May 6, 2016

NC Department of Environmental Quality
Division of Waste Management - Solid Waste Section
217 West Jones Street
Raleigh, North Carolina 27603

Attention: Mr. Ervin Lane sent via email: ervin.lane@ncdenr.gov
Compliance Hydrogeologist

Reference: **Interim Corrective Action Evaluation Report**
**Edgecombe County Landfill (Permit No. 33-01)**
Tarboro, North Carolina
S&ME Project No. 4305-15-176

Dear Mr. Lane:

On behalf of Edgecombe County, S&ME, Inc. is submit this report documenting the progress of corrective actions conducted at the Edgecombe County Landfill located in Tarboro, North Carolina in accordance with the facility's Corrective Action Plan (CAP), approved by NCDENQ on January 16, 2009 and Corrective Action Plan Amendment, approved by NCDENQ August 9, 2010.

This report describes the status of implementation of the selected corrective measures, in situ isolation and monitored natural attenuation (MNA), at the Edgecombe County Landfill including the following:

- Maintaining a consistent contour with pre-1998 waste area;
- Increase slope of the closed MSW area;
- Implementation of a MNA program to address impacted groundwater; and,
- Installation of an upgradient groundwater hydraulic barrier.

If you have any questions about the information presented in this report, please call, or email us.

Sincerely,

**S&ME, Inc.**

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# Interim Corrective Action Evaluation Report
# Edgecombe County Landfill (Permit No. 33-01)
# Tarboro, North Carolina
# S&ME Project No. 4305-15-176

Prepared for:

**Edgecombe County Solid Waste Department**
**201 St. Andrew Street**
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**Tarboro, North Carolina**

Prepared by:

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**May 6, 2016**

**Interim Corrective Action Evaluation Report**
**Edgecombe County Landfill**
**(Permit No. 33-01)**
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**S&ME Project No. 4305-15-176**

I hereby certify this 6th day of May 2016 that this report was prepared by me or under my direct supervision.

NORTH CAROLINA LICENSED SEAL 1806 GEOLOGIST SAMUEL P. WATTS 5/6/16

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Attachment II *Visual Landfill Cover Inspection* - March 2016, April 21, 2016 (S&ME)
Attachment III *Subsurface Exploration & Hydrogeologic Assessment Report*, November 20, 2009 (S&ME)
Attachment IV *Design Report Former Eagles Property Dam Removal*, July 20, 2011 (S&ME)
Attachment V *Notice of Exemption*, dated July 27, 2011 (LQS)

# 1.0 Site Background

## 1.1 Regulatory Status

Edgecombe County currently operates a solid waste facility on a tract of land located off of Colonial Road (S.R. 1601) in Edgecombe County, south of Tarboro, North Carolina (**Figure 1**). In general, the solid waste facility includes a municipal solid waste (MSW) transfer facility; a construction & demolition (C&D) debris landfill unit; white goods and pallets storage area; soil borrow pits; and various operational buildings. The C&D landfill unit is operated over an existing closed MSW landfill, in accordance with North Carolina Department of Environmental Quality, Division of Waste Management (NCDENQ-DWM) Permit No. 33-01.

On behalf of Edgecombe County, S&ME completed a Corrective Action Plan (CAP), dated June 30, 2008 for the landfill in accordance with Solid Waste Rules defined under 15A NCAC 13B .1636 and .1637. The CAP included the selection of in situ isolation combined with monitored natural attenuation (MNA) as the remedial alternatives for groundwater impacted with cobalt, petroleum constituents and chlorinated compounds. In situ isolation was selected because the site conceptual model indicated that surface water and groundwater management issues are the primary mechanism for addressing the release and migration of the constituents of concern at the landfill. MNA has been incorporated into the facility's updated (January, 2010) Water Quality Monitoring Plan (WQMP) to monitor and evaluate the effectiveness of the remedial measures.

The CAP was submitted on behalf of Edgecombe County to the NCDEQ - DWM, Solid Waste Section (Section) and approved for implementation by the Section in a letter dated January 16, 2009. The CAP and the WQMP were submitted as part of the C&D Landfill permit application approved by the Solid Waste Section on March 31, 2010 by the renewal of the C&D landfill Permit to Operate (PTO). After the CAP was submitted to the Solid Waste Section, S&ME collected additional information on the site geology and hydrogeology in the vicinity of the proposed hydraulic barrier as part of the design and implementation process. Additionally, the County purchased the property immediately adjacent to the southern property boundary of the landfill facility (former Eagles Farm, LLC). S&ME reviewed the original design presented in the CAP, considering the additional space available to the south of the landfill and the newly obtained geologic and hydrogeologic information. Based on that review, S&ME prepared a Corrective Action Plan Amendment, report dated July 27, 2010 describing the revised design for implementing the proposed up-gradient hydraulic barrier. The revised design presented in the Corrective Action Plan Amendment uses the same concept as the approved CAP, with minor revisions of the hydraulic barrier. The revised design was intended to reduce capital cost for implementation, minimize future maintenance, and more effectively divert groundwater flow around or away from landfill waste. The Corrective Action Plan Amendment was approved by NCDEQ August 9, 2010.

## 1.2 Corrective Action Plan

The CAP proposes corrective measures focused on "in situ isolation" of the landfill from surface water and groundwater sources that may enter or pass through the waste mass. In situ isolation system will minimize water exposure to the buried waste mass limiting the release of contaminants to the water and to the environment. The CAP corrective measures have three components: 1) management of surface water infiltration and discharge, 2) management of groundwater infiltration and discharge, and 3) monitoring the naturally occurring chemical and biological degradation of constituents.

### *1.2.1 In situ Isolation Surface Water*

The focus of an in situ isolation system for surface water is to reduce infiltration of surface water from storm events and to manage the stormwater drainage discharged from the landfill site. The engineered design to address surface water infiltration includes a grading plan to improve stormwater drainage from the surface of the landfill and reduce surface water infiltration into the waste. The grading plan includes: 1) removing soil berms that were installed on the surface of the landfill as erosion control measures during landfill construction; 2) re-grading and shaping some portions of the landfill cap to increase the percent slope on filled areas to maintain consistent contours with the pre-1998 waste area; 3) increasing the slope of the closed MSW area to facilitate improved surface drainage; and, 4) excavating, stabilizing, and extending the drainage ditch located on the south side of the landfill waste boundary from the west end of the groundwater hydraulic barrier around to the southern and western perimeter of the landfill. The drainage routes for stormwater shed from the landfill will flow to the north to stormwater sedimentation basins lined with low permeability material to manage the stormwater discharged to surface water features. Surface water and groundwater intercepted by the hydraulic barrier to the south of the landfill will flow through the former location of the Eagles Farm pond and will discharge to Jerry's Creek east of the landfill.

### *1.2.2 In situ Isolation Groundwater*

The in situ isolation of the landfill waste from groundwater requires an engineered design to reduce infiltration of groundwater from upgradient and lateral sources that allow groundwater flow through the subsurface toward the landfill waste. The engineered design will divert upgradient and lateral groundwater flow around or away from the landfill waste using a hydraulic barrier to reduce the volume of horizontal groundwater flow into the landfill. The engineered design will manage lateral groundwater flow toward the landfill waste and will discharge groundwater diverted from entry into the landfill waste using an improved perimeter drainage system. Retaining and/or diverting the groundwater from flowing through the waste in the landfill is intended to reduce the volume of water available for the production of leachate in the landfill. Therefore, the transport of leachate from the landfill would be reduced. The reduction of groundwater flow beneath the landfill is also intended to lower groundwater levels in the landfill, thereby minimizing contact of groundwater with waste and/or leachate contained in the landfill.

### *1.2.3 Natural Attenuation Monitoring*

The monitored natural attenuation (MNA) program described in the CAP is necessary to review the performance of the engineered controls that will be implemented to reduce surface water and groundwater infiltration into the waste at the landfill. The monitoring network at the landfill is comprised of monitor wells and piezometers that are measured for water elevations and or sampled on a semiannual schedule. During each semiannual monitoring event, groundwater flow directions and concentrations of target constituents in surface water and groundwater are monitored. The MNA network will be used to evaluate performance of the CAP, specifically change in hydraulic head from upgradient to downgradient of control measures and collecting groundwater geochemical parameters indicating the biological activity occurring in the natural attenuation process.

# 2.0 Aquifer Characteristics

## 2.1 Groundwater Elevations and Flow Direction

The uppermost aquifer at the site is unconfined and is found in the surficial Sunderland Formation, Pleistocene-age marine, silty sands. This aquifer is recharged by inflow from up-gradient areas and by precipitation infiltration. The uppermost aquifer underlying the landfill is expected to discharge to the local surface water features including Jerry's Creek and the drainage features in the active landfill area. During flood conditions, the southwest perimeter trench and the farm pond located in the southeast corner of the site may recharge the aquifer. A massive marine clay layer (Yorktown Formation) underlies the surficial aquifer at depths ranging from approximately 8 to 24 feet below the original ground surface acts. This clay layer acts as an aquitard and confining layer below the landfill.

Based upon the groundwater potentiometric surface elevations, groundwater flow direction beneath the landfill is estimated to be to the north-northeast. The average horizontal hydraulic gradient from two three point solutions using well sets MW-3B, MW-7A, and MW-5, and P-1, MW-7A and MW-5 is estimated to be 0.0218 ft/ft.

## 2.2 Groundwater Flow Velocity

Aquifer rising and falling head tests were previously performed at the site by Law Engineering Company and by S&ME. The aquifer test data were used to estimate the hydraulic conductivity of the sediments in the surficial aquifer intersected by the screened intervals of the monitor wells tested. The aquifer test data (provided in previous reports) were analyzed by the Bouwer and Rice Method.

The hydraulic conductivity, K, values previously measured at the site ranged from 1.29x10-5 centimeters per second (cm/sec) to 3.65x10-4 cm/sec. An average hydraulic conductivity value of 5.95x10-5 cm/sec was used for calculating the site-wide flow velocity. The average hydraulic gradient of 0.0224 ft/ft, calculated from the three point solution described above was used as the site-wide average gradient. An effective soil porosity, n, of 15% was used as the site-wide average.

The average groundwater flow velocity, V, for the site, using the equation and input values above, was estimated at 8.96 ft/yr.

# 3.0 Proposed Corrective Measures

The implementation of the selected corrective measures, in situ isolation and MNA, at the Edgecombe County Landfill includes the following:

- Maintaining a consistent contour with pre-1998 waste area;
- Increase slope of the closed MSW area;
- Implementation of a MNA program to address impacted groundwater; and,
- Installation of an upgradient groundwater hydraulic barrier.

The following sections detail the progress of the above corrective measure activities that have been conducted at the County's landfill in accordance with the facility's Corrective Action Plan (CAP), approved by NCDEQ on January 16, 2009 and Corrective Action Plan Amendment, approved by NCDEQ August 9, 2010.

# 4.0 Maintaining a Consistent Contour with Pre-1998 Waste Area

## 4.1 Description

Maintaining consistent contour elevations across the waste disposal unit where C&D waste is not currently being placed (western portion of waste disposal unit) will reduce groundwater contamination by reducing vertical percolation of pounded rain water into the waste mass which can produce leaching. Maintaining a consistent contour entails some initial grading operations to remove or regrade existing stormwater slope diversion berms on the landfill cap and maintenance to those areas where ditches, slumps, and sinkholes have formed from waste decomposition. Maintaining a consistent contour would involve a continuous process of inspection and backfilling on a quarterly basis for existing or potential surface water collection locations followed by timely addition of backfill soil and reseeding.

## 4.2 Method of Evaluation

Visual inspection is the method for evaluating consistent contour elevations across the closed MSW disposal unit. Edgecombe County employees perform non-routine inspections of the landfill cover system during mowing, while relocating slope drains and while performing operation and maintenance (O&M) on the landfill gas (LFG) collection system. Additionally, Edgecombe County has contracted S&ME to perform an annual inspection of the landfill cover system during performance of the facility quarterly methane monitoring. S&ME summarizes the findings of the annual landfill cover inspection in a letter report to Edgecombe County's landfill manager.

The cover system is examined for signs of settlement, erosion, vector damage, brown or bare vegetation, bulging areas, standing water, deep-rooted or woody vegetation, and signs of gas leakage such as distressed vegetation or fissures. The condition of the landfill gas extraction wells was also inspected while onsite.

## 4.3 Status

Removal and regrading of existing stormwater slope diversion berms on the landfill cap was completed in 2008 (**See Photos 1-9, Attachment I**).

## 4.4 Proposed Schedule

### *4.4.1 Schedule for Completion*

None. This corrective measure has been fully implemented.

### *4.4.2 On-Going Evaluation & Maintenance*

Annually from 2009 to 2016, S&ME has completed landfill cover inspections and reported the findings to the Edgecombe County landfill manager. S&ME's most recent landfill cover inspection was performed on March 17, 2016. S&ME's findings and recommendations from the were provided in a letter report titled *Visual Landfill Cover Inspection - March 2016*, dated April 21, 2016 (**Attachment II**). In summary, S&ME's report recommended Edgecombe County perform the following maintenance activities:

- Repair leachate seepage areas observed on the landfill cap;
- The slope drains in the northern central area of the landfill should be re-connected to provide appropriate drainage;
- Continue regular mowing on the landfill cap and perimeter to promote healthy growth of grass, and to minimize growth of weeds or tall vegetation with a tendency for deep root penetration;
- Continue to monitor steep slopes for signs of erosion and continue using flexible down-drains to intercept and direct surface water away from areas that have not been stabilized;
- Continue inspection and backfilling of existing or potential surface water collection locations

Edgecombe County shall continue to perform visual inspections and perform maintenance to those areas where pipes, roads, ditches, berms or subsidence are causing ponding of surface water over the waste mass.

# 5.0 Increase Slope of Closed MSW Area

## 5.1 Description

Increasing the slope of the landfill cover will decrease the infiltration of stormwater into the MSW waste and reduce the potential for groundwater contamination. The eastern portion of the waste disposal unit is where the current C&D waste disposal is being conducted. The C&D waste has been placed over the existing MSW landfill and has increased the slope in this area.

The slopes in the western portion of the MSW landfill are relatively flat with a majority of the area at a slope of approximately 5 to 6 percent. Increasing the slope in this area would involve moving the current C&D waste placement operations from the eastern portion of the waste disposal unit to the western portion. The C&D waste placement would increase the slope in this area and also provides an additional barrier to stormwater infiltrating into the MSW landfill.

## 5.2 Method of Evaluation

Visual inspection and topographic survey is the method for evaluating increased slope of the closed MSW disposal unit. As the active working face of the C&D placement operations advances from east to west, the slope of the existing MSW landfill cap increases. **Figure 2** shows the location of active working face of the C&D placement operations as of Mid-2015 relative to the proposed area of future waste placement. Where C&D waste has been placed over the existing MSW landfill cap, the slope of the ground surface has increased.

## 5.3 Status

### *5.3.1 Tasks Completed*

**Figure 2** shows the location of active working face of the C&D placement operations as of June 2015. Where C&D waste has been placed over the closed MSW landfill unit, the slope of the ground surface has increased. From June 2007 to June 2015, Edgecombe County has placed 416,841 tons of C&D waste on top of the closed MSW landfill unit, covering an area of approximately 61,650 square feet. As of June 2015, approximately 37,045 square feet of the closed MSW landfill unit has been covered with C&D waste representing approximately 61 % of the total area to be covered with C&D waste.

### *5.3.2 Tasks In-Progress*

Edgecombe County continues to place C&D waste on the western portion of the closed MSW waste unit.

## 5.4 Proposed Schedule

### *5.4.1 Schedule for Completion*

The current C&D waste placement operation continues to move from the eastern portion of the waste disposal unit to the western portion. As the active working face of the C&D placement operations advances from east to west, the slope of the landfill cover increases.

In the 2010, Permit Application, Section A–Facility Plan outlines the 5-year development plans through 35 years show C&D continuing to be placed over the existing MSW landfill cap from the eastern to the western portion of the MSW landfill. **Figure 3** shows the proposed final grading plan following the completion of C&D disposal operations. Based on the phasing presented in the facility operation plan, the schedule for completing implementation of this corrective measure is as follows:

- 2024 (year) – Complete placement of base footprint of C&D waste (Phases 1-4)
- 2055 (year) – Complete final placement of C&D waste (Phases 5-9)

### *5.4.2 On-Going Evaluation & Maintenance*

Annually, Edgecombe County shall perform a topographic survey of the active C&D landfill and evaluate the placement of C&D waste.

# 6.0 Monitored Natural Attenuation

## 6.1 Description

The COCs in groundwater at the landfill include the organic parameters: vinyl chloride, benzene, cis-1,2-dichloroethene, trichloroethene, and 1,4-dichlorobenzene, and the inorganic constituent: cobalt. Following construction of the corrective measures presented above, surface water and groundwater coming in contact with waste materials in the waste disposal unit will be minimized. Waste material leachate coming into contact with groundwater will then be minimized. The COCs in groundwater are

then expected to naturally attenuate and trend toward cleanup goals. MNA will be implemented as the corrective measure for impacted groundwater.

Based on the years of groundwater monitoring, analytical data coupled with the various studies throughout the groundwater monitoring history of the facility, including the previously discussed NES, the primary substrate at the facility should contain a sufficient quantity of anthropogenic organic carbon to support biodegradation of the chlorinated solvent COCs. In addition, there is likely native organic carbon in trace amounts which will further enhance biodegradation rates of these constituents.

## 6.2 Method of Evaluation

For the Edgecombe County Landfill, it has not yet been determined if the contaminant plume is still in a growth phase, stable phase, or if the plume has already reached its peak and is now a shrinking plume. At a time of one to three years following implementation of the isolation and water management correction measures presented above, the groundwater plume status at the facility would be determined during the MNA process.

This process would involve sampling the appropriate property boundary groundwater monitoring wells for the constituents found exceeding their respective 2L Standards/GWPST. After an appropriate amount of samples have been taken, assumptions may be drawn concerning the constituent magnitude concentration trend (increasing, decreasing, or static) in order to re-evaluate the dispersion and natural attenuation process effectiveness. The objectives for a MNA groundwater remediation program include the following:

- Demonstrate that natural attenuation is occurring;
- Be protective of human health and the environment;
- Monitor natural attenuation and environmental impact; and,
- Restore groundwater at the edges of the plume to below the 2L Standard and GWPST.

The existing monitoring network, plus additional monitor wells to be installed, will be used to monitor groundwater quality and trends. Monitoring wells MW-3B, MW-4, and MW-9, the upgradient wells, would allow determination of geochemical conditions in the groundwater prior to entering the source area. Monitoring well MW-5 is located in the plume and will be utilized to collect data for bioremediation rate calculations. Additional wells will be installed along the downgradient facility boundary to define the edge of the plume and act as sentinel wells. These wells would be monitored and evaluated to determine if bioremediation is working as well as to determine if re-evaluation triggers have been exceeded.

## 6.3 Status

### *6.3.1 Tasks Completed*

The following tasks have been completed for the MNA corrective action:

- January 19, 2010 – Groundwater samples collected and analyzed for geochemical parameters necessary to evaluate monitored natural attenuation (MNA) in addition to the Appendix I constituents for Detection Monitoring (constituents listed in 40 CFR 258).
- July 20, 2010 – Groundwater samples collected and analyzed for geochemical parameters necessary to evaluate monitored natural attenuation (MNA) in addition to the Appendix I constituents for Detection Monitoring (constituents listed in 40 CFR 258).

- January 18, 2011 – Groundwater samples collected and analyzed for geochemical parameters necessary to evaluate monitored natural attenuation (MNA) in addition to the Appendix I constituents for Detection Monitoring (constituents listed in 40 CFR 258).
- July 27, 2011 – Groundwater samples collected and analyzed for geochemical parameters necessary to evaluate monitored natural attenuation (MNA) in addition to the Appendix I constituents for Detection Monitoring (constituents listed in 40 CFR 258).
- July 2012 – S&ME submitted the *Baseline Water Quality and Monitored Natural Attenuation (MNA) Report*, dated July 19, 2012. The Baseline MNA Report concluded that natural attenuation is occurring on site by one of more reductive processes. S&ME recommended:
  1) modifying the SAP to discontinue sampling for several MNA parameters used to evaluate aerobic microbiological activity (volatile fatty acids, biochemical oxygen demand, chemical oxygen demand, and hydrogen);
  2) discontinuing sampling for geochemical/MNA parameters be in all monitor wells, until corrective measures have been implemented at the site;
  3) geochemical/MNA parameters be measured every 18 months, once corrective measures are in place, to allow the parameters to be measured during alternating seasons.
- September 17, 2012 – In a letter dated September 17, 2012, the Section acknowledged receipt and review of the *Baseline MNA Report*. The Section did not approve elimination of ant of the MNA parameters. The Section did approve Edgecombe County discontinuing MNA monitoring until the corrective measures described in the CAP were implemented and approved sampling for MNA parameters every 18 months thereafter.
- January 2013 – S&ME personnel, on behalf of Edgecombe County, met with the Section to discuss approved modifications to the Sampling and Analysis Plan (SAP) for the Edgecombe County landfill. The agreed-upon revisions to the SAP were summarized in a letter to the Section dated April 19, 2013, and the Section confirmed the revisions in an email from Mr. Ervin Lane, of the Section, dated May 1, 2013.

### 6.3.2 Tasks In-Progress

Edgecombe County implemented MNA monitoring on January 19, 2010 as part of the facility semiannual water quality monitoring. On January 18, 2013, S&ME personnel met with the Section to discuss changes to the SAP. During the meeting, the Section approved modifications to the SAP, in which MNA and Geochemical parameters were to be temporarily discontinued until the corrective measures were implemented. Once the corrective measures are in place, the revised SAP for MNA and geochemical parameters will be implemented.

Edgecombe County continues to perform semi-annual water quality monitoring. Geochemical parameters indicative of MNA are collected in accordance within the WQMP. Monitor wells MW-5, MW-12, and MW-15 were selected to provide information on the MNA processes in conjunction with the Appendix I analytical data. MNA parameters include the following performance parameters as required by the NCDEQ DWM: chloride, sulfate, alkalinity, biochemical oxygen demand, chemical oxygen demand, total organic carbon, nitrate as N, nitrate/nitrite as N, sulfide, total dissolved solids, iron, manganese, carbon dioxide, ethane, ethene, methane, volatile fatty acids, and hydrogen.

## 6.4 Proposed Schedule

### *6.4.1 Schedule for Completion*

None. This corrective measure has been fully implemented.

### *6.4.2 On-Going Evaluation & Maintenance*

MNA parameters sampling and statistical analysis was allowed to be temporarily suspended until the hydraulic barrier construction was complete. MNA monitoring was last completed in 2012; based on the partial implementation of corrective measures, S&ME recommends resuming collection of MNA parameters in compliance monitoring wells MW-5, MW-12, MW-15, and MW-16 beginning in June 2016, and every 18 months thereafter over the next three years (June 2016, December 2017 and, June 2019).

This schedule will allow the parameters to be measured during alternating seasons, thus facilitating a more representative analysis of conditions at the site. Evaluation of MNA should also include a USEPA approved MNA screening model every 18 months to simulate the groundwater remediation at the facility and determine the mass flux and mass balance starting in June 2016.

# 7.0 Installation of Upgradient Hydraulic Barrier

## 7.1 Description

The conceptual in situ isolation plan in the CAP involves the construction of a barrier to intercept and divert groundwater flowing beneath the landfill. This proposed hydraulic barrier is to extend along the southern (upgradient) boundary of the landfill. Diverting the upgradient groundwater flowing on top of the Yorktown marine clay toward the landfill should 1) reduce the volume of water that contributing to the production of leachate and 2) lower groundwater levels, thereby increasing the vertical separation between the groundwater table and the bottom of the buried waste mass. The reduced volume of water and the reduced groundwater flow velocity has the intended purpose of decreasing the migration of contaminants of concern and keeping them "in situ."

S&ME performed a subsurface investigation and hydrogeologic assessment for use in designing the hydraulic barrier and stormwater drainage system components necessary to implement the corrective measures selected in the CAP. This information was included in S&ME's report *Subsurface Exploration & Hydrogeologic Assessment Report*, dated November 20, 2009. A copy of this report is included as **Attachment III**.

Based on the site specific information obtained from the Subsurface Exploration & Hydrogeologic Assessment, S&ME prepared revised design for the implementation of the hydraulic barrier. The revised design was submitted to the Section in S&ME's report *Corrective Action Plan Amendment*, dated July 27, 2010. The revised design presented in the *Corrective Action Plan Amendment* used the same concept as the approved CAP, with minor revisions of the hydraulic barrier. The revised design was intended to reduce capital cost for implementation, minimize future maintenance, and more effectively divert groundwater flow around or away from landfill waste. Significant design features included:

- Re-design the outfall structure that regulates the flow through the ponds or remove the dam to the pond located on the southeast corner of the facility;

- Install 1,150 linear feet of groundwater barrier trench drain on the former Eagles Farm LLC property to direct groundwater to the existing pond to the east and/or drainage ditch to the west.

The location of the proposed hydraulic barrier system is presented in the *Corrective Action Plan Amendment*, dated July 27, 2010. The *CAP Amendment* also presents a profile that depicts the ground surface; the top of the Yorktown Formation; the proposed groundwater barrier trench invert, and construction details for the hydraulic barrier trench.

## 7.2 Method of Evaluation

Changes in groundwater elevation within the waste disposal unit, and reduction in groundwater flow beneath the landfill are the methods for evaluating the effectiveness of the in-situ isolation. In-situ isolation is proposed as part of the corrective measures in this report. However, there are currently no in-situ isolation structures in-place at the landfill facility. Groundwater elevation data will be collected from the facility's water quality monitoring network on a quarterly basis.

### *7.2.1 Tasks Completed*

- October 2008 through March 2009 – S&ME performed additional assessment necessary to develop design specifications for the hydraulic barrier. The findings were summarized in S&ME's report titled *Subsurface Exploration and Hydrogeologic Assessment Report*, dated November 20, 2009. A copy of this report is provided as **Attachment III**.
- August 2009 – Edgecombe County purchased the adjoining Eagles Farm LLC property to the south of the landfill.
- July, 2010 – S&ME submitted *Corrective Action Plan Amendment*, dated July 27, 2010, with a revised design for the implementation of the hydraulic barrier.
- August 9, 2010 – The Solid Waste Section approved the *Corrective Action Plan Amendment*.
- March 11, 2009 – S&ME submitted a revised *Erosion and Sedimentation Control Plan (E&SC)* to Land Quality Section (LQS) to obtain a permit for land disturbance for the construction of the proposed corrective measures.
- May 20. 2009 – LQS issued a final Letter of Approval with Modifications to E&SC Permit.
- July 20, 2011 – S&ME submitted a dam removal application to NCDEQ LQS for removal of the dam impounding surface water in the former Eagles Farm pond located in the southeast corner of the facility. (**Attachment IV**).
- July 27, 2011 – LQS, State Dam Safety Engineer issued a letter acknowledging receipt of S&ME's application. LQS determined the former Eagles Farm pond dam to be classified low hazard, and issued a Notice of Exemption for the removal of the dam (not requiring approval from LQS). A copy of the Notice of Exemption is provided as **Attachment V**.
- June 2011 through April 2012 – Edgecombe County lowering the water level in the former Eagles Farm pond located in the southeast corner of the facility by dismantling the concrete block riser/outlet structure. **(Photos 10 through 15, Attachment I)** When the riser was dismantled to its lowest point, the outlet (two corrugated metal pipes) was still approximately 10 feet above the bottom of the pond.

- May 11, 2012 through May 15, 2012 – Edgecombe County mechanically dewatered the pond with a large agriculture pump and removed/relocated viable fish. (**Photos 16 through 19, Attachment I**)
- May 2013 – S&ME completed preparation of construction specifications for the site grading and corrective measures installation for the in situ isolation.
- August 17, 2015 - Edgecombe County completed final removal of the former Eagles Farm pond dam (**Photos 20 and 21, Attachment I**).

### *7.2.2 Tasks In-Progress*

- The land disturbance permit issued by LQS has expired. S&ME is updating the E&SC plan to apply for a new land disturbance permit for the construction corrective measures associated with the in situ corrective measures.
- S&ME is revising the final construction specifications for corrective measures installation.
- S&ME is measuring groundwater elevations, and evaluating the effect of draining the pond on the up gradient hydrogeology.

## 7.3 Proposed Schedule

A proposed schedule of dewatering the existing drainage ditch and pond features and installing a groundwater barrier trench drain activities is as follows:

### *7.3.1 Schedule for Completion*

August 2016 – November 2016

- Re-submit Erosion and Sedimentation Control Plan (E&SC) to LQS to obtain a new land disturbance permit for the construction areas of the landfill corrective measures
- Review and update the construction specifications for corrective measures installation.
- Continue collection of quarterly groundwater elevation data.

December 2016 – March 2017

- Corrective measures grading project let for bid
- Selection of Contractor to install corrective measures

May 2017 - December 2017

- Construction of in situ isolation system -- improve diversion ditches, install up gradient hydraulic barrier, install additional monitor wells and place low permeability fill in sedimentation ponds.

### *7.3.2 On-Going Evaluation & Maintenance*

On a quarterly basis, Edgecombe County shall collect water levels and evaluate in-situ isolation.

# 8.0 Conclusions

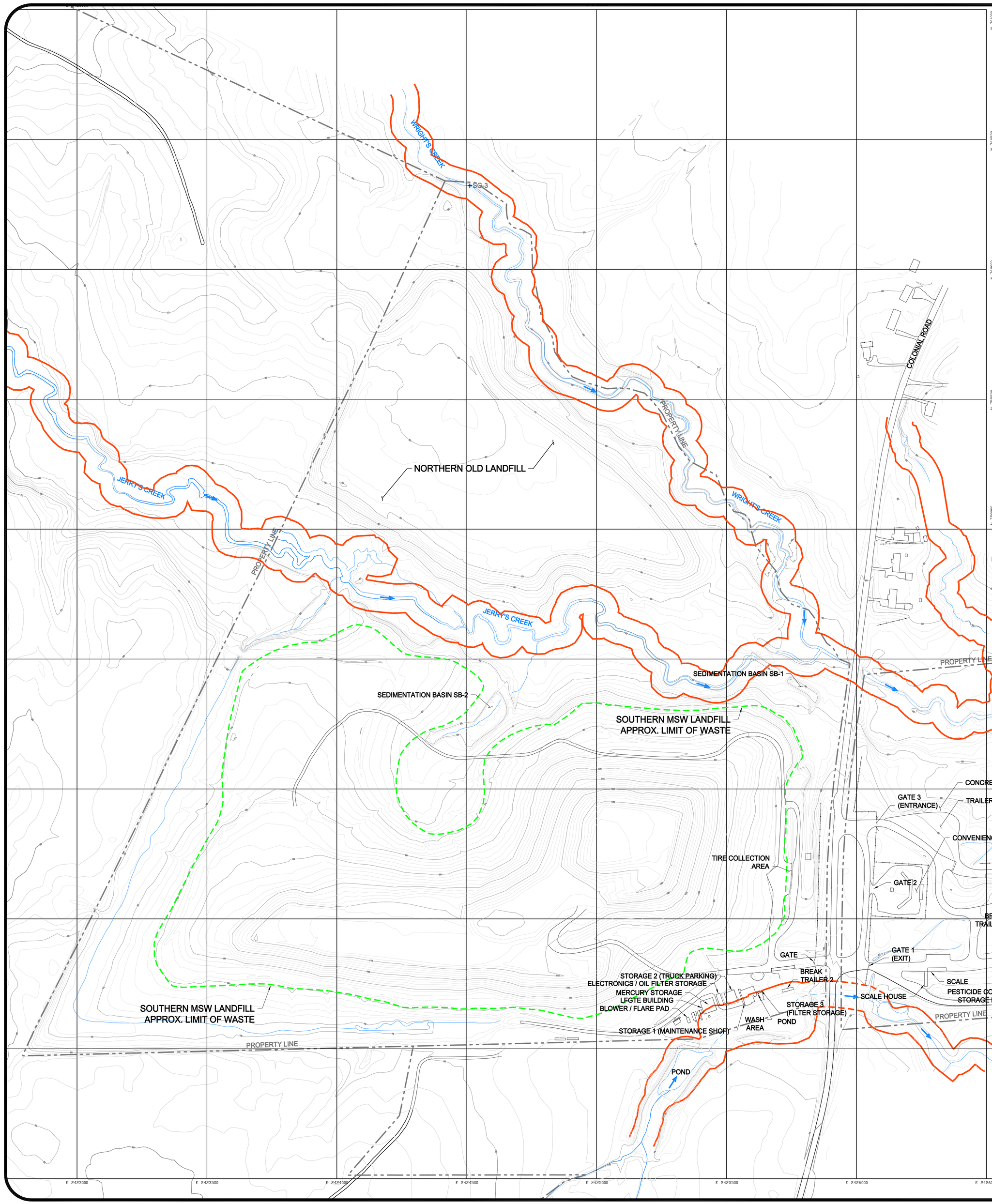
The CAP for the Edgecombe County Landfill proposes corrective measures focused on "in situ isolation" of the landfill from surface water and groundwater sources that may enter or pass through the waste mass.

In situ isolation system will minimize water exposure to the buried waste mass limiting the release of contaminants to the water and to the environment.

Edgecombe County has begun implementing the corrective measures. Some of the corrective measures have been fully implemented and some of the corrective measures are still in the process of being implemented. Edgecombe County has begun are in the ongoing evaluation and maintenance of the implemented corrective measures. Below is a summary of the implementation of the selected corrective measures, in situ isolation and MNA, at the Edgecombe County Landfill:

| Corrective Measure | Implementation Begun | Implementation Complete | Date Implementation Complete | Evaluation Schedule |
|---|---|---|---|---|
| Maintaining consistent contour with pre-1998 waste area | X | X | **2008** | **Annually** (Started in 2008) |
| Increase slope of the closed MSW area | X | | **2024** (estimate Phase 4 filling complete) | **Annually** (Started in 2007) |
| Monitored Natural Attenuation (MNA) | X | X | **June 2011** (baseline MNA) | **Every 18 Months** (Started June 2016) |
| Install upgradient groundwater hydraulic barrier | X | | **December 2017** (estimated) | **Quarterly** (Start March 2018) |

# Figures




## LEGEND

- LIMIT OF MSW WASTE
- PROPERTY LINE
- 50-FOOT STREAM BUFFER
- GROUND SURFACE ELEVATION CONTOUR - 10-FOOT INTERVAL
- GROUND SURFACE ELEVATION CONTOUR - 2-FOOT INTERVAL
- FENCE

## NOTES:

1. TOPOGRAPHIC MAP DEVELOPED BY GEODATA CORPORATION OF ZEBULON, NC USING PHOTOGRAMETRIC METHODS FROM AERIAL PHOTOGRAPHY FLOWN ON FEBRUARY 5, 2007.
2. GROUNDWATER MONITOR WELL, PIEZOMETER, AND METHANE GAS MONITOR WELL LOCATIONS SURVEYED BY SPRUILL & ASSOCIATES ON MAY 26, 2002, DECEMBER 23, 2004, AND SEPTEMBER 4, 2007 AND BY BATEMAN CIVIL SURVEY COMPANY, PC, ON OCTOBER 26, 2008.
3. TOPOGRAPHIC MAP UPDATED WITH GROUND SURVEY BY BATEMAN CIVIL SURVEY COMPANY, PC OF HOLLY SPRINGS, NC ON JULY 2011, JUNE 2012, & JUNE 2013.
4. PROPERTY BOUNDARY OBTAINED FROM EDGECOMBE COUNTY GIS DEPARTMENT.
5. POTABLE WELL NEAR GATE 2 USED FOR IRRIGATION ONLY.

GRAPHIC SCALE

200 0 100 200 400

( IN FEET )

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NC ENG. LICENSE #F-0176 PHONE: (919) 872-2660
3201 SPRING FOREST ROAD, RALEIGH, NC 27616

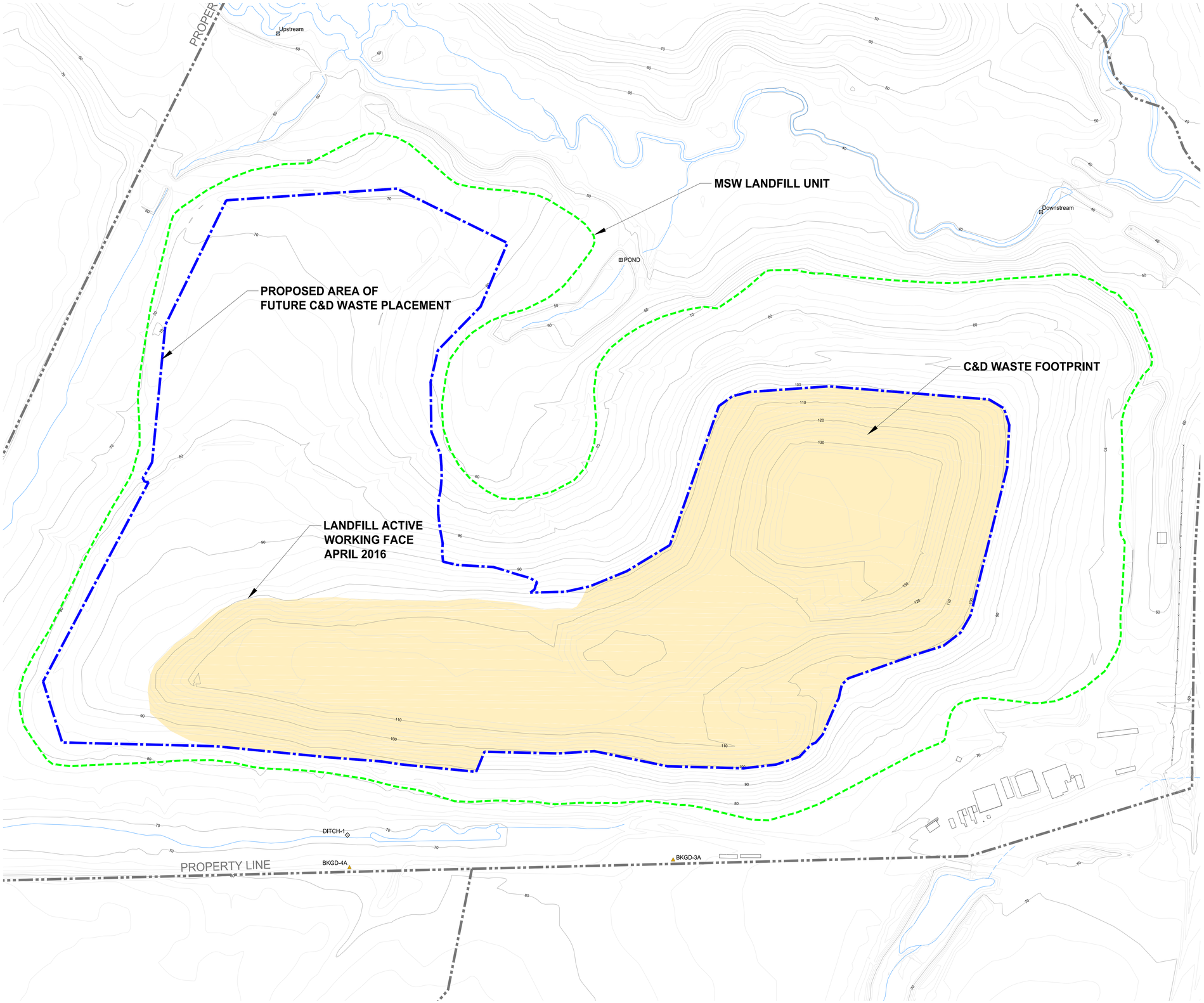
| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | KSO |

GENERAL SITE PLAN

EDGECOMBE COUNTY LANDFILL
TARBORO, NORTH CAROLINA

| | |
|---|---|
| DRAWN BY: BTR | CHECKED BY: |
| DESIGNED BY: | APPROVED BY: |
| PROJECT NUMBER: 4305-15-175 | |
| SCALE: 1" = 200' | DATE: MAY 2016 |
| DRAWING NUMBER: D-1435 | |
| DRAWING: 1 | OF: |

Q:\PROJECTS\2015\4305-15-175\CAD\D1435.dwg, FIG1, 5/6/2016 1:59:39 PM, 1:1




GRAPHIC SCALE

100 0 50 100 200

( IN FEET )

NOTES:

1. TOPOGRAPHIC MAP DEVELOPED BY GEODATA CORPORATION OF ZEBULON, NC USING PHOTOGRAMETRIC METHODS FROM AERIAL PHOTOGRAPHY FLOW ON FEBRUARY 5, 2007.
2. TOPOGRAPHIC MAP UPDATED WITH GROUND SURVEY BY BATEMAN CIVIL SURVEY COMPANY, PC OF HOLLY SPRINGS, NC ON JUNE 23, 2015.
3. C&D WASTE QUANTITY, 7,677 CUBIC YARDS FILL.

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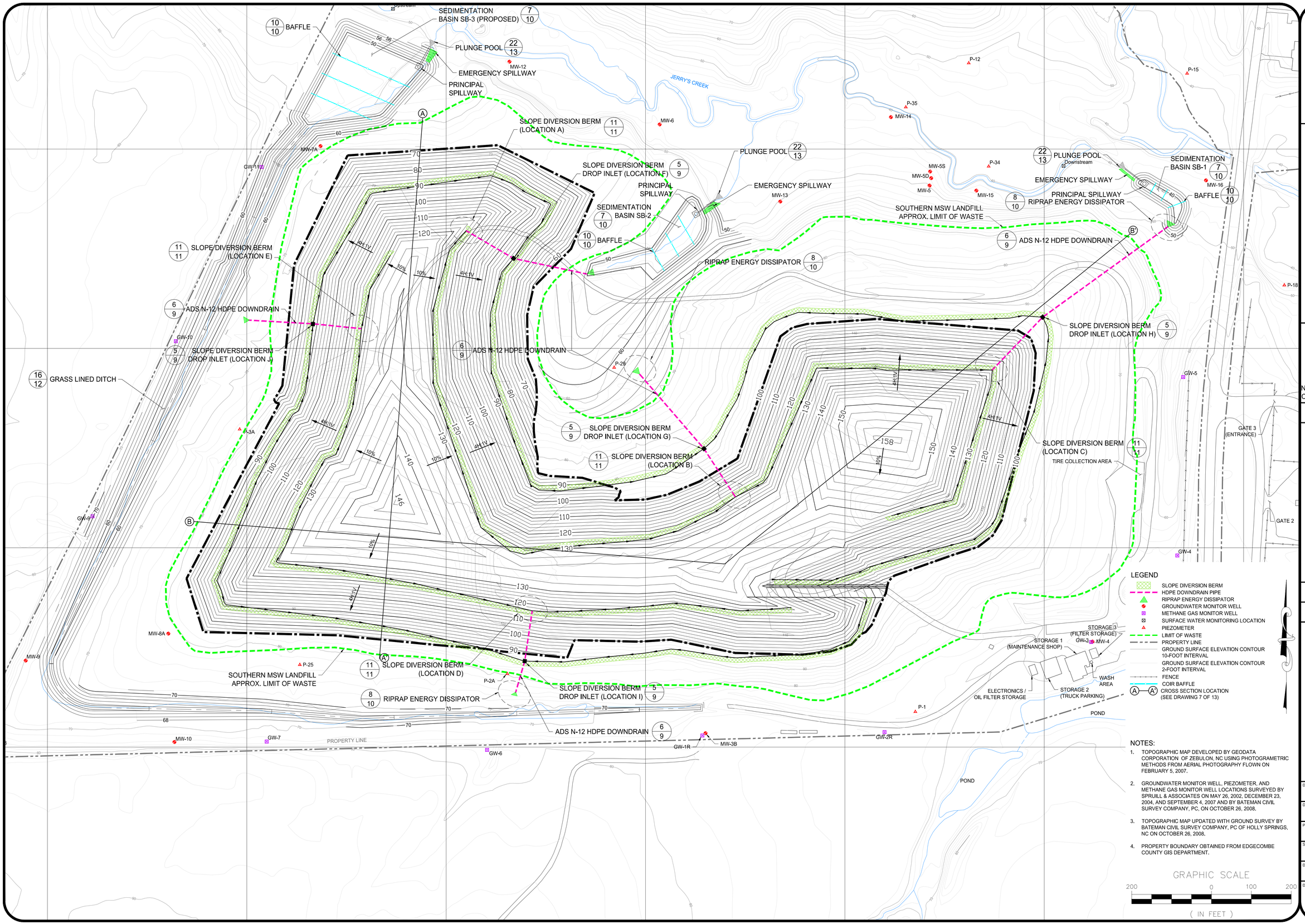
| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|

C&D WASTE PLACEMENT

EDGECOMBE COUNTY LANDFILL
TARBORO, NORTH CAROLINA

| | |
|---|---|
| DRAWN BY: BTR | CHECKED BY: |
| DESIGNED BY: | APPROVED BY: |
| PROJECT NUMBER: 4305-15-175 | |
| SCALE: 1" = 100' | DATE: MAY 2016 |
| DRAWING NUMBER: D-1435 | |
| DRAWING: 2 | OF: |

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4. PROPERTY BOUNDARY OBTAINED FROM EDGECOMBE COUNTY GIS DEPARTMENT.

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THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY JOHN A. MOODY, P.E. (N.C.) #024294 ON AUGUST 31, 2009. THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT.

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|

PROPOSED FINAL GRADING

EDGECOMBE COUNTY LANDFILL
TARBORO, NORTH CAROLINA

| | |
|---|---|
| DRAWN BY: BTR | CHECKED BY: |
| DESIGNED BY: | APPROVED BY: |
| PROJECT NUMBER: 4305-15-175 | |
| SCALE: 1" = 100' | DATE: MAY 2016 |
| DRAWING NUMBER: D-1437 | |
| DRAWING: 3 | OF: |

# Attachment I

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 10-20-08**

Photographer: S. Watts

| | | |
|---|---|---|
| **1** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

**Date: 10-20-08**

Photographer: S. Watts

| | | |
|---|---|---|
| **2** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 10-20-16**

Photographer: S. Watts

| | | |
|---|---|---|
| **3** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

**Date:10-20-08**

Photographer: S. Watts

| | | |
|---|---|---|
| **4** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 10-20-08**

Photographer: S. Watts

| | | |
|---|---|---|
| **5** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

**Date: 10-20-08**

Photographer: S. Watts

| | | |
|---|---|---|
| **6** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 2008**

Photographer: S. Watts

| | | |
|---|---|---|
| **6** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

**Date: 2008**

Photographer: S. Watts

| | | |
|---|---|---|
| **7** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 2008**

Photographer: S. Watts

| | | |
|---|---|---|
| **8** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

**Date: 10-20-08**

Photographer: S. Watts

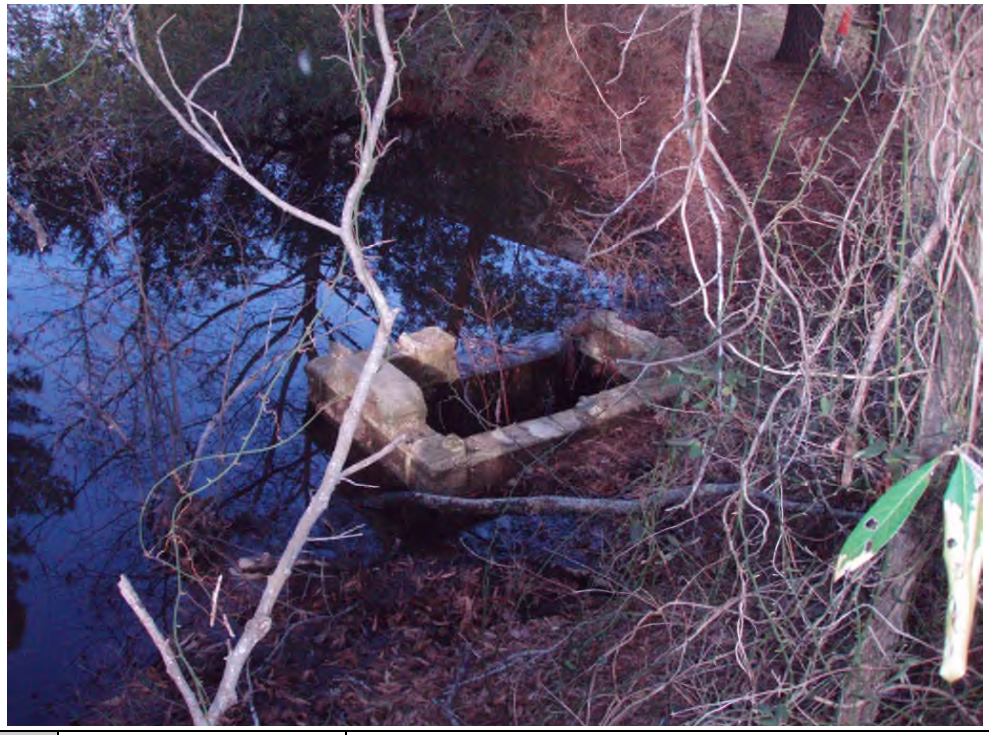
| | | |
|---|---|---|
| **9** | **Location / Orientation** | Landfill Cap |
| | **Remarks** | Removal and regrading of existing stormwater slope diversion berms |

S&ME
3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 01-08-09**

Photographer: M. Logut

| | | |
|---|---|---|
| **10** | **Location / Orientation** | Pond south of the landfill (former Eagles farm), looking north |
| | **Remarks** | Representative photo of pond surface water elevation prior to dewatering |



**Date: 01-08-09**

Photographer: M. Logut

| | | |
|---|---|---|
| **11** | **Location / Orientation** | View of the riser/outlet structure for the former Eagles farm pond. |
| | **Remarks** | The lid of the riser has been removed to evaluate the structure prior to dewatering the pond. |

S&ME
3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 01-08-09**

Photographer: M. Logut

| | | |
|---|---|---|
| **12** | **Location / Orientation** | Two metal corrugated pipes discharging water through the dam the on the former Eagles farm pond. |
| | **Remarks** | Prior to dewatering the pond. |

**Date: 06-24-11**

Photographer: M. Logut

| | | |
|---|---|---|
| **13** | **Location / Orientation** | View of the riser/outlet structure for the former Eagles farm pond. |
| | **Remarks** | Four courses of concrete blocks have been removed, lowering the water level approximately three feet below the original pool level. |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 06-24-11**

Photographer: M. Logut

| | | |
|---|---|---|
| **10** | **Location / Orientation** | Former Eagles farm pond. Looking south. |
| | **Remarks** | View of the pond after lowering the water level approximately three feet below the original pool level. |

**Date: 06-24-11**

Photographer: M. Logut

| | | |
|---|---|---|
| **11** | **Location / Orientation** | Former Eagles farm pond. Looking west |
| | **Remarks** | View of the pond after lowering the water level approximately three feet below the original pool level. |

S&ME
3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 01-08-09**

Photographer: M. Logut

| | | |
|---|---|---|
| **12** | **Location / Orientation** | View of the riser/outlet for the former Eagles farm pond. |
| | **Remarks** | The riser has been partially deconstructed, lowering the water level in the pond approximately six feet. |

**Date: 06-24-12**

Photographer: Unknown

| | | |
|---|---|---|
| **13** | **Location / Orientation** | Former Eagles farm pond. Looking south. |
| | **Remarks** | View of the pond after lowering the water level approximately three feet below the original pool level. |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date:03-13-12**

Photographer: W. Rawls

| | | |
|---|---|---|
| **14** | **Location / Orientation** | Former Eagles farm pond. Looking south. |
| | **Remarks** | View of the pond after lowering the water level approximately three feet below the original pool level. |

**Date: 04-10-12**

Photographer: S. Watts

| | | |
|---|---|---|
| **15** | **Location / Orientation** | View of the riser/outlet for the former Eagles farm pond. |
| | **Remarks** | The riser has been deconstructed, down to the bottom, lowering the water level in the pond approximately 10 feet below original pool. |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date:04-10-12**

Photographer: S. Watts

| | | |
|---|---|---|
| **14** | **Location / Orientation** | Former Eagles farm pond. Looking south. |
| | **Remarks** | View of the pond after lowering the water level approximately 10 feet below the original pool level. |

**Date: 04-10-12**

Photographer: S. Watts

| | | |
|---|---|---|
| **16** | **Location / Orientation** | Former Eagles farm pond. Looking east. |
| | **Remarks** | View of the pond after lowering the water level approximately 10 feet below the original pool level. |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 5-15-12**

Photographer: S. Watts

| | | |
|---|---|---|
| **17** | **Location / Orientation** | Former Eagles farm pond. Looking east. |
| | **Remarks** | Water being pumped out. |

**Date: 5-15-12**

Photographer: S. Watts

| | | |
|---|---|---|
| **18** | **Location / Orientation** | Former Eagles farm pond. Looking southeast. |
| | **Remarks** | Water pumped out for fish removal |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 5-15-12**

Photographer: A. Watts

| | | |
|---|---|---|
| **19** | **Location / Orientation** | Former Eagles farm pond. Looking south. |
| | **Remarks** | Fish Removal |

**Date: 8-25-15**

Photographer: A. Culpepper

| | | |
|---|---|---|
| **20** | **Location / Orientation** | Former Eagles farm pond. Looking west. |
| | **Remarks** | Breach in dam. |

3201 Spring Forest Road
Raleigh, North Carolina 27616

**Date: 8-25-15**

Photographer: A. Culpepper

| | | |
|---|---|---|
| **21** | **Location / Orientation** | Former Eagles farm pond. Looking south. |
| | **Remarks** | View of the pond after the dam was breached, lowering the water level approximately 20 feet below the original pool level. |

# Attachment II

April 21, 2016

Edgecombe County Landfill
Administration Building, Box 10
Tarboro, North Carolina 27886

Attention: Mr. Larry Moore
Landfill Supervisor

Reference: **Visual Landfill Cover Inspection - March 2016**
**Edgecombe County Landfill, Tarboro, North Carolina**
Facility Permit No. 33-01
S&ME Project No. 4305-15-172

Dear Mr. Moore:

S&ME, Inc. (S&ME) is pleased to submit this letter report documenting our inspection of the landfill cover on March 17, 2016 at the Edgecombe County Landfill located in Tarboro, North Carolina. Our services were performed under our existing contract with Edgecombe County (S&ME Proposal No. 43-1500497, dated August 27, 2015) based on directives from the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management (DWM) on May 16, 2001, and to assist Edgecombe County comply with Section .1626(4) of 15A NCAC 13B (Solid Waste Rules).

## ❖ Project Background

Edgecombe County currently operates a solid waste facility on a tract of land located south of Tarboro, North Carolina at 2872 Colonial Road (**Figure 1**). The County operates a construction & demolition (C&D) landfill unit that rests over an existing closed municipal solid waste (MSW) landfill. The landfill is operated in general accordance with North Carolina Department of Environment and Natural Resources (NCDENR) Permit No. 33-01.

On behalf of Edgecombe County, S&ME has performed methane monitoring and visual evaluation services on a quarterly basis in the effort to comply with the facility permits operational requirements and Section .0544 (d) and .1626 (4) of the Solid Waste Management Rules. S&ME has previously transmitted the methane monitoring results for the structures and gas monitor wells to the county by email.

## ❖ Visual Inspection Of Landfill Cover

A visual evaluation of the landfill cover and the landfill gas and groundwater monitoring wells was completed at the Edgecombe County Landfill by Sam Watts, P.G. of S&ME on March 17, 2016. The landfill cover system was examined for signs of settlement, erosion, vector damage, brown or bare vegetation, bulging areas, standing water, deep-rooted or woody vegetation, and signs of gas leakage such as distressed vegetation or fissures. The condition of the landfill gas extraction wells was also inspected while onsite.

Representative photographs of the observed site conditions are attached. The location of the photograph and the observations are shown on **Figure 1**. In summary, S&ME personnel observed the following:

- Grass on the landfill cover was mowed and generally the coverage of the landfill in grass was good (**Photos 1**).
- Leachate seepage was observed along southwestern portion of the landfill cap (**Photo 2**).
- Leachate seepage was also observed across the road on the north side of the landfill (**Photo 3**).
- Areas of wet grass and a seep area were observed along the northeastern side of the landfill (**Photos 4 and 5**).
- A localized wet area within an area of sedge grass is located in the northwestern portion of the landfill (**Photo 6**).
- Other areas of small leachate seeps were in the southeast edge of the landfill and in the northern central area of the landfill.
- Active C&D filling of the landfill was observed as wells as new cover soil being placed over the waste at the top (crown) of the landfill (**Photo 7**).
- Some of the slope drains in the northern central area of the landfill were cutoff or disconnected.

The observed leachate seeps were all contained within the facility boundary. S&ME personnel did not observe any other additional maintenance requirements for the final cover system, erosion control structures, landfill gas monitoring wells, or groundwater monitoring wells.

