WEATHERED ROCK	P-13	5 - 7	Split Spoon	Silty Sand	SM	---	---	---	100	100	100	100	99.6	91.9	---	51.3	---	31.1	24.1	---	---	---	---	---	---	---	---	---	22	21	1	---	---	---
	P-14	10 - 11	Split Spoon	Silty Clay	CL	---	---	---	100	100	100	100	99.8	98.4	---	92.6	---	77.9	55.0	---	---	---	---	---	---	---	---	---	32	23	9	---	---	---
	P-15D	5 - 7	Undisturbed	Silty Sand	ML	---	---	---	100	100	100	100	100	99.6	---	97.6	---	88.5	76.3	---	---	---	---	---	---	---	---	---	35	34	1	---	---	---
	P-19	5 - 7	Bulk	Silty Sand	SM	---	---	---	100	100	100	100	97.3	79.9	---	45.5	---	26.5	19.3	63	8	9	78	9	10	61	9	10	---	---	---	---	18	---
	P-26S	10 - 13	Bulk	Clayey Sand	SC	8.2	---	118.0	100	100	100	100	100	96.8	82.8	63.8	50.6	41.2	33.6	65	18	14	66	16	18	64	16	17	24	16	8	30	13	5.8E-05
	P-30D	16 - 19	Bulk	Silty Sand	SM	3.5	---	115.3	100	100	100	100	98.9	94.1	80.5	61.4	45.1	32.9	22.6	75	14	5	76	16	7	73	15	6	NP	NP	NP	32	28	7.9E-04

NOTES:

1. --- = no data available
2. NP = non-plastic
3. cm/sec = centimeters per second
3. Soils analysis for piezometers P-1 through P-19 performed by Trigon Engineering Consultants, Inc.
4. Soils analysis for piezometers P-24 through P-30D performed by Golder Associates Inc.
5. USCS = Unified Soil Classification System
6. pcf = Pounds per cubic feet
7. USDA = United States Department of Agriculture
8. ASTM = American Standards for Testing and Materials Standards
9. % = Percent

TABLE 5
Summary of Aquifer Test Data
WCA of High Point, LLC

PIEZOMETER IDENTIFICATION	SATURATED AQUIFER THICKNESS VALUE (feet)	SCREEN LENGTH (feet)	PIEZOMETER DIAMETER (inches)	AQUIFER ANALYSIS METHOD	AQUIFER TEST TYPE	HYDRAULIC CONDUCTIVITY (K, cm/sec)	SCREENED LITHOLOGY
P-2	15	5	2	Bouwer-Rice	Rising	1.92E-05	Saprolite
P-2	15	5	2	Bouwer-Rice	Falling	1.18E-04	Saprolite
					Geomean =	4.76E-05	
P-7	20	10	2	Bouwer-Rice	Rising	4.74E-05	PWR
P-26S	17.57	10	2	Bouwer-Rice	Rising	2.17E-05	PWR
P-26S	17.52	10	2	Bouwer-Rice	Falling	2.58E-05	PWR
P-30S	12.68	15	2	Bouwer-Rice	Rising	1.54E-05	PWR
P-30S	12.62	15	2	Bouwer-Rice	Falling	1.05E-05	PWR
					Geomean =	2.12E-05	
P-6	25	25	2	Bouwer-Rice	Rising	2.69E-05	Bedrock
P-9	25	20	2	Bouwer-Rice	Rising	3.82E-05	Bedrock
P-13D	25	10	2	Bouwer-Rice	Rising	6.04E-05	Bedrock
P-13D	25	10	2	Bouwer-Rice	Falling	6.06E-05	Bedrock
P-20	25	10	2	Bouwer-Rice	Rising	2.61E-06	Bedrock
P-23	25	10	2	Bouwer-Rice	Rising	3.94E-06	Bedrock
P-23	25	10	2	Bouwer-Rice	Falling	5.99E-06	Bedrock
P-25	25	10	2	Bouwer-Rice	Rising	1.97E-06	Bedrock
P-25	25	10	2	Bouwer-Rice	Falling	3.88E-06	Bedrock
P-27	25	15	2	Bouwer-Rice	Rising	1.15E-06	Bedrock
P-27	25	15	2	Bouwer-Rice	Falling	1.85E-06	Bedrock
P-30D	50	10	2	Bouwer-Rice	Rising	4.79E-05	Bedrock
P-30D	50	10	2	Bouwer-Rice	Falling	2.98E-05	Bedrock
					Geomean =	9.53E-06	
				Saprolite/PWR/Bedrock Geomean =		**1.37E-05**	

NOTES:

1. Aquifer analyses (slug tests) for P-2, P-6, P-7, P-9, P-13D, P-20 were performed by Joyce Engineering, Inc. in 2002.
2. Aquifer analyses (slug tests) for P-23, P-25, P-26S, P-27, P-30S, and P-30D were performed by Golder Associates in 2006.
3. Geomean = geometric mean

Checked DR 4-13-07
Reviewed AK 4-13-07

TABLE 6
Hydraulic Gradients and Linear Flow Velocities
WCA of High Point, LLC

GRADIENT SEGMENT	HYDRAULIC CONDUCTIVITY (K, cm/s)	GRADIENT SEGMENT LENGTH (ft)	EFFECTIVE POROSITY	FLOW DIRECTION	July 25, 2006		
					Elevation (ft, MSL)	Gradient (ft/ft)	Velocity (ft/yr)
i_1	1.37E-05	588.96	0.09	NW	790 760	0.051	8.03
i_2	1.37E-05	1203.68	0.09	SW	790 730	0.050	7.88
i_3	1.37E-05	709.35	0.09	SSE	790 750	0.056	8.82

NOTES:
1. The geometric mean of K from individual well aquifer tests was used to calculate the hydraulic conductivity.
2. The effective porosity for bedrock was used in velocity calculations as described in the text.
3. cm/sec = centimeters per second
4. ft = Feet
5. MSL = Mean sea level
6. ft/ft = Feet per foot
7. ft/yr = Feet per year

Checked DR 4-13-07
Reviewed RK 4-13-07

TABLE 7
Summary of Vertical Gradients
WCA of High Point, LLC

		07/25/06			09/18/06			10/24/06		
WELL PAIR	**SCREENED INTERVALS (feet)**	**DISTANCE BETWEEN SCREEN MIDPOINTS (feet)**	**ELEVATION ABOVE MEAN SEA LEVEL (feet)**	**VERTICAL GRADIENT (feet/foot)**	**DISTANCE BETWEEN SCREEN MIDPOINTS (feet)**	**ELEVATION ABOVE MEAN SEA LEVEL (feet)**	**VERTICAL GRADIENT (feet/foot)**	**DISTANCE BETWEEN SCREEN MIDPOINTS (feet)**	**ELEVATION ABOVE MEAN SEA LEVEL (feet)**	**VERTICAL GRADIENT (feet/foot)**
MW-4D	60-80	57.22	734.16	-0.097	57.22	734.15	-0.100	57.22	734.23	-0.106
MW-4S	5-20		728.59			728.40			728.14	
P-26D	53.5-73.5	41.19	790.09	0.124	41.19	790.41	0.154	41.19	790.47	0.178
P-26S	18-28		795.18			796.76			797.82	
P-30D	60-70	27.46	730.77	0.027	27.46	730.65	0.024	27.40	730.44	0.023
P-30S	30-45		731.52			731.32			731.08	

NOTES:

1. Positive vertical gradient values indicate downward flow direction and negative vertical gradient values indicate upward flow direction.
2. Groundwater elevation for 10/24/06 was within the screened interval for P-30S. The distance was calculated by taking the midpoint of the screened interval below the static water level.

Checked DR 4-13-07
Reviewed RK 4/13/07

TABLE 8
Historical Precipitation Data
Piedmont Triad International Airport, NC

Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1931	2.36	2.01	3.95	5.19	5.28	1.71	9.04	6.07	0.73	0.38	0.47	6.55	**43.74**
1932	4.41	2.74	5.51	1.81	2.17	6.51	2.26	0.79	5.90	6.77	4.67	5.25	**48.79**
1933	3.07	3.72	2.29	3.40	3.51	1.55	3.91	4.21	0.69	1.66	1.29	2.36	**31.66**
1934	1.79	5.32	5.90	3.28	4.32	6.39	7.63	3.51	8.35	1.31	4.08	3.47	**55.35**
1935	3.43	2.53	6.24	5.62	5.21	2.21	3.90	3.63	5.23	1.69	3.62	2.35	**45.66**
1936	8.40	5.09	6.08	5.45	0.93	7.28	8.01	1.56	4.56	5.71	1.81	4.60	**59.48**
1937	9.65	3.55	1.39	4.73	2.25	2.09	5.57	6.18	3.05	5.45	2.29	1.48	**47.68**
1938	2.66	1.55	2.17	2.50	2.72	5.11	5.62	2.97	1.05	0.94	5.57	3.98	**36.84**
1939	3.76	6.50	3.62	2.98	1.96	3.30	7.93	8.76	3.10	2.22	1.79	3.06	**48.98**
1940	3.36	2.63	2.54	2.67	5.25	3.43	3.54	6.71	2.16	0.76	6.57	3.28	**42.90**
1941	2.03	1.13	3.40	2.82	1.30	3.42	6.30	1.56	1.76	0.65	0.53	3.28	**28.18**
1942	1.79	3.70	4.13	1.06	6.09	8.95	4.28	4.14	4.70	3.41	1.23	3.84	**47.32**
1943	5.04	2.28	4.78	2.76	3.47	8.09	8.57	2.41	2.47	0.55	1.36	3.11	**44.89**
1944	3.26	4.62	7.27	5.02	1.72	2.64	4.65	2.50	8.70	2.49	3.23	2.14	**48.24**
1945	1.95	5.27	2.51	3.06	4.72	0.76	4.22	3.06	12.24	1.85	2.49	6.38	**48.51**
1946	2.88	4.85	1.77	2.95	6.92	2.45	5.59	4.16	2.09	2.43	2.41	1.80	**40.30**
1948	3.95	2.48	4.85	2.28	4.45	4.23	2.22	4.49	1.95	2.28	7.72	4.01	**44.91**
1949	2.75	2.95	2.45	3.93	3.06	1.89	7.13	11.71	2.22	5.36	1.60	1.29	**46.34**
1950	1.81	1.66	3.23	1.49	5.39	5.05	5.11	3.31	1.93	3.70	2.11	1.96	**36.75**
1951	1.60	1.98	2.99	4.16	0.42	7.96	2.40	5.19	1.66	0.68	2.84	5.29	**37.17**
1952	3.58	4.04	7.21	3.94	3.19	1.39	6.78	7.28	2.48	1.45	2.39	4.45	**48.18**
1953	4.34	5.50	4.96	3.07	0.91	7.90	0.98	2.27	4.12	0.27	0.44	4.55	**39.31**
1954	6.19	2.21	4.00	2.52	2.62	2.69	3.45	2.95	0.35	7.03	3.43	3.33	**40.77**
1955	1.84	3.99	2.33	3.67	2.50	1.86	3.03	6.64	4.11	1.93	1.81	0.33	**34.04**
1956	1.04	5.32	2.54	3.69	4.18	2.66	4.71	4.76	7.19	2.89	1.93	3.14	**44.05**
1957	5.09	3.95	2.15	3.79	1.96	5.33	2.14	3.28	5.27	1.54	6.18	2.49	**43.17**
1958	3.36	2.87	3.03	6.11	2.98	3.70	5.28	4.63	0.64	2.02	1.84	4.37	**40.83**
1959	3.01	3.32	3.10	4.37	3.07	2.47	9.81	3.69	5.55	9.60	1.57	2.86	**52.42**
1960	4.44	5.81	4.78	4.30	4.68	0.95	4.24	3.78	2.32	4.04	0.66	2.54	**42.54**
1961	2.35	3.43	4.86	3.95	4.31	6.21	3.30	7.17	0.20	1.02	1.70	5.30	**43.80**
1962	5.77	4.74	4.76	2.89	2.18	7.08	2.93	1.19	5.66	0.65	6.33	4.94	**49.12**
1963	2.41	2.96	6.46	2.49	2.92	3.54	3.49	2.34	4.01	0.26	4.77	1.54	**37.19**
1964	4.48	4.09	2.75	2.93	0.56	3.07	6.61	6.75	1.03	8.15	1.57	3.20	**45.19**
1965	2.27	2.80	5.04	3.07	1.00	7.99	9.08	3.91	4.31	3.72	1.29	0.64	**45.12**
1966	4.48	5.44	1.53	0.97	4.15	4.04	2.01	3.01	3.59	3.25	1.55	2.26	**36.28**
1967	1.84	2.76	1.21	2.03	4.03	2.11	3.11	5.43	2.39	1.23	1.40	6.34	**33.88**
1968	3.74	0.88	3.97	2.64	3.92	1.62	2.60	2.51	0.58	4.60	3.55	2.25	**32.86**
1969	2.01	3.01	3.72	2.30	3.17	7.86	4.11	3.95	3.44	1.89	1.41	4.93	**41.80**
1970	1.66	3.25	3.81	4.52	2.76	3.59	2.56	9.13	0.70	5.57	2.87	2.37	**42.79**
1971	1.80	4.46	3.32	2.74	5.37	2.99	3.88	4.22	2.51	6.71	2.58	1.61	**42.19**
1972	2.60	3.71	2.65	2.72	6.24	6.37	2.54	0.71	3.72	1.82	4.87	4.49	**42.44**
1973	3.50	3.53	5.69	4.31	5.71	4.88	5.30	2.72	1.15	2.31	1.24	6.44	**46.78**
1974	4.58	3.13	3.32	2.15	5.69	2.72	1.71	7.14	7.57	0.81	2.42	4.23	**45.47**
1975	5.31	3.15	8.76	2.00	6.23	1.71	12.35	1.48	7.29	2.62	1.81	3.80	**56.51**
1976	2.25	1.47	2.42	0.62	2.94	3.91	1.87	2.63	2.35	8.61	1.69	3.92	**34.68**
1977	2.27	1.69	2.79	2.25	0.70	1.54	1.52	4.03	6.35	4.67	3.11	3.30	**34.22**
1978	7.70	0.73	4.38	4.13	5.09	3.72	9.23	9.60	2.70	1.25	3.17	4.45	**56.15**
1979	5.87	5.03	2.95	3.21	4.46	2.72	4.30	1.13	13.08	2.64	4.78	1.12	**51.29**
1980	4.00	1.77	5.04	3.24	3.23	3.44	2.68	2.14	2.95	2.13	2.58	0.78	**33.98**
1981	0.66	3.61	2.59	1.13	2.78	2.92	8.99	2.60	6.35	3.63	0.35	5.60	**41.21**
1982	2.91	4.64	2.39	2.72	8.35	7.28	3.46	1.46	1.22	4.65	2.73	3.56	**45.37**
1983	1.31	3.82	5.75	5.16	4.12	5.15	2.78	1.44	2.68	4.09	5.37	4.38	**46.05**
1984	3.51	5.25	5.31	2.77	5.83	3.10	12.72	5.55	1.12	1.16	2.02	1.90	**50.24**
1985	4.34	3.77	0.67	0.94	4.32	2.25	4.31	4.86	0.00	1.92	8.26	1.46	**37.10**
1986	0.74	1.61	2.00	0.47	1.12	1.10	3.21	8.03	1.05	3.24	3.50	3.60	**29.67**
1987	3.77	4.72	3.24	8.03	2.48	1.20	5.80	3.55	7.22	0.71	3.66	3.38	**47.76**
1988	2.35	1.27	1.86	2.55	3.97	3.19	4.47	3.50	3.24	4.09	3.55	1.19	**35.23**
1989	0.93	4.48	5.71	3.23	6.36	7.09	2.96	2.31	6.08	5.04	2.92	3.53	**50.64**
1990	3.76	4.32	2.64	2.90	6.54	0.00	1.50	2.01	1.16	12.59	1.93	4.17	**43.52**
1991	4.53	1.15	7.75	6.66	3.89	1.96	3.95	1.91	3.66	1.90	1.67	2.80	**41.83**
1992	3.54	3.02	2.74	5.83	2.34	2.92	5.43	2.97	3.06	3.66	6.05	2.48	**44.04**
1993	3.65	3.40	7.61	6.08	2.95	3.14	3.28	2.31	2.82	1.25	2.58	3.28	**42.35**
1994	3.66	2.49	5.04	1.45	1.71	3.92	4.51	5.84	1.61	1.13	2.55	0.60	**34.51**
1995	2.94	3.59	1.84	0.41	2.15	9.53	2.39	5.41	2.26	5.98	3.49	1.36	**41.35**
1996	4.49	2.38	4.29	3.67	3.84	1.93	4.71	5.22	10.82	4.21	2.57	3.87	**52.00**
1997	2.89	3.43	4.06	7.22	1.79	3.33	3.03	1.97	3.88	2.38	2.65	2.17	**38.80**
1998	6.88	4.39	3.65	5.52	5.04	3.53	3.86	5.63	2.34	0.62	1.55	5.22	**48.23**
1999	5.39	1.50	1.96	4.37	1.00	4.26	4.14	5.00	8.62	2.32	1.28	2.04	**41.88**
2000	4.03	1.54	2.95	4.47	2.31	4.05	2.18	3.97	9.98	0.00	1.95	1.14	**38.57**
2001	2.53	2.51	5.05	1.81	2.69	3.09	4.06	3.08	2.05	0.41	0.34	2.21	**29.83**
2002	2.38	1.18	3.10	0.84	3.06	3.76	2.94	3.23	3.70	5.63	4.52	4.27	**38.62**
2003	2.08	3.77	6.70	6.39	5.19	4.18	6.54	8.49	7.86	1.70	1.64	2.40	**56.96**
2004	0.60	1.85	1.62	2.48	1.74	2.35	6.97	2.09	8.53	0.64	4.57	2.67	**36.14**
2005	1.82	2.46	2.78	2.23	1.29	3.92	5.34	1.85	0.25	2.89	3.55	3.96	**32.36**
2006	2.40	1.53	0.88	2.65	2.34	10.24	6.72	5.29	6.68	2.96	5.95	-	-
Monthly Averages	3.36	3.24	3.80	3.33	3.48	3.93	4.72	4.09	3.87	3.02	2.89	3.23	
											1931-2005 Yearly Average:		**42.77**
											2002-2005 Average:		**41.02**

NOTES:
1. Data for 1931-2001 taken from National Climatic Data Center web page (http://www.ncdc.noaa.gov).
2. Data for January 2002 through August 2002 taken from National Oceanic and Atmospheric Administration web page (http://www.ncdc.noaa.gov/cgi-bin/res40.pl?page=climvisgsod.html).
3. Data for September 2002 through November 2006 from the State Climate Office of North Carolina web page (http://www.nc-climate.ncsu.edu/cronos/query.php).
4. - = no data available

TABLE 9
Estimated Seasonal High Groundwater Elevation Calculations
WCA of High Point, LLC

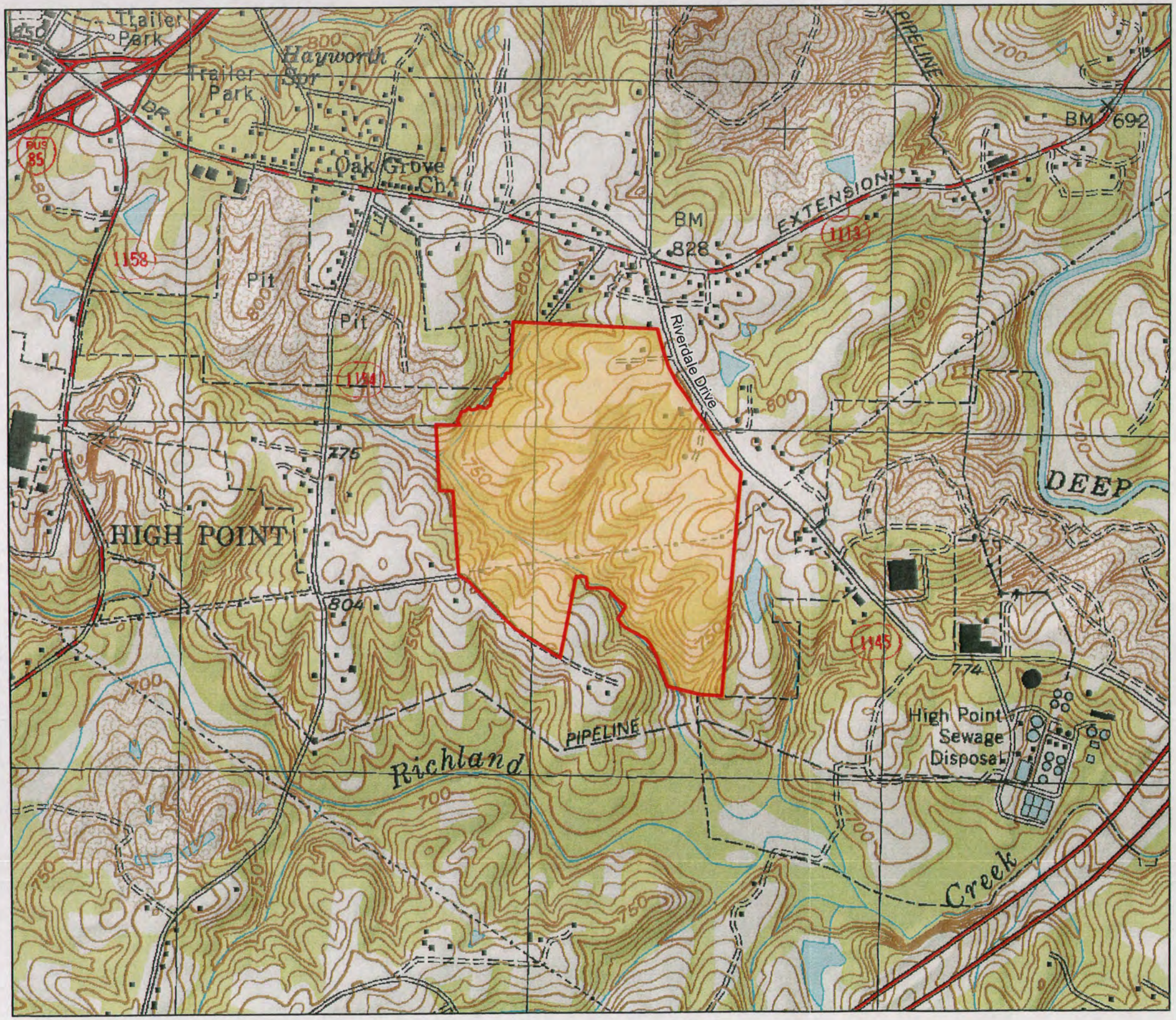
WELL/PIEZOMETER IDENTIFICATION	MW-1	MW-2	MW-3	MW-4S	MW-5	MW-6	P-3	P-6	P-7	P-11
MAXIMUM GW ELEVATION	795.37	749.37	739.48	729.41	740.31	732.83	786.94	780.49	777.97	746.25
7/25/2006 GW ELEVATION	793.43	749.37	737.41	728.59	735.59	727.84	785.26	778.64	776.00	746.18
MAXIMUM - 7/25/06	1.94	0.00	2.07	0.82	4.72	4.99	1.68	1.85	1.97	0.07
ADJUSTMENT FOR SEASONAL HIGH	2.00	1.00	3.00	1.00	5.00	5.00	2.00	2.00	2.00	1.00
SEASONAL HIGH GW ELEVATION	**795.43**	**750.37**	**740.41**	**729.59**	**740.59**	**732.84**	**787.26**	**780.64**	**778.00**	**747.18**

WELL/PIEZOMETER IDENTIFICATION	P-23	P-24	P-25	P-26S	P-27	P-28	P-29	P-30S	P-31
MAXIMUM GW ELEVATION	759.20	785.27	790.49	796.76	777.99	765.97	743.19	731.52	731.42
7/25/2006 GW ELEVATION	759.20	784.90	790.43	795.18	777.99	765.60	742.94	731.52	731.42
MAXIMUM - 7/25/06	0.00	0.37	0.06	1.58	0.00	0.37	0.25	0.00	0.00
ADJUSTMENT FOR SEASONAL HIGH	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
SEASONAL HIGH GW ELEVATION	**760.20**	**786.90**	**792.43**	**797.18**	**779.99**	**767.60**	**744.94**	**733.52**	**733.42**

NOTES:

1. GW = Groundwater
2. Elevations are in feet above mean sea level.
3. The adjustments for seasonal high groundwater elevations were determined by evaluating groundwater fluctuations in wells and piezometers that had a minimum of 3 years of groundwater elevation data. Wells and piezometers with less than 3 years of groundwater elevation data were compared topographically and spatially with those with 3 or more years of groundwater elevation data and adjusted by a similar value.
4. Seasonal high groundwater elevation estimates for all hand auger piezometers (HA-1 through HA-5) are equal to ground surface.

FIGURES



LEGEND

WCA of High Point Property

REFERENCE

NAD 1983 State Plane North Carolina FIPS 3200 Feet
Projection: Lambert Conformal Conic

Topographic Map Base: High Point East 7.5 Minute USGS Topographic Quadrangle.

1,000 0 1,000 Feet

SCALE 1:12,000

Golder Associates
Golder Associates NC, Inc.

PROJECT No. 0636526.100

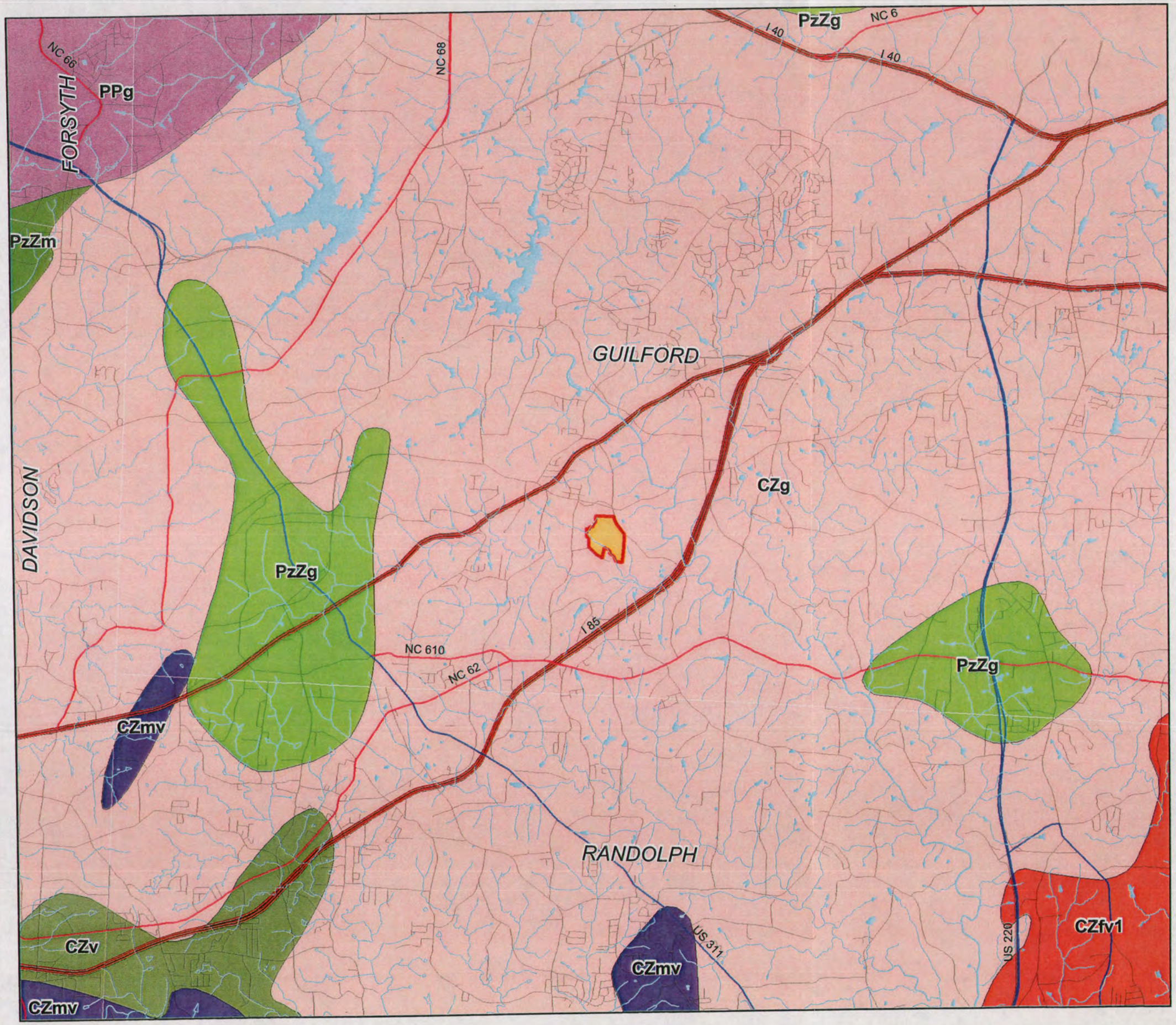
FILE Figure 1 Location Map.mxd

TITLE **Site Location Map**

CLIENT WCA of High Point, LLC

DATE 12/13/06
DESIGN CGP
GIS CGP
CHECK DR 4-13-07
REVIEW AJK 4-13-07 REV. 0

FIGURE: 1



N

LEGEND

- WCA of High Point Property
- Surface Water Bodies
- Rivers and Streams

Primary Roads

- Interstate
- NC - Highway
- US - Highway
- Secondary Roads

Geologic Units

- CZfv1 - FELSIC METAVOLCANIC ROCK (Uwarrie Formation)
- CZg - METAMORPHOSED GRANITIC ROCK
- CZmv - MAFIC METAVOLCANIC ROCK
- CZv - METAVOLCANIC ROCK
- PPg - GRANITIC ROCK
- PzZg - METAMORPHOSED GABBRO AND DIORITE
- PzZm - METAMORPHOSED MAFIC ROCK

REFERENCE

NAD 1983 State Plane North Carolina FIPS 3200 Feet
Projection: Lambert Conformal Conic

Geologic Map Base: Digitized geologic coverage of the 1985 state geologic map, produced by the NC DEHNR-Division of Land Resources, NC Geological Survey.

8,000 0 8,000 Feet

SCALE 1:96,000 1 inch equals 8,000 feet

Golder Associates

Golder Associates NC, Inc.

PROJECT No. 0636526.100

FILE Figure 2 Geology Map.mxd

TITLE **Geologic Map of Study Area**

CLIENT WCA of High Point, LLC

DATE 12/13/06

DESIGN CGP

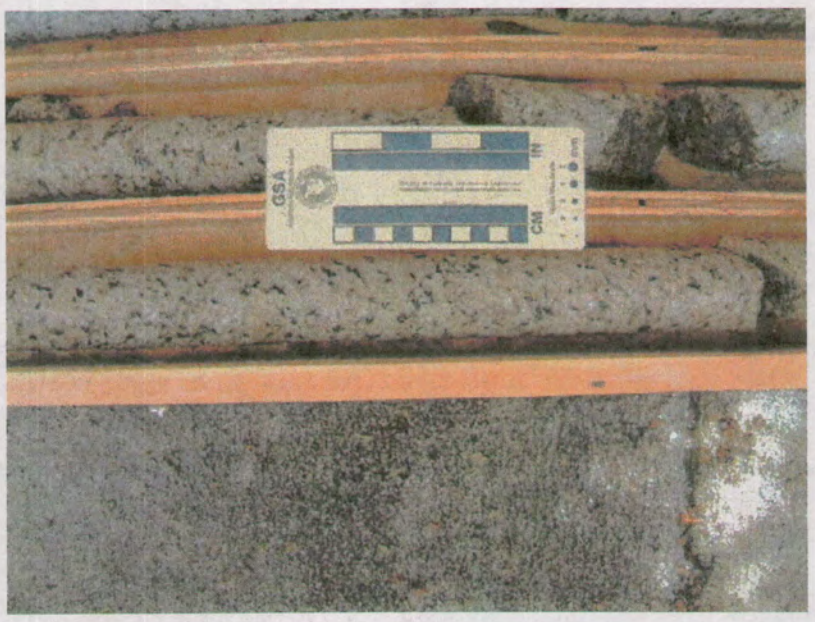
GIS CGP

CHECK DR 4.13.07

REVIEW RK 4/13/07 REV. 0

FIGURE: 2

FIGURE 3
Rock Core Photographs
WCA of High Point, LLC



Photograph 1. Section of rock core from piezometer P-10 showing preferred orientation of biotite and fractures (photograph taken from the Design Hydrogeologic Report prepared by Joyce Engineering, Inc., 2002).

Photograph 2. Section of rock core from piezometer P-26D showing preferred orientation of biotite and fractures (July 2006).

Photographs 3 & 4. Sections of rock core from piezometer P-30D showing weathering, preferred orientation of biotite, metavolcanic rock, and fractures (July 2006).

FIGURE 4
Groundwater Elevation Summary for Wells and Piezometers with at Least 3 Years of Data
WCA of High Point, LLC

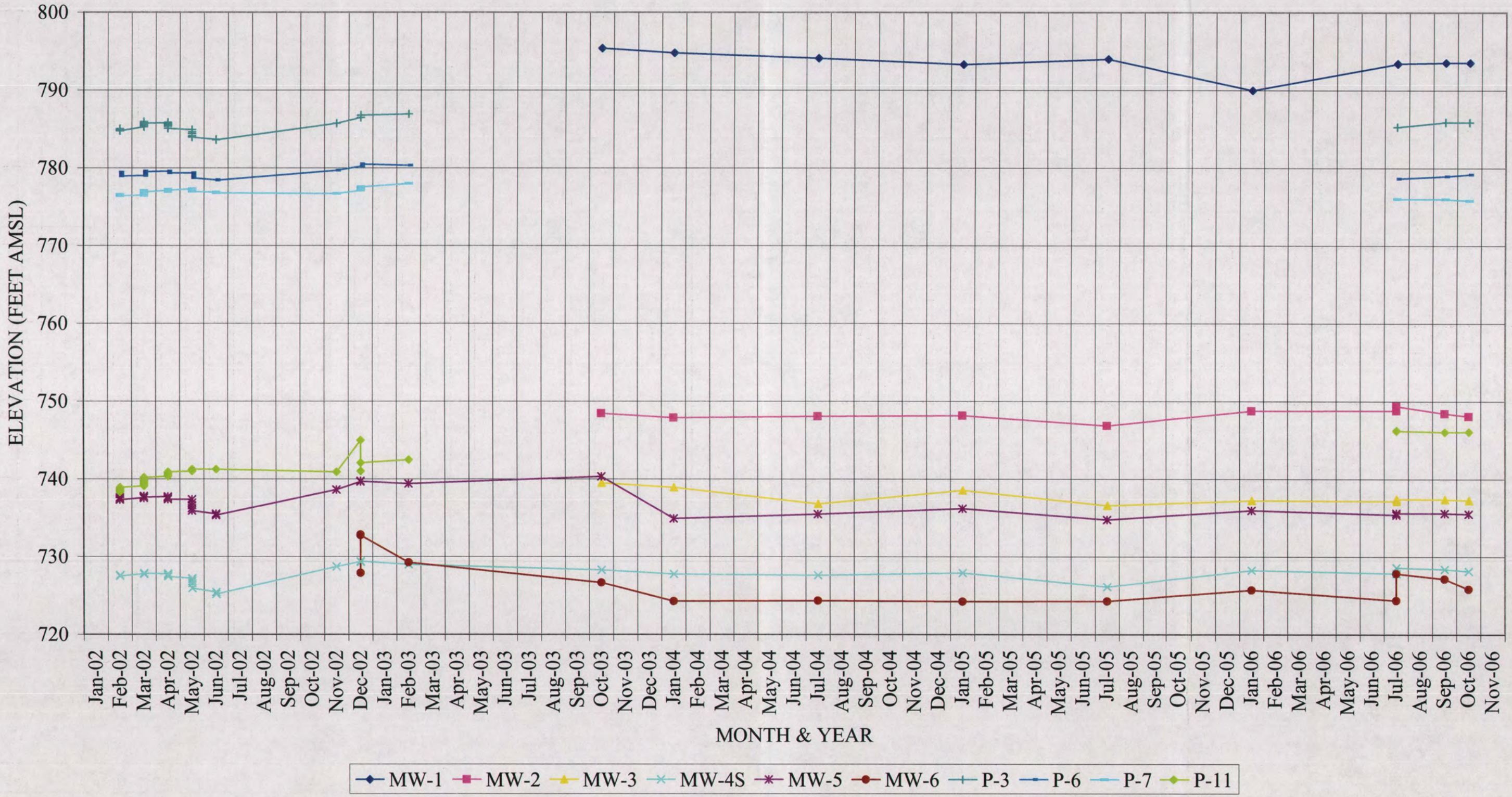
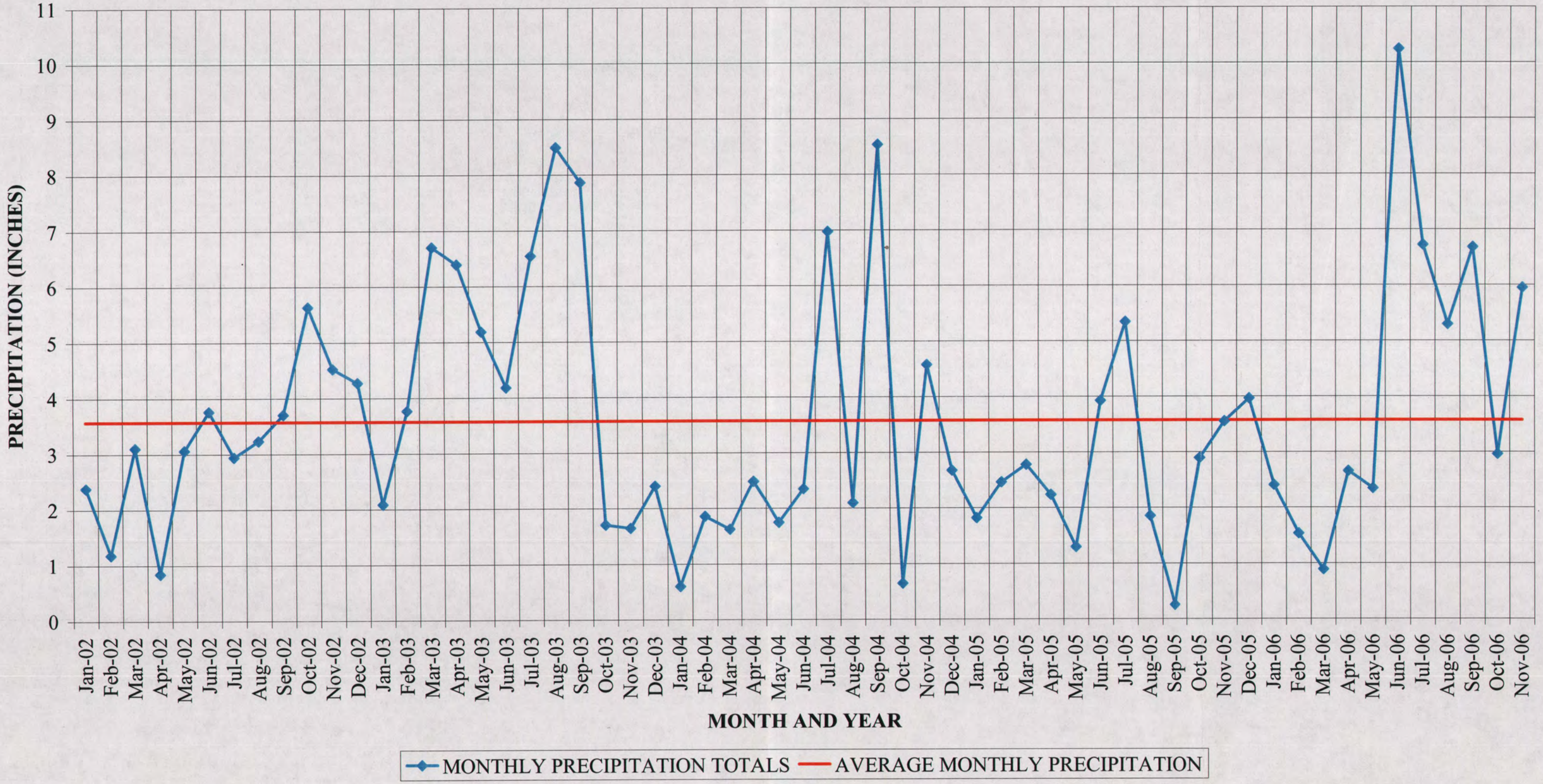
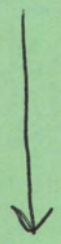


FIGURE 5
Monthly Precipitation (2002-2006)
Piedmont Triad International Airport, NC



DRAWINGS

See back of this file for



DRAWINGS

APPENDIX DH-A

BORING LOGS AND WELL CONSTRUCTION DIAGRAMS, WELL DEVELOPMENT FORMS, AND FIELD LOGS

RECORD OF BOREHOLE P-23/ 4116-MW-8

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 25.0 ft
LOCATION: Jamestown, NC

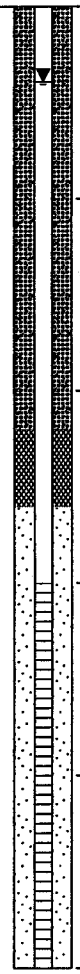
DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/5/06
DATE COMPLETED: 7/5/06

NORTHING: 802,748.0
EASTING: 1,726,285.2
GS ELEVATION: 760.6 ft
TOC ELEVATION: 762.6 ft

DEPTH W.L.: 2.0 ft
ELEVATION W.L.: 760.6 ft
DATE W.L.: 7/6/06
TIME W.L.: 12:11 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC
0	760	0.0 - 3.0 SILTY SAND - brown fine grained silty sand, moist Medium grained silty sand at 0.75 ft Gray medium grained silty sand at 1.25 ft Auger refusal at 3 ft	SM		757.6		SPT	3-3-4-8	7	100.0 2.0
		3.0 - 12.5 BEDROCK - granitic cuttings consisting of mainly quartz and biotite, coarse sand size cuttings, very competent			3.0					
5	755									
10	750	Less competent from 11 to 11.25 ft (possible fracture) based on drilling response			748.1					
		12.5 - 24.0 BEDROCK - mafic rock, small pebble size black cuttings with green dust Apparent fracture at 20.5 ft based on drilling response, ~0.5 ft thick			12.5					
15	745									
20	740	Less competent at 21.5 ft								
		Some granitic cuttings mixed with mafic rock cuttings at 23 ft			736.6					
		24.0 - 25.0 BEDROCK - granitic cuttings with some mafic rock cuttings			24.0 735.6					
25	735	Boring completed at 25.0 ft								
30	730									
35	725									
40										

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: -2.04-15 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 15-25 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 13-25 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 11-13 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-11 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

RECORD OF BOREHOLE P-24

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 33.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 6/30/06
DATE COMPLETED: 6/30/06

NORTHING: 802,562.7
EASTING: 1,726,620.0
GS ELEVATION: 797.4 ft
TOC ELEVATION: 799.3 ft

DEPTH W.L.: 17.2 ft
ELEVATION W.L.: 782.1 ft
DATE W.L.: 7/3/06
TIME W.L.: 9:26 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)
0		0.0 - 5.3 SILTY SAND - Tan medium grained silty sand, moist Changes to orange medium grained silty sand at 0.75 ft, moist at 1 ft	SM		
5	795				792.2
		5.3 - 9.0 PARTIALLY WEATHERED ROCK - orange and white mottled coarse grained silty sand	SM		5.3
	790	Auger refusal at 9 ft			788.4
10		9.0 - 33.0 BEDROCK - very weathered, tan medium grained to pebble size cuttings, granitic			9.0
	785				
15		More competent at 14 ft, tan medium grained sand size cuttings consisting mainly of quartz			
	780				
20		Apparent large fracture from 20.75 to 23 ft based on drilling response			
	775				
25		White and tan coarse sand size cuttings consisting of mainly quartz with some biotite at 25 ft Apparent small fracture from 26.5 to 26.75 ft based on drilling response			
	770				
30		Apparent fracture from 29 to 29.5 ft based on drilling response. Coarse sand to small pebble size cuttings with some iron staining Less competent material from 31.5 to 32 ft			
	765				764.4
		Boring completed at 33.0 ft			
35					
	760				
40					

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC
	SPT	2-2-3-8	5	100.0 / 2.0
	SPT	25-50/4	50/4	40.0 / 2.0

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES

WELL CONSTRUCTION DETAILS

WELL CASING
Interval: -2.05-18 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 18-33 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 16-33 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 14-16 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-14 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: None
Protective Casing: None

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

RECORD OF BOREHOLE P-25

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 37.5 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 6/29/06
DATE COMPLETED: 6/29/06

NORTHING: 802,762.7
EASTING: 1,726,810.0
GS ELEVATION: 802.5 ft
TOC ELEVATION: 805.2 ft

DEPTH W.L.: 21.1 ft
ELEVATION W.L.: 784.2 ft
DATE W.L.: 6/30/06
TIME W.L.: 9:27 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.0 - 6.0 SILTY SAND - orange fine to medium grained silty sand, moist	SM				SPT	6-5-5-7	10	100.0 / 2.0		**WELL CASING** Interval: -2.75-27.5 ft Material: PVC Diameter: 2-inch Joint Type: Threaded
	800											**WELL SCREEN** Interval: 27.5-37.5 ft Material: PVC Diameter: 2-inch Slot Size: 0.010 End Cap: Threaded
5		Gray and orange medium to coarse grained silty sand at 5 ft, dry			796.5 / 6.0		SPT	4-6-50	>50	70.0 / 2.0		**FILTER PACK** Interval: 26-37.5 ft Type: #2 Sand
	795	6.0 - 13.5 PARTIALLY WEATHERED ROCK - white weathered quartz sand with large quartz gravel	SWG									**FILTER PACK SEAL** Interval: 24-26 ft Type: 3/8 Bentonite Chip
10							SPT	50/5	50/5	10.0 / 2.0	Grout	**ANNULUS SEAL** Interval: 0-24 ft Type: Portland/Bentonite Mix
	790	Auger refusal at 13.5 ft			789.0 / 13.5							**WELL COMPLETION** Pad: None Protective Casing: None
15		13.5 - 37.5 BEDROCK - coarse sand to pebble size granitic cuttings consisting of mainly quartz and biotite										**DRILLING METHODS** Soil Drill: 6.25-inch ID Hollow Stem Augers Rock Drill: 6-inch Downhole Hammer
	785	Fine to medium grained sand size cuttings by 18 ft										
20												
	780											
25											Bentonite #2 Sand	
	775											
30		Small fracture at 30 ft based on drilling response Fracture from 31.5 to 32 ft based on drilling response. Granitic cuttings with some gravel size mafic rock cuttings that show some iron staining Pebble size granitic cuttings with some mafic rock cuttings at 33 ft Medium sand size granitic cuttings at 34 ft									Screen	
	770											
35		Weathered cuttings at 36 ft										
	765	Boring completed at 37.5 ft			765.0							
40												

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

RECORD OF BOREHOLE P-26D

SHEET 1 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 74.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/3/06
DATE COMPLETED: 7/7/06

NORTHING: 802,352.0
EASTING: 1,726,918.8
GS ELEVATION: 805.8 ft
TOC ELEVATION: 807.0 ft

DEPTH W.L.: 17.0 ft
ELEVATION W.L.: 790.1 ft
DATE W.L.: 7/11/06
TIME W.L.: 11:08 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	805	0.0 - 10.0 SILTY SAND - orange and tan mottled medium grained silty sand with minor organics, moist Some cley at 1.75 ft	SM				SPT	1-5-5-6	10	100.0 / 2.0		**WELL CASING** Interval: -1.25-53.5 ft Material: PVC Diameter: 2-inch Joint Type: Threaded
5	800	White medium grained silty sand with granitic texture at 5 ft, dry More dense at 8 ft					SPT	4-16-20-31	36	100.0 / 2.0		**WELL SCREEN** Interval: 53.5-73.5 ft Material: PVC Diameter: 2-inch Slot Size: 0.010 End Cap: Threaded
10	795	795.8 10.0 - 15.0 PARTIALLY WEATHERED ROCK - white medium grained clayey sand with granitic texture, dry	SC		10.0		SPT	31-50/3	50/3	35.0 / 2.0		**FILTER PACK** Interval: 51-73.5 ft Type: #2 Sand **FILTER PACK SEAL** Interval: 49-51 ft Type: 3/8 Bentonite Chip **ANNULUS SEAL** Interval: 0-49 ft Type: Portland/Bentonite Mix
15	790	790.8 15.0 - 25.0 PARTIALLY WEATHERED ROCK - white medium grained silty sand, dense	SM		15.0		SPT	50/4	50/4	10.0 / 2.0		**WELL COMPLETION** Pad: None Protective Casing: None **DRILLING METHODS** Soil Drill: 6.25-inch ID Hollow Stem Augers Rock Drill: HQ Core, 6-inch Downhole Hammer
20	785	White and tan coarse grained silty sand with granitic texture at 20 ft, dry, weathered quartz and biotite grains					SPT	35-50/4	50/4	25.0 / 2.0	Grout	
25	780	780.8 25.0 - 28.0 PARTIALLY WEATHERED ROCK - grayish green mafic rock fragments and silt. Nearly vertical foliation present Gravel size rock fragments in cuttings at 27 ft	GM		25.0		SPT	8-50/5	50/5	15.0 / 2.0		
30	775	Auger refusal at 28 ft 777.8 28.0 - 29.0 BEDROCK - grayish green mafic rock cuttings 776.8 29.0 - 40.0 BEDROCK - coarse grained sand size quartz cuttings, very weathered, moist at 30 ft			28.0 29.0							
35	770	More competent at 32.5 ft, wet Core Run (33 to 38 ft) Rec = 100%, RQD = 100%, very competent granitic rock consisting primarily of quartz and biotite, one natural fracture at 36.4 ft with ~30 degree dip										
40		Core Run (38 to 41.25 ft) Rec = 89%, RQD = 89%, granitic rock consisting of quartz and biotite, one natural fracture with iron staining at 40.9 ft with ~40 degree dip. 765.8										

Log continued on next page

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/6/06

RECORD OF BOREHOLE P-26D

SHEET 2 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 74.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/3/06
DATE COMPLETED: 7/7/06

NORTHING: 802,352.0
EASTING: 1,726,918.8
GS ELEVATION: 805.8 ft
TOC ELEVATION: 807.0 ft

DEPTH W.L.: 17.0 ft
ELEVATION W.L.: 790.1 ft
DATE W.L.: 7/11/06
TIME W.L.: 11:08 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
40	765	40.0 - 56.0 Stop coring at 41.25 ft because boring washing out			40.0							
45	760											
50	755										Bentonite #2 Sand	
55	750				749.8							
		56.0 - 60.5 BEDROCK - black mafic rock cuttings			56.0							
60	745	Mafic rock cuttings with some granitic cuttings by 59 ft			745.3							
		60.5 - 73.5 BEDROCK - granitic rock consisting of quartz and biotite cuttings			60.5						Screen	
65	740											
70	735											
75	730				732.3							
		Boring completed at 74.0 ft			73.5							
80												

WELL CASING
Interval: -1.25-53.5 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 53.5-73.5 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 51-73.5 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 49-51 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-49 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: None
Protective Casing: None

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: HQ Core, 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/6/06

RECORD OF BOREHOLE P-26S

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 28.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/10/06
DATE COMPLETED: 7/10/06

NORTHING: 802,360.8
EASTING: 1,726,918.7
GS ELEVATION: 806.5 ft
TOC ELEVATION: 808.7 ft

DEPTH W.L.: 16.1 ft
ELEVATION W.L.: 792.7 ft
DATE W.L.: 7/11/06
TIME W.L.: 11:09 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	805	0.0 - 10.5 SILTY SAND - brown silty sand, moist Orange silty sand by 1 ft								
5	800	White and tan silty sand by 5 ft	SM						Grout	
10	795				796.0					
		10.5 - 28.0 PARTIALLY WEATHERED ROCK - white medium grained silty sand			10.5				Bentonite #2 Sand	
15	790									
20	785		SM							
25	780	More competent at 25 ft							Screen	
					778.5					
		Boring completed at 28.0 ft								
30	775									
35	770									
40										

WELL CASING
Interval: -2.25-18 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 18-28 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 16-28 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 14-16 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-14 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: None
Protective Casing: None

DRILLING METHODS
Soil Drill: 6-inch Tricone
Rock Drill: None

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

RECORD OF BOREHOLE P-27

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 40.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 6/29/06
DATE COMPLETED: 6/30/06

