PREPARED FOR:
GRANVILLE COUNTY
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BUTNER LANDFILL
PERMIT NO. 39-02

ASSESSMENT OF CORRECTIVE MEASURES

May 2013

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MAY 2013

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Conclusions presented in this report are based upon a review of available information, results of our field studies, results of chemical analyses, and professional judgment. Our conclusions do not reflect variations in subsurface groundwater quality that might exist between or beyond sampling points or between specific sampling events.

To the best of our knowledge, information provided by others is true and accurate, unless otherwise noted.

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ASSESSMENT OF CORRECTIVE MEASURES
Butner Landfill - Granville County - Permit No. 39-02

EXECUTIVE SUMMARY

On behalf of Granville County, Joyce Engineering, (JOYCE) has prepared this *Assessment of Corrective Measures Report* (ACM) for the Butner Landfill permit no 39-02. The ACM was prepared in accordance with North Carolina Solid Waste Management Rules (NCSWMR) 15A NCAC 13B §.1635. This ACM was developed as a result of the confirmed exceedance of Groundwater Protection Standards (GPS) in samples collected from the monitoring well network at the Butner Landfill, and the requirements of NCSWMR §.1634 and §.1635. The contaminant plume at the Butner Landfill consists of one volatile organic compound, benzene, with recent GPS exceedances.

According to §.1635 of the NCSWMR, the purpose of the ACM is to present an analysis of the effectiveness of potential remedial alternatives for this facility. This ACM includes the performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination. The ACM also addresses the time required to begin and complete each remedy, estimated costs of remedy implementation, and institutional requirements, such as State and local permit requirements or other environmental or public health requirements that may substantially affect implementation of each remedy. The ACM is not required or intended to include the selection and/or engineering design of any potential remedial alternatives.

In accordance with the NCSWMR, the County assessed remedial alternatives relevant to the reported release and site-specific conditions at the landfill. Remedial alternatives were evaluated by first identifying those remedial alternatives applicable to the contaminants observed at the site and the impacted media at the facility. The applicable remedies were then screened using a rapid assessment-screening matrix designed to identify those remedial alternatives most applicable to conditions at the facility. Based on the results of recent assessment activities, conclusions from the risk assessment, and the ACM screening matrix, the following remedial alternatives were retained for further evaluation as potential corrective strategies at the Butner Landfill:

- Landfill Gas Control;
- Monitored Natural Attenuation;
- Phytoremediation;
- Constructed Wetlands;
- Enhanced Bioremediation;
- Air Sparging;
- Pump and Treat; and
- Permeable Reactive Barrier.

Granville County will discuss the results of the ACM, prior to the selection of a remedy, in a public meeting upon preliminary approval of the ACM by the North Carolina Department of Environment and Natural Resources (DENR) Solid Waste Section (SWS). The County will provide public notice at least 30 days prior to the meeting, and will adhere to the remaining requirements of *15A NCAC 13B .1635(d)*.

ASSESSMENT OF CORRECTIVE MEASURES
Butner Landfill - Granville County - Permit No. 39-02

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ASSESSMENT OF CORRECTIVE MEASURES
Butner Landfill - Granville County - Permit No. 39-02

1.0 INTRODUCTION

On behalf of Granville County, Joyce Engineering, Inc. (JOYCE) has prepared this *Assessment of Corrective Measures Report* (ACM) for the Butner Landfill (facility). This ACM was prepared in accordance with §.1635 of the North Carolina Solid Waste Management Regulations (NCSWMR) 15A NCAC 13B, in response to confirmed exceedances of the 15A NCAC 2L.0202 (NC 2L) Groundwater Standard for benzene in MW-2R during the second semiannual sampling event of 2012, conducted in November 2012. The ACM was initiated on January 30, 2012 with a letter from JOYCE to the SWS.

This ACM addresses the requirements presented in §.1635 and §.1636 of the NCSWMR, and provides an analysis of the effectiveness of potential corrective measures for the treatment of impacted groundwater at the facility. The ACM addresses the performance, reliability, ease of implementation, and potential environmental impacts of remedies; and includes safety impacts, cross-media impacts, and residual contamination exposure control. The ACM also addresses the time required to implement and complete the remediation, the estimated costs of implementation and maintenance, and institutional requirements such as State or local permits or other environmental or public health requirements that may substantially affect the implementation of the potential remedies. The ACM is not required to, and does not provide, engineering designs for the potential remedial alternatives, nor does it provide corrective action monitoring plans or corrective action schedules.

1.1 Site Background

The Butner Landfill is a closed municipal solid waste (MSW) landfill, located off State Route 1004 near the town of Butner, in Granville County, North Carolina (Figure 1). The Butner facility started receiving waste prior to May 1973. Permit Number 39-02, was issued from the State of North Carolina on March 3, 1982. The facility stopped receiving waste in August 1998. A small recycling center and transfer station are operated by the County of Granville at the entrance of the closed landfill.

The facility's monitoring well network was upgraded during 1994 when the site's existing up-gradient and down-gradient wells were replaced and three more down-gradient wells were added. The current compliance network consists of the following six monitoring wells: MW-1R (facility background well), MW-2R, MW-3R, MW-4, MW-5, and MW-6. An additional well, NES-1, was installed as part of a Nature and Extent Study on November 14, 2007. Monitoring well construction details are summarized in Table 1, and the well locations are shown on Drawing 1. Boring Logs for the monitoring wells are included in Appendix A.

In accordance with NCSWMR, the Butner Landfill entered an Assessment Monitoring Program in December of 1997 as a result of detections of volatile organic compounds and pesticides

above NC-2L Groundwater Standards. An ACM was initiated in 2003, and then suspended by North Carolina Department of Environment and Natural Resources (DENR) because there had been no more NC-2L exceedances. The Nature and Extent Study (NES) and ACM recommenced in 2007, when apparent volatile organic compound (VOC) exceedances of the NC-2L Standards began to appear; however, they were again suspended when it was determined that the apparent exceedances were not statistically significant increases (SSIs) above background. Due to the recent detections of benzene above its GPS during the December 2012 semiannual sampling event, the January 2013 verification sampling event, and subsequent verification sampling events, Granville County is again proceeding with the Butner Landfill's ACM.

1.2 Aquifer Characteristics

The depth to groundwater in the Piedmont is highly variable depending on soil thickness and subsurface fractures. Groundwater can occur in substantial volumes where soils are very thick, but typically groundwater is found in minimal volumes in bedrock, primarily restricted to fractures. The water table under the area of investigation was encountered in the unconfined aquifer that is mostly in the transition zone that consists of saprolite and highly fractured bedrock. Groundwater in the saprolite feeds the fractures in the bedrock and is discharged into creeks south of the landfill. Groundwater flow direction at deeper levels within the fractured bedrock is controlled by fracture orientation. This unconfined aquifer is pervasive across the site and the water table generally mimics the surface topography.

Depth to water ranges from 2 to 10 feet below grade in wells MW-2R, MW-3R, and MW-4; and 10 to 15 feet below grade in MW-5, MW-2, and MW-6. The saturated portion of the uppermost aquifer beneath the study area is vertically continuous to bedrock, as no confining layers were encountered during the site investigation. Depth to groundwater is measured in all compliance monitoring wells at the site prior to each sampling event. The groundwater elevations calculated relative to the surveyed measuring point (top of casing) for each monitoring well are summarized in Table 2. The groundwater elevation contours shown in Drawing 2 are based on data from the December 2012 sampling event. Groundwater flow beneath the facility is predominantly to the south and southeast. Aquifer hydraulic properties are summarized in Table 3, and groundwater flow velocity calculations are included in Table 4. Aquifer test data and calculations are included in Appendix B. For more details on the hydrogeologic flow regime, see Section 1.4.2.

1.3 Contaminant Distribution

Based on recent groundwater sampling at the facility there appears to be one plume and associated area of concern (AOC) for the Butner Landfill. The AOC is characterized and defined by groundwater samples collected from MW-1R, MW-2R, MW-3R, MW-4, MW-5 and NES-1. Monitoring wells MW-1R, MW-2R, MW-3R MW-4 and MW-5 are included in the facility compliance network and have been sampled semiannually since their installation in 1994. The 1994 Water Quality Monitoring Plan, which was part of the site's Transition Plan, is included as Appendix C. Well NES-1 was installed in November 2007 and has been sampled three times,

twice (December 2007 and June 2009) in conjunction with the compliance network sampling and once (January 2013) in conjunction with a verification sampling event. The locations of the monitoring wells are shown on Drawing 1.

The AOC is located hydraulically downgradient of the waste disposal area. Based on the groundwater surface contours shown on Drawing 2, groundwater flow from this area is expected to be southward, toward drainage features located along the southern and edges of the site. Surface water drainage from the site is predominately to an unnamed tributary of Picture Creek, which is also considered to be a groundwater discharge feature. Flow in the unnamed tributary along the southern edged of the site is to the west.

Table 5 presents a summary of NC Appendix I and II constituents which have been detected at quantifiable concentrations above North Carolina Solid Waste Section Limits (SWSL) in the groundwater at the facility. Table 5 includes information about exceedances of various groundwater protection standards for each constituent. Historical detections of inorganic and organic constituents in the groundwater are presented in Tables 6 and 7, respectively; and historical detections of inorganic and organic constituents in the surface water are presented in Tables 8 and 9, respectively. Table 10 presents historical field parameter data for groundwater and surface water. Table 11 presents groundwater quality geochemical data available for the site. The complete laboratory report and chain-of-custody for the December 2012 sampling event are included in Appendix D.

Currently, only benzene in MW-2R is present at a concentrations greater than the regulatory GPS as defined in NCSWMR §.1634.g. A few other organic constituents have been historically detected in MW-2R, MW-3R, and MW-4; however, they have generally been detected at low concentrations below the SWSL, and/or below the GPS. Only two other organic constituents are currently detected at concentrations above the SWSL: 1,4-Dichlorobenzene in MW-3R and MW-4R; and chlorobenzene in MW-3R.

Figure 3 presents a plot of the total Appendix I VOC concentrations versus time in MW-2R (excluding some 1997-1998 detections of carbon disulfide, which are suspect, and isolated detections of isobutanol in June 2010 and June 2011, which is not an Appendix I constituent). The plot shows no clear trend in total VOC concentrations in MW-2R. Figure 4 presents a plot of the benzene concentrations versus time in all monitoring wells at the facility. The plot shows no benzene detections prior to December 2006. From December 2006 to present, benzene in MW-2R has fluctuated generally between 1 µg/L and 2 µg/L, with no clear trend. From December 2007 to present, benzene in MW-3R has fluctuated generally between 0.3 µg/L and 0.7 µg/L, with a possible slight upward trend. From December 2007 to present, benzene in MW-4R has fluctuated generally between 0.0 µg/L and 0.4 µg/L, with no apparent trend.

Cross sections A-A' and B-B' are presented in Drawing 3 (see Drawing 2 for cross-section locations). The cross sections depict the horizontal and vertical extent of the benzene and total VOC plumes. Isoconcentration maps of total VOCs and benzene from the December 2012 sampling event are included as Drawings 4 and 5, respectively.

The downgradient distribution of the plume is defined by wells MW-1R, MW-2R, and NES-1, from north to south as shown in Drawing 3 as Cross-section A–A'. To date, no organic constituents have been detected in NES-1; therefore, the downgradient extent of the plume is well-constrained. The cross-gradient area of the plume is defined by wells MW-2R and MW-4 from west to the east and show as Cross-section B–B' in Drawing 3.

The vertical extent of the plume is defined by well MW-3R, which is located next to MW-2R, but with a deeper screened interval. MW-2R is screened from 1.51-16.51 feet below ground surface (ft-bgs), and MW-3R is screened from 23.65-33.65 ft-bgs. Benzene has not been detected above its NC 2L standard in MW-3R; therefore, the vertical extent of the exceedance is constrained to the zone above the screened interval of MW-3R, that is to say, to less than 23 ft-bgs.

Drawing 6 shows the surface water quality data for the site, and Tables 8 and 9 present historical surface water data. Surface water samples S-1 and S-2 have shown no detections of VOCs (except for some blank-qualified detections of acetone), including benzene, in the last three years of semiannual sampling, and there has never been an exceedance of NC 2B surface water standards. This adds further control for the downgradient extent of the plume. Furthermore, since the creek is considered a groundwater discharge feature, it is expected to act as a natural barrier to southward migration of the plume.

Based on the most recent data, only benzene in MW-2R is present at a concentration greater than its GPS. As shown on the benzene isoconcentration map (Drawing 5), the extent of the plume is considered to be limited and contained within the facility boundary.

1.4 Site Conceptual Model

1.4.1 Site Geology

The Butner Landfill is located in the Carolina Slate Belt of the Piedmont Physiographic Province of North Carolina. The geologic province is characterized by a rolling topography with a thick mantle of saprolite overlying Late Proterozoic and Paleozoic igneous and metamorphic bedrock. The Carolina Slate Belt is comprised of 550 to 650 million year old, metamorphosed sedimentary and volcanic rocks, intruded by granitic rocks. A geologic map of the area has been included as Figure 2.

The topography of the area consists of rolling hills that support farmland and forest. The majority of the landfill area is underlain by Carolina Slate Belt felsic volcanic rocks, which have been metamorphosed into greenish grey foliated tuffs. The southeastern portion of the site is underlain by Triassic Sanford Formation (conglomerate, sandstone, and mudstone), which unconformably overlies the Carolina Slate Belt felsic volcanic rocks. There is no exposure of the Sanford Formation at the site; however, float material consisting of grey, coarse-grained sandstone with quartz pebbles was observed. Diabase dikes have also been observed in the

vicinity of the site. Geologic descriptions were taken from GAI Consultants-NC, Inc. December 1993 *Groundwater and Surface Water Monitoring System* report.

1.4.2 Site Hydrogeology

The water table under the area of investigation was encountered in the regolith and in the transition zone that consists of saprolite and highly fractured bedrock. The saturated portion of the uppermost aquifer beneath the study area is vertically continuous to bedrock, and no confining layers have been encountered during site investigations. This unconfined aquifer is pervasive across the site. The groundwater table generally mimics the surface topography. Depth to water ranges from 2 to 10 feet below grade in wells MW-2R, MW-3R, and MW-4; and 10 to 15 feet below grade in MW-5, MW-2, and MW-6 (Table 2).

The groundwater elevation contours shown in Drawing 2 are based on data from the December 2012 sampling event. Groundwater flow beneath the facility is predominantly to the south and southeast. Horizontal groundwater gradients were estimated from the December 2012 groundwater levels and are summarized in Table 2. Horizontal gradients across the site ranged from 0.0495 to 0.0534 ft/ft, with an average of approximately 0.0520 ft/ft. This value is consistent with previous estimates.

Linear groundwater flow velocities were computed using the modified Darcy equation: $\boldsymbol{V = Ki/n_e}$, where **V** = average linear velocity (feet/day), $\boldsymbol{K}$ = hydraulic conductivity (feet/day), $\boldsymbol{i}$ = horizontal hydraulic gradient, and $\boldsymbol{n_e}$ = effective porosity. The average of hydraulic conductivities ($\boldsymbol{K}$ = 2.18×10^{-05} cm/sec = 6.18×10^{-02} feet/day) from slug-tests conducted in 1994 (GAI, 1994) was used in these calculations (see Tables 3 & 4). The average effective porosity ($\boldsymbol{n_e}$ = 18%) based on 90% of reported total porosity for soils (GAI, 1994), and 10% for fractured bedrock was also used (see Tables 3 & 4). Although the regolith and bedrock are hydraulically connected, the effective porosity generally decreases with depth into the underlying fractured bedrock. The modified Darcy equation makes the simplifying assumption of a homogeneous and isotropic aquifer. The calculated linear groundwater velocities range from approximately 6.2 to 6.7 feet/year, and the average estimated linear groundwater flow velocity under the facility was calculated at approximately 6.5 feet/year (see Table 4). Groundwater flow direction beneath the landfill is predominantly to the south and southeast.

Because of our conservative estimate of effective porosity, actual groundwater velocities may be significantly less than those calculated. Also, the linear velocity equation and resulting rates make the simplified assumptions of a homogeneous and isotropic aquifer. This equation can over estimate velocity when applied to heterogeneous and/or anisotropic conditions such as are believed to exist at this site.

Monitoring wells MW-2R and MW-3R represent of nested pair of wells with different screened intervals. MW-2R is screened from 1.51-16.51 feet below ground surface (ft-bgs), and MW-3R is screened from 23.65-33.65 ft-bgs, giving a vertical distance between screen midpoints of 19.64 feet. The groundwater elevation is typically higher in MW-2R than in MW-3R, indicating a downward vertical hydraulic gradient. The December 2012 water level measurements

indicated a groundwater elevation of 329.19 feet above mean sea level (ft-amsl) in MW-2R, and 328.36 ft-amsl in MW-3R. This gives us a calculated downward gradient of 0.042 ft/ft between these two wells, indicating a weak downward component to groundwater flow.

1.4.3 Groundwater Flow Modeling

Groundwater flow modeling was performed to model theoretical migration of the contaminant plume based on known and estimated aquifer characteristics and current plume data. The use of groundwater flow models is prevalent in the field of environmental hydrogeology to predict the fate and transport of contaminants for risk evaluation purposes. For the Butner landfill, JOYCE developed a groundwater flow model by using Visual MODFLOW Version 2011.1 from SWS Inc. The conceptual model was built by analyzing the hydrogeological and topographic data for the site. Hydrologic parameters have been calibrated based on the available data observed in 2012 and the calibrated results show that the computed water heads fit well into the measured data, which indicate that the conceptual model and the parameters used in the model can reflect the actual physical system of the study domain. The calibrated parameters were very useful in identifying the aquifer properties and were used to analyze the groundwater flow dynamics, contaminant concentrations and the changes of groundwater levels in the study area.

Modfow was used to predict fate and transport of the total VOC plume over the next 5, 10, 20, and 30 years. The results of Modflow modeling are presented in Appendix E. Current (2012) contaminant data were used to calibrate this model. Total predicted VOC contaminant concentrations are shown in the current year 2012 (Appendix E, Figure 1), as well as future years: 2017 (Appendix E, Figure 2), 2022 (Appendix E, Figure 3), 2032 (Appendix E, Figure 4) and 2042 (Appendix E, Figure 5). Appendix E, Figure 6 shows the observed heads versus the heads predicted by the groundwater flow model. As can be seen from this figure, the modeled heads represent a good fit for the observed data. The results indicate that even after 30 years of migration under current conditions, the plume is not likely to migrate beyond the property boundary.

2.1 Contaminants of Concern (COC)

Currently, the only contaminant of concern (COC) is benzene, which has been detected in exceedance of its GPS in MW-2R.

2.1.1 Benzene

Benzene is a colorless liquid or gas with a sweet-smelling odor. The vapor pressure of Benzene is characteristic of the rapid evaporation of aromatic hydrocarbons into air. Benzene is highly flammable. The origin of benzene can be from both natural and human processes and activities. Benzene naturally occurs in crude oil, and is found in refined petroleum products, such as gasoline. Benzene can be released in volcanic activity, forest fires, or even cigarette smoke. Benzene is used to make other chemicals, which are in turn used in the production for some plastics, resins, nylon and other synthetic fibers, some types of rubber, lubricants, dyes, detergent, solvents, drugs, and pesticides. Benzene is slightly soluble in water.

The primary human exposure pathway for benzene is via inhalation. Dermal absorption is poor. Reactive metabolites such as benzene oxide have been implicated in the mechanisms of benzene toxicity. Health effects and symptoms of acute exposure to benzene include drowsiness, dizziness, delirium, loss of consciousness, respiratory arrest, and/or death. Health effects of chronic exposure include anemia and leukemia. Benzene is a known human carcinogen and clastogen, but is not considered to be a reproductive toxicant.

Physical and chemical properties of benzene are presented in Table 12. Fate and transport characteristics of benzene are summarized in Table 13. Tables 14, 15, and 16 present benzene toxicity data for oral ingestion, inhalation, and dermal exposure, respectively.

2.2 Contaminant Source Confirmation

There are two possible sources of the above-listed contaminant of concern. The first is leaching of constituents from waste in the closed, unlined MSW landfill into the groundwater as a result of percolation of rainwater through the waste. The second is partitioning of VOC's in landfill gas into the groundwater, either within a well, or in the capillary fringe where vapors in the vadose zone come into contact with groundwater near a well. Impact from leachate is expected to only impact groundwater down-gradient of the landfill. Impacts detected upgradient or side-gradient from the landfill are most-likely indicative of gas impacts; however, gas can also affect down-gradient wells. There are no known off-site sources for these contaminants.

2.3 Source Control Measures

The unlined MSW Butner landfill ceases accepting waste in August of 1998 and began Closure and Post Closure Requirements as outlined in NCSWMR §.1627(c)(1) regarding the installation of a cap system over the waste. According to the Rule, existing MSW landfills are required to install a low permeability cap system that is designed to minimize infiltration and erosion. The cap system was constructed with earthen material and was completed in 1998. Following the installation of the cap system, passive landfill gas vents were installed.

2.4 Groundwater End Use

The facility does not have any direct use of the groundwater or surface water at the site. According to the Granville County's GIS records, shown in Drawing 7, all of the land surrounding the Butner Landfill, with the exception of a small sewer pump station, is state owned, undeveloped, protected wildlife land. The only onsite supply well was abandoned on May 29, 2007. The well abandonment recorded has been included as Appendix F. The closest downgradient private property is approximately a half a mile away. Currently, a municipal water supply serves the landfill and surrounding area. The water main is shown on Drawing 7. Neither the aquifer nor surface water in the vicinity of the facility is considered to be a primary source of potable drinking water. There are no known potable water supply wells or potable surface water intakes within at least ½ mile of the Butner landfill. Lake Butner, a water supply

lake, is located approximately 3000 feet northwest of the facility (Figure 1, Drawing 7); however, there is a hydraulic divide between the site and the lake, and groundwater flow from the site is toward the south, away from the lake.

2.5 Sensitive Receptor Pathways

Numerous surface water features, including intermittent, ephemeral, and perennial drainages, man-made drainage ditches, and three man-made sediment basins, are located at or near the Butner County Landfill. The landfill is bound to the south by an unnamed tributary of the Picture Creek. The landfill is bound to the west by a man-made drainage ditch that runs along the side of Butner Road. All of the drainages on the site eventually flow into the unnamed tributary of the Picture Creek. Historically, two surface water points SW-1 (upgradient) and SW-2 (downgradient) have been sampled semiannually in conjunction with the groundwater sampling at the Butner Landfill. Historical surface water sampling data (Table 8 and 9) indicate that groundwater discharge into the surface water features has not significantly impacted the surface water; therefore, the surface water does not constitute a sensitive receptor pathway risk.

As a part of every semiannual monitoring event, JOYCE has instituted a visual inspection program in order to detect potential releases. This inspection program involves field personnel making the following observations:

- Observation of stress induced on the biological community (i.e., dead or dying vegetation),
- Indications of leachate impact (i.e., seeps, impacted surface water),
- Observations of erosion; and
- Negative changes around the waste facility

Currently there is no obvious evidence of distressed vegetation or obvious impacts to wildlife as a result exposure to the contaminant plume associated with the AOC.

2.6 Exposure Pathways – Risks

Potential pathways for human exposure include inhalation of vapors, dermal contact, and ingestion of contaminated groundwater. A pathway is considered complete if contaminants have impacted or can potentially impact a receptor. Pathways for flora, fauna, and microbial populations include the uptake/consumption of impacted water, the uptake/inhalation of impacted air, and contact with and/or ingestion of impacted soil. The potential pathways for each of the potential receptors identified previously are discussed in the following sections.

Currently the only human exposure pathways will be through direct contact with contaminated groundwater by personnel involved in installation and/or sampling of monitoring wells on the site. Personnel engaged in these activities are well-trained in sampling techniques, personal protective equipment, and incident response so as to minimize the potential for unsafe exposure.

2.6.1 Butner Landfill Contract Workers

Butner Landfill contract workers can potentially be exposed to the COC via contact with impacted groundwater during groundwater monitoring and gauging activities. Although contract workers are trained to minimize their exposure by using appropriate personal protective equipment and by avoiding contact with groundwater, this pathway is considered complete.

2.6.2 Flora and Fauna

The potential risk to the environment is to downgradient flora or fauna, and microorganisms in the impacted aquifer. Flora and fauna on or above the ground surface are at minimal risk, because there have been no confirmed detections of the COC in the downstream surface water samples. Organisms suspected to be living in the subsurface at the site are at potential risk; however, soil microorganisms are known to use the organic acids and by-products of the degradation process of the groundwater plumes as a food source; therefore, the potential risk to the environment from the impacted groundwater is considered to be low.

2.7 Background Concentrations

Monitoring well MW-1R is designated as the background well for the facility. This well replaced the previous background well (MW-1) beginning with the April 1994 sampling event. It is located approximately 450 feet north of the limits of waste. Facility background data used to evaluate the groundwater monitoring data include all data collected for wells MW-1R from April 1994 to present. Results from historical sampling events indicate only the presence of naturally occurring metals in MW-1R. The historical concentrations of constituents in the background wells are included in Tables 6 and 7.

2.8 Groundwater Protection Standards (GPS)

In accordance with the NCSWMR §.1634.g, the regulatory GPS for constituents detected in the groundwater for this site are equal to the 15-NCAC-2L.0202 (NC 2L) Groundwater Standards for each constituent, with the following three exceptions: 1) for constituents which have no official NC 2L standard, the DENR-SWS has established GWPS values; 2) for constituents with NC 2L standards below the Solid Waste Section Limits (SWSL), the GPS is the SWSL; and 3) if the statistical background value for a constituent is greater that the NC 2L, GWPS, or SWSL, the background value can be considered the GPS, with DENR approval. A list of all NC Appendix I and II constituents and their respective NC 2L Standards and/or GWPS values is included in Appendix G of this report.

Constituents with historical NC 2L exceedances in compliance wells since the current monitoring network was implemented in 1999 include benzene and 1,4-dichlorobenzene. 1,4-dichlorobenzene has been detected consistently in MW-2R, but has not been detected above its NC 2L since December 2009. Benzene has been consistently detected above its GPS in MW-2R since December 2006. Prior to the April 2011 revision of the NCSWMR, a constituent detection had to represent a statistically significant exceedance of the NC 2L Standard in order to trigger

corrective action. After the April 2011 revision, any exceedance of a GPS triggers corrective action.

2.9 Surface Water Quality Standards (SWQS)

The surface water quality standards (SWQS) for constituents detected in the groundwater for this site are equal to the 15-NCAC-2B (NC-2B) Surface Water Standards for Water Supply-classified surface waters. For any detected constituent without a listed NC-2B standard, the SWQS will be considered equal to the SWSL. A list of all NC-2B Surface Water Standards is included in Appendix H of this report. The landfill is bordered to the east and southeast by an unnamed tributary to the Picture Creek, which is classified "C", for waters protected for secondary recreation, aquatic life, and wildlife. To date, there have been no SWQS exceedances for this site.

2.9 Media of Concern

Benzene has been detected in one exposure medium at the landfill: groundwater. Groundwater beneath the landfill property appears to have been impacted by leachate that originates from the unlined landfill and/or by the migration of landfill gas.

Soil is not considered to be an exposure medium, since the constituent-of-concern concentrations in the soil are expected to be very low outside of the landfill waste footprint, where impacts from leachate may be occurring. Outside of the waste footprint, impacts to soil are expected only from landfill gas and volatile emissions from groundwater. Since the potential risk associated with vadose zone emissions of soil gas should be less than the risk associated with dermal contact and ingestion of impacted soils, soil is not considered as an exposure medium. Similarly, landfill gas is not considered to be an exposure medium, since quarterly compliance monitoring results indicates that methane concentrations in soil are generally below the regulatory limit of 5% methane by volume.

Surface water is not considered to be an exposure medium. Surface water samples that are collected semiannually, downgradient from the waste cell, from an unnamed tributary of the Picture Creek to the southeast and southwest of the disposal area have not contained concentrations of benzene above laboratory detection limits.

3.0 CORRECTIVE MEASURES SCREENING AND EVALUATION

3.1 Overview/Screening

The purpose of this ACM is to identify technologies that are realistic, potential remedies for the reported release at the landfill. Selection of realistic remedies is driven by site conditions and characteristics of the COC (benzene) reported at the facility.

There are numerous technologies available that can remediate groundwater contaminated with dissolved-phase VOCs; however, the selection of a successful remedy is based on the geologic and hydrogeologic conditions underlying the facility, and the potential risks associated with the release. Additionally, the type and size of the source (one that can be removed versus one that cannot be removed) and the urgency of the remedial effort, or aggressiveness, are considered when selecting a remedy. The need for an aggressive or non-aggressive remedy is usually controlled by the risk(s) associated with the release (i.e., a high risk may dictate an aggressive remedy while a low risk may dictate a less aggressive, more cost effective remedy). Additionally, the use of more than one remedy may be required to meet regulatory standards.

Some remedial technologies are already in place at the facility. These include institutional controls and infiltration controls, which will be described in Sections 3.2 and 3.3, respectively. In addition, some landfill gas controls are already in place, including gas monitoring probes and 3 gas vents (see Drawing 1). Further gas controls will be discussed in Section 3.3.

Due to the above considerations, as well as the remedy selection criteria set forth in NCSWMR § .1636.b, and the remedy implementation criteria presented in § .1637.d, a screening matrix (Table 17) was used to objectively rate available and proven remedial technologies capable of attaining approved groundwater protection standards. Upon reviewing the screening results, the remedial options that scored 35 or higher were retained for further consideration.

The following eight remedial technologies are considered to be the most applicable and/or appropriate for this facility based on the screening results. More detailed review of each option can be found in the referenced section of this report.

- Control of Landfill Gas (LFG) – Section 3.4;
- Monitored Natural Attenuation (MNA) – Section 3.5;
- Phytoremediation – Section 3.6;
- Constructed Wetlands – Section 3.7;
- Enhanced Bioremediation (EB) – Section 3.8;
- Air Sparging (AS) – Section 3.9;
- Pump-and-Treat (P&T) – Section 3.10; and
- Permeable Reactive Barrier (PRB) – Section 3.11.

3.2 Institutional Controls

Corrective measures that involve institutional controls are discussed in the following section. These activities do not actively modify the quality of the groundwater, but they represent safety measures and controls that monitor the source area and/or ensure there are no risk pathways to human receptors.

3.2.1 Site Monitoring

Presently, Groundwater and surface water monitoring at the Butner Landfill is completed in accordance with NCSWMR §.1634. The site is currently in an Assessment Monitoring

Program. Groundwater samples are collected semiannually and analyzed for all constituents listed in NCSWMR Appendix I plus previously detected Appendix II constituents during the fall sampling event, and all NCSWMR Appendix I and Appendix II constituents during the spring sampling event. Surface water samples are collected and sampled for Appendix I constituents during each sampling event. As a part of every semiannual monitoring event JOYCE has instituted a visual inspection program in order to detect potential releases.

As a part of every semiannual monitoring event JOYCE has instituted a visual inspection program in order to detect potential releases. This inspection program involves field personnel making the following observations:

- Observation of stress induced on the biological community (i.e., dead or dying vegetation),
- Indications of leachate impact (i.e., seeps, impacted surface water),
- Observations of erosion; and
- Negative changes around the waste facility

Currently there is no obvious evidence of distressed vegetation or obvious impacts to wildlife as a result exposure to the contaminant plume.

3.2.2 Access Controls

Currently, the only potential human receptors at the site are workers, consultants, and visitors to the convenience center. Access to the landfill facility is controlled by fencing and locked gates, and all monitoring wells are protected by a locked steel cover. Both the workers and visitors to the convenience center should never become exposed to the AOC as the convenience center is located at the upgradient northern corner of the property. The AOC is located at the southern edge of the property, and access is controlled by an onsite attendant. Consultants include personnel monitoring landfill gas boundary probes and collecting compliance groundwater samples. Personnel engaged in these activities are well-trained in sampling techniques, personal protective equipment, and incident response so as to minimize the potential for unsafe exposure.

3.2.3 County Restrictions on Water Supply Wells

One potential exposure to impacted groundwater by human receptors is through drinking water wells. The only onsite supply well was abandoned on May 29, 2007. The well abandonment recorded has been included as Appendix G. All of the property surrounding the landfill is undeveloped, state owned, protected land. In addition, the area is served by the municipal water supply (Drawing 7). There is currently no need for the county to place any deed restrictions on the surrounding land at this time.

3.2.4 Alternate Water Supply

Potential human receptors at the landfill fall under the convenience center workers and visitor scenario. Placement of the convenience center on the upgradient corner of the property, there is minimal risk or direct exposure to the impacted groundwater through inhalation, ingestion, or

dermal contact. The convenience center and surrounding area is served by the municipal water supply, as shown in Drawing 7; therefore, providing an additional alternative water supply source is not necessary at this time.

3.3 Infiltration Controls

The Butner Landfill was closed and stopped receiving waste in August 1998. The landfills waste unit is covered with up to approximately six feet of vegetated soil. The current cap system on the landfill meets the requirements of the NCSWMR. Installation of additional, lower permeability cap would probably not reduce infiltration appreciably, taking into account implementation of best management practices with respect to storm water and sedimentation control.

3.4 Landfill Gas Controls

Control of migrating landfill gas is a viable remedy for groundwater as it addresses one mechanism by which the groundwater can be impacted by VOCs from a landfill. VOC's detected in groundwater samples collected from wells near solid waste landfills are often attributed to impacts by landfill liquids (leachate) without consideration of other potential sources, such as landfill gas. Typically, landfill gas (LFG) is made up of approximately 50-55% methane, 40-45% carbon dioxide, and 1-5% other VOC's, including vinyl chloride and benzene (Allen, et al, 1997; Deipser and Stegmann, 1994; Cowie, 2004). Numerous studies have established that VOC's present in landfill gas can readily partition into groundwater. Transfer of VOC's from gas to groundwater can occur both inside monitor wells and/or in the vadose zone outside of the monitor wells.

With the closure of the Butner landfill, an impermeable soil cap was placed over the MSW landfill. This impermeable cap could potentially force LFG to migrate outward, away from the waste disposal unit, cross-contaminating the groundwater in the process. Four passive gas vents are currently in place in the closed waste cells to control LFG buildup and migration; however, additional passive landfill gas vents could be installed in and around the waste disposal cells, particularly on the southern face, above the contaminant plume, to increase control of LFG migration and reduce LFG impacts to groundwater. Additionally, the passive LFG vents could be connected to an active LFG extraction system as needed in the future to increase the control of decomposition gases at the site.

An alternate mechanism for control of decomposition gases (LFG) may be installation of a gas intercept trench along the southern boundary of the waste unit, between the edge of waste and MW-2R. The trench could be approximately 500-750 feet long, 2-3 feet wide, and 10-15 feet deep. The depth will vary along the trench based on the depth to groundwater and/or bedrock.

3.4.1 Performance and Reliability

Passive landfill gas vents have been used as a reliable means to control decomposition gases at solid waste disposal facilities for many years. The overall performance of passive landfill gas

vents is highly dependent on the properties of the soil they are installed in. The more porous the soil media the more effective passive landfill gas vents perform. To enhance their performance, the vents may be installed in trenches excavated to groundwater and filled with gravel. One passive landfill gas vent typically has a radius of influence of 15-20 feet.

3.4.2 Implementation Requirements

Implementation of landfill gas control for groundwater remediation will require the following steps: 1) Design of a passive vent system for the southern end of the landfill, or design of a gas intercept trench along just south of the edge of waste; and 2) Design of an optional active gas extraction system that can be hooked up to either the gas vents or the intercept trench as a contingency in case the passive system proves ineffective.

3.4.3 Remediation Impacts

There is cross-media impact expected by using passive landfill gas vents. Venting landfill gas will transfer the impacts to the atmosphere. Although the gas control remedy is intended to eliminate risk by removing the exposure route (groundwater) from the risk equation, a potential risk will remain. By venting landfill gas into the atmosphere, the potential for an explosive environment could be created and a potential risk to exposure to the COC by inhalation could be created; however, vented landfill gas readily disperses in the atmosphere, and the risk to human health is considered low. An active gas extraction system could be used to apply vacuum to the gas vents and may allow the gas to be burned off by flare, however the Butner facility is a relatively small, older site, and volatilization may not produce landfill gas in sufficient quality to maintain a burning gas flare.

3.4.4 Remediation Timeframe

The timeframe for an observable decrease in the COC will vary depending on the number of passive landfill gas vents that are installed. If sufficient additional passive vents are installed, an observable decrease in the COC could be documented within 1-3 years. Since the source of contamination is continually renewed, an observable decrease may not be noticed until after landfill gas production ceases. If the LFG impacts are not effectively reduced by passive venting, a second phase of active landfill gas extraction could be designed and implemented. An active landfill gas extraction system (AGES) would apply vacuum to the installed passive vents, effectively increasing the area of influence and rate of LFG removal from the waste that could be adjusted according to field conditions. An AGES could significantly decrease the remediation timeframe.

3.4.5 Permitting or Institutional Requirements

If control of landfill gas is selected as a groundwater remedy for this facility, a Corrective Action Plan (CAP) outline technical details of the proposed remedy will be submitted to the DENR in accordance with the NCSWMR §.1637. Under some circumstances, air permitting may be required for a landfill gas control system. If needed, air permitting will be addressed in conjunction with the CAP.

3.4.6 Remedy Costs

Costs associated with controlling decomposition gases include design costs, construction and installation costs, and evaluation costs. The estimated full-scale implementation costs for the control of decomposition gases (capping and other closure requirements not included) are as follows:

Initial Evaluation:	$5,000 - $10,000
Design Costs:	$25,000 - $35,000
Construction Costs:	
Installation of Passive Landfill Gas Vents	$50,000 - $75,000
Construction Oversight & CQA	$40,000 - $60,000
Start-up Costs:	
Initial Tuning:	$3,000 - $5,000
Follow-up & Reporting:	$2,000 - $5,000
Contingencies:	$15,000 - $20,000
Total Estimated Remedy Implementation Costs:	**$140,000 - $210,000**

The actual cost and design of the passive landfill gas vents will be determined if control of decomposition gases is selected as a remedial alternative. Depending on the final design of the network and the monitoring frequency, the annual monitoring and reporting costs associated with control of decomposition gases is estimated at $8,000 - $10,000 per year until the landfill remediation goals are achieved. Operations and Maintenance Costs are estimated at $3,000 - $5,000 per year.

3.5 Monitored Natural Attenuation

Monitored Natural Attenuation (MNA) consists of monitoring natural attention processes (both biological and physical) and is a proven remedial alternative for sites where natural attenuation is documented and a more aggressive remedy is not required (i.e., the site does not pose a substantial or imminent risk to human health or the environment). The United States Environmental Protection Agency (USEPA) defines natural attenuation to include non-destructive mechanisms, such as dilution, sorption, volatilization, dispersion, and chemical or biological stabilization, as well as the biological degradation of contaminants. The biological processes that result in transformation and/or destruction of organic contaminants are important processes when considering a long-term source. MNA is appropriate as a remedial alternative if the threat to human life and the environment is minimal, and the occurrence of degradation can be demonstrated, and the site conditions can be demonstrated to be conducive to degradation.

Under a MNA remedial alternative, a site is monitored at regular intervals to demonstrate that the degradation processes (or indicators thereof) are occurring at a rate sufficient to prevent potential exposures, and that the dissolved-phase contaminants are not migrating to a receptor. It may also include measurements of contaminant concentrations in soil, groundwater, or soil gas, or measures of bioactivity indicators such as carbon dioxide production or oxygen consumption.

MNA is most widely used at sites with aromatic and/or chlorinated organic compounds. In anaerobic conditions, bacteria degrade chlorinated hydrocarbons in a process called reductive dehalogenation. The microorganisms use chlorinated hydrocarbons as electron acceptors just as aerobic organisms use oxygen. This use, in turn, requires a suitable electron donor such as hydrogen or organic compounds. Ample evidence suggests that reductive dehalogenation rates can be effective enough to stabilize if not shrink plumes of chlorinated compounds provided site conditions are conducive to the existence and reproduction of the bacteria. The major environmental requirement is the presence of sufficient concentrations of other organic molecules and that can serve as electron donors for energy metabolism.

Non-chlorinated aromatic hydrocarbons, such as benzene, are most efficiently degraded under aerobic conditions. The persistence of benzene in aqueous environments seems to be primarily controlled by the abundance of oxygen, as benzene is often persistent under anoxic conditions. Aerobic benzene-degrading microorganisms are ubiquitous and have been known for a long time. The first report in regard to aerobic benzene-degrading microorganisms was almost 100 years ago (Söhngen, 1913). Benzene degradation under anaerobic conditions has also been documented where there are sufficient electron acceptors such as nitrate, sulfate, ferric iron or carbon dioxide present.

An assessment of the risks posed to human health and the environment at the Butner Landfill has been summarized in Section 4.0 of this document. The exposure pathway to off-site human receptors is not complete. The risk to environmental receptors is also very low. Due to the low risk posed by the groundwater impacts that are confined to the facility's property, MNA can be considered an appropriate remedial measure for the Butner Landfill.

The demonstration and documentation of measurable MNA processes is key in the application of this remedial strategy. Typically, MNA programs indicate the status of the groundwater plume at different locations in the plume (stable, shrinking, or expanding), enable estimation of remediation rates, and warn of potential impacts to sensitive receptors. Primary evidence of natural attenuation includes demonstration of a stable or shrinking plume, or a plume expanding more slowly than groundwater movement adjusted for retardation. Secondary evidence of natural attenuation includes monitoring for an inverse correlation between electron acceptors and contaminant concentrations, alkalinity, and the presence of expected daughter products.

The monitoring frequency for MNA depends on the contaminants present, plume status, water table fluctuations and seasonal variability, groundwater velocity, and distance from the plume to sensitive receptors. One year of quarterly monitoring or two years of semiannual monitoring is

often sufficient to establish the relationship between readily degraded contaminants and electron acceptor/reduction product concentrations (USEPA, May 1996).

3.5.1 Performance and Reliability

MNA is a proven remedial alternative, which has been used at Resource Conservation and Recovery Act (RCRA), Underground Storage Tank (UST), Superfund, and Brownfield sites to treat both impacted groundwater and soils. Often, MNA is not implemented as a stand-alone remedy, but as part of a comprehensive remedial strategy that includes source control or source removal, or active remediation methods. MNA alone may be adequate where there is no identified risk, no continuing source, and/or or where active remediation is not feasible. In the case of the Butner Landfill, the lack of risk to an off-site receptor makes MNA a candidate for further consideration; however, the landfill is a continuing source, so some source control or active remedy may be appropriate as a supplement to MNA. Natural attenuation of the contaminants, combined with some type of active remedy would further contain and reduce the extent of the plume.

MNA performance differs at every site and is dependent on the site conditions; therefore, performance of MNA is typically determined by long-term monitoring for the COC, daughter products (if any), and other indicators of attenuation such as electron acceptors (oxygen, sulfate, nitrate, and ferrous iron) and waste products (ethane, ethane, ethanol, chlorides, carbon dioxide, acetate, acetic acid, etc.) For MNA to be selected as a remedy or part of a remedy, data supporting the existence of MNA should be obtained during a feasibility study. The feasibility study will evaluate contaminant and remedial goals.

3.5.2 Implementation Requirements

Implementation of MNA requires documentation that there are no imminent risks to human health or the environment posed by the site as it currently exists (i.e., there is no threat to potential groundwater and surface water receptors). Based on the information currently available, there are no identified off-site risks associated with the impacted groundwater at the Butner Landfill.

The implementation of MNA at the Butner Landfill would require a comprehensive initial round of sampling designed to collect the data necessary to estimate the degradation rates and the biological processes active at the site. If the evaluation of the data supports the conditions for natural attenuation, and the rate of degradation is determined to be sufficient to keep up with the release rate from the source (i.e., the plume is stable), a MNA Monitoring Plan will be developed.

The MNA Monitoring Plan would identify the groundwater and surface water sampling locations, the sampling frequency, the analyte list (COC, their daughter products, electron acceptors, and indicators of destruction), and any other data deemed necessary to document the biodegradation rates. Finally, the MNA Monitoring Plan would detail the procedures to be used in determining the biodegradation rates and would contain a series of trigger concentrations or

locations at which MNA would be deemed insufficient for meeting the remediation goals. After the MNA Monitoring Plan has been approved by the SWS, the monitoring and evaluation requirements in the MNA Monitoring Plan could be implemented immediately.

3.5.3 Remediation Impacts

There are no major remediation-related impacts associated with MNA, since MNA results in the natural destruction of the contamination. Minor impacts would include the generation of contaminated purge water during groundwater sampling events; however, the volume of water produced is relatively small, particularly at this facility.

3.5.4 Remediation Timeframe

Since the landfill represents a continuing source, it is not possible to determine the length of time required to remediate the groundwater plume to below GPS; therefore, the goal is for natural attenuation to degrade the COC at a rate at least equal to its continuing release and migration rate, thus controlling the plume. Because the contaminant plume is not migrating off site at detectable concentrations, MNA is expected to constrain the plume to its current footprint, or reduce the footprint over time. If the plume expands significantly beyond its current footprint based on a minimum of 3-5 years of monitoring data, then more aggressive remedies should be considered.

3.5.5 Permitting or Institutional Requirements

If MNA is selected as a groundwater remedy for this facility, a Corrective Action Plan (CAP) outline technical details of the proposed remedy will be submitted to the DENR in accordance with the NCSWMR §.1637. The DENR may require a supplemental remedy to augment MNA. No other permitting is required for MNA.

3.5.6 Remedy Costs

The costs associated with MNA would include: preparation of a MNA Monitoring Plan; installing additional monitoring wells, if required; sampling and analysis; and data evaluation and reporting. Based on the existing site conditions, we estimate the implementation costs of MNA at the Butner Landfill as follows:

Initial Costs:	
MNA Monitoring Plan	$5,000 - $10,000
Initial Monitoring and Data Evaluation	$5,000 - $10,000
Design Costs:	
Design Costs	$5,000 - $10,000

Construction Costs:	
Drilling and Construction of Additional Wells	$15,000 - $25,000
Well Construction Planning & Oversight	$15,000 - $25,000
Contingencies:	$5,000 - $10,000
Total Estimated Remedy Implementation Costs:	**$50,000 - $90,000**

The actual cost and design of the MNA program will be determined if MNA is selected as a remedial alternative. Depending on the final design of the MNA monitoring network and the monitoring frequency, the annual monitoring and reporting costs associated with MNA are estimated at $10,000 - $15,000 per year until the landfill remediation goals are achieved.

3.6 Phytoremediation

Phytoremediation is the use of plants to remove, transfer or stabilize contaminants in soil or groundwater. Plants may remove contaminants from groundwater from either direct plant uptake and metabolization or by microbial degradation in the root zone. Contaminants in groundwater can be removed when plant-produced enzymes break down contaminants that enter the plant during transpiration (phytodegredation). Another method by which plants can enhance groundwater quality is by phytoaccumulation, which is the process of uptake and storage of contaminants in the root systems. Plants may also uptake contaminants and transpire them through the leaves (phytovolatization). Finally, plants can provide secretions that enhance microbial activity in the root zone that aid in the breakdown of contaminants (ITRC, 2003). Phytoremediation via direct uptake of groundwater contaminants has been demonstrated to be a very efficient removal mechanism for VOCs, such as those observed at the site. The EPA and Department of Defense has investigated the effectiveness of various types of plants, including deciduous trees, grasses, and flowers.

3.6.1 Performance and Reliability

Phytoremediation has been shown to be effective in remediating VOC-impacted soil and groundwater both in laboratory experiments (Burken, et al, 2001; Weishaar, et al, 2009) and case studies (Van Den Bos, 2002; Cook, R.L., 2008; Campos, et al, 2008). The United States Environmental Protection Agency (EPA) has recognized phytoremediation as an effective remedy for many sites with a wide variety of contaminants (EPA, 2009). Phytoremediation is particularly effective in areas of relatively shallow groundwater contaminant plumes, where the root zones of the plants can intercept the plume. Also, it is most effective where the plume underlies open, wooded, or undeveloped land with appropriate natural flora or the potential for supporting introduced flora. Since phytoremediation offers multiple paths to remove, degrade, or bind both inorganic and organic compounds, with little or no environmental impact, it is considered to have a high benefit-to-risk ratio, as well as a high benefit-to-cost ratio. Phytoremediation can be an effective supplement to MNA.

3.6.2 Implementation Requirements

Specific methodologies for the application of phytoremediation to contaminated sites have been standardized, and general principals have been established (EPA 2009). The design and implementation of a phytoremediation project typically includes:

- Site characterization, including determination of soil and water chemistry/conditions, climate, population of native flora, and etc.;
- Implementation Plan to address the need for supplemental planting, density of planting, location, irrigation, fertilization, potential rates of remediation, etc.;
- Full-scale remediation; and
- Assessment and disposition of resulting affected plant material, if needed.

3.6.3 Remediation Impacts

There are no major remediation-related impacts associated with phytoremediation, since phytoremediation results in the natural uptake of the contamination. Minor impacts would include the generation of contaminated purge water during groundwater sampling events; however, the volume of water produced is relatively small, particularly at this facility.

3.6.4 Remediation Timeframe

Since the landfill represents a continuing source, it is not possible to determine the length of time required to remediate the groundwater plume to below GPS; therefore, the primary goal is for phytoremediation is to control the plume and prevent its migration off site or toward potential receptors. Also, the length of time required for phytoremediation depends on the type and maturity of the existent flora, which has not yet been determined. If the plume expands significantly beyond its current footprint based on a minimum of 3-5 years of monitoring data, then more aggressive remedies should be considered.

3.6.5 Permitting or Institutional Requirements

If phytoremediation is selected as a groundwater remedy for this facility, a Corrective Action Plan (CAP) outline technical details of the proposed remedy will be submitted to the DENR in accordance with the NCSWMR §.1637. No other permitting is required.

3.6.6 Remedy Costs

The potential associated costs to employ phytoremediation technology at the site would include: design, permitting, capital costs for materials such as plants, irrigation systems, etc., procurement, construction, and construction oversight costs, and operation and maintenance costs. Phytoremediation is not expected to be an energy intensive operation or require extensive ongoing maintenance; however, it would require regular inspection and assessment of the health of the flora in the remediation zone. Current estimates of costs for phytoremediation vary widely, and little information was found as to the conditions on which the estimates were based.

Evaluation & Implementation:	
Site Characterization	$20,000 - $30,000
Implementation Plan	$5,000 - $10,000
Design Costs:	
Engineering Costs	$5,000 - $10,000
Permitting Costs	$3,000 - $5,000
Construction Costs:	
Planting, irrigation, fertilization (if needed)	$10,000 - $20,000
Additional Observation Wells, as required	$10,000 - $15,000
Oversight of Construction	$15,000 - $30,000
Assessment & O&M:	
Post Implementation Inspection	$5,000 - $10,000
Monitoring and O&M	$3,000 - $5,000
Contingencies:	$10,000 - $15,000
Total Estimated Remedy Implementation Costs:	***$86,000 - $150,000***

The actual cost and design of phytoremediation will be determined if phytoremediation is selected as a remedial alternative. Depending on the final design of the phytoremediation monitoring network and the monitoring frequency, the annual monitoring and reporting costs associated with phytoremediation are estimated at $5,000 to $10,000 per year until the landfill remediation goals are achieved.

3.7 Constructed Wetlands

Natural wetlands have been documented to provide a purifying effect in cases of groundwater contamination. In the absence of a naturally occurring wetland, one can be constructed down gradient of the contaminant plume. Constructed wetland systems may be converted natural or constructed shallow ecosystems designed to capitalize on intrinsic physical, chemical, and biological processes for the primary purpose of water quality improvement (Hammer et al., 1989; Imfelda, et al, 2009). A constructed wetland is designed to provide material filtration, chemical transformation, and biological degradation that would act to purify the contaminated groundwater flowing through it. There are four principle components in a wetland system; soils and other drainage and filtering materials, water, wetland and aquatic plants, and a beneficial micro-organism population. These systems are generally coupled to a drain field or polishing pond, engineered to return the filtered water back to the environment.

There are two types of constructed wetlands, subsurface flow and surface flow. Subsurface flow wetlands are constructed to move water through well sorted gravel or sand in which the plants are rooted. Subsurface flows can be efficient in a smaller area, but are less hospitable to wildlife.

In surface flow wetlands, the effluent moves along the surface in a planted marsh or swamp. The surface flow wetland typically requires a greater land area and can be a breeding ground for mosquitos (carnivorous plants can be used to help control the mosquitos); however, surface flow wetlands have the advantage of being supported by a wider variety of soils, reducing construction materials and design costs.

A constructed wetland could act as a primary remedy, along with MNA and/or phytoremediation, or as a stage in an ex-situ remedy such as a pump-and-treat system. Constructed wetlands are visually unobtrusive but also environmentally friendly and provide habitat for wildlife; a relevant consideration based on the adjacent land use.

Within a wetland, phytoremediation is part of the biodegradation and remediation process. In phytoremediation, plants can stabilize, break down, translocate or remove contaminants from sediment, soil, groundwater, and treated discharge water. Plants can stabilize contaminant migration through the production of compounds that immobilize the contaminants at the root/soil interface in the process called phytostabilization. Enhanced rhizosphere biodegradation occurs in soil and water in and around the plants' roots. Phytoaccumulation is the process of removing contaminants from soil and groundwater through the roots along with the uptake of water and nutrients effectively storing them in the shoots and leaves. In a constructed wetland beneficial plants are selected and quickly established to perform in the system. Metals and inorganics tend to concentrate within the plants, while many of the organic compounds are mineralized, reduced and removed by the biological processes of plants so that phytoremediation in conjunction with the primary remediation technologies can be clean, efficient, relatively inexpensive and non-disruptive to the surrounding environment.

3.7.1 Performance and Reliability

The application and reliability of constructed wetland systems for sewage treatment, treatment of industrial waste, and groundwater remediation has been well-established as a cost-efficient and operationally effective alternative to conventional technologies for the elimination of various contaminants (Imfelda. et al, 2009; Sundaravadivel and Vigneswaran, 2001; Griffin, 2003; Kadlec et al., 2000; Pardue, 2002; Hammer et al., 1989). Once created, a constructed wetland would operate on its own, without the need for energy, materials, or other operational costs; however, regular inspections will be needed to evaluate the health of the wetland, and occasional maintenance may be needed to insure that it is functioning as designed. Depending on the plants selected and site conditions, weather and seasonality could reduce performance during winter months or droughts, and in extreme conditions, threaten the reliability of the system.

3.7.2 Implementation Requirements

Wetlands are generally custom-designed and built to accommodate site-specific conditions; however, turn-key systems are available for suitable sites. The components of a complete system include: filtered tanks or a stabilization pond; bermed or retained cells containing an impermeable liner, a gravel substrate, mulch, and hydrophilic plants; a distribution system

including header pipe, distribution pipes within the cell, collection pipes, water level control structures, various cleanouts, and possibly pumps (if needed); and a drainage field if required by regulatory agencies. Treated water is high quality and could, in the right conditions, be directly released to a river or aquifer. Low-flow plumbing fixtures can act as a "pretreatment" method to minimize required cell area.

Constructed wetland designs are site-specific. Expert design and additional calculations to determine the economics are advised. In colder climates larger cells are needed for freeze-prevention design, and efficiency may be compromised. On steep slopes, cut-and-fill may be necessary to keep the effluent flow slow enough for proper absorption.

3.7.3 Remediation Impacts

There are no major remediation-related impacts associated with constructed wetlands, since phytoremediation in the constructed wetlands results in the natural uptake of the contamination. Minor impacts would include the generation of contaminated purge water during groundwater sampling events; however, the volume of water produced is relatively small, particularly at this facility.

3.7.4 Remediation Timeframe

Because the landfill is a continuing source and it is unknown whether the contaminant plume is in a growth phase, stable phase, or if the plume has already reached its peak and is now decreasing, we cannot reasonably predict a time frame for obtaining the GPS in the compliance data; therefore, the primary goal of a constructed wetland will be to control the plume and prevent off-site migration. The timeframe for achieving objectives should be reasonable compared to other alternatives. Existing and historical data can be used as a predictor of future results.

3.7.5 Permitting or Institutional Requirements

If constructed wetlands is selected as a groundwater remedy for this facility, a CAP outlining technical details of the proposed remedy will be submitted to the DENR in accordance with the NCSWMR §.1637. A National Pollutant Discharge Elimination System (NPDES) permit may be required for discharge of treated groundwater to surface water. Construction of treatment wetlands may require a permit from the U.S. Army Corps of Engineers. If such permitting is required, it will be addressed in the CAP.

3.7.6 Remedy Costs

The associated costs to employ construct wetlands at the site would include: design, permitting, capital costs for materials such as plants, irrigation systems, etc., procurement, construction, and construction oversight costs, and operation and maintenance costs. Phytoremediation is not expected to be an energy intensive operation; however, this type of system would require regular inspection and periodic maintenance. Costs for constructed wetlands vary widely, and are highly site-specific.

Initial Evaluation:	$20,000 - $40,000
Design Costs:	
Engineering Costs	$15,000 - $30,000
Permitting Costs	$5,000 - $10,000
Equipment Costs:	$60,000 - $100,000
Construction Costs:	
Tanks, ponds, cells, piping, etc.	$30,000 - $50,000
Additional Observation Wells, as required	$20,000 - $30,000
Oversight, Administration and CQA	$50,000 - $80,000
Contingencies:	$20,000 - $30,000
Total Estimated Remedy Implementation Costs:	**$220,000 - $370,000**

The actual cost and design of constructed wetlands will be determined if it is selected as a remedial alternative. Depending on the final design of the constructed wetlands, monitoring network, and the monitoring frequency, the annual monitoring and reporting costs associated with a constructed wetland are estimated at $20,000 to $30,000 per year until the landfill remediation goals are achieved.

3.8 Enhanced Bioremediation

Enhanced Bioremediation (EB) is an *in situ* active treatment method that introduces chemicals and/or bacteria to the contaminated media to enhance the biodegradation process. Bioremediation is a process in which indigenous or inoculated microorganisms degrade contaminants by metabolizing organic constituents in groundwater. The rate of bioremediation can be enhanced by increasing the concentration of electron acceptors and/or nutrients in the groundwater. Most organic compounds are degraded by microbial bacteria, if they are present at non-toxic concentrations. Groundwater naturally contains low concentrations of oxygen because of the minimal aeration resulting from flow beneath the surface; however, the subsurface is typically nutrient deficient. Other factors affecting biological treatment of impacted groundwater include moisture, temperature, and pH.

3.8.1 Performance and Reliability

EB is a proven remedial alternative that has been used at a variety of contaminated sites to treat organic contamination in soil and groundwater (Hinchee et al., 1994; Cunningham, et al, 2001; US EPA, 2000). If properly designed, monitored, and maintained, EB is a reliable remedial alternative that can rapidly destroy organic contaminants in the subsurface. As with all *in situ* remediation methods, the limitation to an effective EB plan is the contact area of the treatment with the impacted medium. In order for EB to be effective, the treatment must come in contact with contaminated groundwater.

Injection of hydrogen releasing compounds (HRC) into the groundwater is a common EB method to treat chlorinated organic compounds. HRC, can be be injected into the affected aquifer using a series of direct-push probes or permanent injection points. The HRC will produce low concentrations of hydrogen ions, which are used by reductive dehalogenator organisms that strip the chlorine atoms from the chlorinated hydrocarbons as part of their metabolism.

To enhance the degradation of the COC at the Butner Landfill (benzene), oxygen in the form of air, dilute hydrogen peroxide, or other proprietary compounds can be injected using similar methods as used for HRC. This process will create an aerobic environment within the aquifer, which is necessary for the degradation of the COC. Chemical oxidation may also be used at the facility. Chemical oxidation involves the oxidation of the COC by the use of a strong oxidizing agent. Typically, concentrated hydrogen peroxide (or a proprietary material such as VTX) is injected along with a catalyst, which will oxidize the COC to produce heat, water, and carbon dioxide.

The ultimate success of ER is dependent upon soil properties, aquifer characteristics, and the ability to obtain sufficient contact between the impacted groundwater and the treatment agents. Design of an effective delivery system will be paramount.

3.8.2 Implementation Requirements

Implementation requirements for EB include preliminary laboratory testing, which would be used to create a treatability study. The treatability study would need to be performed prior to field implementation. Upon a successful treatability study, a field-scale pilot study would be undertaken to identify if site conditions are conducive to EB and then to develop an application/injection plan for the HRC, oxygen, or other treatment agents. Field work would be required to install injection wells and perform the injection of the compound, followed by routine monitoring of the progress of the EB effort. Periodic re-injections could be required to achieve the acceptable regulatory concentrations of the COC in groundwater.

3.8.3 Remediation Impacts

There can be cross-media impacts associated with EB, if the injection of agents is not properly controlled or implemented. Development of and adherence to a well-designed injection plan and adequate monitoring can eliminate this problem. Minor impacts would include the generation of contaminated purge water during groundwater sampling events. Safety impacts would also be present on site, since the source would not be removed.

3.8.4 Remediation Timeframe

The timeframe for an observable decrease in concentration is dependent upon the application of EB at the site. This remediation strategy could be utilized as a bioremediation barrier along the southern boundary at the facility. By utilizing EB in this manner, an observable decrease in the concentration of the COC downgradient of the barrier is expected within 6 to 12 months. Since

the source of the groundwater contamination is continually renewed, follow-up injections may be required based on monitoring results.

3.8.5 Permitting or Institutional Requirements

If EB is selected as a groundwater remedy for this facility, a CAP outlining technical details of the proposed remedy will be submitted to the DENR in accordance with the NCSWMR §.1637. An injection permit may be required by DENR; if so, it will be addressed in the CAP.

3.8.6 Remedy Costs

Costs associated with EB include design costs, permitting costs, capital costs to purchase the HRC or other compounds, construction and installation costs, and evaluation costs. The estimated full-scale implementation costs for EB in the southeastern and southern portions of the landfill are as follows:

Initial Evaluation:	
Treatability Study	$20,000 - $40,000
Pilot Study	$80,000 - $100,000
Design Costs:	
Engineering Costs	$20,000 - $40,000
Permitting Costs	$10,000 - $20,000
Equipment Costs:	
Proprietary Compounds (if used)	$50,000 - $100,000
Injection Equipment	$30,000 - $50,000
Construction Costs:	
Permanent Injection Points	$40,000 - $60,000
Additional Observation Wells, as required	$30,000 - $40,000
Oversight of Drilling	$60,000 - $80,000
Injection Oversight and Documentation	$20,000 - $40,000
Contingencies:	$20,000 - $30,000
Total Estimated Remedy Implementation Costs:	**$380,000 - $600,000**

Depending on the final design of the monitoring network and the monitoring frequency, annual monitoring and reporting costs for EB are estimated at $15,000 to $25,000 per year until remediation goals are achieved. Additional injections of oxygen or chemical compounds may be required periodically as needed. Estimated follow-up injection costs, including supplies, subcontractors, and oversight, are $50,000 to $100,000 per event.

3.9 Air Sparging

Air Sparging (AS) is an *in situ* active treatment method that introduces air into groundwater impacted by VOCs to remove the VOCs by volatilization. Air is injected through sparge points, typically with micro-bubbler screens installed in the aquifer below the contaminant plume, and percolates upward through the aquifer. As the air contacts VOCs in the groundwater, the VOCs volatilize and are carried to the surface in the air bubbles. Often, soil vapor extraction (SVE) wells are installed in the vadose zone above the plume to capture the sparge air more efficiently and vent the air with the volatilized contaminants to the atmosphere. AS also increases the dissolved oxygen in the groundwater, accelerating aerobic biodegradation of organic contaminants, therefore acting as a type or EB.

3.9.1 Performance and Reliability

AS is a proven remedial alternative that has been used at a variety of contaminated sites to treat organic contamination in soil and groundwater. If properly designed, air sparging is a reliable remedial alternative that can rapidly remove volatile organic contaminants in the subsurface. As with all *in situ* remediation methods, the limitation to an effective AS system plan is the contact area with the impacted medium. In order for AS to be effective, the air must come in contact with contaminated groundwater. AS is most effective in homogeneous, porous media. In areas where groundwater plumes are in very low permeability soils or bedrock, AS may not be as effective. The success of an AS system is dependent upon soil properties, aquifer characteristics, and the ability to obtain sufficient contact between the injected air and impacted groundwater.

A potential detriment of an AS system is the possibility of creating artificial mounding of the water table, thus altering local groundwater flow patterns. Another potential danger is vapor intrusion into structures near an AS system. These issues can be minimized or prevented by proper design, construction, and monitoring of the AS system.

3.9.2 Implementation Requirements

Implementation requirements for AS include pilot tests to determine the air-permeability of the aquifer, potential air pumping rates, and the potential radius of influence of sparge points.

3.9.3 Remediation Impacts

There can be cross-media impacts associated with AS, as the volatilized contaminants may eventually be vented to the atmosphere, either passively as the air migrates upward to the ground surface, or actively is an SVE system is used. Minor impacts would include the generation of contaminated purge water during groundwater sampling events. Safety impacts would also be present on site, since the source would not be removed.

3.9.4 Remediation Timeframe

The timeframe for an observable decrease in concentration of COCs is dependent upon the application of AS at the site, the characteristics of the subsurface media, and the rate at which air can be pumped into the aquifer. An observable decrease in COC concentrations within the

immediate vicinity of the AS system is expected within a few months to a year of implementation. If there are parts of the plume that are beyond the radius of influence of the AS system, those areas will not be impacted and natural attenuation will be relied upon to remediate those areas of the plume.

3.9.5 Permitting or Institutional Requirements

If AS is selected as a groundwater remedy for this facility, a CAP outlining technical details of the proposed remedy will be submitted to the DENR in accordance with the NCSWMR §.1637. No other permitting is required.

3.9.6 Remedy Costs

Costs vary from site to site depending on hydrogeologic conditions and plume dimensions. Costs include design, permitting, procurement, and capital costs for an AS system, construction and construction oversight costs, and operating and maintenance costs. Continuous AS is an energy-intensive operation. The pumps, associated plumbing, and electrical connections require regular inspection and maintenance. The estimated full-scale implementation cost for a P&T system with on-site treatment is as follows:

Initial Evaluation:	
Pilot Study	$40,000 - $60,000
Design Costs:	
Engineering Costs	$25,000 - $40,000
Permitting Costs	$5000 - $10,000
Equipment Costs:	
Air pumps or Compressors	$15,000 - $25,000
Piping and Control Systems	$15,000 - $25,000
Construction Costs:	
Permanent Air Injection Points	$20,000 - $30,000
Shallow SVE Wells or Trenches	$10,000 - $20,000
Additional Performance Wells	$20,000 - $30,000
Oversight of Drilling	$40,000 - $60,000
Trenching and Pipe Installation	$20,000 - $30,000
System Start-up and Documentation	$10,000 - $20,000
Contingencies:	$20,000 - $30,000
Total Estimated Remedy Implementation Costs:	**$240,000 - $380,000**

Depending on the final design of the AS system, the operating and maintenance costs for the AS system are estimated at $15,000 to $25,000 per year. Depending on the final design of the

monitoring network and the monitoring frequency, annual monitoring and reporting costs for AS are estimated at $20,000 to $30,000 per year until remediation goals are achieved.

3.10 Pump-and-Treat

Groundwater pumping is one of the most commonly used groundwater remediation technologies at contaminated sites. Groundwater pumping can be used as a cleanup or containment technology. A groundwater Pump-and-Treat (P&T) System combines a groundwater extraction system with a surface treatment system to remove contaminants from the subsurface and/or to control/prevent contaminant migration. The extraction wells and/or trenches and pumping system are typically designed to capture contaminated groundwater, although in some cases, the system may be used as a source control in the form of a migration barrier. Groundwater removed from the aquifer is treated to remove the COC and disposed of either on site or off site.

Treatment may be performed on site using a variety of conventional wastewater treatments (i.e., an air stripper or filtration system), or extracted groundwater may be sent off-site for treatment at a POTW. Treatment systems are numerous; however, for the levels of total VOCs reported from the site, carbon filtering, air stripping, or constructed wetland would all be effective.

P&T systems can be expensive to install and expensive to operate, requiring regular maintenance and sampling. P&T is a viable option for the facility because of the limited size of the plume; however, the expense may be prohibitive. Installation of pilot wells and pump tests to determine design and operational parameters is highly recommended.

Important considerations in evaluating the potential effectiveness of a P&T system at a specific site include the following:

- aquifer conditions: hydraulic conductivity, gradient, recharge rates, and groundwater flow boundary conditions;
- depth to water and saturated thickness;
- volume of water to be withdrawn;
- treatment and handling of extracted groundwater; and
- any construction access restrictions to siting pumping wells.

The chemical characteristics of the contaminants to be removed are critical to the success or failure of a P&T system. The solubility and partitioning coefficients (K_d and/or K_{ow}) of the contaminants for soil and water must be considered to assess the feasibility of such a system. Groundwater pumping is most effective on compounds with low partitioning coefficients and high solubility.

3.10.1 Performance and Reliability

Pumping is a reliable alternative for quickly controlling a release as may be required to protect a potential receptor and prevent off-site migration. The plume is well-suited for P&T, and should be intercepted by installing groundwater extraction wells in the saprolitic overburden and/or

directly in the bedrock fractures that control groundwater flow. A properly designed extraction well system is expected to be able to meet GPS downgradient of the extraction system once steady-state conditions have been reached.

3.10.2 Implementation Requirements

The design methods and construction of a P&T system are conventional. For a P&T system, the fundamental design elements include the number of withdrawal points, extraction well placement, pumping rates, and extracted groundwater management. An analytical groundwater flow model or site numerical flow model is often used during design to optimize the number, location, and pumping rate of the extraction wells.

The extracted groundwater would be treated either on site and discharged to the surrounding creeks under a NPDES permit, or transported off site to a POTW for treatment. Given the site location, the nature of the contamination observed, and the anticipated volume of water to be treated, on-site treatment of extracted groundwater is likely to be more cost-effective than off-site treatment.

3.10.3 Remediation Impacts

A P&T system could result in cross-media impacts if treated on-site. Contaminants identified at the site to date are organic compounds that could be treated using oxidizing chemicals, an air stripper, or other passive treatment methods such as a constructed wetland. The use of an air stripper would result in cross-media impacts through the transfer of VOCs from extracted groundwater to ambient air. Use of oxidizing chemicals or a constructed wetland would not result in cross-media impacts.

3.10.4 Remediation Timeframe

The P&T system would be designed to control further releases from the landfill, and therefore, would likely be constructed along the southern property boundary. The remediation timeframe for a P&T system depends on the placement of the extraction points, the characteristics of the aquifer, and the hydrodynamics of the system. If the plume is completely captured, the remediation goals will be achieved downgradient of the extraction wells in a relatively short period of time (estimated at one to three years of continuous operation). Points in the plume not located within the capture zone of the extraction wells will take longer to reach the remediation goals, since natural attenuation would be relied upon to attenuate the contaminants. Since the landfill is an continuing source, The P&T system may have to be operated until the landfill ceases production of significant quantities of leachate.

3.10.5 Permitting or Institutional Requirements

If P&T is selected as a groundwater remedy for this facility, a CAP outlining technical details of the proposed remedy will be submitted to the DENR in accordance with the NCSWMR §.1637. A NPDES permit from the DENR Division of Water Quality will be required if treated

groundwater is to be discharged to surface water. An air permit may be required for discharging VOCs to the atmosphere. If such permitting is required, it will be addressed in the CAP.

3.10.6 Remedy Cost

Costs vary from site to site depending on hydrogeologic conditions and plume dimensions. Costs include design, permitting, procurement, and capital costs for pumps and the treatment system, construction and construction oversight costs, and operating and maintenance costs. Continuous pump-and-treat is an energy-intensive operation. The pumps, associated plumbing, and electrical connections require regular inspection and maintenance. There also are capital and operation costs associated with treatment and/or transport of the extracted groundwater. The estimated full-scale implementation cost for a P&T system with on-site treatment is as follows:

Evaluation:	
Pilot Wells	$20,000 - $30,000
Pumping Tests	$30,000 - $40,000
Design Costs:	
Engineering Costs	$30,000 - $60,000
Permitting Costs	$20,000 - $30,000
Equipment Costs:	
Pumps, Piping, Controls, and Holding Tanks	$80,000 - $100,000
Air stripper and/or Carbon Filters	$60,000 - $120,000
Treatment Building	$10,000 - $30,000
Construction Costs:	
Extraction Wells & Performance Wells	$50,000 - $100,000
Trenching & Pipe Installation	$30,000 - $50,000
Installation & Hookup of Treatment System	$10,000 - $20,000
Construction Oversight and CQA	$80,000 - $120,000
Contingencies:	$30,000 - $50,000
Total Estimated Remedy Implementation Costs:	**$450,000 – $750,000**

The actual equipment and construction costs are dependent on the final design of the systems. The annual operating and maintenance costs for a P&T system are estimated at $30,000 to $45,000 per year, depending on final design, utilities, and water disposal methods. Depending on the final design of the monitoring network and the monitoring frequency, annual monitoring and reporting costs for a P&T system are estimated at $25,000 to $35,000 per year until remediation goals are achieved.

3.11 Permeable Reactive Barrier

Permeable Reactive Barrier (PRB) Systems are innovative passive alternatives to traditional Pump and Treat Systems for addressing long-term groundwater contamination concerns. PRB Systems act as a treatment system within a plume and can be used to treat impacted groundwater before it leaves the facility property boundary. PRB Systems consists of a zone of reactive material, such as zero-valent iron or activated carbon, placed in the path of impacted groundwater. The PRB may be installed as a continuous barrier or it may be designed as funnel-gate system. A continuous PRB consists of a reactive cell with reactive medium intercepting the entire plume while a funnel-gate system consists of an impermeable section (funnel) that directs the plume into the reactive cell (gate). As groundwater flows through the PRB, constituents-of-concern contact the reactive medium and are degraded to nontoxic compounds.

The main advantage of a PRB is that no pumping or above-ground treatment is required, since the barrier acts passively after installation. Zero-valent iron is commonly used for chlorinated hydrocarbons. As the plume flows through the PRB, the iron is oxidized and a chlorine atom is removed from the chlorinated hydrocarbon using electrons supplied by the oxidation of the iron. The process dissolves the iron granules; however, the iron should dissolve at such a slow rate that the reactive medium should last for years and possibly decades.

Important considerations in evaluating the potential effectiveness of a Pump and Treat System at a specific site include the following:

- aquifer conditions: hydraulic conductivity, gradient, and groundwater flow boundary conditions;
- depth to competent bedrock;
- typical depth to water and saturated thickness; and
- any construction access restrictions to installing PRB

3.11.1 Performance and Reliability.

To date, most PRB systems have been designed with a granular iron reactive medium and have been used to treat chlorinated volatile organic compounds (CVOC) (McMahon, et al, 1999; Vogana, et al, 1999; Thiruvenkatacharia, et al, 2008). The degradation of CVOC has been demonstrated at several sites. In addition, historical applications of PRB have been on a pilot scale, but recent applications have been full scale which further indicates the confidence in this technology. PRB has also been applied successfully to remediate aromatic hydrocarbons, like benzene (Guerina, et al, 2002; Thiruvenkatacharia, et al, 2008).

The key factor in evaluating the effectiveness of a PRB is the ability of the system to intercept the plume. Sufficient permeability contrast must be established and maintained to avoid plume deflection. To achieve effective permeability contrast, sand or some other porous material is often mixed with the reactive medium. The northern plume will be intercepted with a continuous PRB. A properly designed PRB system is expected to intercept the plume requiring treatment. Therefore, additional geotechnical work, aquifer tests, groundwater monitoring well installation,

and groundwater sampling and analysis will be needed to optimize the design. PRB Systems require no regular maintenance to continue operating as designed; they also do not require experienced operator oversight or frequent operational changes to be effective. However, they do require regular monitoring of field conditions to evaluate groundwater velocity and flow direction through the PRB. In addition, the reactive medium may at some point need to be replaced.

Performance of a properly designed PRB System is expected to reduce the facility COC (benzene) to below its GPS as groundwater moves through it; therefore, remediation goals should be achieved immediately beyond the PRB very quickly. Any portion of the plume lies downgradient of the PRB location at the time of installation will not be remediated by the PRB; therefore, natural attenuation will be relied upon to remediate that portion of the plume.

3.11.2 Implementation Requirements

The design methods and construction of a PRB require an extensive site characterization study to develop a PRB specific to facility conditions. In addition, a pilot study is recommended to ensure the effectiveness of the proposed PRB. For a PRB, the fundamental design element is the interface between the aquifer and the PRB. The PRB will need to be installed to sufficient depth to capture the plume and to prevent plume deflection into lower portions of the uppermost aquifer. Similarly, the PRB will need to extend latterly beyond the transverse edges of the plume, to insure that the plum does not flow around it.

3.11.3 Remediation Impacts

A PRB will not result in cross-media impacts. Constituents-of-concern will be treated passively in the subsurface. The waste product concern for the PRB system will be the potential need to excavate and dispose of spent reactive medium at some time in the future.

3.11.4 Remediation Timeframe

A PRB System would be designed to control further release from the landfill, and therefore would likely be constructed along the southern boundary of the landfill. The remediation timeframe for a PRB System will depend on the placement of the reaction medium. If the reaction medium is placed between the leading edge of the plume and the compliance boundary, the remediation goals will be achieved beyond the PRB immediately. If the PRB is not placed beyond the leading edge of the plume, either due to site conditions, or to clean up the plume closer to the source area, the plume beyond the PRB will take longer to reach redial goals, since it will relay on natural attenuation.

3.11.5 Permitting or Institutional Requirements

If a PRB is selected as a groundwater remedy for this facility, a CAP outlining technical details of the proposed remedy will be submitted to the DENR in accordance with the NCSWMR §.1637. No other permitting is required.

3.11.6 Remedy Cost

Costs associated with a PRB System include site characterization, design costs, permitting costs, construction and construction oversight costs, and monitoring costs. For the facility, the estimated full-scale implementation cost for a PRB System is as follow:

Design Costs:	
Site Characterization Costs	$15,000 - $30,000
Pilot Studies	$20,000 - $40,000
Engineering Costs	$20,000 - $40,000
Permitting Costs	$5,000 - $10,000
Equipment Costs:	
Reactive Medium	$50,000 - $70,000
Construction Costs:	
Excavation and Construction of PRB	$50,000 - $80,000
Installation of Performance Wells	$20,000 - $30,000
Construction Oversight and Documentation	$50,000 - $70,000
Contingencies:	$20,000 - $30,000
Total Estimated Remedy Implementation Costs:	**$250,000 - $400,000**

The actual equipment and construction costs will be highly dependent on the final design of the PRB System. Depending on the final design, the PRB annual monitoring costs are estimated at $15,000 to $20,000 per year.

4.0 CONCLUSIONS

4.1 Retained Remedies

The purpose of the ACM is to evaluate potential corrective measures so that a remedy can be selected based on its effectiveness in the protection of the environment and human health; attaining groundwater protection standards; controlling the contaminant source; and complying with NCSWMR §.1636 and §.1637. The corrective measures discussed in Sections 3.4 through 3.11 were those identified as the most effective and applicable methods of remediation based on the screening matrix, site conditions, and observed COC concentrations. The following eight technologies are retained as viable remedies for possible selection and inclusion in a Corrective Action Plan (CAP) for the facility:

- Landfill Gas (LFG) Control;
- Monitored Natural Attenuation (MNA);
- Phytoremediation;
- Constructed Wetlands;

- Enhanced Bioremediation (EB);
- Air Sparging (AS);
- Pump and Treat (P&T); and
- Permeable Reactive Barrier (PRB).

4.2 Recommendations

Of these eight remedies, MNA and phytoremediation are considered the most appropriate and cost effective for this facility at this time. MNA is appropriate because of the low risk of the contaminant plume impacting potential receptors, and the fact that the plume is contained within the facility property. Also, existing data support the assumption that natural attenuation is actively occurring on the site. Phytoremediation is appropriate because of the shallow groundwater table in the vicinity of the plume, and the large expanse of already wooded or partially wooded land downgradient of the plume. Phytoremediation is likely already occurring, and may require little or no supplemental planting or maintenance. LFG control through passive vent installation and/or constructed wetlands are considered the best supplemental remedies if MNA and phytoremediation prove to be inadequate to control the plume.

4.3 Public Meeting

Upon receiving approval from the SWS, this ACM and recommended remedies will be presented to the public in a public meeting per the requirements of NCSWMR §.1635.d. The County will post the requisite advertisements for the meeting 30 days prior to the meeting in appropriate news media. The minutes of the meeting, and any written comments from the public, will be submitted to the DEQ for consideration in their final review of this ACM.

Upon final approval of the ACM, Granville County will initiate the next phase of corrective action by selecting a remedy as set forth in NCSWMR §.1636, preparing a CAP, and fulfilling the remaining requirements of NCSWMR §.1637.

4.4 Financial Assurance

Granville County maintains financial assurance for its two landfills (Butner Landfill and Oxford Landfill) per NCSWMR requirements. Appendix I contains the December 2012 Financial Assurance Letter from the County to the DENR.

5.0 REFERENCES

The references cited herein may or may not be cited in the text of this report. They are listed here since they were used as references in the identification of applicable remedial alternatives for the initial screening of remedial alternatives or for more detailed review of specific remedies.

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6.0 ACRONYMS

ACM	Assessment of Corrective Measures (report)
AOC	Area of Concern
AS	Air Sparging
C&D	Construction and Demolition Waste
CAP	Corrective Action Plan (report)
CAER	Corrective Action Evaluation Report (report)
CPVC	Chlorinated Poly Vinyl Chloride
COC	Contaminant of Concern
DENR	North Carolina Department of Environment and Natural Resources
DL	Detection Limit (for laboratory data)
DO	Dissolved Oxygen
EB	Enhanced Bioremediation

EPA	United States Environmental Protection Agency
GEU	Gas Extraction Unit
GPS	Groundwater Protection Standards (per NCSWMR §.1634.g)
GWPS	NC Solid Waste Section Groundwater Protection Standards
HASP	Site-specific Health and Safety Plan
HDPE	High-density Polyethylene
HRC	Hydrogen-releasing Compound
JOYCE/JEI	Joyce Engineering, Inc.
LFG	Landfill Gas
LEL	Lower Explosive Limit
MNA	Monitored Natural Attenuation
MSW	Municipal Solid Waste
MW	Monitoring Well
NC 2B	North Carolina Surface Water Standards found in 15A NCAC 2B.0101
NC 2L	North Carolina Groundwater Standards found in 15A NCAC 2L.0202
NCAC	North Carolina Administrative Code
NCSWMR	North Carolina Solid Waste Management Regulations (15A NCAC 13B)
ND	Not Detected (for laboratory data)
NES	Nature and Extent Study (report)
O&M	Operations and Maintenance
OSHA	Occupational Health and Safety Association
P&T	Pump and Treat
PRB	Permeable Reactive Barrier
PVC	Poly Vinyl Chloride
QL	Quantitation Limit (for laboratory data)
QRA	Quantitative Risk Assessment (report)
RL	Reporting Limit (for laboratory data)
SVE	Soil Vapor Extraction
SWQS	Surface Water Quality Standards
SWS	DENR Division of Waste Management, Solid Waste Section
SWSL	North Carolina Solid Waste Section Reporting Limits (for laboratory data)
VOC	Volatile Organic Compound
WQMP	Water Quality Monitoring Plan (report)

TABLES

TABLE 1:
MONITORING WELL CONSTRUCTION DETAILS

WELL ID		[4]LOCATION			Elevation (Ft-AMSL)						Other Information			
Permit #	Well #	Lat.	Long.	Surface Elevation	Top of Casing	Top of Screen	Bottom of Screen	Total Depth	[1]Water Level	Depth to Bedrock	[2]Geologic Unit	[3]Construction Date	Driller's Reg. #	Comments
39-02	MW-1R	N36º 09' 55.49"	W78º 45' 37.80"	461.01	461.01	420.01	405.01	405.01	420.01	431.01	Fractured Bedrock	4/21/1994	446	background well replacement
39-02	MW-2R	N36º 09' 38.57"	W78º 45' 34.97"	326.60	328.94	322.75	307.75	307.75	324.00	313.60	Weathered Bedrock	4/12/1994	446	compliance well replacement
39-02	MW-3R	N36º 09' 38.58"	W78º 45' 34.85"	328.77	330.95	302.94	292.94	292.94	325.77	315.77	Fractured Bedrock	4/14/1994	446	compliance well replacement
39-02	MW-4	N36º 09' 38.93"	W78º 45' 30.15"	338.97	340.92	322.54	307.54	307.54	329.17	325.97	Fractured Bedrock	4/18/1994	446	compliance well
39-02	MW-5	N36º 09' 39.35"	W78º 45' 23.77"	341.88	344.00	333.36	318.36	318.36	329.08	324.88	Fractured Bedrock	4/18/1994	446	compliance well
39-02	MW-6	N36º 09' 47.00"	W78º 45' 25.47"	360.80	362.80	343.17	328.17	328.17	349.10	339.60	Fractured Bedrock	4/19/1994	446	compliance well
39-02	NES-1	N36º 09' 35.65"	W78º 45' 31.59"	326.22	328.72	311.22	296.22	296.22	304.22	300.22	Fractured Bedrock	11/14/2007	2675	nature & extent well

Notes:

1. Water Level from T.O.C. , approx. 24 hours after drilling
2. Geology where well bore ends, documented as fractured metavolcanic bedrock of Carolina slate belt
3. Typical Montoring Well Construction, materials are 2 inch SCH40 PVC casing and screen with 0.010 inch slot, sand pack, bentonite seal, grout pad, & steel outer casing.
4. Locations from March 2013 survey

Montoring Well Summary data is from well construction records, GAI Consultants June 1994, & Joyce Engineering November 2007, and field observations.

TABLE 2:
HISTORICAL GROUNDWATER ELEVATION DATA

Well No.	Background	Downgradient					
	MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1
Well TOC Elev.	460.51	331.60	330.96	340.80	343.88	362.53	328.40
Well Depth	56.00	18.85	35.83	31.43	23.52	32.63	30.00
Aug-99	418.68	329.13	328.06	330.50	330.83	352.10	NI
Nov-99	419.75	325.38	324.51	331.53	334.33	352.97	NI
May-00	424.53	329.60	328.83	334.15	334.49	355.72	NI
Oct-00	419.21	329.26	328.15	331.33	330.94	352.78	NI
Apr-01	418.76	329.42	328.63	333.57	334.36	354.22	NI
Oct-01	412.53	329.04	327.94	330.57	330.23	350.92	NI
Jun-02	413.70	328.38	327.41	330.21	330.29	351.04	NI
Nov-02	413.40	329.25	328.35	331.57	337.17	350.94	NI
Jun-03	423.61	329.57	328.93	334.24	333.99	355.21	NI
Dec-03	420.23	329.70	329.11	334.49	334.78	354.92	NI
Jun-04	418.81	329.38	328.48	332.26	331.39	353.10	NI
Dec-04	418.02	329.50	328.91	333.45	334.14	355.14	NI
Jun-05	418.81	329.10	329.26	331.62	330.90	352.76	NI
Dec-05	413.38	329.29	328.71	332.78	334.27	351.52	NI
27-Jun-06	414.75	329.17	328.40	332.18	333.56	353.43	NI
28-Dec-06	415.54	329.40	328.86	333.57	335.24	354.02	NI
12-Jul-07	438.64	328.69	327.97	331.31	330.52	352.30	NI
18-Dec-07	412.59	328.94	328.08	330.32	327.92	347.90	306.54
08-Jul-08	414.52	329.20	326.00	331.46	330.85	351.03	NM
17-Dec-08	412.79	329.39	328.84	333.15	335.03	350.82	NM
09-Jul-09	417.16	329.17	329.48	332.30	331.36	352.17	310.12
16-Dec-09	418.11	329.55	329.09	334.57	336.94	352.87	NM
24-Jun-10	422.42	329.41	328.77	333.65	333.15	353.62	NM
13-Dec-10	415.96	329.49	328.85	332.81	330.34	350.08	NM
20-Jun-11	416.00	328.95	328.18	336.77	331.38	351.83	NM
05-Dec-11	412.94	329.31	328.65	332.32	329.51	349.87	NM
11-Jun-12	414.56	329.10	328.35	332.52	331.33	351.75	312.50
12-Dec-12	412.83	329.19	328.36	331.67	330.35	349.48	NM

Notes:

TOC = top of casing

Water levels are measured from TOC.

NM = water level not measured.

NI = well not yet installed.

TABLE 3:
AQUIFER HYDROLOGIC PROPERTIES

Hydrogeologic Properties at Monitoring Well Locations, Butner Landfill, Granville County[1]				
Monitoring Well ID	Hydraulic Conductivity[2] *K* in cm/sec.	Soil / Geology Description	Total Porosity[3] %	Effective Porosity[4] %
MW-1 R	1.70E-05	Fractured metavolcanic, rock	30	10
MW-2R	6.70E-05	Silty clay with rock fragments	40	36.0
MW-3 R	1.70E-05	Fractured metavolcanic rock	30	10
MW-4	1.60E-06	Fractured metavolcanic rock	20	10
MW-5	1.40E-05	Silty sand with rock fragments	34	30.6
MW-6	1.40E-05	Fractured metavolcanic rock	30	10
Average	*2.18E-05*		*30.67*	*17.77*

Notes: [1] The hydrogeology data presented in this table was obtained from the Addenda prepared by GAI Consultants in a Response to Review Comments letter addressed to Municipal Engineering Services Co., April 28, 1995.

[2] Hydraulic Conductivity was referred to as Permeability in the tables original prepared by GAI Consultants.

[3] Total Porosity as reported in GAI, 1995.

[4] Effective Porosity based on 90% of reported Total Porosity (GAI, 1995) for soils, or 10% (estimated) for fractured rock.

TABLE 4:
ESTIMATED HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

			December 12, 2012				
GRADIENT CALCULATION SEGMENT	FLOW LINE LENGTH (feet)	FLOW DIRECTION	GROUND-WATER ELEVATION (feet)	HORIZ. GRADIENT, **i** (ft/ft)	HYDRAULIC CONDUCTIVITY, **K** (ft/day)	EFFECTIVE POROSITY $\mathbf{n_e}$	LINEAR VELOCITY, **V** (ft/year)
i_1	1310	ESE	410 340	0.0534	6.18E-02	0.18	6.70
i_2	1615	SE	400 320	0.0495	6.18E-02	0.18	6.21
i_3	1695	SSE	410 320	0.0531	6.18E-02	0.18	6.66
			Average	0.0520		Average	6.52

Notes:
Hydraulic conductivity (K) value is the average of results from slug-tests conducted in 1994 (GAI, 1994).
Effective Porosity based on average of 90% of reported Total Porosity (GAI, 1995) for soils, or 10% (estimated) for fractured rock.
Linear flow velocity = Ki/n (modified Darcy equation).
Refer to Figure 4 for gradient segments.

TABLE 5:
SUMMARY OF DETECTED CONSTITUENTS IN GROUNDWATER

Historically Quantified Constituents	Exceedance of:				Comments
	NC 2L	GWPS	Background	GPS	
Antimony	N/A	Yes (June 2011)	No	No	Not an SSI above background
Arsenic	Yes (June 2012)	N/A	No	No	Not an SSI above background
Barium	No	N/A	No	No	
Beryllium	N/A	No	No	No	
Cadmium	No	N/A	No	No	
Chromium	No	N/A	No	No	
Cobalt	N/A	Yes (December 2012)	No	No	Not an SSI above background
Lead	No	N/A	No	No	
Mercury	No	N/A	No	No	
Nickel	No	N/A	No	No	
Selenium	No	N/A	No	No	
Silver	No	N/A	No	No	
Thallium	N/A	Yes (December 2010)	No	No	Not an SSI above background
Tin	N/A	No	No	No	
Vanadium	N/A	No	No	No	
Zinc	No	N/A	No	No	
Benzene	Yes (December 2012)	N/A	N/A	Yes	
Carbon Disulfide	Yes (December 2009)	N/A	No	No	NC 2L increased, eliminating the exceedance.
Chlorobenzene	No	N/A	N/A	No	
Chloroethane	No	N/A	N/A	No	
1,2-Dichlorobenzene	No	N/A	N/A	No	
1,4-Dichlorobenzene	No	N/A	N/A	No	
Trans-1,4-dichloro-2-butene	No	N/A	N/A	No	
1,1-Dichloroethane	No	N/A	N/A	No	
Methylene Chloride	No	N/A	N/A	No	
Toluene	No	N/A	N/A	No	
Vinyl Chloride	No	N/A	N/A	No	
Phorate	No	N/A	N/A	No	
Gamma-BHC	No	N/A	N/A	No	
Heptachlor	No	N/A	N/A	No	
2,4-D	No	N/A	N/A	No	
Endrin Aldehyde	No	N/A	N/A	No	

Notes:

NC 2L = Groundwater Standards set forth in 15A NCAC 2L.0202.
GWPS = Solid Waste Section Groundwater protrection Standard (espblished for constiutents with no listed NC 2L Standard.
Background = Site-specific statistical background concentration based on background water quality data from the site.
GPS = Groundwater Protection Strandard as defined by NCSWMR - 15A NCAC 13B.1634.g.

Data used to create this table came from Tables 6 and 7.
Date in parentheses ( ) is of most recent exceedance.
SSI = Statistically significant increase.