## ❖ Recommendations

Based upon the above observations, S&ME recommends Edgecombe County perform the following:

- Repair leachate seepage areas observed on the landfill cap (see the attached steps to repair a leachate breakout);
- The slope drains in the northern central area of the landfill should be re-connected to provide appropriate drainage;
- Continue regular mowing on the landfill cap and perimeter to promote healthy growth of grass, and to minimize growth of weeds or tall vegetation with a tendency for deep root penetration;
- Continue to monitor steep slopes for signs of erosion and continue using flexible down-drains to intercept and direct surface water away from areas that have not been stabilized;
- Continue methane monitoring at the facility in accordance with the facility closure plan; and,
- Place a copy of this report in the facility operating record.

## ❖ CLOSING

Please call us at (919) 872-2660 if you have any questions about the information presented in this letter, or if we can be of further assistance.

Sincerely,
**S&ME, Inc.**

Claudia Irvin, E.I.T.
Environmental Scientist

Samuel P. Watts, P.G.
Senior Project Manager

Attachments: Figure 1 – Landfill Cover Inspection Observations
Photograph Log
Leachate Breakout Repair Process

cc: Jimmy Price, Edgecombe County Interim Solid Waste Director

LEGEND

(#) PHOTO LOCATION AND DIRECTION

0 200 400

GRAPHIC SCALE (IN FEET)

IMAGE SOURCE: NC ONEMAP, DATED 2013

| | |
|---|---|
| SCALE: 1" = 200' | DATE: APRIL 2016 |
| PROJECT NUMBER: 4305-15-172 | DRAWN BY: BTR |
| DRAWING NUMBER: B-2582 | CHECKED BY: |

S&ME
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NC ENGINEER LICENSE #F-0176
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LANDFILL COVER INSPECTION OBSERVATIONS

EDGECOMBE COUNTY LANDFILL
TARBORO, NORTH CAROLINA

FIGURE NO.

1

| | |
|---|---|
| 1 | View looking northwest at C&D landfill from entrance road. Overall, grass looks established. |

| | |
|---|---|
| 2 | Leachate seep located in the southwestern portion of the landfill. |

| | |
|---|---|
| 3 | Leachate seep across access road on north side of landfill. |

| | |
|---|---|
| 4 | An area of wet in the grassed area to the left of the access road located on the north side of the landfill. |

| | | | |
|---|---|---|---|
| S&ME | **Visual Landfill Cover Inspection - Edgecombe County Landfill<br>Tarboro, North Carolina** | S&ME Project No. 4305-15-172 | |
| | | Taken by: S. Watts | Date Taken: 3/17/2016 |

| | |
|---|---|
| **5** | Leachate seep area located on the south side of the north access road. |

| | |
|---|---|
| **6** | Wet area and sedge grass located in the northwestern portion of the landfill. |

| | |
|---|---|
| **7** | Looking southwest from the northern access road. New cover soil is visible to the left. |

| | | | |
|---|---|---|---|
| S&ME | **Visual Landfill Cover Inspection - Edgecombe County Landfill<br>Tarboro, North Carolina** | S&ME Project No. 4305-15-172 | |
| | | Taken by: S. Watts | Date Taken: 3/17/2016 |

## LEACHATE BREAKOUT REPAIR

At locations where leachate breakout repair is required, the following steps shall be taken:

Step 1:
The surrounding grade elevation and boundary of the leachate breakout shall be established by surveying or string-lining and marked by staking as necessary.

Step 2:
An impervious and heavy duty tarp or heavy mil plastic sheet shall be set close to the excavation areas and shall be used for the stockpiling of excavated material.

Step 3:
Soil within 3 feet of the marked edge of the leachate breakout shall be excavated. Excavated material down-slope of the leachate breakout shall be disposed of as waste. Excavated material up-slope of the leachate breakout shall be stockpiled as Topsoil (for the top 9 inches) or General Fill (for soil between the top 9 inches and the waste).

Step 4:
Once waste material is reached, excavation shall proceed further until four feet of waste is excavated. Drainage aggregate shall then be placed to within 2.5 feet of existing grade.

Step 5:
Above the drainage aggregate, General Fill shall be placed in loose lifts not exceeding 6 inches in thickness. The fill shall be moisture conditioned and compacted. Dry bentonite powder shall be spread over each compacted lift at a rate of 2.5 lbs. per square foot. Lifts shall be placed in this manner to a depth from existing grade of 8 inches.

Step 6:
The stockpiled Topsoil shall be combined with imported Topsoil and placed evenly back into the excavated area such that the elevation of the final surface of the excavated area is now approximately at the existing grade elevation. The exposed Topsoil layer shall be fertilized, seeded, and matted. It is expected that the 1-inch height difference will even out to desired elevation over time.

Step 7:
Dispose of any remaining excavated waste in a MSW landfill. Remove the tarp or heavy mil plastic sheet and uncover any grass covered by repair activities.

# Attachment III

# SUBSURFACE EXPLORATION & HYDROGEOLOGIC ASSESSMENT REPORT EDGECOMBE COUNTY LANDFILL TARBORO, NORTH CAROLINA

S&ME Project No. 1054-07-241A

**Prepared for:**

Edgecombe County
P.O. Box 10
Tarboro, North Carolina 27886

**Prepared by:**

S&ME, Inc.
3201 Spring Forest Road
Raleigh, North Carolina 27616

November 2009

November 20, 2009

Edgecombe County Solid Waste Department
201 St. Andrew Street
P.O. Box 10
Tarboro, North Carolina 27886

Attention: Mr. Danny Bagley, Solid Waste Manager

**Reference: Subsurface Exploration & Hydrogeologic Assessment Report**
Edgecombe County Landfill
Tarboro, North Carolina
S&ME Project Number 1054-07-241A

Dear Mr. Bagley:

S&ME, Inc. (S&ME) is submitting this report documenting the subsurface exploration and hydrogeologic assessment that will be used to review, select, and design a corrective measures alternative for the Edgecombe County Landfill located in Tarboro, North Carolina. These services have been performed in general accordance with S&ME Proposal No. P4550-08V, dated September 5, 2008. The corrective measures are described in the Corrective Action Plan (CAP) for the facility.

This report describes our understanding of the project, presents the results of the field exploration and laboratory testing, and discusses our conclusions and recommendations. S&ME, Inc. appreciates this opportunity to be of service to you. Please call if you have questions concerning this report or any of our services.

Sincerely,

**S&ME, Inc.**

J. Adam Browning, P.E.
Project Engineer

David B. Wells, P.G.
Senior Geologist

Thomas P. Raymond, P.E.
Senior Consultant

dbw/JAB/DBW/TPR
S:\PROJECTS\2007\07-241A Edgecombe - Corrective Measures Services\!Environ\Report\1054-07-241A.Edgecombe Co.Subsurface Exploration & Hydrogeologic Assessment Report.doc

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**FIGURES**

Figure 1 Site Plan
Figure 2 Cross Section of Study Area

**APPENDICIES**

Appendix I Summary of Test Pit Data Records
Appendix II SPT Boring Logs
Appendix III Laboratory Test Records
Appendix IV Pond Study Measurements and Calculations

# 1. INTRODUCTION

Edgecombe County currently operates a construction and demolition (C&D) debris landfill on top of a closed municipal solid waste (MSW) landfill on a tract of land located off of Colonial Road (State Road 1601) in Edgecombe County, south of Tarboro, North Carolina. S&ME has previously assisted the County with environmental and engineering services for the landfill facility as required by the North Carolina Solid Waste Management Rules (15A NCAC 13B).

As a part of those services, S&ME completed a Corrective Action Plan (CAP) for the landfill in accordance with Solid Waste Rules defined under 15A NCAC 13B .1636 and .1637. That CAP (dated June 30, 2008) was submitted on behalf of Edgecombe County to the North Carolina Department and Natural Resources (NCDENR) Division of Waste Management (DWM). The CAP included the selection of In-situ Isolation combined with monitored natural attenuation (MNA) as the remedial alternatives for groundwater impacted with cobalt, petroleum constituents and chlorinated compounds. In-situ Isolation was selected because the site conceptual model indicates that surface water and groundwater management issues are the primary mechanism for addressing the release and migration of the constituents of concern at the landfill. MNA has been incorporated into the facility's updated (August, 2009) water quality monitoring plan (WQMP) to monitor and evaluate the effectiveness of the remedial measures.

This report was prepared to present the findings of the subsurface investigation and hydrogeologic assessment. The data from the subsurface investigation and hydrogeologic assessment was collected for use in designing the hydraulic barrier and stormwater drainage system components necessary to implement the corrective measures selected in the CAP. The findings from these investigations may also be used to review corrective measures alternatives that may be well suited to meet the Edgecombe County long-term objectives for the landfill facility.

## 2. PROJECT DESCRIPTION

The implementation of the selected corrective measures, In-situ Isolation and MNA, as the proposed remedies at the Edgecombe County Landfill will involve the following:

- Installation of an upgradient groundwater hydraulic barrier;
- Maintaining a consistent contour with the pre-1998 waste area;
- Increase slope of the closed MSW area;
- Stormwater improvements on the western half of the landfill; and,
- Implementation of a MNA program to address impacted groundwater.

The proposed design and installation of the hydraulic barrier on the upgradient south side of the landfill and the stormwater drainage improvements proposed for the west side of the landfill required a more thorough understanding of subsurface soil and groundwater conditions in those specific areas of the site to prepare an engineered design. Subsurface exploration was performed to review the lithologic sequence and soil engineering properties for the geotechnical engineering component of the corrective measure design. The barrier wall on the upgradient side of the landfill and the stormwater improvements also required both conceptual and design engineering services. A hydraulic stress test using the pond as a discharge point was performed to review the aquifer response and effects of dewatering for use in the review of cost effective barrier system options to be selected for a design. S&ME utilized test pits and soil borings and performed a hydrogeologic evaluation to collect site-specific data to support the engineered CAP design.

Improvements to the landfill cap drainage system involved a review of existing site drainage conditions. Material volume estimates were required and sources for suitable soil from accessible locations for landfill cap system grading modifications were reviewed.

A meeting was held on March 12, 2009 with Mr. Lorenzo Carmon and Mr. Danny Bagley of Edgecombe County and Mr. Sam Watts and Mr. David Wells of S&ME, Inc. During this meeting, Mr. Carmon indicated that Edgecombe County was considering the option to purchase the adjoining property to the south of the landfill. The purchase plan would expand the property boundary to the south so that the acquired land could be utilized to construct a collection trench, instead of a barrier wall, and to utilize dewatering of the existing pond and drainage features associated with the property to the south to form the hydraulic barrier on the south side of the landfill.

As a result of this meeting, S&ME has prepared a separate feasibility evaluation report that compares alternatives for the hydraulic barrier system that may be used in the corrective measures system. The report compares the approved proposed design described in the 2008 CAP and two alternatives based on the findings of this subsurface exploration and hydrogeologic assessment. The feasibility report presents conceptual models for the alternatives with estimated installation costs compared to the corrective measures described in the approved CAP. The options presented in the feasibility evaluation report are for review and/or approval by Edgecombe County.

# 3. SUBSURFACE EXPLORATION

## 3.1 Test Pit Excavations

A representative of S&ME was present at the site on October 7, 2008 to observe test pit excavations conducted using a rubber tire backhoe. Seven test pits were excavated by Edgecombe County Landfill personnel at locations and depths determined by S&ME in the field based on encountered soil conditions. The test pits were performed to review soil properties that would be encountered by future grading activities for the corrective measures.

Test pit locations:

- **TP-1, TP-2, TP-3, TP-4**, and **TP-5** were positioned near the proposed location of the open ditch near the south and west boundary of the site.
- **TP-6** was located within the limits of the proposed Sedimentation Pond SB-3 near the northwest corner of the site.
- **TP-7** was centrally located on the site east of the proposed ditch line near the south property boundary.

Soil descriptions for the lithologic sequence were documented on test pit data log forms. Approximate test pit locations are shown on the Site Plan, **Figure 1**.

Test pits were excavated to depths that ranged from approximately eight to ten feet below ground surface (bgs). Test pit TP-7 encountered buried waste materials at an approximate depth of three feet bgs and was terminated at that depth. Encountered soils were visually classified in the field by an S&ME representative in general accordance with Unified Classification System (USCS) guidelines. If groundwater was observed in a test pit, the groundwater level from below the ground surface was measured in the test pit after its completion. Summaries of subsurface conditions encountered in test pits are presented in **Appendix I**, Summary of Test Pit Data logs.

Approximately three inches of grass and topsoil was encountered at the ground surface at test pit locations TP-3, TP-4, TP-5, and TP-7. Beneath the surface materials, natural soils were typically encountered to test pit termination depths. Natural soils consist of clayey and silty sands (SP-SC, SC, SM), sandy and clayey silts (ML), and sandy and silty clays (CL). The typical profile consists of near surface silty and clayey sands to approximate depths of three to five feet bgs underlain by silts and clays. The majority of the excavated materials were visually observed as wet of their optimum moisture content. Test pit TP-1 was excavated to a depth of approximately eight feet below the land surface. Water was encountered in test pit TP-1. The depth to water in test pit TP-1 approximately two hours after excavation completion was approximately four feet bgs. Note that test pit TP-1 is located in the ditch on the southwestern portion of the site. At the time of the excavation, the backhoe became stuck in the ditch at test pit TP-1. Therefore, the other test pit locations were offset to locations topographically higher than the ditch. After up to 1.75 hours of test pit completion, no accumulated groundwater was observed in the excavation bottoms at test pit locations TP-2 through TP-7. **Figure 1** shows test pit locations along with site topography.

## 3.2 Standard Penetration Test (SPT) Borings

S&ME personnel were present at the site on February 13 and 17, 2009 to observe standard penetration test (SPT) borings conducted using hollow stem auger drilling procedures with S&ME's CME-550 drill mounted on an all terrain vehicle. Thirteen SPT borings were completed by S&ME personnel at locations along the proposed open drainage ditch or barrier wall near the southeastern property boundary. Approximate SPT boring locations are shown on the Site Plan, **Figure 1**. SPT boring logs are presented in **Appendix II**.

SPT borings were performed to depths ranging from approximately 15 to 30 feet bgs. Within each boring, samples were collected at 2.5-foot intervals with a split-spoon sampler, with the exception of borings B-11 and B-13. SPT borings B-11 and B-13 were sampled at five-foot intervals with a split-spoon sampler. Standard penetration tests were conducted in conjunction with split-spoon sampling in general accordance with ASTM D 1586. Soils were classified in the field during drilling operations by S&ME personnel. Borings were backfilled with soil cuttings mixed with bentonite.

The typical SPT boring profile consists of near surface sand, silty sand, and clayey sand underlain by silts and clays. The subsurface exploration identified a marine clay (Yorktown Formation), underlying the near surface soils at the landfill site at depths ranging from nine feet bgs in boring B-3 to 24.5 feet bgs in boring B-11. **Figure 1** shows SPT boring locations.

## 3.3 Interpretation of Lithology for Barrier Design

The boring locations were positioned to correlate with proposed corrective measures locations including the open drainage ditch, the barrier wall, or the French drain that will be used to implement controls on surface water and/or groundwater flowing toward the landfill. The summary of the test pit and boring lithology and the target layers encountered in the sample locations that influence the engineered design for corrective measure options is presented below. **Figure 2** presents a cross-section of the assessment area.

### *3.3.1 Open Ditch – Hydraulic Barrier Corrective Measure Option*

Grading and excavation were proposed to construct an open drainage ditch that would act as a hydraulic barrier and groundwater diversion from the central portion of the south property boundary toward the southwest corner of the property and parallel to the west property boundary to the north toward Jerry's Creek. Test Pits TP-1 through TP-5 and soil borings B-1 through B-4 were drilled to review the soil types present for the purpose of ditch design as well as to review the potential re-use of excavated material that will be removed to construct the ditch. Boring depths were targeted to terminate in the marine clay. The lithology from the soil borings and test pits presented in order from east to west to north in the area of the proposed open ditch is summarized below.

- **Boring B-4** – encountered silty sand, silty clay, and clayey silt, clayey sands resting over marine clay at a depth of 21 feet bgs. The bottom of the ditch could correspond to the elevation of the top of the marine clay.

- **Boring B-3** – encountered silty and clayey sands and wet sandy clay resting over marine clay at a depth of nine feet. The bottom of the ditch could correspond to the elevation of the top of the marine clay.

- **Boring B-2** – encountered silt, silty sand, silty clay, and clayey sands resting over marine clay at a depth of ten feet bgs. Soft clay and sandy silt over the marine clay indicate that the bottom of the ditch could correspond to the elevation of the top of the marine clay.

- **Boring B-1** – encountered silty and clayey sands resting over marine clay at a depth of 11 feet bgs. No significant clay was present above marine clay from this boring. For design purposes, the bottom of the ditch could correspond to the elevation of the top of the marine clay.

- **TP-1** – encountered approximately five feet of poorly sorted wet to saturated sand to clayey sand that was resting over saturated clay.

- **TP-2** – encountered approximately two feet of wet silty clay that was present over two feet of wet silty sand that rests over wet silty clay.

- **TP-3** – encountered approximately five feet of sandy silt that was present over wet silty clay;.

- **TP-4** – encountered approximately five feet of wet silty sand that was present over wet clayey silt.

- **TP-5** – encountered approximately one foot of wet silty sand resting on three feet of clayey fine sand that was resting over wet clayey silt.

The soil borings and test pits performed to assess the proposed open ditch location indicate that a marine clay (Yorktown Formation) encountered on the south boundary of the facility was at elevation of approximately 61 feet msl (feet relative to mean sea level). The surface of the marine clay appears to be generally flat with little undulation west of soil boring B-3 and slopes downward to the south toward Jerry's Creek. The soil material observed in the test pits was moist to saturated.

### *3.3.2 Sedimentation Basin SB-3*

The outfall from the proposed open ditch will be designed to discharge into a proposed sedimentation basin located near the northwest corner of the facility. A significant quantity of material will likely be excavated from this area to construct the sedimentation basin. Test pit TP-6 was located near the middle in an area likely to be excavated to the greatest depth of the proposed sedimentation basin. The findings from test pit TP-6 are as follows:

- **TP-6** – encountered approximately 3.5 feet of moist silty fine sand resting over approximately 3.5 feet of wet clayey silt that both over lay wet silty sand.

Based on the lithology from test pit TP-6, the material excavated during construction for the sedimentation basin will likely be suitable for daily cover material at the C&D landfill.

### *3.3.3 Subsurface Barrier Wall - Hydraulic Barrier Corrective Measure Option*

The proposed hydraulic barrier options may include a barrier wall or a French drain for groundwater diversion from the central south property boundary to the east corner of the landfill property. Test pit TP-7 and soil borings B-5 through B-13 were performed to review the soil types present for the proposed barrier wall design as well as to review the depth and thickness of water bearing units for designing a French drain that would divert groundwater and bypass the landfill. The samples were also used to review the potential re-use of excavated material that will be removed to construct the barrier system. Boring depths were targeted to terminate in the marine clay. The lithology from the soil borings and test pit presented in order from west to east in the area of the proposed hydraulic barrier is summarized below.

- **Boring B-7** – encountered sandy clay, silty sand, and sandy clay resting over marine clay at a depth of 19 feet bgs. The sandy clay was soft at 11.5 feet bgs. Therefore the barrier bottom may target the marine clay top elevation.

- **Boring B-5** – was performed to a depth of three feet bgs and then off-set to the south since waste materials were encountered between three and 8.5 feet bgs. Silty sand, sandy silt and sandy clay to sandy silt were observed over the top of a blue gray marine clay at a depth of 17 feet bgs. The bottom of the barrier could correspond to the elevation of the top of the marine clay.

- **Boring B-8** – encountered sand, sandy clay, and sandy clay to clayey sand layers resting over the top of marine clay at a depth of 21 feet bgs. The bottom of the barrier could correspond to the elevation of the top of the marine clay.

- **TP-7** – encountered approximately one foot of silty sand resting approximately one half foot of gravel that was resting on moist silty sand.

- **Boring B-6** – encountered silty sand resting over waste material at a depth of five feet bgs where it was terminated.

- **Boring B-9** – encountered silty sand, silty clay, sand, sandy clay, silty sand, wet clay and clayey sand resting over the top of marine clay at a depth of 22 feet bgs. The bottom of the barrier could correspond to the elevation of the top of the marine clay.

- **Boring B-10** – encountered sand, silty clay, and sandy clay to clayey sand resting over marine clay at a depth of 21 feet bgs. The bottom of the barrier could correspond to the elevation of the top of the marine clay.

- **Boring B-11** – encountered sandy silty clay, sand, clay, and coarse sand resting over the top of marine clay at a depth of approximately 24.5 feet bgs.

The barrier bottom could target the marine clay at approximately 24.5 feet bgs.

- **Boring B-12** – encountered sand resting over black silty clay present from three to 15 feet.

- **Boring B-13** – encountered sandy and silty clay resting over the top of marine clay at a depth of 18 feet bgs. The silty clay was soft at 15 feet bgs. The bottom of the barrier could correspond to the elevation of the top of the marine clay.

The soil borings performed to assess the proposed barrier system location indicate that a marine clay (Yorktown Formation) was encountered at elevations ranging from approximately 45 feet msl to 62 feet msl. An apparent ridge in the clay (62 feet msl) was indicated by the boring data from boring location B-5 near the south boundary of the facility. The surface of the marine clay appears generally flat with some undulation west of the ridge and slopes more steeply down from the ridge to east with some undulation. The borings east of the ridge indicate that the marine clay slopes more steeply downward to the east toward the pond.

## 3.4 Laboratory Testing

Soil samples were submitted to the laboratory for testing to determine natural moisture content, grain size distribution, plasticity indices (Atterberg Limits), moisture density standard proctor curves, or soil permeability rates. Tests were performed on split spoon samples collected from selected soil borings as well as selected bulk samples obtained from the test pits. The soil permeability (hydraulic conductivity) tests were performed on re-compacted bulk samples. The laboratory testing was performed in general accordance with applicable ASTM standards.

### *3.4.1 Soil Boring Sample Data*

Grain size analysis testing (ASTM D 422) was performed on soil samples obtained from soil borings B-1, B-3, B-5, B-8, B-9, B-12, and B-13. The results of the soil grain size distribution tests, natural moisture content, and Atterberg Limits are summarized in **Table 1**.

### *3.4.2 Test Pit Bulk Sample Data*

Grain size analysis testing (ASTM D 422) was performed on bulk samples obtained from test pits TP-1, TP-2, TP-3, and TP-6. The results of the soil grain size distribution tests incorporated with the test pit log indicated the following:

Atterberg limits testing (ASTM D 4318) was performed on bulk samples obtained from test pits TP-2 and TP-3. Results of Atterberg limits tests indicate liquid limits (LL) between 34 and 47 percent, plastic limits between 15 and 25 percent, and plasticity indices (PI) between 13 and 22 percent. Testing indicates that the tested soils have low plasticity indicative of sandy clay, and moderate plasticity characteristics typical of silty clay. The results of the soil grain size distribution tests, natural moisture content, and Atterberg Limits from the Test Pit samples are summarized in **Table 2**.

Standard Proctor compaction tests (ASTM D 698) were performed on bulk samples obtained from test pits TP-1, TP-2, and TP-3. The Standard Proctor compaction tests results are summarized in Table 3. The natural moisture contents of the bulk samples ranged from approximately 15.7 to 65.4 percent. Natural moisture content testing indicates a majority of the tested soils are well above their optimum moisture.

Hydraulic conductivity testing (ASTM D 5084) was performed on five recompacted bulk samples to review the potential for re-use of excavated material in the design and construction phase of corrective measures at the landfill. The samples were recompacted to approximately 95 percent of their Standard Proctor maximum dry density near their corresponding optimum moisture content. The permeability values (k) in centimeters per second (cm/s) are summarized below from the re-compacted samples tested:

TP-1 five to six feet bgs $2.29 \times 10^{-6}$;
TP-2 surface to two feet bgs $1.01 \times 10^{-6}$;
TP-2 four to five ft bgs $6.41 \times 10^{-7}$;
TP-3 surface to two feet bgs$7.22 \times 10^{-7}$;
TP-3 six to eight feet bgs $4.60 \times 10^{-7}$.

The k values measured by the permeability tests indicate that material with low permeability soil (approximately $10^{-6}$ cm/s and $10^{-7}$ cm/s) is present on site.

Laboratory tests were conducted in general accordance with applicable ASTM test procedures. Dry density and optimum moisture contents from the Standard Proctor Tests are summarized in **Table 3**. A tabular summary of laboratory testing and individual laboratory test data sheets are presented in **Appendix III**.

## 3.5 Findings Subsurface Exploration

In general, the results of the subsurface exploration indicated that soils encountered within the test pits and soil test borings are suitable for use as general site fill (i.e. raising grades in landfill area, daily cover for the C&D waste operations, and vegetative cover). However, soils encountered at ground surface at some test pit locations contain organic material which will require removal prior to use as fill. Significant portions of the soil materials encountered in the test pits are wet and will require extensive drying prior to re-use as fill. Tests performed on clay material from test pit bulk samples indicate that low permeability soils (k values less than $10^{-5}$ cm/s) were present on site. Low permeability soil is required for landfill cap material and can also be used as liner material for sedimentation basins.

The soil borings performed to assess the proposed barrier system location indicate that a marine clay (Yorktown Formation) was encountered at elevations ranging from approximately 45 feet msl to 62 feet msl. An apparent ridge in the clay (62 feet msl) was indicated by the boring data from boring location B-5 near the south boundary of the facility. The surface of the marine clay appears generally flat with some undulation west of the ridge and slopes more steeply down from the ridge to east with some undulation

# 4. HYDROGEOLOGIC STUDY

A hydraulic study was performed to collect data that was used to review potential options and configurations for a groundwater barrier to implement the "in-situ isolation" corrective measures plan.

The conceptual In-situ Isolation plan in the CAP involves the construction of a barrier to block and divert groundwater flow on top of the Yorktown marine clay from flowing beneath the landfill. This proposed hydraulic barrier is to extend along the southern (upgradient) boundary of the landfill. By retaining and diverting the upgradient groundwater flow toward the landfill, the volume of water that could contribute to the production of leachate and for the transport of leachate that is generated will likely be reduced. The reduction of groundwater flow beneath the landfill will likely result in reduced contaminant concentrations in the groundwater over time and lower groundwater table levels below the landfill resulting in an increased vertical separation between the bottom of the buried waste and the remaining groundwater above the clay.

The hydrogeologic study used data from soil borings described in **Section 3.3**, the test pits discussed in **Section 3.4** as well as soil borings, temporary piezometers, and monitored dewatering of the surface water impoundments located on the southeast boundary of the landfill site. The surface water impoundments (Study Ponds), shown on **Figure 2**, are near Storage 1 and Break Trailer 2.

## 4.1 Soil Borings, Piezometers, and Site Measurements

Three shallow soil borings with temporary piezometers were installed on January 8, 2009. Borings Pond 1, Pond 2 and Pond 3 were completed to 12 feet bgs, 11 feet bgs and 6.5 feet bgs, respectively. The borings with piezometers were installed to review the lithology and groundwater levels in the vicinity of two surface water features located near the southeast corner of the Edgecombe County facility west of Colonial Road. The three borings were positioned on the facility. The surface water features are two retention ponds that are connected by a small stream channel. The southernmost pond is entirely located off-site south of the facility. The primary pond reviewed by the study is the pond that is located partially on the facility and partially off-site. **Figure 1** shows the locations of the piezometers and the study ponds.

**Soil boring Pond 1** was located south of the break trailer on the facility approximately 26 feet from the north edge of the pond at full pool, and approximately 35 feet from the pond outfall structure. The boring for Pond 1 encountered silty sand, gravel, clayey silt, and silty sand over silty clay at a depth of 3.5 feet. There was organic layer within the silty clay was present at 4.5 feet and soils were wet at approximately 5 feet bgs. The silty clay rested on sandy silt present between 5 and 7.5 feet bgs. Gray silty clay was observed from 7.5 feet to the termination of the boring at 12 feet bgs. A two-inch diameter PVC well screen and casing were installed into the borehole. The well screen was ten feet long and terminated at a depth of approximately 12 feet below the ground surface. Sand was placed around the well screen to approximately one foot above the screen interval. Bentonite was placed in the annular space of the boring around the riser pipe from the top of the sand pack to the ground surface to seal the temporary well. Approximately three feet of riser pipe stuck up above the ground surface.

**Soil boring Pond 2** was positioned approximately 105 feet west of soil boring Pond 1 and was approximately 35 feet from the north edge of the pond at full pool. The boring for Pond 2 encountered silty gravel, sandy clay, silty sand, that rest on the top of silty clay present from 4.5 feet bgs to 5.5 feet bgs. The silty clay rests on clayey sand at a depth of 5.5 feet. The clayey sand rested on sandy silt observed between 7 feet bgs and the termination of the boring at 11 feet bgs. A two-inch diameter PVC well screen and casing were installed into the borehole. The well screen was five feet long and terminated at a depth of approximately 11 feet below the ground surface. Sand was placed around the well screen to approximately two feet above the screen interval. Bentonite was placed in the annular space of the boring around the riser pipe from the top of the sand pack to the ground surface to seal the temporary well. Approximately one foot of riser pipe stuck up above the ground surface.

**Soil boring Pond 3** was approximately 400 feet west-southwest of the outfall to the northern pond, and was positioned between the off-site pond and the facility pond. Boring Pond 3 encountered roots, silty clay, sandy silt, clayey silt, and silty sand resting over sandy clay from 5 feet bgs to the termination of the boring at 6.5 feet bgs. The soils reviewed in the boring were wet at approximately two feet bgs. A two-inch diameter PVC well screen and casing were installed into the borehole. The well screen was five feet long and terminated at a depth of approximately 6.5 feet below the ground surface. Sand was placed around the well screen to approximately one foot above the screen interval. Bentonite was placed in the annular space of the boring around the riser pipe from the top of the sand pack to the ground surface to seal the temporary well. Approximately 3.5 feet of riser pipe stuck up above the ground surface.

S&ME measured the elevations of the top of the piezometers using a tripod, level, and rod marked in feet in 1/100$^{th}$ of a foot increments. The top of casing (TOC) elevations for piezometers Pond 1 and Pond 2 and the elevation of the top of the outfall to the Edgecombe County pond were measured on January 8, 2009. The top of casing for piezometer Pond 3 was measured on January 13, 2009. The elevation measurements were made relative to the well casing elevation at monitor well MW-4. Groundwater levels were monitored from Pond 1, Pond 2, Pond 3, MW-4, GW-4, MW-3B, GW-2R GW-1R, and P-1. The pond pool elevation was monitored by measurements made from the measuring point on the top of the outfall. Initial groundwater level measurements while the pond was at full pool were recorded January 8, 2009 from the monitoring points.

## 4.2 Hydraulic Monitoring and Groundwater/Surface Water Interaction

The January 8, 2009 groundwater level measurements from the piezometer and monitor well TOCs in the pond study monitoring network (Pond 1, Pond 2, Pond 3, MW-4, GW-4, MW-3B, GW-2R GW-1R, and P-1) and the pond pool elevation measured from the point on the top of the outfall in the pond were compared. The elevations indicate that the pond elevation is higher than the groundwater levels in the piezometers and monitor wells located adjacent to the pond. Therefore, the pond is acting as a recharge feature of surface water to the groundwater aquifer while the pond elevation is at full pool.

Since the pond was a man-made surface water feature, a study was performed to review the impact of dewatering the pond. While surface water was released from the pond to lower the pool elevation, the pond study monitoring network of points was monitored to review the groundwater level changes in the adjacent monitor wells.

## 4.3 Pond Discharge Test

A continuous discharge from the pond was established using a siphon system where surface water was discharged from the pond outfall structure. The flow rate was initially approximately 60 gallons per minute. Since the flow was the result of a siphon system, the discharge rate decreased slightly as the head in the pond pool elevation was lowered.

The discharge commenced on February 13, 2009. Groundwater and surface water levels were monitored for the network on February 13, 2009 and on February 17, 2009. Continuous water level data was collected using pressure transducers in piezometers Pond 1, Pond 2 and in monitor well MW-4. The water level data was reviewed and analysis was performed using water level measurements at start up and immediately before the discharge from the siphon was stopped on February 17, 2009.

## 4.4 Pond Study Results

The hydrogeologic study was performed to assess the interaction of the surface water in the facility pond located on the southeast corned of the facility property. The study indicated that the pond acts as a recharge feature to the water table while the pond is at full pool elevation. The water levels measured during the discharge test indicated that a partial reversal in the recharge affect to the aquifer from the pond would occur when the pond level was lowered approximately 7.5 feet below the January 8, 2009 full pool elevation. At the point that the pond level is lowered approximately eight feet (elevation of ~56 feet-msl) below the top of the outfall structure, the pond becomes a discharge feature and groundwater from the aquifer will flow toward the pond. Selected groundwater elevation data is presented in **Table 4** to show this relationship. The elevations of the temporary piezometers (Pond 1 through Pond 3) and the top of the outfall structure to the pond were measured relative to the top of casing elevation reported by Spruill and Associates September 4, 2007 for monitor well MW-4. Elevation measurements of the points used for the hydrogeologic assessment by S&ME and a copy of the drawdown analysis made from the groundwater and surface water elevations for the pond study are located in **Appendix IV**.

The analysis of the interaction of groundwater and surface water elevation data during dewatering of the pond indicates that lowering the pond elevation by eight feet below the current pool elevation controlled by the outfall structure would impose a hydraulic barrier on the upgradient (southeastern) corner of the landfill. Lowering the surface water level in the ponds is an alternative that the County may review to use as a component to the hydraulic barrier described in the CAP.

## 5. CONCLUSIONS

The results of the subsurface exploration assisted in defining the depth to the Yorktown Formation marine clay and describing the lithology in locations for the proposed hydraulic barrier and stormwater drainage system described in the 2008 CAP. The elevations of the marine clay surface will be used to prepare the designs and grading plans for the subsurface drainage and stormwater improvements for the hydraulic barrier system.

The soil borings performed to assess the proposed barrier system location indicate that the Yorktown Formation marine clay was encountered at elevations ranging from approximately 45 feet msl to 62 feet msl. The subsurface exploration obtained sufficient depth and elevation data for the top of the marine clay to prepare a design for a hydraulic barrier that penetrates the surface of the marine clay layer.

In general, the subsurface exploration found that the soils are suitable for use as general site fill (i.e. raising grades in landfill area, daily cover for the C&D waste operations, and vegetative cover). Organic material that was encountered at the ground surface at some test pit locations may be used for the vegetative cover layer over the low permeable soil in the landfill cap. The soil materials encountered in the test pits are wet and will require extensive drying prior to re-use as fill material. Testing performed on clay material from test pit bulk samples indicate that low permeability soils (k values less than $10^{-5}$ cm/s) were present on site. Low permeability soil is required for landfill cap material and may also be used as liner material for sedimentation basins.

The hydrogeologic study was performed to assess the interaction of the surface water in the facility pond located on the southeast corned of the facility property. The study indicated that the pond acts as a recharge feature to the water table while the pond is at full pool elevation. The drawdown analysis of water levels measured during a pond discharge test predicts that the pond will reverses from a recharge feature to a discharge feature when to pool elevation is lowered approximately 8 feet below the current full pool elevation controlled at the outfall structure.

The pond study indicates that lowering the pond elevation by eight feet below the current pool elevation controlled by the outfall structure would impose a hydraulic barrier on the upgradient (southeastern) corner of the landfill. Lowering the surface water level in the pond is an alternative that the County may review to use as a component to the hydraulic barrier described in the CAP.

## 6. RECOMMENDATIONS

S&ME recommends that the information presented in this subsurface exploration report be used to evaluate alternatives for hydraulic barrier systems and the respective costs for these alternatives. Based on this feasibility study of the corrective measures alternatives, Edgecombe County may select the most cost effective alternative that meets the objective of the corrective measure and the long term goal of the County.

# TABLES

**Table 1**
**Soil Boring Sample Test Results**
**Subsurface Exploration & Hydrogeologic Assessment**
**Edgecombe County Landfill**
**Tarboro, North Carolina**
**S&ME Project No. 1054-07-241A**



| Boring | Depth (feet-bgs) | Soil Type | Natural Moisture (%) | Sand (%) | Silty Clay (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) |
|---|---|---|---|---|---|---|---|---|
| B-1 | 8.5-10 | Clayey Sand | 31.4 | 71 | 29 | 31 | 19 | 12 |
| B-1 | 13.5-15 | Highly Plastic Clay | 58.5 | 22 | 78 | 93 | 28 | 65 |
| B-3 | 6-7.5 | Clayey Sand | 42.8 | 51 | 49 | 46 | 16 | 30 |
| B-5 | 11-12.5 | Clayey Sand | 28 | 66 | 34 | 37 | 17 | 20 |
| B-8 | 16-17.5 | Clayey Sand | 31.9 | 75 | 25 | 29 | 17 | 12 |
| B-8 | 18.5-20 | Clayey Sand | 37.9 | 54 | 46 | 47 | 20 | 27 |
| B-9 | 3.5-5 | Clayey Sand | 31.2 | 59 | 41 | 44 | 17 | 27 |
| B-12 | 6-7.5 | Clayey Sand | 31.2 | 71 | 29 | 30 | 14 | 16 |
| B-12 | 11-12 | Highly Plastic Clay | 62.3 | 8.5 | 91.5 | 87 | 24 | 63 |
| B-13 | 22.5-24 | Clayey Sand | 30.8 | 62.5 | 29 | 54 | 19 | 35 |

Notes:
feet-bgs = feet below the ground surface
Soil Samples Collected February 13 and 17, 2009 using split spoon sampling techniques.

**Table 2**
**Test Pit Sample Test Results**
**Subsurface Exploration & Hydrogeologic Assessment**
**Edgecombe County Landfill**
**Tarboro, North Carolina**
**S&ME Project No. 1054-07-241A**



| Boring | Depth (feet-bgs) | Soil Type | Natural Moisture (%) | Sand (%) | Silty Clay (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) |
|---|---|---|---|---|---|---|---|---|
| TP-1 | 0-2 | Clayey Sand | 15.7 | 90 | 10 | | | |
| TP-1 | 5-6 | Clay | 35 | 50 | 50 | | | |
| TP-2 | 0-2 | Clayey | 25.2 | 43 | 37 | 34 | 15 | 19 |
| TP-2 | 2-4 | Silty Sand | 22 | 82 | 18 | | | |
| TP-2 | 4-5 | Clay | 47.1 | 27 | 73 | 34 | 21 | 13 |
| TP-3 | 0-2 | Silt | 39.3 | 37 | 63 | | | |
| TP-3 | 6-8 | Clay | 65.1 | 9 | 90.6 | 47 | 25 | 22 |
| TP-6 | 5-7 | Silt | 65.4 | 6 | 94 | | | |
| TP-6 | 7-9 | Silty Sand | 35.5 | 60 | 40 | | | |

Notes:
Soil Samples collected October 7, 2008 using a rubber-tired backhoe.
feet bgs = feet below the ground surface
Blank fields indicate sample not analyzed for parameter.

**Table 3**
**Standard Proctor Test Pit Data**
**Subsurface Exploration & Hydrogeologic Assessment**
**Edgecombe County Landfill**
**Tarboro, North Carolina**
**S&ME Project No. 1054-07-241A**

| Test Pit | Material | Depth (feet-bgs) | Max Dry Density (pcf) | Optimum Moisture (%) | Permeability (K) (cm/sec) |
|---|---|---|---|---|---|
| TP-1 | Clay | 5-6 | 113 | 15.5 | 2.29E-06 |
| TP-2 | Clay | 0-2 | 110.2 | 16.1 | 1.01E-06 |
| TP-2 | Clay | 4-5 | 96.7 | 24.2 | 6.41E-07 |
| TP-3 | Clayey Silt | 0-2 | 90.4 | 29.1 | 7.22E-07 |
| TP-3 | Clay | 6-8 | 88.1 | 28.8 | 4.60E-07 |

Notes:
feet-bgs = feet below the ground surface
pcf = pounds per cubic foot
K (cm/sec) = Permeability in centimeters per second
Soil samples collected with a rubber-tired back October 7, 2008.
Permeability (K) samples were recompacted in soils lab to ~95 % Proctor max, and tested for K.

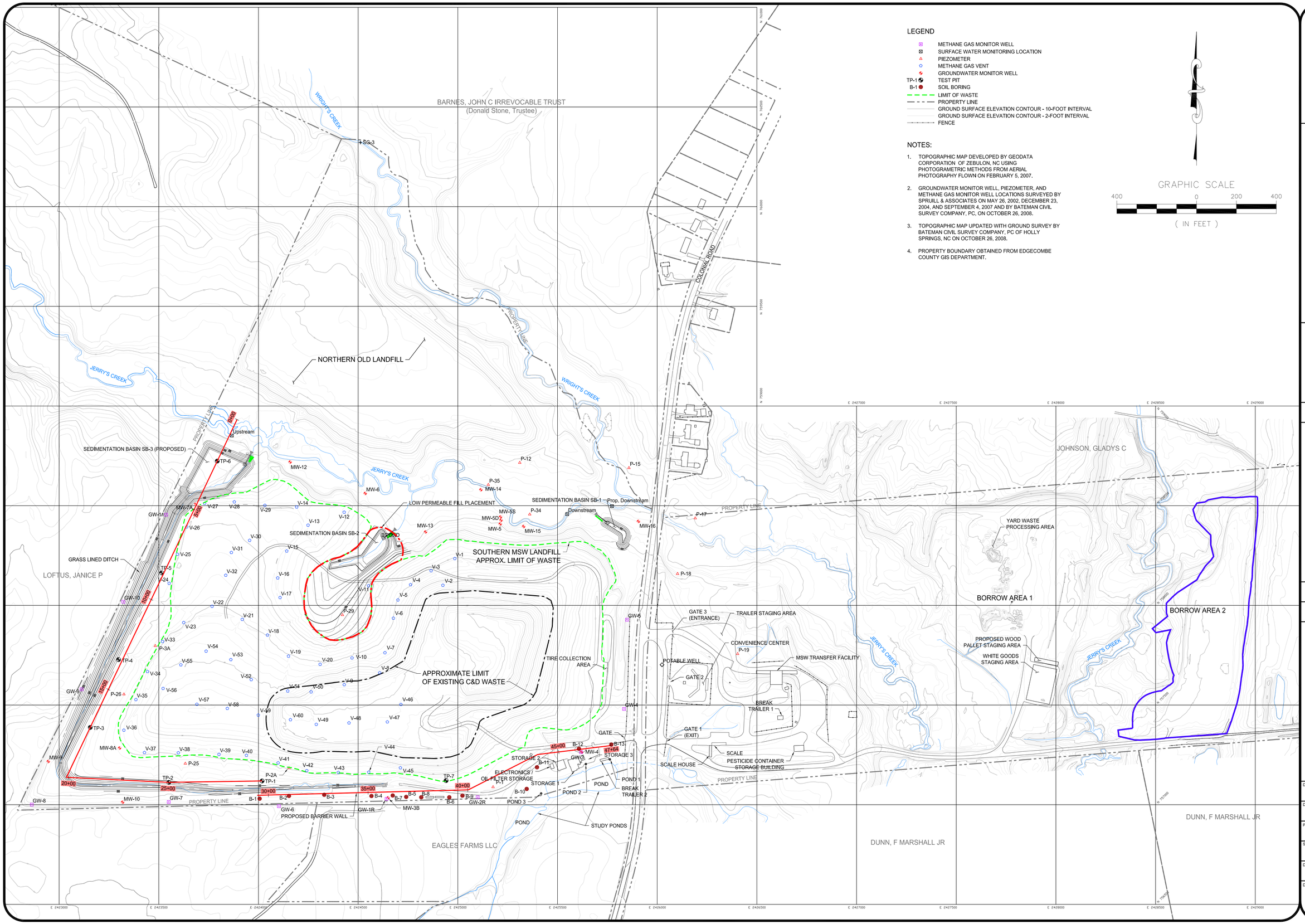
**Table 4**
**Pond Study Water Level Data**
**Subsurface Exploration & Hydrogeologic Assessment**
**Edgecombe County Landfill**
**Tarboro, North Carolina**
**S&ME Project No. 1054-07-241A**



| Measuring Point ID | TOC/MP Elev (ft-msl) | Date | DTW (ft-toc/mp) | W Elev (ft-msl) | Drawdown (ft) | Pump Status |
|---|---|---|---|---|---|---|
| Pond 1 | 68.16 | 1/8/2009 | 8.97 | 59.19 | 0 | Off |
| | | 2/13/2009 | NM | NC | NC | On |
| | | 2/17/2009 | 9.7 | 58.46 | 0.73 | On |
| Pond 2 | 70.26 | 1/8/2009 | 6.79 | 63.47 | 0 | Off |
| | | 2/13/2009 | NM | NC | NC | On |
| | | 2/17/2009 | 7.72 | 62.54 | 0.93 | On |
| Pond 3 | 69.89 | 1/8/2009 | 5.06 | 64.83 | 0 | Off |
| | | 2/13/2009 | 5.42 | 64.47 | 0.36 | On |
| | | 2/17/2009 | 5.55 | 64.34 | 0.49 | On |
| MW-4 | 68.95 | 1/8/2009 | 5.29 | 63.66 | 0 | Off |
| | | 2/13/2009 | NM | NC | NC | On |
| | | 2/17/2009 | 6.14 | 62.81 | 0.85 | On |
| PZ-1 | 74.48 | 1/8/2009 | 6.91 | 67.57 | 0 | Off |
| | | 2/13/2009 | NM | NC | NC | On |
| | | 2/17/2009 | 8.11 | 66.37 | 1.2 | On |
| MW-3B | 81.18 | 1/8/2009 | 9.79 | 71.39 | 0 | Off |
| | | 2/13/2009 | 9.23 | 71.95 | -0.56 | On |
| | | 2/17/2009 | 9.34 | 71.84 | -0.45 | On |
| Top of Concrete Overflow to Pond | 63.99 | 1/8/2009 | 0 | 63.99 | 0 | Off |
| | | 2/13/2009 | 0.73 | 63.26 | 0.73 | On |
| | | 2/17/2009 | 1.833 | 62.16 | 1.83 | On |
| GW-2R | 75.72 | 1/8/2009 | 9.17 | 66.55 | 0 | Off |
| | | 2/13/2009 | NM | NC | NC | On |
| | | 2/17/2009 | NM | NC | NC | On |
| GW-4 | 69.93 | 1/8/2009 | 9.41 | 60.52 | 0 | Off |
| | | 2/13/2009 | NM | NC | NC | On |
| | | 2/17/2009 | NM | NC | NC | On |
| GW-1R | 81.08 | 1/8/2009 | 9.61 | 71.47 | 0 | Off |
| | | 2/13/2009 | NM | NC | NC | On |
| | | 2/17/2009 | NM | NC | NC | On |

Notes:
TOC/MP = Top of Casing / Measuring Point
ft-msl = feet relative to mean sea level
ft-toc/mp = feet below top of casing / measuring point
NM = not measured
NC = not calculated

# FIGURES




NOTES:

1. TOPOGRAPHIC MAP DEVELOPED BY GEODATA CORPORATION OF ZEBULON, NC USING PHOTOGRAMETRIC METHODS FROM AERIAL PHOTOGRAPHY FLOWN ON FEBRUARY 5, 2007.
2. GROUNDWATER MONITOR WELL, PIEZOMETER, AND METHANE GAS MONITOR WELL LOCATIONS SURVEYED BY SPRUILL & ASSOCIATES ON MAY 26, 2002, DECEMBER 23, 2004, AND SEPTEMBER 4, 2007 AND BY BATEMAN CIVIL SURVEY COMPANY, PC, ON OCTOBER 26, 2008.
3. TOPOGRAPHIC MAP UPDATED WITH GROUND SURVEY BY BATEMAN CIVIL SURVEY COMPANY, PC OF HOLLY SPRINGS, NC ON OCTOBER 26, 2008.
4. PROPERTY BOUNDARY OBTAINED FROM EDGECOMBE COUNTY GIS DEPARTMENT.

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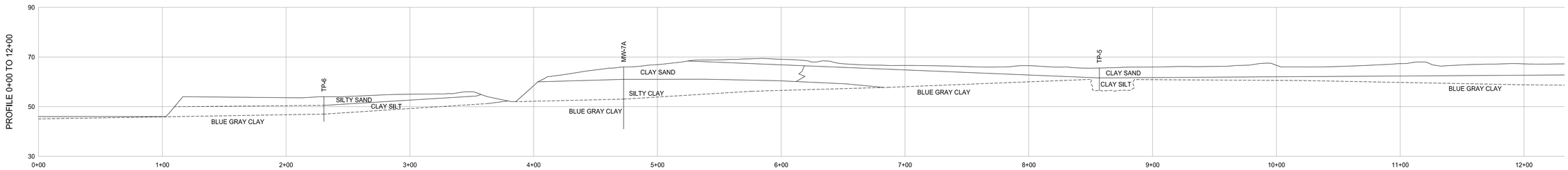
| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|

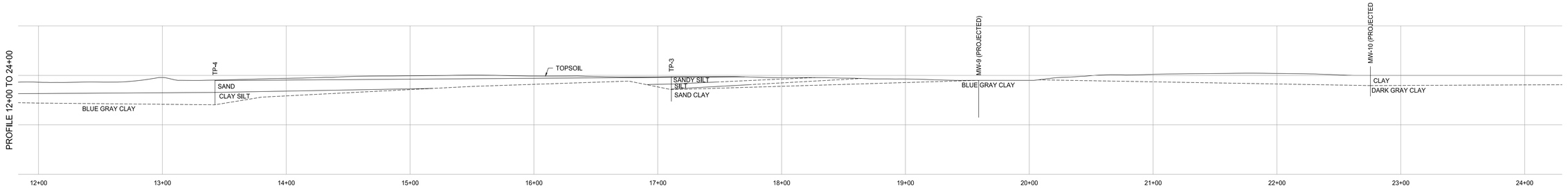
SITE PLAN WITH
DITCH PROFILE LOCATION

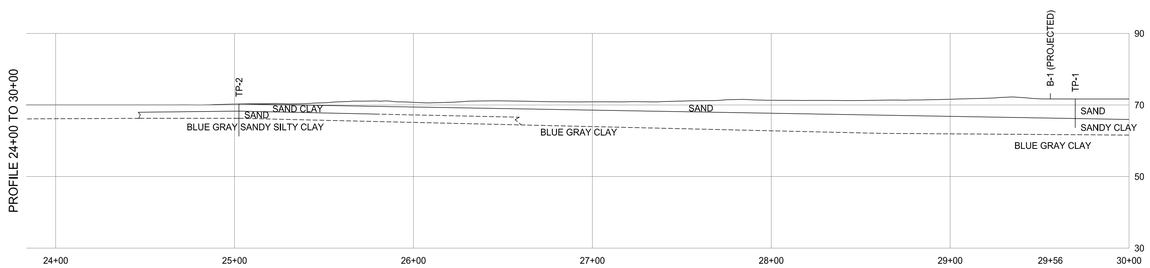
CORRECTIVE MEASURES DESIGN
EDGECOMBE COUNTY LANDFILL
TARBORO, NORTH CAROLINA

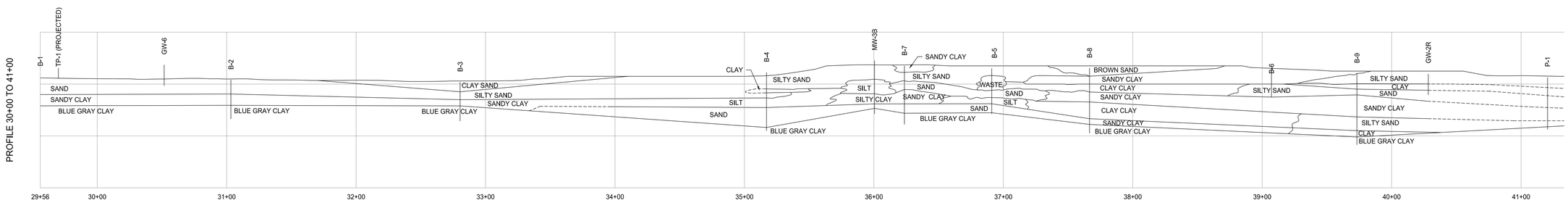
| | |
|---|---|
| DRAWN BY: BTR | CHECKED BY: |
| DESIGNED BY: | APPROVED BY: |
| PROJECT NUMBER: 1054-07-241A | |
| SCALE: 1" = 200' | DATE: NOV. 2009 |
| DRAWING NUMBER: D-1119 | |
| DRAWING: 1 | OF: |

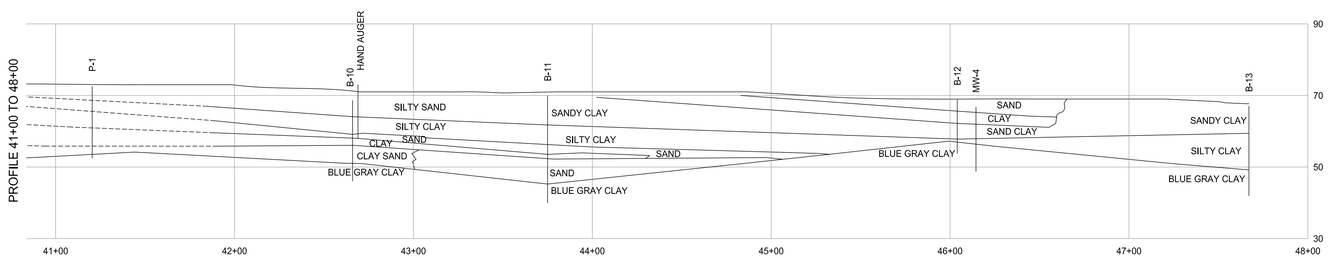
S:\PROJECTS\2007\07-241 Edgecombe-Asurnt of Corrective Measures\CAD\D1119.dwg, D1119, 12/3/2009 9:43:02 AM, 1:1




VERTICAL GRAPHIC SCALE

40 0 20 40

( IN FEET )

HORIZONTAL GRAPHIC SCALE

80 0 40 80

( IN FEET )

## NOTE

TOP OF YORKTOWN MARINE CLAY (BLUE GRAY CLAY) ESTIMATED FROM LITHOLOGY OBSERVED IN TEST PITS AND SOIL BORINGS PERFORMED FOR THE SUBSURFACE EXPLORATION REPORT, BORING DATA FROM MONITOR WELL INSTALLATIONS FOR GROUNDWATER QUALITY MONITORING AND CONE PENETRATION TEST (CPT) BORINGS INSTALLED DURING THE NATURE AND EXTENT STUDY (S&ME, 2008).

TEST PIT, SOIL BORING, PIEZOMETER / MONITORING WELL AND CPT BORING LOCATIONS FROM THE NATURE AND EXTENT STUDY ARE NOT SHOWN ON PLAN OR PROFILE SHEETS.