NORTHING: 801,970.9
EASTING: 1,726,699.4
GS ELEVATION: 796.3 ft
TOC ELEVATION: 800.0 ft

DEPTH W.L.: 18.5 ft
ELEVATION W.L.: 781.5 ft
DATE W.L.: 7/3/06
TIME W.L.: 9:30 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	795	0.0 - 5.0 SILTY SAND - dark brown silty sand, moist Tan and orange mottled medium grained silty sand, dry	SM				SPT	4-4-10-24	14	100.0 2.0		
5	790	5.0 - 13.5 PARTIALLY WEATHERED ROCK - medium to coarse grained silty sand, dry Attempted to push Shelby tube from 5-7 ft, bent tube	SM		791.3 5.0		SPT	50/4	50/4	10.0 2.0		
10	785	Some pebble size rock fragments present at 10 ft					SPT	50/2	50/2	10.0 2.0	Grout	
		Auger refusal at 13.5 ft			782.8							
15	780	13.5 - 40.0 BEDROCK - weathered tan coarse grained sand to pebble size granitic cuttings			13.5							
20	775	White and tan medium grained sand size granitic cuttings at 20 ft Some mafic rock pieces mixed in with granitic cuttings at 22 ft									Bentonite #2 Sand	
25	770	Apparent fracture from 25.5 to 26 ft based on drilling response										
30	765	Apparent small fracture at 32.5 to 32.75 ft based on drilling response, coarse grained sand to small pebble size cuttings consisting of weathered quartz, biotite, and feldspar at 33.5 ft									Screen	
35	760	Apparent fracture from 37.5 to 37.75 ft based on drilling response, dust died slightly, gravel size quartz and biotite cuttings										
40		Boring completed at 40.0 ft			756.3							

WELL CASING
Interval: -3.65-25 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 25-40 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 23-40 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 20-23 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-20 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: None
Protective Casing: None

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

RECORD OF BOREHOLE P-28

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 32.5 ft
LOCATION: Jamestown, NC

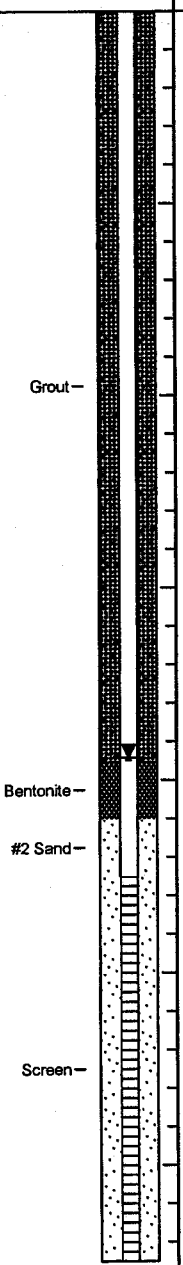
DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/6/06
DATE COMPLETED: 7/6/06

NORTHING: 801,976.8
EASTING: 1,726,891.0
GS ELEVATION: 784.6 ft
TOC ELEVATION: 787.4 ft

DEPTH W.L.: 19.4 ft
ELEVATION W.L.: 767.9 ft
DATE W.L.: 7/7/06
TIME W.L.: 3:53 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC
0		0.0 - 6.0 SILTY SAND - brown medium grained silty sand Orange medium grained silty sand with some clay at 1.75 ft, moist	SM				SPT	2-2-3-5	5	75.0 / 2.0
5	780						SPT	9-46-50/5	>50	50.0 / 2.0
					778.6					
		6.0 - 19.5 PARTIALLY WEATHERED ROCK - tan and white fine to medium grained silty sand, very dense, dry			6.0					
10	775	Granitic texture with highly weathered quartz and mica grains at 10 ft	SM				SPT	17-32-50/4	44.5	60.0 / 2.0
15	770						SPT	15-37-50/4	49.5	40.0 / 2.0
		Auger refusal at 19.5 ft			765.1					
20	765	19.5 - 32.5 BEDROCK - very weathered gray granitic silt to pebble size cuttings			19.5					
		More competent by 22 ft								
25	760	Apparent fracture at 25 ft based on drilling response								
		Apparent fracture at 28 ft based on drilling response								
30	755	Apparent fracture at 30 ft based on drilling response, tan dust								
					752.1					
		Boring completed at 32.5 ft								
35	750									
40	745									

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: -2.79-22.5
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 22.5-32.5 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 21-32.5 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 19-21 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-19 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: None
Protective Casing: None

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

RECORD OF BOREHOLE P-29

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 27.0 ft
LOCATION: Jamestown, NC

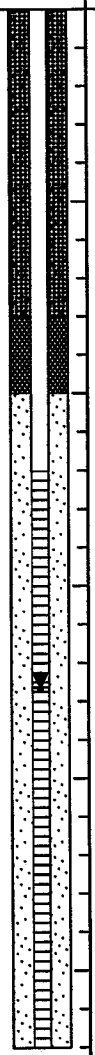
DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/6/06
DATE COMPLETED: 7/6/06

NORTHING: 801,623.8
EASTING: 1,726,871.6
GS ELEVATION: 759.3 ft
TOC ELEVATION: 762.8 ft

DEPTH W.L.: 17.6 ft
ELEVATION W.L.: 745.2 ft
DATE W.L.: 7/7/06
TIME W.L.: 3:58 pm

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC
0		0.0 - 9.0 SILTY SAND - orange medium grained fill, dry								
		Dark brown silty sand with organics at 2.5 ft								
	755	Orange medium grained silty sand at 4 ft White and orange silty sand with granitic texture at 5 ft, very dense	SM							
5							SPT	13-29-32-42	>50	50.0 / 2.0
		Auger refusal at 9 ft			750.3					
	750	9.0 - 13.0 BEDROCK - very weathered tan silt to pebble size cuttings, dry Tannish gray cuttings at 10 ft			9.0 746.3					
10										
		13.0 - 18.0 BEDROCK - very weatherad green mafic rock cuttings, dry			13.0 741.3					
	745									
15										
		18.0 - 27.0 BEDROCK - weathered tan granitic cuttings			18.0					
	740									
20										
	735									
25		Competent rock at 25 ft, quartz and biotite cuttings			732.3					
		Boring completed at 27.0 ft								
	730									
30										
	725									
35										
	720									
40										

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: -3.47-12 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 12-27 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 10-27 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 8-10 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-8 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: None
Protective Casing: None

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

RECORD OF BOREHOLE P-30D/4116-MW-7D

SHEET 1 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 70.0 ft
LOCATION: Jamestown, NC

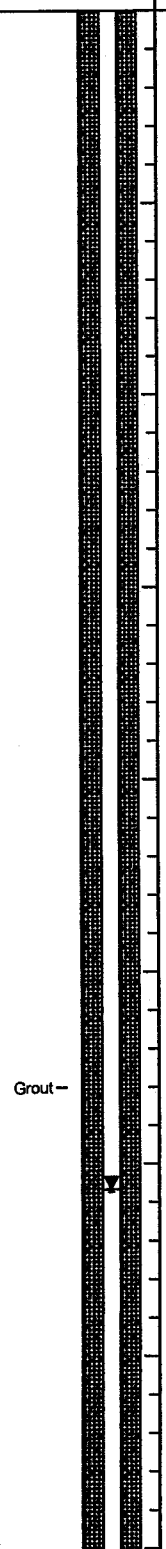
DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/10/06
DATE COMPLETED: 7/11/06

NORTHING: 801,341.6
EASTING: 1,726,657.8
GS ELEVATION: 761.2 ft
TOC ELEVATION: 763.3 ft

DEPTH W.L.: 30.7 ft
ELEVATION W.L.: 732.6 ft
DATE W.L.: 7/12/06
TIME W.L.: 10:59 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC
0	760	0.0 - 9.5 SILTY SAND - orange silty sand fill material In-place orange silty sand at 2ft, dry Shleby Tube pushed from 3-5 ft	SM							
							SH			100.0 / 2.0
5	755						SPT	4-2-22-50/4	24	75.0 / 2.0
					751.7					
10	750	9.5 - 40.0 PARTIALLY WEATHERED ROCK - white and tan medium grained silty sand, very dense, dry Cuttings slightly moist at 11 ft			9.5		SPT	50/4	50/4	25.0 / 2.0
15	745	White coarse-grained silty sand at 15 ft, dry					SPT	45-50/1	50/1	35.0 / 2.0
20	740	Very competent at 20 ft					SPT	50/1	50/1	10.0 / 2.0
25	735		SM							
30	730									
35	725									
40		Log continued on next page			721.2					

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: -2.03-60 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 60-70 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 58-70 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 56-58 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-56 ft
Type: Portland/Bentonite

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Tricone,HQ Core, 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

RECORD OF BOREHOLE P-30D/4116-MW-7D

SHEET 2 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 70.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/10/06
DATE COMPLETED: 7/11/06

NORTHING: 801,341.6
EASTING: 1,726,657.8
GS ELEVATION: 761.2 ft
TOC ELEVATION: 763.3 ft

DEPTH W.L.: 30.7 ft
ELEVATION W.L.: 732.6 ft
DATE W.L.: 7/12/06
TIME W.L.: 10:59 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
40		40.0 - 43.0 White coarse grained silty sand with pebble to gravel size granitic rock fragments at 40 ft	SM		40.0							
	720	Auger refusal at 43 ft			718.2							
		43.0 - 57.0 BEDROCK - weathered granitic cuttings			43.0							
45		Core Run (45 to 50 ft) Rec = 99%, RQD = 82%, very weathered granitic rock mainly consisting of quartz and biotite, natural fractures throughout ranging from 20 to 60 degree dips										
	715											
50		Core Run (50 to 55 ft) Rec = 100%, RQD = 68%, very weathered granitic rock with highly fractured zones from 51 to 52 ft and 54 to 55 ft with one fracture at 53 ft. Fractures range from nearly horizontal to ~45 degrees, visible foliation at ~ 35 degrees										
	710											
55		Core Run (55 to 60 ft) Rec = 48%, RQD = 40%, very weathered granitic rock to 57 ft, highly fractured			704.2							
	705	57.0 - 61.0 BEDROCK - very weathered green mafic rock, highly fractured with poor recovery			57.0						Bentonite	
		Core Run (60 to 65 ft) Rec = 86%, RQD = 31%, very weathered green mafic rock to 61 ft, highly broken up			700.2						#2 Sand	
60	700	61.0 - 67.0 BEDROCK - very weathered granitic rock, highly broken up			61.0							
65											Screen	
	695				694.2							
		67.0 - 69.5 BEDROCK - black pebble size mafic rock fragments Fracture at 68 ft based on drilling response			67.0							
					691.7							
70		69.5 - 70.0 BEDROCK - very weathered granitic rock cuttings, large fracture at 69.5 ft based on drilling response			691.2							
	690	Boring completed at 70.0 ft										
75	685											
80												

WELL CASING
Interval: -2.03-60 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 60-70 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 58-70 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 56-58 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-56 ft
Type: Portland/Bentonite

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Tricone,HQ Core, 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

RECORD OF BOREHOLE P-30S/4116-MW-7S

SHEET 1 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 45.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/13/06
DATE COMPLETED: 7/13/06

NORTHING: 801,358.3
EASTING: 1,726,660.5
GS ELEVATION: 761.2 ft
TOC ELEVATION: 763.5 ft

DEPTH W.L.: 29.7 ft
ELEVATION W.L.: 733.8 ft
DATE W.L.: 7/25/06
TIME W.L.: 12:19 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	760	0.0 - 9.5 SILTY SAND - orange silty sand fill material, dry	SM							**WELL CASING** Interval: -2.32-30 ft Material: PVC Diameter: 2-inch Joint Type: Threaded
		In-place orange silty sand at 2 ft								**WELL SCREEN** Interval: 30-45 ft Material: PVC Diameter: 2-inch Slot Size: 0.010 End Cap: Threaded
5	755	Cuttings lighter at 5 ft								**FILTER PACK** Interval: 28-45 ft Type: #2 Sand
		More competent at 7 ft								**FILTER PACK SEAL** Interval: 24-28 ft Type: 3/8 Bentonite Chip
					751.7					
10	750	9.5 - 42.0 PARTIALLY WEATHERED ROCK - tan medium grained silty sand, dry	MLG		9.5				Grout	**ANNULUS SEAL** Interval: 0-24 ft Type: Portland/Bentonite Mix
										WELL COMPLETION Pad: 3x3x0.5 ft concrete Protective Casing: 4-inch square aluminum
15	745	Light tan cuttings at 14 ft								**DRILLING METHODS** Soil Drill: 6-inch Tricone Rock Drill: None
20	740									
25	735								Bentonite #2 Sand	
30	730	Light gray cuttings at 30 ft								
35	725								Screen	
40		Log continued on next page								

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

RECORD OF BOREHOLE P-30S/4116-MW-7S

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 45.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/13/06
DATE COMPLETED: 7/13/06

NORTHING: 801,358.3
EASTING: 1,726,660.5
GS ELEVATION: 761.2 ft
TOC ELEVATION: 763.5 ft

DEPTH W.L.: 29.7 ft
ELEVATION W.L.: 733.8 ft
DATE W.L.: 7/25/06
TIME W.L.: 12:19 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
40	720		MLG		719.2					
		42.0 - 44.0 PARTIALLY WEATHERED ROCK - dark green gravelly silt with weathered mafic rock fragments	SM		42.0 717.2					
45	715	44.0 - 45.0 PARTIALLY WEATHERED ROCK - light tan silty sand Tricone refusal at 45 ft Boring completed at 45.0 ft			44.0 716.2					
50	710									
55	705									
60	700									
65	695									
70	690									
75	685									
80										

WELL CASING
Interval: -2.32-30 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 30-45 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 28-45 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 24-28 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-24 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 6-inch Tricone
Rock Drill: None

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

RECORD OF BOREHOLE P-31

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 30.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/11/06
DATE COMPLETED: 7/11/06

NORTHING: 801,352.8
EASTING: 1,726,661.7
GS ELEVATION: 761.1 ft
TOC ELEVATION: 763.1 ft

DEPTH W.L.: 27.7 ft
ELEVATION W.L.: 735.3 ft
DATE W.L.: 7/25/06
TIME W.L.: 12:23 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	760	0.0 - 9.5 SILTY SAND - orange silty sand fill material In-place orange silty sand, dry	SM							
5	755	Cuttings become lighter at 5 ft Harder to drill at 7 ft			751.6				Grout	
10	750	9.5 - 30.0 PARTIALLY WEATHERED ROCK - tan medium grained silty sand Gray pebble size rock fragments in cuttings at 10 ft, dry			9.5				Bentonite	
15	745	Light tan cuttings at 14 ft							#2 Sand	
20	740		SM							
25	735	Moist cuttings by 22 ft							Screen	
30	730	More competent at 28 ft Boring completed at 30.0 ft			731.1					
35	725									
40										

WELL CASING
Interval: -1.97-15 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 15-30 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 13-30
Type: #2 Sand

FILTER PACK SEAL
Interval: 11-13 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-11 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 4.25-inch ID HSA
Rock Drill: None

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/6/06

RECORD OF BOREHOLE HA-3

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 5.0 ft
LOCATION: Jamestown, NC

DRILL RIG: N/A
DATE STARTED: 7/11/06
DATE COMPLETED: 7/11/06

NORTHING: 801,744.7
EASTING: 1,727,020.7
GS ELEVATION: 748.6 ft
TOC ELEVATION: 752.2 ft

DEPTH W.L.: 0.5 ft
ELEVATION W.L.: 751.8 ft
DATE W.L.: 7/12/06
TIME W.L.: 12:05 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.0 - 5.0 SILTY SAND - brown silty sand, moist	SM						Bentonite	**WELL CASING** Interval: -3.68-1 Material: PVC Diameter: 2-inch Joint Type: Threaded
		Saturated by 3 ft							#2 Sand Screen	**WELL SCREEN** Interval: 1-5 ft Material: PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: Threaded
	745									
5		Boring completed at 5.0 ft			743.6					**FILTER PACK** Interval: 1-5 ft Type: #2 Sand
	740									**FILTER PACK SEAL** Interval: 0-1 ft Type: 3/8 Bentonite Chip
10										**ANNULUS SEAL** Interval: 0-1 ft Type: 3/8 Bentonite chip
	735									**WELL COMPLETION** Pad: None Protective Casing: None
15										**DRILLING METHODS** Soil Drill: 3-inch Hand Auger Rock Drill: None
	730									
20										
	725									
25										
	720									
30										
	715									
35										
	710									
40										

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: Golder Associates Inc.
DRILLER: N/A

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

RECORD OF BOREHOLE HA-4

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 2.5 ft
LOCATION: Jamestown, NC

DRILL RIG: N/A
DATE STARTED: 7/11/06
DATE COMPLETED: 7/11/06

NORTHING: 801,478.1
EASTING: 1,726,859.1
GS ELEVATION: 735.0 ft
TOC ELEVATION: 737.8 ft

DEPTH W.L.: 1.3 ft
ELEVATION W.L.: 736.6 ft
DATE W.L.: 7/12/06
TIME W.L.: 12:15 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	735	0.0 - 2.5 SILTY SAND - brown silty sand Saturated by 2 ft	SM		732.5				Bentonite #2 Sand Screen	**WELL CASING** Interval: -2.79-1.5 ft Material: PVC Diameter: 2-inch Joint Type: Threaded **WELL SCREEN** Interval: 1.5-2.5 ft Material: PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: **FILTER PACK** Interval: 0.5-2.5 ft Type: #2 Sand **FILTER PACK SEAL** Interval: 0-0.5 ft Type: 3/8 Bentonite Chip **ANNULUS SEAL** Interval: Type: **WELL COMPLETION** Pad: None Protective Casing: None **DRILLING METHODS** Soil Drill: 3-inch Hand Auger Rock Drill: None
		Boring completed at 2.5 ft								
5	730									
10	725									
15	720									
20	715									
25	710									
30	705									
35	700									
40										

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: Golder Associates Inc.
DRILLER: N/A

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

RECORD OF BOREHOLE HA-5

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 4.0 ft
LOCATION: Jamestown, NC

DRILL RIG: N/A
DATE STARTED: 7/11/06
DATE COMPLETED: 7/11/06

NORTHING: 801,203.2
EASTING: 1,726,752.8
GS ELEVATION: 725.9 ft
TOC ELEVATION: 728.2 ft

DEPTH W.L.: 0.3 ft
ELEVATION W.L.: 727.8 ft
DATE W.L.: 7/12/06
TIME W.L.: 12:10 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	725	0.0 - 4.0 SILTY SAND - brown silty sand with organics Saturated by 2 ft	SM						Bentonite #2 Sand Screen	**WELL CASING** Interval: -2.24-0.5 FT Material: PVC Diameter: 2-inch Joint Type: Threaded **WELL SCREEN** Interval: 2-4 ft Material: PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: **FILTER PACK** Interval: 0.5-4 ft Type: #2 Sand **FILTER PACK SEAL** Interval: 0-0.5 ft Type: 3/8 Bentonite Chip **ANNULUS SEAL** Interval: 0-0.5 ft Type: 3/8 Bentonite Chip **WELL COMPLETION** Pad: None Protective Casing: None **DRILLING METHODS** Soil Drill: 3-inch Hand Auger Rock Drill: None
					721.9					
5	720	Boring completed at 4.0 ft								
10	715									
15	710									
20	705									
25	700									
30	695									
35	690									
40										

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: Golder Associates Inc.
DRILLER: N/A

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/5/06

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 North Field DR.
Ft. Mill SC
City or Town State Zip Code
803 - 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-23
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 7/5/06
TIME COMPLETED 10:00 AM ☒ PM ☐

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive 27282
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3
LONGITUDE
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WGA's High Point CCD Landfill
STREET ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
(336) - 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 25'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 4 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm) _____ METHOD OF TEST _____
f. DISINFECTION: Type _____ Amount _____
g. WATER ZONES (depth)
From _____ To _____ From _____ To _____
From _____ To _____ From _____ To _____
From _____ To _____ From _____ To _____

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 15'	Ft.	2"	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 11'	Ft.	Portland	Pour
From	To	Ft.		
From	To	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 15'	To 25'	Ft.	2" in.	.010 in.	PVC
From	To	Ft.	in.	in.	
From	To	Ft.	in.	in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 13'	To 25'	Ft.	2/30	Silica
From	To	Ft.		
From	To	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	3	Silty Sand
3	25	Rock

11. REMARKS:
2' Bentonite Seal 11' to 13'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Robert L. Miller 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 North Field DR.
Ft. Mill SC
City or Town State Zip Code
(803) 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-24
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 6/30/06
TIME COMPLETED 11:00 AM ☒ PM ☐

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive 27282
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3 ___ ___
LONGITUDE ___ ___ ___
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY INGA'S High Point C&D LANDFILL
STREET ADDRESS 5830 Riverdale DR.
Jamestown NC 27282
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
(336) 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 33'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 15 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): ___ METHOD OF TEST ___
f. DISINFECTION: Type ___ Amount ___
g. WATER ZONES (depth)
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 18'	Ft.	2"	SCH40	PVC
From ___	To ___	Ft.			
From ___	To ___	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 14'	Ft.	Portland	Pour
From ___	To ___	Ft.		
From ___	To ___	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 18'	To 33'	Ft.	2" in.	.010 in.	PVC
From ___	To ___	Ft.	___ in.	___ in.	
From ___	To ___	Ft.	___ in.	___ in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 16'	To 33'	Ft.	20/30	Silica
From ___	To ___	Ft.		
From ___	To ___	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	9	Silty Sand
9	33	Rock

11. REMARKS:
2' Bentonite Seal 14'-16'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Robert L. Miller 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 North Field DR.
Ft. Mill SC
City or Town State Zip Code
803 - 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-25
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 6/29/06
TIME COMPLETED 2:30 AM ☐ PM ☒

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive 27282
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3 ___ ___
LONGITUDE ___ ___ ___
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- Is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WCA's High Point C&D LANDFILL
STREET ADDRESS 5830 Riverdale DRIVE
Jamestown NC 27282
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
(336) - 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 38'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 15 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): ___ METHOD OF TEST ___
f. DISINFECTION: Type ___ Amount ___
g. WATER ZONES (depth)
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

6. CASING:

	Depth To	Ft.	Diameter	Thickness/ Weight	Material
From 0	28'	Ft.	2"	SCH 40	PVC
From ___	To ___	Ft. ___			
From ___	To ___	Ft. ___			

7. GROUT:

	Depth To	Ft.	Material	Method
From 0	24'	Ft.	Portland	Pour
From ___	To ___	Ft. ___		
From ___	To ___	Ft. ___		

8. SCREEN:

	Depth To	Ft.	Diameter	Slot Size	Material
From 28'	38'	Ft.	2" in.	.010 in.	PVC
From ___	To ___	Ft. ___	in.	in.	
From ___	To ___	Ft. ___	in.	in.	

9. SAND/GRAVEL PACK:

	Depth To	Ft.	Size	Material
From 26'	38'	Ft.	2 9/30	Silica
From ___	To ___	Ft. ___		
From ___	To ___	Ft. ___		

10. DRILLING LOG

From	To	Formation Description
0	13.5	Silty Sand
13.5	37.5	Rock

11. REMARKS:
2' Bentonite seal 24' to 26'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE 7/13/06

Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 North Field DR.
Ft. Mill SC
City or Town State Zip Code
803 - 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-260
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 7/7/06
TIME COMPLETED 3:00 AM ☐ PM ☒

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive 27282
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3
LONGITUDE
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY - is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WCA's High Point C&D Landfill
STREET ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
(336) - 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 74'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 19 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): METHOD OF TEST
f. DISINFECTION: Type Amount
g. WATER ZONES (depth)
From To From To
From To From To
From To From To

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 52'	Ft.	2"	SCH 40	PVC
From	To	Ft.			
From	To	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 50'	Ft.	Portland	Tremi
From	To	Ft.		
From	To	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 54'	To 74'	Ft.	2" in.	.010 in.	PVC
From	To	Ft.	in.	in.	
From	To	Ft.	in.	in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 52'	To 74'	Ft.	20/30	Silica Sand
From	To	Ft.		
From	To	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	28	Silty Sand
28	73.5	Rock

11. REMARKS:
2' Bentonite Seal 50' to 52'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Robert L. Miller — 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 Northfield DR.
Ft. Mill SC
City or Town State Zip Code
(803) 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-265
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 7/10/06
TIME COMPLETED 1:00 AM ☐ PM ☒

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☒ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3 ___ ___
LONGITUDE ___ ___ ___
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WCA's High Point C&D Landfill
STREET ADDRESS 5830 Riverdale Drive
Jamestown NC
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
(336) 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 27'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 18' FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): ___ METHOD OF TEST ___
f. DISINFECTION: Type ___ Amount ___
g. WATER ZONES (depth)
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 17'	Ft.	2"	SCH40	PVC
From ___	To ___	Ft.			
From ___	To ___	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 13'	Ft.	Portland	Pour
From ___	To ___	Ft.		
From ___	To ___	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 17'	To 27'	Ft.	2" in.	.010 in.	PVC
From ___	To ___	Ft.	___ in.	___ in.	
From ___	To ___	Ft.	___ in.	___ in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 15'	To 27'	Ft.	20/30	Silica Sand
From ___	To ___	Ft.		
From ___	To ___	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	30	

11. REMARKS:
2' Bentonite Seal 13' to 15'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE 7/13/06

Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 North Field DR.
Ft. Mill SC
City or Town State Zip Code
803) 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-27
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 6/30/06
TIME COMPLETED 4:00 AM ☐ PM ☒

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive 27282
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3 ___ ___
LONGITUDE ___ ___ ___
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY - is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WCA's High Point C&D Landfill
STREET ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
(336) 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 45'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 22 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): ___ METHOD OF TEST ___
f. DISINFECTION: Type ___ Amount ___
g. WATER ZONES (depth)
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 30'	Ft.	2"	Sch 40	PVC
From ___	To ___	Ft.			
From ___	To ___	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 26'	Ft.	Portland	Pour
From ___	To ___	Ft.		
From ___	To ___	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 30'	To 45'	Ft.	2" in.	.010 in.	PVC
From ___	To ___	Ft.	___ in.	___ in.	
From ___	To ___	Ft.	___ in.	___ in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 28'	To 45'	Ft.	20/30	Silica
From ___	To ___	Ft.		
From ___	To ___	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	13.5	silty sand
13.5	40	Rock

11. REMARKS:
2' Bentonite seal 26' to 28'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Robert L. Miller — 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 North Field DR.
Ft. Mill SC
City or Town State Zip Code
803) 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-28
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 7/6/06
TIME COMPLETED 11:30 AM ☒ PM ☐

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive 27282
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3 ___ ___
LONGITUDE ___ ___ ___
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WCA's High Point C&D Landfill
STREET ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
(336) 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 32'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 22 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): ___ METHOD OF TEST ___
f. DISINFECTION: Type ___ Amount ___
g. WATER ZONES (depth)
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 22'	Ft.	2"	SCH 40	PVC
From ___	To ___	Ft.			
From ___	To ___	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 18'	Ft.	Portland	Pour
From ___	To ___	Ft.		
From ___	To ___	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 22'	To 32'	Ft.	2" in.	.010 in.	PVC
From ___	To ___	Ft.	___ in.	___ in.	
From ___	To ___	Ft.	___ in.	___ in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 20'	To 32'	Ft.	2/30	Silica
From ___	To ___	Ft.		
From ___	To ___	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	19.5	Silty Sand
19.5	32.5	Rock

11. REMARKS:
2' Bentonite Seal 18'-20'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.
Robert L. Miller 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE
Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 North Field DR.
Ft. Mill SC
City or Town State Zip Code
(803) 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-29
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 7/6/06
TIME COMPLETED 10:00 AM ☒ PM ☐

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive 27282
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3
LONGITUDE
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WCA's High Point C&D Landfill
STREET ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Drive
Jamestown NC 27282
City or Town State Zip Code
(336) 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 27'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 21 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): METHOD OF TEST
f. DISINFECTION: Type Amount
g. WATER ZONES (depth)
From To From To
From To From To
From To From To

6. CASING:

	Depth			Diameter	Thickness/ Weight	Material
From 0	To 12'	Ft.		2"	Sch 40	PVC
From	To	Ft.				
From	To	Ft.				

7. GROUT:

	Depth			Material	Method
From 0	To 8'	Ft.		Portland	Pour
From	To	Ft.			
From	To	Ft.			

8. SCREEN:

	Depth			Diameter		Slot Size		Material
From 12'	To 27'	Ft.		2"	in.	.010	in.	PVC
From	To	Ft.			in.		in.	
From	To	Ft.			in.		in.	

9. SAND/GRAVEL PACK:

Depth			Size	Material
From 10'	To 27'	Ft.	2/30	Silica Sand
From	To	Ft.		
From	To	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	9	Silty Sand
9	27	Rock

11. REMARKS:
2' Bentonite Seal 8'+010'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Robert L. Miller — 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 Northfield DR.
Ft. Mill SC
City or Town State Zip Code
(803) - 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-30D
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 7/11/06
TIME COMPLETED 1130 AM ☒ PM ☐

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale DR.
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3 ___ ___
LONGITUDE ___ ___ ___
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WCA's High Point C&D Landfill
STREET ADDRESS 5830 Riverdale Drive
Jamestown NC
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale DR.
Jamestown NC 27282
City or Town State Zip Code
(336) - 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 70'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 28 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): ___ METHOD OF TEST ___
f. DISINFECTION: Type ___ Amount ___
g. WATER ZONES (depth)
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 60'	Ft.	2"	Sch 40	PVC
From ___	To ___	Ft.			
From ___	To ___	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 56'	Ft.	Portland	Tremi
From ___	To ___	Ft.		
From ___	To ___	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 60'	To 70'	Ft.	2" in.	.010 in.	PVC
From ___	To ___	Ft. ___	in.	___ in.	
From ___	To ___	Ft. ___	in.	___ in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 58'	To 70'	Ft.	20/30	Silica Sand
From ___	To ___	Ft.		
From ___	To ___	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	30'	TN Silt
30'	45'	Weathered Rock
45'	70'	Rock

11. REMARKS:
2' Bentonite Seal 56' to 58'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.
Robert L. Miller — 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE
Robert Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # _____

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 NorthField DR.
Ft. Mill SC
City or Town State Zip Code
(803)-548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-305
STATE WELL PERMIT#(if applicable) _____
DWQ or OTHER PERMIT #(if applicable) _____
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use) _____
DATE DRILLED 7/13/06
TIME COMPLETED 9:00 AM ☒ PM ☐

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Dr.
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other _____
(check appropriate box)
LATITUDE 3 ___ _____
LONGITUDE ___ ___ _____
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.
FACILITY ID #(if applicable) _____
NAME OF FACILITY WCA's High Point CED LANDFILL
STREET ADDRESS 5830 Riverdale Dr.
Jamestown NC 27282
City or Town State Zip Code
CONTACT PERSON Shawn Edmonson
MAILING ADDRESS 5830 Riverdale Dr.
Jamestown NC 27282
City or Town State Zip Code
(336)-886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 45'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: 33' FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): _____ METHOD OF TEST _____
f. DISINFECTION: Type _____ Amount _____
g. WATER ZONES (depth)
From _____ To _____ From _____ To _____
From _____ To _____ From _____ To _____
From _____ To _____ From _____ To _____

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 30'	Ft.	2"	SCH40	PVC
From ___	To ___	Ft.			
From ___	To ___	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 26'	Ft.	Portland	Pour
From ___	To ___	Ft.		
From ___	To ___	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 30'	To 45'	Ft.	2" in.	.010 in.	PVC
From ___	To ___	Ft.	___ in.	___ in.	
From ___	To ___	Ft.	___ in.	___ in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 28'	To 45'	Ft.	#2	Silica Sand
From ___	To ___	Ft.		
From ___	To ___	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	35'	TN Silt
35	45	weathered rock

11. REMARKS:
2' Bentonite Seal 26' to 28'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Robert L. Miller 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Robert L. Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2675

1. WELL CONTRACTOR:
Robert L. Miller
Well Contractor (Individual) Name
Saedacco
Well Contractor Company Name
STREET ADDRESS 9088 North Field Dr.
Ft. Mill SC
City or Town State Zip Code
(803) 548-2180
Area code- Phone number

2. WELL INFORMATION:
SITE WELL ID #(if applicable) P-3[illegible]5
STATE WELL PERMIT#(if applicable)
DWQ or OTHER PERMIT #(if applicable)
WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 7/11/06
TIME COMPLETED 2:00 AM ☐ PM ☒

3. WELL LOCATION:
CITY: Jamestown COUNTY Guilford
5830 Riverdale Drive
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
TOPOGRAPHIC / LAND SETTING:
☒ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)
LATITUDE 3 ___ ___
LONGITUDE ___ ___ ___
May be in degrees, minutes, seconds or in a decimal format
Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.
FACILITY ID #(if applicable)
NAME OF FACILITY WCA'S High Point C&D Landfill
STREET ADDRESS 5830 Riverdale Dr.
Jamestown NC
City or Town State Zip Code
CONTACT PERSON Shawn B Edmonson
MAILING ADDRESS 5830 Riverdale Dr.
Jamestown NC 27282
City or Town State Zip Code
(336) 886-3560
Area code - Phone number

5. WELL DETAILS:
a. TOTAL DEPTH: 30'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
c. WATER LEVEL Below Top of Casing: [illegible]DRY FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. YIELD (gpm): ___ METHOD OF TEST ___
f. DISINFECTION: Type ___ Amount ___
g. WATER ZONES (depth)
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0	To 15'	Ft.	2"	SCH 40	PVC
From ___	To ___	Ft.			
From ___	To ___	Ft.			

7. GROUT:

	Depth		Material	Method
From 0	To 11'	Ft.	Portland	Pour
From ___	To ___	Ft.		
From ___	To ___	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 15'	To 30'	Ft.	2" in.	.010 in.	PVC
From ___	To ___	Ft. ___	in.	___ in.	
From ___	To ___	Ft. ___	in.	___ in.	

9. SAND/GRAVEL PACK:

Depth			Size	Material
From 13'	To 30'	Ft.	20/30	Silica Sand
From ___	To ___	Ft.		
From ___	To ___	Ft.		

10. DRILLING LOG

From	To	Formation Description
0	30'	TN SILT

11. REMARKS:
2' Bentonite Seal 11'+0 13'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Robert L. Miller — 7/13/06
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

Robert Miller
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

Project Name	WCA of High Point	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	Gus Pech GP-1100E
Groundwater elevation		Logged By	Dusty Reedy
Date Start/Finish	7-5-06	Total Depth	

BORING NO. P-23

Page 1 of 1

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
			3 3 4 8			1038		Brown fine grained silty sand to 0.75 ft. changes to brown medium grained silty sand changes to gray medium grained silty sand by 1.25 ft. moist throughout. Boulder @ 3 ft. Auger refusal @ 3 ft.
	5					AR 0050 - switch over to air. started air drilling @ 1215		Cuttings consist of granitic rock mainly quartz and biotite, coarse sand size cuttings, very competent. Cuttings same material, but much finer, silt to medium grained sand by 9 ft.
	10							Appears to be less competent around 11 ft based on drilling response. Thin, competent again by 11.25 ft. Changes to diabase @ 12.5 ft. dark black small pebble size cuttings and green dust.
	15							
	20							Apparent fracture @ 20.5 ft based on drilling response, dust died down temporarily indicating it is water bearing. ~0.5 ft thick. Appears less competent @ 21.5 ft, but no indication of water @ that depth.
	25							Some monzonite cuttings mixed in diabase @ 23 ft. Monzonite cuttings with some diabase by 24 ft. Mainly monzonite with minor amount of diabase by 25 ft.
	30					1520 Hydrated bentonite @ 1530		Terminated boring @ 25 ft.
	35							
	40							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrell
Rec - Recovery Length of Sample RQD
Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U
Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)
6 1/4.25 ID HSA
6 inch Downhole hammer

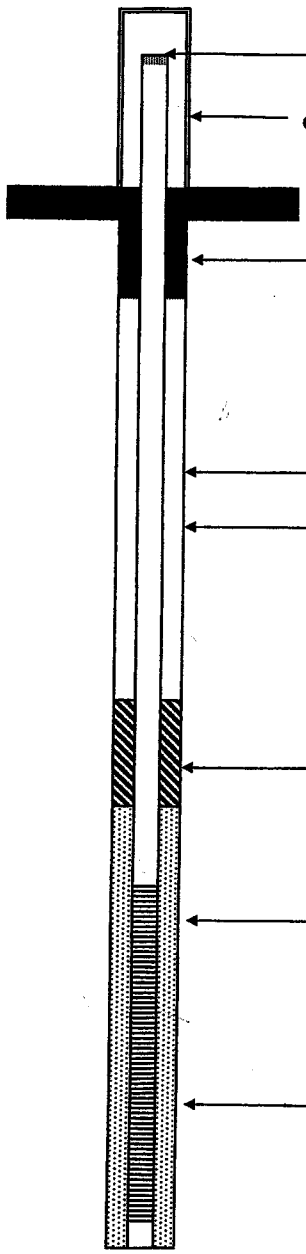
Golder Associates

MONITORING WELL INSTALLATION SKETCH

Golder Associates

Project:	WCA of Highland	Monitoring Well No.:	D-23
Drilling Subcontractor:	SAEDACCO	Date/time of Well Installation:	7-5-06
Driller:	Robert Miller	Depth to Bottom of Well From Top of Monitoring Well Pipe:	
Logged By:	Dusty Reed		

Depth or Height (ft) From Ground Surface



0

11

13

15

25

- Approx. Stickup: 2.5
- O.D. of Outer Protective Casing: 4x4 aluminum
- Dimensions of Concrete Pad: NA
- Type of Surface Seal:
- Type of Backfill: Portland/Bentonite Mix
- Diameter of Borehole: 6.25
- Type of Seal: 3/8 bentonite chip
- I.D. of screen: 2"
- Size of Screen Opening: 0.010
- Type of Screen: PVC
- Size of Filter Sand: #2

WATER LEVEL MEASUREMENTS

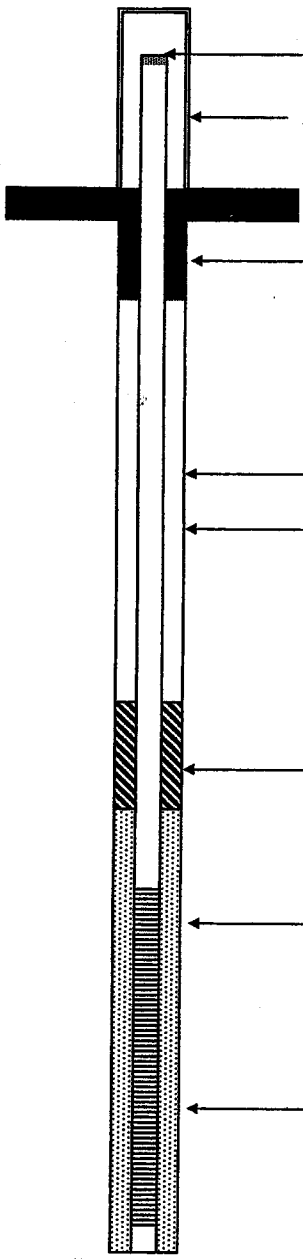
Date	7-5-06						
Depth from TOC	Dry						
Time	1540						

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA at Highpoint
Drilling Subcontractor: SAEDACCO
Driller: Robert Miller
Logged By: Dusty Reed

Monitoring Well No.: MP-24
Date/time of Well Installation: 6-30-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

14

16

18

33

Approx. Stickup: 2

O.D. of Outer Protective Casing:

Dimensions of Concrete Pad: NA

Type of Surface Seal:

Type of Backfill: Bentonite/Bentonite Mix

Diameter of Borehole: 8.25 to 9 ft
6.25 to 33 ft.

Type of Seal: 3/8 bentonite chip

I.D. of screen: 2"

Size of Screen Opening: 0.010

Type of Screen: PVC

Size of Filter Sand: #2

WATER LEVEL MEASUREMENTS

Date	6-30-06						
Depth from TOC	Dry						
Time	1420						

Project Name	WCA of Highpoint	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	Gus Pech GP-1100E
Groundwater elevation		Logged By	Dusty Reedy
Date Start/Finish	6-30-06	Total Depth	

BORING NO. P-24

Page 1 of 1

Elev. Ft.	Depth ft.	Sample Type & No.	Blows per 6"	Pen in.	Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
			2 2 3 8		100	Shelby Tube from 2ft to 4ft.		Tan medium grained silty sand to 0.75 ft. Changes to an orange medium grained silty sand, moist, to ~1 ft.
	5		25 50/4		40			Orange and white coarse grained silty sand. PVR @ 5.25 ft based on SPT
								Auger refusal @ 9 ft.
	10					1257		Tan medium grained sand to pebble size cuttings very weathered rock.
	15							~~[illegible]~~ 14 ft. tan medium grained sand size cuttings consisting of mostly quartz, more competent.
	20							Apparent large fracture from 20.75 - 23 ft based on drilling response
	25							white and tan cuttings, coarse sand size, mainly quartz with some biotite @ 25.
	30							Apparent small fracture from 26.5 to 26.75 ft based on drilling response
								Apparent fracture from 29 to 29.5 ft based on drilling response. Coarse sand to small pebble size cuttings. Some iron staining
	35							Less competent material from 31.5 to 32 ft.
						1410 hydrated bentonite @ 1420		Terminated drilling @ 33 ft
	40							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrel
Rec - Recovery Length of Sample RQD
Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U
Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6.25" ID HSA
6" Down hole hammer

Golder Associates

Project Name	WCA of Hi[illegible]nt	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	GeoRock GP-1100E
Groundwater elevation		Logged By	Dusty Reed
Date Start/Finish	6-29-06	Total Depth	

BORING NO. P-25

Page 1 of ____

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
			6 5 5 7		100			Orange fine to medium grained silty sand. moist.
	5		4 6 50/6		70			Gray and orange medium to coarse grained silty sand, dry. PWR @ 6ft based on SPT wet 1inch sandy clay zone @ 6 ft.
	10		50/5		10			white weathered quartz sand with large quartz ~~cuttings~~ gravel. Auger refusal @ 13.5 ft.
	15							Coarse sand to pebble size granitic cuttings. Primarily consists of quartz and biotite Fine to medium grained sandsize cuttings @ 18ft,
	20							
	25							Same material @ 24 Same material @ 28
	30							small fracture (1/2-inches) @ 30 ft based on drilling response. Fracture from 31.5 to 32 feet based on drilling response. cuttings show some iron staining and dark colored rock along with granitic cuttings. (Gravel size) cuttings consists of granitic rock with mafic rock, pebble size. @ 33ft. medium sand size cuttings @ 34ft, granitic. weathered cuttings @ 36 ft. Terminated drilling @ ~~37~~ ft. 37.5
	35							
	40							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
[illegible]n - Penetration Length of Sampler or Core Barrell
[illegible]ec - Recovery Length of Sample RQD
- Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U - Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6 1/2 ID HSA
6" Downhole hammer

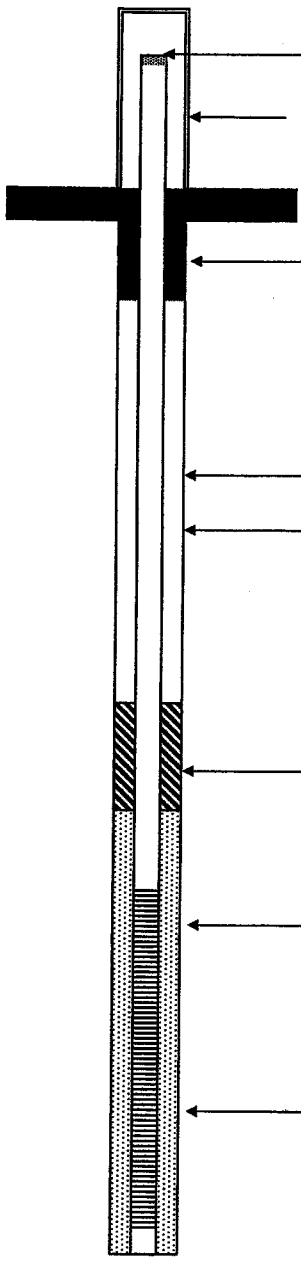
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of High Point
Drilling Subcontractor: SAEDACCO
Driller: Robert Miller
Logged By: Dusty Roedy

Monitoring Well No.: P-25
Date/time of Well Installation: 6-29-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

24

26

27.5

37.5

Approx. Stickup 2.5
O.D. of Outer Protective Casing
Dimensions of Concrete Pad NA
Type of Surface Seal
Type of Backfill Portland / Bentonite Mix
Diameter of Borehole 8.25 to 13.5 ft.
6.25 to
Type of Seal 3/8 bentonite chip
I.D. of screen 2"
Size of Screen Opening 0.010
Type of Screen PVC
Size of Filter Sand #2

WATER LEVEL MEASUREMENTS

Date	6-29-06						
Depth from TOC	Dry						
Time	1437						

Project Name	WCA of Big Point	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	GusPech 6P-1100E
Groundwater elevation		Logged By	Dusty Reedy
Date Start/Finish	7-3-06	Total Depth	

BORING NO. P-26 HR D

Page 1 of 2

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
			1			11:05		Orange and tan mottled medium grained silty sand, minor organics, some clay @ 1.75 ft. moist throughout.
			5		100			
			5					
			6					
	5		4					white medium grained silty sand with granitic texture, dry.
			16		100			
			20					Appears to become more competent @ 8ft
			31					
	10		31					white medium grained silty sand with granitic texture, dry. (PWR based on spt)
			50/3		35			
	15		50/4		10			Same material, more dense, dry
	20		35		25			white and tan coarse grained silty sand with granitic texture, dry, weathered quartz and biotite grains
			50/4					
	25		8		15			Grayish green meta-volcanic rock fragments and silt. Nearly vertical foliation present. Gravel size rock fragments in cuttings by 27 ft, disease
			50/5					
	30					1330 Air to clean up hole		Auger refusal @ 28ft. In granitic type rock, based on cuttings by 29 ft., moist cuttings by 30 ft, very weathered and very competent., cuttings consistent mainly of coarse sand size quartz cuttings.
	35	35-36 - Grab Sample 36-37 Sample 37-38 Sample				1345 to 1450 set up for coring		wet cuttings by 32.5 ft. (More competent @ 32.6 ft.)
		Dust from washing in advance of core run. Air lifting to 38 caused excess dust.					33-38	Terminated downhole hammer drilling @ 33 ft.
	40	Core 9:57				7-7-06		Core Run 33-38 ft. Rec % = 100% RQD = 100%
						ROB start core 8:36 end 10:20		very competent, quartz and biotite (muscovite) one natural fracture @ 36.4 ft to 36.8 ft. fracture dipping 30°
						Had to stop @ 42.25 ft due to lightning.		Core Run 38-42.25 ft Rec % = 89% RQD = 89%
							24 ft	Same as above, one natural fracture @ 40.9 ft with iron staining, dipping ~40°
						Stopped drilling @	1045	

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrel
Rec - Recovery Length of Sample RQD - Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U - Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6.25" ID HSA
6" Down hole hammer
HQ Core Barrell

Golder Associates

Project Name	WCA of High Point	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAED ACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	Gus Pech GP-1100E
Groundwater elevation		Logged By	Dusty Reedy
Date Start/Finish	7-3-06 12-2-06	Total Depth	

BORING NO. P-26D

Elev. Ft.	Depth ft.	Sample Type & No.	Blows per 6"	Pen in.	Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
	50							
	55							Mafic small pebble size cuttings @ 56 ft.
								Mafic cuttings with some quartz cuttings by 59 ft.
	60							Almost entirely quartz and mica cuttings by 60.5 ft.
	65							
	70							Terminated drilling @ ~~73 ft.~~ 73.5 ft
	75							
	80							
	85							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrel
Rec - Recovery Length of Sample RQD
[illegible]t of Sound Cores >4in./Length Cored %
[illegible] Spoon Sample U
Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

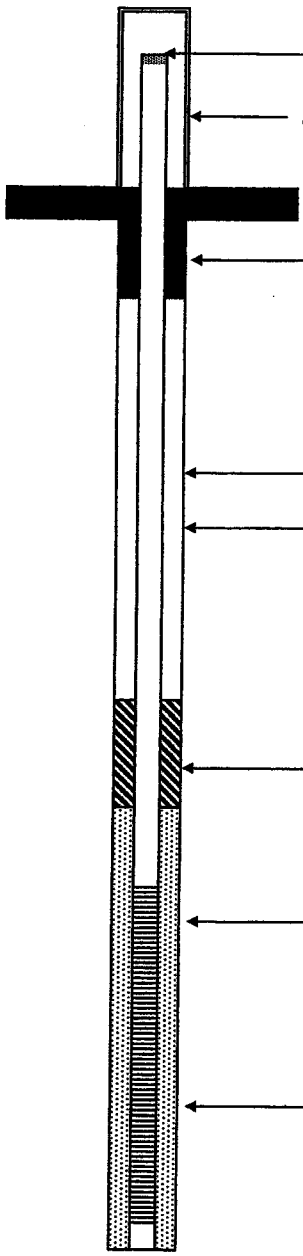
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of High Point
Drilling Subcontractor: SAEDACCO
Driller: Robert Miller
Logged By: Dusty Reedy

Monitoring Well No.: P-26D
Date/time of Well Installation: 7-7-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

49

51

53.5

73.5

Approx. Stickup: 2
O.D. of Outer Protective Casing:
Dimensions of Concrete Pad: NA
Type of Surface Seal:
Type of Backfill:
Diameter of Borehole: 8.25 to 28 ft
6.25 to 73.5
Type of Seal: 3/8 bentonite chip
I.D. of screen: 2"
Size of Screen Opening: 0.010
Type of Screen: PVC
Size of Filter Sand: #2

WATER LEVEL MEASUREMENTS

Date		7-10-06					
Depth from TOC		18.94					
Time		1101					

Project Name	WCA of Bitz/Paint	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SEEDARCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	GusPath GP-1100
Groundwater elevation		Logged By	Dusty Reed
Date Start/Finish	7-10-06	Total Depth	

BORING NO. P-265

Page 1 of 1

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
								Brown silty sand,
								changes to orange silty sand @ 1 ft.
	5							
								changes to white/tan silty sand
	10							
	15							
	20							
	25							more compacted @ 25 ft.
								Terminated drilling @ 28 ft.
						28		
	30					Stopped drilling on top of rock @ 105 to check for water		
	35							
	40							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrell
Rec - Recovery Length of Sample
RQD - Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample
U - Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6-inch Tricone

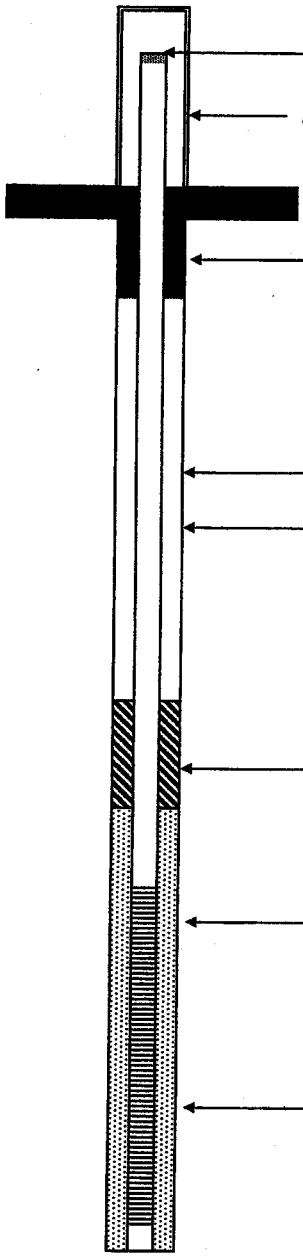
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of Hazel Pond
Drilling Subcontractor: SAGTACO
Driller: Robert Miller
Logged By: Dusty Reedy

Monitoring Well No.: P-265
Date/time of Well Installation: 7-10-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

4

16

18

28

Approx. Stickup: 2
O.D. of Outer Protective Casing:
Dimensions of Concrete Pad: NA
Type of Surface Seal:
Type of Backfill: Portland/Bentonite Mix
Diameter of Borehole: 6.25
Type of Seal: 3/8 bentonite chip
I.D. of screen: 2"
Size of Screen Opening: 0.010
Type of Screen: PVC
Size of Filter Sand: #2

WATER LEVEL MEASUREMENTS

Date	7-10-06						
Depth from TOC	29.00						
Time	402						

Project Name	WCA of High Point	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	GusRech GP-1100 E
Groundwater elevation		Logged By	Dusty Reedy
Date Start/Finish	6-29-06	Total Depth	

BORING NO. P-27

Page 1 of 1

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
			4					Dark brown fine grained ~~sandy silt~~ silty sand, moist to 0.5 ft. changes to a tan and orange mottled medium grained silty sand, dry.
			4		100			
			10					
			24					
	5		50/4		10	Dried Shelby tube from 5-7, Lost Tube.		Medium to coarse grained silty sand (COARSE) dry.
	10		50/2		10			Same material with some pebble size fragments, dry.
								Auger Refusal @ 13.5 ft.
	15							Coarse sand to pebble size decomposed granitic cuttings.
	20							Medium grained sand size cuttings, white and tan, ~~grey~~ weathered granitic rock
								Some mafic rock pieces mixed in granitic cuttings @ 22 ft.
	25							Apparent fracture from 25.5 to 26 ft based on drilling response.
	30							Apparent small fracture @ 32.5 to 32.75 ft based on drilling response. coarse sand, small pebble size cuttings, weathered quartz, biotite and feldspar. @ 33.5
						Stopped drilling at 34 ft. 6-29-06 Started back up 6-30-06		
	35							Apparent fracture from 37.5 to 37.75 ft based on drilling response, dust died slightly, coarse gravel size quartz and biotite cuttings
	40							Terminated drilling @ 40 ft.