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)																		
		DL	RL	Background		Downgradient														Blanks
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1				
Antimony	Sep-94	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Dec-94	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Feb-95	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Mar-95	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-95	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	May-96	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-96	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Jun-97	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Dec-97	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	May-98	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-98	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Jul-99	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-99	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	May-00	NR	30	ND		80.0		38.0		32.0		33.0		31.0		NI				NS
	Oct-00	NR	30	30.0		ND		ND		ND		ND		ND		NI				NS
	Apr-01	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Oct-01	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Jun-02	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-02	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Jun-03	NR	30	ND		ND		ND		ND		ND		ND		NI				NS
	Dec-03	NR	30	ND		ND		ND		ND		ND		ND		NI				ND
	Jun-04	NR	30	ND		ND		ND		ND		ND		ND		NI				ND
	Dec-04	NR	30	ND		ND		ND		ND		ND		ND		NI				ND
	Jun-05	NR	30	ND		ND		ND		ND		ND		ND		NI				ND
	Dec-05	NR	30	ND		ND		ND		ND		ND		ND		NI				ND
	28-Jun-06	NR	30	ND		ND		ND		ND		ND		ND		NI				ND
	29-Dec-06	NR	6	ND		ND		ND		ND		ND		ND		NI				ND
	12-Jul-07	NR	6	ND		ND		ND		ND		ND		ND		NI				ND
GWPS = 1.4 ug/L (10/23/07)	19-Dec-07	NR	6	ND		ND		ND		ND		ND		ND		ND				ND
	08-Jul-08	NR	6	ND		ND		ND		ND		ND		ND		NS				ND
	17-Dec-08	2.6	6.0	ND		ND		ND		ND		ND		ND		NS				ND
	09-Jul-09	2.6	6.0	ND		ND		ND		ND		ND		ND		ND				ND
	16-Dec-09	2.6	6.0	ND		ND		ND		ND		ND		ND		NS				ND
NC 2B = NE (03/24/10)	24-Jun-10	2.6	6.0	ND		ND		ND		2.9	J	ND		ND		NS				ND
GWPS = 1 ug/L (8/1/10)	13-Dec-10	2.6	6.0	ND		ND		3.0	J	ND		2.8	J	ND		NS				ND
	20-Jun-11	5.0	6.0	ND		ND		ND		ND		6.0		ND		NS				ND
	05-Dec-11	5.0	6.0	ND		ND		ND		ND		ND		ND		NS				ND
	11-Jun-12	5.0	6.0	ND		ND		ND		ND		ND		ND		NS				ND
	12-Dec-12	5.0	6.0	ND		ND		ND		ND		ND		ND		NS				ND
Arsenic	Sep-94	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Dec-94	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Feb-95	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Mar-95	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-95	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	May-96	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-96	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Jun-97	NR	10	6.0	J	15.0		ND		ND		ND		ND		NI				NS
	Dec-97	NR	10	ND		5.0	J	ND		ND		ND		ND		NI				NS
	May-98	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-98	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Jul-99	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-99	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	May-00	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Oct-00	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Apr-01	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Oct-01	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Jun-02	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Nov-02	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Jun-03	NR	10	ND		ND		ND		ND		ND		ND		NI				NS
	Dec-03	NR	10	ND		ND		ND		ND		ND		ND		NI				ND
	Jun-04	NR	10	ND		ND		ND		ND		ND		ND		NI				ND
	Dec-04	NR	10	ND		ND		ND		ND		ND		ND		NI				ND
	Jun-05	NR	10	ND		ND		ND		ND		ND		ND		NI				ND
	Dec-05	NR	10	ND		ND		ND		ND		ND		ND		NI				ND
	28-Jun-06	NR	10	ND		ND		ND		ND		ND		ND		NI				ND
	29-Dec-06	NR	10	2.0	J	ND		ND		ND		ND		ND		NI				ND
	12-Jul-07	NR	10	ND		ND		ND		ND		ND		ND		NI				ND
NC 2L = 50 ug/L (10/23/07)	19-Dec-07	NR	10	ND		4.1	J	ND		ND		ND		ND		ND				ND
	08-Jul-08	NR	10	ND		4.9	J	ND		ND		ND		ND		NS				ND
	17-Dec-08	2.7	10.0	ND		ND		ND		ND		ND		ND		NS				ND
	09-Jul-09	2.7	10.0	ND		13.5		10.9		5.6	J	ND		4.0	J	ND				ND
	16-Dec-09	2.7	10.0	ND		10.6		6.4	J	5.0	J	ND		3.6	J	NS				ND
NC 2L = 10 ug/L (02/05/10)	24-Jun-10	2.7	10.0	ND		11.8		8.1	J	8.2	J	3.3	J	3.1	J	NS				ND
Resample >	12-Aug-10	2.7	10.0	NS		NS		7.2	J	NS		NS		NS		NS				ND
Resample >	31-Aug-10	2.7	10.0	NS		15.4		NS		NS		NS		NS		NS				ND
	13-Dec-10	2.7	10.0	ND		4.9	J	2.7	J	5.4	J	ND		ND		NS				ND
	20-Jun-11	5.0	10.0	ND		ND		ND		ND		ND		ND		NS				ND
	05-Dec-11	5.0	10.0	ND		ND		ND		ND		ND		ND		NS				ND
	11-Jun-12	5.0	10.0	ND		5.4	J	ND		ND		ND		ND		NS				ND
	12-Dec-12	5.0	10.0	ND		ND		ND		ND		ND		ND		NS				ND

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)																	
		DL	RL	Background		Downgradient												Blanks	
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1			
Barium	Sep-94	NR	500	ND		270		ND		ND		830		860		NI		NS	
	Dec-94	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Feb-95	NR	500	ND		ND		ND		ND		510		ND		NI		NS	
	Mar-95	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-95	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	May-96	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-96	NR	500	ND		82.0		30.0		ND		15.0		ND		NI		NS	
	Jun-97	NR	500	200		320		37.0		17.0		210		31.0		NI		NS	
	Dec-97	NR	500	61.0		180		43.0		46.0		220		33.0		NI		NS	
	May-98	NR	500	30.0		150		45.0		13.0		180		22.0		NI		NS	
	Nov-98	NR	500	48.0		120		42.0		ND		380		12.0		NI		NS	
	Jul-99	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-99	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	May-00	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-00	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Apr-01	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-01	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-02	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-02	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-03	NR	500	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-03	NR	500	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-04	NR	500	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	500	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	500	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-05	NR	500	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-05	NR	500	ND		ND		ND		ND		ND		ND		NI		ND	
	28-Jun-06	NR	500	ND		ND		ND		ND		ND		ND		NI		ND	
	29-Dec-06	NR	100	5.2	J	120		64.9		1.5	J	64.1		1.8	J	NI		0.20	J
	12-Jul-07	NR	100	2.5	J	129		65.7	J	1.1	J	77.0	J	1.3	J	NI		ND	
NC 2L = 2,000 ug/L (10/23/07)	19-Dec-07	NR	100	2.8	B	99.2		50.0	B	1.4	B	49.6	B	1.7	B	87.8		11.7	
	08-Jul-08	NR	100	5.8	J	102		58.4	J	1.1	B	57.9	J	1.2	B	NS		0.29	J
	17-Dec-08	0.20	100	2.7	B	92.9	J	53.1	B	1.2	B	55.5	J	1.1	B	NS		10.7	J
	09-Jul-09	0.20	100	4.6	B	121		63.4	B	0.37	B	81.4	B	0.94	B	72.4	B	17.6	J
	16-Dec-09	0.20	100	2.9	B	108		62.8	B	0.61	B	56.8	B	0.87	B	NS		17.1	J
NC 2L = 700 ug/L (02/05/10)	24-Jun-10	0.20	100	2.5	B	115	B	61.1	B	1.6	B	93.5	B	1.4	B	NS		27.3	J
	13-Dec-10	0.20	100	4.3	B	122		67.9	J	1.3	B	90.6	J	1.5	B	NS		12.1	J
	20-Jun-11	5.00	100	ND		108		70.7	J	ND		84.7	J	ND		NS		ND	
	05-Dec-11	5.00	100	ND		118		73.0	J	ND		90.6	J	ND		NS		ND	
	11-Jun-12	5.00	100	ND		138		65.2	J	ND		76.4	J	ND		61.3	J	ND	
	12-Dec-12	5.00	100	ND		113		64.7	J	ND		73.6	J	ND		NS		ND	
Beryllium	Sep-94	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-94	NR	2	ND		ND		ND		ND		4.0		ND		NI		NS	
	Feb-95	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Mar-95	NR	2	ND		ND		ND		ND		2.0		ND		NI		NS	
	Nov-95	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	May-96	NR	2	ND		ND		ND		ND		6.0		ND		NI		NS	
	Nov-96	NR	2	ND		ND		ND		ND		3.0		ND		NI		NS	
	Jun-97	NR	2	2.0		3.0		ND		ND		1.0		ND		NI		NS	
	Dec-97	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	May-98	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-98	NR	2	ND		ND		ND		ND		2.0		ND		NI		NS	
	Jul-99	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-99	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	May-00	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-00	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Apr-01	NR	2	ND		12.0		ND		ND		ND		ND		NI		NS	
	Oct-01	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-02	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-02	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-03	NR	2	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-03	NR	2	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-04	NR	2	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	2	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	2	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-05	NR	2	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-05	NR	2	ND		ND		ND		ND		ND		ND		NI		ND	
	28-Jun-06	NR	2	ND		ND		ND		ND		ND		ND		NI		ND	
	29-Dec-06	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
	12-Jul-07	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
GWPS = 4 ug/L (10/23/07)	19-Dec-07	NR	1	ND		ND		ND		ND		ND		ND		ND		ND	
	08-Jul-08	NR	1	ND		ND		ND		ND		ND		ND		NS		ND	
	17-Dec-08	0.10	1.0	ND		ND		ND		ND		0.14	J	ND		NS		ND	
	09-Jul-09	0.10	1.0	ND		0.18	J	0.22	J	0.17	J	ND		ND		0.23	J	ND	
	16-Dec-09	0.10	1.0	ND		0.15	J	0.17	J	0.15	J	0.25	J	ND		NS		ND	
NC 2B = 6.5 ug/L (02/05/10)	24-Jun-10	0.10	1.0	ND		ND		0.27	J	0.16	J	ND		ND		NS		ND	
	13-Dec-10	0.10	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
	20-Jun-11	1.0	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
	05-Dec-11	1.0	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
	11-Jun-12	1.0	1.0	ND		ND		ND		ND		ND		ND		ND		ND	
	12-Dec-12	1.0	1.0	ND		ND		ND		ND		ND		ND		NS		ND	

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)																	
		DL	RL	Background		Downgradient												Blanks	
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1			
Cadmium	Sep-94	NR	1	ND		ND		ND		ND		ND		4.0		NI		NS	
	Dec-94	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Feb-95	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Mar-95	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-95	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	May-96	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-96	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-97	NR	1	ND		3.0		1.0		ND		ND		ND		NI		NS	
	Dec-97	NR	1	ND		2.0		ND		ND		ND		ND		NI		NS	
	May-98	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-98	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Jul-99	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-99	NR	1	ND		3.0		3.0		ND		2.0		ND		NI		NS	
	May-00	NR	1	5.0		ND		ND		ND		ND		ND		NI		NS	
	Oct-00	NR	1	ND		2.0		ND		ND		ND		ND		NI		NS	
	Apr-01	NR	1	ND		11.0		ND		ND		ND		ND		NI		NS	
	Oct-01	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-02	NR	1	ND		2.0		ND		ND		ND		ND		NI		NS	
	Nov-02	NR	1	2.0		2.0		ND		ND		2.0		ND		NI		NS	
	Jun-03	NR	1	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-03	NR	1	ND		1.0		ND		ND		ND		ND		NI		ND	
	Jun-04	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-05	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-05	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
	28-Jun-06	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
	29-Dec-06	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
	12-Jul-07	NR	1	ND		ND		ND		ND		ND		ND		NI		ND	
NC 2L = 1.75 ug/L (10/23/07)	19-Dec-07	NR	1	ND		ND		ND		ND		ND		ND		ND		ND	
	08-Jul-08	NR	1	ND		ND		ND		ND		ND		ND		NS		ND	
	17-Dec-08	0.50	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
	09-Jul-09	0.50	1.0	ND		1.4		ND		ND		ND		ND		ND		ND	
	16-Dec-09	0.50	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
NC 2L = 2 ug/L (02/05/10)	24-Jun-10	0.50	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
	13-Dec-10	0.50	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
	20-Jun-11	1.0	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
	05-Dec-11	1.0	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
	11-Jun-12	1.0	1.0	ND		ND		ND		ND		ND		ND		ND		ND	
	12-Dec-12	1.0	1.0	ND		ND		ND		ND		ND		ND		NS		ND	
Chromium	Sep-94	NR	10	8.0		44.0		ND		6.0		48.0		80.0		NI		NS	
	Dec-94	NR	10	14.0		ND		ND		ND		18.0		ND		NI		NS	
	Feb-95	NR	10	14.0		ND		ND		10.0		ND		ND		NI		NS	
	Mar-95	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-95	NR	10	13.0		13.0		ND		ND		ND		ND		NI		NS	
	May-96	NR	10	33.0		ND		ND		ND		ND		ND		NI		NS	
	Nov-96	NR	10	3.0		ND		ND		ND		ND		3.0		NI		NS	
	Jun-97	NR	10	57.0		43.0		ND		3.0		2.0		6.0		NI		NS	
	Dec-97	NR	10	29.0		ND		ND		ND		ND		ND		NI		NS	
	May-98	NR	10	10.0		3.0		ND		ND		12.0		ND		NI		NS	
	Nov-98	NR	10	17.0		3.0		ND		ND		5.0		ND		NI		NS	
	Jul-99	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-99	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	May-00	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-00	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Apr-01	NR	10	ND		12.0		ND		ND		ND		ND		NI		NS	
	Oct-01	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-02	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-02	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-03	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-03	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-04	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-05	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-05	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	28-Jun-06	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	29-Dec-06	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	12-Jul-07	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
NC 2L = 50 ug/L (10/23/07)	19-Dec-07	NR	10	ND		2.0	B	ND		ND		ND		ND		1.1	B	1.4	J
	08-Jul-08	NR	10	ND		0.54	J	0.58	J	ND		ND		ND		NS		ND	
	17-Dec-08	0.40	10.0	0.73	J	1.8	J	0.96	J	ND		0.96	J	0.70	J	NS		ND	
	09-Jul-09	0.40	10.0	1.2	J	2.4	J	1.1	J	1.6	J	0.68	J	0.53	J	4.8	J	ND	
	16-Dec-09	0.40	10.0	1.3	J	ND		ND		ND		0.95	J	ND		NS		ND	
NC 2L = 10 ug/L (02/05/10)	24-Jun-10	0.40	10.0	1.1	B	3.5	B	2.8	B	2.4	B	1.2	B	1.4	B	NS		0.71	J
	13-Dec-10	0.40	10.0	2.5	J	1.3	J	1.8	J	0.69	J	0.57	J	1.2	J	NS		ND	
	20-Jun-11	5.00	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
	05-Dec-11	5.00	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
	11-Jun-12	5.00	10.0	ND		8.6	J	ND		ND		ND		ND		ND		ND	
	12-Dec-12	5.00	10.0	ND		5.2	J	ND		ND		ND		ND		NS		ND	

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)																
		DL	RL	Background		Downgradient											Blanks	
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1		
Cobalt	Sep-94	NR	10	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-94	NR	10	11.0		ND		13.0		16.0		22.0		ND		NI	NS	
	Feb-95	NR	10	20.0		14.0		ND		48.0		39.0		ND		NI	NS	
	Mar-95	NR	10	16.0		21.0		ND		29.0		121.0		ND		NI	NS	
	Nov-95	NR	10	20.0		21.0		ND		ND		27.0		ND		NI	NS	
	May-96	NR	10	30.0		16.0		ND		ND		122		ND		NI	NS	
	Nov-96	NR	10	6.0		13.0		ND		4.7		93.0		ND		NI	NS	
	Jun-97	NR	10	130		38.0		ND		6.0		45.0		3.0		NI	NS	
	Dec-97	NR	10	32.0		21.0		ND		12.0		36.0		4.0		NI	NS	
	May-98	NR	10	15.0		16.0		2.0		9.0		100		3.0		NI	NS	
	Nov-98	NR	10	21.0		16.0		2.0		7.0		180		3.0		NI	NS	
	Jul-99	NR	10	ND		16.0		ND		ND		100		ND		NI	NS	
	Nov-99	NR	10	ND		15.0		ND		ND		38.0		ND		NI	NS	
	May-00	NR	10	ND		17.0		ND		ND		61.0		ND		NI	NS	
	Oct-00	NR	10	ND		15.0		ND		ND		ND		ND		NI	NS	
	Apr-01	NR	10	ND		27.0		ND		ND		74.0		ND		NI	NS	
	Oct-01	NR	10	ND		12.0		ND		ND		47.0		ND		NI	NS	
	Jun-02	NR	10	ND		14.0		ND		ND		251		ND		NI	NS	
	Nov-02	NR	10	ND		10.0		ND		ND		57.0		ND		NI	NS	
	Jun-03	NR	10	ND		15.0		ND		ND		75.0		ND		NI	NS	
	Dec-03	NR	10	ND		17.0		ND		ND		52.0		ND		NI	ND	
	Jun-04	NR	10	ND		16.0		ND		ND		31.0		ND		NI	ND	
	Dec-04	NR	10	ND		11.0		ND		ND		46.0		ND		NI	ND	
	Jun-05	NR	10	ND		11.0		ND		ND		43.0		ND		NI	ND	
	Dec-05	NR	10	ND		12.0		ND		ND		30.0		ND		NI	ND	
		NR	10	ND		ND		ND		ND		72.5		ND		NI	ND	
	29-Dec-06	NR	10	ND		11.4		ND		ND		37.5		ND		NI	ND	
	12-Jul-07	NR	10	ND		11.8		ND		2.7		58.4		ND		NI	ND	
GWPS = 70 ug/L (10/23/07)	19-Dec-07	NR	10	2.5	B	ND		ND		2.0	B	103		2.6	B	8.0	B	1.8	J
	08-Jul-08	NR	10	10.3	B	12.1	B	2.0	B	9.0	B	130		4.8	B	NS		6.2	J
	17-Dec-08	0.60	10.0	2.1	B	11.8	B	2.3	B	3.6	B	43.7		1.6	B	NS		2.5	J
	09-Jul-09	0.60	10.0	ND		6.2	J	ND		ND		100		ND		2.2	J	ND	
	16-Dec-09	0.60	10.0	ND		4.7	J	ND		ND		6.6	J	ND		NS		ND	
	24-Jun-10	0.60	10.0	ND		16.3		ND		ND		25.0		ND		NS		ND	
GWPS = 1 ug/L (10/23/07)	13-Dec-10	0.60	10.0	2.5	B	15.5		ND		ND		{129}		{ND}		NS		1.6 {1.0 J}	J
	20-Jun-11	5.0	10.0	ND		14.2		ND		ND		81.8		ND		NS		ND	
	05-Dec-11	5.0	10.0	ND		12.7		ND		ND		146		ND		NS		ND	
Resample >	25-Jan-12	5.0	10.0	NS		NS		NS		NS		47.5		NS		NS		ND	
	11-Jun-12	5.0	10.0	ND		14.2		ND		ND		101.0		ND		ND		ND	
	12-Dec-12	5.0	10.0	ND		11.3		ND		ND		113		ND		NS		ND	
Copper	Sep-94	NR	200	ND		ND		ND		ND		ND		660		NI	NS	
	Dec-94	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Feb-95	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Mar-95	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-95	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	May-96	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-96	NR	200	ND		ND		32.0		13.0		100		ND		NI	NS	
	Jun-97	NR	200	34.0		350		13.0		37.0		28.0		77.0		NI	NS	
	Dec-97	NR	200	19.0		72.0		14.0		88.0		15.0		34.0		NI	NS	
	May-98	NR	200	12.0		48.0		380		41.0		53.0		28.0		NI	NS	
	Nov-98	NR	200	10.0		ND		410		28.0		53.0		14.0		NI	NS	
	Jul-99	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-99	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	May-00	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Oct-00	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Apr-01	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Oct-01	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-02	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-02	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-03	NR	200	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-03	NR	200	ND		ND		ND		ND		ND		ND		NI	ND	
	Jun-04	NR	200	ND		ND		ND		ND		ND		ND		NI	ND	
	Dec-04	NR	200	ND		ND		ND		ND		ND		ND		NI	ND	
	Jun-05	NR	200	ND		ND		ND		ND		ND		ND		NI	ND	
	Dec-05	NR	200	ND		ND		ND		ND		ND		ND		NI	ND	
	28-Jun-06	NR	200	ND		ND		ND		ND		ND		ND		NI	ND	
	29-Dec-06	NR	10	ND		ND		11.3		5.50	J	10.4		1.90	B	NI	0.60	J
	12-Jul-07	NR	10	ND		ND		13.4		7.90		2.6	J	ND		NI	ND	
NC 2L = 1,000 ug/L (10/23/07)	19-Dec-07	NR	10	2.0	B	ND		8.6	B	3.8	B	7.0	B	0.73	B	5.8	B	9.8	
	08-Jul-08	NR	10	0.64	J	ND		12.1		3.7	J	8.5	J	ND		NS		ND	
	17-Dec-08	0.30	10.0	0.80	J	13.6		10.2		3.9	J	11.9		0.37	J	NS		ND	
	09-Jul-09	0.30	10.0	ND		ND		6.3	J	ND		5.7	J	ND		8.8	J	ND	
	16-Dec-09	0.30	10.0	ND		ND		9.2	J	1.6	J	5.7	J	ND		NS		ND	
	24-Jun-10	0.30	10.0	ND		ND		10		1.2	J	5.1	J	ND		NS		ND	
	13-Dec-10	0.30	10.0	1.1	B	ND		13.6		5.8	J	5.6	J	0.59	B	NS		0.49	J
	20-Jun-11	5.0	10.0	ND		ND		15.3		8.1	J	8.7	J	ND		NS		ND	
	05-Dec-11	5.0	10.0	ND		ND		16.9		10.0	J	7.6	J	ND		NS		ND	
	11-Jun-12	5.0	10.0	ND		10.7		12.2		6.3	J	7.4	J	ND		ND		ND	
	12-Dec-12	5.0	10.0	ND		ND		11.6		8.5	J	10.4		ND		NS		ND	

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
Lead	Sep-94	NR	10	ND	13.0	ND	ND	30.0	36.0	NI	NS
	Dec-94	NR	10	11.0	ND	ND	ND	36.0	ND	NI	NS
	Feb-95	NR	10	ND	ND	ND	10.0	37.0	ND	NI	NS
	Mar-95	NR	10	ND	ND	ND	ND	44.0	ND	NI	NS
	Nov-95	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	May-96	NR	10	ND	ND	ND	ND	42.0	ND	NI	NS
	Nov-96	NR	10	ND	ND	ND	ND	13.0	ND	NI	NS
	Jun-97	NR	10	20.0	29.0	ND	ND	13.0	ND	NI	NS
	Dec-97	NR	10	8.0	14.0	ND	5.0	14.0	ND	NI	NS
	May-98	NR	10	ND	6.0	ND	6.0	21.0	ND	NI	NS
	Nov-98	NR	10	5.0	ND	ND	ND	58.0	ND	NI	NS
	Jul-99	NR	10	ND	12.0	14.0	ND	ND	ND	NI	NS
	Nov-99	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	May-00	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Apr-01	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-01	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	10	11.0	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	10	ND	ND	ND	ND	12.0	ND	NI	NS
	Jun-03	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-03	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	10	ND	ND	ND	ND	ND	2.1 J	NI	ND
	12-Jul-07	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = 15 ug/L (10/23/07)	19-Dec-07	NR	10	ND	ND	ND	ND	ND	ND	ND	ND
	08-Jul-08	NR	10	ND	ND	ND	ND	ND	ND	NS	ND
	17-Dec-08	4.0	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	09-Jul-09	4.0	10.0	ND	ND	ND	ND	ND	ND	ND	ND
	16-Dec-09	4.0	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	24-Jun-10	4.0	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	13-Dec-10	4.0	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	5.0	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	5.0	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	5.0	10.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	5.0	10.0	ND	ND	ND	ND	ND	ND	NS	ND
Mercury	Dec-97	NR	0.5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	0.5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	0.5	ND	0.59	0.65	0.65	0.76	ND	NI	NS
	May-00	NR	0.5	NS	ND	ND	ND	ND	NS	NI	NS
	Oct-00	NR	0.5	NS	ND	ND	ND	ND	NS	NI	NS
	Apr-01	NR	0.5	NS	ND	ND	ND	ND	NS	NI	NS
	Jun-02	NR	0.5	NS	ND	ND	ND	ND	NS	NI	NS
	Jun-03	NR	0.5	NS	ND	ND	ND	ND	NS	NI	NS
	Dec-03	NR	0.5	NS	NS	NS	NS	NS	NS	NI	NS
	Jun-04	NR	0.5	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	Jun-05	NR	0.5	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	28-Jun-06	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	12-Jul-07	NR	0.2	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = 1.05 ug/L (10/23/07)	19-Dec-07	NR	NR	NS	NS	NS	NS	NS	NS	ND	NS
	08-Jul-08	NR	0.2	ND	ND	ND	ND	ND	ND	NS	ND
	17-Dec-08	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	09-Jul-09	0.070	0.2	ND	ND	ND	ND	ND	ND	NS	ND
	16-Dec-09	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
NC 2L = 1 ug/L (02/05/10)	24-Jun-10	0.070	0.20	ND	ND	ND	ND	ND	0.098 J	NS	ND
	13-Dec-10	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	20-Jun-11	0.10	0.20	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	11-Jun-12	0.10	0.20	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)																							
		DL	RL	Background		Downgradient																		Blanks	
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1									
Nickel	Sep-94	NR	50	ND		ND		ND		ND		ND		ND		NI								NS	
	Dec-94	NR	50	ND		ND		ND		ND		ND		ND		NI								NS	
	Feb-95	NR	50	ND		72		ND		ND		ND		ND		NI								NS	
	Mar-95	NR	50	ND		100		ND		ND		ND		ND		NI								NS	
	Nov-95	NR	50	ND		61.0		ND		ND		ND		ND		NI								NS	
	May-96	NR	50	ND		85.0		ND		ND		ND		ND		NI								NS	
	Nov-96	NR	50	ND		72.0		ND		ND		ND		ND		NI								NS	
	Jun-97	NR	50	75		98.0		ND		ND		ND		ND		NI								NS	
	Dec-97	NR	50	ND		89.0		ND		ND		ND		ND		NI								NS	
	May-98	NR	50	ND		91.0		ND		ND		ND		ND		NI								NS	
	Nov-98	NR	50	ND		83.0		ND		ND		ND		ND		NI								NS	
	Jul-99	NR	50	ND		109		ND		ND		ND		ND		NI								NS	
	Nov-99	NR	50	ND		122		ND		ND		ND		ND		NI								NS	
	May-00	NR	50	ND		104		ND		ND		ND		ND		NI								NS	
	Oct-00	NR	50	ND		93.0		ND		ND		ND		ND		NI								NS	
	Apr-01	NR	50	ND		107		ND		ND		ND		ND		NI								NS	
	Oct-01	NR	50	ND		92.0		ND		ND		ND		ND		NI								NS	
	Jun-02	NR	50	ND		98.0		ND		ND		ND		ND		NI								NS	
	Nov-02	NR	50	ND		74.0		ND		ND		ND		ND		NI								NS	
	Jun-03	NR	50	ND		85.0		ND		ND		ND		ND		NI								NS	
	Dec-03	NR	50	ND		100		ND		ND		ND		ND		NI								ND	
	Jun-04	NR	50	ND		120 (81.0)		ND		ND		ND		ND		NI								ND	
	Dec-04	NR	50	ND		100		ND		ND		ND		ND		NI								ND	
	Jun-05	NR	50	ND		150 (92.0)		ND		ND		ND		ND		NI								ND	
	Dec-05	NR	50	ND		96.0		ND		ND		ND		ND		NI								ND	
	28-Jun-06	NR	50	ND		88.7		ND		ND		ND		ND		NI								ND	
	29-Dec-06	NR	50	ND		94.7		30.1		14.2		8.9	J	ND		NI								ND	
	12-Jul-07	NR	50	ND		99.0		30.6	J	13.9	J	13.7	J	ND		NI								ND	
NC 2L = 100 ug/L (10/23/07)	19-Dec-07	NR	50	ND		83.4		23.7		11.0		18.3		ND		11.4								ND	
	08-Jul-08	NR	50	ND		76.0		28.1	J	11.5	J	27.0	J	ND		NS								ND	
	17-Dec-08	1.7	50.0	ND		75.5		27.8	J	12.2	J	11.0	B	ND		NS								2.4	J
	09-Jul-09	1.7	50.0	2.2	J	93.5		29.4	J	11.7	J	23.2	J	ND		13.1	J							ND	
	16-Dec-09	1.7	50.0	ND		81.2		28.2	J	11.8	B	2.6	B	ND		NS								3.0	J
	24-Jun-10	1.7	50.0	ND		76.3		19.7	J	9.0	J	7.0	J	4.5	J	NS								ND	
	13-Dec-10	1.7	50.0	ND		83.0		23.5	J	6.8	B	20.7	J	ND		NS								2.7	J
	20-Jun-11	5.0	50.0	ND		78.8		30.1	J	11.2	J	15.3	J	ND		NS								ND	
	05-Dec-11	5.0	50.0	ND		89.1		32.8	J	11.7	J	24.3	J	ND		NS								ND	
	11-Jun-12	5.0	50.0	ND		91.8		28.9	J	10.0	J	17.3	J	ND		ND								ND	
	12-Dec-12	5.0	50.0	ND		91.8		29.2	J	9.3	J	21.1	J	ND		NS								ND	
Selenium	Sep-94	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Dec-94	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Feb-95	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Mar-95	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Nov-95	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	May-96	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Nov-96	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Jun-97	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Dec-97	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	May-98	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Nov-98	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Jul-99	NR	20	ND		ND		ND		ND		36.0		ND		NI								NS	
	Nov-99	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	May-00	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Oct-00	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Apr-01	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Oct-01	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Jun-02	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Nov-02	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Jun-03	NR	20	ND		ND		ND		ND		ND		ND		NI								NS	
	Dec-03	NR	20	ND		ND		ND		ND		ND		ND		NI								ND	
	Jun-04	NR	20	ND		ND		ND		ND		ND		ND		NI								ND	
	Dec-04	NR	20	ND		ND		ND		ND		ND		ND		NI								ND	
	Jun-05	NR	20	ND		ND		ND		ND		ND		ND		NI								ND	
	Dec-05	NR	20	ND		ND		ND		ND		ND		ND		NI								ND	
	28-Jun-06	NR	20	ND		ND		ND		ND		ND		ND		NI								ND	
	29-Dec-06	NR	10	ND		ND		ND		ND		ND		ND		NI								ND	
	12-Jul-07	NR	10	ND		ND		ND		ND		ND		ND		NI								ND	
NC 2L = 50 ug/L (10/23/07)	19-Dec-07	NR	10	ND		11.5		ND		ND		ND		ND		ND								ND	
	08-Jul-08	NR	10	ND		ND		ND		ND		ND		ND		NS								ND	
	17-Dec-08	3.8	10.0	4.8	B	5.1	B	4.8	B	ND		ND		ND		NS								4.9	J
	09-Jul-09	3.8	10.0	ND		ND		4.2	J	ND		ND		ND		ND								ND	
	16-Dec-09	3.8	10.0	ND		ND		ND		5.1	J	ND		ND		NS								ND	
NC 2L = 20 ug/L (02/05/10)	24-Jun-10	3.8	10.0	ND		ND		ND		ND		ND		ND		NS								ND	
	13-Dec-10	3.8	10.0	ND		ND		ND		ND		ND		ND		NS								ND	
	20-Jun-11	10.0	10.0	ND		ND		ND		ND		ND		ND		NS								ND	
	05-Dec-11	10.0	10.0	ND		ND		ND		ND		ND		ND		NS								ND	
	11-Jun-12	10.0	10.0	ND		ND		ND		ND		ND		ND		ND								ND	
	12-Dec-12	10.0	10.0	ND		ND		ND		ND		ND		ND		NS								ND	

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)																	
		DL	RL	Background		Downgradient												Blanks	
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1			
Silver	Sep-94	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-94	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Feb-95	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Mar-95	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-95	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	May-96	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-96	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-97	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-97	NR	10	ND		8.0		ND		ND		ND		3		NI		NS	
	May-98	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-98	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jul-99	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-99	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	May-00	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-00	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Apr-01	NR	10	ND		15.0		ND		ND		ND		ND		NI		NS	
	Oct-01	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-02	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-02	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-03	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-03	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-04	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-05	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-05	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	28-Jun-06	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	29-Dec-06	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	12-Jul-07	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
NC 2L = 17.5 ug/L (10/23/07)	19-Dec-07	NR	10	ND		0.57	J	0.60	J	0.55	J	ND		0.33	J	ND		ND	
	08-Jul-08	NR	10	ND		2.7	J	2.3	J	1.1	J	0.22	J	0.69	J	NS		0.12	J
	17-Dec-08	0.10	10.0	0.13	J	1.8	J	1.4	J	0.85	J	0.12	J	0.51	J	NS		ND	
	09-Jul-09	0.10	10.0	ND		0.84	J	0.63	J	0.45	J	ND		0.11	J	ND		ND	
	16-Dec-09	0.10	10.0	0.12	J	2.0	J	1.6	J	1.0	J	0.12	J	0.52	J	NS		ND	
NC 2L = 20 ug/L (02/05/10)	24-Jun-10	0.10	10.0	ND		0.38	J	0.33	J	0.35	J	ND		ND		NS		ND	
	13-Dec-10	0.10	10.0	0.15	B	1.3	J	0.99	J	0.45	B	{ND}		{ND}		NS		0.21 {0.19 J}	J
	20-Jun-11	5.0	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
	05-Dec-11	5.0	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
	11-Jun-12	5.0	10.0	ND		ND		ND		ND		ND		ND		ND		ND	
	12-Dec-12	5.0	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
Thallium	Sep-94	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-94	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Feb-95	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Mar-95	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-95	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	May-96	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-96	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-97	NR	10	ND		3.0		ND		ND		ND		ND		NI		NS	
	Dec-97	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	May-98	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-98	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jul-99	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-99	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	May-00	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-00	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Apr-01	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-01	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-02	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-02	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-03	NR	10	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-03	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-04	NR	10	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	10	ND		10 J (ND)		ND		ND		ND		ND		NI		ND	
	Jun-05	NR	10	ND		22.0 (30.0)		13.0 (24.0)		ND		ND		ND		NI		ND	
	Dec-05	NR	10	ND		23.0		20.0		ND		ND		ND		NI		ND	
	28-Jun-06	NR	10	ND		25.7		12.6		ND		ND		ND		NI		ND	
	29-Dec-06	NR	6	ND		ND		ND		ND		ND		ND		NI		ND	
	12-Jul-07	NR	5.5	ND		ND		ND		ND		ND		ND		NI		ND	
GWPS = 0.28 ug/L (10/23/07)	19-Dec-07	NR	5.5	ND		4.0	J	ND		ND		ND		ND		ND		ND	
	08-Jul-08	NR	5.5	ND		ND		ND		ND		ND		ND		NS		ND	
	17-Dec-08	3.0	5.5	ND		3.2	J	3.2	J	ND		ND		ND		NS		ND	
	09-Jul-09	3.0	5.5	ND		ND		ND		4.1	J	ND		ND		ND		ND	
	16-Dec-09	3.0	5.5	ND		ND		ND		ND		ND		ND		NS		ND	
	24-Jun-10	3.0	5.5	ND		ND		5.2	J	3.1	J	ND		ND		NS		ND	
GWPS = 0.2 ug/L (10/1/10)	13-Dec-10	3.0	5.5	ND		ND		7.7		ND		ND		ND		NS		ND	
	20-Jun-11	5.4	5.5	ND		ND		ND		ND		ND		ND		NS		ND	
	05-Dec-11	5.4	5.5	ND		ND		ND		ND		ND		ND		NS		ND	
	11-Jun-12	5.4	5.5	ND		ND		ND		ND		ND		ND		ND		ND	
	12-Dec-12	5.4	5.5	ND		ND		ND		ND		ND		ND		NS		ND	

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)																	
		DL	RL	Background		Downgradient												Blanks	
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1			
Tin	Dec-97	NR	100	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-98	NR	100	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-99	NR	100	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-00	NR	100	NS		ND		ND		ND		ND		NS		NI		NS	
	Apr-01	NR	100	NS		ND		ND		ND		ND		NS		NI		NS	
	Oct-01	NR	100	NS		NS		NS		NS		NS		NS		NI		NS	
	Jun-02	NR	100	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-02	NR	100	NS		NS		NS		NS		NS		NS		NI		NS	
	Jun-03	NR	100	ND		149		127		ND		ND		ND		NI		NS	
	Dec-03	NR	100	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-04	NR	100	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	100	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-05	NR	100	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-05	NR	100	ND		ND		ND		ND		ND		ND		NI		ND	
	28-Jun-06	NR	100	ND		ND		ND		ND		ND		ND		NI		ND	
	29-Dec-06	NR	100	ND		41.1		14.4		3.2	J	ND		ND		NI		ND	
	12-Jul-07	NR	100	ND		35.2	J	13.9	J	5.2	J	ND		ND		NI		ND	
NC 2L = NE ug/L (10/23/07)	19-Dec-07	NR	100	ND		33.6		7.4		ND		ND		ND		ND		ND	
	08-Jul-08	NR	100	4.4	J	28.6	J	15.1	J	5.4	J	3.0	J	3.6	J	NS		ND	
	17-Dec-08	1.8	100	ND		22.5	J	9.2	J	ND		ND		ND		NS		ND	
	09-Jul-09	1.8	100	ND		21.4	J	8.6	J	ND		ND		ND		NS		ND	
	16-Dec-09	1.8	100	ND		26.3	J	10.7	J	ND		ND		ND		NS		ND	
GWPS = 2100 ug/L (02/05/10)	24-Jun-10	1.8	100	ND		23.4	J	10.7	J	3.2	J	2.2	J	1.9	J	NS		ND	
	13-Dec-10	1.8	100	ND		30.3	J	12.1	J	5.8	J	ND		ND		NS		ND	
	20-Jun-11	5.0	100	ND		26.8	J	13.8	J	ND		ND		ND		NS		ND	
	5-Dec-11	5.0	100	ND		25.8	J	13.9	J	ND		ND		ND		NS		ND	
	11-Jun-12	5.0	100	ND		22.2	J	9.0	J	ND		ND		ND		ND		ND	
	12-Dec-12	5.0	100	ND		30.0	J	13.2	J	ND		ND		ND		NS		ND	
Vanadium	Sep-94	NR	40	ND		ND		ND		ND		ND		130		NI		NS	
	Dec-94	NR	40	63.0		ND		ND		45.0		ND		ND		NI		NS	
	Feb-95	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Mar-95	NR	40	41.0		ND		ND		45.0		ND		ND		NI		NS	
	Nov-95	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	May-96	NR	40	83.0		ND		ND		ND		ND		ND		NI		NS	
	Nov-96	NR	40	7.0		17		ND		21.0		ND		ND		NI		NS	
	Jun-97	NR	40	450		560		ND		19.0		ND		ND		NI		NS	
	Dec-97	NR	40	62.0		88.0		ND		41.0		ND		10.0		NI		NS	
	May-98	NR	40	25.0		15.0		ND		10.0		5.0		ND		NI		NS	
	Nov-98	NR	40	33.0		29.0		5.0		16.0		9.0		5.0		NI		NS	
	Jul-99	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-99	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	May-00	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-00	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Apr-01	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Oct-01	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-02	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Nov-02	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Jun-03	NR	40	ND		ND		ND		ND		ND		ND		NI		NS	
	Dec-03	NR	40	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-04	NR	40	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-04	NR	40	ND		ND		ND		ND		ND		ND		NI		ND	
	Jun-05	NR	40	ND		ND		ND		ND		ND		ND		NI		ND	
	Dec-05	NR	40	ND		ND		ND		ND		ND		ND		NI		ND	
	28-Jun-06	NR	40	ND		ND		ND		ND		ND		ND		NI		ND	
	29-Dec-06	NR	25	2.7	J	ND		ND		14.5		ND		1.0	J	NI		ND	
	12-Jul-07	NR	25	ND		ND		ND		19.4	J	ND		ND		NI		ND	
GWPS = 3.5 ug/L (10/23/07)	19-Dec-07	NR	25	2.2	B	2.2	B	ND		15.7	J	3.0	B	1.2	B	4.0	J	0.62	J
	08-Jul-08	NR	25	2.6	J	2.4	J	ND		14.6	J	1.4	J	1.2	J	NS		0.20	J
	17-Dec-08	0.20	25.0	1.9	B	2.3	B	ND		13.9	J	2.5	B	1.2	B	NS		0.76	J
	09-Jul-09	0.20	25.0	3.9	B	9.7	J	2.5	B	18.4	J	2.9	B	2.2	B	8.5	J	1.30	J
	16-Dec-09	0.20	25.0	2.0	B	4.4	J	1.3	B	14.0	J	2.2	B	1.5	B	NS		0.53	J
	24-Jun-10	0.20	25.0	1.8	J	4.4	J	1.5	J	13.3	J	2.2	J	1.3	J	NS		ND	
GWPS = 0.3 ug/L (10/1/10)	13-Dec-10	0.20	25.0	3.2	J	3.6	J	0.35	B	16.6	J	1.8	B	1.0	B	NS		0.36	J
	20-Jun-11	5.0	25.0	ND		ND		ND		14.5	J	ND		ND		NS		ND	
	5-Dec-11	5.0	25.0	ND		ND		ND		13.5	J	ND		ND		NS		ND	
	11-Jun-12	5.0	25.0	ND		18.0	J	ND		12.3	J	ND		ND		ND		ND	
	12-Dec-12	5.0	25.0	ND		ND		ND		13.6	J	ND		ND		NS		ND	

TABLE 6:
HISTORICAL INORGANIC CONSTITUENTS IN GROUNDWATER

Constituent	Date	Concentration (µg/L)																
		DL	RL	Background		Downgradient											Blanks	
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1		
Zinc	Sep-94	NR	50	110		160		ND		ND		320		430		NI	NS	
	Dec-94	NR	50	132		ND		ND		70		164		ND		NI	NS	
	Feb-95	NR	50	144		89		ND		91		79		74		NI	NS	
	Mar-95	NR	50	67		ND		ND		ND		111		ND		NI	NS	
	Nov-95	NR	50	ND		50		ND		ND		ND		ND		NI	NS	
	May-96	NR	50	136		ND		ND		ND		122		ND		NI	NS	
	Nov-96	NR	50	79.0		48.0		28.0		ND		38.0		ND		NI	NS	
	Jun-97	NR	50	370		410		33.0		39.0		36.0		69.0		NI	NS	
	Dec-97	NR	50	140		110		11.0		45.0		34.0		30.0		NI	NS	
	May-98	NR	50	70.0		63.0		23.0		31.0		47.0		34.0		NI	NS	
	Nov-98	NR	50	61.0		33.0		21.0		17.0		53.0		10.0		NI	NS	
	Jul-99	NR	50	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-99	NR	50	ND		ND		ND		ND		ND		ND		NI	NS	
	May-00	NR	50	ND		ND		ND		ND		ND		ND		NI	NS	
	Oct-00	NR	50	ND		ND		ND		ND		ND		ND		NI	NS	
	Apr-01	NR	50	ND		ND		ND		ND		ND		ND		NI	NS	
	Oct-01	NR	50	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-02	NR	50	ND		ND		ND		ND		382		ND		NI	NS	
	Nov-02	NR	50	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-03	NR	50	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-03	NR	50	ND		ND		ND		ND		ND		ND		NI	ND	
	Jun-04	NR	50	ND		ND		ND		ND		ND		ND		NI	ND	
	Dec-04	NR	50	ND		ND		ND		66.0		ND		ND		NI	ND	
	Jun-05	NR	50	ND		54.0		56.0		ND		ND		ND		NI	ND	
	Dec-05	NR	50	ND		ND		ND		ND		ND		ND		NI	ND	
	28-Jun-06	NR	50	ND		ND		ND		ND		ND		ND		NI	ND	
	29-Dec-06	NR	50	8.0	J	ND		ND		4.1	J	4.3	J	4.1	J	NI	ND	
	12-Jul-07	NR	10	9.6	J	ND		ND		ND		ND		ND		NI	ND	
NC 2L = 1,050 ug/L (10/23/07)	19-Dec-07	NR	10	4.3	B	14.3	B	6.3	B	ND		ND		ND		2.4	B	102	
	08-Jul-08	NR	10	5.9	B	ND		ND		ND		4.1	B	ND		NS		1.2	J
	17-Dec-08	0.40	10.0	2.4	B	6.3	J	ND		ND		4.6	J	0.60	B	NS		0.49	J
	09-Jul-09	0.40	10.0	3.4	B	ND		ND		ND		ND		ND		6.1	B	1.6	J
	16-Dec-09	0.40	10.0	4.6	B	ND		ND		ND		7.4	B	ND		NS		7.7	J
NC 2L = 1,000 ug/L (02/05/10)	24-Jun-10	0.40	10.0	0.58	J	ND		ND		ND		ND		1.3	J	NS		ND	
	13-Dec-10	0.40	10.0	4.5	B	ND		ND		ND		ND		ND		NS		6.7	J
	20-Jun-11	10.0	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
	05-Dec-11	10.0	10.0	ND		ND		ND		ND		ND		ND		NS		12.4	
	11-Jun-12	10.0	10.0	ND		20.9		ND		ND		ND		ND		ND		ND	
	12-Dec-12	10.0	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
Cyanide	09-Jul-09	5.0	10	ND		ND		ND		ND		46.9		ND		ND		ND	
Resample >	28-Sep-09	5.0	10	NS		NS		NS		NS		ND		NS		NS		ND	
NC 2L = 70 ug/L (10/23/07)	16-Dec-09	NR	NR	NS		NS		NS		NS		NS		NS		NS		NS	
	24-Jun-10	5.0	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
	13-Dec-10	NR	NR	NS		NS		NS		NS		NS		NS		NS		NS	
Resample >	20-Jun-11	5.0	10.0	ND		ND		ND		ND		ND		ND		NS		ND	
	05-Dec-11	NR	NR	NS		NS		NS		NS		NS		NS		NS		NS	
	11-Jun-12	5.0	10.0	ND		6.4	J	ND		ND		8.7	J	ND		NS		ND	
	12-Dec-12	NR	NR	NS		NS		NS		NS		NS		NS		NS		NS	

Notes:
1. All concentrations are in micrograms per liter (mg/L).
2. RL = Laboratory reporting limit (NC SWSL from October 2007 to present).
3. ND = Not detected above laboratory reporting limit.
4. B = Blank-qualified data; result is expected to be biased high based on concentrations in the blanks
5. NC 2L = North Carolina 2L Groundwater Standards.
6. GWPS = Groundwater Protection Standards.
7. When the NC 2L has not been established, the GWPS will be used.
8. Shaded values for groundwater are above the NC 2L Groundwater Standards or Groundwater Protection Standards.
7. Shaded values for surface water are above the NC 2B Surface Water Standards (NC2B) or National Criteria per EPA (EPA NC).
9. DL = Laboratory detection limit.
10. J = Estimated value between the DL and the RL
11. NI = Well/Piezometer not installed.
12. NS = Not sampled.
13. NR = Not Reported.
14. DRY = Monitoring well or surface water point considered to be dry.
15. Surface waters are classified as WS-IV/NSW (WS, human health, and fresh-water aquatic life).

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)															
		DL	RL	Background		Downgradient										Blanks	
				MW-1R		MW-2R		MW-3R		MW-4		MW-5		MW-6		NES-1		
Acetone	Sep-94	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-94	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Feb-95	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Mar-95	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-95	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	May-96	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-96	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-97	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-97	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	May-98	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-98	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Jul-99	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-99	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	May-00	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Oct-00	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Apr-01	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Oct-01	NR	100	244	B	109	B	ND		130	B	128	B	476	B	NI	479	
	Jun-02	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-02	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-02	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-03	NR	100	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-03	NR	100	ND		ND		ND		ND		ND		ND		NI	ND	
	Jun-04	NR	100	ND		ND		ND		ND		ND		ND		NI	ND	
	Dec-04	NR	100	ND		ND		ND		ND		ND		ND		NI	ND	
	Jun-05	NR	100	ND		ND		ND		ND		ND		ND		NI	ND	
	Dec-05	NR	100	ND		ND		ND		ND		ND		ND		NI	ND	
	28-Jun-06	NR	100	ND		ND		ND		ND		ND		ND		NI	ND	
	29-Dec-06	NR	100	ND		ND		ND		ND		ND		ND		NI	ND	
	12-Jul-07	NR	100	ND		ND		ND		ND		ND		ND		NI	ND	
NC 2L = 700 ug/L (10/23/07)	19-Dec-07	NR	100	ND		ND		ND		ND		ND		ND		ND	4.5	J
	08-Jul-08	NR	100	ND		ND		ND		ND		ND		ND		NS	ND	
	17-Dec-08	20.0	100	ND		ND		ND		ND		ND		ND		NS	ND	
	09-Jul-09	20.0	100	ND		ND		ND		ND		ND		ND		ND	ND	
	16-Dec-09	2.2	100	ND		ND		ND		ND		ND		ND		NS	2.8	J
NC 2L = 6,000 ug/L (02/05/10)	24-Jun-10	2.2	100	ND		18.5	B	6.5	B	ND		2.2	B	ND		NS	7.7	J
	13-Dec-10	2.2	100	ND		ND		ND		ND		ND		ND		NS	ND	
	20-Jun-11	2.2	100	ND		ND		ND		ND		ND		2.4	B	NS	3.9	J
	05-Dec-11	2.2	100	ND		2.3	B	ND		ND		ND		ND		NS	8.8	J
	11-Jun-12	2.2	100	ND		3.5	B	ND		ND		ND		ND		ND	4.7	J
	12-Dec-12	10.0	100	ND		ND		ND		ND		ND		ND		NS	ND	
Benzene	Sep-94	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-94	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Feb-95	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Mar-95	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-95	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	May-96	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-96	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-97	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-97	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	May-98	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-98	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Jul-99	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-99	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	May-00	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Oct-00	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Apr-01	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Oct-01	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-02	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Nov-02	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Jun-03	NR	5	ND		ND		ND		ND		ND		ND		NI	NS	
	Dec-03	NR	5	ND		ND		ND		ND		ND		ND		NI	ND	
	Jun-04	NR	5	ND		ND		ND		ND		ND		ND		NI	ND	
	Dec-04	NR	5	ND		ND		ND		ND		ND		ND		NI	ND	
	Jun-05	NR	5	ND		ND		ND		ND		ND		ND		NI	ND	
	Dec-05	NR	5	ND		ND		ND		ND		ND		ND		NI	ND	
	28-Jun-06	NR	5	ND		ND		ND		ND		ND		ND		NI	ND	
	29-Dec-06	NR	3	ND		1.5		ND		ND		ND		ND		NI	ND	
Resample >	23-Feb-07	NR	3	NS		1.2		NS		NS		NS		NS		NI	ND	
	12-Jul-07	NR	1	ND		1.9		ND		ND		ND		ND		NI	ND	
NC 2L = 1 ug/L (10/23/07)	19-Dec-07	NR	1	ND		1.8		0.48	J	0.26	J	ND		ND		ND	ND	
	08-Jul-08	NR	1	ND		1.4		0.51	J	0.32	J	ND		ND		NS	ND	
	17-Dec-08	0.25	1.0	ND		1.7		0.54	J	ND		ND		ND		NS	ND	
	09-Jul-09	0.25	1.0	ND		1.7		0.34	J	ND		ND		ND		ND	ND	
	16-Dec-09	0.25	1.0	ND		1.7		0.60	J	0.29	J	ND		ND		NS	ND	
	24-Jun-10	0.25	1.0	ND		0.77	J	0.49	J	0.33	J	ND		ND		NS	ND	
	13-Dec-10	0.25	1.0	ND		1.8		0.59	J	0.37	J	ND		ND		NS	ND	
Resample >	08-Feb-11	0.25	1.0	NS		1.4		NS		NS		NS		NS		NS	ND	
	20-Jun-11	0.25	1.0	ND		1.7		0.60	J	0.39	J	ND		ND		NS	ND	
	05-Dec-11	0.25	1.0	ND		1.4		0.69	J	0.40	J	ND		ND		NS	ND	
	11-Jun-12	0.25	1.0	ND		ND		0.51	J	ND		ND		ND		ND	ND	
	12-Dec-12	0.25	1.0	ND		1.6		0.73	J	0.32	J	ND		ND		NS	ND	
Resample >	10-Jan-13	0.25	1.0	ND		1.4		NS		NS		NS		NS		ND	ND	

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
Bromomethane	17-Dec-08	0.29	10.0	ND	ND	0.58 J	ND	ND	ND	NS	ND
NC 2L = NE ug/L (10/23/07)	09-Jul-09	0.29	10.0	ND	ND	ND	ND	ND	ND	ND	ND
	16-Dec-09	0.29	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	24-Jun-10	0.29	10.0	ND	ND	ND	ND	ND	ND	NS	ND
GWPS = 10 ug/L (8/1/10)	13-Dec-10	0.29	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.29	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.29	10.0	ND	ND	ND	ND	ND	ND	ND	ND
	11-Jun-12	0.29	10.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.29	10.0	ND	ND	ND	ND	ND	ND	NS	ND
2-Butanone	17-Dec-08	0.96	100	ND	ND	ND	ND	1.2 J	ND	NS	ND
NC 2L = 4,200 ug/L (10/23/07)	09-Jul-09	0.96	100	ND	ND	ND	ND	ND	ND	ND	ND
	16-Dec-09	0.96	100	ND	ND	ND	ND	ND	ND	NS	ND
NC 2L = 4,000 ug/L (02/05/10)	24-Jun-10	0.96	100	ND	ND	ND	ND	ND	ND	NS	ND
	13-Dec-10	0.96	100	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.96	100	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.96	100	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	0.96	100	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.96	100	ND	ND	ND	ND	ND	ND	NS	ND
Carbon Disulfide	Sep-94	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-94	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Feb-95	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Mar-95	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-95	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	May-96	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-96	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-97	NR	100	ND	64.0	ND	ND	ND	ND	NI	NS
	Dec-97	NR	100	ND	5.0	8.0	ND	ND	ND	NI	NS
	May-98	NR	100	ND	7.5	6.2	ND	ND	ND	NI	NS
	Nov-98	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Jul-99	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	May-00	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Apr-01	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-01	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-03	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-03	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	12-Jul-07	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = 700 ug/L (10/23/07)	19-Dec-07	NR	100	ND	ND	ND	ND	ND	ND	ND	ND
	08-Jul-08	NR	100	ND	ND	ND	ND	ND	ND	NS	ND
	17-Dec-08	1.2	100	ND	ND	ND	ND	ND	ND	NS	ND
	09-Jul-09	1.2	100	ND	ND	ND	ND	ND	ND	ND	ND
	16-Dec-09	1.2	100	ND	ND	ND	ND	ND	ND	NS	ND
	24-Jun-10	1.2	100	ND	ND	ND	ND	ND	ND	NS	ND
	13-Dec-10	1.2	100	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	1.2	100	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	1.2	100	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	1.2	100	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	1.2	100	ND	ND	ND	ND	ND	ND	NS	ND

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
Chlorobenzene	Sep-94	NR	5	ND	10.0	7.0	ND	ND	ND	NI	NS
	Dec-94	NR	5	ND	ND	7.0	ND	ND	ND	NI	NS
	Feb-95	NR	5	ND	13.0	8.0	6.0	ND	ND	NI	NS
	Mar-95	NR	5	ND	12.0	9.0	ND	ND	ND	NI	NS
	Nov-95	NR	5	ND	14.0	8.0	9.0	ND	ND	NI	NS
	May-96	NR	5	ND	15.0	9.0	10.0	ND	ND	NI	NS
	Nov-96	NR	5	ND	15.0	ND	11.0	ND	ND	NI	NS
	Jun-97	NR	5	ND	19.0	11.0	14.0	ND	ND	NI	NS
	Dec-97	NR	5	ND	17.0	9.0	14.0	ND	ND	NI	NS
	May-98	NR	5	ND	20.0	8.6	12.0	ND	ND	NI	NS
	Nov-98	NR	5	ND	17.2	9.2	10.0	ND	ND	NI	NS
	Jul-99	NR	5	ND	14.0	10.0	11.0	ND	ND	NI	NS
	Nov-99	NR	5	ND	16.0	10.0	8.0	ND	ND	NI	NS
	May-00	NR	5	ND	17.0	11.0	10.0	ND	ND	NI	NS
	Oct-00	NR	5	ND	16.0	12.0	9.0	ND	ND	NI	NS
	Apr-01	NR	5	ND	16.0	13.0	6.0	ND	ND	NI	NS
	Oct-01	NR	0.5	ND	17.0	12.0	9.0	ND	ND	NI	NS
	Jun-02	NR	0.5	ND	16.0	11.0	8.0	ND	ND	NI	NS
	Nov-02	NR	0.5	ND	18.0	15.0	9.0	ND	ND	NI	NS
	Jun-03	NR	0.5	ND	17.7	13.3	7.4	ND	ND	NI	ND
	Dec-03	NR	5	ND	20.0	15.0	6.1	ND	ND	NI	ND
	Jun-04	NR	5	ND	18.0	15.0	9.9	ND	ND	NI	ND
	Dec-04	NR	5	ND	19.0	16.0	9.4	ND	ND	NI	ND
	Jun-05	NR	5	ND	15.0	13.0	8.0	ND	ND	NI	ND
	Dec-05	NR	5	ND	18.0	16.0	5.0	ND	ND	NI	ND
	28-Jun-06	NR	5	ND	16.5	10.8	7.8	ND	ND	NI	ND
	29-Dec-06	NR	3	ND	17.0	17.0	4.2	ND	ND	NI	ND
	12-Jul-07	NR	3	ND	17.0	16.0	ND	ND	ND	NI	ND
NC 2L = 50 ug/L (10/23/07)	19-Dec-07	NR	3	ND	17.3	16.9	4.7	ND	ND	ND	ND
	08-Jul-08	NR	3	ND	17.2	17.4	6.5	ND	ND	NS	ND
	17-Dec-08	0.23	3.0	ND	15.9	15.6	2.6 J	ND	ND	NS	ND
	09-Jul-09	0.23	3.0	ND	16.1	17.2	6.1	ND	ND	ND	ND
	16-Dec-09	0.23	3.0	ND	15.5	17.7	4.8	ND	ND	NS	ND
	24-Jun-10	0.23	3.0	ND	8.3	15.7	6.3	ND	ND	NS	ND
	13-Dec-10	0.23	3.0	ND	17.7	18.2	6.4	ND	ND	NS	0.28 J
	20-Jun-11	0.23	3.0	ND	16.3	17.2	6.7	ND	ND	NS	ND
	05-Dec-11	0.23	3.0	ND	14.2	17.0	5.8	ND	ND	NS	ND
	11-Jun-12	0.23	3.0	ND	12	14.8	4.4	ND	ND	ND	ND
	12-Dec-12	0.23	3.0	ND	15.8	17.9	4.5	ND	ND	NS	ND
Chloroethane	Sep-94	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-94	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Feb-95	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Mar-95	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-95	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	May-96	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-96	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-97	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-97	NR	10	ND	5.0	2.0	2.0	ND	ND	NI	NS
	May-98	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jul-99	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	May-00	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Apr-01	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-01	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-03	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-03	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	10	ND	2.2	1.9	ND	ND	ND	NI	ND
	12-Jul-07	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = 2,800 ug/L (10/23/07)	19-Dec-07	NR	10	ND	1.9	1.9	1.5	ND	ND	ND	ND
	08-Jul-08	NR	10	ND	2.2 J	2.5 J	1.8 J	ND	ND	NS	ND
	17-Dec-08	0.54	10.0	ND	1.6 J	ND	ND	ND	ND	NS	ND
	09-Jul-09	0.54	10.0	ND	ND	ND	3.8 J	ND	ND	ND	ND
	16-Dec-09	0.54	10.0	ND	ND	2.2 J	2.0 J	ND	ND	NS	ND
NC 2L = 3,000 ug/L (02/05/10)	24-Jun-10	0.54	10.0	ND	ND	2.1 J	2.0 J	ND	ND	NS	ND
	13-Dec-10	0.54	10.0	ND	1.8 J	2.0 J	1.7 J	ND	ND	NS	ND
	20-Jun-11	0.54	10.0	ND	1.2 J	2.2 J	2.0 J	ND	ND	NS	ND
	05-Dec-11	0.54	10.0	ND	1.3 J	2.0 J	1.7 J	ND	ND	NS	ND
	11-Jun-12	0.54	10.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.54	10.0	ND	ND	ND	ND	ND	ND	NS	ND

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
Chloromethane	09-Jul-09	0.11	1.0	ND	ND	ND	ND	ND	ND	ND	ND
NC 2L = 2.6 ug/L (10/23/07)	12/16/2009	0.11	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	6/24/2010	0.11	1.0	ND	ND	ND	ND	ND	0.11 J	NS	ND
NC 2L = 3 ug/L (02/05/10)	12/13/2010	0.11	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.11	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.11	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	0.11	1.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.11	1.0	ND	ND	ND	ND	ND	ND	NS	ND
1,2-Dichlorobenzene	Sep-94	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-94	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Feb-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Mar-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	May-96	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-96	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-97	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-97	NR	5	ND	3.0	2.0	1.0	ND	ND	NI	NS
	May-98	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	5	ND	2.4	2.3	ND	ND	ND	NI	NS
	Jul-99	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	May-00	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Apr-01	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-01	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-03	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-03	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	5	ND	1.5	2.3	ND	ND	ND	NI	ND
	12-Jul-07	NR	5	ND	1.4 J	1.7 J	0.31 J	ND	ND	NI	ND
NC 2L = 24 ug/L (10/23/07)	19-Dec-07	NR	5	ND	1.6	2.0	0.37 J	ND	ND	ND	ND
	08-Jul-08	NR	5	ND	1.6 J	2.0 J	0.39 J	ND	ND	NS	ND
	17-Dec-08	0.30	5.0	ND	1.4 J	1.9 J	ND	ND	ND	NS	ND
	09-Jul-09	0.30	5.0	ND	1.6 J	2.0 J	0.36 J	ND	ND	ND	ND
	16-Dec-09	0.30	5.0	ND	1.6 J	2.0 J	0.33 J	ND	ND	NS	ND
NC 2L = 20 ug/L (02/05/10)	24-Jun-10	0.30	5.0	ND	0.96 J	1.7 J	0.31 J	ND	ND	NS	ND
	13-Dec-10	0.30	5.0	ND	1.9 J	1.9 J	0.43 J	ND	ND	NS	ND
	20-Jun-11	0.30	5.0	ND	1.5 J	1.7 J	0.37 J	ND	ND	NS	ND
	05-Dec-11	0.30	5.0	ND	1.3 J	1.6 J	ND	ND	ND	NS	ND
	11-Jun-12	0.30	5.0	ND	1 J	1.5 J	ND	ND	ND	ND	ND
	12-Dec-12	0.30	5.0	ND	1.3 J	1.7 J	ND	ND	ND	NS	ND

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
1,4-Dichlorobenzene	9/8/1994	NR	5	ND	ND	5.0	ND	ND	ND	NI	NS
	12/1/1994	NR	5	ND	ND	5.0	ND	ND	ND	NI	NS
	2/9/1995	NR	5	ND	8.0	6.0	ND	ND	ND	NI	NS
	3/2/1995	NR	5	ND	7.0	6.0	ND	ND	ND	NI	NS
	11/15/1995	NR	5	ND	7.0	6.0	ND	ND	ND	NI	NS
	5/28/1996	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	11/22/1996	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	6/17/1997	NR	5	ND	7.6	6.2	ND	ND	ND	NI	NS
	12/1/1997	NR	5	ND	6.0	5.0	4.0	ND	ND	NI	NS
	5/20/1998	NR	5	ND	7.6	ND	ND	ND	ND	NI	NS
	11/19/1998	NR	5	ND	3.7	2.8	ND	ND	ND	NI	NS
	7/21/1999	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	11/16/1999	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	5/10/2000	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	10/26/2000	NR	5	ND	5.0	6.0	ND	ND	ND	NI	NS
	4/18/2001	NR	5	ND	ND	5.0	6.0	ND	ND	NI	NS
	10/27/2001	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	6/13/2002	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	11/19/2002	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	6/27/2003	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	12/30/2003	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	6/30/2004	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	12/29/2004	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	6/29/2005	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	12/29/2005	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	6/28/2006	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	12/29/2006	NR	3	ND	3.0	3.3	ND	ND	ND	NI	ND
Resample >	2/23/2007	NR	3	NS	3.2	3.3	NS	NS	NS	NI	ND
	7/12/2007	NR	1	ND	3.3	2.9	0.31 J	ND	ND	NI	ND
NC 2L = 1.4 ug/L (10/23/07)	12/19/2007	NR	1	ND	3.0	2.7	ND	ND	ND	ND	ND
	7/8/2008	NR	1	ND	3.0	2.4	ND	ND	ND	NS	ND
	12/17/2008	0.33	1.0	ND	2.9	2.5	ND	ND	ND	NS	ND
	7/9/2009	0.33	1.0	ND	ND	ND	ND	ND	ND	ND	ND
	12/16/2009	0.33	1.0	ND	2.8	2.2	ND	ND	ND	NS	ND
NC 2L = 6 ug/L (02/05/10)	6/24/2010	0.33	1.0	ND	1.6	ND	ND	ND	ND	NS	ND
	12/13/2010	0.33	1.0	ND	3.1	1.9	ND	ND	ND	NS	ND
	20-Jun-11	0.33	1.0	ND	2.7	1.6	ND	ND	ND	NS	ND
	05-Dec-11	0.33	1.0	ND	2.2	1.4	ND	ND	ND	NS	ND
	11-Jun-12	0.33	1.0	ND	1.8	1.4	ND	ND	ND	ND	ND
	12-Dec-12	0.33	1.0	ND	2.4	1.3	ND	ND	ND	NS	ND
Trans-1,4-Dichloro-2-Butene	Sep-94	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-94	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Feb-95	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Mar-95	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-95	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	May-96	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-96	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-97	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-97	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	May-98	NR	100	ND	ND	5.1	ND	ND	ND	NI	NS
	Nov-98	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Jul-99	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	May-00	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Apr-01	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-01	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-03	NR	100	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-03	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
	12-Jul-07	NR	100	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = NE ug/L (10/23/07)	19-Dec-07	NR	100	ND	ND	ND	ND	ND	ND	ND	ND
	08-Jul-08	NR	100	ND	ND	ND	ND	ND	ND	NS	ND
	17-Dec-08	1.0	100	ND	ND	ND	ND	ND	ND	NS	ND
	09-Jul-09	1.0	100	ND	ND	ND	ND	ND	ND	ND	ND
	16-Dec-09	1.0	100	ND	ND	ND	ND	ND	ND	NS	ND
	24-Jun-10	1.0	100	ND	ND	ND	ND	ND	ND	NS	ND
	13-Dec-10	1.0	100	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	1.0	100	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	1.0	100	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	1.0	100	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	1.0	100	ND	ND	ND	ND	ND	ND	NS	ND

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
1,1-Dichloroethane	Sep-94	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-94	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Feb-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Mar-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	May-96	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-96	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-97	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-97	NR	5	ND	ND	1.0	ND	ND	ND	NI	NS
	May-98	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jul-99	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	May-00	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Apr-01	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-01	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-03	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-03	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	12-Jul-07	NR	5	ND	ND	0.36 J	0.52 J	ND	ND	NI	ND
NC 2L = 70 ug/L (10/23/07)	19-Dec-07	NR	5	ND	ND	ND	0.57 J	ND	ND	ND	ND
	08-Jul-08	NR	5	ND	ND	ND	0.60 J	ND	ND	NS	ND
	17-Dec-08	0.32	5.0	ND	ND	ND	0.51 J	ND	ND	NS	ND
	09-Jul-09	0.32	5.0	ND	ND	ND	0.84 J	ND	ND	ND	ND
	16-Dec-09	0.32	5.0	ND	ND	ND	0.73 J	ND	ND	NS	ND
NC 2L = 6 ug/L (02/05/10)	24-Jun-10	0.32	5.0	ND	ND	ND	0.53 J	ND	ND	NS	ND
	13-Dec-10	0.32	5.0	ND	ND	ND	0.60 J	ND	ND	NS	ND
	20-Jun-11	0.32	5.0	ND	ND	ND	0.63 J	ND	ND	NS	ND
	05-Dec-11	0.32	5.0	ND	ND	ND	0.67 J	ND	ND	NS	ND
	11-Jun-12	0.32	5.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.32	5.0	ND	ND	ND	0.61 J	ND	ND	NS	ND
1,2-Dichloroethane	17-Dec-08	0.12	1.0	ND	ND	0.15 J	ND	ND	ND	NS	ND
NC 2L = 0.38 ug/L (10/23/07)	09-Jul-09	0.12	1.0	ND	ND	ND	ND	ND	ND	ND	0.19 J
	16-Dec-09	0.12	1.0	ND	ND	0.14 J	ND	ND	ND	NS	ND
NC 2L = 0.4 ug/L (02/05/10)	24-Jun-10	0.12	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	13-Dec-10	0.12	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.12	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.12	1.0	ND	ND	ND	ND	0.18 J	ND	NS	ND
	11-Jun-12	0.12	1.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.12	1.0	ND	ND	ND	ND	(0.20) J	ND	NS	0.20 (ND) J
Ethylbenzene	17-Dec-08	0.30	1.0	ND	0.31 J	ND	ND	ND	ND	NS	ND
NC 2L = 550 ug/L (10/23/07)	09-Jul-09	0.30	1.0	ND	ND	ND	ND	ND	ND	ND	ND
	16-Dec-09	0.30	1.0	ND	ND	ND	ND	ND	ND	NS	ND
NC 2L = 600 ug/L (02/05/10)	24-Jun-10	0.30	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	13-Dec-10	0.30	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.30	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.30	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	0.30	1.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.30	1.0	ND	ND	ND	ND	ND	ND	NS	ND
Isobutanol	24-Jun-10	35.0	100	ND	59.0 J	ND	ND	ND	ND	NS	ND
NC 2L = NE ug/L (02/05/10)	13-Dec-10	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	20-Jun-11	35.0	100	ND	39.5 J	ND	ND	ND	ND	NS	ND
	05-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	11-Jun-12	35.0	100.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
Methylene Chloride	09-Jul-09	0.97	2.0	ND	ND	ND	ND	ND	ND	ND	9.6
NC 2L = 4.3 ug/L (10/23/07)	16-Dec-09	0.97	2.0	ND	ND	ND	ND	ND	ND	NS	ND
	24-Jun-10	0.97	1.0	ND	19.0	ND	ND	ND	ND	NS	ND
NC 2L = 5 ug/L (02/05/10) *Resample* >	12-Aug-10	0.97	1.0	NS	ND	NS	NS	NS	NS	NS	ND
	13-Dec-10	0.97	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.97	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.97	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	0.97	1.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.97	1.0	ND	ND	ND	ND	ND	ND	NS	ND

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)										
		DL	RL	Background	Downgradient							Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1		
Naphthalene	08-Jul-08	NR	10	ND	3.8 J	ND	ND	ND	ND	NS		ND
NC 2L = 21 ug/L (10/23/07)	17-Dec-08	NR	NR	NS	NS	NS	NS	NS	NS	NS		NS
	09-Jul-09	0.24	10.0	ND	2.4 J	ND	ND	ND	ND	NS		ND
	16-Dec-09	NR	NR	NS	NS	NS	NS	NS	NS	NS		NS
NC 2L = 6 ug/L (02/05/10)	24-Jun-10	0.24	10.0	ND	7.4 J	ND	ND	ND	ND	NS		ND
	13-Dec-10	NR	NR	NS	NS	NS	NS	NS	NS	NS		NS
	20-Jun-11	0.24	10.0	ND	4.6 J	ND	ND	ND	ND	NS		0.39 J
	05-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS		NS
	11-Jun-12	0.2	10.0	ND	4.6 J	ND	ND	ND	ND	ND		ND
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS		NS
Toluene	Sep-94	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Dec-94	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Feb-95	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Mar-95	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Nov-95	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	May-96	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Nov-96	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Jun-97	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Dec-97	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	May-98	NR	5	ND	ND	8.1	ND	ND	ND	NI		NS
	Nov-98	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Jul-99	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Nov-99	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	May-00	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Oct-00	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Apr-01	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Oct-01	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Jun-02	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Nov-02	NR	5	ND	ND	ND	ND	ND	ND	NI		NS
	Jun-03	NR	5	ND	ND	ND	ND	ND	ND	NI		-
	Dec-03	NR	5	ND	ND	ND	ND	ND	ND	NI		ND
	Jun-04	NR	5	ND	ND	ND	ND	ND	ND	NI		ND
	Dec-04	NR	5	ND	ND	ND	ND	ND	ND	NI		ND
	Jun-05	NR	5	ND	ND	ND	ND	ND	ND	NI		ND
	Dec-05	NR	5	ND	ND	ND	ND	ND	ND	NI		ND
	28-Jun-06	NR	5	ND	ND	ND	ND	ND	ND	NI		ND
	29-Dec-06	NR	5	ND	ND	ND	ND	ND	ND	NI		ND
	12-Jul-07	NR	1	ND	0.49 B	ND	ND	ND	ND	NI		0.34 J
NC 2L = 1,000 ug/L (10/23/07)	19-Dec-07	NR	1	ND	0.51 J	ND	ND	ND	ND	ND		ND
	08-Jul-08	NR	1	ND	0.39 J	ND	ND	1.3	ND	NS		ND
	17-Dec-08	0.26	1.0	1.4	1.6	ND	ND	11.7	ND	NS		ND
	09-Jul-09	0.26	1.0	ND	0.46 J	ND	ND	ND	ND	ND		ND
	16-Dec-09	0.26	1.0	ND	0.42 J	ND	ND	ND	ND	NS		ND
NC 2L = 600 ug/L (02/05/10)	24-Jun-10	0.26	1.0	ND	ND	ND	ND	ND	ND	NS		ND
	13-Dec-10	0.26	1.0	ND	0.54 J	ND	ND	ND	ND	NS		ND
	20-Jun-11	0.26	1.0	ND	0.34 J	ND	ND	ND	ND	NS		ND
	05-Dec-11	0.26	1.0	ND	0.28 J	ND	ND	0.30 J	ND	NS		ND
	11-Jun-12	0.26	1.0	ND	0.28 J	ND	ND	ND	ND	ND		ND
	12-Dec-12	0.26	1.0	ND	0.29 J	ND	ND	0.36 J	ND	NS		ND

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
Vinyl Chloride	Sep-94	NR	10	ND	ND	12.0	ND	ND	ND	NI	NS
	Dec-94	NR	10	ND	ND	13.0	ND	ND	ND	NI	NS
	Feb-95	NR	10	ND	ND	15.0	ND	ND	ND	NI	NS
	Mar-95	NR	10	ND	ND	14.0	ND	ND	ND	NI	NS
	Nov-95	NR	10	ND	ND	11.0	ND	ND	ND	NI	NS
	May-96	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-96	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-97	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-97	NR	10	ND	ND	7.0	4.0	ND	ND	NI	NS
	May-98	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jul-99	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	May-00	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Apr-01	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-01	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-03	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-03	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	5.5	ND	ND	0.98 J	ND	ND	ND	NI	ND
Resample >	23-Feb-07	NR	5.5	NS	NS	1.0	NS	NS	NS	NI	ND
	12-Jul-07	NR	1	ND	ND	ND	ND	ND	ND	NS	ND
NC 2L = 0.015 ug/L (10/23/07)	19-Dec-07	NR	1	ND	ND	ND	ND	ND	ND	ND	ND
	08-Jul-08	NR	1	ND	ND	0.76 J	ND	ND	ND	NS	ND
	17-Dec-08	0.62	1.0	ND	ND	0.76 J	ND	ND	ND	NS	ND
	09-Jul-09	0.62	1.0	ND	ND	0.99 J	ND	ND	ND	ND	ND
	16-Dec-09	0.62	1.0	ND	ND	0.81 J	ND	ND	ND	NS	ND
NC 2L = 0.03 ug/L (02/05/10)	24-Jun-10	0.62	1.0	ND	ND	0.77 J	ND	ND	ND	NS	ND
	13-Dec-10	0.62	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.62	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.62	1.0	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	0.62	1.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.62	1.0	ND	ND	ND	ND	ND	ND	NS	ND
Total Xylenes	Sep-94	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-94	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Feb-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Mar-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-95	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	May-96	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-96	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-97	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-97	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	May-98	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jul-99	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	May-00	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Apr-01	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-01	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-03	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Dec-03	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	5	ND	1.4	ND	ND	ND	ND	NI	ND
	12-Jul-07	NR	4	ND	1.2 J	ND	ND	ND	ND	NI	ND
NC 2L = 530 ug/L (10/23/07)	19-Dec-07	NR	4	ND	2.0	ND	ND	ND	ND	ND	ND
	08-Jul-08	NR	4	ND	1.1 J	ND	ND	ND	ND	NS	ND
	17-Dec-08	0.66	2.0	1.4 J	2.7	ND	ND	ND	ND	NS	ND
	09-Jul-09	0.66	2.0	ND	1.5 J	ND	ND	ND	ND	ND	ND
	16-Dec-09	0.66	2.0	ND	2.2	ND	ND	ND	ND	NS	ND
NC 2L = 500 ug/L (02/05/10)	24-Jun-10	0.66	2.0	ND	0.73 J	ND	ND	ND	ND	NS	ND
	13-Dec-10	0.66	2.0	ND	2.0	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.66	2.0	ND	1.4 J	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.66	2.0	ND	1.1 J	ND	ND	ND	ND	NS	ND
	11-Jun-12	0.66	2.0	ND	0.91 J	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.66	5	ND	0.97 J	ND	ND	ND	ND	NS	ND

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
Benzo(g,h,i)perylene	20-Jun-11	0.4	10.0	ND	ND	ND	ND	ND	1.4 J	NS	ND
NC 2L = 200 ug/L (2/5/10)	05-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	11-Jun-12	0.38	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
Dibenz(a,h)anthracene	20-Jun-11	0.55	10.0	ND	ND	ND	ND	ND	1.5 J	NS	ND
NC 2L = 0.005 ug/L (2/5/10)	05-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	11-Jun-12	0.6	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
Fluorene	6/24/2010	3.8	12.2	ND	4.3 J	ND	ND	ND	ND	NS	ND
NC 2L = 300 ug/L (2/5/10) *Resample >*	8/12/2010	3.1	10.0	NS	ND	NS	NS	NS	NS	NS	ND
	12/13/2010	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	20-Jun-11	0.2	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	11-Jun-12	0.21	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	12-Dec-12	NR	NR	ND	NS	NS	NS	NS	NS	NS	NS
Indeno(1,2,3-cd)pyrene	20-Jun-11	0.29	10.0	ND	ND	ND	ND	ND	1.3 J	NS	ND
NC 2L = 0.05 ug/L (2/5/10)	5-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	11-Jun-12	0.29	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
2-Methylnaphthalene	6/24/2010	5.1	12.2	ND	38.9	ND	ND	ND	ND	NS	ND
NC 2L = 30 ug/L (02/05/10) *Resample >*	8/12/2010	4.2	10	NS	ND	NS	NS	NS	NS	NS	ND
	12/13/2010	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	20-Jun-11	0.3	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	11-Jun-12	0.28	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
Phorate	Dec-97	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	10	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	10	NS	ND	ND	ND	ND	NS	NI	NS
	Apr-01	NR	10	NS	3.2	ND	ND	ND	NS	NI	NS
	Oct-01	NR	5	ND	8.1	ND	ND	ND	ND	NI	NS
	Oct-01	NR	0.5	NS	8.1	1.3	ND	ND	NS	NI	NS
	Jun-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	0.5	NS	ND	ND	ND	ND	NS	NI	NS
	Nov-02	NR	5	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-03	NR	5	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	28-Jun-06	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	12-Jul-07	NR	10	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = 1.4 ug/L (10/23/07)	19-Dec-07	NR	NR	NS	NS	NS	NS	NS	NS	ND	NS
	08-Jul-08	NR	10	ND	ND	ND	ND	ND	ND	NS	ND
	17-Dec-08	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	09-Jul-09	6.6	22.2	ND	ND	ND	ND	ND	ND	NS	ND
	16-Dec-09	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
NC 2L = 1 ug/L (02/05/10)	24-Jun-10	6.5	24.1	ND	ND	ND	ND	ND	ND	NS	ND
	13-Dec-10	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	20-Jun-11	5.4	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
	11-Jun-12	5.4	10.0	ND	ND	ND	ND	ND	ND	NS	ND
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
Beta-BHC	11-Jun-12	0.05	0.05	ND	ND	0.16	ND	ND	ND	NS	ND
NC 2L = 0.019 ug/L (10/23/07) Resample>	19-Jul-12	0.05	0.05	NS	NS	ND	NS	NS	NS	NS	NS
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
Delta-BHC	11-Jun-12	0.05	0.05	ND	ND	0.090	ND	ND	ND	NS	ND
NC 2L = 0.019 ug/L (10/23/07) Resample>	19-Jul-12	0.05	0.05	NS	NS	ND	NS	NS	NS	NS	NS
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
Gamma-BHC	Dec-97	NR	0.05	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	0.05	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	0.05	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	0.05	NS	ND	ND	ND	ND	NS	NI	NS
	Apr-01	NR	0.05	NS	ND	ND	ND	ND	NS	NI	NS
	Oct-01	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	Jun-02	NR	0.05	ND	ND	ND	ND	ND	ND	NI	NS
	Jun-02	NR	0.05	NS	ND	ND	ND	ND	NS	NI	NS
	Jun-02	NR	0.5	NS	ND	ND	ND	ND	NS	NI	NS
	Nov-02	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	Jun-03	NR	1.05	ND	0.085	ND	ND	ND	ND	NI	ND
	Dec-03	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	12-Jul-07	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = 0.2 ug/L (10/23/07)	19-Dec-07	NR	0.05	ND	ND	ND	ND	ND	ND	ND	ND
	08-Jul-08	NR	0.50	ND	ND	ND	ND	ND	ND	NS	ND
	17-Dec-08	0.050	0.050	ND	ND	ND	ND	ND	ND	NS	ND
	09-Jul-09	0.050	0.050	ND	ND	ND	ND	ND	ND	NS	ND
	16-Dec-09	0.01	0.1	ND	ND	ND	ND	ND	ND	NS	ND
NC 2L = 0.03 ug/L (02/05/10)	24-Jun-10	0.00021	0.010	ND	ND	0.052	ND	ND	ND	NS	ND
Resample >	12-Aug-10	0.00020	0.010	NS	NS	ND	NS	NS	NS	NS	ND
	13-Dec-10	0.00020	0.050	ND	ND	0.013 J	ND	ND	ND	NS	ND
	20-Jun-11	0.00020	0.050	ND	ND	0.066	ND	ND	ND	NS	ND
Resample >	28-Jul-11	0.00020	0.010	NS	NS	ND	NS	NS	NS	NS	ND
	5-Dec-11	0.05	0.05	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.05	0.05	ND	ND	ND	ND	ND	ND	NS	ND
Heptachlor	Dec-97	NR	0.05	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-98	NR	0.05	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-99	NR	0.05	ND	ND	ND	ND	ND	ND	NI	NS
	Oct-00	NR	0.05	NS	ND	ND	ND	ND	NS	NI	NS
	Apr-01	NR	0.05	NS	ND	ND	ND	ND	NS	NI	NS
	Oct-01	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	Jun-02	NR	1.05	ND	ND	ND	ND	ND	ND	NI	NS
	Nov-02	NR	NR	NS	NS	NS	NS	NS	NS	NI	NS
	Jun-03	NR	1.05	ND	0.03	0.17	ND	ND	ND	NI	ND
	Dec-03	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
	12-Jul-07	NR	0.05	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = 0.0078 ug/L (10/23/07)	19-Dec-07	NR	0.05	ND	ND	ND	ND	ND	ND	ND	ND
	08-Jul-08	NR	0.05	ND	ND	ND	ND	ND	ND	NS	ND
	17-Dec-08	0.050	0.050	ND	ND	ND	ND	ND	ND	NS	ND
	09-Jul-09	0.050	0.050	ND	ND	ND	ND	ND	ND	NS	ND
	16-Dec-09	0.02	0.1	ND	ND	ND	ND	ND	ND	NS	ND
NC 2L = 0.008 ug/L (02/05/10)	24-Jun-10	0.0015	0.010	ND	ND	ND	ND	ND	ND	NS	ND
	13-Dec-10	0.0500	0.0015	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.050	0.0015	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.050	0.056	ND	0.062	ND	ND	ND	ND	NS	ND
Resample >	25-Jan-12	0.050	0.0500	NS	ND	NS	NS	NS	NS	NS	ND
	11-Jun-12	0.050	0.0500	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.050	0.050	ND	ND	ND	ND	ND	ND	NS	ND
2,4-D	Jun-03	NR	3	NS	5.9	ND	ND	ND	NS	NI	NS
	Dec-03	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-04	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-04	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
	Jun-05	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
	Dec-05	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
	28-Jun-06	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
	29-Dec-06	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
	12-Jul-07	NR	2	ND	ND	ND	ND	ND	ND	NI	ND
NC 2L = 70 ug/L (10/23/07)	19-Dec-07	NR	2	ND	ND	ND	ND	ND	ND	ND	ND
	08-Apr-08	NR	2	ND	ND	ND	ND	ND	ND	NS	ND
	17-Dec-08	NR	2.0	ND	ND	ND	ND	ND	ND	NS	ND
	09-Jul-09	NR	2.0	ND	ND	ND	ND	ND	ND	NS	ND
	16-Dec-09	0.11	5.0	ND	ND	ND	ND	ND	ND	NS	ND
	24-Jun-10	0.23	2.1	ND	ND	ND	ND	ND	ND	NS	ND
	10-Dec-10	0.22	2.0	ND	ND	ND	ND	ND	ND	NS	ND
	20-Jun-11	0.22	2.0	ND	ND	ND	ND	ND	ND	NS	ND
	05-Dec-11	0.22	2.0	ND	ND	ND	ND	ND	ND	NS	ND
	11-Jun-12	0.22	2.0	ND	ND	ND	ND	ND	ND	ND	ND
	12-Dec-12	0.22	2.0	ND	ND	ND	ND	ND	ND	NS	ND

TABLE 7:
HISTORICAL ORGANIC CONSTITUENTS IN GROUNDWATER

Constituent		Concentration (µg/L)									
		DL	RL	Background	Downgradient						Blanks
				MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	
4,4'-DDD	11-Jun-12	0.05	0.05	ND	ND	0.13	ND	ND	ND	NS	ND
NC 2L = 0.1 µg/L (2/5/10) *Resample>*	19-Jul-12	0.05	0.10	NS	NS	ND	NS	NS	NS	NS	NS
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
4,4'-DDT	11-Jun-12	0.05	0.05	ND	ND	0.10	ND	ND	ND	NS	ND
NC 2L = 0.1 µg/L (2/5/10) *Resample>*	19-Jul-12	0.05	0.10	NS	NS	0.063 J	NS	NS	NS	NS	NS
	12-Dec-12	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS
Endrin aldehyde	11-Jun-12	0.050	0.050	ND	ND	0.14	ND	ND	ND	NS	NS
NC 2L= 2 (2/5/10)	12-Dec-12	0.050	0.10	ND	ND	ND	ND	ND	ND	NS	NS

Notes:
1. All concentrations are in micrograms per liter (mg/L).
2. RL = Laboratory reporting limit (NC SWSL from October 2007 to present).
3. ND = Not detected above laboratory reporting limit.
4. B = Blank-qualified data; result is expected to be biased high based on concentrations in the blanks
5. NC 2L = North Carolina 2L Groundwater Standards.
6. GWPS = Groundwater Protection Standards.
7. When the NC 2L has not been established, the GWPS will be used.
8. Shaded values for groundwater are above the NC 2L Groundwater Standards or Groundwater Protection Standards.
7. Shaded values for surface water are above the NC 2B Surface Water Standards (NC2B) or National Criteria per EPA (EPA NC).
9. DL = Laboratory detection limit.
10. J = Estimated value between the DL and the RL
11. NI = Well/Piezometer not installed.
12. NS = Not sampled.
13. NR = Not Reported.
14. DRY = Monitoring well or surface water point considered to be dry.
15. Surface waters are classified as WS-IV/NSW (WS, human health, and fresh-water aquatic life).
16. When results for a constituent are reported by both acceptable methods from the lab, the higher result is entered into the historical table.

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)						
		DL	RL	Surface Water				Blanks
				SW-1		SW-2		
Arsenic	Sep-94	NR	10	ND		ND		NS
	Dec-94	NR	10	ND		ND		NS
	Feb-95	NR	10	ND		ND		NS
	Mar-95	NR	10	ND		ND		NS
	Nov-95	NR	10	ND		ND		NS
	May-96	NR	10	ND		ND		NS
	Nov-96	NR	10	ND		ND		NS
	Jun-97	NR	10	ND		ND		NS
	Dec-97	NR	10	ND		ND		NS
	May-98	NR	10	ND		ND		NS
	Nov-98	NR	10	ND		ND		NS
	Jul-99	NR	10	ND		ND		NS
	Nov-99	NR	10	ND		ND		NS
	May-00	NR	10	ND		ND		NS
	Oct-00	NR	10	ND		ND		NS
	Apr-01	NR	10	ND		ND		NS
	Oct-01	NR	10	ND		ND		NS
	Jun-02	NR	10	NS		NS		NS
	Nov-02	NR	10	ND		ND		NS
	Jun-03	NR	10	ND		ND		NS
	Dec-03	NR	10	ND		ND		ND
	Jun-04	NR	10	ND		ND		ND
	Dec-04	NR	10	ND		ND		ND
	Jun-05	NR	10	ND		ND		ND
	Dec-05	NR	10	ND		ND		ND
	28-Jun-06	NR	10	ND		ND		ND
	29-Dec-06	NR	10	ND		ND		ND
	12-Jul-07	NR	10	ND		DRY		ND
	19-Dec-07	NR	10	ND		ND		ND
NC 2B = 10 ug/L (03/28/08)	08-Jul-08	NR	10	ND		ND		ND
	17-Dec-08	2.7	10.0	ND		ND		ND
	09-Jul-09	2.7	10.0	ND		ND		ND
	16-Dec-09	2.7	10.0	ND		ND		ND
	24-Jun-10	2.7	10.0	4.3	J	2.9	J	ND
Resample >	12-Aug-10	2.7	10.0	NS		NS		ND
Resample >	31-Aug-10	2.7	10.0	NS		NS		ND
	13-Dec-10	2.7	10.0	ND		ND		ND
	20-Jun-11	5.0	10.0	ND		ND		ND
	05-Dec-11	5.0	10.0	ND		ND		ND
	11-Jun-12	5.0	10.0	ND		ND		ND
	12-Dec-12	5.0	10.0	ND		ND		ND

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Barium	Sep-94	NR	500	ND		ND		NS	
	Dec-94	NR	500	ND		ND		NS	
	Feb-95	NR	500	ND		ND		NS	
	Mar-95	NR	500	ND		ND		NS	
	Nov-95	NR	500	ND		ND		NS	
	May-96	NR	500	ND		ND		NS	
	Nov-96	NR	500	37.0		37.0		NS	
	Jun-97	NR	500	37.0		62.0		NS	
	Dec-97	NR	500	53.0		45.0		NS	
	May-98	NR	500	24.0		69.0		NS	
	Nov-98	NR	500	ND		100		NS	
	Jul-99	NR	500	ND		ND		NS	
	Nov-99	NR	500	ND		ND		NS	
	May-00	NR	500	ND		ND		NS	
	Oct-00	NR	500	ND		ND		NS	
	Apr-01	NR	500	ND		ND		NS	
	Oct-01	NR	500	ND		ND		NS	
	Jun-02	NR	500	NS		NS		NS	
	Nov-02	NR	500	ND		ND		NS	
	Jun-03	NR	500	ND		ND		NS	
	Dec-03	NR	500	ND		ND		ND	
	Jun-04	NR	500	ND		ND		ND	
	Dec-04	NR	500	ND		ND		ND	
	Dec-04	NR	500	ND		ND		ND	
	Jun-05	NR	500	ND		ND		ND	
	Dec-05	NR	500	ND		ND		ND	
	28-Jun-06	NR	500	ND		ND		ND	
	29-Dec-06	NR	100	37.5		40.6		0.20	J
	12-Jul-07	NR	100	33.3	J	DRY		ND	
	19-Dec-07	NR	100	52.6	B	149		11.7	
NC 2B = 1,000 ug/L (03/28/08)	08-Jul-08	NR	100	33.8	J	161		0.29	J
	17-Dec-08	0.20	100	30.2	B	33.5	B	10.7	J
	09-Jul-09	0.20	100	36.8	B	78.4	B	17.6	J
	16-Dec-09	0.20	100	31.2	B	36.2	B	17.1	J
	24-Jun-10	0.20	100	34.5	B	71.3	B	27.3	J
	13-Dec-10	0.20	100	36.1	B	91.0	J	12.1	J
	20-Jun-11	5.00	100	40.3	J	93.0	J	ND	
	05-Dec-11	5.00	100	32.9	J	59.0	J	ND	
	11-Jun-12	5.00	100	40.0	J	95.6	J	ND	
	12-Dec-12	5.00	100	45.0	J	97.8	J	ND	

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)					
		DL	RL	Surface Water			Blanks
				SW-1		SW-2	
Beryllium	Sep-94	NR	2	ND		ND	NS
	Dec-94	NR	2	ND		ND	NS
	Feb-95	NR	2	ND		ND	NS
	Mar-95	NR	2	ND		ND	NS
	Nov-95	NR	2	ND		ND	NS
	May-96	NR	2	ND		ND	NS
	Nov-96	NR	2	ND		ND	NS
	Jun-97	NR	2	ND		ND	NS
	Dec-97	NR	2	ND		ND	NS
	May-98	NR	2	ND		ND	NS
	Nov-98	NR	2	ND		ND	NS
	Jul-99	NR	2	ND		ND	NS
	Nov-99	NR	2	ND		ND	NS
	May-00	NR	2	ND		ND	NS
	Oct-00	NR	2	ND		ND	NS
	Apr-01	NR	2	ND		ND	NS
	Oct-01	NR	2	ND		ND	NS
	Jun-02	NR	2	NS		NS	NS
	Nov-02	NR	2	ND		ND	NS
	Jun-03	NR	2	ND		ND	NS
	Dec-03	NR	2	ND		ND	ND
	Jun-04	NR	2	ND		ND	ND
	Dec-04	NR	2	ND		ND	ND
	Dec-04	NR	2	ND		ND	ND
	Jun-05	NR	2	ND		ND	ND
	Dec-05	NR	2	ND		ND	ND
	28-Jun-06	NR	2	ND		ND	ND
	29-Dec-06	NR	1	ND		ND	ND
	12-Jul-07	NR	1	ND		DRY	ND
	19-Dec-07	NR	1	ND		ND	ND
NC 2B = 6.5 ug/L (03/28/08)	08-Jul-08	NR	1	0.32	J	ND	ND
	17-Dec-08	0.10	1.0	ND		ND	ND
	09-Jul-09	0.10	1.0	ND		ND	ND
	16-Dec-09	0.10	1.0	0.12	J	ND	ND
NC 2B = 6.5 ug/L (02/05/10)	24-Jun-10	0.10	1.0	ND		ND	ND
	13-Dec-10	0.10	1.0	ND		ND	ND
	20-Jun-11	1.0	1.0	ND		ND	ND
	05-Dec-11	1.0	1.0	ND		ND	ND
	11-Jun-12	1.0	1.0	ND		ND	ND
	12-Dec-12	1.0	1.0	ND		ND	ND

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Chromium	Sep-94	NR	10	ND		ND		NS	
	Dec-94	NR	10	ND		ND		NS	
	Feb-95	NR	10	ND		ND		NS	
	Mar-95	NR	10	ND		ND		NS	
	Nov-95	NR	10	ND		ND		NS	
	May-96	NR	10	ND		ND		NS	
	Nov-96	NR	10	ND		ND		NS	
	Jun-97	NR	10	ND		3.0		NS	
	Dec-97	NR	10	ND		ND		NS	
	May-98	NR	10	ND		ND		NS	
	Nov-98	NR	10	ND		ND		NS	
	Jul-99	NR	10	ND		ND		NS	
	Nov-99	NR	10	ND		ND		NS	
	May-00	NR	10	ND		ND		NS	
	Oct-00	NR	10	ND		ND		NS	
	Apr-01	NR	10	ND		ND		NS	
	Oct-01	NR	10	ND		ND		NS	
	Jun-02	NR	10	NS		NS		NS	
	Nov-02	NR	10	ND		ND		NS	
	Jun-03	NR	10	ND		ND		NS	
	Dec-03	NR	10	ND		ND		ND	
	Jun-04	NR	10	ND		ND		ND	
	Dec-04	NR	10	ND		ND		ND	
	Jun-05	NR	10	ND		ND		ND	
	Dec-05	NR	10	ND		ND		ND	
	28-Jun-06	NR	10	ND		ND		ND	
	29-Dec-06	NR	10	ND		ND		ND	
	12-Jul-07	NR	10	ND		DRY		ND	
	19-Dec-07	NR	10	2.2	B	2.6	B	1.4	J
NC 2B = 50 ug/L (03/28/08)	08-Jul-08	NR	10	2.5	J	2.2	J	ND	
	17-Dec-08	0.40	10.0	1.4	J	2.6	J	ND	
	09-Jul-09	0.40	10.0	2.6	J	1.2	J	ND	
	16-Dec-09	0.40	10.0	4.1	J	3.4	J	ND	
	24-Jun-10	0.40	10.0	3.3	B	7.3	J	0.71	J
	13-Dec-10	0.40	10.0	1.4	J	1.5	J	ND	
	20-Jun-11	5.00	10.0	ND		ND		ND	
	05-Dec-11	5.00	10.0	ND		ND		ND	
	11-Jun-12	5.00	10.0	ND		7.2	J	ND	
	12-Dec-12	5.00	10.0	ND		8.2	J	ND	

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Cobalt	Sep-94	NR	10	ND		ND		NS	
	Dec-94	NR	10	ND		ND		NS	
	Feb-95	NR	10	ND		ND		NS	
	Mar-95	NR	10	ND		ND		NS	
	Nov-95	NR	10	ND		ND		NS	
	May-96	NR	10	ND		ND		NS	
	Nov-96	NR	10	ND		ND		NS	
	Jun-97	NR	10	ND		ND		NS	
	Dec-97	NR	10	ND		ND		NS	
	May-98	NR	10	2.0		2.0		NS	
	Nov-98	NR	10	ND		3.0		NS	
	Jul-99	NR	10	ND		ND		NS	
	Nov-99	NR	10	ND		ND		NS	
	May-00	NR	10	ND		ND		NS	
	Oct-00	NR	10	ND		ND		NS	
	Apr-01	NR	10	ND		ND		NS	
	Oct-01	NR	10	ND		22.0		NS	
	Jun-02	NR	10	NS		NS		NS	
	Nov-02	NR	10	ND		ND		NS	
	Jun-03	NR	10	ND		10.0		NS	
	Dec-03	NR	10	ND		ND		ND	
	Jun-04	NR	10	ND		ND		ND	
	Dec-04	NR	10	ND		ND		ND	
	Jun-05	NR	10	ND		ND		ND	
	Dec-05	NR	10	ND		ND		ND	
		NR	10	ND		ND		ND	
	29-Dec-06	NR	10	ND		ND		ND	
	12-Jul-07	NR	10	ND		DRY		ND	
	19-Dec-07	NR	10	4.2	B	1.2	B	1.8	J
	08-Jul-08	NR	10	4.8	B	10.5	B	6.2	J
	17-Dec-08	0.60	10.0	1.7	B	1.1	B	2.5	J
	09-Jul-09	0.60	10.0	ND		ND		ND	
	16-Dec-09	0.60	10.0	ND		1.0	J	ND	
NC 2B = NE ug/L (03/24/10)	24-Jun-10	0.60	10.0	ND		ND		ND	
	13-Dec-10	0.60	10.0	{4.4}	B	{ND}		1.6 {1.0 J}	J
	20-Jun-11	5.0	10.0	ND		ND		ND	
	05-Dec-11	5.0	10.0	ND		ND		ND	
Resample >	25-Jan-12	5.0	10.0	NS		NS		ND	
	11-Jun-12	5.0	10.0	ND		5.1	J	ND	
	12-Dec-12	5.0	10.0	ND		ND		ND	

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Copper	Sep-94	NR	200	ND		ND		NS	
	Dec-94	NR	200	ND		ND		NS	
	Feb-95	NR	200	ND		ND		NS	
	Mar-95	NR	200	ND		ND		NS	
	Nov-95	NR	200	ND		ND		NS	
	May-96	NR	200	ND		ND		NS	
	Nov-96	NR	200	ND		ND		NS	
	Jun-97	NR	200	ND		ND		NS	
	Dec-97	NR	200	ND		ND		NS	
	May-98	NR	200	ND		ND		NS	
	Nov-98	NR	200	ND		ND		NS	
	Jul-99	NR	200	ND		ND		NS	
	Nov-99	NR	200	ND		ND		NS	
	May-00	NR	200	ND		ND		NS	
	Oct-00	NR	200	ND		ND		NS	
	Apr-01	NR	200	ND		ND		NS	
	Oct-01	NR	200	ND		ND		NS	
	Jun-02	NR	200	NS		NS		NS	
	Nov-02	NR	200	ND		ND		NS	
	Jun-03	NR	200	ND		ND		NS	
	Dec-03	NR	200	ND		ND		ND	
	Jun-04	NR	200	ND		ND		ND	
	Dec-04	NR	200	ND		ND		ND	
	Jun-05	NR	200	ND		ND		ND	
	Dec-05	NR	200	ND		ND		ND	
	28-Jun-06	NR	200	ND		ND		ND	
	29-Dec-06	NR	10	1.30	B	1.10	B	0.60	J
	12-Jul-07	NR	10	ND		DRY		ND	
	19-Dec-07	NR	10	5.3	B	ND		9.8	
NC 2B = 7 ug/L (03/28/08)	08-Jul-08	NR	10	1.7	J	4.2	J	ND	
	17-Dec-08	0.30	10.0	1.4	J	1.5	J	ND	
	09-Jul-09	0.30	10.0	ND		ND		ND	
	16-Dec-09	0.30	10.0	1.9	J	2.0	J	ND	
	24-Jun-10	0.30	10.0	ND		3.1	J	ND	
	13-Dec-10	0.30	10.0	0.31	B	ND		0.49	J
	20-Jun-11	5.0	10.0	ND		ND		ND	
	05-Dec-11	5.0	10.0	ND		ND		ND	
	11-Jun-12	5.0	10.0	ND		5.5	J	ND	
	12-Dec-12	5.0	10.0	ND		ND		ND	

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)				
		DL	RL	Surface Water		Blanks
				SW-1	SW-2	
Lead	Sep-94	NR	10	ND	ND	NS
	Dec-94	NR	10	ND	ND	NS
	Feb-95	NR	10	ND	ND	NS
	Mar-95	NR	10	ND	ND	NS
	Nov-95	NR	10	ND	ND	NS
	May-96	NR	10	ND	ND	NS
	Nov-96	NR	10	ND	ND	NS
	Jun-97	NR	10	ND	ND	NS
	Dec-97	NR	10	ND	ND	NS
	May-98	NR	10	ND	8	NS
	Nov-98	NR	10	ND	ND	NS
	Jul-99	NR	10	ND	10	NS
	Nov-99	NR	10	ND	ND	NS
	May-00	NR	10	ND	ND	NS
	Oct-00	NR	10	ND	ND	NS
	Apr-01	NR	10	ND	ND	NS
	Oct-01	NR	10	ND	ND	NS
	Jun-02	NR	10	NS	NS	NS
	Nov-02	NR	10	ND	ND	NS
	Jun-03	NR	10	ND	ND	NS
	Dec-03	NR	10	ND	ND	ND
	Jun-04	NR	10	ND	ND	ND
	Dec-04	NR	10	ND	ND	ND
	Jun-05	NR	10	ND	ND	ND
	Dec-05	NR	10	ND	ND	ND
	28-Jun-06	NR	10	ND	ND	ND
	29-Dec-06	NR	10	ND	ND	ND
	12-Jul-07	NR	10	ND	DRY	ND
	19-Dec-07	NR	10	ND	ND	ND
NC 2B = 25 ug/L (03/28/08)	08-Jul-08	NR	10	ND	ND	ND
	17-Dec-08	4.0	10.0	ND	ND	ND
	09-Jul-09	4.0	10.0	ND	ND	ND
	16-Dec-09	4.0	10.0	ND	ND	ND
	24-Jun-10	4.0	10.0	ND	ND	ND
	13-Dec-10	4.0	10.0	ND	ND	ND
	20-Jun-11	5.0	10.0	ND	ND	ND
	05-Dec-11	5.0	10.0	ND	ND	ND
	11-Jun-12	5.0	10.0	ND	ND	ND
	12-Dec-12	5.0	10.0	ND	ND	ND

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Nickel	Sep-94	NR	50	ND		ND		NS	
	Dec-94	NR	50	ND		ND		NS	
	Feb-95	NR	50	ND		ND		NS	
	Mar-95	NR	50	ND		ND		NS	
	Nov-95	NR	50	ND		ND		NS	
	May-96	NR	50	ND		ND		NS	
	Nov-96	NR	50	ND		ND		NS	
	Jun-97	NR	50	ND		ND		NS	
	Dec-97	NR	50	ND		ND		NS	
	May-98	NR	50	ND		ND		NS	
	Nov-98	NR	50	ND		ND		NS	
	Jul-99	NR	50	ND		ND		NS	
	Nov-99	NR	50	ND		ND		NS	
	May-00	NR	50	ND		ND		NS	
	Oct-00	NR	50	ND		ND		NS	
	Apr-01	NR	50	ND		ND		NS	
	Oct-01	NR	50	ND		ND		NS	
	Jun-02	NR	50	NS		NS		NS	
	Nov-02	NR	50	ND		ND		NS	
	Jun-03	NR	50	ND		ND		NS	
	Dec-03	NR	50	ND		ND		ND	
	Jun-04	NR	50	ND		ND		ND	
	Dec-04	NR	50	ND		50.0 (ND)		ND	
	Jun-05	NR	50	ND		ND		ND	
	Dec-05	NR	50	ND		ND		ND	
	28-Jun-06	NR	50	ND		ND		ND	
	29-Dec-06	NR	50	ND		2.9	J	ND	
	12-Jul-07	NR	50	3.8	J	DRY		ND	
	19-Dec-07	NR	50	6.0		31.5		ND	
NC 2B = 25 ug/L (03/28/08)	08-Jul-08	NR	50	3.2	J	29.8	J	ND	
	17-Dec-08	1.7	50.0	2.4	B	4.0	B	2.4	J
	09-Jul-09	1.7	50.0	4.1	J	12.3	J	ND	
	16-Dec-09	1.7	50.0	3.8	B	4.4	B	3.0	J
	24-Jun-10	1.7	50.0	ND		2.0	J	ND	
	13-Dec-10	1.7	50.0	ND		14.2	J	2.7	J
	20-Jun-11	5.0	50.0	ND		7.8	J	ND	
	05-Dec-11	5.0	50.0	ND		5.3	J	ND	
	11-Jun-12	5.0	50.0	ND		11.0	J	ND	
	12-Dec-12	5.0	50.0	ND		13.8	J	ND	

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Silver	Sep-94	NR	10	ND		ND		NS	
	Dec-94	NR	10	ND		ND		NS	
	Feb-95	NR	10	ND		ND		NS	
	Mar-95	NR	10	ND		ND		NS	
	Nov-95	NR	10	ND		ND		NS	
	May-96	NR	10	ND		ND		NS	
	Nov-96	NR	10	ND		ND		NS	
	Jun-97	NR	10	ND		ND		NS	
	Dec-97	NR	10	ND		ND		NS	
	May-98	NR	10	ND		ND		NS	
	Nov-98	NR	10	ND		ND		NS	
	Jul-99	NR	10	ND		ND		NS	
	Nov-99	NR	10	ND		ND		NS	
	May-00	NR	10	ND		ND		NS	
	Oct-00	NR	10	ND		ND		NS	
	Apr-01	NR	10	ND		ND		NS	
	Oct-01	NR	10	ND		ND		NS	
	Jun-02	NR	10	NS		NS		NS	
	Nov-02	NR	10	ND		ND		NS	
	Jun-03	NR	10	ND		ND		NS	
	Dec-03	NR	10	ND		ND		ND	
	Jun-04	NR	10	ND		ND		ND	
	Dec-04	NR	10	ND		ND		ND	
	Jun-05	NR	10	ND		ND		ND	
	Dec-05	NR	10	ND		ND		ND	
	28-Jun-06	NR	10	ND		ND		ND	
	29-Dec-06	NR	10	ND		ND		ND	
	12-Jul-07	NR	10	2.2	J	DRY		ND	
	19-Dec-07	NR	10	ND		0.34	J	ND	
NC 2B = 0.06 ug/L (03/28/08)	08-Jul-08	NR	10	0.35	B	1.0	J	0.12	J
	17-Dec-08	0.10	10.0	ND		ND		ND	
	09-Jul-09	0.10	10.0	ND		0.10	J	ND	
	16-Dec-09	0.10	10.0	ND		0.16	J	ND	
	24-Jun-10	0.10	10.0	ND		0.26	J	ND	
	13-Dec-10	0.10	10.0	{ND}		{0.28}	B	0.21 {0.19 J}	J
	20-Jun-11	5.0	10.0	ND		ND		ND	
	05-Dec-11	5.0	10.0	ND		ND		ND	
	11-Jun-12	5.0	10.0	ND		ND		ND	
	12-Dec-12	5.0	10.0	ND		ND		ND	

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)					
		DL	RL	Surface Water			Blanks
				SW-1		SW-2	
Thallium	Sep-94	NR	10	ND		ND	NS
	Dec-94	NR	10	ND		ND	NS
	Feb-95	NR	10	ND		ND	NS
	Mar-95	NR	10	ND		ND	NS
	Nov-95	NR	10	ND		ND	NS
	May-96	NR	10	ND		ND	NS
	Nov-96	NR	10	ND		ND	NS
	Jun-97	NR	10	ND		ND	NS
	Dec-97	NR	10	ND		ND	NS
	May-98	NR	10	ND		ND	NS
	Nov-98	NR	10	ND		ND	NS
	Jul-99	NR	10	ND		ND	NS
	Nov-99	NR	10	ND		ND	NS
	May-00	NR	10	ND		ND	NS
	Oct-00	NR	10	ND		ND	NS
	Apr-01	NR	10	ND		ND	NS
	Oct-01	NR	10	ND		ND	NS
	Jun-02	NR	10	NS		NS	NS
	Nov-02	NR	10	ND		ND	NS
	Jun-03	NR	10	ND		ND	NS
	Dec-03	NR	10	ND		ND	ND
	Jun-04	NR	10	ND		ND	ND
	Dec-04	NR	10	ND		10.0 (ND)	ND
	Jun-05	NR	10	ND		ND	ND
	Dec-05	NR	10	ND		ND	ND
	28-Jun-06	NR	10	ND		ND	ND
	29-Dec-06	NR	6	ND		ND	ND
	12-Jul-07	NR	5.5	ND		DRY	ND
	19-Dec-07	NR	5.5	3.6	J	ND	ND
	08-Jul-08	NR	5.5	3.4	J	ND	ND
	17-Dec-08	3.0	5.5	ND		ND	ND
	09-Jul-09	3.0	5.5	ND		ND	ND
	16-Dec-09	3.0	5.5	ND		ND	ND
NC 2B = NE (03/24/10)	24-Jun-10	3.0	5.5	ND		ND	ND
	13-Dec-10	3.0	5.5	3.8	J	ND	ND
	20-Jun-11	5.4	5.5	ND		ND	ND
	05-Dec-11	5.4	5.5	ND		ND	ND
	11-Jun-12	5.4	5.5	ND		ND	ND
	12-Dec-12	5.4	5.5	ND		ND	ND

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Vanadium	Sep-94	NR	40	ND		ND		NS	
	Dec-94	NR	40	ND		ND		NS	
	Feb-95	NR	40	ND		ND		NS	
	Mar-95	NR	40	ND		ND		NS	
	Nov-95	NR	40	ND		ND		NS	
	May-96	NR	40	ND		ND		NS	
	Nov-96	NR	40	ND		ND		NS	
	Jun-97	NR	40	ND		ND		NS	
	Dec-97	NR	40	ND		ND		NS	
	May-98	NR	40	ND		ND		NS	
	Nov-98	NR	40	ND		ND		NS	
	Jul-99	NR	40	ND		ND		NS	
	Nov-99	NR	40	ND		ND		NS	
	May-00	NR	40	ND		ND		NS	
	Oct-00	NR	40	ND		ND		NS	
	Apr-01	NR	40	ND		ND		NS	
	Oct-01	NR	40	ND		ND		NS	
	Jun-02	NR	40	NS		NS		NS	
	Nov-02	NR	40	ND		ND		NS	
	Jun-03	NR	40	ND		ND		NS	
	Dec-03	NR	40	ND		ND		ND	
	Jun-04	NR	40	ND		ND		ND	
	Dec-04	NR	40	ND		ND		ND	
	Jun-05	NR	40	ND		ND		ND	
	Dec-05	NR	40	ND		ND		ND	
	28-Jun-06	NR	40	ND		ND		ND	
	29-Dec-06	NR	25	1.6	J	2.0	J	ND	
	12-Jul-07	NR	25	4.6	J	DRY		ND	
	19-Dec-07	NR	25	3.3	J	1.4	B	0.62	J
NC 2B = NE ug/L (03/28/08)	08-Jul-08	NR	25	5.2	J	2.3	J	0.20	J
	17-Dec-08	0.20	25.0	1.8	B	2.7	B	0.76	J
	09-Jul-09	0.20	25.0	5.0	B	3.4	B	1.30	J
	16-Dec-09	0.20	25.0	3.6	J	3.5	J	0.53	J
	24-Jun-10	0.20	25.0	5.8	J	2.6	J	ND	
	13-Dec-10	0.20	25.0	1.6	B	0.67	B	0.36	J
	20-Jun-11	5.0	25.0	ND		ND		ND	
	5-Dec-11	5.0	25.0	ND		ND		ND	
	11-Jun-12	5.0	25.0	ND		11.5	J	ND	
	12-Dec-12	5.0	25.0	ND		ND		ND	

TABLE 8:
HISTORICAL INORGANIC CONSTITUENTS IN SURFACE WATER

Constituent	Date	Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Zinc	Nov-96	NR	50	11.0		ND		NS	
	Jun-97	NR	50	ND		ND		NS	
	Dec-97	NR	50	20.0		ND		NS	
	May-98	NR	50	20.0		28.0		NS	
	Nov-98	NR	50	ND		ND		NS	
	Jul-99	NR	50	ND		ND		NS	
	Nov-99	NR	50	ND		ND		NS	
	May-00	NR	50	ND		ND		NS	
	Oct-00	NR	50	ND		ND		NS	
	Apr-01	NR	50	ND		ND		NS	
	Oct-01	NR	50	ND		ND		NS	
	Jun-02	NR	50	NS		NS		NS	
	Nov-02	NR	50	ND		ND		NS	
	Jun-03	NR	50	ND		ND		NS	
	Dec-03	NR	50	ND		ND		ND	
	Jun-04	NR	50	ND		ND		ND	
	Dec-04	NR	50	ND		ND		ND	
	Jun-05	NR	50	ND		ND		ND	
	Dec-05	NR	50	ND		ND		ND	
	28-Jun-06	NR	50	ND		ND		ND	
	29-Dec-06	NR	50	ND		ND		ND	
	12-Jul-07	NR	10	ND		DRY		ND	
	19-Dec-07	NR	10	24.6	B	ND		102	
NC 2B = 50 ug/L (03/28/08)	08-Jul-08	NR	10	ND		ND		1.2	J
	17-Dec-08	0.40	10.0	ND		0.89	B	0.49	J
	09-Jul-09	0.40	10.0	ND		4.9	B	1.6	J
	16-Dec-09	0.40	10.0	2.6	B	2.6	B	7.7	J
	24-Jun-10	0.40	10.0	ND		14.9		ND	
	13-Dec-10	0.40	10.0	ND		9.8	B	6.7	J
	20-Jun-11	10.0	10.0	ND		ND		ND	
	05-Dec-11	10.0	10.0	ND		ND		12.4	
	11-Jun-12	10.0	10.0	ND		ND		ND	
	12-Dec-12	10.0	10.0	ND		ND		ND	

Notes:
1. RL = Laboratory reporting limit (NC SWSL from October 2007 to present).
2. ND = Not detected above laboratory reporting limit.
3. B = Blank-qualified data; result is expected to be biased high based on concentrations in the blanks
4. Shaded values for surface water are above the NC 2B Surface Water Standards (NC2B)
5. DL = Laboratory detection limit.
6. J = Estimated value between the DL and the RL
7. NS = Not sampled.
8. NR = Not Reported.
9. DRY = Monitoring well or surface water point considered to be dry.
10. Surface waters are classified as WS-IV/NSW (WS, human health, and fresh-water aquatic life).