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| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|

TRENCH PROFILE

CORRECTIVE MEASURES DESIGN
EDGECOMBE COUNTY LANDFILL
TARBORO, NORTH CAROLINA

| | |
|---|---|
| DRAWN BY: BTR | CHECKED BY: |
| DESIGNED BY: | APPROVED BY: |
| PROJECT NUMBER: 1054-07-241A | |
| SCALE: AS SHOWN | DATE: NOV. 2009 |
| DRAWING NUMBER: D-1120 | |
| DRAWING: 2 | OF: |

S:\PROJECTS\2007\07-241 Edgecombe-Assmt of Corrective Measures\CADD\1120.dwg, D1120, 12/3/2009 9:45:12 AM, 1:1

# APPENDIX I

(SUMMARY OF TEST PIT DATA RECORDS)

S&ME

# SUMMARY OF TEST PIT DATA

**Project Name:** Edgecombe County Landfill
**Project Location:** Edgecombe County, North Carolina
**Excavation Method:** Rubber Tire Backhoe
**Project No.** 1054-07-241A

| DATE | TEST PIT NO. | APPROX. DEPTH | SOIL DESCRIPTION |
|---|---|---|---|
| 10/7/2008 | TP-1 | 0-3 | Orange-Tan Slightly Clayey Fine to Medium SAND (SP-SC), Wet |
| | | 3-5 | Gray Slightly Clayey Fine to Medium SAND (SP-SC), Saturated |
| | | 5-8 | Orange Silty Sandy CLAY (CL), Saturated |
| | | | |
| | | | |
| | | | Water encountered at 4 feet after 2 hours. |
| 10/7/2008 | TP-2 | 0-2 | Orange-Tan Sandy Silty CLAY (CL), Wet |
| | | 2-4 | Gray Clayey Silty Fine to Medium SAND (SM), Wet |
| | | 4-9 | Gray Sandy Silty CLAY (CL), Wet |
| | | | |
| | | | |
| | | | Dry After 1.75 hours |
| 10/7/2008 | TP-3 | 0-0.3 | Grass/TOPSOIL |
| | | 0.3-3 | Tan-Orange Sandy SILT (ML), Moist |
| | | 3-5 | Gray Sandy SILT (ML), Wet |
| | | 5-10 | Gray Slightly Sandy Silty CLAY (CL), Wet |
| | | | Dry After 1.17 hours |
| 10/7/2008 | TP-4 | 0-0.3 | Grass/TOPSOIL |
| | | 0.3-5 | Orange-Tan Silty Fine to Medium SAND (SM), Wet |
| | | 5-10 | Gray Clayey SILT (ML), Wet |
| | | | |
| | | | Dry after 1 hour. |

S&ME

# SUMMARY OF TEST PIT DATA

**Project Name:** Edgecombe County Landfill
**Project Location:** Edgecombe County, North Carolina
**Excavation Method:** Rubber Tire Backhoe
**Project No.** 1054-07-241A

| DATE | TEST PIT NO. | APPROX. DEPTH (FEET) | SOIL DESCRIPTION |
|---|---|---|---|
| 10/7/2008 | TP-5 | 0-0.3 | Grass/TOPSOIL |
| | | 0.3-1 | Orange-Tan Silty Fine to Medium SAND (SM), Wet |
| | | 1-4 | Orange Clayey Fine SAND (SC), Wet |
| | | 4-9 | Gray Clayey SILT (MH), Wet |
| | | | |
| | | | Dry After .75 hour |
| 10/7/2008 | TP-6 | 0-3.5 | Tan Silty Fine SAND (SM), Moist |
| | | 3.5-7 | Tan Clayey SILT (ML), Wet |
| | | 7-10 | Gray Silty SAND (SM), Wet |
| | | | |
| | | | |
| | | | Dry at termination of test pit. |
| 10/7/2008 | TP-7 | 0-0.3 | Grass/TOPSOIL |
| | | 0.3-1 | Tan Silty Fine SAND (SM) |
| | | 1-1.5 | GRAVEL LAYER |
| | | 1.5-3 | Gray Silty SAND (SM) With Odor, Moist |
| | | 3 | Encountered waste materials |
| | | | Dry at termination of test pit & after 20 minutes |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# APPENDIX II

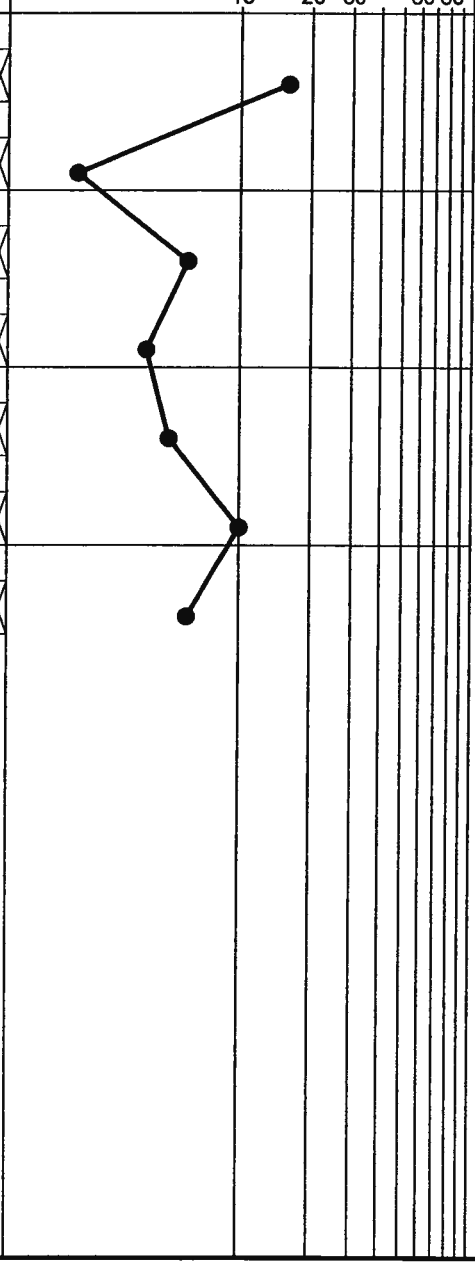
(SPT BORING LOGS)

| PROJECT: Edgecombe County Landfill | BORING LOG B-1 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/13/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **17.5** | |
| LOGGED BY: **DBW** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **JR** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Dark brown silty SAND with some organic material | | | | |
| | | Light gray very fine silty SAND, damp | | | | |
| | | Brown/gray very fine clayey SAND, wet | | | | 16 |
| 5 | | | | | | 2 |
| | | Dark blue/gray clayey SAND | | | | 6 |
| | | (SC) | | | | |
| 10 | | | | | | 4 |
| | | Dark blue/gray silty CLAY | | | | 5 |
| | | (CH) | | | | |
| 15 | | | | | | 10 |
| | | Dark blue/gray silty CLAY, moist | | | | 6 |
| | | Boring terminated at 17.5 feet below ground surface | | | | |

STANDARD PENETRATION TEST DATA (blows/ft)




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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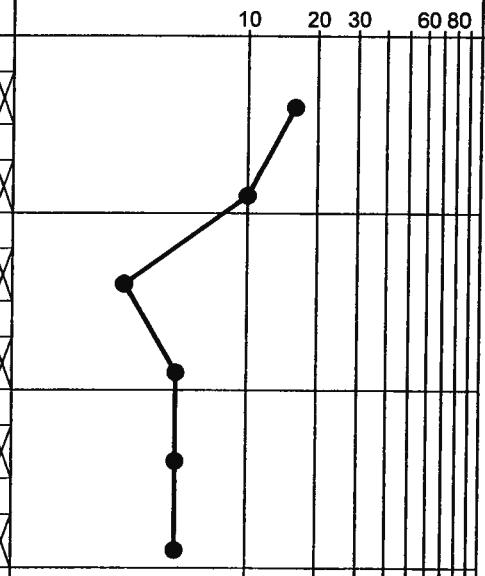
BORING LOG 07-241 BORINGS 1-13.GPJ S&ME.GDT 4/1/09

| PROJECT: Edgecombe County Landfill | BORING LOG B-2 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/13/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **15.0** | |
| LOGGED BY: **DBW** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Dark brown sandy SILT | | | | |
| | | Gray very fine silty SAND, moist | | | | 16 |
| | | Gray very fine silty SAND, wet | | | | 10 |
| 5 | | Light brown mottled gray sandy silty CLAY, soft | | | | 3 |
| | | Orange brown clayey sandy SILT | | | | 5 |
| 10 | | Blue/gray silty CLAY | | | | |
| | | Dark blue/gray silty CLAY, damp | | | | 5 |
| 15 | | Boring terminated at 15 feet below ground surface | | | | 5 |

STANDARD PENETRATION TEST DATA (blows/ft)




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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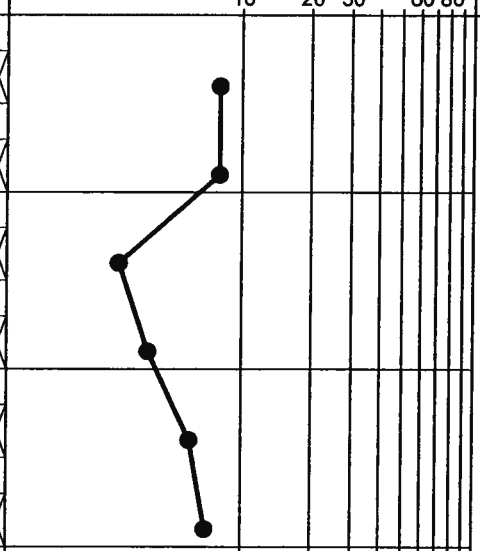
| PROJECT: Edgecombe County Landfill | BORING LOG B-3 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/13/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **15.0** | |
| LOGGED BY: **DBW** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Brown firm silty clayey SAND to sandy CLAY | | | | 8 |
| | | | | | | 8 |
| 5 | | Light gray very fine silty SAND, moist to wet | | | | 3 |
| | | Light brown/gray mottled sandy CLAY, wet | | | | 4 |
| 10 | | Dark blue/gray sandy silty CLAY, moist | | | | 6 |
| | | | | | | 7 |
| 15 | | Boring terminated at 15 feet below ground surface | | | | |

STANDARD PENETRATION TEST DATA (blows/ft)




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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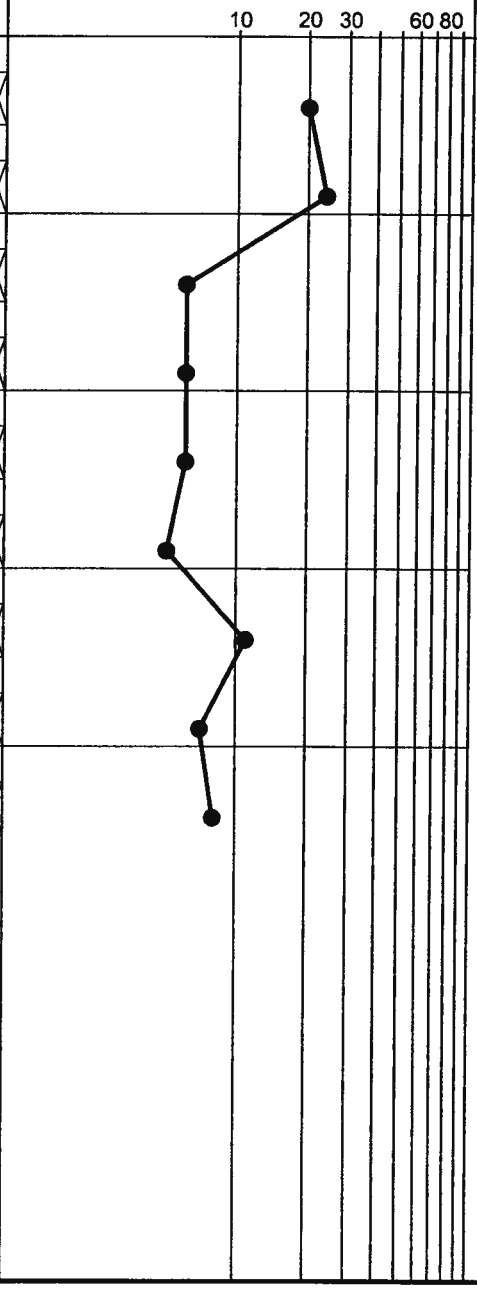
| PROJECT: Edgecombe County Landfill | BORING LOG B-4 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/13/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **22.5** | |
| LOGGED BY: **DBW** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Light tan/brown silty SAND | | | | |
| | | Brown/gray silty SAND | | | | 20 |
| 5 | | | | | | 24 |
| | | Dark brown silty CLAY | | | | 6 |
| | | Dark brown silty SAND | | | | |
| 10 | | Light tan/gray sandy clayey SILT, moist | | | | 6 |
| | | | | | | 6 |
| | | Light brown clayey SAND | | | | 5 |
| 15 | | | | | | |
| | | Red/brown/gray clayey SAND | | | | 11 |
| | | Dark blue/gray silty SAND | | | | |
| | | Dark blue/gray clayey SAND | | | | 7 |
| 20 | | | | | | |
| | | Dark blue/gray silty CLAY, moist | | | | 8 |
| | | Boring terminated at 22.5 feet below ground surface | | | | |

STANDARD PENETRATION TEST DATA (blows/ft)




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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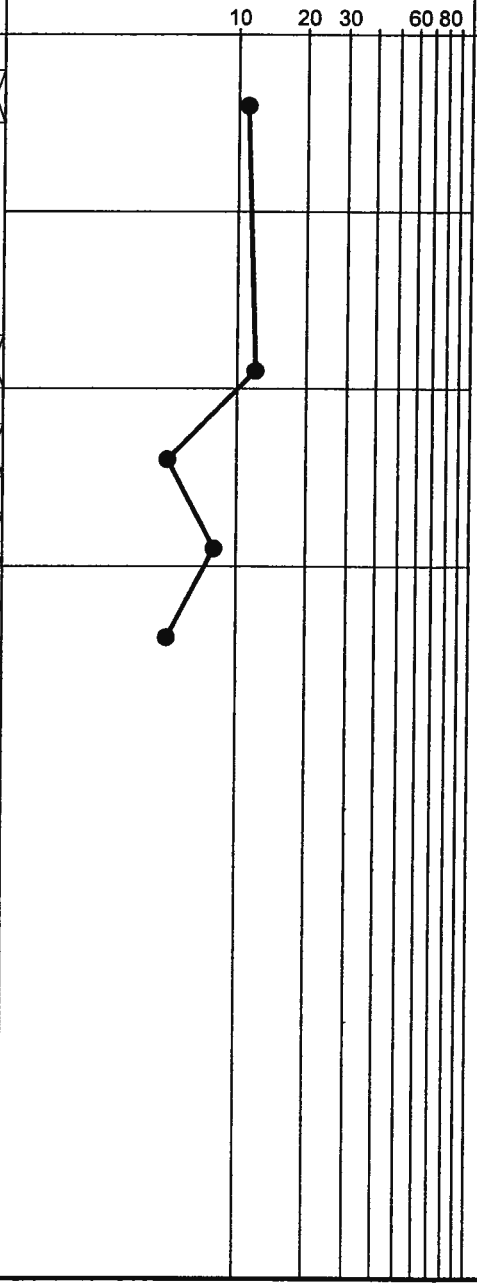
| PROJECT: Edgecombe County Landfill | BORING LOG B-5 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/13/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **17.5** | |
| LOGGED BY: **DBW** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | TOPSOIL | | | | |
| | | Brown/orange silty SAND, damp - waste encountered (cable and pipe debris) - boring off-set | | | | 11 |
| | | Waste encountered (cable debris) - boring off-set south towards perimeter fence | | | | |
| 5 | | | | | | |
| | | Light brown clayey silty SAND | | | | 12 |
| 10 | | | | | | |
| | | Light orange/brown/gray sandy SILT | | | | 5 |
| | | Orange/red/gray sandy CLAY to sandy SILT | | | | 8 |
| 15 | | | | | | |
| | | Dark blue/gray silty CLAY | | | | 5 |
| | | Boring terminated at 17.5 feet below ground surface | | | | |

STANDARD PENETRATION TEST DATA (blows/ft)




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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BORING LOG 07-241_BORINGS_1-13.GPJ S&ME.GDT 4/1/09

| PROJECT: Edgecombe County Landfill | BORING LOG B-6 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/13/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **5.0** | |
| LOGGED BY: **DBW** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | STANDARD PENETRATION TEST DATA (blows/ft) 10 20 30 60 80 | SPT N VALUE |
|---|---|---|---|---|---|---|---|
| | | Brown silty SAND | | | | | 15 |
| | | Brown/gray silty SAND | | | | | 6 |
| 5 | | Waste encountered - boring terminated at 5 feet below ground surface | | | | | |

1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface



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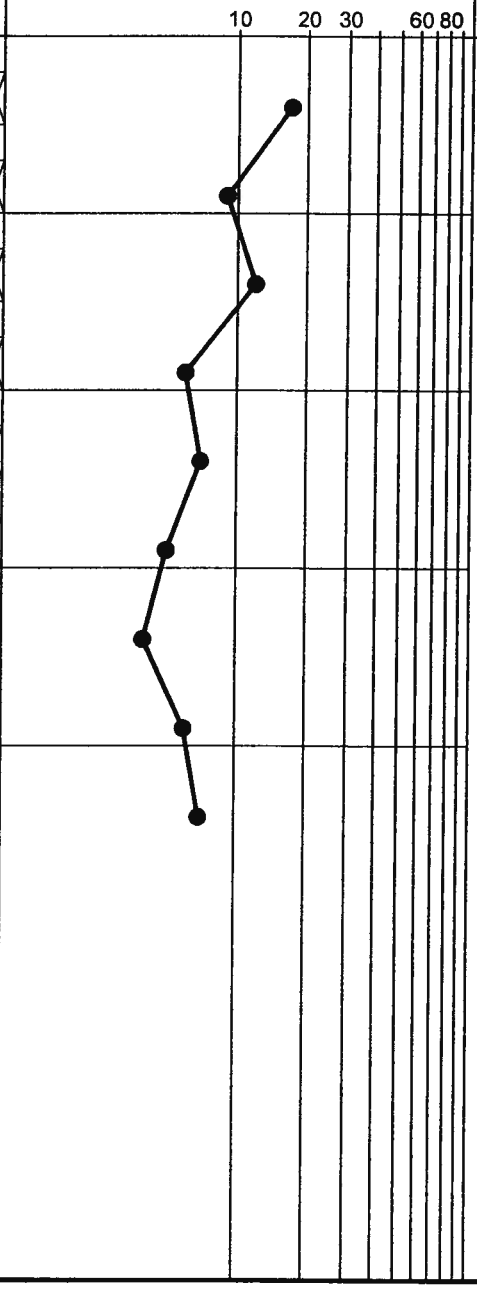
| PROJECT: Edgecombe County Landfill | BORING LOG B-7 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/17/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **22.5** | |
| LOGGED BY: **JLV** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Brown sandy CLAY | | | | 17 |
| | | Brown silty SAND | | | | 9 |
| 5 | | Orange/brown SAND, wet | | | | 12 |
| | | Orange/brown/gray sandy CLAY | | | | 6 |
| 10 | | Orange/brown silty sandy CLAY | | | | 7 |
| 15 | | | | | | 5 |
| | | | | | | 4 |
| | | Dark blue/gray sandy CLAY | | | | 6 |
| 20 | | | | | | 7 |
| | | Boring terminated at 22.5 feet below ground surface | | | | |

STANDARD PENETRATION TEST DATA (blows/ft)




BORING LOG 07-241_BORINGS_1-13.GPJ S&ME.GDT 4/1/09

1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface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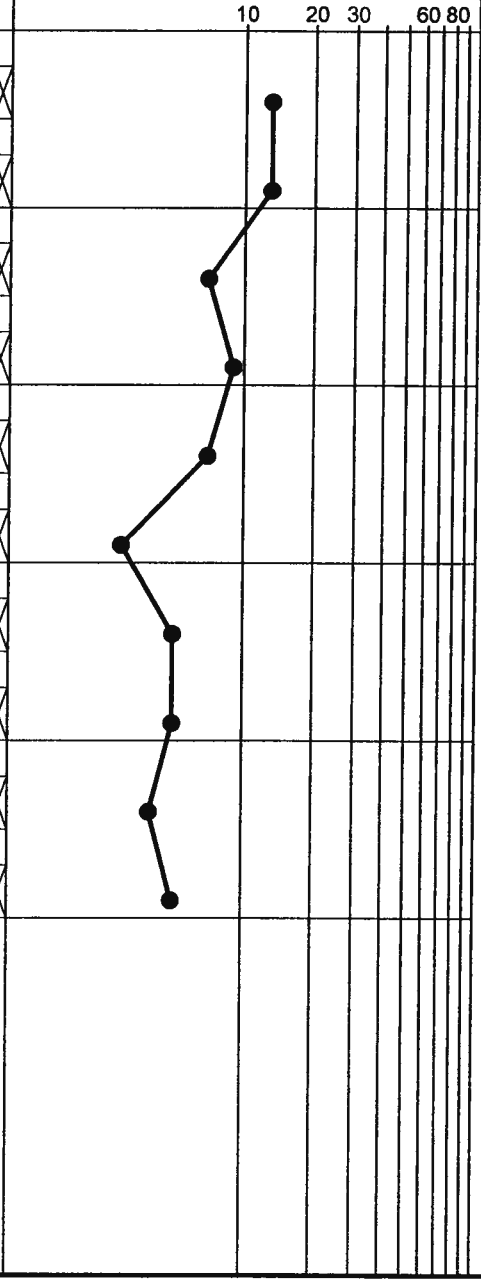
| PROJECT: Edgecombe County Landfill | BORING LOG B-8 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/17/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **25.0** | |
| LOGGED BY: **JLV** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Brown SAND | | | | 13 |
| | | | | | | 13 |
| 5 | | Yellow/brown sandy CLAY, wet | | | | 7 |
| | | Yellow/brown/gray clayey SAND | | | | 9 |
| 10 | | Yellow/brown/gray sandy CLAY | | | | 7 |
| | | Yellow/brown/gray clayey SAND, wet | | | | 3 |
| 15 | | | | | | 5 |
| | | | | | | 5 |
| 20 | | Orange/brown sandy CLAY to clayey SAND | | | | 4 |
| | | Dark blue/gray CLAY | | | | 5 |
| 25 | | Boring terminated at 25 feet below ground surface | | | | |

STANDARD PENETRATION TEST DATA (blows/ft)




BORING LOG 07-241_BORINGS_1-13.GPJ S&ME.GDT 4/1/09

1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface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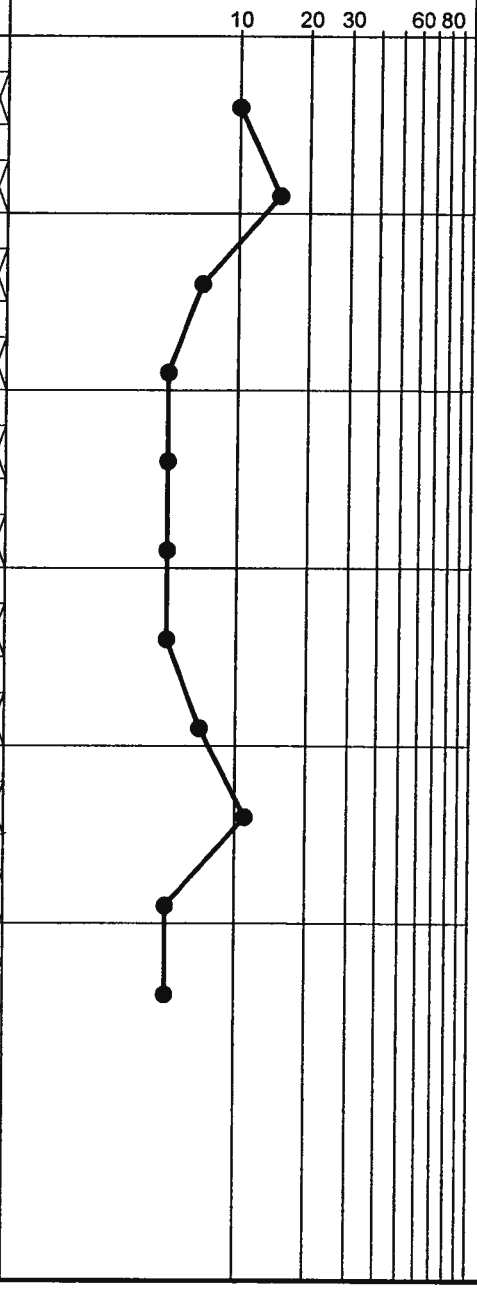
| PROJECT: Edgecombe County Landfill | BORING LOG B-9 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/17/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **27.5** | |
| LOGGED BY: **JLV** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | STANDARD PENETRATION TEST DATA (blows/ft) | SPT N VALUE |
|---|---|---|---|---|---|---|---|
| | | Brown silty SAND | | | | | 10 |
| 5 | | Gray/brown silty CLAY | | | | | 15 |
| | | Brown SAND | | | | | 7 |
| 10 | | Brown sandy CLAY | | | | | 5 |
| | | Brown/gray fine sandy CLAY | | | | | 5 |
| | | Gray fine sandy CLAY | | | | | 5 |
| 15 | | Orange sandy CLAY | | | | | 5 |
| | | Gray silty SAND, wet at approximately 19 feet below ground surface | | | | | 7 |
| 20 | | Orange very firm CLAY | | | | | 11 |
| 25 | | Gray silty CLAY | | | | | 5 |
| | | Boring terminated at 27.5 feet below ground surface | | | | | 5 |




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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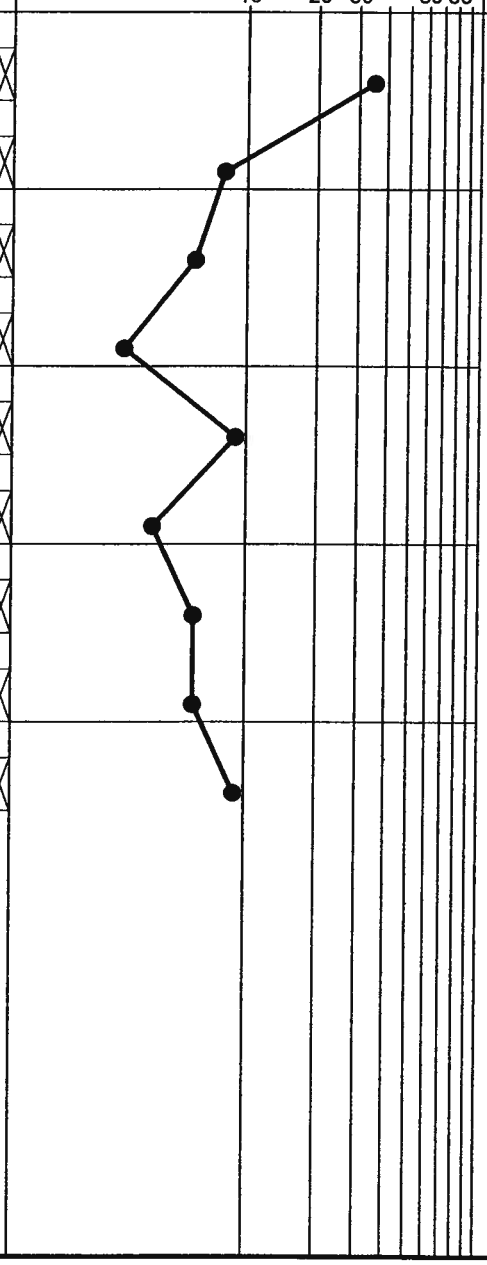
| PROJECT: Edgecombe County Landfill | BORING LOG B-10 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/17/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **22.5** | |
| LOGGED BY: **JLV** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Tan/brown fine to very fine silty SAND | | | | 35 |
| | | Brown/gray silty SAND, wet | | | | 8 |
| 5 | | Yellow/brown/gray firm sandy silty CLAY | | | | 6 |
| | | | | | | 3 |
| 10 | | Orange/gray mottled silty SAND | | | | 9 |
| | | Dark gray sandy CLAY | | | | 4 |
| | | Orange/gray clayey SAND | | | | 6 |
| 15 | | | | | | 6 |
| | | Gray/orange loamy SAND | | | | 9 |
| 20 | | | | | | |
| | | Dark gray firm silty CLAY | | | | |
| | | Boring terminated at 22.5 feet below ground surface | | | | |

STANDARD PENETRATION TEST DATA (blows/ft)




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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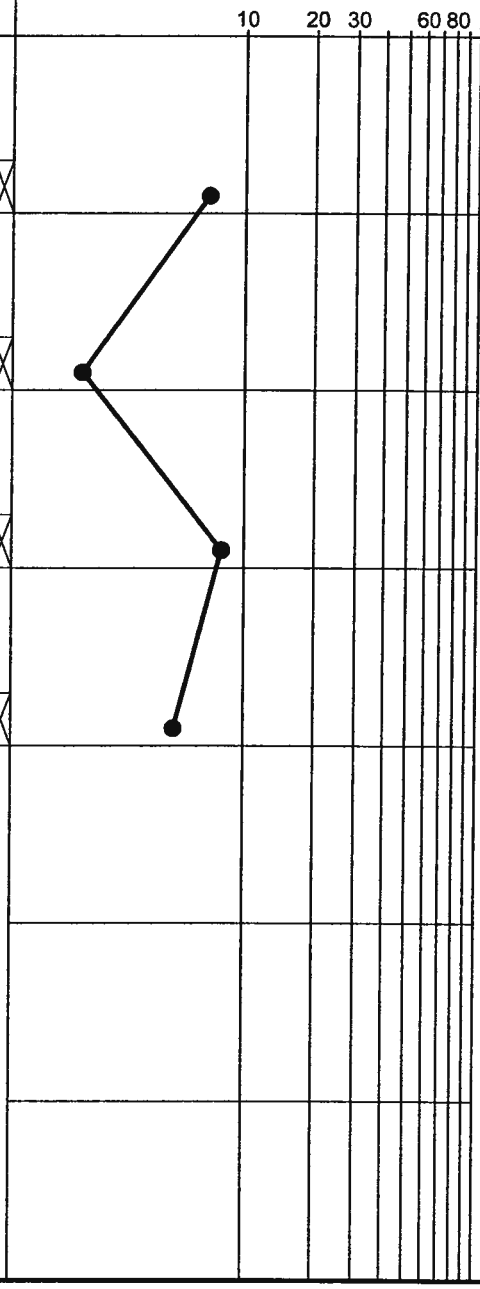
| PROJECT: Edgecombe County Landfill | BORING LOG B-11 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/17/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **30.0** | |
| LOGGED BY: **JLV** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Orange/brown sandy CLAY, wet at approximately 4 feet below ground surface | | | | |
| 5 | | | | | | 7 |
| | | Dark gray soft silty CLAY | | | | |
| | | Orange/brown soft silty CLAY | | | | |
| 10 | | | | | | 2 |
| | | Orange/gray silty SAND | | | | |
| 15 | | | | | | 8 |
| | | Dark gray CLAY | | | | |
| | | Orange/gray silty SAND | | | | |
| 20 | | | | | | 5 |
| | | Orange/gray coarse SAND | | | | |
| 25 | | Blue/gray silty CLAY | | | | |
| | | Dark gray CLAY with white shell fragments | | | | |
| 30 | | Boring terminated at 30 feet below ground surface | | | | |

STANDARD PENETRATION TEST DATA (blows/ft)




BORING LOG 07-241 BORINGS 1-13.GPJ S&ME.GDT 4/1/09

1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface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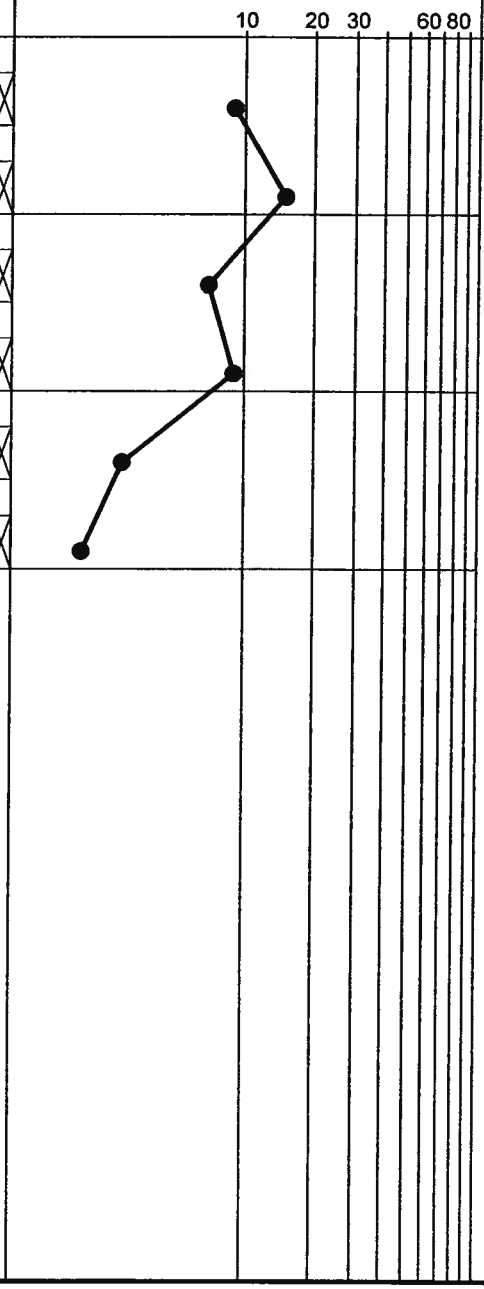
| PROJECT: Edgecombe County Landfill | BORING LOG B-12 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/17/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **15.0** | |
| LOGGED BY: **JLV** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Brown SAND | | | | 9 |
| | | Dark black CLAY | | | | 15 |
| 5 | | Dark black sandy CLAY | | | | 7 |
| | | Orange silty CLAY | | | | 9 |
| 10 | | Dark black firm CLAY | | | | 3 |
| 15 | | Boring terminated at 15 feet below ground surface | | | | 2 |

STANDARD PENETRATION TEST DATA (blows/ft)




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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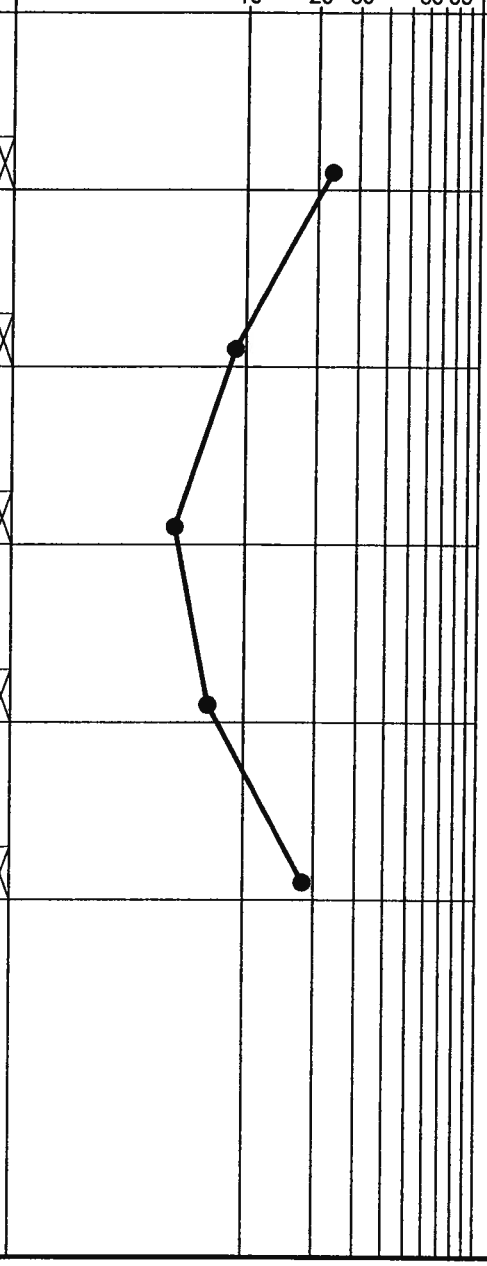
| PROJECT: Edgecombe County Landfill | BORING LOG B-13 |
|---|---|

| | | |
|---|---|---|
| DATE DRILLED: **2/17/09** | ELEVATION: **0.0** | NOTES: |
| DRILLING METHOD: **3¼" H.S.A.** | BORING DEPTH: **25.0** | |
| LOGGED BY: **JLV** | WATER LEVEL (ft-bgs): **Groundwater Not Encountered** | |
| DRILLER: **MM** | DRILL RIG: **CME-55** | |

| DEPTH (feet) | GRAPHIC LOG | SOIL DESCRIPTION & REMARKS | WATER LEVEL | ELEVATION (FEET) | SAMPLE NUMBER | SPT N VALUE |
|---|---|---|---|---|---|---|
| | | Yellow/brown sandy CLAY | | | | |
| 5 | | | | | | 23 |
| | | Orange/dark gray silty CLAY | | | | |
| 10 | | | | | | 9 |
| | | Orange/gray silty CLAY | | | | |
| 15 | | | | | | 5 |
| | | Blue/gray CLAY | | | | |
| 20 | | | | | | 7 |
| | | Blue/gray Clay with shell fragments | | | | |
| 25 | | Boring terminated at 25 feet below ground surface | | | | 18 |

STANDARD PENETRATION TEST DATA (blows/ft)




1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours
3. ft-bgs = feet below ground surface

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Raleigh, NC 27616

# APPENDIX III

(LABORATORY TEST RECORDS)

S&ME

**Edgecombe County Landfill**
**Edgecombe County, NC**
**S&ME Project Number: 1054-07-241A**

| Boring | Depth (feet) | USCS | Natural Moisture Content (%) | GRAIN SIZE ANALYSIS | | | | | ATTERBERG LIMITS | | | STANDARD PROCTOR | | Permeability, k (cm/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Coarse Sand (%) | Medium Sand (%) | Fine Sand (%) | Silt (%) | Clay (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | Optimum Moisture (%) | Maximum Dry Density (pcf) | |
| CA-TP-1 | 0 - 2 | (SP-SC) | 15.7 | 0 | 39 | 50 | 10.2 | | - | - | - | - | - | - |
| CA-TP-1 | 5 - 6 | (CL) | 35.0 | 0 | 5 | 45 | 28.8 | 21.5 | - | - | - | 15.5 | 113.0 | 2.29E-06 |
| CA-TP-2 | 0 - 2 | CL | 25.2 | 0 | 3 | 40 | 26.4 | 30.5 | 34 | 15 | 19 | 16.1 | 110.2 | 1.01E-06 |
| CA-TP-2 | 2 - 4 | (SM) | 22.0 | 2 | 17 | 62 | 17.7 | | - | - | - | - | - | - |
| CA-TP-2 | 4 - 5 | CL | 47.1 | 0 | 4 | 23 | 58.0 | 14.5 | 34 | 21 | 13 | 24.2 | 96.7 | 6.41E-07 |
| CA-TP-3 | 0 - 2 | (ML) | 39.3 | 0 | 4 | 33 | 36.0 | 27.0 | - | - | - | 29.1 | 90.4 | 7.22E-07 |
| CA-TP-3 | 6 - 8 | CL | 65.1 | 0 | 0 | 9 | 57.1 | 33.5 | 47 | 25 | 22 | 28.8 | 88.1 | 4.60E-07 |
| CA-TP-6 | 5 - 7 | (ML) | 65.4 | 0 | 1 | 5 | 41.4 | 53.0 | - | - | - | - | - | - |
| CA-TP-6 | 7 - 9 | (SM) | 35.5 | 0 | 26 | 35 | 19.5 | 20.0 | - | - | - | - | - | - |
| B-1 / S-2 | 8.5 - 10 | (SC) | 31.4 | 0 | 2.3 | 69 | 28.6 | | 31 | 19 | 12 | | | |
| B-1 / S-3 | 13.5 - 15 | (CH) | 58.5 | 0.1 | 1.8 | 19.8 | 78.3 | | 93 | 28 | 65 | | | |
| B-3 / S-4 | 6 - 7.5 | (SC) | 42.8 | 0 | 0.2 | 50.6 | 49.1 | | 46 | 16 | 30 | | | |
| B-5 / S-5 | 11 - 12.5 | (SC) | 28.0 | 0 | 0.6 | 65.6 | 33.7 | | 37 | 17 | 20 | | | |
| B-8 / S-6 | 16 - 17.5 | (SC) | 31.9 | 0 | 0.7 | 74 | 25.5 | | 29 | 17 | 12 | | | |
| B-8 / S-7 | 18.5 - 20 | (SC) | 37.9 | 0.7 | 3.3 | 49.2 | 46.2 | | 47 | 20 | 27 | | | |
| B-9 / S-8 | 3.5 - 5 | (SC) | 31.2 | 0.5 | 3.8 | 54.2 | 41.4 | | 44 | 17 | 27 | | | |
| B-12 / S-9 | 6 - 7.5 | (SC) | 31.2 | 0.5 | 12.8 | 57.8 | 28.8 | | 30 | 14 | 16 | | | |
| B-12 / S-10 | 11 - 12 | (CH) | 62.3 | 0 | 0.4 | 8.2 | 91.4 | | 87 | 24 | 63 | | | |
| B-13 / S-11 | 22.5 - 24 | (SC) | 30.8 | 5.3 | 20.9 | 36.3 | 29.2 | | 54 | 19 | 35 | | | |
| CATP 1A S-1 | 1 - 1.5 | (CH) | 25.4 | 0.1 | 1.4 | 32.1 | 66.4 | | 53 | 17 | 36 | | | |
| B-1 | 8.5-10.0 | x | | x | x | x | x | x | x | x | x | | | |
| | 13.5-15.0 | x | | x | x | x | x | x | x | x | x | | | |
| B-3 | 6-7.5 | x | | x | x | x | x | x | x | x | x | | | |
| | 8.5-10 | x | | x | x | x | x | x | x | x | x | | | |
| B-5 | 1-2.5 | x | | x | x | x | x | x | x | x | x | | | |
| | 11-12.5 | x | | x | x | x | x | x | x | x | x | | | |
| | 16-17.5 | x | | x | x | x | x | x | x | x | x | | | |
| B-8 | 16-17.5 | x | | x | x | x | x | x | x | x | x | | | |
| | 18.5-20 | x | | x | x | x | x | x | x | x | x | | | |
| | 21-22.5 | x | | x | x | x | x | x | x | x | x | | | |
| B-9 | 3.5-5 | x | | x | x | x | x | x | x | x | x | | | |
| B-10 | 3.5-5 | x | | x | x | x | x | x | x | x | x | | | |
| | 8.5-10 | x | | x | x | x | x | x | x | x | x | | | |
| B-12 | 6-7.5 | x | | x | x | x | x | x | x | x | x | | | |
| | 11-12.5 | x | | x | x | x | x | x | x | x | x | | | |
| B-13 | 22.5-24 | x | | x | x | x | x | x | x | x | x | | | |
| | | | | | | | | | | | | | | |

(CL) = Visual USCS Classification
CL = USCS Classification

S&ME

**Edgecombe County Landfill**
**Edgecombe County, NC**
**S&ME Project Number: 1054-07-241A**

| Boring | Depth (feet) | USCS | Natural Moisture Content (%) | GRAIN SIZE ANALYSIS | | | | | ATTERBERG LIMITS | | | STANDARD PROCTOR | | Permeability, k (cm/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Coarse Sand (%) | Medium Sand (%) | Fine Sand (%) | Silt (%) | Clay (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | Optimum Moisture (%) | Maximum Dry Density (pcf) | |
| TP-1 | 0 - 2 | (SP-SC) | 15.7 | 0 | 39 | 50 | 10.2 | | - | - | - | - | - | - |
| TP-1 | 5 - 6 | (CL) | 35.0 | 0 | 5 | 45 | 28.8 | 21.5 | - | - | - | 15.5 | 113.0 | 2.29E-06 |
| TP-2 | 0 - 2 | CL | 25.2 | 0 | 3 | 40 | 26.4 | 30.5 | 34 | 15 | 19 | 16.1 | 110.2 | 1.01E-06 |
| TP-2 | 2 - 4 | (SM) | 22.0 | 2 | 17 | 62 | 17.7 | | - | - | - | - | - | - |
| TP-2 | 4 - 5 | CL | 47.1 | 0 | 4 | 23 | 58.0 | 14.5 | 34 | 21 | 13 | 24.2 | 96.7 | 6.41E-07 |
| TP-3 | 0 - 2 | (ML) | 39.3 | 0 | 4 | 33 | 36.0 | 27.0 | - | - | - | 29.1 | 90.4 | 7.22E-07 |
| TP-3 | 6 - 8 | CL | 65.1 | 0 | 0 | 9 | 57.1 | 33.5 | 47 | 25 | 22 | 28.8 | 88.1 | 4.60E-07 |
| TP-6 | 5 - 7 | (ML) | 65.4 | 0 | 1 | 5 | 41.4 | 53.0 | - | - | - | - | - | - |
| TP-6 | 7 - 9 | (SM) | 35.5 | 0 | 26 | 35 | 19.5 | 20.0 | - | - | - | - | - | - |

(CL) = Visual USCS Classification
CL = USCS Classification

# Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

S&ME

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 10/10/08 |
| Project Name: | Edgecombe County Landfill | Test Date(s): | 10/9 - 10/10/08 |
| Client Name: | | | |
| Client Address: | | | |
| Sample by: | S&ME, Inc. | Sample Dates: | 10/7/08 |
| Sampling Method: | Split spoon and bulk bag sampling | Drill Rig : | NA |

| Boring # | Sample # | Sample Depth | Tare # | Tare Weight | Tare Wt.+ Wet Wt | Tare Wt. + Dry Wt | Water Wt. | Percent Moisture |
|---|---|---|---|---|---|---|---|---|
| | | ft. or m. | | grams | grams | grams | grams | % |
| TP-1 | Jar | 0- 2 ft. | 031 | 113.78 | 374.12 | 338.77 | 35.35 | **15.7%** |
| TP-1 | Bag | 5 - 6 ft. | 2 | 114.20 | 198.35 | 176.55 | 21.80 | **35.0%** |
| TP-2 | Jar | 2 - 4 ft. | 028 | 107.11 | 351.32 | 307.26 | 44.06 | **22.0%** |
| TP-2 | Bag | 0 - 2 ft. | 6 | 111.22 | 195.00 | 178.16 | 16.84 | **25.2%** |
| TP-2 | Bag | 4 - 5 ft. | 015 | 91.88 | 197.70 | 163.80 | 33.90 | **47.1%** |
| TP-3 | Bag | 0 - 2 ft. | 036 | 107.66 | 222.27 | 189.94 | 32.33 | **39.3%** |
| TP-3 | Bag | 6 - 8 ft. | 021 | 108.03 | 224.42 | 178.52 | 45.90 | **65.1%** |
| TP-6 | Jar | 5 - 7 ft. | 023 | 116.71 | 159.59 | 142.63 | 16.96 | **65.4%** |
| TP-6 | Jar | 7 - 9 ft. | 033 | 107.70 | 160.04 | 146.33 | 13.71 | **35.5%** |

**Notes:**

**References:** ASTM D2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
AASHTO T 265: Laboratory Determination of Moisture Content of Soils

Technician Name: Yogesh Chauhan

*Certification #*

Technical Responsibility: Mal Krajan

*Signature*

Laboratory Manager

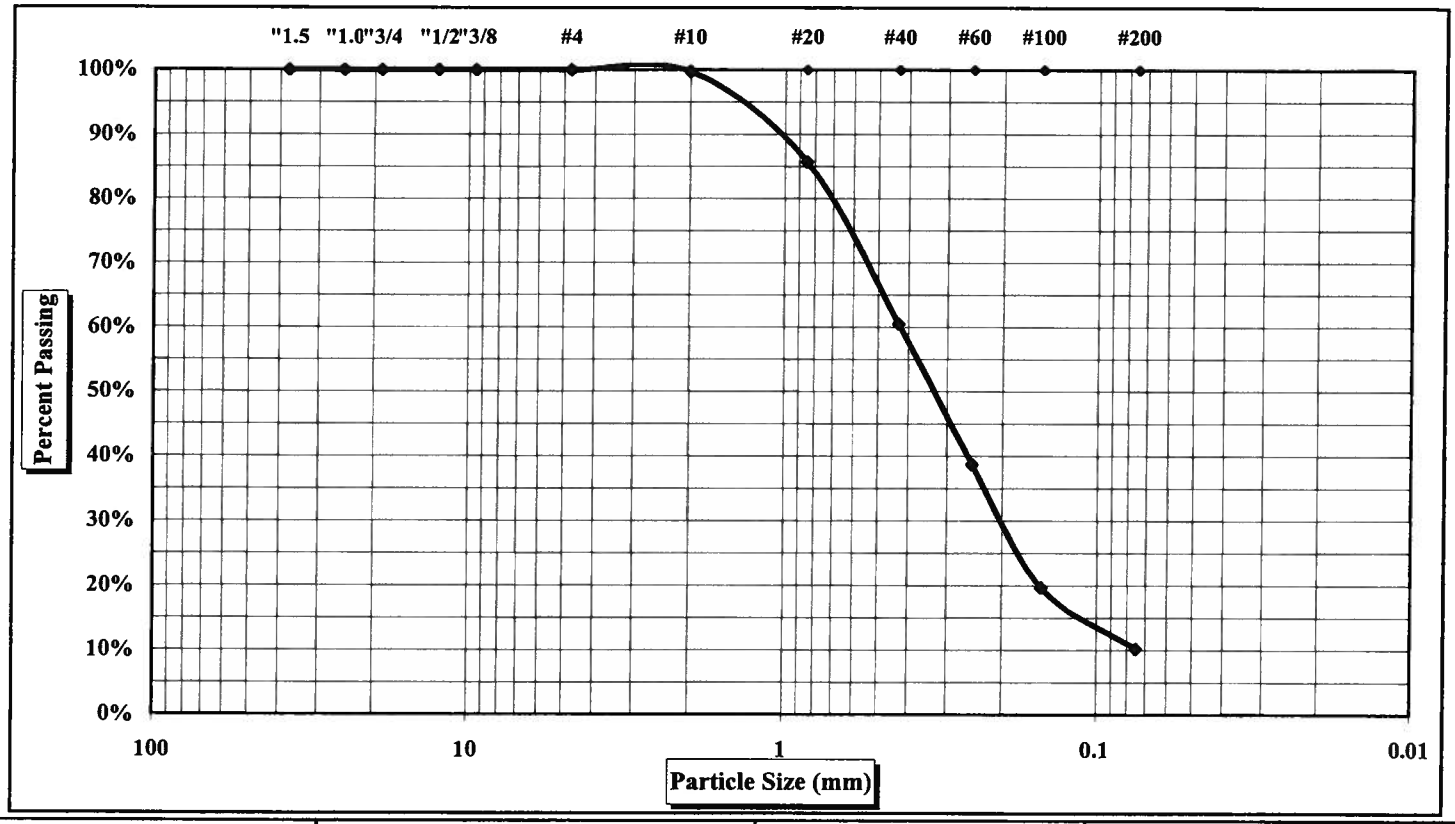
*Position*

# Particle Size Analysis of Soils

ASTM D 422

| | | | |
|---|---|---|---|
| **S&ME Project #:** | **1054-07-241A** | Report Date: | 10/11/08 |
| **Project Name:** | **Edgecombe County Landfill** | Test Date(s): | 10/9 - 10/11/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-1 | Sample #: | Jar | Sample Date: | 10/7/08 |
| Location: | On-Site | | | Depth (ft): | 0 - 2 ft. |
| Sample Description: | Orange-Tan Slightly Clayey Fine to Medium SAND (Visual) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Gravel | 0% | Medium Sand | 39% |
| Silt & Clay (% Passing #200) | 10.2% | Coarse Sand | 0% | Fine Sand | 50% |
| Apparent Relative Density | ND | Moisture Content | 15.7% | Organic Content | ND |
| Liquid Limit | ND | Plastic Limit | ND | Plastic Index | ND |

ND=Not determined

Description of Sand & Gravel

Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

**References:** ASTM D 422: Particle Size Analysis of Soils *Hydrometer portion of test method not utilized.*

ASTM D 421: Dry Preparation of Soil Samples ASTM D 854: Specific Gravity of Soils

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager

*Signature* *Position*

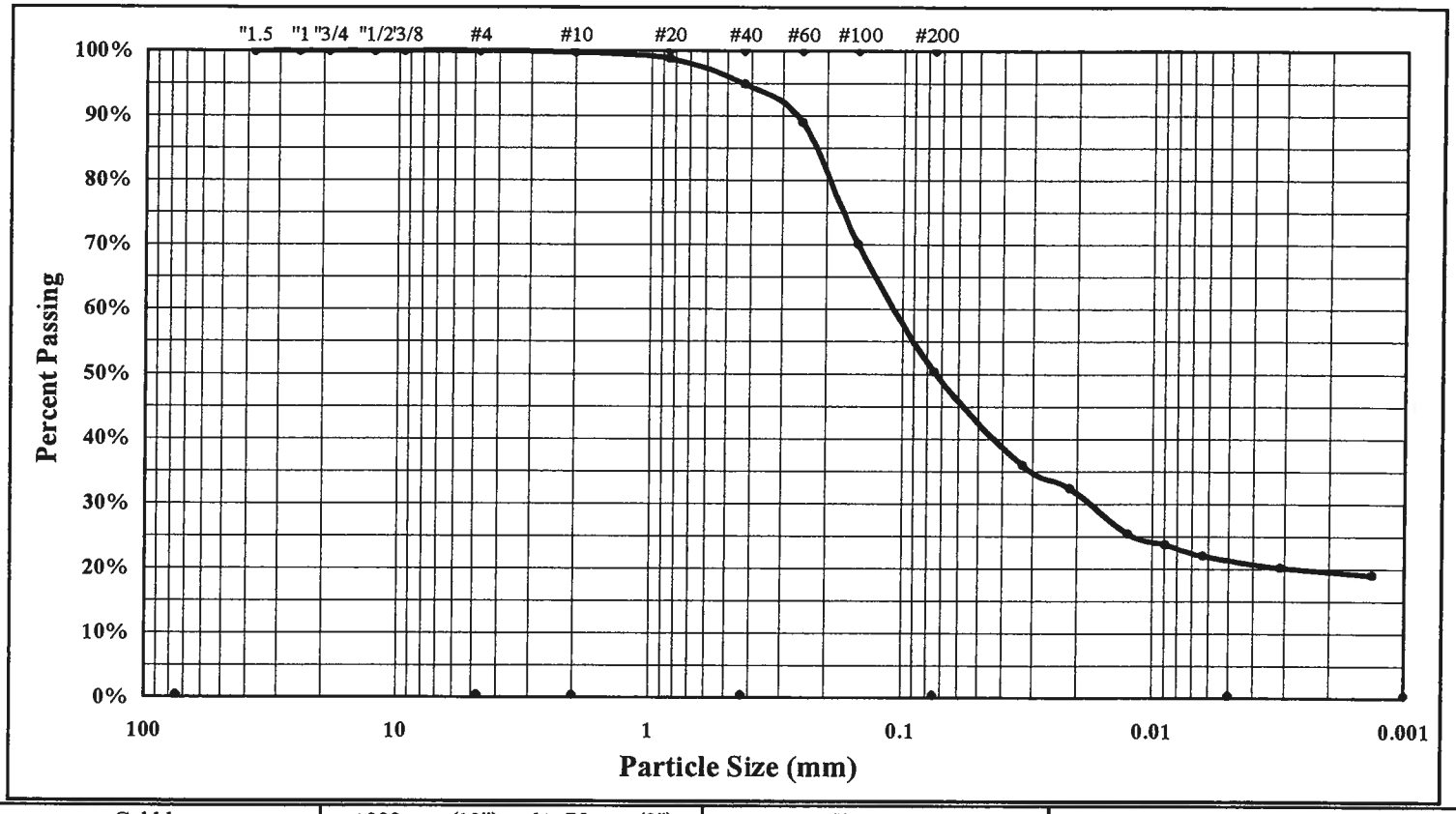
# Particle Size Analysis of Soils

ASTM D 422

S&ME

| | | | |
|---|---|---|---|
| S&ME Project #: | **1054-07-241A** | Report Date: | 10/17/08 |
| Project Name: | **Edgecombe County Landfill** | Test Date(s): | 10/9 - 10/17/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-1 | Sample #: | Bag | Sample Date: | 10/7/08 |
| Location: | Site-Borehole | Offset: | | Depth (ft): | 5 - 6 ft. |
| Sample Description: | Orange Silty Sandy CLAY (Visual) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Gravel | 0.0% | Silt | 28.8% |
| Silt & Clay (% Passing #200) | 50.3% | Sand | 49.7% | Clay | 21.5% |
| Apparent Relative Density | 2.682 | Moisture Content | | Colloids | 19.0% |
| Liquid Limit | ND | Plastic Limit | ND | Plastic Index | ND |

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

**References:** ASTM D 422: Particle Size Analysis of Soils ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

# Moisture - Density Report

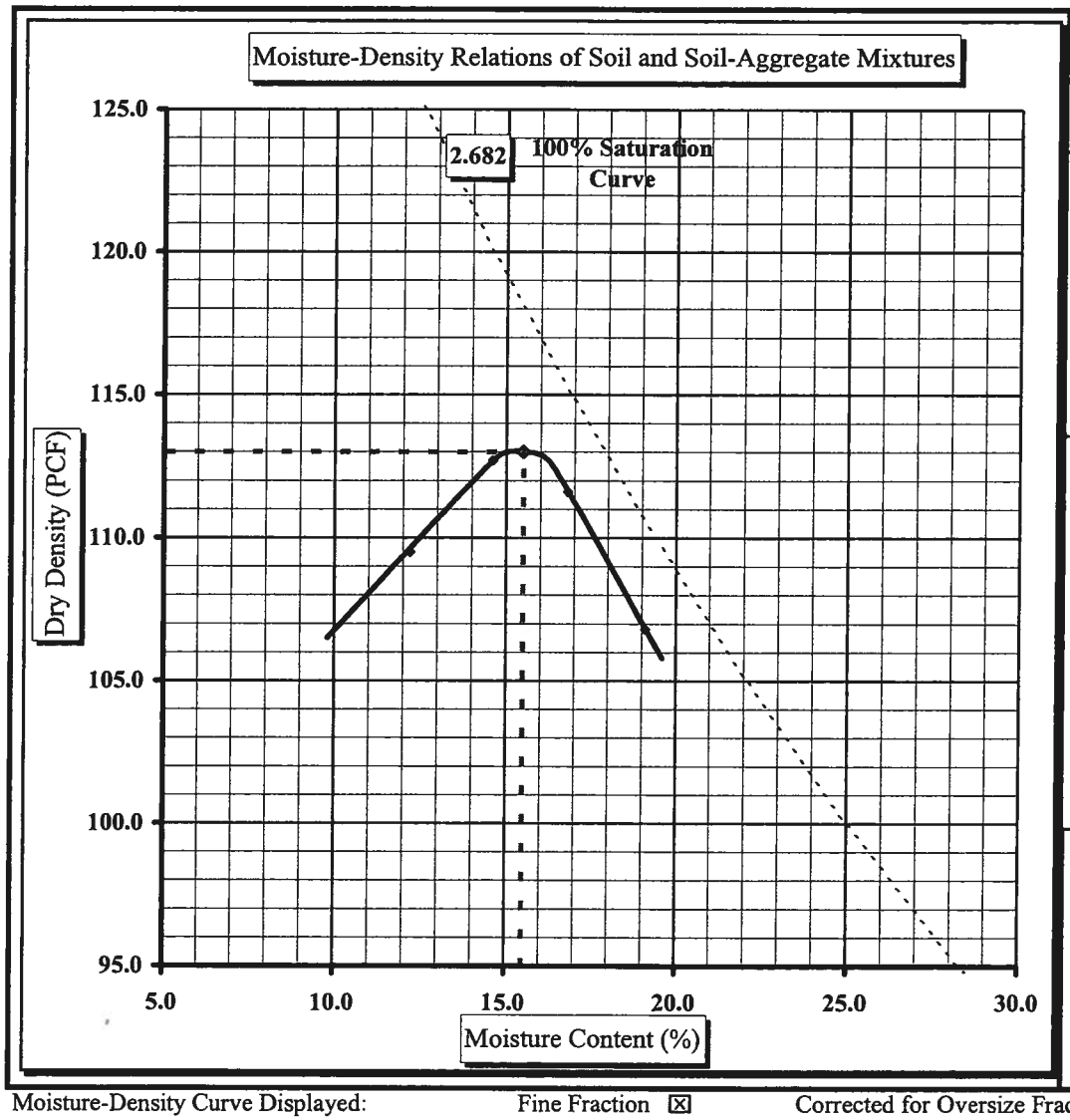
S&ME

**S&ME Project #:** **1054-07-241A** Report Date: October 10, 2008
**Project Name:** Edgecombe County landfill Test Date(s): 10/7 - 10/10/08
Client Name:
Client Address:

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-1 | Sample #: | Bag | Sample Date: | October 7, 2008 |
| Location: | Site-Borehole | Offset: | N/A | Depth (ft): | 5 - 6 ft. |
| Sample Description: | Orange Silty Sandy CLAY (Visual) | | | | |

**Maximum Dry Density 113.0 PCF.** **Optimum Moisture Content 15.5 %**

**ASTM D 698 Method A**




**Soil Properties**

| | |
|---|---|
| Natural Moisture Content: | 35.0% |
| Liquid Limit: | ND |
| Plastic Limit: | ND |
| Plastic Index: | ND |
| Specific Gravity: | 2.682 |

% Passing
#4 100.0

**Oversize Fraction**

Bulk Sp. Gravity
% Moisture
Oversize Fraction
**MDD**
**Opt. MC**

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

**References:** ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

S&ME

# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

**Project #: 1054-07-241A** — Test Date(s): 10/13 - 10/17/08

**Project Name: Edgecombe County Landfill** — Report Date: 10/17/08

Client Name:

Client Address:

Boring #: TP-1 | Sample #: Bag | Depth/Elevation: 5 - 6 ft. | Sample Date: 10/07/08

Location: Site | Offset: N/A | Sample Description: (Visual) Orange Silty Sandy CLAY (Visual)

Liquid Limit: ND | Specific Gravity: 2.682 | Sample Type: lab-compacted | Sampled By: S&ME, Inc.