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrel
Rec - Recovery Length of Sample RQD
Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U - Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6.25" ID HSA
6" Downhole hammer

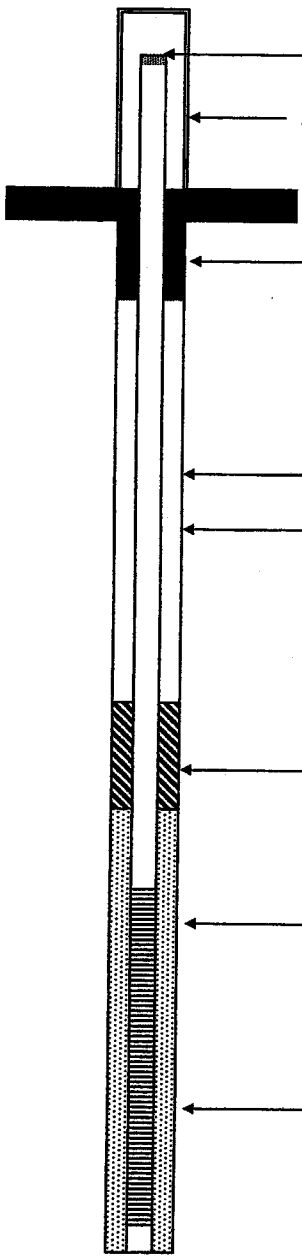
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of High Point
Drilling Subcontractor: SAEDACCO
Driller: Robert Miller
Logged By: Dusty Reedy

Monitoring Well No.: P-27
Date/time of Well Installation: 6-30-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

20

23

25

40

Approx. Stickup: 3
O.D. of Outer Protective Casing:
Dimensions of Concrete Pad: NA
Type of Surface Seal:
Type of Backfill: Bentonite/Bentonite Mix
Diameter of Borehole: 8.25 to 8.5 ft
6.25 to 40
Type of Seal: 3/8 bentonite chip
I.D. of screen: 2"
Size of Screen Opening: 0.010
Type of Screen: PVC
Size of Filter Sand: #2

WATER LEVEL MEASUREMENTS

Date	6-30-06						
Depth from TOC	Dry						
Time	8:05						

Project Name	WCA of High Point	Project Number	063652 6.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	GusRock GP-1100E
Groundwater elevation		Logged By	Dusty Reedy
Date Start/Finish	7-6-06	Total Depth	

BORING NO. P-28

Page 1 of 1

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
		2						Brown silty sand, medium grained to 1.75 ft.
		2			75			Changes to an orange medium grained silty
		3						sand with some clay, moist.
		5						
	5							
		9						Tan and white fine to medium grained silty
		46			50			sand, dry and very dense
		50/5						
	10							
		17						Same material, visible granitic texture with
		32			60			highly weathered quartz and mica grains,
		50/4						very dense dry.
	15							
		15						Same material
		37			40			
		50/4						
	20							Auger refusal @ 19.5 ft
								Gray granitic silt and possile size cuttings,
								very weathered and soft.
	25							Becomes more competent by 22 ft.
								Apparent fracture @ 25 ft based on drilling
								response, No indication of water
	30							Apparent fracture @ 28 ft, ~0.25 ft thick,
								may be water bearing.
								Apparent fracture @ 30 ft based on drilling
								response, tannish dust.
	35							Terminated drilling @ 32.5 ft.
	40							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrel
c - Recovery Length of Sample RQD
enght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U -
Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6¼.25 ID HSA
6-inch downhole hammer.

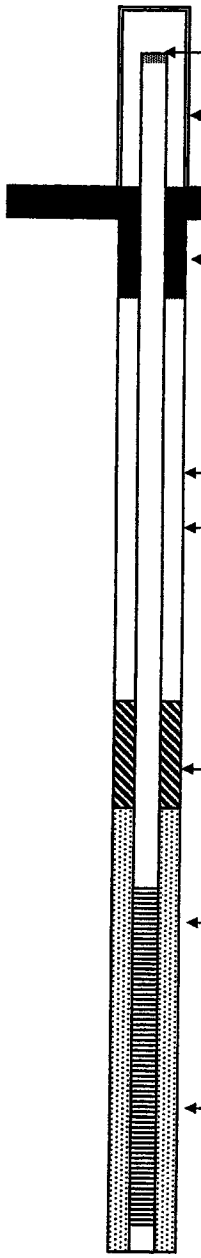
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of High Point
Drilling Subcontractor: SAEDACCO
Driller: Robert Miller
Logged By: Dusty Reedy

Monitoring Well No.: P-28
Date/time of Well Installation: 7-6-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

19

21

22.5

32.5

Approx. Stickup 2.5

O.D. of Outer Protective Casing

Dimensions of Concrete Pad NA

Type of Surface Seal

Type of Backfill Portland/Bentonite Mix

Diameter of Borehole 8.25" to 19.5 ft
6.25" to 32.5 ft

Type of Seal 3/8 bentonite chip

I.D. of screen 2"

Size of Screen Opening 0.010

Type of Screen PVC

Size of Filter Sand #2

WATER LEVEL MEASUREMENTS

Date							
Depth from TOC							
Time							

Project Name	WCA of High Point	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	GeoProbe 6P-1100E
Groundwater elevation		Logged By	Dusty Roedy
Date Start/Finish	7-6-06	Total Depth	

BORING NO. P-29

Page 1 of 1

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
								Orange medium grained silty sand. Fill material to ~ 3ft.
	5							Dark brown silty sand with organics @ 2.5ft changes to orange @ 4 ft.
			13 29 32 42		50			White and orange silty sand with granitic texture, very dense
	10							Auger refusal @ 9ft.
								Tan silt to pebble size cuttings, dry changes to tannish gray cuttings @ 10 ft, very weathered rock.
	15							Very weathered matic rock cuttings @ 13ft, green in color, very soft, dry.
	20							Back into tannish weathered granitic cuttings @ 18ft.
	25							Still very weathered @ 23ft.
								Competent rock @ 25ft, quartz and sulfide cuttings
	30							Terminate boring @ 27ft.
	35							
	40							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrell
Rec - Recovery Length of Sample
RQD - Length of Sound Cores >4in./Length Cored %
S - Split Spoon Sample
U - Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6.25" ID HSA
6" Down hole hammer

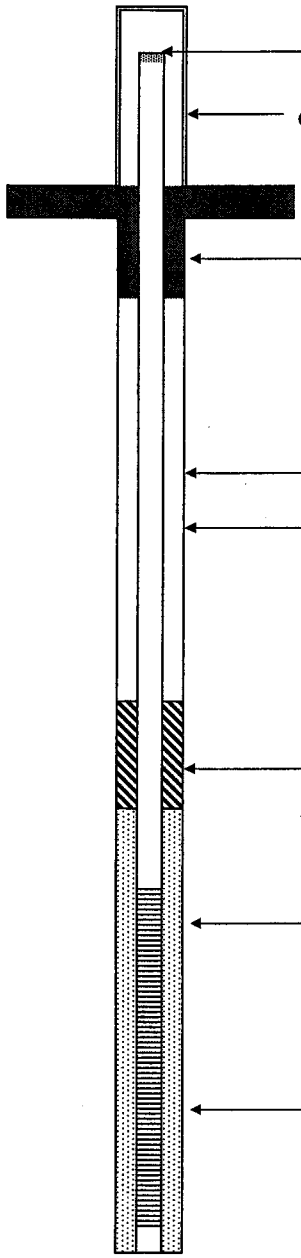
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of High Point
Drilling Subcontractor: SAEDACCO
Driller: Robert Miller
Logged By: Dusty Roady

Monitoring Well No.: P-29
Date/time of Well Installation: 7-6-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

8

10

12

27

Approx. Stickup 3

O.D. of Outer Protective Casing

Dimensions of Concrete Pad NA

Type of Surface Seal

Type of Backfill Portland/Bentonite Mix

Diameter of Borehole 8.25 ft to 9 ft
6.25 ft to 27 ft

Type of Seal 3/8 bentonite chip

I.D. of screen 2"

Size of Screen Opening 0.010

Type of Screen PVC

Size of Filter Sand #2

WATER LEVEL MEASUREMENTS

Date							
Depth from TOC							
Time							

Project Name	WCA of High Point	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	Gus Pech GP-1100E
Groundwater elevation		Logged By	Dusty Reed
Date Start/Finish	7-10-06/7-11-06	Total Depth	

BORING NO. ~~P-30D~~ or P-30D

Page 1 of 2

Elev. Ft.	Depth ft.	Sample Type & No.	Blows per 6"	Pen in.	Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
						1306		Fill material - orange silty sand. 2ft thick.
						Shelby tube 3-5 ft. ~~[illegible]~~ Tube broke off.		Same material, but in place @ 2ft.
	5		15 4 2 22 50/4		26			White and tan medium grained silty sand, very dense (PWR)
	10		50/4		25			Same material Cuttings slightly damp @ 11 ft.
	15		45 50/1		35			White coarse grained silty sand, dense, dry
	20		50/1		10			Same material very hard to drill through @ 20 ft
	25							
	30							
	35							
	40							Same material with some pebble to gravel size rock fragments, granitic.
								Auger refusal @ 43 ft.
						1515		

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrell
Rec - Recovery Length of Sample RQD
Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U -
Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6.25 ID HSA
6" tricone bit
HQ core barrell
6" downhole hammer

Golder Associates

Project Name	WCA of Highland	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	Gus Pech GP-1100E
Groundwater elevation		Logged By	Dusty Reedy
Date Start/Finish	7-10-06/7-11-06	Total Depth	

BORING NO. P-30 D

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
						1530 Tricone 1545 Tricone refusal ~~bottom of nugget~~ @ 45 ft started coring @ 1645-1700 1708-1729 1745-1747 = 1 ft added rod 1750-1807 = 4 ft		Core run 45-50 ft Rec % = 4.95 ft = 99 % RQD = 4.1 ft = 82 % Very weathered granitic rock mainly consisting of quartz and biotite. Natural fractures throughout ranging from 20 to 60° dips
	50							Core Run 50-55 ft Rec % = 100 % RQD % = 3.4 = 0.68 Same material with less fractures, highly fractured between 51 and 52 ft and 54 and 55 ft with one fracture @ 53 ft. Fractures range from nearly horizontal to ~45°. Visible foliation @ ~35°
	55							Core Run 55-60 ft Rec % = 2.4 = 48 % RQD = 2.0 = 40 % Same material to 57 ft, a lot of material is missing with only one green weathered mafic rock fragment. Highly fractured throughout.
	60					717-731 3.5 ft core run		Core Run 60-~~65~~ 63.5 ft Rec % = 3 = 86 % RQD = 1.1 = 31 % Very weathered mafic rock to 61 ft, changes to highly weathered granitic rock, highly broken up.
	65					8:15 air drilling		Back in mafic material @ 67 ft, much more competent than before. Black pebble size cuttings Fracture @ 68 ft based on drilling response. Large fracture @ 69.5 ft, transitioning back to granitic type cuttings, appears to be very weathered.
	70							
	75					9:30		Terminated drilling @ 70 ft
	80							
	85							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Penetration Length of Sampler or Core Barrel
Recovery Length of Sample RQD
Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U
Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

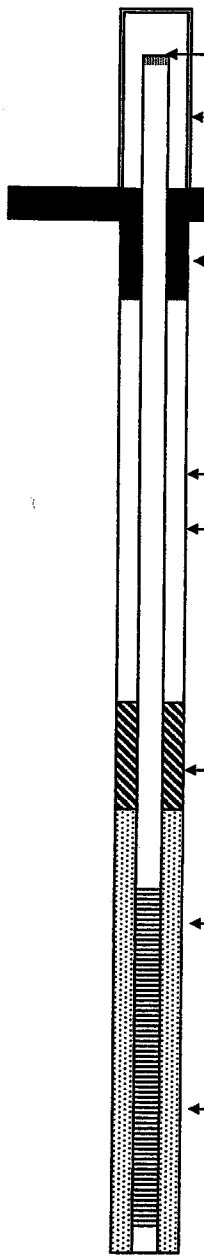
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of High Point
Drilling Subcontractor: SAEDACCO
Driller: Robert Miller
Logged By: Dusty Rood Jr.

Monitoring Well No.: P-30D
Date/time of Well Installation: 7-11-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

56

58

60

70

Approx. Stickup 2.5

O.D. of Outer Protective Casing 4 & 4 square aluminum

Dimensions of Concrete Pad 3 x 3 x 6"

Type of Surface Seal

Type of Backfill Portland Bentonite Mix

Diameter of Borehole 8.25 to 43 ft.
6.25 to

Type of Seal 3/8 bentonite chip

I.D. of screen 2"

Size of Screen Opening 0.010

Type of Screen PVC

Size of Filter Sand #2

Finished Surface @1250

WATER LEVEL MEASUREMENTS

Date							
Depth from TOC							
Time							

Project Name	WCA of Highland	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Miller
Ground Elevation		Rig Type	CME 75
Groundwater elevation		Logged By	Dusty Redd
Date Start/Finish	7-13-06	Total Depth	

BORING NO. P-305

Page 1 of ____

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
								Orange silty sand - fill 2 ft thick
								In place material same
	6							cuttings lighter @ 6 ft
								~~Hard to drill~~ more competent @ 7 ft.
	14							
								light tan cuttings @ 14 ft.
	18							
	20							
	25							
	30							light gray cuttings @ 30 ft
	35							
	40							Dark green cuttings @ 42 ft.
								Back into light tan cuttings @ 44 ft
								~~45~~ Trace coal @ 45 ft

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrel
Rec - Recovery Length of Sample RQD - Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U - Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

6" Trieone SA.

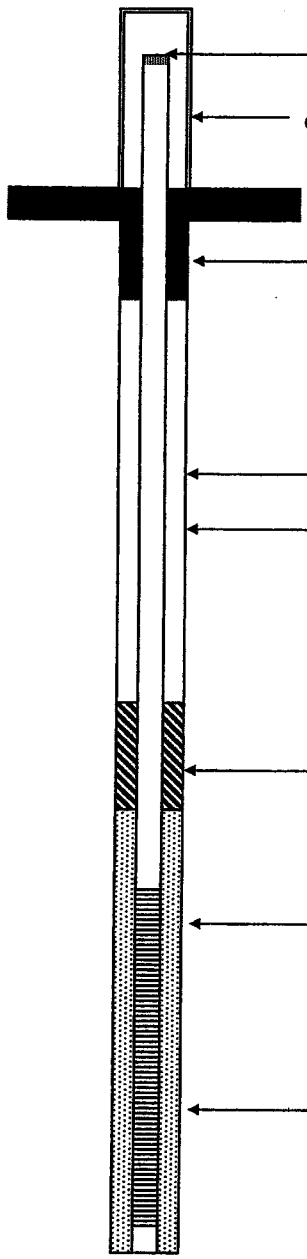
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of High Point
Drilling Subcontractor: SABRACCO
Driller: Robert Miller
Logged By: Matt Reedy

Monitoring Well No.: D-305
Date/time of Well Installation: 7-13-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

24

28

30

45

Approx. Stickup 2.5

O.D. of Outer Protective Casing

Dimensions of Concrete Pad 3x3x6"

Type of Surface Seal

Type of Backfill Portland I Bentonite Mix

Diameter of Borehole 6.25

Type of Seal 3/8 bentonite chips

I.D. of screen 2"

Size of Screen Opening 0.010

Type of Screen PVC

Size of Filter Sand #2

WATER LEVEL MEASUREMENTS

Date	7-13-06						
Depth from TOC	44.40						
Time	942						

Project Name	WCA of Hazlet	Project Number	0636526.100
Project Location		Client	WCA
Drilling Company	SAEDACCO	Driller Name	Robert Mike
Ground Elevation		Rig Type	Geo Tech 6P-11000
Groundwater elevation		Logged By	Dusty Reedy
Date Start/Finish	7-11-06	Total Depth	

BORING NO. P-~~305~~ 31

Page 1 of 1

Elev. Ft.	Depth ft.	Sample Type & No.	Sample Blows per 6"	Sample Pen in.	Sample Rec %	Remarks	Graphic Log (USCS)	Soil and Rock Descriptions
								Orange silty sand - Fill 2ft thick.
								Same material, but in place
	5							cuttings become lighter @ 5ft
								Harder to drill through @ 7ft
	10							Grey pebble size cuttings @ 10ft
								Light tan cuttings @ 14ft.
	15							
	20							Moist cuttings @ 22 ft.
	25							Become more competent @ 28 ft.
	31							Terminated boring @ 30ft.
	35							
	40							

Blows per 6 in. - 140lb hammer falling 30 in. to drive a 2.0 in. OD split spoon sampler.
Pen - Penetration Length of Sampler or Core Barrell
Rec - Recovery Length of Sample RQD
Lenght of Sound Cores >4in./Length Cored %
S - Split Spoon Sample U - Undisturbed Samples

Notes: (Rig Type, drilling method, bit or auger size, PSI, Equipment Failures, possible contamination, deviations from drilling plan, drilling difficulties, ect.)

4.25 ID HSA

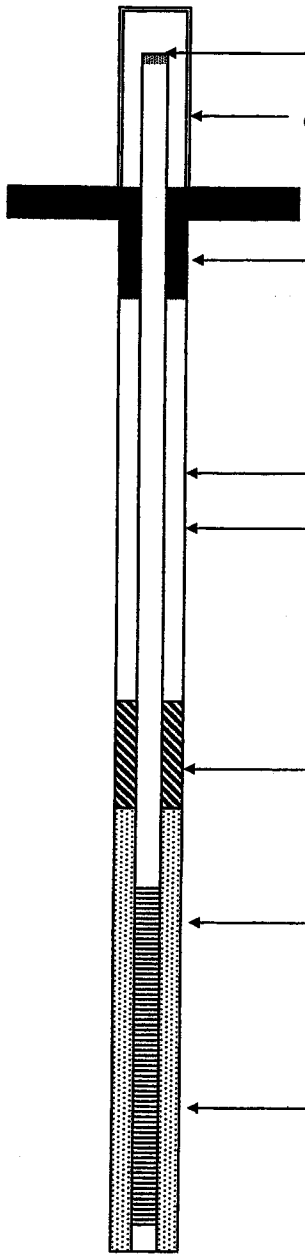
Golder Associates

Golder Associates

MONITORING WELL INSTALLATION SKETCH

Project: WCA of High Point
Drilling Subcontractor: SAEDACCO
Driller: Robert Miller
Logged By: Dusty Reedy

Monitoring Well No.: ~~P-305~~ DA P-31
Date/time of Well Installation: 7-11-06
Depth to Bottom of Well From Top of Monitoring Well Pipe:



Depth or Height (ft) From Ground Surface

0

11

~~18~~ 13

~~20~~ 15

30

Approx. Stickup: 2.5
O.D. of Outer Protective Casing: 4x4 Square Aluminum
Dimensions of Concrete Pad: 3x3x6"
Type of Surface Seal:
Type of Backfill: Portland/Bentonite mix
Diameter of Borehole: 6.25
Type of Seal: 3/8 bentonite chip
I.D. of screen: 2"
Size of Screen Opening: 0.010
Type of Screen: PVC
Size of Filter Sand: #2

WATER LEVEL MEASUREMENTS

Date	7-11-06						
Depth from TOC	dry						
Time	1415						

MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project:	WCA of High Point-Phase 2 Hydrogeologic Report
Date:	09/18/06
Casing Type:	PVC
Well/Boring Number	P-23
Casing Diameter in inches (Dr):	2
Screened Interval:	15-25 ft.
Riser Elevation:	762.60 ft. Above M.S.L.
Total Well Depth (Lw) in feet:	25 ft.
Depth to Water (Lf) in feet:	3.43 ft.
Time of Measurement:	15:17

Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf) =$ 3.54 Gallons

FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conductivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	20.3	6.54	59.8	>1000	0	3.43	15:25
After Purging							
1 Well Vol	20.1	7.03	44.3	230	5	-	15:33
2 Well Vol	19.5	6.71	40.9	87.5	7	-	15:44
3 Well Vol	19.5	7.05	41.7	112	7.5	-	15:49
4 Well Vol							
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Pump If pumped, pumping rate: Max.

Well Purged Dry Yes Continuous Recharge No

Notes concerning condition of well, odors, color, etc.:

Purged dry using Super Twister pump @ 15:49.

Water level taken before pumping started.

Developer's Signature

MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project: WCA of High Point-Phase 2 Hydrogeologic Report
Date: 09/19/06
Casing Type: PVC
Well/Boring Number P-23
Casing Diameter in inches (Dr): 2
Screened Interval: 15-25 ft
Riser Elevation: 762.60 ft. Above M.S.L.
Total Well Depth (Lw) in feet: 25 ft.
Depth to Water (Lf) in feet: 3.05 ft.
Time of Measurement: 8:52

Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf)$ = 3.6 Gallons

FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conduc-tivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	20.5	7.17	39.9	38.5	0	3.05	8:52
After Purging							
1 Well Vol	-	-	-	-	3.25	-	9:16
2 Well Vol							
3 Well Vol							
4 Well Vol							
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Bailer
If pumped, pumping rate: -
Well Purged Dry No
Continuous Recharge -
Notes concerning condition of well, odors, color, etc.:
Bailer dropped in well had to fish out.

Developer's Signature

MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project: WCA of High Point-Phase 2 Hydrogeologic Report
Date: 09/19/06
Casing Type: PVC
Well/Boring Number P-25
Casing Diameter in inches (Dr): 2
Screened Interval: 27.5-37.5 ft.
Riser Elevation: 805.24 ft. Above M.S.L.
Total Well Depth (Lw) in feet: 37.5 ft.
Depth to Water (Lf) in feet: 14.64 ft.
Time of Measurement: 10:45

Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf) =$ 3.75 Gallons

FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conductivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	18	6.44	32.3	789	0	14.64	10:56
After Purging							
1 Well Vol	16.8	6.25	27.6	>1000	5	-	11:05
2 Well Vol	16.9	6.28	53	>1000	8.5	-	11:17
3 Well Vol							
4 Well Vol							
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Bailer
If pumped, pumping rate: -
Well Purged Dry Yes
Continuous Recharge -
Notes concerning condition of well, odors, color, etc.:
Purged dry using a Bailer @ 11:17.

Developer's Signature

MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project: WCA of High Point-Phase 2 Hydrogeologic Report
Date: 09/18/06
Casing Type: PVC
Well/Boring Number P-26S
Casing Diameter in inches (Dr): 2
Screened Interval: 18-28 ft
Riser Elevation: 808.71 ft. Above M.S.L.
Total Well Depth (Lw) in feet: 28 ft.
Depth to Water (Lf) in feet: 11.5 ft.
Time of Measurement: 16:09

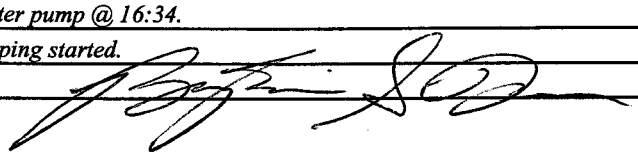
Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf)$ = 2.71 Gallons

FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conductivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	19.3	6.28	25.4	>1000	0	11.5	16:19
After Purging							
1 Well Vol	17.4	6.04	23.6	910	5	-	16:21
2 Well Vol	18.4	6.23	21.8	>1000	8	-	16:25
3 Well Vol	20	6.22	22.1	>1000	10	-	16:34
4 Well Vol							
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Pump If pumped, pumping rate: Max.
Well Purged Dry Yes Continuous Recharge No
Notes concerning condition of well, odors, color, etc.:
Purged dry using Super Twister pump @ 16:34.
Water level taken before pumping started.
Developer's Signature



MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project:	WCA of High Point-Phase 2 Hydrogeologic Report
Date:	09/19/06
Casing Type:	PVC
Well/Boring Number	P-26S
Casing Diameter in inches (Dr):	2
Screened Interval:	18-28 ft
Riser Elevation:	808.71 ft. Above M.S.L.
Total Well Depth (Lw) in feet:	28 ft.
Depth to Water (Lf) in feet:	17.68
Time of Measurement:	9:44

Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf) =$ 1.69 Gallons

FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conduc-tivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	17	6.12	20.8	>1000	0	17.68	9:45
After Purging							
1 Well Vol	-	-	-	-	-	-	-
2 Well Vol	-	-	-	-	-	-	-
3 Well Vol	16.6	6.23	21.1	>1000	5	-	9:52
4 Well Vol	16.7	6.19	21	>1000	7	-	9:59
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Bailer If pumped, pumping rate: -

Well Purged Dry Yes Continuous Recharge -

Notes concerning condition of well, odors, color, etc.:

Purged dry using a Bailer @ 9:59.

Developer's Signature

MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project: WCA of High Point-Phase 2 Hydrogeologic Report
Date: 09/19/06
Casing Type: PVC
Well/Boring Number P-27
Casing Diameter in inches (Dr): 2
Screened Interval: 25-40 ft.
Riser Elevation: 799.99 ft. Above M.S.L.
Total Well Depth (Lw) in feet: 40 ft.
Depth to Water (Lf) in feet: 21.92 ft.
Time of Measurement: 10:07

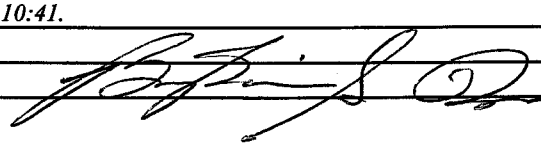
Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf) =$ 3 Gallons

FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conductivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	18.5	6.41	22.4	116	0	21.92	10:16
After Purging							
1 Well Vol	17.8	6.32	22.4	>1000	5	-	10:27
2 Well Vol	17.1	6.54	25.3	>1000	10	-	10:41
3 Well Vol							
4 Well Vol							
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Bailer If pumped, pumping rate: -
Well Purged Dry Yes Continuous Recharge -
Notes concerning condition of well, odors, color, etc.:
Purged dry using a Bailer @ 10:41.

Developer's Signature 

MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project:	WCA of High Point-Phase 2 Hydrogeologic Report
Date:	09/18/06
Casing Type:	PVC
Well/Boring Number	P-30D
Casing Diameter in inches (Dr):	2
Screened Interval:	60-70 ft
Riser Elevation:	763.27 ft. Above M.S.L.
Total Well Depth (Lw) in feet:	70 ft.
Depth to Water (Lf) in feet:	32.85 ft.
Time of Measurement:	14:34

Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf) =$ 6.09 Gallons

FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conduc-tivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	18.3	6.55	33.7	>1000	0	32.85	14:41
After Purging							
1 Well Vol	17	6.58	28.8	790	5	-	14:43
2 Well Vol	16.8	6.48	28.1	97	10	-	14:46
3 Well Vol	18.6	6.62	28.7	150	13.5	-	14:51
4 Well Vol							
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Pump If pumped, pumping rate: Max

Well Purged Dry Yes Continuous Recharge No

Notes concerning condition of well, odors, color, etc.:

Purged dry using Super Twister pump @ 14:51

Water level taken before pumping started.

Developer's Signature

MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project: WCA of High Point-Phase 2 Hydrogeologic Report
Date: 09/18/06
Casing Type: PVC
Well/Boring Number P-30S
Casing Diameter in inches (Dr): 2
Screened Interval: 30-45 ft.
Riser Elevation: 763.52 ft. Above M.S.L.
Total Well Depth (Lw) in feet: 45 ft.
Depth to Water (Lf) in feet: 32.2 ft.
Time of Measurement: 14:04

Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf) =$ 2.1 Gallons

FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conductivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	24.3	6.41	18.3	>1000	0	32.2	14:13
After Purging							
1 Well Vol	-	-	-	-	-	-	-
2 Well Vol	17.6	6.38	26.8	>1000	5	-	14:16
3 Well Vol							
4 Well Vol							
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Pump
If pumped, pumping rate: Max
Well Purged Dry Yes
Continuous Recharge No
Notes concerning condition of well, odors, color, etc.:
Purged dry using the Super Twister pump @ 14:17
Water level taken before pumping started.
Developer's Signature

MONITORING WELL DEVELOPMENT DATA SHEET

Golder Associates

Project: WCA of High Point-Phase 2 Hydrogeologic Report
Date: 09/19/06
Casing Type: PVC
Well/Boring Number P-30S
Casing Diameter in inches (Dr): 2
Screened Interval: 30-45 ft
Riser Elevation: 763.52 ft. Above M.S.L.
Total Well Depth (Lw) in feet: 45 ft.
Depth to Water (Lf) in feet: 32.39 ft.
Time of Measurement: 8:07

Volume of water in well, using $V=0.041\ (Dr)^2\ (Lw - Lf) =$ 2.07 Gallons

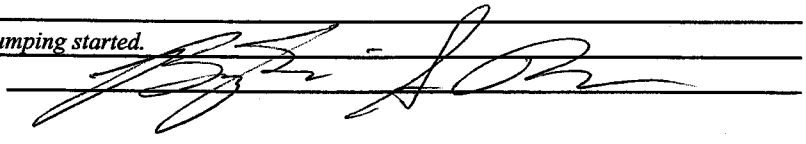
FIELD MEASUREMENT OF PHYSICAL PARAMETERS

	Temp (C)	pH	Conductivity (µS/cm)	Clarity/ Color	Volume (gallons)	Water Level (ft)	Time
Before Development	18.2	6.78	29.9	>1000	0	32.39	8:12
After Purging							
1 Well Vol	16.8	6.72	26.1	>1000	5	-	8:14
2 Well Vol	17.2	6.81	27.4	>1000	6.5	-	8:17
3 Well Vol	18.1	6.74	26.4	>1000	8	-	8:22
4 Well Vol							
5 Well Vol							
6 Well Vol							
7 Well Vol							
8 Well Vol							
9 Well Vol							
10 Well Vol							

(Fill in one or more of the above columns depending on available equipment)

Method of purging (bailer or pump) Pump
If pumped, pumping rate: Max.
Well Purged Dry No
Continuous Recharge No
Notes concerning condition of well, odors, color, etc.:

Water level taken before pumping started.

Developer's Signature 

See end of this file for

↓

APPENDIX DH-B

SURVEYS OF PIEZOMETER LOCATIONS

Fleming Engineering, Inc.

Consulting Engineers & Land Surveyors

To: Rachel P. Kirkman, P.G.
Senior Project Geologist
Golder Associates Inc.
4900 Koger Boulevard, Suite 140
Greensboro, NC 27407

Date: August 31, 2006

Subject: MW-5 Casing Elevation

Rachel,

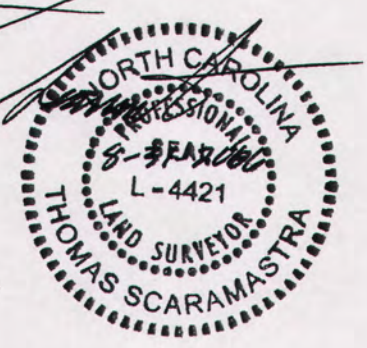
Yesterday, 30 August, 2006, one of my survey crews visited the High Point WCA Landfill site at your request. They shot the elevation on the well casing of monitoring well #MW-5 (AKA #P-12). You provided me with the following horizontal geodetic coordinates:

Northing: 801517.3101
Easting: 1726103.7012

The survey data collected at that time indicates that this well has a top-of-casing elevation of 747.83 feet.

I hope this information suits your needs. If not, please call me anytime.

Sincerely,



Tom Scaramastra, PLS

Fleming Engineering, Inc.
700 Carnegie Place
Greensboro, NC 27409

APPENDIX DH-C

LABORATORY TEST RESULTS FOR SOIL SAMPLES

AUGUST 2006

063-6526

WCA OF HIGH POINT LLC/C&D LF/NC
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classification		Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Porosity	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
			USCS	USDA		L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (lb/cuft)		
P-24	UD	2.0 - 4.0'	SM	Sandy Loam	9.5	NP	NP	NP	NP	100.0	22.5	10.0	-	-	2.71	35	9.5	109.6	2.3E-04	-
P-26S	Bulk	10.0 - 13.0'	SC	Sandy Loam	8.2	24	16	8	-0.90	100.0	33.6	18.0	124.4	9.7	2.70	30	11.9	118.0	5.8E-05	-
P-30D	UD	3.0 - 5.0'	SM	Sandy Loam	10.0	NP	NP	NP	NP	100.0	24.8	10.0	-	-	2.70	32	10.0	115.3	4.5E-06	-
P-30D	Bulk	16.0 - 19.0'	SM	Loamy Sand	3.5	NP	NP	NP	NP	98.9	22.6	7.0	121.9	11.0	2.70	32	12.9	115.3	7.9E-04	-

ABBREVIATIONS:
LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES:
T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

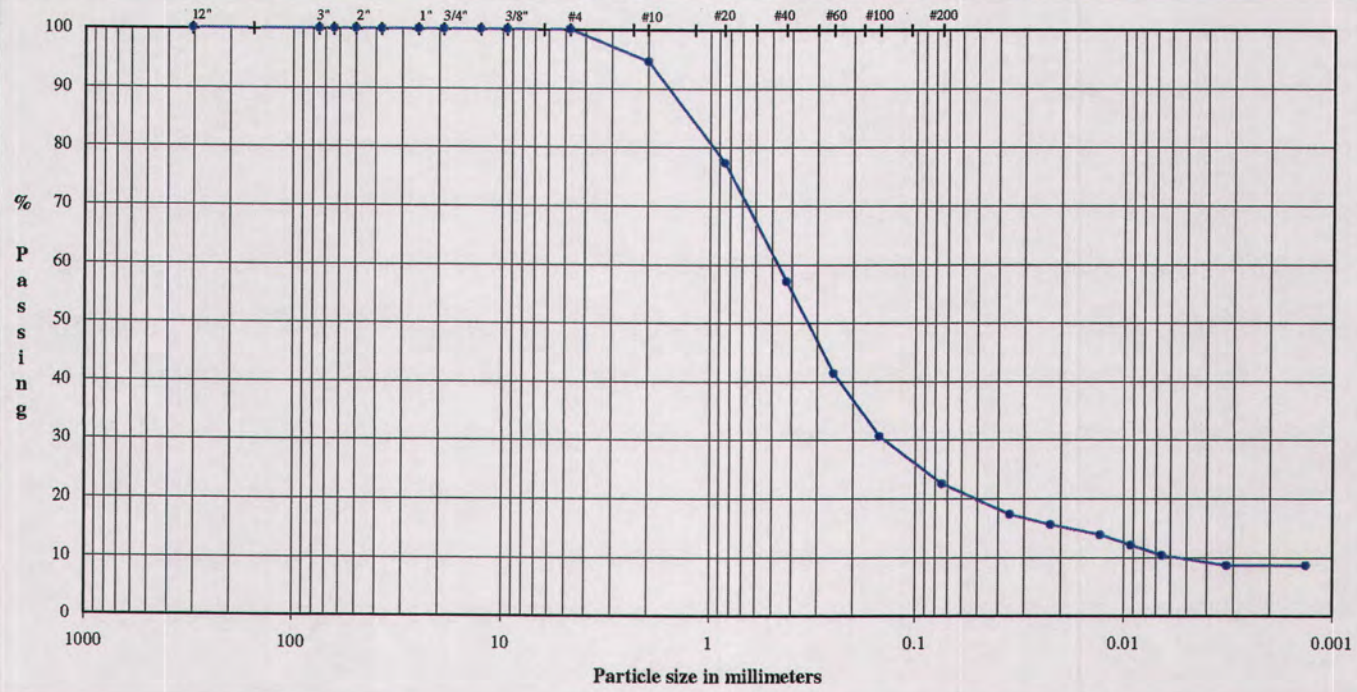
AUGUST 2006

063-6526

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **WCA OF HIGH POINT LLC/C&D LF/NC**
SAMPLE ID: **P-24** Depth: **2.0 - 4.0'**
TYPE: **UD**



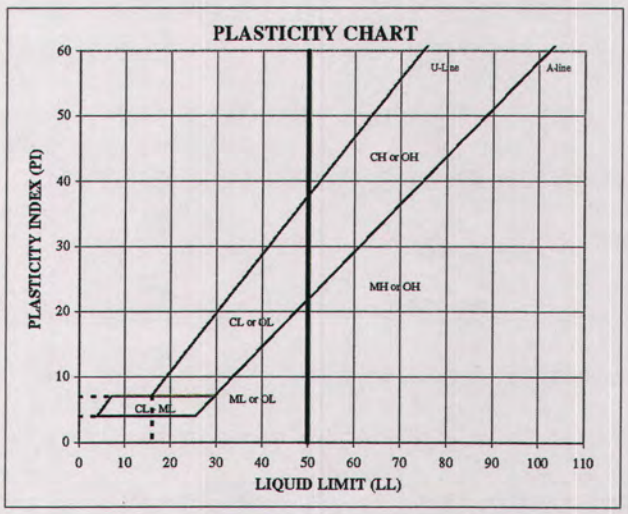
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Wentworth Classification	ASTM Classification	Percentage
12.0"	304.8	100.0			
3.0"	75.0	100.0		Cobbles	0.0
2.5"	63.5	100.0			
2.0"	50.0	100.0			
1.5"	37.5	100.0			
1.0"	25.0	100.0			
0.75"	19.0	100.0		Coarse Gravel	0.0
0.50"	12.7	100.0	Gravel		
0.375"	9.5	100.0	5.5%		
#4	4.8	100.0		Fine Gravel	0.0
#10	2.00	94.5		Coarse Sand	5.5
#20	0.85	77.3			
#40	0.43	57.0		Medium Sand	37.5
#60	0.25	41.4	Sand		
#100	0.15	30.6	72%		
#200	0.075	22.5		Fine Sand	34.5

Hydrometer Analysis

(mm)	%Finer			
0.035	17.3			
0.022	15.6			
0.013	13.9	Silt	Fines	
0.0093	12.1	13.5%	Silt or Clay	22.5
0.0066	10.4			
0.0032	8.7	Mud		
0.0013	8.7	9%		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
9.5	NP	NP	NP	NP

LL (oven-dried) / <0.75 = ORGANIC (OL/OH)

DESCRIPTION: Brownish Yellow, MEDIUM TO FINE SAND, some clayey silt.

USCS SM
USDS Sandy Loam

TECH	TJ
DATE	08/01/06
CHECK	
REVIEW	

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	WCA OF HIGH POINT LLC/C&D LF/NC		Board #	2	COMMENTS [1]Sample was too soft to take final measurements accurately.
PROJECT NUMBER	063-6526		Flow Pump	1	
SAMPLE ID	P-24	2.0 - 4.0'	Flow Pump Speed	1	
SAMPLE TYPE	UD		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.939	B-Value, f	0.95	Height, inches	2.939 [1]
Diameter, inches	2.860	Cell Pres.	85.0	Diameter, inches	2.860 [1]
Area, cm²	41.45	Bot. Pres.	80.0	Area, cm²	41.45
Volume, cm³	309.40	Top Pres.	80.0	Volume, cm³	309.40
Mass, g	595.22	Tot. B.P.	80.0	Mass, g	636.29
Moisture Content, %	9.53	Head, max.	18.99	Moisture Content, %	17.09
Dry Density, pcf	109.60	Head, min.	18.99	Dry Density, pcf	109.60
Spec. Gravity	2.711	Max. Grad.	2.54	Volume Solids, cm³	200.45
Volume Solids, cm³	200.45	Min. Grad.	2.54	Volume Voids, cm³	108.95
Volume Voids, cm³	108.95			Void Ratio	0.54
Void Ratio	0.54			Saturation, %	85.2%
Porosity, %	35				
Saturation, %	47.5%				

Flow Pump Rate: 2.49E-02 cm³/sec

USCS: SM
USDA: Sandy Loam

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	595.22	721.42
Wt Soil & Tare, f	g	543.43	628.61
Wt Tare	g	0.00	85.48
Wt Moisture Lost	g	51.79	92.81
Wt Dry Soil	g	543.43	543.13
Water Content	%	9.53%	17.09%

DESCRIPTION: Brownish Yellow, MEDIUM TO FINE SAND, some clayey silt.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
08/02/06	38931	8	12	20.9	0	0	0	0	0.27	18.99	2.54	2.3E-04
08/02/06	38931	8	12.5	20.9	0.5	0.5	30	30	0.27	18.99	2.54	2.3E-04
08/02/06	38931	8	13	20.9	0.5	1	30	60	0.27	18.99	2.54	2.3E-04
08/02/06	38931	8	13.5	20.9	0.5	1.5	30	90	0.27	18.99	2.54	2.3E-04 *
08/02/06	38931	8	14	20.9	0.5	2	30	120	0.27	18.99	2.54	2.3E-04 *
08/02/06	38931	8	14.5	20.9	0.5	2.5	30	150	0.27	18.99	2.54	2.3E-04 *
08/02/06	38931	8	15	20.9	0.5	3	30	180	0.27	18.99	2.54	2.3E-04 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 2.3E-04 cm/sec **

DATE 8/2/2006
CHECK
REVIEW

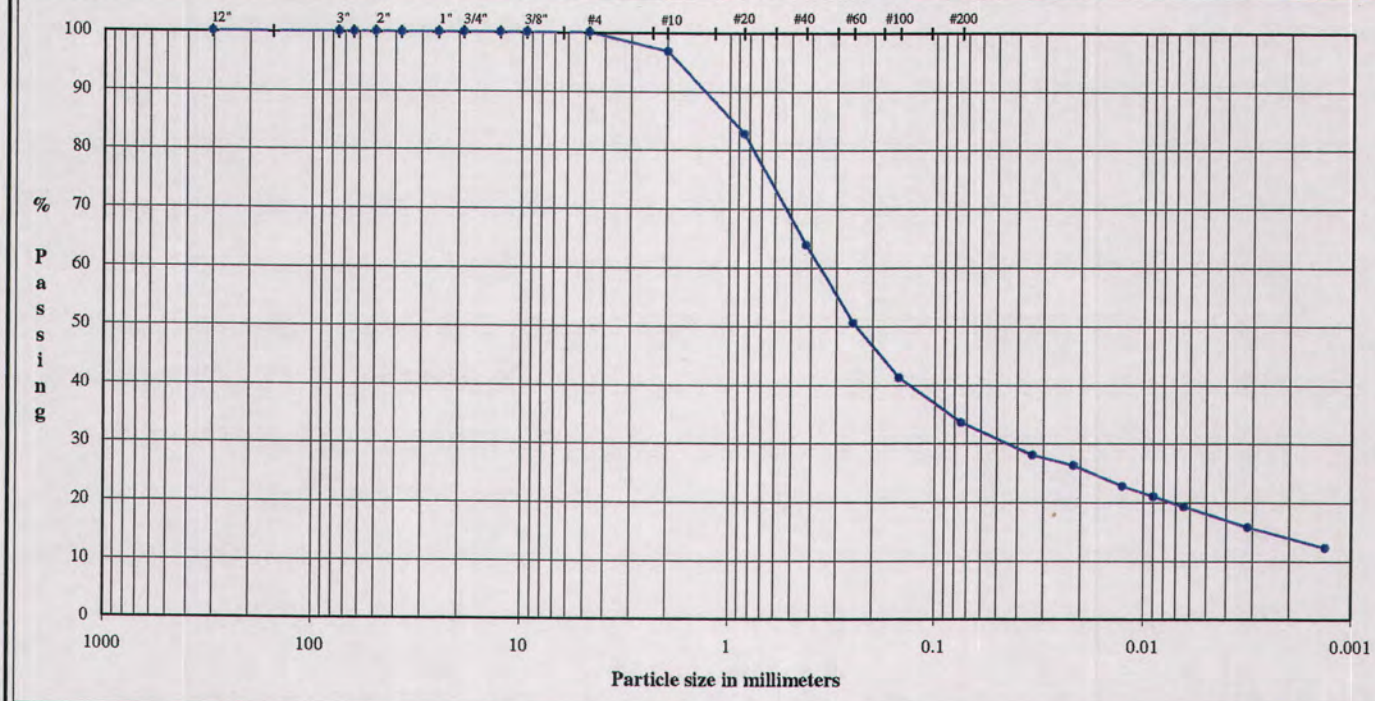
JULY 2006

063-6526

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **WCA OF HIGH POINT LLC/C&D LF/NC**
SAMPLE ID: **P-26S** Depth: **10.0 - 13.0'**
TYPE: **Bulk**



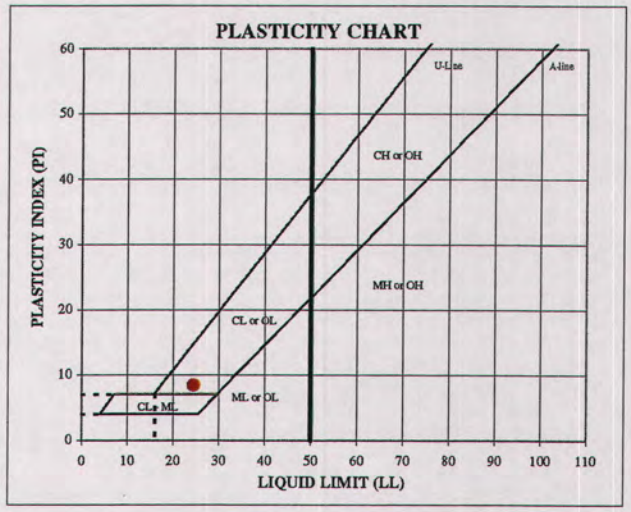
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Wentworth Classification	ASTM Classification	Percentage
12.0"	304.8	100.0			
3.0"	75.0	100.0		Cobbles	0.0
2.5"	63.5	100.0			
2.0"	50.0	100.0			
1.5"	37.5	100.0			
1.0"	25.0	100.0			
0.75"	19.0	100.0		Coarse Gravel	0.0
0.50"	12.7	100.0	Gravel		
0.375"	9.5	100.0	3%		
#4	4.8	100.0		Fine Gravel	0.0
#10	2.00	96.8		Coarse Sand	3.2
#20	0.85	82.8			
#40	0.43	63.8		Medium Sand	33.0
#60	0.25	50.6	Sand		
#100	0.15	41.2	63%		
#200	0.075	33.6		Fine Sand	30.2

Hydrometer Analysis

(mm)	%Finer			
0.034	28.0			
0.022	26.3			
0.013	22.8	Silt	Fines	
0.0090	21.0	18%	Silt or Clay	33.6
0.0064	19.3			
0.0032	15.8	Mud		
0.0013	12.3	16%		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
8.2	24	16	8	-0.90

LL (oven-dried) / <0.75 = ORGANIC (OL/OH)

DESCRIPTION: Yellowish Brown, MEDIUM TO FINE SAND, and silty clay.

USCS: SC
USDS: Sandy Loam

TECH	TJ
DATE	07/31/06
CHECK	
REVIEW	

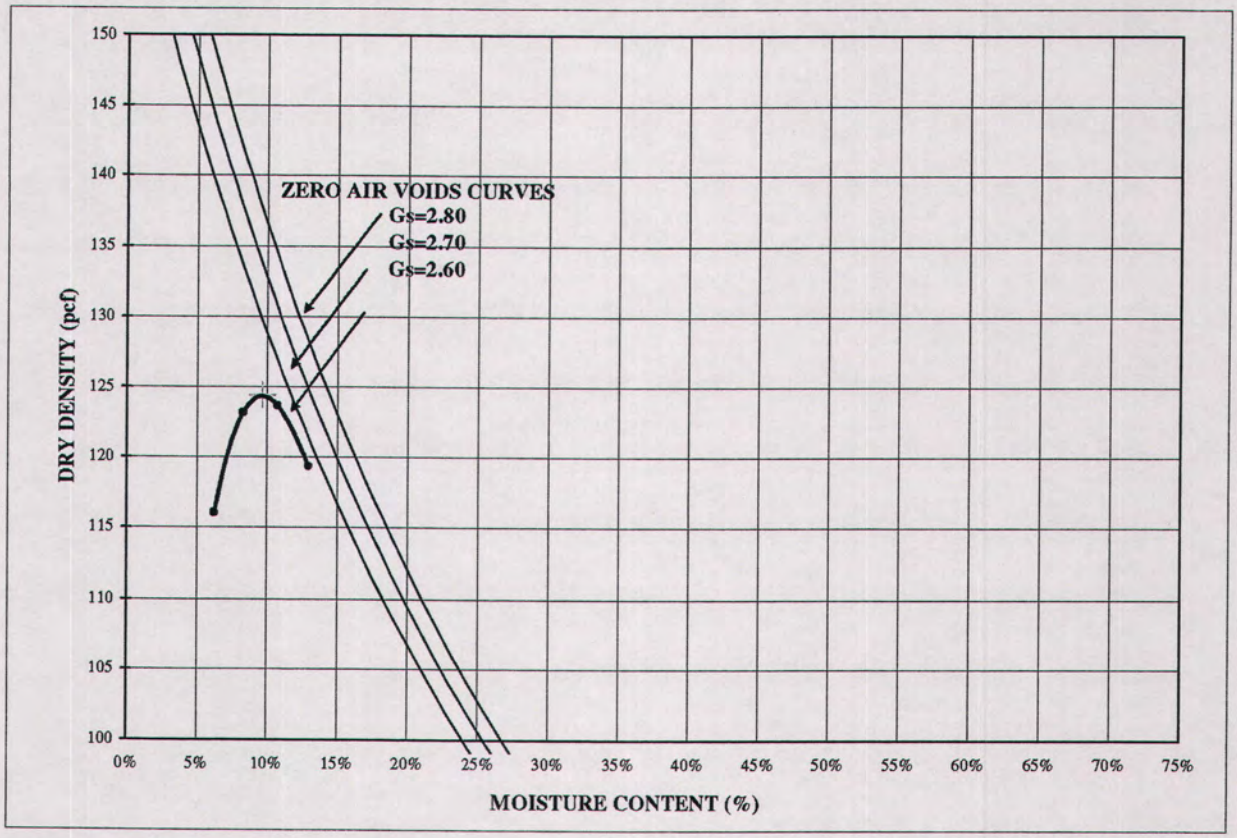
JULY 2006

063-6526

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: WCA OF HIGH POINT LLC/C&D LF/NC
PROJECT NUMBER: 063-6526
SAMPLE ID: P-26S - DEPTH: 10.0 - 13.0' SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	116.0	6.3%
2	123.2	8.3%
3	123.7	10.7%
4	119.4	13.0%

Maximum Dry Density (pcf)	124.4
Optimum Moisture (%)	9.7
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	8.2%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION Yellowish Brown, MEDIUM TO FINE SAND, and silty clay.