TABLE 9:
HISTORICAL ORGANIC CONSTITUENTS IN SURFACE WATER

Constituent		Concentration (µg/L)							
		DL	RL	Surface Water				Blanks	
				SW-1		SW-2			
Acetone	Sep-94	NR	100	ND		ND		NS	
	Dec-94	NR	100	ND		ND		NS	
	Feb-95	NR	100	ND		ND		NS	
	Mar-95	NR	100	ND		ND		NS	
	Nov-95	NR	100	ND		ND		NS	
	May-96	NR	100	ND		ND		NS	
	Nov-96	NR	100	ND		ND		NS	
	Jun-97	NR	100	ND		ND		NS	
	Dec-97	NR	100	ND		ND		NS	
	May-98	NR	100	ND		ND		NS	
	Nov-98	NR	100	ND		ND		NS	
	Jul-99	NR	100	ND		ND		NS	
	Nov-99	NR	100	ND		ND		NS	
	May-00	NR	100	ND		ND		NS	
	Oct-00	NR	100	ND		ND		NS	
	Apr-01	NR	100	ND		ND		NS	
	Oct-01	NR	100	168	B	337	B	479	
	Jun-02	NR	100	NS		NS		NS	
	Jun-02	NR	100	NS		NS		NS	
	Nov-02	NR	100	ND		ND		NS	
	Jun-03	NR	100	ND		ND		NS	
	Dec-03	NR	100	ND		ND		ND	
	Jun-04	NR	100	ND		ND		ND	
	Dec-04	NR	100	ND		ND		ND	
	Jun-05	NR	100	ND		ND		ND	
	Dec-05	NR	100	ND		ND		ND	
	28-Jun-06	NR	100	ND		ND		ND	
	29-Dec-06	NR	100	ND		ND		ND	
	12-Jul-07	NR	100	ND		DRY		ND	
	19-Dec-07	NR	100	12.7	B	ND		4.5	J
NC 2B = 2,000 ug/L (03/28/08)	08-Jul-08	NR	100	ND		ND		ND	
	17-Dec-08	20.0	100	ND		ND		ND	
	09-Jul-09	20.0	100	ND		ND		ND	
NC 2B = NE (03/24/10)	16-Dec-09	2.2	100	ND		ND		2.8	J
	24-Jun-10	2.2	100	2.8	B	ND		7.7	J
	13-Dec-10	2.2	100	ND		3.0	J	ND	
	20-Jun-11	2.2	100	ND		3.8	B	3.9	J
	05-Dec-11	2.2	100	ND		7.2	B	8.8	J
	11-Jun-12	2.2	100	ND		5.5	B	4.7	J
	12-Dec-12	10.0	100	ND		ND		ND	

TABLE 9:
HISTORICAL ORGANIC CONSTITUENTS IN SURFACE WATER

Constituent		Concentration (µg/L)				
		DL	RL	Surface Water		Blanks
				SW-1	SW-2	
Benzene	Sep-94	NR	5	ND	ND	NS
	Dec-94	NR	5	ND	ND	NS
	Feb-95	NR	5	ND	ND	NS
	Mar-95	NR	5	ND	ND	NS
	Nov-95	NR	5	ND	ND	NS
	May-96	NR	5	ND	ND	NS
	Nov-96	NR	5	ND	ND	NS
	Jun-97	NR	5	ND	ND	NS
	Dec-97	NR	5	ND	ND	NS
	May-98	NR	5	ND	ND	NS
	Nov-98	NR	5	ND	ND	NS
	Jul-99	NR	5	ND	ND	NS
	Nov-99	NR	5	ND	ND	NS
	May-00	NR	5	ND	ND	NS
	Oct-00	NR	5	ND	ND	NS
	Apr-01	NR	5	ND	ND	NS
	Oct-01	NR	5	ND	ND	NS
	Jun-02	NR	5	NS	NS	NS
	Nov-02	NR	5	ND	ND	NS
	Jun-03	NR	5	ND	ND	NS
	Dec-03	NR	5	ND	ND	ND
	Jun-04	NR	5	ND	ND	ND
	Dec-04	NR	5	ND	ND	ND
	Jun-05	NR	5	ND	ND	ND
	Dec-05	NR	5	ND	ND	ND
	28-Jun-06	NR	5	ND	ND	ND
	29-Dec-06	NR	3	ND	ND	ND
Resample >	23-Feb-07	NR	3	NS	NS	ND
	12-Jul-07	NR	1	ND	DRY	ND
	19-Dec-07	NR	1	ND	ND	ND
NC 2B = 1.9 ug/L (03/28/08)	08-Jul-08	NR	1	ND	ND	ND
	17-Dec-08	0.25	1.0	ND	ND	ND
	09-Jul-09	0.25	1.0	ND	ND	ND
	16-Dec-09	0.25	1.0	ND	ND	ND
NC 2B = 1.19 (03/24/10)	24-Jun-10	0.25	1.0	ND	ND	ND
	13-Dec-10	0.25	1.0	ND	ND	ND
Resample >	08-Feb-11	0.25	1.0	NS	NS	ND
	20-Jun-11	0.25	1.0	ND	ND	ND
	05-Dec-11	0.25	1.0	ND	ND	ND
	11-Jun-12	0.25	1.0	ND	ND	ND
	12-Dec-12	0.25	1.0	ND	ND	ND

TABLE 9:
HISTORICAL ORGANIC CONSTITUENTS IN SURFACE WATER

Constituent		Concentration (µg/L)				
		DL	RL	Surface Water		Blanks
				SW-1	SW-2	
Chlorobenzene	Sep-94	NR	5	ND	ND	NS
	Dec-94	NR	5	ND	ND	NS
	Feb-95	NR	5	ND	ND	NS
	Mar-95	NR	5	ND	ND	NS
	Nov-95	NR	5	ND	ND	NS
	May-96	NR	5	ND	ND	NS
	Nov-96	NR	5	ND	ND	NS
	Jun-97	NR	5	ND	ND	NS
	Dec-97	NR	5	ND	ND	NS
	May-98	NR	5	ND	ND	NS
	Nov-98	NR	5	ND	ND	NS
	Jul-99	NR	5	ND	ND	NS
	Nov-99	NR	5	ND	ND	NS
	May-00	NR	5	ND	ND	NS
	Oct-00	NR	5	ND	ND	NS
	Apr-01	NR	5	ND	ND	NS
	Oct-01	NR	0.5	ND	ND	NS
	Jun-02	NR	0.5	NS	NS	NS
	Nov-02	NR	0.5	ND	ND	NS
	Jun-03	NR	0.5	ND	7.2	ND
	Dec-03	NR	5	ND	ND	ND
	Jun-04	NR	5	ND	ND	ND
	Dec-04	NR	5	ND	ND	ND
	Jun-05	NR	5	ND	ND	ND
	Dec-05	NR	5	ND	ND	ND
	28-Jun-06	NR	5	ND	ND	ND
	29-Dec-06	NR	3	ND	ND	ND
	12-Jul-07	NR	3	ND	DRY	ND
	19-Dec-07	NR	3	ND	ND	ND
NC 2B = 130 ug/L (03/28/08)	08-Jul-08	NR	3	ND	ND	ND
	17-Dec-08	0.23	3.0	ND	ND	ND
	09-Jul-09	0.23	3.0	ND	ND	ND
	16-Dec-09	0.23	3.0	ND	ND	ND
	24-Jun-10	0.23	3.0	ND	ND	ND
	13-Dec-10	0.23	3.0	ND	ND	0.28 J
	20-Jun-11	0.23	3.0	ND	ND	ND
	05-Dec-11	0.23	3.0	ND	ND	ND
	11-Jun-12	0.23	3.0	ND	ND	ND
	12-Dec-12	0.23	3.0	ND	ND	ND

TABLE 9:
HISTORICAL ORGANIC CONSTITUENTS IN SURFACE WATER

Constituent		Concentration (µg/L)					
		DL	RL	Surface Water			Blanks
				SW-1	SW-2		
Chloromethane	09-Jul-09	0.11	1.0	ND	0.19	J	ND
	12/16/2009	0.11	1.0	ND	ND		ND
NC 2B = NE (03/24/10)	6/24/2010	0.11	1.0	ND	ND		ND
	12/13/2010	0.11	1.0	ND	ND		ND
	20-Jun-11	0.11	1.0	ND	ND		ND
	05-Dec-11	0.11	1.0	ND	ND		ND
	11-Jun-12	0.11	1.0	ND	ND		ND
	12-Dec-12	0.11	1.0	ND	ND		ND

Notes:
1. RL = Laboratory reporting limit (NC SWSL from October 2007 to present).
2. ND = Not detected above laboratory reporting limit.
3. B = Blank-qualified data; result is expected to be biased high based on concentrations in the blanks
4. Shaded values for surface water are above the NC 2B Surface Water Standards (NC2B)
5. DL = Laboratory detection limit.
6. J = Estimated value between the DL and the RL
7. NS = Not sampled.
8. NR = Not Reported.
9. DRY = Monitoring well or surface water point considered to be dry.
10. Surface waters are classified as WS-IV/NSW (WS, human health, and fresh-water aquatic life).

TABLE 10:
HISTORICAL FIELD PARAMETER DATA

Field Parameter	Date	MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	SW-1	SW-2
pH	7/21/1999	6.09	6.45	6.78	6.97	6.85	7.02	NI	7.47	8.01
	11/16/1999	6.14	6.34	6.65	6.78	5.97	7.10	NI	7.27	7.32
	5/10/2000	7.15	6.50	6.80	6.76	6.81	6.62	NI	6.91	7.23
	10/26/2000	6.27	6.59	6.62	6.82	6.79	6.53	NI	6.73	7.31
	4/18/2001	NA	4.42	4.41	4.41	4.39	NA	NI	NA	NA
	10/27/2001	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/13/2002	NA	NA	NA	NA	NA	NA	NI	NA	NA
	11/19/2002	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/27/2003	5.8	6.3	6.6	6.8	6.6	6.9	NI	7.2	6.7
	12/30/2003	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/30/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	12/29/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/29/2005	6.24	5.92	6.77	6.49	6.48	6.35	NI	6.84	6.77
	12/29/2005	6.88	6.52	6.81	6.72	6.87	6.89	NI	6.73	8.32
	6/28/2006	7.05	6.31	6.82	6.60	7.04	6.82	NI	7.05	7.66
	12/29/2006	6.36	6.55	6.88	6.79	6.77	6.82	NI	7.40	8.38
	7/12/2007	7.15	6.63	7.06	7.08	7.65	7.12	NI	7.59	-
	12/19/2007	6.89	6.90	7.07	6.87	7.39	6.67	7.64	7.86	7.34
	7/7/2008	6.77	6.19	6.88	7.19	7.13	6.77	NS	7.65	7.82
	12/15/2008	6.26	5.92	7.81	7.10	6.63	7.03	NS	6.40	7.25
	7/9/2009	7.36	8.01	6.95	7.56	7.15	7.88	7.55	8.03	7.98
	12/16/2009	7.65	7.42	7.14	6.84	7.60	7.90	NS	6.59	8.92
	6/24/2010	5.95	6.61	6.74	6.94	7.61	7.81	NS	7.42	7.71
	12/13/2010	6.90	6.52	6.98	6.91	7.20	7.22	NS	8.00	7.75
	6/20/2011	6.53	6.46	6.71	6.84	6.88	6.95	NS	7.34	7.53
	12/5/2011	7.10	6.61	6.79	7.03	7.25	7.15	NS	8.16	8.03
	6/11/2012	5.77	6.41	6.66	6.77	6.61	6.55	5.82	7.45	7.95
	12/12/2012	7.41	6.60	6.76	6.97	7.10	7.07	NS	7.63	8.10
Conductivity µS	7/21/1999	89.0	2110.0	1580.0	1282.0	249.0	584.0	NI	359.0	892.0
	11/16/1999	143.9	2320.0	1678.0	1373.0	146.8	648.0	NI	268.0	403.0
	5/10/2000	100.0	1986.0	1534.0	1183.0	207.0	957.0	NI	304.0	410.0
	10/26/2000	94.4	1992.0	1473.0	1204.0	289.0	572.0	NI	365.0	747.0
	4/18/2001	NA	1920.0	1702.0	1318.0	137.5	NA	NI	NA	NA
	10/27/2001	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/13/2002	NA	NA	NA	NA	NA	NA	NI	NA	NA
	11/19/2002	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/27/2003	135.0	1835.0	1421.0	1100.0	239.0	669.0	NI	370.0	1701.0
	12/30/2003	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/30/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	12/29/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/29/2005	105.5	1899.0	1604.0	1327.0	515.0	839.0	NI	457.0	253.0
	12/29/2005	96.4	1602.0	1318.0	1012.0	128.4	552.0	NI	134.6	217.0
	6/28/2006	68.0	1704.0	1298.0	1091.0	142.6	573.0	NI	272.0	422.0
	12/29/2006	101.4	2240.0	1708.0	126.4	164.1	668.0	NI	106.5	255.0
	7/12/2007	100.0	1964.0	1591.0	1245.0	480.0	640.0	NI	510.0	332.0
	12/19/2007	100.5	2300.0	1704.0	1318.0	406.0	724.0	NI	377.0	NA
	7/7/2008	113.1	1665.0	1410.0	1122.0	258.0	592.0	NI	211.0	1635.0
	12/15/2008	61.0	100.4	291.0	562.0	384.0	530.0	NI	113.6	158.6
	7/9/2009	104.4	1921.0	1525.0	1262.0	423.0	643.0	139.4	299.0	743.0
	12/16/2009	105.5	1429.0	1193.0	1056.0	114.8	557.0	NS	109.2	215.0
	6/24/2010	94.3	1170.0	999.0	961.0	332.0	563.0	NS	358.0	601.0
	12/13/2010	128.1	2.5	1620.0	1370.0	478.0	616.0	NS	374.0	1138.0
	6/20/2011	119.4	1948.0	164.4	1474.0	394.0	657.0	NS	383.0	800.0
	12/5/2011	124.4	1897.0	1569.0	1356.0	543.0	590.0	NS	180.2	479.0
	6/11/2012	83.0	1828.0	1527.0	1275.0	371.0	573.0	98	363.0	605.0
	12/12/2012	122.3	197.0	1629.0	1464.0	646.0	641.0	NS	390.0	1227.0

TABLE 10:
HISTORICAL FIELD PARAMETER DATA

Field Parameter	Date	MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	SW-1	SW-2
Temperature	7/21/1999	22.5	22.3	20.2	19.6	20.7	20.9	NI	23.8	25.7
°C	11/16/1999	14.3	15.3	14.5	14.3	14.0	16.1	NI	10.4	9.8
	5/10/2000	19.5	18.0	18.9	17.3	17.4	18.9	NI	18.3	19.4
	10/26/2000	18.6	16.9	19.2	18.3	18.3	20.2	NI	17.1	16.6
	4/18/2001	NA	13.3	13.6	13.3	12.0	NA	NI	NA	NA
	10/27/2001	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/13/2002	NA	NA	NA	NA	NA	NA	NI	NA	NA
	11/19/2002	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/27/2003	17	19	18	17	18	19	NI	21	19
	12/30/2003	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/30/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	12/29/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	12/29/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/29/2005	20	17.1	17.1	18.8	17.4	21.2	NI	23.6	23.4
	12/29/2005	15.3	13.8	12.1	14.4	13.7	15.5	NI	9.5	9.5
	6/28/2006	18	16	18.1	16.7	17.7	19.3	NI	25	26.3
	12/29/2006	13.7	14	11.8	12.6	12.9	13.8	NI	6.0	7.0
	7/12/2007	19.6	16.7	17.0	19.5	18.8	20.1	NI	23.8	NA
	12/19/2007	22.5	12.5	13.1	14.4	14.9	14.4	13.3	3.8	6.8
	7/7/2008	18.1	21.1	20.8	18.1	16.8	18.4	NS	24.7	24.0
	12/15/2008	14.5	13.5	12.8	12.8	15.7	12.4	NS	11.5	11.1
	7/9/2009	18.4	16.0	16.7	16.6	15.9	17.0	15.9	20.3	22.0
	12/16/2009	11.9	10.1	10.2	12.4	10.6	11.9	NS	5.7	5.8
	6/24/2010	16.5	14.3	17.2	17.7	16.3	18.0	NS	22.4	22.8
	12/13/2010	13.5	10.3	10.7	12.5	12.0	13.8	NS	2.2	3.2
	6/20/2011	17.9	19.1	17.2	17.4	16.7	18.0	NS	23.4	23.9
	12/5/2011	16.7	15.3	15.2	17.1	16.5	17.0	NS	11.4	12.4
	6/11/2012	17.2	16.99	18.29	17.0	16.5	18.2	17.5	22.1	22.2
	12/12/2012	15.4	14.2	13.6	10.8	15.7	14.4	NS	9.1	8.7
Turbidity	7/21/1999	80.8	0.34	0.06	0.14	103	0.11	NI	0.08	0.13
n.t.u.	11/16/1999	160.0	-	-	35.1	785	0.37	NI	NA	NA
	5/10/2000	6.10	75.0	4.30	17.6	357	6.01	NI	3.84	2.63
	10/26/2000	178	33.5	4.99	198	480	3.51	NI	2.27	1.54
	4/18/2001	3.46	90.6	3.46	103	327	NA	NI	NA	NA
	10/27/2001	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/13/2002	NA	NA	NA	NA	NA	NA	NI	NA	NA
	11/19/2002	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/27/2003	NA	NA	NA	NA	NA	NA	NI	NA	NA
	12/30/2003	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/30/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	12/29/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	12/29/2004	NA	NA	NA	NA	NA	NA	NI	NA	NA
	6/29/2005	49.0	66.0	30.0	862	59.0	22.0	NI	20.0	253
	12/29/2005	64.9	7.10	2.84	3.71	23.2	12.2	NI	7.92	8.08
	6/28/2006	942.0	37.6	6.24	233.0	85.3	40.0	NI	6.49	3.18
	12/29/2006	32.8	4.01	2.39	3.90	15.2	5.68	NI	8.52	10.0
	7/12/2007	14.5	4.52	4.65	5.89	5.27	6.26	NI	17.4	-
	12/19/2007	52.7	5.84	6.75	125	57.0	30.4	62.4	7.02	1.12
	7/7/2008	30.7	48.2	1.99	2.78	13.59	3.99	NS	21.7	18.24
	12/15/2008	140.0	21.3	19.90	33.2	42.50	8.35	NS	100.1	25.60
	7/9/2009	49.8	15.0	2.92	4.91	18.10	10.18	56.8	22.8	6.82
	12/16/2009	8.57	5.84	0.89	1.96	28.10	1.72	NS	16.92	10.52
	6/24/2010	55.0	18.9	2.02	5.35	82.60	7.35	NS	3.84	6.36
	12/13/2010	20.6	15.45	6.41	10.51	13.48	8.22	NS	9.68	6.04
	6/20/2011	34.8	20.50	15.24	18.10	27.10	13.97	NS	13.84	21.50
	12/5/2011	14.6	14.44	3.30	6.64	7.62	20.17	NS	4.71	4.35
	6/11/2012	14.5	48.70	5.77	20.0	14.68	6.71	9.1	12.74	105
	12/12/2012	22.2	47.30	5.82	5.55	112	4.76	NS	4.27	13.38

Notes:
1. NI = Well/Piezometer not installed.
2. NA = No data is avaliable for the sampling event.

TABLE 11: GROUNDWATER GEOCHEMICAL CHARACTERISTICS

Parameter	Date	Units	DL	RL	Groundwater Monitoring Wells							Surface Water		
					MW-1R	MW-2R	MW-3R	MW-4	MW-5	MW-6	NES-1	SW-1	SW-2	BLANKS
Alkalinity (as CaCO3)	Dec-03	mg/L	9	10	37	800	690	640	68	350	-	69	86	ND
	Dec-07	mg/L	-	5.0	39.0	763	726	619	-	-	190	-	-	ND
Chloride	Dec-03	mg/L	0.2	1	3.5	280	170	82	13	44	-	10	15	ND
	Dec-07	mg/L	-	5.0	ND	13.1	297	89.1	-	-	7.9	-	-	ND
Dissolved Oxygen	Dec-03	mg/L	-	-	9.49	4.84	26.19	24.19	15.31	20.17	-	23.04	28.70	-
	Dec-07	mg/L	-	-	-	1.88	1.44	3.21	-	-	0.70	-	-	-
Dissolved CO_2	Dec-07	mg/L	-	-	25	365	175	295	-	-	60	-	-	-
Fe, Ferrous	Dec-30	mg/L	0.03	0.1	ND	1.5	ND	ND	0.22	ND	-	ND	ND	ND
	Dec-07	mg/L	-	-	ND	7.2	ND	ND	-	-	0.2	-	-	-
Hydrogen Sulfide	Dec-03	mg/L	1	1	ND	ND	ND	ND	ND	ND	-	ND	ND	-
	Dec-07	mg/L	-	-	0.0	0.0	0.0	0.0	-	-	0.0	-	-	-
Nitrate-N	Dec-03	mg/L	0.02	0.05	0.12	ND	ND	ND	ND	0.13	-	ND	ND	ND
	Dec-07	mg/L	-	0.10	ND	ND	ND	ND	-	-	13.0	-	-	ND
Redox Potential	Dec-03	mV	-	-	257.2	76.2	207.6	212.7	187.3	123.6	-	147.3	122.9	-
(ORP)	Dec-07	mv	-	-	146	45	142	134	-	-	138	-	-	-
Sulfate	Dec-03	mg/L	0.06	2	ND	ND	ND	2.6	9.6	9.0	-	11	11	ND
	Dec-07	mg/L	-	5.0	ND	ND	ND	ND	-	-	36.8	-	-	ND
Total Organic Carbon	Dec-07	mg/L	-	1.0 *	2.9	54.3	23.2	17.2	-	-	7.2	-	-	ND
Dissolved Ethane	Dec-03	mg/L	0.0002	0.001	ND	ND	ND	ND	ND	ND	-	ND	ND	ND
	Dec-07	mg/L	-	20.0	ND	ND	ND	ND	-	-	ND	-	-	ND
Dissolved Ethene	Dec-03	mg/L	0.0003	0.001	ND	ND	ND	ND	ND	ND	-	ND	ND	ND
	Dec-07	mg/L	-	20.0	ND	ND	ND	ND	-	-	ND	-	-	ND
Dissolved Methane	Dec-03	mg/L	0.0002	0.001	ND	0.66	0.13	0.0099	0.0010	ND	-	0.0023	0.0023	ND
	Dec-07	mg/L	-	10.0	ND	0.116	0.186	ND	-	-	ND	-	-	ND
Pyruvic Acid	Dec-07	mg/L	-	0.1	2.5	ND	1.5	2.0	-	-	1.2	-	-	ND
Lactic Acid	Dec-07	mg/L	-	1.0	ND	5.4	11.9	3.1	-	-	ND	-	-	ND
Acetic Acid	Dec-07	mg/L	-	1.0	ND	ND	ND	ND	-	-	ND	-	-	ND
Propionic Acid	Dec-07	mg/L	-	1.0	ND	63.7	38.3	12.8	-	-	ND	-	-	ND
Butyric Acid	Dec-07	mg/L	-	1.0	ND	ND	ND	ND	-	-	ND	-	-	ND
										-				

NOTES:

DL = laboratory detection limit
RL = laboratory reporting limit
ND = not detected above detection limit
J = estimated concentration.
- = not analyzed, or if used in DL/QL columns, DL/QL not reported

mg/L = milligrams per liter
mV = millivolt
s.u. = standard unit

C = degress Celcius
m.s. = microsiemen
ntu = nephelometric turbidity units

TABLE 12:
PHYSICAL AND CHEMICAL PROPERTIES OF COC PROPERTIES

Constituent of Concern: Benzene	
NC 2L Groundwater Standard	1 µg/L
EPA MCL	5 µg/L
CAS #	71-43-2
Molecular Formula	C_6H_6
Molar Mass	78.11 g/mole
Appearance	Clear/Colorless
Density	0.88
Melting Point	5.5°C
Boiling Point	80.1°C
Solubility in water	Slightly
Odor	Aromatic
Vapor Pressure	10 kPa
Vapor Density	2.8
Organic Soil Partition Coefficient (log k_{oc})	61.7
Water Partition Coefficient (log k_{ow})	2.13
Toxicity	Carcinogenic

Data taken from Material Safety Data Sheets and other sources available in the public domain.

TABLE 13:
COC FATE AND TRANSPORT CHARACTERISTICS

Contaminant	Fate & Transport Characteristics		
	In AIR	In SOIL	In WATER
Benzene	volatilizes from soil and water photochemicaly degrades	mobile anaerobically	mobile and slightly soluable anaerobically

TABLE 14:
COC TOXICITY VALUES FOR ORAL INGESTION

Contaminant	Well	Refrence Dose	Maximum Concentration (µg/L)	LADD Maximum		Concentration December 2012 (µg/L)	LADD December 2012		HI Risk Maxium		HI Risk December 2012	
		Oral Sfo (µg/kg-day)		Adult (µg/kg-day)	Child (µg/kg-day)		Adult (µg/kg-day)	Child (µg/kg-day)	Adult	Child	Adult	Child
Benzene	MW-2R	55	1.9	0.02	0.01	1.6	0.02	0.01	4.23E-04	1.40E-04	3.56E-04	1.18E-04
	MW-3R	55	0.73	0.01	0.00	0.73	0.01	0.00	1.63E-04	5.38E-05	1.63E-04	5.38E-05
	MW-4	55	0.40	0.00	0.00	0.32	0.00	0.00	8.91E-05	2.95E-05	7.12E-05	2.36E-05

Notes:
1. LADD is lifetime average daily dose from ingested groundater at the specified concentration
2. Sfo values taken from the Region 9 Risk Based Concentration Table. These values represent a cancer slope factor.
4. Formulas used for calculations:

LADD = (C*IR*ED)/(BW*AT)
HI = LADD/Sfo

C = Constitutent concentration
IR = Ingestion Rate (L/day) — An ingestion rate of 2L/day was used for adults and 1L/day for children
ED = Exposure Duration (days) — An exposure duration of 30 years was used for adults and 8 for children
BW = Body weight (kg) — An average weight of 70 Kg was used for adults, 28.2 kg for children
AT = Average time (days) — A time of 70 years for adults and chlidren was used

TABLE 15:
COC TOXICITY VALUES FOR INHALATION EXPOSURE

Contaminant	Well	Refrence Dose	Maximum Concentration ($\mu g/m^3$)	LADD Maximum		Concentration December 2012 ($\mu g/m^3$)	LADD December 2012		HI Risk Maxium		HI Risk December 2012	
		Inhalation Sfi (μg/kg-day)		Adult (μg/kg-day)	Child (μg/kg-day)		Adult (μg/kg-day)	Child (μg/kg-day)	Adult	Child	Adult	Child
Benzene	MW-2R	27	1.9	0.12	0.05	1.6	0.10	0.04	4.31E-03	1.71E-03	3.63E-03	1.44E-03
	MW-3R	27	0.73	0.04	0.02	0.73	0.04	0.02	1.66E-03	6.57E-04	1.66E-03	6.57E-04
	MW-4	27	0.40	0.02	0.01	0.32	0.02	0.01	9.07E-04	3.60E-04	7.26E-04	2.88E-04

Notes:
1. LADD is lifetime average daily dose inhaled at the specified concentration
2. Sfo values taken from the Region 9 Risk Based Concentration Table. These values represent a cancer slope factor.
4. Formulas used for calculations:

LADD = (C*IR*ED*K)/(BW*AT)
HI = LADD/Sfo

C = Constitutent concentration

K= Volatilization factor (L/m^3)	A volitilization factor of 0.5 L/m^3 was used based on EPA published values
IR = Ingestion Rate (m^3/day)	An inhalation rate of 20 m^3/day was used for adults and 12 m^3/day for children
ED = Exposure Duration (days)	An exposure duration of 30 years was used for adults and 8 for children
BW = Body weight (kg)	An average weight of 70 Kg was used for adults, 28.2 kg for children
AT = Average time (days)	A time of 70 years for adults and chlidren was used

TABLE 16:
COC TOXICITY VALUES FOR DERMAL EXPOSURE

Contaminant	Well	Refrence Dose	Maximum Concentration (µg/L)	LADD Maximum		Concentration December 2012 (µg/L)	LADD December 2012		HI Risk Maxium		HI Risk December 2012	
		Oral Sfo (µg/kg-day)		Adult (µg/kg-day)	Child (µg/kg-day)		Adult (µg/kg-day)	Child (µg/kg-day)	Adult	Child	Adult	Child
Benzene	MW-2R	55	1.9	1.22E-03	3.78E-04	1.6	1.03E-03	3.19E-04	2.22E-05	6.88E-06	1.87E-05	5.79E-06
	MW-3R	55	0.73	4.69E-04	1.45E-04	0.73	4.69E-04	1.45E-04	8.53E-06	2.64E-06	8.53E-06	2.64E-06
	MW-4	55	0.40	2.57E-04	7.97E-05	0.32	2.06E-04	6.37E-05	4.68E-06	1.45E-06	3.74E-06	1.16E-06

Notes:
1. LADD is lifetime average daily dose from ingested groundater at the specified concentration
2. Sfo values taken from the Region 9 Risk Based Concentration Table. These values represent a cancer slope factor.
4. Formulas used for calculations:

LADD = (C*K*EV*ED*EF*SA)/(BW*AT)*CF
HI = LADD/Sfo

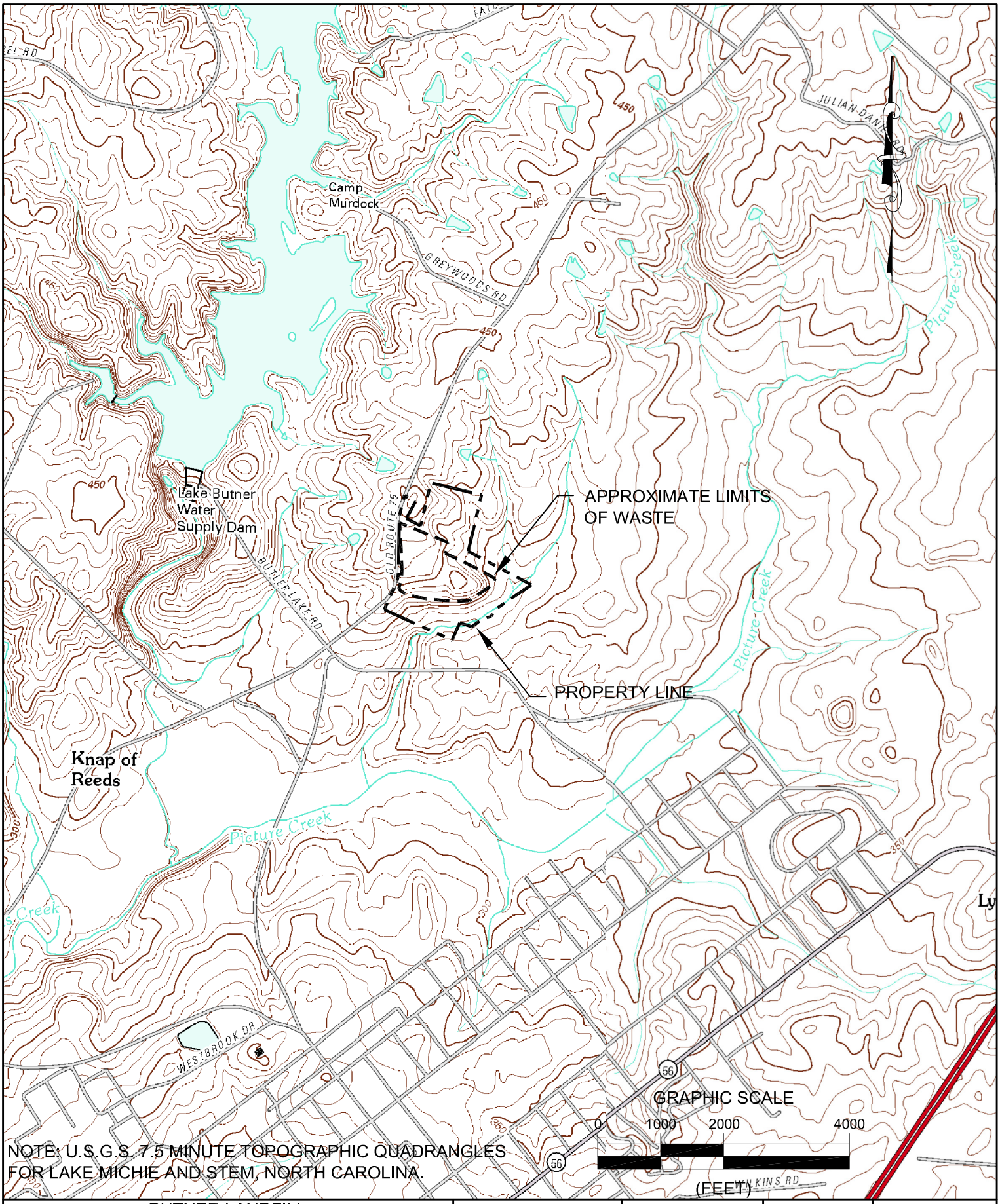
C = Constitutent concentration	
K= Peremeability cofficient (cm/day)	0.504 (contaminant dependent)
EV= Event Frequency	15 min/day (0.010417 days)
ED = Exposure Duration (years)	An exposure duration of 30 years was used for adults and 8 for children
EF = Exposure Frequency (days/year)	365 days per year
SA = Skin surface area (cm^2)	20,000 cm^2 for adults and 9,360 cm^2 for children
BW = Body weight (kg)	An average weight of 70 Kg was used for adults, 28.2 kg for children
AT = Average time (days)	A time of 70 years for adults and chlidren was used
CF = Conversion Factor	1L/ 1000 cm^3

TABLE 17: CORRECTIVE MEASURES SCREENING MATRIX

Remedial Technology:	Feasibility and Effectiveness											Implementability					Cost				SCORE	Comments
	Achieve Target Contaminant Levels	Protective of Human Health & Environment	Long-Term Effectiveness	Addresses (T) toxicity, (M) mobility, or (V) volume		Safety Impacts	Cross-Media Impacts	Residuals Produced -- (S) solid, (L) liquid, (V) vapor		Rating for VOCs	Exposure to Residual Contamination	Ease to Implement	Environmental Conditions	System Reliability and Maintainability	Regulatory/Permitting Acceptability	Community Acceptability	Capital Costs	O&M Costs	Time to Implement	Time to Complete Cleanup		
Ranking system:	Yes=3; Unkwn=2; No=1	Yes=3; Unkwn=2; No=1	Yes=3; Unkwn=2; No=1	1 Pt. Each		Best=3; Avg.=2; Worse=1	Best=3; Avg.=2; Worse=1	-1 Pt. Each		Best=3; Avg.=2; Worse=1	Best=3; Avg.=2; Worse=1	Best=3; Avg.=2; Worse=1	Best=3; Unkwn/ Avg.=2; Worse=1	Best=3; Unkwn/ Avg.=2; Worse=1	Best=3; Unkwn/ Avg.=2; Worse=1	Best=3; Unkwn/ Avg.=2; Worse=1	Best=3; Unkwn/Avg.=2; Worse=1	Best=3; Unkwn/ Avg.=2; Worse=1	Best=3; Unkwn/ Avg.=2; Worse=1	Best=3; Unkwn/ Avg.=2; Worse=1		
Non-Intrusive Controls																						
Monitored Natural Attenuation (MNA)	2	2	2	1	T	3	3	0	---	3	3	3	3	3	3	3	3	3	3	1	**44**	Analytical results demonstrate good conditions for natural attenuation.
Phytoremediation	2	2	2	2	T,M	3	3	0	---	3	3	2	3	3	3	3	2	3	2	1	**42**	Existing vegetation may be sufficient, or may be augmented by planting.
Control of Landfill Gas (Passive Vent Installation)	2	2	2	2	T,M	2	2	-1	V	3	2	2	3	3	3	2	2	3	3	2	**39**	Most likely to be used in addition to other remedial strategies
Constructed Wetlands (for natural near-surface groundwater, no P&T)	3	3	3	2	T,V	3	2	0	---	2	3	2	3	2	2	2	2	3	2	2	**41**	Very shallow groundwater and expansive available treatment area may increase feasibility and reduce costs.
Groundwater Containment																						
Vertical Barrier Walls	1	1	1	1	M	3	3	-1	S	2	3	1	2	2	2	2	1	3	2	2	**31**	Site conditions would require a laterally extensive barrier system, resulting in high costs.
Pump & Treat (P&T) System (see Ex-situ treatment for P&T options)	3	3	3	3	T,M,V	2	1	-1	L	2	2	1	2	2	3	3	1	1	2	2	**35**	Highly visible, very expensive remedial alternative. Not warranted by existing COC levels and site conditions.
Hydraulic Gradient Controls (Injection)	1	1	1	1	M	3	3	0	---	1	2	1	1	1	1	2	1	1	2	1	**24**	May result in undesirable redirection of contaminated groundwater or leachate.
In-Situ - Groundwater Biological Treatment																						
Enhanced Bioremediation (EB) with HRC	3	3	3	2	T,V	2	3	0	---	2	2	1	1	1	2	2	1	2	2	3	**35**	May be effective depending on site conditions. HRC not best choice for benzene at low concentrations. Permit required for injection.
Enhanced Remediation (EB) with O_2 CH_4, $C_6H_{15}O_4P$, or N_2O)	3	3	3	2	T,V	2	3	0	---	2	2	1	1	1	2	2	1	2	2	3	**35**	May be effective depending on site conditions. O_2 good choice for benzene. Permit required for injection.
Enhanced Bioremediation (EB) with co-metabolic processes	3	3	3	2	T,V	2	3	0	---	2	2	1	1	1	2	2	1	1	2	2	**33**	Full scale cost unknown; permit required for subsurface injection. May not be effective.
Enhanced Bioremediation (EB) with Nitrate Enhancement	3	3	3	2	T,V	2	3	0	---	1	2	1	1	1	2	2	2	1	2	2	**33**	Full scale success not documented. Permit required for injection. Effective on narrow contaminant range.
In-Situ - Groundwater Abiotic Treatment																						
Permeable Reactive Barrier (PRB)	3	3	2	2	T,V	3	3	-1	S	2	3	1	2	2	2	2	2	2	2	2	**37**	A laterally extensive barrier will increase costs; however, shallow groundwater & plume make it feasible. Biofouling and loss of reactive capacity may require replacement.
Air Sparging (AS)	3	3	3	2	T,V	2	2	-1	L	3	2	1	2	2	3	2	2	2	2	2	**37**	Treatment will be limited to area of sparging. Dual remedial mechanisms (volatilization & EB).
Fenton's Reagent	2	2	2	2	T,V	2	2	-1	L	2	2	1	2	1	2	2	1	1	2	2	**29**	Limited effectiveness on halogenated volatiles and has significant O&M costs.
Hot Water or Steam Flushing/Stripping	2	2	2	1	T	2	1	-2	L,V	2	1	1	1	1	2	2	1	1	2	3	**25**	No full scale success has been achieved; injection prohibited; not cost effective.
Dual Phase Extraction	2	2	1	2	T,M	2	1	-2	L,V	3	1	1	1	2	2	2	2	2	2	2	**28**	Dual phase extraction requires both groundwater and vapor treatment. Vapor is not a substantial concern at this facility. Significant O & M costs.
Soil Vapor Extraction (SVE)	2	2	2	2	T,M	2	2	-1	V	3	2	2	2	2	2	2	2	2	2	2	**34**	May help relive LFG impacts outside of waste. May be used in conjunction with AS.
Ex-Situ Groundwater Treatment (for P&T)																						
Filtration / Sedimentation	2	2	2	3	T,M,V	2	1	-1	S	1	1	2	2	2	2	2	2	1	1	2	**29**	Used as pre-treatment or post-treatment process to remove suspended solids or precipitated metals.
Ion Exchange Filtration	3	3	3	3	T,M,V	2	1	-1	S	1	2	1	1	2	2	2	2	1	1	2	**31**	Treatability study recommended; oxidants in ground water may damage ion exchange resin; generates wastewater during regeneration step.
Bioreactors	3	3	3	3	T,M,V	2	2	-2	S,L	3	1	1	1	2	2	2	1	2	1	2	**32**	Treatability study recommended; residuals from sludge processes require treatment or disposal; air pollution controls may need to be considered.
Constructed Wetlands (for extracted water)	3	2	2	3	T,M,V	3	2	-1	L	2	2	1	2	1	2	2	2	1	2	2	**33**	Very shallow groundwater and expansive available treatment area may increase feasibility and reduce costs.
Air Stripping w/ NPDES Disposal	3	3	3	3	T, M,V	2	1	-2	L,V	3	2	2	2	2	3	2	2	2	2	2	**37**	Best ex-situ option for benzene. Non-volatile compounds not removed. Requires a NPDES permit. Off-gases may require treatment.
Carbon Adsorption (liquid phase)	3	3	3	3	T,M,V	2	2	-1	S	2	2	2	2	2	3	2	2	1	2	2	**37**	Water soluble compounds and small molecules are not adsorbed well. Good option for benzene. Requires a NPDES permit.
Publicly Owned Treatment Work	3	3	3	3	T,M,V	2	2	-2	S,L	2	2	2	1	2	3	2	1	1	2	2	**34**	Pretreatment could be required prior to acceptance of wastewater. Volume-based fees could be exorbitant.
UV Oxidation	2	2	2	2	T,M,V	1	2	-1	L	2	2	2	1	2	2	2	1	1	2	1	**28**	Handling and storage of oxidizers requires special safety precautions; significant O&M costs.

Shaded remedial options retained for further consideration.

FIGURES



BUTNER LANDFILL GRANVILLE COUNTY, NORTH CAROLINA	JOYCE ENGINEERING 2211 W. MEADOWVIEW ROAD GREENSBORO, NC 27407 PHONE: (336) 323-0092	DESIGNED HRW DRAWN HRW CHECKED ACE APPROVED GVB DATE 04/10/13	SCALE 1" = 2000'	PROJECT NO. 660.1301.12
SITE LOCATION MAP		© 2013 Joyce Engineering, Inc. All rights reserved.	NC CORP LIC: C-0782	FIGURE NO. 1

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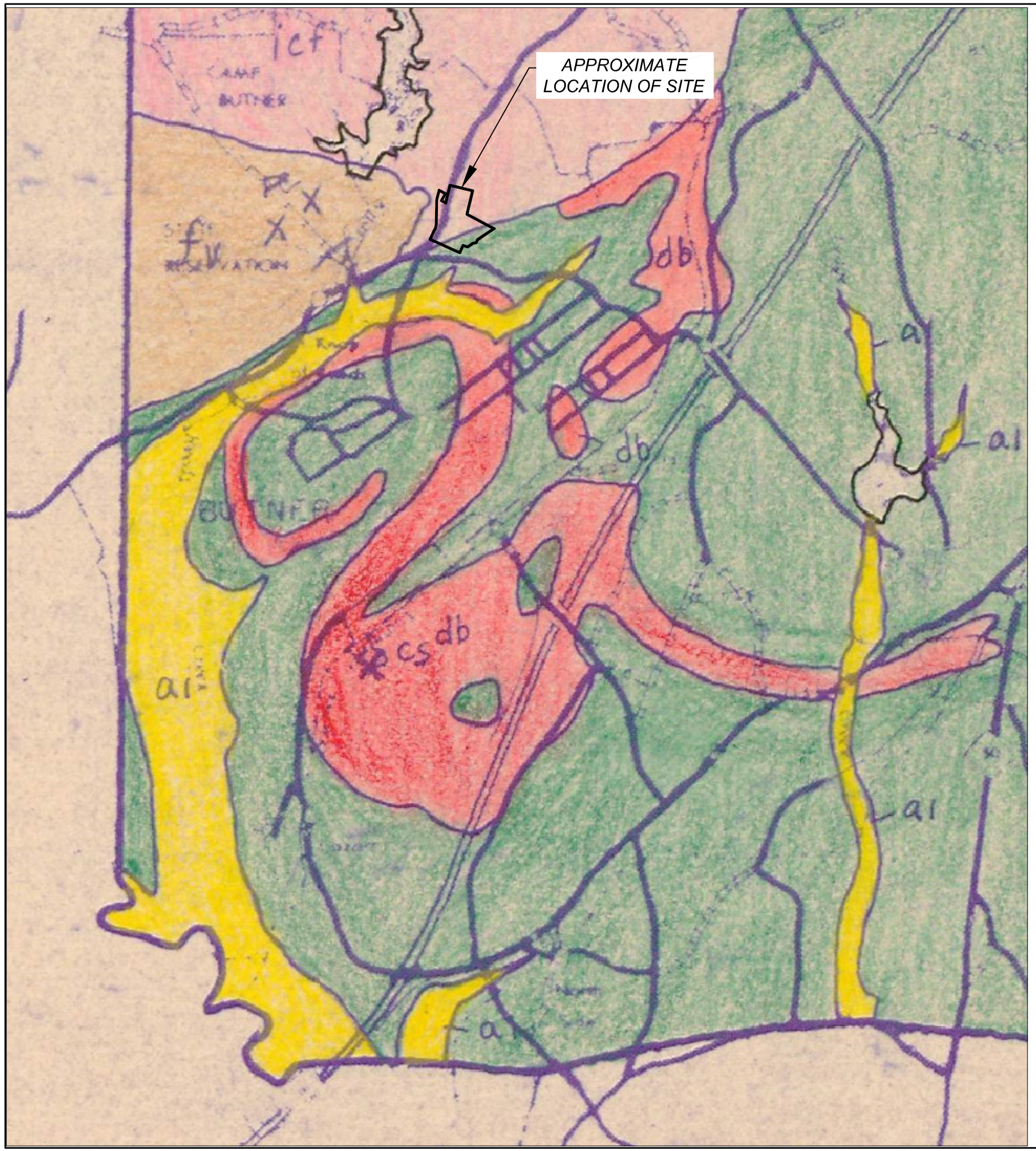

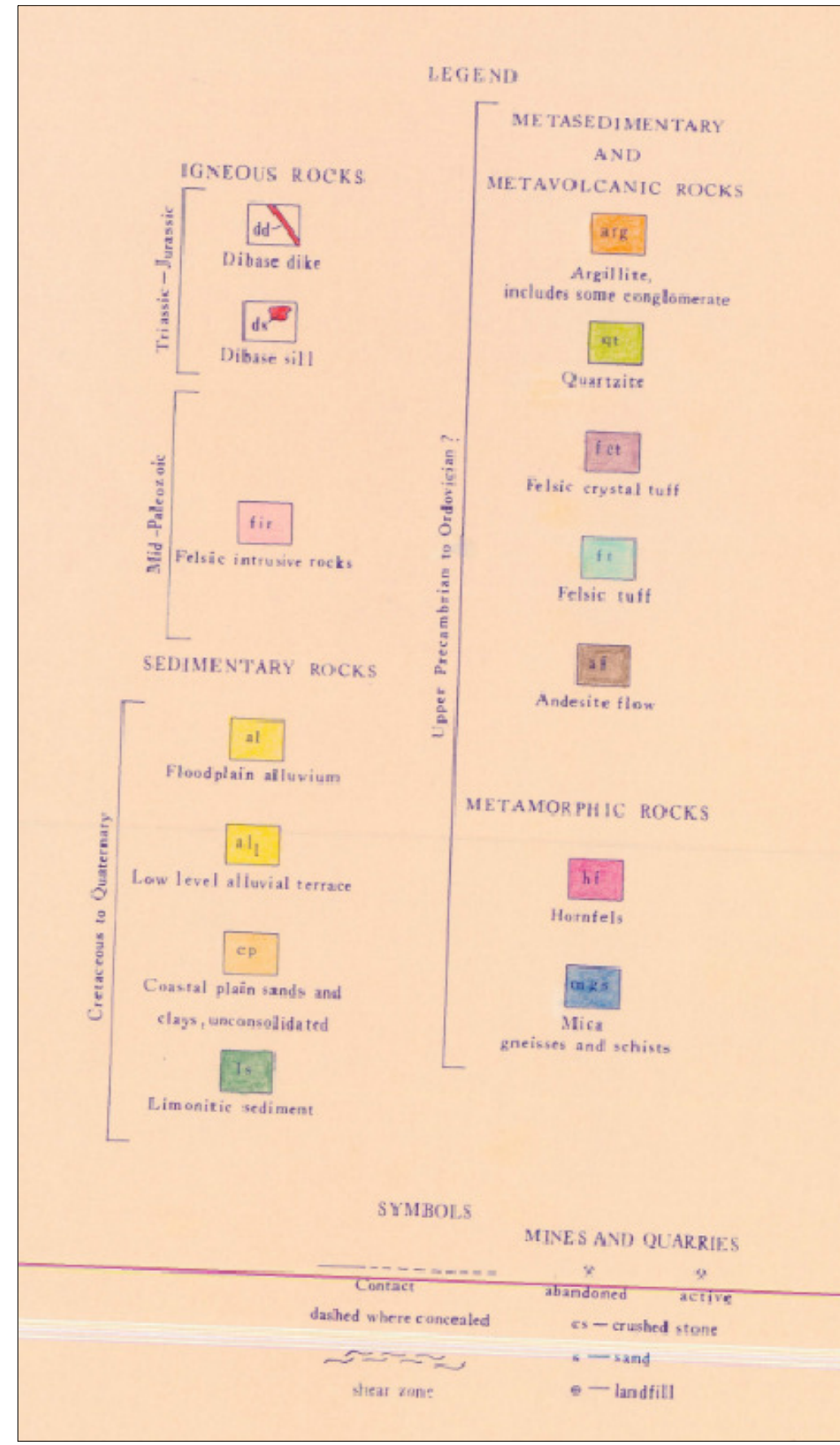

SOURCE: GEOLOGIC MAP OF REGION BY RONALD D. MCDANIEL (1980)

NO.	BY	CK.	APP.

DATE	REVISIONS AND RECORD OF ISSUE

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CHECKED ACE
APPROVED GVB
DATE 04/16/13

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2211 W. MEADOWVIEW ROAD
GREENSBORO, NC 27407
PHONE: (336) 323-0092
NO CORP LIC: C-0782

BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

GEOLOGIC MAP

PROJECT NO.
660.1301.12

SCALE
N.T.S.

FIGURE NO.
2

L:\Granville\dwg\Butner\BUTNER ACM\2013_4\2013_04 ACM.dwg\Fig 2

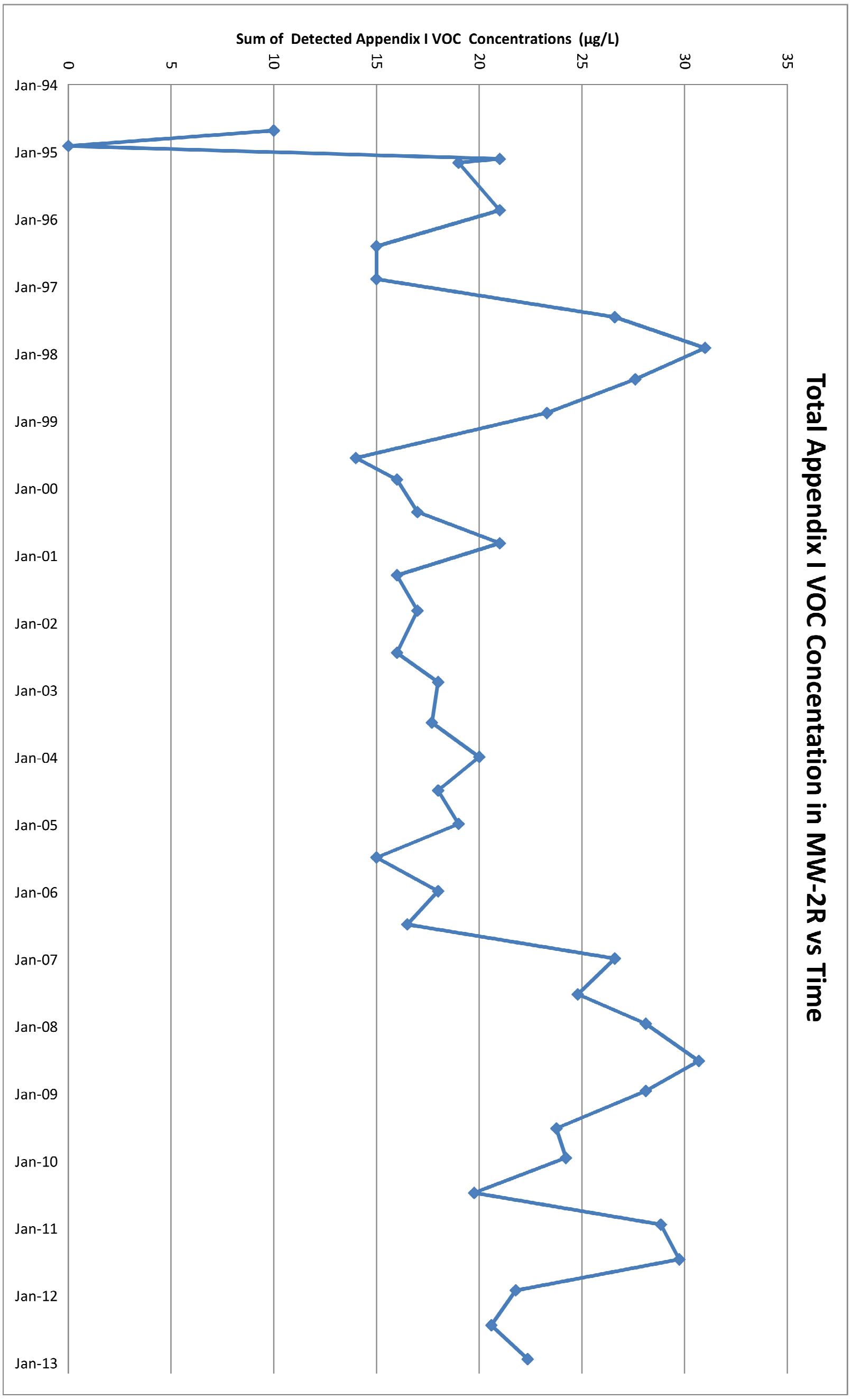
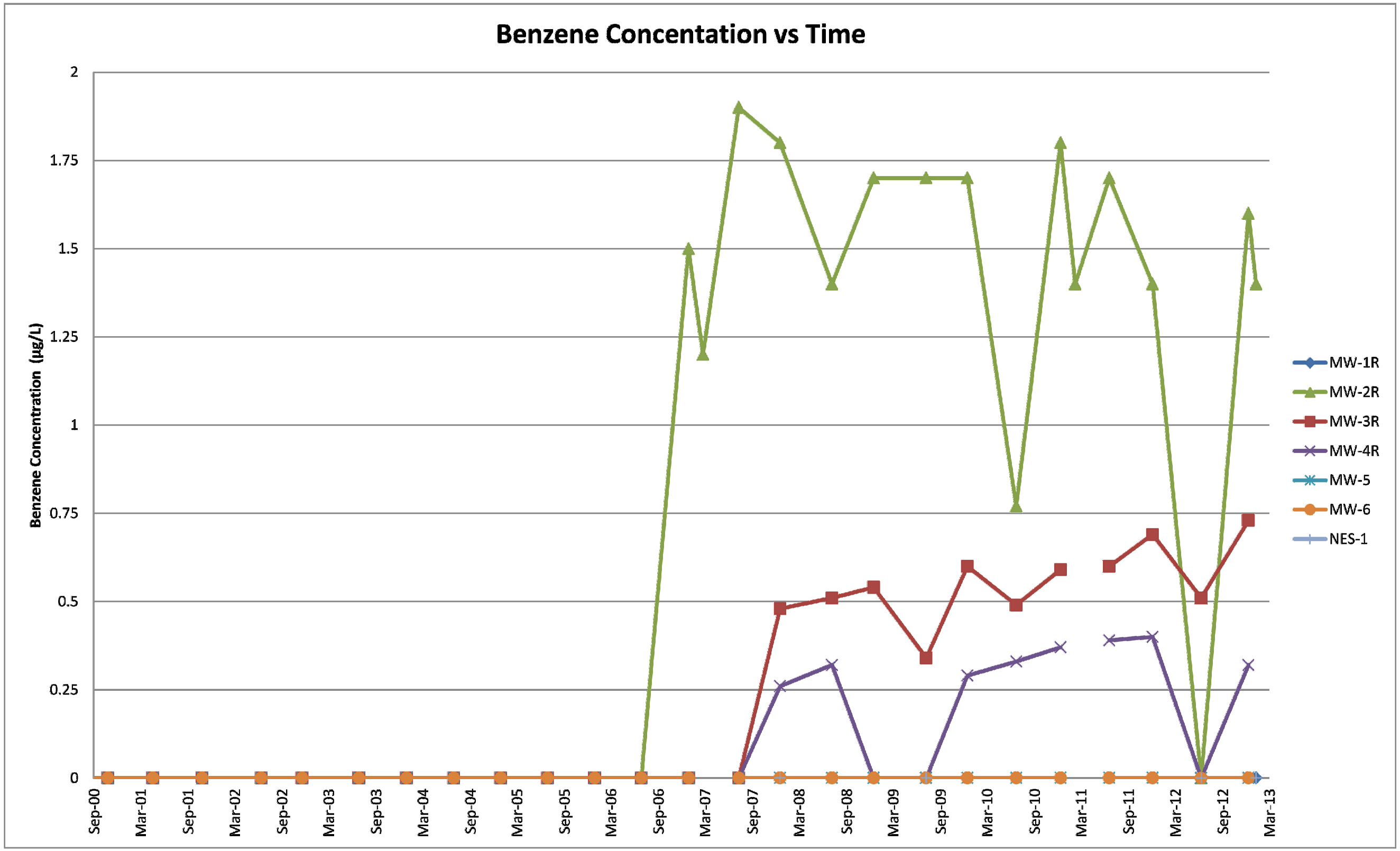


FIGURE NO.	SCALE	PROJECT NO.	BUTNER LANDFILL GRANVILLE COUNTY, NORTH CAROLINA	JOYCE ENGINEERING	DESIGNED ACE DRAWN HRW CHECKED ACE APPROVED GVB DATE 04/16/13	DATE / REVISIONS AND RECORD OF ISSUE / NO / BY / CK / APP
3	N.T.S.	660.1301.12	TOTAL VOCS IN MW-2R VS. TIME	2211 W. MEADOWVIEW ROAD GREENSBORO, NC 27407 PHONE: (336) 323-0092 NO CORP LIC: C-0782	© 2013 Joyce Engineering, Inc. All rights reserved.	

L:\Granville\dwg\Butner\BUTNER ACM\2013_4\2013_04 ACM.dwgFig 3



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NO CORP LIC: C-0782

BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

HISTORICAL BENZENE
CONCENTRATIONS VS. TIME

PROJECT NO.
660.1301.12

SCALE
N.T.S.

FIGURE NO.
4

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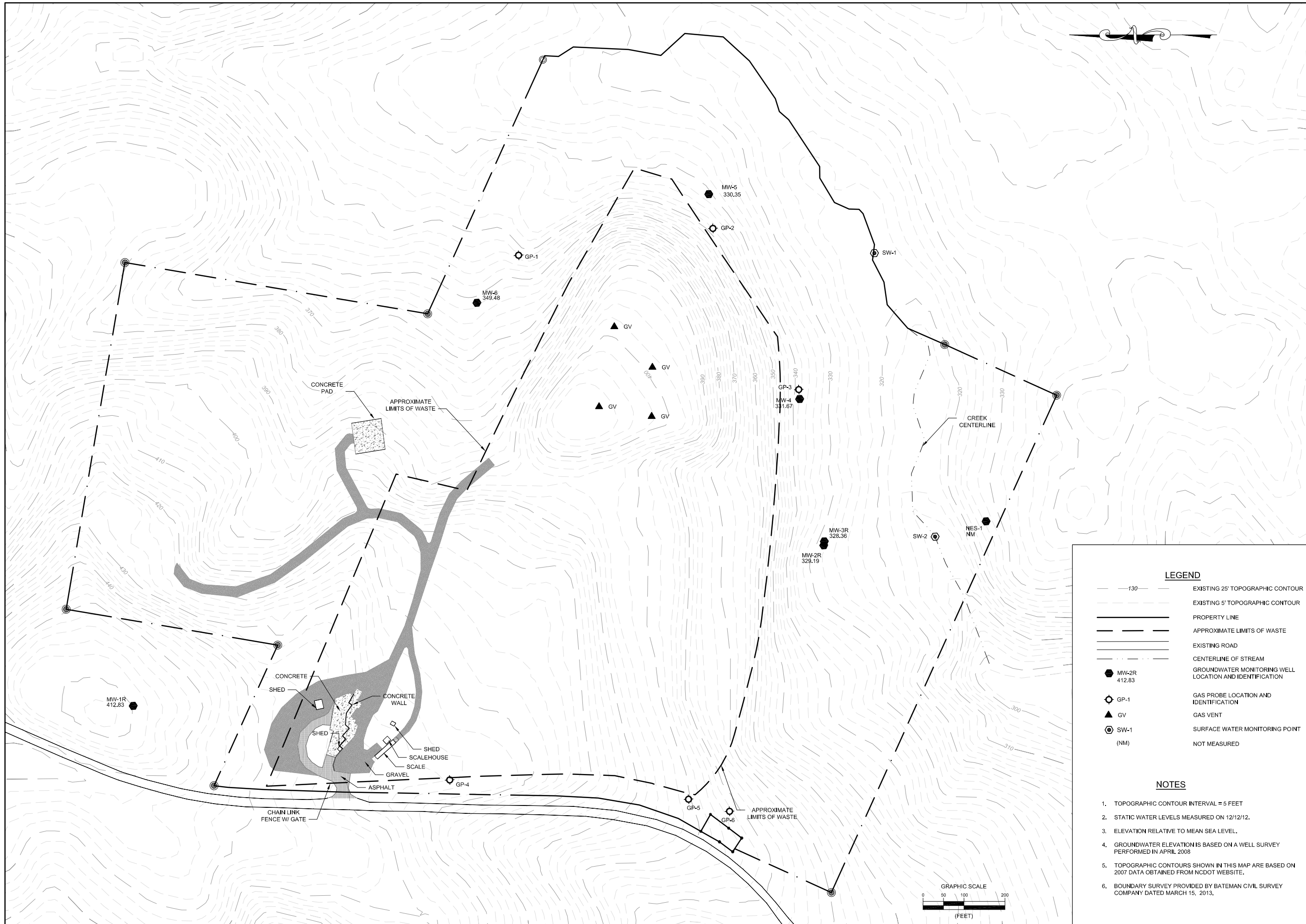
DRAWINGS



LEGEND

130	EXISTING 25' TOPOGRAPHIC CONTOUR
	EXISTING 5' TOPOGRAPHIC CONTOUR
	PROPERTY LINE
	APPROXIMATE LIMITS OF WASTE
	EXISTING ROAD
	CENTERLINE OF STREAM
MW-2R 412.83	GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION
GP-1	GAS PROBE LOCATION AND IDENTIFICATION
GV	GAS VENT
SW-1	SURFACE WATER MONITORING POINT
(NM)	NOT MEASURED

NOTES

1. TOPOGRAPHIC CONTOUR INTERVAL = 5 FEET
2. STATIC WATER LEVELS MEASURED ON 12/12/12.
3. ELEVATION RELATIVE TO MEAN SEA LEVEL.
4. GROUNDWATER ELEVATION IS BASED ON A WELL SURVEY PERFORMED IN APRIL 2008
5. TOPOGRAPHIC CONTOURS SHOWN IN THIS MAP ARE BASED ON 2007 DATA OBTAINED FROM NCDOT WEBSITE.
6. BOUNDARY SURVEY PROVIDED BY BATEMAN CIVIL SURVEY COMPANY DATED MARCH 15, 2013.

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

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NC CORP LIC: C-0782

BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

SITE MAP WITH SAMPLING LOCATIONS

PROJECT NO.
660.1301.12

SCALE
AS NOTED

DRAWING NO.
1

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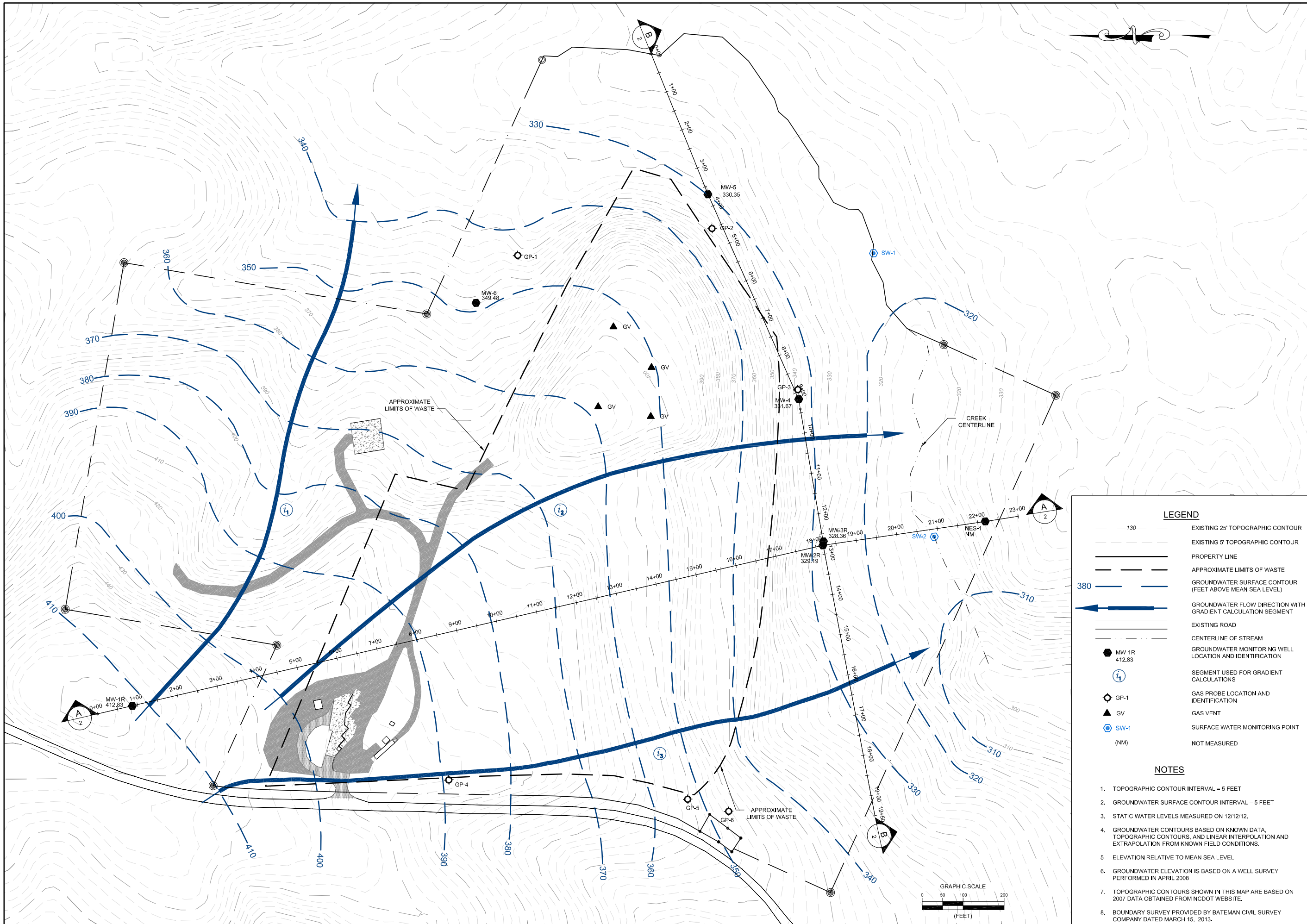

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BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

GROUNDWATER ELEVATION MAP
DECEMBER 12, 2012

PROJECT NO.
660.1301.12

SCALE
AS NOTED

DRAWING NO.
2

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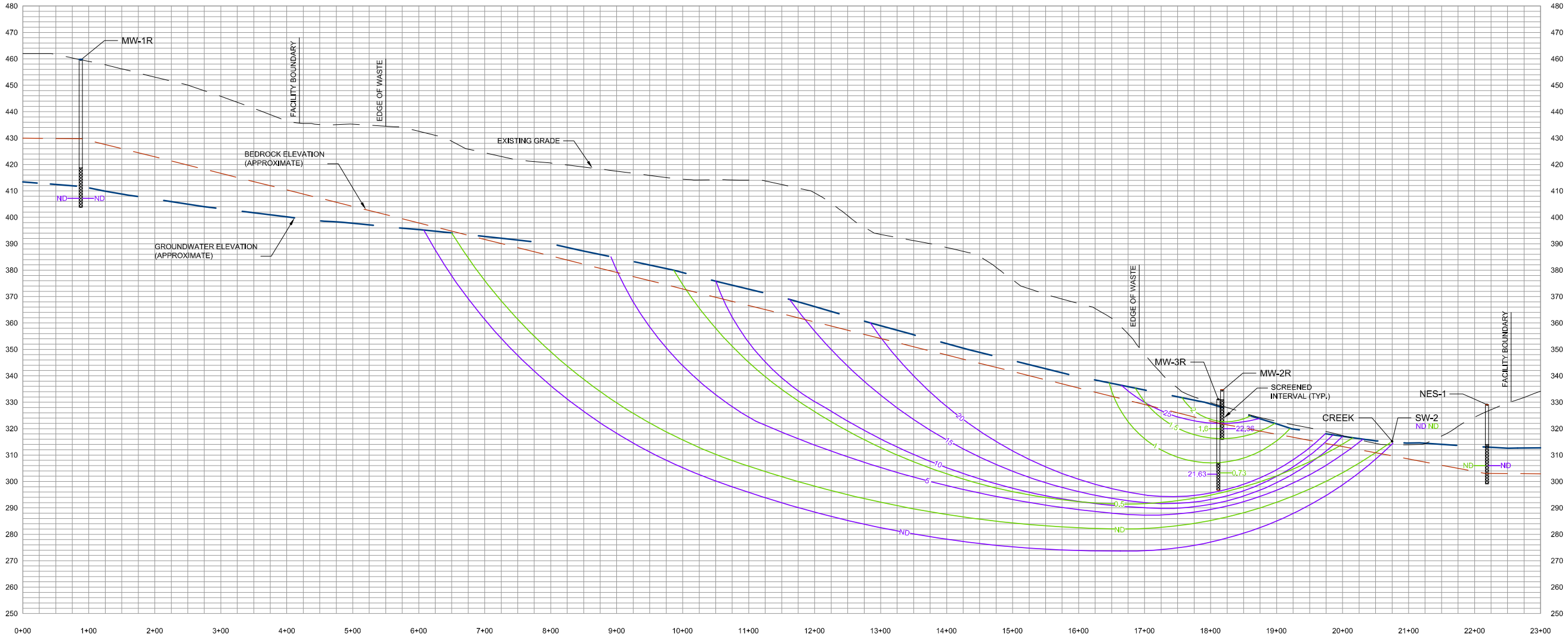


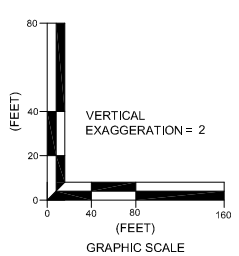
ALIGNMENT A - A' PROFILE

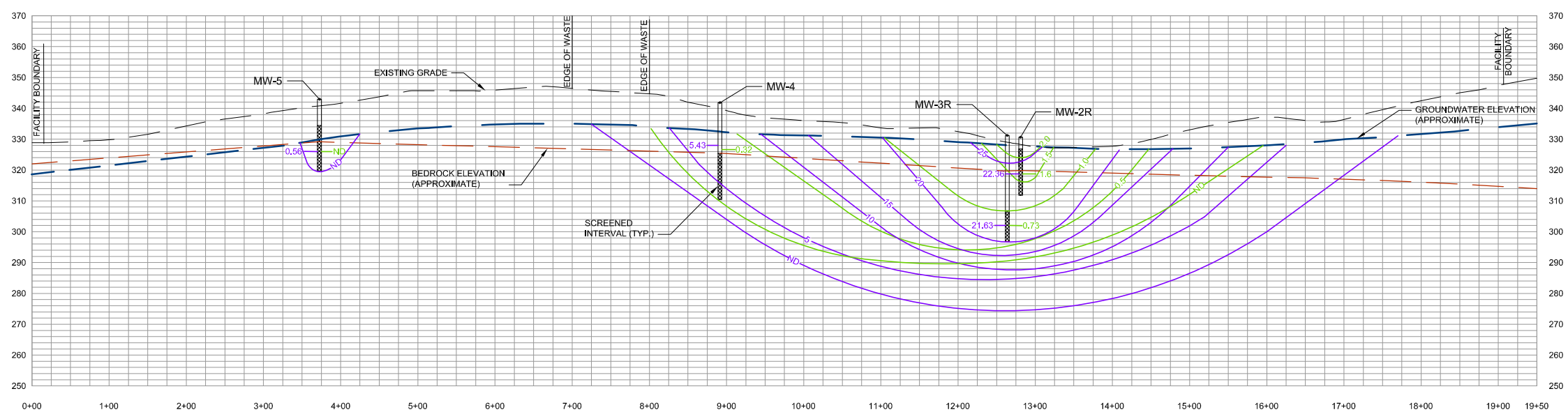
LEGEND

- EXISTING GROUND
- GROUNDWATER ELEVATION (DEC 2012)
- BEDROCK ELEVATION
- 25 TOTAL VOC'S CONCENTRATION (µg / L)
- 2.0 BENZENE CONCENTRATION (µg / L)
- SCREENED INTERVAL

NOTES

1. DATA FROM 12/12/12 SAMPLING EVENT USED FOR MW-1R, 2R, 3R, 4, 5, 6 AND SW-2.
2. DATA FROM 1/10/13 SAMPLING EVENT USED FOR NES-1.





ALIGNMENT B - B' PROFILE

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BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

CROSS SECTIONS A - A' & B - B'

PROJECT NO.
660.1301.12

SCALE
AS NOTED

DRAWING NO.
3

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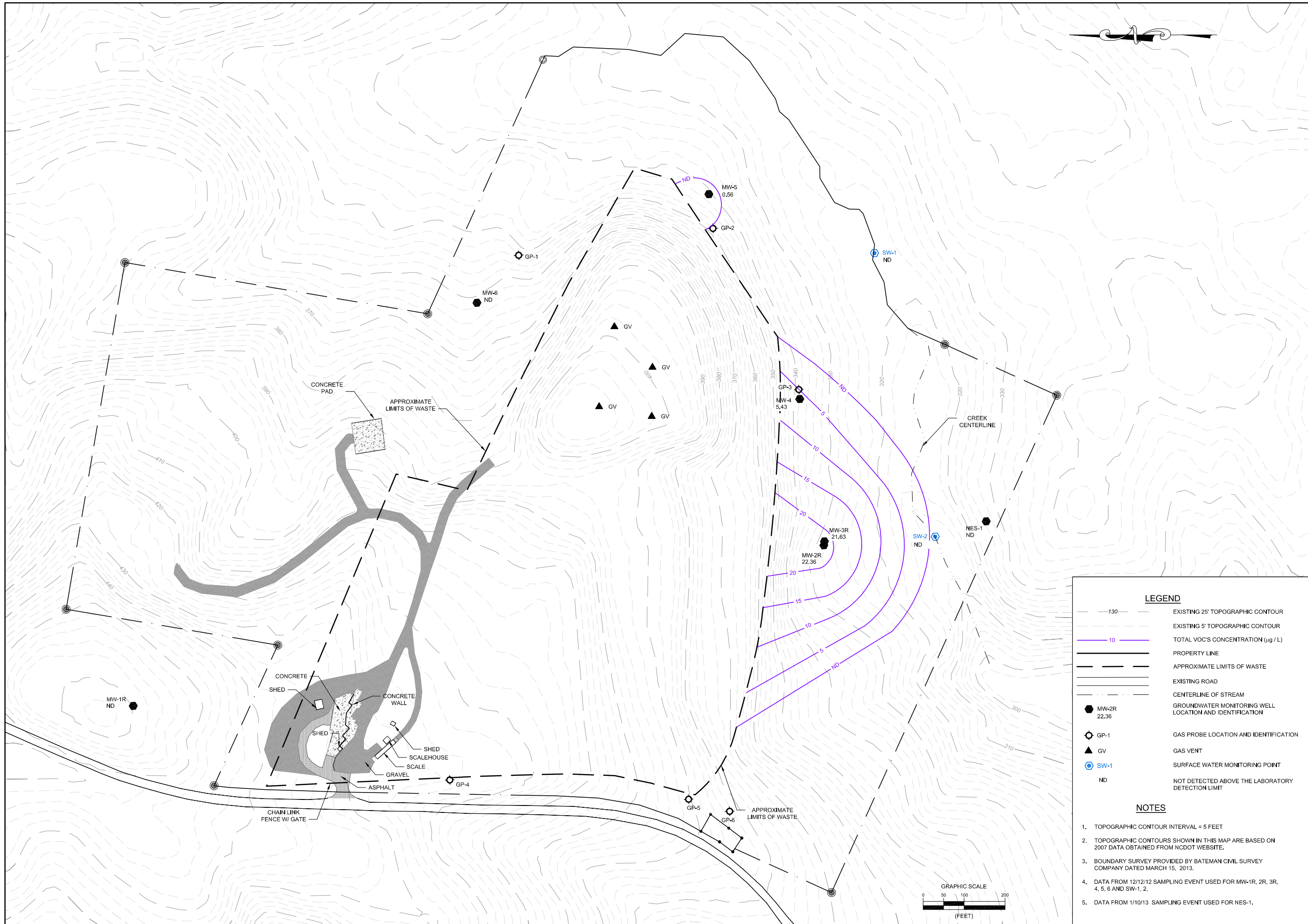

LEGEND

130	EXISTING 25' TOPOGRAPHIC CONTOUR
	EXISTING 5' TOPOGRAPHIC CONTOUR
10	TOTAL VOC'S CONCENTRATION (µg / L)
	PROPERTY LINE
	APPROXIMATE LIMITS OF WASTE
	EXISTING ROAD
	CENTERLINE OF STREAM
MW-2R 22.36	GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION
GP-1	GAS PROBE LOCATION AND IDENTIFICATION
GV	GAS VENT
SW-1	SURFACE WATER MONITORING POINT
ND	NOT DETECTED ABOVE THE LABORATORY DETECTION LIMIT

NOTES

1. TOPOGRAPHIC CONTOUR INTERVAL = 5 FEET
2. TOPOGRAPHIC CONTOURS SHOWN IN THIS MAP ARE BASED ON 2007 DATA OBTAINED FROM NCDOT WEBSITE.
3. BOUNDARY SURVEY PROVIDED BY BATEMAN CIVIL SURVEY COMPANY DATED MARCH 15, 2013.
4. DATA FROM 12/12/12 SAMPLING EVENT USED FOR MW-1R, 2R, 3R, 4, 5, 6 AND SW-1, 2.
5. DATA FROM 1/10/13 SAMPLING EVENT USED FOR NES-1.

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BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

TOTAL VOC ISOCONCENTRATION MAP

PROJECT NO.
660.1301.12

SCALE
AS NOTED

DRAWING NO.
4

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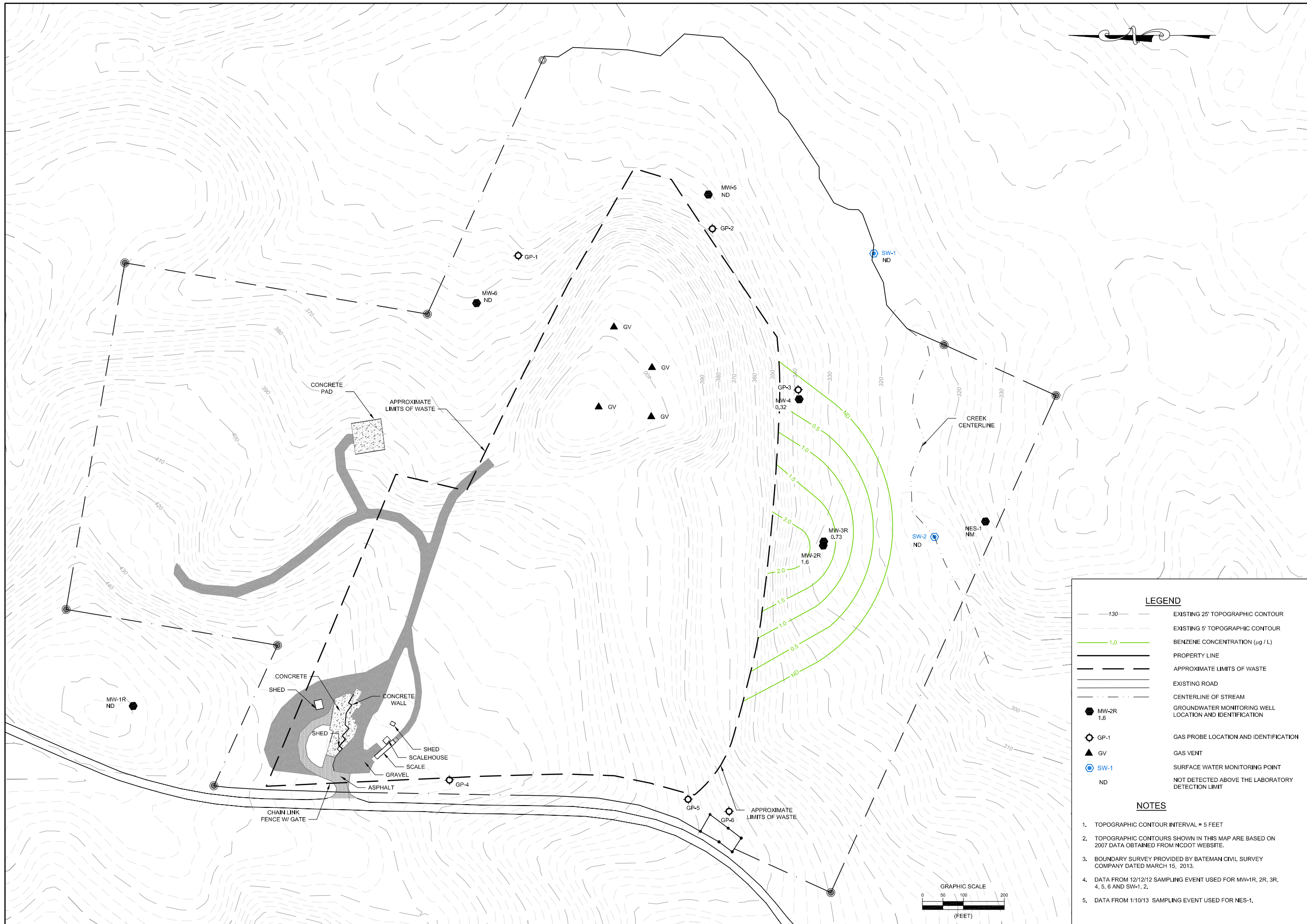

LEGEND

130	EXISTING 25' TOPOGRAPHIC CONTOUR
	EXISTING 5' TOPOGRAPHIC CONTOUR
1.0	BENZENE CONCENTRATION (µg / L)
	PROPERTY LINE
	APPROXIMATE LIMITS OF WASTE
	EXISTING ROAD
	CENTERLINE OF STREAM
MW-2R 1.6	GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION
GP-1	GAS PROBE LOCATION AND IDENTIFICATION
GV	GAS VENT
SW-1	SURFACE WATER MONITORING POINT
ND	NOT DETECTED ABOVE THE LABORATORY DETECTION LIMIT

NOTES

1. TOPOGRAPHIC CONTOUR INTERVAL = 5 FEET
2. TOPOGRAPHIC CONTOURS SHOWN IN THIS MAP ARE BASED ON 2007 DATA OBTAINED FROM NCDOT WEBSITE.
3. BOUNDARY SURVEY PROVIDED BY BATEMAN CIVIL SURVEY COMPANY DATED MARCH 15, 2013.
4. DATA FROM 12/12/12 SAMPLING EVENT USED FOR MW-1R, 2R, 3R, 4, 5, 6 AND SW-1, 2.
5. DATA FROM 1/10/13 SAMPLING EVENT USED FOR NES-1.