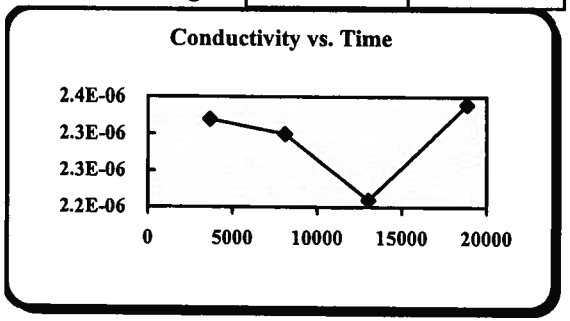
Plastic Limit: ND | Plasticity Index: ND | Percent Passing #200: 50.3 | Maximum Particle Size: #4

| Initial Sample Conditions | | | | Final Sample Conditions | | | |
|---|---|---|---|---|---|---|---|
| Height (cm): | 9.639 | Wet Unit Weight (lbs/ft$^3$): | 124.1 | Height (cm): | 9.639 | Dry Unit Weight (lbs/ft$^3$): | 107.1 |
| Diameter (cm): | 7.338 | Dry Unit Weight (lbs/ft$^3$): | 107.1 | Diameter (cm): | 7.338 | Percent Saturation: | 100.0 |
| Area (cm$^2$): | 42.29 | Percent Saturation: | 75.4 | Area (cm$^2$) | 42.29 | Void Ratio: | 0.5622 |
| Volume (cm$^3$): | 407.63 | Void Ratio: | 0.5622 | Volume (cm$^3$) | 407.63 | Porosity: | 0.3599 |
| Wet weight (grams): | 810.1 | Porosity: | 0.3599 | Wet weight (grams) | 847.5 | Measured ***B*** coefficient: 0.98 | |
| Dry Weight (grams): | 699.6 | **Station Corrections (cm)** | | Dry Weight (grams) | 699.6 | MDD (pcf): 113.0 | Opt. (%): 15.5 |
| Percent Moisture: | 15.8 | Influent: -2.190 | Effluent: -2.825 | Percent Moisture: | 21.1 | | |

| Testing Station | Burette Areas (cm$^2$): | | | | Effective Consolidation Stress (psi): | 3.0 | Permeant Liquid Used: | Deaired Demineralized water |
|---|---|---|---|---|---|---|---|---|
| 2 | Influent: | 0.720 | Influent: | 0.720 | Cell Pressure (psi): | 73.0 | Influent Pressure (psi): 70.0 | Effluent Pressure (psi) 70.0 |

| Start Date | Start Time | End Date | End Time | Time (seconds) | Temperature (°C) Initial | Temperature (°C) Final | Temperature (°C) Avg. | Corr. Factor | Initial INF. | Initial EFF. | Final INF. | Final EFF. | $h_1$ (cm) | $h_2$ (cm) | Gradient | K-Value (cm/sec) Uncorrected | K-Value (cm/sec) Corrected |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/16/08 | 10:01:00 AM | 10/16/08 | 11:02:00 AM | 3660 | 21.2 | 21.2 | 21.2 | 0.969 | 34.60 | 47.80 | 35.30 | 47.10 | 13.84 | 12.44 | 1.4 | 2.39E-06 | 2.32E-06 |
| 10/16/08 | 11:02:00 AM | 10/16/08 | 12:16:00 PM | 4440 | 21.2 | 21.2 | 21.2 | 0.969 | 35.30 | 47.10 | 36.10 | 46.40 | 12.44 | 10.94 | 1.2 | 2.37E-06 | 2.30E-06 |
| 10/16/08 | 12:16:00 PM | 10/16/08 | 1:38:00 PM | 4920 | 21.2 | 21.2 | 21.2 | 0.969 | 36.10 | 46.40 | 36.80 | 45.70 | 10.94 | 9.54 | 1.1 | 2.28E-06 | 2.21E-06 |
| 10/16/08 | 1:38:00 PM | 10/16/08 | 3:15:00 PM | 5820 | 21.2 | 21.2 | 21.2 | 0.969 | 36.80 | 45.70 | 37.60 | 45.00 | 9.54 | 8.04 | 0.9 | 2.41E-06 | 2.34E-06 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | ***Averages:*** | **2.36E-06** | **2.29E-06** |

Remarks: ND= Not Determined. Test specimen compacted to 95% at opt. moisture.




References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan — Certification #:

Technical Responsibility: Mal Krajan — Position: Laboratory Manager

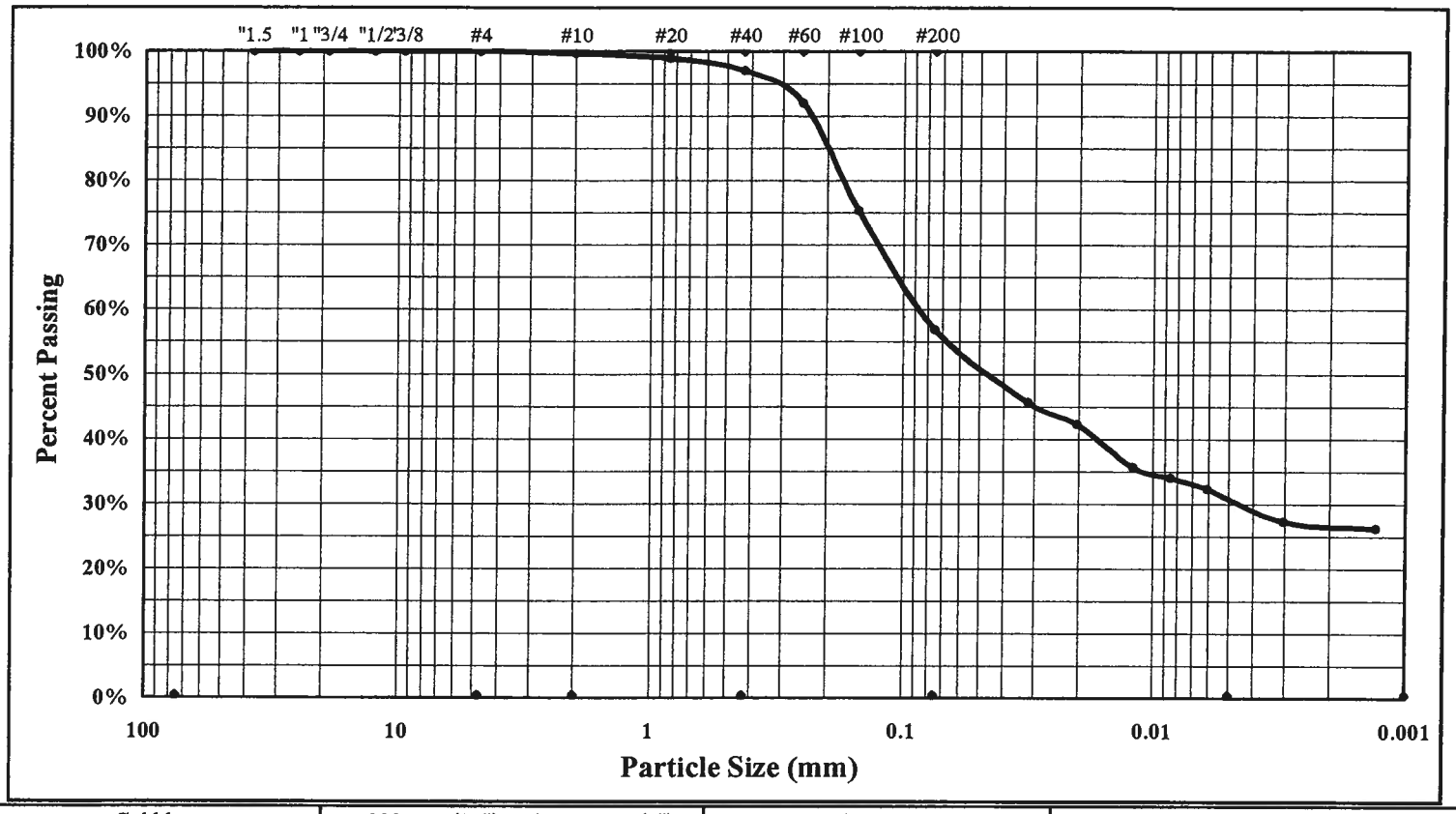
# Particle Size Analysis of Soils

ASTM D 422

S&ME

| | | | |
|---|---|---|---|
| S&ME Project #: | **1054-07-241A** | Report Date: | 10/17/08 |
| Project Name: | **Edgecombe County Landfill** | Test Date(s): | 10/9 - 10/17/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-2 | Sample #: | Bag | Sample Date: | 10/7/08 |
| Location: | Site-Borehole | Offset: | | Depth (ft): | 0 - 2 ft. |
| Sample Description: | Orange-Tan Sandy Silty CLAY (CL) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Gravel | 0.0% | Silt | 26.4% |
| Silt & Clay (% Passing #200) | 56.9% | Sand | 43.1% | Clay | 30.5% |
| Apparent Relative Density | 2.716 | Moisture Content | | Colloids | 26.2% |
| Liquid Limit | 34 | Plastic Limit | 15 | Plastic Index | 19 |

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

**References:** ASTM D 422: Particle Size Analysis of Soils ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

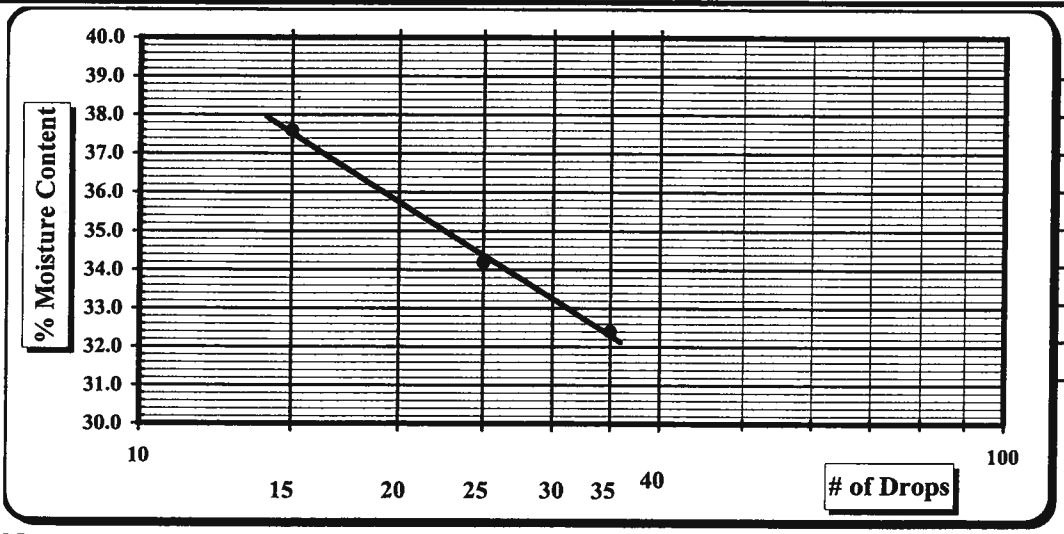
Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: **1054-07-241A** Report Date: 10/17/2008
Project Name: Edgecombe County Landfill Test Date(s): 10/9 - 10/17/08
Client Name:
Client Address:
Boring #: TP-2 Sample #: Bag Sample Date: 10/7/2008
Location: Site Borehole Offset: N/A Depth (ft): 0 - 2 ft.
Sample Description: Orange-Tan Sandy Silty CLAY (CL)

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Test # | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 |
| | Tare # | 17 | 16 | 6 | | | | 7 | 1 | |
| A | Tare Weight | 12.95 | 13.02 | 12.95 | | | | 12.94 | 12.94 | |
| B | Wet Soil Weight + A | 29.12 | 28.06 | 29.55 | | | | 25.70 | 25.77 | |
| C | Dry Soil Weight + A | 25.00 | 24.38 | 25.01 | | | | 24.02 | 24.06 | |
| D | Water Weight (B-C) | 4.12 | 3.68 | 4.54 | | | | 1.68 | 1.71 | |
| E | Dry Soil Weight (C-A) | 12.05 | 11.36 | 12.06 | | | | 11.08 | 11.12 | |
| F | % Moisture Content (D/E)*100 | 34.2% | 32.4% | 37.6% | | | | 15.2% | 15.4% | |
| N | # OF DROPS | 25 | 35 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| Ave. | Average | | | | | | | 15.3% | | |




| One Point Liquid Limit | | | |
|---|---|---|---|
| N | Factor | N | Factor |
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.990 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Preparation: | Wet Preparation ☐ | Dry Preparation ☒ | Air Dried ☒ | NP, Non-Plastic | ☐ |
| Liquid limit Test: | Multipoint Method ☒ | One-point Method ☐ | | Liquid Limit | 34 |
| Classification: | ASTM D 2487 ☒ | AASHTO M 145 ☐ | | Plastic Limit | 15 |
| Liquid limit Test: | ASTM D 4318 ☒ | AASHTO T 89 ☐ | | Plastic Index | 19 |
| Plastic limit Test: | ASTM D 4318 ☒ | AASHTO T 90 ☐ | | Group Symbol | CL |

Technician Name: Yogesh Chauhan

Technical Responsibility: Mal Krajan — *Certification #* — *Signature* — Laboratory Manager *Position*

# Moisture - Density Report

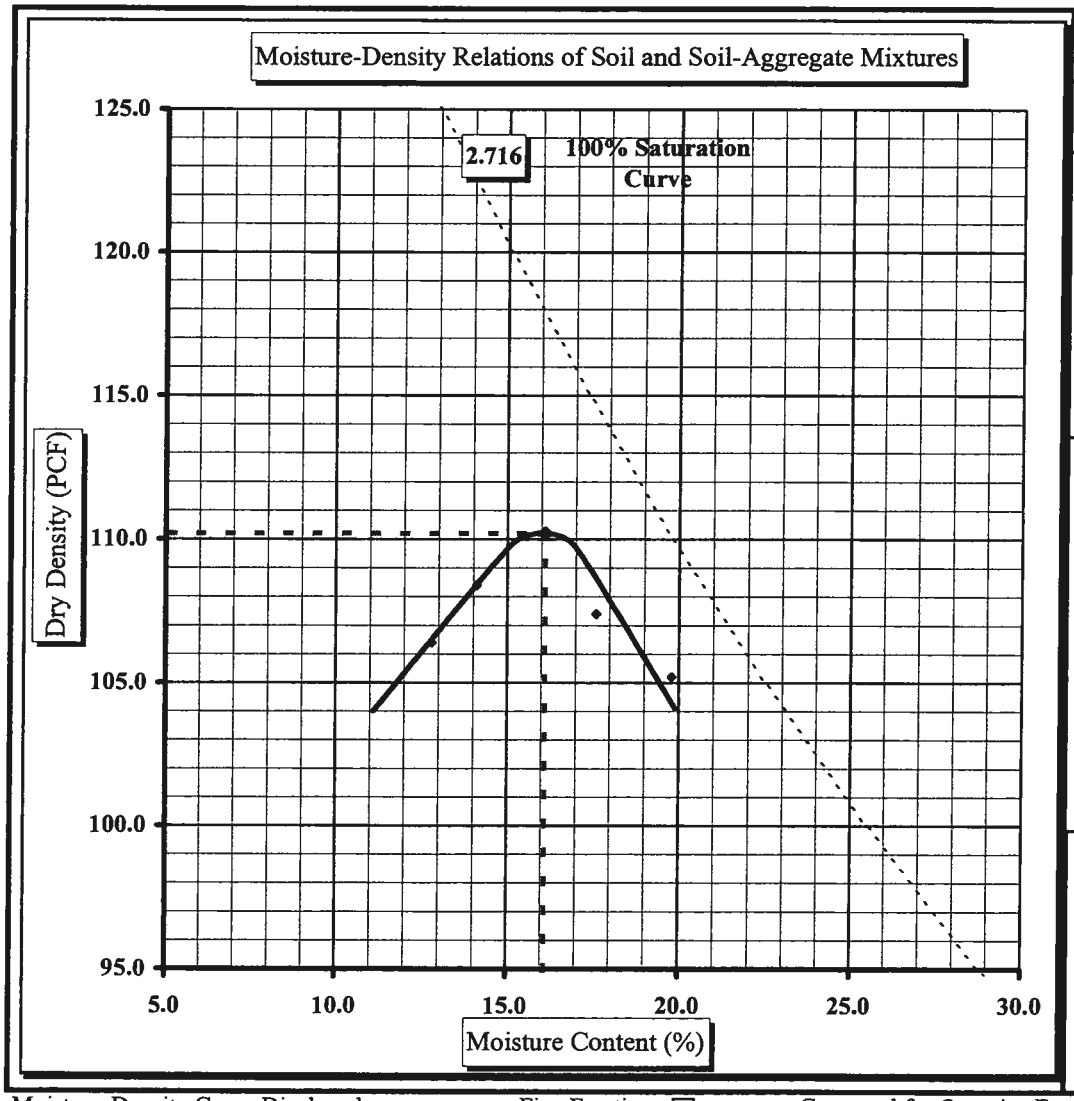
S&ME

**S&ME Project #:** **1054-07-241A** Report Date: October 10, 2008
**Project Name:** Edgecombe County landfill Test Date(s): 10/7 - 10/10/08
Client Name:
Client Address:

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-2 | Sample #: | Bag | Sample Date: | October 7, 2008 |
| Location: | Site-Borehole | Offset: | N/A | Depth (ft): | 0 - 2 ft. |
| Sample Description: | Orange-Tan Sandy Silty CLAY (CL) | | | | |

**Maximum Dry Density 110.2 PCF.** **Optimum Moisture Content 16.1 %**

**ASTM D 698 Method A**




**Soil Properties**

| | |
|---|---|
| Natural Moisture Content: | 65.1% |
| Liquid Limit: | 34 |
| Plastic Limit: | 15 |
| Plastic Index: | 19 |
| Specific Gravity: | 2.716 |

% Passing
#4 100.0

**Oversize Fraction**

Bulk Sp. Gravity
% Moisture
Oversize Fraction
**MDD**
**Opt. MC**

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

**References:** ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

S&ME

# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

**Project #: 1054-07-241A** — Test Date(s): 10/13 - 10/17/08

**Project Name: Edgecombe County Landfill** — Report Date: 10/17/08

Client Name:

Client Address:

Boring #: TP-2 | Sample #: Bag | Depth/Elevation: 0 - 2 ft. | Sample Date: 10/07/08

Location: Site | Offset: N/A | Sample Description: Orange-Tan Sandy Silty CLAY (CL)

Liquid Limit: 34 | Specific Gravity: 2.716 | Sample Type: lab-compacted | Sampled By: S&ME, Inc.

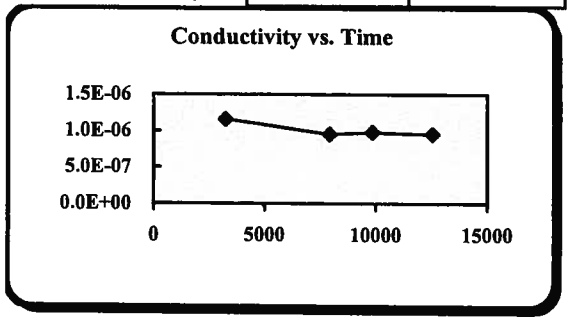
Plastic Limit: 15 | Plasticity Index: 19 | Percent Passing #200: 56.9 | Maximum Particle Size: #4

| Initial Sample Conditions | | | | Final Sample Conditions | | | |
|---|---|---|---|---|---|---|---|
| Height (cm): | 9.601 | Wet Unit Weight (lbs/ft$^3$): | 120.8 | Height (cm): | 9.601 | Dry Unit Weight (lbs/ft$^3$): | 104.8 |
| Diameter (cm): | 7.341 | Dry Unit Weight (lbs/ft$^3$): | 104.8 | Diameter (cm): | 7.341 | Percent Saturation: | 100.0 |
| Area (cm$^2$): | 42.33 | Percent Saturation: | 70.4 | Area (cm$^2$) | 42.33 | Void Ratio: | 0.6177 |
| Volume (cm$^3$): | 406.41 | Void Ratio: | 0.6177 | Volume (cm$^3$) | 406.41 | Porosity: | 0.3818 |
| Wet weight (grams): | 786.3 | Porosity: | 0.3818 | Wet weight (grams) | 845.0 | Measured *B* coefficient: 0.96 | |
| Dry Weight (grams): | 681.9 | **Station Corrections (cm)** | | Dry Weight (grams) | 681.9 | | |
| Percent Moisture: | 16.0 | Influent: 18.219 | Effluent: 18.335 | Percent Moisture: | 23.9 | MDD (pcf): 110.2 | Opt. (%): 16.1 |

| Testing Station | Burette Areas (cm$^2$): | | | | Effective Consolidation Stress (psi): | 3.0 | Permeant Liquid Used: | Deaired Demineralized water | |
|---|---|---|---|---|---|---|---|---|---|
| 5 | Influent: | 0.196 | Influent: | 0.196 | Cell Pressure (psi): | 73.0 | Influent Pressure (psi): | 70.5 | Effluent Pressure (psi) 70.0 |

| Start Date | Start Time | End Date | End Time | Time (seconds) | Temperature (°C) Initial | Temperature (°C) Final | Temperature (°C) Avg. | Corr. Factor | Initial INF. | Initial EFF. | Final INF. | Final EFF. | $h_1$ (cm) | $h_2$ (cm) | Grad-ient | K-Value (cm/sec) Uncorrected | K-Value (cm/sec) Corrected |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/16/08 | 10:06:00 AM | 10/16/08 | 11:00:00 AM | 3240 | 21.2 | 21.2 | 21.2 | 0.969 | 4.26 | 10.00 | 5.04 | 8.76 | 64.33 | 54.02 | 6.2 | 1.20E-06 | 1.16E-06 |
| 10/16/08 | 11:00:00 AM | 10/16/08 | 12:18:00 PM | 4680 | 21.2 | 21.2 | 21.2 | 0.969 | 5.04 | 8.76 | 6.06 | 7.80 | 54.02 | 43.92 | 5.1 | 9.83E-07 | 9.53E-07 |
| 10/16/08 | 12:18:00 PM | 10/16/08 | 12:50:00 PM | 1920 | 21.2 | 21.2 | 21.2 | 0.969 | 6.06 | 7.80 | 6.38 | 7.40 | 43.92 | 40.25 | 4.4 | 1.01E-06 | 9.79E-07 |
| 10/16/08 | 12:50:00 PM | 10/16/08 | 1:35:00 PM | 2700 | 21.2 | 21.2 | 21.2 | 0.969 | 6.38 | 7.40 | 6.82 | 6.95 | 40.25 | 35.71 | 4.0 | 9.85E-07 | 9.54E-07 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | ***Averages:*** | **1.04E-06** | **1.01E-06** |

Remarks: Test specimen compacted to 95% at opt. moisture.




References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan — Certification #:

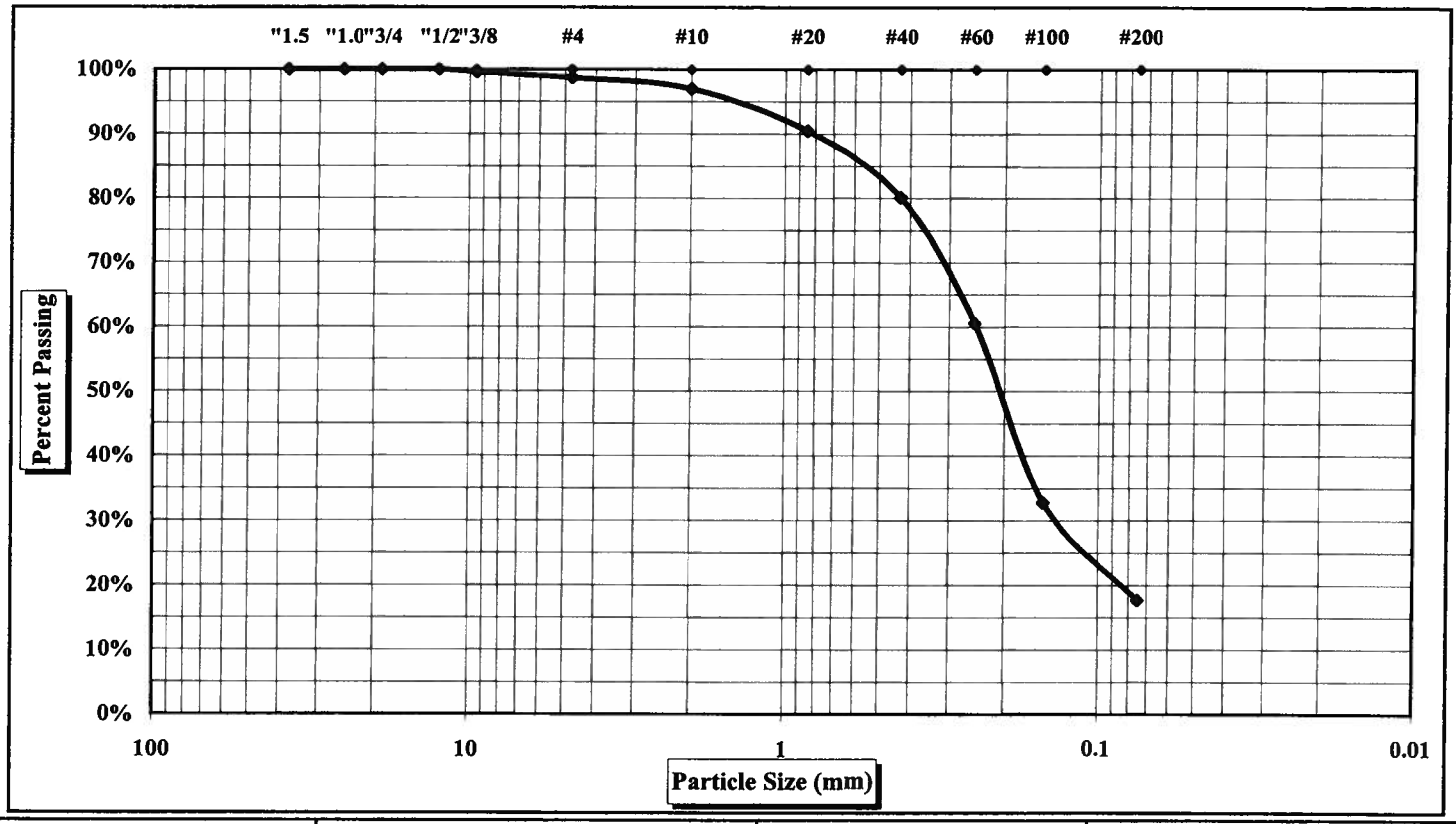
Technical Responsibility: Mal Krajan — Position: Laboratory Manager

# Particle Size Analysis of Soils

ASTM D 422

**S&ME Project #:** **1054-07-241A** Report Date: 10/11/08
**Project Name:** **Edgecombe County Landfill** Test Date(s): 10/9 - 10/11/08
Client Name:
Client Address:

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-2 | Sample #: | Jar | Sample Date: | 10/7/08 |
| Location: | On-Site | | | Depth (ft): | 2 - 4 ft. |
| Sample Description: | Gray Clayey Silty Fine to Medium SAND (Visual) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | 1/2" | Gravel | 1% | Medium Sand | 17% |
| Silt & Clay (% Passing #200) | 17.7% | Coarse Sand | 2% | Fine Sand | 62% |
| Apparent Relative Density | ND | Moisture Content | 22.0% | Organic Content | ND |
| Liquid Limit | ND | Plastic Limit | ND | Plastic Index | ND |

ND=Not determined

Description of Sand & Gravel

Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

**References:** ASTM D 422: Particle Size Analysis of Soils *Hydrometer portion of test method not utilized.*
ASTM D 421: Dry Preparation of Soil Samples ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

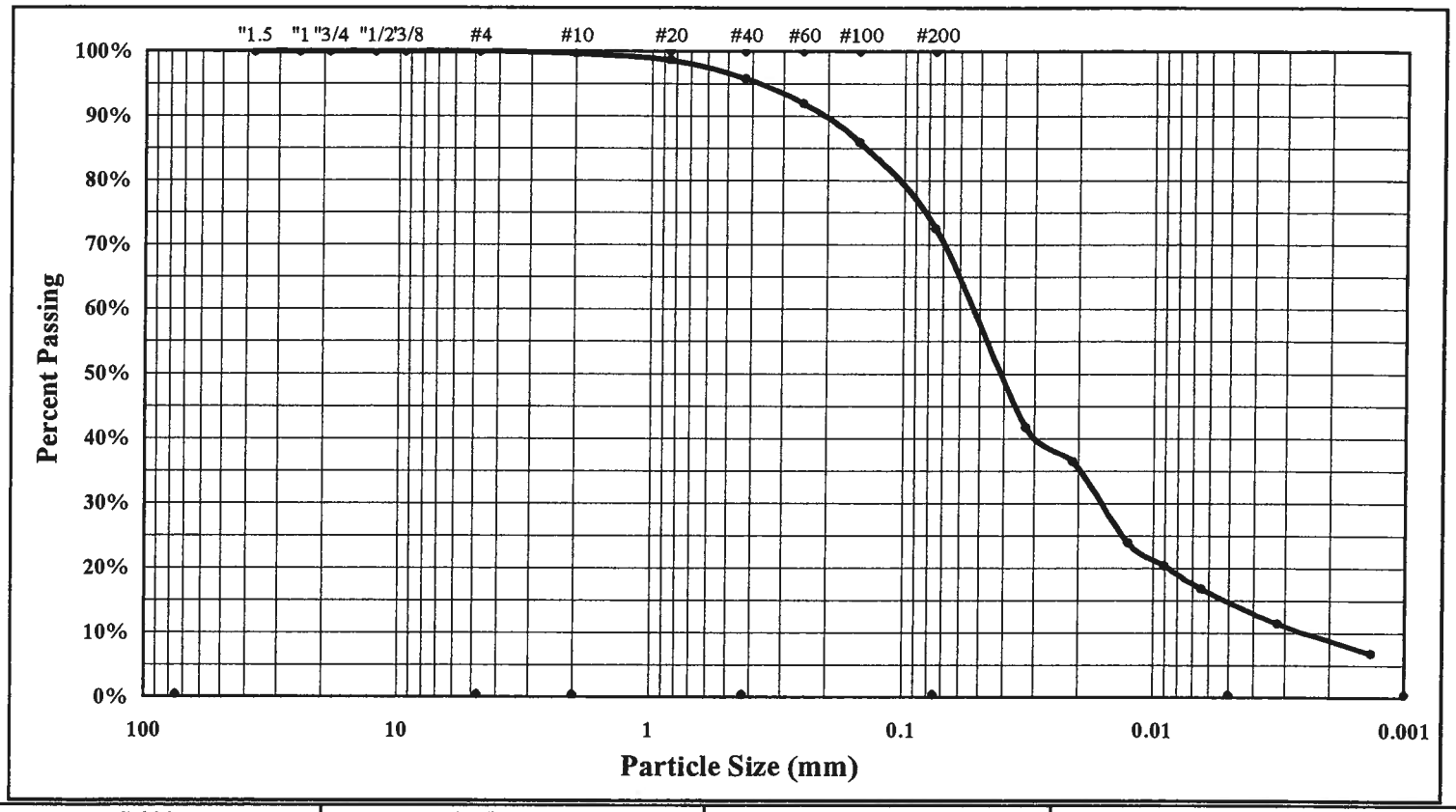
# Particle Size Analysis of Soils

ASTM D 422

S&ME

| | | | |
|---|---|---|---|
| S&ME Project #: | **1054-07-241A** | Report Date: | 10/17/08 |
| Project Name: | **Edgecombe County Landfill** | Test Date(s): | 10/9 - 10/17/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-2 | Sample #: | Bag | Sample Date: | 10/7/08 |
| Location: | Site-Borehole | Offset: | | Depth (ft): | 4 - 5 ft. |
| Sample Description: | Gray Sandy Silty CLAY (CL) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Gravel | 0.0% | Silt | 58.0% |
| Silt & Clay (% Passing #200) | 72.5% | Sand | 27.5% | Clay | 14.5% |
| Apparent Relative Density | 2.726 | Moisture Content | | Colloids | 6.8% |
| Liquid Limit | 34 | Plastic Limit | 21 | Plastic Index | 13 |

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

**References:** ASTM D 422: Particle Size Analysis of Soils ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

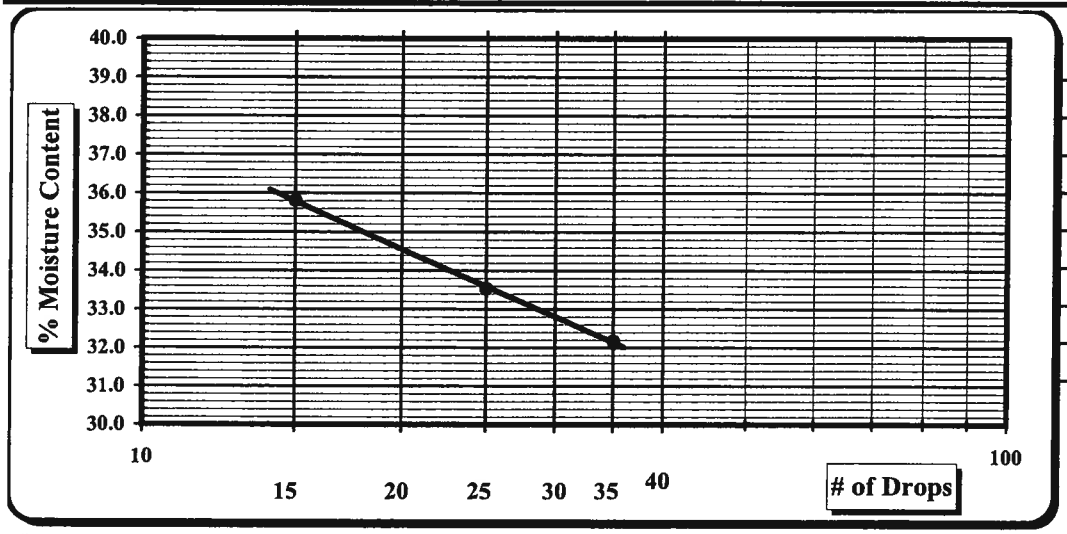
Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: **1054-07-241A** Report Date: 10/17/2008
Project Name: Edgecombe County Landfill Test Date(s): 10/9 - 10/17/08
Client Name:
Client Address:
Boring #: TP-2 Sample #: Bag Sample Date: 10/7/2008
Location: Site Borehole Offset: N/A Depth (ft): 4 - 5 ft.
Sample Description: Gray Sandy Silty CLAY (CL)

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Test # | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 |
| | Tare # | 23 | 22 | 15 | | | | 3 | 11 | |
| A | Tare Weight | 13.05 | 13.06 | 12.46 | | | | 13.03 | 12.54 | |
| B | Wet Soil Weight + A | 28.37 | 28.07 | 24.95 | | | | 25.94 | 26.31 | |
| C | Dry Soil Weight + A | 24.33 | 24.30 | 21.91 | | | | 23.70 | 23.91 | |
| D | Water Weight (B-C) | 4.04 | 3.77 | 3.04 | | | | 2.24 | 2.40 | |
| E | Dry Soil Weight (C-A) | 11.28 | 11.24 | 9.45 | | | | 10.67 | 11.37 | |
| F | % Moisture Content (D/E)*100 | 35.8% | 33.5% | 32.2% | | | | 21.0% | 21.1% | |
| N | # OF DROPS | 15 | 25 | 35 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| Ave. | Average | | | | | | | 21.1% | | |




| One Point Liquid Limit | | | |
|---|---|---|---|
| N | Factor | N | Factor |
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.990 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Preparation: | Wet Preparation ☐ | Dry Preparation ☒ | Air Dried ☒ | NP, Non-Plastic | ☐ |
| Liquid limit Test: | Multipoint Method ☒ | One-point Method ☐ | | Liquid Limit | 34 |
| Classification: | ASTM D 2487 ☒ | AASHTO M 145 ☐ | | Plastic Limit | 21 |
| Liquid limit Test: | ASTM D 4318 ☒ | AASHTO T 89 ☐ | | Plastic Index | 13 |
| Plastic limit Test: | ASTM D 4318 ☒ | AASHTO T 90 ☐ | | Group Symbol | CL |

Technician Name: Yogesh Chauhan

Certification #

Technical Responsibility: Mal Krajan _____ Laboratory Manager

Signature Position

# Moisture - Density Report

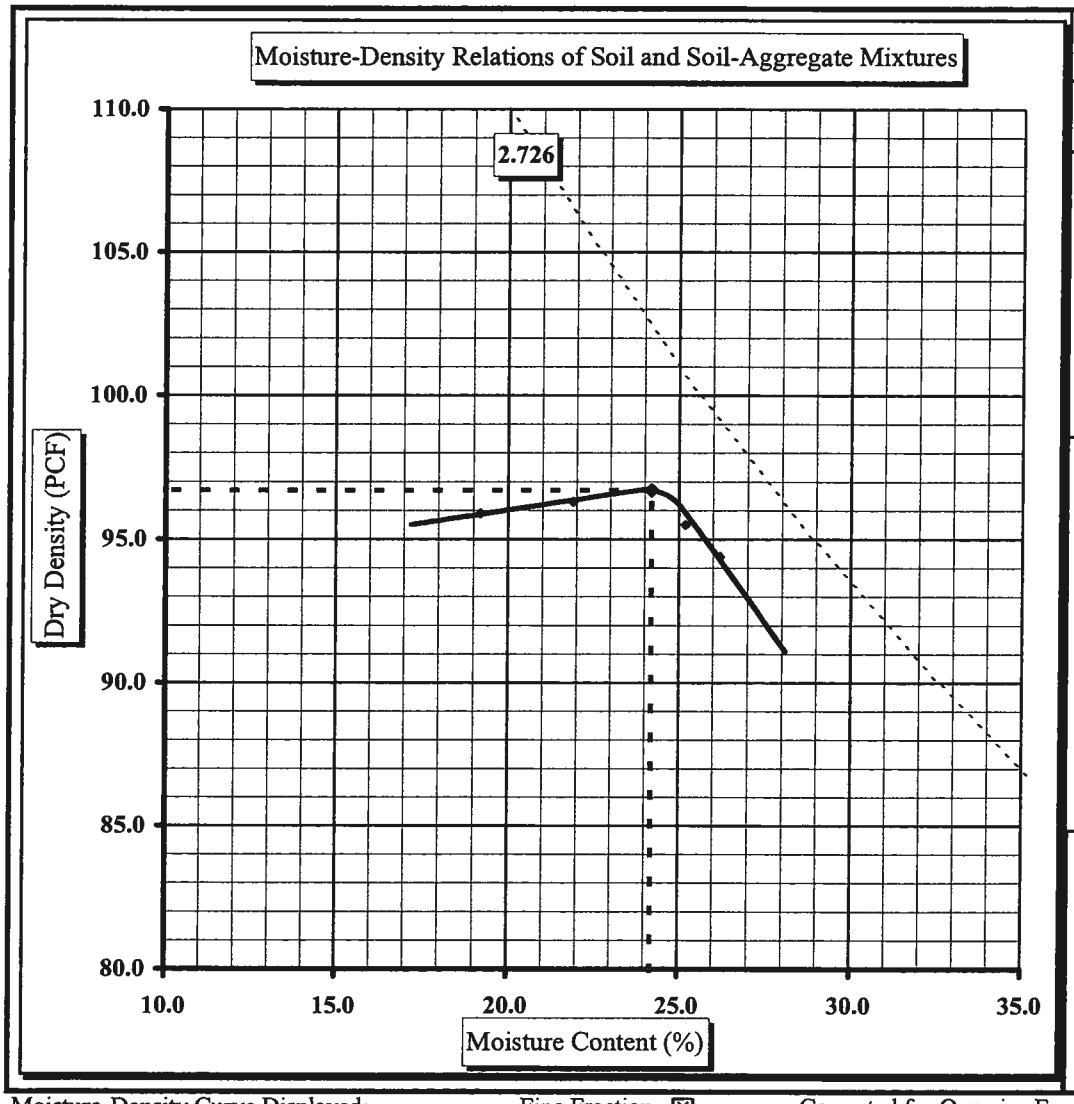
S&ME

**S&ME Project #:** **1054-07-241A** Report Date: October 10, 2008
**Project Name:** Edgecombe County landfill Test Date(s): 10/7 - 10/10/08
Client Name:
Client Address:

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-2 | Sample #: | Bag | Sample Date: | October 7, 2008 |
| Location: | Site-Borehole | Offset: | N/A | Depth (ft): | 4 - 5 ft. |
| Sample Description: | Gray Sandy Silty CLAY (CL) | | | | |

**Maximum Dry Density** **96.7** **PCF.** **Optimum Moisture Content** **24.2** **%**

**ASTM D 698 Method A**




**Soil Properties**

| | |
|---|---|
| Natural Moisture Content: | 47.1% |
| Liquid Limit: | 34 |
| Plastic Limit: | 21 |
| Plastic Index: | 13 |
| Specific Gravity: | 2.726 |

% Passing
#4 100.0

**Oversize Fraction**

Bulk Sp. Gravity
% Moisture
Oversize Fraction
**MDD**
**Opt. MC**

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

**References:** ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

S&ME

# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

**Project #: 1054-07-241A** — Test Date(s): 10/13 - 10/17/08

**Project Name: Edgecombe County Landfill** — Report Date: 10/17/08

Client Name:

Client Address:

Boring #: TP-2 | Sample #: Bag | Depth/Elevation: 4 - 5 ft. | Sample Date: 10/07/08

Location: Site | Offset: N/A | Sample Description: Gray Sandy Silty CLAY (CL)

Liquid Limit: 34 | Specific Gravity: 2.726 | Sample Type: lab-compacted | Sampled By: S&ME, Inc.

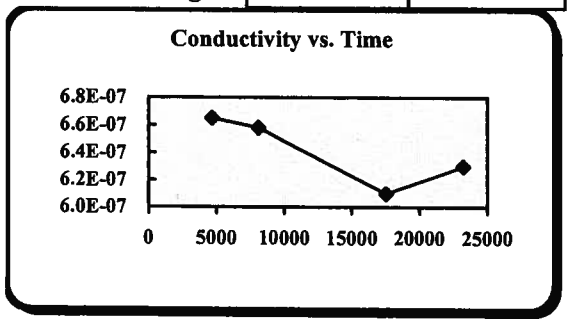
Plastic Limit: 21 | Plasticity Index: 13 | Percent Passing #200: 72.5 | Maximum Particle Size: #4

| Initial Sample Conditions | | | | Final Sample Conditions | | | |
|---|---|---|---|---|---|---|---|
| Height (cm): | 9.619 | Wet Unit Weight (lbs/ft$^3$): | 114.9 | Height (cm): | 9.619 | Dry Unit Weight (lbs/ft$^3$): | 92.4 |
| Diameter (cm): | 7.343 | Dry Unit Weight (lbs/ft$^3$): | 92.4 | Diameter (cm): | 7.343 | Percent Saturation: | 100.0 |
| Area (cm$^2$): | 42.35 | Percent Saturation: | 78.7 | Area (cm$^2$) | 42.35 | Void Ratio: | 0.8414 |
| Volume (cm$^3$): | 407.36 | Void Ratio: | 0.8414 | Volume (cm$^3$) | 407.36 | Porosity: | 0.4569 |
| Wet weight (grams): | 749.9 | Porosity: | 0.4569 | Wet weight (grams) | 793.9 | Measured ***B*** coefficient: 0.95 | |
| Dry Weight (grams): | 602.8 | **Station Corrections (cm)** | | Dry Weight (grams) | 602.8 | MDD (pcf): 96.7 | Opt. (%): 24.2 |
| Percent Moisture: | 24.3 | Influent: -2.454 | Effluent: -2.613 | Percent Moisture: | 31.7 | | |

| Testing Station | Burette Areas (cm$^2$): | | | | Effective Consolidation Stress (psi): | 3.0 | Permeant Liquid Used: | Deaired Demineralized water | |
|---|---|---|---|---|---|---|---|---|---|
| 4 | Influent: | 0.720 | Influent: | 0.720 | Cell Pressure (psi): | 73.0 | Influent Pressure (psi): | 70.1 | Effluent Pressure (psi) 70.0 |

| Start | | End | | Time | Temperature (°C) | | | Corr. | Initial | | Final | | $h_1$ | $h_2$ | Grad- | K-Value (cm/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Date | Time | (seconds) | Initial | Final | Avg. | Factor | INF. | EFF. | INF. | EFF. | (cm) | (cm) | ient | Uncorrected | Corrected |
| 10/16/08 | 8:47:00 AM | 10/16/08 | 10:05:00 AM | 4680 | 21.2 | 21.2 | 21.2 | 0.969 | 30.50 | 49.30 | 31.00 | 48.80 | 25.99 | 24.99 | 2.6 | 6.86E-07 | 6.65E-07 |
| 10/16/08 | 10:05:00 AM | 10/16/08 | 11:02:00 AM | 3420 | 21.2 | 21.2 | 21.2 | 0.969 | 31.00 | 48.80 | 31.30 | 48.40 | 24.99 | 24.29 | 2.6 | 6.79E-07 | 6.58E-07 |
| 10/16/08 | 11:02:00 AM | 10/16/08 | 1:39:00 PM | 9420 | 21.2 | 21.2 | 21.2 | 0.969 | 31.30 | 48.40 | 32.20 | 47.60 | 24.29 | 22.59 | 2.4 | 6.30E-07 | 6.10E-07 |
| 10/16/08 | 1:39:00 PM | 10/16/08 | 3:14:00 PM | 5700 | 21.2 | 21.2 | 21.2 | 0.969 | 32.20 | 47.60 | 32.70 | 47.10 | 22.59 | 21.59 | 2.3 | 6.50E-07 | 6.30E-07 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | ***Averages:*** | **6.61E-07** | **6.41E-07** |

Remarks: Test specimen compacted to 95% at opt. moisture.




References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan — Certification #:

Technical Responsibility: Mal Krajan — Position: Laboratory Manager

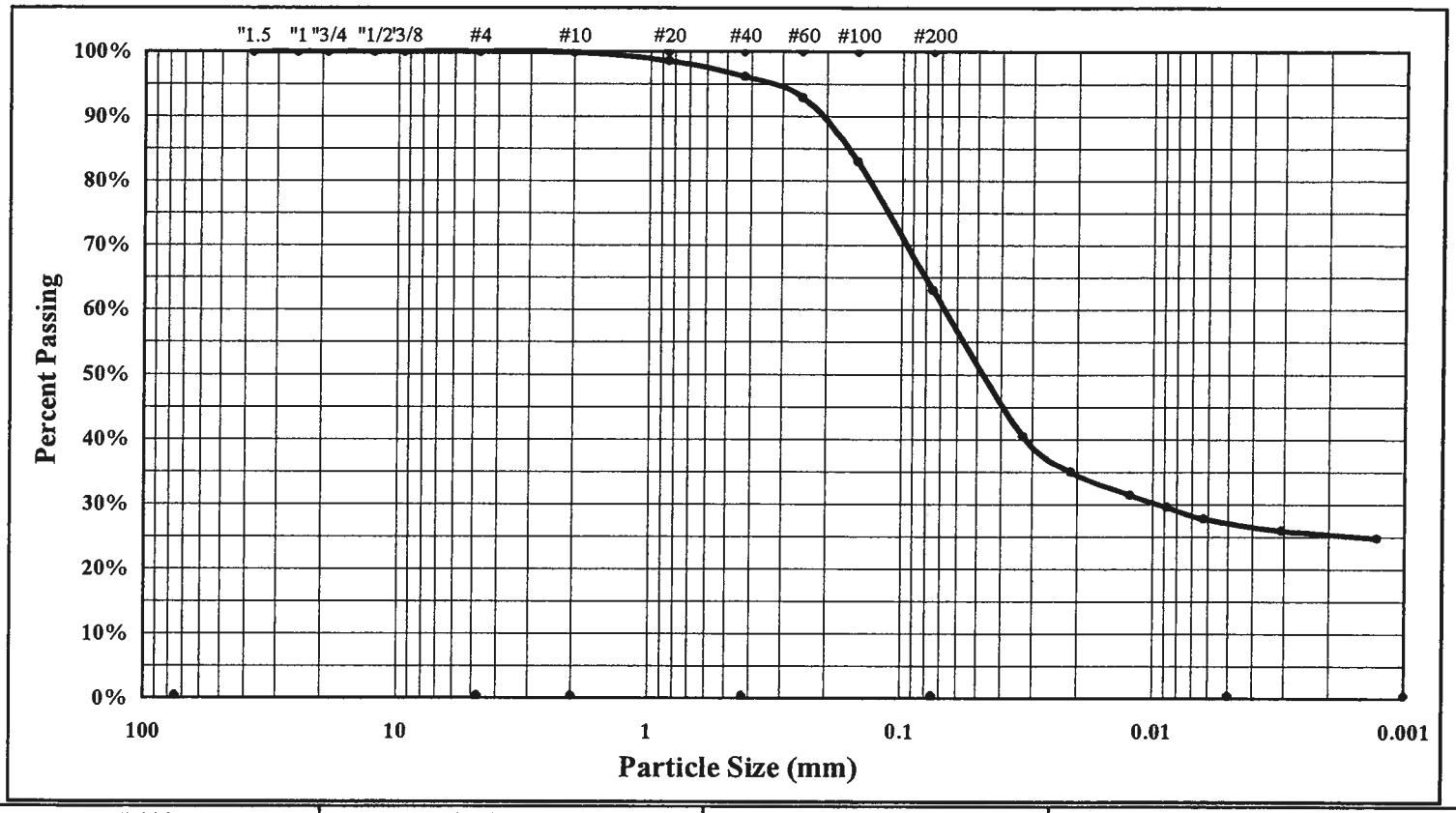
# Particle Size Analysis of Soils

ASTM D 422

S&ME

| | | | |
|---|---|---|---|
| S&ME Project #: | **1054-07-241A** | Report Date: | 10/17/08 |
| Project Name: | **Edgecombe County Landfill** | Test Date(s): | 10/9 - 10/17/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-3 | Sample #: | Bag | Sample Date: | 10/7/08 |
| Location: | Site-Borehole | Offset: | | Depth (ft): | 0 - 2 ft. |
| Sample Description: | Tan-Orange Sandy SILT (Visual) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Gravel | 0.0% | Silt | 36.0% |
| Silt & Clay (% Passing #200) | 63.0% | Sand | 37.0% | Clay | 27.0% |
| Apparent Relative Density | 2.725 | Moisture Content | | Colloids | 24.8% |
| Liquid Limit | ND | Plastic Limit | ND | Plastic Index | ND |

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

**References:** ASTM D 422: Particle Size Analysis of Soils ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

# Moisture - Density Report

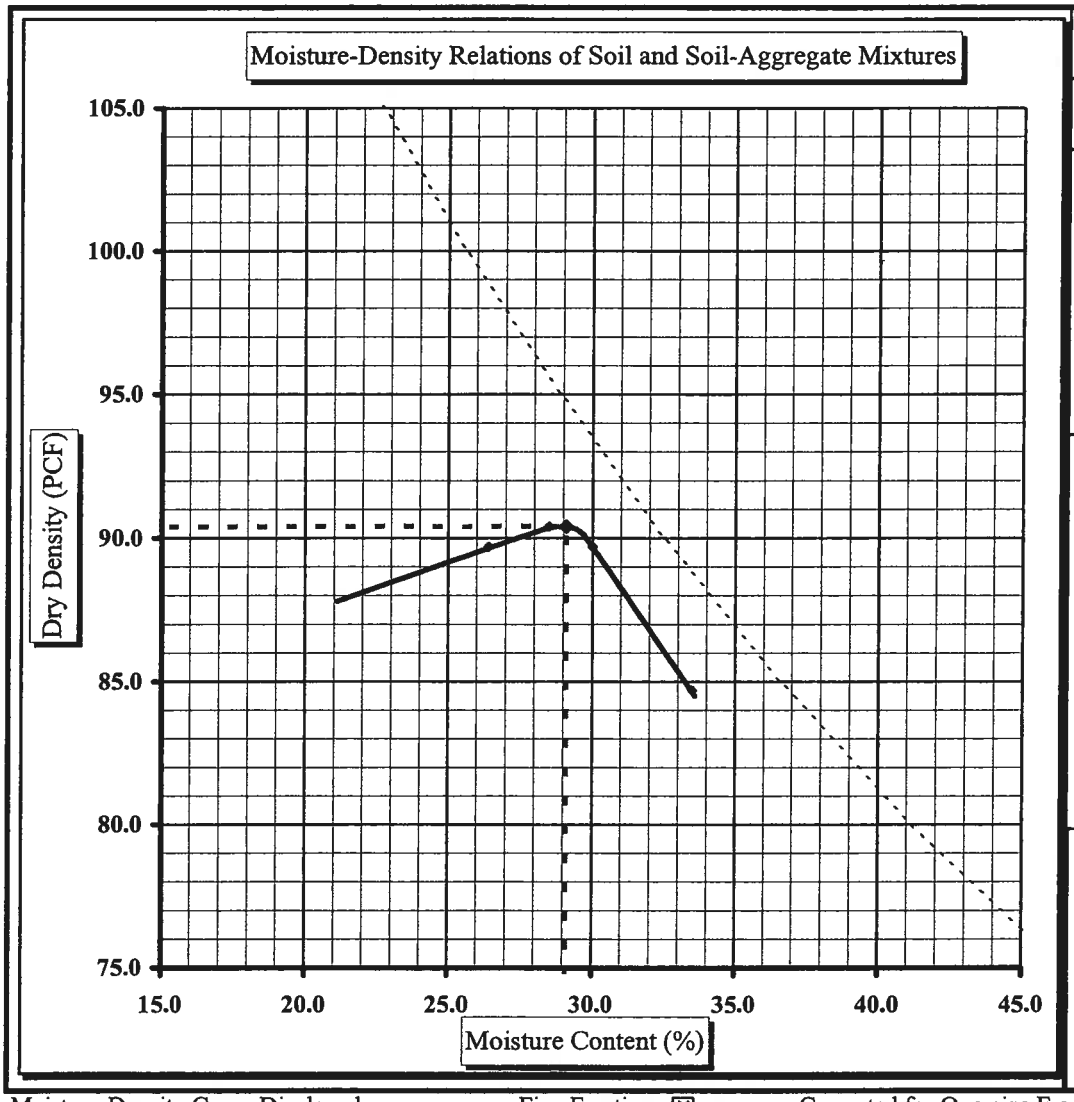
S&ME

| | | | |
|---|---|---|---|
| **S&ME Project #:** | **1054-07-241A** | Report Date: | October 10, 2008 |
| **Project Name:** | Edgecombe County landfill | Test Date(s): | 10/7 - 10/10/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-3 | Sample #: | Bag | Sample Date: | October 7, 2008 |
| Location: | Site-Borehole | Offset: | N/A | Depth (ft): | 0 - 2 ft. |
| Sample Description: | Tan-Orange Sandy SILT (Visual) | | | | |

**Maximum Dry Density** **90.4** **PCF.** **Optimum Moisture Content** **29.1** **%**

**ASTM D 698 Method A**




**Soil Properties**

| | |
|---|---|
| Natural Moisture Content: | 39.3% |
| Liquid Limit: | ND |
| Plastic Limit: | ND |
| Plastic Index: | ND |
| Specific Gravity: | 2.725 |

% Passing

| | |
|---|---|
| #4 | 100.0 |

**Oversize Fraction**

Bulk Sp. Gravity
% Moisture
Oversize Fraction
**MDD**
**Opt. MC**

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

**References:** ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

S&ME

# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

**Project #: 1054-07-241A** — Test Date(s): 10/13 - 10/17/08

**Project Name: Edgecombe County Landfill** — Report Date: 10/17/08

Client Name:

Client Address:

Boring #: TP-3 | Sample #: Bag | Depth/Elevation: 0 - 2 ft. | Sample Date: 10/07/08

Location: Site | Offset: N/A | Sample Description: (Visual) Tan-Orange Sandy SILT (Visual)

Liquid Limit: ND | Specific Gravity: 2.725 | Sample Type: lab-compacted | Sampled By: S&ME, Inc.