USCS SC

USDS Sandy Loam

CHECK

REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	WCA OF HIGH POINT LLC/C&D LF/NC		Board #	2	COMMENTS: The sample was remolded to 95.2% of the Maximum Dry Density and OPTM + 1.9% (using ASTM D 698).
PROJECT NUMBER	063-6526		Flow Pump	1	
SAMPLE ID	P-26S	10.0 - 13.0'	Flow Pump Speed	2	
SAMPLE TYPE	Bulk		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	3.000	B-Value, f	0.96	Height, inches	2.995
Diameter, inches	2.790	Cell Pres.	85.0	Diameter, inches	2.804
Area, cm^2	39.44	Bot. Pres.	80.0	Area, cm^2	39.84
Volume, cm^3	300.55	Top Pres.	80.0	Volume, cm^3	303.07
Mass, g	636.26	Tot. B.P.	80.0	Mass, g	653.42
Moisture Content, %	11.94	Head, max.	30.95	Moisture Content, %	14.96
Dry Density, pcf	118.01	Head, min.	30.95	Dry Density, pcf	117.03
Spec. Gravity	2.696	Max. Grad.	4.07	Volume Solids, cm^3	210.83
Volume Solids, cm^3	210.83	Min. Grad.	4.07	Volume Voids, cm^3	92.24
Volume Voids, cm^3	89.72			Void Ratio	0.44
Void Ratio	0.43			Saturation, %	92.2%
Porosity, %	30				
Saturation, %	75.6%				

Flow Pump Rate: 9.99E-03 cm^3/sec

USCS: SC

USDA: Sandy Loam

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	636.26	738.00
Wt Soil & Tare, f	g	568.39	653.01
Wt Tare	g	0.00	84.87
Wt Moisture Lost	g	67.87	84.99
Wt Dry Soil	g	568.39	568.14
Water Content	%	11.94%	14.96%

DESCRIPTION: Yellowish Brown, MEDIUM TO FINE SAND, and silty clay.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
08/07/06	38936	8	20	22.5	0	0	0	0	0.44	30.95	4.07	5.8E-05
08/07/06	38936	8	21	22.5	1	1	60	60	0.44	30.95	4.07	5.8E-05
08/07/06	38936	8	22	22.5	1	2	60	120	0.44	30.95	4.07	5.8E-05
08/07/06	38936	8	25	22.5	3	5	180	300	0.44	30.95	4.07	5.8E-05 *
08/07/06	38936	8	26	22.5	1	6	60	360	0.44	30.95	4.07	5.8E-05 *
08/07/06	38936	8	28	22.5	2	8	120	480	0.44	30.95	4.07	5.8E-05 *
08/07/06	38936	8	30	22.5	2	10	120	600	0.44	30.95	4.07	5.8E-05 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 5.8E-05 cm/sec **

DATE 8/7/2006

CHECK

REVIEW

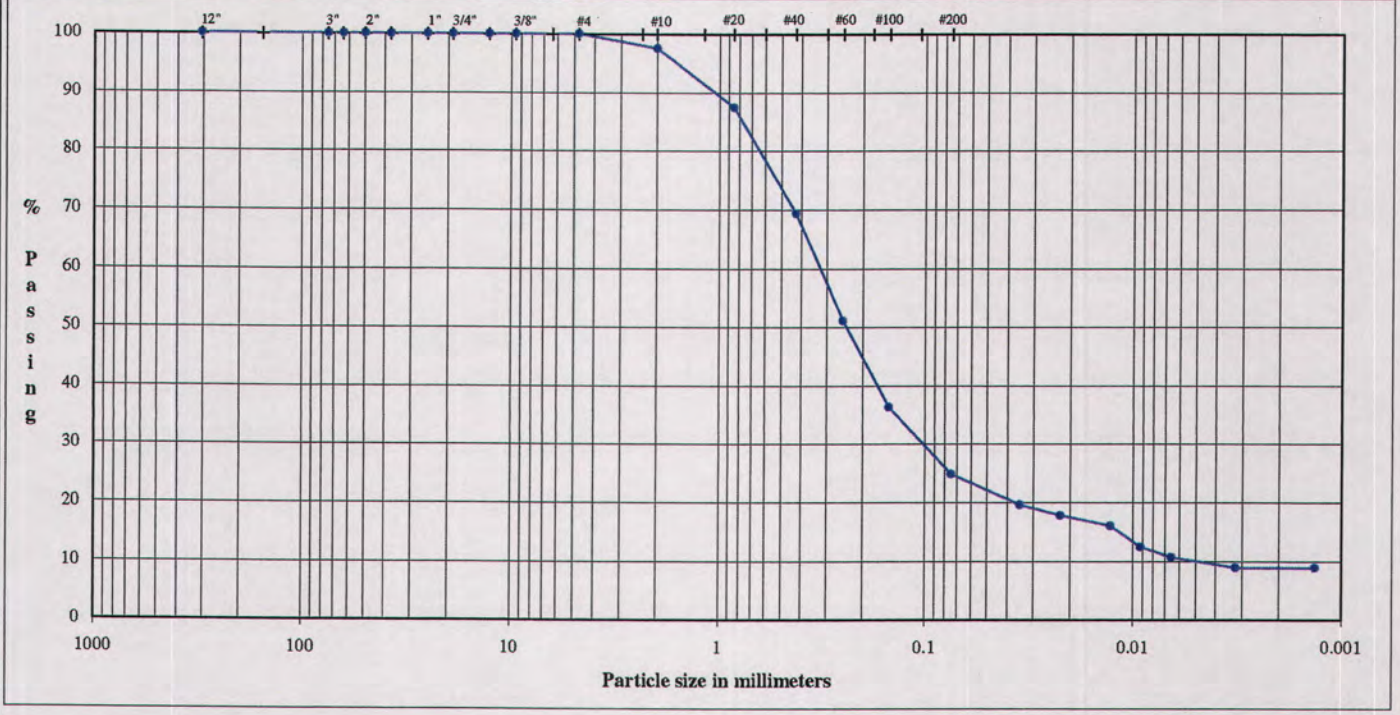
AUGUST 2006

063-6526

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **WCA OF HIGH POINT LLC/C&D LF/NC**
SAMPLE ID: **P-30D** Depth: **3.0-5.0'**
TYPE: **UD**



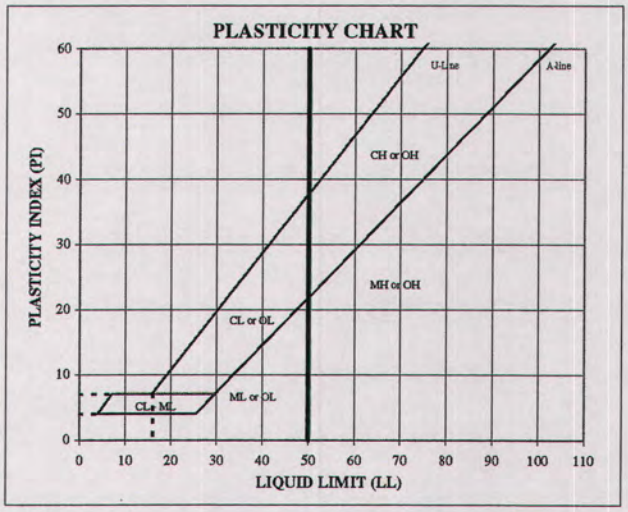
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Wentworth Classification	ASTM Classification	Percentage
12.0"	304.8	100.0			
3.0"	75.0	100.0		Cobbles	0.0
2.5"	63.5	100.0			
2.0"	50.0	100.0			
1.5"	37.5	100.0			
1.0"	25.0	100.0			
0.75"	19.0	100.0		Coarse Gravel	0.0
0.50"	12.7	100.0	Gravel		
0.375"	9.5	100.0	3%		
#4	4.8	100.0		Fine Gravel	0.0
#10	2.00	97.5		Coarse Sand	2.5
#20	0.85	87.4			
#40	0.43	69.3		Medium Sand	28.2
#60	0.25	51.1	Sand		
#100	0.15	36.3	73%		
#200	0.075	24.8		Fine Sand	44.5

Hydrometer Analysis

(mm)	%Finer			
0.035	19.6			
0.022	17.8			
0.013	16.0	Silt	Fines	
0.0093	12.5	14%	Silt or Clay	24.8
0.0066	10.7			
0.0032	8.9	Mud		
0.0013	8.9	10%		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
10.0	NP	NP	NP	NP

LL (oven-dried) / <0.75 = ORGANIC (OL/OH)

DESCRIPTION: Pale Yellow, MEDIUM TO FINE SAND, some clayey silt.

USCS: SM

USDS: Sandy Loam

TECH	TJ
DATE	08/01/06
CHECK	
REVIEW	

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	WCA OF HIGH POINT LLC/C&D LF/NC		Board #	3	COMMENTS
PROJECT NUMBER	063-6526		Flow Pump	2	
SAMPLE ID	P-30D	3.0-5.0'	Flow Pump Speed	4	
SAMPLE TYPE	UD		Technician	SDM	

Sample Data, Initial				Sample Data, Final	
Height, inches	2.975	B-Value, f	0.97	Height, inches	2.981
Diameter, inches	2.891	Cell Pres.	85.0	Diameter, inches	2.862
Area, cm²	42.35	Bot. Pres.	80.0	Area, cm²	41.50
Volume, cm³	320.02	Top Pres.	80.0	Volume, cm³	314.26
Mass, g	650.87	Tot. B.P.	80.0	Mass, g	681.95
Moisture Content, %	10.04	Head, max.	93.55	Moisture Content, %	15.30
Dry Density, pcf	115.33	Head, min.	93.55	Dry Density, pcf	117.44
Spec. Gravity	2.704	Max. Grad.	12.36	Volume Solids, cm³	218.74
Volume Solids, cm³	218.74	Min. Grad.	12.36	Volume Voids, cm³	95.52
Volume Voids, cm³	101.28			Void Ratio	0.44
Void Ratio	0.46			Saturation, %	94.7%
Porosity, %	32				
Saturation, %	58.7%				

Flow Pump Rate: 2.35E-03 cm³/sec

USCS: SM
USDA: Sandy Loam

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	650.87	764.81
Wt Soil & Tare, f	g	591.47	674.37
Wt Tare	g	0.00	83.18
Wt Moisture Lost	g	59.40	90.44
Wt Dry Soil	g	591.47	591.19
Water Content	%	10.04%	15.30%

DESCRIPTION: Pale Yellow, MEDIUM TO FINE SAND, some clayey silt.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
08/02/06	38931	8	20	20.9	0	0	0	0	1.33	93.55	12.36	4.5E-06
08/02/06	38931	8	25	20.9	5	5	300	300	1.33	93.55	12.36	4.5E-06
08/02/06	38931	8	30	20.9	5	10	300	600	1.33	93.55	12.36	4.5E-06
08/02/06	38931	8	35	20.9	5	15	300	900	1.33	93.55	12.36	4.5E-06 *
08/02/06	38931	8	40	20.9	5	20	300	1200	1.33	93.55	12.36	4.5E-06 *
08/02/06	38931	8	45	20.9	5	25	300	1500	1.33	93.55	12.36	4.5E-06 *
08/02/06	38931	8	50	20.9	5	30	300	1800	1.33	93.55	12.36	4.5E-06 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 4.5E-06 cm/sec **

DATE 8/2/2006
CHECK
REVIEW

JULY 2006 063-6526

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **WCA OF HIGH POINT LLC/C&D LF/NC**
SAMPLE ID: **P-30D** Depth: **16.0 - 19.0'**
TYPE: **Bulk**

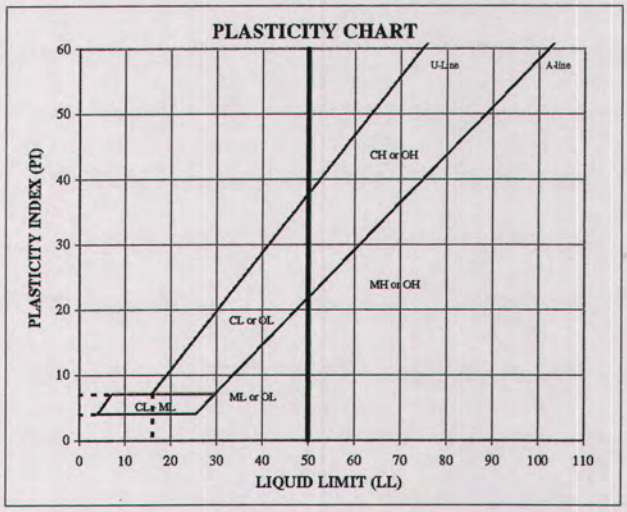
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Wentworth Classification	ASTM Classification	Percentage
12.0"	304.8	100.0			
3.0"	75.0	100.0		Cobbles	0.0
2.5"	63.5	100.0			
2.0"	50.0	100.0			
1.5"	37.5	100.0			
1.0"	25.0	100.0			
0.75"	19.0	100.0		Coarse Gravel	0.0
0.50"	12.7	100.0	Gravel		
0.375"	9.5	100.0	5%		
#4	4.8	98.9		Fine Gravel	1.1
#10	2.00	94.1		Coarse Sand	4.8
#20	0.85	80.5			
#40	0.43	61.4		Medium Sand	32.6
#60	0.25	45.1	Sand		
#100	0.15	32.9	72%		
#200	0.075	22.6		Fine Sand	38.9

Hydrometer Analysis

(mm)	%Finer			
0.035	15.4			
0.023	12.9			
0.013	12.0	Silt	Fines	
0.0093	8.6	18%	Silt or Clay	22.6
0.0066	7.7			
0.0033	5.1	Mud		
0.0014	5.1	5%		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
3.5	NP	NP	NP	NP

LL (oven-dried) / <0.75 = ORGANIC (OL/OH)

DESCRIPTION: Pale Yellow, MEDIUM TO FINE SAND, some clayey silt, trace fine gravel.

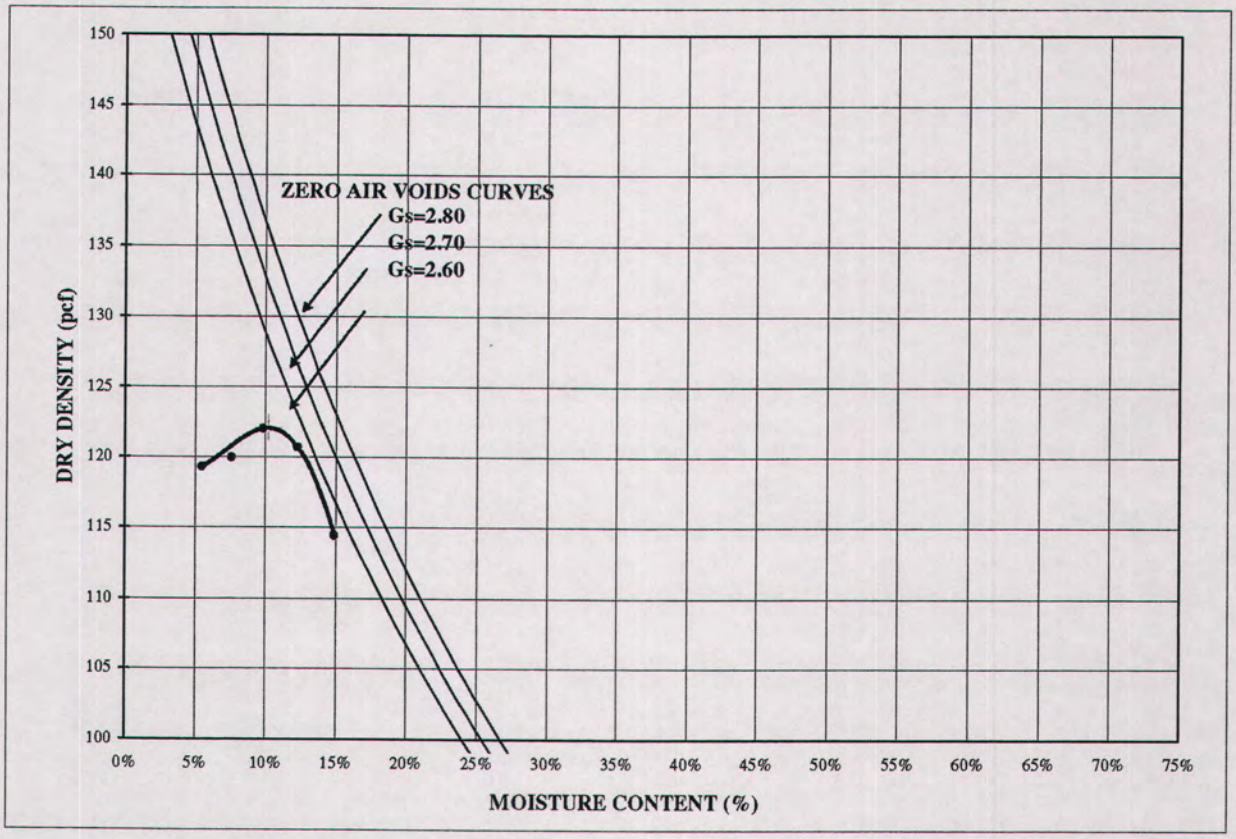
USCS SM
USDS Loamy Sand

TECH	TJ
DATE	07/31/06
CHECK	
REVIEW	

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: WCA OF HIGH POINT LLC/C&D LF/NC
PROJECT NUMBER: 063-6526
SAMPLE ID: P-30D - DEPTH: 16.0 - 19.0' SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	119.3	5.5%
2	120.0	7.6%
3	122.0	9.9%
4	120.7	12.3%
5	114.5	14.9%

Maximum Dry Density (pcf)	122.1
Optimum Moisture (%)	10.2
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	3.5%
% Retained on # 4 sieve	1.1%
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION Pale Yellow, MEDIUM TO FINE SAND, some clayey silt, trace fine gravel.

USCS SM
USDS Loamy Sand

CHECK
REVIEW

FLEXIBLE WALL TRIAXIAL PERMEABILITY
ASTM D 5084
METHOD C, FALLING HEAD W/INCREASING TAIL WATER PRESSURE

PROJECT TITLE	WCA OF HIGH POINT LLC/C&D LF/NC		Using Pipettes Only	YES	COMMENTS	The sample was remolded to 95.1% of the Maximum Dry Density and OPTM + 2.0% (using ASTM D698)	
PROJECT NUMBER	063-6526		Using Pipettes & Burettes	NO			
SAMPLE ID	P-30D	16.0 - 19.0'	BOARD#	3	TECH	SDM	
SAMPLE TYPE	Bulk		CELL #	3	DATE	8/7/2006	

Sample Data, Initial

Height, inches	3.000
Diameter, inches	2.790
Area, cm^2	39.44
Volume, cm^3	300.55
Mass, g	627.22
Moisture Content, %	12.90
Dry Density, pcf	115.34
Spec. Gravity	2.704
Volume Solids, cm^3	205.45
Volume Voids, cm^3	95.10
Void Ratio	0.46
Porosity, %	32
Saturation	75.4%

B-Value,f	0.98
Cell Pres	85.00
Bot. Pres.	80.00
Top Pres.	80.00
Head, cm	0.00
Max. Grad.	3.22
Min. Grad.	0.43
Max. E.S.	5.00
Min. E.S.	5.00

Sample Data, Final

Height, inches	2.990
Diameter, inches	2.802
Area, cm^2	39.78
Volume, cm^3	302.13
Mass, g	643.45
Moisture Content %	15.82
Dry Density, pcf	114.74
Saturation	90.9%
Inflow Volume per (1 cc)	1.00
Outflow Volume per (1 cc)	1.00

PERMEANT: Deaired Tap Water

Water Contents	Initial	Final
Wt soil&tare, i	627.22	726.98
Wt soil&tare, f	555.54	639.13
Wt Tare	0.00	83.97
Wt Moisture Lost	71.68	87.85
Wt Dry Soil	555.54	555.16
Water Content	12.90%	15.82%

DESCRIPTION: Pale Yellow, MEDIUM TO FINE SAND, some clayey silt, trace fine gravel.

USCS: SM USDS: Loamy Sand

TIME FUNCTION			READINGS			TIME IN MINUTES & SECONDS						VOLUME		PERMEABILITY	
DATE	HOUR	MIN	Inflow (cc)	Outflow (cc)	Temp.	dt (min)	dt (sec)	dt, acc (sec)	Head (cm)	(H1/H2) (inc.)	Gradient	Inflow (cc)	Outflow (cc)	@ 20 Degrees C (cm/sec)	
08/07/06	8	49.0	0.0	25.0	22.5	0.0	0.0	0	24.42		3.22	0.00	0.00	0.0E+00	
08/07/06	8	50.0	5.1	19.8	22.5	1.0	60	60	14.38	1.70	1.89	5.10	5.20	8.0E-04	
08/07/06	8	51.0	8.0	17.0	22.5	1.0	60	120	8.82	1.63	1.16	2.90	2.80	7.4E-04	
08/07/06	8	52.0	9.6	15.1	22.5	1.0	60	180	5.41	1.63	0.71	1.60	1.90	7.4E-04	
08/07/06	8	53.0	10.7	14.0	22.5	1.0	60	240	3.27	1.66	0.43	1.10	1.10	7.6E-04	
08/07/06	8	54.0	0.0	25.0	22.5	1.0	60	300	24.42	0.13	3.22	0.00	0.00	-	
08/07/06	8	54.5	3.0	22.0	22.5	0.5	30	330	18.57	1.31	2.45	3.00	3.00	8.2E-04	
08/07/06	8	55.0	5.2	19.8	22.5	0.5	30	360	14.28	1.30	1.88	2.20	2.20	7.9E-04	
08/07/06	8	55.5	6.8	18.2	22.5	0.5	30	390	11.16	1.28	1.47	1.60	1.60	7.4E-04	*
08/07/06	8	56.0	8.1	16.8	22.5	0.5	30	420	8.53	1.31	1.12	1.30	1.40	8.1E-04	*
08/07/06	8	56.5	9.1	15.8	22.5	0.5	30	450	6.58	1.30	0.87	1.00	1.00	7.8E-04	*
08/07/06	8	57.0	9.9	15.0	22.5	0.5	30	480	5.02	1.31	0.66	0.80	0.80	8.1E-04	*

Inflow Rate	0.0429
Outflow Rate	0.0438
Outflow/Inflow Ratio	1.02

PERMEABILITY REPORTED AS: 7.9E-04 cm/sec

DATE: 8/7/2006
CHECK:
REVIEW:

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

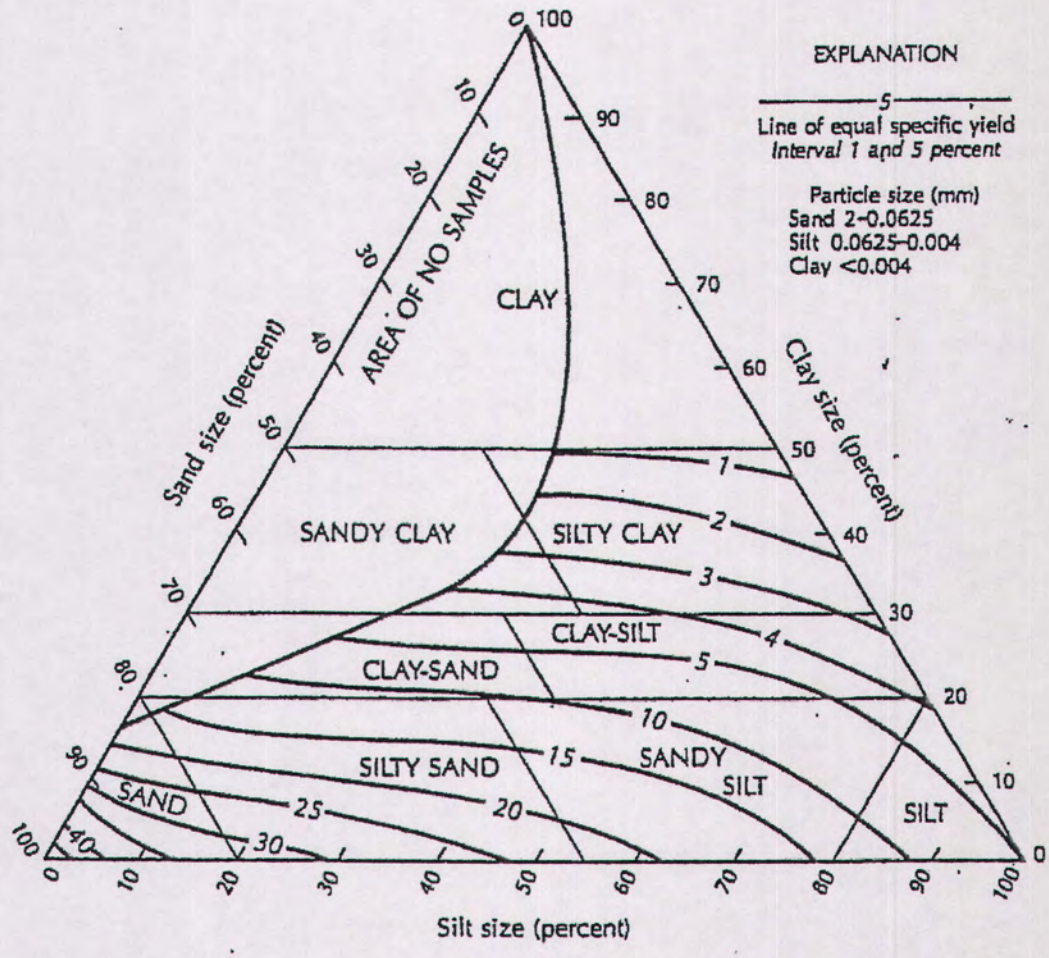
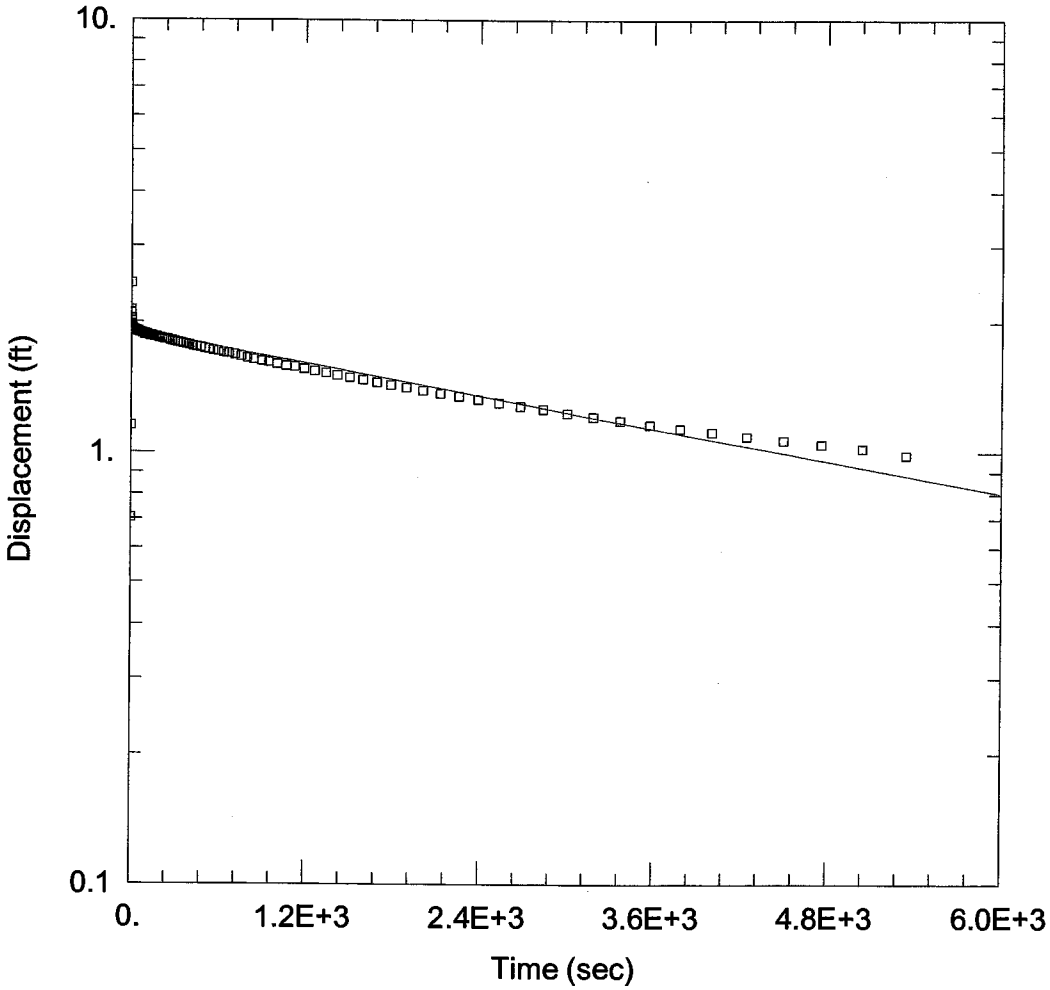


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A.I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.

APPENDIX DH-D

SINGLE WELL AQUIFER (SLUG) TEST RESULTS



WELL TEST ANALYSIS

Data Set: G:\...\P-23 Rising.aqt
Date: 12/05/06 Time: 14:16:46

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-23 Rising
Test Date: 9/28/06

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-23)

Initial Displacement: 2.46 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.24 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
K = 3.936E-6 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.905 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-23
Date: 12/05/06
Time: 13:58:56

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/28/06
Test Well: P-23 Rising

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-23

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.46 ft
Static Water Column Height: 22.24 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 10. ft
Total Well Penetration Depth: 25. ft

No. of Observations: 142

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.265	0.704	94.8	1.88
0.501	1.155	100.8	1.867
1.141	2.46	106.8	1.876
1.344	2.135	112.8	1.868
1.548	1.904	119.4	1.867
1.751	1.951	126.6	1.866
1.99	2.093	134.4	1.855
2.221	2.106	142.2	1.861
2.44	2.036	150.6	1.857
2.652	1.971	159.6	1.853
2.862	1.978	169.2	1.85
3.065	2.003	178.8	1.845
3.272	1.96	189.6	1.841
3.901	1.957	201.	1.837
4.104	1.959	213.	1.833
4.308	1.96	225.6	1.829
4.553	1.962	238.8	1.827

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
4.773	1.956	253.2	1.823
4.977	1.952	268.2	1.813
5.181	1.95	283.8	1.809
5.385	1.952	300.6	1.803
5.588	1.956	318.6	1.795
5.791	1.952	337.2	1.79
6.015	1.943	357.6	1.785
6.361	1.945	378.6	1.776
6.721	1.944	400.8	1.768
7.141	1.939	424.8	1.761
7.561	1.939	450.	1.753
7.993	1.933	476.4	1.745
8.461	1.932	504.6	1.737
9.	1.931	534.6	1.728
9.48	1.928	566.4	1.718
10.08	1.931	600.	1.711
10.68	1.93	636.	1.698
11.28	1.928	672.	1.693
11.94	1.931	714.	1.68
12.66	1.926	756.	1.666
13.44	1.929	798.	1.652
14.22	1.926	846.	1.641
15.06	1.925	900.	1.627
15.96	1.925	948.	1.616
16.92	1.924	1008.	1.601
17.88	1.915	1068.	1.584
18.96	1.924	1128.	1.575
20.1	1.914	1194.	1.557
21.3	1.921	1266.	1.539
22.56	1.921	1344.	1.522
23.88	1.914	1422.	1.504
25.32	1.917	1506.	1.486
26.82	1.917	1596.	1.469
28.38	1.911	1692.	1.449
30.06	1.91	1788.	1.43
31.86	1.909	1896.	1.41
33.72	1.912	2010.	1.389
35.76	1.91	2130.	1.368
37.86	1.914	2256.	1.347
40.08	1.907	2388.	1.325
42.48	1.906	2532.	1.302
45.	1.906	2682.	1.28
47.64	1.903	2838.	1.26
50.46	1.908	3006.	1.234
53.46	1.893	3186.	1.211
56.64	1.897	3372.	1.187
60.	1.896	3576.	1.161
63.6	1.895	3786.	1.138
67.2	1.894	4008.	1.116
71.4	1.891	4248.	1.09
75.6	1.888	4500.	1.068
79.8	1.886	4764.	1.044
84.6	1.884	5046.	1.021

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
90.	1.872	5346.	0.986

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.277

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	3.696E-6	cm/sec
y0	1.888	ft

T = T*b = 0.002816 cm²/sec

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
K	3.936E-6	2.208E-7	+/- 4.365E-7	17.83	cm/sec
y0	1.905	0.01378	+/- 0.02725	138.2	ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

T = T*b = 0.002999 cm²/sec

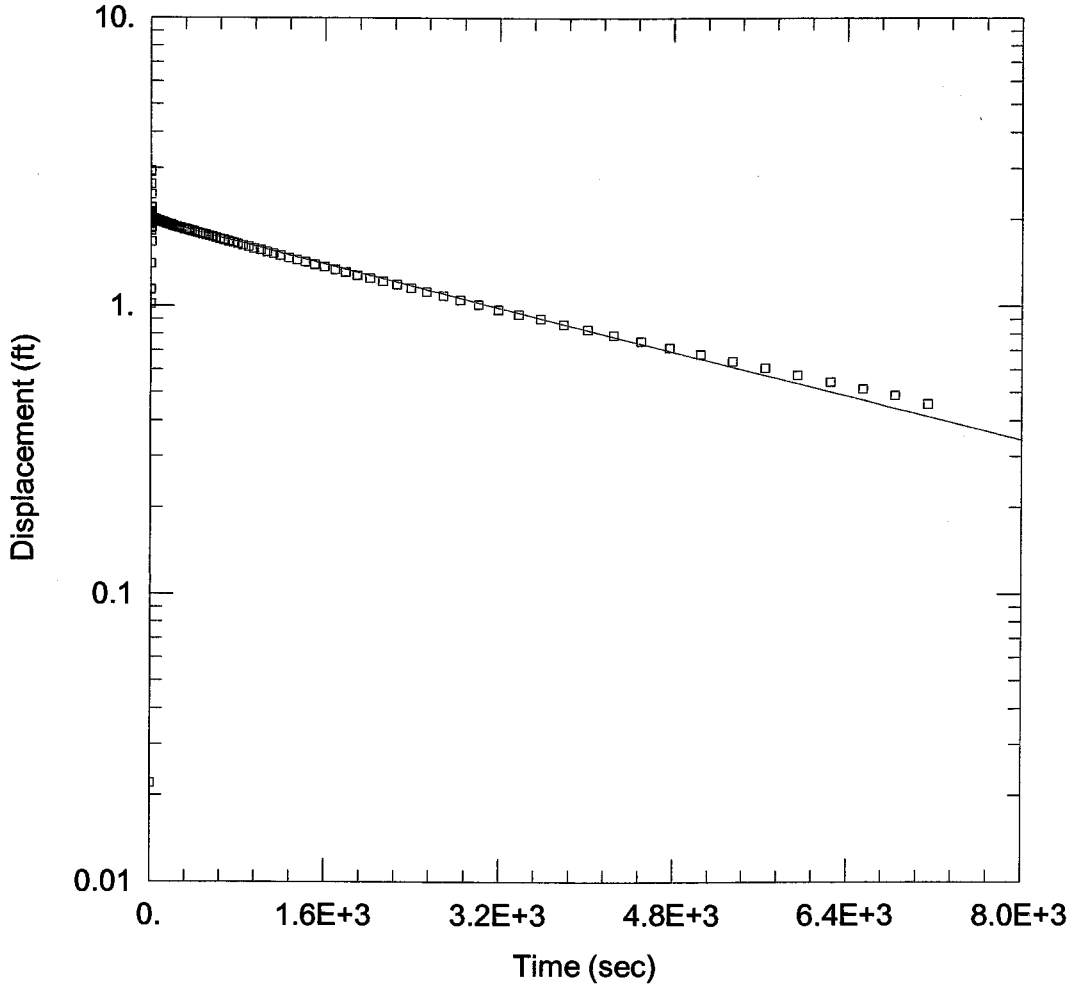
Parameter Correlations

	K	y0
K	1.00	0.44
y0	0.44	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 2.635 ft^2
Variance . . . . . 0.01882 ft^2
Std. Deviation . . . . . 0.1372 ft
Mean . . . . . 0.000423 ft
No. of Residuals 142
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: G:\...\P-23 Falling.aqt
Date: 12/05/06 Time: 14:16:31

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-23 Falling
Test Date: 9/28/06

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-23)

Initial Displacement: 2.94 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.85 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 5.994E-6 cm/sec
y0 = 1.979 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-23
Date: 12/05/06
Time: 13:57:47

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/28/06
Test Well: P-23 Falling

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-23

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.94 ft
Static Water Column Height: 21.85 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 10. ft
Total Well Penetration Depth: 25. ft

No. of Observations: 148

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.022	112.8	1.946
0.504	1.399	119.4	1.944
0.751	1.857	126.6	1.946
1.338	2.909	134.4	1.934
1.543	2.94	142.2	1.932
1.748	2.64	150.6	1.927
1.957	1.973	159.6	1.922
2.188	1.015	169.2	1.917
2.393	1.139	178.8	1.912
2.605	1.948	189.6	1.911
2.82	2.198	201.	1.9
3.366	1.928	213.	1.894
3.569	1.821	225.6	1.884
3.772	1.92	238.8	1.883
3.979	2.05	253.2	1.875
4.19	2.116	268.2	1.868
4.398	2.079	283.8	1.859

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
4.6	2.016	300.6	1.847
4.804	1.978	318.6	1.845
5.007	1.986	337.2	1.836
5.251	2.014	357.6	1.826
5.501	2.037	378.6	1.818
5.751	2.434	400.8	1.806
6.001	2.084	424.8	1.796
6.361	1.665	450.	1.784
6.721	1.873	476.4	1.773
7.141	2.193	504.6	1.761
7.561	1.974	534.6	1.747
7.981	1.96	566.4	1.735
8.461	2.038	600.	1.722
9.001	2.006	636.	1.705
9.481	2.009	672.	1.69
10.08	2.022	714.	1.673
10.68	2.021	756.	1.658
11.28	2.005	798.	1.64
11.94	2.01	846.	1.622
12.66	2.008	900.	1.602
13.44	2.008	948.	1.584
14.22	2.006	1008.	1.562
15.06	2.007	1068.	1.54
15.96	2.005	1128.	1.518
16.92	2.006	1194.	1.497
17.88	2.004	1266.	1.471
18.96	2.004	1344.	1.446
20.1	2.002	1422.	1.421
21.3	2.003	1506.	1.394
22.56	2.003	1596.	1.367
23.88	2.002	1692.	1.337
25.32	2.003	1788.	1.311
26.82	2.	1896.	1.278
28.38	2.001	2010.	1.248
30.06	2.	2130.	1.217
31.86	1.994	2256.	1.185
33.72	1.999	2388.	1.153
35.76	1.997	2532.	1.118
37.86	1.996	2682.	1.083
40.08	1.994	2838.	1.048
42.48	1.994	3006.	1.012
45.	1.991	3186.	0.972
47.64	1.986	3372.	0.935
50.46	1.984	3576.	0.903
53.46	1.983	3786.	0.864
56.64	1.979	4008.	0.829
60.	1.984	4248.	0.791
63.6	1.976	4500.	0.754
67.2	1.975	4764.	0.716
71.4	1.97	5046.	0.679
75.6	1.968	5346.	0.644
79.8	1.973	5646.	0.61
84.6	1.965	5946.	0.575

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
90.	1.962	6246.	0.545
94.8	1.958	6546.	0.515
100.8	1.954	6846.	0.489
106.8	1.955	7146.	0.457

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.277

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	5.51E-6	cm/sec
y0	1.899	ft

T = T*b = 0.004199 cm²/sec

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
K	5.994E-6	4.182E-7	+/- 8.264E-7	14.33	cm/sec
y0	1.979	0.0246	+/- 0.04862	80.42	ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

T = T*b = 0.004567 cm²/sec

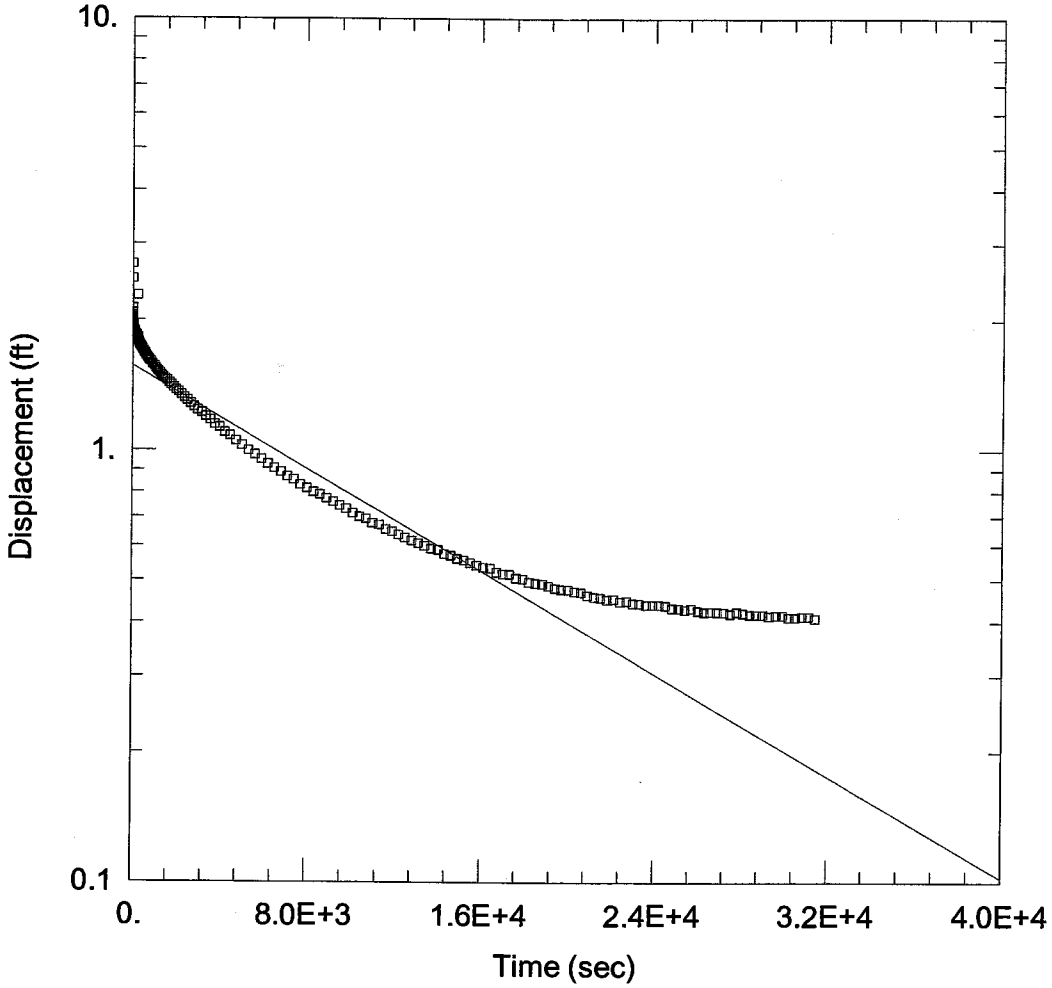
Parameter Correlations

	K	y0
K	1.00	0.40
y0	0.40	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 8.616 ft^2
Variance . . . . . 0.05901 ft^2
Std. Deviation . . . . . 0.2429 ft
Mean . . . . . 0.0007525 ft
No. of Residuals 148
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: G:\...\P-25 Rising.aqt
Date: 12/05/06 Time: 14:17:18

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-25 Rising
Test Date: 10/12/06

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-25)

Initial Displacement: 2.692 ft
Total Well Penetration Depth: 37.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.12 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.969E-6 cm/sec
y0 = 1.562 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-25
Date: 12/05/06
Time: 14:01:36

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 10/12/06
Test Well: P-25 Rising

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-25

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.692 ft
Static Water Column Height: 23.12 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 10. ft
Total Well Penetration Depth: 37.5 ft

No. of Observations: 229

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	2.488	1194.	1.521
0.501	1.887	1266.	1.507
0.763	1.846	1344.	1.491
1.001	2.079	1422.	1.476
1.251	2.126	1506.	1.462
1.874	1.901	1596.	1.448
2.077	2.005	1692.	1.43
2.28	2.077	1788.	1.414
2.484	2.081	1896.	1.395
2.687	2.05	2010.	1.376
2.89	2.019	2130.	1.362
3.093	2.009	2256.	1.341
3.296	2.027	2388.	1.321
3.499	2.036	2532.	1.304
3.751	2.035	2682.	1.281
4.001	2.022	2838.	1.261
4.251	2.018	3006.	1.239

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
4.908	2.02	3186.	1.221
5.111	2.014	3372.	1.197
5.314	2.012	3576.	1.175
5.517	2.015	3786.	1.148
5.723	2.016	4008.	1.129
5.926	2.016	4248.	1.1
6.13	2.014	4500.	1.081
6.361	2.013	4764.	1.052
6.721	2.008	5046.	1.026
7.141	2.009	5346.	1.
7.561	2.006	5646.	0.978
8.075	2.002	5946.	0.954
8.461	2.002	6246.	0.93
9.001	2.003	6546.	0.91
9.65	1.999	6846.	0.892
10.08	1.998	7146.	0.87
10.74	1.991	7446.	0.855
11.28	1.982	7746.	0.833
11.94	1.987	8046.	0.817
12.66	1.989	8346.	0.8
13.44	1.987	8646.	0.789
14.22	1.981	8946.	0.774
15.06	1.981	9246.	0.759
15.96	1.979	9546.	0.744
16.92	1.977	9846.	0.731
17.88	1.973	1.015E+4	0.714
18.96	1.97	1.045E+4	0.701
20.1	1.967	1.075E+4	0.694
21.33	1.969	1.105E+4	0.677
22.56	1.962	1.135E+4	0.671
23.88	1.958	1.165E+4	0.656
25.34	1.956	1.195E+4	0.648
26.82	1.953	1.225E+4	0.637
28.38	1.951	1.255E+4	0.627
30.06	1.947	1.285E+4	0.618
31.86	1.945	1.315E+4	0.609
33.72	1.945	1.345E+4	0.601
35.76	1.943	1.375E+4	0.592
37.86	1.939	1.405E+4	0.588
40.08	1.938	1.435E+4	0.575
42.48	1.931	1.465E+4	0.57
45.	1.929	1.495E+4	0.56
47.64	1.925	1.525E+4	0.556
50.46	1.922	1.555E+4	0.548
53.46	1.92	1.585E+4	0.541
56.64	1.914	1.615E+4	0.535
60.	1.917	1.645E+4	0.533
63.6	1.908	1.675E+4	0.522
67.2	1.909	1.705E+4	0.517
71.41	1.902	1.735E+4	0.516
75.6	1.898	1.765E+4	0.506
79.8	1.894	1.795E+4	0.503
84.6	1.89	1.825E+4	0.496

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
90.	1.886	1.855E+4	0.492
94.8	1.882	1.885E+4	0.491
100.8	1.881	1.915E+4	0.486
106.9	1.876	1.945E+4	0.48
112.8	1.869	1.975E+4	0.477
119.4	1.862	2.005E+4	0.476
126.6	1.859	2.035E+4	0.472
134.4	1.855	2.065E+4	0.469
142.2	1.849	2.095E+4	0.462
150.6	1.846	2.125E+4	0.458
159.6	1.837	2.155E+4	0.457
169.2	1.831	2.185E+4	0.452
178.8	1.827	2.215E+4	0.453
189.6	1.846	2.245E+4	0.447
201.	1.819	2.275E+4	0.448
213.	1.809	2.305E+4	0.443
225.6	2.277	2.335E+4	0.442
238.8	1.828	2.365E+4	0.439
253.2	1.788	2.395E+4	0.439
268.2	1.782	2.425E+4	0.439
283.8	1.779	2.455E+4	0.438
300.6	1.766	2.485E+4	0.432
318.6	1.76	2.515E+4	0.431
337.2	1.75	2.545E+4	0.428
357.6	1.744	2.575E+4	0.431
378.6	1.735	2.605E+4	0.426
400.8	1.732	2.635E+4	0.423
424.8	1.722	2.665E+4	0.424
450.	1.712	2.695E+4	0.423
476.4	1.701	2.725E+4	0.422
504.6	1.694	2.755E+4	0.419
534.6	1.682	2.785E+4	0.423
566.4	1.674	2.815E+4	0.42
600.	1.662	2.845E+4	0.417
636.	1.652	2.875E+4	0.417
672.	1.643	2.905E+4	0.417
714.	1.631	2.935E+4	0.414
756.	1.62	2.965E+4	0.415
798.	1.611	2.995E+4	0.415
846.	1.602	3.025E+4	0.411
900.	1.584	3.055E+4	0.411
948.	1.576	3.085E+4	0.413
1008.	1.563	3.115E+4	0.413
1068.	1.547	3.145E+4	0.409
1128.	1.533		

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.525

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	1.969E-6	cm/sec
y0	1.562	ft

T = T*b = 0.0015 cm²/sec

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
K	2.367E-6	6.693E-8	+/- 1.319E-7	35.36	cm/sec
y0	1.878	0.0138	+/- 0.02719	136.1	ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

T = T*b = 0.001804 cm²/sec

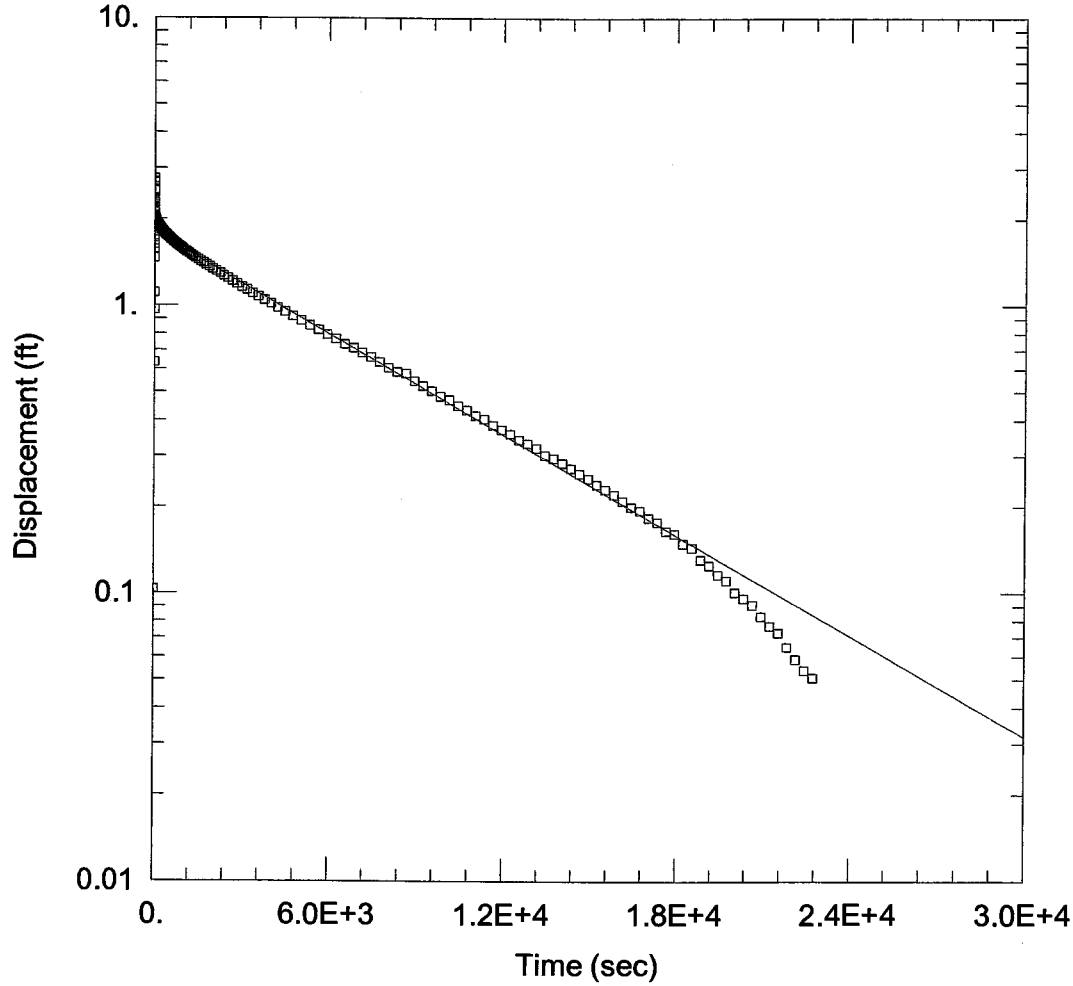
Parameter Correlations

	K	y0
K	1.00	0.35
y0	0.35	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 5.201 ft^2
Variance . . . . . 0.02291 ft^2
Std. Deviation . . . . . 0.1514 ft
Mean . . . . . 0.02041 ft
No. of Residuals 229
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: G:\...\P-25 Falling.aqt
Date: 12/05/06 Time: 14:17:07

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-25 Falling
Test Date: 10/12/06

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-25)

Initial Displacement: 2.75 ft
Total Well Penetration Depth: 37.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.08 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
K = 3.878E-6 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.778 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-25
Date: 12/05/06
Time: 14:00:13

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 10/12/06
Test Well: P-25 Falling

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-25

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.75 ft
Static Water Column Height: 23.08 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 10. ft
Total Well Penetration Depth: 37.5 ft

No. of Observations: 200

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.103	504.6	1.721
0.501	0.966	534.6	1.709
0.751	2.312	566.4	1.699
1.42	2.052	600.	1.687
1.625	1.629	636.	1.675
1.828	1.717	672.	1.662
2.035	2.306	714.	1.648
2.665	2.132	756.	1.636
2.869	2.041	798.	1.622
3.073	2.019	846.	1.609
3.461	2.113	900.	1.594
3.665	2.505	948.	1.579
3.901	2.75	1008.	1.564
4.144	2.693	1068.	1.547
4.379	2.358	1128.	1.533
4.598	1.799	1194.	1.515
4.805	0.633	1266.	1.498

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
5.012	1.105	1344.	1.479
5.218	1.987	1422.	1.462
5.431	2.249	1506.	1.443
5.635	2.28	1596.	1.422
5.838	2.672	1692.	1.404
6.041	2.755	1788.	1.383
6.244	2.05	1896.	1.361
6.449	1.565	2010.	1.338
6.721	1.458	2130.	1.315
7.14	2.526	2256.	1.292
7.929	2.338	2388.	1.267
8.134	1.898	2532.	1.243
8.461	2.008	2682.	1.215
9.068	1.966	2838.	1.187
9.48	2.137	3006.	1.158
10.08	2.018	3186.	1.134
10.68	2.05	3372.	1.104
11.28	2.048	3576.	1.076
11.94	2.039	3786.	1.045
12.66	2.042	4008.	1.016
13.44	2.034	4248.	0.984
14.22	2.035	4500.	0.953
15.06	2.037	4764.	0.92
15.96	2.04	5046.	0.888
16.92	2.03	5346.	0.855
17.88	2.03	5646.	0.825
18.96	2.026	5946.	0.794
20.1	2.025	6246.	0.767
21.3	2.023	6546.	0.735
22.56	2.018	6846.	0.713
23.88	2.02	7146.	0.685
25.32	2.029	7446.	0.661
26.82	1.975	7746.	0.636
28.38	2.021	8046.	0.608
30.06	2.009	8346.	0.588
31.86	2.004	8646.	0.581
33.72	2.006	8946.	0.546
35.76	1.998	9246.	0.526
37.86	1.995	9546.	0.505
40.08	1.991	9846.	0.483
42.5	1.989	1.015E+4	0.47
45.	1.986	1.045E+4	0.448
47.64	1.985	1.075E+4	0.434
50.46	1.98	1.105E+4	0.415
53.46	1.976	1.135E+4	0.404
56.64	1.975	1.165E+4	0.385
60.	1.969	1.195E+4	0.371
63.6	1.965	1.225E+4	0.359
67.2	1.962	1.255E+4	0.342
71.4	1.957	1.285E+4	0.332
75.6	1.957	1.315E+4	0.32
79.8	1.949	1.345E+4	0.302
84.6	1.944	1.375E+4	0.295