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BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

BENZENE ISOCONCENTRATION MAP

PROJECT NO.
660.1301.12

SCALE
AS NOTED

DRAWING NO.
5

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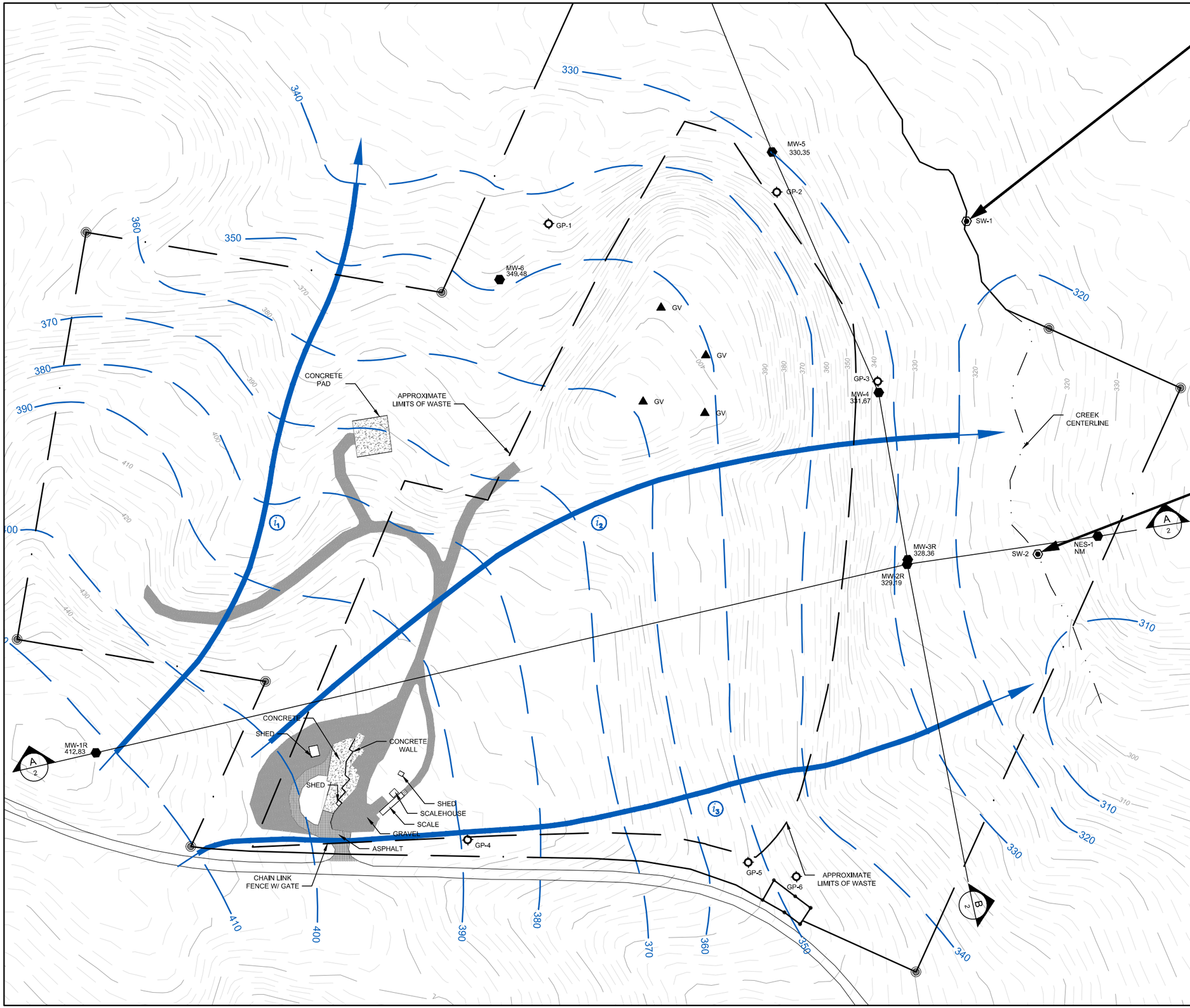

SW-1		
	Concentration (µg/L)	
Sample Date	Total VOCs	Benzene
Sep-94	ND	ND
Dec-94	ND	ND
Feb-95	ND	ND
Mar-95	ND	ND
Nov-95	ND	ND
May-96	ND	ND
Nov-96	ND	ND
Jun-97	ND	ND
Dec-97	ND	ND
May-98	ND	ND
Nov-98	ND	ND
Jul-99	ND	ND
Nov-99	ND	ND
May-00	ND	ND
Oct-00	ND	ND
Apr-01	ND	ND
Oct-01	ND	ND
Nov-02	ND	ND
Jun-03	ND	ND
Dec-03	ND	ND
Jun-04	7.2	ND
Dec-04	ND	ND
Jun-05	ND	ND
Dec-05	ND	ND
28-Jun-06	ND	ND
29-Dec-06	ND	ND
12-Jul-07	DRY	ND
19-Dec-07	ND	ND
08-Jul-08	ND	ND
17-Dec-08	ND	ND
09-Jul-09	ND	ND
16-Dec-09	0.19 J	ND
24-Jun-10	ND	ND
13-Dec-10	3.0 J	ND
20-Jun-11	ND	ND
05-Dec-11	ND	ND
11-Jun-12	ND	ND
12-Dec-12	ND	ND

Notes:
ND = Not detected above laboratory reporting limit.
DRY = Monitoring well or surface water point considered to be dry.
Surface waters are classified as WS-IV/NSW (WS, human health, and fresh-water aquatic life).

SW-2		
	Concentration (µg/L)	
Sample Date	Total VOCs	Benzene
Sep-94	ND	ND
Dec-94	ND	ND
Feb-95	ND	ND
Mar-95	ND	ND
Nov-95	ND	ND
May-96	ND	ND
Nov-96	ND	ND
Jun-97	ND	ND
Dec-97	ND	ND
May-98	ND	ND
Nov-98	ND	ND
Jul-99	ND	ND
Nov-99	ND	ND
May-00	ND	ND
Oct-00	ND	ND
Apr-01	ND	ND
Oct-01	ND	ND
Jun-02	NS	ND
Jun-02	NS	ND
Nov-02	ND	ND
Jun-03	ND	ND
Dec-03	ND	ND
Jun-04	ND	ND
Dec-04	ND	ND
Jun-05	ND	ND
Dec-05	ND	ND
28-Jun-06	ND	ND
29-Dec-06	ND	ND
12-Jul-07	ND	ND
19-Dec-07	ND	ND
08-Jul-08	ND	ND
17-Dec-08	ND	ND
09-Jul-09	ND	ND
16-Dec-09	ND	ND
24-Jun-10	ND	ND
13-Dec-10	ND	ND
20-Jun-11	ND	ND
05-Dec-11	ND	ND
11-Jun-12	ND	ND
12-Dec-12	ND	ND

Notes:
ND = Not detected above laboratory reporting limit.
J = Estimated value between the DL and the RL
DRY = Monitoring well or surface water point considered to be dry.
Surface waters are classified as WS-IV/NSW (WS, human health, and fresh-water aquatic life).

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BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

SURFACE WATER QUALITY

PROJECT NO.
660.1301.12

SCALE
N.T.S.

DRAWING NO.
6

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BUTNER LANDFILL
GRANVILLE COUNTY, NORTH CAROLINA

ADJACENT PROPERTIES AND WATER MAIN

PROJECT NO.
660.1301.12

SCALE
AS SHOWN

DRAWING NO.
7

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APPENDIX A

Boring Logs and Well Construction Diagrams

LOG OF BORING MW-1R

JOYCE ENGINEERING

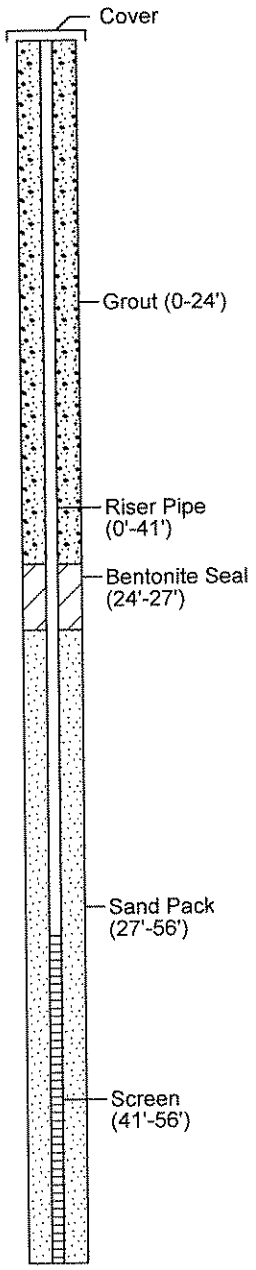
Granville County Landfill
Butner, North Carolina
JOYCE Project No.660.1301.12 Task 01

Date Started	: 4/21/1994	Drilling Company	: GAI Consultants-NC, Inc.
Date Completed	: 4/21/1994	Northing Coord.	: 879199.0110
Hole Diameter	:	Easting Coord.	: 2070698.9032
Drilling Method	:	Survey By	:
Sampling Method	:	Logged By	:

Well: MW-1R
TOC Elev.:

Depth in Feet	Surf. Elev.	Blow Count	% Rec.	USCS	DESCRIPTION
0					Red Brown Clay, trace rock fragments
					Red Brown to Tan Clay, with weathered rock fragments
5					
10					
15					
20					Tan Gray Clay, with saprolite of metavolcanics
25					
30					Grayish Green Metavolcanics, fractured
35					
40					
45					
50					
55					
60					

Total Depth 56.0'



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 4/21/1994
Hole Diameter(s)	:
Drilling Method(s)	:
Company Rep.	:
Drilling Method(s)	:
Company Rep.	:

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Approx. Csg. Stickup	: 0-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Opening	: 0.010 inch

GRAVEL PACK

Type : Grout

WELL SCREEN SEAL

Type : Sand

ANNULUS SEAL

Type : Bentonite

PROTECTIVE CSG.

Type :

WELL PAD

Type : Concrete

Drillers log doesn't match field observations of well depth and construction. This log was adjusted to match field observations.

LOG OF BORING MW-2R

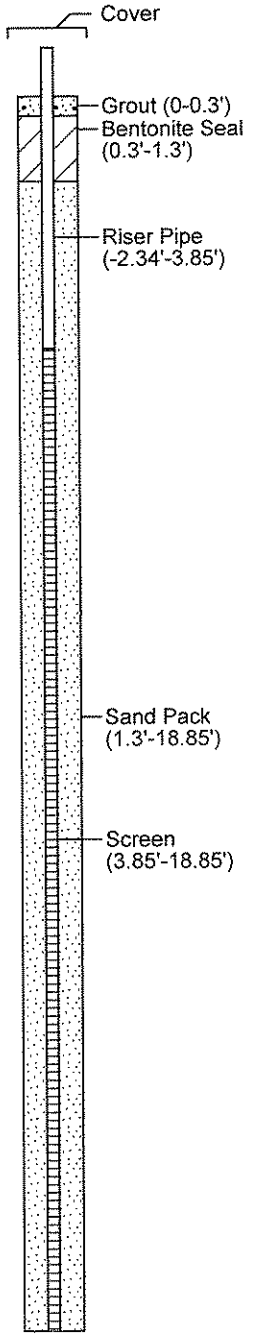
JOYCE ENGINEERING

Granville County Landfill
Butner, North Carolina
JOYCE Project No.660.1301.12 Task 01

Date Started	: 4/12/1994	Drilling Company	: GAI Consultants-NC, Inc.
Date Completed	: 4/12/1994	Northing Coord.	: 877488.3457
Hole Diameter	:	Easting Coord.	: 2070935.1249
Drilling Method	:	Survey By	:
Sampling Method	:	Logged By	:

Depth in Feet	Surf. Elev.	Blow Count	% Rec.	USCS	DESCRIPTION
0					Brown Clay, trace organics and medium sand
					Red Silty Clay, with tan increasing metavolcanics rock fragments downward
5					
10					
					Grayish Green metavolcanics, weathered
15					
20					Total Depth 18.85'

Well: MW-2R
TOC Elev.:



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 4/12/1994
Hole Diameter(s)	:
Drilling Method(s)	:
Company Rep.	:
Drilling Method(s)	:
Company Rep.	:

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Approx. Csg. Stickup	: 3-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Opening	: 0.010 inch

GRAVEL PACK

Type : Grout

WELL SCREEN SEAL

Type : Sand

ANNULUS SEAL

Type : Bentonite

PROTECTIVE CSG.

Type : Steel

WELL PAD

Type : Concrete

Drillers log doesn't match field observations of well depth and construction. This log was adjusted to match field observations.

LOG OF BORING MW-3R

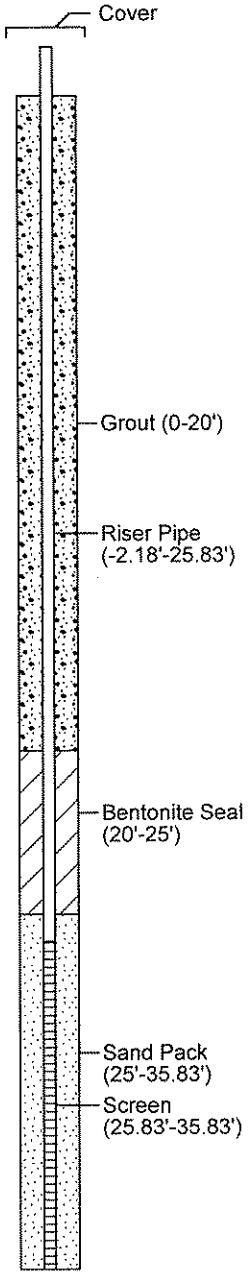
JOYCE ENGINEERING

Granville County Landfill
Butner, North Carolina
JOYCE Project No.660.1301.12 Task 01

Date Started	: 4/21/1994	Drilling Company	: GAI Consultants-NC, Inc.
Date Completed	: 4/21/1994	Northing Coord.	: 877491.7292
Hole Diameter	:	Easting Coord.	: 2070944.8476
Drilling Method	:	Survey By	:
Sampling Method	:	Logged By	:

Depth in Feet	Surf. Elev.	Blow Count	% Rec.	USCS	DESCRIPTION
0					Brown Clay, trace organics and medium sand
					Brown silty clay with tan increaing metavolcanics fragments downward
					Reddish Gray Metavolcanics, weathered, fractured
35					Total Depth 35.83'

Well: MW-3R
TOC Elev.:



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 4/21/1994
Hole Diameter(s)	:
Drilling Method(s)	:
Company Rep.	:
Drilling Method(s)	:
Company Rep.	:

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Approx. Csg. Stickup	: 3-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Opening	: 0.010 inch

GRAVEL PACK

Type	: Grout

WELL SCREEN SEAL

Type	: Sand

ANNULUS SEAL

Type	: Bentonite

PROTECTIVE CSG.

Type	: Steel

WELL PAD

Type	: Concrete

Drillers log doesn't match field observations of well depth and construction. This log was adjusted to match field observations.

LOG OF BORING MW-4

JOYCE ENGINEERING

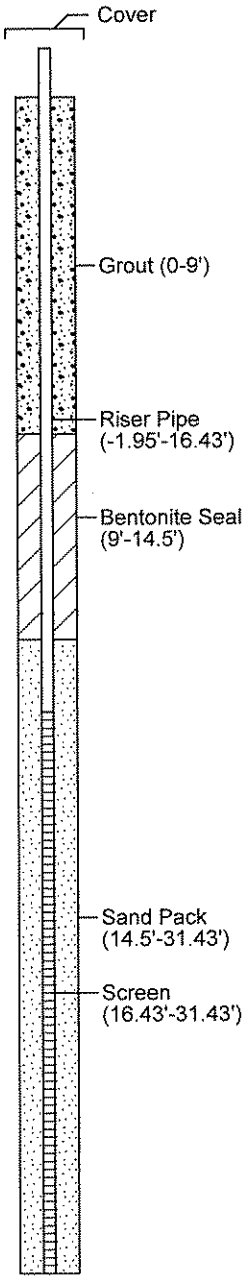
Granville County Landfill
Butner, North Carolina
JOYCE Project No.660.1301.12 Task 01

Date Started	: 4/11/1994	Drilling Company	: GAI Consultants-NC, Inc.
Date Completed	: 4/11/1994	Northing Coord.	: 877526.3318
Hole Diameter	:	Easting Coord.	: 2071330.4495
Drilling Method	:	Survey By	:
Sampling Method	:	Logged By	:

Depth in Feet	Surf. Elev.	Blow Count	% Rec.	USCS	DESCRIPTION
0					Brown Silty Clay, trace medium sand
					Medium to coarse sandy clay, trace sandstone
5					
10					Medium to coarse sandy clay, abumdant metavolcanics rock fragments
					Greenish gray metavolcanics, weathered, fractured
15					
20					
25					
30					
35					

Total Depth 31.43'

Well: MW-4
TOC Elev.:



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 4/11/1994
Hole Diameter(s)	:
Drilling Method(s)	:
Company Rep.	:
Drilling Method(s)	:
Company Rep.	:

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Approx. Csg. Stickup	: 3-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Opening	: 0.010 inch

GRAVEL PACK

Type	: Grout

WELL SCREEN SEAL

Type	: Sand

ANNULUS SEAL

Type	: Bentonite

PROTECTIVE CSG.

Type	: Steel

WELL PAD

Type	: Concrete

Drillers log doesn't match field observations of well depth and construction. This log was adjusted to match field observations.

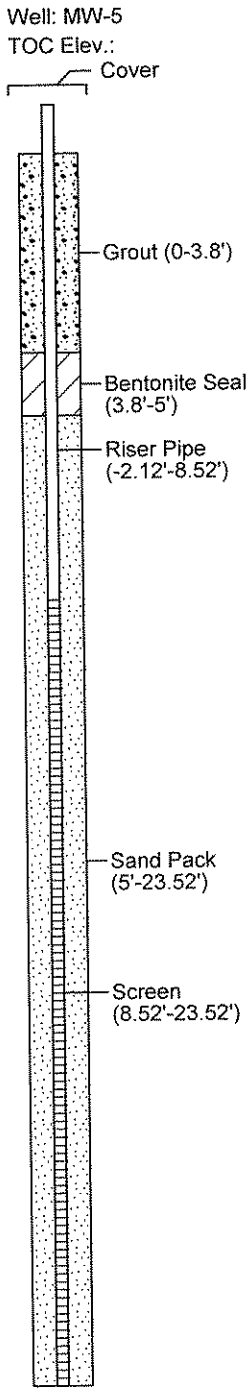
LOG OF BORING MW-5

JOYCE ENGINEERING

Granville County Landfill
Butner, North Carolina
JOYCE Project No.660.1301.12 Task 01

Date Started	: 4/18/1994	Drilling Company	: GAI Consultants-NC, Inc.
Date Completed	: 4/18/1994	Northing Coord.	: 877572.5762
Hole Diameter	:	Easting Coord.	: 2071852.6625
Drilling Method	:	Survey By	:
Sampling Method	:	Logged By	:

Depth in Feet	Surf. Elev.	Blow Count	% Rec.	USCS	DESCRIPTION
0					silt, sandy (m-c) yellowish tan, sand stone fragments
5					
10					sand (f-m), silty, yellowish tan, sand stone fragments
15					saprolite of metavolcanics
20					Metavolcanics, greenish grey weathered fractured
25					Total Depth 23.52'



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 4/18/1994
Hole Diameter(s)	:
Drilling Method(s)	:
Company Rep.	:
Drilling Method(s)	:
Company Rep.	:

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Approx. Csg. Stickup	: 3-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Opening	: 0.010 inch

GRAVEL PACK

Type : Grout

WELL SCREEN SEAL

Type : Sand

ANNULUS SEAL

Type : Bentonite

PROTECTIVE CSG.

Type : Steel

WELL PAD

Type : Concrete

Drillers log doesn't match field observations of well depth and construction. This log was adjusted to match field observations.

LOG OF BORING MW-6

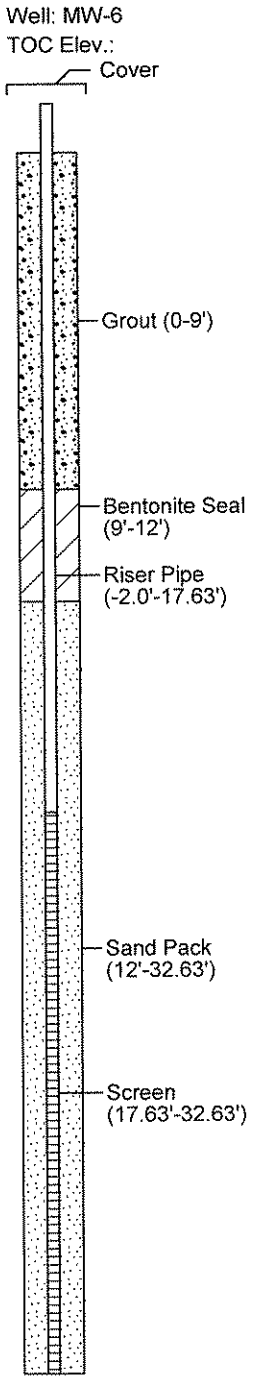
JOYCE ENGINEERING

Granville County Landfill
Butner, North Carolina
JOYCE Project No.660.1301.12 Task 01

Date Started	: 4/19/1994	Drilling Company	: GAI Consultants-NC, Inc.
Date Completed	: 4/19/1994	Northing Coord.	: 878343.2924
Hole Diameter	:	Easting Coord.	: 2071711.4184
Drilling Method	:	Survey By	:
Sampling Method	:	Logged By	:

Depth in Feet	Surf. Elev.	Blow Count	% Rec.	USCS	DESCRIPTION
0					clay tan, trace of organics
5					
					clay, purplish red, abundant metavolcanic fragments
10					
15					
20					
					metavolcanics, greenish gray to gray broken weathered fractured.
25					
30					
35					

Total depth 32.63



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 4/19/1994
Hole Diameter(s)	:
Drilling Method(s)	:
Company Rep.	:
Drilling Method(s)	:
Company Rep.	:

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Approx. Csg. Stickup	: 3-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush
Opening	: 0.010 inch

GRAVEL PACK

Type	: Grout

WELL SCREEN SEAL

Type	: Sand

ANNULUS SEAL

Type	: Bentonite

PROTECTIVE CSG.

Type	: Steel

WELL PAD

Type	: Concrete

Drillers log doesn't match field observations of well depth and construction. This log was adjusted to match field observations.

Boring Log: Observation Well NES-1

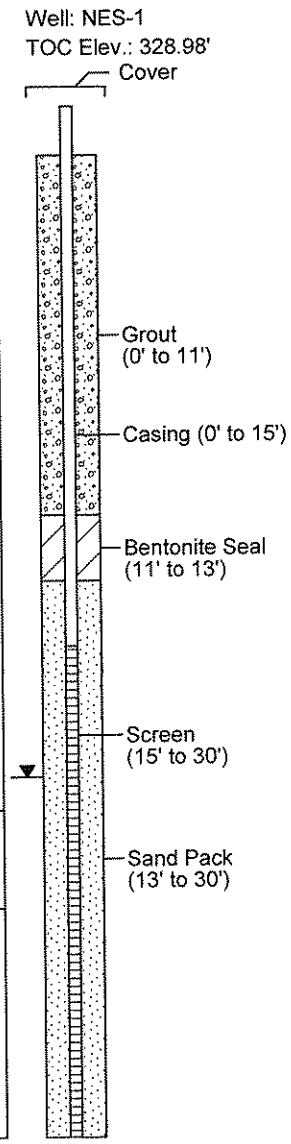
JOYCE ENGINEERING

Butner Landfill, Permit# 39-02
Granville County, NC
NATURE AND EXTENT STUDY

JEI Project No. 660.06.20

Date Started	: 11/14/07	Drilling Company	: SAEDACCO
Date Completed	: 11/14/07	Northing Coord.	: 877116.16625
Hole Diameter	: 6-inch	Easting Coord.	: 2071143.03942
Drilling Method	: Tri-cone bit/Air Hammer	Survey By	:
Sampling Method	: Cuttings	Logged By	: Van Burbach, PG

Depth in Feet	Surf. Elev.	GRAPHIC	DESCRIPTION
0			Quartz SAND to SANDY SILT and SANDY CLAY, tan, fine to medium grained.
20			METAMORPHIC ROCK, grey to dark grey, wet cuttings at 22 ft.
25			METAMORPHIC ROCK, hard, dark grey.
30			Drilling stoppped at 30'



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 11/14/07
Hole Diameter(s)	: 6-inch
Drilling Method(s)	: 5.875-inch tri-cone bit
Company Rep.	: Robert L. Miller
Drilling Method(s)	: Air Rotary
Company Rep.	: Robert L. Miller

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 3-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch

GRAVEL PACK

Type	: 20/30 Silica Sand

WELL SCREEN SEAL

Type	: Bentonite

ANNULUS SEAL

Type	: portland cement/grout

PROTECTIVE CSG.

Type	: steel

WELL PAD

Type	: concrete

1. Drilling performed with a mobilerig, utilizing 5.875-inch tri-coned bit to auger refusal. Borehole was continued with a mobilerig, utilizing a 6-inch air hammer to approximately 30.0 feet.

2. Water level from 11/14/07 was 22.0' below TOC.

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

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QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants-NC Inc

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A MW-1R

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Butner County: Granville
SR 1004
(Road, Community, or Subdivision and Lot No.)

2. OWNER Granville Co Attn Rita Hicks Solid Waste Div
ADDRESS PO Box 906 (Street or Route No.)
Oxford (City or Town) NC (State) 27565 (Zip Code)

3. DATE DRILLED 4/21/94 USE OF WELL Monitoring
4. TOTAL DEPTH 43.2
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [X] NO [ ]
7. STATIC WATER LEVEL Below Top of Casing: 41.0 FT. (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.15 FT. Above Land Surface*
38.8

* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): 37.0 to 43.2

11. CHLORINATION: Type N/A Amount N/A
12. CASING:

Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
+2.15	27.9	2 in.	Sch40	PVC

13. GROUT:

Depth From	Depth To	Material	Method
0	24.0	cement	grout
24.0	27.0	bentonite	pellet

14. SCREEN:

Depth From	Depth To	Diameter	Slot Size	Material
27.9	42.9	2 in.	.010 in.	PVC
		in.	in.	
		in.	in.	

15. SAND/GRAVEL PACK:

Depth From	Depth To	Size	Material
27.0	43.2	concrete	sand

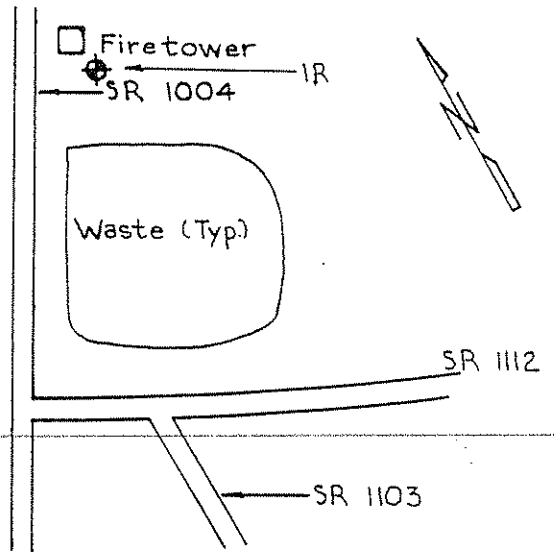
16. REMARKS: Monitoring Well 1R GW at depth of 38.8 after 24 hours

DRILLING LOG

Depth From	Depth To	Formation Description
0	1.5	Clay, red brown, trace rock fragments
1.5	18	Clay, red brown to tan w/weathered rock fragments
18	30	Clay, tan gray, with saprolite of metavolcanics
30	43.2	Metavolcanics, grayish green, fractured

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



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.

* Insufficient water

Edward A Cuestas Jr 6/24/94
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 9/91

Submit original to Division of Environmental Management and copy to well owner

North Carolina
Department of Natural Resources and Community Development
Division of Environmental Management

P. O. Box 27687 - Raleigh, N. C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR GAI Consultants-NC Inc REG. NO. 446

1. WELL LOCATION: (Show a sketch of the location on back of form.)
   Nearest Town: Butner County Granville
   SR 1004 Quadrangle No.
   (Road, Community, Subdivision, Lot No.)
2. OWNER: Granville County
3. ADDRESS: P O Box 906 Oxford NC 27565
4. TOPOGRAPHY: draw, slope, (hilltop), valley, flat
5. USE OF WELL: Monitoring DATE:
6. TOTAL DEPTH: 62.25 DIAMETER: 2 in.
7. CASING REMOVED:

feet	diameter
5	2 in.

8. SEALING MATERIAL:

Neat cement	Sand cement
bags of cement 3	bags of cement
gals. of water	yds. of sand
	gals. of water

Other
Type material
Amount

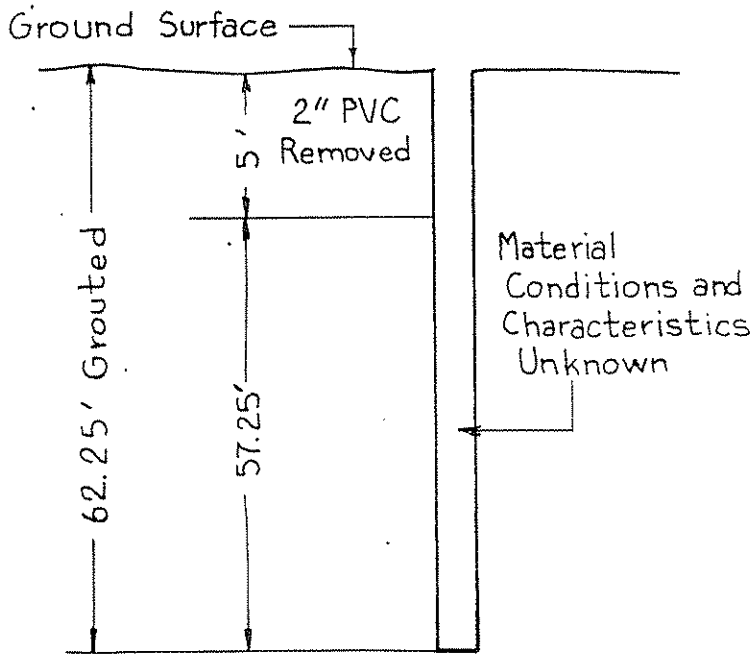
9. EXPLAIN METHOD OF EMPLACEMENT OF MATERIAL
   Grouted well from bottom to top

I do hereby certify that this well abandonment record is true and exact.

Edward H Austin Jr 6/24/91
Signature of Contractor or Agent Date

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.

Monitoring Well 1
Near firetower
Method of construction unknown



Submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the Owner.

GW-30 Revised 10/1/80

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants-NC Inc

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A MW-2R

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Butner County: Granville
SR 1004
(Road, Community, or Subdivision and Lot No.)

2. OWNER Granville Co Attn: Rita Hicks
ADDRESS P O Box 906 Solid Waste Director
(Street or Route No.)
Oxford NC 27565
City or Town State Zip Code

3. DATE DRILLED 4/12/94 USE OF WELL Monitoring
4. TOTAL DEPTH 17.0
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [X] NO [ ]
7. STATIC WATER LEVEL Below Top of Casing: 2.6 FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.34 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): 8.0 to 17.0
11. CHLORINATION: Type N/A Amount N/A
12. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	+2.34	1.7 Ft.	2 in.	Sch 40	PVC
		Ft.			
		Ft.			

13. GROUT:

	Depth From	Depth To	Material	Method
	0.0	0.3 Ft.	cement	grout
	0.3	1.3 Ft.	bentonite	pellet

14. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	1.7	16.7 Ft	2 in.	.010 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

15. SAND/GRAVEL PACK:

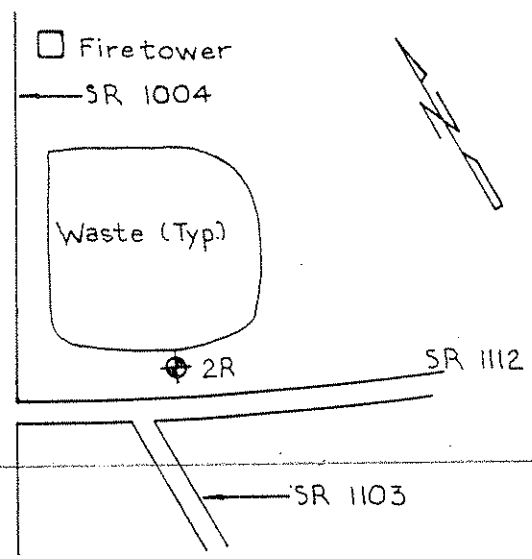
	Depth From	Depth To	Size	Material
	1.3	17.0 Ft.	concrete	sand
		Ft.		

16. REMARKS: Monitoring Well 2R GW at depth of 0.2 after 24 hours

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0	1.5	Clay, brown, trace of organics and medium sand
1.5	13.0	Clay, silty, brown w/ tan increasing metavolcanics Rock fragments downward
13.0	17.0	Metavolcanics, grayish green, weathered

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



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.

Too Shallow +

Edward Houston Jr 6/24/94
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 9 91
Submit original to Division of Environmental Management and copy to well owner

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

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QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants-NC, Inc.

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A MW-3R

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Butner County: Granville
SR 1004
(Road, Community, or Subdivision and Lot No.)

2. OWNER Granville County Attn: Rita Hicks
ADDRESS PO Box 906 Solid Waste Director
(Street or Route No.)
Oxford NC 27565
City or Town State Zip Code

3. DATE DRILLED 4/14/94 USE OF WELL Monitoring
4. TOTAL DEPTH 35.8
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [X] NO [ ]
7. STATIC WATER LEVEL Below Top of Casing: 3.0 FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.18 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): 8.0 to 35.8

11. CHLORINATION: Type N/A Amount N/A
12. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	20 Ft.	4 in.	Sch 40	PVC
	+2.18	25.0 Ft.	2 in.	Sch 40	PVC
		Ft.			

13. GROUT:

	Depth From	Depth To	Material	Method
	0	20.0 Ft.	cement	grout
	16.0	21.0 Ft.	bentonite	pellets

14. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	25.0	35.0 Ft	2 in.	.010 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

15. SAND/GRAVEL PACK:

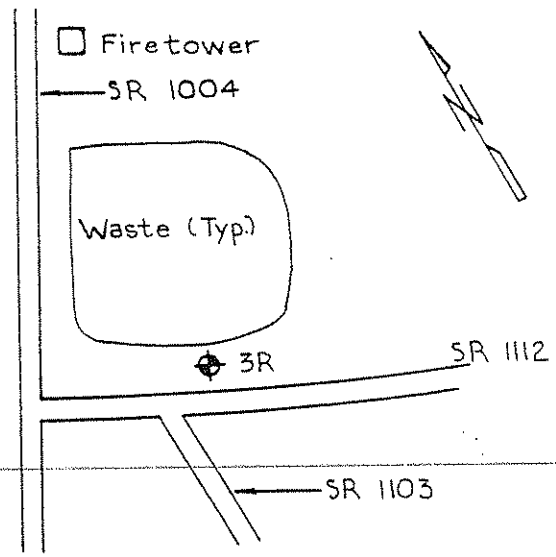
	Depth From	Depth To	Size	Material
	21.0	35.8 Ft.	concrete	sand
		Ft.		

16. REMARKS: Monitoring Well 3R GW at depth of 0.8 after 24 hours

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0	1.5	Clay, brown, trace of organics and medi sand
1.5	13.0	Clay, silty, brown w/tan increasing metavolcanic fragmen downward
13.0	35.8	Metavolcanics, reddi gray, weathered fractured

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



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.

Edward Kurtz Jr 6/24/94
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 9-91
Submit original to Division of Environmental Management and copy to well owner

North Carolina
Department of Natural Resources and Community Development
Division of Environmental Management

P. O. Box 27687 - Raleigh, N. C. 27611

WELL ABANDONMENT RECORD

CONTRACTOR GAI Consultants-NC Inc REG. NO. 446

1. WELL LOCATION: (Show a sketch of the location on back of form.)
   Nearest Town: Butner County Granville
   SR 1004 Quadrangle No.
   (Road, Community, Subdivision, Lot No.)
2. OWNER: Granville County
3. ADDRESS: P O Box 906 Oxford NC 27565
4. TOPOGRAPHY: draw, slope, hilltop, valley, flat
5. USE OF WELL: Monitoring DATE:
6. TOTAL DEPTH: 4.83 DIAMETER: 2 in.
7. CASING REMOVED:

feet	diameter
4.83	2 in.

8. SEALING MATERIAL:

Neat cement	Sand cement
bags of cement ½	bags of cement
gals. of water	yds. of sand
	gals. of water

Other
Type material
Amount

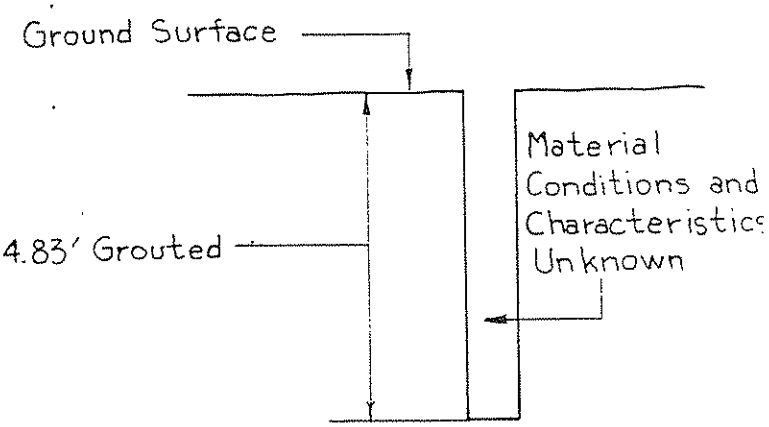
9. EXPLAIN METHOD OF EMPLACEMENT OF MATERIAL
   Grouted

I do hereby certify that this well abandonment record is true and exact.

Edward L Cuestas Jr 6/24/84
Signature of Contractor or Agent Date

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.

Monitoring Well 3
Method of construction unknown



Submit original to the Division of Environmental Management, one copy to the Driller, and one copy to the Owner.

GW-30 Revised 10/1/80

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Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants-NC, Inc

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A MW-4

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Butner County: Granville
SR 1004
(Road, Community, or Subdivision and Lot No.)

2. OWNER Granville County Attn: Rita Hicks Solid Waste Director
ADDRESS PO Box 906 (Street or Route No.)
Oxford (City or Town) NC (State) 27565 (Zip Code)

3. DATE DRILLED 4/18/94 USE OF WELL Monitoring
4. TOTAL DEPTH 30.0
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 9.8 FT. (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.95 FT. Above Land Surface* 7.8
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): 15.0 to 30.0

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From +1.95	To 14.5	Ft.	2 in.	Sch 40	PVC
From	To	Ft.			
From	To	Ft.			

13. GROUT:

	Depth		Material	Method
From 0	To 9.0	Ft.	cement	grout
From 9.0	To 10.5	Ft.	bentonite	pellets

14. SCREEN: X

	Depth		Diameter	Slot Size	Material
From 14.5	To 29.5	Ft	2 in.	.010 in.	PVC
From	To	Ft.	in.	in.	
From	To	Ft.	in.	in.	

15. SAND/GRAVEL PACK:

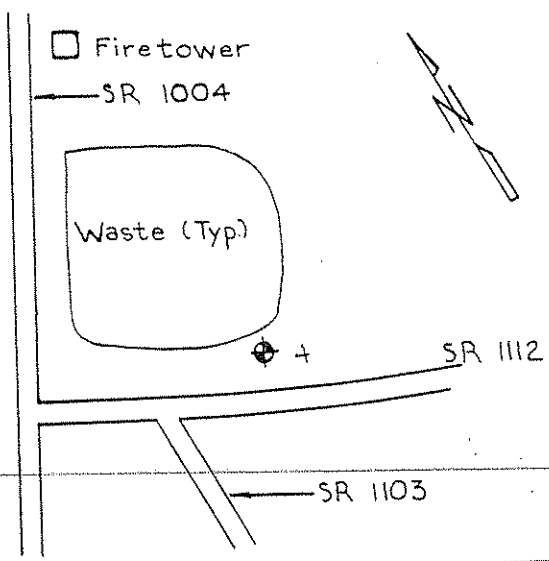
	Depth		Size	Material
From 10.5	To 30.0	Ft.	concrete	sand
From	To	Ft.		

16. REMARKS: Monitoring Well 4 GW at depth of 7.8 after 24 hours

DEPTH From	To	DRILLING LOG Formation Description
0	1.5	Clay, silty,brown, trace medium sand
1.5	11.0	Clay sandy (m-c) trace of sandstone
11.0	13.0	Clay, sandy (m-c) abundant metavolcani rock fragments
13.0	30.0	Metavolcanics, greenish gray, weathered, fractured

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



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.

Too Deep

Edward Houston Jr 6/24/94
SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Environmental Management and copy to well owner

GW-1 REV 3/91

North Carolina - Department of Environment, Health, and Natural Resources
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Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants-Nc, Inc.

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A MW-5

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Butner County: Granville
SR 1004
(Road, Community, or Subdivision and Lot No.)

2. OWNER Granville County Attn: Rita Hicks
ADDRESS P O Box 906 Solid Waste Director
(Street or Route No.)
Oxford NC 27565
City or Town State Zip Code

3. DATE DRILLED 4/18/94 USE OF WELL Monitoring
4. TOTAL DEPTH 21.7
5. CUTTINGS COLLECTED YES [ ] NO [x]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [x]
7. STATIC WATER LEVEL Below Top of Casing: 12.8 FT.
10.7
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.12 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): 13.0 to 21.7

11. CHLORINATION: Type N/A Amount N/A
12. CASING:

	Depth From	Depth To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
	+2.12	6.3		2 in.	Sch 40	PVC

13. GROUT:

	Depth From	Depth To	Ft.	Material	Method
	0	3.8		cement	grout
	3.8	5.0		bentonite	pellets

14. SCREEN:

	Depth From	Depth To	Ft.	Diameter	Slot Size	Material
	6.3	21.3		2 in.	.010 in.	PVC
				in.	in.	
				in.	in.	

15. SAND/GRAVEL PACK:

	Depth From	Depth To	Ft.	Size	Material
	5.0	21.7		concrte	sand

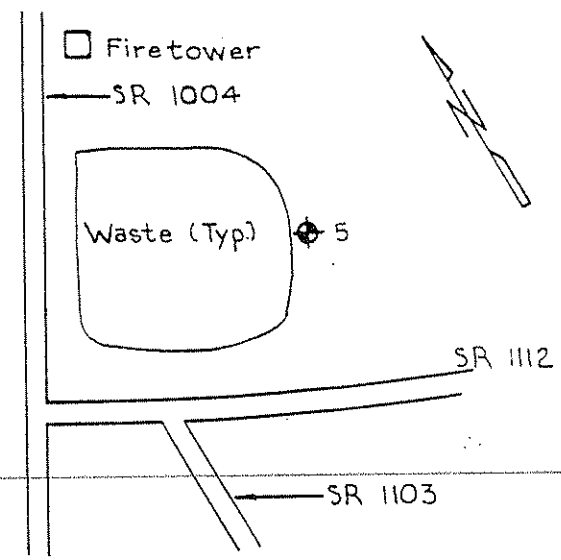
16. REMARKS: Monitoring Well 5 Gw at depth of 10.7 after 24 hours

DRILLING LOG

Depth From	Depth To	Formation Description
0	8.0	Silt, sandy (m-c) yellowish tan, sandstone fragments
8.0	13.0	Sand (f-m), silty, yellowish tan, sandstone fragments
13.0	17.0	Saprolite of metavolcanics
17.0	21.7	Metavolcanics, green gray, weathered, fractured

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



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.

Edward S Barton Jr 6/24/94
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 3/91
Submit original to Division of Environmental Management and copy to well owner

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY	
QUAD. NO.	SERIAL NO.
Lat.	Long. RO
Minor Basin	
Basin Code	
Header Ent.	GW-1 Ent.

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants-NC, Inc.

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A MW-6

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Butner County: Granville
   SR 1004
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Granville County Attn: Rita Hicks
   ADDRESS P O Box 906 Solid Waste Director
   (Street or Route No.)
   Oxford NC 27565
   City or Town State Zip Code
3. DATE DRILLED 4/19/94 USE OF WELL Monitoring
4. TOTAL DEPTH 31.2
5. CUTTINGS COLLECTED YES [ ] NO [x]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [x]
7. STATIC WATER LEVEL Below Top of Casing: 11.7 FT. 9.7
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.0 FT. Above Land Surface*

* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): 21.2 to 31.2
11. CHLORINATION: Type N/A Amount N/A
12. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	+2.0	14.7 Ft.	2 in.	Sch 40	PVC
		Ft.			
		Ft.			

13. GROUT:

	Depth From	Depth To	Material	Method
	0	9.0 Ft.	cement	grout
	9.0	12.0 Ft.	bentonite	pellet

14. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	14.7	29.7 Ft	2 in.	.010 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

15. SAND/GRAVEL PACK:

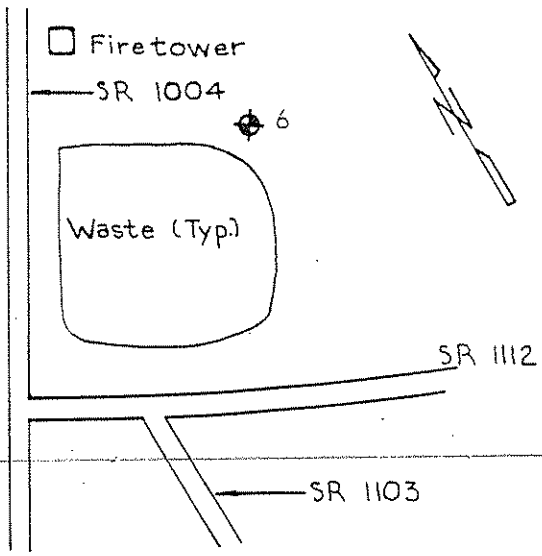
	Depth From	Depth To	Size	Material
	12.0	31.2 Ft.	concrete	sand
		Ft.		

16. REMARKS: Monitoring Well 6 GW at depth of 9.7 after 24 hours

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0	8.0	Clay tan, trace of organics
8.0	21.2	Clay, purplish red, abundant metavolcanic fragments
21.2	31.2	Metavolcanics, greenish gray to gray Broken weathered, fractured

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



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.

Too Deep

Edward Houston Jr. 6/24/94

SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Environmental Management and copy to well owner

GW-1 REV 9/91

MONITORING WELL NO. 1R

PROJECT: Granville County Landfill
Butner, North Carolina
LOCATION: see Landfill Plans

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION
			Red Brown Clay, trace rock fragments
			Red Brown to Tan Clay, with weathered rock fragments
5			
10			
15			
			Tan Gray Clay, with saprolite of metavolcanics
20			
25			
30			Grayish Green Metavolcanics, fractured
35			
40			
			End of Boring
45			

COMPLETION DEPTH: 43.2 ft DATE: 4-21-94
DEPTH TO WATER: 37 ft while drilling, 38.8 ft after 24 hours

MONITORING WELL NO. 2R

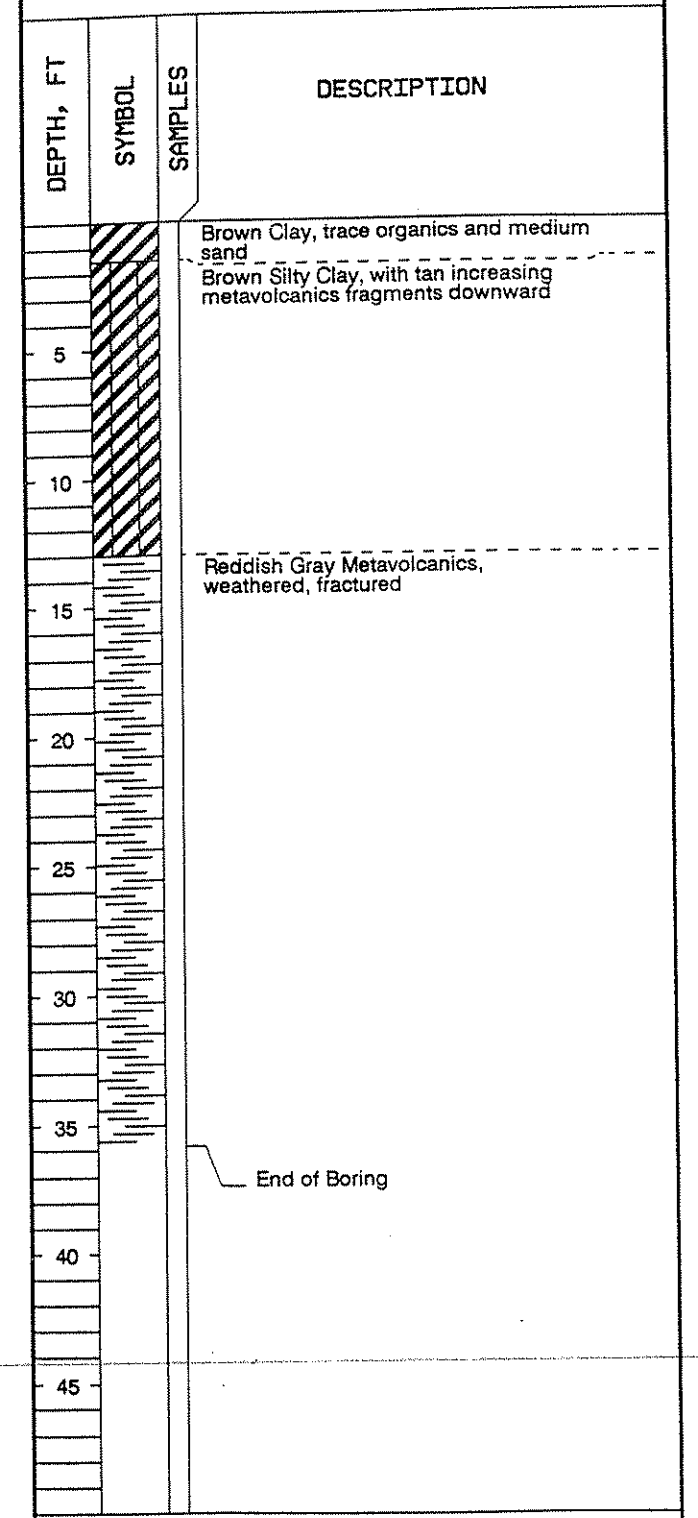
PROJECT: Granville County Landfill
Butner, North Carolina
LOCATION: see Landfill Plans

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION
			Brown Clay, trace organics and medium sand
			Brown Silty Clay, with tan increasing metavolcanics rock fragments downward
5			
10			
			Grayish Green Metavolcanics, weathered
15			
			End of Boring
20			
25			
30			
35			
40			
45			

COMPLETION DEPTH: 17.0 ft DATE: 4-12-94
DEPTH TO WATER: 8 ft while drilling, 0.2 ft after 24 hours

MONITORING WELL NO. 3R

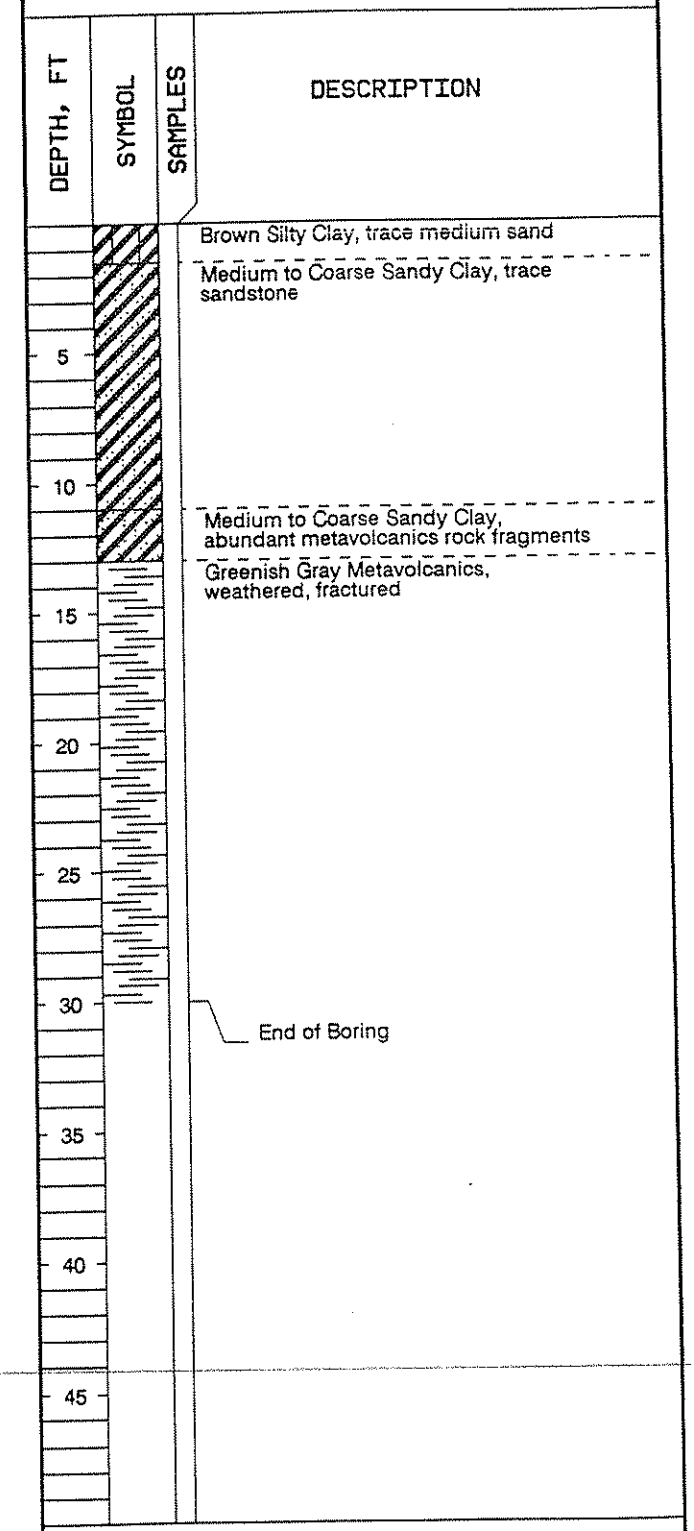
PROJECT: Granville County Landfill
Butner, North Carolina
LOCATION: see Landfill Plans



COMPLETION DEPTH: 35.8 ft DATE: 4-21-94
DEPTH TO WATER: 8 ft while drilling, 0.8 ft after 24 hours

MONITORING WELL NO. 4

PROJECT: Granville County Landfill
Butner, North Carolina
LOCATION: see Landfill Plans



COMPLETION DEPTH: 30.0 ft DATE: 4-11-94
DEPTH TO WATER: 15 ft while drilling, 7.8 ft after 24 hours

#6735 Joyce Eng.

NON RESIDENTIAL WELL CONSTRUCTION RECORD

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

WELL CONTRACTOR CERTIFICATION # 2075

1. WELL CONTRACTOR:

Robert L. Miller
Well Contractor (Individual) Name

Saedacco
Well Contractor Company Name

STREET ADDRESS 9088 Northfield Dr.

Ft. Mill SC 29715
City or Town State Zip Code

(803) 548-2180
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) NES #1

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 11/14/07

TIME COMPLETED 12:30 AM ☐ PM ☑

3. WELL LOCATION:

CITY: Butner COUNTY Granville

State RD. 1004 / Old Hwy 75
(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 Butner Landfill

STREET ADDRESS State RD. 1004 / Old Hwy 75

Butner NC
City or Town State Zip Code

CONTACT PERSON Joyce Engineering

MAILING ADDRESS 2211 W. Meadowview Rd #101

Greensboro NC 27407
City or Town State Zip Code

(336) 323-0092
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: 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:

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

7. GROUT:

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

8. SCREEN:

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

9. SAND/GRAVEL PACK:

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

10. DRILLING LOG

From	To	Formation Description
0	20'	TN Silty Sand
20'	26'	PWR
26'	30	Rock

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

[signature] 11/15/07
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

APPENDIX B

Aquifer Test Data and Calculations

(GAI Consultants, 1995)

GAI CONSULTANTS

GAI Consultants – NC, Inc.

3812-H Tarheel Drive
Raleigh, NC 27609
919/878-4478
FAX 919/878-4032

April 28, 1995

Mr. Wayne Sullivan
Municipal Engineering Services Company
Post Office Box 97
Garner, North Carolina 27529

Re: Responses to Review Comments
Granville County - Butner Landfill Transition Plan
Butner, North Carolina
Project No. 94108.02

Dear Mr. Sullivan:

Three addenda to three reports prepared by GAI pertaining to the Transition Plan for the Granville County - Butner Landfill, Permit # 39-02, are enclosed in response to review comments by Mr. Bobby Lutfy of the Solid Waste Section of the North Carolina Department of Environment, Health, and Natural Resources in a letter dated March 8, 1995 concerning Hydrogeologic Reviews of the three reports. In addition, a revised Sampling and Analysis Plan for sampling and testing surface and groundwater has been submitted in response to comments by Mr. Lutfy. Addenda have been punched for inclusion in corresponding reports as considered appropriate.

The three addenda and revised report are applicable to the Ground and Surface Water Monitoring System report, GAI Report No. 93165.02 dated March 30, 1994; Ground and Surface Water Monitoring System letter, GAI Project No. 94108.02 dated June 23, 1994; Ground and Surface Water Sampling and Analysis Plan, dated February 10, 1994; and the Water Sampling and Testing Report, GAI Report No. 94108.02 dated October 5, 1994.

Sincerely,
GAI Consultants-NC, Inc.

Thomas J. Rossbach, Ph.D., P.G.
Staff Geologist

Wendell W. Parker, Ph.D., P.E.
Vice President

WWP/TJT/tjt

APR 1995
Received
Solid Waste
Section

GAI CONSULTANTS

APR 1995
Received
Solid Waste
Section

ADDENDUM A

ADDENDUM A
WATER SAMPLING AND TESTING
GRANVILLE COUNTY - BUTNER LANDFILL
BUTNER, NORTH CAROLINA
OCTOBER 5, 1994

The following responses are made to review comments by Mr. Bobby Lutfy in a letter dated March 8, 1995.

Lutfy Comment: Page 2 indicates that monitoring well MW-2 was not sampled. Previous correspondence from the Solid Waste Section stated than [sic] well MW-2 should continue to be sampled as part of the detection monitoring system. (Reference 3-25-94 letter.)

Response: GAI did not sample Groundwater Monitoring Well 2. Groundwater Monitoring Well 2R was planned, recommended, and installed as a replacement well for Groundwater Monitoring Well 2. That is, Monitoring Well 2R as planned and installed was and is expected to sample the same water source as Monitoring Well 2. Monitoring Well 2 appeared to be in a functional condition but its method and condition of installation was and is unknown. Monitoring Well 2 was anticipated to be used as a part of the detection monitoring system until it was determined that it could be abandoned based on comparative results from Monitoring Well 2R.

Comparative results have been achieved by sampling and testing Monitoring Well 2R. Sampling and testing results of groundwater from Monitoring Well 2R indicates evidence of some potential contaminants similar to those indicated from sampling and testing Monitoring Well 2. Monitoring Well 2R is, in our opinion, clearly sampling the same groundwater source and condition as Monitoring Well 2. Consequently, in our opinion, Monitoring Well 2 can be abandoned since Monitoring Well 2R is an apparent duplicate as far as sampling the same groundwater source and condition. However, Monitoring Well 2R is constructed in general accordance with current North Carolina State Requirements; Monitoring Well 2 may or may not be constructed in accordance with current North Carolina State Requirements.

Although Monitoring Well 2 was inadvertently not sampled for the October 1994 baseline sampling event, Monitoring Well 2 is still considered to be functional and could be sampled. Based on the results achieved using Monitoring Well 2R, Monitoring Well 2 could and should be abandoned without impacting the effectiveness of the groundwater monitoring system.

Monitoring Well 2 was inadvertently left off the drawing containing the surveyed well locations. This drawing was provided to the well sampler who naturally sampled only the wells shown on the drawing. Monitoring Well 2 is now shown on the surveyed well location drawing (see Plate 1 attached).

Lutfy Comment: Table 1 As discussed in an earlier meeting with GAI, a distinction needs to be made between total porosity and effective porosity, and revised effective porosity values need to be provided. Also documentation and calculations need to be provided for the hydraulic conductivity values (permeability values), porosity values, direction of flow, etc. No ground-water flow rate values were provided.

Response: GAI recently met with the Solid Waste Section to discuss in general soil and rock porosity. The discussion included total or primary porosity, secondary porosity, effective porosity, volumetric porosity, and areal porosity. Porosity data in Table 1 of this addendum considers the results of the discussion. Documentation and calculations for

permeability, porosity, and groundwater flow rate and direction are provided in Appendix A. Groundwater flow rate values are clearly indicated in Table 1 of the report reviewed by Mr. Lutfy under the column heading "Groundwater Flow Rate and Direction, (ft/yr)" and are similarly indicated in Table 1 of this addendum.

Lutfy Comment: Plate 1 Monitoring well MW-2 is not shown on Plate 1.

Response: Monitoring Well 2 is now indicated on Plate 1.

Lutfy Comment: Clarification is needed on the location of wells 2, 2R and 3R. The approved plan was to install a deeper well nested with well 2 in the lower part of the drainage swale.

Response: Monitoring Wells 2, 2R, and 3R are at the locations on Plate 1 of this addendum. Monitoring Well 3R is nested with Monitoring Well 2R, is located near Monitoring Well 2R, and has essentially the same ground surface elevation within a few inches of Monitoring Well 2R. Monitoring Wells 2R and 3R are considered to be installed in compliance with what was planned.

Lutfy Comment: Unapproved analytical methods were used for Silver and Vanadium. Incorrect PQLs were reported for Nickel and Vanadium.

Response: The ground and surface water samples obtained in September 1994 were analyzed for silver and vanadium using EPA Method 6010. Subsequent samples were analyzed using EPA Methods 7761 and 7911 for silver and vanadium, respectively. PQLs for nickel and vanadium are 50 and 40 ppb, respectively, in revised chemical analyses reports in Appendix B in accordance with the January 18, 1995 memo from the Solid Waste Section.

Lutfy Comment: No data was reported for the field test parameters: pH, temperature, and specific conductivity.

Response: Field test parameter data--pH, temperature, and specific conductivity--are clearly labeled on the Sampling Field Data Sheets in Appendix D of the Water Sampling and Testing report reviewed by Mr. Lutfy and are also included in Appendix B.

Lutfy Comment: Well Construction: Monitoring well MW-2R was installed shallower than is desired. Monitoring wells MW-4 and MW-6 were installed below the water table and are therefore deeper than what was approved in the Monitoring Plan. The sand pack for wells MW-3R and MW-4 extended more than two feet above the top of the screen. The sand pack for well MW-6 extends slightly more above and below the screen than what is called for in the approved Monitoring Plan.

Response: As noted on the boring logs for Monitoring Wells 4 and 6, the groundwater is under artesian pressure. Groundwater was not encountered during well installation until the clay unit above weathered metavolcanics was fully penetrated and the boring was drilled

into the metavolcanics. Groundwater rose significantly in the monitoring wells into the level of the clay following installation. Concerning the relatively shallow depth of Monitoring Well 2R and the sand pack in Monitoring Wells 3R, 4, and 6, the wells are functioning adequately and are considered to provide representative groundwater samples. In an effort to sample water with any potential volatiles at or near the surface of the groundwater, the sand and screen of Monitoring Well 2R was installed as near the surface of the groundwater table as reasonably possible.

Monitoring Well 3R exhibits a groundwater level in excess of 16 feet above the sand over the screen. The top of the sand over the screen in Monitoring Well 3R is 4 feet below the bottom of the sand under the screen in Monitoring Well 2R. Monitoring Well 3R is monitoring the groundwater as planned. The sand and screen of Monitoring Well 3R are in the same groundwater source. Monitoring Well 3R is effectively nested with Monitoring Well 2R as planned.

Monitoring Wells 4 and 6 are monitoring the artesian groundwater as planned. With purging of Monitoring Well 4, groundwater flows into the sampling zone of the well from the artesian aquifer starting at a depth of about 15 feet or about 4.5 feet below the sand over the screen. With purging of Monitoring Well 6, groundwater flows into the sampling zone of the well from the artesian aquifer starting at a depth of about 21 feet or about 9 feet below the sand over the screen. Monitoring Wells 4 and 6 are monitoring the groundwater as planned. The sand over the screens in Monitoring Wells 4 and 6 are in a clay stratum which will provide very little, if any, water and, consequently, has no impact on the source of groundwater being sampled.

TABLE 1
PERMEABILITY AND POROSITY

Monitoring Well	Permeability (cm/sec)	Porosity (%)
1R	8.7×10^{-6}	30
2R	6.7×10^{-5}	40
3R	1.7×10^{-5}	30
4	1.6×10^{-6}	20
5	1.4×10^{-5}	34
6	1.4×10^{-5}	30

TABLE 1
HYDROLOGIC PROPERTIES AT MONITORING WELL LOCATIONS

Monitoring Well	Permeability (cm/sec)	Total Porosity (%)	Effective Porosity (%)	Groundwater Flow Rate and Direction (ft/yr)
1R	1.7×10^{-5}	30	1	96 S 30°E
2R	6.7×10^{-5}	40	5	73 S 12°E
3R	1.7×10^{-5}	30	1	63 S 13°E
4	1.6×10^{-6}	20	1	3 S 22°W
5	1.4×10^{-5}	34	1	27 S 23°W
6	1.4×10^{-5}	30	1	90 S 7°E

Note: Where monitoring wells are in soil and rock, groundwater flow through soil is considered to control. Effective porosity is considered to control groundwater flow and is estimated for the rock based on visual observations during well installation.

APPENDIX A

CALCULATIONS

Client MESCO

Job No. 94108.02

Subject Granville-Butner

GAI CONSULTANTS-NC, INC.

Raleigh, NC

Final Page No.

Prel. Page No.

Calc. TJR Date 04/10/95

Chkd. CLM Date 4-10-95

MW	Ground	3/2/95 GW depth	GW Elev
1R	480.00	47.7	432.30
2R	348.36	0.16	348.20
3R	348.47	0.67	347.80
4	358.29	8.05	350.24
5	361.13	5.58	355.55
6	379.31	12.3	367.01

432.30 − 347.80 = 84.50

CI: 10 / 5

MW6 - MW5	367.01 − 355.55 = 11.46	L = 672	$\frac{10(672)}{11.46}$ =	586.39	293.19
MW5 - MW4	355.55 − 350.24 = 5.31	L = 540	$\frac{10(540)}{5.31}$ =	1016.95	508.47
MW6 - MW4	367.01 − 350.24 = 16.77	L = 898	$\frac{10(898)}{16.77}$ =	535.48	267.74
MW1R - MW6	432.30 − 367.01 = 65.29	L = 1337	$\frac{10(1337)}{65.29}$ =	204.78	102.39
MW1R - MW3R	432.30 − 347.80 = 84.5	L = 1730	$\frac{10(1730)}{84.5}$ =	204.73	102.37
MW6 - MW2R	367.01 − 348.20 = 18.81	L = 1128	$\frac{10(1128)}{18.81}$ =	599.68	299.84

MW	K	i =	ne	$\bar{V}$	Dir
1R	1.7×10^{-5}	$\frac{2.3}{42}$	1	96	S 30° E
2R	6.7×10^{-5}	$\frac{2.2}{42}$	5	73	S 12° E
3R	1.7×10^{-5}	$\frac{1.8}{50}$	1	63	S 13° E
4	1.6×10^{-6}	$\frac{5}{270}$	1	3	S 22° W
5	1.4×10^{-5}	$\frac{5}{265}$	1	27	S 23° W
6	1.4×10^{-5}	$\frac{2.99}{48}$	1	90	S 7° E

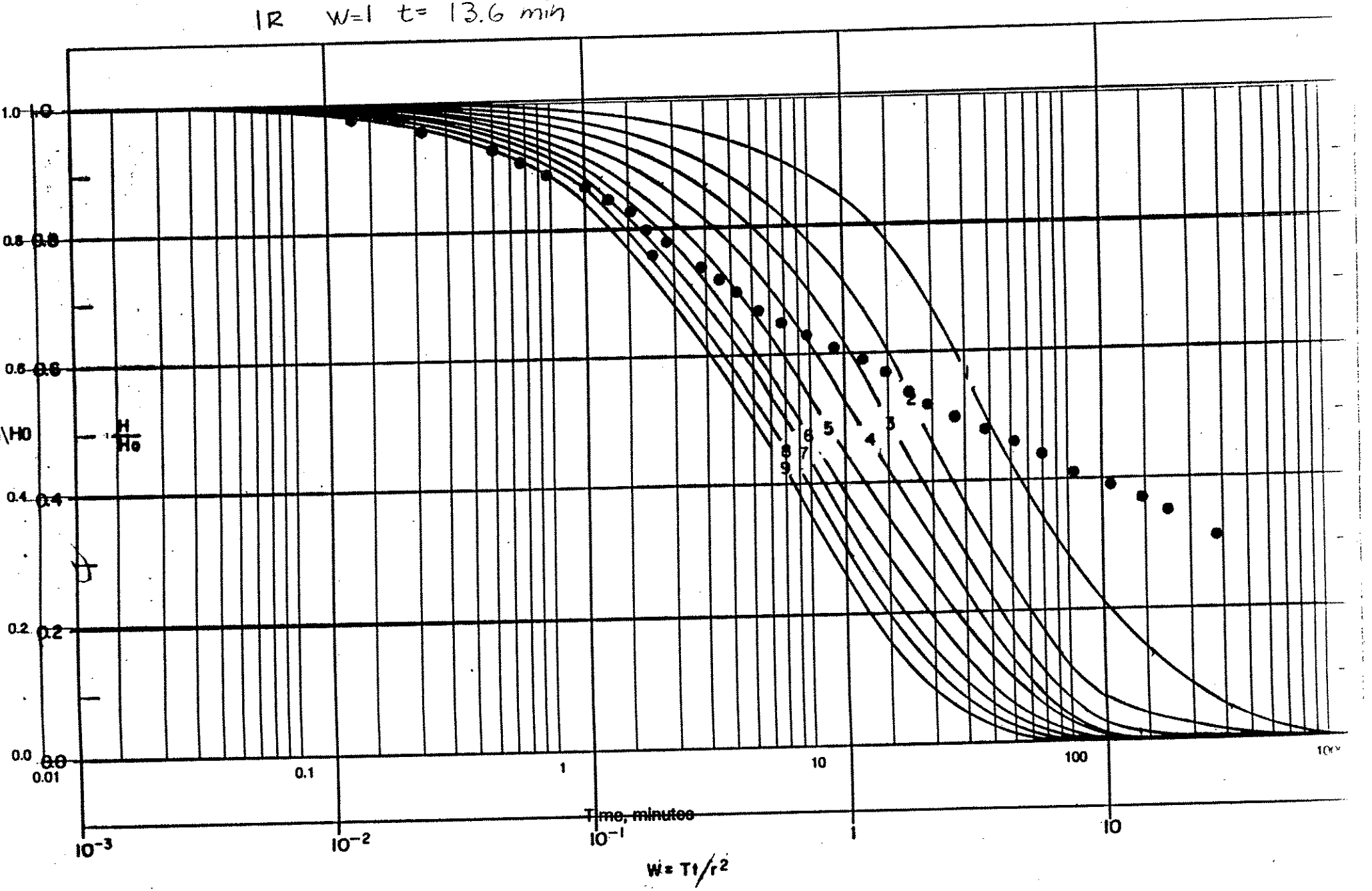
$$\bar{V} = \frac{K \cdot i}{ne} \times 1{,}034{,}645.669 \ \frac{ft/yr}{cm/sec}$$

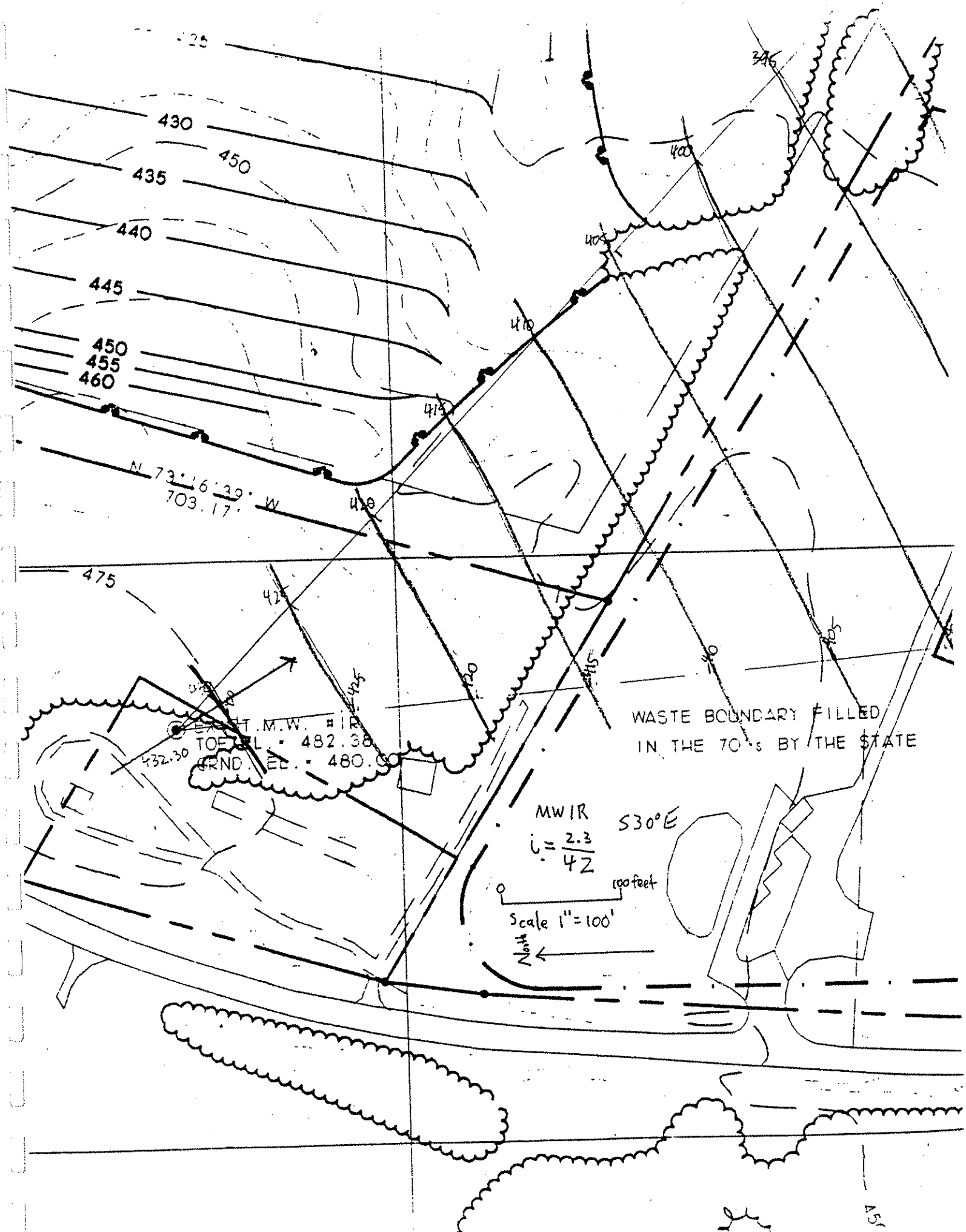
SLUG TEST MW1R GRANVILLE BUTNER

DEPTH TO GW	45.6	RADIUS, in.	1
HT OF STICKUP	2.5	WET SCREEN, ft	15
INITIAL GW READING	2	t, min	13.6
INITIAL TIME	638.77	k, cm/sec	1.7E-05
INITIAL GW BELOW TOC	48.1		
HO	46.1		

GW READING	DH	H	H/HO	HOUR	MIN	SEC	TIME
3	1	45.1	0.98	10	38	55	0.15
5	3	43.1	0.93	10	39	12	0.43
6	4	42.1	0.91	10	39	22	0.60
7	5	41.1	0.89	10	39	34	0.80
8	6	40.1	0.87	10	39	58	1.20
9	7	39.1	0.85	10	40	17	1.51
10	8	38.1	0.83	10	40	39	1.88
11	9	37.1	0.80	10	40	57	2.18
12	10	36.1	0.78	10	41	26	2.66
13	11	35.1	0.76	10	41	50	3.06
14	12	34.1	0.74	10	42	27	3.68
15	13	33.1	0.72	10	43	6	4.33
16	14	32.1	0.70	10	43	49	5.05
17	15	31.1	0.67	10	44	56	6.16
18	16	30.1	0.65	10	46	22	7.60
19	17	29.1	0.63	10	48	19	9.55
20	18	28.1	0.61	10	51	3	12.28
21	19	27.1	0.59	10	54	39	15.88
22	20	26.1	0.57	10	58	17	19.51
23	21	25.1	0.54	11	2	46	24.00
24	22	24.1	0.52	11	7	13	28.45
25	23	23.1	0.50	11	15	11	36.41
26	24	22.1	0.48	11	26	31	47.75
27	25	21.1	0.46	11	40	22	61.60
28	26	20.1	0.44	11	58	1	79.25
29	27	19.1	0.41	12	23	44	104.96
30	28	18.1	0.39	13	4	38	145.86
31	29	17.1	0.37	13	52	14	193.46
32	30	16.1	0.35	14	42	19	243.55
33.71	31.71	14.39	0.31	16	56	39	377.88

1R W=1 t= 13.6 min

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455
460
N 73°16'39" W
703.17'
475
WASTE BOUNDARY FILLED
IN THE 70's BY THE STATE
MW1R
S30°E
i = 2.3/42
0
100 feet
Scale 1" = 100'
North

Client MESCO

Job No. 94108.02

Subject Slug Tests

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Prel. Page No. 2

Calc. TJT Date 6-23-94

Chkd. Date

2R

$H_0 = 2.9$

$r = 1''$

$b = 15'$

Screen 4.0

$H' = -1.1$

t (min)	H (ft)	H/H_0
0.7	1.9	0.66
1.8	1.4	0.48
3.3	0.9	0.31
6.5	0.4	0.14
20.1	0	0

$W = 1$

$t = 3.5$

$T = 0.002 \frac{ft^2}{min}$

$K = 6.7 \times 10^{-5}$ cm/sec

3R

$H_0 = 3.6$

$r = 1''$

$b = 10'$

Screen 27.2

$H' = -23.7$

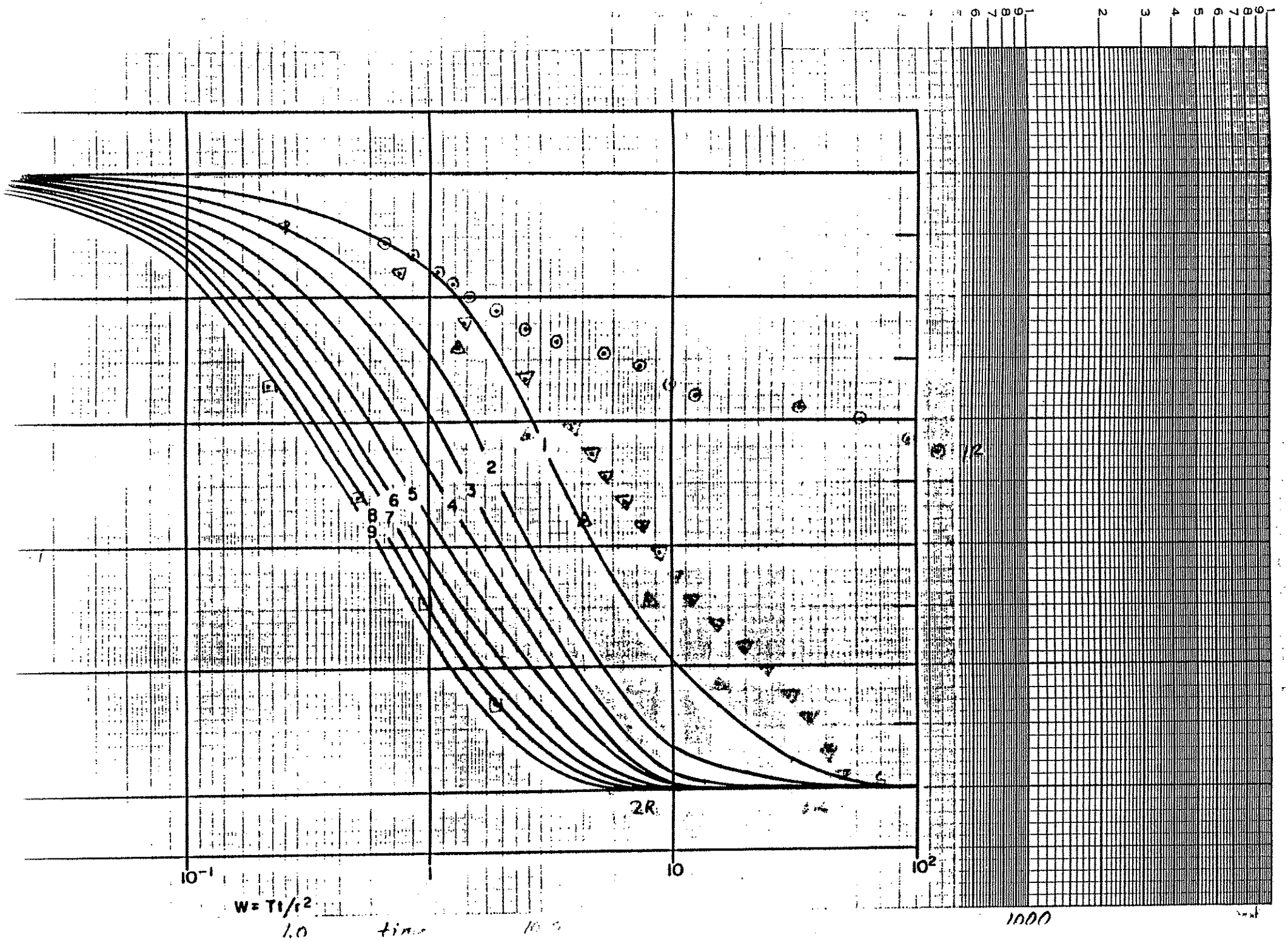
t (min)	H (ft)	H/H_0
4.6	2.6	0.72
9.0	2.1	0.58
15.1	1.6	0.44
28.0	1.1	0.31
54.0	0.6	0.17
105.3	0	0

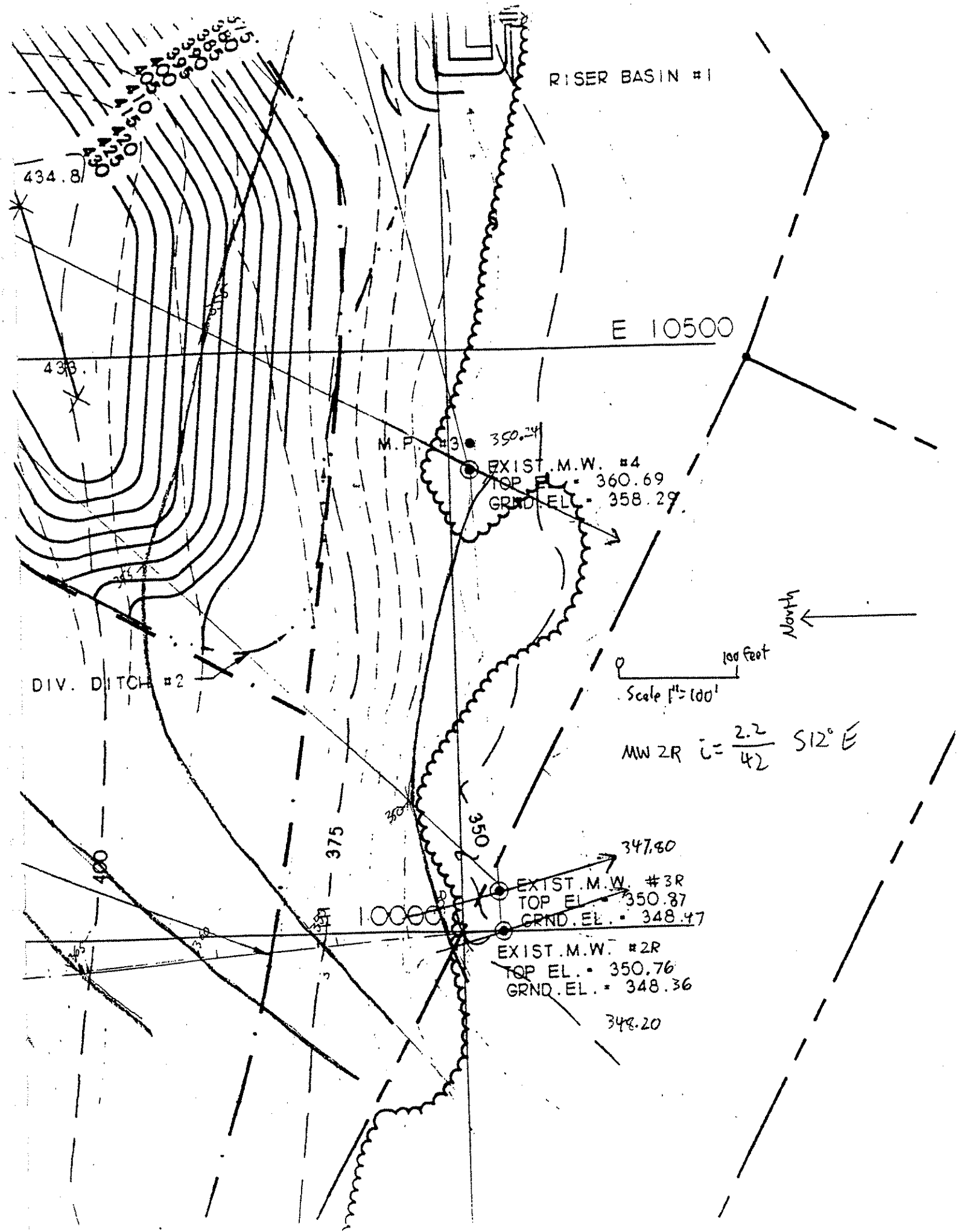
$W = 1$

$t = 20.5$

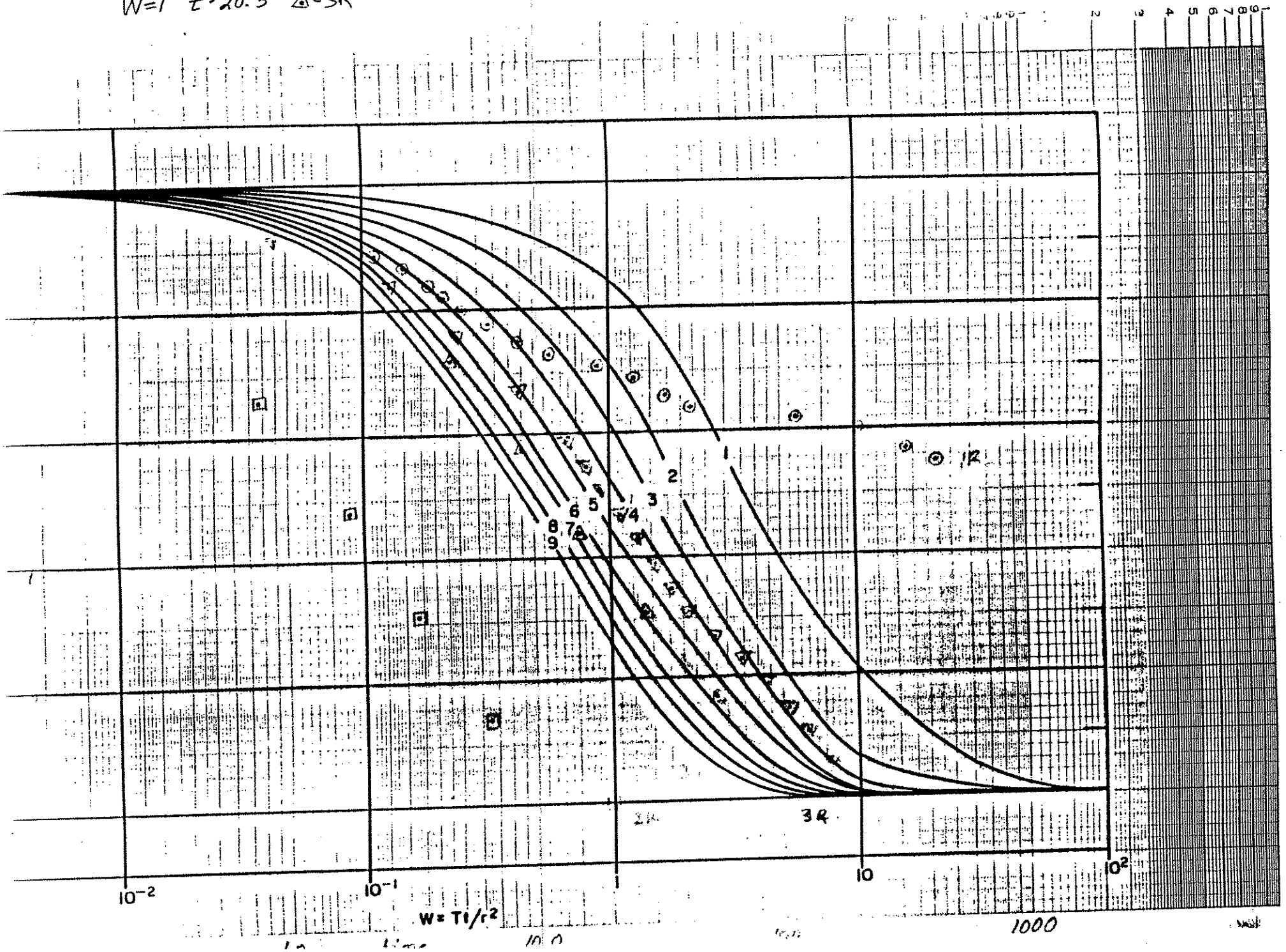
$T = 3.4 \times 10^{-4}$ ft²/min

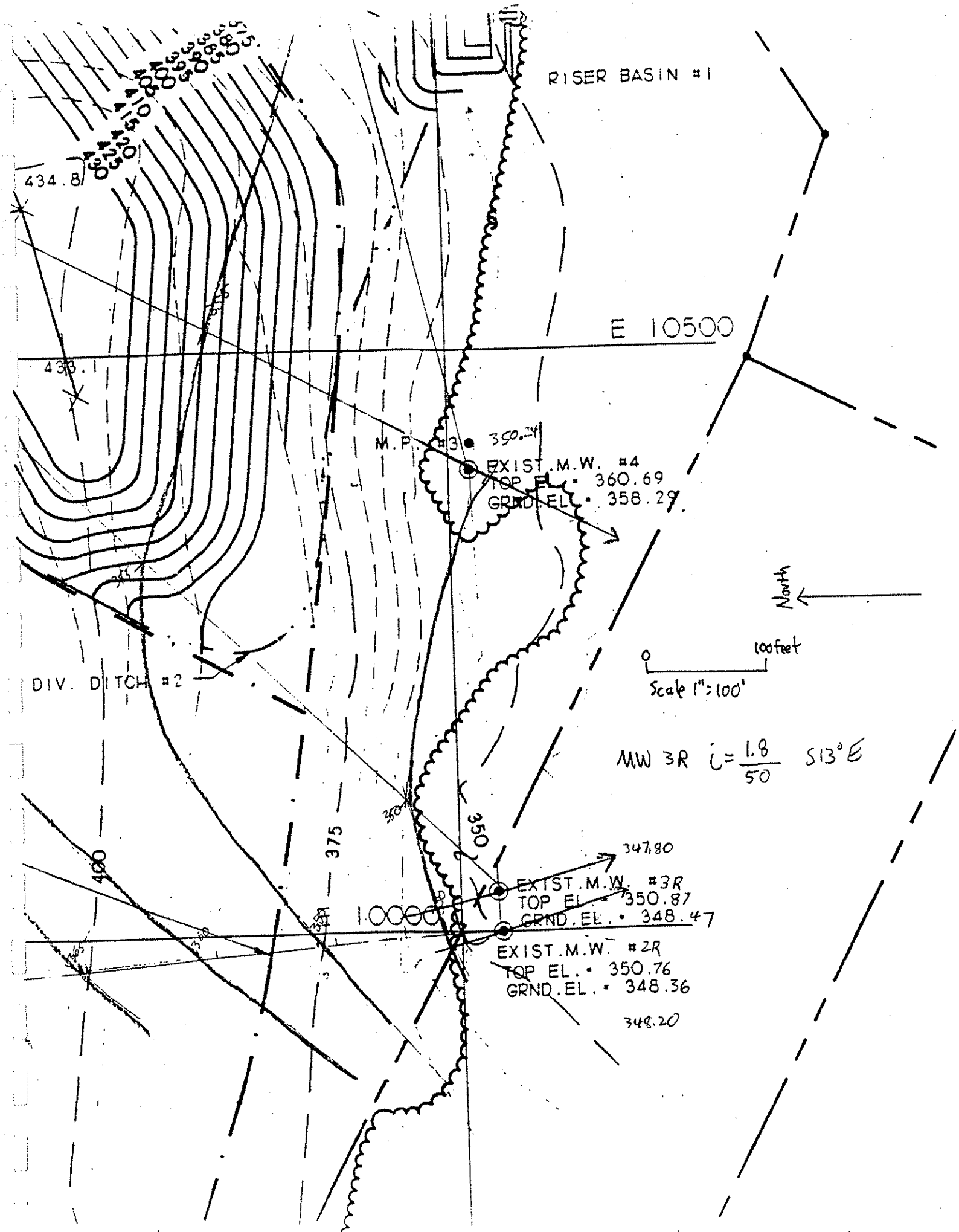
$K = 1.7 \times 10^{-5}$ cm/sec


W=1 t=3.5 ⊡= 2R
1
2
3
4
5
6
7
8
9
1/2
2R
10^{-1}
1
10
10^2
$W = Tt/r^2$
1.0
time
1000


RISER BASIN #1
434.8
E 10500
433.1
M.P. #3
350.24
EXIST. M.W. #4
TOP EL. = 360.69
GRND. EL. = 358.29
North
100 feet
Scale 1" = 100'
DIV. DITCH #2
MW 2R i = 2.2/42 S12° E
375
350
347.80
EXIST. M.W. #3R
TOP EL. = 350.87
GRND. EL. = 348.47
EXIST. M.W. #2R
TOP EL. = 350.76
GRND. EL. = 348.36
348.20

W=1 t=20.5 Δ=3R




RISER BASIN #1
E 10500
434.8
433.1
M.P. #3
350.34
EXIST. M.W. #4
TOP EL. = 360.69
GRND. EL. = 358.29
North
0
100 feet
Scale 1" = 100'
DIV. DITCH #2
MW 3R i = 1.8/50 S13°E
375
350
400
347.80
EXIST. M.W. #3R
TOP EL. = 350.87
GRND. EL. = 348.47
10000
EXIST. M.W. #2R
TOP EL. = 350.76
GRND. EL. = 348.36
348.20

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Job No. 94108.02

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4

$H_o = 10.2$

$r = 1''$

$b = 15'$

Screen 16.4

$H' = -6.5$

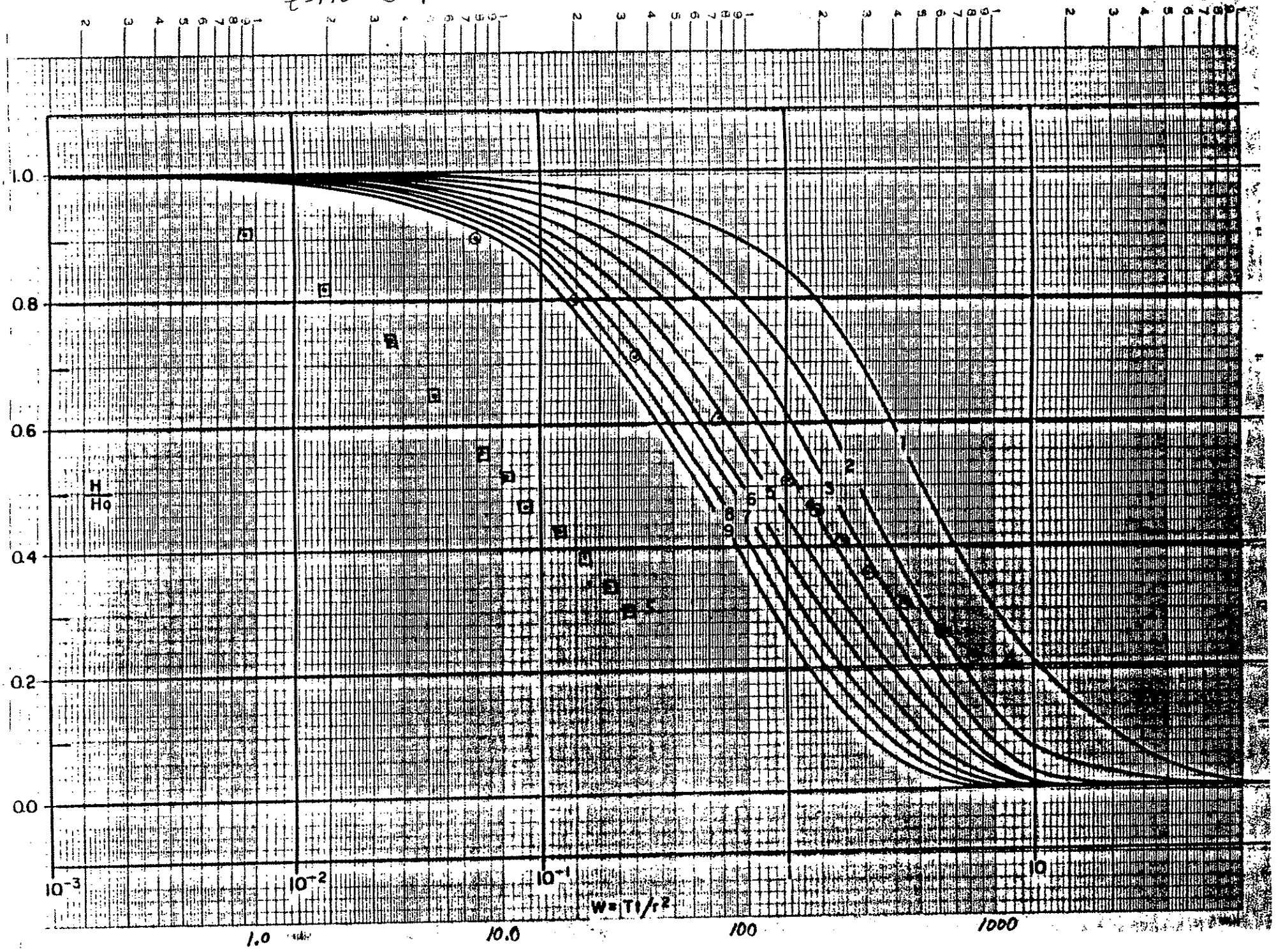
t (min)	H (ft)	H/H_o
7.9	9.2	0.90
19.7	8.2	0.80
34.2	7.2	0.71
77.3	6.2	0.61
148.6	5.2	0.51
191.1	4.7	0.46
240.6	4.2	0.41
305.3	3.7	0.36
437.9	3.2	0.31
614.6	2.7	0.26
835.0	2.2	0.22