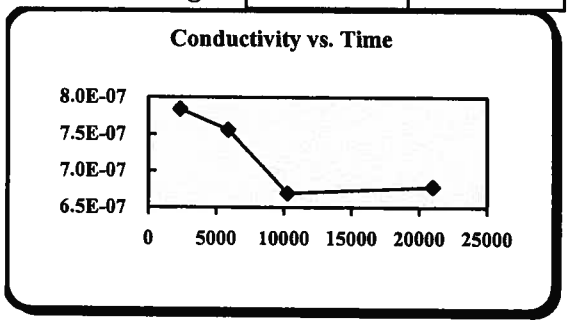
Plastic Limit: ND | Plasticity Index: ND | Percent Passing #200: 63.0 | Maximum Particle Size: #4

| Initial Sample Conditions | | | | Final Sample Conditions | | | |
|---|---|---|---|---|---|---|---|
| Height (cm): | 9.609 | Wet Unit Weight (lbs/ft$^3$): | 112.2 | Height (cm): | 9.609 | Dry Unit Weight (lbs/ft$^3$): | 85.7 |
| Diameter (cm): | 7.328 | Dry Unit Weight (lbs/ft$^3$): | 85.7 | Diameter (cm): | 7.328 | Percent Saturation: | 98.2 |
| Area (cm$^2$): | 42.18 | Percent Saturation: | 81.6 | Area (cm$^2$) | 42.18 | Void Ratio: | 0.9849 |
| Volume (cm$^3$): | 405.31 | Void Ratio: | 0.9849 | Volume (cm$^3$) | 405.31 | Porosity: | 0.4962 |
| Wet weight (grams): | 728.5 | Porosity: | 0.4962 | Wet weight (grams) | 753.3 | Measured ***B*** coefficient: 0.98 | |
| Dry Weight (grams): | 556.1 | **Station Corrections (cm)** | | Dry Weight (grams) | 556.1 | MDD (pcf): 90.4 | Opt. (%): 29.1 |
| Percent Moisture: | 29.5 | Influent: -2.962 | Effluent: -2.962 | Percent Moisture: | 35.5 | | |

| Testing Station | Burette Areas (cm$^2$): | | | | Effective Consolidation Stress (psi): | 3.0 | Permeant Liquid Used: | Deaired Demineralized water | |
|---|---|---|---|---|---|---|---|---|---|
| 3 | Influent: | 0.720 | Influent: | 0.720 | Cell Pressure (psi): | 73.0 | Influent Pressure (psi): | 70.5 | Effluent Pressure (psi) 70.0 |

| Start Date | Start Time | End Date | End Time | Time (seconds) | Temperature (°C) Initial | Final | Avg. | Corr. Factor | Initial INF. | Initial EFF. | Final INF. | Final EFF. | $h_1$ (cm) | $h_2$ (cm) | Gradient | K-Value (cm/sec) Uncorrected | Corrected |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/16/08 | 9:25:00 AM | 10/16/08 | 10:04:00 AM | 2340 | 21.2 | 21.2 | 21.2 | 0.969 | 31.10 | 48.50 | 31.70 | 47.90 | 52.56 | 51.36 | 5.4 | 8.09E-07 | 7.84E-07 |
| 10/16/08 | 10:04:00 AM | 10/16/08 | 11:03:00 AM | 3540 | 21.2 | 21.2 | 21.2 | 0.969 | 31.70 | 47.90 | 32.50 | 47.00 | 51.36 | 49.66 | 5.3 | 7.80E-07 | 7.56E-07 |
| 10/16/08 | 11:03:00 AM | 10/16/08 | 12:16:00 PM | 4380 | 21.2 | 21.2 | 21.2 | 0.969 | 32.50 | 47.00 | 33.40 | 46.10 | 49.66 | 47.86 | 5.1 | 6.91E-07 | 6.70E-07 |
| 10/16/08 | 12:16:00 PM | 10/16/08 | 3:15:00 PM | 10740 | 21.2 | 21.2 | 21.2 | 0.969 | 33.40 | 46.10 | 35.50 | 44.00 | 47.86 | 43.66 | 4.8 | 7.01E-07 | 6.79E-07 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | ***Averages:*** | **7.45E-07** | **7.22E-07** |

Remarks: ND= Not Determined. Test specimen compacted to 95% at opt. moisture.




References:
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ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan — Certification #:

Technical Responsibility: Mal Krajan — Position: Laboratory Manager

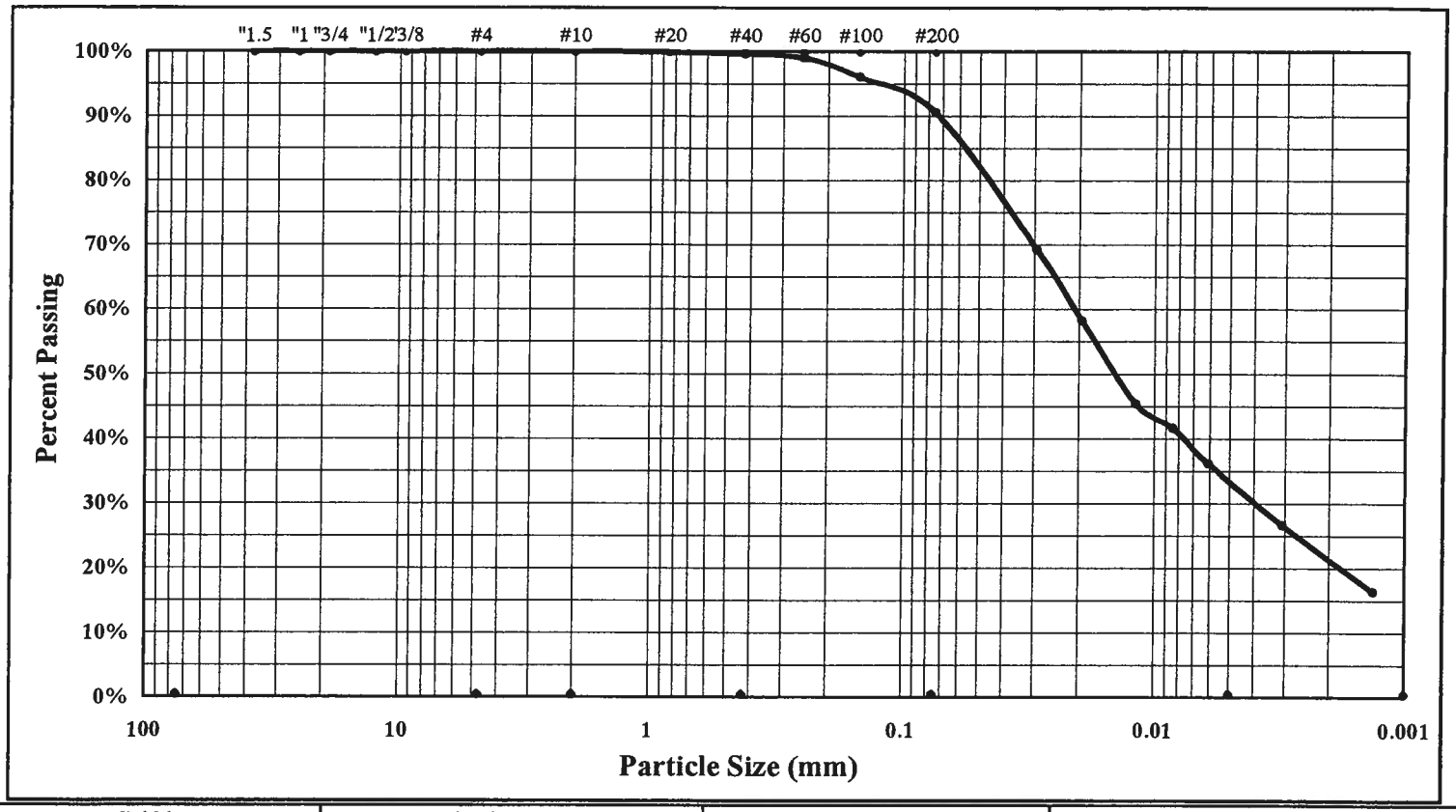
# Particle Size Analysis of Soils

ASTM D 422

S&ME

| | | | |
|---|---|---|---|
| S&ME Project #: | **1054-07-241A** | Report Date: | 10/17/08 |
| Project Name: | **Edgecombe County Landfill** | Test Date(s): | 10/9 - 10/17/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-3 | Sample #: | Bag | Sample Date: | 10/7/08 |
| Location: | Site-Borehole | Offset: | | Depth (ft): | 6 - 8 ft. |
| Sample Description: | Gray Slightly Sandy Silty CLAY (CL) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Gravel | 0.0% | Silt | 57.1% |
| Silt & Clay (% Passing #200) | 90.6% | Sand | 9.4% | Clay | 33.5% |
| Apparent Relative Density | 2.754 | Moisture Content | | Colloids | 16.3% |
| Liquid Limit | ND | Plastic Limit | ND | Plastic Index | ND |

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

**References:** ASTM D 422: Particle Size Analysis of Soils ASTM D 421: Dry Preparation of Soil Samples
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ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

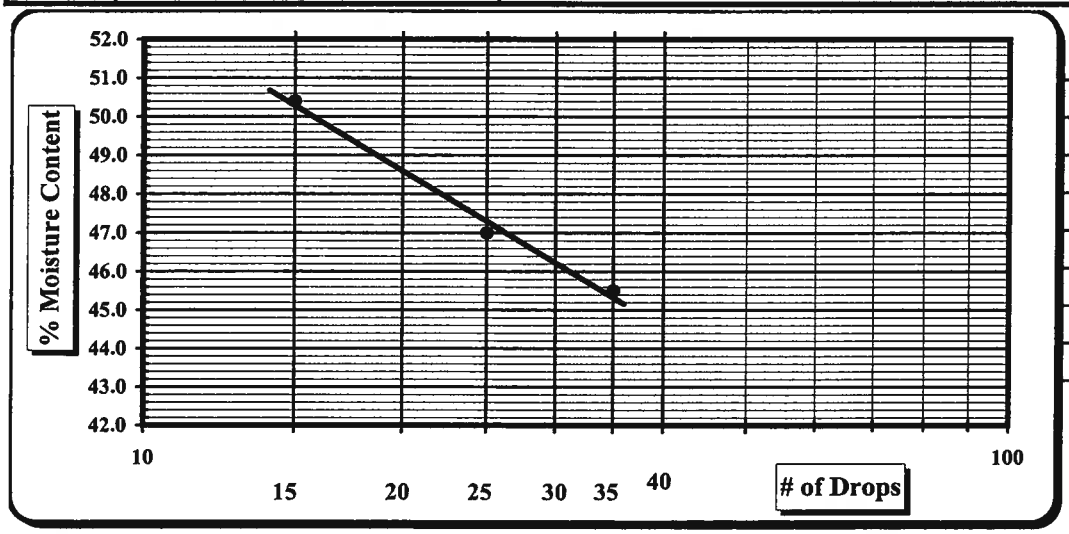
Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: **1054-07-241A** Report Date: 10/17/2008
Project Name: Edgecombe County Landfill Test Date(s): 10/9 - 10/17/08
Client Name:
Client Address:
Boring #: TP-3 Sample #: Bag Sample Date: 10/7/2008
Location: Site Borehole Offset: N/A Depth (ft): 6 - 8 ft.
Sample Description: Gray Slightly Sandy Silty CLAY (CL)

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Test # | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 |
| | Tare # | 21 | 29 | 19 | | | | 27 | 24 | |
| A | Tare Weight | 12.90 | 13.00 | 13.07 | | | | 13.02 | 13.02 | |
| B | Wet Soil Weight + A | 25.27 | 28.48 | 31.88 | | | | 26.03 | 26.13 | |
| C | Dry Soil Weight + A | 21.40 | 23.53 | 25.58 | | | | 23.47 | 23.55 | |
| D | Water Weight (B-C) | 3.87 | 4.95 | 6.30 | | | | 2.56 | 2.58 | |
| E | Dry Soil Weight (C-A) | 8.50 | 10.53 | 12.51 | | | | 10.45 | 10.53 | |
| F | % Moisture Content (D/E)*100 | 45.5% | 47.0% | 50.4% | | | | 24.5% | 24.5% | |
| N | # OF DROPS | 35 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| Ave. | Average | | | | | | | 24.5% | | |




| One Point Liquid Limit | | | |
|---|---|---|---|
| N | Factor | N | Factor |
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.990 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Preparation: | Wet Preparation ☐ | Dry Preparation ☒ | Air Dried ☒ | NP, Non-Plastic | ☐ |
| Liquid limit Test: | Multipoint Method ☒ | One-point Method ☐ | | Liquid Limit | 47 |
| Classification: | ASTM D 2487 ☒ | AASHTO M 145 ☐ | | Plastic Limit | 25 |
| Liquid limit Test: | ASTM D 4318 ☒ | AASHTO T 89 ☐ | | Plastic Index | 22 |
| Plastic limit Test: | ASTM D 4318 ☒ | AASHTO T 90 ☐ | | Group Symbol | CL |

Technician Name: Yogesh Chauhan

Technical Responsibility: Mal Krajan _____ (Signature) Certification # Laboratory Manager (Position)

# Moisture - Density Report

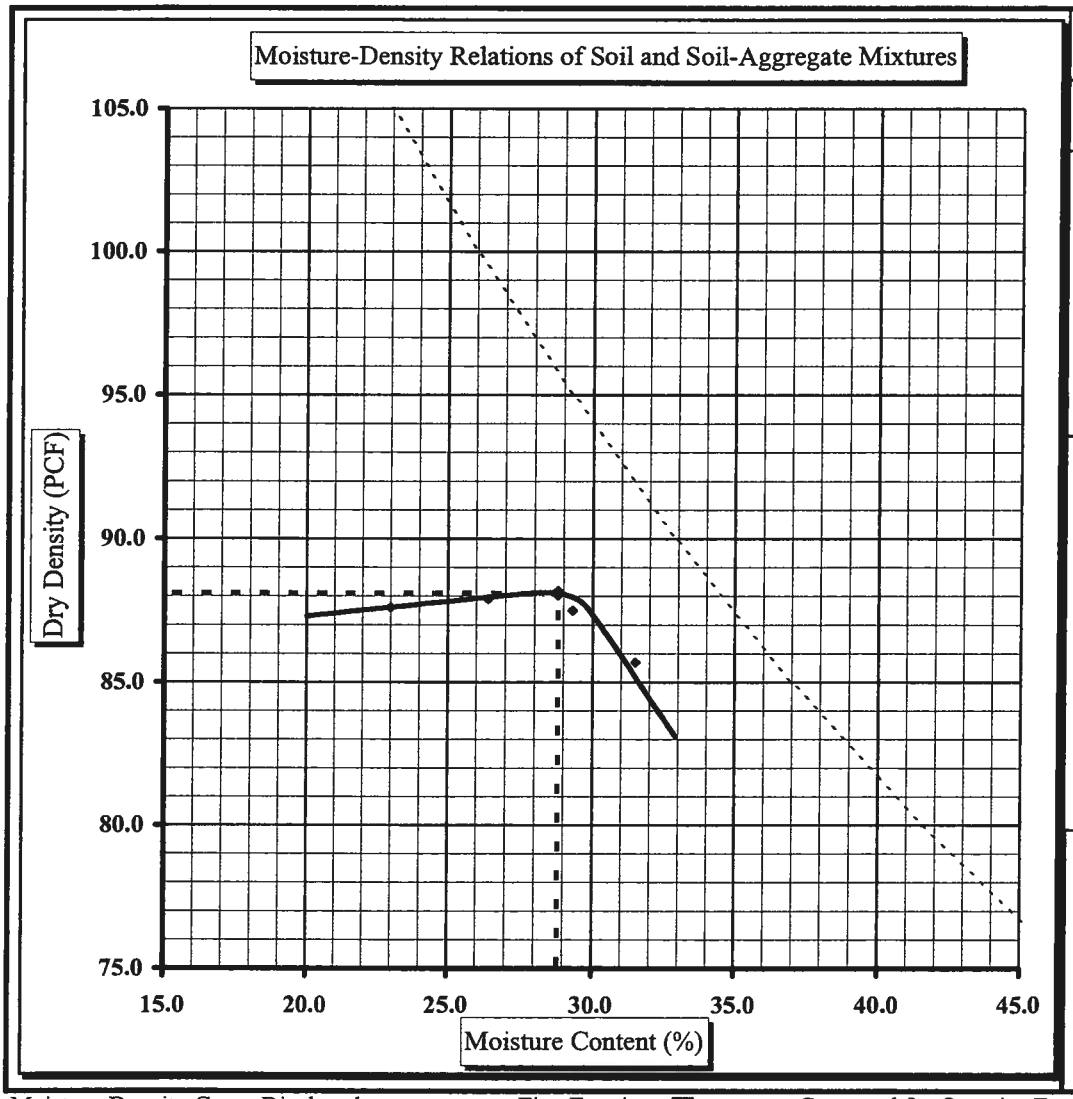
S&ME

| | | | |
|---|---|---|---|
| **S&ME Project #:** | **1054-07-241A** | Report Date: | October 10, 2008 |
| **Project Name:** | Edgecombe County landfill | Test Date(s): | 10/7 - 10/10/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-3 | Sample #: | Bag | Sample Date: | October 7, 2008 |
| Location: | Site-Borehole | Offset: | N/A | Depth (ft): | 6 - 8 ft. |
| Sample Description: | Gray Slightly Sandy Silty CLAY (CL) | | | | |

**Maximum Dry Density** **88.1** **PCF.** **Optimum Moisture Content** **28.8** **%**

**ASTM D 698 Method A**




**Soil Properties**

| | |
|---|---|
| Natural Moisture Content: | 65.1% |
| Liquid Limit: | 47 |
| Plastic Limit: | 25 |
| Plastic Index: | 22 |
| Specific Gravity: | 2.754 |

% Passing

| | |
|---|---|
| #4 | 100.0 |

**Oversize Fraction**

Bulk Sp. Gravity
% Moisture
Oversize Fraction
**MDD**
**Opt. MC**

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

**References:** ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

S&ME

# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

**Project #: 1054-07-241A** — Test Date(s): 10/13 - 10/17/08

**Project Name: Edgecombe County Landfill** — Report Date: 10/17/08

Client Name:

Client Address:

Boring #: TP-3 | Sample #: Bag | Depth/Elevation: 6 - 8 ft. | Sample Date: 10/07/08

Location: Site | Offset: N/A | Sample Description: Gray Slightly Sandy Silty CLAY (CL)

Liquid Limit: 47 | Specific Gravity: 2.754 | Sample Type: lab-compacted | Sampled By: S&ME, Inc.

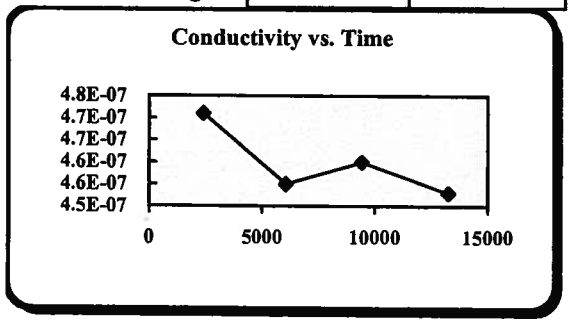
Plastic Limit: 25 | Plasticity Index: 22 | Percent Passing #200: 90.6 | Maximum Particle Size: #4

| Initial Sample Conditions | | | | Final Sample Conditions | | | |
|---|---|---|---|---|---|---|---|
| Height (cm): | 9.634 | Wet Unit Weight (lbs/ft$^3$): | 108.0 | Height (cm): | 9.634 | Dry Unit Weight (lbs/ft$^3$): | 83.7 |
| Diameter (cm): | 7.338 | Dry Unit Weight (lbs/ft$^3$): | 83.7 | Diameter (cm): | 7.338 | Percent Saturation: | 100.0 |
| Area (cm$^2$): | 42.29 | Percent Saturation: | 76.6 | Area (cm$^2$) | 42.29 | Void Ratio: | 1.0536 |
| Volume (cm$^3$): | 407.42 | Void Ratio: | 1.0536 | Volume (cm$^3$) | 407.42 | Porosity: | 0.5131 |
| Wet weight (grams): | 704.6 | Porosity: | 0.5131 | Wet weight (grams) | 762.6 | Measured *B* coefficient: 0.96 | |
| Dry Weight (grams): | 546.2 | Station Corrections (cm) | | Dry Weight (grams) | 546.2 | MDD (pcf): 88.1 | Opt. (%): 28.8 |
| Percent Moisture: | 29.3 | Influent: 18.181 | Effluent: 18.656 | Percent Moisture: | 39.6 | | |

| Testing Station | Burette Areas (cm$^2$): | | | | Effective Consolidation Stress (psi): | 3.0 | Permeant Liquid Used: | Deaired Demineralized water | |
|---|---|---|---|---|---|---|---|---|---|
| 6 | Influent: | 0.196 | Influent: | 0.196 | Cell Pressure (psi): | 73.0 | Influent Pressure (psi): | 70.7 | Effluent Pressure (psi) 70.0 |

| Start Date | Start Time | End Date | End Time | Time (seconds) | Temperature (°C) Initial | Final | Avg. | Corr. Factor | Initial INF. | Initial EFF. | Final INF. | Final EFF. | $h_1$ (cm) | $h_2$ (cm) | Gradient | K-Value (cm/sec) Uncorrected | Corrected |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/16/08 | 1:36:00 PM | 10/16/08 | 2:16:00 PM | 2400 | 21.2 | 21.2 | 21.2 | 0.969 | 4.84 | 9.80 | 5.18 | 9.40 | 74.05 | 70.28 | 7.5 | 4.86E-07 | 4.71E-07 |
| 10/16/08 | 2:16:00 PM | 10/16/08 | 3:17:00 PM | 3660 | 21.2 | 21.2 | 21.2 | 0.969 | 5.18 | 9.40 | 5.70 | 8.90 | 70.28 | 65.07 | 7.0 | 4.70E-07 | 4.55E-07 |
| 10/16/08 | 3:17:00 PM | 10/16/08 | 4:13:00 PM | 3360 | 21.2 | 21.2 | 21.2 | 0.969 | 5.70 | 8.90 | 6.16 | 8.48 | 65.07 | 60.58 | 6.5 | 4.75E-07 | 4.60E-07 |
| 10/16/08 | 4:13:00 PM | 10/16/08 | 5:17:00 PM | 3840 | 21.2 | 21.2 | 21.2 | 0.969 | 6.16 | 8.48 | 6.60 | 8.00 | 60.58 | 55.89 | 6.0 | 4.68E-07 | 4.53E-07 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | *Averages:* | **4.75E-07** | **4.60E-07** |

Remarks: Test specimen compacted to 95% at opt. moisture.




References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan — Certification #:

Technical Responsibility: Mal Krajan — Position: Laboratory Manager

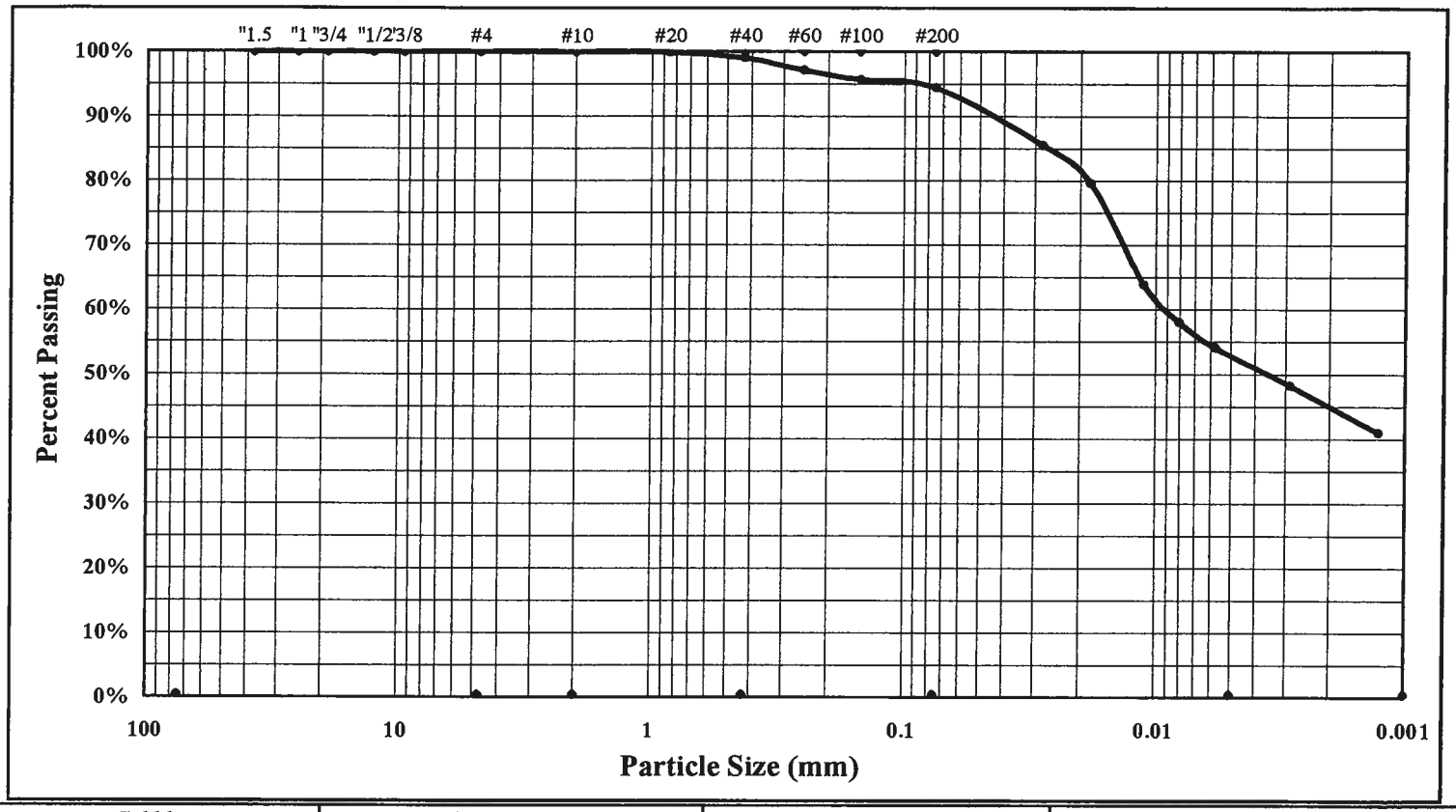
# Particle Size Analysis of Soils

ASTM D 422

S&ME

| | | | |
|---|---|---|---|
| S&ME Project #: | **1054-07-241A** | Report Date: | 10/17/08 |
| Project Name: | **Edgecombe County Landfill** | Test Date(s): | 10/9 - 10/17/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-6 | Sample #: | Jar | Sample Date: | 10/7/08 |
| Location: | Site-Borehole | Offset: | | Depth (ft): | 5 - 7 ft. |
| Sample Description: | Tan Clayey SILT (Visual) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #10 | Gravel | 0.0% | Silt | 41.4% |
| Silt & Clay (% Passing #200) | 94.4% | Sand | 5.6% | Clay | 53.0% |
| Apparent Relative Density | 2.715 | Moisture Content | | Colloids | 40.9% |
| Liquid Limit | ND | Plastic Limit | ND | Plastic Index | ND |

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

**References:** ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

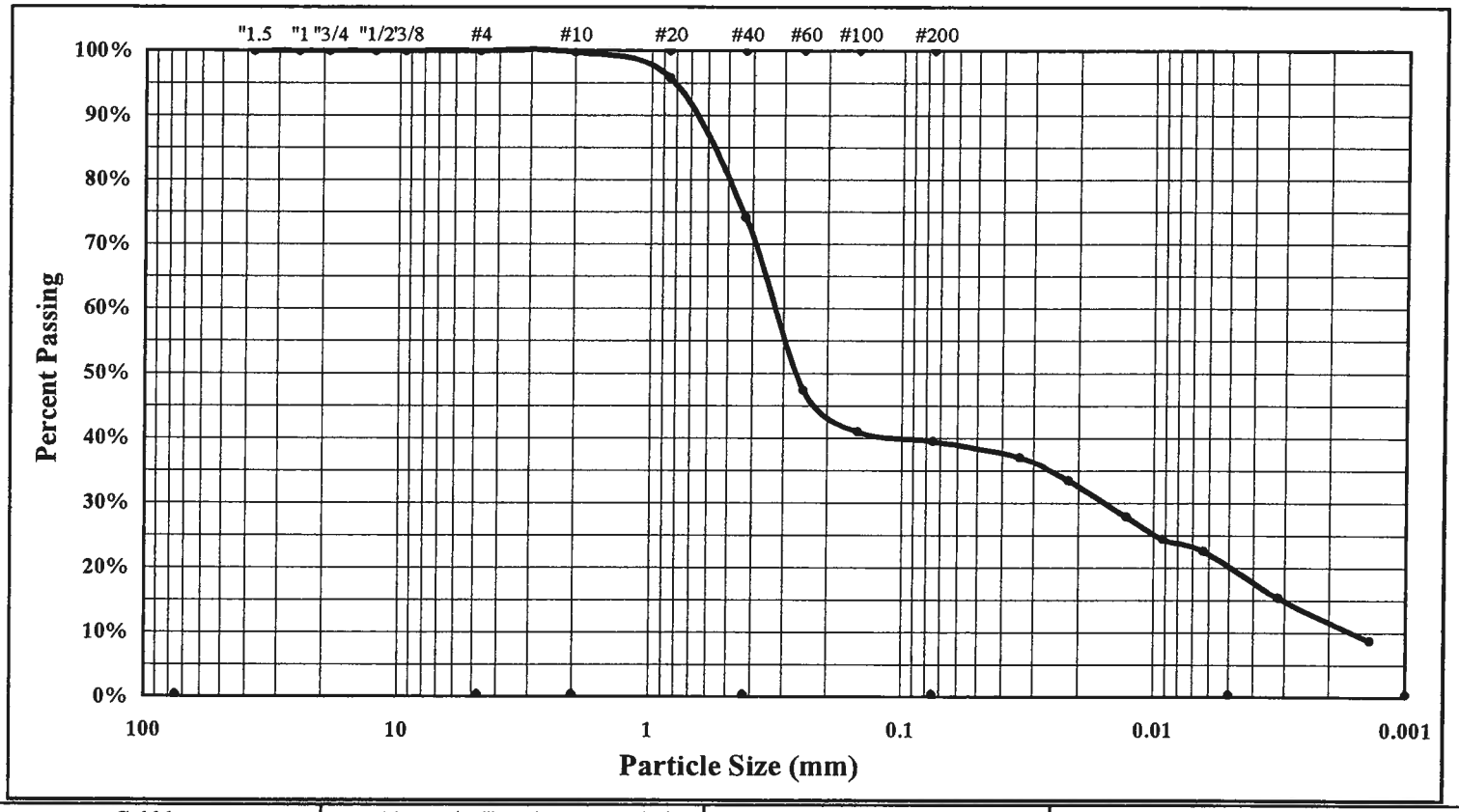
# Particle Size Analysis of Soils

ASTM D 422

S&ME

| | | | |
|---|---|---|---|
| S&ME Project #: | **1054-07-241A** | Report Date: | 10/17/08 |
| Project Name: | **Edgecombe County Landfill** | Test Date(s): | 10/9 - 10/17/08 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | TP-6 | Sample #: | Jar | Sample Date: | 10/7/08 |
| Location: | Site-Borehole | Offset: | | Depth (ft): | 7 - 9 ft. |
| Sample Description: | Gray Silty SAND (Visual) | | | | |




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Gravel | 0.0% | Silt | 19.5% |
| Silt & Clay (% Passing #200) | 39.5% | Sand | 60.5% | Clay | 20.0% |
| Apparent Relative Density | 2.666 | Moisture Content | | Colloids | 8.7% |
| Liquid Limit | ND | Plastic Limit | ND | Plastic Index | ND |

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

**References:** ASTM D 422: Particle Size Analysis of Soils ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan _____ Laboratory Manager
*Signature* *Position*

*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-1 | Sample: S-2 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 8.5 - 10 ft. |

*Sample Description:* Gray Silty Clayey SAND (SC)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | 47 | Tare Wt. | **133.31** | Mass of Sample after Wash + Tare Wt. | **344.92** |
| Total Sample Wet Wt. + Tare Wt. | | | **510.46** | Mass of Sample after Wash | **211.61** |
| Total Sample Dry Wt. + Tare Wt. | | | **420.41** | Mass passing #200 | **75.49** |
| **Total Sample Dry Weight** | | | **287.10** | % Passing #200 **(D1140)** | **26.3%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | **NA** |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | **NA** |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | **NA** |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | **NA** |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | **NA** |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | **NA** |
| #4 | 4.75 | 0.00 | 0.0% | 0.0% | **100.0%** | **NA** |
| #10 | 2.000 | 0.09 | 0.0% | 0.0% | **100.0%** | **NA** |
| #20 | 0.850 | 1.16 | 0.4% | 0.4% | **99.6%** | **NA** |
| #40 | 0.425 | 6.79 | 2.0% | 2.4% | **97.6%** | **NA** |
| #60 | 0.250 | 27.07 | 7.1% | 9.4% | **90.6%** | **NA** |
| #100 | 0.150 | 132.64 | 36.8% | 46.2% | **53.8%** | **NA** |
| #200 | 0.075 | 205.01 | 25.2% | 71.4% | **28.6%** | **NA** |
| Pan | <0.075 | 211.73 | | **% Passing #200 (D422) =** | | **28.6%** |

| | | | | | |
|---|---|---|---|---|---|
| ***D2487*** | Maximum Particle Size | **#4** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **2.3%** |
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.0%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **69.0%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.0%** | % Silt & Clay | < 0.075 mm | **28.6%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

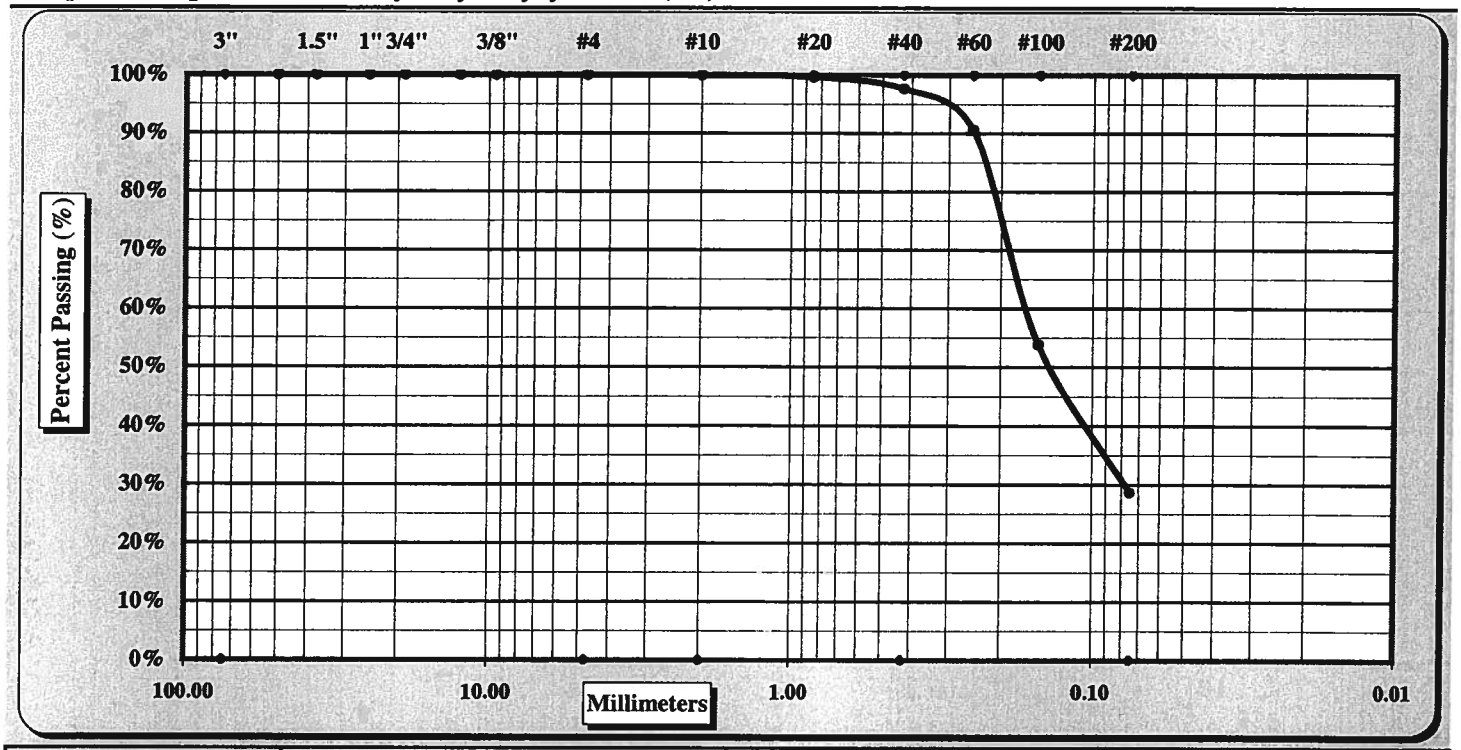
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-1 | Sample: | S-2 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 8.5 - 10 ft. |

***Sample Description:*** Gray Silty Clayey SAND (SC)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Coarse Sand | 0.0% | Fine Sand | 69.0% |
| Gravel | 0.0% | Medium Sand | 2.3% | Silt & Clay | 28.6% |
| Liquid Limit | 31 | Plastic Limit | 19 | Plastic Index | 12 |
| Specific Gravity | ND | | | Moisture Content | 31.4% |
| Coarse Sand | 0.0% | Medium Sand | 2.3% | Fine Sand | 69.0% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

**Project #:** **1054-07-241A** Report Date: 4/18/09

Project Name: Edgecombe County Test Date(s) 4/15 - 4/18/09

Client Name:

Client Address:

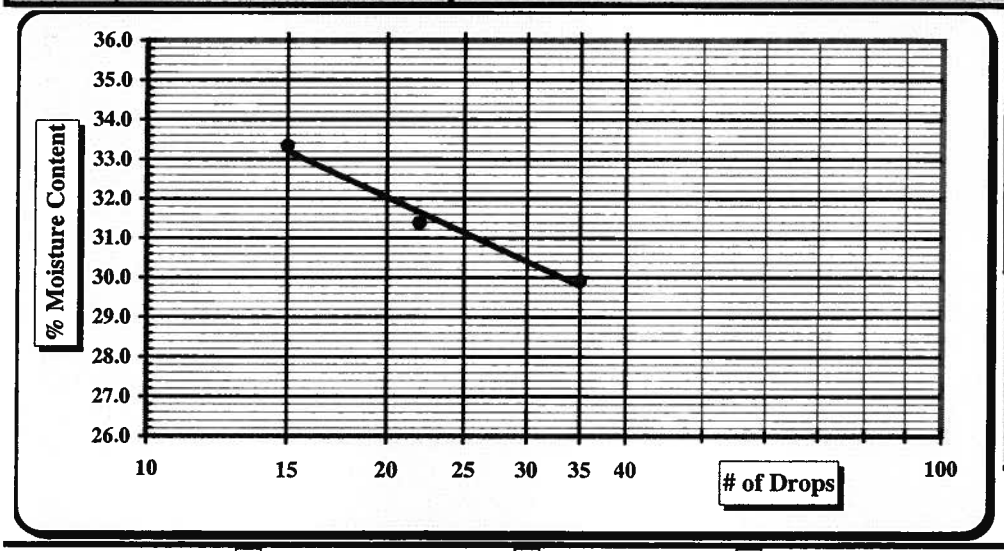
Boring #: B-1 Sample #: S-2 Sample Date: NA

Location: Site-Borehole Offset: NA Depth (ft): 8.5 - 10 ft.

Sample Description: Gray Silty Clayey SAND (SC)

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 5 | 7 | 20 | | | | 11 | 17 | |
| A | Tare Weight | 12.42 | 13.11 | 12.96 | | | | **12.53** | 12.96 | |
| B | Wet Soil Weight + A | 25.46 | 27.01 | 28.99 | | | | 24.98 | 25.35 | |
| C | Dry Soil Weight + A | 22.20 | 23.69 | 25.30 | | | | 23.04 | 23.41 | |
| D | Water Weight (B-C) | 3.26 | 3.32 | 3.69 | | | | 1.94 | 1.94 | |
| E | Dry Soil Weight (C-A) | 9.78 | 10.58 | 12.34 | | | | 10.51 | 10.45 | |
| F | % Moisture (D/E)*100 | 33.3% | 31.4% | 29.9% | | | | 18.5% | 18.6% | |
| N | # OF DROPS | 15 | 22 | 35 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **18.5%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

NP, Non-Plastic ☐

Liquid Limit **31**

Plastic Limit **19**

Plastic Index **12**

Group Symbol **SC**

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

Mal Krajan — *Technical Responsibility*

_____ — *Signature*

Laboratory Manager — *Position*

_____ — *Date*

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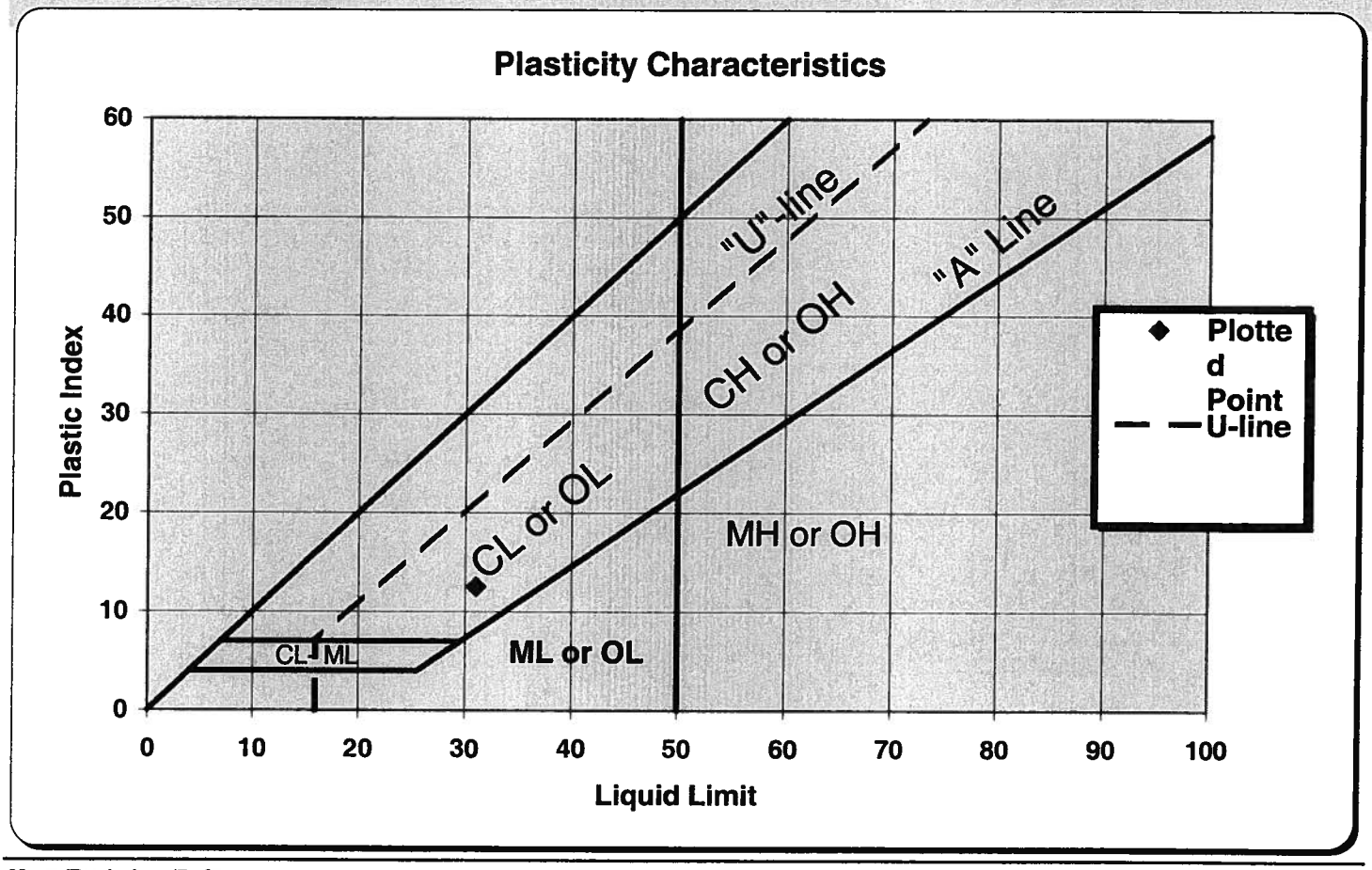
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 31 | 12.488398 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

*This record is for internal use only.*

*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-1 | Sample: S-3 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 13.5 - 15 ft. |

*Sample Description:* Gray Sandy Silty CLAY (CH)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | **8004** | Tare Wt. | **122.90** | Mass of Sample after Wash + Tare Wt. | **181.03** |
| Total Sample Wet Wt. + Tare Wt. | | | **530.97** | Mass of Sample after Wash | **58.13** |
| Total Sample Dry Wt. + Tare Wt. | | | **380.42** | Mass passing #200 | **199.39** |
| **Total Sample Dry Weight** | | | **257.52** | % Passing #200 **(D1140)** | **77.4%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #10 | 2.000 | 0.16 | 0.1% | 0.1% | **99.9%** | NA |
| #20 | 0.850 | 1.11 | 0.4% | 0.4% | **99.6%** | NA |
| #40 | 0.425 | 4.91 | 1.5% | 1.9% | **98.1%** | NA |
| #60 | 0.250 | 12.62 | 3.0% | 4.9% | **95.1%** | NA |
| #100 | 0.150 | 31.32 | 7.3% | 12.2% | **87.8%** | NA |
| #200 | 0.075 | 55.88 | 9.5% | 21.7% | **78.3%** | NA |
| Pan | <0.075 | 58.27 | | **% Passing #200 (D422) =** | | **78.3%** |

| *D2487* | Maximum Particle Size | #4 | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **1.8%** |
|---|---|---|---|---|---|
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.0%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **19.8%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.1%** | % Silt & Clay | < 0.075 mm | **78.3%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

S&ME

*ASTM D 422*

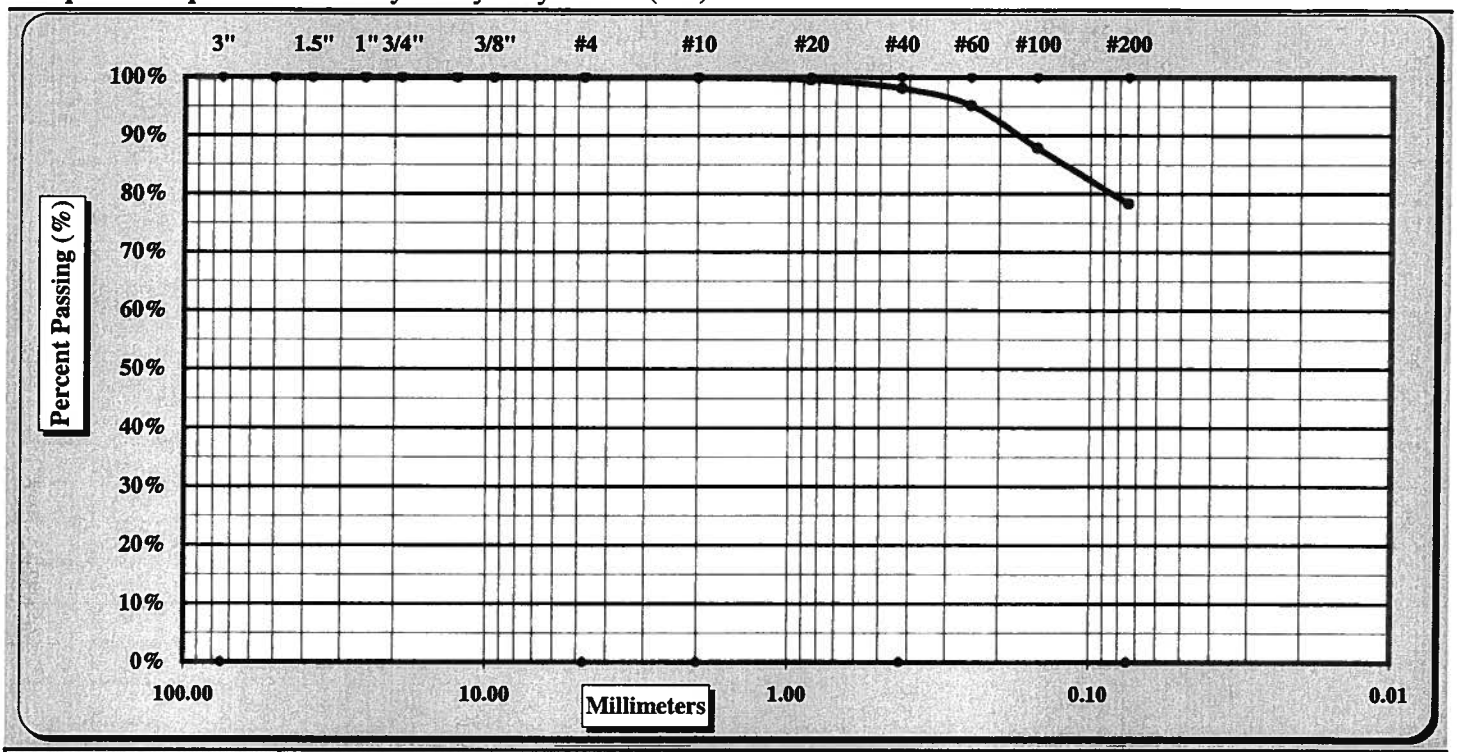
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-1 | Sample: | S-3 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 13.5 - 15 ft. |

***Sample Description:*** Gray Sandy Silty CLAY (CH)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | <2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Coarse Sand | 0.1% | Fine Sand | 19.8% |
| Gravel | 0.0% | Medium Sand | 1.8% | Silt & Clay | 78.3% |
| Liquid Limit | 93 | Plastic Limit | 28 | Plastic Index | 65 |
| Specific Gravity | ND | | | Moisture Content | 58.5% |
| Coarse Sand | 0.1% | Medium Sand | 1.8% | Fine Sand | 19.8% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

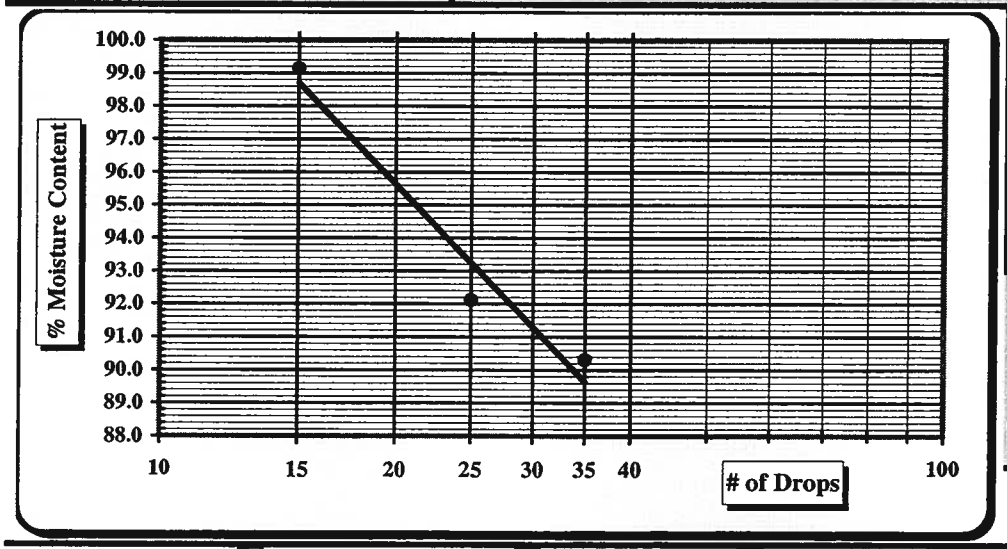
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-1 | Sample #: S-3 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 13.5 - 15 ft. | |
| Sample Description: | Gray Sandy Silty CLAY (CH) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 2 | 18 | 24 | | | | 1 | 3 | |
| A | Tare Weight | 12.96 | 12.98 | 13.01 | | | | **12.92** | 13.01 | |
| B | Wet Soil Weight + A | 24.93 | 26.62 | 29.18 | | | | 21.78 | 21.88 | |
| C | Dry Soil Weight + A | 19.25 | 20.08 | 21.13 | | | | 19.85 | 19.93 | |
| D | Water Weight (B-C) | 5.68 | 6.54 | 8.05 | | | | 1.93 | 1.95 | |
| E | Dry Soil Weight (C-A) | 6.29 | 7.10 | 8.12 | | | | 6.93 | 6.92 | |
| F | % Moisture (D/E)*100 | 90.3% | 92.1% | 99.1% | | | | 27.8% | 28.2% | |
| N | # OF DROPS | 35 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **28.0%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | 93 |
| Plastic Limit | 28 |
| Plastic Index | 65 |
| Group Symbol | CH |

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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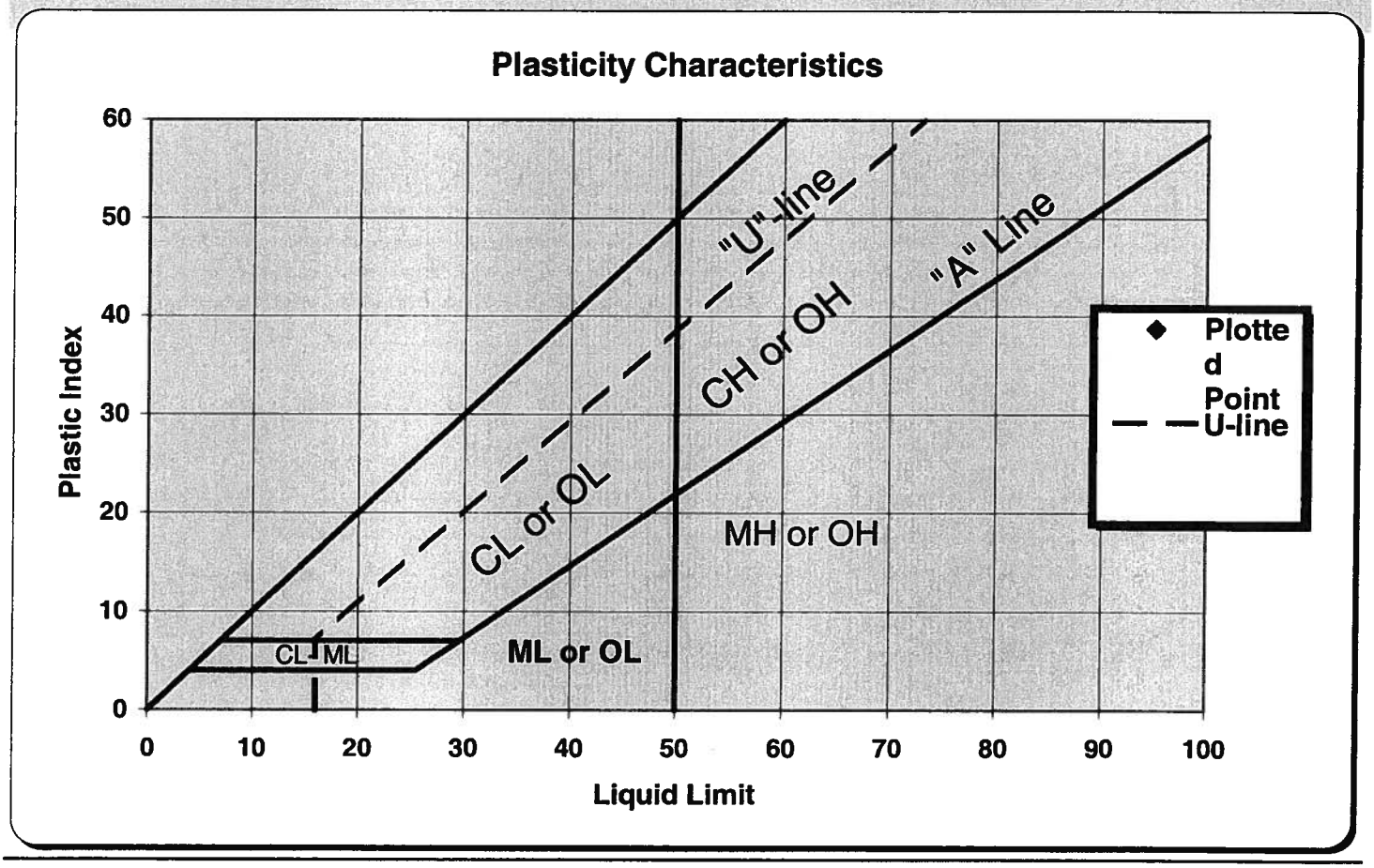
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 93 | 64.985441 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-3 | Sample: S-4 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 6 - 7.5 ft. |