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
90.	1.938	1.405E+4	0.284
94.8	1.935	1.435E+4	0.272
100.8	1.931	1.465E+4	0.261
106.8	1.924	1.495E+4	0.251
112.8	1.921	1.525E+4	0.239
119.4	1.916	1.555E+4	0.23
126.6	1.908	1.585E+4	0.221
134.4	1.904	1.615E+4	0.21
142.2	1.898	1.645E+4	0.2
150.6	1.893	1.675E+4	0.194
159.6	1.886	1.705E+4	0.183
169.2	1.88	1.735E+4	0.177
178.8	1.868	1.765E+4	0.165
189.6	1.867	1.795E+4	0.161
201.	1.86	1.825E+4	0.149
213.	1.852	1.855E+4	0.144
225.6	1.847	1.885E+4	0.131
238.8	1.838	1.915E+4	0.125
253.2	1.832	1.945E+4	0.116
268.2	1.823	1.975E+4	0.111
283.8	1.814	2.005E+4	0.101
300.6	1.806	2.035E+4	0.096
318.6	1.797	2.065E+4	0.091
337.2	1.789	2.095E+4	0.083
357.6	1.777	2.125E+4	0.077
378.6	1.772	2.155E+4	0.073
400.8	1.76	2.185E+4	0.065
424.8	1.753	2.215E+4	0.059
450.	1.74	2.245E+4	0.054
476.4	1.732	2.275E+4	0.051

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.525

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	3.878E-6	cm/sec
y0	1.778	ft

T = T*b = 0.002955 cm²/sec

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio

K	4.452E-6	2.438E-7	+/- 4.809E-7	18.26	cm/sec
y0	1.95	0.02367	+/- 0.04668	82.38	ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

T = T*b = 0.003393 cm²/sec

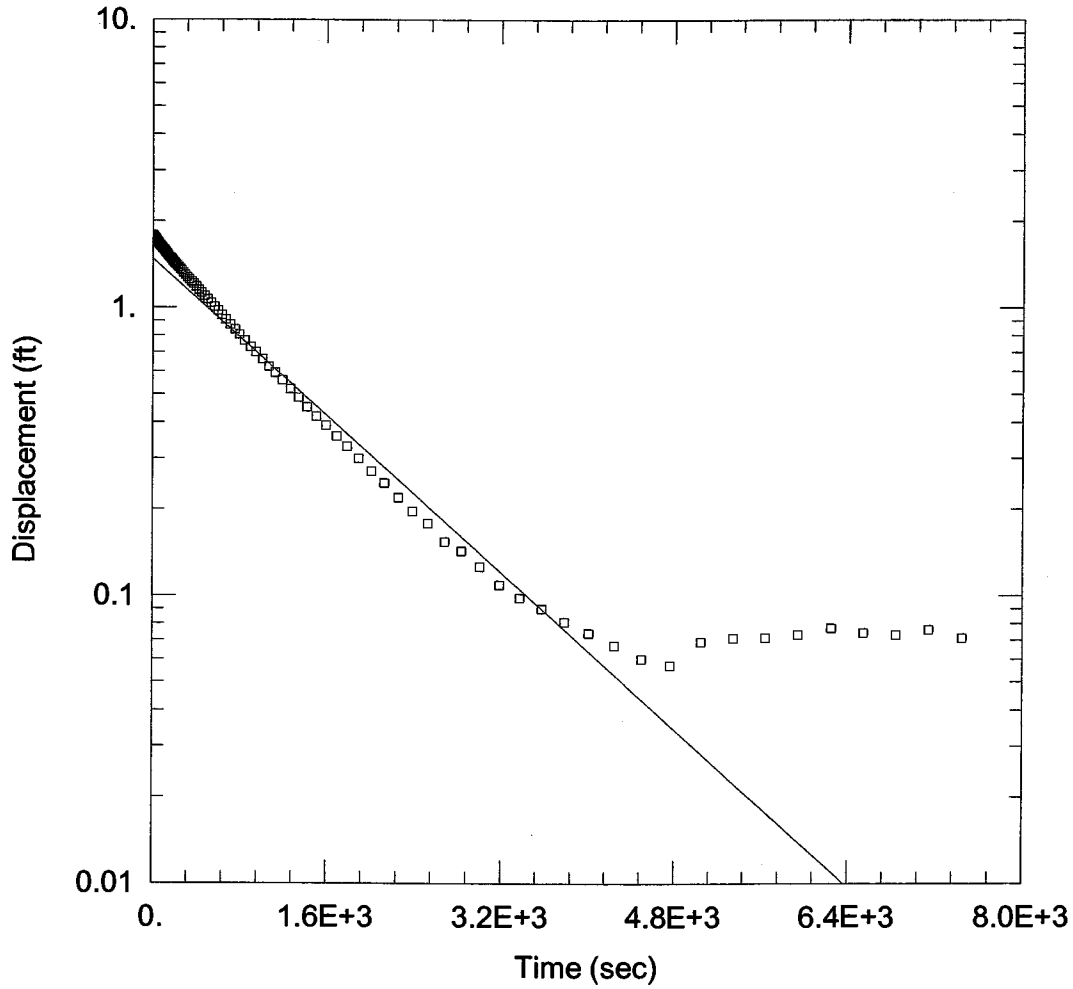
Parameter Correlations

	K	y0
K	1.00	0.35
y0	0.35	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 11.98 ft^2
Variance . . . . . 0.06049 ft^2
Std. Deviation . . . . . 0.246 ft
Mean . . . . . 0.00592 ft
No. of Residuals 200
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: G:\...\P-26S Rising.aqt
Date: 11/10/06 Time: 08:43:54

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-26S Rising
Test Date: 9/28/06

AQUIFER DATA

Saturated Thickness: 17.57 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-26S)

Initial Displacement: 1.783 ft
Total Well Penetration Depth: 28. ft
Casing Radius: 0.083 ft
Static Water Column Height: 17.57 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
K = 2.174E-5 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.472 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-2(
Date: 11/10/06
Time: 08:43:59

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/28/06
Test Well: P-26S Rising

AQUIFER DATA

Saturated Thickness: 17.57 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-26S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.783 ft
Static Water Column Height: 17.57 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 28. ft

No. of Observations: 149

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	1.781	119.4	1.563
0.501	1.782	126.6	1.552
0.751	1.781	134.4	1.539
1.001	1.77	142.2	1.527
1.63	1.776	150.6	1.514
1.834	1.779	159.6	1.501
2.037	1.783	169.2	1.485
2.421	1.777	178.8	1.472
2.624	1.777	189.6	1.454
2.841	1.775	201.	1.438
3.082	1.775	213.	1.42
3.285	1.776	225.6	1.402
3.487	1.778	238.8	1.387
3.69	1.776	253.2	1.363
3.894	1.774	268.2	1.346
4.097	1.776	283.8	1.323
4.3	1.773	300.6	1.301
4.503	1.773	318.6	1.278
4.751	1.768	337.2	1.255
5.001	1.772	357.6	1.231
5.251	1.773	378.6	1.21
5.501	1.773	400.8	1.182
5.751	1.772	424.8	1.154
6.001	1.772	450.	1.125
6.361	1.771	476.4	1.097
6.721	1.765	504.6	1.067
7.141	1.769	534.6	1.038
7.561	1.77	566.4	1.006
7.981	1.767	600.	0.976
8.461	1.765	636.	0.942
9.001	1.765	672.	0.908

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
9.481	1.765	714.	0.872
10.08	1.763	756.	0.839
10.68	1.765	798.	0.805
11.28	1.756	846.	0.768
11.94	1.76	900.	0.73
12.66	1.758	948.	0.699
13.44	1.755	1008.	0.661
14.22	1.754	1068.	0.623
15.06	1.751	1128.	0.594
15.96	1.749	1194.	0.56
16.92	1.747	1266.	0.522
17.88	1.747	1344.	0.487
18.96	1.742	1422.	0.451
20.1	1.742	1506.	0.418
21.3	1.74	1596.	0.39
22.56	1.733	1692.	0.358
23.88	1.736	1788.	0.33
25.32	1.73	1896.	0.299
26.82	1.729	2010.	0.27
28.38	1.722	2130.	0.246
30.06	1.721	2256.	0.219
31.86	1.718	2388.	0.196
33.72	1.713	2532.	0.178
35.76	1.711	2682.	0.154
37.86	1.706	2838.	0.143
40.08	1.701	3006.	0.126
42.48	1.697	3186.	0.109
45.	1.693	3372.	0.098
47.64	1.685	3576.	0.09
50.46	1.686	3786.	0.081
53.46	1.676	4008.	0.074
56.64	1.67	4248.	0.067
60.	1.663	4500.	0.06
63.6	1.657	4764.	0.057
67.2	1.651	5046.	0.069
71.4	1.644	5346.	0.071
75.6	1.637	5646.	0.071
79.8	1.629	5946.	0.073
84.6	1.623	6246.	0.077
90.	1.613	6546.	0.074
94.8	1.608	6846.	0.073
100.8	1.594	7146.	0.076
106.8	1.588	7446.	0.071
112.8	1.575		

SOLUTION

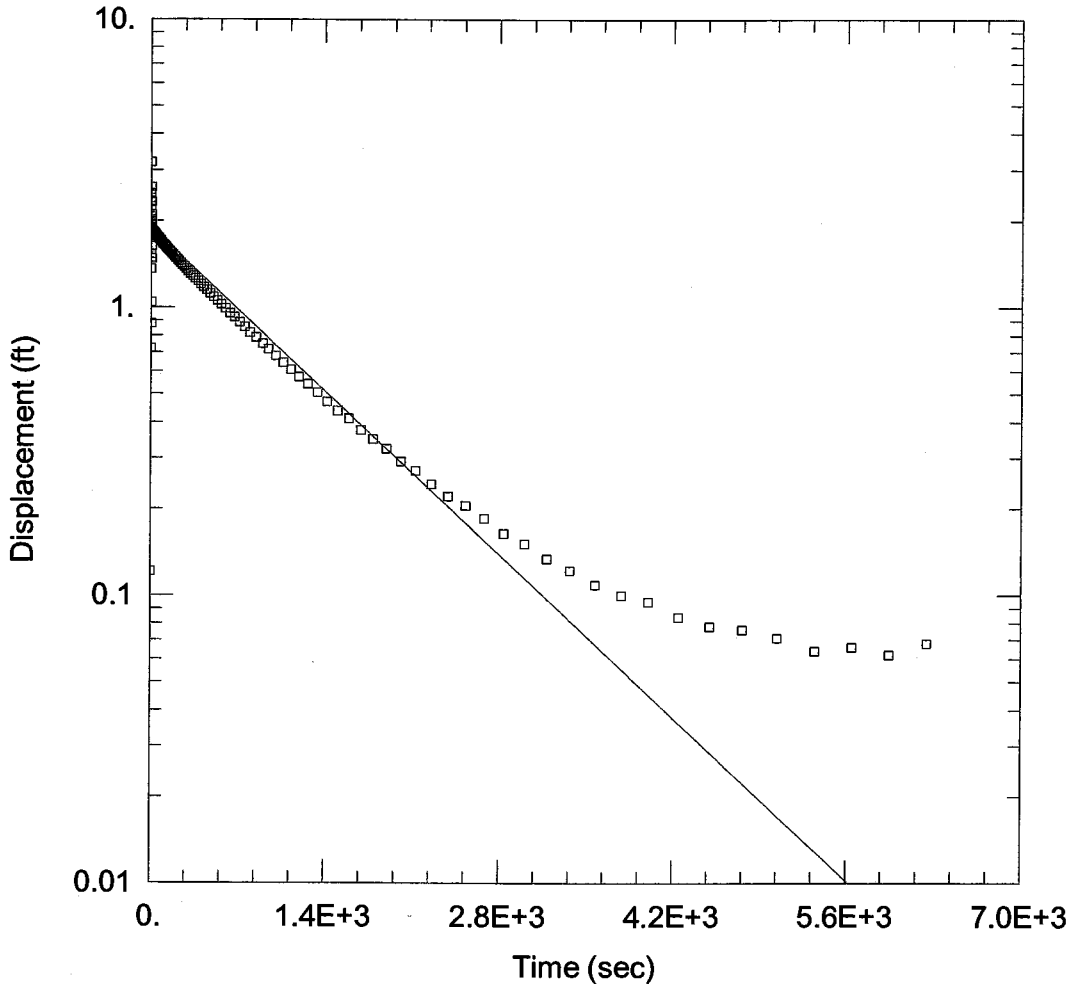
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.347

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.174E-5	cm/sec
y0	1.472	ft

T = T*b = 0.01164 cm²/sec



WELL TEST ANALYSIS

Data Set: G:\...\P-26S Falling.aqt
Date: 11/15/06 Time: 16:07:04

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-26S Falling
Test Date: 9/28/06

AQUIFER DATA

Saturated Thickness: 17.52 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-26S)

Initial Displacement: 3.2 ft
Total Well Penetration Depth: 28. ft
Casing Radius: 0.083 ft
Static Water Column Height: 17.52 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.584E-5 cm/sec
y0 = 1.88 ft

AQTESOLV for Windows

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-2(
Date: 11/15/06
Time: 16:07:11

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/28/06
Test Well: P-26S Falling

AQUIFER DATA

Saturated Thickness: 17.52 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-26S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.2 ft
Static Water Column Height: 17.52 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 28. ft

No. of Observations: 145

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.25	0.121	106.8	1.649
0.5	0.721	112.8	1.638
0.757	1.356	119.4	1.626
1.4	2.012	126.6	1.613
1.604	2.473	134.4	1.599
1.808	2.491	142.2	1.584
2.011	2.244	150.6	1.569
2.347	2.318	159.6	1.555
2.574	2.395	169.2	1.538
2.785	1.491	178.8	1.522
2.995	1.041	189.6	1.504
3.641	3.2	201.	1.486
3.844	2.613	213.	1.465
4.048	1.796	225.6	1.447
4.25	1.532	238.8	1.426
4.547	0.879	253.2	1.405
4.766	1.532	268.2	1.384
4.979	2.063	283.8	1.36
5.182	2.342	300.6	1.337
5.385	2.322	318.6	1.311
5.588	1.988	337.2	1.285
5.791	1.771	357.6	1.259
6.001	1.474	378.6	1.234
6.203	1.626	400.8	1.203
6.408	1.898	424.8	1.176
6.72	2.097	450.	1.149
7.14	1.861	476.4	1.118
7.56	1.741	504.6	1.087
7.98	1.929	534.6	1.057
8.46	1.904	566.4	1.025
9.	1.81	600.	0.991

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
9.48	1.896	636.	0.954
10.08	1.851	672.	0.924
10.68	1.855	714.	0.887
11.28	1.873	756.	0.856
11.94	1.835	798.	0.819
12.66	1.866	846.	0.788
13.44	1.849	900.	0.75
14.22	1.852	948.	0.718
15.06	1.848	1008.	0.681
15.96	1.844	1068.	0.643
16.92	1.846	1128.	0.608
17.88	1.842	1194.	0.573
18.96	1.838	1266.	0.542
20.1	1.836	1344.	0.506
21.3	1.834	1422.	0.47
22.56	1.829	1506.	0.437
23.88	1.827	1596.	0.411
25.32	1.824	1692.	0.375
26.82	1.82	1788.	0.349
28.38	1.818	1896.	0.323
30.06	1.815	2010.	0.292
31.86	1.804	2130.	0.271
33.72	1.806	2256.	0.243
35.76	1.806	2388.	0.221
37.87	1.791	2532.	0.205
40.08	1.786	2682.	0.185
42.48	1.783	2838.	0.164
45.	1.776	3006.	0.151
47.64	1.769	3186.	0.134
50.46	1.763	3372.	0.122
53.46	1.757	3576.	0.109
56.64	1.749	3786.	0.1
60.	1.744	4008.	0.095
63.6	1.731	4248.	0.084
67.2	1.729	4500.	0.078
71.4	1.72	4764.	0.076
75.6	1.709	5046.	0.071
79.8	1.711	5346.	0.064
84.6	1.692	5646.	0.066
90.	1.682	5946.	0.062
94.8	1.672	6246.	0.068
100.8	1.657		

SOLUTION

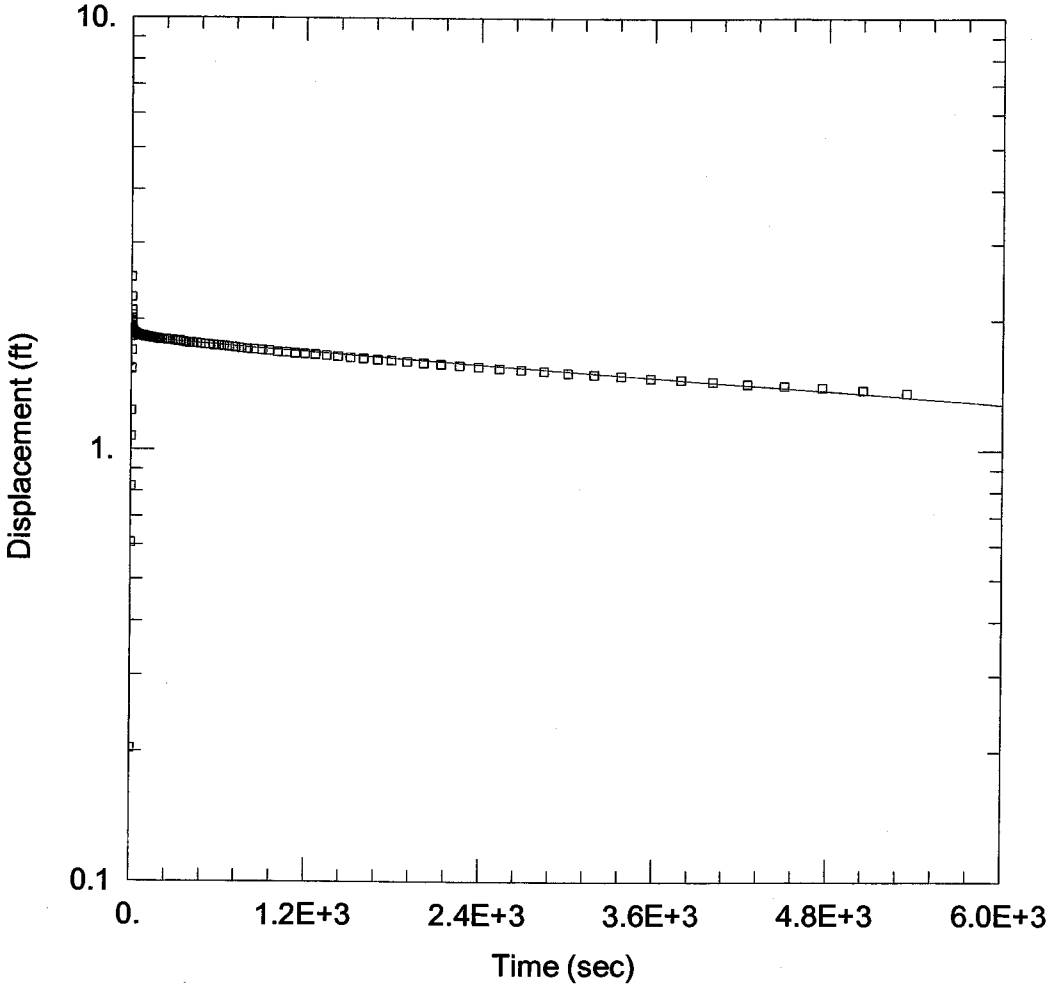
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.347

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.584E-5	cm/sec
y0	1.88	ft

T = T*b = 0.0138 cm²/sec



WELL TEST ANALYSIS

Data Set: G:\...\P-27 Rising.aqt
Date: 12/05/06 Time: 14:18:00

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-27 Rising
Test Date: 9/29/06

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-27)

Initial Displacement: 2.505 ft
Total Well Penetration Depth: 40. ft
Casing Radius: 0.083 ft
Static Water Column Height: 19.18 ft
Screen Length: 15. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.152E-6 cm/sec
y0 = 1.806 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-27
Date: 12/05/06
Time: 14:03:13

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/29/06
Test Well: P-27 Rising

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-27

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.505 ft
Static Water Column Height: 19.18 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 15. ft
Total Well Penetration Depth: 40. ft

No. of Observations: 142

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.282	0.203	94.8	1.825
0.501	0.608	100.8	1.824
0.751	0.821	106.8	1.822
1.001	1.071	112.8	1.82
1.637	1.23	119.4	1.819
1.841	1.971	126.6	1.818
2.046	2.505	134.4	1.816
2.654	1.53	142.2	1.815
2.858	1.54	150.6	1.811
3.062	1.933	159.6	1.809
3.265	2.252	169.2	1.808
3.612	1.987	178.8	1.806
3.818	1.696	189.6	1.803
4.038	1.696	201.	1.801
4.241	1.913	213.	1.797
4.446	2.096	225.6	1.796
4.663	2.041	238.8	1.796

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
4.907	1.845	253.2	1.792
5.557	1.98	268.2	1.789
5.761	2.007	283.8	1.789
5.964	1.933	300.6	1.784
6.167	1.845	318.6	1.781
6.374	1.825	337.2	1.78
6.577	1.888	357.6	1.774
6.781	1.952	378.6	1.768
6.986	1.953	400.8	1.764
7.191	1.904	424.8	1.762
7.56	1.854	450.	1.761
7.98	1.925	476.4	1.753
8.672	1.862	504.6	1.751
9.	1.89	534.6	1.748
9.48	1.888	566.4	1.743
10.08	1.88	600.	1.738
10.68	1.889	636.	1.737
11.28	1.878	672.	1.73
11.94	1.879	714.	1.724
12.66	1.879	756.	1.717
13.44	1.873	798.	1.709
14.22	1.872	846.	1.706
15.06	1.873	900.	1.7
15.96	1.868	948.	1.694
16.92	1.867	1008.	1.685
17.89	1.862	1068.	1.681
18.96	1.862	1128.	1.671
20.1	1.861	1194.	1.668
21.3	1.86	1266.	1.66
22.56	1.856	1344.	1.652
23.9	1.855	1422.	1.643
25.32	1.858	1506.	1.635
26.82	1.854	1596.	1.627
28.38	1.853	1692.	1.617
30.06	1.854	1788.	1.61
31.86	1.851	1896.	1.599
33.72	1.849	2010.	1.588
35.76	1.847	2130.	1.578
37.86	1.845	2256.	1.567
40.08	1.844	2388.	1.556
42.48	1.842	2532.	1.544
45.	1.84	2682.	1.533
47.64	1.84	2838.	1.523
50.46	1.84	3006.	1.508
53.46	1.839	3186.	1.498
56.64	1.836	3372.	1.484
60.	1.837	3576.	1.467
63.6	1.836	3786.	1.457
67.2	1.835	4008.	1.441
71.4	1.832	4248.	1.422
75.6	1.83	4500.	1.409
79.8	1.835	4764.	1.396
84.6	1.83	5046.	1.377

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
90.	1.827	5346.	1.355

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.674

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	1.238E-6	cm/sec
y0	1.849	ft

T = T*b = 0.0009437 cm²/sec

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
K	1.152E-6	2.148E-7	+/- 4.246E-7	5.363	cm/sec
y0	1.806	0.02234	+/- 0.04416	80.84	ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

T = T*b = 0.0008777 cm²/sec

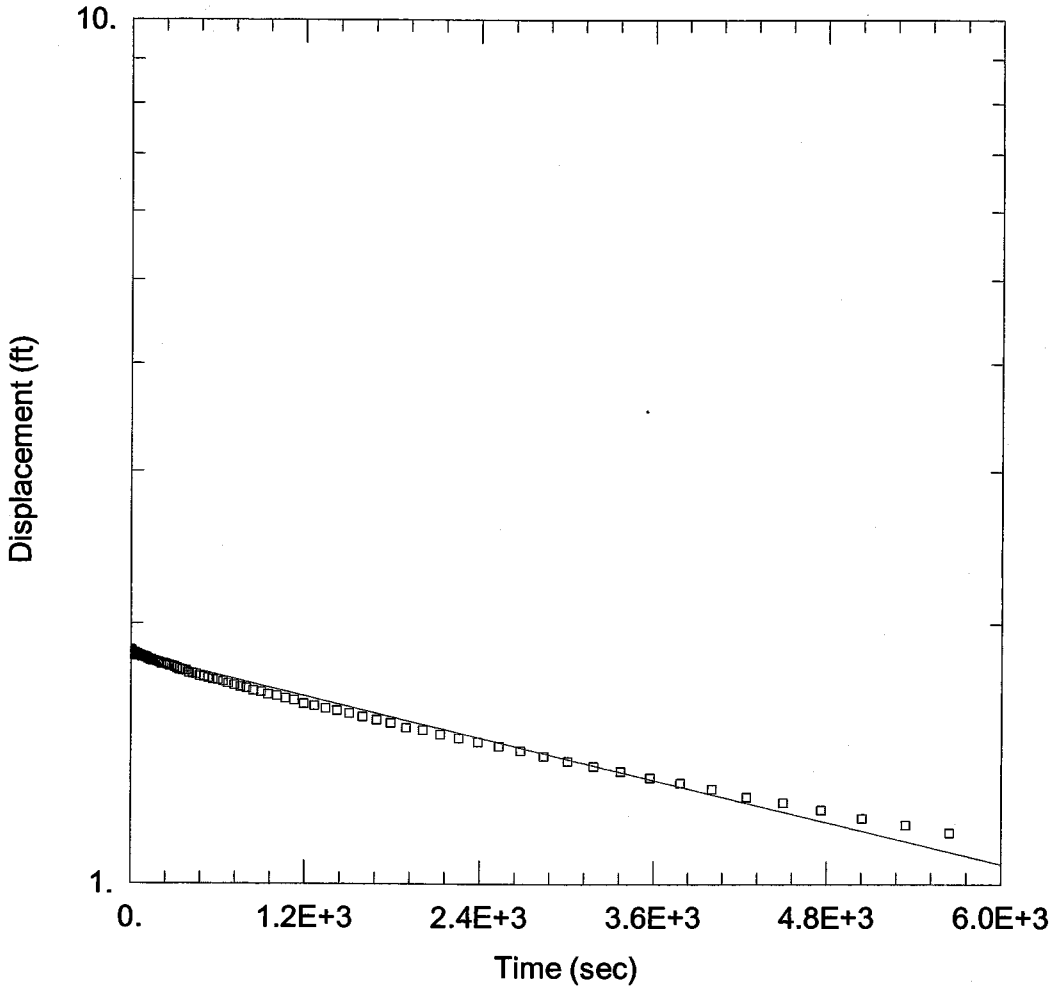
Parameter Correlations

	K	y0
K	1.00	0.47
y0	0.47	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 7.246 ft^2
Variance . . . . . 0.05176 ft^2
Std. Deviation . . . . . 0.2275 ft
Mean . . . . . 1.627E-5 ft
No. of Residuals 142
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: G:\...\P-27 Falling.aqt
Date: 12/05/06 Time: 14:17:45

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-27 Falling
Test Date: 9/29/06

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-27)

Initial Displacement: 1.863 ft
Total Well Penetration Depth: 40. ft
Casing Radius: 0.083 ft
Static Water Column Height: 18.05 ft
Screen Length: 15. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
K = 1.854E-6 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.842 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-27
Date: 12/05/06
Time: 14:02:25

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/29/06
Test Well: P-27 Falling

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-27

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.863 ft
Static Water Column Height: 18.05 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 15. ft
Total Well Penetration Depth: 40. ft

No. of Observations: 143

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	1.863	100.8	1.825
0.502	1.86	106.8	1.827
0.751	1.855	112.8	1.823
1.001	1.857	119.4	1.819
1.667	1.856	126.6	1.817
1.871	1.858	134.4	1.813
2.074	1.86	142.2	1.816
2.281	1.863	150.6	1.81
2.911	1.857	159.6	1.809
3.114	1.856	169.2	1.808
3.317	1.854	178.8	1.805
3.53	1.853	189.6	1.804
3.753	1.856	201.	1.801
4.004	1.856	213.	1.796
4.221	1.855	225.6	1.797
4.453	1.853	238.8	1.794
4.658	1.85	253.2	1.791

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
4.861	1.851	268.2	1.787
5.455	1.854	283.8	1.785
5.658	1.854	300.6	1.78
5.861	1.854	318.6	1.775
6.064	1.834	337.2	1.769
6.679	1.853	357.6	1.766
6.882	1.854	378.6	1.762
7.087	1.854	400.8	1.754
7.34	1.858	424.8	1.75
7.584	1.847	450.	1.748
7.791	1.849	476.4	1.739
7.997	1.851	504.6	1.734
8.461	1.852	534.6	1.729
9.001	1.85	566.4	1.723
9.481	1.851	600.	1.721
10.08	1.852	636.	1.713
10.68	1.852	672.	1.705
11.28	1.852	714.	1.697
11.94	1.849	756.	1.691
12.66	1.85	798.	1.684
13.44	1.851	846.	1.673
14.22	1.85	900.	1.667
15.06	1.851	948.	1.656
15.96	1.848	1008.	1.65
16.92	1.85	1068.	1.639
17.88	1.851	1128.	1.631
18.96	1.847	1194.	1.615
20.1	1.847	1266.	1.608
21.3	1.85	1344.	1.596
22.58	1.848	1422.	1.587
23.88	1.85	1506.	1.575
25.32	1.846	1596.	1.561
26.82	1.848	1692.	1.548
28.38	1.844	1788.	1.535
30.06	1.844	1896.	1.515
31.86	1.844	2010.	1.506
33.72	1.845	2130.	1.489
35.76	1.845	2256.	1.473
37.86	1.844	2388.	1.458
40.08	1.844	2532.	1.442
42.48	1.843	2682.	1.425
45.	1.841	2838.	1.405
47.64	1.842	3006.	1.387
50.46	1.842	3186.	1.368
53.46	1.839	3372.	1.349
56.64	1.837	3576.	1.327
60.	1.835	3786.	1.309
63.6	1.835	4008.	1.288
67.2	1.836	4248.	1.261
71.4	1.835	4500.	1.242
75.6	1.829	4764.	1.218
79.8	1.83	5046.	1.192
84.6	1.831	5346.	1.17

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
90.	1.83	5646.	1.147
94.8	1.828		

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.674

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	1.807E-6	cm/sec
y0	1.839	ft

T = T*b = 0.001377 cm²/sec

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
K	1.854E-6	1.725E-8	+/- 3.41E-8	107.5	cm/sec
y0	1.842	0.001714	+/- 0.003388	1074.8	ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

T = T*b = 0.001412 cm²/sec

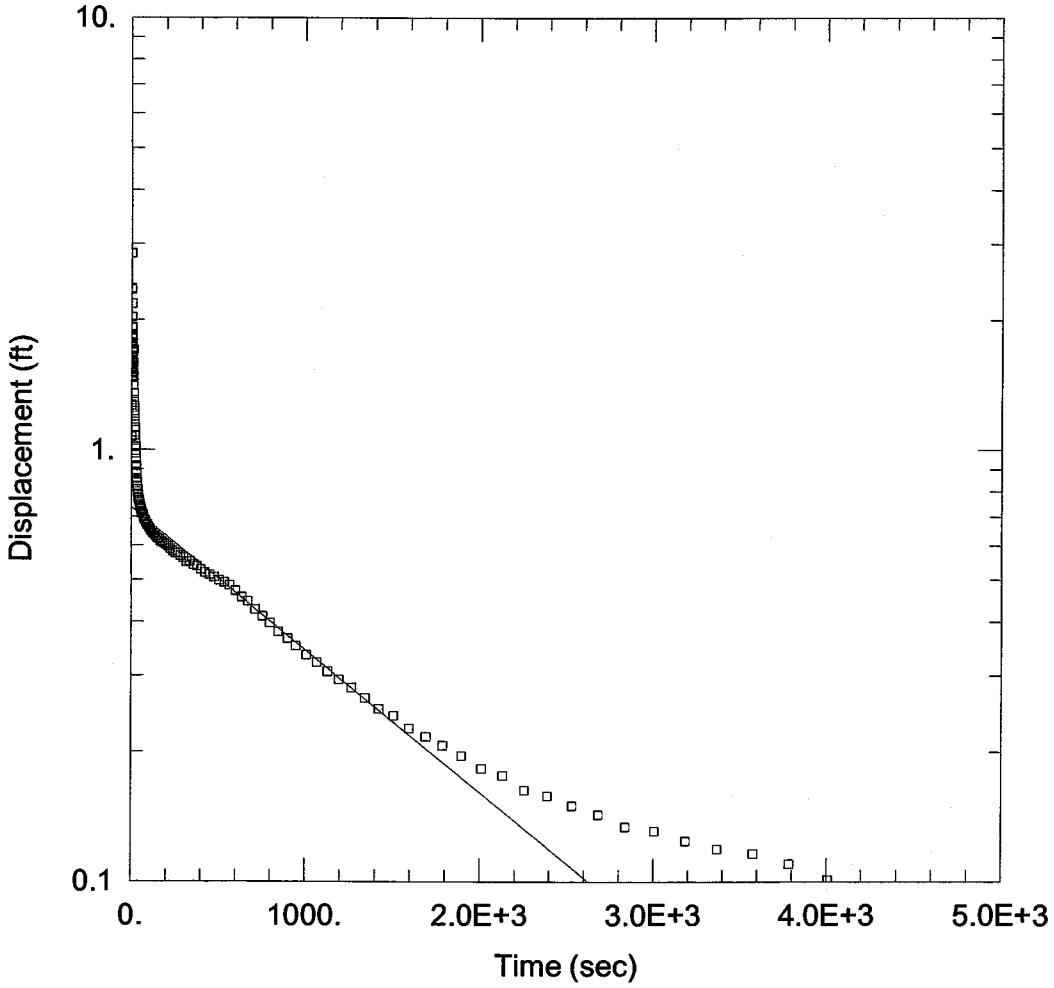
Parameter Correlations

	K	y0
K	1.00	0.45
y0	0.45	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 0.04243 ft^2
Variance . . . . . 0.0003009 ft^2
Std. Deviation . . . . . 0.01735 ft
Mean . . . . . 0.0001176 ft
No. of Residuals 143
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: G:\...\P-30S Rising.aqt
Date: 11/15/06 Time: 16:05:47

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-30S Rising
Test Date: 9/20/06

AQUIFER DATA

Saturated Thickness: 12.68 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-30S)

Initial Displacement: 2.85 ft
Total Well Penetration Depth: 45. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.68 ft
Screen Length: 15. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.535E-5 cm/sec
y0 = 0.7343 ft

AQTESOLV for Windows

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-3(
Date: 11/15/06
Time: 16:05:52

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/20/06
Test Well: P-30S Rising

AQUIFER DATA

Saturated Thickness: 12.68 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-30S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.85 ft
Static Water Column Height: 12.68 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 15. ft
Total Well Penetration Depth: 45. ft

No. of Observations: 137

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	1.069	84.6	0.68
0.511	2.85	90.	0.672
0.751	2.369	94.8	0.673
1.001	1.269	100.8	0.662
1.251	2.348	106.8	0.658
1.723	1.773	112.8	0.653
1.926	1.473	119.4	0.647
2.136	1.915	126.6	0.64
2.347	2.18	134.4	0.639
2.557	1.807	142.2	0.632
2.767	1.53	150.6	0.625
3.001	1.848	159.6	0.622
3.251	2.027	169.2	0.615
3.501	1.651	178.8	0.611
4.001	1.924	189.6	0.607
4.205	1.832	201.	0.603
4.409	1.592	213.	0.597
4.613	1.614	225.6	0.59
4.823	1.822	238.8	0.583
5.033	1.808	253.2	0.577
5.251	1.613	268.2	0.576
5.501	1.612	283.8	0.568
5.751	1.764	300.6	0.562
6.001	1.676	318.6	0.55
6.361	1.598	337.2	0.551
6.721	1.712	357.6	0.542
7.141	1.553	378.6	0.537
7.56	1.632	400.8	0.528
7.98	1.51	424.8	0.519
8.461	1.567	450.	0.514
9.	1.478	476.4	0.507

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
9.48	1.502	504.6	0.498
10.08	1.467	534.6	0.493
10.68	1.411	566.4	0.486
11.28	1.478	600.	0.472
11.94	1.704	636.	0.456
12.66	1.586	672.	0.446
13.44	1.347	714.	0.427
14.22	1.301	756.	0.412
15.06	1.259	798.	0.398
15.96	1.228	846.	0.379
16.92	1.194	900.	0.366
17.88	1.159	948.	0.352
18.96	1.122	1008.	0.335
20.1	1.079	1068.	0.322
21.3	1.048	1128.	0.307
22.56	1.014	1194.	0.294
23.88	0.979	1266.	0.282
25.32	0.949	1344.	0.267
26.82	0.916	1422.	0.252
28.38	0.885	1506.	0.243
30.06	0.855	1596.	0.227
31.86	0.838	1692.	0.217
33.72	0.823	1788.	0.207
35.76	0.808	1896.	0.196
37.86	0.793	2010.	0.183
40.08	0.774	2130.	0.176
42.48	0.77	2256.	0.163
45.	0.763	2388.	0.158
47.64	0.753	2532.	0.15
50.46	0.746	2682.	0.143
53.46	0.736	2838.	0.134
56.64	0.727	3006.	0.131
60.	0.719	3186.	0.124
63.6	0.712	3372.	0.119
67.2	0.709	3576.	0.116
71.4	0.698	3786.	0.11
75.6	0.691	4008.	0.101
79.8	0.686		

SOLUTION

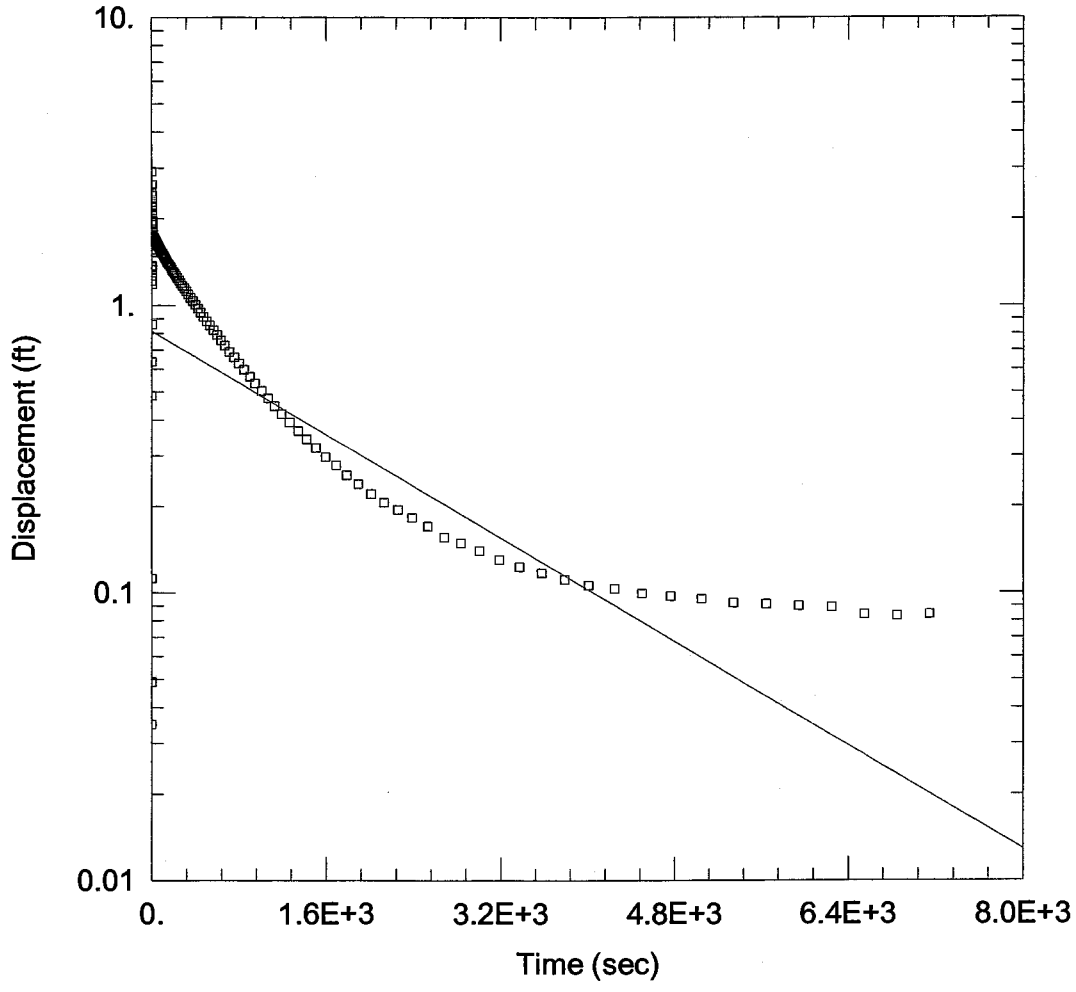
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.748

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	1.535E-5	cm/sec
y0	0.7343	ft

T = T*b = 0.005933 cm²/sec



WELL TEST ANALYSIS

Data Set: G:\...\P-30S Falling.aqt
Date: 11/15/06 Time: 16:04:51

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-30S Falling
Test Date: 9/20/06

AQUIFER DATA

Saturated Thickness: 12.62 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-30S)

Initial Displacement: 2.915 ft
Total Well Penetration Depth: 45. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.62 ft
Screen Length: 15. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
K = 1.046E-5 cm/sec y0 = 0.8111 ft

AQTESOLV for Windows

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-3(
Date: 11/15/06
Time: 16:04:55

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/20/06
Test Well: P-30S Falling

AQUIFER DATA

Saturated Thickness: 12.62 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-30S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.915 ft
Static Water Column Height: 12.62 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 15. ft
Total Well Penetration Depth: 45. ft

No. of Observations: 147

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.035	119.4	1.473
0.501	0.049	126.6	1.457
0.903	0.112	134.4	1.44
1.106	0.485	142.2	1.421
1.31	1.216	150.6	1.408
1.526	0.636	159.6	1.389
1.751	1.609	169.2	1.37
2.001	2.915	178.8	1.353
2.412	1.37	189.6	1.33
2.616	1.938	201.	1.309
2.824	2.484	213.	1.289
3.028	2.29	225.6	1.266
3.251	2.137	238.8	1.244
3.501	2.187	253.2	1.22
3.751	1.558	268.2	1.194
4.001	2.212	283.8	1.17
4.251	2.411	300.6	1.147
4.501	1.268	318.6	1.117
4.751	0.859	337.2	1.091
5.001	1.184	357.6	1.063
5.251	2.63	378.6	1.035
5.501	2.201	400.8	1.007
5.751	1.331	424.8	0.976
6.361	2.094	450.	0.945
6.721	2.076	476.4	0.913
7.141	1.364	504.6	0.882
7.561	1.909	534.6	0.852
7.981	1.935	566.4	0.821
8.461	1.528	600.	0.789
9.001	1.966	636.	0.755
9.481	1.647	672.	0.725

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
10.08	1.841	714.	0.69
10.68	1.696	756.	0.66
11.28	1.793	798.	0.628
11.94	1.71	846.	0.597
12.66	1.8	900.	0.565
13.44	1.712	948.	0.535
14.22	1.749	1008.	0.504
15.06	1.759	1068.	0.475
15.96	1.729	1128.	0.447
16.92	1.723	1194.	0.42
17.88	1.736	1266.	0.393
18.96	1.735	1344.	0.366
20.1	1.727	1422.	0.343
21.3	1.723	1506.	0.32
22.56	1.72	1596.	0.297
23.88	1.715	1692.	0.278
25.32	1.71	1788.	0.257
26.82	1.702	1896.	0.239
28.38	1.697	2010.	0.221
30.06	1.694	2130.	0.206
31.86	1.687	2256.	0.194
33.72	1.682	2388.	0.182
35.76	1.677	2532.	0.17
37.86	1.671	2682.	0.156
40.08	1.665	2838.	0.149
42.48	1.657	3006.	0.14
45.	1.653	3186.	0.13
47.64	1.643	3372.	0.123
50.46	1.637	3576.	0.117
53.46	1.63	3786.	0.111
56.64	1.62	4008.	0.106
60.	1.612	4248.	0.103
63.6	1.602	4500.	0.099
67.2	1.595	4764.	0.097
71.4	1.583	5046.	0.095
75.6	1.574	5346.	0.092
79.8	1.562	5646.	0.091
84.6	1.552	5946.	0.09
90.	1.538	6246.	0.089
94.8	1.524	6546.	0.084
100.8	1.515	6846.	0.083
106.8	1.5	7146.	0.084
112.8	1.487		

SOLUTION

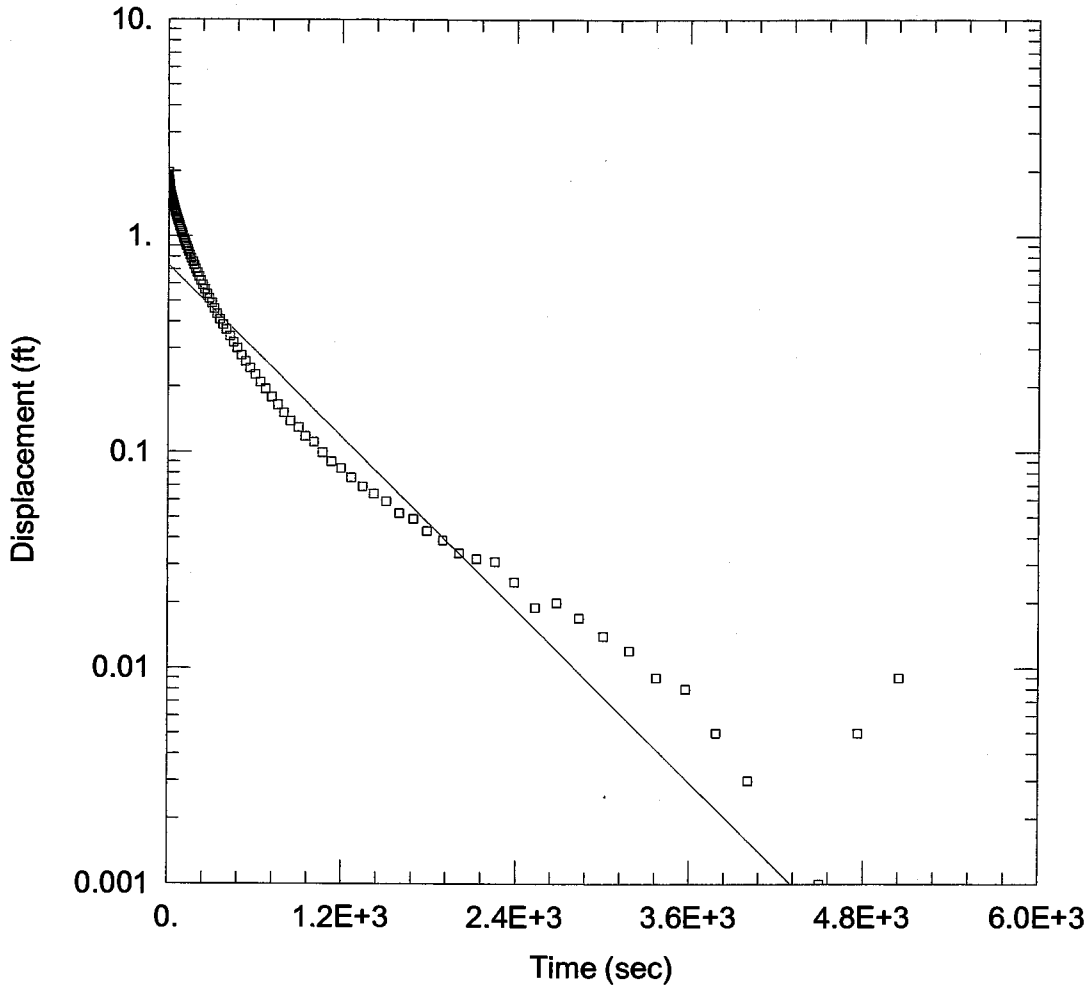
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.748

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	1.046E-5	cm/sec
y0	0.8111	ft

T = T*b = 0.004025 cm²/sec



WELL TEST ANALYSIS

Data Set: G:\...\P-30D Rising.aqt
Date: 12/05/06 Time: 14:18:31

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-30D Rising
Test Date: 9/28/06

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-30D)

Initial Displacement: 1.977 ft
Total Well Penetration Depth: 70. ft
Casing Radius: 0.083 ft
Static Water Column Height: 37.19 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
K = 4.785E-5 cm/sec y0 = 0.7303 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-30
Date: 12/05/06
Time: 14:11:41

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/28/06
Test Well: P-30D Rising

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-30D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.977 ft
Static Water Column Height: 37.19 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 10. ft
Total Well Penetration Depth: 70. ft

No. of Observations: 141

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	1.622	94.8	1.03
0.504	1.886	100.8	1.001
0.751	1.977	106.8	0.972
1.056	1.89	112.8	0.95
1.265	1.859	119.4	0.925
1.501	1.851	126.6	0.898
1.751	1.826	134.4	0.868
2.001	1.835	142.2	0.841
2.251	1.823	150.6	0.813
2.501	1.826	159.6	0.786
2.751	1.811	169.2	0.758
3.001	1.79	178.8	0.731
3.312	1.79	189.6	0.701
3.536	1.782	201.	0.675
3.751	1.774	213.	0.647
4.001	1.772	225.6	0.619
4.251	1.77	238.8	0.593

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
4.501	1.781	253.2	0.564
4.751	1.798	268.2	0.537
5.001	1.75	283.8	0.512
5.251	1.766	300.6	0.487
5.501	1.767	318.6	0.46
5.751	1.762	337.2	0.435
6.001	1.755	357.6	0.41
6.361	1.753	378.6	0.387
6.721	1.742	400.8	0.368
7.141	1.758	424.8	0.342
7.561	1.735	450.	0.321
7.981	1.713	476.4	0.301
8.461	1.724	504.6	0.279
9.001	1.736	534.6	0.261
9.492	1.666	566.4	0.243
10.08	1.651	600.	0.227
10.68	1.641	636.	0.209
11.28	1.632	672.	0.195
11.94	1.627	714.	0.179
12.66	1.617	756.	0.165
13.44	1.612	798.	0.152
14.22	1.6	846.	0.139
15.06	1.591	900.	0.13
15.96	1.58	948.	0.118
16.92	1.567	1008.	0.111
17.88	1.558	1068.	0.099
18.96	1.545	1128.	0.09
20.1	1.535	1194.	0.084
21.3	1.522	1266.	0.076
22.56	1.508	1344.	0.069
23.88	1.495	1422.	0.064
25.32	1.481	1506.	0.059
26.82	1.47	1596.	0.052
28.38	1.453	1692.	0.049
30.06	1.44	1788.	0.043
31.86	1.423	1896.	0.039
33.72	1.408	2010.	0.034
35.76	1.389	2130.	0.032
37.86	1.371	2256.	0.031
40.08	1.353	2388.	0.025
42.49	1.332	2532.	0.019
45.	1.317	2682.	0.02
47.64	1.3	2838.	0.017
50.46	1.28	3006.	0.014
53.46	1.258	3186.	0.012
56.64	1.239	3372.	0.009
60.	1.216	3576.	0.008
63.6	1.194	3786.	0.005
67.2	1.173	4008.	0.003
71.4	1.149	4248.	0.
75.6	1.125	4500.	0.001
79.8	1.101	4764.	0.005
84.6	1.071	5046.	0.009

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
90.	1.05		

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.894

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	4.785E-5	cm/sec
y0	0.7303	ft

T = T*b = 0.07293 cm²/sec

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
K	0.0001513	3.767E-6	+/- 7.446E-6	40.18	cm/sec
y0	1.752	0.01137	+/- 0.02248	154.	ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

T = T*b = 0.2306 cm²/sec

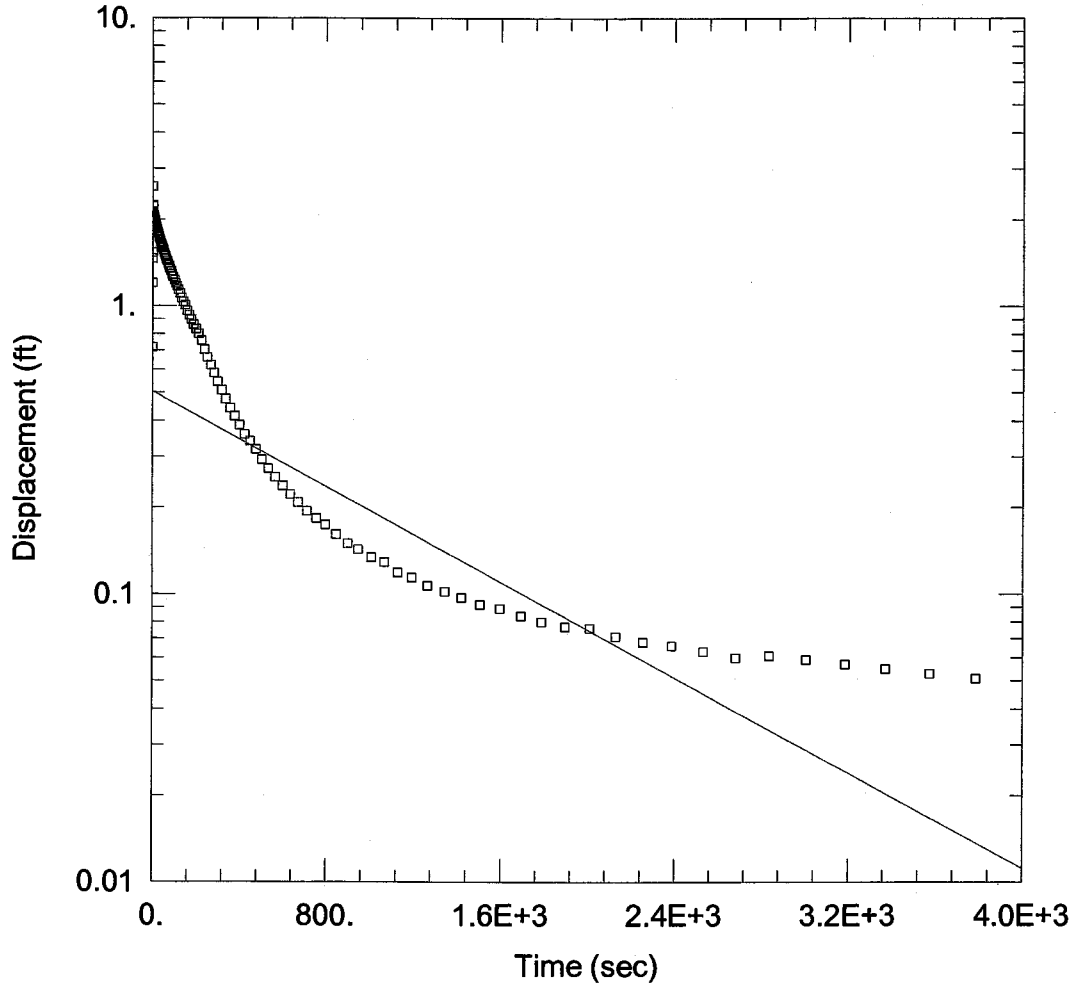
Parameter Correlations

	K	y0
K	1.00	0.52
y0	0.52	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 0.8332 ft^2
Variance . . . . . 0.005994 ft^2
Std. Deviation . . . . . 0.07742 ft
Mean . . . . . 0.01944 ft
No. of Residuals 141
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: G:\...\P-30D Falling.aqt
Date: 12/05/06 Time: 14:18:18