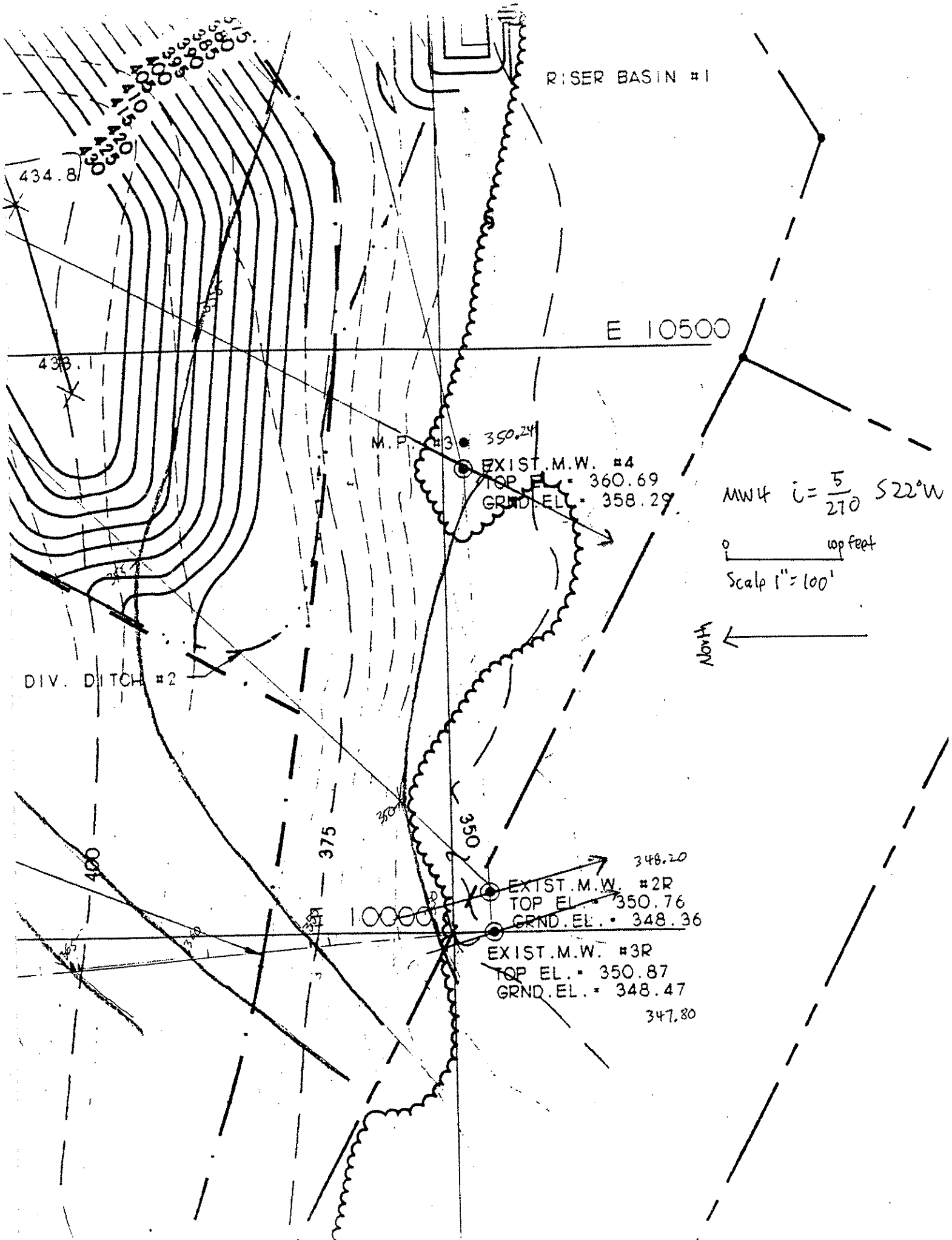
$W = 1$

$t = 145$

$T = 4.8 \times 10^{-5}$ ft^2/min

$K = 1.6 \times 10^{-6}$ cm/sec


W=1
t=145 ⊙=4
1.0
0.8
0.6
0.4
0.2
0.0
H/Ho
10⁻³
10⁻²
10⁻¹
10
W=Tt/r²
1.0
10.0
100
1000


RISER BASIN #1
434.8
E 10500
438.1
M.P. #3
350.24
EXIST.M.W. #4
TOP EL. = 360.69
GRND.EL. = 358.29
MW4 i = 5/270 S22°W
0
100 feet
Scale 1" = 100'
North
DIV. DITCH #2
375
350
400
348.20
EXIST.M.W. #2R
TOP EL. = 350.76
GRND.EL. = 348.36
N 10000
EXIST.M.W. #3R
TOP EL. = 350.87
GRND.EL. = 348.47
347.80

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Job No. 94108.02

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5

$H_0 = 11.4$

$r = 1''$

$b = 15'$

Screen 8.4

$H' = 3$

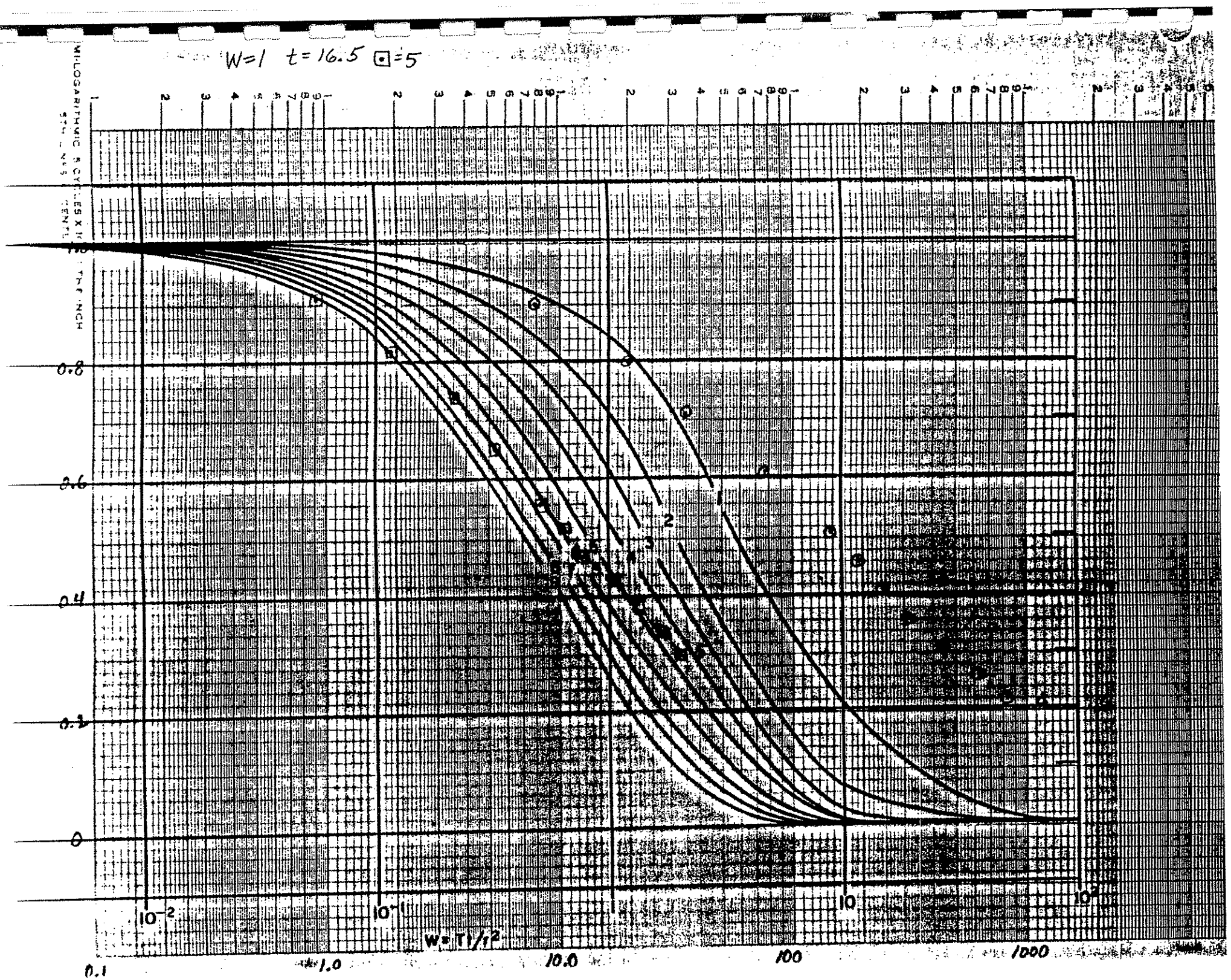
t (min)	H (ft)	H/H_0
0.9	10.4	0.91
1.9	9.4	0.82
3.5	8.4	0.74
5.3	7.4	0.65
8.3	6.4	0.56
10.3	5.9	0.52
12.7	5.4	0.47
17.1	4.9	0.43
21.9	4.4	0.39
27.1	3.9	0.34
32.5	3.4	0.30
39.0	2.9	0.25
45.8	2.4	0.21
52.8	1.9	0.17
62.5	1.4	0.12
74.8	0.9	0.08
125.4	0.4	0.04
183.9	0	0

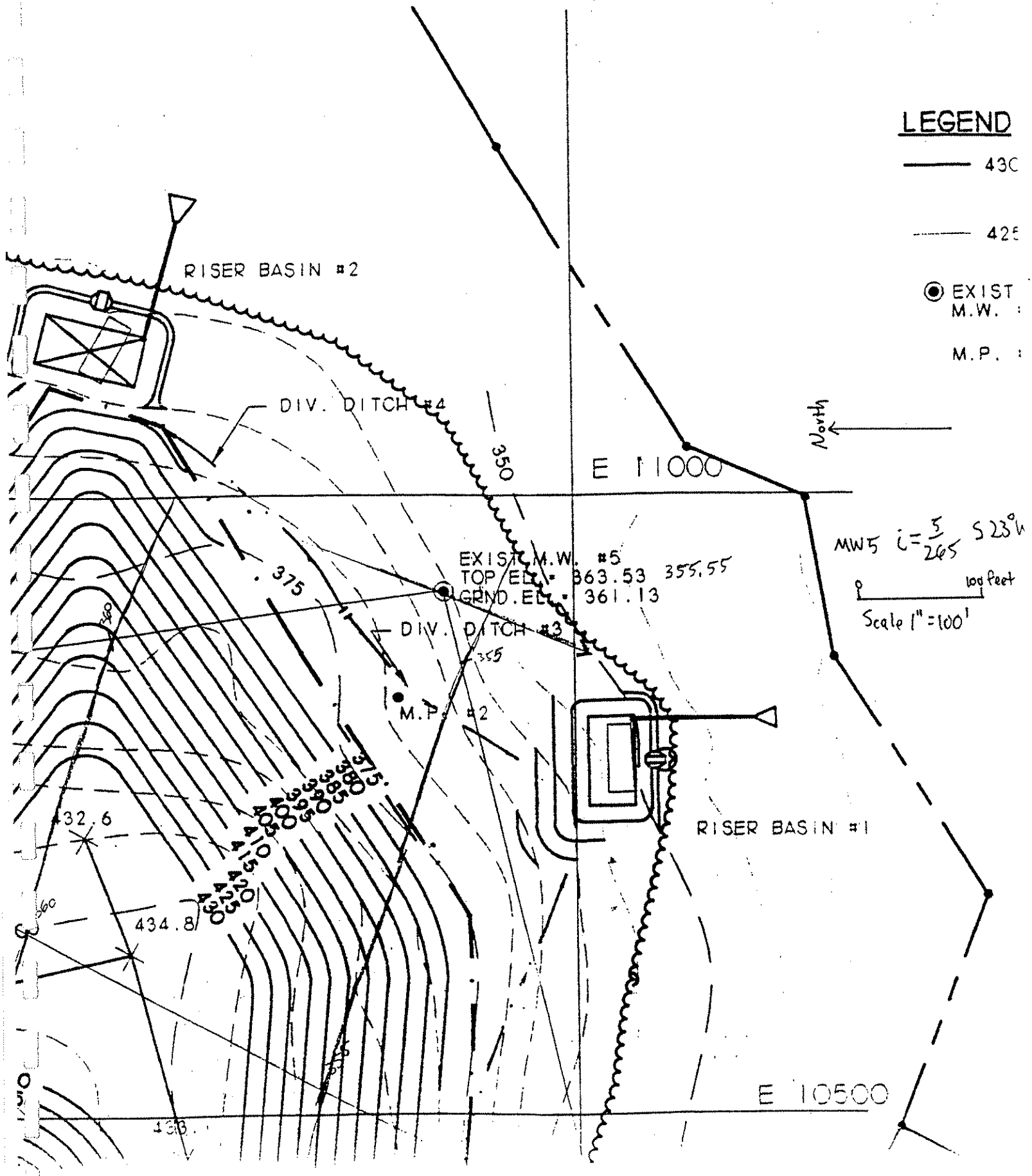
$W = 1$

$t = 16.5$

$T = 4.2 \times 10^{-4}$ ft^2/min

$K = 1.4 \times 10^{-5}$ cm/sec


W=1 t=16.5 ⊡=5
LOGARITHMIC 5 CYCLES X 10 CENTIMETERS
THE INCH
0.8
0.6
0.4
0.2
0
10^{-2}
10^{-1}
10
10^{2}
$W = T/t^2$
0.1
1.0
10.0
100
1000


LEGEND
430
425
EXIST
M.W.
M.P.
North
RISER BASIN #2
DIV. DITCH #4
350
E 11000
MW5 i = 5/265 S 23° W
EXIST. M.W. #5
TOP EL. = 363.53 355.55
GRND. EL. = 361.13
375
DIV. DITCH #3
355
M.P. #2
100 Feet
Scale 1" = 100'
375
380
385
390
395
400
405
410
415
420
425
430
432.6
434.8
RISER BASIN #1
E 10500

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Job No. 94108.02

Subject Slug Tests

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Calc. TJT Date 6-23-94

Chkd. Date

6

$H_o = 12.3$

$r = 1''$

$b = 15'$

Screen 16.7

$H' = -4.4$

t (min)	H (ft	H/H_o
0.9	11.3	0.92
2.6	10.3	0.84
4.9	9.3	0.76
8.7	8.3	0.67
13.6	7.3	0.59
16.3	6.8	0.55
18.9	6.3	0.51
22.2	5.8	0.47
26.5	5.3	0.43
31.0	4.8	0.39
36.6	4.3	0.35
41.6	3.8	0.31
52.6	3.3	0.27
68.9	2.8	0.23
86.8	2.3	0.19
105.8	1.8	0.15
128.1	1.3	0.11
152.6	0.8	0.06
178.8	0.3	0.02
194.1	0	0

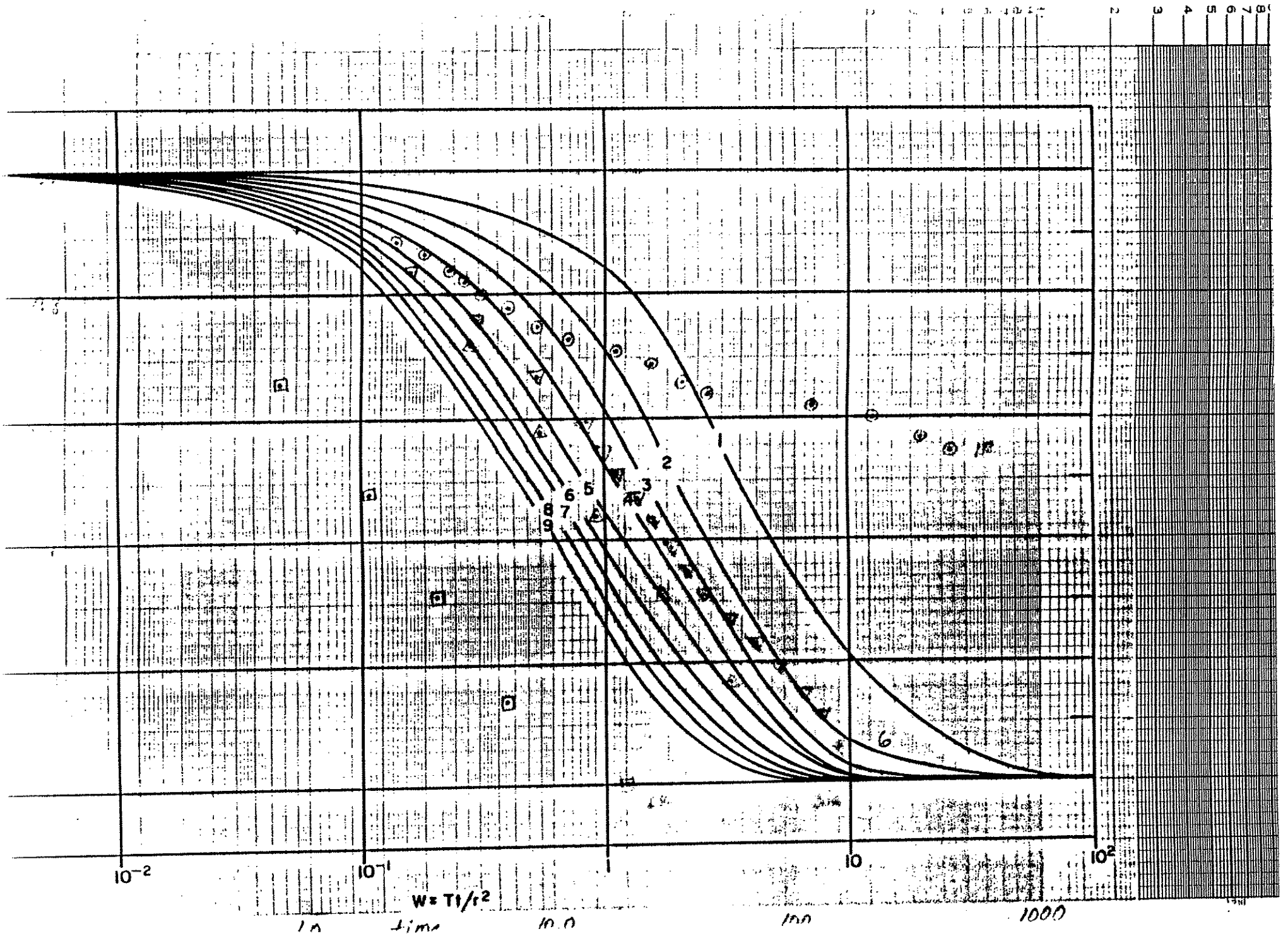
$W = 1$

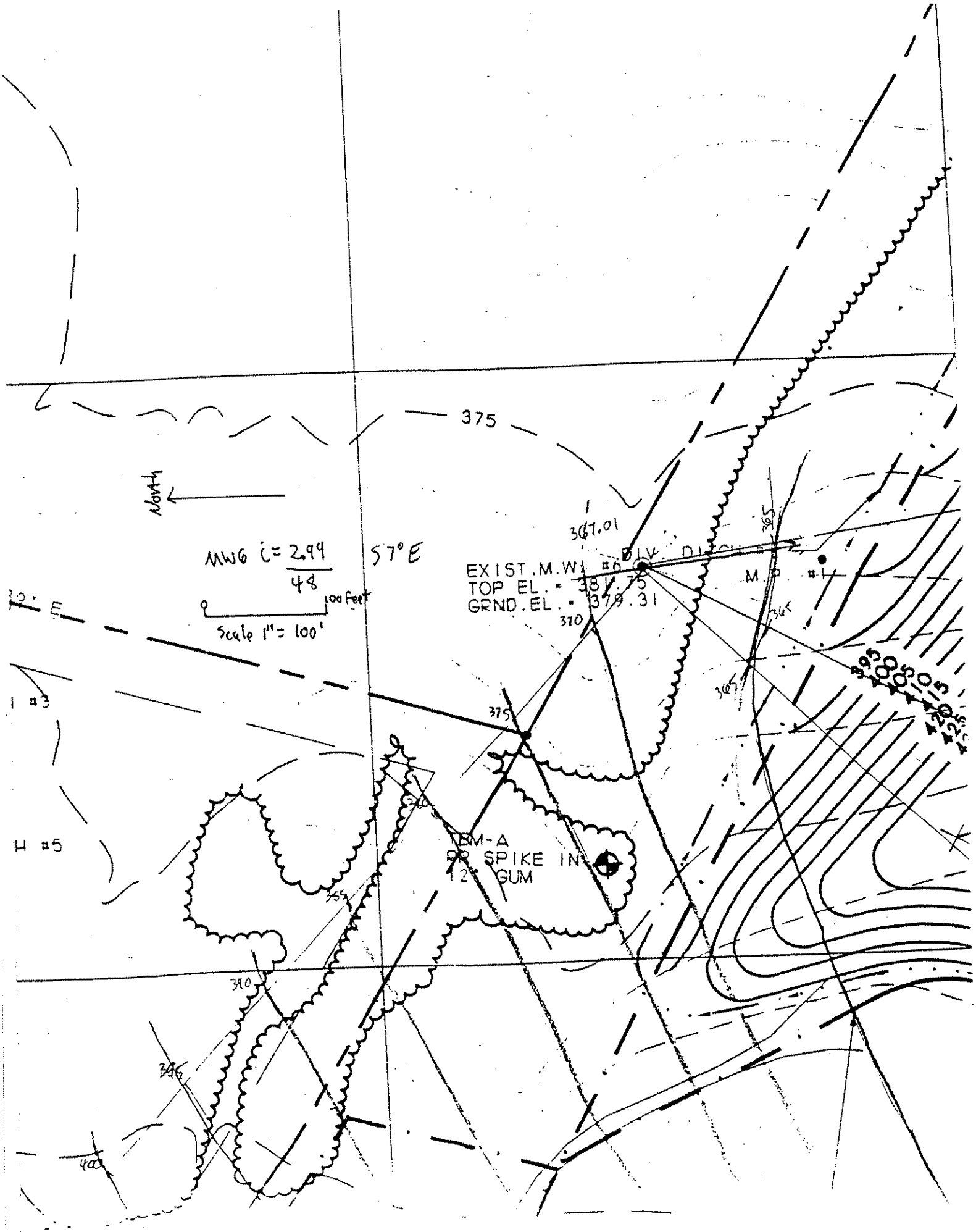
$t = 16.5$

$T = 4.2 \times 10^{-4}$ ft²/min

$K = 1.4 \times 10^{-5}$ cm/sec

W=1 t=16.5 ∇=6




375
North
MWG i = 2.99 / 48
57°E
100 feet
Scale 1" = 100'
367.01
EXIST. M.W. #6
TOP EL. = 381.75
GRND. EL. = 379.31
M.W. #1
370
365
375
395
400
405
410
415
420
425
TEM-A
PR SPIKE IN
12" GUM
390
400

Client _____ **GAI CONSULTANTS-NC, INC.** Final Page No. _____

Job No. 94108.02 Raleigh, NC Prel. Page No. _____

Calc. _____ Date _____

Subject _____ Chkd. _____ Date _____

Granville County-Butner

Well	Permeability (cm/sec)	Soil Type	G_s	γ_d	Total Porosity (%)	Effective Porosity (%)
1R	1.7×10^{-5}	Fractured Metavolcanics			30	1
2R	6.7×10^{-5}	SiCl w/ Rock Fragments	2.65	100	40	5
3R	1.7×10^{-5}	Fractured Metavolcanics			30	1
4	1.6×10^{-6}	Fractured Metavolcanics			20	1
5	1.4×10^{-5}	SiSa w/ Rock Fragments	2.67	110	34	1
6	1.4×10^{-5}	Fractured Metavolcanics			30	1

Total porosity $n = 1 - \frac{\gamma_d}{G_s(62.4)}$ γ_d = dry density, 62.4 = Unit weight of water, G_s = specific gravity

Effective Porosity values taken from typical values for soils and rocks published by Barari and Hedges (1985).

Total Porosity values for 1R, 3R, 4, and 6 estimated from field observations, RQD, and experience with similar material.

G_s and γ_d values estimated from field observations, blow counts, and experience with similar material.

TABLE 3-1. DEFAULT VALUES FOR EFFECTIVE POROSITY (Ne) FOR USE IN TIME OF TRAVEL (TOT) ANALYSES

Soil textural classes	Effective porosity of saturation[a]
Unified soil classification system	
GS, GP, GM, GC, SW, SP, SM, SC	0.20 (20%)
ML, MH	0.15 (15%)
CL, OL, CH, OH, PT	0.01 (1%)[b]
USDA soil textural classes	
Clays, silty clays, sandy clays	0.01 (1%)[b]
Silts, silt loams, silty clay loams	0.10 (10%)
All others	0.20 (20%)
Rock units (all)	
Porous media (nonfractured rocks such as sandstone and some carbonates)	0.15 (15%)
Fractured rocks (most carbonates, shales, granites, etc.)	0.0001 (0.01%)

Source: Barari, A., and L. S. Hedges. 1985. Movement of Water in Glacial Till. *Proceedings of the 17th International Congress of the International Association of Hydrogeologists*, pp. 129-134.

a These values are estimates and there may be differences between similar units. For example, recent studies indicate that weathered and unweathered glacial till may have markedly different effective porosities (Barari and Hedges, 1985; Bradbury et al., 1985).

b Assumes *de minimus* secondary porosity. If fractures or soil structure are present, effective porosity should be 0.001 (0.1%).

OPERATION/CONSTRUCTION MANAGERS

Municipal Services

P.O. Box 97, Garner, North Carolina 27529 (919)772-5393

CIVIL/SANITARY ENGINEERS

Engineering Company, P.A.

P.O. Box 349, Boone, North Carolina 28607 (704)262-1767

November 5, 1997

NOV 1997
Received
Solid Waste
Section

Larry Rose
Solid Waste Section
Division of Solid Waste Management
State of North Carolina Department of Environment,
Health, and Natural Resources
401 Oberlin Road
Raleigh, NC 27611

Reference: Granville County
Butner Sanitary Landfill
Project Number: G97042.0

Dear Mr. Rose:

Please find the enclosed potentiometric map for the Granville County Sanitary Landfill in Butner, North Carolina. The map was generated using data from the June 17, 1997 sampling event. Table 1 provides hydrologic properties for each monitoring well.

If you need additional information please contact us.

Sincerely,

Richard R Allison
Geologist

Enclosures

Granville County-Butner Sanitary Landfill

Table 1

HYDROLOGIC PORPERTIES AT MONITORING WELL LOCATIONS

Monitoring Well	Permeability (cm/sec)	Effective Porosity (%)	Change in Head/ Change in distance	Groundwater Flow Rate (ft/year)	Groundwater Flow Direction
1R	1.70E-05	1.0%	0.059	103.8	S19E
2R	6.70E-05	5.0%	0.061	84.6	S03E
3R	1.70E-05	1.0%	0.061	107.3	S03E
4	1.60E-05	1.0%	0.037	61.3	S01W
5	1.40E-05	1.0%	0.035	50.7	S25E
6	1.40E-05	1.0%	0.062	89.8	S78E

Note: Data for effective porosity and permeability obtained from GAI Consultants' Water Sampling Report (April, 1995).
Other data obtained from the June 17, 1997 sampling event.

NOV 1997
Received
Solid Waste
Section

TABLE 1
HYDROLOGIC PROPERTIES AT MONITORING WELL LOCATIONS

Monitoring Well	Permeability (cm/sec)	Total Porosity (%)	Effective Porosity (%)	Groundwater Flow Rate (ft/yr)	Groundwater Flow Direction
1R	1.70E-05	30	1	106	S 26° E
2	*	*	*	*	S 0° E
2R	6.70E-06	40	5	4	S 0° E
3R	1.70E-05	30	1	70	S 4° E
4	1.60E-06	20	1	7	S 7° W
5	1.40E-05	34	1	43	S 22° E
6	1.40E-05	40	1	72	S 47° E

Note: * These hydraulic properties could not be determined due to insufficient information.

APPENDIX C

Water Quality Monitoring Plan from 1994 Transition Plan

(Woodward-Clyde Consultants, 1994)

WATER

QUALITY

MONITORING

PLAN

GAI CONSULTANTS

REVISED REPORT
GROUND AND SURFACE WATER MONITORING SYSTEM
GRANVILLE COUNTY LANDFILL
BUTNER, NORTH CAROLINA

FOR

MUNICIPAL ENGINEERING SERVICES COMPANY, PA
GARNER, NORTH CAROLINA

PROJECT NO. 93165.12

MARCH 1994

GAI CONSULTANTS

GAI Consultants-NC, Inc.

4000 Blue Ridge Road
Suite 500
Raleigh, NC 27612
919/783-4783
FAX 919/783-0241

March 30, 1994

Mr. Wayne Sullivan
Municipal Engineering Services Company, P.A.
Post Office Box 97
Garner, North Carolina 27529

Re: **REVISED REPORT**
Ground and Surface Water Monitoring System
Granville County Landfill (Permit No. 39-02)
Butner, North Carolina
Project No. 93165.12

Dear Mr Sullivan:

INTRODUCTION

The groundwater monitoring system for the Granville County municipal landfill located adjacent to North Carolina Route 1004 near Butner, North Carolina is being evaluated as a part of the transition from previous North Carolina regulations to current North Carolina regulations (Subtitle D). This letter presents data and information pertaining to the existing groundwater and surface water monitoring system, discusses the geology of the area, and makes recommendations for improving the groundwater monitoring system. This report is a revision of GAI's report on the Ground and Surface Water Monitoring System dated December 16, 1993. This revision considers the comments made by the Solid Waste Section of the North Carolina Division of Solid Waste Management in a memorandum dated March 2, 1994 from Mr. Bobby Lutfy to Mr. Bill Sessoms.

GEOLOGY

The landfill is located in the Piedmont physiographic province consisting of rolling hills supporting either farmland or forests. The streams draining the area generally flow to the south into the Neuse River. The landfill is located on the northwest side of the drainage area of an unnamed tributary to Picture Creek.

The majority of the landfill area is underlain by Carolina Slate Belt metamorphosed felsic volcanic rocks. In the southeast part of the site, the area is underlain by Triassic rocks of the Sanford Formation which uncomformably overlie felsic volcanic rocks. The metamorphosed felsic volcanics consist of greenish gray foliated tuffs containing feldspar, quartz, sericite, chlorite, and epidote. These rocks weather along their foliation to a red brown clay. At a rock outcrop at the landfill, the strike of the foliation was North 30°

East and dipped to the southeast at 77°. No exposure of the Triassic rocks was located. However, float material, up to cobbles and boulders in size, was observed on the ground surface in a soil matrix of sandy clay/clayey sand. The rock fragments consist of gray, coarse-grained sandstone with quartz pebbles and reddish sandy shale. The regional dip of the Triassic rocks is to the southeast at 10° to 15°. The location of the unconformable contact between the Triassic rocks and felsic volcanic rocks is considered to be in the general area shown on the attached Plate 1. The dip angle of this unconformity is unknown, but it is anticipated to be greater than the dip angle of the Triassic rocks.

No Holocene or older faults are located in the area of the site based on a literature search. The landfill is in a seismic impact zone.

SITE REVIEW

The three existing monitoring wells and one piezometer were reviewed on December 7, 1993. No geotechnical studies, well construction records, or boring logs have been located in the files of Granville County, Municipal Engineering Services Company, and the Solid Waste Section. Based on the site inspection, all wells and the piezometer lack tags and locks. The surface protection casing and the PVC stand pipe of Background Monitoring Well 1 are both broken. The piezometer does not have a protective casing, only a PVC casing projects from the ground. Monitoring Well 2 appeared to be in a functional condition, although it is unknown how the well was constructed and what materials were used. Monitoring Well 3 could only be measured to a depth of 4.8 feet; either the well is blocked or installed to a very shallow depth.

A water supply well is located at the landfill that is not used as a drinking water source. Information and data on the design and construction of the well are unknown. No other private or community water supply wells were located downstream within 2,000 feet of the landfill.

Evidence of two small leachate seeps were observed on the south side of the landfill near its base. The more southwestern seep had been recently repaired and the repaired ground surface seeded. The other seep has reportedly been covered and repaired since the site visit.

The estimated elevation of the ground surface at the well locations, as well as the groundwater elevation and total depth of the wells, is presented on Table 1. Elevations of the wells and groundwater were estimated using the topography on Plate 1.

REPLACEMENT MONITORING WELL SYSTEM

Based on the groundwater levels presented in Table 1, the groundwater is significantly higher on the west side of the site in the area where the fire tower is located as shown on Plate 1. Based on the groundwater elevations in Table 1 and the corresponding locations of the wells on Plate 1, the relative surface elevations of the groundwater at the wells and piezometer, and the location of the potential discharge feature, the flow of groundwater appears to be generally to the southeast. However, the sharply dipping felsic volcanic rocks and associated permeable foliated zones could cause discontinuities in the groundwater flow pattern across the site. In addition, the contact between the Triassic rocks and the felsic volcanic rocks could be a zone of preferential flow. The Triassic rocks tend to be impermeable because of the abundance of shale interbeds. Consequently, monitoring wells should be nested at two of the planned monitoring well locations. Depending on groundwater control by the contact between the two rock formations, Monitoring Well 7 may also function as a background well for water in the Triassic rocks.

Groundwater Monitoring Well 1R is proposed to replace Well 1 which is damaged and probably was installed too deep. Proposed Wells 2R and 3R will be nested. Well 2R will be a shallow well installed to replace Well 2 which appears to be functioning correctly, but its method of installation is unknown. However, Well 2 will be used as a part of the detection monitoring system until it is determined that Well 2 can be abandoned. Well 3R will be a deeper nested well that is proposed to monitor the possible preferential flow at the unconformable contact between the Triassic and volcanic rocks. Wells 4 and 5 will also be nested with Well 4 being installed in the Triassic regolith and Well 5 is intended to be installed at the contact between the Triassic and volcanic rocks. Well 6 is proposed as a replacement for Well 3 which is not functional and will be abandoned. This well will be installed in the Triassic regolith. Depending on groundwater control by the contact between the two geologic formations, Well 7 may function as an upgradient well in the Triassic regolith. Wells 2, 2R, 3R, 4, 5, 6, and 7 are intended to detect any plume of contamination that might develop from the landfill. Well 1R is intended to be the upgradient well for the landfill.

The proposed seven groundwater monitoring wells and locations are presented on Plate 1. Table 2 presents recommended installation data and information for the monitoring wells. Recommended elevations and depths are based on data and information obtained during the site visit, study of the geology, anticipated groundwater flow patterns, groundwater levels in the monitoring wells and piezometer, and the topography shown on Plate 1.

Monitoring wells will be located as shown on Plate 1 in areas free of garbage, refuse, or debris and in areas that appear to be outside of flooding. Nested Wells 2R and 3R are planned to be installed in the low part of the drainage swale as directed by the Division of Solid Waste Management and surface water will be diverted as much as reasonably possible.

A geologist will continuously monitor the installation of the nested wells to determine when the deeper piezometers need to be installed to determine if more conductive zones exist. If the contact is too deep, a decision will be made in the field and discussed with the Solid Waste Section where the deeper wells of the two nests should be installed.

The measured dip, strike, and foliation at a rock outcrop were used to locate where the nested wells should be. The estimated contact between the felsic volcanic and Triassic rocks along with site topography was also used in determining recommended monitoring well locations.

Surface water is drained from the landfill area via an unnamed tributary to Picture Creek. Surface water sampling should be done upstream (SW-1) and downstream (SW-2) of the landfill in the unnamed tributary in the general area of the surface water sampling locations shown on Plate 2. Permanent markers should be placed on the adjacent stream bank so that sampling can be performed at the same location each time.

The wells should be installed in accordance with North Carolina regulations. Well construction should be in accordance with attached Plate 3 which shows a typical monitoring well schematic as recommended by the state of North Carolina. Each well is proposed to have no more than one foot of sand pack below the bottom of the screen as suggested by the construction guidelines. Groundwater monitoring wells should be constructed considering actual static groundwater levels, soil and rock types, and conditions encountered during well installation. All wells must be tagged, numbered, provided with vented caps, locked, and their locations surveyed.

As used herein, the definition of certify is "to state or declare a professional opinion of conditions whose true properties cannot be known at the time certification is made, despite appropriate professional evaluation." A professional's certification of conditions in no way relieves any other party from meeting requirements imposed by contract, rules, regulations, or other means, including commonly accepted industry practices.

Bearing the above in mind and based on the following:

- no well construction records,
- no geotechnical studies,
- maps provided,
- the limited amount of groundwater data,
- visual field inspection of the wells and their locations,
- accuracy of well and landfill locations, and
- information provided by the operator of the landfill,

it is GAI's professional opinion that the ground and surface monitoring plan, as described above, will be effective in early detection of any release of hazardous constituents to the uppermost aquifer, so as to be protective of public health and the environment.

Respectfully submitted,
GAI Consultants - NC, Inc.

Edward S. Custer Jr

Edward S. Custer, Jr., Ph.D., P.G.
Staff Geologist

NORTH CAROLINA LICENSED SEAL 730 GEOLOGIST EDWARD S. CUSTER, JR.

Wendell W. Parker

Wendell W. Parker, Ph.D., P.E.
Vice President

NORTH CAROLINA PROFESSIONAL SEAL 15945 ENGINEER WENDELL W. PARKER

WWP/kla

cc: Mr. Bobby Lutfy, Division of Solid Waste

TABLES

TABLE 1

EXISTING WELL DATA

Monitoring Well	Ground Surface Elevation (ft)	Groundwater Elevation (ft)	Depth of Well (ft)
1	477.0	427.50	62.25
2	351.0	350.45	10.25
3	356.0	Dry	4.83
Piezometer	396.0	382.75	13.45

Notes:

1. Ground surface elevations at the wells were estimated from Plate 1.
2. Groundwater elevations were based on depth to water and estimated ground surface elevations.
3. Depth of well is referenced to ground surface.
4. Monitoring Well 1 has broken protector and PVC casings.
5. Monitoring Well 2 shows no apparent damage.
6. Monitoring Well 3 is blocked or installed to a very shallow depth.
7. The piezometer has no protective casing.

TABLE 2

MONITORING WELL INSTALLATIONS

Monitoring Well	Ground Surface Elevation (ft)	Groundwater Elevation (ft)	Screen Elevation (ft) Top	Screen Elevation (ft) Bottom	Hole Depth (ft)
1R	477.0	427.5	431.5	416.5	61.5
2R	347.0	346.0	347.0	332.0	16.0
3R	347.0	346.0	328.0	318.0	30.0
4	358.0	355.0	355.0	340.0	19.0
5	358.0	308.0	308.0	298.0	61.0
6	361.0	356.0	356.0	341.0	21.0
7	384.0	374.0	374.0	359.0	26.0

Notes:

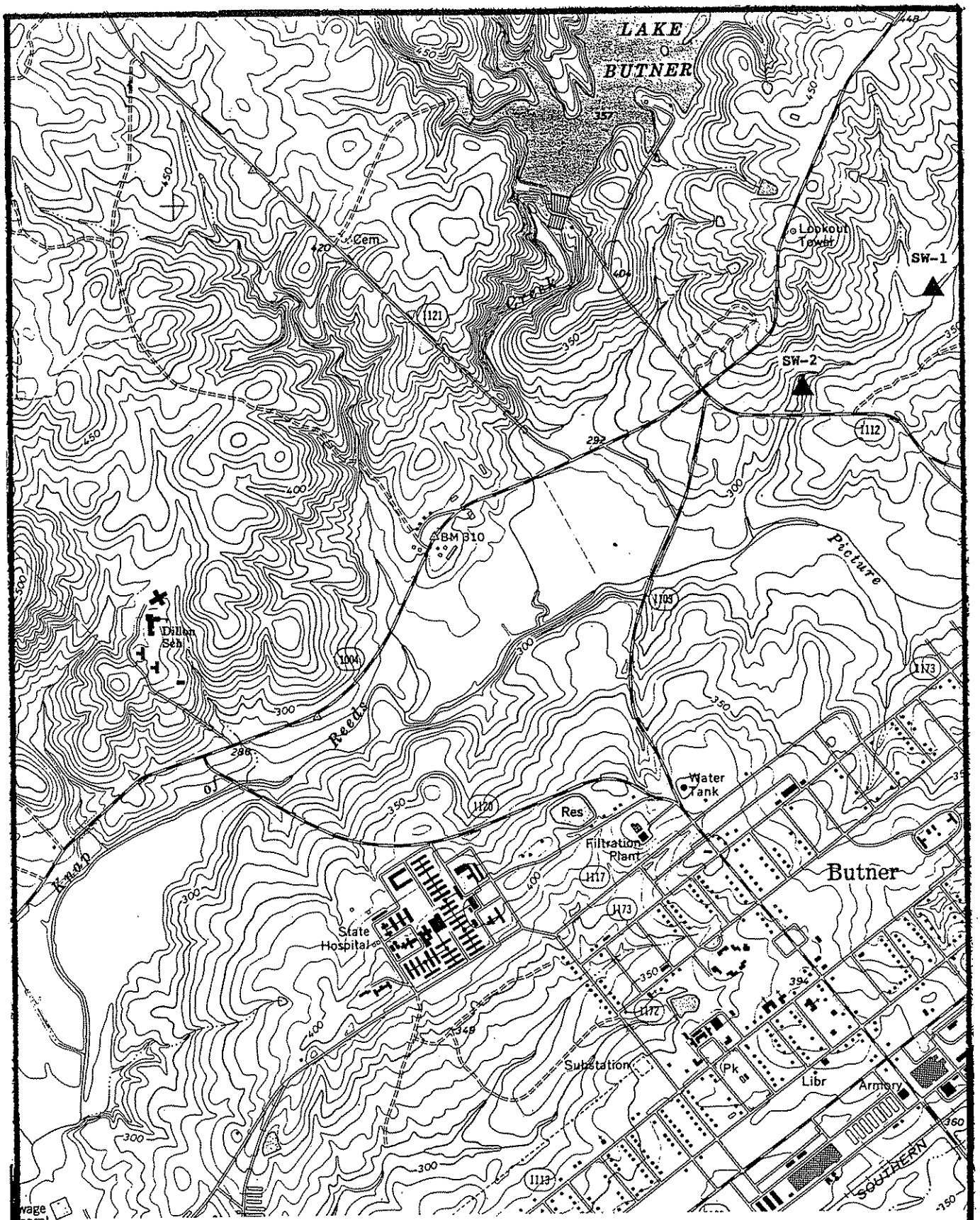
1. All elevations are estimated from the topography on Plate 1 and water levels in existing wells; monitoring wells will be installed in accordance with actual groundwater elevations and subsurface conditions encountered.

2. Monitoring Well 2R will be nested with Monitoring Well 3R; Monitoring Well 4 will be nested with Monitoring Well 5.

3. Wells will be mounded with soil if necessary to install a one foot bentonite seal and four feet of grout above the top of the screen. The total depth includes one foot of sand pack below the bottom of the screen.

PLATES

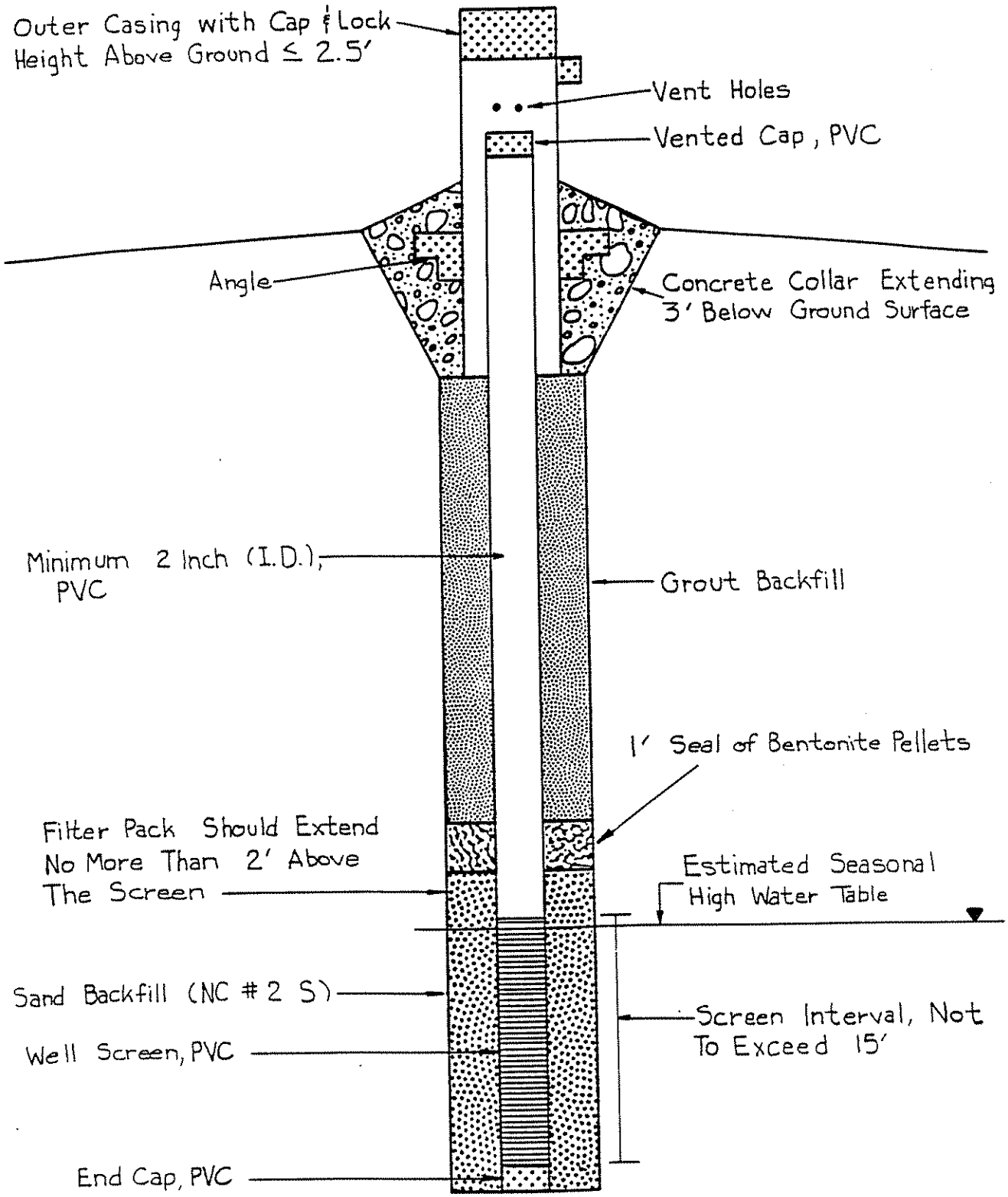
93165.12



▲ Sampling Locations

Proposed Surface Water Sampling Locations

Plate 2



TYPICAL MONITORING WELL
PLATE 3

GAI CONSULTANTS

GAI Consultants – NC, Inc.

3812-H Tarheel Drive
Raleigh, NC 27609
919/878-4478
FAX 919/878-4032

April 28, 1995

Mr. Wayne Sullivan
Municipal Engineering Services Company
Post Office Box 97
Garner, North Carolina 27529

Re: Responses to Review Comments
Granville County - Butner Landfill Transition Plan
Butner, North Carolina
Project No. 94108.02

Dear Mr. Sullivan:

Three addenda to three reports prepared by GAI pertaining to the Transition Plan for the Granville County - Butner Landfill, Permit # 39-02, are enclosed in response to review comments by Mr. Bobby Lutfy of the Solid Waste Section of the North Carolina Department of Environment, Health, and Natural Resources in a letter dated March 8, 1995 concerning Hydrogeologic Reviews of the three reports. In addition, a revised Sampling and Analysis Plan for sampling and testing surface and groundwater has been submitted in response to comments by Mr. Lutfy. Addenda have been punched for inclusion in corresponding reports as considered appropriate.

The three addenda and revised report are applicable to the Ground and Surface Water Monitoring System report, GAI Report No. 93165.02 dated March 30, 1994; Ground and Surface Water Monitoring System letter, GAI Project No. 94108.02 dated June 23, 1994; Ground and Surface Water Sampling and Analysis Plan, dated February 10, 1994; and the Water Sampling and Testing Report, GAI Report No. 94108.02 dated October 5, 1994.

Sincerely,
GAI Consultants-NC, Inc.

Thomas J. Rossbach

Thomas J. Rossbach, Ph.D., P.G.
Staff Geologist

Wendell W. Parker

Wendell W. Parker, Ph.D., P.E.
Vice President

WWP/TJT/tjt

APR 1995
Received
Solid Waste
Section

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ADDENDUM A

GAI CONSULTANTS

GAI Consultants – NC, Inc.

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April 28, 1995

Mr. Wayne Sullivan
Municipal Engineering Services Company
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Sincerely,
GAI Consultants-NC, Inc.

Thomas J. Rossbach, Ph.D., P.G.
Staff Geologist

Wendell W. Parker, Ph.D., P.E.
Vice President

WWP/TJT/tjt

APR 1995
Received
Solid Waste
Section

GAI CONSULTANTS

ADDENDUM A

ADDENDUM A
GROUND AND SURFACE WATER MONITORING SYSTEM
GRANVILLE COUNTY LANDFILL
BUTNER, NORTH CAROLINA
MARCH 30, 1994

The following responses are made to review comments by Mr. Bobby Lutfy in a letter dated March 8, 1995.

Lutfy Comment: The monitoring well elevations are "estimated". The monitoring wells must be surveyed for horizontal and vertical control.

Response: Horizontal and vertical locations of the monitoring wells have been surveyed as shown on Plate 1 in this addendum.

Lutfy Comment: Table 2, Proposed Monitoring Well Installations:
Note 3 states "Wells will be mounded with soil if necessary to install a one foot bentonite seal and four feet of grout above the top of the screen". While normally the Solid Waste Section prefers that shallow monitoring wells be screened so that the water table falls within the screen, this may not be appropriate for wells with very shallow water tables. It is more important to construct the well so that a proper seal can be established to avoid surface water infiltration. Therefore the top of the well screen should never be set shallower than about five feet, in order to allow adequate room for a proper bentonite seal and grout. Mounding of soil as described should not be necessary if the wells are constructed in the manner described above. Proper grading and rip-rap may be used to divert surface water around a monitoring well.

Note 3 also states that "The total depth includes one foot of sand pack below the bottom of the screen". The guidelines the Solid Waste Section has made regarding having "the sand pack extend no more than one foot below the screen" should not be interpreted to mean the Section prefers wells constructed with one foot of sand below the screen. This guideline was issued to make it clear that sand packs should not extend deeper than the well screen, which in effect extends the screened interval. Generally it is preferred that the well screen be set as close to the bottom of the borehole as possible. This is especially important if the well screen is set on top of a confining unit or bedrock.

Response: The monitoring wells were not constructed in accordance with the note that stated "Mounding of soil around the wells will be done to achieve one foot of bentonite and four feet of grout above the sand around the screens." It is understood that sand below and above the screen will in effect extend the screened interval. The sand packs actually installed are in general conformance with the approved plan with the exception of Monitoring Wells 3R, 4, and 6 which have approximately 4 feet of sand above the top of the screen. The additional sand is considered to have little significance in performance of the monitoring wells. The screens are in weathered metavolcanic rocks, and a slight extension of the screened interval is considered to have little, if any, impact on performance of the monitoring wells

PLATE

GAI CONSULTANTS

GAI Consultants - NC, Inc.

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FAX 919/878-4032

April 28, 1995

Mr. Wayne Sullivan
Municipal Engineering Services Company
Post Office Box 97
Garner, North Carolina 27529

Re: Responses to Review Comments
Granville County - Butner Landfill Transition Plan
Butner, North Carolina
Project No. 94108.02

Dear Mr. Sullivan:

Three addenda to three reports prepared by GAI pertaining to the Transition Plan for the Granville County - Butner Landfill, Permit # 39-02, are enclosed in response to review comments by Mr. Bobby Lutfy of the Solid Waste Section of the North Carolina Department of Environment, Health, and Natural Resources in a letter dated March 8, 1995 concerning Hydrogeologic Reviews of the three reports. In addition, a revised Sampling and Analysis Plan for sampling and testing surface and groundwater has been submitted in response to comments by Mr. Lutfy. Addenda have been punched for inclusion in corresponding reports as considered appropriate.

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Sincerely,
GAI Consultants-NC, Inc.

Thomas J. Rossbach

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Wendell W. Parker

Wendell W. Parker, Ph.D., P.E.
Vice President

WWP/TJT/tjt

APR 1995
Received
Solid Waste
Section

GAI CONSULTANTS

ADDENDUM A

ADDENDUM A
GROUND AND SURFACE WATER MONITORING SYSTEM
GRANVILLE COUNTY - BUTNER LANDFILL
JUNE 23, 1994

The following responses are made to review comments by Mr. Bobby Lutfy in a letter dated March 8, 1995.

Lutfy Comment: Table 1, Permeability and Porosity: Documentation and calculations should be provided for the permeability values and the porosity values. Effective porosity values should be provided, with support documentation.

Response: GAI recently met with the Solid Waste Section to discuss, in general, soil and rock porosity. The discussion included total or primary porosity, secondary porosity, effective porosity, volumetric porosity, and areal porosity. Porosity data in Table 1 of this addendum considers the results of the discussion. Documentation and calculations for permeability, porosity, and groundwater flow rate and direction are provided in Appendix A.

Lutfy Comment: The Well Construction Record for well MW-1R indicates there is only about four feet of water in the well at a time of the year that normally would approximate a seasonal high water table elevation. It appears that this well may not be capable of providing a representative sample of water quality, especially during seasonal low water table conditions.

Response: During a sampling event on September 8, 1994 of Monitoring Well 1R installed April 21, 1994, the well was found to contain no water. A new Monitoring Well 1R was installed on September 12, 1994 and the previously installed Monitoring Well 1R abandoned. The well construction record submitted for Monitoring Well 1R in June 1994 has been superseded by the well construction record submitted for Monitoring Well 1R in October 1994.

TABLE

Refer to Revised Table 1.

TABLE 1
HYDROLOGIC PROPERTIES AT MONITORING WELL LOCATIONS

Monitoring Well	Permeability (cm/sec)	Total Porosity (%)	Effective Porosity (%)	Groundwater Flow Rate and Direction (ft/yr)
1R	1.7×10^{-5}	30	1	96 S 30°E
2R	6.7×10^{-5}	40	5	73 S 12°E
3R	1.7×10^{-5}	30	1	63 S 13°E
4	1.6×10^{-6}	20	1	3 S 22°W
5	1.4×10^{-5}	34	1	27 S 23°W
6	1.4×10^{-5}	30	1	90 S 7°E

Note: Where monitoring wells are in soil and rock, groundwater flow through soil is considered to control. Effective porosity is considered to control groundwater flow and is estimated for the rock based on visual observations during well installation.

APPENDIX A

CALCULATIONS

Client MESCO

Job No. 94108.02

Subject Granville-Butner

GAI CONSULTANTS-NC, INC.

Raleigh, NC

Final Page No.

Prel. Page No.

Calc. TJR Date 04/10/95

Chkd. CLM Date 4-10-95

MW	Ground	3/7/95 GW depth	GW Elev
1R	480.00	47.7	432.30
2R	348.36	0.16	348.20
3R	348.47	0.67	347.80
4	358.29	8.05	350.24
5	361.13	5.58	355.55
6	379.31	12.3	367.01

432.30
− 347.80
84.50

10 9
5 17

CI
10 5

MW6 - MW5 367.01 - 355.55 = 11.46 L = 672 $\frac{10(672)}{11.46}$ = 586.39 293.19

MW5 - MW4 355.55 - 350.24 = 5.31 L = 540 $\frac{10(540)}{5.31}$ = 1016.95 508.47

MW6 - MW4 367.01 - 350.24 = 16.77 L = 898 $\frac{10(898)}{16.77}$ = 535.48 267.74

MW1R - MW6 432.30 - 367.01 = 65.29 L = 1337 $\frac{10(1337)}{65.29}$ = 204.78 102.39

MW1R - MW3R 432.30 - 347.80 = 84.5 L = 1730 $\frac{10(1730)}{84.5}$ = 204.73 102.37

MW6 - MW2R 367.01 - 348.20 = 18.81 L = 1128 $\frac{10(1128)}{18.81}$ = 599.68 299.84

MW	K	i	ne	$\bar{V}$	Dir
1R	1.7×10^{-5}	$\frac{2.3}{42}$	1	96	S 30° E
2R	6.7×10^{-5}	$\frac{2.2}{42}$	5	73	S 12° E
3R	1.7×10^{-5}	$\frac{1.8}{50}$	1	63	S 13° E
4	1.6×10^{-6}	$\frac{5}{270}$	1	3	S 22° W
5	1.4×10^{-5}	$\frac{5}{265}$	1	27	S 23° W
6	1.4×10^{-5}	$\frac{2.99}{48}$	1	90	S 7° E

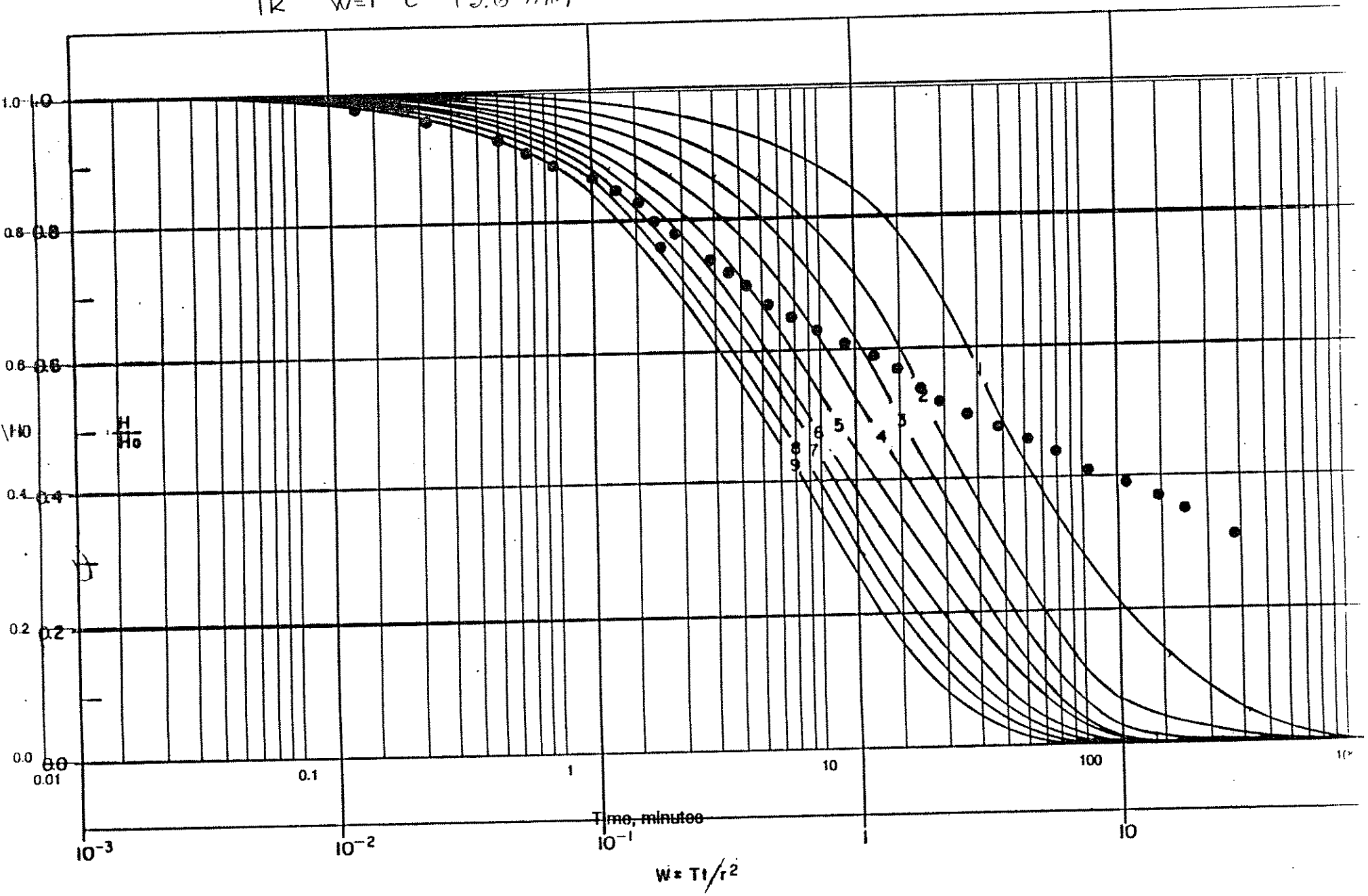
$$\bar{V} = \frac{K \cdot i}{ne} \times 1{,}034{,}645.669 \frac{ft/yr}{cm/sec}$$

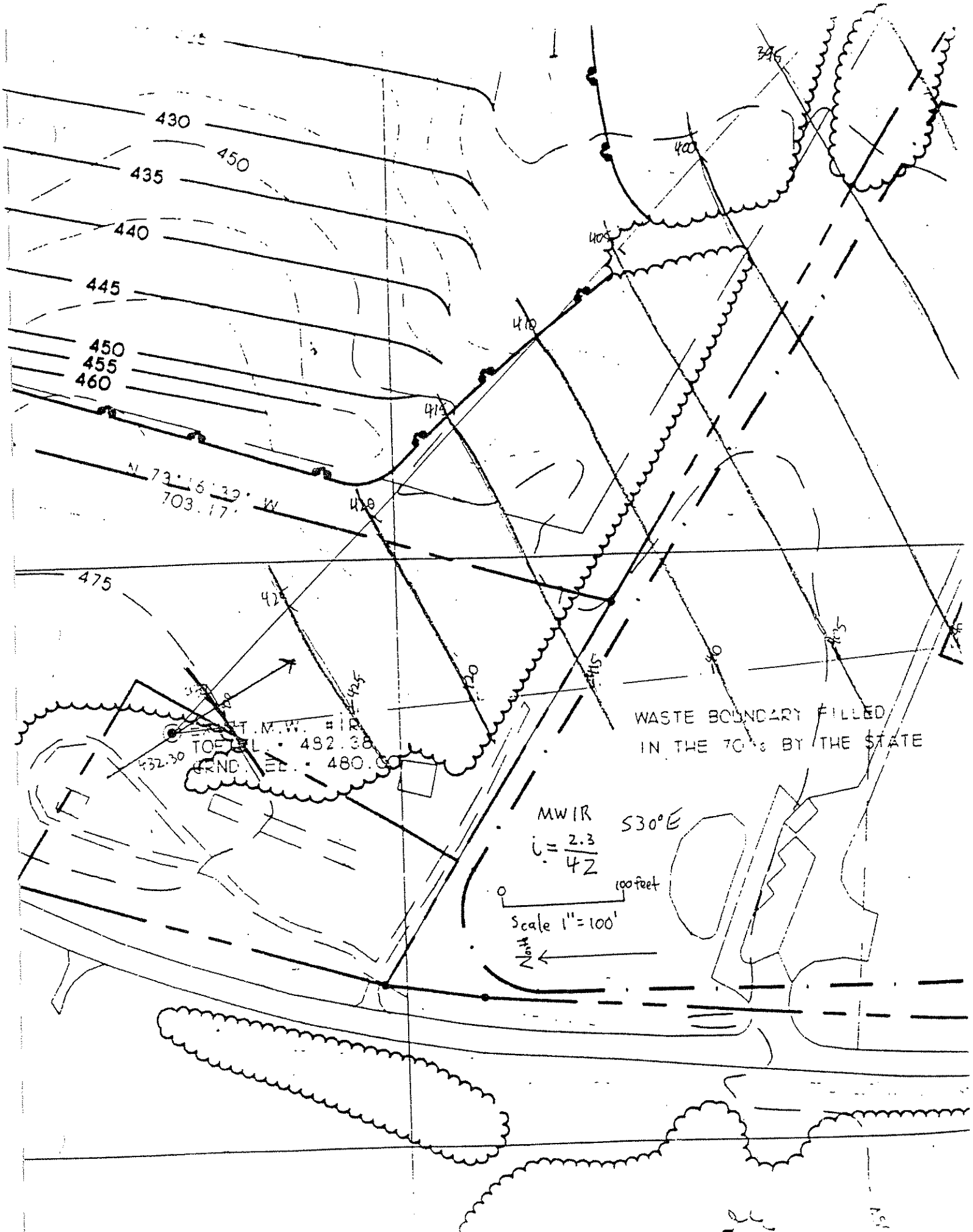
UG TEST MW1R GRANVILLE BUTNER

DEPTH TO GW	45.6	RADIUS, in.	1
HT OF STICKUP	2.5	WET SCREEN, ft	15
INITIAL GW READING	2	t, min	13.6
INITIAL TIME	638.77	k, cm/sec	1.7E-05
INITIAL GW BELOW TOC	48.1		
H0	46.1		

GW READING	DH	H	H/H0	HOUR	MIN	SEC	TIME
3	1	45.1	0.98	10	38	55	0.15
5	3	43.1	0.93	10	39	12	0.43
6	4	42.1	0.91	10	39	22	0.60
7	5	41.1	0.89	10	39	34	0.80
8	6	40.1	0.87	10	39	58	1.20
9	7	39.1	0.85	10	40	17	1.51
10	8	38.1	0.83	10	40	39	1.88
11	9	37.1	0.80	10	40	57	2.18
12	10	36.1	0.78	10	41	26	2.66
13	11	35.1	0.76	10	41	50	3.06
14	12	34.1	0.74	10	42	27	3.68
15	13	33.1	0.72	10	43	6	4.33
16	14	32.1	0.70	10	43	49	5.05
17	15	31.1	0.67	10	44	56	6.16
18	16	30.1	0.65	10	46	22	7.60
19	17	29.1	0.63	10	48	19	9.55
20	18	28.1	0.61	10	51	3	12.28
21	19	27.1	0.59	10	54	39	15.88
22	20	26.1	0.57	10	58	17	19.51
23	21	25.1	0.54	11	2	46	24.00
24	22	24.1	0.52	11	7	13	28.45
25	23	23.1	0.50	11	15	11	36.41
26	24	22.1	0.48	11	26	31	47.75
27	25	21.1	0.46	11	40	22	61.60
28	26	20.1	0.44	11	58	1	79.25
29	27	19.1	0.41	12	23	44	104.96
30	28	18.1	0.39	13	4	38	145.86
31	29	17.1	0.37	13	52	14	193.46
32	30	16.1	0.35	14	42	19	243.55
33.71	31.71	14.39	0.31	16	56	39	377.88

1R W=1 t= 13.6 min




430
450
435
440
445
450
455
460
475
N 73°16'39" W
703.17'
WASTE BOUNDARY FILLED
IN THE 70's BY THE STATE
MW1R
S30°E
i = 2.3/42
100 feet
Scale 1" = 100'

Client MESCO

Job No. 94108.02

Subject Slug Tests

GAI CONSULTANTS-NC, INC.

Raleigh, NC

Final Page No.

Prel. Page No. 2

Calc. TJT Date 6-23-94

Chkd. Date

2R

$H_o = 2.9$

$r = 1''$

$b = 15'$

Screen 4.0

$H' = 7.1$

t (min)	H (ft)	H/H_o
0.7	1.9	0.66
1.8	1.4	0.48
3.3	0.9	0.31
6.5	0.4	0.14
20.1	0	0

$W = 1$

$t = 3.5$

$T = 0.002 \frac{ft^2}{min}$

$K = 6.7 \times 10^{-5}$ cm/sec

3R

$H_o = 3.6$

$r = 1''$

$b = 10'$

Screen 27.2

$H' = -23.7$

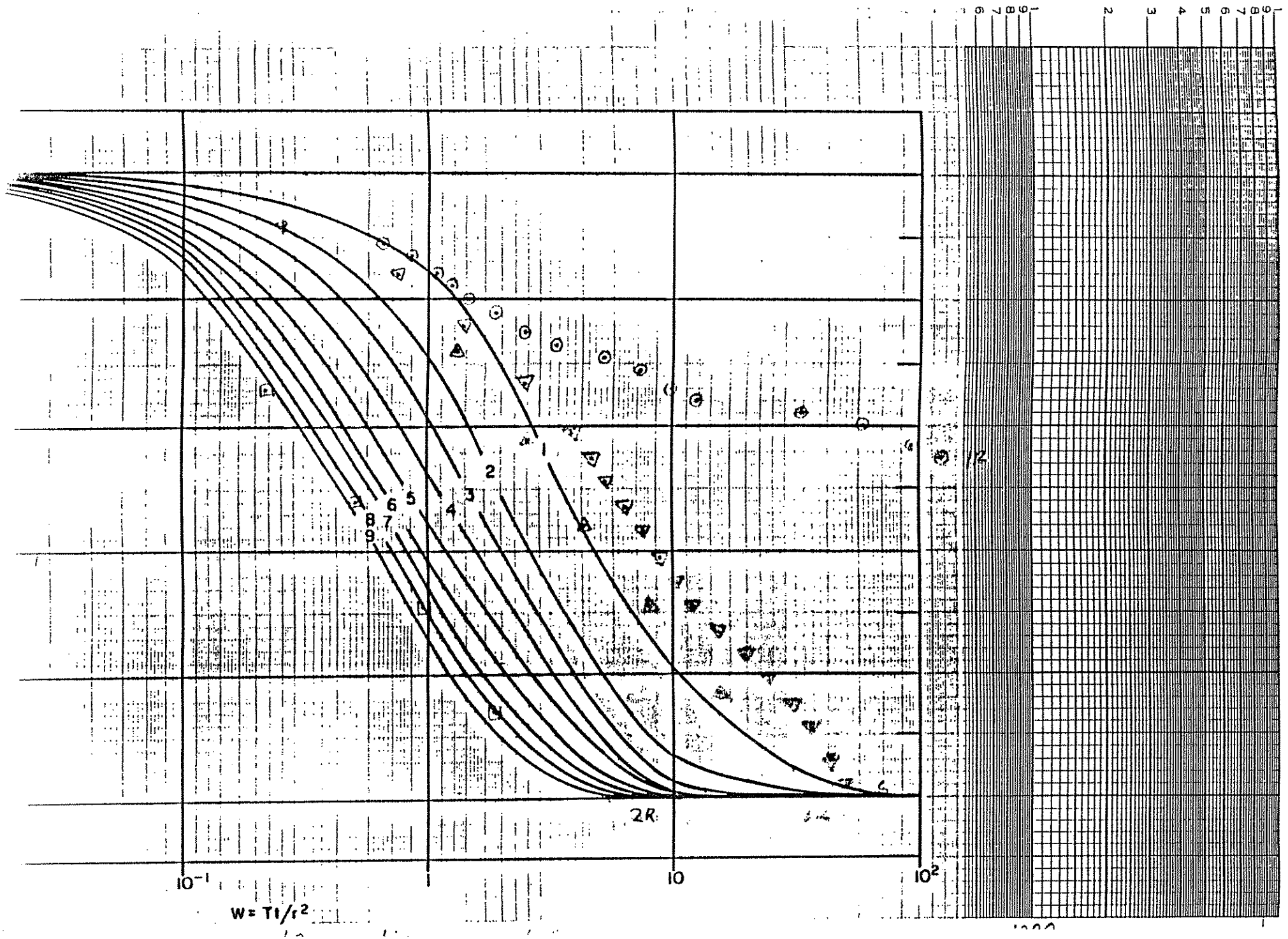
t (min)	H (ft)	H/H_o
4.6	2.6	0.72
9.0	2.1	0.58
15.1	1.6	0.44
28.0	1.1	0.31
54.0	0.6	0.17
105.3	0	0

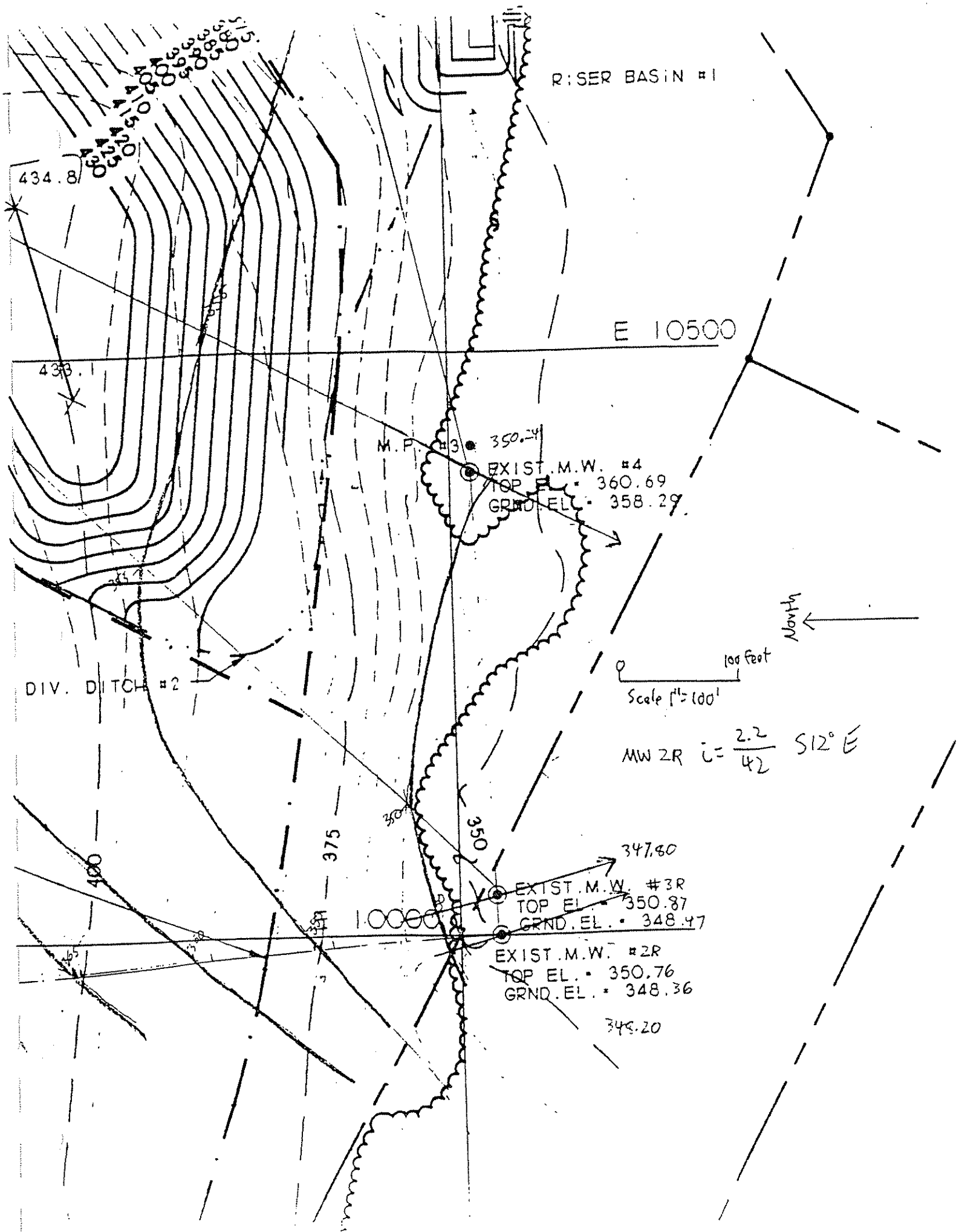
$W = 1$

$t = 20.5$

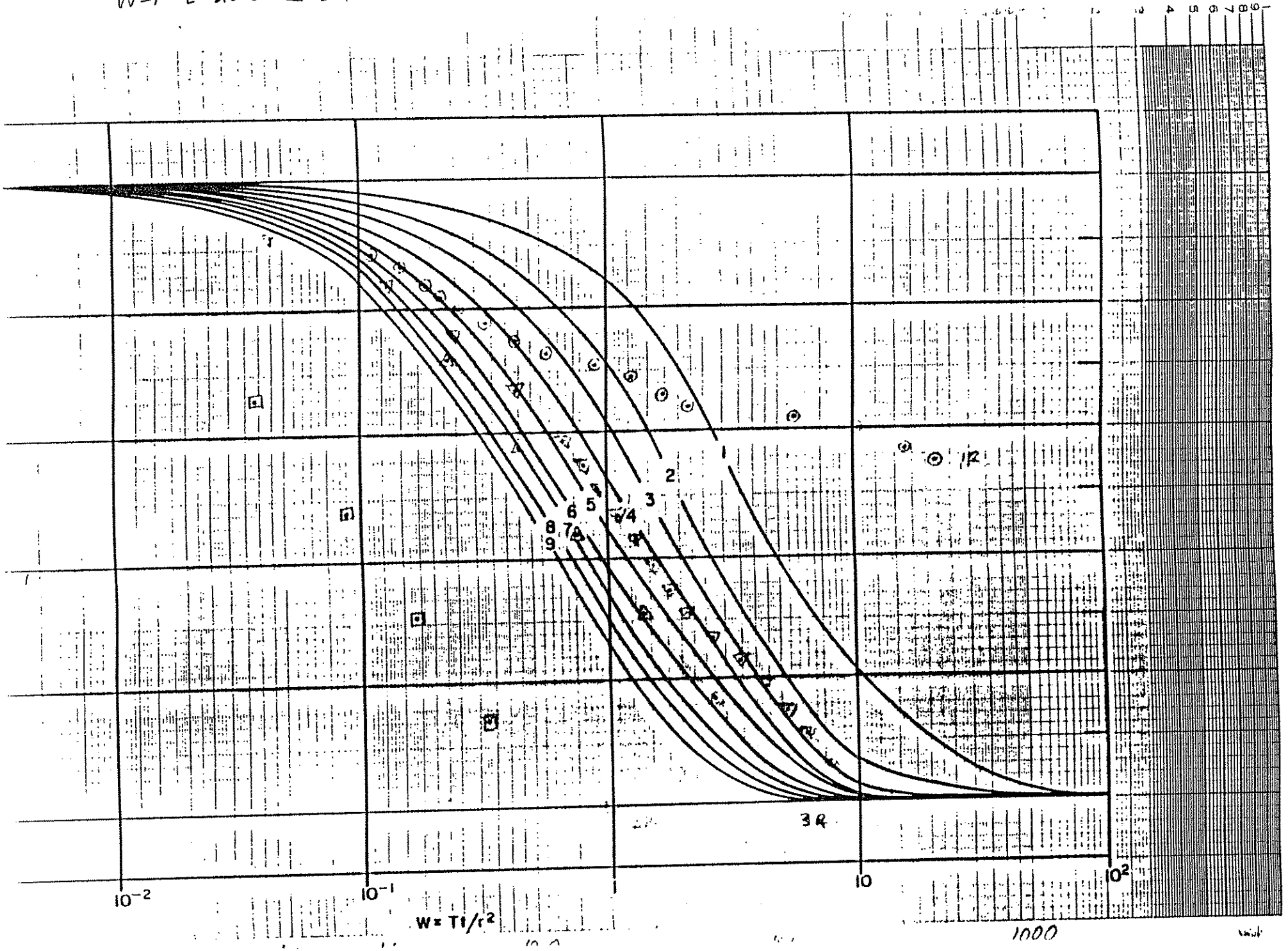
$T = 3.4 \times 10^{-4}$ ft^2/min

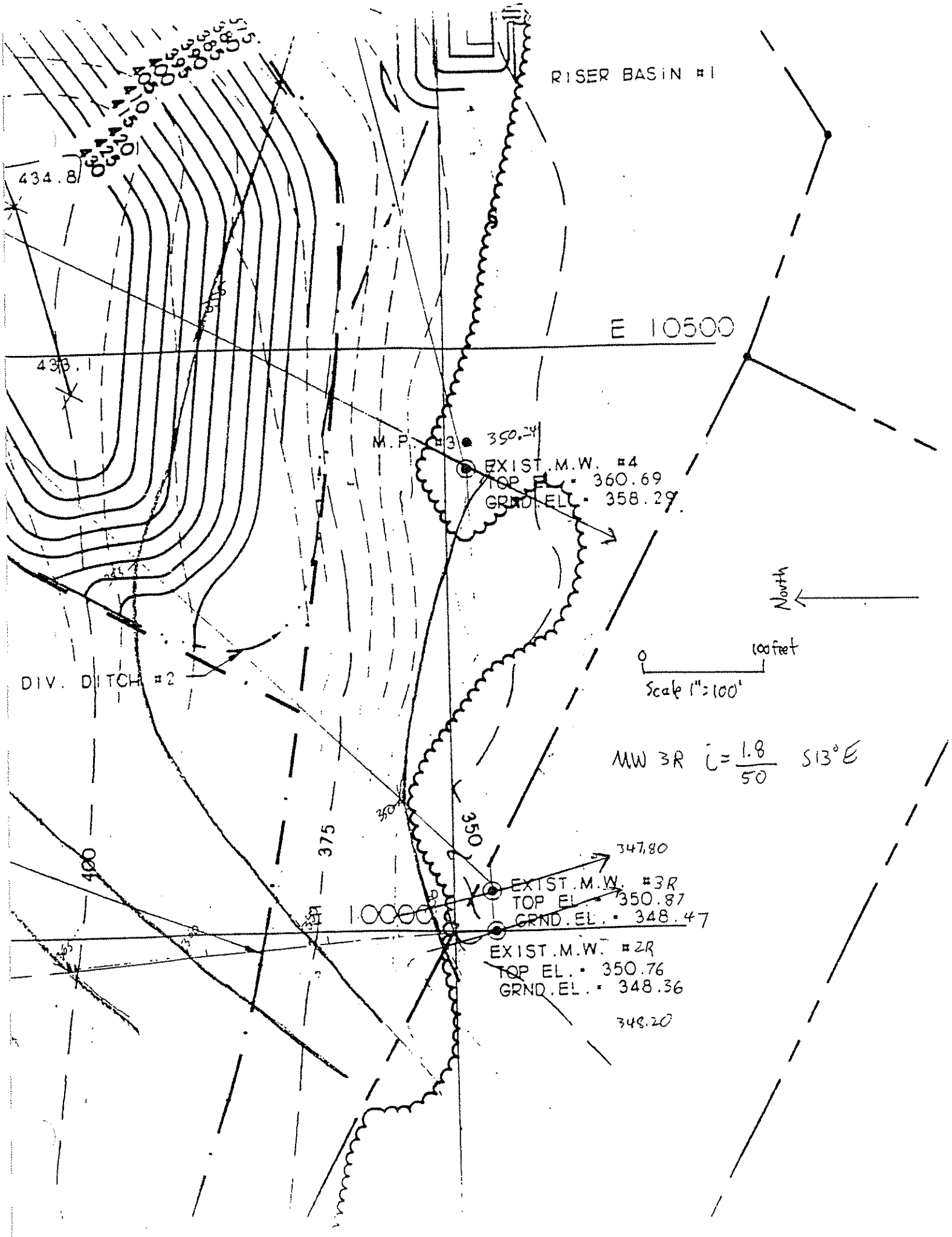
$K = 1.7 \times 10^{-5}$ cm/sec


W=1 t=3.5 ⊡= 2R
1
2
3
4
5
6
7
8
9
12
2R
10^{-1}
1
10
10^{2}
$W = Tt/r^2$


RISER BASIN #1
E 10500
434.8
433.1
M.P. #3
350.24
EXIST. M.W. #4
TOP EL. = 360.69
GRND. EL. = 358.29
North
100 feet
Scale 1" = 100'
DIV. DITCH #2
MW 2R i = 2.2/42 S12° E
375
350
400
347.80
EXIST. M.W. #3R
TOP EL. = 350.87
GRND. EL. = 348.47
EXIST. M.W. #2R
TOP EL. = 350.76
GRND. EL. = 348.36
345.20

W=1 t=20.5 Δ=3R




RISER BASIN #1
E 10500
434.8
438.1
M.P. #3
350.24
EXIST. M.W. #4
TOP EL. = 360.69
GRND. EL. = 358.29
North
0
100 feet
Scale 1" = 100'
DIV. DITCH #2
MW 3R i = 1.8/50 S13°E
350
375
400
347.80
EXIST. M.W. #3R
TOP EL. = 350.87
GRND. EL. = 348.47
EXIST. M.W. #2R
TOP EL. = 350.76
GRND. EL. = 348.36
348.20

Client MESCO

Job No. 94108.02

Subject Slug tests

GAI CONSULTANTS-NC, INC.

Raleigh, NC

Final Page No.

Prel. Page No. 3

Calc. TJT Date 6-23-9

Chkd. Date

4

$H_o = 10.2$

$r = 1''$

$b = 15'$

Screen 16.4

$H' = -6.5$

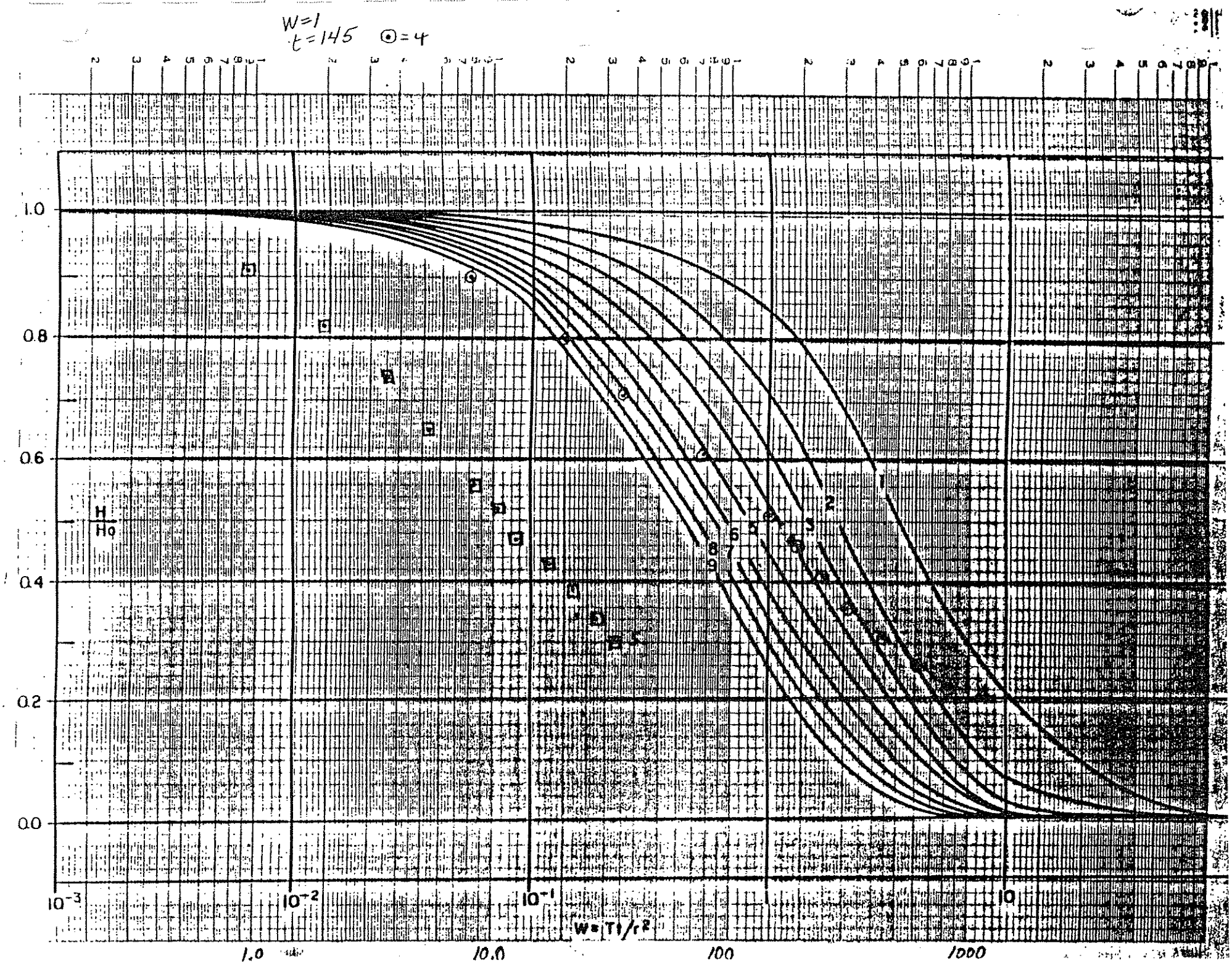
t (min)	H (ft)	H/H_o
7.9	9.2	0.90
19.7	8.2	0.80
34.2	7.2	0.71
77.3	6.2	0.61
148.6	5.2	0.51
191.1	4.7	0.46
240.6	4.2	0.41
305.3	3.7	0.36
437.9	3.2	0.31
614.6	2.7	0.26
835.0	2.2	0.22

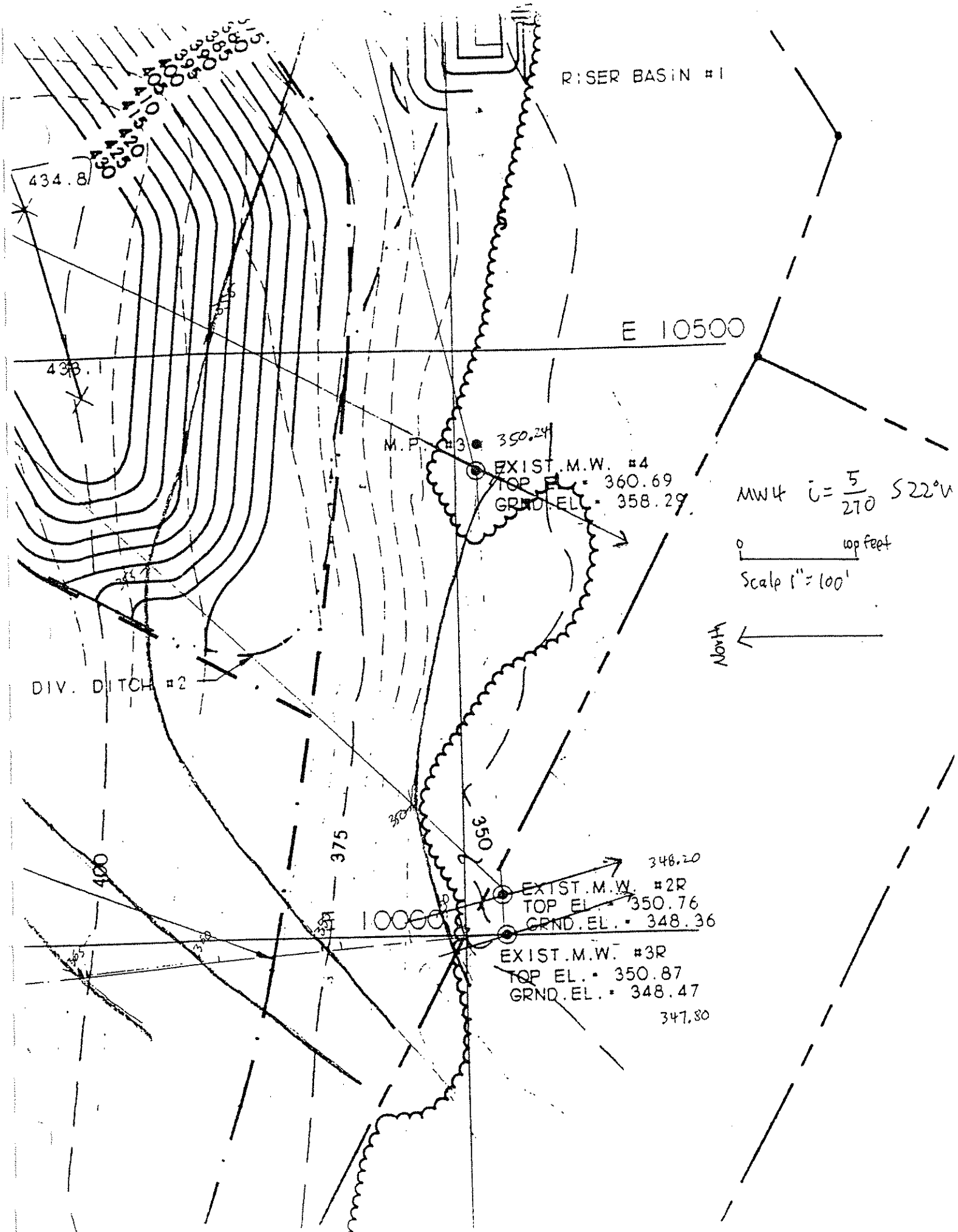
$W = 1$

$t = 145$

$T = 4.8 \times 10^{-5}$ ft²/min

$K = 1.6 \times 10^{-6}$ cm/sec


W=1
t=145 ⊙=4
1.0
0.8
0.6
0.4
0.2
0.0
H/Ho
1
2
3
4
5
6
7
8
9
10⁻³
10⁻²
10⁻¹
10
W=Tt/r²
1.0
10.0
100
1000


RISER BASIN #1
E 10500
434.8
438.1
M.P. #3
350.24
EXIST. M.W. #4
TOP EL. = 360.69
GRND. EL. = 358.29
MW4 i = 5/270 S22°W
0 100 feet
Scale 1" = 100'
North
DIV. DITCH #2
400
375
350
348.20
EXIST. M.W. #2R
TOP EL. = 350.76
GRND. EL. = 348.36
E 10000
EXIST. M.W. #3R
TOP EL. = 350.87
GRND. EL. = 348.47
347.80

Client MESCO

Job No. 94108.02

Subject Slug Tests

GAI CONSULTANTS-NC, INC.

Raleigh, NC

Final Page No.

Prel. Page No. 4

Calc. TJT Date 6-23-9

Chkd. Date

5

$H_0 = 11.4$

$r = 1''$

$b = 15'$

Screen 8.4

$H' = 3$

t (min)	H (ft)	H/H_0
0.9	10.4	0.91
1.9	9.4	0.82
3.5	8.4	0.74
5.3	7.4	0.65
8.3	6.4	0.56
10.3	5.9	0.52
12.7	5.4	0.47
17.1	4.9	0.43
21.9	4.4	0.39
27.1	3.9	0.34
32.5	3.4	0.30
39.0	2.9	0.25
45.8	2.4	0.21
52.8	1.9	0.17
62.5	1.4	0.12
74.8	0.9	0.08
125.4	0.4	0.04
183.9	0	0

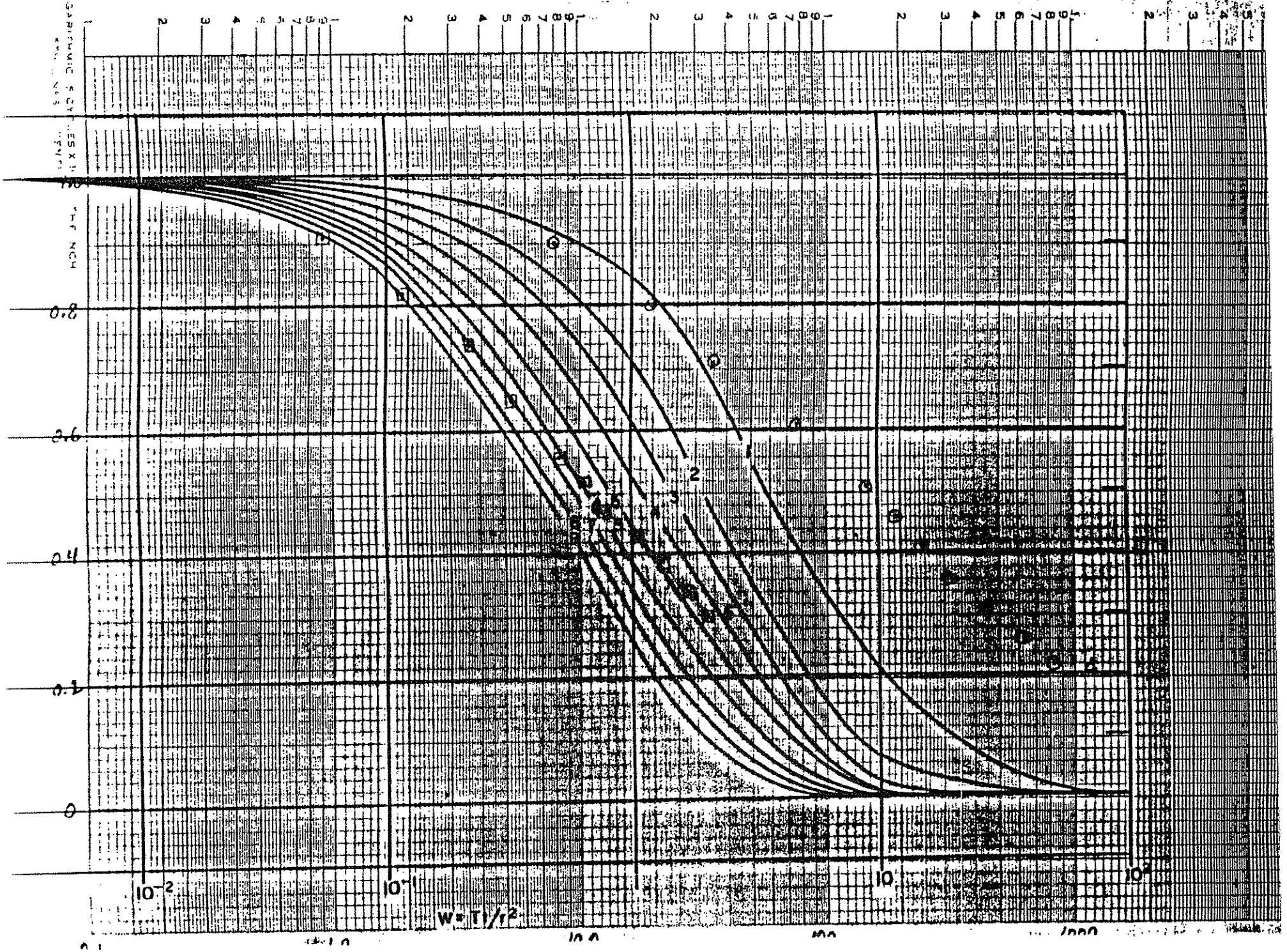
$W = 1$

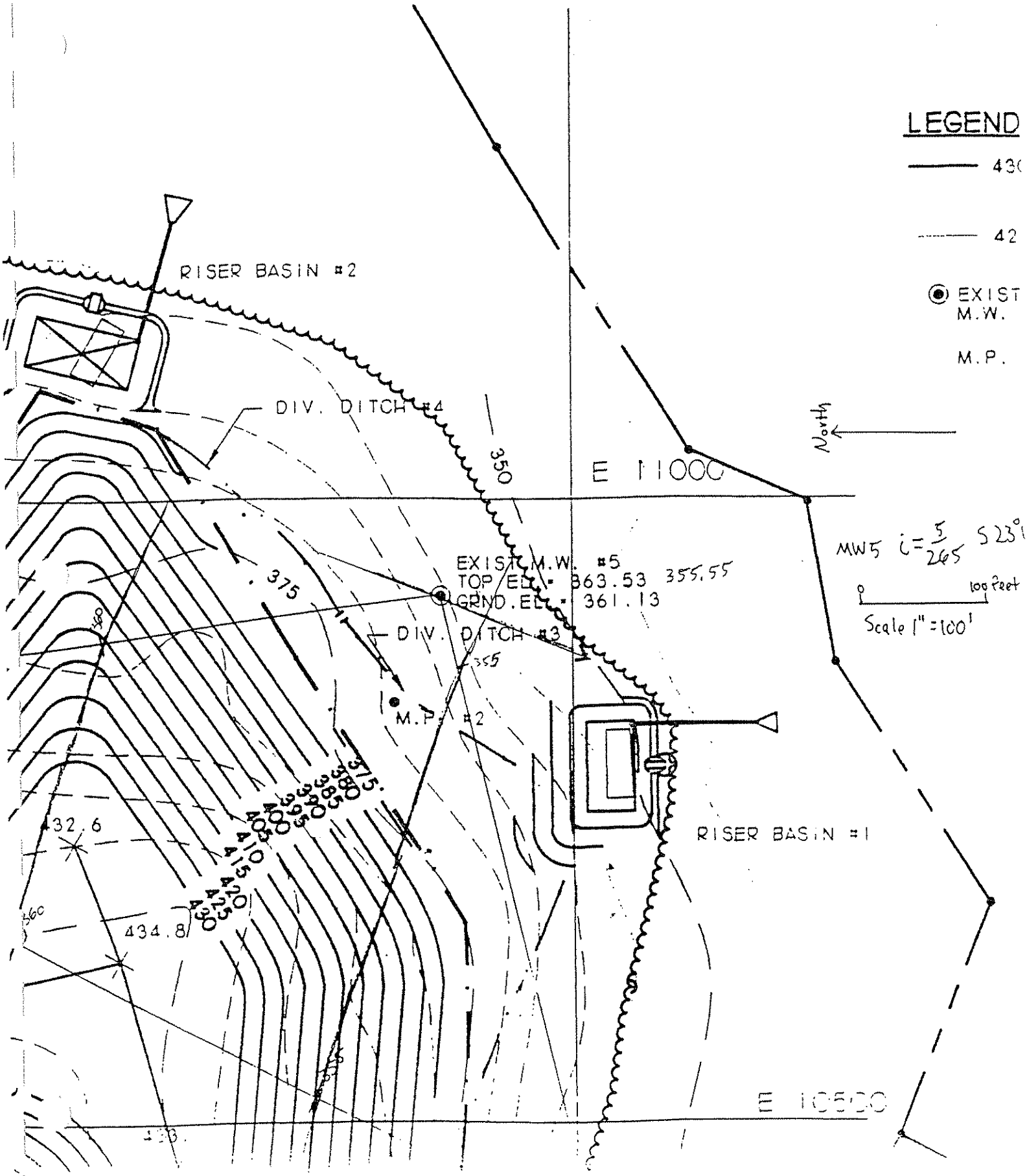
$t = 16.5$

$T = 4.2 \times 10^{-4}$ ft^2/min

$K = 1.4 \times 10^{-5}$ cm/sec

W=1 t=16.5 ⊡=5




LEGEND
430
42
EXIST M.W.
M.P.
RISER BASIN #2
DIV. DITCH #4
350
E 11000
North
MW5 i = 5/265 S 23°
EXIST. M.W. #5
TOP EL. = 363.53 355.55
GRND. EL. = 361.13
375
DIV. DITCH #3
355
M.P. #2
375
380
385
390
395
400
405
410
415
420
425
430
432.6
434.8
360
RISER BASIN #1
E 10500
100 feet
Scale 1" = 100'

Client MESCO

Job No. 94108.02

Subject Slug Tests

GAI CONSULTANTS-NC, INC.