*Sample Description:* Tan Silty Clayey SAND (SC)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | 51 | Tare Wt. | **141.38** | Mass of Sample after Wash + Tare Wt. | **229.69** |
| Total Sample Wet Wt. + Tare Wt. | | | **383.57** | Mass of Sample after Wash | **88.31** |
| Total Sample Dry Wt. + Tare Wt. | | | **311.04** | Mass passing #200 | **81.35** |
| **Total Sample Dry Weight** | | | **169.66** | % Passing #200 **(D1140)** | **47.9%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #10 | 2.000 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #20 | 0.850 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #40 | 0.425 | 0.42 | 0.2% | 0.2% | **99.8%** | NA |
| #60 | 0.250 | 11.55 | 6.6% | 6.8% | **93.2%** | NA |
| #100 | 0.150 | 48.68 | 21.9% | 28.7% | **71.3%** | NA |
| #200 | 0.075 | 86.32 | 22.2% | 50.9% | **49.1%** | NA |
| Pan | <0.075 | 88.23 | | **% Passing #200 (D422) =** | | **49.1%** |

| ***D2487*** | Maximum Particle Size | **#20** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **0.2%** |
|---|---|---|---|---|---|
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.0%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **50.6%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.0%** | % Silt & Clay | < 0.075 mm | **49.1%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

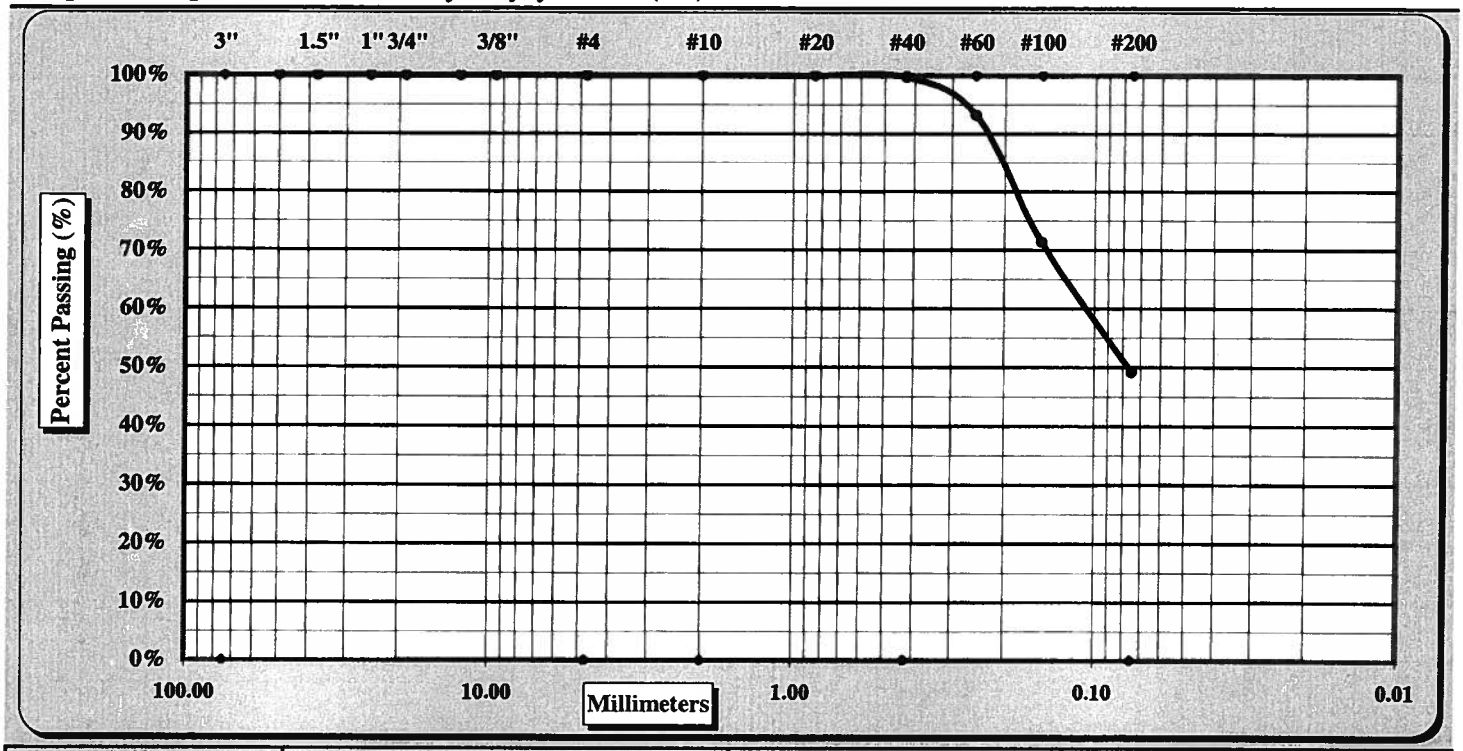
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-3 | Sample: | S-4 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 6 - 7.5 ft. |

***Sample Description:*** Tan Silty Clayey SAND (SC)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #20 | Coarse Sand | 0.0% | Fine Sand | 50.6% |
| Gravel | 0.0% | Medium Sand | 0.2% | Silt & Clay | 49.1% |
| Liquid Limit | 46 | Plastic Limit | 16 | Plastic Index | 30 |
| Specific Gravity | ND | | | Moisture Content | 42.8% |
| Coarse Sand | 0.0% | Medium Sand | 0.2% | Fine Sand | 50.6% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| | | | |
|---|---|---|---|
| Mal Krajan | | Laboratory Manager | |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* · *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

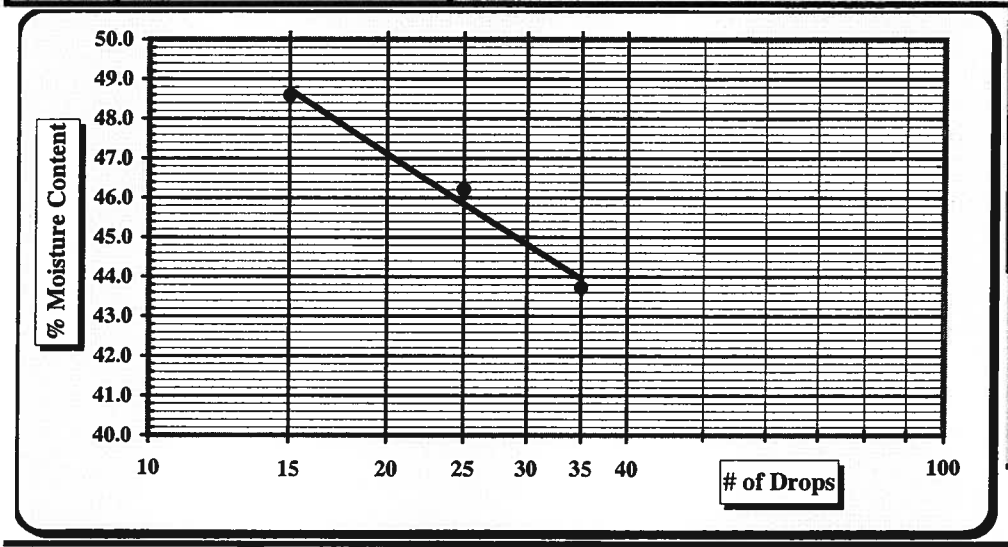
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-3 | Sample #: S-4 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 6 - 7.5 ft. | |
| Sample Description: | Tan Silty Clayey SAND (SC) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 30 | 16 | 29 | | | | 15 | 12 | |
| A | Tare Weight | 13.05 | 13.01 | 13.01 | | | | **12.47** | 12.98 | |
| B | Wet Soil Weight + A | 25.41 | 29.56 | 29.25 | | | | 24.74 | 25.24 | |
| C | Dry Soil Weight + A | 21.65 | 24.33 | 23.94 | | | | 23.06 | 23.54 | |
| D | Water Weight (B-C) | 3.76 | 5.23 | 5.31 | | | | 1.68 | 1.70 | |
| E | Dry Soil Weight (C-A) | 8.60 | 11.32 | 10.93 | | | | 10.59 | 10.56 | |
| F | % Moisture (D/E)*100 | 43.7% | 46.2% | 48.6% | | | | 15.9% | 16.1% | |
| N | # OF DROPS | 35 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **16.0%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | **46** |
| Plastic Limit | **16** |
| Plastic Index | **30** |
| Group Symbol | **SC** |

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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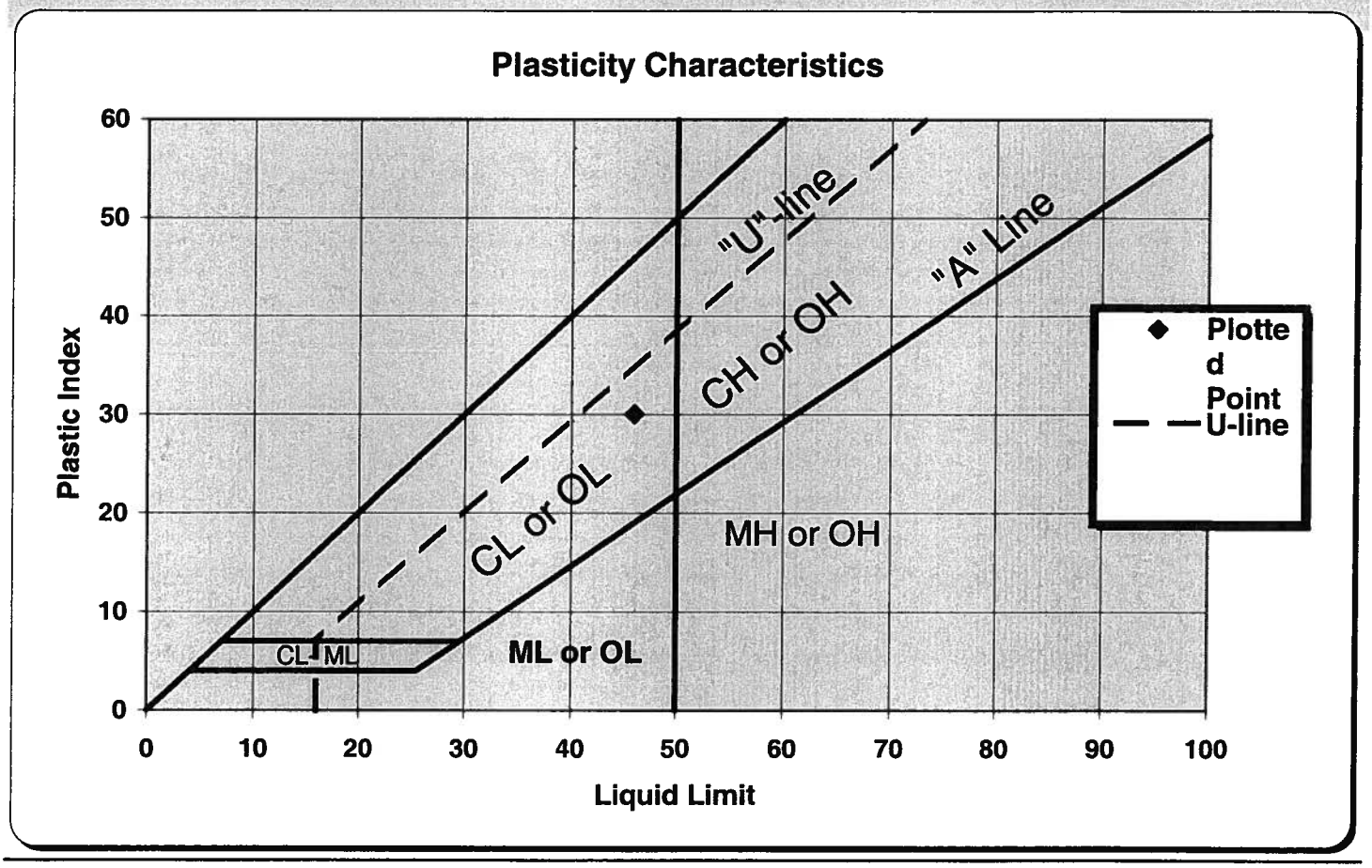
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 46 | 30.018746 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-5 | Sample: S-5 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 11 - 12.5 ft. |

*Sample Description:* Tan Silty Clayey SAND (SC)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | **8002** | Tare Wt. | **123.39** | Mass of Sample after Wash + Tare Wt. | **338.43** |
| Total Sample Wet Wt. + Tare Wt. | | | **528.78** | Mass of Sample after Wash | **215.04** |
| Total Sample Dry Wt. + Tare Wt. | | | **440.10** | Mass passing #200 | **101.67** |
| **Total Sample Dry Weight** | | | **316.71** | % Passing #200 **(D1140)** | **32.1%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #10 | 2.000 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #20 | 0.850 | 0.33 | 0.1% | 0.1% | **99.9%** | NA |
| #40 | 0.425 | 1.98 | 0.5% | 0.6% | **99.4%** | NA |
| #60 | 0.250 | 14.23 | 3.9% | 4.5% | **95.5%** | NA |
| #100 | 0.150 | 71.05 | 17.9% | 22.4% | **77.6%** | NA |
| #200 | 0.075 | 209.90 | 43.8% | 66.3% | **33.7%** | NA |
| Pan | <0.075 | 215.09 | | **% Passing #200 (D422) =** | | **33.7%** |

| | | | | | |
|---|---|---|---|---|---|
| ***D2487*** | Maximum Particle Size | **#10** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **0.6%** |
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.0%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **65.6%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.0%** | % Silt & Clay | < 0.075 mm | **33.7%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

S&ME

*ASTM D 422*

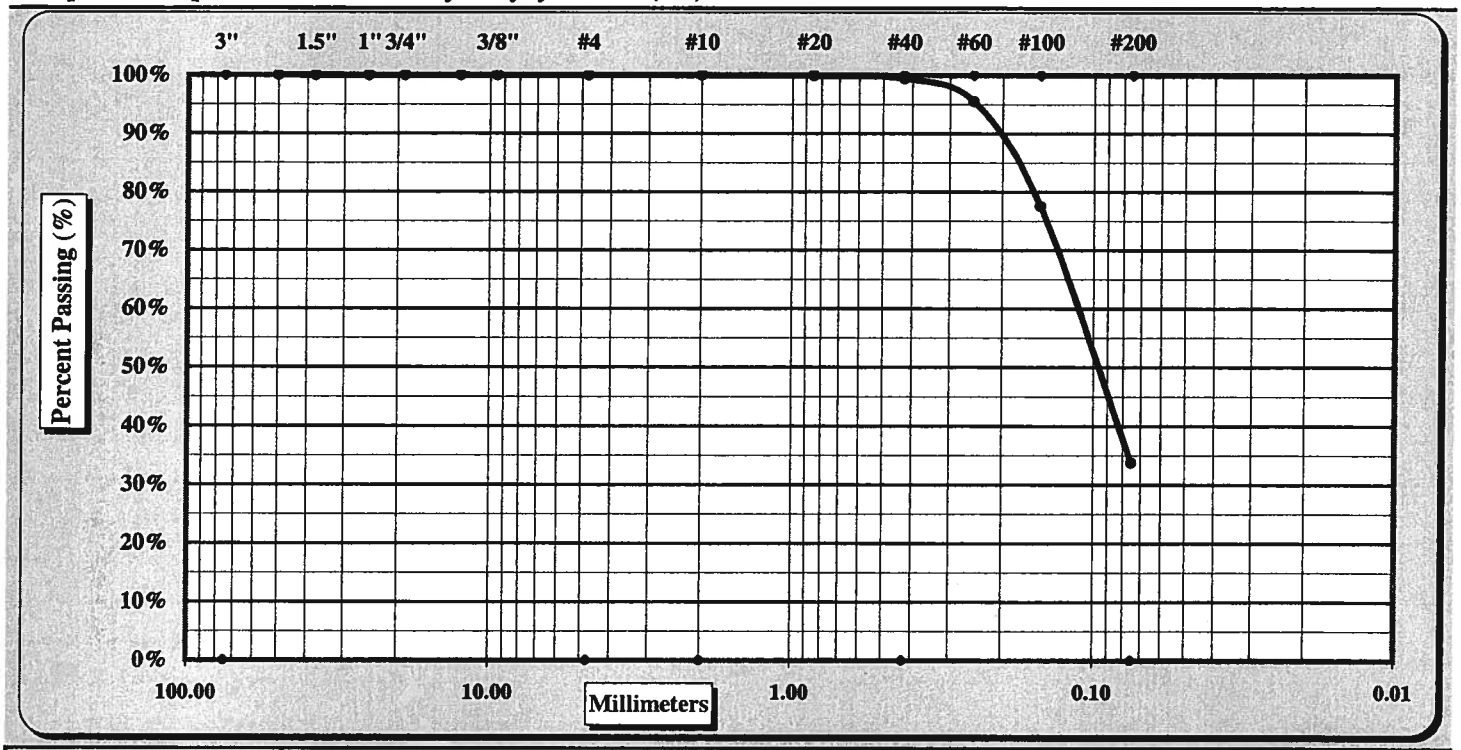
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-5 | Sample: | S-5 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 11 - 12.5 ft. |

***Sample Description:*** Tan Silty Clayey SAND (SC)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #10 | Coarse Sand | 0.0% | Fine Sand | 65.6% |
| Gravel | 0.0% | Medium Sand | 0.6% | Silt & Clay | 33.7% |
| Liquid Limit | 37 | Plastic Limit | 17 | Plastic Index | 20 |
| Specific Gravity | ND | | | Moisture Content | 28.0% |
| Coarse Sand | 0.0% | Medium Sand | 0.6% | Fine Sand | 65.6% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

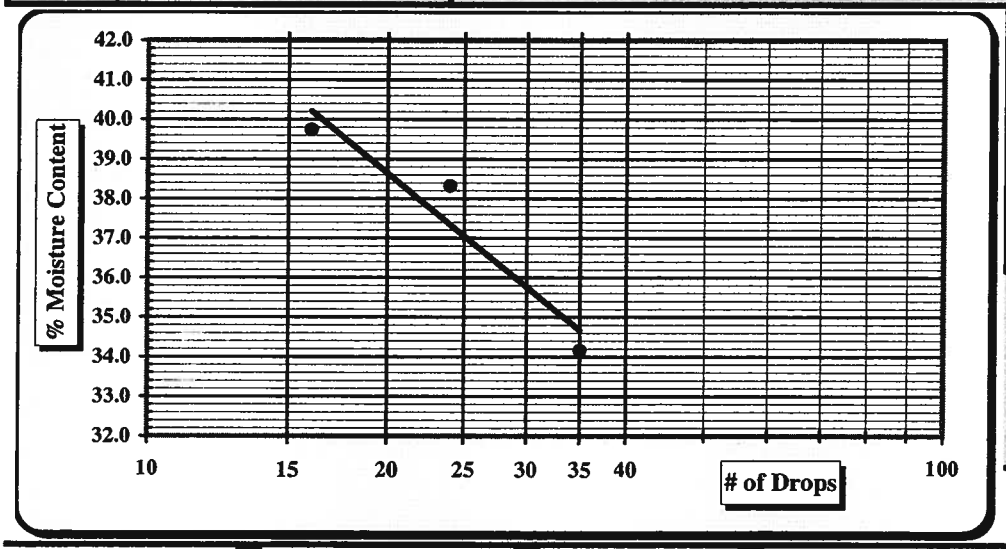
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-5 | Sample #: S-5 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 11 - 12.5 ft. | |
| Sample Description: | Tan Silty Clayey SAND (SC) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 14 | 13 | 19 | | | | 8 | 6 | |
| A | Tare Weight | 12.97 | 13.03 | 13.01 | | | | **13.01** | 12.94 | |
| B | Wet Soil Weight + A | 26.09 | 30.79 | 29.01 | | | | 26.13 | 25.57 | |
| C | Dry Soil Weight + A | 22.75 | 25.87 | 24.46 | | | | 24.26 | 23.73 | |
| D | Water Weight (B-C) | 3.34 | 4.92 | 4.55 | | | | 1.87 | 1.84 | |
| E | Dry Soil Weight (C-A) | 9.78 | 12.84 | 11.45 | | | | 11.25 | 10.79 | |
| F | % Moisture (D/E)*100 | 34.2% | 38.3% | 39.7% | | | | 16.6% | 17.1% | |
| N | # OF DROPS | 35 | 24 | 16 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **16.8%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | 37 |
| Plastic Limit | 17 |
| Plastic Index | 20 |
| Group Symbol | SC |

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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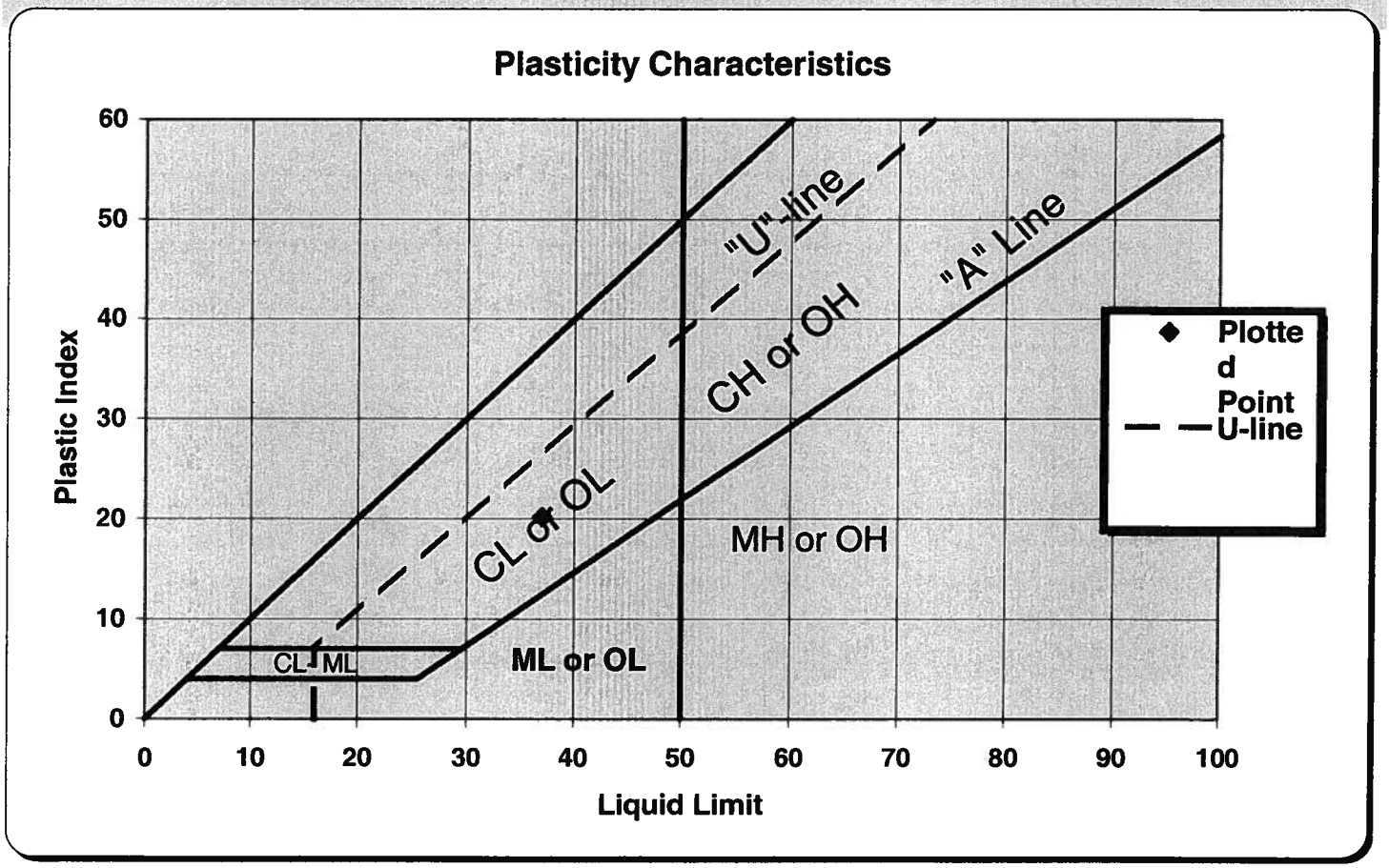
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 37 | 20.162476 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

S&ME

*ASTM D 422*

*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-13 | Sample: S-11 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 22.5 - 24 ft. |

*Sample Description:* Gray Silty Clayey SAND with Shell Materials (SC)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | 53 | Tare Wt. | **120.02** | Mass of Sample after Wash + Tare Wt. | **345.28** |
| Total Sample Wet Wt. + Tare Wt. | | | **534.30** | Mass of Sample after Wash | **225.26** |
| Total Sample Dry Wt. + Tare Wt. | | | **436.75** | Mass passing #200 | **91.47** |
| **Total Sample Dry Weight** | | | **316.73** | % Passing #200 **(D1140)** | **28.9%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | *Cumulative* | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | *Total Sample* | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 6.13 | 1.9% | 1.9% | **98.1%** | NA |
| #4 | 4.75 | 26.32 | 6.4% | 8.3% | **91.7%** | NA |
| #10 | 2.000 | 43.19 | 5.3% | 13.6% | **86.4%** | NA |
| #20 | 0.850 | 61.28 | 5.7% | 19.3% | **80.7%** | NA |
| #40 | 0.425 | 109.29 | 15.2% | 34.5% | **65.5%** | NA |
| #60 | 0.250 | 189.80 | 25.4% | 59.9% | **40.1%** | NA |
| #100 | 0.150 | 217.31 | 8.7% | 68.6% | **31.4%** | NA |
| #200 | 0.075 | 224.20 | 2.2% | 70.8% | **29.2%** | NA |
| Pan | <0.075 | 225.14 | | **% Passing #200 (D422) =** | | **29.2%** |

| | | | | | |
|---|---|---|---|---|---|
| ***D2487*** | Maximum Particle Size | **1/2"** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **20.9%** |
| Gravel | < 75 mm and > 4.75 mm (#4) | **8.3%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **36.3%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **5.3%** | % Silt & Clay | < 0.075 mm | **29.2%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

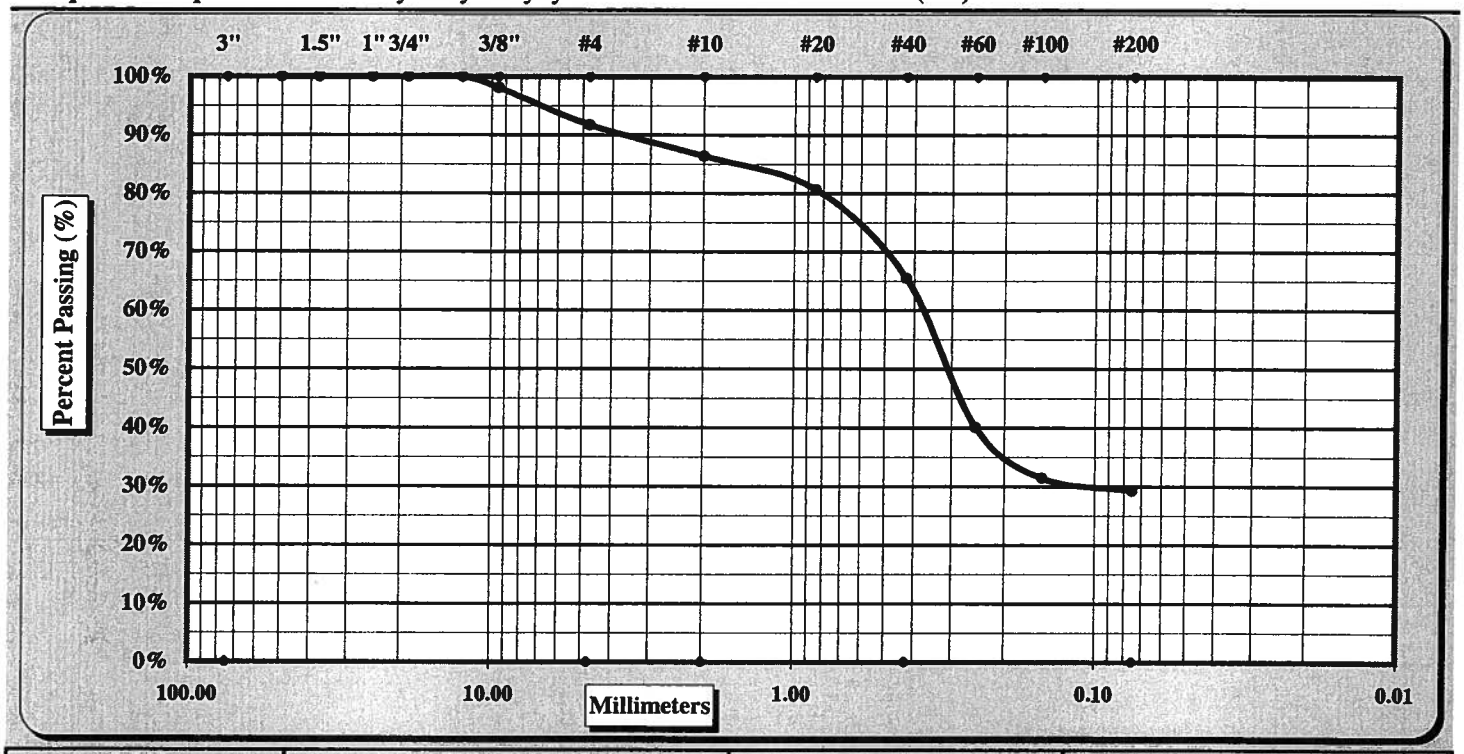
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-13 | Sample: | S-11 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 22.5 - 24 ft. |

***Sample Description:*** Gray Silty Clayey SAND with Shell Materials (SC)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | 1/2" | Coarse Sand | 5.3% | Fine Sand | 36.3% |
| Gravel | 8.3% | Medium Sand | 20.9% | Silt & Clay | 29.2% |
| Liquid Limit | 54 | Plastic Limit | 19 | Plastic Index | 35 |
| Specific Gravity | ND | | | Moisture Content | 30.8% |
| Coarse Sand | 5.3% | Medium Sand | 20.9% | Fine Sand | 36.3% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| | | | |
|---|---|---|---|
| Mal Krajan | | Laboratory Manager | |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ *Quality Assurance*

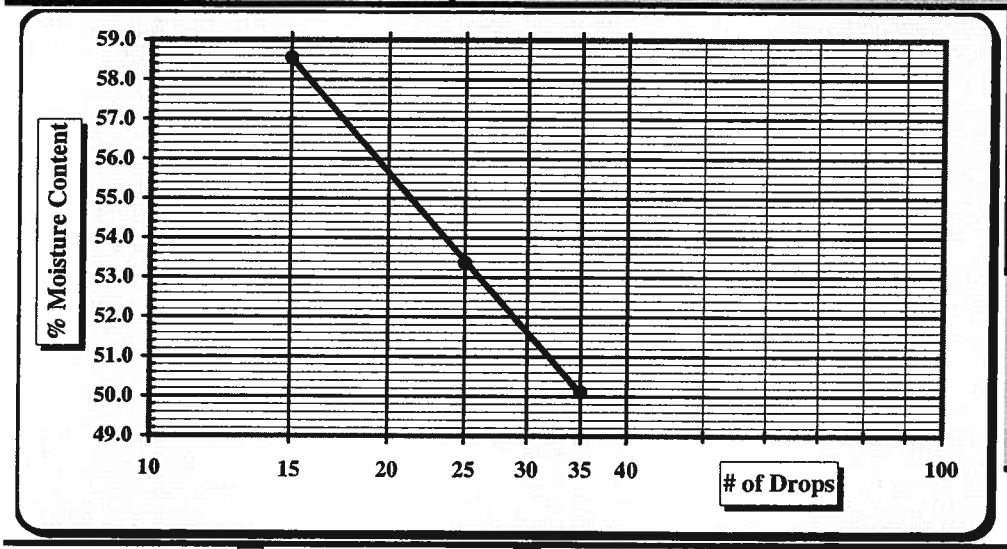
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-13 | Sample #: S-11 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 22.5 - 24 ft. | |
| Sample Description: | Gray Silty Clayey SAND with Shell Materials (SC) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID.#* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 9 | 26 | 22 | | | | 5 | 7 | |
| A | Tare Weight | 13.07 | 12.92 | 13.06 | | | | **12.42** | 13.11 | |
| B | Wet Soil Weight + A | 27.90 | 26.60 | 30.04 | | | | 24.03 | 24.74 | |
| C | Dry Soil Weight + A | 22.95 | 21.84 | 23.77 | | | | 22.18 | 22.90 | |
| D | Water Weight (B-C) | 4.95 | 4.76 | 6.27 | | | | 1.85 | 1.84 | |
| E | Dry Soil Weight (C-A) | 9.88 | 8.92 | 10.71 | | | | 9.76 | 9.79 | |
| F | % Moisture (D/E)*100 | 50.1% | 53.4% | 58.5% | | | | 19.0% | 18.8% | |
| N | # OF DROPS | 35 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **18.9%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | **54** |
| Plastic Limit | **19** |
| Plastic Index | **35** |
| Group Symbol | **SC** |

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-12 | Sample: S-10 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 11 - 12 ft. |

*Sample Description:* Gray Sandy Silty CLAY (CH)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | 2K | Tare Wt. | **122.00** | Mass of Sample after Wash + Tare Wt. | **141.03** |
| Total Sample Wet Wt. + Tare Wt. | | | **459.97** | Mass of Sample after Wash | **19.03** |
| Total Sample Dry Wt. + Tare Wt. | | | **330.20** | Mass passing #200 | **189.17** |
| **Total Sample Dry Weight** | | | **208.20** | % Passing #200 **(D1140)** | **90.9%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #10 | 2.000 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #20 | 0.850 | 0.20 | 0.1% | 0.1% | **99.9%** | NA |
| #40 | 0.425 | 0.82 | 0.3% | 0.4% | **99.6%** | NA |
| #60 | 0.250 | 2.25 | 0.7% | 1.1% | **98.9%** | NA |
| #100 | 0.150 | 6.71 | 2.1% | 3.2% | **96.8%** | NA |
| #200 | 0.075 | 17.87 | 5.4% | 8.6% | **91.4%** | NA |
| Pan | <0.075 | 19.20 | | **% Passing #200 (D422) =** | | **91.4%** |

| ***D2487*** | Maximum Particle Size | **#10** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **0.4%** |
|---|---|---|---|---|---|
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.0%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **8.2%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.0%** | % Silt & Clay | < 0.075 mm | **91.4%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

S&ME

*ASTM D 422*

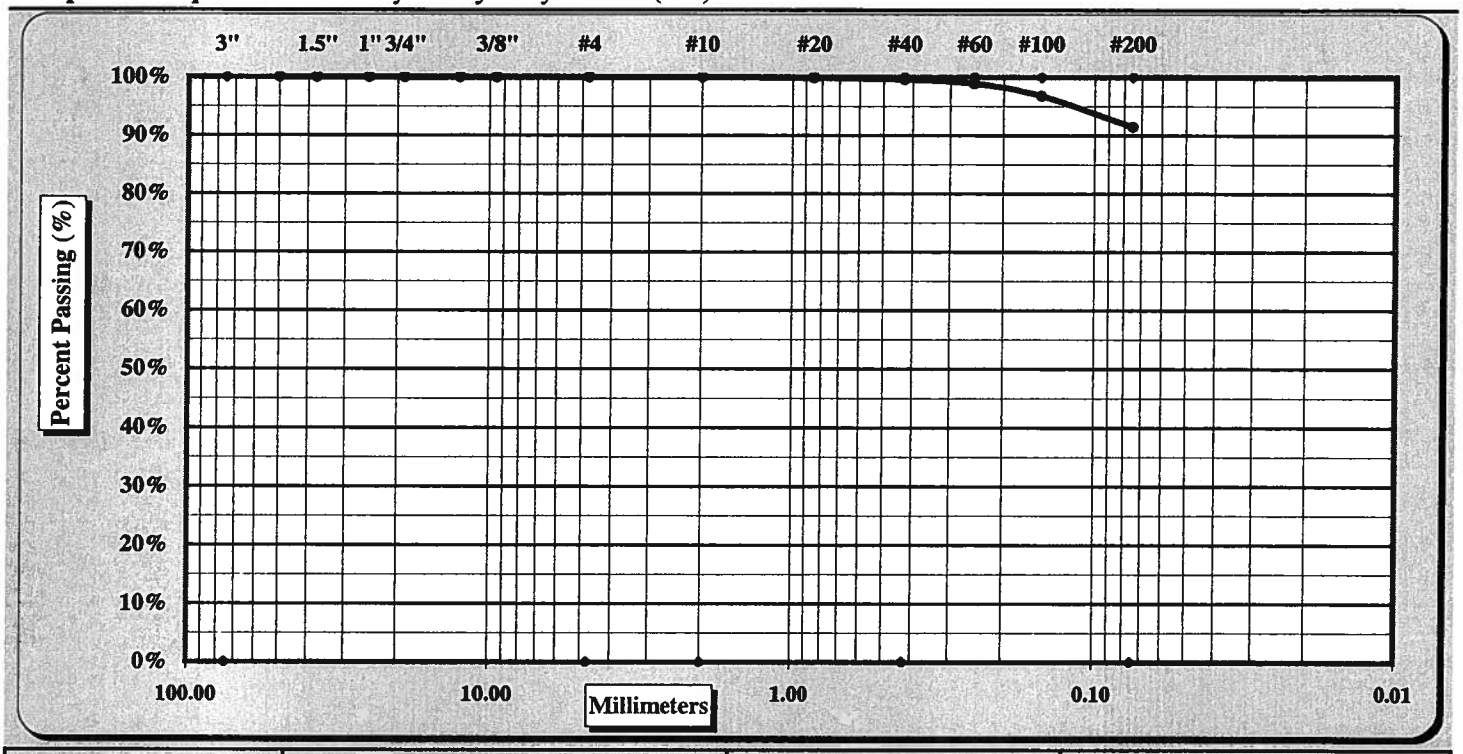
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-12 | Sample: | S-10 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 11 - 12 ft. |

***Sample Description:*** Gray Sandy Silty CLAY (CH)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #10 | Coarse Sand | 0.0% | Fine Sand | 8.2% |
| Gravel | 0.0% | Medium Sand | 0.4% | Silt & Clay | 91.4% |
| Liquid Limit | 87 | Plastic Limit | 24 | Plastic Index | 63 |
| Specific Gravity | ND | | | Moisture Content | 62.3% |
| Coarse Sand | 0.0% | Medium Sand | 0.4% | Fine Sand | 8.2% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

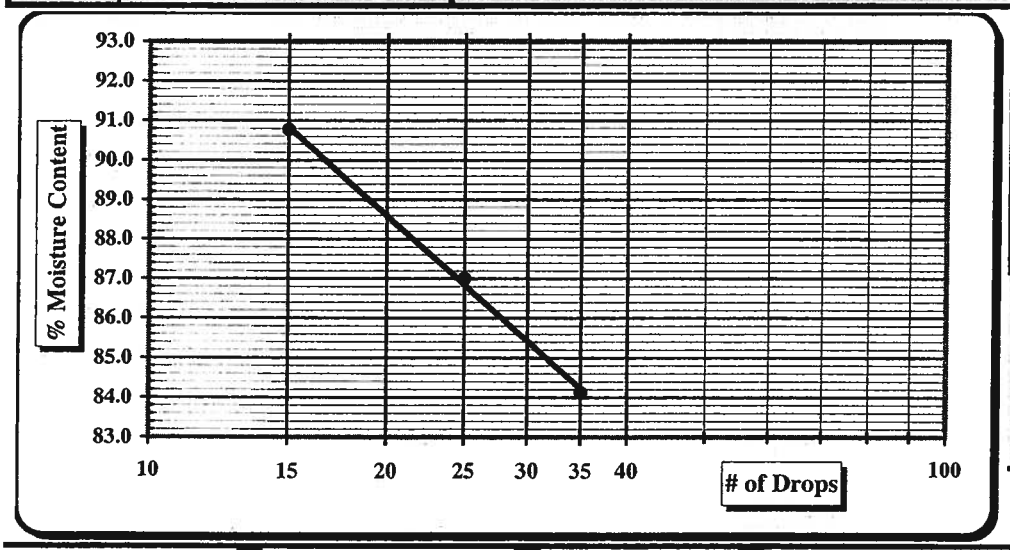
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-12 | Sample #: S-10 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 11 - 12 ft. | |
| Sample Description: | Gray Sandy Silty CLAY (CH) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 19 | 13 | 14 | | | | 27 | 17 | |
| A | Tare Weight | 13.07 | 13.03 | 12.97 | | | | **13.03** | 12.95 | |
| B | Wet Soil Weight + A | 26.40 | 27.26 | 31.36 | | | | 23.48 | 23.37 | |
| C | Dry Soil Weight + A | 20.31 | 20.64 | 22.61 | | | | 21.46 | 21.34 | |
| D | Water Weight (B-C) | 6.09 | 6.62 | 8.75 | | | | 2.02 | 2.03 | |
| E | Dry Soil Weight (C-A) | 7.24 | 7.61 | 9.64 | | | | 8.43 | 8.39 | |
| F | % Moisture (D/E)*100 | 84.1% | 87.0% | 90.8% | | | | 24.0% | 24.2% | |
| N | # OF DROPS | 35 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **24.1%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | 87 |
| Plastic Limit | 24 |
| Plastic Index | 63 |
| Group Symbol | CH |

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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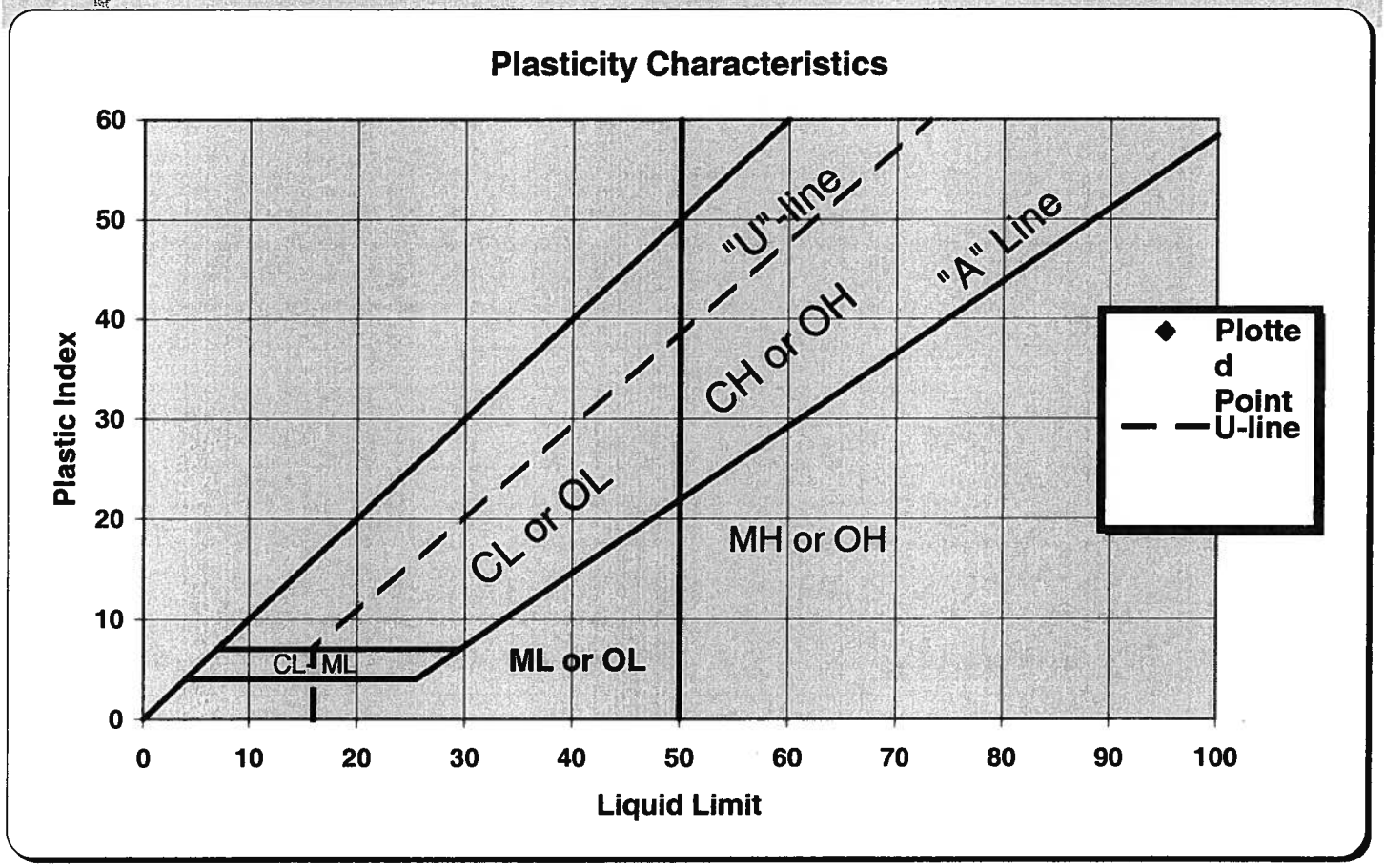
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 87 | 62.921244 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-12 | Sample: S-9 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 6 - 7.5 ft. |

*Sample Description:* Tan-Gray Silty Clayey SAND (SC)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | 52 | Tare Wt. | **130.39** | Mass of Sample after Wash + Tare Wt. | **356.54** |
| Total Sample Wet Wt. + Tare Wt. | | | **533.65** | Mass of Sample after Wash | **226.15** |
| Total Sample Dry Wt. + Tare Wt. | | | **445.42** | Mass passing #200 | **88.88** |
| **Total Sample Dry Weight** | | | **315.03** | % Passing #200 **(D1140)** | **28.2%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 0.38 | 0.1% | 0.1% | **99.9%** | NA |
| #10 | 2.000 | 1.97 | 0.5% | 0.6% | **99.4%** | NA |
| #20 | 0.850 | 21.80 | 6.3% | 6.9% | **93.1%** | NA |
| #40 | 0.425 | 42.26 | 6.5% | 13.4% | **86.6%** | NA |
| #60 | 0.250 | 76.12 | 10.7% | 24.2% | **75.8%** | NA |
| #100 | 0.150 | 126.99 | 16.1% | 40.3% | **59.7%** | NA |
| #200 | 0.075 | 224.31 | 30.9% | 71.2% | **28.8%** | NA |
| Pan | <0.075 | 226.07 | | **% Passing #200 (D422) =** | | **28.8%** |

| | | | | | |
|---|---|---|---|---|---|
| ***D2487*** | Maximum Particle Size | **3/8"** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **12.8%** |
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.1%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **57.8%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.5%** | % Silt & Clay | < 0.075 mm | **28.8%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

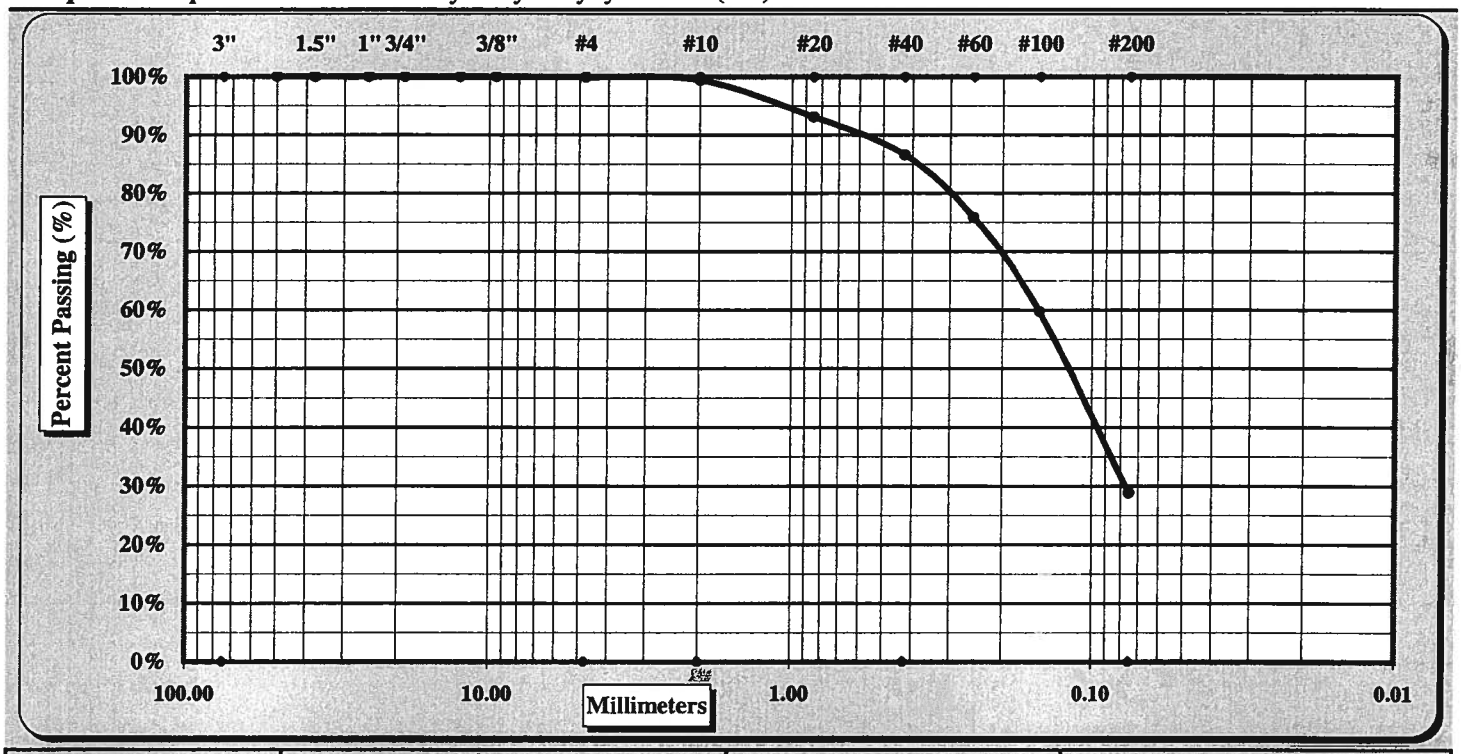
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-12 | Sample: | S-9 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 6 - 7.5 ft. |

***Sample Description:*** Tan-Gray Silty Clayey SAND (SC)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | 3/8" | Coarse Sand | 0.5% | Fine Sand | 57.8% |
| Gravel | 0.1% | Medium Sand | 12.8% | Silt & Clay | 28.8% |
| Liquid Limit | 30 | Plastic Limit | 14 | Plastic Index | 16 |
| Specific Gravity | ND | | | Moisture Content | 28.0% |
| Coarse Sand | 0.5% | Medium Sand | 12.8% | Fine Sand | 57.8% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| | | | |
|---|---|---|---|
| Mal Krajan | | Laboratory Manager | |
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

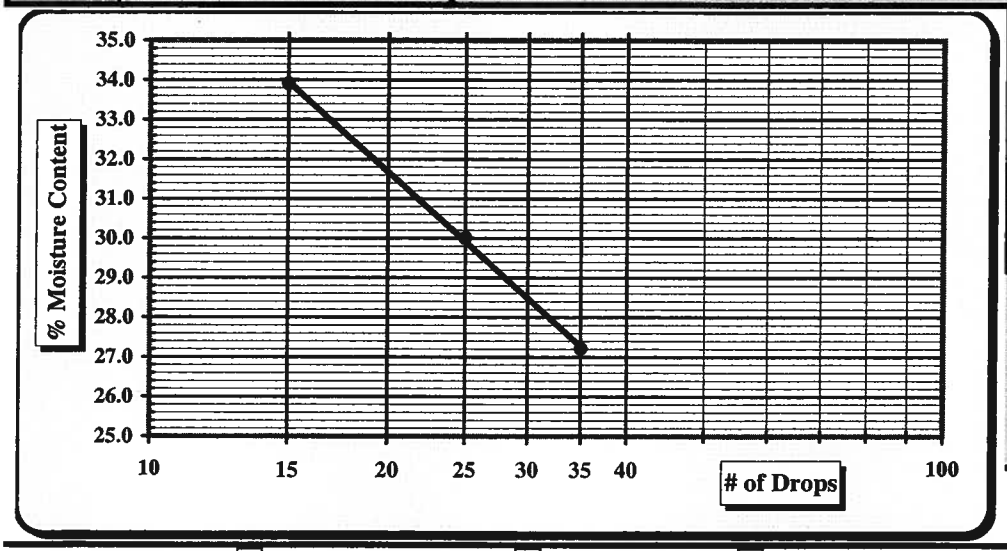
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-12 | Sample #: S-9 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 6 - 7.5 ft. | |
| Sample Description: | Tan-Gray Silty Clayey SAND (SC) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 29 | 15 | 12 | | | | 2 | 8 | |
| A | Tare Weight | 13.00 | 12.46 | 12.97 | | | | **12.96** | 13.01 | |
| B | Wet Soil Weight + A | 26.70 | 27.15 | 31.69 | | | | 25.44 | 25.48 | |
| C | Dry Soil Weight + A | 23.77 | 23.76 | 26.95 | | | | 23.93 | 23.94 | |
| D | Water Weight (B-C) | 2.93 | 3.39 | 4.74 | | | | 1.51 | 1.54 | |
| E | Dry Soil Weight (C-A) | 10.77 | 11.30 | 13.98 | | | | 10.97 | 10.93 | |
| F | % Moisture (D/E)*100 | 27.2% | 30.0% | 33.9% | | | | 13.8% | 14.1% | |
| N | # OF DROPS | 35 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **13.9%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | 30 |
| Plastic Limit | 14 |
| Plastic Index | 16 |
| Group Symbol | SC |
| Multipoint Method | ☑ |
| One-point Method | ☐ |