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Well: P-30D Falling
Test Date: 9/28/06

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-30D)

Initial Displacement: 2.599 ft
Total Well Penetration Depth: 70. ft
Casing Radius: 0.083 ft
Static Water Column Height: 51.19 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.976E-5 cm/sec
y0 = 0.5035 ft

Data Set: G:\Projects\WCA\High Point\Phase 2 Expansion\Hydrogeologic Investigation-Phase 2\Slug Tests\P-30
Date: 12/05/06
Time: 14:09:22

PROJECT INFORMATION

Company: Golder Associates Inc.
Client: WCA of High Point, LLC
Project: 063-6526.100
Location: Jamestown, NC
Test Date: 9/28/06
Test Well: P-30D Falling

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: P-30D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.599 ft
Static Water Column Height: 51.19 ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Well Skin Radius: 0.427 ft
Screen Length: 10. ft
Total Well Penetration Depth: 70. ft

No. of Observations: 136

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.718	79.8	1.349
0.504	1.202	84.6	1.321
0.751	1.458	90.	1.288
1.001	1.847	94.8	1.262
1.251	2.113	100.8	1.231
1.501	2.216	106.8	1.198
1.751	2.599	112.8	1.17
2.001	2.122	119.4	1.138
2.251	1.531	126.6	1.106
2.501	1.941	134.4	1.065
2.751	2.22	142.2	1.032
3.001	2.031	150.6	1.006
3.251	2.092	159.6	0.961
3.501	2.237	169.2	0.929
3.751	2.12	178.8	0.898
4.001	2.001	189.6	0.861
4.251	2.058	201.	0.83

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
4.501	2.054	213.	0.799
4.751	2.085	225.6	0.757
5.001	2.091	238.8	0.705
5.251	2.084	253.2	0.662
5.501	2.078	268.2	0.622
5.751	2.068	283.8	0.583
6.001	2.064	300.6	0.545
6.36	2.058	318.6	0.509
6.721	2.053	337.2	0.476
7.14	2.044	357.6	0.443
7.56	2.038	378.6	0.415
7.98	2.032	400.8	0.387
8.461	2.024	424.8	0.359
9.	2.013	450.	0.34
9.48	2.007	476.4	0.318
10.08	1.996	504.6	0.293
10.68	1.991	534.6	0.273
11.28	1.978	566.4	0.255
11.94	1.971	600.	0.238
12.66	1.957	636.	0.222
13.44	1.946	672.	0.208
14.22	1.935	714.	0.194
15.06	1.924	756.	0.183
15.96	1.913	798.	0.174
16.92	1.899	846.	0.161
17.88	1.885	900.	0.15
18.96	1.874	948.	0.143
20.1	1.86	1008.	0.134
21.3	1.846	1068.	0.129
22.56	1.829	1128.	0.119
23.88	1.816	1194.	0.114
25.32	1.8	1266.	0.107
26.82	1.781	1344.	0.102
28.38	1.766	1422.	0.097
30.06	1.747	1506.	0.092
31.86	1.727	1596.	0.089
33.72	1.707	1692.	0.084
35.76	1.692	1788.	0.08
37.86	1.666	1896.	0.077
40.08	1.647	2010.	0.076
42.48	1.625	2130.	0.071
45.	1.603	2256.	0.068
47.64	1.581	2388.	0.066
50.46	1.564	2532.	0.063
53.46	1.533	2682.	0.06
56.64	1.507	2838.	0.061
60.	1.483	3006.	0.059
63.6	1.456	3186.	0.057
67.2	1.433	3372.	0.055
71.4	1.405	3576.	0.053
75.6	1.377	3786.	0.051

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.894

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.976E-5	cm/sec
y0	0.5035	ft

T = T*b = 0.04536 cm²/sec

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
K	0.000136	6.583E-6	+/- 1.302E-5	20.67	cm/sec
y0	2.005	0.02494	+/- 0.04933	80.37	ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

T = T*b = 0.2073 cm²/sec

Parameter Correlations

	K	y0
K	1.00	0.51
y0	0.51	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 4.01 ft^2
Variance . . . . . 0.02993 ft^2
Std. Deviation . . . . . 0.173 ft
Mean . . . . . 0.02101 ft
No. of Residuals 136
No. of Estimates 2

APPENDIX DH-E

WATER QUALITY MONITORING PLAN

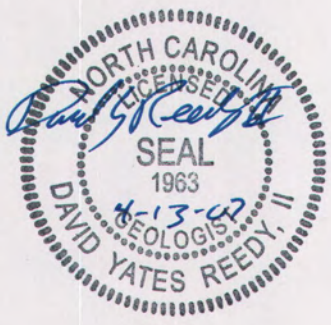
WATER QUALITY MONITORING PLAN

WCA OF HIGH POINT CONSTRUCTION AND DEMOLITION LANDFILL
PERMIT NO. 41-16
GUILFORD COUNTY, NORTH CAROLINA

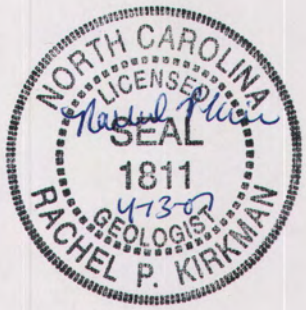
MARCH 2007

PREPARED FOR:

WCA OF HIGH POINT, LLC
5830 RIVERDALE DRIVE
JAMESTOWN, NORTH CAROLINA 27282



PREPARED BY:



GOLDER ASSOCIATES NC, INC.
4900 KOGER BOULEVARD, SUITE 140
GREENSBORO, NC 27407
PROJECT NO. 063-6526.100

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1.0 INTRODUCTION

This Water Quality Monitoring Plan (WQMP) will serve as a guidance document for collecting and analyzing groundwater samples, evaluating the associated analytical results, and monitoring for any potential releases to the uppermost aquifer from the WCA of High Point, LLC Construction and Demolition Landfill in Guilford County, North Carolina (Permit No. 41-16). The WQMP complies with Rules .0544 through .0545 of the North Carolina Solid Waste Management Rules (NCSWMR), Title 15A, Subchapter 13B. The WQMP also addresses the requirements for surface water monitoring specified in Rule .0544. The pertinent geologic and hydrogeologic characteristics of the site, as described in the *Design Hydrogeologic Report for Phase Two Expansion* of the WCA of High Point, LLC Landfill, prepared by Golder Associates NC, Inc. (Golder), dated December 2006, are summarized below.

1.1 Site Description

The WCA of High Point C&D Landfill and is located along Riverdale Drive within the city limits of High Point in Guilford County, North Carolina. The site consists of approximately 154 acres, of which, approximately 12 acres is currently permitted as the Phase 1 waste unit. The proposed Phase 2 waste unit will be approximately 9.4 acres. The site is located in the central portion of the Piedmont Physiographic Province on a group of knolls and valleys.

There are three small unnamed streams that traverse the site that flow into an unnamed tributary of Richland Creek, which forms the southern property boundary as shown on Drawing WQMP-1. The first unnamed tributary is a southwest trending stream that forms the northwestern property boundary. The second tributary is a southwest trending drainage in the center of the property and lies just east of the proposed Phase 2 waste unit. The third tributary is southwest trending drainage in the eastern portion of the site. A large man-made pond is located near the eastern property boundary. A small storm water basin was constructed in the northwest corner of the facility and a larger storm water basin was constructed along the southwestern part of the site during the construction of Phase 1.

The western portion of the site mainly consisted of trees and heavy brush before Phase 1 of the C&D landfill was constructed. Now, most of that area consists of landfill operations. The eastern portion of the site has historically been used for agricultural purposes. A reclamation facility is now located at the northernmost part of the site. A large portion of the surrounding properties are agricultural or owned by the City of High Point for operations associated with Kersey Valley Landfill.

1.2 Site Hydrogeology

Geologically, the facility is located within the Carolina Slate Belt of the Piedmont Physiographic Province of North Carolina (NCGS, 1985). Generally, the Carolina Slate Belt consists of Late Proterozoic to Cambrian volcanic and greenschist-facies metasedimentary rocks intruded by plutonic suites (Butler and Secor, 1991). The site geology is characterized by a regional-scale

felsic intrusive complex, which consists mainly of white to gray, fine- to coarse-grained, massive to foliated metamorphosed granitic rocks. The region is characterized by regional and small scale Mesozoic diabase dikes.

Three hydrogeologic units have been identified on site. They consist of the saprolite, partially weathered rock (PWR), and bedrock. For the purpose of this investigation, the saprolite hydrogeologic unit consists of in-place media below the water table with standard penetration test (SPT) results of less than 50 blows per 6 inches with a split spoon sampler. The PWR hydrogeologic unit is media below the water table with SPT results of greater than 50 blows per 6 inches with a split spoon sampler, but above auger refusal. For this investigation, auger refusal defines the top of bedrock for the site. Therefore, the bedrock hydrogeologic unit is media below the water table and below the depth that auger refusal was encountered.

Static water level measurements obtained on July 25, 2006, were used to prepare the groundwater contours presented on Drawing WQMP-1. Groundwater flow across most of the site is to the northwest, southwest and southeast from the topographic high within Phase 2 development area. This is consistent with previously submitted interpretations for this facility.

2.0 GROUNDWATER MONITORING SYSTEM

2.1 Monitoring Well Network

The proposed monitoring network as shown on Drawing No. WQMP-1 is designed to monitor for potential releases to the uppermost aquifer at the site. The proposed network will consist of wells screened in the uppermost aquifer (4116-MW-1, 4116-MW-2, 4116-MW-3, 4116-MW-4S, 4116-MW-5, 4116-MW-6, 4116-MW-7S and 4116-MW-8). Deep wells 4116-MW-4D and 4116-MW-7D will be monitored for water levels only. Monitoring well 4116-MW-1 is the facility's background compliance well and is located upgradient of the landfill; the remaining wells are located sidegradient or downgradient of the landfill.

Monitoring wells 4116-MW-7S and 4116-MW-8 are proposed additions to the existing monitoring network, and are designed to monitor water quality from the Phase 2 unit. The well construction details are presented on Table 1.

The well locations were selected to yield groundwater samples representative of the conditions in the uppermost aquifer underlying the facility, and to monitor for potential releases from the landfill unit. Well placement, well construction methods, well development, well maintenance, and well decommissioning procedures are discussed in the following sections. Groundwater monitoring wells shall be sampled during the active life of the landfill as well as the post-closure period, in accordance with Rule .0544 of the NCSWMR.

2.2 Changes in Groundwater Elevations

After each sampling event, groundwater surface elevations will be evaluated to determine whether the monitoring system remains adequate, and to determine the rate and direction of groundwater flow.

The direction of groundwater flow will be determined semiannually by comparing the groundwater surface elevations among the monitoring wells, and constructing a groundwater surface contour map. The groundwater flow rate shall be determined using the following modified Darcy equation:

$$V=\frac{ki}{n_e}$$

where V = the groundwater flow rate (feet/day)
k = the hydraulic conductivity (feet/day)
i = the hydraulic gradient, $\Delta h/\Delta l$ (foot/foot)
n_e = the effective porosity of the host medium (unitless)
Δh= the change in groundwater elevation between groundwater contours along a hypothetical flow line (feet)
Δl = the distance between the same groundwater contours (feet)

If the evaluation shows that the groundwater monitoring system does not satisfy the requirements of the NCSWMR, the monitoring system will be modified accordingly. These modifications may include a change in the number, location, and/or depth of the monitoring wells.

2.3 Monitoring Well Construction

The well completion details for the existing and proposed groundwater monitoring wells are included in Section 2.1 and Table 1. The completed boring and well construction logs for the new proposed wells are included in Appendix A. Boring logs/well construction records for proposed monitoring wells will be submitted to the Solid Waste Section (SWS) following installation.

Drilling and installation of any new monitoring wells will be performed in accordance with the specifications outlined in 15A NCAC Subchapter 2C, Section .0100. Further guidance is provided in the *Draft North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities; Solid Waste Section, Division of Solid Waste Management; Department of Environment, Health and Natural Resources* (March 1995). A geologist will oversee drilling activities and prepare boring and well construction logs for each newly installed well. New wells will be located by a licensed surveyor to within $\pm$0.1 foot on the horizontal plane and $\pm$0.01 foot vertically in reference to existing survey points. A boring log, well construction log, groundwater monitoring network map, and well installation certification will be submitted to the SWS upon completion.

2.4 Monitoring Well Development

Newly constructed wells will be developed to remove particulates that are present in the well due to construction activities, and to interconnect the well with the aquifer. Development of new monitoring wells will be performed no sooner than 24 hours after well construction. Wells may be developed with disposable PVC bailers, a mechanical well developer, or other approved method. A surge block may be used as a means of assessing the integrity of the well screen and riser. In the event a pump is employed, the design of the pump will be such that any groundwater that has come into contact with air is not allowed to drain back into the well. In general, each well will be developed until sediment-free water with stabilized field parameters (i.e., temperature, pH, and specific conductance) is obtained.

Well development equipment (bailers, pumps, surge blocks) and any additional equipment that contacts subsurface formations will be decontaminated prior to on-site use, between consecutive on-site uses, and/or between consecutive well installations.

The purge water will be disposed of on the ground surface at least 10 feet downgradient of the monitoring well being purged, unless field characteristics suggest the water will need to be disposed of otherwise. If field characteristics suggest, the purge water will be containerized and disposed of by other approved disposal means.

Samples withdrawn from the facility's monitoring wells should be clay- and silt-free; therefore, existing wells may require redevelopment from time to time based upon observed turbidity levels during sampling activities. If redevelopment of an existing monitoring well is required, it will be performed in a manner similar to that used for a new well.

2.5 Maintenance and Recordkeeping

The existing monitoring wells will be used and maintained in accordance with design specifications throughout the life of the monitoring program. Routine well maintenance will include inspection and correction/repair of, as necessary, identification labels, concrete aprons, locking caps and locks, and access to the wells. Should it be determined that background or compliance monitoring wells no longer provide samples representative of the quality of groundwater passing the relevant point of compliance, the SWS will be notified. The owner will re-evaluate the monitoring network, and provide recommendations to the SWS for modifying, rehabilitating, decommissioning, or installing replacement or additional monitoring wells, as appropriate.

Laboratory analytical results will be submitted to the SWS semiannually, along with sample collection field logs, statistical analyses, groundwater flow rate and direction calculations, and groundwater contour map(s) as described in the following sections. Analytical data, calculations, and other relevant groundwater monitoring records will be kept throughout the active life of the facility and the post-closure care period, including notices and reports of any North Carolina 2L Standard exceedances, resampling notifications, and resampling results.

2.6 Monitoring Well Decommissioning

Piezometers and wells installed within the proposed landfill footprint will be properly decommissioned in accordance with the procedures for permanent decommissioning, as described in 15A NCAC 2C Rule .0113(b). The piezometers and wells will be progressively decommissioned as necessary to complete construction activities. The piezometers and wells that are within the proposed footprint will be overdrilled to remove well construction materials, and then grouted with a cement-bentonite grout. Other piezometers and wells that will potentially interfere with clearing and construction activities will be grouted in place without overdrilling by grouting the well in place with a cement-bentonite grout and removing all surface features, such as concrete aprons, protective casings, and stickups. In each case, the bentonite content of the cement-bentonite grout shall be approximately 5%, and a tremie pipe will be used to ensure that grout is continuously placed from the bottom of the borehole/monitoring well upward.

If a monitoring well becomes unusable during the monitoring period of the landfill, the well will be decommissioned in accordance with the procedures described above. Approval from the SWS will be obtained prior to decommissioning any monitoring well.

For each monitoring well decomissioned, the following information will be provided to the SWS in a report sealed by a licensed geologist: the monitoring well name, a description of the procedure by which the monitoring well was decommissioned, the date when the monitoring well was considered to be taken out of service, and the date when the monitoring well was decommissioned.

3.0 DETECTION GROUNDWATER MONITORING PROGRAM

Groundwater samples will be obtained and analyzed semiannually for the Appendix I list of constituents, as defined in the Detection Monitoring Program under .0544(1)(D), during the life of the facility and the post-closure care period. In addition, semiannual groundwater samples will be obtained and analyzed for the following indicator parameters: mercury, chloride, manganese, sulfate, iron, specific conductance, alkalinity, total dissolved solids and required field parameters in accordance with the NCSWMR. Refer to Appendix B of this report for a list of the required constituents, analytical methods, and reporting limits. These lists were updated in memos dated October 27, 2006, and February 23, 2007, from the SWS (a copy of which is included in Appendix B). The results of the statistical analyses of the groundwater data will be submitted to the SWS semiannually. Reports will be submitted with analytical data submitted in the required format, and be accompanied by the required Environmental Monitoring Form, which will be signed and sealed by a licensed geologist in the State of North Carolina. A copy of this form is also included in Appendix B for reference.

3.1 Sampling Frequency

Groundwater samples will be collected and analyzed for NC Appendix I Detection Monitoring constituents plus indicators outlined above. In addition required field parameters, including but

not limited to, pH, conductivity, temperature and turbidity will be collected. If the facility's groundwater monitoring program must progress to the Assessment Program, notification and sampling will be conducted according to the schedule specified in Rule .0545.

3.2 Establishment of Background Data

During future phases of facility development, a minimum of four independent pre-waste groundwater samples will be collected from the newly installed monitoring wells or as specified in the Permit to Construct, once issued. Samples collected from these wells will be analyzed for the NC Appendix I constituents and indicator parameters. The intent of background sampling is to collect data to more accurately reflect the natural fluctuations that may occur with these constituents. The data will be submitted to the SWS after completing the fourth background sampling event.

3.3 Evaluation of Detection Monitoring Data

During the Detection Groundwater Monitoring Program, the reported constituent concentrations from downgradient compliance wells will be statistically compared to the site-specific background values using approved statistical procedures in .1632(g), (h) and (i) to determine if a release has occurred. If a constituent is detected above both its groundwater quality standard as defined in 15A NCAC 02L.0202 and its background value, the following procedures will be followed:

(1) Notify SWS within 14 days of determining exceedance, and place a notice in the site operating record indicating which constituents have shown exceedances above background and groundwater standard values.

(2) Within a reasonable time frame install at least one additional groundwater monitoring well at the facility boundary or compliance boundary as defined in 15A NCAC 02L.0100 in the direction of likely contaminant migration, except as discussed below.

(3) Notify within 14 days all persons who own land or reside on land that directly overlies an part of the plume of contamination if contaminants are likely to have migrated off site, except as discussed below.

(4) Within 30 days, submit an Assessment Monitoring Work Plan meeting the requirements of Rule .0545, except as discussed below.

The data may be re-evaluated within 120 days following the statistical analysis, and wells may be resampled if appropriate, to determine if the concentration resulted from an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality; or a source other than the facility [Rule .0544(1)(I)]. If it can be demonstrated that one of these factors occurred, a report (Alternate Source Demonstration) certified by a licensed geologist will be submitted to the SWS within 120 days of identifying the suspect exceedance. A copy of this report will be placed in the operating record. If the SWS approves the demonstration, the Detection Monitoring

Program will be resumed with the required semiannual sampling and analysis. If the SWS does not accept the demonstration within 90 days, the Assessment Monitoring Program will be initiated.

4.0 ASSESSMENT GROUNDWATER MONITORING PROGRAM

Assessment Monitoring is required whenever one or more NC Appendix I constituents are detected at levels that represent both statistically significant concentrations over background and exceed the groundwater quality standards (15A NCAC 2L, .0202), and no source of error, alternate source, or naturally occurring condition can be identified. If a false positive result cannot be demonstrated, an Assessment Monitoring Program meeting the requirements of Rule .0545 will be established within 90 days, as described below.

Within 30 days of triggering the Assessment Monitoring Program, an Assessment Monitoring Work Plan (Plan) will be submitted to the SWS. This Plan will include the installation of additional monitoring wells to characterize the nature and extent of the release by determining the lithology of the aquifer, hydraulic conductivity of the aquifer and unsaturated zone, groundwater flow rates, travel distances, resource value of the aquifer, and the nature/fate/transport of detected constituents. The Plan will also include groundwater sampling and analysis of an approved list of additional parameters, which may include the NC Appendix II list of constituents. A minimum of one groundwater sample will be collected from each well and submitted for analysis during each Assessment Monitoring sampling event. However, the NCSWMR allow for petitions to the SWS for an appropriate subset of wells or a reduction in the parameter sampling list as allowed under .0545(b)(6).

If any additional constituents are detected in groundwater from the downgradient wells, a minimum of four independent samples will be collected from each background and downgradient well to establish background concentrations for the detected constituents.

After receipt of the initial or subsequent sampling analytical data, a report identifying the detected additional constituents will be submitted to the SWS, and a notice will be placed in the operating record. Background concentrations of any detected additional constituents will be established and reported to the SWS.

If the additional detected constituents do not have an established 15A NCAC 02L .0202 groundwater quality standard, a standard must be established and approved by the SWS. The standard will be protective of the maximum concentration levels (MCLs) as established under Section 1412 of the Safe Drinking Water Act codified under 40 CFR Part 141; the water quality standards established under the NC Rules Governing Public Water Supply Systems (15A NCAC 18C); and the background concentration established in accordance with .1631(a)(1) and .1632(g), (h) and (i). An alternate groundwater protection standard may be established for constituents that do not have any of the aforementioned standards in accordance with .0545(b)(4) and (5).

The SWS will determine whether Groundwater Protection Standards must be established for the facility, and may specify a more appropriate alternate sampling frequency for repeated sampling

and analysis for the additional constituents. Groundwater monitoring will continue in one of three ways, based on the results of the Assessment Monitoring analyses:

(1) If the constituents are at or less than background values and groundwater protection standards using approved statistical procedures for two consecutive sampling events, the facility may resume Detection Monitoring with the approval of SWS.

(2) If the concentrations of constituents exceed the background concentrations, but all concentrations are below the approved Groundwater Protection Standards, the facility will continue Assessment Monitoring.

(3) If one or more constituents are detected at statistically significant concentrations in excess of the approved Groundwater Protection Standards, and no source of error can be identified, the operator will initiate an Assessment of Corrective Measures and proceed according to Rules .0545(c). If the facility proceeds to corrective action, a revised WQMP will be submitted to the SWS with the Corrective Action Plan.

Refer to Appendix B of this report for a list of the required constituents, analytical methods, and reporting limits. These lists were updated in a memo dated October 27, 2006, from the SWS. The results of the statistical analyses of the groundwater data will be submitted to the SWS semiannually. Reports will be submitted with analytical data submitted in the required format, and be accompanied by the required Environmental Monitoring Form, which will be signed and sealed by a licensed geologist in the State of North Carolina. A copy of this form is also included in Appendix B.

5.0 GROUNDWATER SAMPLING METHODOLOGY

Groundwater samples will be collected in accordance with Solid Waste Management Rules 15A NCAC 13B .1632 and guidance provided in the *Draft North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities; Solid Waste Section, Division of Solid Waste Management; Department of Environment, Health and Natural Resources* (NCDEHNR,1995). Procedures for well purging, sample withdrawal, and decontamination methods as well as chain-of-custody procedures are outlined below. Field parameter measurements will be submitted electronically to the SWS in a format consistent with that required in the October 27, 2006, memorandum (NCDENR, 2006).

5.1 Sample Collection

The procedures for collecting groundwater samples are presented below. The background well 4116-MW-1 will be sampled first, followed by the downgradient compliance wells. The downgradient wells will be sampled so that the most contaminated well, if one is identified from the previous sampling event, is sampled last.

5.1.1 Sampling Frequency

The above-mentioned samples will be collected on a semiannual basis during the Detection and/or Assessment Monitoring programs.

5.1.2 Static Water Elevations

The static water and total well depth will be measured with an electronic water level indicator, to the nearest 0.01 foot, in each well prior to sampling. Static water elevations will be calculated from water depth measurements and top of casing elevations. A reference point will be marked on the top of casing of each well to ensure the same measuring point is used each time static water levels are measured.

If a monitoring well contains a dedicated pump, the depth to water shall be measured without removing the pump. Depth-to-bottom measurements should be taken from the well construction data and updated when pumps are removed for maintenance.

5.1.3 Well Evacuation

The preferred well evacuation and sampling procedure for the site is a standard evacuation procedures. Low-flow purge (micropurge) and sample methodology and procedures are also outlined below based on USEPA Guidance (USEPA, 1996). in the event that the owner decides to use them.

5.1.3 (a) Standard Evacuation Procedures

Monitoring wells will be evacuated with a submersible pump or a disposable bailer. If the pump is used for multiple wells, it and any other non-dedicated equipment will be decontaminated before use and between each well.

A low-yield well (one that yields less than 0.5 gallon per minute) will be purged so that water is removed from the bottom of the screened interval. Low-yield wells will be evacuated to dryness once. However, at no time will a well be evacuated to dryness if the recharge rate causes the formation water to vigorously cascade down the sides of the screen and cause an accelerated loss of volatiles. Upon recharging of the well and no longer than a time period of 24 hours, the first sample will be field-tested for pH, temperature, specific conductivity and turbidity. Samples will then be collected and containerized in the order of the volatilization sensitivity of the target constituents.

A high-yield well (one that yields 0.5 gallon per minute or more) will be purged so that water is drawn down from above the screen in the uppermost part of the water column to ensure that fresh water from the formation will move upward in the screen. If a pump is used for purging, a high-yield well should be purged at less than 4 gallons per minute to prevent further well development.

A minimum of three casing volumes will be evacuated from each well prior to sampling. An alternative purge will be considered complete if the monitoring well goes dry before removing the calculated minimum purge volume. The well casing volume for a 2-inch well will be calculated using the following formula:

$$V_c \text{ (gallons)} = 0.163 \times h_w$$

where:
V_c = volume in the well casing = $(d_c^2/4) \times 3.14 \times h_w \times 7.48$ gallons/cubic foot
d_c = casing diameter in feet ($d_c = 0.167$)
h_w = height of the water column (i.e., well depth minus depth to water)

The purge water will be disposed of on the ground surface at least 10 feet downgradient of the monitoring well being purged, unless field characteristics suggest the water will need to be disposed of otherwise.

The monitoring wells will be sampled using disposable bailers within 24 hours of completing the purge. The bailers will be equipped with a check valve and bottom-emptying device. The bailer will be lowered gently into the well to minimize the possibility of degassing the water.

Field measurements of temperature, pH, specific conductance, and turbidity will be made before and after sample collection as a check on the stability of the groundwater sampled over time. The direct-reading equipment used at each well will be calibrated in the field according to the manufacturer's specifications prior to each day's use. Calibration information should be documented in the instrument's calibration logbook and the field book.

5.1.3 (b) Low-Flow Procedures

Monitoring wells may also be purged and sampled using the low-flow sampling method in accordance with the United States Environmental Protection Agency's (EPA) *Low-Flow (Minimal Drawdown) Sampling Procedures* (April, 1996), as allowed under the NCSWMR. A summary of these procedures is listed below, and a copy of the procedures is presented in Appendix C.

Depth-to-water measurements will be obtained using an electronic water level indicator capable of recording the depth to an accuracy of 0.01 feet. A determination of whether or not the water table is located within the screened interval of the well will be made. If the water table is not within the screened interval, the amount of drawdown that can be achieved before the screen is intersected will be calculated. If the water table is within the screened interval, total drawdown should not exceed 1 foot so as to minimize the amount of aeration and turbidity. If the water table is above the top of the screened interval, the amount of drawdown should be minimized to keep the screen from being exposed.

If the purging equipment is non-dedicated, the equipment will be lowered into the well, taking care to minimize the disturbance to the water column. If conditions (i.e., water column height

and well yield) allow, the pump will be placed in the uppermost portion of the water column (minimum of 18 inches of pump submergence is recommended).

The minimum volume/time period for obtaining independent Water Quality Parameter Measurements (WQPM) will be determined. The minimum volume/time period is determined based on the stabilized flow rate and the amount of volume in the pump and the discharge tubing (alternatively, the volume of the flow cell can be used, provided it is greater than the volume of the pump and discharge tubing). Volume of the bladder pump should be obtained from the manufacturer. Volume of the discharge tubing is as follows:

3/8-inch inside diameter tubing:	20 milliliters per foot
1/4-inch inside diameter tubing:	10 milliliters per foot
3/16-inch inside diameter tubing:	5 milliliters per foot

Once the volume of the flow-cell or the pump and the discharge tubing has been calculated, the well purge will begin. The flow rate should be based on historical data for that well (if available) and should not exceed 500 milliliters per minute. The initial round of WQPM should be recorded and the flow rate adjusted until drawdown in the well stabilizes. Water levels should be measured periodically to maintain a stabilized water level. The water level should not fall within 1 foot of the top of the well screen. If the purge rate has been reduced to 100 milliliters or less and the head level in the well continues to decline, the required water samples should be collected following stabilization of the WQPM, based on the criteria presented below.

If neither the head level nor the WQPM stabilize, a passive sample should be collected. Passive sampling is defined as sampling before WQMP have stabilized if the well yield is low enough that the well will purge dry at the lowest possible purge rate (generally 100 milliliters per minute or less).

WQPM stabilization is defined as follows: pH (+/- 0.2 S.U.), conductance (+/- 10% of reading), temperature (+/- 10% of reading or 0.2°C), and dissolved oxygen [+/- 10% of reading or 0.2 mg/L (whichever is greater)]. Oxidation reduction potential will also be measured and ideally should also fall within +/- 10% of reading; however, this is not a required parameter. At a minimum, turbidity measurements should also be recorded at the beginning of purging, following the stabilization of the WQPM, and following the collection of the samples. The optimal turbidity range for micropurging is 25 NTU or less. Turbidity measurements above 25 NTU are generally indicative of an excessive purge rate or natural conditions related to excessive fines in the aquifer matrix.

Stabilization of the WQPM should occur in most wells within five to six rounds of measurements. If stabilization does not occur following the removal of a purge volume equal to three well volumes, a passive sample will be collected.

The direct-reading equipment used at each well will be calibrated in the field according to the manufacturer's specifications prior to each day's use and checked at a minimum at the end of each sampling day. Calibration information should be documented in the instrument's calibration logbook and the field book.

Each well is to be sampled immediately following stabilization of the WQPM. The sampling flow rate must be maintained at a rate that is less than or equal to the purging rate. For volatile organic compounds, lower sampling rates (100 - 200 milliliters/minute) should be used. Final field parameter readings should be recorded prior to and after sampling.

5.1.4 Collection

Samples will be collected and containerized in the order described below.

- Volatile Organic Compounds (SW- 846 Method 8260);
- Semi-Volatile Organic Compounds (SW- 846 Method 8270);
- Herbicides (SW-846 Method 8151);
- Pesticides (SW- 846 Method 8080);
- Polychlorinated Biphenyls (PCBs; SW-846 Method 8082);
- Cyanide and Sulfide; and
- Total Metals.

Total metals samples may be collected out of sequence if the turbidity increases during sample collection. Samples will be transferred directly from field sampling equipment into pre-preserved, laboratory-supplied containers. Containers for volatile organic analyses will be filled in such a manner that no headspace remains after filling.

5.1.5 Decontamination

Non-dedicated field equipment that is used for purging or sample collection shall be cleaned with a phosphate-free detergent, and triple-rinsed with distilled water. Any disposable polyethylene tubing used with non-dedicated pumps should be discarded after use at each well. Clean, chemical-resistant nitrile gloves will be worn by sampling personnel during well evacuation and sample collection. Measures will be taken to prevent surface soils, which could introduce contaminants into the well being sampled, from coming in contact with the purging and sampling equipment.

5.2 Sample Preservation and Handling

Upon containerizing groundwater samples, the samples will be packed into pre-chilled, ice-filled coolers and either hand-delivered or shipped overnight by a commercial carrier to the laboratory for analysis. Sample preservation methods will be used to retard biological action and hydrolysis, as well as to reduce sorption effects. These methods will include chemical preservation, cooling/refrigeration at 4° C, and protection from light. The sample container, minimum volume, chemical preservative, and holding times for each analysis type are provided in Table 2.

5.3 Chain-of-Custody Program

The chain-of-custody program will allow for tracing sample possession and handling from the time of field collection through laboratory analysis. The chain-of-custody program includes sample labels, sample seal, field logbook, and chain-of-custody record.

5.3.1 Sample Labels

Legible labels sufficiently durable to remain legible when wet will contain the following information:

- Site and sample identification number;
- Monitoring well number or other location;
- Date and time of collection;
- Name of collector;
- Parameters to be analyzed; and
- Preservative, if applicable.

5.3.2 Sample Seal

The shipping container will be sealed to ensure that the samples have not been disturbed during transport to the laboratory. The tape is labeled with instructions to notify the shipper if the seal is broken prior to receipt at the laboratory.

5.3.3 Field Logbook

The field logbook will contain sheets documenting the following information:

- Identification of the well;
- Well depth;
- Field meter calibration information;
- Static water level depth and measurement technique;
- Purge volume (given in gallons);
- Time well was purged;
- Date and time of collection;
- Well sampling sequence;
- Types of sample containers used and sample identification numbers;
- Preservative used;
- Field analysis data and methods;
- Field observations on sampling event;
- Name of collector(s); and
- Climatic conditions including air temperatures and precipitation.

5.3.4 Chain-of-Custody Record

The chain-of-custody record is required for tracing sample possession from time of collection to time of receipt at the laboratory. A chain-of-custody record will accompany each individual shipment. The record will contain the following information:

- Sample destination and transporter;
- Sample identification numbers;
- Signature of collector;
- Date and time of collection;
- Sample type;
- Identification of well;
- Number of sample containers in shipping container;
- Parameters requested for analysis;
- Signature of person(s) involved in the chain of possession;
- Inclusive dates of possession; and
- Internal temperature of shipping container upon opening in laboratory (noted by the laboratory).

A copy of the completed chain-of-custody form will accompany the shipment and will be returned to the shipper after the shipping container reaches its destination. The chain-of-custody record will also be used as the analysis request sheet.

5.4 Analytical Procedures

A laboratory certified by the North Carolina Department of Environment and Natural Resources will be utilized for analysis of groundwater and surface water samples from the facility. Analyses will be performed in accordance with U.S. EPA SW-846 methods in accordance with the EPA guidance document (EPA, 1997). For Detection Monitoring, method numbers and reporting limits to be used will be those listed in the October 27, 2006, SWS memorandum (NCDENR, 2006). The memorandum, titled *New Guidelines for Electronic Submittal of Environmental Monitoring Data*, is included in Appendix B of this WQMP. The monitoring parameters are also included in Appendix B, along with the proposed analytical methods and reporting limits. Alternate SW-846 methods may be used if they have the same or lower reporting limit. The laboratory must report any detection of any constituent even if it is detected below the solid waste reporting limit (as revised in the October 27, 2006, memorandum).

The laboratory certificates-of-analyses shall, at a minimum, include the following information:

- Narrative: Must include a brief description of the sample group (number and type of samples, field and associated lab sample identification numbers, preparation and analytical methods used). The data reviewer shall also include a statement that all holding times and Quality Control (QC) criteria were met, samples were received intact and properly preserved, with a brief discussion of any deviations potentially affecting data usability. This includes, but is not limited to, test

method deviation(s), holding time violations, out-of-control incidents occurring during the processing of QC or field samples and corrective actions taken, and repeated analyses and reasons for the reanalyses (including, for example, contamination, failing surrogate recoveries, matrix effects, or dilutions). The narrative shall be signed by the laboratory director or authorized laboratory representative, signifying that all statements are true to the best of the reviewer's knowledge, and that the data meet the data quality objectives as described in this plan (except as noted). One narrative is required for each sample group.

- Original Chain-of Custody Form.

- Target Analyte List (TAL)/Target Compound List (TCL): The laboratory shall list all compounds for which the samples were analyzed. The TAL/TCL is typically included as part of the analytical reporting forms.

- Dilution factors with a narrative of the sample results, including the reasons for the dilution (if any).

- Blank Data: For organic analyses, the laboratory shall report the results of any method blanks, reagent blanks, trip blanks, field blanks, and any other blanks associated with the sample group. For inorganic analyses, the laboratory shall provide the results of any preparation or initial calibration blanks associated with the sample group.

- QC Summary: The laboratory will provide summary forms detailing laboratory QC sample results, which include individual recoveries and relative percent differences (if appropriate) for the following Quality Assurance (QA)/QC criteria: surrogates, MS analyses, MSD analyses, LCS, and sample duplicate analyses. QC control limits shall also be reported; if any QC limits are exceeded, a flag or footnote shall be placed to indicate the affected samples.

Additional QA data and/or other pertinent data may be reported as requested by the owner/operator of the facility.

5.5 Quality Assurance and Quality Control Program

Trip and field blanks will be collected and analyzed during each monitoring event to verify that the sample collection and handling process has not affected the quality of the samples. The trip blank will be prepared in the laboratory each time a group of bottles is prepared for use in the field. The appropriate number of bottles for VOA analysis will be filled with Type II reagent grade water, transported to the site, handled like the samples, and shipped to the laboratory for analysis. The field blank will be prepared in the field and exposed to the sampling environment. As with all other samples, the time of the blank exposure will be recorded so that the sampling sequence is documented. The field blank will be analyzed for the same list of constituents as the groundwater samples. The trip blank will be analyzed for volatile organic compounds only.

The assessment of blank analysis results will be in general accordance with EPA guidance documents (EPA, 1993 and 1994). No positive sample results will be relied upon unless the concentration of the compound in the sample exceeds 10 times the amount in any blank for common laboratory contaminants (see next paragraph), or five times the amount for other compounds. If necessary, resampling will be performed as necessary to confirm or refute suspect data; such resampling will occur within the individual compliance monitoring period.

Concentrations of any contaminants found in the blanks will be used to qualify the groundwater data. Any compound (other than those listed below) detected in the sample, which was also detected in any associated blank, will be qualified "B" when the sample concentration is less than five times the blank concentration. For common laboratory contaminants (methylene chloride, acetone, 2-butanone, and common phthalate esters), the results will be qualified "B" when the reported sample concentration is less than 10 times the blank concentration. The "B" qualifier designates that the reported detection is considered to represent cross-contamination and that the reported constituent is not considered to be present in the sample at the reported concentration.

6.0 STATISTICAL METHODS

Groundwater monitoring data for landfill compliance wells screened in the uppermost aquifer will be evaluated using statistical procedures, as discussed below. The statistical test used to evaluate the groundwater monitoring data will be the prediction interval procedure unless the test is inappropriate with the data collected. Statistical evaluation of groundwater monitoring data will be performed in compliance with Rule .1632 (g), (h), and (i) and the USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance* (USEPA, 1989) and the *Addendum to Interim Final Guidance* (USEPA, 1992).

7.0 SURFACE WATER MONITORING (RULE .0544(c))

In accordance with Rule .0544(c) of the NCSWMR, several surface water monitoring locations have been established for the facility to monitor water quality surrounding the proposed waste footprint. Upstream monitoring point 4116-SW-1 is located to monitor the unnamed tributary of Richland Creek as it enters the site. Downstream point 4116-SW-2 monitors the downstream portion of this creek at the property line. Upstream point 4116-SW-3 monitors the larger (northwest-southeast) tributary at the westernmost property line. Downstream point 4116-SW-4 monitors the downstream portion of the larger creek. These sampling points were established during the Phase 1 investigation and locations are shown on Drawing WQMP-1.

These points will be sampled semiannually for analysis of the NC Appendix I list of constituents and required water quality parameters (pH, specific conductivity, temperature, and turbidity). The results of the analysis of the surface water data will be submitted to the SWS semiannually in conjunction with the groundwater data.

8.0 REFERENCES

The references cited below were used in the preparation of this report, and may or may not be referenced in the text.

Butler, J. Robert and Secor, Donald T., Jr., The Central Piedmont, in Horton, J. W., Jr., and Zullo, V.A., eds., The Geology of the Carolinas: The University of Tennessee Press, p. 59 - 78.

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North Carolina Dept. Environment, Health, and Natural Resources (NCDEHNR). 1995. N.C. *Water Quality Monitoring Guidance Document for Solid Waste Facilities.*

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USEPA. June 1997. *SW-846 Methods for Evaluating Solid Waste, Physical/Chemical Methods, Final Update III.*

USEPA. 1992. *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities - Addendum to Interim Final Guidance.* Office of Solid Waste. Washington, D.C.

USEPA. 1989. *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities - Interim Final Guidance.* EPA/530-SW-89-026. Office of Solid Waste. Washington, D.C.

TABLES

TABLE 1

SUMMARY OF WELL CONSTRUCTION INFORMATION
WCA OF HIGH POINT, LLC CONSTRUCTION AND DEMOLITION LANDFILL
GUILFORD COUNTY, NORTH CAROLINA

WELL & PIEZOMETER NUMBER	DATE INSTALLED	CASING DIAMETER (inches)	WELL ELEVATIONS		TOTAL DEPTH DRILLED		SCREENED INTERVAL				LITHOLOGY OF SCREENED INTERVAL	STATUS
			GROUND SURFACE	T.O.C.	DEPTH (feet B.G.S.)	ELEV. (feet M.S.L.)	DEPTH (feet B.G.S.)		ELEVATION (feet M.S.L.)			
			feet above M.S.L.				from	to	from	to		
4116-MW-1	09/29/03	2	809.79	813.17	30.0	779.79	15.0	30.0	794.79	779.79	Bedrock	Compliance Well
4116-MW-2	09/30/03	2	752.30	754.85	16.5	735.80	6.5	16.5	745.80	735.80	PWR/Bedrock	Compliance Well
4116-MW-3	10/02/03	2	752.65	755.48	27.0	725.65	12.0	27.0	740.65	725.65	PWR/Bedrock	Compliance Well
4116-MW-4S	02/20/02	2	731.60	733.76	20.0	711.60	5.0	20.0	726.60	711.60	PWR/Bedrock	Compliance Well
4116-MW-4D	02/19/02	2	731.88	734.23	80.0	651.88	60.0	80.0	671.88	651.88	Bedrock	Water Levels Only
4116-MW-5	02/19/02	2	741.16	743.44	20.0	721.16	5.0	20.0	736.16	721.16	Saprolite/PWR/Bedrock	Compliance Well
4116-MW-6	12/17/02	2	733.53	735.23	15.5	718.03	8.5	15.5	725.03	718.03	PWR/Bedrock	Compliance Well
4116-MW-7S	07/13/06	2	761.20	763.52	45.0	716.20	30.0	45.0	731.20	716.20	PWR	Compliance Well
4116-MW-7D	07/11/06	2	761.24	763.27	70.0	691.24	60.0	70.0	701.24	691.24	Bedrock	Water Levels Only
4116-MW-8	07/05/06	2	760.57	762.60	25.0	735.57	15.0	25.0	745.57	735.57	Bedrock	Compliance Well

NOTES:
1. All elevations are referenced to mean sea level (M.S.L.); depths are referenced to ground surface (G.S.).
2. B.G.S. = below ground surface
3. T.O.C. = top of casing
4. PWR = partially weathered rock
5. MW-4S and MW-4D were installed as piezometers P-15S and P-15D, respectively, on February 19-20, 2002.
6. MW-5 was installed as piezometer P-12 on February 19, 2002.
7. MW-6 was installed as piezometer P-18 on December 17, 2002.
8. MW-7S and MW-7D were installed as piezometers P-30S and P-30D, respectively, on July 13 and 11, 2006.
9. MW-8 was installed as piezometer P-23 on July 5, 2006.

TABLE 2

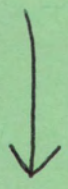
SAMPLING AND PRESERVATION PROCEDURES
WCA OF HIGH POINT, LLC CONSTRUCTION AND DEMOLITION FACILITY
GUILFORD COUNTY, NORTH CAROLINA

Parameter	Container & Volume	Preservative	Maximum Holding Time
Cyanide	P,G; 500 mL	4°C, NaOH to pH>12, 0.6 g Ascorbic Acid	14 days
Sulfide	P,G; 500 mL	4°C, add Zinc Acetate	7 days
Mercury (total)	P; 300 mL	HNO_3 to pH<2	28 days
Metals (total) except mercury	P; 1000 mL	HNO_3 to pH<2	6 months
Acrolein and acrylonitrile	2-40 ml VOA w/G, Teflon-lined septum	4°C, 0.008% $Na_2S_2O_3$, adjust pH to 4 to 5	14 days
Benzidines	G, Teflon-lined cap 1000 mL	4°C, 0.008% $Na_2S_2O_3$, adjust pH to 4 to 5	7 days to extraction, 40 days after extraction
Haloethers	G, Teflon-lined cap 1000 mL	4°C, 0.008% $Na_2S_2O_3$	7 days to extraction, 40 days after extraction
Phthalate esters	G 1000 mL	4°C	7 days to extraction, 40 days after extraction
Nitrosamines	G, Teflon-lined cap 1000 mL	4°C, store in dark, 0.008% $Na_2S_2O_3$	7 days to extraction, 40 days after extraction
Nitroaromatics and cyclic ketones	G, Teflon-lined cap 1000 mL	4°C, store in dark, 0.008% $Na_2S_2O_3$	7 days to extraction, 40 days after extraction
PCBs	G, Teflon-lined cap 1000 mL	4°C	7 days to extraction, 40 days after extraction
Phenols	G, Teflon-lined cap 1000 mL	4°C, 0.008% $Na_2S_2O_3$	7 days to extraction, 40 days after extraction
Purgeable Aromatic Hydrocarbons	2-40 ml VOA w/G, Teflon-lined septum	4°C, 0.008% $Na_2S_2O_3$, HCl to pH 2	14 days
Purgeable halocarbons	2-40 ml VOA w/G, Teflon-lined septum	4°C, 0.008% $Na_2S_2O_3$	14 days
Polynuclear aromatic hydrocarbons	G, Teflon-lined cap 1000 mL	4°C, store in dark, 0.008% $Na_2S_2O_3$	7 days to extraction, 40 days after extraction
Chlorinated hydrocarbons	G, Teflon-lined cap 1000 mL	4°C	7 days to extraction, 40 days after extraction
Pesticides	G, Teflon-lined cap 1000 mL	4°C, pH 5 to 9	7 days to extraction, 40 days after extraction

Notes: P - Plastic, G - Glass, T - Fluorocarbon Resin (PTFE, TeflonÒ, FEP, etc.)

No headspace should be allowed in the volatile organic compound containers.

See end of this file for



DRAWING

APPENDICES

APPENDIX A

BORING LOGS/WELL CONSTRUCTION RECORDS

JOYCE ENGINEERING, INC.

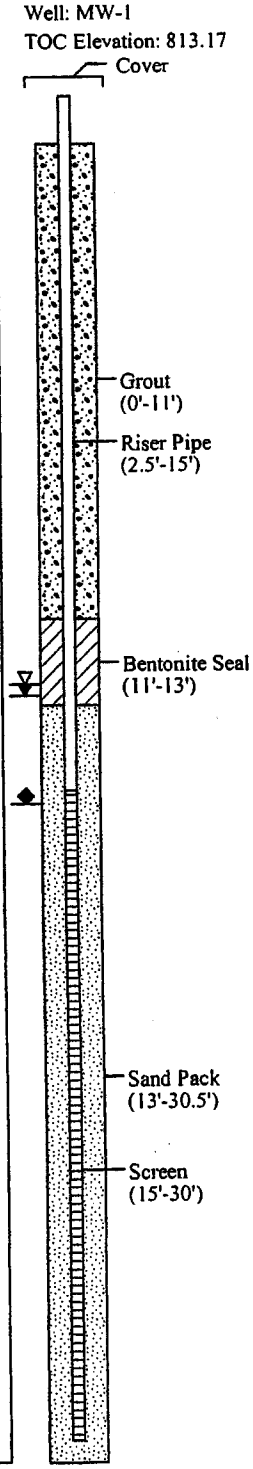
LOG OF BORING MW-1

MRR of High Point, LLC C&D Landfill
Guilford County, NC

JEI Project No. 600.00, Task 11

Date Started	: 10/02/03	Drilling Company	: Driller Temporary Services
Date Completed	: 10/02/03	Northing Coordinate	: 802679.0731
Hole Diameter	: 10.25-inch/6-inch	Easting Coordinate	: 1727481.9653
Drilling Method	: HSA/Downhole Hammer	Surveyed By	: Flemming Engineering
Sampling Method	: Split Spoons, Cuttings	Logged By	: Dusty Reedy

Depth in Feet	Surf. Elev. 809.79	Blow Count	% Rec.	USCS	DESCRIPTION
0	809	1 1 2 1	80	SM	SILTY SAND - orange and tan silty sand
2	808			CL	LEAN CLAY - tan sandy clay, moist
3	807			PWR	PARTIALLY WEATHERED ROCK - orange and tan medium grained silty sand that changes to a white and orange mottled appearance, very dense, slightly moist
5	805	24			
6	804	32	100		*Auger refusal at 6 ft*
7	803	50/5			BEDROCK - tan weathered cuttings, drilling response indicates relatively soft material with the hammer only occassionally firing
8	802				
9	801				
10	800				Possible fracture zones based on drilling response at 10-12 ft and 12.5-14 ft, cuttings consist of medium to fine quartz sand, tan to white in color, moist
11	799				
12	798				
13	797				
14	796				
15	795				Cuttings become wetter at 15 ft, possibly in water table
16	794				Material continues to be relatively soft with the hammer firing occassionally
17	793				
18	792			BR	
19	791				Competent rock at 18.5 ft, light gray cuttings and hard, granitic appearance
20	790				Apparent small fracture at 20 ft based on drilling response
21	789				Becomes very hard at 21 ft, cuttings consist of quartz and plagioclase, coarse grained sand sized cuttings
22	788				
23	787				Apparent large water bearing fracture from 23-24 ft based on drilling response, cutting become moist
24	786				
25	785				
26	784				
27	783				Changes to metavolcanic rock at 27 ft, green and black cuttings, very weathered and soft, moist
28	782				
29	781				Becomes very wet at 29 ft
30	780				Drilling terminated at 30.5 ft



Well Construction Information

WELL CONSTRUCTION

Date Completed	: 10/02/03
Hole Diameter	: 10.25-inch/6-inch
Drilling Method	: HSA/Downhole Hammer
Company Rep.	: William Dew

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 3.38 feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type : DSI # 2 Sand

WELL SCREEN SEAL

Type : 3/8" Bentonite pellets

ANNULUS SEAL

Type : Portland Type I grout

PROTECTIVE CASING

Type : 4" Anod. Alum.

WELL PAD

Type : 3'x3'x8" concrete

1. Drilling was performed with a CME 550 ATV drilling rig with 6.25-inch ID hollow stem augers to auger refusal. Drilling was advanced using a 5.75-inch downhole hammer with a portable air compressor.

2. Solid triangle represents the water level at the time of well construction (15.16 feet below TOC). Open triangle represents the water level approximately 24 hours after well construction (15.15 feet below TOC). Solid diamond represents the water level approximately 5 days after well construction (17.80 feet below TOC).

12-10-2003 P:\MRR of High Point\Task 11 Well Installation,etc\High Point Boring Logs\MW-1.bor

ENGINEERING, INC.