Raleigh, NC

Final Page No.

Prel. Page No. 5

Calc. TJT Date 6-23-94

Chkd. Date

6

$H_o = 12.3$

$r = 1''$

$b = 15'$

Screen 16.7

$H' = -4.4$

t (min)	H (ft)	H/H_o
0.9	11.3	0.92
2.6	10.3	0.84
4.9	9.3	0.76
8.7	8.3	0.67
13.6	7.3	0.59
16.3	6.8	0.55
19.7	6.3	0.51
22.2	5.8	0.47
26.5	5.3	0.43
31.0	4.8	0.39
36.5	4.3	0.35
41.6	3.8	0.31
52.6	3.3	0.27
68.7	2.8	0.23
86.8	2.3	0.19
105.3	1.8	0.15
128.1	1.3	0.11
152.6	0.8	0.06
178.8	0.3	0.02
194.1	0	0

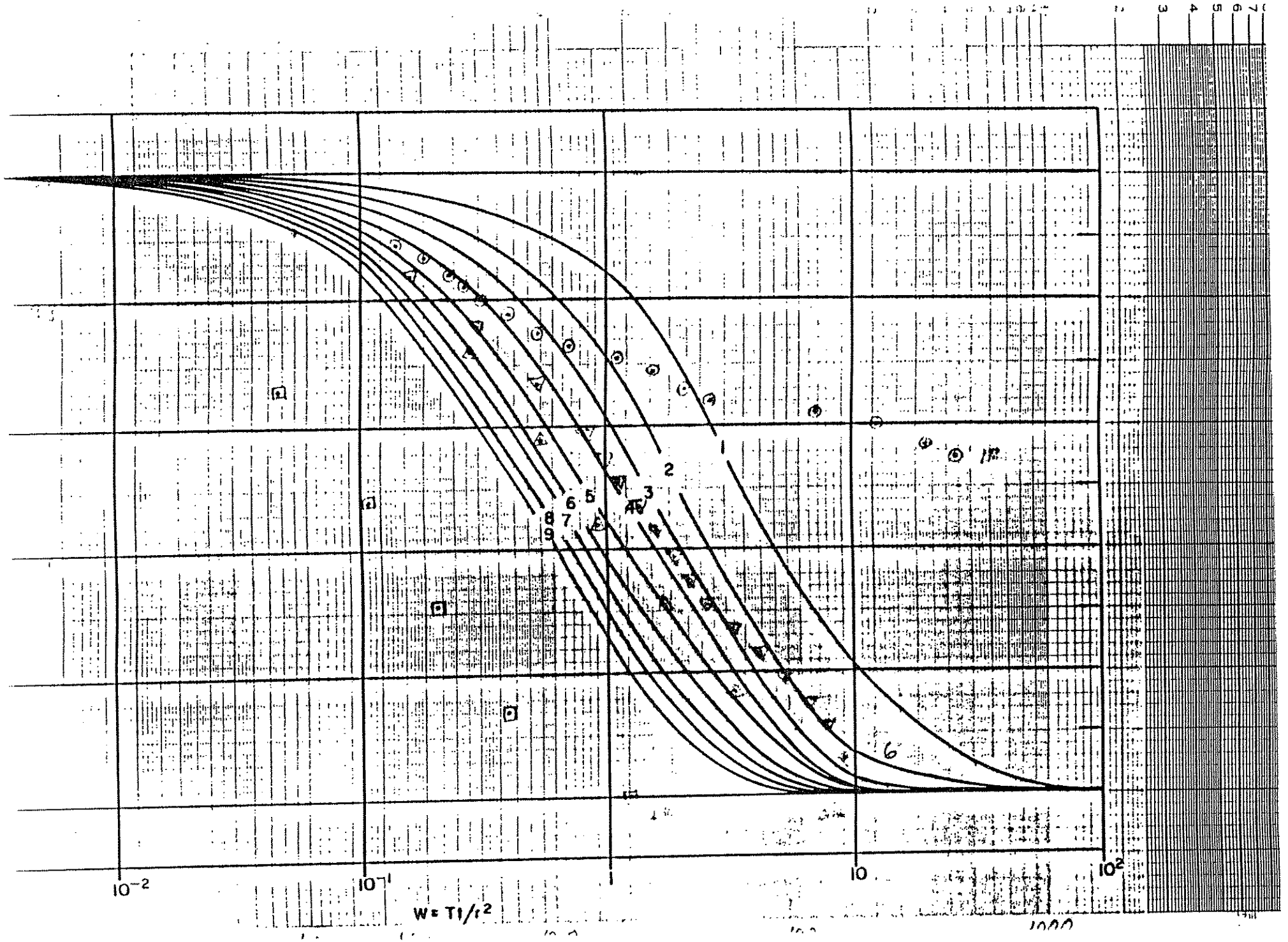
$W = 1$

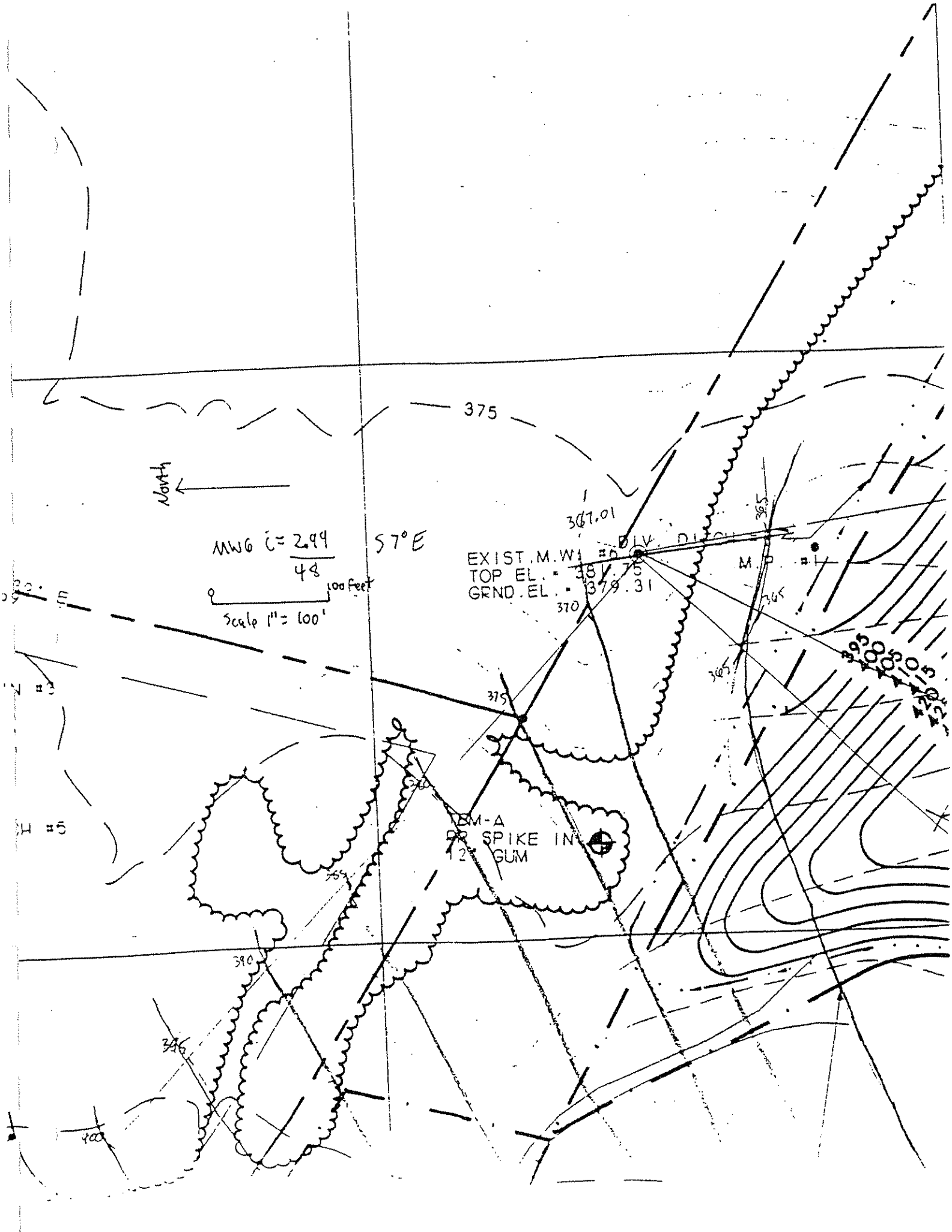
$t = 16.5$

$T = 4.2 \times 10^{-4}$ ft²/min

$K = 1.4 \times 10^{-5}$ cm/sec

W=1 t= 16.5 ▽ =6




375
North
MW6 i = 2.99 / 48
S 7° E
100 Feet
Scale 1" = 100'
367.01
EXIST. M.W. #6
TOP EL. = 381.75
GRND. EL. = 379.31
M.P. #1
370
365
375
395
400
405
410
415
420
BM-A
PK SPIKE IN
12" GUM
390
395
400

Client _____ **GAI CONSULTANTS-NC, INC.** Final Page No. _____

Job No. 94105.02 Raleigh, NC Prel. Page No. _____

Subject _____ Calc. _____ Date _____

Chkd. _____ Date _____

Granville County - Butner

Well	Permeability (cm/sec)	Soil Type	G_s	γ_d	Total Porosity (%)	Effective Porosity (%)
1R	1.7×10^{-5}	Fractured Metavolcanics			30	1
2R	6.7×10^{-5}	SiCl w/ Rock Fragments	2.65	100	40	5
3R	1.7×10^{-5}	Fractured Meta volcanics			30	1
4	1.6×10^{-6}	Fractured Metavolcanics			20	1
5	1.4×10^{-5}	SiSa w/ Rock Fragments	2.67	110	34	1
6	1.4×10^{-5}	Fractured Metavolcanics			30	1

Total porosity $n = 1 - \frac{\gamma_d}{G_s(62.4)}$ γ_d = dry density, 62.4 = unit weight of water, G_s = specific gravity

Effective Porosity values taken from typical values for soils and rocks published by Bavari and Hedges (1985).

Total Porosity values for 1R, 3R, 4, and 6 estimated from field observations, RQD, and experience with similar material.

G_s and γ_d values estimated from field observations, blow counts, and experience with similar material.

TABLE 3-1. DEFAULT VALUES FOR EFFECTIVE POROSITY (Ne) FOR USE IN TIME OF TRAVEL (TOT) ANALYSES

Soil textural classes	Effective porosity of saturation[a]
Unified soil classification system	
GS, GP, GM, GC, SW, SP, SM, SC	0.20 (20%)
ML, MH	0.15 (15%)
CL, OL, CH, OH, PT	0.01 (1%)[b]
USDA soil textural classes	
Clays, silty clays, sandy clays	0.01 (1%)[b]
Silts, silt loams, silty clay loams	0.10 (10%)
All others	0.20 (20%)
Rock units (all)	
Porous media (nonfractured rocks such as sandstone and some carbonates)	0.15 (15%)
Fractured rocks (most carbonates, shales, granites, etc.)	0.0001 (0.01%)

Source: Barari, A., and L. S. Hedges. 1985. Movement of Water in Glacial Till. *Proceedings of the 17th International Congress of the International Association of Hydrogeologists*, pp. 129-134.

a These values are estimates and there may be differences between similar units. For example, recent studies indicate that weathered and unweathered glacial till may have markedly different effective porosities (Barari and Hedges, 1985; Bradbury et al., 1985).

b Assumes *de minimus* secondary porosity. If fractures or soil structure are present, effective porosity should be 0.001 (0.1%).

OPERATION/CONSTRUCTION MANAGERS

Municipal Services

P.O. Box 97, Garner, North Carolina 27529 (919)772-5393

CIVIL/SANITARY ENGINEERS

Engineering Company, P.A.

P.O. Box 349, Boone, North Carolina 28607 (704)262-1767

January 25, 1996

Mr. Bobby Lutfy
Hydrogeologist
Solid Waste Section
P.O. Box 27687
Raleigh, NC 27611-7687

Re: Hydrogeologic Review Granville County - Butner
Transition Plan Permit No. 39-02 Project No. G93115

Dear Mr. Lutfy:

Enclosed you will find the responses to your November 9, 1995 letter concerning the transition plan of the above referenced landfill.

At this time we are conducting a more extensive search for information concerning the on-site water supply well. As soon as it is complete we will further this information on to you.

If you have any questions, please advise.

Very truly yours,
MUNICIPAL ENGINEERING SERVICES CO., PA

D. Wayne Sullivan

D. Wayne Sullivan
Project Manager

DWS:sl

Enclosures

cc: Mick Berry, Granville County Manager

JAN 1996
Received
Solid Waste
Section

GAI CONSULTANTS

RESPONSES TO REVIEW COMMENTS
GRANVILLE COUNTY - BUTNER LANDFILL
PERMIT #39-02
BUTNER, NORTH CAROLINA

SUBMITTED TO

MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.
GARNER, NORTH CAROLINA

JANUARY 1996
PROJECT NO. 94108.02

GAI CONSULTANTS

GAI Consultants – NC, Inc.

3812-H Tarheel Drive
Raleigh, NC 27609
919/878-4478
FAX 919/878-4032

January 22, 1996

Mr. Wayne Sullivan
Municipal Engineering Services Company, P.A.
Post Office Box 97
Garner, North Carolina 27529

Re: Responses to Review Comments
Granville County - Butner Landfill, Permit #39-02
Butner, North Carolina
Project No. 94108.02

Dear Mr. Sullivan:

INTRODUCTION

Responses are made herein to the review comments of Mr. Bobby Lutfy of the Division of Solid Waste Management of the Department of Environment, Health and Natural Resources made in a letter dated November 9, 1995 pertaining to the transition plan for the Granville County Landfill, Permit #39-02.

RESPONSES TO COMMENTS

April 28, 1995, Responses to Review Comments - Addendum A, Water Quality Monitoring System Modifications (June 23, 1994)

Lutfy Comment: Table 1: Based upon the Note for Table 1, it is my assumption that the effective porosity values of 1% were used for wells screened in fractured bedrock. However, based upon the boring logs, small portions of the screened intervals for monitoring wells MW-1R and MW-4 and significant portions of the screened intervals for monitoring wells MW-5 and MW-6 are in soil or partially weathered rock materials. (It is not clear what type of drill rig was used to install these wells. Typically, anything above auger refusal would be considered soil, saprolite, or partially weathered rock, and not fractured bedrock.) Therefore it appears that the effective porosity values need to be re-evaluated for these wells. If changes are necessary, then groundwater flow rates would need to be recalculated.

Response: The effective porosity of the materials around the screens of Monitoring Wells 1, 4R, and 6, which are screened in fractured metavolcanics, is in our opinion reasonably considered as 1%. Monitoring Well 1R encountered metavolcanics at a depth of 42.5 feet, Monitoring Well 4 at a depth of 12 feet, and Monitoring Well 6 at a depth of 21.2 feet based on the boring logs.

Groundwater Monitoring Well 5 (Well 5) has a screened interval that may be in as little as 4.7 feet of fractured metavolcanics with the remaining interval in saprolite and soil. An effective porosity value of 18% is considered applicable for the material around the screened interval of Well 5. The groundwater flow rate for Well 5 is 3 ft/yr. Table 1 in Enclosure I presents the permeability, total porosity, effective porosity, and

groundwater flow rate and direction at each monitoring well. Documentation and calculations for support of the effective porosity value and groundwater flow rate for Well 5 is in Enclosure II.

April 28, 1995, Responses to Review Comments - Addendum A, Water Sampling and Testing (October 5, 1994)

Lutfy Comment: While the explanation provided regarding the failure to sample old well MW-2 provides useful information, it does not change the fact that it is the policy of the Solid Waste Section to sample both old and replacement wells (old MW-2 and new MW-2R) in order to provide information necessary for the Section to make a determination as to whether continued sampling of the old well is necessary. Therefore, for at least the next two sampling events, both wells should be sampled in order to provide the information necessary for the Solid Waste Section to make such a determination.

Response: Monitoring Well 2 was sampled on November 16, 1995 as part of the November 15, 1995 sampling event and will be included in the next sampling event to provide information to the Solid Waste Section for determination if further sampling is necessary.

Lutfy Comment: The explanation provided regarding the well design was generally satisfactory. There is still some concern on the part of the Solid Waste Section regarding possible surface water infiltration into shallow well MW-2R. The Section will allow the use of MW-2R as long as it is judged to be providing representative ground-water quality samples. However for the reasons previously discussed in my memo of March 8, 1995, in the future monitoring wells should never be installed with the top of the well screen shallower than five feet from ground surface or the top of the sand pack shallower than four feet from ground surface.

Response: GAI certainly wants to be sure that surface water does not enter Groundwater Monitoring Well 2R. The area around the well will be reviewed to assure that the grading and well construction at ground surface is sufficient to control and divert surface water such that no surface water will contaminate the monitoring well. All monitoring wells by GAI are being installed with the top of the sand pack no shallower than four feet or the top of the well screen no shallower than five feet below ground surface.

Lutfy Comment: The Solid Waste Section disagrees with the last statement in the responses that "the clay stratum" "will provide very little, if any, water and, consequently, has no impact on the source of groundwater being sampled," especially in the case of well MW-6, where the well screen itself (not merely the sand filter pack) has a significant interval in the saprolite.

Response: Since GAI's statement concerning the clay stratum is not considered to be critical to the performance or evaluation of the water quality monitoring system, GAI withdraws the last statement of Addendum A, Page 3, referring to the clay stratum.

Sampling and Analysis Plan (SAP)

Lutfy Comment:	The Revised Sampling And Analysis Plan (SAP), dated April 1995 appears generally okay. At the bottom of page 5, specific conductivity should be reported along with the other field test parameters.
Response:	Sampling and Analysis Plan dated November 1995 submitted herewith requires reporting specific conductivity and is included in the Transition Plan.
Lutfy Comment:	GAI needs to provide a separate copy of the Revised SAP to each County to be included in their copy of the Transition Plan. For the Transition Plans to be retained by the Solid Waste Section, either a sheet referencing the Revised SAP on file should be placed in each County's Transition Plan or a separate copy of the Revised SAP needs to be placed in each of the various Counties Transition Plans.
Response:	The Sampling and Analysis Plan dated November 1995 is included in the Transition Plan.

CLOSURE

This letter responds to review comments of Mr. Bobby Lutfy on the Granville County - Butner Landfill pertaining to GAI. Responses to other comments by Mr. Lutfy are considered to be the responsibility of Municipal Engineering Services Company or others.

Respectfully submitted,
GAI Consultants - NC, Inc.

Cheryl Marks

Cheryl L. Marks
Geologist

Wendell W. Parker

Wendell W. Parker, Ph.D., P.E.
Vice President

ENCLOSURE I

HYDROLOGIC PROPERTIES TABLE

Refer to Revised Table 1

TABLE 1
HYDROLOGIC PROPERTIES AT MONITORING WELL LOCATIONS

Monitoring Well	Permeability (cm/sec)	Total Porosity (%)	Effective Porosity (%)	Groundwater Flow Rate and Direction (ft/yr)
1R	1.7×10^{-5}	30	1	96 S 30°E
2R	6.7×10^{-5}	40	5	50 S 13°E
3R	1.7×10^{-5}	30	1	92 S 12°E
4	1.6×10^{-6}	20	1	3 S 22°W
5	1.4×10^{-5}	34	18	1.5 ~~3~~ S 23°W
6	1.4×10^{-5}	30	~~1~~ 7.5	12 ~~90~~ S 7°E

Note: Where monitoring wells are in soil and rock, groundwater flow through soil is considered to control. Effective porosity is considered to control groundwater flow and is estimated for the rock based on visual observations during well installation.

ENCLOSURE II

DOCUMENTATION AND CALCULATIONS

Client MESCO

Job No. 94108.02

Subject Hydrologic Properties, Butner

GAI CONSULTANTS-NC, INC.

Raleigh, NC

Final Page No. 1 of 6

Prel. Page No.

Calc. CLM Date 1-2-96

Chkd. TJR Date 1-3-96

$V = \frac{Ki}{n}(c)$ where c is 1,034,645.67 ft/yr.

	K Permeability (cm/sec)	n Effective Porosity (%)	i Gradient	V Flow Rate (ft./yr)
MW-5	1.4×10^{-5}	18	5/265	~~8~~ 1.5

Effective Porosity Silty Sand/Saprolite 18%

Effective porosity was estimated from Table 3.1.

These values are EPA default values.

ML is 15% and SM 20%. Silt Loams 10% Average 15%

Textural classification Triangle for Silty Sand ranges from 12 To 30%

Average of 21%

Total Porosity Silty Sand/Saprolite 34%

Total porosity is estimated from Table 1.4 and Table 2.4 based on soil obtained and the Typical values for similar soil Types.

TABLE 3-1. DEFAULT VALUES FOR EFFECTIVE POROSITY (Ne) FOR USE IN TIME OF TRAVEL (TOT) ANALYSES

Soil textural classes	Effective porosity of saturation[a]
Unified soil classification system	
GS, GP, GM, GC, SW, SP, SM, SC	0.20 (20%)
ML, MH	0.15 (15%)
CL, OL, CH, OH, PT	0.01 (1%)[b]
USDA soil textural classes	
Clays, silty clays, sandy clays	0.01 (1%)[b]
Silts, silt loams, silty clay loams	0.10 (10%)
All others	0.20 (20%)
Rock units (all)	
Porous media (nonfractured rocks such as sandstone and some carbonates)	0.15 (15%)
Fractured rocks (most carbonates, shales, granites, etc.)	0.0001 (0.01%)

Source: Barari, A., and L. S. Hedges. 1985. Movement of Water in Glacial Till. *Proceedings of the 17th International Congress of the International Association of Hydrogeologists*, pp. 129-134.

a These values are estimates and there may be differences between similar units. For example, recent studies indicate that weathered and unweathered glacial till may have markedly different effective porosities (Barari and Hedges, 1985; Bradbury et al., 1985).

b Assumes *de minimus* secondary porosity. If fractures or soil structure are present, effective porosity should be 0.001 (0.1%).

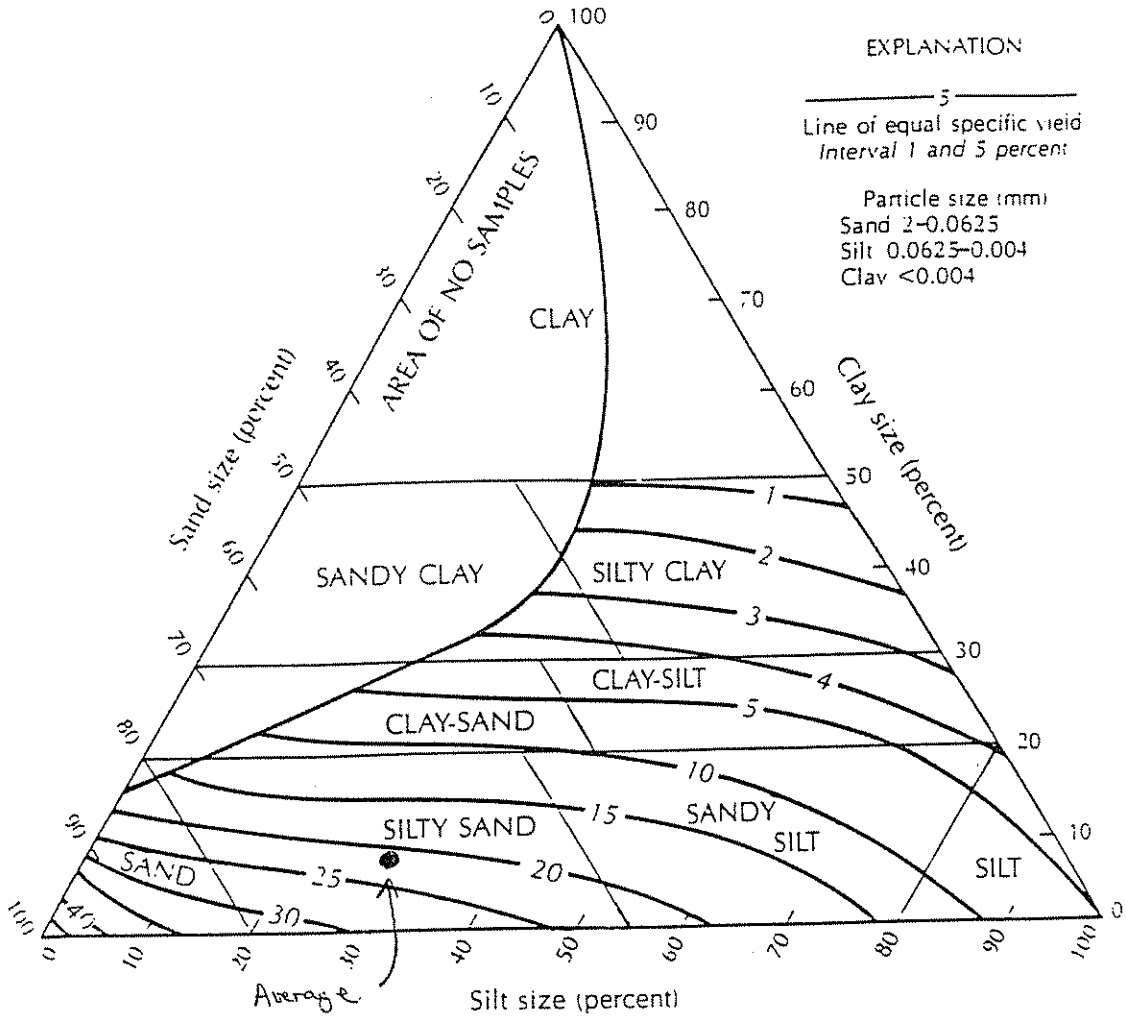


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.

Table 1.1 Porosity, Void Ratio, and Unit Weight of Typical Soils in Natural State

Description	Porosity (n)	Void Ratio (e)	Water Content (w)[a]	Unit Weight g/cu cm γ_d[b]	Unit Weight g/cu cm γ_{sat}[c]	Unit Weight lb/cu ft γ_d	Unit Weight lb/cu ft γ_{sat}
1. Uniform sand, loose	0.46	0.85	32	1.43	1.89	90	118
2. Uniform sand, dense	0.34	0.51	19	1.75	2.09	109	130
3. Mixed-grained sand, loose	0.40	0.67	25	1.59	1.99	99	124
most similar → 4. Mixed-grained sand, dense	0.30	0.43	16	1.86	2.16	116	135
5. Windblown silt (loess)	0.50	0.99	21	1.36	1.86	85	116
6. Glacial till, very mixed-grained	0.20	0.25	9	2.12	2.32	132	145
7. Soft glacial clay	0.55	1.2	45	1.22	1.77	76	110
8. Stiff glacial clay	0.37	0.6	22	1.70	2.07	106	129
9. Soft slightly organic clay	0.66	1.9	70	0.93	1.58	58	98
10. Soft very organic clay	0.75	3.0	110	0.68	1.43	43	89
11. Soft montmorillonitic clay (calcium bentonite)	0.84	5.2	194	0.43	1.27	27	80

[a] w = water content when saturated, in per cent of dry weight.
[b] γ_d = dry unit weight.
[c] γ_{sat} = saturated unit weight.

TABLE 4.4 Specific yields in percent

Material	Specific Yield Maximum	Minimum	Average
Clay	5	0	2
Sandy clay	12	3	7
Silt	19	3	18
Fine sand	28	10	21
Medium sand	32	15	26
Coarse sand	35	20	27
Gravelly sand	35	20	25
Fine gravel	35	21	25
Medium gravel	26	13	23
Coarse gravel	26	12	22

Source: Johnson (1967).

Table 2.4 Range of Values of Porosity

	n(%)
Unconsolidated deposits	
Gravel	25–40
most similar → Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

$30 + \frac{\left(\frac{25+50}{2}\right)}{2} = 34\%$

TABLE 2-1 Some Typical Values for Different Densities of Some Common Soil Materials*

Soil Type	Density (Mg/m³) ρ_{sat}	ρ_d	ρ'
Sands and gravels	1.9–2.4	1.5–2.3	1.0–1.3
Silts and clays	1.4–2.1	0.6–1.8	0.4–1.1
Glacial tills	2.1–2.4	1.7–2.3	1.1–1.4
Crushed rock	1.9–2.2	1.5–2.0	0.9–1.2
Peats	1.0–1.1	0.1–0.3	0.0–0.1
Organic silts and clays	1.3–1.8	0.5–1.5	0.3–0.8

*Modified after Hansbo (1975).

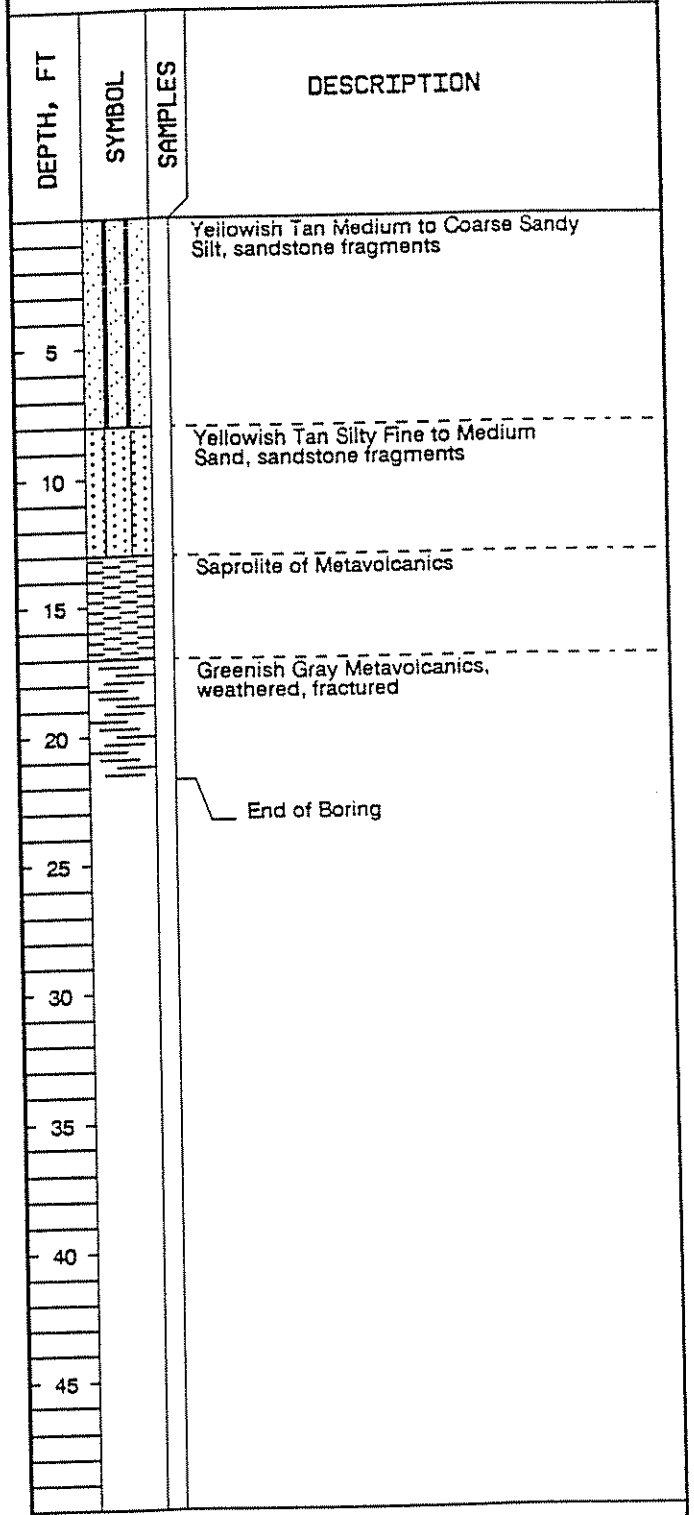
Coefficient of Permeability of Various Soils

k (cm/sec)	Drainage	Soil Type	Determination of k				
10^2	Good	Clean gravels	Pumping tests. Reliable if properly conducted	Constant head permeameter-reliable	Falling-head permeameter	Reliable	Computation from grain size
10^1	Good	Clean gravels					
1.0	Good	Clean sands					
10^{-1}	Good	Clean sand and gravel mixtures					
10^{-2}	Good						
10^{-3}	Good						
10^{-4}	Good						
10^{-5}	Poor	Very fine sands				Unstable. Much experience required	
10^{-6}	Poor	Organic and inorganic silts, mixtures of sand silt and clay, glacial till, stratified clay deposits.					
10^{-7}	Practically impervious	Impervious soils, for example, homogeneous clays below zone of weathering.				Fairly reliable	Computation from consolidation data (reliable)
10^{-8}							
10^{-9}							

After Casagrande and Fadum (1940).

MONITORING WELL NO. 5

PROJECT: Granville County Landfill
Butner, North Carolina
LOCATION: see Landfill Plans



COMPLETION DEPTH: 21.7 ft DATE: 4-18-94
DEPTH TO WATER: 13 ft while drilling, 10.7 ft after 24 hours

GAI CONSULTANTS

GAI CONSULTANTS

GAI Consultants – NC, Inc.

3812-H Tarheel Drive
Raleigh, NC 27609
919/878-4478
FAX 919/878-4032

February 26, 1996

Mr. Bobby Lutfy
State of North Carolina
Department of Environment, Health, and
Natural Resources
Division of Solid Waste Management
Post Office Box 27687
Raleigh, North Carolina 27611-7687

Re: Responses to Review Comments
Granville County - Butner Landfill, Permit #39-02
Butner, North Carolina
Project No. 94108.02

Dear Mr. Lutfy:

Responses are made herein to your comments on February 15, 1996 pertaining to the transition plan for the Granville County - Butner Landfill, Permit #39-02. You requested a re-evaluation of the effective porosities for Groundwater Monitoring Wells (Wells) 1R, 4, 5, and 6 and a recalculation of groundwater velocity in Well 5.

A subsequent phone conversation with you resolved questions pertaining to the effective porosities for Wells 1R, 4, and 5. Static water levels were compared to the soil/rock interval of the well screen for Wells 1R, 4, 5, and 6. An effective porosity of 7.5% and a groundwater velocity of 12 ft/yr for Well 6 were recomputed considering average water levels. Hydrologic properties for the monitoring wells are in Table 1, which includes the recomputed groundwater velocity for Well 5.

We trust this meets with your approval and look forward to completion of the transition plan.

Respectfully submitted,
GAI Consultants - NC, Inc.

Cheryl L. Marks
Geologist

Wendell W. Parker, Ph.D., P.E.
Vice President

Copy to: Mr Wayne Sullivan, Municipal Engineering Services Company, P.A.

Feb. 26, 1996

TABLE 1
HYDROLOGIC PROPERTIES FOR MONITORING WELLS
GRANVILLE COUNTY - BUTNER LANDFILL

Monitoring Well	Permeability (cm/sec)	Total Porosity (%)	Effective Porosity (%)	Groundwater Flow Rate and Direction (ft/yr)
1R	1.7×10^{-5}	30	1	96 S 30°E
2R	6.7×10^{-5}	40	5	50 S 13°E
3R	1.7×10^{-5}	30	1	92 S 12°E
4	1.6×10^{-6}	20	1	3 S 22°W
5	1.4×10^{-5}	34	18	1.5 S 23°W
6	1.4×10^{-5}	30	7.5	12 S 7°E

Notes: 1. Where monitoring wells are in soil and rock, groundwater flow through soil is considered to control. Effective porosity is estimated for the rock based on visual observations during well installation.

2. Table prepared for April 28, 1995, Responses to Review Comments - Addendum A, Water Quality Monitoring System Modifications (June 23, 1994).

GSI CONSULTANTS

GROUND AND SURFACE WATER SAMPLING AND ANALYSIS PLAN

FOR INCLUSION IN

EXISTING MUNICIPAL SANITARY LANDFILL TRANSITIONS PLANS
NORTH CAROLINA

NOVEMBER 1995

GROUND AND SURFACE WATER SAMPLING AND ANALYSIS PLAN

INTRODUCTION

The objective of the ground and surface water sampling and analysis plan is to provide clear guidelines and procedures to be followed by field and laboratory personnel when obtaining and testing ground and surface water samples.

The goal of the sampling plan is to obtain the desired sample while neither adding nor subtracting any constituent to or from the sample or the monitoring well. The plan details described below, when followed, are considered adequate to eliminate any cross-contamination or contamination from external sources of the wells sampled. These guidelines are drawn, in part, directly from and are intended to be used in conjunction with the N.C. Water Quality Monitoring Guidance Document for Solid Waste Facilities (Guidance Document); a copy is in Appendix A.

The goal of the analysis plan is to test and detect, if present, selected chemical constituents (Appendix I constituents) in the ground and surface water. Testing will be conducted to the desired detection levels with accuracy and precision under controlled sampling and testing procedures such that chemical constituents not present are neither added to the water nor detected.

SAMPLING EQUIPMENT

Groundwater samples will be obtained in the field using a dedicated, laboratory-cleaned, stainless steel bailer. Each bailer will be cleaned in a laboratory controlled environment prior to sampling in accordance with the following steps.

1. Completely disassemble bailer.
2. Phosphate-free, laboratory grade soap and distilled water wash.
3. Distilled water rinse.
4. Isopropyl alcohol rinse.
5. Distilled water rinse.
6. Air dry.
7. Wrap bailer in aluminum foil, shiny side out.
8. Wrap bailer in plastic.

In addition to laboratory cleaned bailers for each well sampled, standard equipment necessary to conduct the sampling includes sample containers, including trip blanks and equipment blanks, wide-mouth container, at least two 600-ft spools of ¼-inch nylon rope, at least two boxes of latex gloves, one box of large plastic bags, temperature indicator, pH indicator, conductivity indicator, water level indicator, storage coolers, and ice. In case of emergency, supplies to clean bailers as described above may also be brought to the site. If the total depth of all

wells to be sampled exceeds 1200 feet, additional spools of rope will be obtained to complete the sampling. If the number of wells to be sampled exceeds one third of the number of pairs of gloves in stock, additional boxes of gloves will be obtained.

The bailers, wrapped in foil and plastic, will be transported between pieces of peaked foam rubber to prevent damage to the wrappings. Other equipment subject to damage and contamination will be transported in sealed, plastic bags. The water level indicator will be cleaned in accordance with Steps 2 and 3 described above prior to placement in a clean plastic bag.

SAMPLE CONTAINERS

Various sample containers are required for a complete sampling and analysis effort. Routine groundwater and surface water monitoring may include the following:

- Volatile organic analysis (VOA),
- Total organic halogens (TOX), and
- Inorganic analysis, such as heavy metals or general chemistry.

Samples will be collected for the various analyses in the containers described below in the order listed.

Samples to be analyzed for VOA and/or TOX will be collected first in four 40-ml glass vials with teflon caps. The sample vials will be completely filled with no air left in the vials.

Samples to be analyzed for inorganic contamination will be collected next in two 1-quart/1-liter plastic containers.

Samples to be analyzed for complete organics, including acid-base neutrals, will be collected in a ½-gallon/2-liter glass jar with aluminum foil or teflon-lined caps.

Samples to be analyzed for radiologic parameters will be collected next in 1-gallon/4-liter plastic containers.

Samples to be analyzed for bacteriological parameters will be collected in one 120-ml plastic vial.

All sample containers will be obtained from an independent laboratory in a sterilized condition. Some of the containers will have a premeasured amount of preservative in them as necessary. In this event, care will be taken not to rinse the container or allow the preservative to wash out during sampling.

GROUNDWATER SAMPLING

Preparation. Sampling a groundwater monitoring well begins with unlocking and opening the locking cap and removing the PVC well cap. The depth to water will be determined using the water level indicator. Before storage and/or reuse, the water level indicator will be cleaned in accordance with Steps 2 and 3 described above and replaced in a clean plastic bag.

The total well depth read from the well tag and the measured depth to water will be used to compute the depth of water in the well. The total well depth will be measured and compared to the depth indicated on the well tag as a check for siltation or blockage at depth. Using the chart in the Guidance Document, the volume of water in the well will be determined. For example, if a two-inch well is 29 feet deep and has a measured depth to water of 10 feet, there are 19 feet of standing water or 3.3 gallons in the well. Each well will be purged three to five well volumes (quantity of water in the well), or until dry, prior to sampling. In the example, 10 gallons would be adequate. Purged water will be measured in 5-gallon buckets until the desired amount is purged. Care will be taken not to bring the bailer into contact with the bucket during purging.

Based on the number of wells to be sampled and their proximity to each other, all the wells may be purged one after another with sampling to follow. In this manner, if a well is purged dry, it will have time to recharge prior to sampling.

Purging. After the amount of water to be purged from a well is determined, the equipment necessary for purging will be assembled at the well including rope, 5-gallon bucket, bailer, and gloves. With the wrapped bailer maintained in a stable, upright position, the top portion of aluminum foil will be pulled away exposing only the eyelet used for securing the rope to the bailer. After the rope has been secured to the bailer with gloved hands, the bailer will be suspended as the aluminum foil and plastic are removed. The gloved hand used to remove the aluminum foil and plastic will be considered contaminated and may not come into contact with the bailer or rope. The bailer will be lowered slowly into the well using the uncontaminated, gloved hand that suspended the bailer until the bailer contacts the water. The rope will be cut to an adequate length and secured to prevent losing the bailer in the well. The gloves will be discarded and a new pair used during the purging.

In order not to allow the rope to touch the ground during purging, the rope will be gathered when raising the bailer either by gathering in loops in one hand or by the wind mill method. The wind mill method requires hooking the rope with alternating thumbs as the rope is pulled from the well. When purging deep wells, the ground around the well head may be covered with a clean plastic bag or sheet of plastic with a slit cut to allow the plastic to slide over the well head. The plastic will be placed over the sampler's boots to allow the rope to fall on the plastic without contamination. Alternatively, the rope may be lowered into an open bag placed in a 5-gallon bucket beside the well head. In any case, the rope will not contact anything considered contaminated including ground, boots, dirtied plastic, etc.

If purging and sampling of a well is performed at separate times, the bailer will be left suspended in the well above the water table and the rope secured. The remaining rope will be doubled and grasped in a tight loop in one hand. With the free hand, the glove on the hand holding the rope will be removed by pulling away from the hand and over the rope in an inside-out position until rope is encased in the glove. The rope will be transferred to the opposite hand and the procedure repeated to cover any portion of rope remaining uncovered. The glove-encased rope will be set on top of the well head until time to sample. Alternatively, the rope remaining after securing may be gathered in a tight loop and pushed into the 2-inch PVC well pipe and left. If sampling immediately follows purging, new gloves will not be necessary.

Equipment Blank. Prior to sampling the wells, an equipment blank will be prepared using a representative bailer. This procedure entails removing the top and bottom portions of the aluminum foil while sustaining the bailer in one hand, removing the lid of the bailer and filling with distilled water, and replacing the lid. The distilled water is then dispensed through the small holes at the top of the bailer into the appropriately labeled equipment blank containers.

Sampling. Prior to sampling the well, the necessary equipment will be assembled at the well, including pH, conductivity, and temperature indicators, sampling jars, a thoroughly cleansed wide mouthed container, and a box of latex gloves.

With gloves on, the bailer will be lowered into the well slowly. To avoid releasing any volatiles from the groundwater, care will be exercised while the bailer is lowered so that it does not splash or smack the water surface. Once full, the bailer will be retrieved and containers filled in the order described above. The containers will be filled by inverting the bailer until water issues from the small holes at the top of the bailer. In addition to collecting the samples, water will be collected in the wide-mouth container for pH, temperature, and conductivity measurements. The pH, temperature, and conductivity indicators and wide-mouth container will be rinsed with

distilled water after sampling each monitoring well and will be cleaned in accordance with Steps 2 through 5 above at the completion of the project.

Following completion of the sampling, the containers, including the equipment blank and trip blank, will be stored and transported on ice. The used latex gloves and rope will be discarded.

SURFACE WATER SAMPLING

Surface water samples will be obtained from adjacent rivers, streams, or brooks upstream and downstream of the landfill at designated surface water sampling sites. Actual collection points for surface water sampling will be selected with consideration given to minimal turbulence and aeration.

Surface water sample containers will be handled with one hand near the base. The container will be rinsed with the water to be sampled prior to filling the container unless the container contains a premeasured amount of preservative. When collecting surface water samples, sample containers will be dipped at location points with extreme caution in order to avoid contamination at the mouth of the container. The container will be pushed rapidly into the water to a depth of about six inches, mouth down, and tilted towards the stream current to fill. Care will be taken not to let the mouth of the container breech the surface while filling. If there is little current movement, the container will be moved slowly through the water laterally. During times of drought, if the water is not deep enough to allow submersion of the container, a pool may be scooped out of the bottom of the stream to obtain a sample. The pool will be allowed to clear before sampling. The container will be lifted from the water and sealed with the cap, leaving an airspace at the top of about ½ inch. Glass vial containers collected for VOA and TOX analyses will be filled completely as described above. The samples will be stored and transported on ice.

SAMPLE TRANSPORT AND CHAIN-OF-CUSTODY

Sample containers will be clearly labeled as the samples are obtained and stored on ice along with the equipment blanks and trip blanks. Trip blanks will remain in the condition they are received from the laboratory and will not be opened or tampered with during the sampling. A chain-of-custody record will be completed for each day's samples, indicating the date and time, sample location, sample matrix (soil, water, etc.), and laboratory analyses to be conducted. In addition, a field sampling data sheet will be completed indicating the depth to water measured in each well sampled and the pH, temperature, and specific conductivity of the sample measured in the field. Sample copies of the chain-of-custody record and field sampling data sheet are in Appendix B.

GROUND AND SURFACE WATER ANALYSIS

Water samples obtained in the field will be maintained in the sample containers on ice and transported to an approved laboratory for analysis. If the individual transporting the samples is different from the individual that did the sampling, the chain of custody forms will be used to document the transfer of custody from the water sampler to the water transporter. When the water samples reach the laboratory, they will be transferred to a sample custodian who will sign the chain of custody documentation for receipt of the samples. Internal control of the water samples in the laboratory will be in accordance with QA/QC procedures for the laboratory. Copies of QA/QC manuals for approved laboratories are on file with the Division of Solid Waste.

Ground and surface water samples will be analyzed for Subtitle D Appendix I constituents. Table 1 contains a list of the Appendix I constituents as well as a list of EPA methods to be utilized in detection of the constituents. References where these test methods are documented are also presented in Table 1. In addition, practical quantitation limits for each of the constituents and a list of the equipment that will be used in the laboratory testing are presented in Table 1. QA/QC procedures utilized during the testing will be in conformance with the laboratory QA/QC manual.

TABLE

TABLE 1
GROUND AND SURFACE WATER ANALYSES METHODOLOGY

Inorganic Constituent	Test Method	Equipment	POL, µg/L
Antimony	EPA[1] 7041	GF/AA	30
Arsenic	EPA 7060A	GF/AA	10
Barium	EPA 6010A	ICP	500
Beryllium	EPA 7091	GF/AA	2
Cadmium	EPA 7131A	GF/AA	1
Chromium	EPA 7191	GF/AA	10
Cobalt	EPA 7201	GF/AA	10
Copper	EPA 6010A	ICP	200
Lead	EPA 7421	GF/AA	10
Nickel	EPA 6010A	ICP	50
Selenium	EPA 7740	GF/AA	20
Silver	EPA 7761	GF/AA	10
Thallium	EPA 7841	GF/AA	10
Vanadium	EPA 7911	GF/AA	40
Zinc	EPA 6010A	ICP	50
Organic Constituent			
Acetone	EPA 8260	GC/MS	100
Acrylonitrile	EPA 8260	GC/MS	200
Benzene	EPA 8260	GC/MS	5
Bromochloromethane	EPA 8260	GC/MS	5
Bromodichloromethane	EPA 8260	GC/MS	5
Bromoform	EPA 8260	GC/MS	5
Carbon disulfide	EPA 8260	GC/MS	100
Carbon tetrachloride	EPA 8260	GC/MS	10
Chlorobenzene	EPA 8260	GC/MS	5
Chloroethane	EPA 8260	GC/MS	10
Chloroform	EPA 8260	GC/MS	5
Dibromochloromethane	EPA 8260	GC/MS	5
1,2-Dibromo-3-chloropropane	EPA 8260	GC/MS	25

TABLE 1
(continued)

Organic Constituent	Test Method	Equipment	PQL, µg/L
1,2-Dibromoethane (Ethylene dibromide)	EPA 8260	GC/MS	5
1,2-Dichlorobenzene	EPA 8260	GC/MS	5
1,4-Dichlorobenzene	EPA 8260	GC/MS	5
trans-1,4-Dichloro-2-butene	EPA 8260	GC/MS	100
1,1-Dichloroethane	EPA 8260	GC/MS	5
1,2-Dichloroethane	EPA 8260	GC/MS	5
1,1-Dichloroethylene	EPA 8260	GC/MS	5
cis-1,2-Dichloroethylene	EPA 8260	GC/MS	5
trans-1,2-Dichloroethylene	EPA 8260	GC/MS	5
1,2-Dichloropropane	EPA 8260	GC/MS	5
cis-1,3-Dichloropropene	EPA 8260	GC/MS	10
trans-1,3-Dichloropropene	EPA 8260	GC/MS	10
Ethylbenzene	EPA 8260	GC/MS	5
2-Hexanone	EPA 8260	GC/MS	50
Methyl bromide	EPA 8260	GC/MS	10
Methyl chloride	EPA 8260	GC/MS	10
Methylene bromide	EPA 8260	GC/MS	10
Methylene chloride	EPA 8260	GC/MS	10
Methyl ethyl ketone	EPA 8260	GC/MS	100
Methyl iodide	EPA 8260	GC/MS	10
4-Methyl-2-pentanone	EPA 8260	GC/MS	100
Styrene	EPA 8260	GC/MS	10
1,1,1,2-Tetrachloroethane	EPA 8260	GC/MS	5
1,1,2,2-Tetrachloroethane	EPA 8260	GC/MS	5
Tetrachloroethylene	EPA 8260	GC/MS	5
Toluene	EPA 8260	GC/MS	5
1,1,1-Trichloroethane	EPA 8260	GC/MS	5
1,1,2-Trichloroethane	EPA 8260	GC/MS	5
Trichloroethylene	EPA 8260	GC/MS	5
Trichlorofluoromethane	EPA 8260	GC/MS	5

TABLE 1
(continued)

Organic Constituent	Test Method	Equipment	POL, µg/L
1,2,3-Trichloropropane	EPA 8260	GC/MS	15
Vinyl acetate	EPA 8260	GC/MS	50
Vinyl chloride (Chloroethylene)	EPA 8260	GC/MS	10
Xylenes	EPA 8260	GC/MS	5

Legend

PQL	Practical Quantitation Limit
ICP	Inductively Coupled Plasma - Atomic Emission Spectrophotometer
GF/AA	Graphite Furnace - Atomic Absorption Spectrophotometer
GC/MS	Gas Chromatograph - Mass Spectrometer

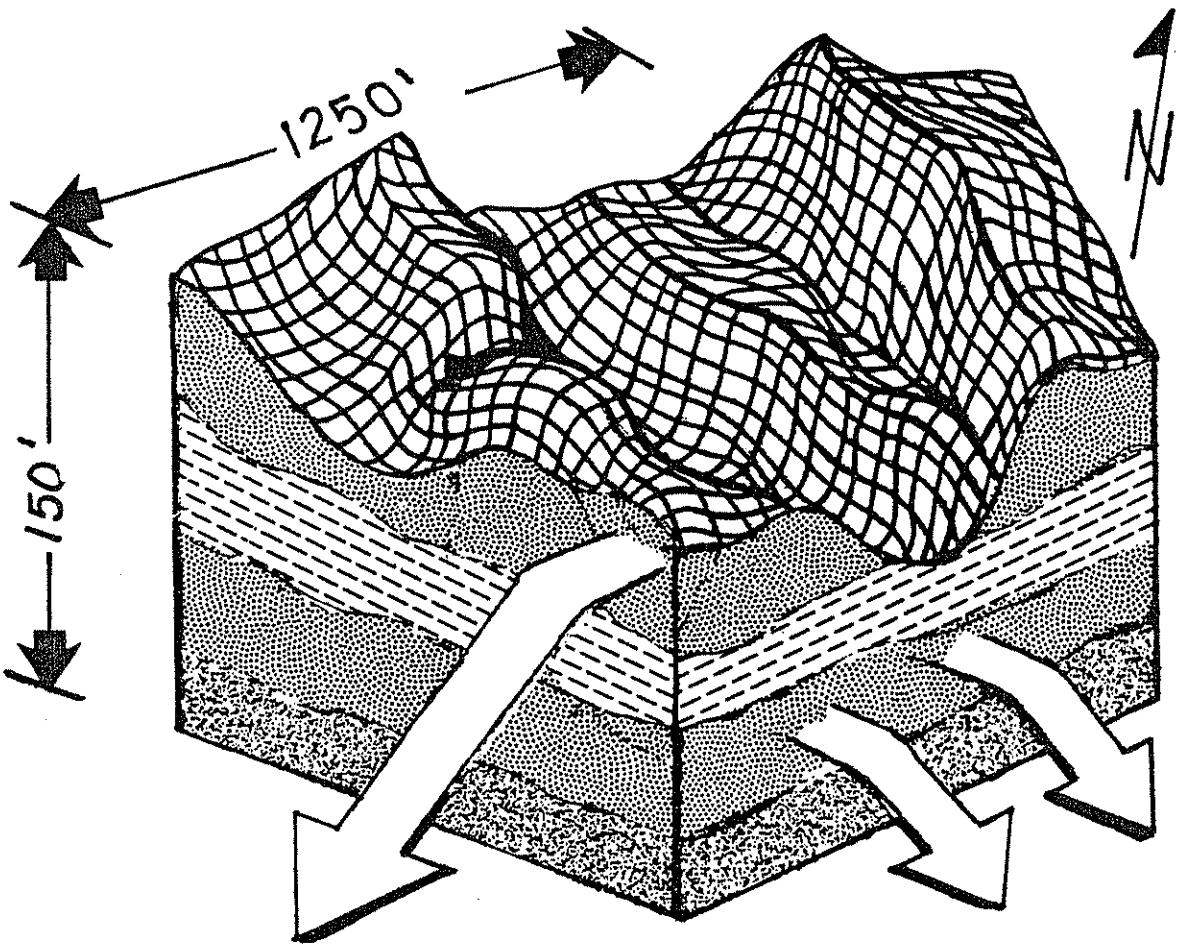
Note:

1. EPA Test Methods from "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. EPA Publication SW-846, 3rd Edition, September 1986, Amended by Update I, July 1992. Update I methods are designated with the letter "A" on the end of the method numbers. Update I was promulgated by 58 FR, August 31, 1993.

APPENDIX A

N.C. WATER QUALITY MONITORING GUIDANCE DOCUMENT

NORTH CAROLINA WATER QUALITY
MONITORING GUIDANCE DOCUMENT FOR SOLID WASTE FACILITIES



GROUND-WATER FLOW
DIRECTION OF UPPER
AQUIFER

GROUND-WATER FLOW
DIRECTION OF LOWER
AQUIFER

Prepared by the
SOLID & HAZARDOUS WASTE MANAGEMENT BRANCH
ENVIRONMENTAL HEALTH SECTION
DIVISION of HEALTH SERVICES
DEPARTMENT of HUMAN RESOURCES
1987
SW-1001-87

NORTH CAROLINA WATER QUALITY
MONITORING GUIDANCE DOCUMENT FOR SOLID WASTE FACILITIES

Prepared by the
SOLID & HAZARDOUS WASTE MANAGEMENT BRANCH
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DEPARTMENT of HUMAN RESOURCES

1987

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--ACKNOWLEDGEMENTS--

The following individuals are acknowledged for their constructive suggestions and input regarding this document: Gary Babb, Bob Glaser, and Paula Byrd. Additionally, the comments and feedback from Nathaniel Wilson and Ray Porter are also greatfully acknowledged. Last but not least, the assistance of Michelle Johnson and Lynelle Parrish in preparing the draft is warmly appreciated.

Michael L. Babuin, 1987

DEFINITIONS

Monitoring Well - any well constructed for the primary or incidental purpose of obtaining subsurface samples of water or other liquids. This definition excludes lysimeters, tensiometers, and other devices used to investigate the characteristics of the unsaturated zone.

Observation Well - any well constructed for the purpose of obtaining ground-water level information only

Permittee - an individual, corporation, company, association, partnership, unit of local government, State agency, Federal agency or other legal entity upon which a permit to operate a sanitary landfill has been issued.

Water Table - the upper limit of the portion of the ground wholly saturated with water.

GENERAL INTRODUCTION

The purpose of this report is to provide a simple, clear and thorough overview of acceptable methods regarding ground and surface-water monitoring at solid waste facilities. The procedures and techniques outlined in this report have been compiled in response to the need for reliable, accurate and consistent data for ground-water and surface-water quality evaluation of sanitary landfills. The standardization of these methods of data collection will undoubtedly clarify proper ground-water monitoring techniques required by the State for all solid waste facilities, and subsequently, minimize much of the subjectivity associated with landfill evaluation. Clearly, it is in the best interests of each facility to utilize these guidelines whereas the probability of contamination is significantly reduced by following the steps outlined in this document.

INTRODUCTION

In order to fully acknowledge the scope and purpose of ground-water monitoring, it is of the utmost importance to fully understand and define the difference between a ground-water monitoring well and a public water supply well. This distinction is very obvious when comparing well construction techniques characteristic of various geologic formations throughout the State. For instance, the western part of North Carolina is dominated by a series of crystalline and metamorfic rocks. Subsequently, water supply wells in these regions typically are constructed by drilling through the saprolite (weathered rock) and into very hard, resistant rock bodies below the true water table. Because of the resistant lithologic character of these units, many well drillers feel that it is unnecessary to case a well characteristic of these type of conditions. This rationale may hold true for drinking water supply wells but is clearly unacceptable for ground-water monitoring purposes due to contamination problems associated with uncased or partially-cased holes and to possible logistic problems. For instance, monitoring equipment may become entangled on the bottom of a well casing which does not span the entire depth of the borehole. Subsequently, this office requires completely cased boreholes in all ground-water monitoring wells.

This office strongly urges all contractors and consultants to become familiar with well construction techniques and specifications illustrated on the ground-water monitoring well schematic (Figure 1). Further information regarding construction standards of other types of wells may be found in 15 NCAC 2C "Well Construction Standards: Criteria and Standards Applicable to Water Supply and Certain Other Types of Wells".

A. Specific Monitoring Well Construction Requirements

Because the location of ground-water monitoring wells at the proposed landfill is one of the most crucial phases of site development, the importance of a thorough hydrogeologic evaluation which clearly delineates ground water elevation and flow characteristics is of the highest significance. In order to assure consistent and thorough installation techniques which are in accordance with EPA regulations, all deviations to the following methods, or questions regarding materials, monitoring well locations or other techniques, should be directed to the Solid Waste Hydrogeologist at (919) 733-2178, c/o the Solid and Hazardous Waste Management Branch P.O. Box 2091 Raleigh, North Carolina 27602-2091. Additionally, the Solid and Hazardous Waste Management Branch reserves the right to evaluate in the field, the actual well installation techniques and procedures.

Drilling through the unsaturated soil mantle to the water bearing formation is a standard procedure with most consulting and well-drilling firms. Utmost caution and discretion in minimizing the use of drilling fluids (bentonite-gel mixture), flocculants (mixtures of sodium pyrophosphate) and excessive use of lubricants is highly recommended. If any of these products, or related products, are used in the drilling process the hole should be flushed to remove as much of the contaminants as possible.

Installation of the monitoring well and subsequent placement of the well screen is critical to assure that the ground water sample represents the

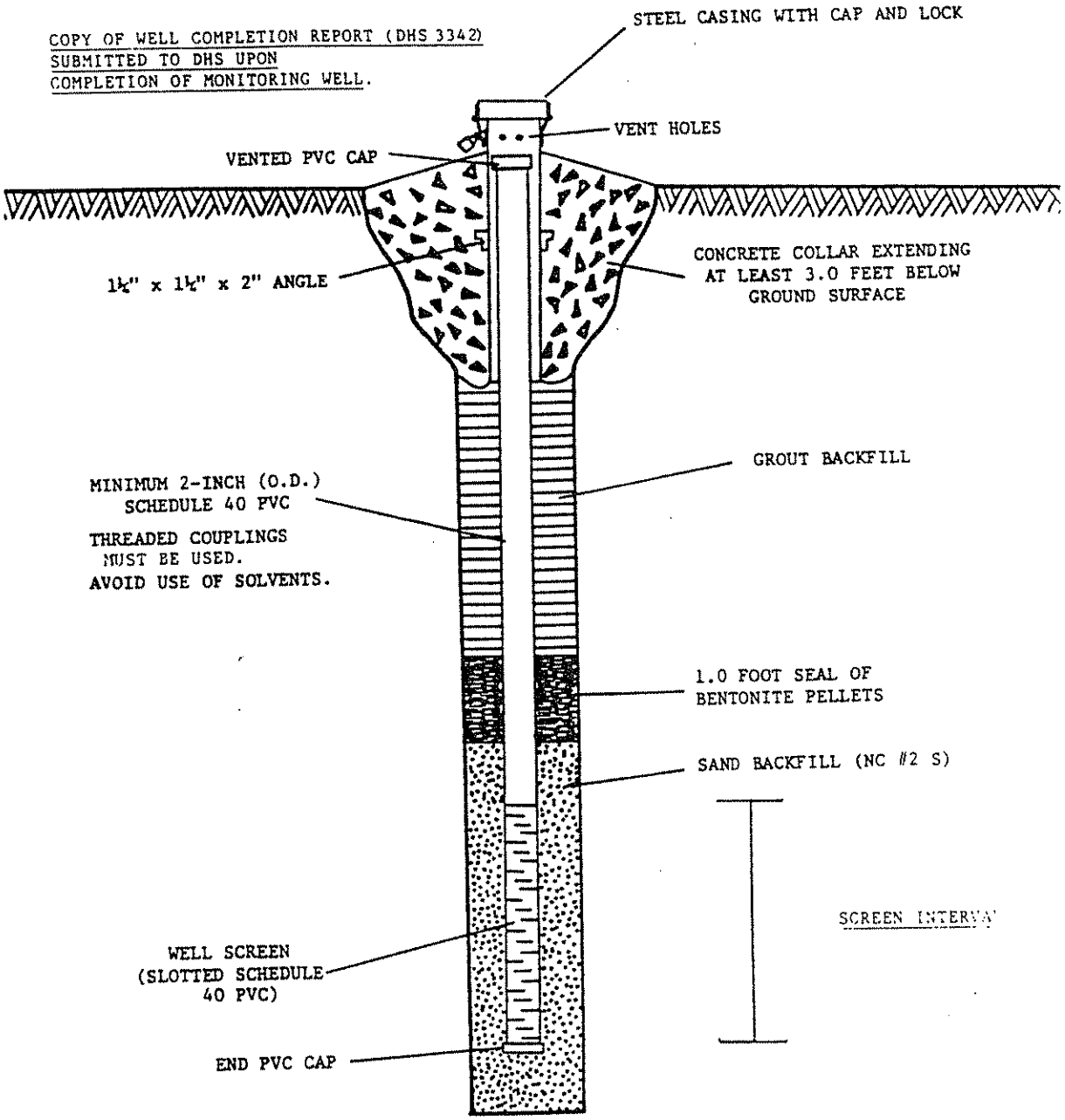

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Figure 1. Typical ground-water monitoring well schematic diagram.

portion of the aquifer where contaminants may migrate. The minimum length of the screened interval is 10 feet and will be placed at a depth specified as a condition of the permit based upon hydrogeologic data collected during the site investigation. Recommended screen depths will be submitted by the applicant under the heading "proposed comprehensive ground-water monitoring plan" as part of the site plan application as per section .0504 (1)(G)(iv). Well-sorted sand used as a pre-screening of influent ground water should be washed to remove all fines and prevent clogging of the well screen. Finally, in connecting sections of PVC pipe, clamps or threaded pipe fittings are required whereas various types of epoxy cement and other PVC glues have the potential for contaminating the ground-water reservoirs. For these reasons they are not authorized for construction of ground-water monitoring wells.

Various drilling methods and casing sizes are available for installation of monitoring wells. Generally, the most common size bore holes include those which are drilled with an eight inch hollow-stem auger. The casings which are placed in these holes are typically 4" or 2" I.D., and composed of PVC, stainless steel or teflon materials. For reasons which are discussed later under the "Ground-Water Monitoring" heading, this office recommends the use of 2" I.D. casings for wells drilled 100' or less. Ground-water monitoring wells drilled to depths exceeding 100' such as wells designed to monitor water quality through possible fracture patterns, should be cased with a 4" or 6" I.D. casing to readily promote rapid purging via jet pumps. Casings and screens may be composed of PVC or stainless steel. Teflon casings and screens are relatively maleable and may not hold-up under various conditions.

As mentioned above, this office recommends the installation of 2" I.D. cased wells for shallow and semi-shallow ground-water monitoring purposes. The use of 2" I.D. casings readily promotes rapid purging via teflon bailers. For example, a 2" I.D, cased well drilled 20 feet deep may contain up to approximately 3.3 gallons of standing water. Because three to five times the volume must be purged to avoid contamination (EPA, 1977), it is foreseeable that 9.9 to 16.5 gallons of water must be purged prior to sampling (Figure 2) in the above example. Assuming a purging minimum of 9.9 gallons of water, and also assuming that a 3' long bailer (which holds 1-liter of water) will be used for purging of the wells, it will take approximately 40 bails of water to adequately purge this well. Comparatively, a 4" I.D. cased well drilled to an extremely shallow depth of 16' will contain approximately 10.5 gallons of water, and subsequently, require between 31.5 and 52.5 gallons of purged water. Attempts to purge 52.5 gallons of water with a 1-liter bailer will require 210 bails of water-- which will undoubtly displease the field personnel and more importantly, occupy additional hours of expensive and needless labor as well.

An obvious difference shown on the schematic of a typical ground-water monitoring well (Figure 1), compared to other types of wells, is the concrete collar surrounding the stick-up (or outer casing) above the ground surface. This collar should contain small angle-irons attached to the outer casing as outlined on the diagram (Figure 1). The purpose of this set-up is to prevent accidental (or willfull) damage to the well whereas the stick-up could otherwise be pulled loose at the surface without the use of angle-irons to support the collar.

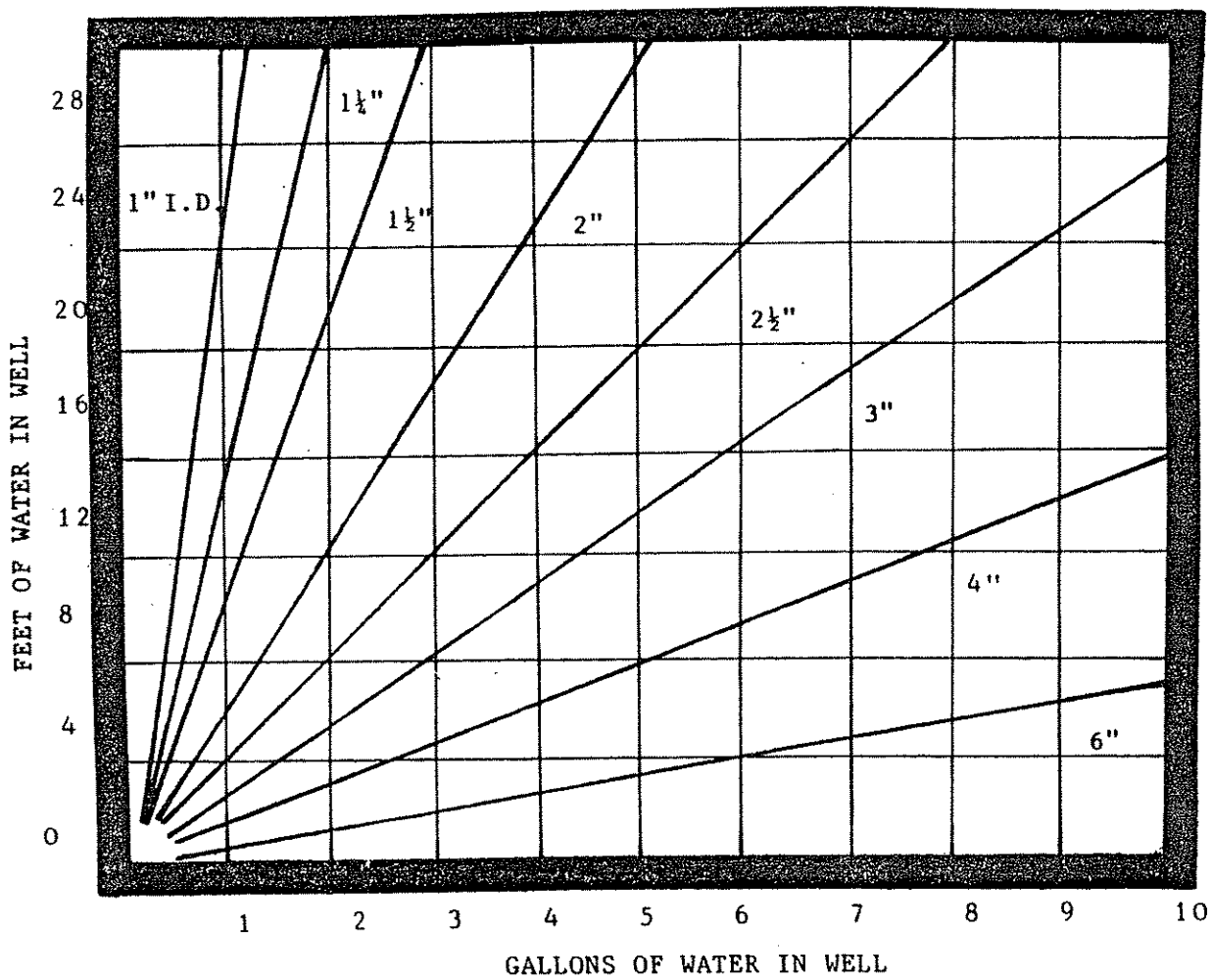

Figure 2. Graphical plot of standing volumes of water.

Because accidental or natural events may influence the status and condition of pre-existing ground-water monitoring wells, an on-going well inspection program is being conducted by personnel of the Solid andHazardous Waste Management Branch. Some of the items which must be regularily maintained by the facility after the wells are installed include: 1) ensuring that all caps are rust-free and locked at all times, 2) ensuring that all inner casings are securely fit with a threaded cap, 3) ensuring that the outer casing is upright and undamaged from equipment or vehicles which may inadvertently back-up into the well, 4) ensuring that a clear unobstructed path, free from dense vegetation exists leading to each well. These maintenance factors are critical to the implementation of proper ground-water monitoring.

B. Ground-Water Monitoring

Because a tremendous liability is associated with water quality data obtained from analytical laboratory results, it is of the utmost importance to ensure the validity and integrity of sampling techniques and methodology. Two distinct monitoring systems exist which may be used to purge and subsequently sample a monitoring well. These systems include the portable monitoring system and the dedicated monitoring system.

Portable Monitoring

The portable monitoring system is by far the most common method of monitoring ground-water quality. This method includes purging the total standing water within the well and subsequent sampling of a representative portion of the aquifer. Purging is required in all instances in order to avoid sampling of stagnant, possibly stratified water above the well screen. In many cases, however, the recharge rate may meet or exceed the purging rate. For these instances three to five times the volume of standing water must be purged prior to sampling. Several methods exist for removing the standing water within a well. Among these methods are various types of automated pumps, compressed air, hand pumps and bailers, each of which has several advantages and disadvantages which will be discussed below.

In some instances dependant upon the hydrogeologic setting, the recharge rate may be exceptionally slow (EPA, 1977), subsequently, sampling may not be possible until the next day when the well is recharged. Generally however, all attempts should be made to purge the wells dry or purge until the necessary three to five times the well volume is extracted. In other settings where the soils are relatively permeable purging and subsequent sampling may be possible in the same day.

1. Purging Methods

Depending upon time constraints and spatial variability of the monitoring wells, the decision whether to purge and sample a facility on the same day must be made by the field personnel performing the monitoring operation. Additional concerns regarding the depth of the well, water volumes, well access and inclement weather are all important in determining which type of device to use in purging the well. For instance, if fully automated, effortless purging is desired and time is not a major concern, the use of an automated pump may be in order. The major disadvantage of

these pumps, however, include slow pumping rates (typically a maximum of 0.5 gallons/minute) and the potential for cross contamination from well to well.

The hand pump is another type of purging device which is available invarious lengths and pumping rates (typically 2.75 gallons/minute). This device has the advantage of easy assembly, low cost and relatively high pumping rates. An obvious disadvantage, however, is the need for a thorough cleaning in the field before purging from one well to the next.

Another popular purging device is the teflon bailer. Teflon is considered to be the preferred material to use for ground water monitoring because of its relatively inert chemical character. Stainless steel is also an acceptable purging/sampling mechanism for similar reasons. Regardless of the composition, bailers are available in various lengths, the most popular being the 3' bailer which holds a volume of water equal to 1 liter or 0.26 gallons.

2. Sampling Methods

Thus far the focus of this discussion has primarily been upon purging techniques, subseqently, a short discussion which addresses sampling procedures is now in order. The use of automated pumps for sampling purposes requires considerable effort to avoid contamination. Many automated pumps are designed to remain on the ground surface while a specified length of flexible tubing is placed into the well. For sampling purposes if this technique is to be used, it is mandatory that the flexible tubing be composed of teflon and adequately cleaned prior to sampling from one well to another. The inevitable question arises, however, whether or not adequate cleaning is possible in the field for these types of automated pumps.

Because laboratory analyses evaluate water quality in terms of parts per million and parts per billion, it is not recommended to clean and prepare sampling devices in the field when a laboratory cleaning will undoubtedly produce a higher quality final product. Other types of automated pumps (called bladder pumps) are designed to fit down the borehole and are typically composed of teflon and stainless steel. One inherent difficulty associated with some bladder pumps in addition to possible sample contamination problems is the inability of many bladder pumps to adequately control and regulate the rate at which the flow of water leaves the flexible tubing. This is critical for samples to be analyzed for volatile organic analysis (VOA) whereas a rapid flow rate will cause aeration which subsequently volatilizes certain chemicals. For these reasons this office urges that the utmost consideration and thought be given to the feasibility of whether or not to utilize traditional automated pumps for sampling purposes.

Hand pumps are useful tools for purging wells in a relatively short period of time but, unfortunately, are highly unsuitable for sampling. The main reason being the likelihood of contamination and the unavailability of teflon or stainless steel hand-pumps in the commercial market. Additionally, no present technology exists for regulating the effluent discharge of water from a hand pump which, as mentioned before, presents a volatilization problem for certain samples.

The overall preferred method of acquiring ground-water samples via portable monitoring is by the use of telfon bailers. In a properly established and equipped laboratory setting, a standardized cleaning and preparation procedure may be followed. The obvious advantage of laboratorycleaning includes minimal generation of contaminants and consistency in preparatory procedures.

Dedicated Monitoring

Thus far the previous discussions have all focused upon techniques and procedures related to portable ground-water monitoring systems. At this time, a short overview of dedicated systems is in order. Dedicated well monitoring differs from portable monitoring primarily by the permanency of the set-up and the higher initial cost. Because portable systems require the use of much of the same equipment from well to well, great care must be exercised in avoiding cross contamination. Dedicated systems, however, require no between-well cleaning procedures. These systems offer permanently affixed down-well and well-head components which are capped after initial set-up.

Because ground water is not in contact with incompatible constituents that otherwise may enter the well from the surface, virtually no contamination is possible from an extrinsic source during times between sampling intervals. As with all sampling methods the competency and integrety of the individual extracting the sample is of the utmost importance. For instance, a great deal of manual dexterity must be exercised in regulating the flow of water leaving the flexible tubing from dedicated systems when collecting VOA samples in order to avoid unnecessary volatilization. In conclusion, dedicated systems have the potential for accurate and reliable ground-water monitoring and are therefore recommended for consideration.

In contrast to this, many individuals are under the false impression that bailers which are initially cleaned in a laboratory and permanently placed in monitoring wells are considered dedicated systems and subsequently are acceptable for ground-water monitoring purposes. Unfortunately, this is not true due to the possibility of extrinsic contamination during sampling intervals, such as decomposition of the bailer line, airborne dirt and dust, or other accidentally induced contaminants. Because the detection limits for the various parameters are measured in terms of parts per million and parts per billion, the utmost discretion is required in selecting sampling procedures which will accomodate these analyses.

1. Equipment Cleaning Procedures

If automatic pumps and flexible tubing are used, a minimum field cleaning procedure will entail using a phosphate-free soap/deionized water solution followed by a deionized water rinse. This method constitutes an absolute minimum field cleaning procedure and should only be used if sampling one G.W. monitoring well. These pumps are not recommended or authorized for sampling more than one well due to probable contamination problems.

Stainless steel bailers require the following minimum cleaning techniques prior to groundwater sample collection:

1. Phosphate-free soap and tap water wash
2. Tap-water rinse
3. Deionized or distilled water rinse
4. Isopropyl alcohol rinse
5. Deionized or distilled water rinse
6. Air dry
7. Wrap bailer to prevent contamination before use (specify the material used for wrapping the bailer, example: aluminum foil shiny side out).

Teflon bailers require the following minimum cleaning techniques prior to ground water sample collection:

1. Phosphate-free soap and tap water wash
2. Tap water rinse
3. 10% nitric or 10% hydrochloric acid rinse
4. Deoinized or distilled water rinse
5. Isopropyl alcohol rinse
6. Deionized or distilled water rinse
7. Air dry
8. Wrap to prevent contamination before use (specify material used for wrapping for wrapping the bailer, example: aluminum foil, shiny side out).

The bailer line which attaches to the teflon or stainless steel bailers should consist of either 1) teflon coated wire, 2) single-strand stainless-steel wire, 3) other monofilament line or 4) nylon rope. In order to avoid contamination, a new segment of one of the above approved types of line should be used at each well. Reusing old line will increase the probability of cross contamination (even if the line is cleaned) and therefore is not approved. Any variation to the above cleaning procedures should be submitted to this office for approval.

Condition

The above cleaning procedures were obtained from EPA Region IV. If changes occur in any procedure specified above, the facility will be notified and be requested to make the necessary ammendments to the sampling and analysis plan.

Sample Containers

Because water samples are analyzed for various parameters, several types of containers are required for a complete sampling scheme. Routine ground-water monitoring should include (in the following order as extracted from the well): 1) VOA samples (for TOX analysis), and 2) heavy metal (inorganic) analysis. If additional analyses are required, the samples should be collected in the order listed below.

For instance, samples which are analyzed for volatile organic analysis (VOA) and/or total organic halogens (TOX) should be collected first in 40 ml glass vials with teflon caps. Two full vials per sample are required.

N. C. Department of Human Resources
Division of Health Services

SAMPLE ANALYSES REQUEST

State Laboratory of Public Health
P. O. Box 28047
306 N. Wilmington Street
Raleigh, 27611

Site Number _____ Field Sample Number _____

Name of Site _____ Site Location _____

Collected By _____ ID# _____ Date Collected _____ Time _____

Type of Sample:

Environmental	Concentrate	Comments
____ Groundwater (1)	____ Solid (5)	_____
____ Surface Water (2)	____ Liquid (6)	_____
____ Soil (3)	____ Sludge (7)	_____
____ Other (4)	____ Other (8)	_____

INORGANIC CHEMISTRY

Extractables		Total			
Parameter	Results mg/l	Parameter	Results mg/l	Parameter	Results mg/l
____ Arsenic	_____	____ Arsenic	_____	____ Silver	_____
____ Barium	_____	____ Barium	_____	____ Sulfates	_____
____ Cadmium	_____	____ Cadmium	_____	____ Zinc	_____
____ Chromium	_____	____ Chloride	_____	____ Ph	_____
____ Lead	_____	____ Chromium	_____	____ Conductivity	_____
____ Mercury	_____	____ Copper	_____	____ TDS	_____
____ Selenium	_____	____ Fluoride	_____	____ TOC	_____
____ Silver	_____	____ Iron	_____	____ _____	_____
____ _____	_____	____ Lead	_____	____ _____	_____
____ _____	_____	____ Manganese	_____	____ _____	_____
____ _____	_____	____ Mercury	_____	____ _____	_____
____ _____	_____	____ Nitrate	_____	____ _____	_____
____ _____	_____	____ Selenium	_____	____ _____	_____

ORGANIC CHEMISTRY

Parameter	Results mg/l	Parameter	Results mg/l	Parameter	Results mg/l
____ P&T:GC/MS	_____	____ EDB	_____	____ Methoxychlor	_____
____ Acid:B/N Ext.	_____	____ PCB's	_____	____ Toxaphene	_____
____ TOX	_____	____ Petroleum	_____	____ 2,4-D	_____
____ _____	_____	____ Endrin	_____	____ 2,4,5-TP (silvex)	_____
____ _____	_____	____ Lindane	_____	____ _____	_____

MICROBIOLOGY

Parameter
____ (MF) Coliform Colonies/100mls
____ (MPN) Coliform Colonies/100mls
____ _____
____ _____

RADIOCHEMISTRY

Parameter	Results PCi/l
____ Gross Alpha	_____
____ Gross Beta	_____
____ _____	_____
____ _____	_____

Date Received _____ Date Reported _____

Date Extracted _____ Date Analyzed _____

Reported By _____ Lab Number _____

DHS 3191 (Revised 7/85)
Solid and Hazardous Waste (Review 7/87)

Figure 3. Laboratory analysis request sheet.

Chain of Custody Record

Solid & Hazardous Waste Materials

Location of Sampling: _____Generator _____Transporter _____Treatment Facility

_____Storage Facility _____Disposal Facility _____Landfill

_____Other: _____

Company's Name _____ Telephone(_____)_____

Address _____

Collector's Name _____ Telephone(_____)_____
signature

Date Sampled _____ Time Sampled _____

Type of Process Generating Waste _____

Field Information

_____

_____

Field Sample No. _____ _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____ _____

Chain of Possession:

1. _____ _____ _____
signature title inclusive dates

2. _____ _____ _____
signature title inclusive dates

3. _____ _____ _____
signature title inclusive dates

Results reported

_____ _____ _____
signature title date

Instuctions: Complete all applicable information including signature, and submit with analysis request forms.

Figure 4. Chain of custody record.

Samples which will be analyzed for inorganic constituents such as heavy metals should be collected following the VOA samples. These samples are collected in small, disposable, 1-quart/1-liter plastic cubes. Two full cubes per sample are required. Depending upon the source of the sample containers, particularly, containers which hold water to be analyzed for heavy metals, some containers may have a pre-measured amount of acid placed in the container to act as a preservative. In these instances do not rinse the sample container prior to use, if uncertain, consult the laboratory where the containers were purchased.

If organic contamination is suspected it may be necessary to undergo a complete organic analysis. In this event, samples which will be analyzed for organics such as an acid-base neutral analysis should be collected in one half gallon/2-liter glass jars with aluminum foil or teflon lined caps. Samples to be tested via acid-base neutral analysis require one full jar of water per sample.

Water samples to be analyzed for radiologic parameters should be collected following acid-base neutral collection. These samples must be collected in the large 1-gallon/4-liter plastic cubes.

Finally, samples which will be analyzed for bacteriological parameters should be collected last in 120ml plastic vials containing a pre-measured amount of sodium thyosulphate. One vial per sample is required to perform the analysis.

Transport and Storage of Samples

Upon completion of water sample collecting all samples will be stored and subsequently transported on ice or in a refrigerated state to the laboratory performing the analyses (APHA, 1985; EPA, 1977). The samples should be stored in such a manner as to inhibit breakage or accidental spills. Unless unusually extraordinary circumstances prevent otherwise, all samples should be delivered to the laboratory on the same day.

Administrative procedures

Samples are to be delivered to a State Certified Drinking Water Laboratory and need to be accompanied by two administrative forms. The first form is a laboratory analysis request sheet (Figure 3). This form stipulates which constituents are to be analyzed for a given sample. The other form is a chain of custody record sheet (Figure 4). This form documents who handled the sample from collection time to lab delivery. These forms (or equivalents) will be submitted to the solid waste hydrogeologist within 15 days of receipt of the analytical results.

Per 10 NCAC 10G section .0601 (a), routine ground-water monitoring shall be the responsibility of the permittee and may be State supervised at the discretion of the Division of Health Services. An exception to this being the initial sampling of newly constructed wells by personnel of the Division of Health Services. Additionally, the State may request "split" or replicate samples from the facility during any of the routine sampling intervals.

Routine ground-water monitoring which encompasses the parameters listed below shall be conducted twice during the first year of operation (for newly-permitted sites) and annually thereafter. Newly-permitted facilities are required to properly install all proposed ground-water monitoring wells and subsequently notify the State within 30 days upon completion, so that the Division of Health Services may schedule a date to initially sample the wells. As mentioned above, subsequent sampling is the responsibility of the facility. All pre-existing (permitted) facilities as of July 1, 1987 are responsible for annual ground-water monitoring activities, and shall forward a copy of the analytical laboratory results within 15 days upon receipt to the solid waste hydrogeologist P.O. Box 2091, Raleigh, North Carolina 27602-2091 c/o the Solid and Hazardous Waste Management Branch.

All facilities (newly-permitted and pre-existing) shall send written notice by July 1, 1987 designating a tentative, annual sampling date for their facility. The purpose of which is to inform State personnel as to a specific date that they may expect the annual water quality results and to accomodate scheduling purposes by State personnel.

The following total inorganic parameters will be included for routine, annual ground-water quality analysis: arsenic, barium, cadmium, chloride,chromium, copper, fluoride, iron, lead, manganese, mercury, nitrate, selenium, silver, sulphates and zinc. The following indicators should be included in all routine, annual ground-water analysis : TOX (total organic halogens), TOC (total organic carbon, TDS (total dissolved solids), BOD (biological oxygen demand), COD (chemical oxygen demand), conductivity and PH. In the event that a contaminant plume is indicated by routine analysis of the monitoring wells, further analysis may be required to adequately assess contaminant migration and extent. Such anaysis may include purge and trap analysis (utilizing the gas chromatograph and mass spectrometer) and acid base-neutral extraction. Finally, a broad level of consistency should be exercised in listing the various quanities of chemical constituents. For instance, units should be PPM (parts per million) or PPB (parts per billion) not both. It is suggested tht parts per million (PPM) be used whenever possible.

C. Surface-Water Monitoring

Sites which contain and/or border small rivers, streams or branches should include within the site plan application, a prospective surface water monitoring plan. This plan will be used to gauge the effect of the landfill upon surficial flow at a given point. A simple procedure for selecting surface-water monitoring sites is to locate a point on the stream where drainage leaves the site. This promulgates detection of contamination through, and possibly downstream, of the site via discharge of surface waters. The sampling points selected should be downstream from any new, old or proposed areas which may be disturbed, including borrow and rubble areas (Babb and Glaser, 1985). An upstream surface water sample should be obtained in order to determine the water quality upstream of the influence of the sanitary landfill.

The following procedure is recommended regarding sample collection of surface water samples. Prior to collecting the sample in the appropriate

container, specific collection points should be determined. Generally, automated or semi-automated samplers or other manual devices accessible from the banks of a stream should be used whenever possible. If logistic or naturally occurring conditions inhibit this method of sample collection, the samples may be obtained manually by wading up-current (and down-stream) of the sample station. The sample should be collected in an area representative of minimal turbulence and aeration (Babb and Glaser, 1985). Because sample containers may be dipped by hand into the stream, extreme caution must be employed in avoiding contamination into the mouth of the container. The following procedures extracted from the "approved RCRA Ground-Water Sampling and Analysis Plan" (Babb and Glaser, 1985) are recommended for extraction and subsequent collection of surface water samples.

1. Hold the bottle near the base with one hand, and with the other, remove the cap.

2. Rinse the sample container with the water to be sampled prior to filling the container. One exception to this is the coliform sample bottle. This bottle may have a pre-measured amount of sodium thyosulphate to neutralize any chlorine present in the water, therefore, this container should not be rinsed prior to sampling.

3. Push the sample container rapidly into the water (mouth down) and tilt-up towards the current to fill. A depth of about six inches is satisfactory. Great care should be taken to avoid breaching the surface while filling the container.

4. During times of little current movement move the container slowly through the water laterally.

5. During times of extreme drought when stream depths are to shallow to allow submersion of the sample container, a pool may be scooped-out of the channel bottom and allowed to clear prior to sampling.

6. Lift the container from the water, and leave one-half inch of air space, and place the uncontaminated cap back-on the container.

7. Place the samples in styrofoam shipping cartons (on ice) for courier transport to the laboratory.

8. A completed Division of Health Services Form 2887 or equivalent (Figure 3) must be submitted along with the samples to the appropriate certified laboratory performing the analysis.

For additional details and further information on how to properly collect, store and transport stream samples, see N.R.C.D. draft on physical and chemical monitoring (in preparation).

D. Fractured Rock Monitoring

Many portions of Western and Central North Carolina are dominated by fractured cystalline rock. These fractures may be expressed on the surface, but more typically, are characteristic of subsurface environments. Areas

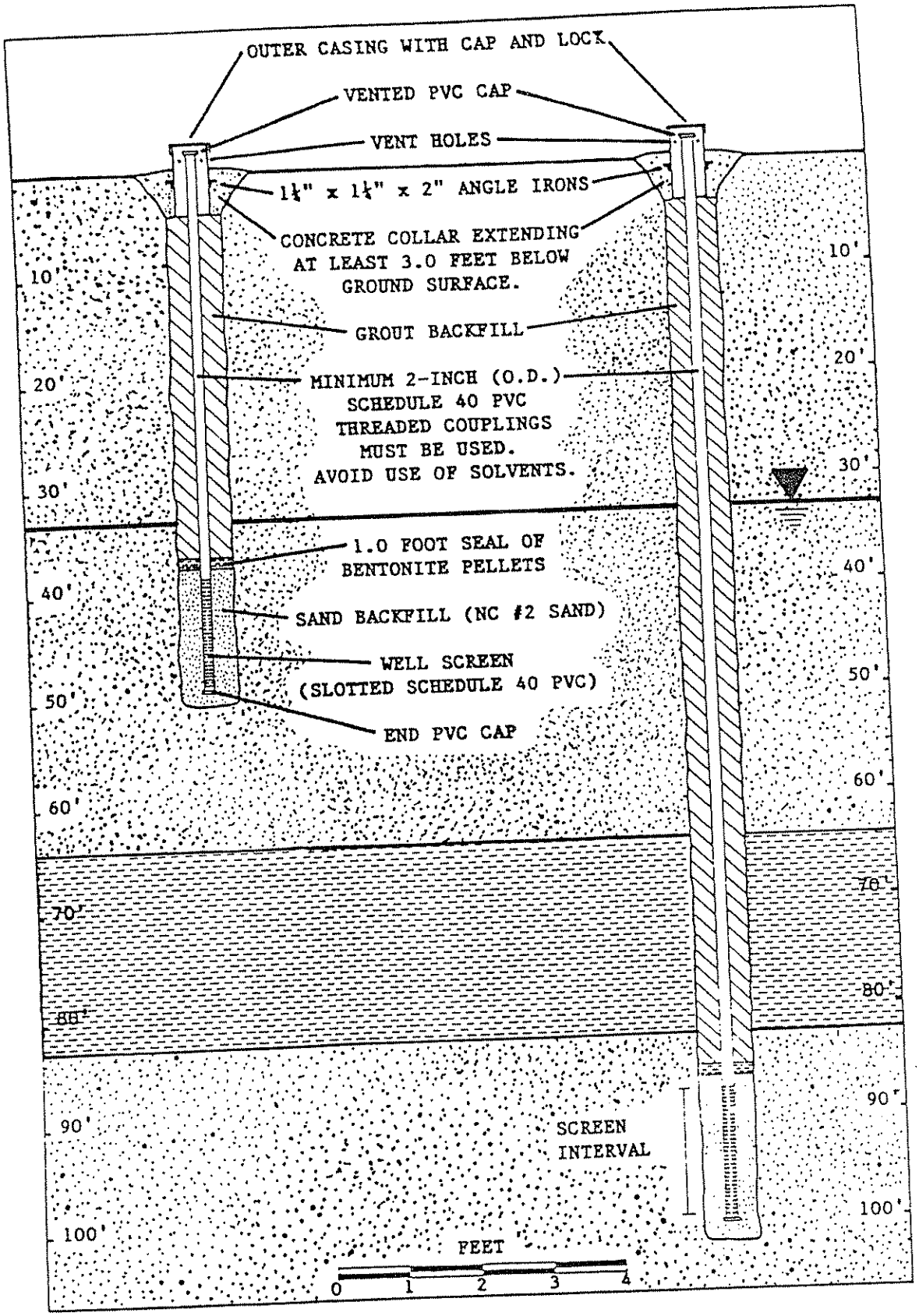

Figure 5. Typical ground-water monitoring well nest schematic.

such as these present inherent technical problems with landfill design and subsequently challenge the effectiveness and integrity of a ground-water monitoring system. The main reason being that fractured rock aquifers offer less predictability and certainty in estimating ground water flow patterns (EPA, 1977).

In order to overcome these difficulties the extent and inclination at depth of these fractures must be ascertained. The most common methods which are available to determine these factors include remote sensing and geophysical surveys. Consultants and engineering firms, may however, specifically utilize and employ these techniques as they see fit in order to adequately address the question of inclination and depth of fracture patterns.

Upon completion of a fracture trace analysis the consulting engineering firm which is responsible for submitting the site plan application will include as part of the proposed ground-water monitoring plan, tentative deep ground-water monitoring well locations at points where fractures intersect and/or at localities characteristic of pronounced lineations which may border or disect the prospective site. As with all proposed well sites, the borehole depths, screen depths and screened intervals will be defined in the report and confirmed with the Division of Health Services prior to drilling. If two aquifers exist beneath a site, a well nest (Figure 5) may be required to adequately assess the migration of potentially contaminanted ground water in both hydrologic regimes..