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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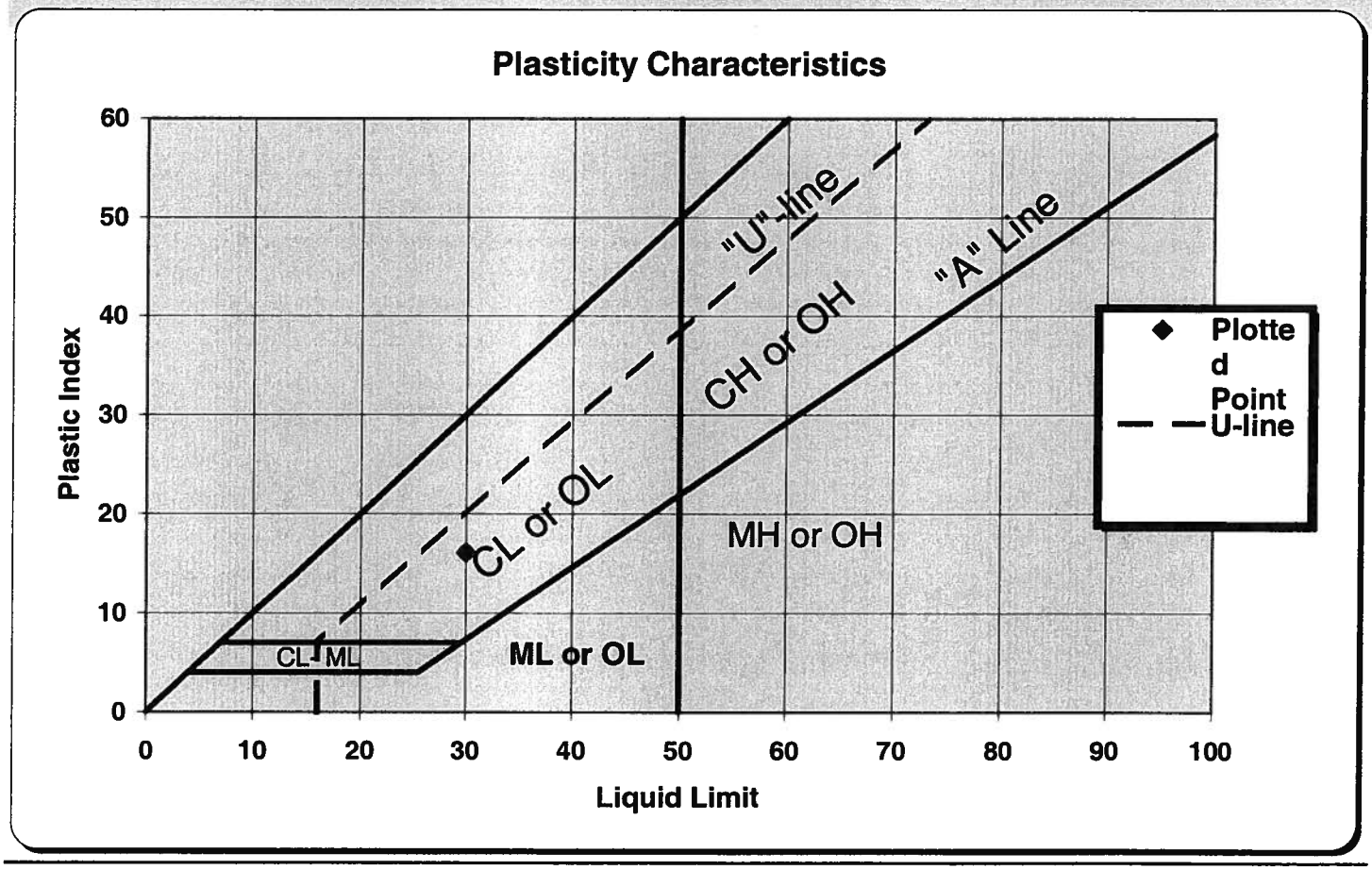
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 30 | 16.072763 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-9 | Sample: S-8 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 3.5 - 5 ft. |

*Sample Description:* Brown Silty Clayey SAND (SC)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | **8003** | Tare Wt. | **121.09** | Mass of Sample after Wash + Tare Wt. | **264.03** |
| Total Sample Wet Wt. + Tare Wt. | | | **430.64** | Mass of Sample after Wash | **142.94** |
| Total Sample Dry Wt. + Tare Wt. | | | **357.01** | Mass passing #200 | **92.98** |
| **Total Sample Dry Weight** | | | **235.92** | % Passing #200 **(D1140)** | **39.4%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #10 | 2.000 | 1.29 | 0.5% | 0.5% | **99.5%** | NA |
| #20 | 0.850 | 4.37 | 1.3% | 1.9% | **98.1%** | NA |
| #40 | 0.425 | 10.33 | 2.5% | 4.4% | **95.6%** | NA |
| #60 | 0.250 | 24.37 | 6.0% | 10.3% | **89.7%** | NA |
| #100 | 0.150 | 71.30 | 19.9% | 30.2% | **69.8%** | NA |
| #200 | 0.075 | 138.15 | 28.3% | 58.6% | **41.4%** | NA |
| Pan | <0.075 | 142.78 | | **% Passing #200 (D422) =** | | **41.4%** |

| | | | | | |
|---|---|---|---|---|---|
| ***D2487*** | Maximum Particle Size | **#4** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **3.8%** |
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.0%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **54.2%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.5%** | % Silt & Clay | < 0.075 mm | **41.4%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

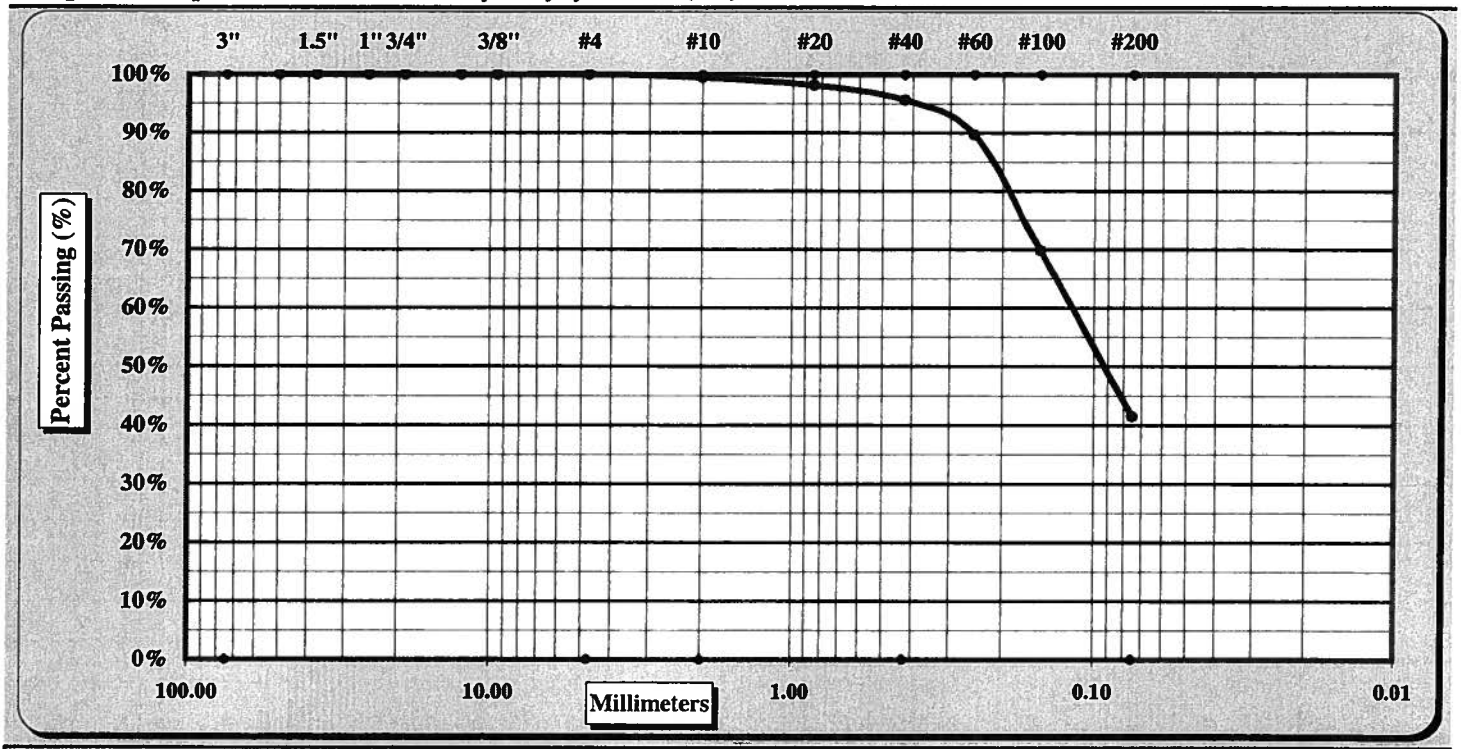
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-9 | Sample: | S-8 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 3.5 - 5 ft. |

***Sample Description:*** Brown Silty Clayey SAND (SC)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | <2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Coarse Sand | 0.5% | Fine Sand | 54.2% |
| Gravel | 0.0% | Medium Sand | 3.8% | Silt & Clay | 41.4% |
| Liquid Limit | 44 | Plastic Limit | 17 | Plastic Index | 27 |
| Specific Gravity | ND | | | Moisture Content | 31.2% |
| Coarse Sand | 0.5% | Medium Sand | 3.8% | Fine Sand | 54.2% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | _____ | Laboratory Manager | _____ |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

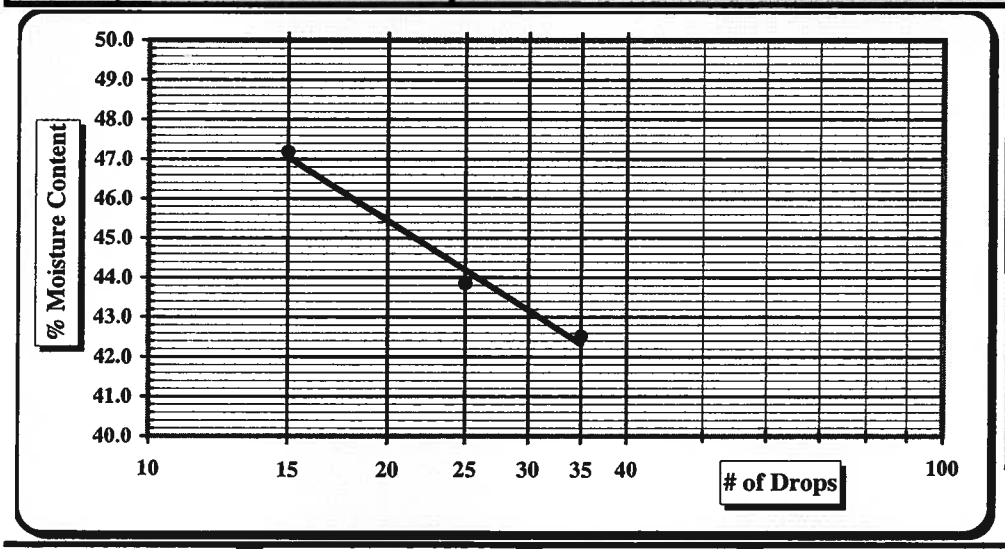
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-9 | Sample #: S-8 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 3.5 - 5 ft. | |
| Sample Description: | Brown Silty Clayey SAND (SC) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 3 | 24 | 1 | | | | 16 | 18 | |
| A | Tare Weight | 13.01 | 13.03 | 12.92 | | | | **13.01** | 13.00 | |
| B | Wet Soil Weight + A | 24.71 | 28.81 | 26.21 | | | | 25.06 | 25.12 | |
| C | Dry Soil Weight + A | 21.22 | 24.00 | 21.95 | | | | 23.30 | 23.33 | |
| D | Water Weight (B-C) | 3.49 | 4.81 | 4.26 | | | | 1.76 | 1.79 | |
| E | Dry Soil Weight (C-A) | 8.21 | 10.97 | 9.03 | | | | 10.29 | 10.33 | |
| F | % Moisture (D/E)*100 | 42.5% | 43.8% | 47.2% | | | | 17.1% | 17.3% | |
| N | # OF DROPS | 35 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **17.2%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | 44 |
| Plastic Limit | 17 |
| Plastic Index | 27 |
| Group Symbol | SC |
| Multipoint Method | ☑ |
| One-point Method | ☐ |

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

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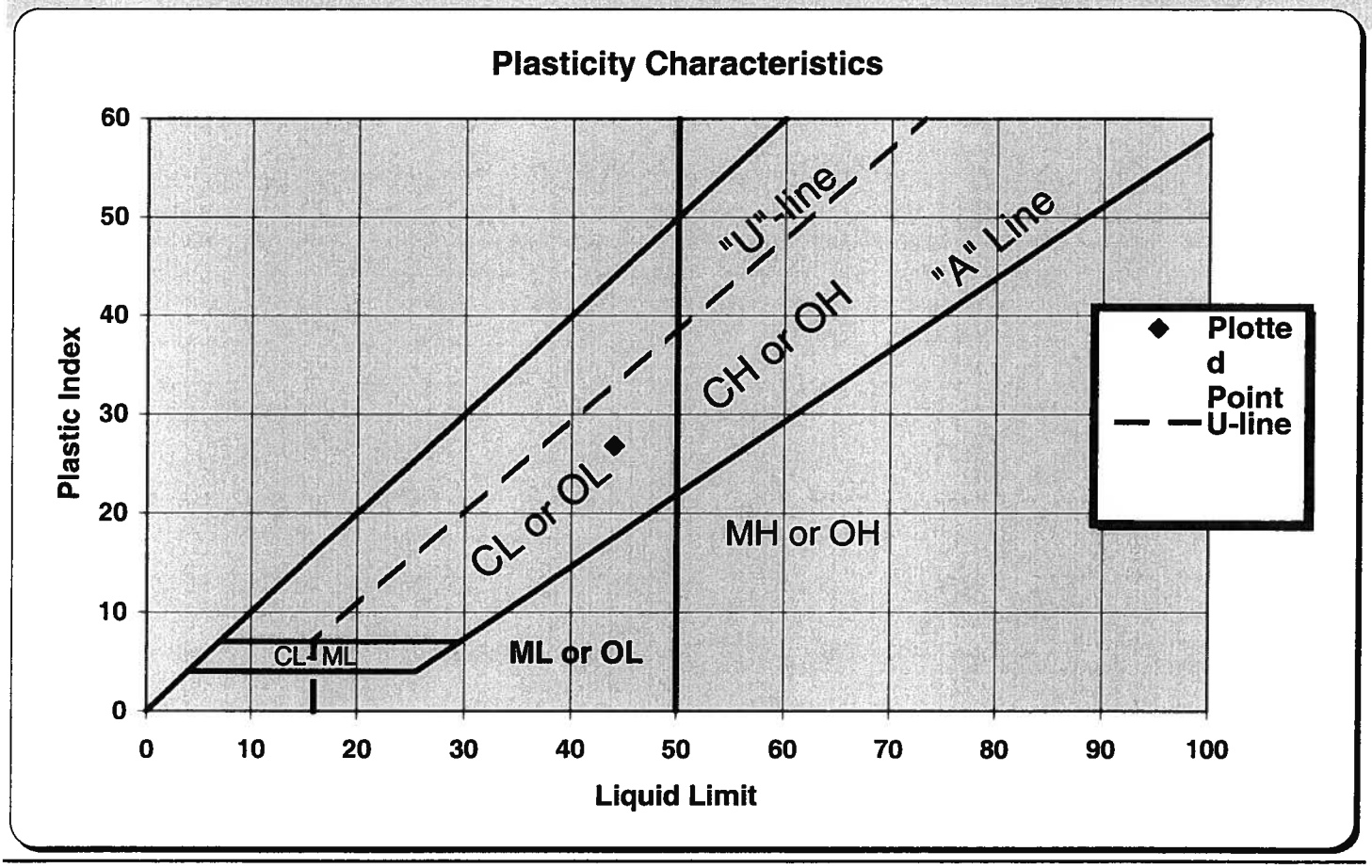
| LL | PI |
|---|---|
| 44 | 26.783923 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-8 | Sample: S-7 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 18.5 - 20 ft. |

*Sample Description:* Tan-Brown Silty Clayey SAND (SC)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | **8001** | Tare Wt. | **123.23** | Mass of Sample after Wash + Tare Wt. | **284.85** |
| Total Sample Wet Wt. + Tare Wt. | | | **529.61** | Mass of Sample after Wash | **161.62** |
| Total Sample Dry Wt. + Tare Wt. | | | **418.02** | Mass passing #200 | **133.17** |
| **Total Sample Dry Weight** | | | **294.79** | % Passing #200 **(D1140)** | **45.2%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | *Cumulative* | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | *Total Sample* | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 1.65 | 0.6% | 0.6% | **99.4%** | NA |
| #10 | 2.000 | 3.77 | 0.7% | 1.3% | **98.7%** | NA |
| #20 | 0.850 | 5.98 | 0.7% | 2.0% | **98.0%** | NA |
| #40 | 0.425 | 13.36 | 2.5% | 4.5% | **95.5%** | NA |
| #60 | 0.250 | 39.12 | 8.7% | 13.3% | **86.7%** | NA |
| #100 | 0.150 | 104.79 | 22.3% | 35.5% | **64.5%** | NA |
| #200 | 0.075 | 158.46 | 18.2% | 53.8% | **46.2%** | NA |
| Pan | <0.075 | 161.50 | | **% Passing #200 (D422) =** | | **46.2%** |

| | | | | | |
|---|---|---|---|---|---|
| ***D2487*** | Maximum Particle Size | **3/8"** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **3.3%** |
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.6%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **49.2%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.7%** | % Silt & Clay | < 0.075 mm | **46.2%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

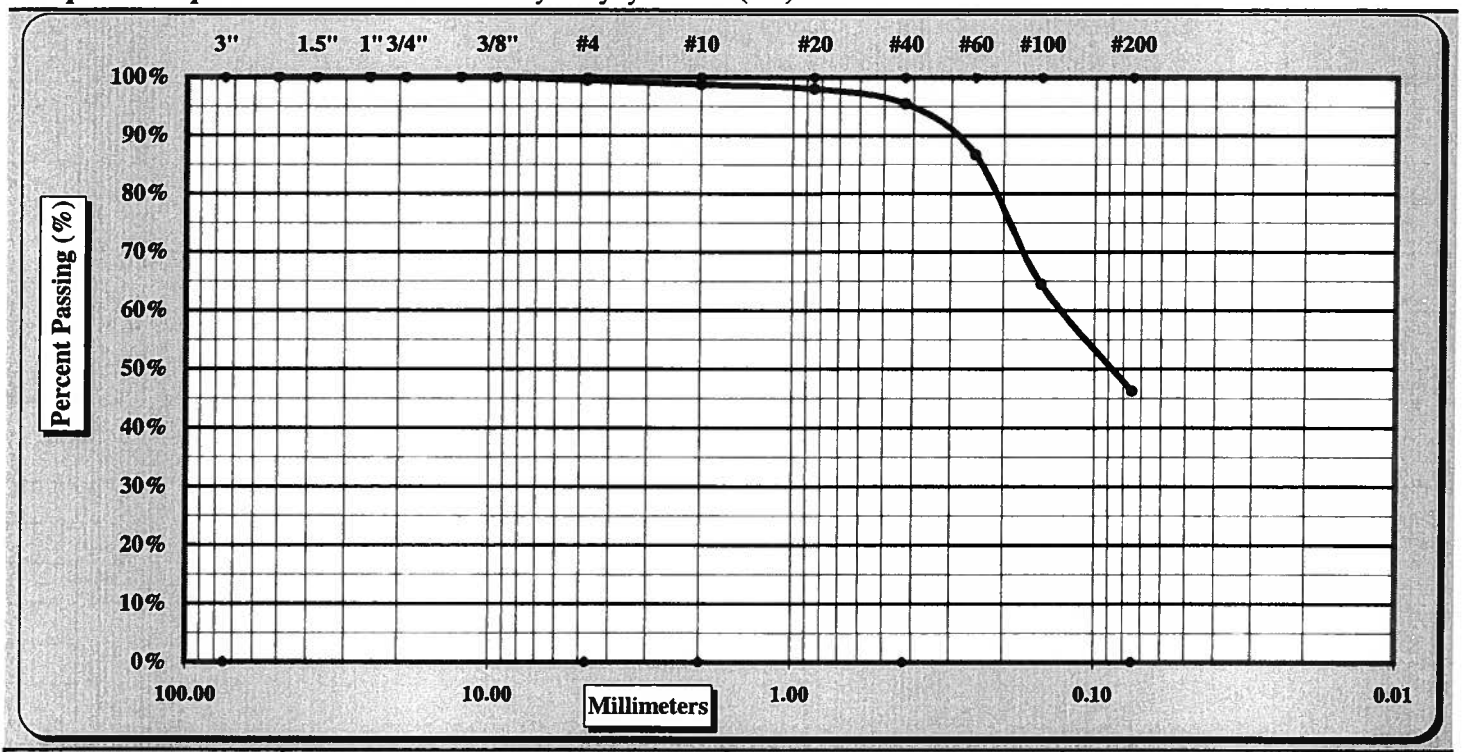
*Quality Assurance*

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-8 | Sample: | S-7 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 18.5 - 20 ft. |

***Sample Description:*** Tan-Brown Silty Clayey SAND (SC)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | 3/8" | Coarse Sand | 0.7% | Fine Sand | 49.2% |
| Gravel | 0.6% | Medium Sand | 3.3% | Silt & Clay | 46.2% |
| Liquid Limit | 47 | Plastic Limit | 20 | Plastic Index | 27 |
| Specific Gravity | ND | | | Moisture Content | 37.9% |
| Coarse Sand | 0.7% | Medium Sand | 3.3% | Fine Sand | 49.2% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

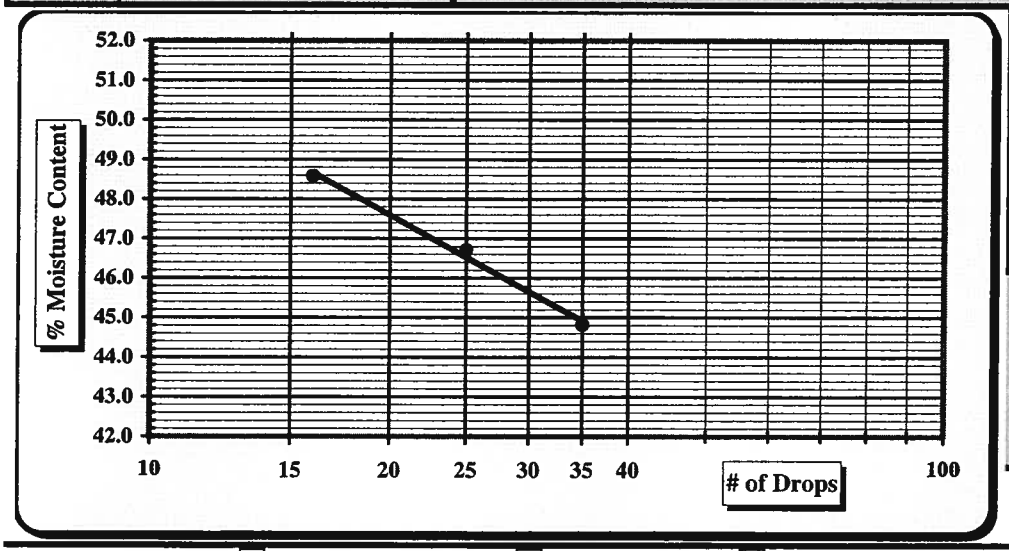
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-8 | Sample #: S-7 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 18.5 - 20 ft. | |
| Sample Description: | Tan-Brown Silty Clayey SAND (SC) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 809 | 801 | 805 | | | | 804 | 808 | |
| A | Tare Weight | 16.68 | 16.66 | 16.69 | | | | **16.62** | 16.69 | |
| B | Wet Soil Weight + A | 34.91 | 28.44 | 32.72 | | | | 28.09 | 28.09 | |
| C | Dry Soil Weight + A | 28.95 | 24.69 | 27.76 | | | | 26.20 | 26.21 | |
| D | Water Weight (B-C) | 5.96 | 3.75 | 4.96 | | | | 1.89 | 1.88 | |
| E | Dry Soil Weight (C-A) | 12.27 | 8.03 | 11.07 | | | | 9.58 | 9.52 | |
| **F** | % Moisture (D/E)*100 | 48.6% | 46.7% | 44.8% | | | | 19.7% | 19.7% | |
| N | # OF DROPS | 16 | 25 | 35 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **19.7%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | 47 |
| Plastic Limit | 20 |
| Plastic Index | 27 |
| Group Symbol | SC |

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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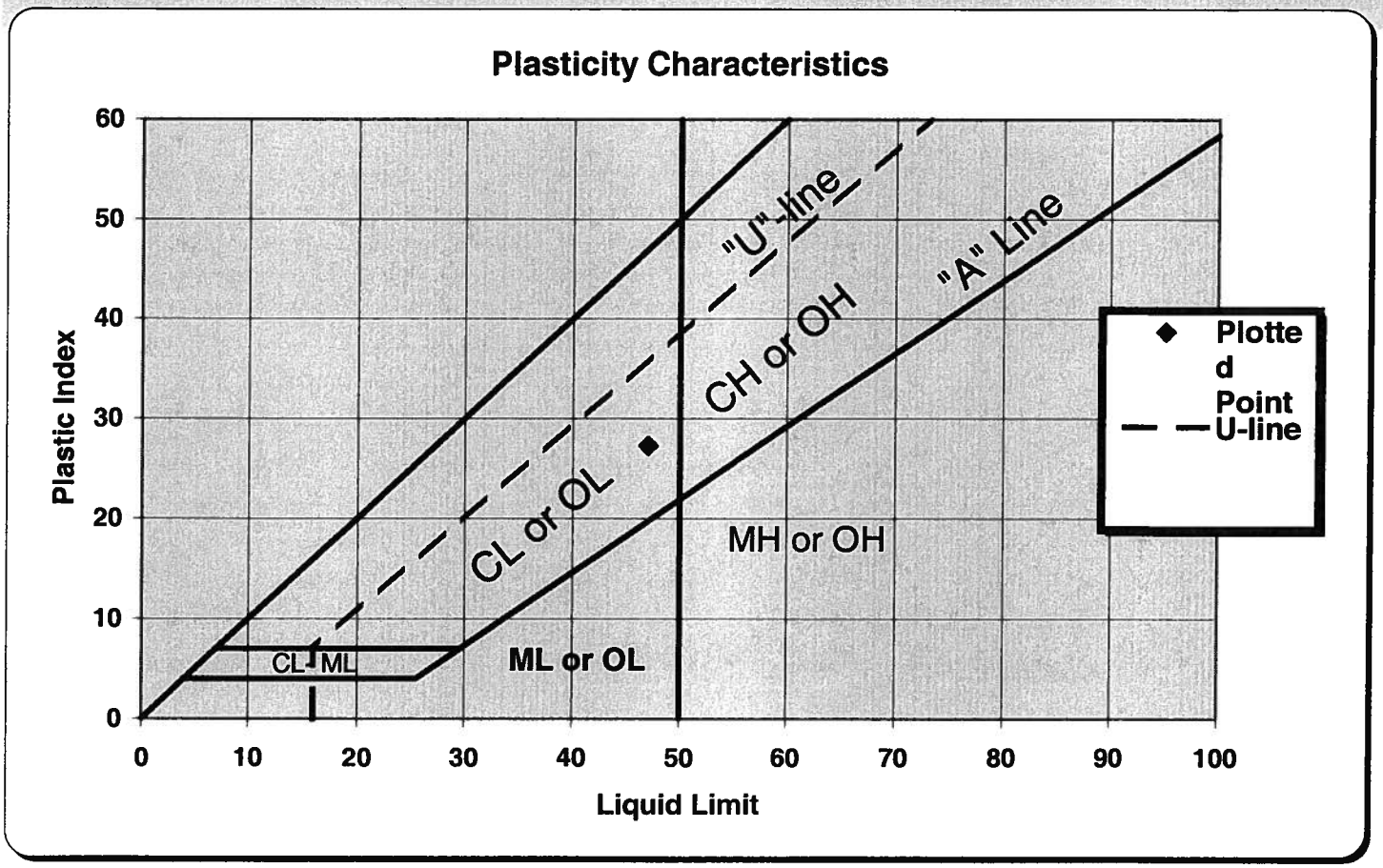
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 47 | 27.26175 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: B-8 | Sample: S-6 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 16 - 17.5 ft. |

*Sample Description:* Tan Silty Clayey SAND (SC)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | 2 | Tare Wt. | **151.60** | Mass of Sample after Wash + Tare Wt. | **330.63** |
| Total Sample Wet Wt. + Tare Wt. | | | **465.12** | Mass of Sample after Wash | **179.03** |
| Total Sample Dry Wt. + Tare Wt. | | | **389.28** | Mass passing #200 | **58.65** |
| **Total Sample Dry Weight** | | | **237.68** | % Passing #200 **(D1140)** | **24.7%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #10 | 2.000 | 0.09 | 0.0% | 0.0% | **100.0%** | NA |
| #20 | 0.850 | 0.38 | 0.1% | 0.2% | **99.8%** | NA |
| #40 | 0.425 | 1.87 | 0.6% | 0.8% | **99.2%** | NA |
| #60 | 0.250 | 22.80 | 8.8% | 9.6% | **90.4%** | NA |
| #100 | 0.150 | 140.21 | 49.4% | 59.0% | **41.0%** | NA |
| #200 | 0.075 | 177.83 | 15.8% | 74.8% | **25.2%** | NA |
| Pan | <0.075 | 178.85 | | **% Passing #200 (D422) =** | | **25.2%** |

| | | | | | |
|---|---|---|---|---|---|
| ***D2487*** | Maximum Particle Size | **#4** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **0.7%** |
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.0%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **74.0%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.0%** | % Silt & Clay | < 0.075 mm | **25.2%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

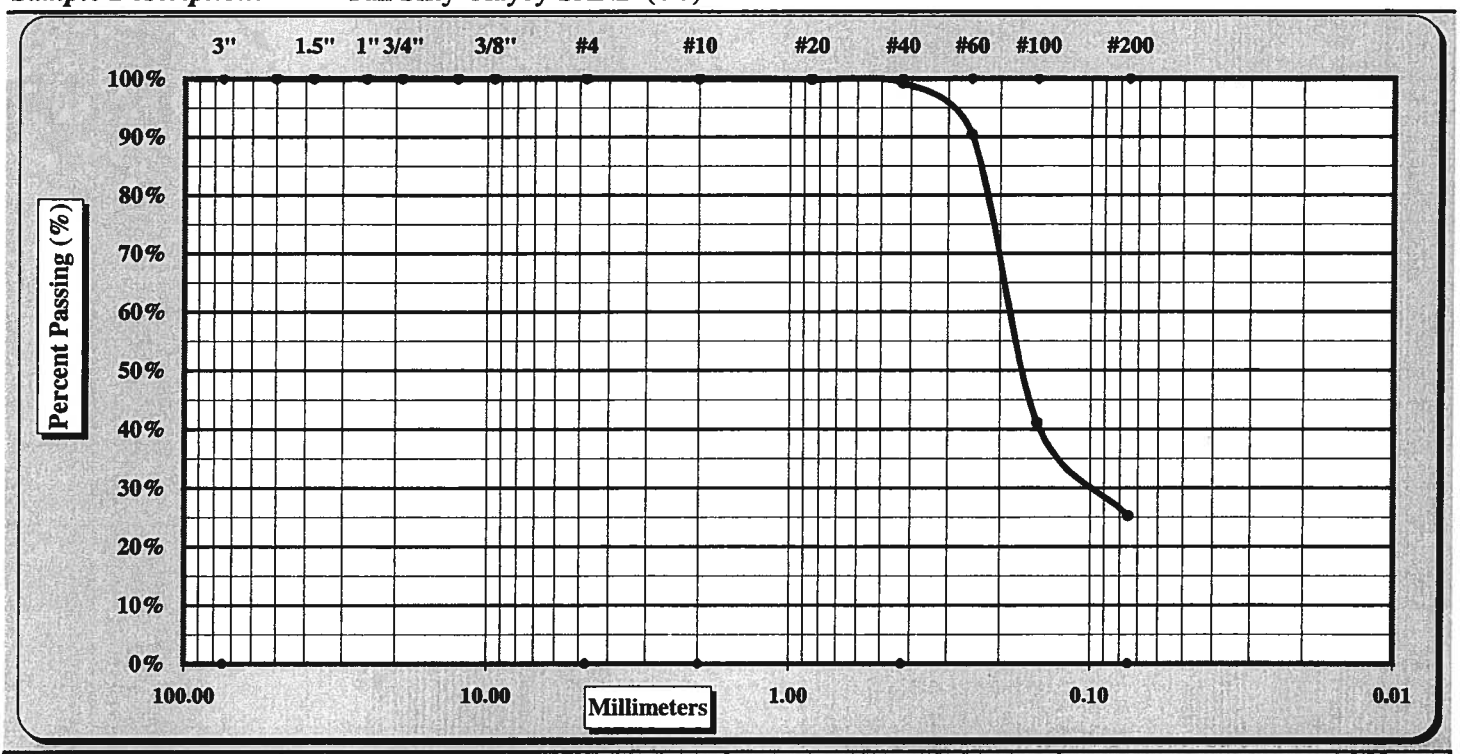
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | B-8 | Sample: | S-6 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 16 - 17.5 ft. |

***Sample Description:*** Tan Silty Clayey SAND (SC)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Coarse Sand | 0.0% | Fine Sand | 74.0% |
| Gravel | 0.0% | Medium Sand | 0.7% | Silt & Clay | 25.2% |
| Liquid Limit | 29 | Plastic Limit | 17 | Plastic Index | 12 |
| Specific Gravity | ND | | | Moisture Content | 31.9% |
| Coarse Sand | 0.0% | Medium Sand | 0.7% | Fine Sand | 74.0% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | _____ | Laboratory Manager | _____ |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

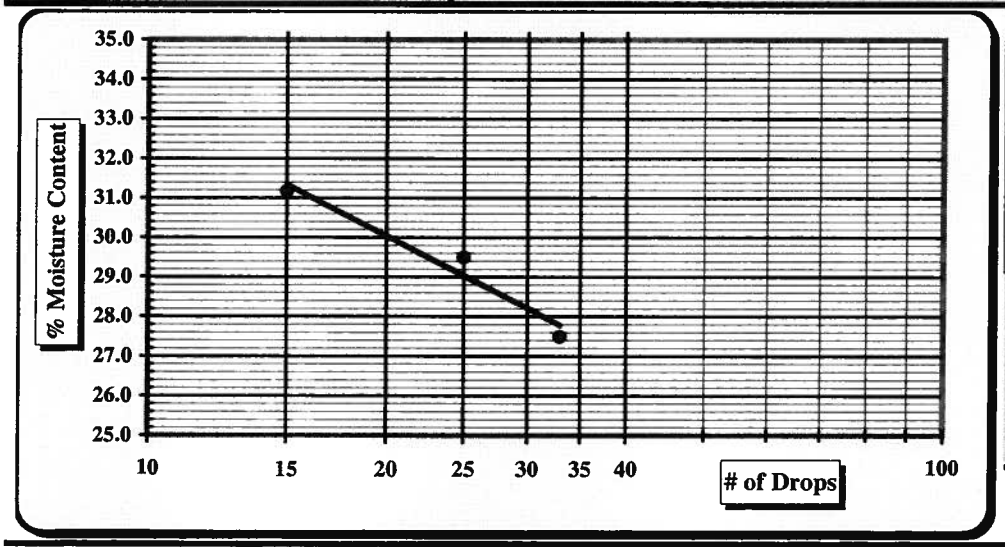
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | B-8 | Sample #: S-6 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 16 - 17.5 ft. | |
| Sample Description: | Tan Silty Clayey SAND (SC) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 28 | 22 | 10 | | | | 21 | 804 | |
| A | Tare Weight | 13.03 | 13.06 | 13.02 | | | | **12.89** | 16.63 | |
| B | Wet Soil Weight + A | 29.73 | 25.97 | 29.35 | | | | 26.74 | 30.38 | |
| C | Dry Soil Weight + A | 26.13 | 23.03 | 25.47 | | | | 24.71 | 28.38 | |
| D | Water Weight (B-C) | 3.60 | 2.94 | 3.88 | | | | 2.03 | 2.00 | |
| E | Dry Soil Weight (C-A) | 13.10 | 9.97 | 12.45 | | | | 11.82 | 11.75 | |
| F | % Moisture (D/E)*100 | 27.5% | 29.5% | 31.2% | | | | 17.2% | 17.0% | |
| N | # OF DROPS | 33 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **17.1%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | **29** |
| Plastic Limit | **17** |
| Plastic Index | **12** |
| Group Symbol | **SC** |

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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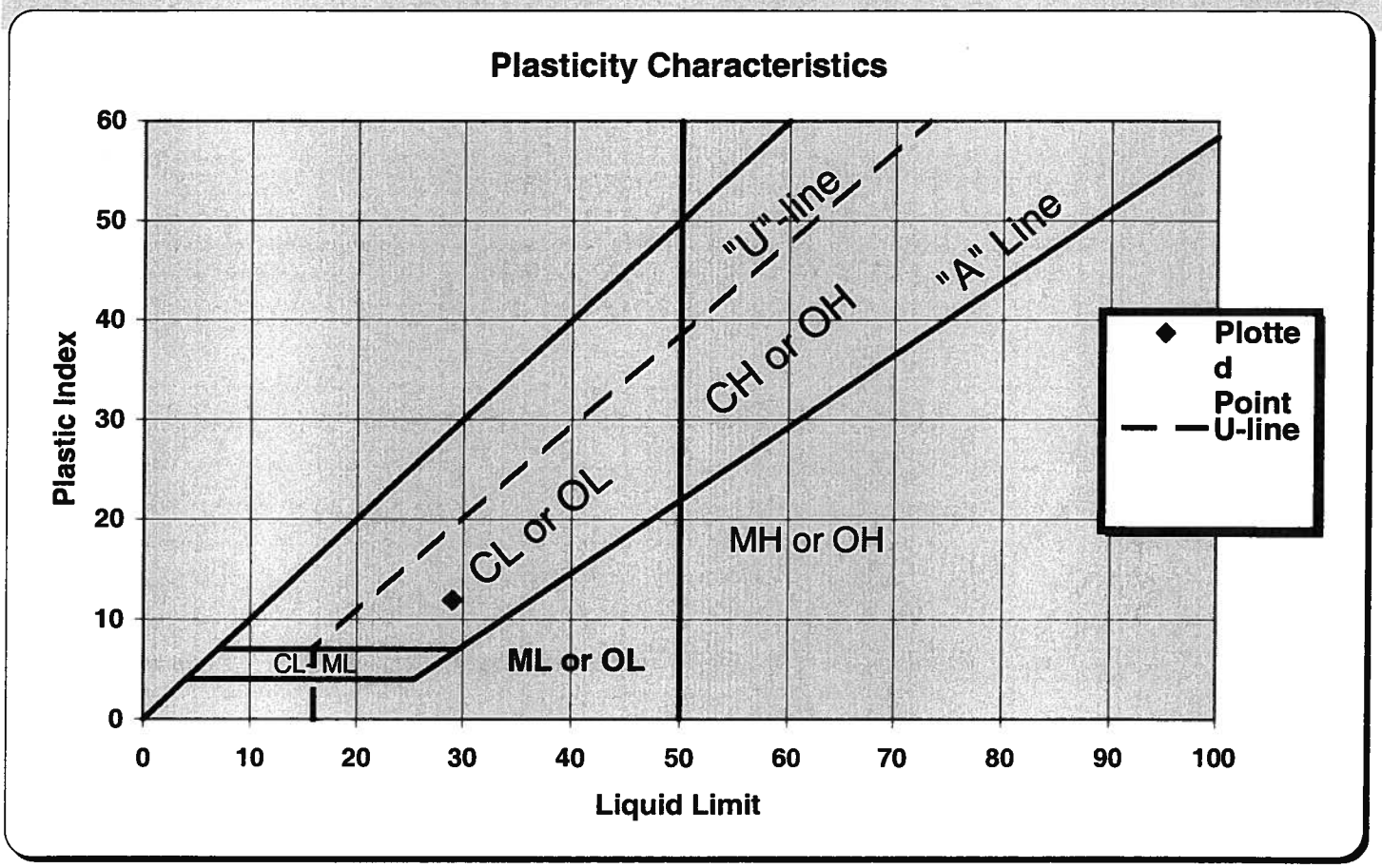
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 29 | 11.902221 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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*Form No: TR-D422-WH-1*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

S&ME

***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |
| Boring No.: CATP 1A | Sample: S-1 | Sample Date: | NA |
| Location: Site-Borehole | Offset: NA | Depth (ft): | 1 - 1.5 ft. |

*Sample Description:* Gray-Tan Sandy Silty CLAY (CH)

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

| **Particle Size Analysis / Without Hydrometer Analysis** | | | | *Material Excluded:* | |
|---|---|---|---|---|---|
| Tare No. | 4 | Tare Wt. | **128.44** | Mass of Sample after Wash + Tare Wt. | **234.91** |
| Total Sample Wet Wt. + Tare Wt. | | | **509.27** | Mass of Sample after Wash | **106.47** |
| Total Sample Dry Wt. + Tare Wt. | | | **432.11** | Mass passing #200 | **197.20** |
| **Total Sample Dry Weight** | | | **303.67** | % Passing #200 **(D1140)** | **64.9%** |

| **Sieve Size** | | **Retained Weight** | **% Retained Between Sieves** | **% Retained** | **% Passing** | **SPECS** |
|---|---|---|---|---|---|---|
| | | | | ***Cumulative*** | | |
| *Standard* | *mm.* | *Cumulative* | *Individual* | ***Total Sample*** | | |
| 2.0" | 50.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.5" | 37.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1.0" | 25.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/4" | 19.00 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 1/2" | 12.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| 3/8" | 9.50 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #4 | 4.75 | 0.00 | 0.0% | 0.0% | **100.0%** | NA |
| #10 | 2.000 | 0.40 | 0.1% | 0.1% | **99.9%** | NA |
| #20 | 0.850 | 1.87 | 0.5% | 0.6% | **99.4%** | NA |
| #40 | 0.425 | 4.52 | 0.9% | 1.5% | **98.5%** | NA |
| #60 | 0.250 | 12.41 | 2.6% | 4.1% | **95.9%** | NA |
| #100 | 0.150 | 52.86 | 13.3% | 17.4% | **82.6%** | NA |
| #200 | 0.075 | 102.07 | 16.2% | 33.6% | **66.4%** | NA |
| Pan | <0.075 | 106.60 | | **% Passing #200 (D422) =** | | **66.4%** |

| ***D2487*** | Maximum Particle Size | **#4** | Medium Sand | < 2.00 mm and > 0.425 mm (#40) | **1.4%** |
|---|---|---|---|---|---|
| Gravel | < 75 mm and > 4.75 mm (#4) | **0.0%** | Fine Sand | < 0.425 mm and > 0.075 mm (#200) | **32.1%** |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | **0.1%** | % Silt & Clay | < 0.075 mm | **66.4%** |

***Notes / Deviations / References:***

D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No: TR-D422-WH-1Ga*
*Revision No. 0*
*Revision Date: 07/14/08*

# Sieve Analysis of Soils

*ASTM D 422*

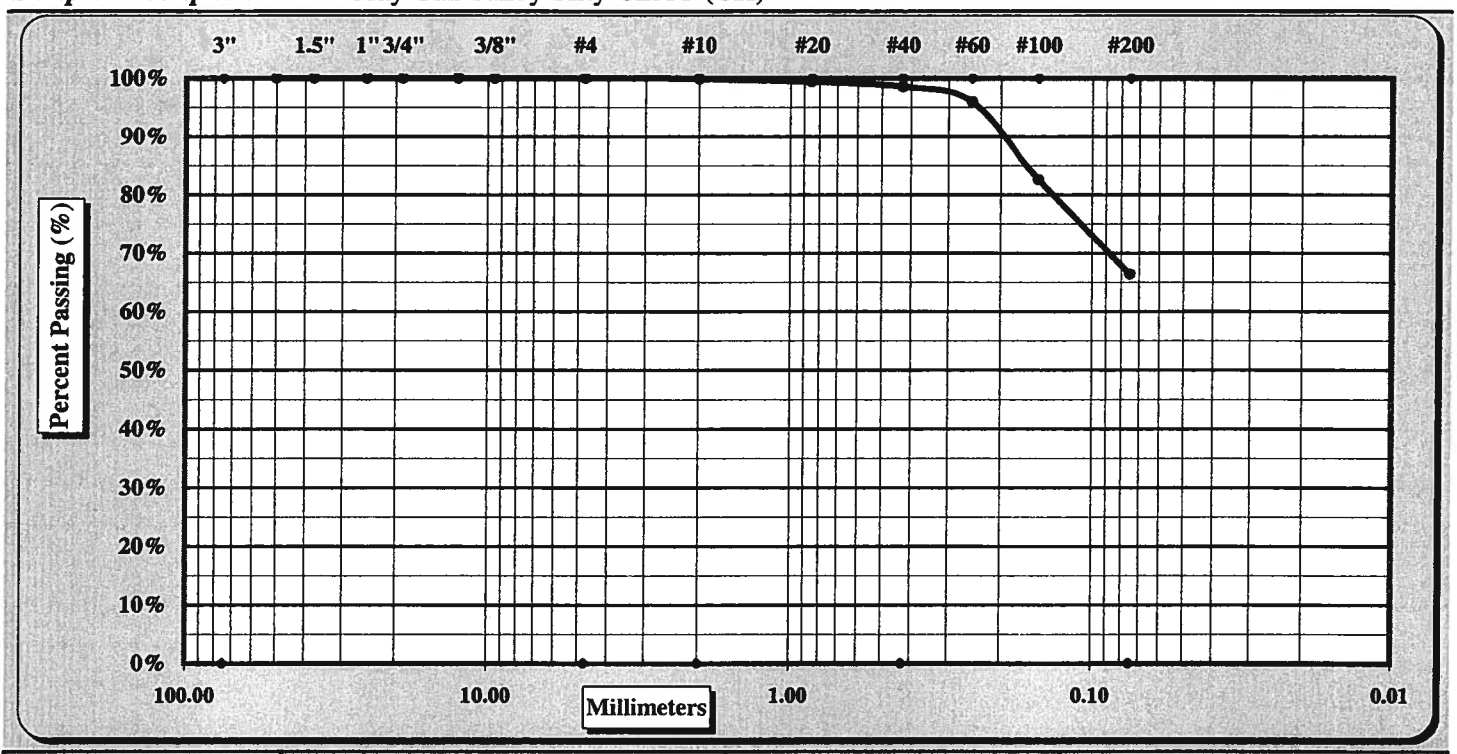
***Quality Assurance***

**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s): | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring No.: | CATP 1A | Sample: | S-1 | Sample Date: | NA |
| Location: | Site-Borehole | Offset: | NA | Depth (ft): | 1 - 1.5 ft. |

***Sample Description:*** Gray-Tan Sandy Silty CLAY (CH)




| | | | |
|---|---|---|---|
| Cobbles | < 300 mm (12") and > 75 mm (3") | Fine Sand | < 0.425 mm and > 0.075 mm (#200) |
| Gravel | < 75 mm and > 4.75 mm (#4) | Silt | < 0.075 and > 0.005 mm |
| Coarse Sand | < 4.75 mm and >2.00 mm (#10) | Clay | < 0.005 mm |
| Medium Sand | < 2.00 mm and > 0.425 mm (#40) | Colloids | < 0.001 mm |

| | | | | | |
|---|---|---|---|---|---|
| Maximum Particle Size | #4 | Coarse Sand | 0.1% | Fine Sand | 32.1% |
| Gravel | 0.0% | Medium Sand | 1.4% | Silt & Clay | 66.4% |
| Liquid Limit | 53 | Plastic Limit | 17 | Plastic Index | 36 |
| Specific Gravity | ND | | | Moisture Content | 25.4% |
| Coarse Sand | 0.1% | Medium Sand | 1.4% | Fine Sand | 32.1% |

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

***Notes / Deviations / References:*** ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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*Form No. TR-D4318-T89-90* *Client code* *Client Test #* *state #*

*Revision No. 0*

*Revision Date: 11/20/07*

# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Another code* *ASTM D 4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

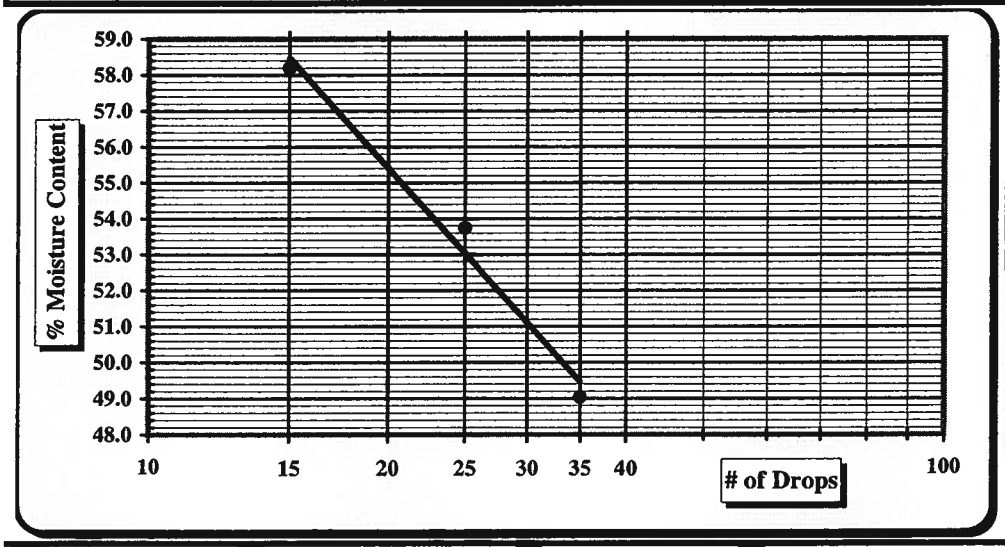
**S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616**

| | | | |
|---|---|---|---|
| **Project #:** | **1054-07-241A** | Report Date: | 4/18/09 |
| Project Name: | Edgecombe County | Test Date(s) | 4/15 - 4/18/09 |
| Client Name: | | | |
| Client Address: | | | |

| | | | | | |
|---|---|---|---|---|---|
| Boring #: | CATP 1A | Sample #: S-1 | | Sample Date: NA | |
| Location: | Site-Borehole | Offset: NA | | Depth (ft): 1 - 1.5 ft. | |
| Sample Description: | Gray-Tan Sandy Silty CLAY (CH) | | | | |

| *Type and Specification* | *S&ME ID #* | *Cal Date:* | *Type and Specification* | *S&ME ID #* | *Cal Date:* |
|---|---|---|---|---|---|
| Balance (0.01 g) | 1024 | 11/12/2008 | Grooving tool | S-1 | 8/22/2008 |
| LL Apparatus | 1084 | 8/22/2008 | Grooving tool | | |
| Oven | 1454 | 2/14/2009 | Grooving tool | | |

| *Pan #* | | Liquid Limit | | | | | | Plastic Limit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tare #: | 25 | 23 | 26 | | | | 9 | 27 | |
| A | Tare Weight | 12.93 | 13.03 | 12.90 | | | | **13.07** | 13.04 | |
| B | Wet Soil Weight + A | 26.00 | 30.54 | 29.13 | | | | 23.96 | 23.97 | |
| C | Dry Soil Weight + A | 21.70 | 24.42 | 23.16 | | | | 22.37 | 22.36 | |
| D | Water Weight (B-C) | 4.30 | 6.12 | 5.97 | | | | 1.59 | 1.61 | |
| E | Dry Soil Weight (C-A) | 8.77 | 11.39 | 10.26 | | | | 9.30 | 9.32 | |
| F | % Moisture (D/E)*100 | 49.0% | 53.7% | 58.2% | | | | 17.1% | 17.3% | |
| N | # OF DROPS | 35 | 25 | 15 | | | | *Moisture Contents determined by ASTM D 2216* | | |
| LL | LL = F * FACTOR | | | | | | | | | |
| *Ave.* | *Average* | | | | | | | **17.2%** | | |




One Point Liquid Limit

| N | Factor | N | Factor |
|---|---|---|---|
| 20 | 0.974 | 26 | 1.005 |
| 21 | 0.979 | 27 | 1.009 |
| 22 | 0.985 | 28 | 1.014 |
| 23 | 0.99 | 29 | 1.018 |
| 24 | 0.995 | 30 | 1.022 |
| 25 | 1.000 | | |

| | |
|---|---|
| NP, Non-Plastic | ☐ |
| Liquid Limit | 53 |
| Plastic Limit | 17 |
| Plastic Index | 36 |
| Group Symbol | CH |

Multipoint Method ☑

One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐ *Estimate the % Retained on the #40 Sieve:*

***Notes / Deviations / References:***

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

*ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

| Mal Krajan | | Laboratory Manager | |
|---|---|---|---|
| *Technical Responsibility* | *Signature* | *Position* | *Date* |

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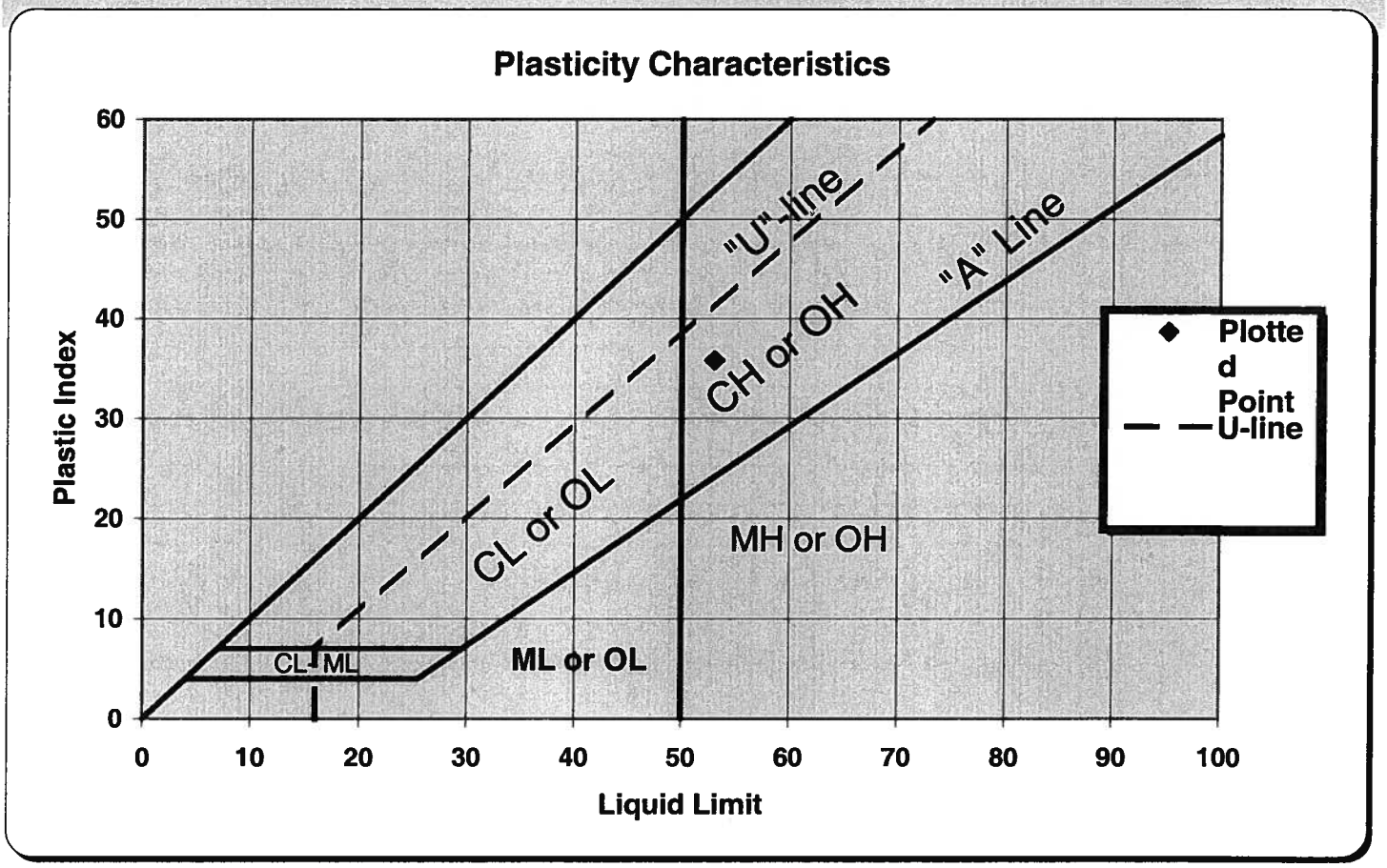
# Liquid Limit, Plastic Limit, and Plastic Index

S&ME

*Quality Assurance*

| LL | PI |
|---|---|
| 53 | 35.814274 |




*Notes/Deviations/References*

| U-Line | |
|---|---|
| 16 | 0 |
| 16 | 7 |
| 73 | 60 |

| A-Line | |
|---|---|
| 100 | 58.4 |
| 25.5 | 4 |
| 4 | 4 |
| 60 | 60 |

| Cl-ML line | |
|---|---|
| 7 | 7 |
| 29.5 | 7 |

| 50,0 Line | |
|---|---|
| 50 | 0 |
| 50 | 60 |

| | |
|---|---|
| 60 | 60 |
| 4 | 4 |
| 0 | 0 |

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# APPENDIX IV

(POND STUDY MEASUREMENTS AND CALCULATIONS)

# LEVEL LOOP DATA SHEET

| | | | |
|---|---|---|---|
| JOB #:1054-07-241A | PERSONNEL:DW/SL/JV | PAGE: of | |
| DATE:1/8/09 & 1/13/09 | WEATHER:Sunny mild | INSTRUMENT: | INSTRUMENT:David White |

COMMENTS:

| STA. | B.S. | H.I. | I.S. | F.S. | ELEV. | DESCRIPTION | R.R. | DIFF | DIST | AZIMUTH |
|---|---|---|---|---|---|---|---|---|---|---|
| BM-1 | 2.17 | 71.12 | | | 68.95 | MW-4 TOC | | | | |
| | | | 0.86 | | 70.26 | Pond 2 | | | | |
| | | | 2.96 | | 68.16 | Pond 1 | | | | |
| | | | 6.31 | | 64.81 | Top Score Pond Overflow | | | | |
| | | | 7.13 | | 63.99 | Bottom Score (Top Concrete) | | | | |
| | | | 2.17 | | 68.95 | MW-4 TOC | | | | |
| | | | | 0.86 | 70.26 | Pond 2 | | | | |
| | 2.55 | 72.81 | | | 70.26 | Pond 2 | | | | |
| | | | | 3.86 | 68.95 | MW-4 TOC | | | | |
| | 6.07 | 75.02 | | | 68.95 | MW-4 TOC | | | | |
| | | | 5.13 | | 69.89 | Pond 3 | | | | |
| | | | | 6.07 | 68.95 | MW-4 TOC | | | | |
| | 4.45 | 73.40 | | | 68.950 | MW-4 TOC | | | | |
| | | | | 3.13 | 70.270 | Pond 2 | | | | |

Notes: STA. - Station B.S. - Back Site H.I. - Height of Inst. I.S. - Intermediate Site F.S. - Fore Site Elev. - Elevation T.P. - Turning Point
R.R. - Rod Reading Top/Bottom Hatch DIFF - R.R. Top-R.R. Bottom DIST - DIFFx100

Remember: Exisiting elevation + B.S. = H.I. H.I. - F.S. = New elevation ALSO, H.I. - F.S. = T.P. elevation T.P. elevation+ B.S. = new H.I.

| ARITHMETIC CHECK - | REF. ELEV. | + SUM B.S. | - SUM F.S. | = LAST ELEV. | |
|---|---|---|---|---|---|
| | 68.95 | 15.24 | 13.92 | 70.27 | CHECKED BY: Checked By: DBW |

**Drawdown Analysis Edgecombe County Landfil Pond Study**

| DD Cycle | Point | M1 | M2 | % Lower | M3 | % Lower | Cycles( n) | %DD * Cycles n | DD in n cycles | New Water Elev/(n) cycles | Drawdown | Diff DD Point to Pond |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.73 | Pond 1 | 59.19 | | | 58.46 | 0.01 | 3.25 | 0.04 | 2.34 | 56.12 | 3.07 | -0.25 |
| 0.93 | Pond 2 | 63.47 | | | 62.54 | 0.01 | 3.25 | 0.05 | 2.98 | 59.56 | 3.91 | 3.19 |
| 0.49 | Pond 3 | 64.83 | 64.47 | 0.01 | 64.34 | 0.01 | 3.25 | 0.02 | 1.58 | 62.76 | 2.07 | 6.39 |
| 0.85 | MW-4 | 63.66 | | | 62.81 | 0.01 | 3.25 | 0.04 | 2.73 | 60.08 | 3.58 | 3.71 |
| 1.833 | Pond Pool | 63.99 | 63.26 | 0.01 | 62.157 | 0.03 | 3.25 | 0.09 | 5.79 | 56.37 | 7.62 | |
| | | | | | | | | | | **Partial Reversal** | | |

| DD Cycle | Point | M1 | M2 | % Lower | M3 | % Lower | Cycles( n) | %DD * Cycles n | DD in n cycles | New Water Elev /n cycles | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.73 | Pond 1 | 59.19 | | | 58.46 | 0.01 | 3.5 | 0.04 | 2.52 | 55.94 | 3.25 | 0.01 |
| 0.93 | Pond 2 | 63.47 | | | 62.54 | 0.01 | 3.5 | 0.05 | 3.21 | 59.33 | 4.14 | 3.41 |
| 0.49 | Pond 3 | 64.83 | 64.47 | 0.01 | 64.34 | 0.01 | 3.5 | 0.03 | 1.70 | 62.64 | 2.19 | 6.71 |
| 0.85 | MW-4 | 63.66 | | | 62.81 | 0.01 | 3.5 | 0.05 | 2.94 | 59.87 | 3.79 | 3.95 |
| 1.833 | Pond Pool | 63.99 | 63.26 | 0.01 | 62.157 | 0.03 | 3.5 | 0.10 | 6.23 | 55.93 | 8.06 | |
| | | | | | | | | | | **Full Reversal** | | |

| DD Cycle | Point | M1 | M2 | % Lower | M3 | % Lower | Cycles( n) | %DD * Cycles n | DD in n cycles | New Water Elev /n cycles | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.73 | Pond 1 | 59.19 | | | 58.46 | 0.01 | 3.75 | 0.05 | 2.70 | 55.76 | 3.43 | 0.28 |
| 0.93 | Pond 2 | 63.47 | | | 62.54 | 0.01 | 3.75 | 0.05 | 3.44 | 59.10 | 4.37 | 3.62 |
| 0.49 | Pond 3 | 64.83 | 64.47 | 0.01 | 64.34 | 0.01 | 3.75 | 0.03 | 1.82 | 62.52 | 2.31 | 7.04 |
| 0.85 | MW-4 | 63.66 | | | 62.81 | 0.01 | 3.75 | 0.05 | 3.14 | 59.67 | 3.99 | 4.18 |
| 1.833 | Pond Pool | 63.99 | 63.26 | 0.01 | 62.157 | 0.03 | 3.75 | 0.11 | 6.68 | 55.48 | 8.51 | |
| | | | | | | | | | | **Full Reversal** | | |

# Attachment IV

# DESIGN REPORT
# FORMER EAGLES PROPERTY
# DAM REMOVAL
# EDGECOMBE COUNTY, NORTH CAROLINA

S&ME Project No. 1054-07-241

Prepared for:
Edgecombe County Solid Waste
Tarboro, North Carolina

Prepared by:
S&ME, Inc.
9751 Southern Pine Blvd.
Charlotte, North Carolina 28273

July 20, 2011

RECEIVED
JUL 21 2011
LAND QUALITY SECTION

S&ME

RECEIVED
JUL 21 2011
LAND QUALITY SECTION

July 20, 2011

Mr. Steve McEvoy
512 N. Salisbury Street
Raleigh, North Carolina 27604

**Reference:** **Design Report**
**Former Eagles Property Dam Removal**
Tarboro, North Carolina
S&ME Project No. 1054-07-241

Dear Mr. McEvoy:

The enclosed report presents the results of the design and analyses by S&ME, Inc. for the removal of the former Eagles Property dams in Edgecombe County, North Carolina. This report and the enclosed plans have been prepared for submittal to the Dam Safety Office of the North Carolina Department of Environment and Natural Resources (NCDENR) for review and approval prior to construction activities.