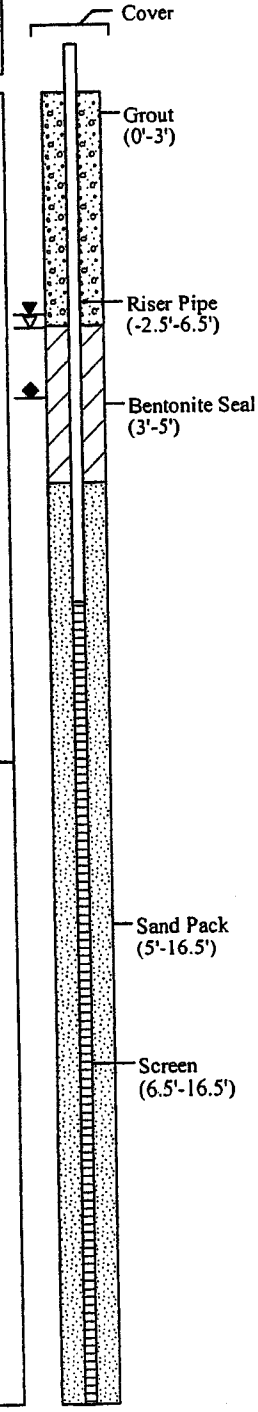
LOG OF BORING MW-2

MRR of High Point, LLC C&D Landfill
Guilford County, NC

JEI Project No. 600.00, Task 11

Date Started	: 09/29/03	Drilling Company	: Driller Temporary Services
Date Completed	: 09/29/03	Northing Coordinate	: 802512.1189
Hole Diameter	: 8.25-inch/3.5-inch	Easting Coordinate	: 1726072.1395
Drilling Method	: HSA/Downhole Hammer	Surveyed By	: Flemming Engineering
Sampling Method	: Split Spoons, Cuttings	Logged By	: Dusty Reedy

Depth in Feet	Surf. Elev. 752.30	Blow Count	% Rec.	USCS	DESCRIPTION
0	752	2	50	SM	SILTY SAND - dark brown organic rich silty sand
1	751	1 2			
2	750	1			Changes to a saturated tan silty sand at 2 ft
3	749				Becomes more dense at 3.5 ft, tan medium grained silty sand
4	748				Changes to gray in color with abundant clay present
5	747	3			
6	746	6 21	100		
7	745	19			
8	744				*Auger refusal at 8.5 ft*
9	743			BR	BEDROCK - cuttings are tan and generally fine to medium grained
10	742				Apparent fracture at 10 ft based on drilling response
11	741	50/2	0		
12	740				Apperent water producing fracture at 12 ft based on drilling response and increase in water from boring, large quartz fragments up to 1.5 inches in diameter present
13	739				
14	738				Apparent fracture at 14.5-15 ft based on drilling response
15	737				
16					Drilling terminated at 16.5 ft



Well Construction Information

WELL CONSTRUCTION

Date Completed	: 09/29/03
Hole Diameter	: 8.25-inch/3.5-inch
Drilling Method	: HSA/Air Rotary
Company Rep.	: William Dew

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 2.55 feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type : DSI # 2 Sand

WELL SCREEN SEAL

Type : 3/8" Bentonite pellets

ANNULUS SEAL

Type : Portland Type I grout

PROTECTIVE CASING

Type : 4" Anod. Alum.

WELL PAD

Type : 3'x3'x6" concrete

1. Drilling was performed with a CME 550 ATV drilling rig with 4.25-inch ID hollow stem augers to auger refusal. Drilling was advanced using a 3.25-inch tricone bit with a portable air compressor.

2. Solid triangle represents the water level at the time of well construction (5.43 feet below TOC). Open triangle represents the water level approximately 24 hours after well construction (5.52 feet below TOC). Solid diamond represents the water level approximately 8 days after well construction (6.42 feet below TOC).

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JOYCE ENGINEERING, INC.

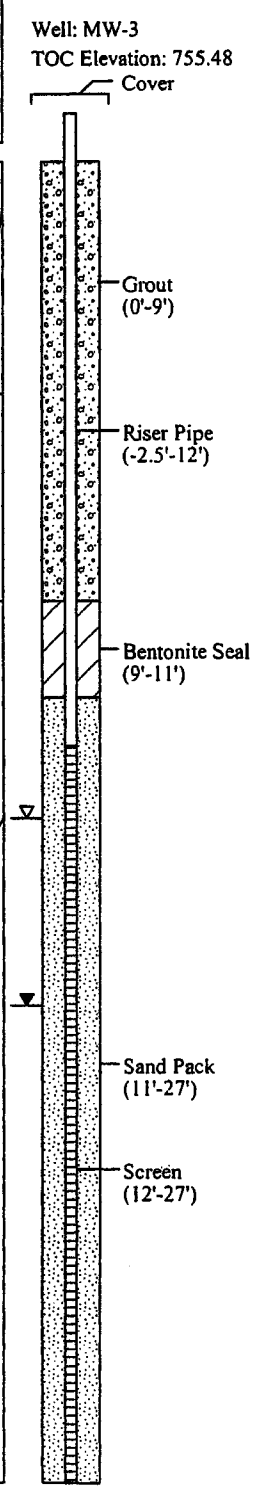
LOG OF BORING MW-3

MRR of High Point, LLC C&D Landfill
Guilford County, NC

JEI Project No. 600.00, Task 11

Date Started	: 09/29/03	Drilling Company	: Driller Temporary Services
Date Completed	: 10/01/03	Northing Coordinate	: 802153.7584
Hole Diameter	: 10.25-inch/6-inch	Easting Coordinate	: 1725818.6900
Drilling Method	: HSA/Downhole Hammer	Surveyed By	: Flemming Engineering
Sampling Method	: Split Spoons, Cuttings	Logged By	: Dusty Reedy

Depth in Feet	Surf. Elev. 752.65	Blow Count	% Rec.	USCS	DESCRIPTION
0	752	2 2 2 2	70	SM	SILTY SAND - dark brown, organic rich silty sand Changes to a tan, medium grained silty sand
2	751				
3	750			CL	LEAN CLAY - orange sandy clay Grinded through a boulder from 3-4 ft
4	749				
5	748	3 6 7 10	70	SM	SILTY SAND - orange, coarse grained silty sand Diabase gravel encountered at 5 ft Changes to a mottled orange and white medium grained silty sand at 5.25 ft Encountered boulder at 7 ft Encountered another boulder at 7.5 ft
6	747				
7	746				
8	745				
9	744				
10	743	6 7 12 13	70	PWR	PARTIALLY WEATHERED ROCK - brown and white, medium grained silty sand with visible weathered quartz and mica with some iron staining, slightly moist Becomes more competent at 11 ft Gets softer at 13 ft, may have encountered water *Auger refusal at 13.5 ft*
11	742				
12	741				
13	740				
14	739				BEDROCK - moist brown cuttings that change to dry gray cuttings
15	738				
16	737	50/4	0		Apparent fracture between 16.5-17 ft based on driller response, very soft with clay-like cuttings
17	736				
18	735				
19	734				
20	733			BR	Granitic cuttings with quartz, plagioclase, and biotite
21	732				
22	731				
23	730				
24	729				
25	728				
26	727				
27	726				Drilling terminated at 27 ft



Well Construction Information

WELL CONSTRUCTION

Date Completed	: 10/01/03
Hole Diameter	: 10.25-inch/6-inch
Drilling Method	: HSA/Downhole Hammer
Company Rep.	: William Dew

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 2.83 feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type : DSI # 2 Sand

WELL SCREEN SEAL

Type : 3/8" Bentonite pellets

ANNULUS SEAL

Type : Portland Type I grout

PROTECTIVE CASING

Type : 4" Anod. Alum.

WELL PAD

Type : 3'x3'x8" concrete

1. Drilling was performed with a CME 550 ATV drilling rig with 6.25-inch ID hollow stem augers to auger refusal. Drilling was advanced using a 5.75-inch downhole hammer with a portable air compressor.

2. The well was dry at the time of well construction. Solid triangle representsthe water level approximately 24 hours after well construction (19.88 feet below TOC). Open triangle represents the water level approximately 6 days after well construction (16.00 feet below TOC).

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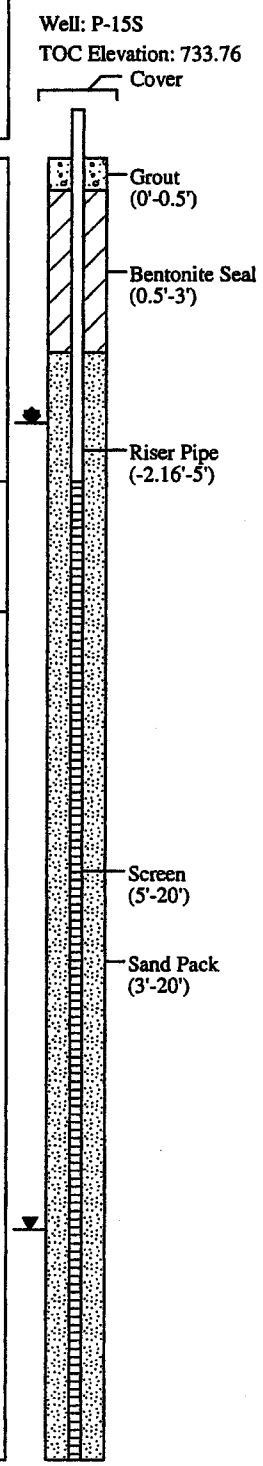
JOYCE ENGINEERING, INC.

LOG OF BORING P-15S

MRR of High Point, LLC
C&D Permit Application
High Point, NC
JEI Project No. 600.00, Task 04

Date Started	: 02/20/02	Drilling Company	: Bedford Well Drilling, Inc.
Date Completed	: 02/20/02	Northing Coordinate	: 801841.4130
Hole Diameter	: 6.25-inch	Easting Coordinate	: 1725570.0413
Drilling Method	: Air Rotary	Surveyed By	: Robert E. Wilson, Inc.
Sampling Method	: Cuttings, Shelby tube	Logged By	: Rachel P. Kirkman, P.G.

Depth in Feet	Surf. Elev. 731.60	USCS	DESCRIPTION
0	731	SM	SILTY SAND - tan, moist, loose, some alluvial sands?
2	729		
4	727		
6	725	PWR	PARTIALLY WEATHERED ROCK silty sand, tan/white, slightly moist *Auger refusal at 7 feet (based on P-15D)*
8	723	BR	BEDROCK - dry rock flour, light brown/gray
10	721		
12	719		
14	717		
16	715		
18	713		
20			Drilling terminated at 20 feet



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 02/20/02
Hole Diameter	: 6.25-inch
Drilling Method	: Air Rotary
Company Rep.	: Mike Monaghan

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 2.16-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type : DSI # 1 Sand

WELL SCREEN SEAL

Type : No. 1 Portand grout

ANNULUS SEAL

Type : 3/8" Bentonite chips

PROTECTIVE CASING

Type : 4" X 4" Alum., locked

WELL PAD

Type : 3' X 3' X 6" concrete

1. Drilling was performed with an Ingersol Rand T3W air rotary rig utilizing a 6-inch hammer and borehole was progressed to approximately 20 feet.

2. Solid triangle represents water level at time of drilling at 18.65 feet below TOC. Open triangle represents 24-hour water level at 6.25 feet below TOC. Solid diamond represents 8-day water level at 6.26 feet below TOC.

3. Shelby tube was attempted from 5-7 feet. Approximatley 1 foot was recovered before tube began to bend. Not enough undisturbed sample for complete analysis.

4. Auger refusal was estimated to be approximately 7 feet based on data taken from P-15D.

5. Bedrock descriptions bsed on rock core data from P-15D, air hammer response, and cuttings.

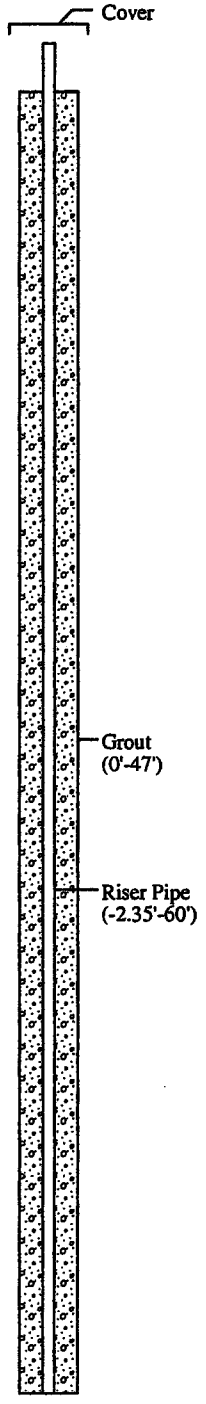
JOYCE ENGINEERING, INC.

LOG OF BORING P-15D

MRR of High Point, LLC
C&D Permit Application
High Point, NC
JEI Project No. 600.00, Task 04

Date Started	: 02/14/02	Drilling Company	: Bedford Well Drilling, Inc.
Date Completed	: 02/19/02	Northing Coordinate	: 801847.0387
Hole Diameter(s)	: 8.25/6.25-inch	Easting Coordinate	: 1725576.6237
Drilling Method(s)	: HSA/Air Rotary	Surveyed By	: Robert E. Wilson, Inc.
Sampling Method	: Split Spoons, cuttings, rock core	Logged By	: Rachel P. Kirkman, P.G.

Depth in Feet	Surf. Elev. 731.88	Blow Count	% Rec.	USCS	DESCRIPTION
0	731	1 1 1	75	SP	TOPSOIL - dark brown with organic matter SAND - tan, well sorted, slightly moist, soft, alluvial sands?
5	726	16 15 50/4	90	PWR	PARTIALLY WEATHERED ROCK silty sand, tan/white, moist, soft, faint granitic texture *Auger refusal at 7 feet*
10	721				BEDROCK 7-13 foot core run: %REC = 46% %RQD = 38% biotite granite, with feldspar and quartz, medium-grained, slight preferential orientation in biotite, some quartz-rich veins and brittle zones, fractures from horizontal to ~ 30 degrees
15	716				13-17 foot core run: %REC = 98% %RQD = 66% as above
20	711				Hard rock and dry, gray rock flour from 20-29 feet
25	706			BR	
30	701				
35	696				
40					



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 02/19/02
Hole Diameter(s)	: 8.25/6.25-inch
Drilling Method	: Hollow Stem Augers
Company Rep.	: Kevin Kendrick
Drilling Method	: Air Rotary
Company Rep.	: Mike Monaghan

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 2.35-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type : DSI # 1 Sand

WELL SCREEN SEAL

Type : No. 1 Portand grout

ANNULUS SEAL

Type : 3/8" Bentonite chips

PROTECTIVE CASING

Type : 4" X 4" Alum., locked

WELL PAD

Type : 3' X 3' X 6" concrete

1. Drilling performed with an Acker Soil Max drilling rig utilizing 4.25-inch ID hollow stem augers to auger refusal at approximately 7 feet. Ten feet of rock core were obtained using an NQ wire-line rock coring device. Borehole was overdrilled with an Ingersol Rand T3W air rotary rig utilizing a 6-inch hammer and advanced to approximately 80 feet.

2. Well was dry at time of drilling. Open triangle represents 24-hour water level at 81.28 feet below TOC. Solid diamond represents 8-day water level at 70.16 feet below TOC and still rising.

3. Pentration rate during rock coring was approximately 1 ft/min. for the 7-13 foot run and approximately 4 in./min for the 13-17 foot run.

4. Bedrock descriptions based on rock core obtained from 7-17 feet, air hammer response and cuttings.

JOYCE ENGINEERING, INC.

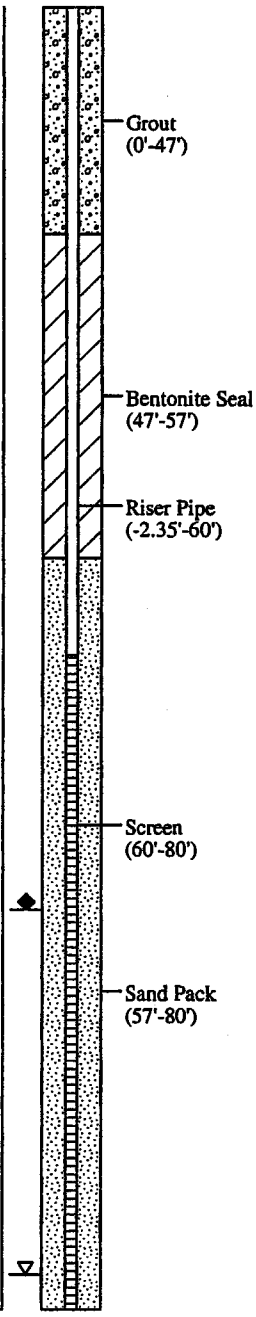
LOG OF BORING P-15D

MRR of High Point, LLC
C&D Permit Application
High Point, NC
JEI Project No. 600.00, Task 04

Date Started	: 02/14/02	Drilling Company	: Bedford Well Drilling, Inc.
Date Completed	: 02/19/02	Northing Coordinate	: 801847.0387
Hole Diameter(s)	: 8.25/6.25-inch	Easting Coordinate	: 1725576.6237
Drilling Method(s)	: HSA/Air Rotary	Surveyed By	: Robert E. Wilson, Inc.
Sampling Method	: Split Spoons, cuttings, rock core	Logged By	: Rachel P. Kirkman, P.G.

Depth in Feet	Surf. Elev. 731.88	Blow Count	% Rec.	USCS	DESCRIPTION
40	691				
45	686				
50	681				
55	676				
60	671			BR	
65	666				
70	661				
75	656				
80					Drilling terminated at approximately 80 feet

Well: P-15D
TOC Elevation: 734.23



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 02/19/02
Hole Diameter(s)	: 8.25/6.25-inch
Drilling Method	: Hollow Stem Augers
Company Rep.	: Kevin Kendrick
Drilling Method	: Air Rotary
Company Rep.	: Mike Monaghan

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 2.35-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type : DSI # 1 Sand

WELL SCREEN SEAL

Type : No. 1 Portand grout

ANNULUS SEAL

Type : 3/8" Bentonite chips

PROTECTIVE CASING

Type : 4" X 4" Alum., locked

WELL PAD

Type : 3' X 3' X 6" concrete

1. Drilling performed with an Acker Soil Max drilling rig utilizing 4.25-inch ID hollow stem augers to auger refusal at approximately 7 feet. Ten feet of rock core were obtained using an NQ wire-line rock coring device. Borehole was overdrilled with an Ingersol Rand T3W air rotary rig utilizing a 6-inch hammer and advanced to approximately 80 feet.

2. Well was dry at time of drilling. Open triangle represents 24-hour water level at 81.28 feet below TOC. Solid diamond represents 8-day water level at 70.16 feet below TOC and still rising.

3. Pentration rate during rock coring was approximately 1 ft/min. for the 7-13 foot run and approximately 4 in./min for the 13-17 foot run.

4. Bedrock descriptions based on rock core obtained from 7-17 feet, air hammer response and cuttings.

ENGINEERING, INC.

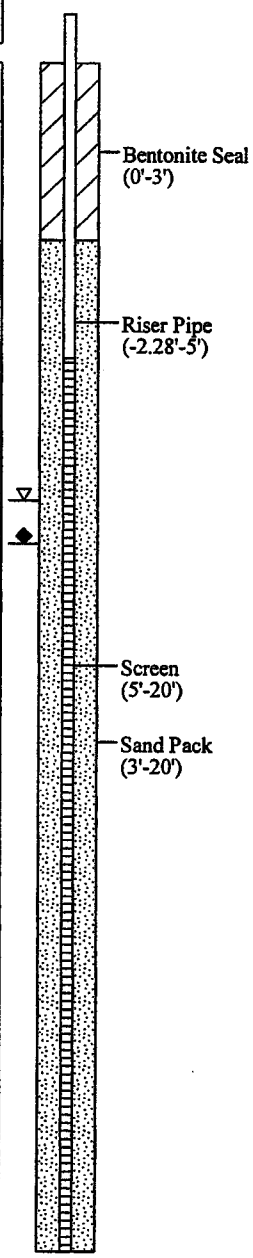
LOG OF BORING P-12

MRR of High Point, LLC
C&D Permit Application
High Point, NC
JEI Project No. 600.00, Task 04

Date Started	: 02/14/02	Drilling Company	: Bedford Well Drilling, Inc.
Date Completed	: 02/19/02	Northing Coordinate	: 801517.3101
Hole Diameter(s)	: 8.25/6.25-inch	Easting Coordinate	: 1726103.7012
Drilling Method(s)	: HSA/Air Rotary	Surveyed By	: Robert E. Wilson, Inc.
Sampling Method	: Split Spoons, cuttings	Logged By	: Rachel P. Kirkman, P.G.

Depth in Feet	Surf. Elev. 741.16	Blow Count	% Rec.	USCS	DESCRIPTION
0	741	1			TOPSOIL - dark brown with organic matter
		1	75		SANDY SILT - dark brown, soft, slightly moist
		2		SM	
5	736	12		SM	SILTY SAND - tan/brown, coarse-grained
		19	50		PARTIALLY WEATHERED ROCK silty sand, tan/brown/white, coarse-grained, granitic texture
		16		PWR	
					Auger refusal at 10 feet
10	731				BEDROCK - Hard rock and light gray rock flour, slightly moist
		50/1	0		
					Very dry rock flour
15	726			BR	
					Drilling terminated at approximately 20 feet
20					

Well: P-12
TOC Elevation: 743.44



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 02/19/02
Hole Diameter(s)	: 8.25/6.25-inch
Drilling Method	: Hollow Stem Augers
Company Rep.	: Kevin Kendrick
Drilling Method	: Air Rotary
Company Rep.	: Mike Monaghan

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 2.28-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type : DSI # 1 Sand

WELL SCREEN SEAL

Type : 3/8" Bentonite chips

ANNULUS SEAL

Type : 3/8" Bentonite chips

1. Drilling performed with an Acker Soil Max drilling rig utilizing 4.25-inch ID hollow stem augers to auger refusal at approximately 10 feet. Cave-in to approximately 7 feet occured. Borehole was advanced with an Ingersol Rand T3W utilizing a 6-inch hammer to approximately 20 feet.

2. Borehole was dry at time of drilling after the initial 10 feet were drilled on 02/15/02, the water level rose to 6.98 feet below ground surface. The water level rose to 2.50 feet below ground surface on 02/18/02 and to 2.45 feet below ground surface on 02/19/02, prior to advancing the borehole with air rotary methods.

3. After well construction, well was dry. Open triangle represents 24-hour water level at 9.70 feet below TOC. Solid diamond represents 8-day water level at 10.43 feet below TOC.

4. Bedrock descriptions based on air hammer response and cuttings.

JOYCE ENGINEERING, INC.

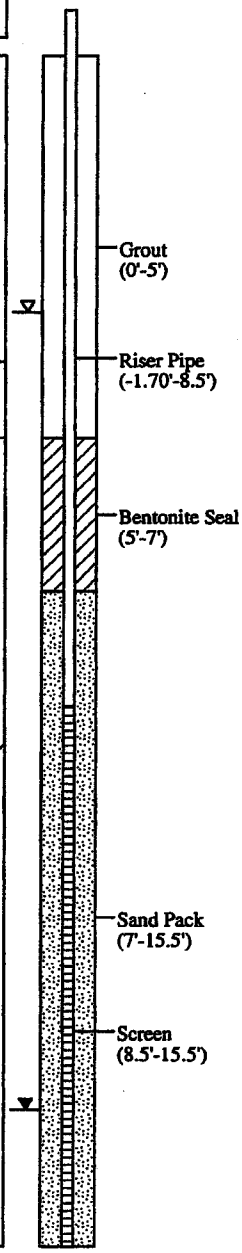
LOG OF BORING P-18

MRR of High Point
C&D Permit Application Response to Comments
High Point, NC

JEI Project No. 600.00, Task 06

Date Started	: 12/04/02	Drilling Company	: J&L Drilling, Inc.
Date Completed	: 12/17/02	Northing Coord.	: 801625.0677
Hole Diameter	: 8.25-inch, 6.25-inch	Easting Coord.	: 1725754.7189
Drilling Method	: HSA/Downhole Hammer	Survey By	: Fleming Engineering, Inc.
Sampling Method	: Split Spoons, Cuttings	Logged By	: David Y. Reedy

Depth in Feet	Surf. Elev. 733.53	Blow Count	% Rec.	USCS	DESCRIPTION
0	733	2	80%	SM	SILTY SAND - yellow fine to medium grained silty sand, quartz grains, moist
1		2			
		4			
2	732	5			
3	731				
4	730				
5	729			CL	LEAN CLAY - orange sandy clay, moist
6	728	14	50%	PWR	PWR - white coarse grained silty sand with abundant iron staining, granitic texture, moist
7	727	21			
8	726	27			
9	725	25			Granitic rock fragments at end of split-spoon with quartz, feldspar, and biotite
10	724				*Auger refusal at 9 ft*
11	723	50/5	5%	BR	BEDROCK - granitic rock with quartz, feldspar, and biotite, gray damp cuttings, no dust
12	722				Wet cuttings at 10 ft
13	721				
14	720				Green cuttings at 13.5 ft that may represent metavolcanics, damp
15	719				White and gray granitic cuttings at 14.5 ft
16	718				Drilling terminated at approximately 15.5 ft



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 12/17/02
Hole Diameter(s)	: 8.25-inch/6.25-inch
Drilling Method	: Hollow Stem Augers
Drilling Method	: Downhole Hammer
Company Rep.	: Lee Charbonneau

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 1.70

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type : DSI # 1 Sand

WELL SCREEN SEAL

Type : 3/8" Bentonite chips

ANNULUS SEAL

Type : No. 1 Portland grout

1. Drilling performed with a CME 75 rig utilizing 6.25-inch ID hollow stem augers, and 6-inch downhole hammer. An external air compressor was used for downhole hammer drilling.

2. The drilling method consisted of advancing 6.25-inch ID hollow stem augers to auger refusal and then rock drilling with a 6-inch downhole hammer to the desired depth.

3. Solid triangle represent water level at time of drilling (15.43 feet below TOC). Open triangle represents water level 8 days after well construction (5.05 feet below TOC). Dry cuttings were observed with air rotary drilling from 9-10 feet.

RECORD OF BOREHOLE P-23/ 4116-MW-8

SHEET 1 of 1

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 25.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/5/06
DATE COMPLETED: 7/5/06

NORTHING: 802,748.0
EASTING: 1,726,285.2
GS ELEVATION: 760.6 ft
TOC ELEVATION: 762.6 ft

DEPTH W.L.: 2.0 ft
ELEVATION W.L.: 760.6 ft
DATE W.L.: 7/6/06
TIME W.L.: 12:11 pm

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC
0	760	0.0 - 3.0 SILTY SAND - brown fine grained silty sand, moist Medium grained silty sand at 0.75 ft Gray medium grained silty sand at 1.25 ft Auger refusal at 3 ft	SM				SPT	3-3-4-8	7	100.0 / 2.0
					757.6 / 3.0					
5	755	3.0 - 12.5 BEDROCK - granitic cuttings consisting of mainly quartz and biotite, coarse sand size cuttings, very competent								
10	750	Less competent from 11 to 11.25 ft (possible fracture) based on drilling response			748.1 / 12.5					
		12.5 - 24.0 BEDROCK - mafic rock, small pebble size black cuttings with green dust Apparent fracture at 20.5 ft based on drilling response, ~0.5 ft thick								
15	745									
20	740	Less competent at 21.5 ft								
		Some granitic cuttings mixed with mafic rock cuttings at 23 ft			736.6 / 24.0					
25	735	24.0 - 25.0 BEDROCK - granitic cuttings with some mafic rock cuttings			735.6					
		Boring completed at 25.0 ft								
30	730									
35	725									
40										

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES

WELL CONSTRUCTION DETAILS

WELL CASING
Interval: -2.04-15 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 15-25 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 13-25 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 11-13 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-11 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

RECORD OF BOREHOLE P-30S/4116-MW-7S

SHEET 1 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 45.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/13/06
DATE COMPLETED: 7/13/06

NORTHING: 801,358.3
EASTING: 1,726,660.5
GS ELEVATION: 761.2 ft
TOC ELEVATION: 763.5 ft

DEPTH W.L.: 29.7 ft
ELEVATION W.L.: 733.8 ft
DATE W.L.: 7/25/06
TIME W.L.: 12:19 pm

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	760	0.0 - 9.5 SILTY SAND - orange silty sand fill material, dry	SM							**WELL CASING** Interval: -2.32-30 ft Material: PVC Diameter: 2-inch Joint Type: Threaded
		In-place orange silty sand at 2 ft								**WELL SCREEN** Interval: 30-45 ft Material: PVC Diameter: 2-inch Slot Size: 0.010 End Cap: Threaded
5	755	Cuttings lighter at 5 ft								**FILTER PACK** Interval: 28-45 ft Type: #2 Sand
		More competent at 7 ft								**FILTER PACK SEAL** Interval: 24-28 ft Type: 3/8 Bentonite Chip
					751.7					
10	750	9.5 - 42.0 PARTIALLY WEATHERED ROCK - tan medium grained silty sand, dry			9.5				Grout	**ANNULUS SEAL** Interval: 0-24 ft Type: Portland/Bentonite Mix **WELL COMPLETION** Pad: 3x3x0.5 ft concrete Protective Casing: 4-inch square aluminum
15	745	Light tan cuttings at 14 ft								**DRILLING METHODS** Soil Drill: 6-inch Tricone Rock Drill: None
20	740									
25	735		MLG						Bentonite #2 Sand	
30	730	Light gray cuttings at 30 ft								
35	725								Screen	
40		Log continued on next page								

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

RECORD OF BOREHOLE P-30S/4116-MW-7S

SHEET 2 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 45.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/13/06
DATE COMPLETED: 7/13/06

NORTHING: 801,358.3
EASTING: 1,726,660.5
GS ELEVATION: 761.2 ft
TOC ELEVATION: 763.5 ft

DEPTH W.L.: 29.7 ft
ELEVATION W.L.: 733.8 ft
DATE W.L.: 7/25/06
TIME W.L.: 12:19 pm

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER / TYPE / REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
40								
	720		MLG		719.2			
		42.0 - 44.0 PARTIALLY WEATHERED ROCK - dark green gravelly silt with weathered mafic rock fragments	SM		42.0 717.2			
		44.0 - 45.0 PARTIALLY WEATHERED ROCK - light tan silty sand Tricone refusal at 45 ft			44.0 716.2			
45	715	Boring completed at 45.0 ft						
50	710							
55	705							
60	700							
65	695							
70	690							
75	685							
80								

WELL CASING
Interval: -2.32-30 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 30-45 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 28-45 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 24-28 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-24 ft
Type: Portland/Bentonite Mix

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 6-inch Tricone
Rock Drill: None

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

RECORD OF BOREHOLE P-30D/4116-MW-7D

SHEET 1 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 70.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/10/06
DATE COMPLETED: 7/11/06

NORTHING: 801,341.6
EASTING: 1,726,657.8
GS ELEVATION: 761.2 ft
TOC ELEVATION: 763.3 ft

DEPTH W.L.: 30.7 ft
ELEVATION W.L.: 732.6 ft
DATE W.L.: 7/12/06
TIME W.L.: 10:59 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	760	0.0 - 9.5 SILTY SAND - orange silty sand fill material In-place orange silty sand at 2ft, dry Shleby Tube pushed from 3-5 ft	SM				SH			100.0 / 2.0		
5	755						SPT	4-2-22-50/4	24	75.0 / 2.0		
10	750				751.7 / 9.5		SPT	50/4	50/4	25.0 / 2.0		
15	745	9.5 - 40.0 PARTIALLY WEATHERED ROCK - white and tan medium grained silty sand, very dense, dry Cuttings slightly moist at 11 ft White coarse-grained silty sand at 15 ft, dry					SPT	45-50/1	50/1	35.0 / 2.0		
20	740	Very competent at 20 ft					SPT	50/1	50/1	10.0 / 2.0		
25	735		SM								Grout	
30	730											
35	725											
40		Log continued on next page			721.2							

WELL CASING
Interval: -2.03-60 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 60-70 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 58-70 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 56-58 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-56 ft
Type: Portland/Bentonite

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Tricone,HQ Core, 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

RECORD OF BOREHOLE P-30D/4116-MW-7D

SHEET 2 of 2

PROJECT: WCA of High Point, LLC
PROJECT NUMBER: 0636526.100
DRILLED DEPTH: 70.0 ft
LOCATION: Jamestown, NC

DRILL RIG: Gus Pech GP-1100B
DATE STARTED: 7/10/06
DATE COMPLETED: 7/11/06

NORTHING: 801,341.6
EASTING: 1,726,657.8
GS ELEVATION: 761.2 ft
TOC ELEVATION: 763.3 ft

DEPTH W.L.: 30.7 ft
ELEVATION W.L.: 732.6 ft
DATE W.L.: 7/12/06
TIME W.L.: 10:59 am

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
40	720	40.0 - 43.0 White coarse grained silty sand with pebble to gravel size granitic rock fragments at 40 ft Auger refusal at 43 ft	SM		40.0 718.2							
45	715	43.0 - 57.0 BEDROCK - weathered granitic cuttings Core Run (45 to 50 ft) Rec = 99%, RQD = 82%, very weathered granitic rock mainly consisting of quartz and biotite, natural fractures throughout ranging from 20 to 60 degree dips			43.0							
50	710	Core Run (50 to 55 ft) Rec = 100%, RQD = 68%, very weathered granitic rock with highly fractured zones from 51 to 52 ft and 54 to 55 ft with one fracture at 53 ft. Fractures range from nearly horizontal to ~45 degrees, visible foliation at ~ 35 degrees										
55	705	Core Run (55 to 60 ft) Rec = 48%, RQD = 40%, very weathered granitic rock to 57 ft, highly fractured			704.2							
60	700	57.0 - 61.0 BEDROCK - very weathered green mafic rock, highly fractured with poor recovery Core Run (60 to 65 ft) Rec = 86%, RQD = 31%, very weathered green mafic rock to 61 ft, highly broken up			57.0 700.2						Bentonite #2 Sand	
65	695	61.0 - 67.0 BEDROCK - very weathered granitic rock, highly broken up			61.0 694.2						Screen	
70	690	67.0 - 69.5 BEDROCK - black pebble size mafic rock fragments Fracture at 68 ft based on drilling response			67.0 691.7							
		69.5 - 70.0 BEDROCK - very weathered granitic rock cuttings, large fracture at 69.5 ft based on drilling response Boring completed at 70.0 ft			691.2							
75	685											
80												

WELL CASING
Interval: -2.03-60 ft
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL SCREEN
Interval: 60-70 ft
Material: PVC
Diameter: 2-inch
Slot Size: 0.010
End Cap: Threaded

FILTER PACK
Interval: 58-70 ft
Type: #2 Sand

FILTER PACK SEAL
Interval: 56-58 ft
Type: 3/8 Bentonite Chip

ANNULUS SEAL
Interval: 0-56 ft
Type: Portland/Bentonite

WELL COMPLETION
Pad: 3x3x0.5 ft concrete
Protective Casing: 4-inch square aluminum

DRILLING METHODS
Soil Drill: 6.25-inch ID Hollow Stem Augers
Rock Drill: 6-inch Tricone,HQ Core, 6-inch Downhole Hammer

LOG SCALE: 1 in = 5 ft
DRILLING COMPANY: SAEDACCO
DRILLER: Robert Miller

GA INSPECTOR: David Reedy, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 12/1/06

Golder Associates

BOREHOLE RECORD 063526.100.GPJ PIEDMONT.GDT 12/19/06

APPENDIX B

ANALYTICAL REQUIREMENTS

NCDENR
North Carolina Department of Environment and Natural Resources
Dexter R. Matthews, Director | Division of Waste Management | Michael F. Easley, Governor
William G. Ross Jr., Secretary

October 27, 2006

To: SW Director/County Manager/Consultant/Laboratory

From: NC DENR-DWM, Solid Waste Section

Re: New Guidelines for Electronic Submittal of Environmental Monitoring Data

The Solid Waste Section receives and reviews a wide variety of environmental monitoring data from permitted solid waste management facilities, including the results from groundwater and surface water analyses, leachate samples, methane gas readings, potentiometric measurements, and corrective action data. We are in the process of developing a database to capture the large volume of data submitted by facilities.

To maintain the integrity of the database, it is critical that facilities, consultants, and laboratories work with the Solid Waste Section to ensure that environmental samples are collected and analyzed properly with the resulting data transferred to the Solid Waste Section in an accurate manner.

In order to better serve the public and to expedite our review process, the Solid Waste Section is requesting specific formatting for environmental monitoring data submittals for all solid waste management facilities.

Effective, December 1, 2006, please submit a Solid Waste Environmental Monitoring Data Form in addition to your environmental monitoring data report. This form will be sent in lieu of your current cover letter to the Solid Waste Section. The Solid Waste Environmental Monitoring Data Form must be filled out completely, signed, and stamped with a Board Certified North Carolina Geologist License Seal.

The solid waste environmental monitoring data form will include the following:

1. Contact Information
2. Facility Name
3. Facility Permit Number
4. Facility Address
5. Monitoring Event Date (MM/DD/YYYY)
6. Water Quality Status: Monitoring, Detection Monitoring, or Assessment Monitoring
7. Type of Data Submitted: Groundwater Monitoring Wells, Groundwater Potable Wells, Leachate, Methane Gas, or Corrective Action Data
8. Notification of Exceedance of Groundwater, Surface Water, or Methane Gas (in table form)
9. Signature
10. North Carolina Geologist Seal

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-508-8400 \ FAX: 919-733-4810 \ Internet http://wastenotnc.org
An Equal Opportunity / Affirmative Action Employer – Printed on Dual Purpose Recycled Paper

Most of these criteria are already being included or can be added with little effort. The Solid Waste Environmental Monitoring Data Form can be downloaded from our website: http://www.wastenotnc.org/swhome/enviro_monitoring.asp.

The Solid Waste Section is also requesting a new format for monitoring wells, potable wells, surface water sampling locations, and methane probes. This format is essential in the development and maintenance of the database. The Solid Waste Section is requesting that each sampling location at all North Carolina solid waste management facilities have its own unique identification number. We are simply asking for the permit number to be placed directly in front of the sampling location number (example: 9901-MW1 = Permit Number 99-01 and Monitoring Well MW-1). No changes will need to be made to the well tags, etc. This unique identification system will enable us to accurately report data not only to NCDENR, but to the public as well. We understand that this new identification system will take some time to implement, but we feel that this will be beneficial to everyone involved in the long term.

Additionally, effective December 1, 2006, the Practical Quantitation Limits (PQLs) established in 1994 will change. The Solid Waste Section is requiring that all solid waste management facilities use the new Solid Waste Reporting Limits (SWRL) for all groundwater analyses by a North Carolina Certified Laboratory. Laboratories must also report any detection of a constituent even it is detected below the new SWRL (e.g., J values where the constituent was detected above the detection limit, but below the quantitation limit).

PQLs are technology-based analytical levels that are considered achievable using the referenced analytical method. The PQL is considered the lowest concentration of a contaminant that the lab can accurately detect and quantify. PQLs provided consistency and available numbers that were achievable by the given analytical method. However, PQLs are not health-based, and analytical instruments have improved over the years resulting in lower achievable PQLs for many of the constituents. As a result, the Solid Waste Section has established the SWRLs as the new reporting limits eliminating the use of the PQLs.

We would also like to take this opportunity to encourage electronic submittal of the reports. This option is intended to save resources for both the public and private sectors. The Solid Waste Section will accept the entire report including narrative text, figures, tables, and maps on CD-ROM. The CD-ROM submittal shall contain a CD-ROM case and both CD-ROM and the case shall be labeled with the site name, site address, permit number, and the monitoring event date (MM/DD/YYYY). The files may be a .pdf, .txt, .csv, .xls, or .doc type. Also, analytical lab data should be reported in an .xls file. We have a template for analytical lab data available on the web at the address listed above.

If you have any questions or concerns, please call (919) 508-8400. Thank you for your anticipated cooperation in this matter.

NCDENR
North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director | **Division of Waste Management** | Michael F. Easley, Governor
William G. Ross Jr., Secretary

February 23, 2007

MEMORANDUM

To: Solid Waste Directors, Landfill Operators, North Carolina Certified Laboratories, and Consultants

From: North Carolina Division of Waste Management, Solid Waste Section

Re: Addendum to October 27, 2006, North Carolina Solid Waste Section Memorandum Regarding New Guidelines for Electronic Submittal of Environmental Data.

The purpose of this addendum memorandum is to provide further clarification to the October 27, 2006, North Carolina Solid Waste Section memo titled, "New Guidelines for Electronic Submittal of Environmental Data."

The updated guidelines is in large part due to questions and concerns from laboratories, consultants, and the regulated community regarding the detection of constituents in groundwater at levels below the previous practical quantitation limits (PQLs). The North Carolina Solid Waste Section solicited feedback from the regulated community, and, in conjunction with the regulated community, developed new limits. The primary purpose of these changes was to improve the protection of public health and the environment. The North Carolina Solid Waste Section is concerned about analytical data at these low levels because the earliest possible detection of toxic or potentially carcinogenic chemicals in the environment is paramount in the North Carolina Solid Waste Section's mission to protect human health and the environment. Low level analytical data are critical for making the correct choices when designing site remediation strategies, alerting the public to health threats, and protecting the environment from toxic contaminants. The revised limits were updated based on readily available laboratory analytical methodology and current health-based groundwater protection standards.

Definitions

Many definitions relating to detection limits and quantitation limits are used in the literature and by government agencies, and commonly accepted procedures for calculating these limits exist. Except for the Solid Waste Section Limit and the North Carolina 2L Standards, the definitions listed below are referenced from the Environmental Protection Agency (EPA). The definitions are also an attempt to clarify the meaning of these terms as used by the North Carolina Solid Waste Section.

Method Detection Limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.

Method Reporting Limit or Method Quantitation Limit (MRL or MQL) is the minimum concentration of a target analyte that can be accurately determined by the referenced method.

Practical Quantitation Limit (PQL) is a quantitation limit that represents a practical and routinely achievable quantitation limit with a high degree of certainty (>99.9% confidence) in the results. Per EPA Publication Number SW-846, the PQL is the lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions in accordance with "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods. The PQL appears in older NCDENR literature; however, it is no longer being used by the North Carolina Solid Waste Section.

Solid Waste Section Limit (SWSL) is the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy. The SWSL is the concentration below which reported analytical results must be qualified as estimated. *The SWSL is the updated version of the PQL that appears in older North Carolina Solid Waste Section literature. The SWSL is the limit established by the laboratory survey conducted by the North Carolina Solid Waste Section. The nomenclature of the SWRL described in the October 27, 2006, memorandum has changed to the SWSL.*

North Carolina 2L Standards (2L) are water quality standards for the protection of groundwaters of North Carolina as specified in 15A NCAC 2L .0200, Classifications and Water Quality Standards Applicable to the Groundwaters of North Carolina.

Method Detection Limits (MDLs)

Clarification of detection limits referenced in the October 27, 2006, memorandum needed to be addressed because of concerns raised by the regulated community. The North Carolina Solid Waste Section is now requiring laboratories to report to the method detection limit.

Method detection limits are statistically determined values that define the concentration at which measurements of a substance by a specific analytical protocol can be distinguished from measurements of a blank (background noise). Method detection limits are matrix-specific and require a well defined analytical method. In the course of routine operations, laboratories generally report the highest method detection limit for all the instruments used for a specific method.

In many instances, the North Carolina Solid Waste Section gathers data from many sources prior to evaluating the data or making a compliance decision. Standardization in data reporting significantly enhances the ability to interpret and review data because the reporting formats are comparable. Reporting a method detection limit alerts data users of the known uncertainties and limitations associated with using the data. Data users must understand these limitations in order to minimize the risk of making poor environmental decisions. Censoring data below unspecified or non-statistical reporting limits severely biases data sets and restricts their usefulness.

Solid Waste Section Limits (SWSLs)

Due to comments from the regulated community, the North Carolina Solid Waste Section has changed the nomenclature of the new limits referenced on Page 2 of the October 27, 2006, memorandum, from the North Carolina Solid Waste Reporting Limits (SWRL) to the Solid Waste Section Limits (SWSL). Data must be reported to the laboratory specific method detection limits and must be quantifiable at or below the SWSL. The SWSLs must be used for both groundwater and surface water data reported to the North Carolina Solid Waste Section. The PQLs will no longer be used.

The North Carolina Solid Waste Section has considered further feedback from laboratories and the regulated community and has made some additional changes to the values of the SWSLs. These changes may be viewed on our webpage:
http://www.wastenotnc.org/sw/swenvmonitoringlist.asp

Analytical Data Reporting Requirements

The strategy for implementing the new analytical data reporting requirements involves reporting the actual laboratory method detection limit with all analytical laboratory results along with the following requirements:

1) Any analyte detected at a concentration greater than the MDL but less than the SWSL is known to be present, but the uncertainty in the value is higher than a value reported above the SWSL. As a result, the actual concentration is estimated. The estimated concentration is reported along with a qualifier ("J" flag) to alert data users that the result is between the MDL and the SWSL. Any analytical data below quantifiable levels should be examined closely to evaluate whether the analytical data should be included in any statistical analysis. A statistician should make this determination. If an analyte is detected below the North Carolina 2L Standards, even if it is a quantifiable concentration, compliance action may not be taken unless it is statistically significant increase over background.

These analytical results may require additional confirmation.

2) Any analyte detected at a concentration greater than the SWSL is present, and the quantitated value can be reported with a high degree of confidence. These analytes are reported without estimated qualification. The laboratory's MDL and SWSL must be included in the analytical laboratory report. Any reported concentration of an organic or inorganic constituent at or above the North Carolina 2L Standards will be used for compliance purposes, unless the inorganic constituent is not statistically significant). Exceedance of the North Carolina 2L Standards or a statistically significant increase over background concentrations define when a violation has occurred. Any reported concentration of an organic or inorganic constituent at or above the SWSL that is not above an North Carolina 2L Standard will be used as a tool to assess the integrity of the landfill system and predict the possibility that a constituent concentration may exceed the North Carolina 2L Standards in the future.

These analytical results may be used for compliance without further confirmation.

Failure to comply with the requirements described in the October 27, 2006, memorandum and this addendum to the October 27, 2006, memorandum will constitute a violation of 15A NCAC 13B .0601, .0602, or .1632(b), and the analytical data will be returned and deemed unacceptable. Submittal of unacceptable data may lead to enforcement action.

Electronic Data Deliverable (EDD) Submittal

The North Carolina Solid Waste Section would also like to take this opportunity to encourage electronic submittal of the reports in addition to the analytical laboratory data. This option is intended to save resources for both the public and private sectors.

The North Carolina Solid Waste Section will accept the entire report including narrative text, figures, tables, and maps on CD-ROM. Please separate the figures and tables from the report when saving in order to keep the

size of the files smaller. The CD-ROM submittal shall contain a CD-ROM case and both CD-ROM and the case shall be labeled with the site name, site address, permit number, and the monitoring event date (MM/DD/YYYY). The reporting files may be submitted as a .pdf, .txt, .csv, .xls,. or .doc type.

Also, analytical lab data and field data should be reported in .xls files. The North Carolina Solid Waste Section has a template for analytical lab data and field data. This template is available on our webpage: http://www.wastenotnc.org/swhome/enviro_monitoring.asp. Methane monitoring data may also be submitted electronically in this format.

Pursuant to the October 27, 2006, memorandum, please remember to submit a Solid Waste Section Environmental Monitoring Reporting Form in addition to your environmental monitoring data report. This form should be sealed by a geologist or engineer licensed in North Carolina if hydrogeologic or geologic calculations, maps, or interpretations are included with the report. Otherwise, any representative that the facility owner chooses may sign and submit the form. Also, if the concentration of methane generated by the facility exceeds 100% of the lower explosive limits (LEL) at the property boundary or exceeds 25% of the LEL in facility structures (excluding gas control or recovery system components), include the exceedance(s) on the North Carolina Solid Waste Section Environmental Monitoring Reporting Form.

If you have any questions or concerns, please feel free to contact Jaclynne Drummond (919-508-8500) or Ervin Lane (919-508-8520).

Thank you for your continued cooperation with this matter.

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).
- In Accordance with NC General Statutes Chapter 89C and 89E and NC Solid Waste Management Rules 15A NCAC 13B, be sure to affix a seal to the bottom of this page, when applicable.
- 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):

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

Name: _____ Phone: _____

E-mail: _____

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)

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 or explosive methane gas limits 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.

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

Signature Date

Affix NC Licensed/ Professional Geologist/Engineer Seal here:

Revised 10/2006

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Other compounds for leachates or surface waters and field parameters are also listed.