In most instances, fracture monitoring requires drilling 100 to 200 feet below the surface. This presents a problem for conventional purging methods as described previously in this document. For these wells, a jet pump or equivalent pump which offers a rapid displacement of water will be required for purging. Sampling is performed as described earlier via teflon bailers. A dedicated monitoring system may be used in lui of bailers if depths are not considered a major problem. Consult your industrial representative before purchasing dedicated systems to evaluate the effectiveness of the dedicated device as applied to your specific well requirements.

REFERENCES

American Public Health Association, 1985. Standard Method for the Examination of Water and Waste Water, 13th edition.

Babb, G., and Glaser, R., 1985. An Approved RCRA Groundwater Sampling and Analysis Plan. N.C. Solid & Hazardous Waste Management Branch Technical Report, 7p.

Department of Human Resources, Division of Health Services, 1985. Solid Waste Management Rules (10 NCAC 10G sections .0101-.0707), p. 1-31.

Department Natural Resources and Community Development, 1984. Criteria and Standards Applicable to Injection Wells (15 NCAC 2C sections .0200-.0214), p. 33-56.

Department of Natural Resources and Community Development, 1985. Well Construction Standards: Criterea and Standards Applicable to Water Supply and Certain Other Type Wells (15 NCAC 2C sections .0101-.0119). p.1-29.

Department of Natural Resources and Community Development,1985. Classifications and Water Quality Standards Applicable to the Ground Waters of North Carolina (15 NCAC 2K sections .0101-.0319), p. 1-18.

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Department of Natural Resources and Community Development, 1986. Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina (15 NCAC 2B sections .0201-.0216), p. 7-37.

Department of Natural Resources and Community Development, Division of Environmental Management. Water Quality Section (in preparation). Standard Operating Procedures Manual-Physical and Chemical Monitoring, 165p.

Environmental Protection Agency, 1977. Procedures Manual for Ground-Water Monitoring at Solid Waste Disposal Facilities, 269p.

APPENDIX B

CHAIN OF CUSTODY AND FIELD SAMPLING DATA SHEET

Sampling Field Data Sheet

GSI CONSULTANTS, INC.

PROJECT: _____

SAMPLERS: _____

FIELD DATA SHEET

MONITORING PT. NUMBER	SAMPLE NUMBER	DATE OF COLLECT.	TIME SAMPLED	SAMPLING PARAMETERS					WATER QUALITY PARAMETERS				
				DTH-G.W.	REF. PT.	VOL. PUR.	SAMP. TY.	SAMP.DTH	pH	TEMP.	SP. COND		

COMMENTS

CHAIN OF CUSTODY RECORD

Date: _____

Customer Name _____

Address _____

_____

Person to Contact _____ Telephone _____

Billing Address _____

_____

Sample Collection Information

Sampling Site _____

Project # _____ Sampler _____

Date of Sample Shipment _____ How Shipped _____

SAMPLE LOG AND ANALYSES REQUEST

Turnaround Requirements

_____ Regular

_____ Rush

_____ FAX Results

Sample ID	Containers # and Type	Date	Time	Matrix	Grab / Comp.	Analysis Requested						Remarks

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Condition on Arrival:

Comments _____

_____

Possible Interfering Compounds _____

Requested by _____

APPENDIX D

Laboratory Analytical Report & Chain of Custody
December 2012 Semiannual Sampling Event

Pace Analytical Services, Inc.
205 East Meadow Road - Suite A
Eden, NC 27288
(336)623-8921

Pace Analytical Services, Inc.
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

Pace Analytical Services, Inc.
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

December 27, 2012

Mr. Van Burbach
Joyce Engineering-NC
2211 West Meadowview Rd
Boone Bldg, Suite 101
Greensboro, NC 27407

RE: Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Dear Mr. Burbach:
Enclosed are the analytical results for sample(s) received by the laboratory on December 13, 2012. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Analyses were performed at the Pace Analytical Services location indicated on the sample analyte page for analysis unless otherwise footnoted.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin

kevin.godwin@pacelabs.com
Project Manager

Enclosures

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without the written consent of Pace Analytical Services, Inc..

CERTIFICATIONS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Ormond Beach Certification IDs
8 East Tower Circle, Ormond Beach, FL 32174
Alabama Certification #: 41320
Arizona Certification #: AZ0735
Colorado Certification: FL NELAC Reciprocity
Connecticut Certification #: PH-0216
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maine Certification #: FL01264
Massachusetts Certification #: M-FL1264
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nevada Certification: FL NELAC Reciprocity
New Hampshire Certification #: 2958
New Jersey Certification #: FL765
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
Pace Analytical Services - Ormond certification number E83509
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
Washington Certification #: C955
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

Charlotte Certification IDs
9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
West Virginia Certification #: 357
Virginia/VELAP Certification #: 460221

Asheville Certification IDs
2225 Riverside Dr., Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
West Virginia Certification #: 356
Virginia/VELAP Certification #: 460222

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(336)623-8921

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2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

Pace Analytical Services, Inc.
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SAMPLE SUMMARY

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92141831001	**3902-MW1R**	Water	12/12/12 08:55	12/13/12 14:00
92141831002	**3902-MW2R**	Water	12/12/12 10:35	12/13/12 14:00
92141831003	**3902-MW3R**	Water	12/12/12 10:25	12/13/12 14:00
92141831004	**3902-MW4**	Water	12/12/12 10:10	12/13/12 14:00
92141831005	**3902-MW5**	Water	12/12/12 10:00	12/13/12 14:00
92141831006	**3902-MW6**	Water	12/12/12 09:15	12/13/12 14:00
92141831007	**3902-SW1**	Water	12/12/12 09:45	12/13/12 14:00
92141831008	**3902-SW2**	Water	12/12/12 11:00	12/13/12 14:00

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(704)875-9092

SAMPLE ANALYTE COUNT

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92141831001	**3902-MW1R**	EPA 8081	RES	5	PASI-C
		EPA 8151	LJM	2	PASI-O
		EPA 6010	JMW	16	PASI-A
		EPA 8260	MCK	51	PASI-C
92141831002	**3902-MW2R**	EPA 8081	RES	5	PASI-C
		EPA 8151	LJM	2	PASI-O
		EPA 6010	JMW	16	PASI-A
		EPA 8260	MCK	51	PASI-C
92141831003	**3902-MW3R**	EPA 8081	RES	5	PASI-C
		EPA 8151	LJM	2	PASI-O
		EPA 6010	JMW	16	PASI-A
		EPA 8260	MCK	51	PASI-C
92141831004	**3902-MW4**	EPA 8081	RES	5	PASI-C
		EPA 8151	LJM	2	PASI-O
		EPA 6010	JMW	16	PASI-A
		EPA 8260	MCK	51	PASI-C
92141831005	**3902-MW5**	EPA 8081	RES	5	PASI-C
		EPA 8151	LJM	2	PASI-O
		EPA 6010	JMW	16	PASI-A
		EPA 8260	MCK	51	PASI-C
92141831006	**3902-MW6**	EPA 8081	RES	5	PASI-C
		EPA 8151	LJM	2	PASI-O
		EPA 6010	JMW	16	PASI-A
		EPA 8260	MCK	51	PASI-C
92141831007	**3902-SW1**	EPA 6010	JMW	15	PASI-A
		EPA 8260	MCK	51	PASI-C
92141831008	**3902-SW2**	EPA 6010	JMW	15	PASI-A
		EPA 8260	MCK	51	PASI-C

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(704)875-9092

HITS ONLY

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92141831002	**3902-MW2R**					
EPA 6010	Barium	113	ug/L	100	12/19/12 18:33	
EPA 6010	Chromium	5.2J	ug/L	10.0	12/19/12 18:33	
EPA 6010	Cobalt	11.3	ug/L	10.0	12/19/12 18:33	
EPA 6010	Nickel	91.8	ug/L	50.0	12/19/12 18:33	
EPA 6010	Tin	30.0J	ug/L	100	12/19/12 18:33	
EPA 8260	Benzene	1.6	ug/L	1.0	12/21/12 01:13	
EPA 8260	Chlorobenzene	15.8	ug/L	3.0	12/21/12 01:13	
EPA 8260	1,2-Dichlorobenzene	1.3J	ug/L	5.0	12/21/12 01:13	
EPA 8260	1,4-Dichlorobenzene	2.4	ug/L	1.0	12/21/12 01:13	
EPA 8260	Toluene	0.29J	ug/L	1.0	12/21/12 01:13	
EPA 8260	Xylene (Total)	0.97J	ug/L	5.0	12/21/12 01:13	
92141831003	**3902-MW3R**					
EPA 6010	Barium	64.7J	ug/L	100	12/19/12 20:01	
EPA 6010	Copper	11.6	ug/L	10.0	12/19/12 20:01	
EPA 6010	Nickel	29.2J	ug/L	50.0	12/19/12 20:01	
EPA 6010	Tin	13.2J	ug/L	100	12/19/12 20:01	
EPA 8260	Benzene	0.73J	ug/L	1.0	12/21/12 01:31	
EPA 8260	Chlorobenzene	17.9	ug/L	3.0	12/21/12 01:31	
EPA 8260	1,2-Dichlorobenzene	1.7J	ug/L	5.0	12/21/12 01:31	
EPA 8260	1,4-Dichlorobenzene	1.3	ug/L	1.0	12/21/12 01:31	
92141831004	**3902-MW4**					
EPA 6010	Copper	8.5J	ug/L	10.0	12/19/12 20:05	
EPA 6010	Nickel	9.3J	ug/L	50.0	12/19/12 20:05	
EPA 6010	Vanadium	13.6J	ug/L	25.0	12/19/12 20:05	
EPA 8260	Benzene	0.32J	ug/L	1.0	12/21/12 01:50	
EPA 8260	Chlorobenzene	4.5	ug/L	3.0	12/21/12 01:50	
EPA 8260	1,1-Dichloroethane	0.61J	ug/L	5.0	12/21/12 01:50	
92141831005	**3902-MW5**					
EPA 6010	Barium	73.6J	ug/L	100	12/19/12 20:09	
EPA 6010	Cobalt	113	ug/L	10.0	12/19/12 20:09	
EPA 6010	Copper	10.4	ug/L	10.0	12/19/12 20:09	
EPA 6010	Nickel	21.1J	ug/L	50.0	12/19/12 20:09	
EPA 8260	1,2-Dichloroethane	0.20J	ug/L	1.0	12/21/12 16:05	
EPA 8260	Toluene	0.36J	ug/L	1.0	12/21/12 16:05	
92141831007	**3902-SW1**					
EPA 6010	Barium	45.0J	ug/L	100	12/19/12 20:16	
92141831008	**3902-SW2**					
EPA 6010	Barium	97.8J	ug/L	100	12/19/12 22:29	
EPA 6010	Nickel	13.8J	ug/L	50.0	12/19/12 22:29	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW1R **Lab ID: 92141831001** Collected: 12/12/12 08:55 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8081 Organochlorine Pesticides	Analytical Method: EPA 8081 Preparation Method: EPA 3510								
gamma-BHC (Lindane)	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 21:36	58-89-9	
Endrin aldehyde	ND	ug/L	0.10	0.050	1	12/14/12 15:00	12/18/12 21:36	7421-93-4	
Heptachlor	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 21:36	76-44-8	
Surrogates									
Tetrachloro-m-xylene (S)	61	%	20-130		1	12/14/12 15:00	12/18/12 21:36	877-09-8	
Decachlorobiphenyl (S)	68	%	20-130		1	12/14/12 15:00	12/18/12 21:36	2051-24-3	
8151 Chlorinated Herbicides	Analytical Method: EPA 8151 Preparation Method: EPA 8151								
2,4-D	ND	ug/L	2.0	0.22	1	12/18/12 08:00	12/19/12 08:44	94-75-7	
Surrogates									
2,4-DCAA (S)	81	%	42-142		1	12/18/12 08:00	12/19/12 08:44	19719-28-9	
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-38-2	
Barium	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 19:58	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 19:58	7440-43-9	
Chromium	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-47-3	
Cobalt	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-48-4	
Copper	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-50-8	
Lead	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7439-92-1	
Nickel	ND	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 19:58	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/14/12 05:50	12/19/12 19:58	7440-28-0	
Tin	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-31-5	
Vanadium	ND	ug/L	25.0	5.0	1	12/14/12 05:50	12/19/12 19:58	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 19:58	7440-66-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/21/12 00:55	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/21/12 00:55	107-13-1	
Benzene	ND	ug/L	1.0	0.25	1		12/21/12 00:55	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/21/12 00:55	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/21/12 00:55	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/21/12 00:55	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/21/12 00:55	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/21/12 00:55	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/21/12 00:55	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/21/12 00:55	56-23-5	
Chlorobenzene	ND	ug/L	3.0	0.23	1		12/21/12 00:55	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/21/12 00:55	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/21/12 00:55	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/21/12 00:55	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/21/12 00:55	96-12-8	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW1R **Lab ID: 92141831001** Collected: 12/12/12 08:55 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/21/12 00:55	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/21/12 00:55	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/21/12 00:55	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	5.0	0.30	1		12/21/12 00:55	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		12/21/12 00:55	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/21/12 00:55	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/21/12 00:55	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/21/12 00:55	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/21/12 00:55	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/21/12 00:55	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/21/12 00:55	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/21/12 00:55	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/21/12 00:55	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/21/12 00:55	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/21/12 00:55	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/21/12 00:55	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/21/12 00:55	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/21/12 00:55	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/21/12 00:55	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/21/12 00:55	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/21/12 00:55	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/21/12 00:55	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/21/12 00:55	127-18-4	
Toluene	ND	ug/L	1.0	0.26	1		12/21/12 00:55	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/21/12 00:55	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/21/12 00:55	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/21/12 00:55	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/21/12 00:55	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/21/12 00:55	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/21/12 00:55	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/21/12 00:55	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/21/12 00:55	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	83	%	70-130		1		12/21/12 00:55	460-00-4	
Dibromofluoromethane (S)	108	%	70-130		1		12/21/12 00:55	1868-53-7	
1,2-Dichloroethane-d4 (S)	111	%	70-130		1		12/21/12 00:55	17060-07-0	
Toluene-d8 (S)	100	%	70-130		1		12/21/12 00:55	2037-26-5	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW2R **Lab ID: 92141831002** Collected: 12/12/12 10:35 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8081 Organochlorine Pesticides	Analytical Method: EPA 8081 Preparation Method: EPA 3510								
gamma-BHC (Lindane)	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 21:53	58-89-9	
Endrin aldehyde	ND	ug/L	0.10	0.050	1	12/14/12 15:00	12/18/12 21:53	7421-93-4	
Heptachlor	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 21:53	76-44-8	
Surrogates									
Tetrachloro-m-xylene (S)	63	%	20-130		1	12/14/12 15:00	12/18/12 21:53	877-09-8	
Decachlorobiphenyl (S)	92	%	20-130		1	12/14/12 15:00	12/18/12 21:53	2051-24-3	
8151 Chlorinated Herbicides	Analytical Method: EPA 8151 Preparation Method: EPA 8151								
2,4-D	ND	ug/L	2.0	0.22	1	12/18/12 08:00	12/19/12 09:44	94-75-7	M1
Surrogates									
2,4-DCAA (S)	72	%	42-142		1	12/18/12 08:00	12/19/12 09:44	19719-28-9	
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-38-2	
Barium	**113**	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 18:33	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 18:33	7440-43-9	
Chromium	**5.2J**	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-47-3	
Cobalt	**11.3**	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-48-4	
Copper	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-50-8	
Lead	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7439-92-1	
Nickel	**91.8**	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 18:33	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/14/12 05:50	12/19/12 18:33	7440-28-0	
Tin	**30.0J**	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-31-5	
Vanadium	ND	ug/L	25.0	5.0	1	12/14/12 05:50	12/19/12 18:33	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 18:33	7440-66-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/21/12 01:13	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/21/12 01:13	107-13-1	
Benzene	**1.6**	ug/L	1.0	0.25	1		12/21/12 01:13	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/21/12 01:13	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/21/12 01:13	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/21/12 01:13	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/21/12 01:13	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/21/12 01:13	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/21/12 01:13	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/21/12 01:13	56-23-5	
Chlorobenzene	**15.8**	ug/L	3.0	0.23	1		12/21/12 01:13	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/21/12 01:13	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/21/12 01:13	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/21/12 01:13	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/21/12 01:13	96-12-8	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW2R **Lab ID: 92141831002** Collected: 12/12/12 10:35 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/21/12 01:13	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/21/12 01:13	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/21/12 01:13	74-95-3	
1,2-Dichlorobenzene	**1.3J**	ug/L	5.0	0.30	1		12/21/12 01:13	95-50-1	
1,4-Dichlorobenzene	**2.4**	ug/L	1.0	0.33	1		12/21/12 01:13	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/21/12 01:13	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/21/12 01:13	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/21/12 01:13	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/21/12 01:13	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/21/12 01:13	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/21/12 01:13	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/21/12 01:13	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/21/12 01:13	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/21/12 01:13	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/21/12 01:13	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/21/12 01:13	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/21/12 01:13	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/21/12 01:13	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/21/12 01:13	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/21/12 01:13	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/21/12 01:13	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/21/12 01:13	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/21/12 01:13	127-18-4	
Toluene	**0.29J**	ug/L	1.0	0.26	1		12/21/12 01:13	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/21/12 01:13	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/21/12 01:13	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/21/12 01:13	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/21/12 01:13	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/21/12 01:13	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/21/12 01:13	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/21/12 01:13	75-01-4	
Xylene (Total)	**0.97J**	ug/L	5.0	0.66	1		12/21/12 01:13	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	88	%	70-130		1		12/21/12 01:13	460-00-4	
Dibromofluoromethane (S)	105	%	70-130		1		12/21/12 01:13	1868-53-7	
1,2-Dichloroethane-d4 (S)	108	%	70-130		1		12/21/12 01:13	17060-07-0	
Toluene-d8 (S)	99	%	70-130		1		12/21/12 01:13	2037-26-5	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW3R **Lab ID: 92141831003** Collected: 12/12/12 10:25 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8081 Organochlorine Pesticides	Analytical Method: EPA 8081 Preparation Method: EPA 3510								
gamma-BHC (Lindane)	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 22:46	58-89-9	
Endrin aldehyde	ND	ug/L	0.10	0.050	1	12/14/12 15:00	12/18/12 22:46	7421-93-4	
Heptachlor	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 22:46	76-44-8	
Surrogates									
Tetrachloro-m-xylene (S)	50	%	20-130		1	12/14/12 15:00	12/18/12 22:46	877-09-8	
Decachlorobiphenyl (S)	153	%	20-130		1	12/14/12 15:00	12/18/12 22:46	2051-24-3	S5
8151 Chlorinated Herbicides	Analytical Method: EPA 8151 Preparation Method: EPA 8151								
2,4-D	ND	ug/L	2.0	0.22	1	12/18/12 08:00	12/19/12 11:14	94-75-7	
Surrogates									
2,4-DCAA (S)	8	%	42-142		1	12/18/12 08:00	12/19/12 11:14	19719-28-9	S5
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-38-2	
Barium	**64.7J**	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:01	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:01	7440-43-9	
Chromium	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-47-3	
Cobalt	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-48-4	
Copper	**11.6**	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-50-8	
Lead	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7439-92-1	
Nickel	**29.2J**	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:01	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/14/12 05:50	12/19/12 20:01	7440-28-0	
Tin	**13.2J**	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-31-5	
Vanadium	ND	ug/L	25.0	5.0	1	12/14/12 05:50	12/19/12 20:01	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:01	7440-66-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/21/12 01:31	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/21/12 01:31	107-13-1	
Benzene	**0.73J**	ug/L	1.0	0.25	1		12/21/12 01:31	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/21/12 01:31	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/21/12 01:31	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/21/12 01:31	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/21/12 01:31	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/21/12 01:31	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/21/12 01:31	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/21/12 01:31	56-23-5	
Chlorobenzene	**17.9**	ug/L	3.0	0.23	1		12/21/12 01:31	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/21/12 01:31	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/21/12 01:31	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/21/12 01:31	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/21/12 01:31	96-12-8	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW3R **Lab ID: 92141831003** Collected: 12/12/12 10:25 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/21/12 01:31	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/21/12 01:31	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/21/12 01:31	74-95-3	
1,2-Dichlorobenzene	**1.7J**	ug/L	5.0	0.30	1		12/21/12 01:31	95-50-1	
1,4-Dichlorobenzene	**1.3**	ug/L	1.0	0.33	1		12/21/12 01:31	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/21/12 01:31	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/21/12 01:31	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/21/12 01:31	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/21/12 01:31	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/21/12 01:31	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/21/12 01:31	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/21/12 01:31	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/21/12 01:31	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/21/12 01:31	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/21/12 01:31	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/21/12 01:31	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/21/12 01:31	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/21/12 01:31	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/21/12 01:31	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/21/12 01:31	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/21/12 01:31	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/21/12 01:31	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/21/12 01:31	127-18-4	
Toluene	ND	ug/L	1.0	0.26	1		12/21/12 01:31	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/21/12 01:31	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/21/12 01:31	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/21/12 01:31	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/21/12 01:31	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/21/12 01:31	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/21/12 01:31	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/21/12 01:31	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/21/12 01:31	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	85	%	70-130		1		12/21/12 01:31	460-00-4	
Dibromofluoromethane (S)	107	%	70-130		1		12/21/12 01:31	1868-53-7	
1,2-Dichloroethane-d4 (S)	109	%	70-130		1		12/21/12 01:31	17060-07-0	
Toluene-d8 (S)	102	%	70-130		1		12/21/12 01:31	2037-26-5	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW4 **Lab ID: 92141831004** Collected: 12/12/12 10:10 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8081 Organochlorine Pesticides	Analytical Method: EPA 8081 Preparation Method: EPA 3510								
gamma-BHC (Lindane)	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 23:04	58-89-9	
Endrin aldehyde	ND	ug/L	0.10	0.050	1	12/14/12 15:00	12/18/12 23:04	7421-93-4	
Heptachlor	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 23:04	76-44-8	
Surrogates									
Tetrachloro-m-xylene (S)	58	%	20-130		1	12/14/12 15:00	12/18/12 23:04	877-09-8	
Decachlorobiphenyl (S)	134	%	20-130		1	12/14/12 15:00	12/18/12 23:04	2051-24-3	S5
8151 Chlorinated Herbicides	Analytical Method: EPA 8151 Preparation Method: EPA 8151								
2,4-D	ND	ug/L	2.0	0.22	1	12/18/12 08:00	12/19/12 11:45	94-75-7	
Surrogates									
2,4-DCAA (S)	99	%	42-142		1	12/18/12 08:00	12/19/12 11:45	19719-28-9	
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-38-2	
Barium	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:05	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:05	7440-43-9	
Chromium	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-47-3	
Cobalt	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-48-4	
Copper	**8.5J**	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-50-8	
Lead	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7439-92-1	
Nickel	**9.3J**	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:05	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/14/12 05:50	12/19/12 20:05	7440-28-0	
Tin	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-31-5	
Vanadium	**13.6J**	ug/L	25.0	5.0	1	12/14/12 05:50	12/19/12 20:05	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:05	7440-66-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/21/12 01:50	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/21/12 01:50	107-13-1	
Benzene	**0.32J**	ug/L	1.0	0.25	1		12/21/12 01:50	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/21/12 01:50	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/21/12 01:50	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/21/12 01:50	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/21/12 01:50	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/21/12 01:50	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/21/12 01:50	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/21/12 01:50	56-23-5	
Chlorobenzene	**4.5**	ug/L	3.0	0.23	1		12/21/12 01:50	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/21/12 01:50	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/21/12 01:50	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/21/12 01:50	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/21/12 01:50	96-12-8	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW4 **Lab ID: 92141831004** Collected: 12/12/12 10:10 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/21/12 01:50	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/21/12 01:50	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/21/12 01:50	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	5.0	0.30	1		12/21/12 01:50	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		12/21/12 01:50	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/21/12 01:50	110-57-6	
1,1-Dichloroethane	**0.61J**	ug/L	5.0	0.32	1		12/21/12 01:50	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/21/12 01:50	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/21/12 01:50	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/21/12 01:50	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/21/12 01:50	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/21/12 01:50	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/21/12 01:50	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/21/12 01:50	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/21/12 01:50	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/21/12 01:50	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/21/12 01:50	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/21/12 01:50	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/21/12 01:50	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/21/12 01:50	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/21/12 01:50	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/21/12 01:50	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/21/12 01:50	127-18-4	
Toluene	ND	ug/L	1.0	0.26	1		12/21/12 01:50	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/21/12 01:50	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/21/12 01:50	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/21/12 01:50	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/21/12 01:50	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/21/12 01:50	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/21/12 01:50	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/21/12 01:50	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/21/12 01:50	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	84	%	70-130		1		12/21/12 01:50	460-00-4	
Dibromofluoromethane (S)	105	%	70-130		1		12/21/12 01:50	1868-53-7	
1,2-Dichloroethane-d4 (S)	110	%	70-130		1		12/21/12 01:50	17060-07-0	
Toluene-d8 (S)	101	%	70-130		1		12/21/12 01:50	2037-26-5	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW5 **Lab ID: 92141831005** Collected: 12/12/12 10:00 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8081 Organochlorine Pesticides	Analytical Method: EPA 8081 Preparation Method: EPA 3510								
gamma-BHC (Lindane)	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 23:21	58-89-9	
Endrin aldehyde	ND	ug/L	0.10	0.050	1	12/14/12 15:00	12/18/12 23:21	7421-93-4	
Heptachlor	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 23:21	76-44-8	
Surrogates									
Tetrachloro-m-xylene (S)	43	%	20-130		1	12/14/12 15:00	12/18/12 23:21	877-09-8	
Decachlorobiphenyl (S)	58	%	20-130		1	12/14/12 15:00	12/18/12 23:21	2051-24-3	
8151 Chlorinated Herbicides	Analytical Method: EPA 8151 Preparation Method: EPA 8151								
2,4-D	ND	ug/L	2.0	0.22	1	12/18/12 08:00	12/19/12 12:15	94-75-7	
Surrogates									
2,4-DCAA (S)	77	%	42-142		1	12/18/12 08:00	12/19/12 12:15	19719-28-9	
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-38-2	
Barium	**73.6J**	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:09	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:09	7440-43-9	
Chromium	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-47-3	
Cobalt	**113**	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-48-4	
Copper	**10.4**	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-50-8	
Lead	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7439-92-1	
Nickel	**21.1J**	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:09	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/14/12 05:50	12/19/12 20:09	7440-28-0	
Tin	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-31-5	
Vanadium	ND	ug/L	25.0	5.0	1	12/14/12 05:50	12/19/12 20:09	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:09	7440-66-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/21/12 16:05	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/21/12 16:05	107-13-1	
Benzene	ND	ug/L	1.0	0.25	1		12/21/12 16:05	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/21/12 16:05	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/21/12 16:05	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/21/12 16:05	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/21/12 16:05	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/21/12 16:05	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/21/12 16:05	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/21/12 16:05	56-23-5	
Chlorobenzene	ND	ug/L	3.0	0.23	1		12/21/12 16:05	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/21/12 16:05	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/21/12 16:05	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/21/12 16:05	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/21/12 16:05	96-12-8	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW5 **Lab ID: 92141831005** Collected: 12/12/12 10:00 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/21/12 16:05	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/21/12 16:05	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/21/12 16:05	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	5.0	0.30	1		12/21/12 16:05	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		12/21/12 16:05	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/21/12 16:05	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/21/12 16:05	75-34-3	
1,2-Dichloroethane	**0.20J**	ug/L	1.0	0.12	1		12/21/12 16:05	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/21/12 16:05	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/21/12 16:05	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/21/12 16:05	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/21/12 16:05	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/21/12 16:05	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/21/12 16:05	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/21/12 16:05	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/21/12 16:05	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/21/12 16:05	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/21/12 16:05	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/21/12 16:05	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/21/12 16:05	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/21/12 16:05	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/21/12 16:05	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/21/12 16:05	127-18-4	
Toluene	**0.36J**	ug/L	1.0	0.26	1		12/21/12 16:05	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/21/12 16:05	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/21/12 16:05	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/21/12 16:05	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/21/12 16:05	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/21/12 16:05	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/21/12 16:05	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/21/12 16:05	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/21/12 16:05	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	86	%	70-130		1		12/21/12 16:05	460-00-4	
Dibromofluoromethane (S)	101	%	70-130		1		12/21/12 16:05	1868-53-7	
1,2-Dichloroethane-d4 (S)	103	%	70-130		1		12/21/12 16:05	17060-07-0	
Toluene-d8 (S)	101	%	70-130		1		12/21/12 16:05	2037-26-5	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW6 **Lab ID: 92141831006** Collected: 12/12/12 09:15 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8081 Organochlorine Pesticides	Analytical Method: EPA 8081 Preparation Method: EPA 3510								
gamma-BHC (Lindane)	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 23:39	58-89-9	
Endrin aldehyde	ND	ug/L	0.10	0.050	1	12/14/12 15:00	12/18/12 23:39	7421-93-4	
Heptachlor	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 23:39	76-44-8	
Surrogates									
Tetrachloro-m-xylene (S)	69	%	20-130		1	12/14/12 15:00	12/18/12 23:39	877-09-8	
Decachlorobiphenyl (S)	96	%	20-130		1	12/14/12 15:00	12/18/12 23:39	2051-24-3	
8151 Chlorinated Herbicides	Analytical Method: EPA 8151 Preparation Method: EPA 8151								
2,4-D	ND	ug/L	2.0	0.22	1	12/19/12 08:00	12/20/12 02:27	94-75-7	
Surrogates									
2,4-DCAA (S)	73	%	42-142		1	12/19/12 08:00	12/20/12 02:27	19719-28-9	
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-38-2	
Barium	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:12	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:12	7440-43-9	
Chromium	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-47-3	
Cobalt	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-48-4	
Copper	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-50-8	
Lead	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7439-92-1	
Nickel	ND	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:12	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/14/12 05:50	12/19/12 20:12	7440-28-0	
Tin	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-31-5	
Vanadium	ND	ug/L	25.0	5.0	1	12/14/12 05:50	12/19/12 20:12	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:12	7440-66-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/21/12 16:24	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/21/12 16:24	107-13-1	
Benzene	ND	ug/L	1.0	0.25	1		12/21/12 16:24	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/21/12 16:24	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/21/12 16:24	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/21/12 16:24	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/21/12 16:24	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/21/12 16:24	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/21/12 16:24	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/21/12 16:24	56-23-5	
Chlorobenzene	ND	ug/L	3.0	0.23	1		12/21/12 16:24	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/21/12 16:24	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/21/12 16:24	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/21/12 16:24	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/21/12 16:24	96-12-8	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-MW6 **Lab ID: 92141831006** Collected: 12/12/12 09:15 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/21/12 16:24	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/21/12 16:24	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/21/12 16:24	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	5.0	0.30	1		12/21/12 16:24	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		12/21/12 16:24	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/21/12 16:24	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/21/12 16:24	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/21/12 16:24	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/21/12 16:24	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/21/12 16:24	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/21/12 16:24	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/21/12 16:24	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/21/12 16:24	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/21/12 16:24	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/21/12 16:24	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/21/12 16:24	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/21/12 16:24	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/21/12 16:24	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/21/12 16:24	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/21/12 16:24	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/21/12 16:24	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/21/12 16:24	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/21/12 16:24	127-18-4	
Toluene	ND	ug/L	1.0	0.26	1		12/21/12 16:24	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/21/12 16:24	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/21/12 16:24	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/21/12 16:24	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/21/12 16:24	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/21/12 16:24	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/21/12 16:24	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/21/12 16:24	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/21/12 16:24	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	86	%	70-130		1		12/21/12 16:24	460-00-4	
Dibromofluoromethane (S)	103	%	70-130		1		12/21/12 16:24	1868-53-7	
1,2-Dichloroethane-d4 (S)	107	%	70-130		1		12/21/12 16:24	17060-07-0	
Toluene-d8 (S)	101	%	70-130		1		12/21/12 16:24	2037-26-5	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-SW1 **Lab ID: 92141831007** Collected: 12/12/12 09:45 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-38-2	
Barium	**45.0J**	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:16	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 20:16	7440-43-9	
Chromium	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-47-3	
Cobalt	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-48-4	
Copper	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-50-8	
Lead	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7439-92-1	
Nickel	ND	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:16	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/14/12 05:50	12/19/12 20:16	7440-28-0	
Vanadium	ND	ug/L	25.0	5.0	1	12/14/12 05:50	12/19/12 20:16	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 20:16	7440-66-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/21/12 16:42	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/21/12 16:42	107-13-1	
Benzene	ND	ug/L	1.0	0.25	1		12/21/12 16:42	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/21/12 16:42	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/21/12 16:42	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/21/12 16:42	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/21/12 16:42	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/21/12 16:42	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/21/12 16:42	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/21/12 16:42	56-23-5	
Chlorobenzene	ND	ug/L	3.0	0.23	1		12/21/12 16:42	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/21/12 16:42	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/21/12 16:42	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/21/12 16:42	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/21/12 16:42	96-12-8	
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/21/12 16:42	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/21/12 16:42	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/21/12 16:42	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	5.0	0.30	1		12/21/12 16:42	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		12/21/12 16:42	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/21/12 16:42	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/21/12 16:42	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/21/12 16:42	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/21/12 16:42	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/21/12 16:42	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/21/12 16:42	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/21/12 16:42	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/21/12 16:42	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/21/12 16:42	10061-02-6	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-SW1 **Lab ID: 92141831007** Collected: 12/12/12 09:45 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/21/12 16:42	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/21/12 16:42	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/21/12 16:42	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/21/12 16:42	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/21/12 16:42	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/21/12 16:42	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/21/12 16:42	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/21/12 16:42	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/21/12 16:42	127-18-4	
Toluene	ND	ug/L	1.0	0.26	1		12/21/12 16:42	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/21/12 16:42	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/21/12 16:42	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/21/12 16:42	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/21/12 16:42	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/21/12 16:42	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/21/12 16:42	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/21/12 16:42	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/21/12 16:42	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	86	%	70-130		1		12/21/12 16:42	460-00-4	
Dibromofluoromethane (S)	105	%	70-130		1		12/21/12 16:42	1868-53-7	
1,2-Dichloroethane-d4 (S)	108	%	70-130		1		12/21/12 16:42	17060-07-0	
Toluene-d8 (S)	100	%	70-130		1		12/21/12 16:42	2037-26-5	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-SW2 **Lab ID: 92141831008** Collected: 12/12/12 11:00 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-38-2	
Barium	**97.8J**	ug/L	100	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/15/12 12:00	12/19/12 22:29	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/15/12 12:00	12/19/12 22:29	7440-43-9	
Chromium	ND	ug/L	10.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-47-3	
Cobalt	ND	ug/L	10.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-48-4	
Copper	ND	ug/L	10.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-50-8	
Lead	ND	ug/L	10.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7439-92-1	
Nickel	**13.8J**	ug/L	50.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/15/12 12:00	12/19/12 22:29	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/15/12 12:00	12/19/12 22:29	7440-28-0	
Vanadium	ND	ug/L	25.0	5.0	1	12/15/12 12:00	12/19/12 22:29	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/15/12 12:00	12/19/12 22:29	7440-66-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/21/12 17:00	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/21/12 17:00	107-13-1	
Benzene	ND	ug/L	1.0	0.25	1		12/21/12 17:00	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/21/12 17:00	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/21/12 17:00	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/21/12 17:00	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/21/12 17:00	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/21/12 17:00	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/21/12 17:00	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/21/12 17:00	56-23-5	
Chlorobenzene	ND	ug/L	3.0	0.23	1		12/21/12 17:00	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/21/12 17:00	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/21/12 17:00	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/21/12 17:00	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/21/12 17:00	96-12-8	
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/21/12 17:00	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/21/12 17:00	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/21/12 17:00	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	5.0	0.30	1		12/21/12 17:00	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		12/21/12 17:00	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/21/12 17:00	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/21/12 17:00	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/21/12 17:00	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/21/12 17:00	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/21/12 17:00	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/21/12 17:00	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/21/12 17:00	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/21/12 17:00	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/21/12 17:00	10061-02-6	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Sample: 3902-SW2 **Lab ID: 92141831008** Collected: 12/12/12 11:00 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/21/12 17:00	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/21/12 17:00	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/21/12 17:00	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/21/12 17:00	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/21/12 17:00	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/21/12 17:00	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/21/12 17:00	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/21/12 17:00	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/21/12 17:00	127-18-4	
Toluene	ND	ug/L	1.0	0.26	1		12/21/12 17:00	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/21/12 17:00	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/21/12 17:00	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/21/12 17:00	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/21/12 17:00	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/21/12 17:00	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/21/12 17:00	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/21/12 17:00	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/21/12 17:00	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	84	%	70-130		1		12/21/12 17:00	460-00-4	
Dibromofluoromethane (S)	103	%	70-130		1		12/21/12 17:00	1868-53-7	
1,2-Dichloroethane-d4 (S)	107	%	70-130		1		12/21/12 17:00	17060-07-0	
Toluene-d8 (S)	100	%	70-130		1		12/21/12 17:00	2037-26-5	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

QC Batch: MPRP/12197 Analysis Method: EPA 6010
QC Batch Method: EPA 3010 Analysis Description: 6010 MET NC Groundwater
Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004, 92141831005, 92141831006, 92141831007

METHOD BLANK: 890466 Matrix: Water
Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004, 92141831005, 92141831006, 92141831007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	6.0	12/19/12 18:26	
Arsenic	ug/L	ND	10.0	12/19/12 18:26	
Barium	ug/L	ND	100	12/19/12 18:26	
Beryllium	ug/L	ND	1.0	12/19/12 18:26	
Cadmium	ug/L	ND	1.0	12/19/12 18:26	
Chromium	ug/L	ND	10.0	12/19/12 18:26	
Cobalt	ug/L	ND	10.0	12/19/12 18:26	
Copper	ug/L	ND	10.0	12/19/12 18:26	
Lead	ug/L	ND	10.0	12/19/12 18:26	
Nickel	ug/L	ND	50.0	12/19/12 18:26	
Selenium	ug/L	ND	10.0	12/19/12 18:26	
Silver	ug/L	ND	10.0	12/19/12 18:26	
Thallium	ug/L	ND	5.5	12/19/12 18:26	
Tin	ug/L	ND	100	12/19/12 18:26	
Vanadium	ug/L	ND	25.0	12/19/12 18:26	
Zinc	ug/L	ND	10.0	12/20/12 16:09	

LABORATORY CONTROL SAMPLE: 890467

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	492	98	80-120	
Arsenic	ug/L	500	481	96	80-120	
Barium	ug/L	500	495	99	80-120	
Beryllium	ug/L	500	494	99	80-120	
Cadmium	ug/L	500	500	100	80-120	
Chromium	ug/L	500	505	101	80-120	
Cobalt	ug/L	500	501	100	80-120	
Copper	ug/L	500	494	99	80-120	
Lead	ug/L	500	497	99	80-120	
Nickel	ug/L	500	499	100	80-120	
Selenium	ug/L	500	487	97	80-120	
Silver	ug/L	250	248	99	80-120	
Thallium	ug/L	500	473	95	80-120	
Tin	ug/L	500	497	99	80-120	
Vanadium	ug/L	500	509	102	80-120	
Zinc	ug/L	500	491	98	80-120	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 890471 890472

Parameter	Units	92141831002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	500	500	525	527	105	105	75-125	0	25	
Arsenic	ug/L	ND	500	500	532	530	106	106	75-125	0	25	
Barium	ug/L	113	500	500	585	586	94	95	75-125	0	25	
Beryllium	ug/L	ND	500	500	481	491	96	98	75-125	2	25	
Cadmium	ug/L	ND	500	500	469	470	94	94	75-125	0	25	
Chromium	ug/L	5.2J	500	500	484	484	96	96	75-125	0	25	
Cobalt	ug/L	11.3	500	500	481	482	94	94	75-125	0	25	
Copper	ug/L	ND	500	500	531	534	106	107	75-125	1	25	
Lead	ug/L	ND	500	500	448	448	90	90	75-125	0	25	
Nickel	ug/L	91.8	500	500	554	555	92	93	75-125	0	25	
Selenium	ug/L	ND	500	500	526	521	105	104	75-125	1	25	
Silver	ug/L	ND	250	250	263	263	104	104	75-125	0	25	
Thallium	ug/L	ND	500	500	418	420	84	84	75-125	0	25	
Tin	ug/L	30.0J	500	500	515	516	97	97	75-125	0	25	
Vanadium	ug/L	ND	500	500	500	500	100	100	75-125	0	25	
Zinc	ug/L	ND	500	500	502	508	100	101	75-125	1	25	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

QC Batch: MPRP/12211
QC Batch Method: EPA 3010
Analysis Method: EPA 6010
Analysis Description: 6010 MET NC Groundwater
Associated Lab Samples: 92141831008

METHOD BLANK: 891430
Matrix: Water
Associated Lab Samples: 92141831008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	6.0	12/19/12 22:23	
Arsenic	ug/L	ND	10.0	12/19/12 22:23	
Barium	ug/L	ND	100	12/19/12 22:23	
Beryllium	ug/L	ND	1.0	12/19/12 22:23	
Cadmium	ug/L	ND	1.0	12/19/12 22:23	
Chromium	ug/L	ND	10.0	12/19/12 22:23	
Cobalt	ug/L	ND	10.0	12/19/12 22:23	
Copper	ug/L	ND	10.0	12/19/12 22:23	
Lead	ug/L	ND	10.0	12/19/12 22:23	
Nickel	ug/L	ND	50.0	12/19/12 22:23	
Selenium	ug/L	ND	10.0	12/19/12 22:23	
Silver	ug/L	ND	10.0	12/19/12 22:23	
Thallium	ug/L	ND	5.5	12/19/12 22:23	
Vanadium	ug/L	ND	25.0	12/19/12 22:23	
Zinc	ug/L	ND	10.0	12/19/12 22:23	

LABORATORY CONTROL SAMPLE: 891431

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	478	96	80-120	
Arsenic	ug/L	500	470	94	80-120	
Barium	ug/L	500	475	95	80-120	
Beryllium	ug/L	500	483	97	80-120	
Cadmium	ug/L	500	484	97	80-120	
Chromium	ug/L	500	495	99	80-120	
Cobalt	ug/L	500	487	97	80-120	
Copper	ug/L	500	474	95	80-120	
Lead	ug/L	500	482	96	80-120	
Nickel	ug/L	500	486	97	80-120	
Selenium	ug/L	500	475	95	80-120	
Silver	ug/L	250	244	98	80-120	
Thallium	ug/L	500	457	91	80-120	
Vanadium	ug/L	500	493	99	80-120	
Zinc	ug/L	500	483	97	80-120	

MATRIX SPIKE SAMPLE: 891432

Parameter	Units	92141831008 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	ND	500	505	101	75-125	
Arsenic	ug/L	ND	500	501	100	75-125	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

MATRIX SPIKE SAMPLE: 891432

Parameter	Units	92141831008 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	97.8J	500	563	93	75-125	
Beryllium	ug/L	ND	500	481	96	75-125	
Cadmium	ug/L	ND	500	473	95	75-125	
Chromium	ug/L	ND	500	487	97	75-125	
Cobalt	ug/L	ND	500	475	95	75-125	
Copper	ug/L	ND	500	501	100	75-125	
Lead	ug/L	ND	500	458	92	75-125	
Nickel	ug/L	13.8J	500	488	95	75-125	
Selenium	ug/L	ND	500	502	100	75-125	
Silver	ug/L	ND	250	253	101	75-125	
Thallium	ug/L	ND	500	430	86	75-125	
Vanadium	ug/L	ND	500	495	99	75-125	
Zinc	ug/L	ND	500	494	98	75-125	

SAMPLE DUPLICATE: 891433

Parameter	Units	92141862001 Result	Dup Result	RPD	Max RPD	Qualifiers
Antimony	ug/L	ND	ND		25	
Arsenic	ug/L	ND	ND		25	
Barium	ug/L	117	113	3	25	
Beryllium	ug/L	ND	ND		25	
Cadmium	ug/L	ND	ND		25	
Chromium	ug/L	ND	ND		25	
Cobalt	ug/L	115	112	3	25	
Copper	ug/L	ND	8.2J		25	
Lead	ug/L	ND	ND		25	
Nickel	ug/L	5.4J	5.3J	2	25	
Selenium	ug/L	ND	ND		25	
Silver	ug/L	ND	ND		25	
Thallium	ug/L	ND	ND		25	
Vanadium	ug/L	ND	ND		25	
Zinc	ug/L	12.1	16.0	28	25	D6

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

QC Batch: MSV/21527 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004

METHOD BLANK: 894583 Matrix: Water
Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	5.0	12/21/12 00:18	
1,1,1-Trichloroethane	ug/L	ND	1.0	12/21/12 00:18	
1,1,2,2-Tetrachloroethane	ug/L	ND	3.0	12/21/12 00:18	
1,1,2-Trichloroethane	ug/L	ND	1.0	12/21/12 00:18	
1,1-Dichloroethane	ug/L	ND	5.0	12/21/12 00:18	
1,1-Dichloroethene	ug/L	ND	5.0	12/21/12 00:18	
1,2,3-Trichloropropane	ug/L	ND	1.0	12/21/12 00:18	
1,2-Dibromo-3-chloropropane	ug/L	ND	13.0	12/21/12 00:18	
1,2-Dibromoethane (EDB)	ug/L	ND	1.0	12/21/12 00:18	
1,2-Dichlorobenzene	ug/L	ND	5.0	12/21/12 00:18	
1,2-Dichloroethane	ug/L	0.20J	1.0	12/21/12 00:18	
1,2-Dichloropropane	ug/L	ND	1.0	12/21/12 00:18	
1,4-Dichlorobenzene	ug/L	ND	1.0	12/21/12 00:18	
2-Butanone (MEK)	ug/L	ND	100	12/21/12 00:18	
2-Hexanone	ug/L	ND	50.0	12/21/12 00:18	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	100	12/21/12 00:18	
Acetone	ug/L	ND	100	12/21/12 00:18	
Acrylonitrile	ug/L	ND	200	12/21/12 00:18	
Benzene	ug/L	ND	1.0	12/21/12 00:18	
Bromochloromethane	ug/L	ND	3.0	12/21/12 00:18	
Bromodichloromethane	ug/L	ND	1.0	12/21/12 00:18	
Bromoform	ug/L	ND	3.0	12/21/12 00:18	
Bromomethane	ug/L	ND	10.0	12/21/12 00:18	
Carbon disulfide	ug/L	ND	100	12/21/12 00:18	
Carbon tetrachloride	ug/L	ND	1.0	12/21/12 00:18	
Chlorobenzene	ug/L	ND	3.0	12/21/12 00:18	
Chloroethane	ug/L	ND	10.0	12/21/12 00:18	
Chloroform	ug/L	ND	5.0	12/21/12 00:18	
Chloromethane	ug/L	ND	1.0	12/21/12 00:18	
cis-1,2-Dichloroethene	ug/L	ND	5.0	12/21/12 00:18	
cis-1,3-Dichloropropene	ug/L	ND	1.0	12/21/12 00:18	
Dibromochloromethane	ug/L	ND	3.0	12/21/12 00:18	
Dibromomethane	ug/L	ND	10.0	12/21/12 00:18	
Ethylbenzene	ug/L	ND	1.0	12/21/12 00:18	
Iodomethane	ug/L	ND	10.0	12/21/12 00:18	
Methylene Chloride	ug/L	ND	1.0	12/21/12 00:18	
Styrene	ug/L	ND	1.0	12/21/12 00:18	
Tetrachloroethene	ug/L	ND	1.0	12/21/12 00:18	
Toluene	ug/L	ND	1.0	12/21/12 00:18	
trans-1,2-Dichloroethene	ug/L	ND	5.0	12/21/12 00:18	
trans-1,3-Dichloropropene	ug/L	ND	1.0	12/21/12 00:18	
trans-1,4-Dichloro-2-butene	ug/L	ND	100	12/21/12 00:18	
Trichloroethene	ug/L	ND	1.0	12/21/12 00:18	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

METHOD BLANK: 894583 Matrix: Water

Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	12/21/12 00:18	
Vinyl acetate	ug/L	ND	50.0	12/21/12 00:18	
Vinyl chloride	ug/L	ND	1.0	12/21/12 00:18	
Xylene (Total)	ug/L	ND	5.0	12/21/12 00:18	
1,2-Dichloroethane-d4 (S)	%	110	70-130	12/21/12 00:18	
4-Bromofluorobenzene (S)	%	85	70-130	12/21/12 00:18	
Dibromofluoromethane (S)	%	104	70-130	12/21/12 00:18	
Toluene-d8 (S)	%	101	70-130	12/21/12 00:18	

LABORATORY CONTROL SAMPLE: 894584

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	52.5	105	70-130	
1,1,1-Trichloroethane	ug/L	50	52.1	104	70-130	
1,1,2,2-Tetrachloroethane	ug/L	50	50.8	102	70-130	
1,1,2-Trichloroethane	ug/L	50	52.3	105	70-130	
1,1-Dichloroethane	ug/L	50	51.2	102	70-130	
1,1-Dichloroethene	ug/L	50	48.7	97	70-132	
1,2,3-Trichloropropane	ug/L	50	49.8	100	70-130	
1,2-Dibromo-3-chloropropane	ug/L	50	46.7	93	70-130	
1,2-Dibromoethane (EDB)	ug/L	50	53.8	108	70-130	
1,2-Dichlorobenzene	ug/L	50	50.3	101	70-130	
1,2-Dichloroethane	ug/L	50	49.8	100	70-130	
1,2-Dichloropropane	ug/L	50	53.6	107	70-130	
1,4-Dichlorobenzene	ug/L	50	50.9	102	70-130	
2-Butanone (MEK)	ug/L	100	113	113	70-145	
2-Hexanone	ug/L	100	111	111	70-144	
4-Methyl-2-pentanone (MIBK)	ug/L	100	113	113	70-140	
Acetone	ug/L	100	102	102	50-175	
Acrylonitrile	ug/L	250	256	102	70-143	
Benzene	ug/L	50	53.2	106	70-130	
Bromochloromethane	ug/L	50	52.8	106	70-130	
Bromodichloromethane	ug/L	50	53.0	106	70-130	
Bromoform	ug/L	50	42.7	85	70-130	
Bromomethane	ug/L	50	58.7	117	54-130	
Carbon disulfide	ug/L	50	58.4J	117	70-131	
Carbon tetrachloride	ug/L	50	52.1	104	70-132	
Chlorobenzene	ug/L	50	52.8	106	70-130	
Chloroethane	ug/L	50	61.6	123	64-134	
Chloroform	ug/L	50	50.9	102	70-130	
Chloromethane	ug/L	50	49.5	99	64-130	
cis-1,2-Dichloroethene	ug/L	50	50.3	101	70-131	
cis-1,3-Dichloropropene	ug/L	50	55.5	111	70-130	
Dibromochloromethane	ug/L	50	53.8	108	70-130	
Dibromomethane	ug/L	50	51.0	102	70-131	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

LABORATORY CONTROL SAMPLE: 894584

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Ethylbenzene	ug/L	50	53.2	106	70-130	
Iodomethane	ug/L	100	114	114	49-180	
Methylene Chloride	ug/L	50	53.7	107	63-130	
Styrene	ug/L	50	50.7	101	70-130	
Tetrachloroethene	ug/L	50	50.9	102	70-130	
Toluene	ug/L	50	53.0	106	70-130	
trans-1,2-Dichloroethene	ug/L	50	49.6	99	70-130	
trans-1,3-Dichloropropene	ug/L	50	54.8	110	70-132	
trans-1,4-Dichloro-2-butene	ug/L	50	48.2J	96	70-141	
Trichloroethene	ug/L	50	50.2	100	70-130	
Trichlorofluoromethane	ug/L	50	45.0	90	62-133	
Vinyl acetate	ug/L	100	120	120	66-157	
Vinyl chloride	ug/L	50	47.9	96	69-130	
Xylene (Total)	ug/L	150	164	109	70-130	
1,2-Dichloroethane-d4 (S)	%			97	70-130	
4-Bromofluorobenzene (S)	%			98	70-130	
Dibromofluoromethane (S)	%			101	70-130	
Toluene-d8 (S)	%			100	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 894585 894586

Parameter	Units	92141831002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
1,1-Dichloroethene	ug/L	ND	50	50	47.9	50.6	96	101	70-166	6	30	
Benzene	ug/L	1.6	50	50	47.5	50.5	92	98	70-148	6	30	
Chlorobenzene	ug/L	15.8	50	50	66.1	70.3	101	109	70-146	6	30	
Toluene	ug/L	0.29J	50	50	51.5	55.0	102	109	70-155	7	30	
Trichloroethene	ug/L	ND	50	50	47.6	49.8	95	100	69-151	5	30	
1,2-Dichloroethane-d4 (S)	%						95	94	70-130			
4-Bromofluorobenzene (S)	%						84	84	70-130			
Dibromofluoromethane (S)	%						97	99	70-130			
Toluene-d8 (S)	%						103	102	70-130			

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

QC Batch: MSV/21534 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92141831005, 92141831006, 92141831007, 92141831008

METHOD BLANK: 895219 Matrix: Water
Associated Lab Samples: 92141831005, 92141831006, 92141831007, 92141831008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	5.0	12/21/12 12:09	
1,1,1-Trichloroethane	ug/L	ND	1.0	12/21/12 12:09	
1,1,2,2-Tetrachloroethane	ug/L	ND	3.0	12/21/12 12:09	
1,1,2-Trichloroethane	ug/L	ND	1.0	12/21/12 12:09	
1,1-Dichloroethane	ug/L	ND	5.0	12/21/12 12:09	
1,1-Dichloroethene	ug/L	ND	5.0	12/21/12 12:09	
1,2,3-Trichloropropane	ug/L	ND	1.0	12/21/12 12:09	
1,2-Dibromo-3-chloropropane	ug/L	ND	13.0	12/21/12 12:09	
1,2-Dibromoethane (EDB)	ug/L	ND	1.0	12/21/12 12:09	
1,2-Dichlorobenzene	ug/L	ND	5.0	12/21/12 12:09	
1,2-Dichloroethane	ug/L	ND	1.0	12/21/12 12:09	
1,2-Dichloropropane	ug/L	ND	1.0	12/21/12 12:09	
1,4-Dichlorobenzene	ug/L	ND	1.0	12/21/12 12:09	
2-Butanone (MEK)	ug/L	ND	100	12/21/12 12:09	
2-Hexanone	ug/L	ND	50.0	12/21/12 12:09	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	100	12/21/12 12:09	
Acetone	ug/L	ND	100	12/21/12 12:09	
Acrylonitrile	ug/L	ND	200	12/21/12 12:09	
Benzene	ug/L	ND	1.0	12/21/12 12:09	
Bromochloromethane	ug/L	ND	3.0	12/21/12 12:09	
Bromodichloromethane	ug/L	ND	1.0	12/21/12 12:09	
Bromoform	ug/L	ND	3.0	12/21/12 12:09	
Bromomethane	ug/L	ND	10.0	12/21/12 12:09	
Carbon disulfide	ug/L	ND	100	12/21/12 12:09	
Carbon tetrachloride	ug/L	ND	1.0	12/21/12 12:09	
Chlorobenzene	ug/L	ND	3.0	12/21/12 12:09	
Chloroethane	ug/L	ND	10.0	12/21/12 12:09	
Chloroform	ug/L	ND	5.0	12/21/12 12:09	
Chloromethane	ug/L	ND	1.0	12/21/12 12:09	
cis-1,2-Dichloroethene	ug/L	ND	5.0	12/21/12 12:09	
cis-1,3-Dichloropropene	ug/L	ND	1.0	12/21/12 12:09	
Dibromochloromethane	ug/L	ND	3.0	12/21/12 12:09	
Dibromomethane	ug/L	ND	10.0	12/21/12 12:09	
Ethylbenzene	ug/L	ND	1.0	12/21/12 12:09	
Iodomethane	ug/L	ND	10.0	12/21/12 12:09	
Methylene Chloride	ug/L	ND	1.0	12/21/12 12:09	
Styrene	ug/L	ND	1.0	12/21/12 12:09	
Tetrachloroethene	ug/L	ND	1.0	12/21/12 12:09	
Toluene	ug/L	ND	1.0	12/21/12 12:09	
trans-1,2-Dichloroethene	ug/L	ND	5.0	12/21/12 12:09	
trans-1,3-Dichloropropene	ug/L	ND	1.0	12/21/12 12:09	
trans-1,4-Dichloro-2-butene	ug/L	ND	100	12/21/12 12:09	
Trichloroethene	ug/L	ND	1.0	12/21/12 12:09	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

METHOD BLANK: 895219 Matrix: Water

Associated Lab Samples: 92141831005, 92141831006, 92141831007, 92141831008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	12/21/12 12:09	
Vinyl acetate	ug/L	ND	50.0	12/21/12 12:09	
Vinyl chloride	ug/L	ND	1.0	12/21/12 12:09	
Xylene (Total)	ug/L	ND	5.0	12/21/12 12:09	
1,2-Dichloroethane-d4 (S)	%	107	70-130	12/21/12 12:09	
4-Bromofluorobenzene (S)	%	85	70-130	12/21/12 12:09	
Dibromofluoromethane (S)	%	104	70-130	12/21/12 12:09	
Toluene-d8 (S)	%	100	70-130	12/21/12 12:09	

LABORATORY CONTROL SAMPLE: 895220

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	52.6	105	70-130	
1,1,1-Trichloroethane	ug/L	50	52.8	106	70-130	
1,1,2,2-Tetrachloroethane	ug/L	50	50.5	101	70-130	
1,1,2-Trichloroethane	ug/L	50	51.8	104	70-130	
1,1-Dichloroethane	ug/L	50	51.9	104	70-130	
1,1-Dichloroethene	ug/L	50	51.1	102	70-132	
1,2,3-Trichloropropane	ug/L	50	50.2	100	70-130	
1,2-Dibromo-3-chloropropane	ug/L	50	48.0	96	70-130	
1,2-Dibromoethane (EDB)	ug/L	50	54.3	109	70-130	
1,2-Dichlorobenzene	ug/L	50	50.8	102	70-130	
1,2-Dichloroethane	ug/L	50	49.5	99	70-130	
1,2-Dichloropropane	ug/L	50	52.9	106	70-130	
1,4-Dichlorobenzene	ug/L	50	50.5	101	70-130	
2-Butanone (MEK)	ug/L	100	112	112	70-145	
2-Hexanone	ug/L	100	110	110	70-144	
4-Methyl-2-pentanone (MIBK)	ug/L	100	112	112	70-140	
Acetone	ug/L	100	105	105	50-175	
Acrylonitrile	ug/L	250	268	107	70-143	
Benzene	ug/L	50	52.4	105	70-130	
Bromochloromethane	ug/L	50	53.2	106	70-130	
Bromodichloromethane	ug/L	50	53.7	107	70-130	
Bromoform	ug/L	50	46.0	92	70-130	
Bromomethane	ug/L	50	54.9	110	54-130	
Carbon disulfide	ug/L	50	60.3J	121	70-131	
Carbon tetrachloride	ug/L	50	53.4	107	70-132	
Chlorobenzene	ug/L	50	52.6	105	70-130	
Chloroethane	ug/L	50	61.6	123	64-134	
Chloroform	ug/L	50	51.2	102	70-130	
Chloromethane	ug/L	50	56.6	113	64-130	
cis-1,2-Dichloroethene	ug/L	50	50.5	101	70-131	
cis-1,3-Dichloropropene	ug/L	50	53.8	108	70-130	
Dibromochloromethane	ug/L	50	56.2	112	70-130	
Dibromomethane	ug/L	50	50.5	101	70-131	

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9800 Kincey Ave. Suite 100
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(704)875-9092

QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

LABORATORY CONTROL SAMPLE: 895220

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Ethylbenzene	ug/L	50	53.6	107	70-130	
Iodomethane	ug/L	100	112	112	49-180	
Methylene Chloride	ug/L	50	57.3	115	63-130	
Styrene	ug/L	50	50.6	101	70-130	
Tetrachloroethene	ug/L	50	52.6	105	70-130	
Toluene	ug/L	50	51.8	104	70-130	
trans-1,2-Dichloroethene	ug/L	50	50.9	102	70-130	
trans-1,3-Dichloropropene	ug/L	50	53.0	106	70-132	
trans-1,4-Dichloro-2-butene	ug/L	50	49.7J	99	70-141	
Trichloroethene	ug/L	50	51.0	102	70-130	
Trichlorofluoromethane	ug/L	50	46.6	93	62-133	
Vinyl acetate	ug/L	100	120	120	66-157	
Vinyl chloride	ug/L	50	49.2	98	69-130	
Xylene (Total)	ug/L	150	164	109	70-130	
1,2-Dichloroethane-d4 (S)	%			98	70-130	
4-Bromofluorobenzene (S)	%			99	70-130	
Dibromofluoromethane (S)	%			102	70-130	
Toluene-d8 (S)	%			99	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 895221 895222

Parameter	Units	92142546004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
1,1-Dichloroethene	ug/L	0.57J	50	50	54.6	49.3	108	97	70-166	10	30	
Benzene	ug/L	2.0	50	50	49.3	45.3	95	87	70-148	9	30	
Chlorobenzene	ug/L	0.25J	50	50	56.6	50.9	113	101	70-146	11	30	
Toluene	ug/L	ND	50	50	54.9	50.9	110	102	70-155	8	30	
Trichloroethene	ug/L	2.4	50	50	56.6	51.7	108	99	69-151	9	30	
1,2-Dichloroethane-d4 (S)	%						101	102	70-130			
4-Bromofluorobenzene (S)	%						87	85	70-130			
Dibromofluoromethane (S)	%						100	100	70-130			
Toluene-d8 (S)	%						97	99	70-130			

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

QC Batch: OEXT/20107 Analysis Method: EPA 8081
QC Batch Method: EPA 3510 Analysis Description: 8081A GCS Pesticides
Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004, 92141831005, 92141831006

METHOD BLANK: 891044 Matrix: Water
Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004, 92141831005, 92141831006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Endrin aldehyde	ug/L	ND	0.10	12/18/12 02:54	
gamma-BHC (Lindane)	ug/L	ND	0.050	12/18/12 02:54	
Heptachlor	ug/L	ND	0.050	12/18/12 02:54	
Decachlorobiphenyl (S)	%	99	20-130	12/18/12 02:54	
Tetrachloro-m-xylene (S)	%	78	20-130	12/18/12 02:54	

LABORATORY CONTROL SAMPLE: 891045

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Endrin aldehyde	ug/L	.25	0.21	85	20-150	
gamma-BHC (Lindane)	ug/L	.25	0.20	82	20-150	
Heptachlor	ug/L	.25	0.17	70	20-150	
Decachlorobiphenyl (S)	%			100	20-130	
Tetrachloro-m-xylene (S)	%			83	20-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 891046 891047

Parameter	Units	92141831002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Endrin aldehyde	ug/L	ND	.5	.5	0.34	0.32	69	64	20-150	7	30	
gamma-BHC (Lindane)	ug/L	ND	.5	.5	0.35	0.34	71	68	20-150	4	30	
Heptachlor	ug/L	ND	.5	.5	0.20	0.33	41	67	20-150	47	30	R1
Decachlorobiphenyl (S)	%						88	65	20-130			
Tetrachloro-m-xylene (S)	%						56	45	20-130			

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

QC Batch: OEXT/10960 Analysis Method: EPA 8151
QC Batch Method: EPA 8151 Analysis Description: 8151A GCS Herbicides
Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004, 92141831005

METHOD BLANK: 527424 Matrix: Water
Associated Lab Samples: 92141831001, 92141831002, 92141831003, 92141831004, 92141831005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
2,4-D	ug/L	ND	2.0	12/18/12 22:34	
2,4-DCAA (S)	%	87	42-142	12/18/12 22:34	

LABORATORY CONTROL SAMPLE: 527425

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
2,4-D	ug/L	6	4.2	71	23-163	
2,4-DCAA (S)	%			88	42-142	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 527426 527427

Parameter	Units	10215243004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
2,4-D	ug/L	2.0	12	12	9.1	12.5	59	87	17-167	31	40	
2,4-DCAA (S)	%						83	104	42-142			

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 528501 528502

Parameter	Units	92141831002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
2,4-D	ug/L	ND	6	6	0.45J	0.40J	8	7	17-167		40	M1
2,4-DCAA (S)	%						12	10	42-142			S0

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

QC Batch: OEXT/10981
QC Batch Method: EPA 8151
Analysis Method: EPA 8151
Analysis Description: 8151A GCS Herbicides
Associated Lab Samples: 92141831006

METHOD BLANK: 528534
Matrix: Water
Associated Lab Samples: 92141831006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
2,4-D	ug/L	ND	2.0	12/19/12 23:26	
2,4-DCAA (S)	%	94	42-142	12/19/12 23:26	

LABORATORY CONTROL SAMPLE: 528535

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
2,4-D	ug/L	6	4.5	75	23-163	
2,4-DCAA (S)	%			102	42-142	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 528536 528537

Parameter	Units	92141998022 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
2,4-D	ug/L	ND	12	12	9.4	9.0	78	75	17-167	4	40	H2
2,4-DCAA (S)	%						83	78	42-142			

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QUALIFIERS

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PRL - Pace Reporting Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Acid preservation may not be appropriate for 2-Chloroethylvinyl ether, Styrene, and Vinyl chloride.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-O	Pace Analytical Services - Ormond Beach

ANALYTE QUALIFIERS

D6	The relative percent difference (RPD) between the sample and sample duplicate exceeded laboratory control limits.
H2	Extraction or preparation conducted outside EPA method holding time.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.
S0	Surrogate recovery outside laboratory control limits.
S5	Surrogate recovery outside control limits due to matrix interferences (not confirmed by re-analysis).

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: GRANVILLE CO-BUTNER MSWLF
Pace Project No.: 92141831

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92141831001	**3902-MW1R**	EPA 3510	OEXT/20107	EPA 8081	GCSV/13566
92141831002	**3902-MW2R**	EPA 3510	OEXT/20107	EPA 8081	GCSV/13566
92141831003	**3902-MW3R**	EPA 3510	OEXT/20107	EPA 8081	GCSV/13566
92141831004	**3902-MW4**	EPA 3510	OEXT/20107	EPA 8081	GCSV/13566
92141831005	**3902-MW5**	EPA 3510	OEXT/20107	EPA 8081	GCSV/13566
92141831006	**3902-MW6**	EPA 3510	OEXT/20107	EPA 8081	GCSV/13566
92141831001	**3902-MW1R**	EPA 8151	OEXT/10960	EPA 8151	GCSV/7530
92141831002	**3902-MW2R**	EPA 8151	OEXT/10960	EPA 8151	GCSV/7530
92141831003	**3902-MW3R**	EPA 8151	OEXT/10960	EPA 8151	GCSV/7530
92141831004	**3902-MW4**	EPA 8151	OEXT/10960	EPA 8151	GCSV/7530
92141831005	**3902-MW5**	EPA 8151	OEXT/10960	EPA 8151	GCSV/7530
92141831006	**3902-MW6**	EPA 8151	OEXT/10981	EPA 8151	GCSV/7549
92141831001	**3902-MW1R**	EPA 3010	MPRP/12197	EPA 6010	ICP/11146
92141831002	**3902-MW2R**	EPA 3010	MPRP/12197	EPA 6010	ICP/11146
92141831003	**3902-MW3R**	EPA 3010	MPRP/12197	EPA 6010	ICP/11146
92141831004	**3902-MW4**	EPA 3010	MPRP/12197	EPA 6010	ICP/11146
92141831005	**3902-MW5**	EPA 3010	MPRP/12197	EPA 6010	ICP/11146
92141831006	**3902-MW6**	EPA 3010	MPRP/12197	EPA 6010	ICP/11146
92141831007	**3902-SW1**	EPA 3010	MPRP/12197	EPA 6010	ICP/11146
92141831008	**3902-SW2**	EPA 3010	MPRP/12211	EPA 6010	ICP/11153
92141831001	**3902-MW1R**	EPA 8260	MSV/21527		
92141831002	**3902-MW2R**	EPA 8260	MSV/21527		
92141831003	**3902-MW3R**	EPA 8260	MSV/21527		
92141831004	**3902-MW4**	EPA 8260	MSV/21527		
92141831005	**3902-MW5**	EPA 8260	MSV/21534		
92141831006	**3902-MW6**	EPA 8260	MSV/21534		
92141831007	**3902-SW1**	EPA 8260	MSV/21534		
92141831008	**3902-SW2**	EPA 8260	MSV/21534		

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A — Required Client Information:

Company:	Joyce Engineering-NC
Address:	2211 West Meadowview Rd. Greensboro, NC 27407
Email To:	dgirdner@joyceengineering.com
Phone:	(336) 323-0092 Fax: (336) 323-0093
Requested Due Date/TAT:	10 Day (Default)

Section B — Required Project Information:

Report To:	Van Burbach
Copy To:	Dan Girdner
Purchase Order No.	00660.1201.12.03
Client Project ID:	GRANVILLE CO - BUTNER MSWLF
Container Order Number:	38604

Section C — Invoice Information:

Attention:	Jason Falls
Company Name:	Granville Co., Solid Waste
Address:	P.O. Box 906, Oxford, NC 27565
Pace Quote Reference:	
Pace Project Manager:	Godwin, Kevin
Pace Profile #:	

Regulatory Agency: | State / Location: North Carolina

Requested Analysis Filtered (Y/N)

ITEM#	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test (Y/N)	Metals (+Sn)	VOCs 8260	Herb. 8151	Pest. 8081	Residual Chlorine (Y/N)	9214/831
1	3902-MW-1R	WT	G			12/12/12	0855		8										X	X	X	X		NC App I + App II Detects 001
2	3902-MW-2R (MS/MSD)	WT	G			"	1035		24										X	X	X	X		NC App I + App II Detects 002
3	3902-MW-3R	WT	G				1025		8										X	X	X	X		NC App I + App II Detects 003
4	3902-MW-4	WT	G				1010		8										X	X	X	X		NC App I + App II Detects 004
5	3902-MW-5	WT	G				1000		8										X	X	X	X		NC App I + App II Detects 005
6	3902-MW-6	WT	G				0915		8										X	X	X	X		NC App I + App II Detects 006
7	3902-SW-1	WT	G				0945		4										X	X				NC App I only 007
8	3902-SW-2	WT	G				1100		4										X	X				NC App I only 008
~~9~~	~~3902-Trip Blank~~	~~WT~~	~~G~~																	~~X~~				~~NC App I VOC~~
10																								
11																								
12																								

MATRIX CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Adam Cox	12/13/12	1134	[signature] Pace	12-13-12	1134				
App II Detects = Tin; Gamma-BHC, Heptachlor; 2,4-D;	[signature]	12-13-12	1400	RP / Pace	12-13-12	1400	4.1	Y	N	Y
Endrin Aldehyde;										
							TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Adam Cox, Dan Girdner

SIGNATURE of SAMPLER: Adam Cox, Dan Girdner

DATE Signed: 12/12/12

Pace Analytical	Document Name: **Sample Condition Upon Receipt (SCUR)**	Document Revised: October 31, 2012 Page 1 of 2
	Document Number: **F-CHR-CS-03-rev.08**	Issuing Authority: Pace Huntersville Quality Office

Client Name: Joyce Engineering Project # 92141831

Where Received: [X] Huntersville [ ] Asheville [ ] Eden [ ] Raleigh

Courier: [ ] Fed Ex [ ] UPS [ ] USPS [ ] Client [ ] Commercial [X] Pace Other_____

Custody Seal on Cooler/Box Present: [ ] yes [X] no Seals intact: [ ] yes [ ] no

Optional: Proj. Due Date: Proj. Name:

Packing Material: [ ] Bubble Wrap [X] Bubble Bags [ ] None [ ] Other_____

Thermometer Used: IR Gun T1101 **T1102** **Type of Ice:** Wet Blue None [X] Samples on Ice, cooling process has begun

Temp Correction Factor **T1101**: No Correction **T1102**: No Correction

Corrected Cooler Temp.: 4.1 **C** **Biological Tissue is Frozen:** Yes No N/A

Temp should be above freezing to 6°C

Date and Initials of person examining contents: RP 12-13-12

		Comments:
Chain of Custody Present:	[X] Yes [ ] No [ ] N/A	1.
Chain of Custody Filled Out:	[X] Yes [ ] No [ ] N/A	2.
Chain of Custody Relinquished:	[X] Yes [ ] No [ ] N/A	3.
Sampler Name & Signature on COC:	[X] Yes [ ] No [ ] N/A	4.
Samples Arrived within Hold Time:	[X] Yes [ ] No [ ] N/A	5.
Short Hold Time Analysis (<72hr):	[ ] Yes [X] No [ ] N/A	6.
Rush Turn Around Time Requested:	[ ] Yes [X] No [ ] N/A	7.
Sufficient Volume:	[X] Yes [ ] No [ ] N/A	8.
Correct Containers Used:	[X] Yes [ ] No [ ] N/A	9.
-Pace Containers Used:	[X] Yes [ ] No [ ] N/A	
Containers Intact:	[X] Yes [ ] No [ ] N/A	10.
Filtered volume received for Dissolved tests	[ ] Yes [ ] No [X] N/A	11.
Sample Labels match COC:	[ ] Yes [X] No [ ] N/A	12. MW1R-8081-NO TIME
-Includes date/time/ID/Analysis Matrix:_____		
All containers needing preservation have been checked.	[X] Yes [ ] No [ ] N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	[X] Yes [ ] No [ ] N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	[ ] Yes [ ] No	Initial when completed
Samples checked for dechlorination:	[X] Yes [ ] No [ ] N/A	14.
Headspace in VOA Vials (>6mm):	[ ] Yes [X] No [ ] N/A	15.
Trip Blank Present:	[ ] Yes [ ] No [X] N/A	16.
Trip Blank Custody Seals Present	[ ] Yes [ ] No [X] N/A	
Pace Trip Blank Lot # (if purchased):_____		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

SCURF Review: [illegible] **Date:** 12/13/12 **SRF Review:** [illegible] **Date:** 12/13/12

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

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December 28, 2012

Mr. Van Burbach
Joyce Engineering-NC
2211 West Meadowview Rd
Boone Bldg, Suite 101
Greensboro, NC 27407

RE: Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Dear Mr. Burbach:
Enclosed are the analytical results for sample(s) received by the laboratory on December 13, 2012. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Analyses were performed at the Pace Analytical Services location indicated on the sample analyte page for analysis unless otherwise footnoted.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin

kevin.godwin@pacelabs.com
Project Manager

Enclosures

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CERTIFICATIONS

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Ormond Beach Certification IDs
8 East Tower Circle, Ormond Beach, FL 32174
Alabama Certification #: 41320
Arizona Certification #: AZ0735
Colorado Certification: FL NELAC Reciprocity
Connecticut Certification #: PH-0216
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maine Certification #: FL01264
Massachusetts Certification #: M-FL1264
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nevada Certification: FL NELAC Reciprocity
New Hampshire Certification #: 2958
New Jersey Certification #: FL765
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
Pace Analytical Services - Ormond certification number E83509
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
Washington Certification #: C955
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

Charlotte Certification IDs
9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
West Virginia Certification #: 357
Virginia/VELAP Certification #: 460221

Asheville Certification IDs
2225 Riverside Dr., Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
West Virginia Certification #: 356
Virginia/VELAP Certification #: 460222

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SAMPLE SUMMARY

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92141825001	**3901/3902-FIELD BLANK**	Water	12/12/12 11:35	12/13/12 14:00
92141825002	**3901/3902-TRIP BLANK**	Water	12/10/12 06:45	12/13/12 14:00

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SAMPLE ANALYTE COUNT

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92141825001	**3901/3902-FIELD BLANK**	EPA 8081	RES	6	PASI-C
		EPA 8151	LJM	2	PASI-O
		EPA 6010	JMW	18	PASI-A
		EPA 7470	SH1	1	PASI-A
		EPA 8260	KJM	52	PASI-C
		SM 2320B	KCS	1	PASI-A
		SM 2540C	LMD	1	PASI-A
		SM 4500-S2D	AES	1	PASI-A
		EPA 300.0	AES	1	PASI-A
		SM 4500-Cl-E	JDA	1	PASI-A
92141825002	**3901/3902-TRIP BLANK**	EPA 8260	KJM	52	PASI-C

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Sample: 3901/3902-FIELD BLANK **Lab ID: 92141825001** Collected: 12/12/12 11:35 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8081 Organochlorine Pesticides	Analytical Method: EPA 8081 Preparation Method: EPA 3510								
beta-BHC	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 21:18	319-85-7	
gamma-BHC (Lindane)	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 21:18	58-89-9	
Endosulfan I	ND	ug/L	0.10	0.050	1	12/14/12 15:00	12/18/12 21:18	959-98-8	
Heptachlor	ND	ug/L	0.050	0.050	1	12/14/12 15:00	12/18/12 21:18	76-44-8	
Surrogates									
Tetrachloro-m-xylene (S)	67	%	20-130		1	12/14/12 15:00	12/18/12 21:18	877-09-8	
Decachlorobiphenyl (S)	90	%	20-130		1	12/14/12 15:00	12/18/12 21:18	2051-24-3	
8151 Chlorinated Herbicides	Analytical Method: EPA 8151 Preparation Method: EPA 8151								
2,4-D	ND	ug/L	2.0	0.22	1	12/19/12 08:00	12/20/12 01:57	94-75-7	
Surrogates									
2,4-DCAA (S)	105	%	42-142		1	12/19/12 08:00	12/20/12 01:57	19719-28-9	
6010 ICP Groundwater	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Antimony	ND	ug/L	6.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-36-0	
Arsenic	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-38-2	
Barium	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-39-3	
Beryllium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 19:55	7440-41-7	
Cadmium	ND	ug/L	1.0	1.0	1	12/14/12 05:50	12/19/12 19:55	7440-43-9	
Chromium	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-47-3	
Cobalt	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-48-4	
Copper	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-50-8	
Iron	ND	ug/L	300	50.0	1	12/14/12 05:50	12/19/12 19:55	7439-89-6	
Lead	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7439-92-1	
Manganese	ND	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7439-96-5	
Nickel	ND	ug/L	50.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-02-0	
Selenium	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 19:55	7782-49-2	
Silver	ND	ug/L	10.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-22-4	
Thallium	ND	ug/L	5.5	5.4	1	12/14/12 05:50	12/19/12 19:55	7440-28-0	
Tin	ND	ug/L	100	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-31-5	
Vanadium	ND	ug/L	25.0	5.0	1	12/14/12 05:50	12/19/12 19:55	7440-62-2	
Zinc	ND	ug/L	10.0	10.0	1	12/14/12 05:50	12/19/12 19:55	7440-66-6	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	ND	ug/L	0.20	0.10	1	12/17/12 17:40	12/18/12 16:08	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/16/12 04:12	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/16/12 04:12	107-13-1	
Benzene	ND	ug/L	1.0	0.25	1		12/16/12 04:12	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/16/12 04:12	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/16/12 04:12	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/16/12 04:12	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/16/12 04:12	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/16/12 04:12	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/16/12 04:12	75-15-0	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Sample: 3901/3902-FIELD BLANK **Lab ID: 92141825001** Collected: 12/12/12 11:35 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/16/12 04:12	56-23-5	
Chlorobenzene	ND	ug/L	3.0	0.23	1		12/16/12 04:12	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/16/12 04:12	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/16/12 04:12	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/16/12 04:12	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/16/12 04:12	96-12-8	
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/16/12 04:12	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/16/12 04:12	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/16/12 04:12	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	5.0	0.30	1		12/16/12 04:12	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		12/16/12 04:12	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/16/12 04:12	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/16/12 04:12	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/16/12 04:12	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/16/12 04:12	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/16/12 04:12	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/16/12 04:12	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/16/12 04:12	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/16/12 04:12	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/16/12 04:12	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/16/12 04:12	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/16/12 04:12	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/16/12 04:12	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/16/12 04:12	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/16/12 04:12	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/16/12 04:12	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/16/12 04:12	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/16/12 04:12	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/16/12 04:12	127-18-4	
Tetrahydrofuran	ND	ug/L	10.0	3.1	1		12/16/12 04:12	109-99-9	
Toluene	ND	ug/L	1.0	0.26	1		12/16/12 04:12	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/16/12 04:12	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/16/12 04:12	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/16/12 04:12	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/16/12 04:12	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/16/12 04:12	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/16/12 04:12	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/16/12 04:12	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/16/12 04:12	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	100	%	70-130		1		12/16/12 04:12	460-00-4	
Dibromofluoromethane (S)	103	%	70-130		1		12/16/12 04:12	1868-53-7	
1,2-Dichloroethane-d4 (S)	100	%	70-130		1		12/16/12 04:12	17060-07-0	
Toluene-d8 (S)	100	%	70-130		1		12/16/12 04:12	2037-26-5	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Sample: 3901/3902-FIELD BLANK **Lab ID: 92141825001** Collected: 12/12/12 11:35 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	ND	ug/L	5000	1000	1		12/22/12 00:33		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	ND	ug/L	25000	25000	1		12/14/12 16:52		
4500S2D Sulfide Water	Analytical Method: SM 4500-S2D								
Sulfide	ND	ug/L	1000	100	1		12/19/12 15:45	18496-25-8	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	ND	ug/L	250000	2000	1		12/28/12 03:20	14808-79-8	
4500 Chloride	Analytical Method: SM 4500-Cl-E								
Chloride	ND	ug/L	1000	1000	1		12/28/12 10:51	16887-00-6	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Sample: 3901/3902-TRIP BLANK **Lab ID: 92141825002** Collected: 12/10/12 06:45 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Acetone	ND	ug/L	100	10.0	1		12/16/12 04:28	67-64-1	
Acrylonitrile	ND	ug/L	200	1.9	1		12/16/12 04:28	107-13-1	
Benzene	ND	ug/L	1.0	0.25	1		12/16/12 04:28	71-43-2	
Bromochloromethane	ND	ug/L	3.0	0.17	1		12/16/12 04:28	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		12/16/12 04:28	75-27-4	
Bromoform	ND	ug/L	3.0	0.26	1		12/16/12 04:28	75-25-2	
Bromomethane	ND	ug/L	10.0	0.29	1		12/16/12 04:28	74-83-9	
2-Butanone (MEK)	ND	ug/L	100	0.96	1		12/16/12 04:28	78-93-3	
Carbon disulfide	ND	ug/L	100	1.2	1		12/16/12 04:28	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		12/16/12 04:28	56-23-5	
Chlorobenzene	ND	ug/L	3.0	0.23	1		12/16/12 04:28	108-90-7	
Chloroethane	ND	ug/L	10.0	0.54	1		12/16/12 04:28	75-00-3	
Chloroform	ND	ug/L	5.0	0.14	1		12/16/12 04:28	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		12/16/12 04:28	74-87-3	
1,2-Dibromo-3-chloropropane	ND	ug/L	13.0	2.5	1		12/16/12 04:28	96-12-8	
Dibromochloromethane	ND	ug/L	3.0	0.21	1		12/16/12 04:28	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	1.0	0.27	1		12/16/12 04:28	106-93-4	
Dibromomethane	ND	ug/L	10.0	0.21	1		12/16/12 04:28	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	5.0	0.30	1		12/16/12 04:28	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		12/16/12 04:28	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	100	1.0	1		12/16/12 04:28	110-57-6	
1,1-Dichloroethane	ND	ug/L	5.0	0.32	1		12/16/12 04:28	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		12/16/12 04:28	107-06-2	
1,1-Dichloroethene	ND	ug/L	5.0	0.56	1		12/16/12 04:28	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	5.0	0.19	1		12/16/12 04:28	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	5.0	0.49	1		12/16/12 04:28	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		12/16/12 04:28	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		12/16/12 04:28	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		12/16/12 04:28	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	0.30	1		12/16/12 04:28	100-41-4	
2-Hexanone	ND	ug/L	50.0	0.46	1		12/16/12 04:28	591-78-6	
Iodomethane	ND	ug/L	10.0	0.32	1		12/16/12 04:28	74-88-4	
Methylene Chloride	ND	ug/L	1.0	0.97	1		12/16/12 04:28	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	100	0.33	1		12/16/12 04:28	108-10-1	
Styrene	ND	ug/L	1.0	0.26	1		12/16/12 04:28	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	5.0	0.33	1		12/16/12 04:28	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	3.0	0.40	1		12/16/12 04:28	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		12/16/12 04:28	127-18-4	
Tetrahydrofuran	ND	ug/L	10.0	3.1	1		12/16/12 04:28	109-99-9	
Toluene	ND	ug/L	1.0	0.26	1		12/16/12 04:28	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		12/16/12 04:28	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		12/16/12 04:28	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		12/16/12 04:28	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		12/16/12 04:28	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		12/16/12 04:28	96-18-4	
Vinyl acetate	ND	ug/L	50.0	0.35	1		12/16/12 04:28	108-05-4	

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ANALYTICAL RESULTS

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Sample: 3901/3902-TRIP BLANK **Lab ID: 92141825002** Collected: 12/10/12 06:45 Received: 12/13/12 14:00 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Vinyl chloride	ND	ug/L	1.0	0.62	1		12/16/12 04:28	75-01-4	
Xylene (Total)	ND	ug/L	5.0	0.66	1		12/16/12 04:28	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	102	%	70-130		1		12/16/12 04:28	460-00-4	
Dibromofluoromethane (S)	103	%	70-130		1		12/16/12 04:28	1868-53-7	
1,2-Dichloroethane-d4 (S)	97	%	70-130		1		12/16/12 04:28	17060-07-0	
Toluene-d8 (S)	100	%	70-130		1		12/16/12 04:28	2037-26-5	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: MERP/4768
QC Batch Method: EPA 7470
Analysis Method: EPA 7470
Analysis Description: 7470 Mercury
Associated Lab Samples: 92141825001

METHOD BLANK: 891841
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	12/18/12 14:29	

LABORATORY CONTROL SAMPLE: 891842

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.2	89	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 891843 891844

Parameter	Units	92141713006 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.1	2.2	84	86	75-125	2	25	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: MPRP/12197
QC Batch Method: EPA 3010
Analysis Method: EPA 6010
Analysis Description: 6010 MET NC Groundwater
Associated Lab Samples: 92141825001

METHOD BLANK: 890466
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	6.0	12/19/12 18:26	
Arsenic	ug/L	ND	10.0	12/19/12 18:26	
Barium	ug/L	ND	100	12/19/12 18:26	
Beryllium	ug/L	ND	1.0	12/19/12 18:26	
Cadmium	ug/L	ND	1.0	12/19/12 18:26	
Chromium	ug/L	ND	10.0	12/19/12 18:26	
Cobalt	ug/L	ND	10.0	12/19/12 18:26	
Copper	ug/L	ND	10.0	12/19/12 18:26	
Iron	ug/L	ND	300	12/19/12 18:26	
Lead	ug/L	ND	10.0	12/19/12 18:26	
Manganese	ug/L	ND	50.0	12/19/12 18:26	
Nickel	ug/L	ND	50.0	12/19/12 18:26	
Selenium	ug/L	ND	10.0	12/19/12 18:26	
Silver	ug/L	ND	10.0	12/19/12 18:26	
Thallium	ug/L	ND	5.5	12/19/12 18:26	
Tin	ug/L	ND	100	12/19/12 18:26	
Vanadium	ug/L	ND	25.0	12/19/12 18:26	
Zinc	ug/L	ND	10.0	12/20/12 16:09	

LABORATORY CONTROL SAMPLE: 890467

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	492	98	80-120	
Arsenic	ug/L	500	481	96	80-120	
Barium	ug/L	500	495	99	80-120	
Beryllium	ug/L	500	494	99	80-120	
Cadmium	ug/L	500	500	100	80-120	
Chromium	ug/L	500	505	101	80-120	
Cobalt	ug/L	500	501	100	80-120	
Copper	ug/L	500	494	99	80-120	
Iron	ug/L	5000	5080	102	80-120	
Lead	ug/L	500	497	99	80-120	
Manganese	ug/L	500	501	100	80-120	
Nickel	ug/L	500	499	100	80-120	
Selenium	ug/L	500	487	97	80-120	
Silver	ug/L	250	248	99	80-120	
Thallium	ug/L	500	473	95	80-120	
Tin	ug/L	500	497	99	80-120	
Vanadium	ug/L	500	509	102	80-120	
Zinc	ug/L	500	491	98	80-120	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 890471 890472

Parameter	Units	92141831002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	500	500	525	527	105	105	75-125	0	25	
Arsenic	ug/L	ND	500	500	532	530	106	106	75-125	0	25	
Barium	ug/L	113	500	500	585	586	94	95	75-125	0	25	
Beryllium	ug/L	ND	500	500	481	491	96	98	75-125	2	25	
Cadmium	ug/L	ND	500	500	469	470	94	94	75-125	0	25	
Chromium	ug/L	5.2J	500	500	484	484	96	96	75-125	0	25	
Cobalt	ug/L	11.3	500	500	481	482	94	94	75-125	0	25	
Copper	ug/L	ND	500	500	531	534	106	107	75-125	1	25	
Iron	ug/L	10600	5000	5000	14700	14800	84	85	75-125	0	25	
Lead	ug/L	ND	500	500	448	448	90	90	75-125	0	25	
Manganese	ug/L	8230	500	500	8530	8570	59	67	75-125	0	25	M1
Nickel	ug/L	91.8	500	500	554	555	92	93	75-125	0	25	
Selenium	ug/L	ND	500	500	526	521	105	104	75-125	1	25	
Silver	ug/L	ND	250	250	263	263	104	104	75-125	0	25	
Thallium	ug/L	ND	500	500	418	420	84	84	75-125	0	25	
Tin	ug/L	30.0J	500	500	515	516	97	97	75-125	0	25	
Vanadium	ug/L	ND	500	500	500	500	100	100	75-125	0	25	
Zinc	ug/L	ND	500	500	502	508	100	101	75-125	1	25	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: MSV/21463
Analysis Method: EPA 8260
QC Batch Method: EPA 8260
Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92141825001, 92141825002

METHOD BLANK: 891526
Matrix: Water
Associated Lab Samples: 92141825001, 92141825002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	5.0	12/16/12 01:34	
1,1,1-Trichloroethane	ug/L	ND	1.0	12/16/12 01:34	
1,1,2,2-Tetrachloroethane	ug/L	ND	3.0	12/16/12 01:34	
1,1,2-Trichloroethane	ug/L	ND	1.0	12/16/12 01:34	
1,1-Dichloroethane	ug/L	ND	5.0	12/16/12 01:34	
1,1-Dichloroethene	ug/L	ND	5.0	12/16/12 01:34	
1,2,3-Trichloropropane	ug/L	ND	1.0	12/16/12 01:34	
1,2-Dibromo-3-chloropropane	ug/L	ND	13.0	12/16/12 01:34	
1,2-Dibromoethane (EDB)	ug/L	ND	1.0	12/16/12 01:34	
1,2-Dichlorobenzene	ug/L	ND	5.0	12/16/12 01:34	
1,2-Dichloroethane	ug/L	ND	1.0	12/16/12 01:34	
1,2-Dichloropropane	ug/L	ND	1.0	12/16/12 01:34	
1,4-Dichlorobenzene	ug/L	ND	1.0	12/16/12 01:34	
2-Butanone (MEK)	ug/L	ND	100	12/16/12 01:34	
2-Hexanone	ug/L	ND	50.0	12/16/12 01:34	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	100	12/16/12 01:34	
Acetone	ug/L	ND	100	12/16/12 01:34	
Acrylonitrile	ug/L	ND	200	12/16/12 01:34	
Benzene	ug/L	ND	1.0	12/16/12 01:34	
Bromochloromethane	ug/L	ND	3.0	12/16/12 01:34	
Bromodichloromethane	ug/L	ND	1.0	12/16/12 01:34	
Bromoform	ug/L	ND	3.0	12/16/12 01:34	
Bromomethane	ug/L	ND	10.0	12/16/12 01:34	
Carbon disulfide	ug/L	ND	100	12/16/12 01:34	
Carbon tetrachloride	ug/L	ND	1.0	12/16/12 01:34	
Chlorobenzene	ug/L	ND	3.0	12/16/12 01:34	
Chloroethane	ug/L	ND	10.0	12/16/12 01:34	
Chloroform	ug/L	ND	5.0	12/16/12 01:34	
Chloromethane	ug/L	ND	1.0	12/16/12 01:34	
cis-1,2-Dichloroethene	ug/L	ND	5.0	12/16/12 01:34	
cis-1,3-Dichloropropene	ug/L	ND	1.0	12/16/12 01:34	
Dibromochloromethane	ug/L	ND	3.0	12/16/12 01:34	
Dibromomethane	ug/L	ND	10.0	12/16/12 01:34	
Ethylbenzene	ug/L	ND	1.0	12/16/12 01:34	
Iodomethane	ug/L	ND	10.0	12/16/12 01:34	
Methylene Chloride	ug/L	ND	1.0	12/16/12 01:34	
Styrene	ug/L	ND	1.0	12/16/12 01:34	
Tetrachloroethene	ug/L	ND	1.0	12/16/12 01:34	
Tetrahydrofuran	ug/L	ND	10.0	12/16/12 01:34	
Toluene	ug/L	ND	1.0	12/16/12 01:34	
trans-1,2-Dichloroethene	ug/L	ND	5.0	12/16/12 01:34	
trans-1,3-Dichloropropene	ug/L	ND	1.0	12/16/12 01:34	
trans-1,4-Dichloro-2-butene	ug/L	ND	100	12/16/12 01:34	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

METHOD BLANK: 891526 Matrix: Water

Associated Lab Samples: 92141825001, 92141825002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichloroethene	ug/L	ND	1.0	12/16/12 01:34	
Trichlorofluoromethane	ug/L	ND	1.0	12/16/12 01:34	
Vinyl acetate	ug/L	ND	50.0	12/16/12 01:34	
Vinyl chloride	ug/L	ND	1.0	12/16/12 01:34	
Xylene (Total)	ug/L	ND	5.0	12/16/12 01:34	
1,2-Dichloroethane-d4 (S)	%	99	70-130	12/16/12 01:34	
4-Bromofluorobenzene (S)	%	101	70-130	12/16/12 01:34	
Dibromofluoromethane (S)	%	103	70-130	12/16/12 01:34	
Toluene-d8 (S)	%	97	70-130	12/16/12 01:34	

LABORATORY CONTROL SAMPLE: 891527

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	51.9	104	70-130	
1,1,1-Trichloroethane	ug/L	50	47.2	94	70-130	
1,1,2,2-Tetrachloroethane	ug/L	50	47.8	96	70-130	
1,1,2-Trichloroethane	ug/L	50	53.8	108	70-130	
1,1-Dichloroethane	ug/L	50	46.0	92	70-130	
1,1-Dichloroethene	ug/L	50	44.7	89	70-132	
1,2,3-Trichloropropane	ug/L	50	51.1	102	70-130	
1,2-Dibromo-3-chloropropane	ug/L	50	53.2	106	70-130	
1,2-Dibromoethane (EDB)	ug/L	50	51.5	103	70-130	
1,2-Dichlorobenzene	ug/L	50	51.0	102	70-130	
1,2-Dichloroethane	ug/L	50	45.4	91	70-130	
1,2-Dichloropropane	ug/L	50	48.4	97	70-130	
1,4-Dichlorobenzene	ug/L	50	49.5	99	70-130	
2-Butanone (MEK)	ug/L	100	83.8J	84	70-145	
2-Hexanone	ug/L	100	100	100	70-144	
4-Methyl-2-pentanone (MIBK)	ug/L	100	98.7J	99	70-140	
Acetone	ug/L	100	91.3J	91	50-175	
Acrylonitrile	ug/L	250	237	95	70-143	
Benzene	ug/L	50	50.9	102	70-130	
Bromochloromethane	ug/L	50	49.8	100	70-130	
Bromodichloromethane	ug/L	50	50.6	101	70-130	
Bromoform	ug/L	50	48.5	97	70-130	
Bromomethane	ug/L	50	39.5	79	54-130	
Carbon disulfide	ug/L	50	50.0J	100	70-131	
Carbon tetrachloride	ug/L	50	51.4	103	70-132	
Chlorobenzene	ug/L	50	51.4	103	70-130	
Chloroethane	ug/L	50	43.7	87	64-134	
Chloroform	ug/L	50	47.0	94	70-130	
Chloromethane	ug/L	50	51.0	102	64-130	
cis-1,2-Dichloroethene	ug/L	50	45.4	91	70-131	
cis-1,3-Dichloropropene	ug/L	50	48.7	97	70-130	
Dibromochloromethane	ug/L	50	55.2	110	70-130	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

LABORATORY CONTROL SAMPLE: 891527

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Dibromomethane	ug/L	50	51.6	103	70-131	
Ethylbenzene	ug/L	50	49.0	98	70-130	
Iodomethane	ug/L	100	108	108	49-180	
Methylene Chloride	ug/L	50	47.2	94	63-130	
Styrene	ug/L	50	52.1	104	70-130	
Tetrachloroethene	ug/L	50	51.5	103	70-130	
Tetrahydrofuran	ug/L	500	475	95	70-130	
Toluene	ug/L	50	50.0	100	70-130	
trans-1,2-Dichloroethene	ug/L	50	42.3	85	70-130	
trans-1,3-Dichloropropene	ug/L	50	49.2	98	70-132	
trans-1,4-Dichloro-2-butene	ug/L	50	54.8J	110	70-141	
Trichloroethene	ug/L	50	51.4	103	70-130	
Trichlorofluoromethane	ug/L	50	39.2	78	62-133	
Vinyl acetate	ug/L	100	113	113	66-157	
Vinyl chloride	ug/L	50	41.3	83	69-130	
Xylene (Total)	ug/L	150	150	100	70-130	
1,2-Dichloroethane-d4 (S)	%			88	70-130	
4-Bromofluorobenzene (S)	%			103	70-130	
Dibromofluoromethane (S)	%			93	70-130	
Toluene-d8 (S)	%			98	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 891528 891529

Parameter	Units	92141713006 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
1,1-Dichloroethene	ug/L	ND	50	50	51.6	58.9	103	118	70-166	13	30	
Benzene	ug/L	ND	50	50	50.4	53.2	101	106	70-148	6	30	
Chlorobenzene	ug/L	ND	50	50	57.3	62.4	115	125	70-146	8	30	
Toluene	ug/L	ND	50	50	56.7	61.3	113	123	70-155	8	30	
Trichloroethene	ug/L	ND	50	50	59.4	63.2	119	126	69-151	6	30	
1,2-Dichloroethane-d4 (S)	%						98	95	70-130			
4-Bromofluorobenzene (S)	%						95	99	70-130			
Dibromofluoromethane (S)	%						101	102	70-130			
Toluene-d8 (S)	%						96	96	70-130			