This report describes our understanding of the project, presents the results of the analyses, and discusses our conclusions and recommendations. S&ME, Inc. appreciates this opportunity to be of service to you. Please call if you have questions concerning this report or any of our services.

Respectfully submitted,

**S&ME, Inc.**

NORTH CAROLINA PROFESSIONAL SEAL 032667 ENGINEER JOSHUA M. BELL

Joshua M. Bell, P.E.
Project Engineer
NC Registration No. 032667

Kyle Baucom
Project Professional

Senior Reviewed by: Jack Amar, P.E. – Senior Vice-President



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## SUMMARY

We understand the dam is causing elevated groundwater levels in the Edgecombe County landfill. In order to lower the groundwater influence posed by the impoundment as part of a Corrective Action Plan for the landfill, Edgecombe County has elected to remove the dams and allow the stream channel to flow through the property. This work will require the excavation and disposal of existing earthen dam materials and the establishment of a stable stream channel through the dam footprints. NCDENR has directed that the channels should be designed for stability for storm flows resulting from the 25-year return period storm.

## 1. INTRODUCTION

S&ME, Inc. has completed the analysis and design of dam removal measures for the referenced site. This report, calculations, and construction plans have been prepared to address dam safety issues which are regulated by the Dam Safety Office of NCDENR. Our work is based, in-part on information provided to us, by Edgecombe County, and survey data from other consultants.

## 2. SITE AND PROJECT DESCRIPTION

### 2.1 Site Description

The existing dams are adjacent to Colonial Road on an un-named tributary to Jerry's Creek, near Tarboro, North Carolina. The coordinates for the dam are: 35.8218° North, 77.5636° West. According to the NCDENR Dam Safety inventory, the dams are not listed as regulated structures. The earthen embankment dams are approximately 13 and 10 feet in height and the ponds are currently impounding water. The upper dam breached at some point prior to the purchase of the property by Edgecombe County. The upper dam as currently exists does not impound water to the original water surface.

### 2.2 Project Description

Recent correspondence with NCDENR Solid Waste Section indicates the dam removal can be used to lower the groundwater elevations impacting the landfill. S&ME has prepared this report and construction documents for submittal to Dam Safety for review and approval for subsequent construction work to remove the existing dam and restore a stream channel.

Based on our understanding and past conversations with the NCDENR Dam Safety Office, the stream channel through the dam footprint is required to be stable under flood conditions up to the 25-year storm event. S&ME, Inc. performed hydrologic analyses for the watershed to determine design flood flows as well as hydraulic analyses of the proposed channel through the dam footprint.

## 3. HYDROLOGIC ANALYSES

S&ME, Inc. developed hydrologic calculations to determine design flows for the referenced watershed system. The data gathered from S&ME drawings and topographic data from NCDOT includes:

| PARAMETER | VALUE |
|---|---|
| Watershed Area | 84.9 Acres, 0.1327 Square-miles |
| Watershed Curve Number | 61 |
| Watershed Lag Time | 23.3 Minutes |

S&ME used the HEC-HMS computer model developed by the USACE to calculate storm runoff for the 25-year rainfall event. Input into the model included basin area, basin lag time, curve number, rainfall depth, and rainfall distribution. We used the Type II, 24-hour rainfall distribution developed by the Natural Resources Conservation Service (NRCS) for rainfall runoff calculations. The 25-year, 24-hour rainfall depth for the basin is 5.83 inches according to the Point Precipitation Frequency Estimates from the NOAA Atlas 14 by the National Weather Service.

## 4. HYDRAULIC DESIGN ANALYSES

S&ME prepared the proposed stream channel armoring design using methods developed by North American Green. This method evaluates shear stresses on the channel bed as a function of flow depth and channel slope. Flow depth is determined by the channel cross section geometry, channel slope, and channel roughness.

The drop of the stream channel over the distance through the dam footprint results in a slope of approximately 1.5% for the channel, as determined by the slope of the existing spillway conduit through the dam. Channel geometry was developed through a trial and error approach taking the surrounding side slopes into consideration. S&ME adjusted the variables of channel side slope, bottom width and channel roughness to provide the final design for the project. A channel geometry approximately 5H:1V in the main channel area was selected since the downstream road culvert controls the flow depth for the 25-year event creating backwater conditions to elevation 58.06 feet. Hydraulic design results are discussed in the following section.

## 5. RESULTS

S&ME developed the design documents based on the data provided and our understanding of the project and applicable engineering design techniques and standards. Our results are summarized in the following table:

| Design Parameter | Calculated Value |
|---|---|
| Watershed Inflow | 110 cubic-feet per second |
| Channel Bottom Width | 0 feet |
| Channel Side Slope | 6H:1V |
| Channel Armor Material Specification | |
| Channel Sections | Grass Vegetation with erosion control matting during growth phase |

# 6. DESIGN RECOMMENDATIONS

## 6.1 Limitations of Report

This report has been prepared in accordance with generally accepted engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based on applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, expressed or implied, is made. The recommendations in this report are contingent on S&ME, Inc.'s observation and monitoring of grading and construction activities. S&ME has used limited portions of data from reports by third parties, as a convenience to you. S&ME makes no representations regarding these reports or the data provided therein. We have reviewed these limited data prior to use in our analyses.

## 6.2 Channel Protection

The channel protection design requires constructing a grass lined channel through the proposed breach area of the existing dam. North American Green C-150 matting or equivalent should be used to protect the soil from erosion during the seeding and growth phase.

# 7. CONSTRUCTION CONSIDERATIONS

## 7.1 Erosion and Sediment Control

Erosion and sediment control measures consist of a stone inlet protection at the culvert entrance at to Colonial Road. The anticipated area of disturbance for the entire project is less than one acre, however, erosion and sediment control permitting is required due to other work associated with the Corrective Action Plan. These protective measures will be added to the permitted plan. The breach of the lower pond should not proceed until the pond has been dewatered by pumping to draw down. S&ME recommends a maximum drawdown rate of 1 foot per day to prevent sudden upstream slope failure and a catastrophic breach.

## 7.2 Permanent Vegetation Establishment

S&ME has made recommendations for permanent plantings in accordance with NCDENR Erosion and Sediment Control criteria. These plantings are selected for regional and site specific considerations. S&ME will defer to your preferences and the expertise of others in this regard. S&ME makes no guarantees regarding the establishment of permanent vegetation.

**APPENDIX I**
(CALCULATIONS)

S&ME

PROJECT NO. 1054-07-241C
SHEET NO. 1 / 5
DATE May 2, 2011
JOB NAME Edgecombe County Landfill – Dam Removal Permit
COMPUTED BY KB
SUBJECT Culvert Design
CHECKED BY JMB

## OBJECTIVE:

Two ponds are currently located southwest of the intersection of Landfill Access Road and Colonial Road at the Edgecombe County Landfill. The downstream pond discharges into a culvert that conveys flow under Colonial Road. The objective of this calculation is to assess the existing hydrology, evaluate the existing culvert crossing assuming the removal of the dams and no peak discharge attenuation through pond storage, and design a channel with capacity to convey flow from the watershed to the existing culvert crossing.

## REFERENCES:

1. Drainage Area Map, S&ME, 2011.
2. Erosion and Sediment Control Planning and Design Manual, NCDENR, June 2006.

## CALCULATIONS:

### 1. Calculate Composite Curve Number:

The contributing drainage area generally consists of primarily pasture/grasslands as well as woodlands. Based on the different land uses, a composite curve number was calculated as shown in the table below:

**Table 1: Composite Curve Number**

| Land Use Description | Hydrologic Soil Group | Runoff Curve Number {CN} [Ref. 2] | Area {A} ($ft^2$) [Ref. 1] | Area {A} (acres) [Ref. 1] | Total Area {A} (acres) [Ref. 1] | Calculated Composite Runoff Curve Number {CN} | Runoff Curve Number Used {CN} |
|---|---|---|---|---|---|---|---|
| Woodlands (good) | B | 55 | 289,727 | 6.65 | 84.95 | 60.5 | 61 |
| Pasture, grassland (good) | B | 61 | 3,410,751 | 78.30 | | | |

### 2. Calculate Time of Concentration for Sheet Flow:

The time of concentration due to sheet flow for the contributing drainage area was calculated using the following equation [Equation 8.03g in Reference 2]:

$$T_{c,sheet} = \frac{0.007(n_{sheet} L_{sheet})^{0.8}}{(P_2)^{0.5} s_{sheet}^{0.4}}$$

Where

$T_{c,sheet}$ = time of concentration for sheet flow (min),
$n_{sheet}$ = Manning's n for the area where sheet flow is expected,
$L_{sheet}$ = flow length for sheet flow (ft),
$P_2$ = 2-year, 24-hour rainfall (in), and
$s_{sheet}$ = average slope for the area where sheet flow is expected (ft/ft).

Sheet flow was assumed to occur within the first 100 feet in the pasture/grassland area north of Suggs Road. A Manning's n of 0.24 was assumed. The time of concentration for sheet flow was calculated as shown in the table below:

| Table 2: Time of Concentration - Sheet Flow | | | | |
|---|---|---|---|---|
| Manning's n {$n_{sheet}$} [Ref. 2] | Flow Length - Sheet {$L_{sheet}$} (ft) [Ref. 1] | 2-year, 24-hour Rainfall {$P_2$} (in) [Ref. 2] | Average Slope {$s_{sheet}$} (ft/ft) [Ref. 1] | Calculated Time of Concentration {$T_{c.sheet}$} (hr) |
| 0.24 | 100 | 3.42 | 0.010 | 0.3036 |

## 3. Calculate Time of Concentration for Shallow Concentrated Flow:

The velocity of shallow concentrated flow for the contributing drainage area was calculated using Figure 8.03f in Reference 2. Using the velocity and flow length of shallow concentrated flow, the time of concentration due to shallow concentrated flow was calculated in the table below:

| Table 3: Time of Concentration - Shallow Concentrated Flow | | | | |
|---|---|---|---|---|
| Length of Shallow Concentrated Flow {$L_{scf}$} (ft) [Ref. 1] | Average Slope {$s_{scf}$} (ft/ft) [Ref. 1] | Paved or Unpaved | Average Velocity {$V_{scf}$} (ft/s) [Ref. 2] | Calculated Time of Concentration {$T_{c.scf}$} (hr) |
| 750 | 0.0133 | Unpaved | 1.85 | 0.1126 |

## 4. Calculate Time of Concentration for Open Channel Flow:

The velocity during open channel flow was calculated using Manning's equation [Equation 8.03h in Reference 2]:

$$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$$

Where

V = average velocity (ft/s),
r = hydraulic radius (ft) and equal to flow area (a) divided by wetted perimeter ($p_w$),
s = slope of hydraulic grade line (ft/ft), and
n = Manning's roughness coefficient.

The hydraulic radius was calculated assuming a triangular channel with a depth of 2 feet and side slopes of 4H:1V and using the following equation:

$$r = \frac{z * h}{2 * \left(1 + z^2\right)^{1/2}}$$

Where

r = hydraulic radius (ft),
z = side slopes (H:1V), and
h = channel depth (ft).

Using the velocity and flow length of open channel flow, the time of concentration due to open channel flow was calculated in the table below:

**Table 4: Time of Concentration - Open Channel Flow**

| Manning's n {n} [Ref. 2] | Length of Shallow Concentrated Flow {$L_{channel}$} (ft) [Ref. 1] | Average Slope {$s_{channel}$} (ft/ft) [Ref. 1] | Hydraulic Radius {r} | Average Velocity {$V_{channel}$} (ft/s) [Ref. 2] | Calculated Time of Concentration {$T_{c.channel}$} (hr) |
|---|---|---|---|---|---|
| 0.05 | 2,087 | 0.0144 | 0.97 | 3.50 | 0.1656 |

## 5. Calculate Total Time of Concentration:

The times of concentration due to sheet, shallow concentrated, and open channel flows were summed to calculate a total time of concentration, as presented in the table below:

**Table 5: Time of Concentration**

| Calculated Time of Concentration {$T_{c.sheet}$} (hr) | Calculated Time of Concentration {$T_{c.scf}$} (hr) | Calculated Time of Concentration {$T_{c.channel}$} (hr) | Total Time of Concentration {$T_c$} (hr) | Total Time of Concentration {$T_c$} (minutes) |
|---|---|---|---|---|
| 0.3036 | 0.1126 | 0.1656 | 0.5817 | 35 |

## 6. Calculate Rainfall and Runoff Depth:

Rainfall and runoff depths were calculated for the 2-, 10-, 25- and 100-year storms using the following equations:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$ [Reference 2]

$$S = \frac{1000}{CN} - 10$$ [Reference 2]

Where

Q = depth of runoff (inches),
P = rainfall (inches),
S = potential maximum retention after runoff begins (inches), and
CN = curve number.
The initial abstraction, $I_a$, value was determined based on the curve number (CN) by referencing Table 8.03i in Reference 2

Runoff depths were calculated for the design storms in the table below:

**Table 6: Rainfall & Runoff Depth**

| Composite Runoff Curve Number {CN} | Potential Maximum Retention {S} (in) | Initial Abstraction {$I_a$} (in) | Storm Recurrence Interval (years) | Rainfall {P} (in) | Runoff {Q} (in) |
|---|---|---|---|---|---|
| 61 | 6.39 | 1.279 | 2 | 3.42 | 0.54 |
| | | | 10 | 4.93 | 1.33 |
| | | | 25 | 5.83 | 1.89 |
| | | | 100 | 7.25 | 2.88 |

## 7. Calculate Design Peak Discharge:

S&ME used HEC-HMS to model the watershed and culvert and to account for attenuation of peak discharge provided by the culvert and the roadway fill. Design peak discharge and peak culvert outflow were calculated for the 2-, 10-, 25- and 100-year, 24-hour storms using the software.

**Table 7: Peak Discharge**

| Area $\{A_m\}$ (acres) [Ref. 1] | Area $\{A_m\}$ ($mi^2$) | Lag Time (min) | Total Time of Concentration $\{T_c\}$ (min) | Storm Recurrence Interval (years) | Rainfall $\{P\}$ (in) | Peak Inflow $\{q_p\}$ (cfs) | Peak Discharge $\{q_p\}$ (cfs) | Peak Elev. (ft) |
|---|---|---|---|---|---|---|---|---|
| 84.95 | 0.1327 | 23.3 | 0.5817 | 2-yr | 3.42 | 24.16 | 23.28 | 52.51 |
| | | | | 10-yr | 4.93 | 76.65 | 57.58 | 56.07 |
| | | | | 25-yr | 5.83 | 115.32 | 69.52 | 58.06 |
| | | | | 100-yr | 7.25 | 183.13 | 173.17 | 59.26 |

## 8. Culvert Evaluation:

The existing culvert crossing was modeled in CulvertMaster computer software to evaluate capacity. The existing culvert is a 30-inch diameter RCP pipe with an upstream invert elevation of 50.00 feet, downstream invert elevation of 49.05 feet, length of 55 feet, and 1.73 percent slope. The road crossing at Colonial Road is at an approximate elevation of 59 feet, which provides approximately 9 feet of headwater on the culvert. Based on this information the 25-year, 24-hour storm passes with approximately 1 foot of freeboard at Colonial Road. The road crossing does adequately handle the estimated 100-year peak discharge, but does pass the 25-year storm event peak discharge. Typical NCDOT secondary roads are designed to pass the 25-year storm event.

## 9. Channel Evaluation:

Proposed channel side slopes were evaluated for the 25-year event with permanent stabilization of grass vegetation using North American Green Erosion Control Materials Design Software. Permanent grass-lined channels were found to be stable for the 25-year event. For the bare-earth condition, C-150 rolled erosion control product is required for stability.

## CONCLUSIONS:

North American Green C-150 matting is required to stabilize the bare-earth stream channel for the 25-year design event.

Project: Edgecombe Simulation Run: 002-year

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2000, 00:00 | Basin Model: | Basin 1 |
| End of Run: | 02Jan2000, 00:01 | Meteorologic Model: | 002-yr |
| Compute Time: | 19Jul2011, 01:21:56 | Control Specifications: | Control 1 |

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak |
|---|---|---|---|
| Subbasin-2 | 0.1327 | 24.2 | 01Jan2000, 12:2 |
| Reservoir-1 | 0.1327 | 23.3 | 01Jan2000, 12:2 |

Project: Edgecombe

Simulation Run: 002-year Reservoir: Reservoir-1

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2000, 00:00 | Basin Model: | Basin 1 |
| End of Run: | 02Jan2000, 00:01 | Meteorologic Model: | 002-yr |
| Compute Time: | 19Jul2011, 01:21:56 | Control Specifications: | Control 1 |

Volume Units: IN

## Computed Results

| | | | |
|---|---|---|---|
| Peak Inflow : | 24.2 (CFS) | Date/Time of Peak Inflow : | 01Jan2000, 12:21 |
| Peak Outflow : | 23.3 (CFS) | Date/Time of Peak Outflow : | 01Jan2000, 12:25 |
| Total Inflow : | 0.53 (IN) | Peak Storage : | 0.1 (AC-FT) |
| Total Outflow : | 0.53 (IN) | Peak Elevation : | 52.5 (FT) |

Project: Edgecombe Simulation Run: 010-year

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2000, 00:00 | Basin Model: | Basin 1 |
| End of Run: | 02Jan2000, 00:01 | Meteorologic Model: | 010-yr |
| Compute Time: | 19Jul2011, 01:29:40 | Control Specifications: | Control 1 |

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak |
|---|---|---|---|
| Reservoir-1 | 0.1327 | 57.6 | 01Jan2000, 12:3 |

Project: Edgecombe

Simulation Run: 010-year Reservoir: Reservoir-1

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2000, 00:00 | Basin Model: | Basin 1 |
| End of Run: | 02Jan2000, 00:01 | Meteorologic Model: | 010-yr |
| Compute Time: | 19Jul2011, 01:29:40 | Control Specifications: | Control 1 |

Volume Units: IN

## Computed Results

| | | | |
|---|---|---|---|
| Peak Inflow : | 76.7 (CFS) | Date/Time of Peak Inflow : | 01Jan2000, 12:18 |
| Peak Outflow : | 57.6 (CFS) | Date/Time of Peak Outflow : | 01Jan2000, 12:31 |
| Total Inflow : | 1.31 (IN) | Peak Storage : | 0.8 (AC-FT) |
| Total Outflow : | 1.31 (IN) | Peak Elevation : | 56.1 (FT) |

Project: Edgecombe

Simulation Run: 025-year Reservoir: Reservoir-1

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2000, 00:00 | Basin Model: | Basin 1 |
| End of Run: | 02Jan2000, 00:01 | Meteorologic Model: | 25-yr |
| Compute Time: | 18Jul2011, 14:46:45 | Control Specifications: | Control 1 |

Volume Units: IN

## Computed Results

| | | | |
|---|---|---|---|
| Peak Inflow : | 115.3 (CFS) | Date/Time of Peak Inflow : | 01Jan2000, 12:17 |
| Peak Outflow : | 69.5 (CFS) | Date/Time of Peak Outflow : | 01Jan2000, 12:36 |
| Total Inflow : | 1.87 (IN) | Peak Storage : | 1.8 (AC-FT) |
| Total Outflow : | 1.87 (IN) | Peak Elevation : | 58.1 (FT) |

Project: Edgecombe Simulation Run: 025-year

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2000, 00:00 | Basin Model: | Basin 1 |
| End of Run: | 02Jan2000, 00:01 | Meteorologic Model: | 25-yr |
| Compute Time: | 18Jul2011, 14:46:45 | Control Specifications: | Control 1 |

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak |
|---|---|---|---|
| Reservoir-1 | 0.1327 | 69.5 | 01Jan2000, 12:3 |

Project: Edgecombe

Simulation Run: 100-year Reservoir: Reservoir-1

| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2000, 00:00 | Basin Model: | Basin 1 |
| End of Run: | 02Jan2000, 00:01 | Meteorologic Model: | 100-yr |
| Compute Time: | 19Jul2011, 01:38:17 | Control Specifications: | Control 1 |

Volume Units: IN

## Computed Results

| | | | |
|---|---|---|---|
| Peak Inflow : | 183.1 (CFS) | Date/Time of Peak Inflow : | 01Jan2000, 12:17 |
| Peak Outflow : | 173.2 (CFS) | Date/Time of Peak Outflow : | 01Jan2000, 12:22 |
| Total Inflow : | 2.85 (IN) | Peak Storage : | 2.6 (AC-FT) |
| Total Outflow : | 2.85 (IN) | Peak Elevation : | 59.3 (FT) |

Project: Edgecombe Simulation Run: 100-year

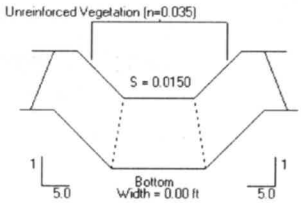
| | | | |
|---|---|---|---|
| Start of Run: | 01Jan2000, 00:00 | Basin Model: | Basin 1 |
| End of Run: | 02Jan2000, 00:01 | Meteorologic Model: | 100-yr |
| Compute Time: | 19Jul2011, 01:38:17 | Control Specifications: | Control 1 |

| Hydrologic Element | Drainage Area (MI2) | Peak Discharge (CFS) | Time of Peak |
|---|---|---|---|
| Reservoir-1 | 0.1327 | 173.2 | 01Jan2000, 12:2 |

| | | | |
|---|---|---|---|
| North American Green - ECMDS Version 4.3 | 7/5/2011 | 02:03 PM | COMPUTED BY: |
| PROJECT NAME: | PROJECT NO.: | | |
| FROM STATION/REACH: | TO STATION/REACH: | DRAINAGE AREA: | DESIGN FREQUENCY: |

## HYDRAULIC RESULTS

| Discharge (cfs) | Peak Flow Period (hrs) | Velocity (fps) | Area (sq.ft) | Hydraulic Radius(ft) | Normal Depth (ft) |
|---|---|---|---|---|---|
| 161.0 | 24.0 | 5.80 | 27.74 | 1.15 | 2.36 |




Not to Scale

## LINER RESULTS

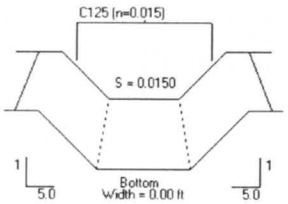
| Reach | Matting Type | Stability Analysis | Vegetation Characteristics | | | | Permissible Shear Stress (psf) | Calculated Shear Stress (psf) | Safety Factor | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | Staple Pattern | | Phase | Class | Type | Density | | | | |
| Straight | Unreinforced | Vegetation | | D | Bunch | 75-95% | 3.33 | 2.20 | 1.51 | STABLE |
| | | Soil | Sandy Loam | | | | 0.035 | 0.225 | 0.16 | UNSTABLE |

Back to Input Screen

| | | | |
|---|---|---|---|
| North American Green - ECMDS Version 4.3 | 7/5/2011 | 02:28 PM | COMPUTED BY: |
| PROJECT NAME: | | PROJECT NO.: | |
| FROM STATION/REACH: | TO STATION/REACH: | DRAINAGE AREA: | DESIGN FREQUENCY: |

## HYDRAULIC RESULTS

| Discharge (cfs) | Peak Flow Period (hrs) | Velocity (fps) | Area (sq ft) | Hydraulic Radius(ft) | Normal Depth (ft) |
|---|---|---|---|---|---|
| 161.0 | 24.0 | 10.64 | 15.13 | 0.85 | 1.74 |




Not to Scale

## LINER RESULTS

| Reach | Matting Type | Stability Analysis | Vegetation Characteristics | | | | Permissible Shear Stress (psf) | Calculated Shear Stress (psf) | Safety Factor | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | Staple Pattern | | Phase | Class | Type | Density | | | | |
| Straight | C125 | Unvegetated | | | | | 2.25 | 1.63 | 1.38 | STABLE |
| | Staple D | | | | | | | | | |

Back to Input Screen

## APPENDIX II

(CONSTRUCTION PLANS)

RECEIVED
AUG 23 2011
LAKES QUALITY SECTION

9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
S&ME
WWW.SMEINC.COM

NORTH CAROLINA PROFESSIONAL SEAL 032567 ENGINEER JOSHUA M. BELL

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

**DAM REMOVAL**
**EXISTING CONDITIONS**

**FORMER EAGLES PROPERTY**
**EDGECOMBE COUNTY, NC**

| | |
|---|---|
| ENGINEERING LICENSE NO: F-0176 | |
| DRAWN BY: JMB | CHECKED BY: |
| DESIGNED BY: JMB | APPROVED BY: |
| PROJECT NUMBER 1054-07-241 | |
| SCALE: 1" = 30' | DATE: 06/26/10 |
| DRAWING: 1 | OF: 3 |

DRAWING PATH: C:\DOCUMENTS AND SETTINGS\JBELL.SMEINC\DESKTOP\EDGECOMBE_DAMSAFETY_MOD.DWG

NOTES:

1. PONDS SHALL BE DEWATERED PRIOR TO REMOVAL OPERATIONS. PUMPS SHALL BE USED TO DEWATER THE DAM. DAM IMPOUNDMENTS SHALL NOT BE DEWATERED BY MECHANICAL BREACHING.
2. MATERIAL REMOVED FROM EMBANKMENT WILL BE STOCKPILED IN EXISTING LANDFILL OPERATIONS STOCKPILE AREAS.
3. AFTER DEWATERING, EMBANKMENT MATERIAL SHALL BE REMOVED AND GRADES BLENDED IN TO SURROUNDING TOPOGRAPHY. GENERAL BLENDED GRADES ARE SHOWN ON THIS DRAWING.
4. DAM FOOTPRINT AREA SHALL BE REGRADED WITH SIDE SLOPES AT A MAXIMUM OF 3H:1V WITH A TYPICAL AS SHOWN ON THE PLANS OF 5H:1V.
5. CHANNEL AREA SHALL BE REGRADED WITH SIDE SLOPES OF 5H:1V TO A DEPTH OF 2.5 FEET ABOVE THE PROPOSED STREAM CENTER. THE CHANNEL AREA SHALL BE MATTED WITH NORTH AMERICAN GREEN C150 MATTING OR ENGINEER APPROVED EQUIVALENT.

**LEGEND**

- PROPOSED CONTOUR (10 FT)
- PROPOSED CONTOUR (2 FT)
- EXISTING CONTOURS (10 FT)
- EXISTING CONTOURS (2 FT)
- PROPOSED CHANNEL CENTERLINE

30 0 30 60

( IN FEET )
1 inch = 30 ft.

RECEIVED
JUL 21 2011
LAND QUALITY SECTION


9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726

S&ME
WWW.SMEINC.COM


NORTH CAROLINA PROFESSIONAL SEAL 032667 ENGINEER JOSHUA M. BELL

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|

**DAM REMOVAL RESTORATION GRADING PLAN**

**FORMER EAGLES PROPERTY EDGECOMBE COUNTY, NC**

| | |
|---|---|
| ENGINEERING LICENSE NO: **F-0176** | |
| DRAWN BY: JMB | CHECKED BY: |
| DESIGNED BY: JMB | APPROVED BY: |
| PROJECT NUMBER 1054-07-241 | |
| SCALE: 1" = 30' | DATE: 06/26/10 |
| DRAWING: **2** | OF: **3** |

DRAWING PATH:

DEFINITION
Controlling runoff and erosion on disturbed areas by establishing perennial vegetative : cover with seed.

PURPOSE
To reduce erosion and decrease sediment yield from disturbed areas, and to permanently stabilize such areas in a manner that is economical, adapts to site conditions, and allows selection of the most appropriate plant materials.

SPECIFICATIONS

SEEDBED REQUIREMENTS
Establishment of vegetation should not be attempted on sites that are unsuitable due to excessive soil compaction, inappropriate soil texture, poor drainage, concentrated overland flow, or steepness of slope until measures have been taken to correct these problems.

To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. The existing soil should have these criteria:

- Enough fine-grained (silt and clay) material to maintain adequate moisture and nutrient supply (available water capacity of at least .05 inches water to 1 inch of soil).
- Sufficient pore space to permit root penetration.
- Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans should be 12 inches or more, except on slopes steeper than 2:1 where the addition of soil is not feasible.
- A favorable pH range for plant growth, usually 6.0 – 6.5.
- Free from large roots, branches, stones, large clods of earth, or trash of any kind. Clods and stones may be left on slopes steeper than 3:1 if they are to be hydro seeded.

If any of the above criteria are not met – i.e., if existing soil is too coarse, dense, shallow or acidic to foster vegetation – special amendments are required. The soil conditioners described below may be beneficial or, preferably, topsoil may be applied.

SEEDBED PREPARATION
Install necessary mechanical erosion and sedimentation control practices before seeding, and complete grading according to the approved plan.

Lime and fertilizer needs should be determined by soil tests. Directions, sample cartons, and information sheets are available through county Agricultural Extension offices. Testing is also done by commercial laboratories.

When soil tests results are not available, follow rates suggested in the seeding specifications shown at right. Application rates usually fall into the following ranges:

- Ground agricultural limestone:
  Light-textured, sandy soils: 1 to 1–1/2 tons/acre
  Heavy-textured, clayey soils: 2–3 tons/acre
- Fertilizer:
  Grasses: 800–1200 lb/acre of 10–10–10 (or the equivalent)
  Grass-legume mixtures: 800–1200 lb/acre of 5–10–10 (or the equivalent)

Apply lime and fertilizer evenly and incorporate into the top 4–6 inches of soil by disking or other suitable means. Operate machinery on the contour. When using a hydro seeder, apply lime and fertilizer to a rough, loose surface.

Roughen surfaces prior to seeding.

Complete seedbed preparation by breaking up large clods and raking into a smooth, uniform surface (slopes less than 3:1). Fill in or level depressions that can collect water. Broadcast seed into a freshly loosened seedbed that has not been sealed by rainfall.

SEEDING
Seeding dates given in the seeding mixture specifications are designated as "best" or "possible". Seedings properly carried out within the "best" dates have a high probability of success. It is also possible to have satisfactory establishment when seeding outside these dates. However, as you deviate from them, the probability of failure increases rapidly. Seeding on the last date shown under "possible" may reduce changes of success by 30–50%. Always take this into account in scheduling land-disturbing activities.

Use certified seed for permanent seeding whenever possible.

Labeling of non-certified seed is also required by law. Labels contain important information on seed purity, germination, and presence of wood seeds. Seeds must meet State standards for content of noxious weeds. Do no accept seed containing "prohibited" noxious weed seed.

Inoculate legume seed with the Rhizobium bacteria appropriate to the species of legume. Apply seed uniformly with a cyclone seeder, drop-type spreader, drill, cultipacker seeder, or hydro seeder on a firm, friable seedbed.

When using a drill or cultipacker seeder, plant small grains no more than 1 inch deep, grasses and legumes no more than 1/2 inch. Equipment should be calibrated in the field for the desired seeding rate.

When using broadcast-seeding methods, subdivide the area into workable sections and determine the amount of seed needed for each section. Apply one-half the seed while moving back and forth across the area, making a uniform pattern: then apply the second half in the same way, but moving at right angles to the first pass.

Mulch all plantings immediately after seeding.

HYDRO SEEDING
Surface roughening is particularly important when hydro seeding, as a roughened slope will provide some natural coverage for lime, fertilizer, and seed. The surface should not be compacted or smooth. Fine seedbed preparation is not necessary for hydro seeding operations: large clods, stones, and irregularities provide cavities in which seeds can lodge.

Rate of wood fiber (cellulose) application should be at least 2,000 lb/acre.

Apply legume inoculants at four times the recommended rate when adding inoculant to a hydro seeder slurry.

If a machinery breakdown of 1/2 to 2 hours occurs, add 50% more seed to the tank, based on the proportion of the slurry remaining. This should compensate for damage to seed. Beyond 2 hours, a full rate of new seed may be necessary.

Lime is not normally applied with a hydraulic seeder because it is abrasive. It can be blown onto steep slopes in dry form.

MAINTENANCE
Generally, a stand of vegetation cannot be determined to be fully established until soil cover has been maintained for one full year from planting. Inspect seeded areas for failure and make necessary repairs and reseedings within the same season, if possible.

Reseeding--If a stand has inadequate cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand after seedbed preparation or over- seed the stand. Consider seeding temporary, annual species if the time of year is not appropriate for permanent seeding.

If vegetation fails to grow, soil must be tested to determine if acidity or nutrient imbalance is responsible.

Fertilization--On the typical disturbed site, full establishment usually requires re-fertilization in the second growing season. Fine turf requires annual maintenance fertilization. Use soil tests if possible or follow the guidelines given for the specific seeding mixture.

TEMPORARY SEEDING SPECIFICATIONS

Seeding mixture (fall)

| Species* | Rate (lb/acre) |
|---|---|
| Rye Grain (*Secale cereale*) | 120 |

Seeding Mixture (late winter early spring)

| Species* | Rate (lb/acre) |
|---|---|
| Rye Grain (*Secale cereale*) | 120 |
| Annual (Korean) Lespedeza (*Kummerowia stipulacea*) | 50 |

Seeding mixture (summer)

| Species* | Rate (lb/acre) |
|---|---|
| German Millet (*Setaria italica*) | 40 |

Seeding dates (Piedmont)

| | |
|---|---|
| Fall: | Aug. 15 – Dec. 30 |
| Late winter (early spring): | Jan. 1 – May 1 Late |
| Summer: | May 1 – Aug. 15 |

Soil amendments
Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10–10–10 fertilizer.

Mulch
Apply 4,000 lb/acre straw. Anchor mulch by tacking with asphalt, roving or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance
Re-fertilize if growth is not fully adequate. Reseed, re-fertilize and mulch immediately following erosion or other damage.

Pursuant to G.S. 113A-57(2), the angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. In any event, slopes left exposed will, within 21 calendar days of completion of any phase of grading, be planted or otherwise provided with temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

Pursuant to G.S. 113A-57(3), provisions for permanent groundcover sufficient to restrain erosion must be accomplished for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction or development.

*REF: 6.10 A,B and C, NC Erosion and Sediment Control Planning and Design Manual, 2006

PERMANENT SEEDING SPECIFICATIONS

Seeding mixture

| Species* | Rate (lb/acre) |
|---|---|
| Tall fescue (*Festuca arundinacea*) (Grass lined Channels) | 200 |
| Tall fescue (*Festuca arundinacea*) (Other Areas) | 100 |

Nurse plants
Between May 1 and Aug. 15, add 10 lb/acre German millet (*Setaria italica*) or 15 lb/acre Sudan grass. Prior to May 1 or after Aug. 15, add 40 lb/acre Rye Grain (*Festuca arundinacea*).

Seeding dates

| | Best | Possible |
|---|---|---|
| Fall: | Aug. 25 – Sept. 15 | Aug. 20 – Oct. 25 |
| Late winter: | Feb. 15 – Mar. 21 | Feb. 1 –Apr. 15 |

Fall is best for tall fescue (*Festuca arundinacea*) and late winter or summer for lespedeza. Over seeding of Kobe lespedeza (*Kummerowia striata*) over fall-seeded tall fescue is very effective.

Soil amendments
Apply lime and fertilizer according to soil tests, or apply 4,000 lb/acre ground agricultural limestone and 1,000 lb/acre 10–10–10 fertilizer.

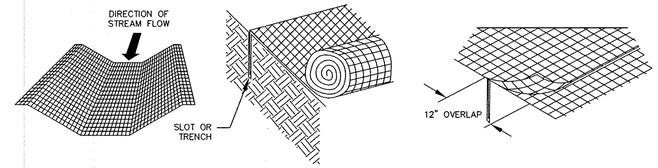
Mulch
Apply 4,000–5,000 lb/acre grain straw or equivalent cover of another suitable mulching material. Anchor mulch by tacking with asphalt, roving, or netting. Netting is the preferred anchoring method on steep slopes.

Maintenance
Re-fertilize in the second year unless growth is fully adequate. May be mowed once or twice a year, but mowing is not necessary. Reseed, fertilize, and mulch damaged areas immediately.

Pursuant to G.S. 113A-57(3), provisions for permanent groundcover sufficient to restrain erosion must be accomplished for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction or development.

*REF: 6.11L NC Erosion and Sediment Control Planning and Design Manual, 2006

## GENERAL SEEDING SPECIFICATIONS




IN CHANNELS, ROLL OUT STRIPS OF MATTING PARALLEL TO THE DIRECTION OF FLOW.

ANCHOR MATTING IN A 12" TRENCH

JOIN STRIPS BY ANCHORING AND OVERLAPPING

GENERAL NOTES:

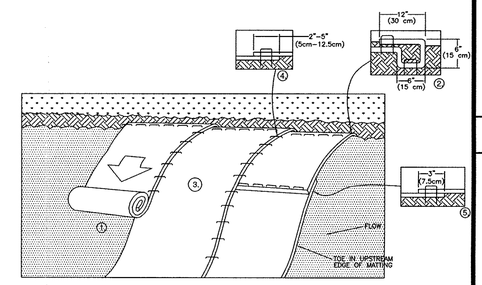
1. DITCH LINES IMPACTED DURING CONSTRUCTION MUST BE MATTED WITH NORTH AMERICAN GREEN MATTING TYPE C-150, OR ENGINEER APPROVED EQUIVALENT.
2. APPLY SEED BEFORE LAYING THE NET OR MAT. IF OPEN-WEAVE NETTING IS USED, LIME MAY BE INCORPORATED BEFORE INSTALLING THE NET AND FERTILIZER AND SEED MAY BE SPRAYED ON AFTERWARD.
3. START LAYING THE NET FROM THE TOP OF THE CHANNEL OR SLOPE AND UNROLL IT DOWN THE GRADE. ALLOW NETTING TO LAY LOOSELY ON THE SOIL BUT WITHOUT WRINKLES-DO NOT STRETCH.
4. TO SECURE THE NET, BURY THE UPSLOPE END IN A SLOT OR TRENCH NO LESS THAN 12 INCHES DEEP, COVER WITH SOIL, AND TAMP FIRMLY. STAPLE THE NET EVERY 12 INCHES ACROSS THE TOP END EVERY 3 FEET AROUND THE EDGES AND BOTTOM. WHERE 2 STRIPS OF NET ARE LAID SIDE BY SIDE, THE ADJACENT EDGES SHOULD BE OVERLAPPED 3 INCHES AND STAPLED TOGETHER. EACH STRIP OF MATTING SHOULD ALSO BE STAPLED DOWN THE CENTER, EVERY 3 FEET.

MAINTENANCE NOTES:

1. INSPECT ROLLED EROSION CONTROL PRODUCTS (RECP) AT LEAST WEEKLY AND AFTER EACH SIGNIFICANT (0.5" OR GREATER) RAIN FALL EVENT.
2. GOOD CONTACT WITH THE GROUND MUST BE MAINTAINED, AND EROSION MUST NOT OCCUR BENEATH THE RECP.
3. ANY AREAS OF THE RECP THAT ARE DAMAGED OR NOT IN CLOSE CONTACT WITH THE GROUND SHALL BE REPAIRED AND STAPLED.
4. IF EROSION OCCURS DUE TO POORLY CONTROLLED DRAINAGE, THE PROBLEM SHALL BE FIXED AND THE ERODED AREA PROTECTED.
5. MONITOR AND REPAIR THE RECP AS NECESSARY UNTIL GROUND COVER IS ESTABLISHED.

*REF: 6.17.12 NC Erosion and Sediment Control Planning and Design Manual, 2006

**1/3 TYPICAL CHANNEL MATTING DETAIL**
NTS




GENERAL NOTES:

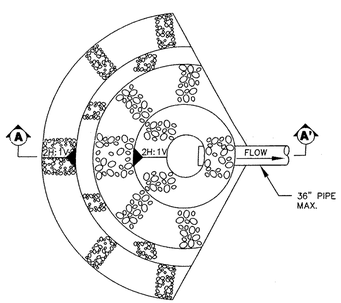
1. DISTURBED STREAMBANKS SHALL BE STABILIZED POST-CONSTRUCTION WITH NORTH AMERICAN GREEN C-150 MATTING AS PER DETAIL 1/3.
2. START LAYING THE NET FROM THE TOP OF THE SLOPE AND UNROLL IT DOWN THE GRADE. ALLOW NETTING TO LAY LOOSELY ON THE SOIL BUT WITHOUT WRINKLES-DO NOT STRETCH.
3. TO SECURE THE NET, BURY THE UPSLOPE END IN A SLOT OR TRENCH NO LESS THAN 12 INCHES DEEP, COVER WITH SOIL, AND TAMP FIRMLY. STAPLE THE NET EVERY 12 INCHES ACROSS THE TOP END EVERY 3 FEET AROUND THE EDGES AND BOTTOM. WHERE 2 STRIPS OF NET ARE LAID SIDE BY SIDE, THE ADJACENT EDGES SHOULD BE OVERLAPPED 3 INCHES AND STAPLED TOGETHER. EACH STRIP OF MATTING SHOULD ALSO BE STAPLED DOWN THE CENTER, EVERY 3 FEET. TOE IN THE UPSTREAM EDGE OF MATTING.
4. APPLY SEED BEFORE LAYING THE NET OR MAT. IF OPEN-WEAVE NETTING IS USED, SEED MAY BE SPRAYED ON AFTERWARD.

MAINTENANCE NOTES:

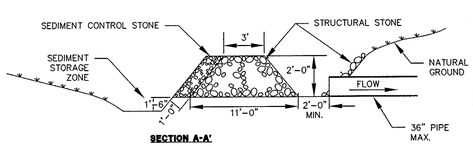
1. INSPECT ROLLED EROSION CONTROL PRODUCTS (RECP) AT LEAST ONCE EVERY 7 CALENDAR DAYS AND AFTER EACH RAINFALL EVENT THAT EXCEEDS 0.5 INCHES.
2. GOOD CONTACT WITH THE GROUND MUST BE MAINTAINED, AND EROSION MUST NOT OCCUR BENEATH THE RECP.
3. ANY AREAS OF THE RECP THAT ARE DAMAGED OR NOT IN CLOSE CONTACT WITH THE GROUND SHALL BE REPAIRED AND STAPLED.
4. IF EROSION OCCURS DUE TO POORLY CONTROLLED DRAINAGE, THE PROBLEM SHALL BE FIXED AND THE ERODED AREA PROTECTED.
5. MONITOR AND REPAIR THE RECP AS NECESSARY UNTIL GROUND COVER IS ESTABLISHED.

*REF: 6.17.12 NC Erosion and Sediment Control Planning and Design Manual, 2006

**4/3 TYPICAL SLOPE MATTING DETAIL**
NTS




PLAN VIEW




SECTION A-A'

GENERAL NOTES:

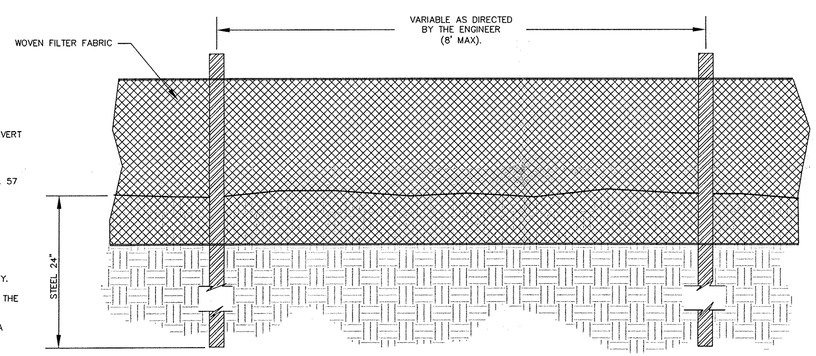
1. INSTALL ROCK PIPE INLET PROTECTION AT ANY CULVERT RECEIVING FLOW ACROSS DISTURBED DITCHLINE.
2. STRUCTURAL STONE SHALL BE CLASS B RIPRAP.
3. SEDIMENT CONTROL STONE SHALL BE NO. 5 OR NO. 57 STONE.
4. DIMENSIONS ARE MINIMUM ACCEPTABLE UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.

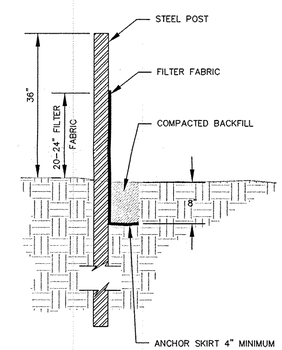
MAINTENANCE NOTES:

1. INSPECT ROCK PIPE INLET PROTECTION AT LEAST WEEKLY AND AFTER EACH SIGNIFICANT (0.5" OR GREATER) RAINFALL EVENT AND REPAIR IMMEDIATELY. REMOVE SEDIMENT AND RESTORE THE SEDIMENT STORAGE AREA TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO ONE-HALF THE DESIGN DEPTH OF THE TRAP. PLACE THE SEDIMENT THAT IS REMOVED IN THE DESIGNED DISPOSAL AREA AND REPLACE THE CONTAMINATED PART OF THE GRAVEL FACING.
2. CHECK THE STRUCTURE FOR DAMAGE. ANY RIPRAP DISPLACED FROM THE STONE HORSESHOE MUST BE REPLACED IMMEDIATELY.
3. AFTER ALL THE SEDIMENT-PRODUCING AREAS HAVE BEEN PERMANENTLY STABILIZED, REMOVE THE STRUCTURE AND ALL THE UNSTABLE SEDIMENT. SMOOTH THE AREA TO BLEND WITH THE ADJOINING AREAS AND PROVIDE PERMANENT GROUND COVER (SURFACE STABILIZATION).

*REF: 6.55.3 NC Erosion and Sediment Control Planning and Design Manual, 2006

**2/3 TYPICAL STONE RING INLET PROTECTION DETAIL**
NTS




GENERAL NOTES:

1. PREFABRICATED SILT FENCE IS NOT ACCEPTABLE ON THIS PROJECT.
2. STEEL POSTS SHALL BE USED ON THIS PROJECT INSTEAD OF WOOD POSTS. STEEL POSTS SHALL BE 5'-0" IN HEIGHT AND BE OF THE SELF-FASTENER ANGLE STEEL TYPE.
3. WOVEN FILTER FABRIC SHALL BE USED WHERE SILT FENCE IS TO REMAIN FOR A PERIOD OF MORE THAN 30 DAYS. FILTER FABRIC FENCE SHALL BE A MINIMUM OF 32" IN WIDTH AND SHALL HAVE A MINIMUM OF 6 LINE WIRES WITH 12" STAY SPACING.
4. SILT FENCE SHALL BE STANDARD STRENGTH FILTER FABRIC WITH WIRE MESH REINFORCEMENT OR EXTRA STRENGTH FILTER FABRIC. WHEN FABRIC IS USED WITH WIRE MESH, 8' CENTERED POSTS MAY BE USED. OMISSION OF THE REINFORCING WIRE IS A CONSTRUCTION CHANGE THAT NECESSITATES MORE POSTS FOR SUPPORT (IE. THE SPACING DISTANCE NEEDS TO BE REDUCED TO NO GREATER THAN SIX (6) FEET APART).
5. TURN SILT FENCE UP SLOPE AT ENDS.
6. THE USE OF SILT FENCE IN AREAS OF CONCENTRATED FLOW IS INAPPROPRIATE

MAINTENANCE NOTES:

1. INSPECT SEDIMENT FENCES AT LEAST ONCE A WEEK AND AFTER EACH SIGNIFICANT (0.5" OR GREATER) RAINFALL. MAKE ANY REQUIRED REPAIRS IMMEDIATELY.
2. SHOULD THE FABRIC OF A SEDIMENT FENCE COLLAPSE, TEAR, DECOMPOSE OR BECOME INEFFECTIVE, REPLACE IT PROMPTLY.
3. REMOVE SEDIMENT DEPOSITS AS NECESSARY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND TO REDUCE PRESSURE ON THE FENCE. TAKE CARE TO AVOID UNDERMINING THE FENCE DURING CLEANOUT.
4. REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AND BRING THE AREA TO GRADE AND STABILIZE IT AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.

*REF: 6.62.7 NC Erosion and Sediment Control Planning and Design Manual, 2006

**3/3 TYPICAL SILT FENCE DETAIL**
NTS

RECEIVED
JUL 23 2011
LAND QUALITY SECTION


S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM


NORTH CAROLINA PROFESSIONAL SEAL 032667 ENGINEER JOSHUA M. BELL

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|

**DAM REMOVAL RESTORATION GRADING PLAN**

**FORMER EAGLES PROPERTY EDGECOMBE COUNTY, NC**

ENGINEERING LICENSE NO: F-0176

| | |
|---|---|
| DRAWN BY: JMB | CHECKED BY: |
| DESIGNED BY: JMB | APPROVED BY: |
| PROJECT NUMBER 1054-07-241 | |
| SCALE: 1" = 30' | DATE: 06/26/10 |
| DRAWING: 3 | OF: 3 |

DRAWING PATH:

# Attachment V

NCDENR
North Carolina Department of Environment and Natural Resources
**Division of Land Resources**
**Land Quality Section**

James D. Simons, PG, PE
Director and State Geologist

Beverly Eaves Perdue, Governor
Dee Freeman, Secretary

**Notice of Exemption**

July 27, 2011

S&ME
Attn: Mr. Joshua M. Bell, PE
9751 Southern Pine Blvd.
Charlotte, North Carolina 28273

RE: Former Eagle's Property Dam
Edgecombe County

Dear Mr. Bell:

This is to acknowledge receipt of your application dated July 20, 2011 for the removal of the subject dam. The application was received in our office on July 21, 2011.

Effective July 1, 2011, the North Carolina Dam Safety Law of 1967 (Law) was amended by increasing the minimum size criteria for low and intermediate hazard jurisdictional dams from 15 feet in height and 10 acre-feet in impoundment capacity to 25 feet in height and 50 acre-feet in impoundment capacity. As a result of this, the subject dam, which has been determined to be classified as low hazard, is exempt from the Law and the proposed work does not require approval from this Division. Therefore, the submitted application is being returned to you.

In the event the proposed removal of the dam is not completed, the following comments are offered:

1. If the dam is to be modified such that it is 25 feet in height or greater as measured from the highest point on the crest of the dam to the lowest point on the downstream toe and will impound 50 acre-feet or more at the highest point on the crest of the dam, this dam will not be exempt, and will be subject to all requirements of the Law.

2. If future downstream development occurs which would be impacted by a failure of the dam, then the hazard classification may be reassessed and may change from low to intermediate or high hazard classification. Please note that in accordance with General Statute 143-215.25A(a)(6), dams which are determined to be high hazard are subject to the provisions of the Dam Safety Law of 1967 regardless of height or impoundment capacity.

The Army Corps of Engineers and the Water Quality Section of this Department should be contacted to determine if additional permits are required. Also, the erosion and sediment control program having jurisdiction should be contacted to determine permit requirements.

Please contact Mr. John Holley, PE, Regional Engineer, Land Quality Section, 3800 Barrett Drive, Raleigh, North Carolina 27609, telephone number (919) 791-4200, or me at telephone number (919) 733-4574 should you have questions concerning this matter.

Sincerely,

Steven M. McEvoy, PE
State Dam Safety Engineer
Land Quality Section

SMM/whd/rdk

cc: Edgecombe County Solid Waste
Mr. John Holley, PE, Land Quality Regional Engineer
Surface Water Protection Supervisor

Filename: EDGEC-___-20110727_RECT-Breach-NOE_Former Eagles Dam