SW ID	CAS Number	Name	Rpt Limit
NC APPENDIX I			
3	67-64-1	Acetone	100
8	107-13-1	Acrylonitrile	200
13	7440-36-0	Antimony	6
14	7440-38-2	Arsenic	10
15	7440-39-3	Barium	100
16	71-43-2	Benzene	1
23	7440-41-7	Beryllium	1
28	74-97-5	Bromochloromethane; Chlorobromethane	3
29	75-27-4	Bromodichloromethane; Dibromochloromethane	1
30	75-25-2	Bromoform; Tribromomethane	3
34	7440-43-9	Cadmium	1
35	75-15-0	Carbon disulfide	100
36	56-23-5	Carbon tetrachloride	1
39	108-90-7	Chlorobenzene	3
41	75-00-3	Chloroethane; Ethyl chloride	10
44	67-66-3	Chloroform; Trichloromethane	5
51	7440-47-3	Chromium	10
53	7440-48-4	Cobalt	10
54	7440-50-8	Copper	10
66	124-48-1	Dibromochloromethane; Chlorodibromomethane	1
67	96-12-8	1,2-Dibromo-3-chloropropane; DBCP	1
68	106-93-4	1,2-Dibromoethane; Ethylene dibromide; EDB	1
69	95-50-1	o-Dichlorobenzene; 1,2-Dichlorobenzene	5
71	106-46-7	p-Dichlorobenzene; 1,4-Dichlorobenzene	1
73	110-57-6	trans-1,4-Dichloro-2-butene	100
75	75-34-3	1,1-Dichloroethane; Ethylidene chloride	5
76	107-06-2	1,2-Dichloroethane; Ethylene dichloride	1
77	75-35-4	1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	5
78	156-59-2	cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	5
79	156-60-5	trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	5
82	78-87-5	1,2-Dichloropropane	1
86	10061-01-5	cis-1,3-Dichloropropene	5.5

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NC APPENDIX I			
87	10061-02-6	trans-1,3-Dichloropropene	1
110	100-41-4	Ethylbenzene	1
124	591-78-6	2-Hexanone; Methyl butyl ketone	50
131	7439-92-1	Lead	10
136	74-83-9	Methyl bromide; Bromomethane	10
137	74-87-3	Methyl chloride; Chloromethane	1
139	74-95-3	Methylene bromide; Dibromomethane	10
140	75-09-2	Methylene chloride; Dichloromethane	1
141	78-93-3	Methyl ethyl ketone; MEK; 2-Butanone	100
142	74-88-4	Methyl iodide; Iodomethane	10
147	108-10-1	4-Methyl-2-pentanone; Methyl isobutyl ketone	100
152	7440-02-0	Nickel	50
183	7782-49-2	Selenium	10
184	7440-22-4	Silver	10
186	100-42-5	Styrene	1
190	630-20-6	1,1,1,2-Tetrachloroethane	5
191	79-34-5	1,1,2,2-Tetrachloroethane	1
192	127-18-4	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	1
194	7440-28-0	Thallium	5.5
196	108-88-3	Toluene	1
200	71-55-6	1,1,1-Trichloroethane; Methylchloroform	1
201	79-01-6	Trichloroethylene; Trichloroethene	1
202	79-00-5	1,1,2-Trichloroethane	5
203	75-69-4	Trichlorofluoromethane; CFC-11	1
206	96-18-4	1,2,3-Trichloropropane	1
209	7440-62-2	Vanadium	25
210	108-05-4	Vinyl acetate	50
211	75-01-4	Vinyl chloride; Chloroethene	1
346	1330-20-7	Xylene (total)	4
213	7440-66-6	Zinc	10
NC APPENDIX II			
1	83-32-9	Acenaphthene	10
2	208-96-8	Acenaphthylene	10
4	75-05-8	Acetonitrile; Methyl cyanide	55
5	98-86-2	Acetophenone	10
6	53-96-3	2-Acetylaminofluorene; 2-AAF	20
7	107-02-8	Acrolein	52
9	309-00-2	Aldrin	0.05
10	107-05-1	Allyl chloride	10
11	92-67-1	4-Aminobiphenyl	15
12	120-12-7	Anthracene	10
17	56-55-3	Benzo[a]anthracene; Benzanthracene	10
18	205-99-2	Benzo[b]fluoranthene	10
19	207-08-9	Benzo[k]fluoranthene	10
20	191-24-2	Benzo[ghi]perylene	10
21	50-32-8	Benzo[a]pyrene	10
22	100-51-6	Benzyl alcohol	20
24	319-84-6	alpha-BHC	0.05

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NC APPENDIX II			
25	319-85-7	beta-BHC	0.05
26	319-86-8	delta-BHC	0.05
27	58-89-9	gamma-BHC; Lindane	0.05
31	101-55-3	4-Bromophenyl phenyl ether	10
32	85-68-7	Butyl benzyl phthalate; Benzyl butyl phthalate	10
33	84-74-2	Di-n-butyl phthalate	10
38	106-47-8	p-Chloroaniline	20
40	510-15-6	Chlorobenzilate	10
42	111-91-1	Bis(2-chloroethoxy)methane	10
43	111-44-4	Bis(2-chloroethyl)ether; Dichloroethyl ether	10
45	59-50-7	p-Chloro-m-cresol; 4-Chloro-3-methylphenol	20
46	108-60-1	Bis(2-chloro-1-methylethyl) ether; 2,2'-Dichlorodiisopropyl ether; DCIP, See footnote 4	10
47	91-58-7	2-Chloronaphthalene	10
48	95-57-8	2-Chlorophenol	10
49	7005-72-3	4-Chlorophenyl phenyl ether	10
50	126-99-8	Chloroprene	20
52	218-01-9	Chrysene	10
56	95-48-7	o-Cresol; 2-Methylphenol	10
58	57-12-5	Cyanide	7.5
59	94-75-7	2,4-D; 2,4-Dichlorophenoxyacetic acid	1.05
60	72-54-8	4,4'-DDD	0.1
61	72-55-9	4,4'-DDE	0.1
62	50-29-3	4,4'-DDT	0.1
63	2303-16-4	Diallate	10
64	53-70-3	Dibenz[a,h]anthracene	10
65	132-64-9	Dibenzofuran	10
70	541-73-1	m-Dichlorobenzene; 1,3-Dichlorobenzene	5
72	91-94-1	3,3'-Dichlorobenzidine	15
74	75-71-8	Dichlorodifluoromethane; CFC 12	5
80	120-83-2	2,4-Dichlorophenol	10
81	87-65-0	2,6-Dichlorophenol	10
83	142-28-9	1,3-Dichloropropane; Trimethylene dichloride	1
84	594-20-7	2,2-Dichloropropane; Isopropylidene chloride	15
85	563-58-6	1,1-Dichloropropene	5
88	60-57-1	Dieldrin	0.075
89	297-97-2	O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	20
90	84-66-2	Diethyl phthalate	10
91	60-51-5	Dimethoate	20
92	60-11-7	p-(Dimethylamino)azobenzene	10
93	57-97-6	7,12-Dimethylbenz[a]anthracene	10

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NC APPENDIX II			
94	119-93-7	3,3'-Dimethylbenzidine	10
95	105-67-9	2,4-Dimethylphenol; m-Xylenol	10
96	131-11-3	Dimethyl phthalate	10
97	99-65-0	m-Dinitrobenzene	20
98	534-52-1	4,6-Dinitro-o-cresol; 4,6-Dinitro-2-methylphenol	50
99	51-28-5	2,4-Dinitrophenol	50
100	121-14-2	2,4-Dinitrotoluene	10
101	606-20-2	2,6-Dinitrotoluene	10
102	88-85-7	Dinoseb; DNBP; 2-sec-Butyl-4,6-dinitrophenol	0.55
103	122-39-4	Diphenylamine	10
104	298-04-4	Disulfoton	10
105	959-98-8	Endosulfan I	0.1
106	33213-65-9	Endosulfan II	0.1
107	1031-07-8	Endosulfan sulfate	0.1
108	72-20-8	Endrin	0.1
109	7421-93-4	Endrin aldehyde	0.1
111	117-81-7	Bis(2-ethylhexyl) phthalate	15
112	97-63-2	Ethyl methacrylate	10
113	62-50-0	Ethyl methanesulfonate	20
114	52-85-7	Famphur	20
115	206-44-0	Fluoranthene	10
116	86-73-7	Fluorene	10
117	76-44-8	Heptachlor	0.05
118	1024-57-3	Heptachlor epoxide	0.075
119	118-74-1	Hexachlorobenzene	10
120	87-68-3	Hexachlorobutadiene	10
121	77-47-4	Hexachlorocyclopentadiene	10
122	67-72-1	Hexachloroethane	10
123	1888-71-7	Hexachloropropene	10
125	193-39-5	Indeno(1,2,3-cd)pyrene	10
126	78-83-1	Isobutyl alcohol	100
127	465-73-6	Isodrin	20
128	78-59-1	Isophorone	10
129	120-58-1	Isosafrole	10
130	143-50-0	Kepone	20
132	7439-97-6	Mercury	0.2
133	126-98-7	Methacrylonitrile	100
134	91-80-5	Methapyrilene	100
135	72-43-5	Methoxychlor	1
138	56-49-5	3-Methylcholanthrene	10
143	80-62-6	Methyl methacrylate	30
144	66-27-3	Methyl methanesulfonate	10
145	91-57-6	2-Methylnaphthalene	10
146	298-00-0	Methyl parathion; Parathion methyl	10
148	91-20-3	Naphthalene	10
149	130-15-4	1,4-Naphthoquinone	10
150	134-32-7	1-Naphthylamine	10
151	91-59-8	2-Naphthylamine	10
153	99-09-2	m-Nitroaniline; 3-Nitroaniline	50

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NC APPENDIX II			
154	88-74-4	o-Nitroaniline; 2-Nitroaniline	50
155	100-01-6	p-Nitroaniline; 4-Nitroaniline	20
156	98-95-3	Nitrobenzene	10
157	99-55-8	5-Nitro-o-toluidine	10
158	88-75-5	o-Nitrophenol; 2-Nitrophenol	20
159	100-02-7	p-Nitrophenol; 4-Nitrophenol	50
160	55-18-5	N-Nitrosodiethylamine	20
161	62-75-9	N-Nitrosodimethylamine	10
162	924-16-3	N-Nitrosodi-n-butylamine	10
163	86-30-6	N-Nitrosodiphenylamine	10
164	621-64-7	N-Nitrosodipropylamine; N-Nitroso-N-dipropylamine; Di-n-propylnitrosamine	10
165	10595-95-6	N-Nitrosomethylethalamine	10
166	100-75-4	N-Nitrosopiperidine	20
167	930-55-2	N-Nitrosopyrrolidine	10
168	117-84-0	Di-n-octyl phthalate	10
169	56-38-2	Parathion	10
170	1336-36-3	Polychlorinated biphenyls; PCBs	2
171	608-93-5	Pentachlorobenzene	10
172	82-68-8	Pentachloronitrobenzene	20
173	87-86-5	Pentachlorophenol	25
174	62-44-2	Phenacetin	20
175	85-01-8	Phenanthrene	10
176	106-50-3	p-Phenylenediamine	10
177	108-95-2	Phenol	10
178	298-02-2	Phorate	10
179	23950-58-5	Pronamide	10
180	107-12-0	Propionitrile; Ethyl cyanide	150
181	129-00-0	Pyrene	10
182	94-59-7	Safrole	10
185	93-72-1	Silvex; 2,4,5-TP	2
187	18496-25-8	Sulfide	1000
188	93-76-5	2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid	2
189	95-94-3	1,2,4,5-Tetrachlorobenzene	10
193	58-90-2	2,3,4,6-Tetrachlorophenol	10
195	7440-31-5	Tin	100
197	95-53-4	o-Toluidine	10
198	8001-35-2	Toxaphene	1.5
199	120-82-1	1,2,4-Trichlorobenzene	10
204	95-95-4	2,4,5-Trichlorophenol	10
205	88-06-2	2,4,6-Trichlorophenol	10
207	126-68-1	O,O,O-Triethyl phosphorothioate	10
208	99-35-4	sym-Trinitrobenzene	10

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SW ID	CAS Number	Name	Rpt Limit
OTHER COMPOUNDS AND FIELD PARAMETERS			
301	SW301	Chloride	NE
303	SW303	Nitrate (as N)	NE
304	SW304	Nitrite (as N)	NE
305	SW305	petroleum aliphatic carbon fraction class C5 - C8	NE
306	SW306	petroleum aliphatic carbon fraction class C9 - C18	NE
307	SW307	petroleum aliphatic carbon fraction class C19 - C36	NE
308	SW308	petroleum aromatics carbon fraction class C9 - C22	NE
309	SW309	Coliform (total)	NE
310	SW310	Color (color units)	NE
311	SW311	Total Dissolved Solids	NE
312	SW312	Fluoride	NE
313	SW313	Foaming Agents	NE
314	SW314	Gross Alpha	NE
315	14808-79-8	Sulfate	NE
316	SW316	Biological Oxygen Demand	NE
317	SW317	Chemical Oxygen Demand	NE
318	SW318	Depth To Water (ft)	NE
319	SW319	Head (ft mean sea level)	NE
320	SW320	pH (field)	NE
321	SW321	pH (lab)	NE
322	7440-23-5	Sodium	NE
323	SW323	SpecCond (field)	NE
324	SW324	SpecCond (lab)	NE
325	SW325	Temp (oC)	NE
328	SW328	Top Of Casing (ft mean sea level)	NE
329	SW329	Landfill Gas	NE
330	SW330	Turbidity	NE
331	SW331	Ethane- Dissolved	NE
332	SW332	Ethene- Dissolved	NE
333	SW333	Methane- Dissolved	NE
334	SW334	Ferrous Iron- Dissolved	NE
335	SW335	Manganese- Dissolved	NE
336	SW336	Oxygen Reduction Potential (mV)	NE
337	SW337	Alkalinity	NE
338	SW338	Hydrogen Sulfide	NE
339	57-74-9	Chlordane	0.5
340	7439-89-6	Iron	NE
342	7439-96-5	Manganese	NE
343	SW343	Total Suspended Solids	NE
344	106-44-5	p-Cresol; 4-Methylphenol	10
345	108-39-4	m-Cresol; 3-Methylphenol	10
346	1330-20-7	Xylene (total)	4
347	SW347	Bicarbonate (as CaCO3)	NE
348	SW348	Carbonate (as CaCO3)	NE
350	94-82-6	2-4 DB	NE

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SW ID	CAS Number	Name	Rpt Limit
OTHER COMPOUNDS AND FIELD PARAMETERS			
351	94-74-6	MCPA	NE
352	120-36-5	2-(2-4-dichlorophenoxy)propionic acid	NE
353	1918-00-9	Dicamba	NE
354	93-65-2	Mecopop, MCPP	NE
355	75-99-0	Dalapon	NE
356	SW356	Dissolved Oxygen	NE
357	E-10195	Total Organic Carbon	NE
358	110-75-8	2-Chloroethylvinyl ether	NE
359	SW359	m-&p-Xylene (combined)	NE
360	108-86-1	Bromobenzene	NE
361	104-51-8	n-Butylbenzene	NE
362	135-98-8	sec-Butylbenzene	NE
363	98-06-6	tert-Butylbenzene	NE
364	95-49-8	o-Chlorotoluene	NE
365	106-43-4	p-Chlorotoluene	NE
366	108-20-3	Isopropyl ether	NE
367	98-82-8	Isopropylbenzene	NE
368	99-87-6	p-Cymene	NE
369	1634-04-4	Methyl-tert-butyl ether (MTBE)	NE
370	103-65-1	n-Propylbenzene	NE
371	87-61-6	1-2-3-Trichlorobenzene	NE
372	95-63-6	Pseudocumene (1-2-4-trimethylbenzene)	NE
373	108-67-8	Mesitylene (1-3-5-trimethylbenzene)	NE
374	SW374	m-&p-Cresol (combined)	NE
375	7440-70-2	Calcium	NE
376	7439-95-4	Magnesium	NE
377	9/7/7440	Potassium	NE
378	5103-74-2	Chlordane, beta	NE
379	5103-71-9	Chlordane, alpha	NE
380	76-01-7	Pentachloroethane	NE
381	62-53-3	Aniline	NE
382	140-57-8	Aramite	NE
383	92-87-5	Benzidine	NE
384	39638-32-9	Bis(2-chloroisopropyl) ether	NE
385	226-36-8	1,2,5,6-Dibenzacridine	NE
386	122-09-8	Benzeneethanamine, alpha,alpha-dimethyl	NE
387	70-30-4	Hexachlorophene	NE
388	56-57-5	4-nitroquinoline-1-oxide	NE
389	59-89-2	N-Nitrosomorpholine	NE
390	109-06-8	2-Picoline	NE
391	110-86-1	Pyridine	NE
392	3689-24-5	Sulfotep	NE
394	122-66-7	1,2-Diphenylhydrazine	NE
395	65-85-0	Benzoic Acid	NE
396	SW396	Total Organic Halides	NE
397	7439-98-7	Molybdenum	NE
398	76-13-1	1,1,2-Trichlorotrifluoroethane	NE

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OTHER COMPOUNDS AND FIELD PARAMETERS			
399	5566-34-7	Chlordane, gamma	NE
400	12789-03-6	Chlordane (constituents)	NE
401	12674-11-2	Aroclor 1016	NE
402	11104-28-2	Aroclor 1221	NE
403	11141-16-5	Aroclor 1232	NE
404	53469-21-9	Aroclor 1242	NE
405	12672-29-6	Aroclor 1248	NE
406	11097-69-1	Aroclor 1254	NE
407	11096-82-5	Aroclor 1260	NE
408	95-47-6	o-Xylene	NE
409	108-38-3	m-Xylene	NE
410	106-42-3	p-Xylene	NE
411	SW411	Total Well Depth (ft)	NE

APPENDIX C

LOW-FLOW GROUNDWATER PURGING AND SAMPLING GUIDANCE

United States Environmental Protection Agency | Office of Research and Development | Office of Solid Waste and Emergency Response | EPA/540/S-95/504 April 1996

EPA Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls[1] and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

For further information contact: Robert Puls, 405-436-8543, Subsurface Remediation and Protection Division, NRMRL, Ada, Oklahoma.

I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines an improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed The prevailing conceptual ideas included convenient genera zations of ground-water resources in terms of large and relatively homogeneous hydrologic *units*. With time it becan apparent that conventional water supply generalizations of *homogeneity* did not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

[1]National Risk Management Research Laboratory, U.S. EPA
[2]University of Michigan

Superfund Technology Support Center for Ground Water

National Risk Management Research Laboratory
Subsurface Protection and Remediation Division
Robert S. Kerr Environmental Research Center
Ada, Oklahoma

Technology Innovation Office
Office of Solid Waste and Emergency Response, US EPA, Washington, DC

Walter W. Kovalick, Jr., Ph.D.
Director

chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling

objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

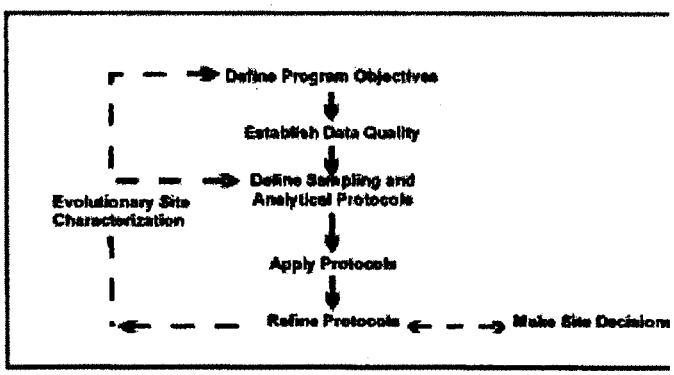

Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short*, of course, is relative to the degree of vertica water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemica changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of th well will cause increased entrainment of solids which have collected in the well over time. These particles are present a a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-

flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

C. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load o contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action*.

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g. , pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;
- maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thumblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over <u>any</u> other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F. Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 µm filters]) concentrations of major ions and trace metals, 0.1 µm filters are recommended although 0.45 µm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO_2 composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 µm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality

indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+}, CH_4, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering o

the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. Low-Permeability Formations (<0.1 L/min recharge)

1. Low-Flow Purging and Sampling with Pumps

a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. Fractured Rock

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop -- A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

The U.S. Environmental Protection Agency through its Office of Research and Development funded and managed the research described herein as part of its in-house research program and under Contract No. 68-C4-0031 to Dynamac Corporation. It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercia products does not constitute endorsement or recommendation for use.

VIII. References

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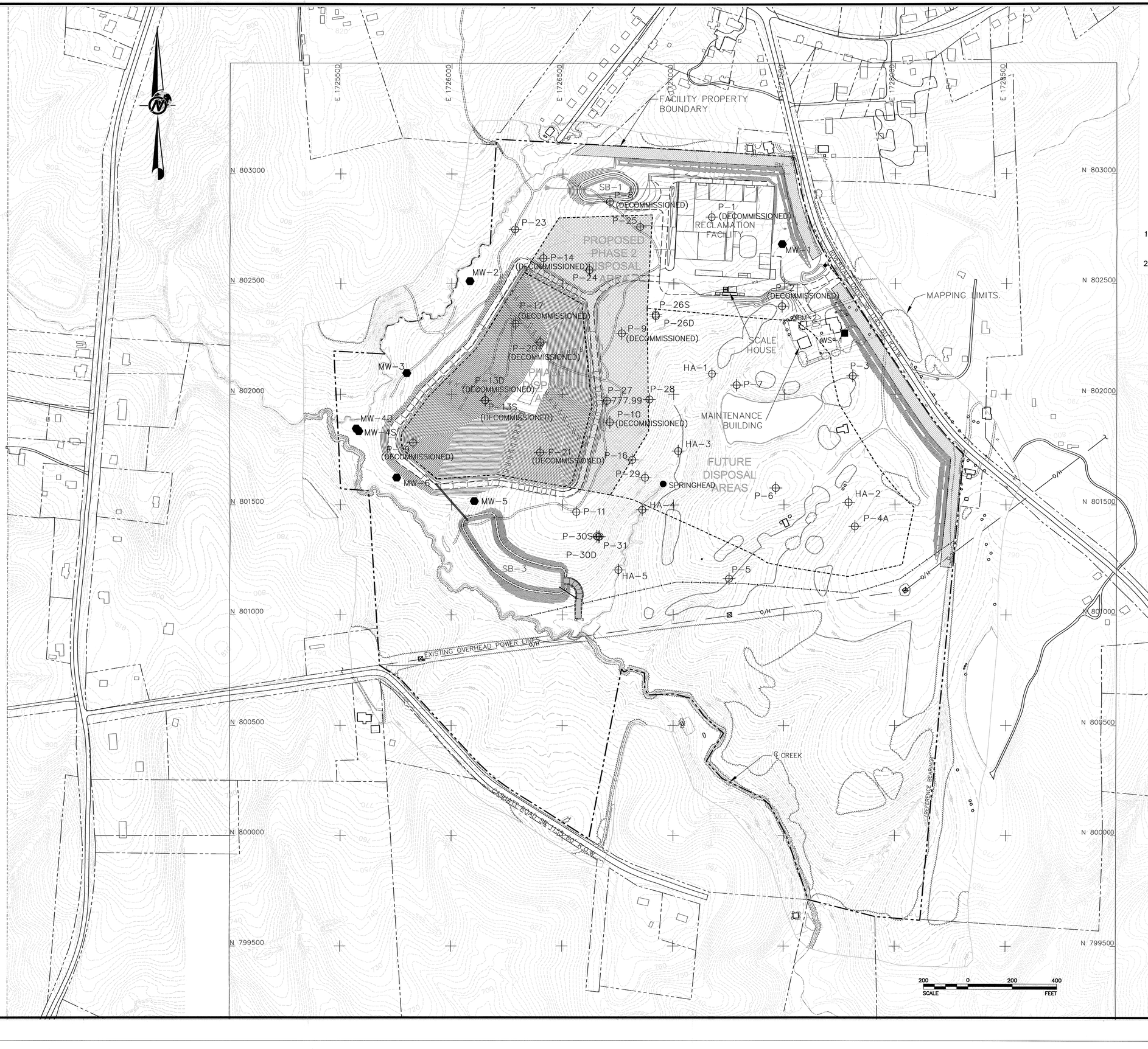


LEGEND

- EXISTING 10 FT. TOPOGRAPHIC CONTOUR
- EXISTING 2 FT. TOPOGRAPHIC CONTOUR
- PROPERTY LINE
- STREAM
- TREELINE
- EXISTING ROAD
- PROPOSED OR EXISTING LIMITS OF WASTE
- MONITORING WELL LOCATION IDENTIFICATION — MW-3
- PIEZOMETER LOCATION IDENTIFICATION — P-25
- WATER SUPPLY WELL — WS-1
- SPRINGHEAD LOCATION AND IDENTIFICATION — SPRINGHEAD
- BENCH MARK — BM-1
- SEDIMENT BASIN — SB-1

NOTES:

1. DRAWING BASED ON SITE PLAN PREPARED BY JOYCE ENGINEERING, INC. DATED JULY 7, 2004.
2. SPRINGHEAD MEASURED ON AUGUST 17, 2006.

Golder Associates
GREENSBORO, NORTH CAROLINA

PROJECT

WCA OF HIGH POINT, LLC
CONSTRUCTION AND
DEMOLITION DEBRIS
LANDFILL AND RECLAMATION
FACILITY
GUILFORD COUNTY, N

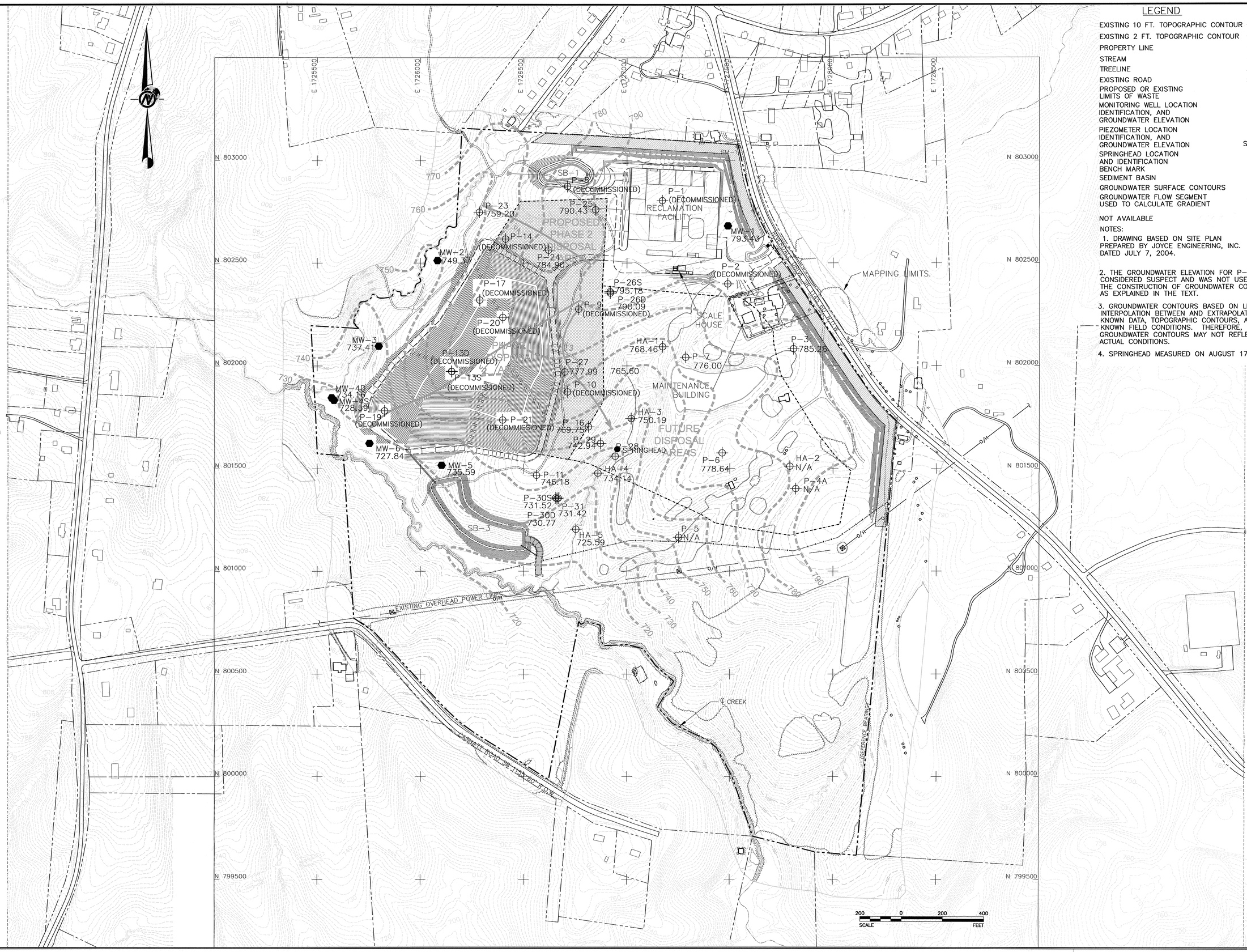
TITLE

BORING, PIEZOMETER, AND MONITORING WELL LOCATION MAP

PROJECT No.		063-65
FILE No.		0636526A
REV.	SCALE	AS SHOW
DESIGN	DYR	09/21/
CADD	CLF	09/25/
CHECK	DJR	4-13-07
REVIEW	[illegible]	4/13/07

DWG. DH-1

Drawing File: Revised 401.dwg Apr 13, 2007 - 2:11pm



LEGEND

- EXISTING 10 FT. TOPOGRAPHIC CONTOUR
- EXISTING 2 FT. TOPOGRAPHIC CONTOUR
- PROPERTY LINE
- STREAM
- TREELINE
- EXISTING ROAD
- PROPOSED OR EXISTING LIMITS OF WASTE
- MONITORING WELL LOCATION IDENTIFICATION, AND GROUNDWATER ELEVATION — MW-3 737.41
- PIEZOMETER LOCATION IDENTIFICATION, AND GROUNDWATER ELEVATION — P-25 790.43
- SPRINGHEAD LOCATION AND IDENTIFICATION — SPRINGHEAD
- BENCH MARK — BM-1
- SEDIMENT BASIN — SB-1
- GROUNDWATER SURFACE CONTOURS — 760
- GROUNDWATER FLOW SEGMENT USED TO CALCULATE GRADIENT — i 1
- NOT AVAILABLE — N/A

NOTES:

1. DRAWING BASED ON SITE PLAN PREPARED BY JOYCE ENGINEERING, INC. DATED JULY 7, 2004.
2. THE GROUNDWATER ELEVATION FOR P-16 IS CONSIDERED SUSPECT AND WAS NOT USED IN THE CONSTRUCTION OF GROUNDWATER CONTOURS AS EXPLAINED IN THE TEXT.
3. 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 CONDITIONS.
4. SPRINGHEAD MEASURED ON AUGUST 17, 2006.

Golder Associates
GREENSBORO, NORTH CAROLINA

PROJECT
WCA OF HIGH POINT,LLC
CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL AND RECLAMATION FACILITY
GUILFORD COUNTY, NC

TITLE
GROUNDWATER SURFACE CONTOUR MAP JULY 25, 2006

PROJECT No.		063-65
FILE No.		0636526A
REV.	SCALE	AS SHOW
DESIGN	DYR	09/21/
CADD	CLF	09/25/
CHECK	DYR	4-13-0
REVIEW	EK	4-13-07

DWG. DH-2

Drawing File: Revised A02.dwg Apr 13, 2007 - 2:08pm

LEGEND

- EXISTING 10 FT. TOPOGRAPHIC CONTOUR
- EXISTING 2 FT. TOPOGRAPHIC CONTOUR
- PROPERTY LINE
- STREAM
- TREELINE
- EXISTING ROAD
- PROPOSED OR EXISTING LIMITS OF WASTE
- MONITORING WELL LOCATION IDENTIFICATION, AND BEDROCK ELEVATION — MW-3 739.15
- PIEZOMETER LOCATION IDENTIFICATION, AND BEDROCK ELEVATION — P-25 788.99
- BENCH MARK — BM-1
- SEDIMENT BASIN — SB-1
- BEDROCK ELEV CONTOURS — 760
- AREAS OF MAGNETIC ANOMOLIES
- ROCK OUTCROPS

NOTES:

1. DRAWING BASED ON SITE PLAN PREPARED BY JOYCE ENGINEERING, INC. DATED JULY 7, 2004.
2. BEDROCK CONTOURS BASED ON LINEAR INTERPOLATION BETWEEN AND EXTROPOLATION FROM KNOWN DATA, TOPOGRAPHIC CONTOURS, AND KNOWN FIELD CONDITIONS. THEREFORE, CONTOURS MAY NOT REFLECT ACTUAL BEDROCK CONDITIONS.
3. AREAS OF MAGNETIC ANOMOLIES AND ROCK OUTCROPS TAKEN FROM THE 2002 DESIGN HYDROGEOLOGIC REPORT PREPARED BY JOYCE ENGINEERING, INC.

Golder Associates
GREENSBORO, NORTH CAROLINA

PROJECT
WCA OF HIGH POINT, LLC
CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL AND RECLAMATION FACILITY

TITLE
BEDROCK ELEVATION CONTOUR MAP WITH PROPOSED BASE GRADES

PROJECT No.		063-65
FILE No.		0636526A
REV.	SCALE	AS SHO
DESIGN	DYR	09/21/
CADD	CLF	09/21/
CHECK	DYR	4-13-0
REVIEW	RK	4-13-07

DWG. DH-

Drawing file: Revised A03.dwg Feb 20, 2007 - 2:01pm

Golder Associates
GREENSBORO, NORTH CAROLINA

PROJECT
WCA OF HIGH POINT, LLC
CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL AND RECLAMATION FACILITY
GUILFORD COUNTY

TITLE
HYDROGEOLOGIC CROSS-SECTIONS
LOCATIONS OF LINES OF SECTION

PROJECT No.		063-65
FILE No.		0636526A
REV.	SCALE	AS SHO
DESIGN	DYR	9/25/
CADD	CLF	10/02/
CHECK	DYR	4-13-0
REVIEW	RJK	4-13-

DWG. DH-

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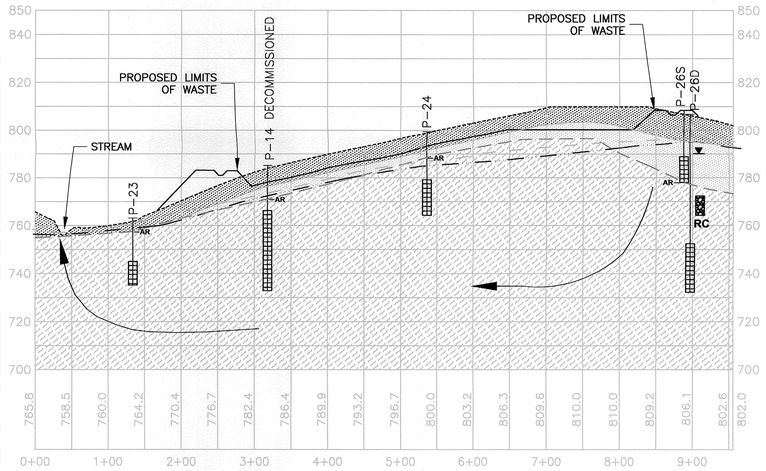
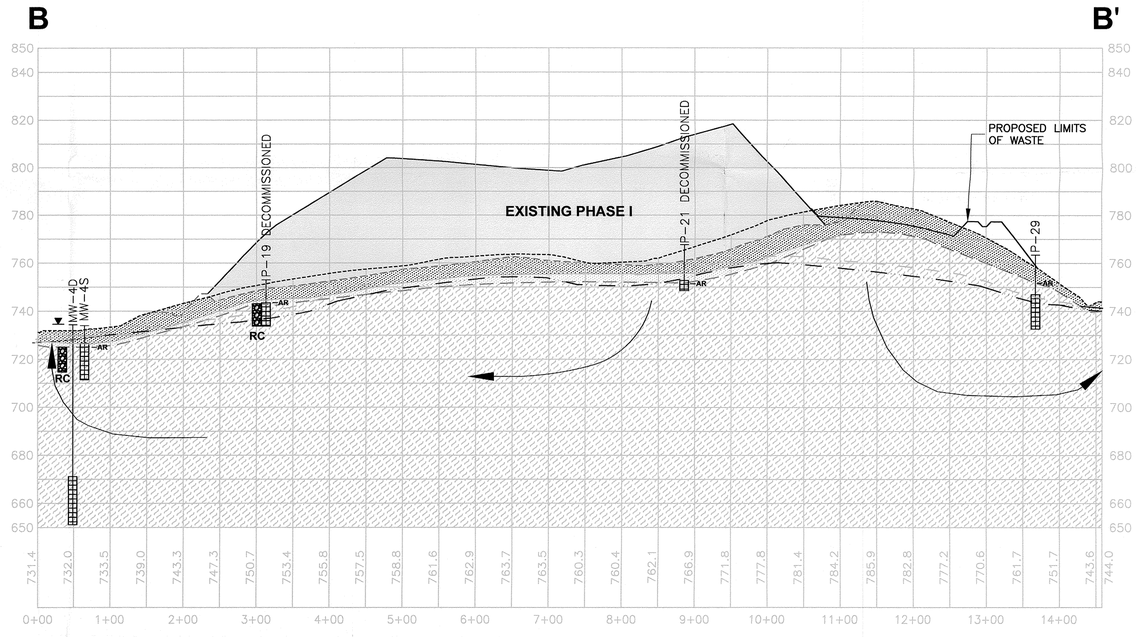
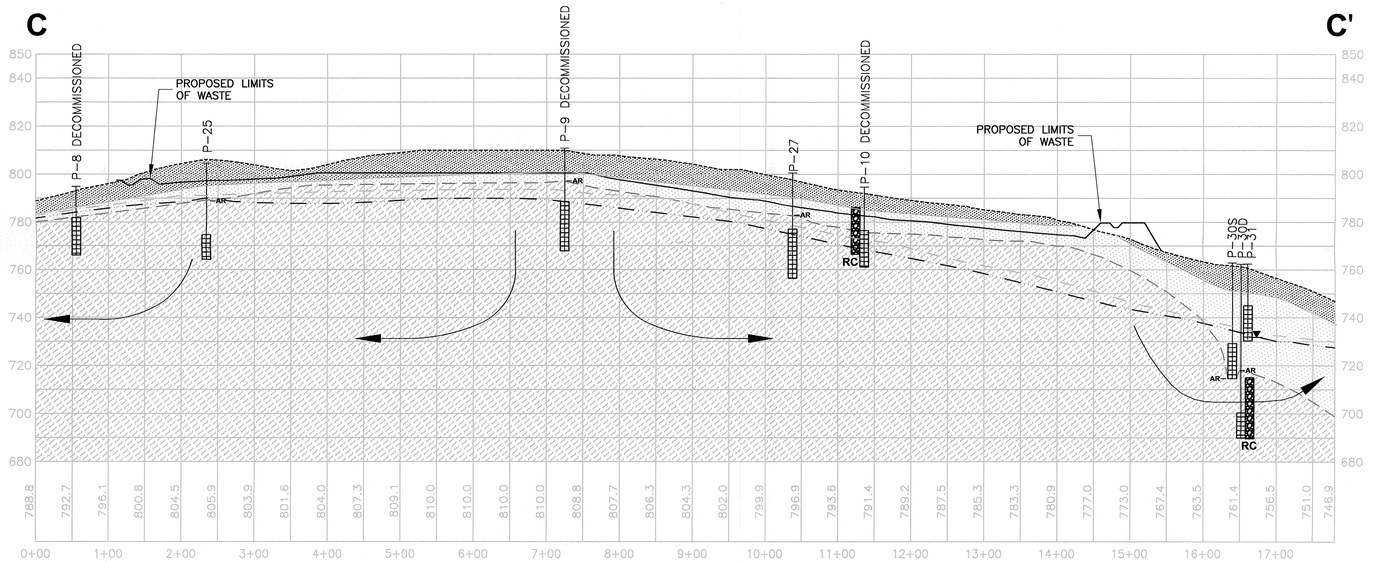






LEGEND

- EXISTING GRADE
- BEDROCK SURFACE
- GROUNDWATER SURFACE (7-25-06)
- SEASONAL HIGH GROUNDWATER SURFACE
- EXISTING BASE GRADE
- PROPOSED BASE GRADE
- ANTICIPATED DIRECTION OF GROUNDWATER FLOW
- PIEZOMETER OR MONITORING WELL
- RC — ROCK CORE INTERVAL
- AR — AUGER REFUSAL
- EXISTING LANDFILL
- WATER LEVEL IN DEEP WELL OF NESTED WELL OR PIEZOMETER PAIRS
- SAPROLITE
- PARTIALLY WEATHERED ROCK
- BEDROCK

SCALE IN FEET: 0, 30, 60

SCALE: 100 0 100 FEET

Golder Associates
GREENSBORO, NORTH CAROLINA

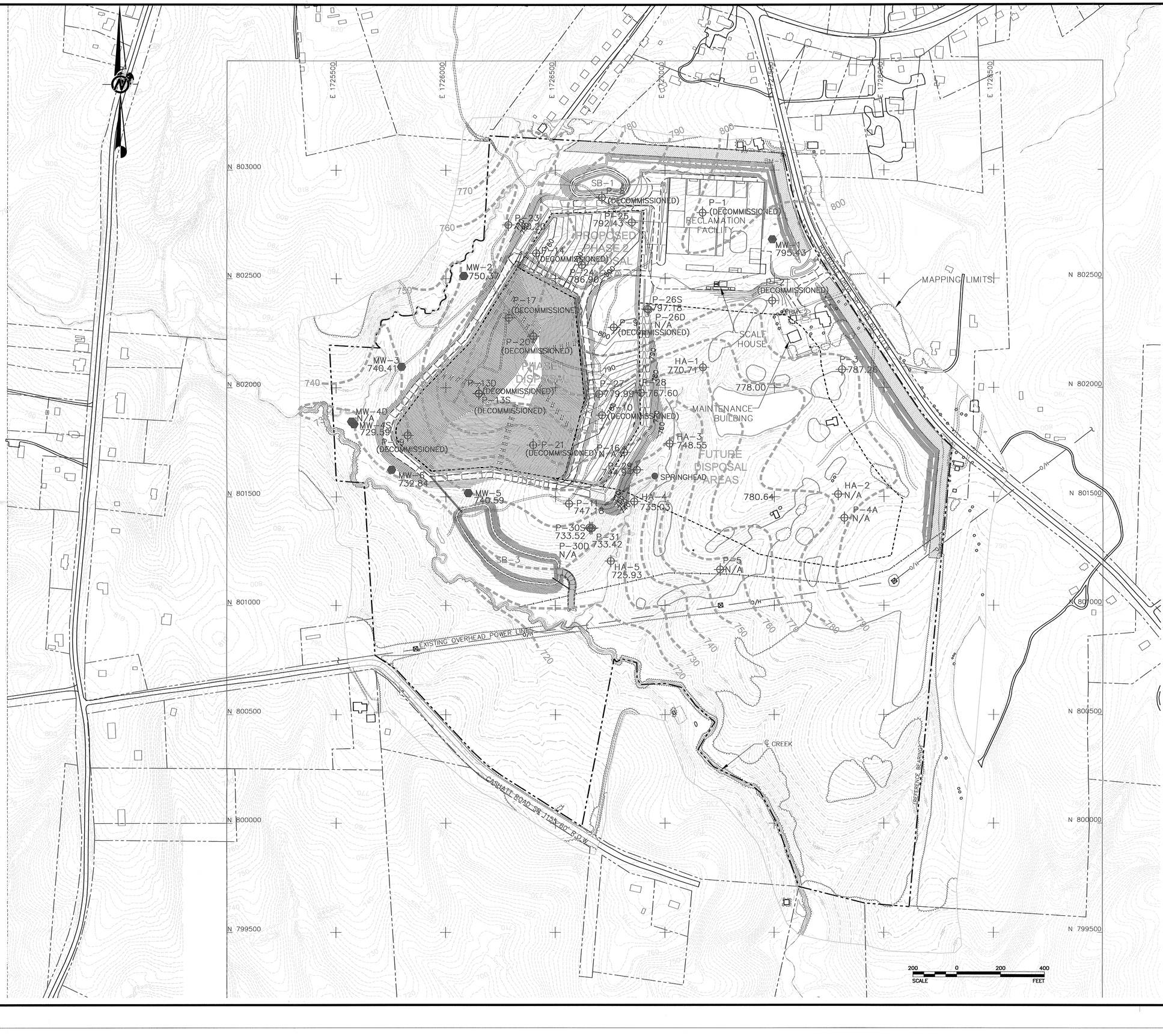
PROJECT
WCA OF HIGH POINT, LLC
CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL AND RECLAMATION FACILITY

TITLE
HDYROGEOLOGIC CROSS-SECTIONS A-A', B-B' AND C-C'

PROJECT No.		063-65
FILE No.		0636526A
REV.	SCALE	AS SHO
DESIGN	DYR	12/6/
CADD	BJK	12/6/
CHECK	DR	4-13-0
REVIEW	RK	4-13-07

DWG. DH-

Drawing file: Revised A05.dwg Apr 10, 2007 - 11:59am



LEGEND

EXISTING 10 FT. CONTOUR	
EXISTING 2 FT. CONTOUR	
PROPERTY LINE	
STREAM	
TREELINE	
EXISTING ROAD	
PROPOSED OR EXISTING LIMITS OF WASTE	
MONITORING WELL LOCATION IDENTIFICATION, AND GROUNDWATER ELEVATION	MW-3 740.41
PIEZOMETER LOCATION IDENTIFICATION, AND GROUNDWATER ELEVATION	P-25 792.43
SPRINGHEAD LOCATION AND IDENTIFICATION	SPRINGHEAD
BENCH MARK	BM-1
SEDIMENT BASIN	SB-1
SEASONAL HIGH GROUNDWATER SURFACE CONTOURS	760
NOT AVAILABLE	N/A

NOTES:

1. DRAWING BASED ON SITE PLAN PREPARED BY JOYCE ENGINEERING, INC. DATED JULY 7, 2004.
2. GROUNDWATER CONTOURS BASED ON LINEAR INTERPOLATION BETWEEN AND EXTRAPOLATION FROM DATA, TOPOGRAPHIC CONTOURS, AND KNOWN FIELD CONDITIONS. THEREFORE, GROUNDWATER CONTOURS MAY NOT REFLECT ACTUAL GROUNDWATER CONDITIONS.
3. SPRINGHEAD MEASURED ON AUGUST 17, 2006.

Golder Associates
GREENSBORO, NORTH CAROLINA

PROJECT
WCA OF HIGH POINT CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL AND RECLAMATION FACILITY

TITLE
SEASONAL HIGH GROUNDWATER SURFACE CONTOUR MAP WITH PROPOSED BASE GRADES

PROJECT No.		063-65
FILE No.		0636526A
REV.	SCALE	AS SHO
DESIGN	DYR	9/25/
CADD	CLF	10/02/
CHECK	DR	4-13-0
REVIEW	RK	4-13-07

DWG. DH-

MONITORING WELL P-23 (MW-8)
N: 802,748.0009
E: 1,726,285.1957
ELEV: 762.60 (TOP OF PVC)
ELEV: 760.57 (GROUND @ WELL)

MONITORING WELL P-25
N: 802,762.7379
E: 1,726,810.0354
ELEV: 805.24 (TOP OF PVC)
ELEV: 802.49 (GROUND @ WELL)

MONITORING WELL P-24
N: 802,562.7000
E: 1,726,620.0444
ELEV: 799.27 (TOP OF PVC)
ELEV: 797.42 (GROUND @ WELL)

MONITORING WELL P-26S
N: 802,360.7709
E: 1,726,918.6903
ELEV: 808.71 (TOP OF PVC)
ELEV: 806.46 (GROUND @ WELL)

MONITORING WELL P-26D
N: 802,351.9716
E: 1,726,918.8177
ELEV: 807.02 (TOP OF PVC)
ELEV: 805.77 (GROUND @ WELL)

1309.64' — N12°11'18"W

1096.37' — N03°03'03"E

1318.46' — N10°51'25"E

961.61' (P-11 TO P-26S) — N21°47'34"E

953.50' (P-11 TO P-26D) — N21°59'46"E

606.18' — N32°54'17"E

521.52' — N15°18'18"E

596.02' — N58°54'29"E

346.97' — N63°18'02"E

411.95' — N71°53'37"E

297.61' — N88°01'22"E

460.66' — N83°52'28"W

158.71' — S37°15'50"E (P-11 TO P-30D)

147.60' — S42°02'27"E (P-11 TO P-30S)

152.45' — S40°59'11"E (P-11 TO P-31)

326.46' — S35°50'15"E

MONITORING WELL P-27
N: 801,970.9058
E: 1,726,699.3513
ELEV: 799.99 (TOP OF PVC)
ELEV: 796.34 (GROUND @ WELL)

MONITORING WELL P-28
N: 801,976.7739
E: 1,726,890.9706
ELEV: 787.35 (TOP OF PVC)
ELEV: 784.56 (GROUND @ WELL)

MONITORING WELL HA-3
N: 801,744.6849
E: 1,727,020.7040
ELEV: 752.23 (TOP OF PVC)
ELEV: 748.55 (GROUND @ WELL)

MONITORING WELL P-29
N: 801,623.7502
E: 1,726,871.6130
ELEV: 762.78 (TOP OF PVC)
ELEV: 759.31(GROUND @ WELL)

SPRINGHEAD S-3
N: 801,595.9073
E: 1,726,953.2419
ELEV: 738.49

MONITORING WELL HA-4
N: 801,478.1484
E: 1,726,859.1261
ELEV: 737.82 (TOP OF PVC)
ELEV: 735.03 (GROUND @ WELL)

MONITORING WELL P-12
N: 801,517.0425
E: 1,726,103.6500
ELEV: 741.16 (TOP OF PVC)

MONITORING WELL P-11
N: 801,467.8865
E: 1,726,561.6768
ELEV: 778.21 (TOP OF PVC)

MONITORING WELL P-30S (MW 7-S)
N: 801,358.2628
E: 1,726,660.5332
ELEV: 763.52 (TOP OF PVC)
ELEV: 761.20 (GROUND @ WELL)

MONITORING WELL P-30D (MW 7-D)
N: 801,341.5679
E: 1,726,657.7895
ELEV: 763.27 (TOP OF PVC)
ELEV: 761.24 (GROUND @ WELL)

MONITORING WELL P-31
N: 801,352.7986
E: 1,726,661.6826
ELEV: 763.07 (TOP OF PVC)
ELEV: 761.10 (GROUND @ WELL)

MONITORING WELL HA-5
N: 801,203.2276
E: 1,726,752.8274
ELEV: 728.17 (TOP OF PVC)
ELEV: 725.93 (GROUND @ WELL)

HARN GRID NORTH

NORTH CAROLINA PROFESSIONAL SEAL L-4421 LAND SURVEYOR THOMAS SCARAMASTRA

8-17-2006

PROPERTY REF:
TAX ID= 523-1-4,1A AND 5 (HIGH POINT)

NOTES:

NO N.C.G.S. MARKER RECOVERED WITHIN 2000 FEET OF PROPERTY.

THIS MAP DOES NOT MEET G.S. 47-30 REQUIREMENTS AND IS NOT FOR RECORDING.

RATIO OF PRECISION IS 1:10,000+.

THIS MAP AND DATA IS NOT TO BE USED FOR THE SALE OR TRANSFER OF ANY REAL PROPERTY.

THIS MAP AND DATA ARE FOR THE EXCLUSIVE USE OF JOYCE ENGINEERING, INC. AND THEIR SPECIFIC ASSIGNS.

THE COODINATES AS SHOWN HEREON ARE BASED ON THE ORIGINAL COORDINATES OF P11 & P12 AS PROVIDED BY JOYCE ENGINEERING FOR THEIR PROJECT 600.00, TASK 06, OF MATERIALS RECOVERY AND RECLAMATION, LLC OF HIGH POINT, RIVERDALE ROAD SITE. THIS BEING THE SAME COORDINATE BASIS USED ON A PREVIOUS PIEZOMETER SURVEY FOR THIS SITE BY FLEMING ENGINEERING, PROJECT #1004-01, DATED 12-19-2002.

PIEZOMETER LOCATION SURVEY FOR:

WCA OF HIGH POINT, LLC

ENGINEER:
GOLDER ASSOCIATES, INC.
4900 KOGER BOULEVARD, SUITE 140
GREENSBORO, NC 27407
(336) 852-4903

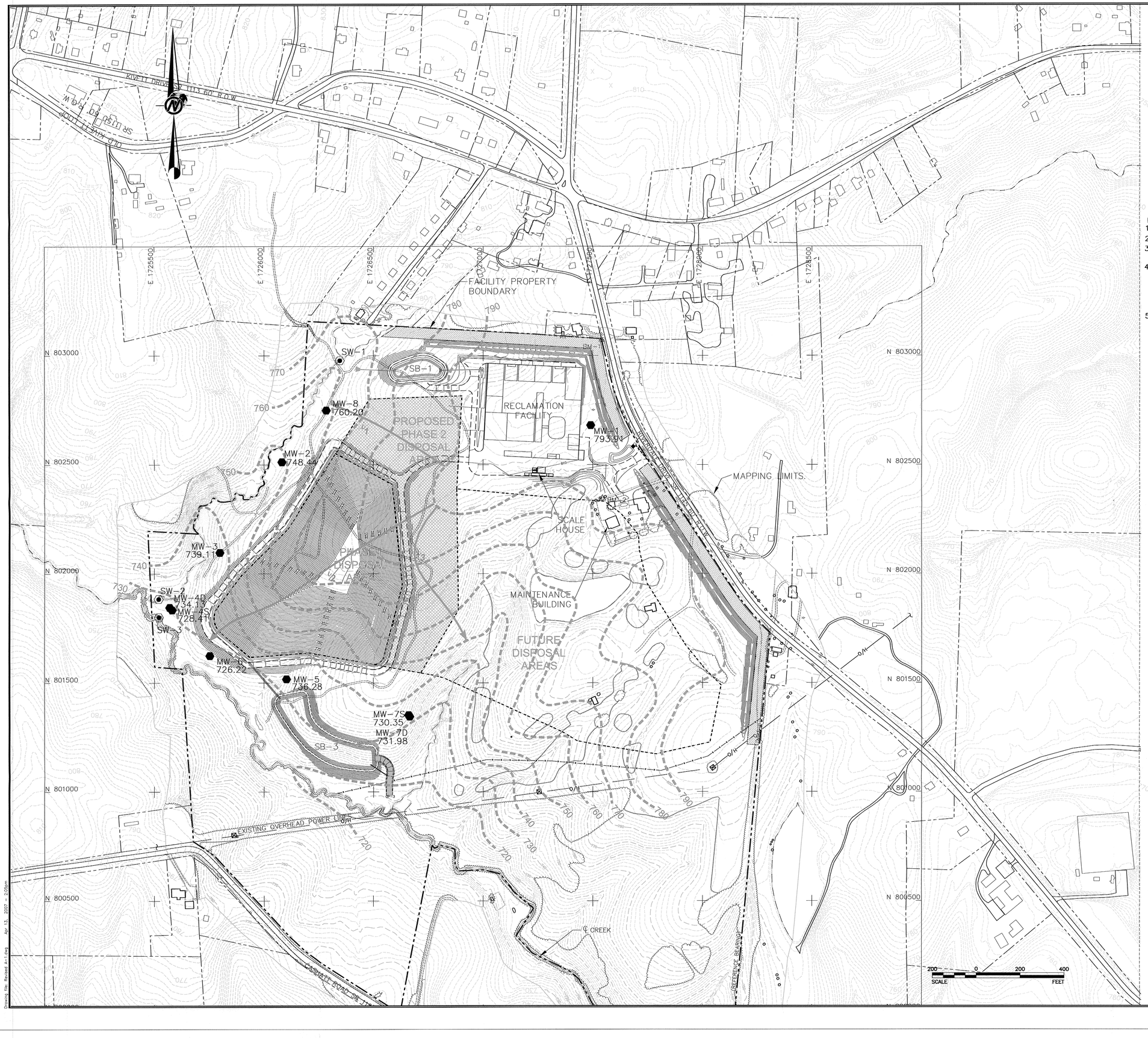
TOWNSHIP:
COUNTY: GUILFORD

NORTH CAROLINA
DATE: 08-16-2006
SCALE: 1"=100'

100 0 50 100 200 400

Fleming Engineering, Inc.
700 Carnegie Place Greensboro, NC 27409
Phone: 336-852-9797 * Fax: 336-852-9766

DRAWN BY: BWC	DRAWING FILE: 729-02\DWG\MW.DWG
PROJ. NO.: 729-02	REF. NO.: 06-041



LEGEND

- EXISTING 10 FT. CONTOUR
- EXISTING 2 FT. CONTOUR
- PROPERTY LINE
- STREAM
- TREELINE
- EXISTING ROAD
- PROPOSED OR EXISTING LIMIT OF WASTE
- MONITORING WELL LOCATION IDENTIFICATION, AND GROUNDWATER ELEVATION — MW-3 ⬢ 737.41
- SURFACE WATER MONITORING POINT — ⬢ SW-1
- BENCH MARK — △BM-1
- SEDIMENT BASIN — SB-1
- GROUNDWATER SURFACE CONTOURS ——760
- GROUNDWATER FLOW SEGMENT USED TO CALCULATE GRADIENT

NOTE:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET
2. GROUNDWATER SURFACE CONTOUR INTERVAL= 10 FEET
3. GROUNDWATER ELEVATIONS MEASURED ON JANUARY 16, 2007.
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 CONDITIONS.
5. 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

Golder Associates

PROJECT

WCA OF HIGH POINT CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL AND RECLAMATION FACILITY

TITLE

PROPOSED MONITORING PLAN

PROJECT No.		063-65
FILE No.		0636526A
REV.	SCALE	AS SHO
DESIGN	DYR	09/21/
CADD	CLF	09/25/
CHECK	DWL	4-13-0
REVIEW	RLK	4-13-0

DWG. WQMP

Drawing File: Revised A-1.dwg Apr 13, 2007 - 1:25pm