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: OEXT/20107
QC Batch Method: EPA 3510
Analysis Method: EPA 8081
Analysis Description: 8081A GCS Pesticides
Associated Lab Samples: 92141825001

METHOD BLANK: 891044
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
beta-BHC	ug/L	ND	0.050	12/18/12 02:54	
Endosulfan I	ug/L	ND	0.10	12/18/12 02:54	
gamma-BHC (Lindane)	ug/L	ND	0.050	12/18/12 02:54	
Heptachlor	ug/L	ND	0.050	12/18/12 02:54	
Decachlorobiphenyl (S)	%	99	20-130	12/18/12 02:54	
Tetrachloro-m-xylene (S)	%	78	20-130	12/18/12 02:54	

LABORATORY CONTROL SAMPLE: 891045

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
beta-BHC	ug/L	.25	0.20	81	20-150	
Endosulfan I	ug/L	.25	0.21	84	20-150	
gamma-BHC (Lindane)	ug/L	.25	0.20	82	20-150	
Heptachlor	ug/L	.25	0.17	70	20-150	
Decachlorobiphenyl (S)	%			100	20-130	
Tetrachloro-m-xylene (S)	%			83	20-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 891046 891047

Parameter	Units	92141831002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
beta-BHC	ug/L	0.13	.5	.5	0.42	0.41	58	58	20-150	1	30	
Endosulfan I	ug/L	ND	.5	.5	0.38	0.48	76	97	20-150	24	30	
gamma-BHC (Lindane)	ug/L	ND	.5	.5	0.35	0.34	71	68	20-150	4	30	
Heptachlor	ug/L	ND	.5	.5	0.20	0.33	41	67	20-150	47	30	R1
Decachlorobiphenyl (S)	%						88	65	20-130			
Tetrachloro-m-xylene (S)	%						56	45	20-130			

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Pace Analytical Services, Inc.
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: OEXT/10981
QC Batch Method: EPA 8151
Analysis Method: EPA 8151
Analysis Description: 8151A GCS Herbicides
Associated Lab Samples: 92141825001

METHOD BLANK: 528534
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
2,4-D	ug/L	ND	2.0	12/19/12 23:26	
2,4-DCAA (S)	%	94	42-142	12/19/12 23:26	

LABORATORY CONTROL SAMPLE: 528535

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
2,4-D	ug/L	6	4.5	75	23-163	
2,4-DCAA (S)	%			102	42-142	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 528536 528537

Parameter	Units	92141998022 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
2,4-D	ug/L	ND	12	12	9.4	9.0	78	75	17-167	4	40	H2
2,4-DCAA (S)	%						83	78	42-142			

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: WET/23585
QC Batch Method: SM 2320B
Analysis Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 92141825001

METHOD BLANK: 895554
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	ug/L	ND	5000	12/21/12 17:40	

LABORATORY CONTROL SAMPLE: 895555

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	ug/L	50000	45300	91	90-110	

MATRIX SPIKE SAMPLE: 895557

Parameter	Units	92141713006 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	ug/L	152000	50000	188000	73	75-125	M1

MATRIX SPIKE SAMPLE: 895559

Parameter	Units	92141862016 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	ug/L	ND	50000	44700	89	75-125	

SAMPLE DUPLICATE: 895556

Parameter	Units	92141713006 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	ug/L	152000	145000	4	20	

SAMPLE DUPLICATE: 895558

Parameter	Units	92141862016 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	ug/L	ND	ND		20	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: WET/23481
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92141825001

METHOD BLANK: 891085
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	ug/L	ND	25000	12/14/12 16:48	

LABORATORY CONTROL SAMPLE: 891086

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	ug/L	250000	274000	110	80-120	

SAMPLE DUPLICATE: 891087

Parameter	Units	92141713006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	ug/L	419000	416000	1	20	

SAMPLE DUPLICATE: 891088

Parameter	Units	92141699008 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	ug/L	908 mg/L	905000	0	20	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: WET/23527
QC Batch Method: SM 4500-S2D
Analysis Method: SM 4500-S2D
Analysis Description: 4500S2D Sulfide Water
Associated Lab Samples: 92141825001

METHOD BLANK: 893143
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfide	ug/L	ND	1000	12/19/12 15:45	

LABORATORY CONTROL SAMPLE: 893144

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfide	ug/L	500	517J	103	90-110	

MATRIX SPIKE SAMPLE: 893145

Parameter	Units	92141741004 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfide	ug/L	ND	500	578J	116	75-125	

SAMPLE DUPLICATE: 893146

Parameter	Units	92141741004 Result	Dup Result	RPD	Max RPD	Qualifiers
Sulfide	ug/L	ND	ND		20	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: WETA/14102
QC Batch Method: EPA 300.0
Analysis Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92141825001

METHOD BLANK: 896432
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	ug/L	ND	250000	12/27/12 20:47	

LABORATORY CONTROL SAMPLE: 896433

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	ug/L	20000	19900J	99	90-110	

MATRIX SPIKE SAMPLE: 896434

Parameter	Units	92141707004 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	ug/L	97.7 mg/L	20000	185000J	438	90-110	M6

MATRIX SPIKE SAMPLE: 896436

Parameter	Units	92141713006 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	ug/L	2900J	20000	21800J	95	90-110	

SAMPLE DUPLICATE: 896435

Parameter	Units	92141707004 Result	Dup Result	RPD	Max RPD	Qualifiers
Sulfate	ug/L	97.7 mg/L	92800J	5	20	

SAMPLE DUPLICATE: 896437

Parameter	Units	92141713006 Result	Dup Result	RPD	Max RPD	Qualifiers
Sulfate	ug/L	2900J	2940J	2	20	

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QUALITY CONTROL DATA

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

QC Batch: WETA/14119
QC Batch Method: SM 4500-Cl-E
Analysis Method: SM 4500-Cl-E
Analysis Description: 4500 Chloride
Associated Lab Samples: 92141825001

METHOD BLANK: 897722
Matrix: Water
Associated Lab Samples: 92141825001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	ug/L	ND	1000	12/28/12 10:05	

LABORATORY CONTROL SAMPLE: 897723

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	ug/L	20000	20100	100	90-110	

MATRIX SPIKE SAMPLE: 897725

Parameter	Units	92141713006 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	ug/L	107000	20000	121000	69	75-125	M1

SAMPLE DUPLICATE: 897724

Parameter	Units	92141713006 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	ug/L	107000	108000	0	20	

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QUALIFIERS

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PRL - Pace Reporting Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Acid preservation may not be appropriate for 2-Chloroethylvinyl ether, Styrene, and Vinyl chloride.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-O	Pace Analytical Services - Ormond Beach

ANALYTE QUALIFIERS

H2	Extraction or preparation conducted outside EPA method holding time.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
M6	Matrix spike and Matrix spike duplicate recovery not evaluated against control limits due to sample dilution.
R1	RPD value was outside control limits.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: GRANVILLE CO-BLANKS
Pace Project No.: 92141825

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92141825001	**3901/3902-FIELD BLANK**	EPA 3510	OEXT/20107	EPA 8081	GCSV/13566
92141825001	**3901/3902-FIELD BLANK**	EPA 8151	OEXT/10981	EPA 8151	GCSV/7549
92141825001	**3901/3902-FIELD BLANK**	EPA 3010	MPRP/12197	EPA 6010	ICP/11146
92141825001	**3901/3902-FIELD BLANK**	EPA 7470	MERP/4768	EPA 7470	MERC/4661
92141825001	**3901/3902-FIELD BLANK**	EPA 8260	MSV/21463		
92141825002	**3901/3902-TRIP BLANK**	EPA 8260	MSV/21463		
92141825001	**3901/3902-FIELD BLANK**	SM 2320B	WET/23585		
92141825001	**3901/3902-FIELD BLANK**	SM 2540C	WET/23481		
92141825001	**3901/3902-FIELD BLANK**	SM 4500-S2D	WET/23527		
92141825001	**3901/3902-FIELD BLANK**	EPA 300.0	WETA/14102		
92141825001	**3901/3902-FIELD BLANK**	SM 4500-Cl-E	WETA/14119		

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A — Required Client Information:

Company:	Joyce Engineering-Greensboro
Address:	2211 West Meadowview Rd
	Greensboro, NC 27407
Email To:	dgirdner@joyceengineering.com
Phone:	(336) 323-0092 Fax:
Requested Due Date/TAT:	10 Day (Default)

Section B — Required Project Information:

Report To:	Van Burbach
Copy To:	Dan Girdner
Purchase Order No.	660.1201.12.02
Client Project ID:	GRANVILLE CO - BLANKS
Container Order Number:	38605

Section C — Invoice Information:

Attention:	Jason Falls
Company Name:	Granville Co. Solid Waste
Address:	P.O. Box 906, Oxford, NC 27565
Pace Quote Reference:	
Pace Project Manager:	Godwin, Kevin
Pace Profile #:	

Regulatory Agency	
State / Location	North Carolina

Requested Analysis Filtered (Y/N)

ITEM#	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Alkalinity/Chloride	TDS	Sulfate	Sulfide	Metals (+ Sn, Hg, Fe, Mn)	VOCs 8260 (+ THF)	Semi-Voa 8270	Pest. 8081/ PCB 8082	Herb. 8151					Residual Chlorine (Y/N)	92141825	
1	3901/3902-FIELD BLANK	WT	G			12/12/12	1135		14										X	X	X	X	X	X	X	X	X						App I +App II detects, C&D	001
2	3901/3902-TRIP BLANK	WT	G			12/12/12	0645		2															X									App I +App II detects, C&D	002
3																																		
4																																		
5																																		
6																																		
7																																		
8																																		
9																																		
10																																		
11																																		
12																																		

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
Detects: Beta-BHC, Endosulfan I	Adam Cox	12/13/12	1134	[signature] / Pace	12-13-12	1134				
	[signature] / Pace	12-13-12	1400	RP / Pace	12-13-12	1400	1.7	Y	N	Y

SAMPLER NAME AND SIGNATURE			
PRINT Name of SAMPLER:	Adam Cox, Dan Girdner		
SIGNATURE of SAMPLER:	Adam Cox, [signature]	DATE Signed:	12/12/12

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

Pace Analytical	Document Name: **Sample Condition Upon Receipt (SCUR)**	Document Revised: October 31, 2012 Page 1 of 2
	Document Number: **F-CHR-CS-03-rev.08**	Issuing Authority: Pace Huntersville Quality Office

Client Name: Joyce Engineering Project # 92141825

Where Received: [X] Huntersville [ ] Asheville [ ] Eden [ ] Raleigh

Courier: [ ] Fed Ex [ ] UPS [ ] USPS [ ] Client [ ] Commercial [X] Pace Other_____

Custody Seal on Cooler/Box Present: [ ] yes [X] no Seals intact: [ ] yes [ ] no

Optional
Proj. Due Date:
Proj. Name:

Packing Material: [ ] Bubble Wrap [X] Bubble Bags [ ] None [ ] Other_____

Thermometer Used: IR Gun T1101 T1102 **Type of Ice:** Wet Blue None [X] Samples on ice, cooling process has begun

Temp Correction Factor **T1101**: No Correction **T1102**: No Correction

Corrected Cooler Temp.: 1.7 C **Biological Tissue Is Frozen:** Yes No N/A

Temp should be above freezing to 6°C

Date and Initials of person examining contents: RP 12-13-12

		Comments:
Chain of Custody Present:	[X]Yes [ ]No [ ]N/A	1.
Chain of Custody Filled Out:	[X]Yes [ ]No [ ]N/A	2.
Chain of Custody Relinquished:	[X]Yes [ ]No [ ]N/A	3.
Sampler Name & Signature on COC:	[X]Yes [ ]No [ ]N/A	4.
Samples Arrived within Hold Time:	[X]Yes [ ]No [ ]N/A	5.
Short Hold Time Analysis (<72hr):	[ ]Yes [X]No [ ]N/A	6.
Rush Turn Around Time Requested:	[ ]Yes [X]No [ ]N/A	7.
Sufficient Volume:	[X]Yes [ ]No [ ]N/A	8. did not receive 8082
Correct Containers Used:	[X]Yes [ ]No [ ]N/A	9.
-Pace Containers Used:	[X]Yes [ ]No [ ]N/A	
Containers Intact:	[X]Yes [ ]No [ ]N/A	10.
Filtered volume received for Dissolved tests	[ ]Yes [ ]No [X]N/A	11.
Sample Labels match COC:	[ ]Yes [X]No [ ]N/A	12. Supplied Bottles – NO TIME. Trip Blank NO TIME & Date } as per COC
-Includes date/time/ID/Analysis Matrix:_____		
All containers needing preservation have been checked.	[X]Yes [ ]No [ ]N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	[X]Yes [ ]No [ ]N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	[ ]Yes [ ]No	initial when completed
Samples checked for dechlorination:	[X]Yes [ ]No [ ]N/A	14.
Headspace in VOA Vials (>6mm):	[ ]Yes [X]No [ ]N/A	15.
Trip Blank Present:	[X]Yes [ ]No [ ]N/A	16.
Trip Blank Custody Seals Present	[X]Yes [ ]No [ ]N/A	
Pace Trip Blank Lot # (if purchased):_____		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: Dan Gardner Date/Time: 12/13/12

Comments/ Resolution: client instructed 8270 + 8082 analysis not needed KG

SCURF Review: [signature] **Date:** 12/13/12 **SRF Review:** [signature] **Date:** 12/13/12

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

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January 17, 2013

Mr. Van Burbach
Joyce Engineering-NC
2211 West Meadowview Rd
Boone Bldg, Suite 101
Greensboro, NC 27407

RE: Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Dear Mr. Burbach:
Enclosed are the analytical results for sample(s) received by the laboratory on January 11, 2013. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Analyses were performed at the Pace Analytical Services location indicated on the sample analyte page for analysis unless otherwise footnoted.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin

kevin.godwin@pacelabs.com
Project Manager

Enclosures

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CERTIFICATIONS

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Charlotte Certification IDs
9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
West Virginia Certification #: 357
Virginia/VELAP Certification #: 460221

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SAMPLE SUMMARY

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92144632001	**3902-MW2R**	Water	01/10/13 13:40	01/11/13 13:35
92144632002	**3902-FIELD BLANK**	Water	01/10/13 14:00	01/11/13 13:35
92144632003	**3902-TRIP BLANK**	Water	01/10/13 08:00	01/11/13 13:35
92144632004	**3902-NES1**	Water	01/10/13 14:00	01/11/13 13:35

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Asheville, NC 28804
(828)254-7176

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Huntersville, NC 28078
(704)875-9092

SAMPLE ANALYTE COUNT

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92144632001	**3902-MW2R**	EPA 8260	KJM	5	PASI-C
92144632002	**3902-FIELD BLANK**	EPA 8260	KJM	5	PASI-C
92144632003	**3902-TRIP BLANK**	EPA 8260	KJM	5	PASI-C
92144632004	**3902-NES1**	EPA 8260	KJM	5	PASI-C

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HITS ONLY

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Lab Sample ID Method	Client Sample ID Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92144632001	**3902-MW2R**					
EPA 8260	Benzene	1.4	ug/L	1.0	01/14/13 17:13	

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ANALYTICAL RESULTS

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Sample: 3902-MW2R **Lab ID: 92144632001** Collected: 01/10/13 13:40 Received: 01/11/13 13:35 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Benzene	**1.4**	ug/L	1.0	0.25	1		01/14/13 17:13	71-43-2	
Surrogates									
4-Bromofluorobenzene (S)	98	%	70-130		1		01/14/13 17:13	460-00-4	
Dibromofluoromethane (S)	113	%	70-130		1		01/14/13 17:13	1868-53-7	
1,2-Dichloroethane-d4 (S)	110	%	70-130		1		01/14/13 17:13	17060-07-0	
Toluene-d8 (S)	100	%	70-130		1		01/14/13 17:13	2037-26-5	

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ANALYTICAL RESULTS

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Sample: 3902-FIELD BLANK **Lab ID: 92144632002** Collected: 01/10/13 14:00 Received: 01/11/13 13:35 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Benzene	ND	ug/L	1.0	0.25	1		01/14/13 17:29	71-43-2	
Surrogates									
4-Bromofluorobenzene (S)	96	%	70-130		1		01/14/13 17:29	460-00-4	
Dibromofluoromethane (S)	110	%	70-130		1		01/14/13 17:29	1868-53-7	
1,2-Dichloroethane-d4 (S)	110	%	70-130		1		01/14/13 17:29	17060-07-0	
Toluene-d8 (S)	100	%	70-130		1		01/14/13 17:29	2037-26-5	

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ANALYTICAL RESULTS

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Sample: 3902-TRIP BLANK **Lab ID: 92144632003** Collected: 01/10/13 08:00 Received: 01/11/13 13:35 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Benzene	ND	ug/L	1.0	0.25	1		01/14/13 17:45	71-43-2	
Surrogates									
4-Bromofluorobenzene (S)	98	%	70-130		1		01/14/13 17:45	460-00-4	
Dibromofluoromethane (S)	108	%	70-130		1		01/14/13 17:45	1868-53-7	
1,2-Dichloroethane-d4 (S)	109	%	70-130		1		01/14/13 17:45	17060-07-0	
Toluene-d8 (S)	101	%	70-130		1		01/14/13 17:45	2037-26-5	

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ANALYTICAL RESULTS

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Sample: 3902-NES1 **Lab ID: 92144632004** Collected: 01/10/13 14:00 Received: 01/11/13 13:35 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260								
Benzene	ND	ug/L	1.0	0.25	1		01/14/13 18:01	71-43-2	
Surrogates									
4-Bromofluorobenzene (S)	99	%	70-130		1		01/14/13 18:01	460-00-4	
Dibromofluoromethane (S)	108	%	70-130		1		01/14/13 18:01	1868-53-7	
1,2-Dichloroethane-d4 (S)	111	%	70-130		1		01/14/13 18:01	17060-07-0	
Toluene-d8 (S)	100	%	70-130		1		01/14/13 18:01	2037-26-5	

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QUALITY CONTROL DATA

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

QC Batch: MSV/21699 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92144632001, 92144632002, 92144632003, 92144632004

METHOD BLANK: 904876 Matrix: Water
Associated Lab Samples: 92144632001, 92144632002, 92144632003, 92144632004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	01/14/13 15:37	
1,2-Dichloroethane-d4 (S)	%	108	70-130	01/14/13 15:37	
4-Bromofluorobenzene (S)	%	95	70-130	01/14/13 15:37	
Dibromofluoromethane (S)	%	111	70-130	01/14/13 15:37	
Toluene-d8 (S)	%	100	70-130	01/14/13 15:37	

LABORATORY CONTROL SAMPLE: 904877

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	52.7	105	70-130	
1,2-Dichloroethane-d4 (S)	%			108	70-130	
4-Bromofluorobenzene (S)	%			99	70-130	
Dibromofluoromethane (S)	%			105	70-130	
Toluene-d8 (S)	%			98	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 904878 904879

Parameter	Units	92144631001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Benzene	ug/L	ND	50	50	49.0	49.2	98	98	70-148	0	30	
1,2-Dichloroethane-d4 (S)	%						105	106	70-130			
4-Bromofluorobenzene (S)	%						94	98	70-130			
Dibromofluoromethane (S)	%						105	97	70-130			
Toluene-d8 (S)	%						99	100	70-130			

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QUALIFIERS

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PRL - Pace Reporting Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Acid preservation may not be appropriate for 2-Chloroethylvinyl ether, Styrene, and Vinyl chloride.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-C Pace Analytical Services - Charlotte

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: BUTNER MSWLF VERTIFICATION
Pace Project No.: 92144632

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92144632001	**3902-MW2R**	EPA 8260	MSV/21699		
92144632002	**3902-FIELD BLANK**	EPA 8260	MSV/21699		
92144632003	**3902-TRIP BLANK**	EPA 8260	MSV/21699		
92144632004	**3902-NES1**	EPA 8260	MSV/21699		

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Pace Analytical

Section A — Required Client Information:

Company:	Joyce Engineering-NC
Address:	2211 West Meadowview Rd. Greensboro, NC 27407
Email To:	dgirdner@joyceengineering.com
Phone:	(336) 323-0092 Fax: (336) 323-0093
Requested Due Date/TAT:	10 Day (Default)

Section B — Required Project Information:

Report To:	Van Burbach
Copy To:	Dan Girdner
Purchase Order No.	00660.1201.12.03
Client Project ID:	BUTNER MSWLF Verification
Container Order Number:	

Section C — Invoice Information:

Attention:	Jason Falls
Company Name:	Granville Co., Solid Waste
Address:	P.O. Box 906, Oxford, NC 27565
Pace Quote Reference:	
Pace Project Manager:	Godwin, Kevin
Pace Profile #:	3566-4

Regulatory Agency	
State / Location	North Carolina

Requested Analysis Filtered (Y/N): Y/N

ITEM#	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test: BENZENE 8260	Residual Chlorine (Y/N)	92144632
1	3902-MW2R	WT	G			1/10/13	1340		3				X					X		001
2	3902-FIELD BLANK	WT	G			↓	1400		3				X					X		002
3	3902-TRIP BLANK	WT	G				[illegible]200		2				X					X		003
4	3902-NES 1	WT	G			↓	1400		3				X					X		004
5		WT	G																	
6		WT	G																	
7		WT	G																	
8		WT	G																	
9		WT	G																	
10																				
11																				
12																				

MATRIX CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	[signature] JSE	1/11/13	1137	[signature]	1-11-13	1137				
	[signature]	1-11-13	1335	[signature]	1-11-13	1335	2.7	y	n	y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Amanda Freeman, Robert Winfield

SIGNATURE of SAMPLER: [signature] DATE Signed: 1/10/13

Pace Analytical	Document Name: Sample Condition Upon Receipt (SCUR)	Document Revised: October 01, 2012 Page 1 of 2
	Document Number: F-CHR-CS-03-rev.08	Issuing Authority: Pace Huntersville Quality Office

Client Name: Joyce Project # 92144632

Where Received: ☐ Huntersville ☐ Asheville ☐ Eden ☐ Raleigh

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace Other_____

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other_____

Thermometer Used: IR Gun T1101 T1102 **Type of Ice:** Wet Blue None ☑ Samples on ice, cooling process has begun

Temp Correction Factor **T1101**: No Correction **T1102**: No Correction

Corrected Cooler Temp.: 2.7 C **Biological Tissue is Frozen:** Yes No N/A

Date and Initials of person examining contents: MJ 1/11

Temp should be above freezing to 6°C

		Comments:
Chain of Custody Present:	☑Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☑Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☑Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☑Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☑Yes ☐No ☐N/A	5.
Short Hold Time Analysis (<72hr):	☐Yes ☑No ☐N/A	6.
Rush Turn Around Time Requested:	☐Yes ☑No ☐N/A	7.
Sufficient Volume:	☑Yes ☐No ☐N/A	8.
Correct Containers Used:	☑Yes ☐No ☐N/A	9.
-Pace Containers Used:	☑Yes ☐No ☐N/A	
Containers Intact:	☑Yes ☐No ☐N/A	10.
Filtered volume received for Dissolved tests	☐Yes ☐No ☑N/A	11.
Sample Labels match COC:	☑Yes ☐No ☐N/A	12.
-Includes date/time/ID/Analysis Matrix:_____		
All containers needing preservation have been checked.	☐Yes ☐No ☑N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	☐Yes ☐No ☑N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☐Yes ☐No	Initial when completed
Samples checked for dechlorination:	☐Yes ☐No ☑N/A	14.
Headspace in VOA Vials (>6mm):	☐Yes ☑No ☐N/A	15.
Trip Blank Present:	☐Yes ☑No ☐N/A	16.
Trip Blank Custody Seals Present	☑Yes ☐No ☐N/A	
Pace Trip Blank Lot # (if purchased):_____		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

SCURF Review: JD **Date:** 1/11/13 **SRF Review:** JD **Date:** 1/14/13

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

APPENDIX E

Modflow Modeling Results

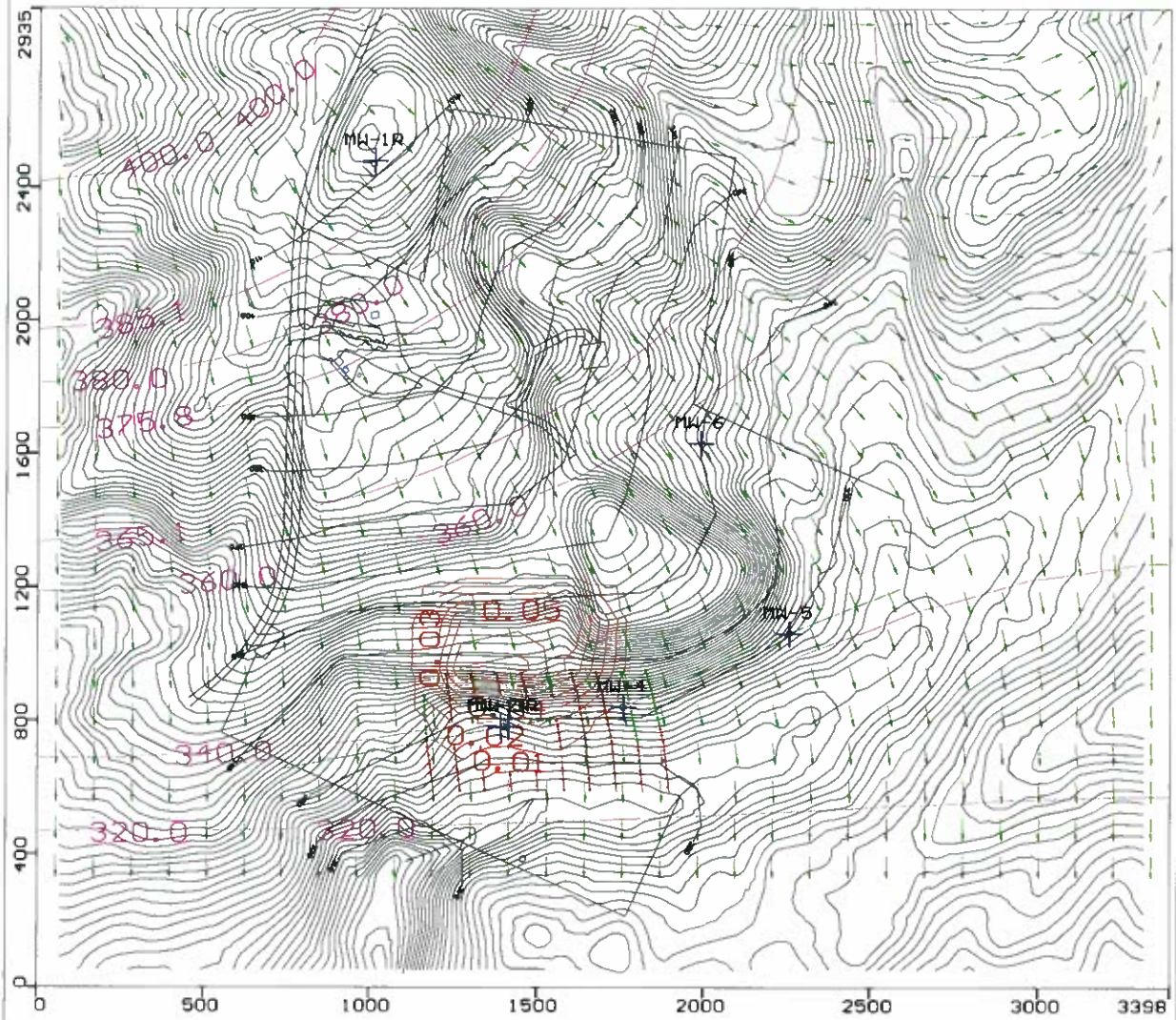


FIGURE 1
TOTAL VOCS (MG/L)
2012

Joyce Engineering, Inc.	Butner Landfill Granville County, North Carolina

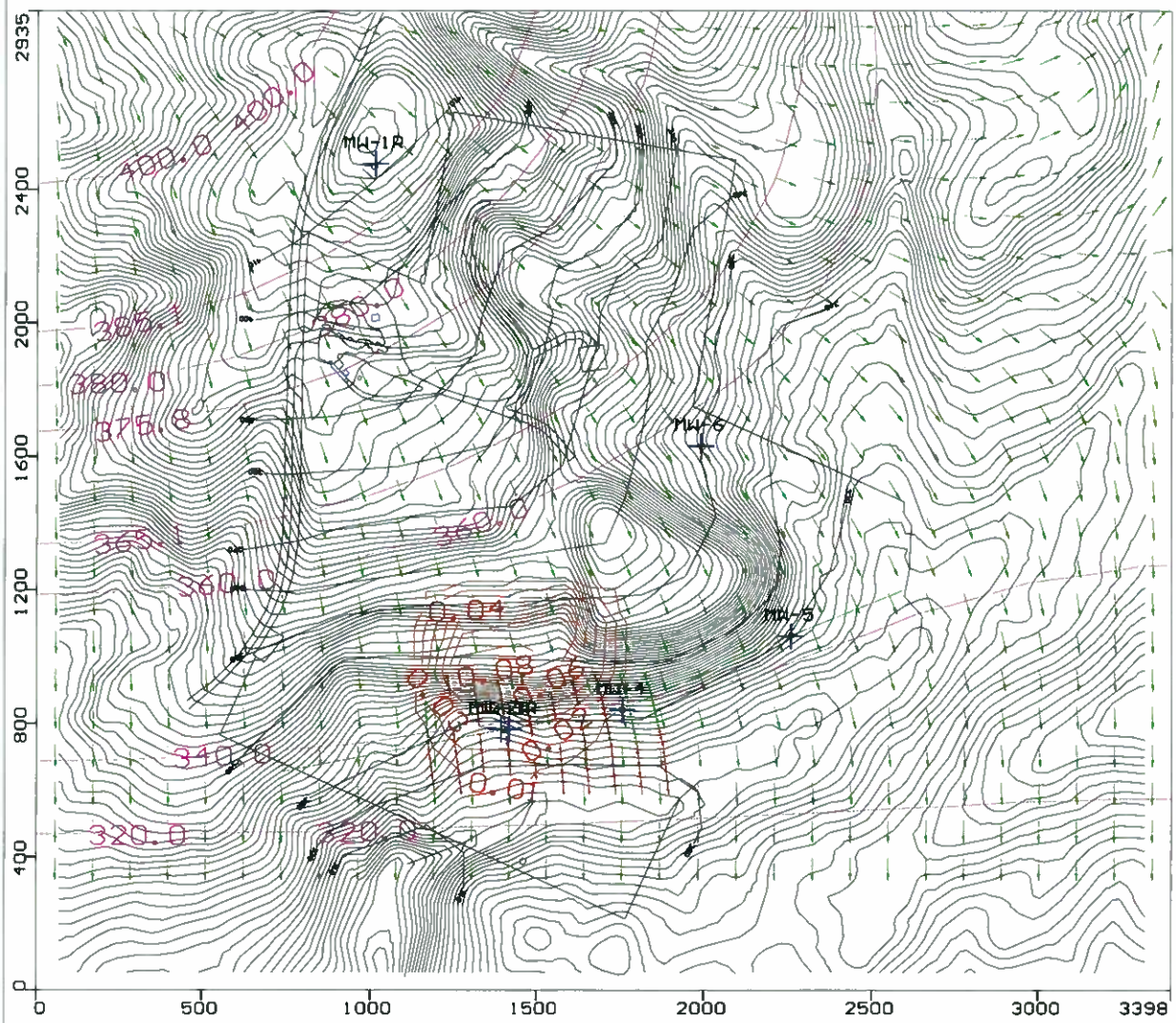


FIGURE 2
TOTAL VOCS (MG/L)
2017

Joyce Engineering, Inc.	Butner Landfill Granville County, North Carolina

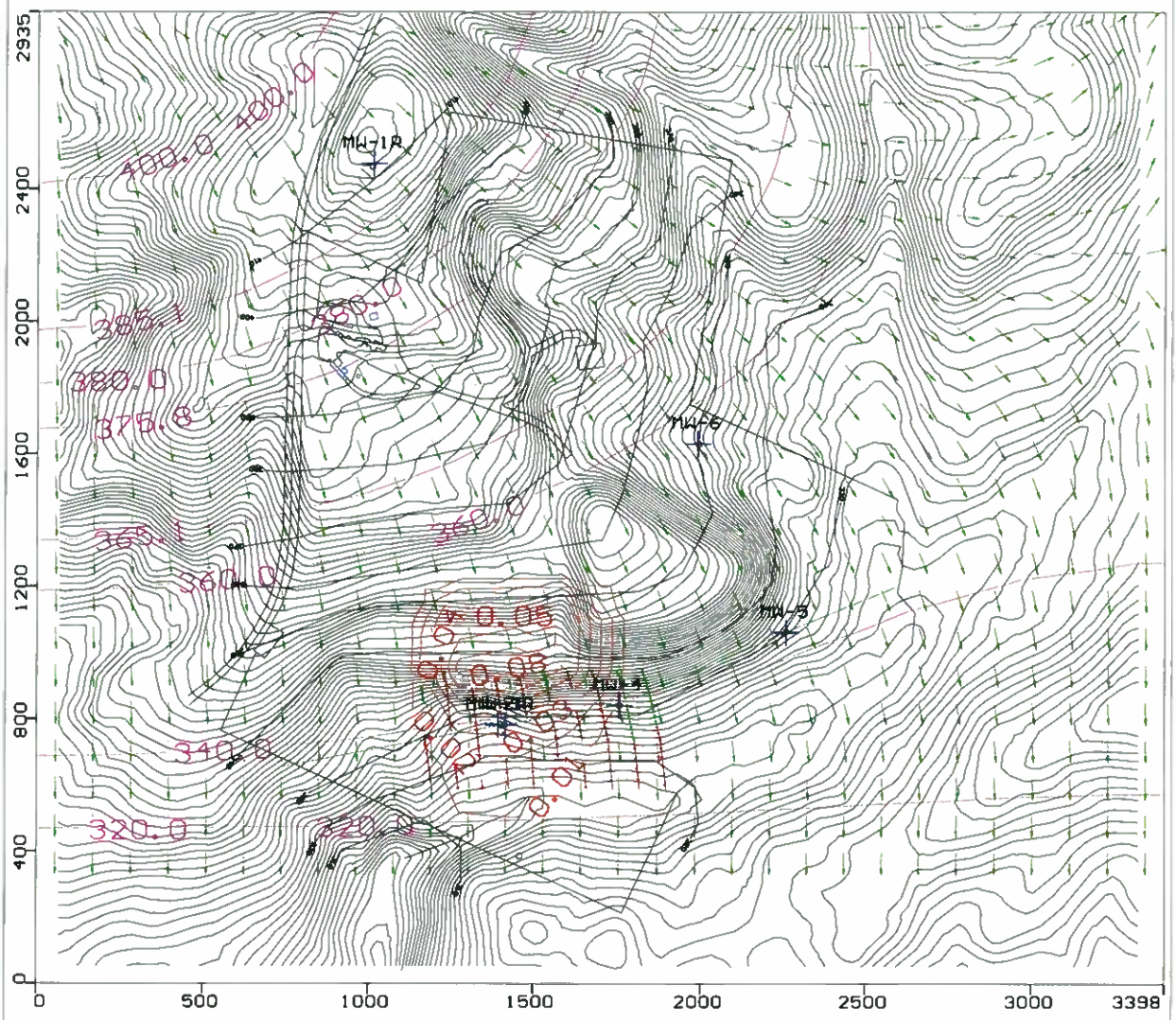


FIGURE 3
TOTAL VOCS (MG/L)
2022

Joyce Engineering, Inc.	Butner Landfill Granville County, North Carolina

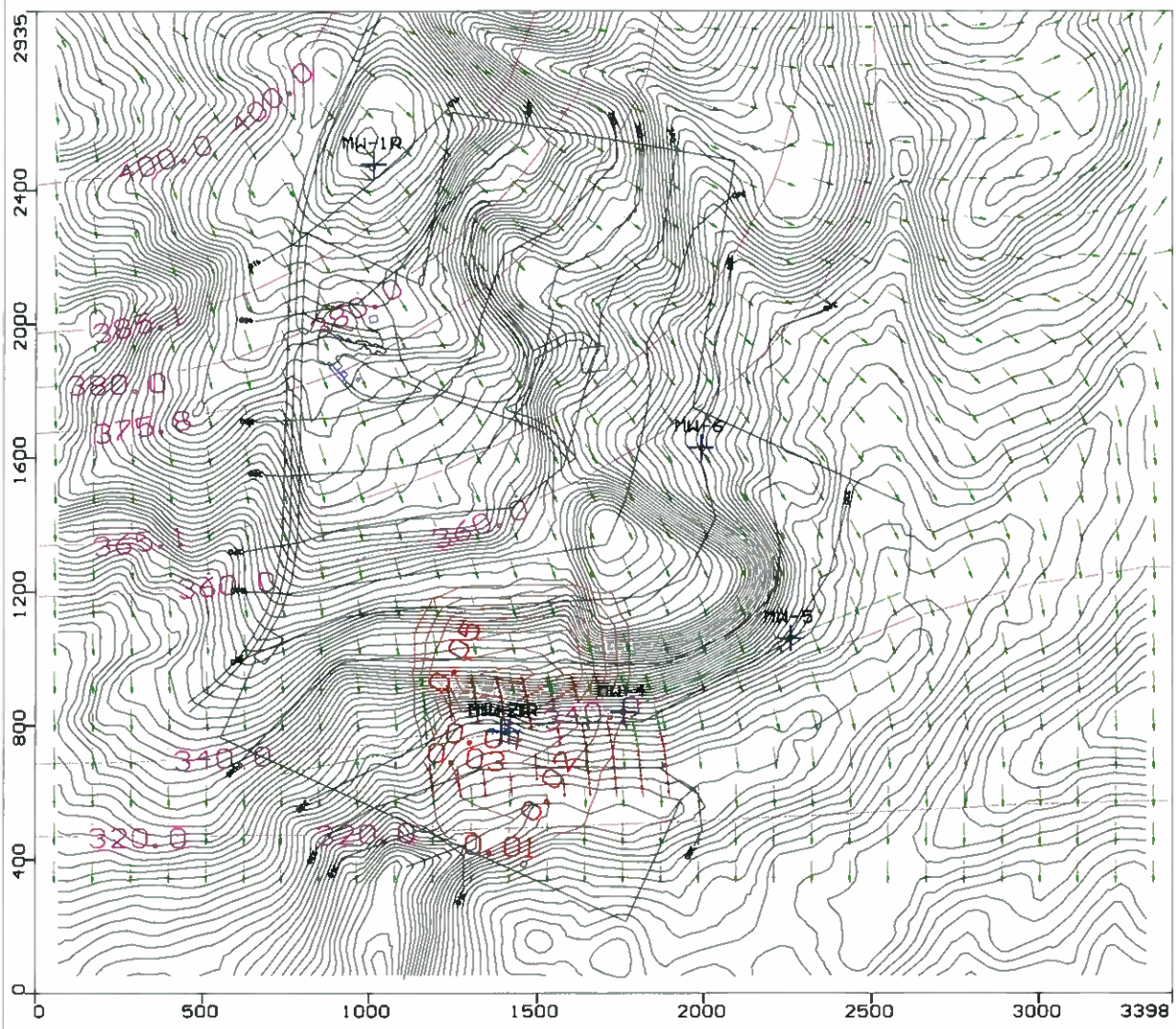


FIGURE 4
TOTAL VOCS (MG/L)
2032

Joyce Engineering, Inc.	Butner Landfill Granville County, North Carolina

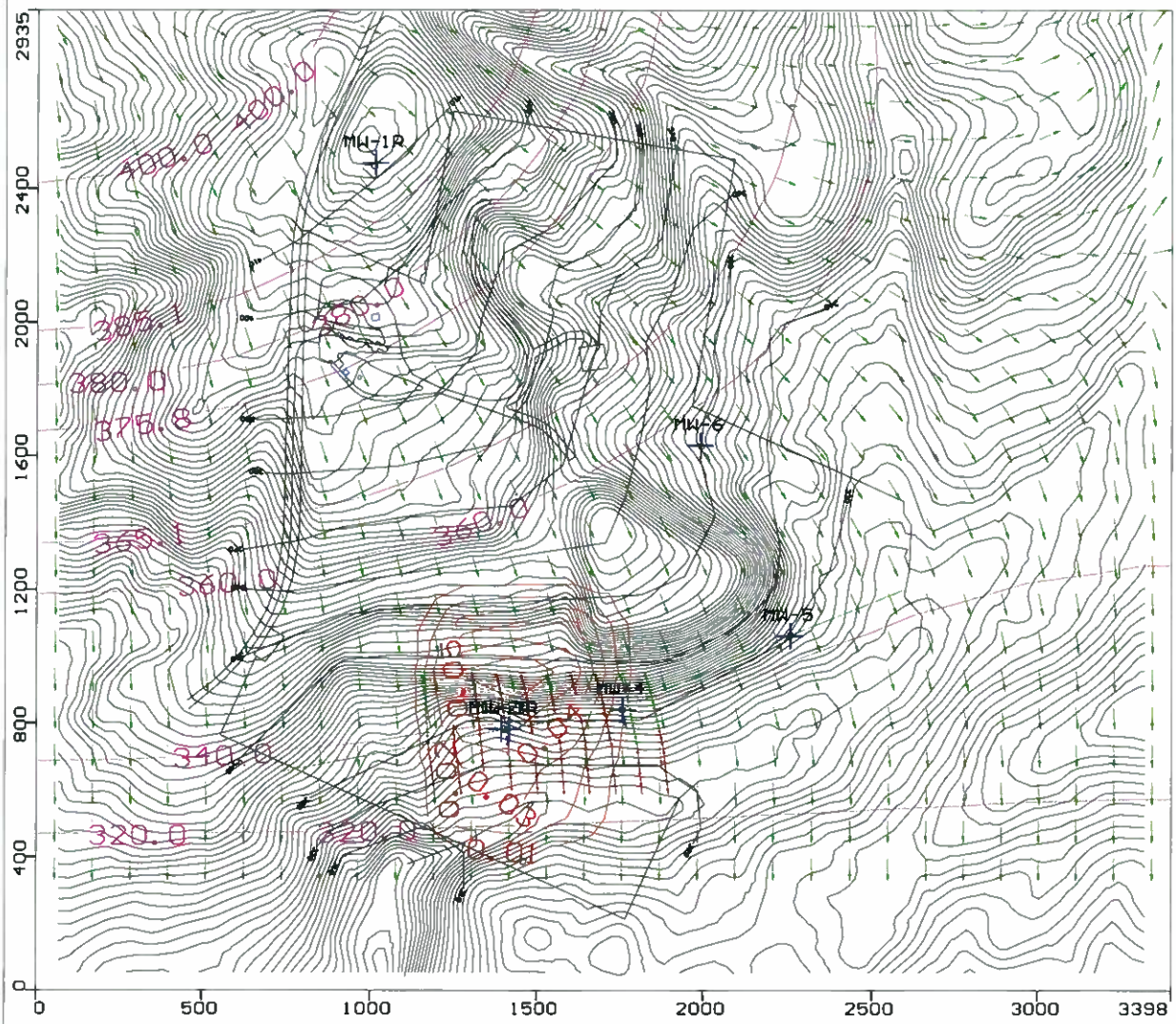
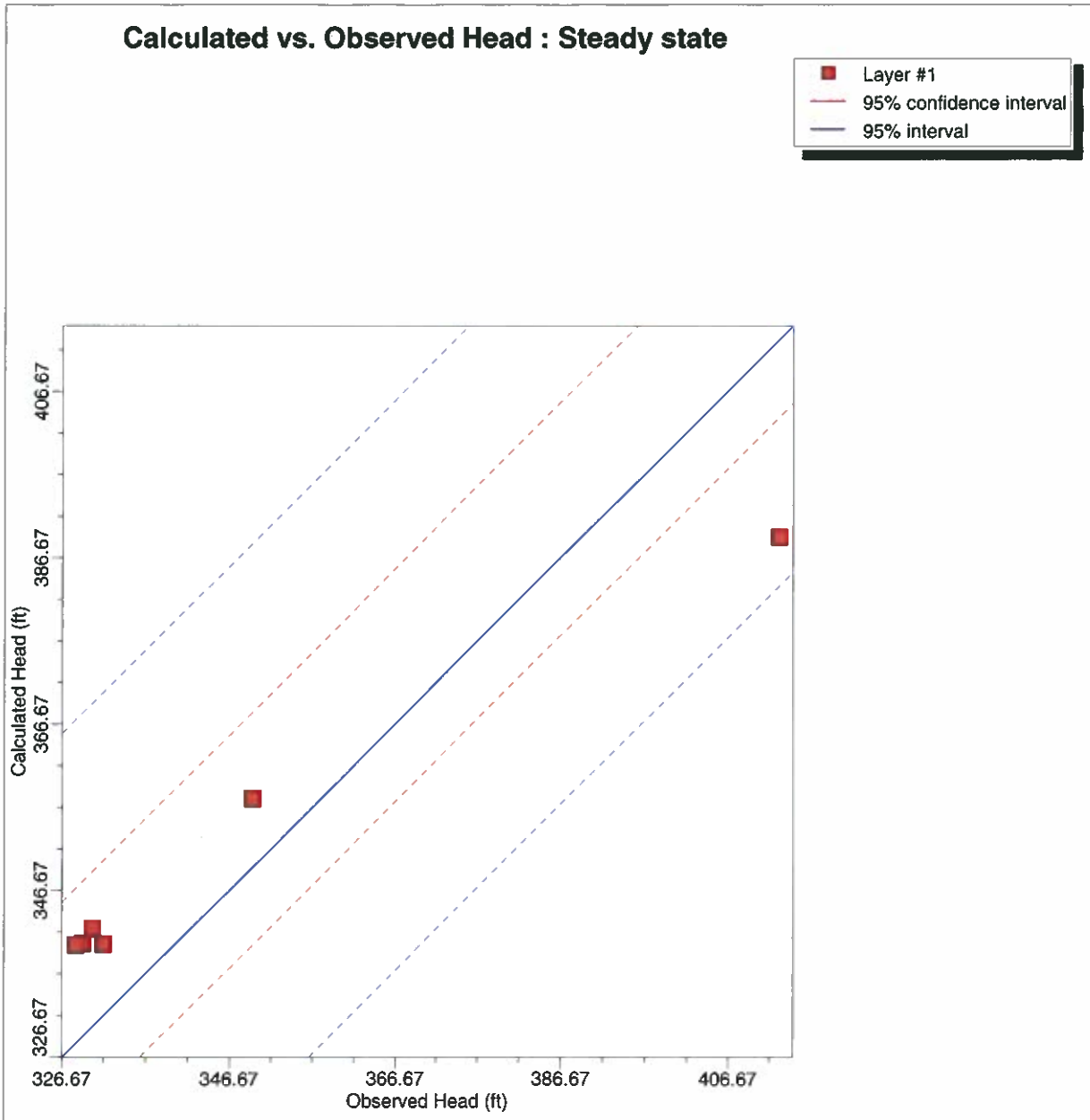


FIGURE 5
TOTAL VOCS (MG/L)
2042

Joyce Engineering, Inc.	Butner Landfill Granville County, North Carolina



Max. Residual: -23.731 (ft) at MW-1R/A
Min. Residual: 8.25 (ft) at MW-6/A
Residual Mean : 4.641 (ft)
Abs. Residual Mean : 12.551 (ft)

Num. of Data Points : 6
Standard Error of the Estimate : 5.71 (ft)
Root Mean Squared : 13.586 (ft)
Normalized RMS : 16.084 (%)
Correlation Coefficient : 0.992

FIGURE 6
CALCULATED VS. OBSERVED HEADS

Joyce Engineering, Inc.	Butner Landfill Granville County, North Carolina

APPENDIX F

Site Supply Well Abandonment Record

GRANVILLE COUNTY ENVIRONMENTAL PROGRAMS

141 WILLIAMSBORO STREET, POST OFFICE BOX 906, OXFORD, NORTH CAROLINA 27565- 0906

Office (919) 603-1354
Fax (919) 690-8610

Email: recycle@granvillecounty.org

MEMORANDUM

To: Mary

From: Jason Falls

Date: June 8, 2007

Re: Closure of Water Supply Well at Butner

Attached is a copy of the notification of the water well closure at Butner. If you have any questions, please call.

RECEIVED
JUN 17
SOLID WASTE SECTION

JF/jf

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-3221

WELL ABANDONMENT RECORD

WELL CONTRACTOR Stephenson's Well Drilling, Inc.
WELL CONTRACTOR CERTIFICATION # 2421

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☐ Recovery ☐ Heat Pump Water Injection ☑ Other ☐ If Other, List Use: Landfill

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: Butner, N.C. County Granville
SR # 1004 Old Hwy. 75
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: Granville County

4. ADDRESS: P.O. Box 906, Oxford, N.C. 27565

5. TOPOGRAPHY: draw, slope, hilltop, valley, flat (circle one)

6. TOTAL DEPTH: 205' DIAMETER 6"

7. CASING REMOVED:

feet	diameter
3'	6"

8. DISINFECTION: 12 oz.
(Amount of 70% hypochlorite used:)

9. SEALING MATERIAL:

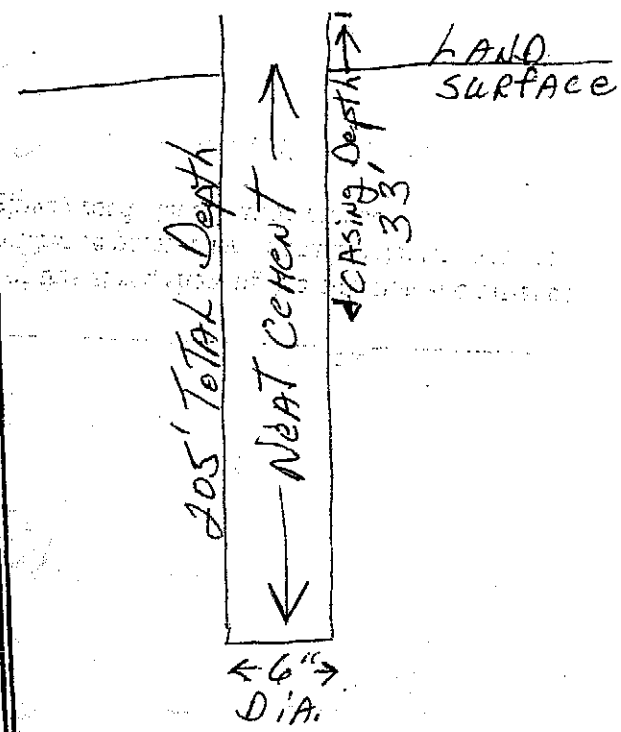
Neat Cement	Sand Cement
bags of cement 80	bags of cement
gallons of water 240	gallons of water

47 lb. -

Other
Type material
Amount

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL:
Pressure grouted with neat cement from bottom to top

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel intervals, intervals of casing perforations, and depths and types of fill materials used.



11. DATE WELL ABANDONED 5-29-07

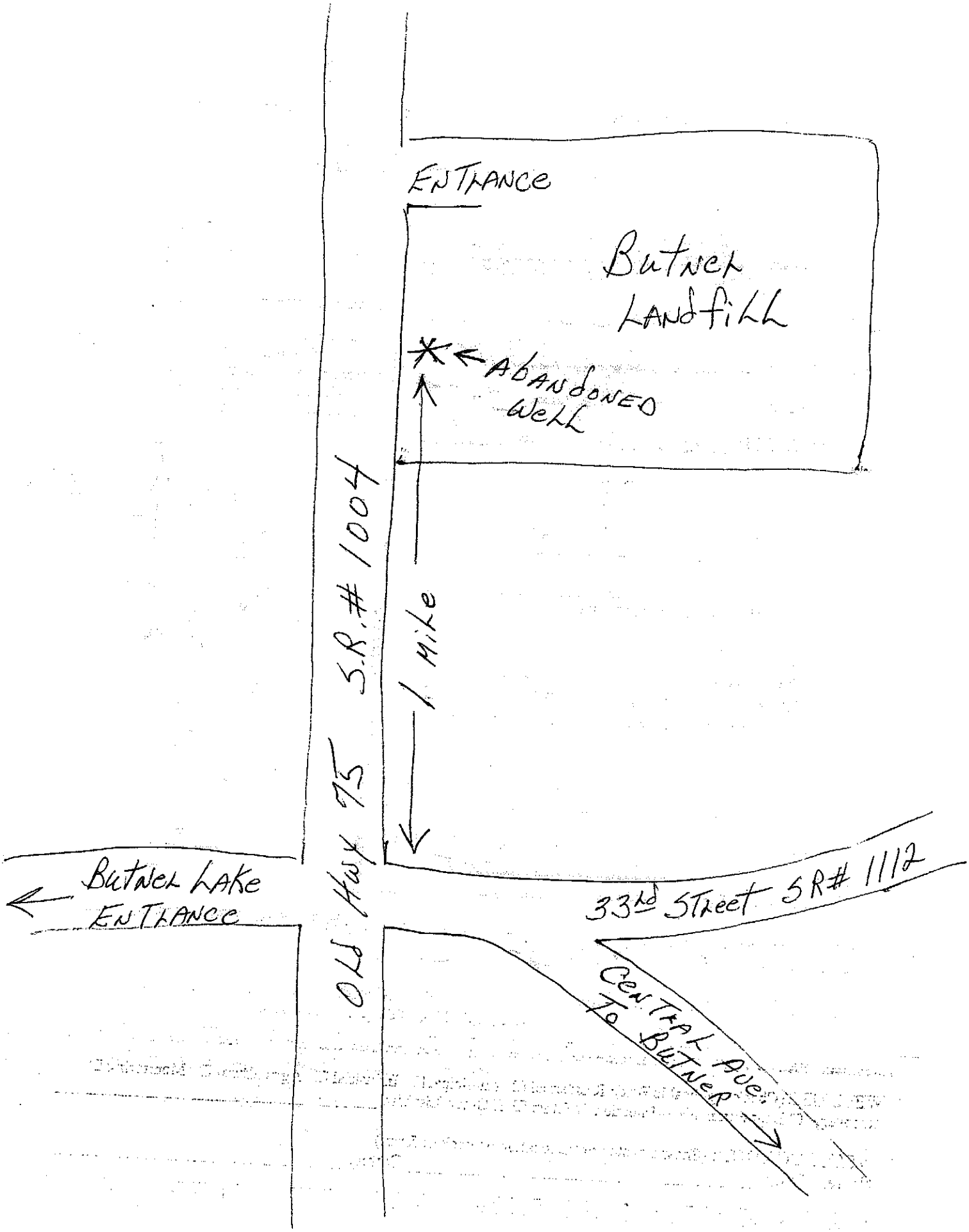
I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well James D. Stephenson Jr. Date 5-29-07

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99


ENTRANCE
Butler Landfill
ABANDONED WELL
1 mile
OLD Hwy 75 S.R. # 1004
Butler Lake ENTRANCE
33rd Street SR # 1112
Central Ave. To Butler

APPENDIX G

NC Appendix I & II Constituents with NC-2L Groundwater Standards & GPS

North Carolina Appendix I, II, and C and D Constituents

NC App. I & II - Total Metals

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. I	**Antimony**	metal	7440-36-0	6010	**6**	**-**	**1**	(RCRA METAL)
2	App. I	**Arsenic**	metal	7440-38-2	6010	**10**	**10**	**-**	(RCRA METAL)
3	App. I	**Barium**	metal	7440-39-3	6010	**100**	**700**	**-**	
4	App. I	**Beryllium**	metal	7440-41-7	6010	**1**	**-**	**4**	(RCRA METAL)
5	App. I	**Cadmium**	metal	7440-43-9	6010	**1**	**2**	**-**	
6	App. I	**Chromium**	metal	7440-47-3	6010	**10**	**10**	**-**	(RCRA METAL)
7	App. I	**Cobalt**	metal	7440-48-4	6010	**10**	**-**	**1**	
8	App. I	**Copper**	metal	7440-50-8	6010	**10**	**1000**	**-**	EPA MCL is a secondary standard.
9	App. I	**Lead**	metal	7439-92-1	6010	**10**	**15**	**-**	EPA MCL is an action level. (RCRA METAL)
10	App. I	**Nickel**	metal	7440-02-0	6010	**50**	**100**	**-**	
11	App. I	**Selenium**	metal	7782-49-2	6010	**10**	**20**	**-**	(RCRA METAL)
12	App. I	**Silver**	metal	7440-22-4	6010	**10**	**20**	**-**	EPA MCL is a secondary standard. (RCRA METAL).
13	App. I	**Thallium**	metal	7440-28-0	6010	**5.5**	**-**	**0.2**	
14	App. I	**Vanadium**	metal	7440-62-2	6010	**25**	**-**	**0.3**	
15	App. I	**Zinc**	metal	7440-66-6	6010	**10**	**1000**	**-**	EPA MCL is a secondary standard. *(AL)* = NC2B Action Level
16	App. II	**Mercury**	metal	7439-97-6	7470	**0.2**	**1**	**-**	(RCRA METAL)
17	App. II	**Tin**	metal	7440-31-5	6010	**100**	**-**	**2000**	

NC App. II - Cyanide/ Sulfide

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	**Cyanide**	inorganic	57-12-5	9012A	**10**	**70**	**-**	
2	App. II	**Sulfide**	inorganic	18496-25-8	9030B	**1000**	**-**	**-**	

NC - Additional Constituents for C&D Landfills

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	C&D	**Alkalinity**	inorganic	SW337	SM 2320B	**-**	**-**	**-**	
2	C&D	**Chloride**	inorganic	SW301	SM 4500-Cl-E	**-**	**250000**	**-**	
3	C&D	**Iron**	metal	7439-89-6	6010	**300**	**300**	**-**	
4	C&D	**Manganese**	metal	7439-96-5	6010	**50**	**50**	**-**	
5	C&D	**Mercury**	metal	7439-97-6	7470	**0.2**	**1**	**-**	(RCRA Metal)
6	C&D	**Sulfate**	inorganic	14808-79-8	300.0	**250000**	**250000**	**-**	
7	C&D	**Total Dissolved Solids (TDS)**	inorganic	SW311	SM 2540C	**-**	**500000**	**-**	
8	C&D	**Tetrahydrofuran**	volatile		8260B	**-**	**-**	**-**	

NC App. I & II - Method 8260

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. I	**Acetone**	volatile	67-64-1	8260B	**100**	**6000**	**-**	
2	App. I	**Acrylonitrile**	volatile	107-13-1	8260B	**200**	**-**	**-**	
3	App. I	**Benzene**	volatile	71-43-2	8260B	**1**	**1**	**-**	
4	App. I	**Bromochloromethane**	volatile	74-97-5	8260B	**3**	**-**	**0.6**	
5	App. I	**Bromodichloromethane**	volatile	75-27-4	8260B	**1**	**0.6**	**-**	*MCL for total trihalomethanes
6	App. I	**Bromoform**	volatile	75-25-2	8260B	**3**	**4**	**-**	*MCL for total trihalomethanes
7	App. I	**Carbon disulfide**	volatile	75-15-0	8260B	**100**	**700**	**-**	
8	App. I	**Carbon tetrachloride**	volatile	56-23-5	8260B	**1**	**0.3**	**-**	
9	App. I	**Chlorobenzene**	volatile	108-90-7	8260B	**3**	**50**	**-**	
10	App. I	**Chloroethane**	volatile	75-00-3	8260B	**10**	**3000**	**-**	
11	App. I	**Chloroform**	volatile	67-66-3	8260B	**5**	**70**	**-**	*MCL for total trihalomethanes
12	App. I	**Dibromochloromethane**	volatile	124-48-1	8260B	**3**	**0.4**	**-**	*MCL for total trihalomethanes
13	App. I	**1,2-Dibromo-3-chloropropane (DBCP)**	volatile	96-12-8	8260B	**13**	**0.04**	**-**	
14	App. I	**1,2-Dibromoethane (EDB)**	volatile	106-93-4	8260B	**1**	**0.02**	**-**	
15	App. I	**o-Dichlorobenzene / 1,2-Dichlorobenzene**	volatile	95-50-1	8260B	**5**	**20**	**-**	
16	App. I	**p-Dichlorobenzene / 1,4-Dichlorobenzene**	volatile	106-46-7	8260B	**1**	**6**	**-**	
17	App. I	**trans-1,4-Dichloro-2-butene**	volatile	110-57-6	8260B	**100**	**-**	**-**	
18	App. I	**1,1-Dichloroethane**	volatile	75-34-3	8260B	**5**	**6**	**-**	
19	App. I	**1,2-Dichloroethane**	volatile	107-06-2	8260B	**1**	**0.4**	**-**	
20	App. I	**1,1-Dichloroethylene**	volatile	75-35-4	8260B	**5**	**7**	**-**	
21	App. I	**cis-1,2-Dichloroethylene**	volatile	156-59-2	8260B	**5**	**70**	**-**	
22	App. I	**trans-1,2-Dichloroethylene**	volatile	156-60-5	8260B	**5**	**100**	**-**	
23	App. I	**1,2-Dichloropropane**	volatile	78-87-5	8260B	**1**	**0.6**	**-**	
24	App. I	**cis-1,3-Dichloropropene**	volatile	10061-01-5	8260B	**1**	**0.4**	**-**	
25	App. I	**trans-1,3-Dichloropropene**	volatile	10061-02-6	8260B	**1**	**0.4**	**-**	
26	App. I	**Ethylbenzene**	volatile	100-41-4	8260B	**1**	**600**	**-**	
27	App. I	**2-Hexanone / Methyl butyl ketone (MBK)**	volatile	591-78-6	8260B	**50**	**-**	**280**	
28	App. I	**Methyl bromide / Bromomethane**	volatile	74-83-9	8260B	**10**	**-**	**10**	
29	App. I	**Methyl chloride / Chloromethane**	volatile	74-87-3	8260B	**1**	**3**	**-**	
30	App. I	**Methylene bromide / Dibromomethane**	volatile	74-95-3	8260B	**10**	**-**	**70**	
31	App. I	**Methylene chloride / Dichloromethane**	volatile	75-09-2	8260B	**1**	**5**	**-**	
32	App. I	**Methyl ethyl ketone / 2-Butanone (MEK)**	volatile	78-93-3	8260B	**100**	**4000**	**-**	
33	App. I	**Methyl iodide / Iodomethane**	volatile	74-88-4	8260B	**10**	**-**	**-**	
34	App. I	**4-Methyl-2-pentanone / Methyl isobutyl ketone**	volatile	108-10-1	8260B	**100**	**-**	**560**	
35	App. I	**Styrene**	volatile	100-42-5	8260B	**1**	**70**	**-**	
36	App. I	**1,1,1,2-Tetrachloroethane**	volatile	630-20-6	8260B	**5**	**-**	**1**	
37	App. I	**1,1,2,2-Tetrachloroethane**	volatile	79-34-5	8260B	**3**	**0.2**	**-**	
38	App. I	**Tetrachloroethylene (PCE)**	volatile	127-18-4	8260B	**1**	**0.7**	**-**	
39	App. I	**Toluene**	volatile	108-88-3	8260B	**1**	**600**	**-**	
40	App. I	**1,1,1-Trichloroethane**	volatile	71-55-6	8260B	**1**	**200**	**-**	
41	App. I	**1,1,2-Trichloroethane**	volatile	79-00-5	8260B	**1**	**-**	**0.6**	
42	App. I	**Trichloroethylene**	volatile	79-01-6	8260B	**1**	**3**	**-**	
43	App. I	**Trichlorofluoromethane (CFC-11)**	volatile	75-69-4	8260B	**1**	**2000**	**-**	
44	App. I	**1,2,3-Trichloropropane**	volatile	96-18-4	8260B	**1**	**0.005**	**-**	
45	App. I	**Vinyl acetate**	volatile	108-05-4	8260B	**50**	**-**	**88**	
46	App. I	**Vinyl chloride**	volatile	75-01-4	8260B	**1**	**0.03**	**-**	
47	App. I	**Xylenes (total)**	volatile	see note	8260B	**5**	**500**	**-**	Includes o-xylene, p-xylene, and unspecified xylenes [dimethyl benzenes (CAS RN 1330-20-7].

NC App. II - Method 8260

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
48	App. II	**Acetonitrile (methyl cyanide)**	volatile	75-05-8	8260B	**55**	**-**	**42**	
49	App. II	**Acrolein**	volatile	107-02-8	8260B	**53**	**-**	**4**	
50	App. II	**Allyl chloride (3-chloroprene)**	volatile	107-05-1	8260B	**10**	**-**	**-**	
51	App. II	**Chloroprene**	volatile	126-99-8	8260B	**20**	**-**	**-**	
52	App. II	**m-Dichlorobenzene / 1,3-Dichlorobenzene**	volatile	541-73-1	8260B	**5**	**200**	**-**	
53	App. II	**Dichlorodifluoromethane**	volatile	75-71-8	8260B	**5**	**1000**	**-**	
54	App. II	**1,3-Dichloropropane**	volatile	142-28-9	8260B	**1**	**-**	**-**	
55	App. II	**2,2-Dichloropropane**	volatile	594-20-7	8260B	**15**	**-**	**-**	
56	App. II	**1,1-Dichloropropene**	volatile	563-58-6	8260B	**5**	**-**	**-**	
57	App. II	**Isobutyl alcohol**	volatile	78-83-1	8260B	**100**	**-**	**-**	
58	App. II	**Methacrylonitrile**	volatile	126-98-7	8260B	**100**	**-**	**-**	
59	App. II	**Methyl methacrylate**	volatile	80-62-6	8260B	**30**	**-**	**25**	
60	App. II	**Propionitrile**	volatile	107-12-0	8260B	**150**	**-**	**-**	
61	App. II	**1,2,4-Trichlorobenzene**	volatile	120-82-1	8260B	**10**	**70**	**70**	
62	App. II	**Naphthalene**	volatile	91-20-3	8260B or 8270C	**10**	**6**	**-**	
63	App. II	**Hexachlorobutadiene**	semi-volatile	87-68-3	8270C or 8260B	**10**	**0.4**	**0.44**	
64	App. II	**Ethyl methacrylate**	semi-volatile	97-63-2	8270C or 8260B	**10**	**-**	**-**	

North Carolina Appendix I, II, and C and D Constituents

NC App. II - Method 8270

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	**Acenaphthene**	semi-volatile	83-32-9	8270C	**10**	**80**	**-**	
2	App. II	**Acenaphthylene**	semi-volatile	208-96-8	8270C	**10**	**200**	**-**	
3	App. II	**Acetophenone**	semi-volatile	98-86-2	8270C	**10**	**-**	**700**	
4	App. II	**2-Acetylaminofluorene**	semi-volatile	53-96-3	8270C	**20**	**-**	**-**	
5	App. II	**4-Aminobiphenyl**	semi-volatile	92-67-1	8270C	**20**	**-**	**-**	
6	App. II	**Anthracene**	PAH	120-12-7	8270C	**10**	**2000**	**-**	
7	App. II	**Benz[a]anthracene; Benzanthracene**	PAH	56-55-3	8270C	**10**	**0.05**	**-**	
8	App. II	**Benzo[b]fluoranthene**	PAH	205-99-2	8270C	**10**	**0.05**	**-**	
9	App. II	**Benzo[k]fluoranthene**	PAH	207-08-9	8270C	**10**	**0.5**	**-**	
10	App. II	**Benzo[g,h,i]perylene**	PAH	191-24-2	8270C	**10**	**200**	**-**	
11	App. II	**Benzo[a]pyrene**	PAH	50-32-8	8270C	**10**	**0.005**	**-**	
12	App. II	**Benzyl alchohol**	semi-volatile	100-51-6	8270C	**20**	**-**	**700**	
13	App. II	**Bis(2-chloroethoxy)methane**	semi-volatile	111-91-1	8270C	**10**	**-**	**-**	
14	App. II	**Bis(2-chloroethyl)ether**	semi-volatile	111-44-4	8270C	**10**	**-**	**0.031**	
15	App. II	**Bis(2-chloro-1-methylethyl)ether**	semi-volatile	108-60-1	8270C	**10**	**-**	**-**	Bis (2-chloroisopropyl) ether
16	App. II	**Bis(2-ethylhexyl)phthalate**	semi-volatile	117-81-7	8270C	**15**	**3**	**-**	
17	App. II	**4-Bromophenyl phenyl ether**	semi-volatile	101-55-3	8270C	**10**	**-**	**-**	
18	App. II	**Butyl benzyl phthalate**	semi-volatile	85-68-7	8270C	**10**	**1000**	**-**	
19	App. II	**p-Chloroaniline (4-Chloroaniline)**	semi-volatile	106-47-8	8270C	**20**	**-**	**-**	
20	App. II	**Chlorobenzilate**	semi-volatile	510-15-6	8270C	**10**	**-**	**-**	
21	App. II	**p-Chloro-m-cresol (4-chloro-3-methylphenol)**	semi-volatile	59-50-7	8270C	**20**	**-**	**-**	
22	App. II	**2-Chloronaphthalene**	semi-volatile	91-58-7	8270C	**10**	**-**	**-**	
23	App. II	**2-Chlorophenol**	semi-volatile	95-57-8	8270C	**10**	**0.4**	**-**	
24	App. II	**4-Chlorophenyl phenyl ether**	semi-volatile	7005-72-3	8270C	**10**	**-**	**-**	
25	App. II	**Chrysene**	PAH	218-01-9	8270C	**10**	**5**	**-**	
26	App. II	**m-Cresol (3-Methylphenol)**	semi-volatile	108-39-4	8270C	**10**	**400**	**-**	
27	App. II	**o-Cresol**	semi-volatile	95-48-7	8270C	**10**	**-**	**35**	
28	App. II	**p-Cresol (4-Methylphenol)**	semi-volatile	106-44-5	8270C	**10**	**40**	**-**	
29	App. II	**Diallate**	semi-volatile	2303-16-4	8270C	**10**	**-**	**-**	
30	App. II	**Dibenz[a,h]anthracene**	PAH	53-70-3	8270C	**10**	**0.005**	**-**	
31	App. II	**Dibenzofuran**	semi-volatile	132-64-9	8270C	**10**	**-**	**28**	
32	App. II	**Di-n-butyl phthalate**	semi-volatile	84-74-2	8270C	**10**	**700**	**-**	
33	App. II	**3,3'-Dichlorobenzidine**	semi-volatile	91-94-1	8270C	**20**	**-**	**-**	
34	App. II	**2,4-Dichlorophenol**	semi-volatile	120-83-2	8270C	**10**	**-**	**0.98**	
35	App. II	**2,6-Dichlorophenol**	semi-volatile	87-65-0	8270C	**10**	**-**	**-**	
36	App. II	**Diethyl phthalate**	semi-volatile	84-66-2	8270C	**6000**	**6000**	**-**	
37	App. II	**O,O-Diethyl O-2-pyrazinyl phosphorothioate**	OP pesticide	297-97-2	8270C	**20**	**-**	**-**	Thionazine
38	App. II	**Dimethoate**	OP pesticide	60-51-5	8270C	**20**	**-**	**-**	
39	App. II	**p-(Dimethylamino)azobenzene**	semi-volatile	60-11-7	8270C	**10**	**-**	**-**	
40	App. II	**7,12-Dimethylbenz[a]anthracene**	semi-volatile	57-97-6	8270C	**10**	**-**	**-**	
41	App. II	**3,3'-Dimethylbenzidine**	semi-volatile	119-93-7	8270C	**10**	**-**	**-**	
42	App. II	**2,4-Dimethylphenol (M-xylenol)**	semi-volatile	105-67-9	8270C	**10**	**100**	**-**	
43	App. II	**Dimethyl phthalate**	semi-volatile	131-11-3	8270C	**10**	**-**	**-**	
44	App. II	**m-Dinitrobenzene**	semi-volatile	99-65-0	8270C	**20**	**-**	**-**	
45	App. II	**4,6-Dinitro-o-cresol (2-methyl 4,6-dinitrolphenol)**	semi-volatile	534-52-1	8270C	**50**	**-**	**-**	
46	App. II	**2,4-Dinitrophenol**	semi-volatile	51-28-5	8270C	**50**	**-**	**-**	
47	App. II	**2,4-Dinitrotoluene**	semi-volatile	121-14-2	8270C	**10**	**-**	**-**	
48	App. II	**2,6-Dinitrotoluene**	semi-volatile	606-20-2	8270C	**10**	**-**	**-**	
49	App. II	**Di-n-octyl phthalate**	semi-volatile	117-84-0	8270C	**10**	**100**	**-**	
50	App. II	**Diphenylamine**	semi-volatile	122-39-4	8270C	**10**	**-**	**-**	
51	App. II	**Disulfoton**	OP pesticide	298-04-4	8270C	**10**	**0.3**	**-**	
52	App. II	**Ethyl methanesulfonate**	semi-volatile	62-50-0	8270C	**20**	**-**	**-**	
53	App. II	**Famphur**	semi-volatile	52-85-7	8270C	**20**	**-**	**-**	
54	App. II	**Fluoranthene**	PAH	206-44-0	8270C	**10**	**300**	**-**	
55	App. II	**Fluorene**	PAH	86-73-7	8270C	**10**	**300**	**-**	

NC App. II - Method 8270

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
56	App. II	**Hexachlorobenzene**	semi-volatile	118-74-1	8270C	**10**	**0.02**	**-**	
57	App. II	**Hexachlorocylopentadiene**	semi-volatile	77-47-4	8270C	**10**	**-**	**50**	
58	App. II	**Hexachloroethane**	semi-volatile	67-72-1	8270C	**10**	**-**	**2.5**	
59	App. II	**Hexachloropropene**	semi-volatile	1888-71-7	8270C	**10**	**-**	**-**	
60	App. II	**Indeno[1,2,3-cd]pyrene**	PAH	193-39-5	8270C	**10**	**0.05**	**-**	
61	App. II	**Isodrin**	semi-volatile	465-73-6	8270C	**20**	**-**	**-**	
62	App. II	**Isophorone**	semi-volatile	78-59-1	8270C	**10**	**40**	**-**	
63	App. II	**Isosafrole**	semi-volatile	120-58-1	8270C	**10**	**-**	**-**	
64	App. II	**Kepone**	pesticide	143-50-0	8270C	**20**	**-**	**-**	
65	App. II	**Methapyrilene**	semi-volatile	91-80-5	8270C	**100**	**-**	**-**	
66	App. II	**3-Methylcholanthrene**	semi-volatile	56-49-5	8270C	**10**	**-**	**-**	
67	App. II	**Methyl methanesulfonate**	semi-volatile	66-27-3	8270C	**10**	**-**	**-**	
68	App. II	**2-Methylnaphthalene**	semi-volatile	91-57-6	8270C	**10**	**30**	**-**	
69	App. II	**Methyl parathion**	semi-volatile	298-00-0	8270C	**10**	**-**	**-**	
70	App. II	**1,4-Naphthoquinone**	semi-volatile	130-15-4	8270C	**10**	**-**	**-**	
71	App. II	**1-Naphthylamine**	semi-volatile	134-32-7	8270C	**10**	**-**	**-**	
72	App. II	**2-Naphthylamine**	semi-volatile	91-59-8	8270C	**10**	**-**	**-**	
73	App. II	**o-Nitroaniline (2-Nitroaniline)**	semi-volatile	88-74-4	8270C	**50**	**-**	**-**	
74	App. II	**m-Nitroaniline (3-Nitroaniline)**	semi-volatile	99-09-2	8270C	**50**	**-**	**-**	
75	App. II	**p-Nitroaniline (4-Nitroaniline)**	semi-volatile	100-01-6	8270C	**20**	**-**	**-**	
76	App. II	**Nitrobenzene**	semi-volatile	98-95-3	8270C	**10**	**-**	**-**	
77	App. II	**5-Nitro-o-toluidine**	semi-volatile	99-55-8	8270C	**10**	**-**	**-**	
78	App. II	**o-Nitrophenol (2-Nitrophenol)**	semi-volatile	88-75-5	8270C	**10**	**-**	**-**	
79	App. II	**p-Nitrophenol (4-Nitrophenol)**	semi-volatile	100-02-7	8270C	**50**	**-**	**-**	
80	App. II	**N-Nitrosodiethylamine**	semi-volatile	55-18-5	8270C	**20**	**-**	**-**	
81	App. II	**N-Nitrosodimethylamine**	semi-volatile	62-75-9	8270C	**10**	**0.0007**	**-**	
82	App. II	**N-Nitrosodi-n-butylamine**	semi-volatile	924-16-3	8270C	**10**	**-**	**-**	
83	App. II	**N-Nitrosodiphenylamine**	semi-volatile	86-30-6	8270C	**10**	**-**	**-**	
84	App. II	**N-Nitrosodipropylamine**	semi-volatile	621-64-7	8270C	**10**	**-**	**-**	
85	App. II	**N-Nitrosomethylethylamine**	semi-volatile	10595-95-6	8270C	**10**	**-**	**-**	
86	App. II	**N-Nitrosopiperidine**	semi-volatile	100-75-4	8270C	**20**	**-**	**-**	
87	App. II	**N-Nitrosopyrrolidine**	semi-volatile	930-55-2	8270C	**10**	**-**	**-**	
88	App. II	**Parathion**	OP pesticide	56-38-2	8270C	**10**	**-**	**-**	
89	App. II	**Pentachlorobenzene**	semi-volatile	608-93-5	8270C	**10**	**-**	**-**	
90	App. II	**Pentachloronitrobenzene**	semi-volatile	82-68-8	8270C	**20**	**-**	**-**	
91	App. II	**Phenacetin**	semi-volatile	62-44-2	8270C	**20**	**-**	**-**	
92	App. II	**Phenanthrene**	PAH	85-01-8	8270C	**10**	**200**	**-**	
93	App. II	**Phenol**	semi-volatile	108-95-2	8270C	**10**	**30**	**-**	
94	App. II	**p-Phenylenediamine**	semi-volatile	106-50-3	8270C	**10**	**-**	**-**	
95	App. II	**Phorate**	OP pesticide	298-02-2	8270C	**10**	**1**	**-**	
96	App. II	**Pronamide**	semi-volatile	23950-58-5	8270C	**10**	**-**	**-**	
97	App. II	**Pyrene**	PAH	129-00-0	8270C	**10**	**200**	**-**	
98	App. II	**Safrole**	semi-volatile	94-59-7	8270C	**10**	**-**	**-**	
99	App. II	**1,2,4,5-Tetrachlorobenzene**	semi-volatile	95-94-3	8270C	**10**	**-**	**2**	
100	App. II	**2,3,4,6-Tetrachlorophenol**	semi-volatile	58-90-2	8270C	**10**	**200**	**-**	
101	App. II	**o-Toluidine**	semi-volatile	95-53-4	8270C	**10**	**-**	**-**	
102	App. II	**2,4,5-Trichlorophenol**	semi-volatile	95-95-4	8270C	**10**	**-**	**63**	
103	App. II	**2,4,6-Trichlorophenol**	semi-volatile	88-06-2	8270C	**10**	**-**	**4**	
104	App. II	**O,O,O-Triethyl phosphorothioate**	semi-volatile	126-68-1	8270C	**10**	**-**	**-**	
105	App. II	**1,3,5-Trinitrobenzene**	semi-volatile	99-35-4	8270C	**10**	**400**	**-**	
106	App. II	**Hexachlorobutadiene**	semi-volatile	87-68-3	8270C or 8260	**10**	**0.4**	**-**	
107	App. II	**Ethyl methacrylate**	semi-volatile	97-63-2	8270C or 8270	**10**	**-**	**-**	
108	App. II	**Naphthalene**	volatile	91-20-3	8260B or 8270	**10**	**6**	**-**	
109	App. II	**Pentachlorophenol**	herbicide	87-86-5	8151 or 8270	**25**	**0.3**	**-**	

North Carolina Appendix I, II, and C and D Constituents

NC App. II - Pesticides Method 8081

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	**Aldrin**	pesticide	309-00-2	8081A	**0.05**	**-**	**0.002**	
2	App. II	**alpha-BHC**	pesticide	319-84-6	8081A	**0.05**	**-**	**0.006**	
3	App. II	**beta-BHC**	pesticide	319-85-7	8081A	**0.05**	**-**	**0.019**	
4	App. II	**delta-BHC**	pesticide	319-86-8	8081A	**0.05**	**-**	**0.019**	
5	App. II	**gamma-BHC (Lindane)**	pesticide	58-89-9	8081A	**0.05**	**0.03**	**-**	
6	App. II	**Chlordane**	pesticide	see note	8081A	**0.5**	**0.1**	**-**	This entry includes alpha-chlordane (CAS RN 5103-71-9), beta chlordane (CAS RN 5103-74-2), gamma-chlordane (CAS RN 566-34-7), and constituents of chlordane (CAS RN 57-74-9 and 12672-29-6).
7	App. II	**4,4'-DDD**	pesticide	72-54-8	8081A	**0.1**	**0.1**	**-**	
8	App. II	**4,4'-DDE**	pesticide	72-55-9	8081A	**0.1**	**-**	**-**	
9	App. II	**4-4'-DDT**	pesticide	50-29-3	8081A	**0.1**	**0.1**	**-**	
10	App. II	**Dieldrin**	pesticide	60-57-1	8081A	**0.002**	**0.002**	**-**	
11	App. II	**Endosulfan I**	pesticide	959-96-8	8081A	**0.1**	**40**	**-**	
12	App. II	**Endosulfan II**	pesticide	33213-65-9	8081A	**0.1**	**42**	**-**	
13	App. II	**Endosulfan sulfate**	pesticide	1031-07-8	8081A	**0.1**	**-**	**-**	
14	App. II	**Endrin**	pesticide	72-20-8	8081A	**0.1**	**2**	**-**	
15	App. II	**Endrin aldehyde**	pesticide	7421-93-4	8081A	**0.1**	**2**	**-**	
16	App. II	**Heptachlor**	pesticide	76-44-8	8081A	**0.05**	**0.008**	**-**	
17	App. II	**Heptachlor epoxide**	pesticide	1024-57-3	8081A	**0.075**	**0.004**	**-**	
18	App. II	**Methoxychlor**	pesticide	72-43-5	8081A	**1**	**40**	**-**	
19	App. II	**Toxaphene**	pesticide	see note	8081A	**1.5**	**0.03**	**-**	Includes congener chemicals contained in technical toxaphene (CAS RN 8001-35-2) such as chlorinated camphene.

NC App. II - PCB's Method 8082

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1-6	App. II	**Polychlorinated Biphenyls (PCBs)**	PCB	see note	8082	**2**	**-**	**0.09**	This category contains congener chemicals, including constituents of Aroclor 1016 (CAS RN 12674-11-2), Aroclor 1221 (CAS RN 11104-28-2), Aroclor 1232 (CAS RN 11141-16-5), Aroclor 1242 (CAS RN 53469-21-9), Aroclor 1248 (CAS RN 12672-29-6), Aroclor 1254 (CAS RN 11097-69-1)). Value given for the NC 2L Standard is the GWP for the Solid Waste Section.

NC App. II - Herbicides 8151

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	**2,4-Dichlorophenoxyacetic acid (2,4-D)**	herbicide	94-75-7	8151A	**2**	**70**	**-**	
2	App. II	**Dinoseb (DNBP); 2-sec-Butyl-4,6-dinitrophenol**	herbicide	86-85-7	8151A	**1**	**-**	**7**	
3	App. II	**Silvex (2,4,5-TP)**	herbicide	93-72-1	8151A	**2**	**50**	**-**	
4	App. II	**2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)**	herbicide	93-76-5	8151A	**2**	**-**	**-**	
5	App. II	**Pentachlorophenol**	herbicide	87-86-5	8151 or 8270	**25**	**0.3**	**-**	

Notes:

Color denotes NC App. I Constituents

Color denotes remaining NC App. II Constituents

Color denotes C&D Constituents

Color denotes constituents that can be analyzed by more than one method

1. CAS RN: Chemical Abstracts Service Registry Number. Where 'Total' is entered, all species that contain the element are included.
2. Class: General type of compound
3. OP = orthophosphate
4. PAH = polynuclear aromatic hydrocarbon.
5. Volatile EQL of 1 ug/L is based on a 25-mL purge per SW-846, Final Update III, Revision 2, December 1996, page 8260B-35 (most recent revision to method 8260 in SW-846).
6. " - " = not available/not applicable
7. Referenced from North Carolina Dvision of Waste Management website (http://www.wastenotnc.org/sw/swenvmonitoringlist.asp)

APPENDIX H

NC-2B Surface Water Standards

Disclaimer: This table is intended to provide summary information only. It does not substitute for any written regulation, nor is it a regulation itself. **May 1, 2007**

The following standards, criteria, or toxic concentrations are adopted per 15A NCAC 2B. See last page for appropriate use information.

Pollutant	CAS #	Freshwater Aquatic Life	Saltwater Aquatic Life	Water Supply (WS)[1]	Human Health (HH)[2]	Trout Waters (Tr)	High Quality Waters (HQW)	Swamp Waters (Sw)	Synonyms & Other Info	Carcinogen
		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)			
Aldrin	309-00-2	0.002	0.003	0.05 ng/L	0.05 ng/L					y
Arsenic	7440-38-2	50	50	10	10					y
Barium	7440-39-3			1.0 mg/L						n
Bacterial Indicators	*see enterococcus and fecal coliform*									NA
Benzene	71-43-2			1.19	51					y
Beryllium	7440-41-7	6.5								n
Cadmium	7440-43-9	2 (N)	5 (N)			0.4 (N)				n
Carbon Tetrachloride	56-23-5			0.254	1.6				Benzinoform; Carbon Chloride	y
Chlordane	57-74-9	0.004	0.004	0.8 ng/L	0.8 ng/L					y
Chloride	16887-00-6	230 mg/L (AL)		250 mg/L						n
Chlorine (TRC)	7782-50-5	17								n
Chlorinated Benzenes				488						y
Chlorinated Phenols				1.0 (N)						NA
Chlorophyll -a, corrected		40(N)	40(N)			15(N)				NA
Chromium		50	20							NA
Copper	7440-50-8	7 (AL)	3 (AL)							n
Cyanide	57-12-5	5 (N)	1							n
D, 2,4-	94-75-7			100					2,4-Dichlorophenoxy acetic acid	n
DDT, 4,4'-	50-29-3	0.001	0.001	0.2 ng/L	0.2 ng/L				4,4'-Dichlorodiphenyltrichloroethane	y
Demeton	8065-48-3	0.1	0.1							n
Dieldrin	60-57-1	0.002	0.002	0.05 ng/L	0.05 ng/L					y
Dioxin (2,3,7,8-TCDD)	1746-01-6			0.000005 ng/L	0.000005 ng/L				2,3,7,8-Tetrachlorodibenzo-p-dioxin	y
Dissolved Gases		110% sat (N)	110% sat (N)							NA

The following standards, criteria, or toxic concentrations are adopted per 15A NCAC 2B. See last page for appropriate use information.

Pollutant	CAS #	Freshwater Aquatic Life	Saltwater Aquatic Life	Water Supply (WS)[1]	Human Health (HH)[2]	Trout Waters (Tr)	High Quality Waters (HQW)	Swamp Waters (Sw)	Synonyms & Other Info	Carcinogen
		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)			
Dissolved Oxygen		not less than 5.0 mg/L (N)	not less than 5.0 mg/L (N)			not less than 6.0 mg/L (N)	not less than 6.0 mg/L (E)	(N)		NA
Endosulfan	115-29-7	0.05	0.009						Same values apply to Endosulfan Sulfate, alpha-Endosulfan, and beta-Endosulfan	n
Endrin	72-20-8	0.002	0.002							n
Enterococcus					geomean of 35 organisms/100 mL (applicable to class SA, SB, and SC Saltwaters) (N)					NA
Fecal Coliform (MFTCC/100mL)[3]					geomean of 200 organisms/100 mL in Class C Freshwaters (N); and a geomean of 14 organisms/100 mL in class SA Saltwaters (N)					NA
Fluoride		1.8 mg/L								NA
Guthion	86-50-0	0.01	0.01							NA
Hardness, Total				100 mg/L Calcium Carbonate						NA
Heptachlor	76-44-8	0.004	0.004	0.08 ng/L	0.08 ng/L					y
Hexachlorobutadiene	87-68-3			0.44	18				HCBD	y
Iron	7439-89-6	1.0 mg/L (AL)								n
Lead	7439-92-1	25 (N)	25 (N)							n
Lindane	58-89-9	0.01	0.004						gamma-BHC, g-HCH	c
Manganese	7439-96-5			200						n
MBAS[4]				500 (N)					Methylene-blue-active substances (see note)	NA

The following standards, criteria, or toxic concentrations are adopted per 15A NCAC 2B. See last page for appropriate use information.

Pollutant	CAS #	Freshwater Aquatic Life	Saltwater Aquatic Life	Water Supply (WS)[1]	Human Health (HH)[2]	Trout Waters (Tr)	High Quality Waters (HQW)	Swamp Waters (Sw)	Synonyms & Other Info	Carcinogen
		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)			
Mercury	7439-97-6	0.012	0.025							n
Methoxychlor	72-43-5	0.03	0.03							n
Mirex	2385-85-5	0.001	0.001							c
Nickel	7440-02-0	88 (N)	8.3 (N)	25						n
Nitrate (as N)	14797-55-8			10.0 mg/L					Total nitrogen may be regulated in NSW waters. See 2B .0200s for further info	n
Oil and Grease		(N)	(N)							NA
Parathion	56-38-2	0.013	0.178							n
PCB, total		0.001 (N)	0.001 (N)		0.064 ng/L (N)				polychlorinated biphenyls / (Total of all identified PCBs)	y
pH		6.0-9.0 (N)	6.8-8.5 (N)					(N)	Freshwater and Saltwater Aquatic Life Standards are listed as acceptable pH ranges	NA
Phenolic Compounds		(N)	(N)		(N)				(phenolic compounds: no fish flesh tainting)	NA
Polynuclear aromatic hydrocarbons (PAH's)[5]				0.0028 Total PAH's	0.0311 Total PAH's					y
Radioactive Substances		(N)	(N)		(N)					NA
Salinity			(N)							NA
Selenium	7782-49-2	5	71							n
Sewage		(N)	(N)	(N)						NA
Silver	7440-22-4	0.06 (AL)	0.1 (AL)							n
Silvex	93-72-1			10					2,4,5-TP; 2,4,5-Trichlorophenoxypropionoic Acid	n
Solids, settleable		(N)	(N)						also includes floating solids and sludge deposits	NA
Solids, total dissolved				500 mg/L						NA
Solids, total suspended		(N)				HQW=10 mg/L (E)	20 mg/L (E)			NA
Sulfates				250 mg/L						n
Temperature		(N)	(N)		(N)					NA
Tetrachloroethane, 1,1,2,2-	79-34-5			0.17	4				acetosol; acetylene tetrachloride	y
Tetrachloroethylene (PERC)	127-18-4			0.7	3.3				PERC; PCE; perchloroethylene	y

The following standards, criteria, or toxic concentrations are adopted per 15A NCAC 2B. See last page for appropriate use information.

Pollutant	CAS #	Freshwater Aquatic Life	Saltwater Aquatic Life	Water Supply (WS)[1]	Human Health (HH)[2]	Trout Waters (Tr)	High Quality Waters (HQW)	Swamp Waters (Sw)	Synonyms & Other Info	Carcinogen
		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)			
Toluene	108-88-3	11				0.36			methyl benzene; phenyl methane	n
Toxaphene	8001-35-2	0.2 ng/L	0.2 ng/L							y
Trialkyltin		0.07	0.007							n
Tributyltin (TBT)	56573-85-4	0.07	0.007							n
Trichloroethylene	79-01-6			2.5	30				TCE	y
Turbidity		50/25 NTU (N)	25 NTU (N)			10 NTU (N)				NA
Vinyl Chloride	75-01-4			0.025	2.4				chloroethylene	y
Zinc	7440-66-6	50 (AL)	86 (AL)							n

Footnotes, Codes, and Additional Information with Reference to Classifications and Standards

*To determine the appropriate standard, use the most stringent of all applicable columns.For Class C, use the most stringent of freshwater (or, if applicable, saltwater) column and the Human Health column.

* For a WS water, use the most stringent of Freshwater, WS & Human Health. Trout Waters & High Quality Waters likewise must adhere to the most stingent of all applicable standards

* All metal criteria are as total recoverable metals.

(AL) Action Level Standard - See 2B .0211 for additional information

(E) For effluent limits only. See 2B .0224

(HQW) High Quality Waters - see 02B .0101 and .0201

(N) = Narrative standard See 2B .0211 and for WS: .0212, 0214,.0215, .0216 and.0218

(NTU) Nephelometric Turbidity Units

(Sw) Swamp Waters - as defined by 02B .0101

(Tr) Trout Waters - as defined by 02B .0101 and 0301

1 WS standards are applicable to *all* Water Supply Classifications. WS standards are based on the consumption of fish and water. See 2B .0208 for equation.

2 Human Health Standards are based on the consumption of fish only unless dermal contact studies are available. See 2B .0208 for applicable equations.

3 MFTCC/100 mL = Membrane Filter Total Coliform Count per 100 mL of sample

4 MBAS: additional narrative language is located in 02B .0212, .0214, .0215, .0216, .0218

5 PAH=Applies to total PAHs present and includes the following: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene

Carcinogenicity Color Key:	
Known to cause cancer in humans (y)	**Blue**
Not known to cause cancer in humans (n)	**Green**
Possible human carcinogen (c)	**Yellow**
Carcinogenicity not assessed or Does Not Apply (NA)	**No Color**

Unit Conversions: 1.0 mg/L = 1000.0 ug/L = 1000000.0 ng/L
1.0 ng/L = 0.001 ug/L = 0.000001 mg/L

APPENDIX I

Financial Assurance Letter (December 2012)

County Of Granville, North Carolina

Post Office Box 1286, Oxford, North Carolina 27565
finance@granvillecounty.org

Finance Department
(919) 693-4182

December 28, 2012 (REVISED 1/7/2013)

Shawn McKee, Compliance Officer
NC Department of Environment and Natural Resources
Division of Waste Management – Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Dear Ms. McKee:

I am the chief financial officer of Granville County. This letter is in support of this unit of local governments use of the financial test to demonstrate financial assurance, as specified in 15A NCAC Rule .1628 (e)(1)(F).

This unit of local government is owner and operator of the following facilities for which financial assurance for closure and post-closure is demonstrated through the financial test specified in 15A NCAC 13B Rule .1628 (e) (1) (F). The closure and post-closure cost estimates covered by the test are shown for each facility:

Facility Name:	Butner Landfill & Oxford Landfill
Facility Address:	P.O. Box 906 Oxford, NC 27565
Permit Numbers	39-02 (Butner) 39-01 (Oxford)
Post-Closure Estimate:	Butner - $ 513,592
Closure Estimate:	Oxford - $ 1,718,090
Post-Closure Estimate:	Oxford - $ 1,205,562
Closure Estimate:	Oxford - $ 1,873,731
Post-Closure Estimate:	Oxford - $ 1,646,012
Required Minimum	Oxford - $ 3,000,000

(See Attached Sheet for Calculation of Estimates)

The fiscal year of this unit of local government ends on June 30th. The figures for the following items marked with an asterisk are derived from this unit of local government's Annual Financial Information Report (AFIR) for fiscal year ended June 30, 2012.

RATIO INDICATORS OF FINANCIAL STRENGTH

1.	Sum of current closure, post closure, and corrective action cost estimates	$ 9,956,987
2	Sum of cash and investments*	$ 41,317,254
3.	Total Expenditures*	$ 65,144,852
4.	Annual debt service*	$ 8,129,930
5.	Assured environmental cost to demonstrate financial Responsibility in the following amounts under Division rules:	
	MSWLF under 15A NCAC 13B Section .1600	$ 9,956,987
	Total assured environmental costs	$ 9,956,987
6.	Total Annual Revenue*	$ 52,507,541
7.	Is line 5 divided by line 6 less than or equal to 0.43?	Yes
8.	Is line 2 divided by line 3 greater than or equal to 0.05?	Yes
9.	Is line 4 divided by line 3 less than or equal to 0.20?	Yes

I certify that the wording of this letter is identical to the wording specified in 15A NCAC 13B .1628 (e) (2) (G) as such rules were constituted on the date shown immediately below. I further certify the following: (1) that the unit of local government has not operated at a total operating fund deficit equal to five percent or more of total revenue in either of the past two fiscal years, (2) that the unit of local government is not in default on any outstanding general obligations bonds or long-term obligations, and (3) does not have any outstanding general obligation bonds rated lower than Baa as issued by Moody's, BBB as issued by Standard & Poors, or 75 as issued by the Municipal Council

Michael S. Felts
Finance Director
December 28, 2012 (REVISED 1/7/2013)

Granville County
Closure Post-Closure Estimates
Butner (3902-MSWLF-1982)
Oxford (*Unit 1:* 3901-MSWLF-1981, 3901-CDLF-1997)
(*Unit 2:* 3901-MSWLF-2012)

Adjustment and Justification	Yrs Remaining	Butner Landfill 3902-MSWLF-1982	Yrs Remaining	Unit 1 3901-MSWLF-1981 3901-CDLF-1997	Yrs Remaining	Unit 2 3901-MSWLF-2012	Reserve for Potential Assessments & Corrective Action
Subtotal as of August 1, 2009 (Restated)	**19**	**$ 547,740**	**30**	**$ 2,955,098**			**$ 3,000,000**
Decrease for Expenditures Incurred		$ (16,725)		$ (80,915)			
Increase for 1.2% inflation		$ 6,372		$ 34,490			
Subtotal as of June 30, 2010 (Restated)	**18**	**$ 537,387**	**30**	**$ 2,908,674**			**$ 3,000,000**
Decrease for Expenditures Incurred		$ (17,466)		$ (47,559)			
Increase for 1.1% inflation		$ 5,719		$ 31,472			
Subtotal as of June 30, 2011 (Restated)	**17**	**$ 525,641**	**30**	**$ 2,892,588**		**$ -**	**$ 3,000,000**
Decrease for Expenditures Incurred		$ (22,612)		$ (29,069)			
Increase for 2.1% inflation		$ 10,564		$ 60,134			
Estimated Closure Costs for 3901-MSWLF-2012						$ 1,873,731	
Estimated Post Closure Costs for 3901-MSWLF-2012						$ 1,646,012	
(above estimates were adjusted for inflation to June 2012)							
Subtotal as of June 30, 2012 (Restated)	**16**	**$ 513,592**	**30**	**$ 2,923,652**	**30**	**$ 3,519,743**	**$ 3,000,000**

Prepared by: Michael S. Felts, Finance Director