CONSTRUCTION QUALITY ASSURANCE REPORT

CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL FACILITY
PERMIT No. 60-13

Prepared For:

GREENWAY WASTE SOLUTIONS OF NORTH MECK, LLC

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
CHARLOTTE, NORTH CAROLINA

CEC Project 111-370.001

August 8, 2012 (Rev. September 25, 2012)

North Carolina Board of Examiners
For
Engineers and Surveyors
License No. C-3035

NORTH CAROLINA PROFESSIONAL SEAL 026435 ENGINEER SCOTT L. BROWN

September 25, 2012

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1.0 INTRODUCTION

This report describes the results of the construction quality assurance (CQA) for cell construction of the Infill Expansion of Phase I (subgrade footprint 3.2 acres) at the Greenway Waste Solutions of North Meck, LLC facility (Landfill) located in Huntersville, NC. Specifically, this report will summarize the construction activities and certify that the construction was completed in accordance with:

1. The CQA Plan.
2. The conditions of the Permit to Construct.
3. The Requirements of 15A NCAC 13B .0541.
4. Acceptable engineering practices

2.0 STORMWATER CONVEYANCE PIPE

An existing reinforced concrete pipe used for stormwater conveyance was supplemented with two additional 36-inch HDPE pipes. These supplemental pipes were installed to insure adequate capacity should failure of the existing pipe occur. The two 36-inch HDPE stormwater pipes were designed to convey runoff from north of the proposed landfill to the existing stream south of the landfill. The pipes were sized to adequately convey the influent peak discharge generated by the NCRS Type II, **100-year, 24-hour** storm event with one pipe out of service without overtopping the northern landfill road. The results indicate that one 36-inch stormwater pipe will adequately covey the influent peak discharge generated by the NCRS Type II, 100-year, 24-hour storm event without overtopping the northern landfill road. Therefore, two 36-inch pipes will provide redundancy in the event of pipe failure.

The stormwater pipes were to be installed in a location that will incur significant overburden pressure due to the deposition of C&D waste during and after the construction of the landfill. A structural engineering firm - Simpson, Gumpertz & Heger, Inc. was contracted by the owner to prepare design details and calculations for the trench excavation and pipe installation, taking into account the C&D waste over the pipes. A copy of the most recent design calculations and installation detail can be found in Appendix A. The installation of the two 36-inch diameter N-12 WT IB stormwater pipes was completed in general accordance with the approved construction plans, specifications and details. A pipe trench was excavated and the pipes were anchored to the bottom of the trench. The pipes were then embedded in a concrete controlled low strength material (flowable fill) mix consisting of cement, sand, fly ash, and water.

Contractor construction submittals for this pipe installation have been included in Appendix B. During the excavation and installation of the pipe, CEC staff observed on-going work and documented the progress with field reports, which are located in Appendix C. Also included in Appendix C are certified copies of survey as-built information collected during the pipe installation.

CEC staff took photographs of the work during field visits. A photograph log, with dates and descriptions of observations, has been included in Appendix D. Summit Engineering and Construction Services, Inc. performed geotechnical observation and testing of the pipe trench excavation, CLSM material, and trench and sidefill compaction. Included in appendix E are field reports and testing results provided by Summit for the pipe installation work.

3.0 EARTHWORK

Soil testing was performed to determine soil densities for the trench excavation bottom and in areas of trench sidefill and fill as required to reach the design subgrade. The field description of the soil observed for the subgrade is classified as SP-SM by Enviro-Pro, PC (Appendix F). In addition to the field compaction testing, three soil samples (Subgrade #1, Subgrade #2 and Subgrade #3) were taken to establish permeability of the subgrade. The permeability of the soil samples were measured by Summit Laboratories with resulting values of 2.12×10^{-5} cm/sec, 4.43×10^{-4} cm/sec, and 6.77×10^{-5} cm/sec. Also, Summit Laboratories performed a Particle Size Distribution (USCS) to determine the Grain Size classification. The laboratory classification confirmed the field observation of a poorly graded sand with silt and gravel (SP-SM).

The cap system will be designed and constructed to a permeability less than or equal to these soils underlying the landfill, but not more permeable than 1×10^{-5} cm/sec. Three bulk soil samples (Borrow Sample #1, Borrow Sample #2 and Borrow Sample #3) were taken to establish availability of soils meeting permeability of final landfill cap. The permeability of the soil samples were measured by Summit Laboratories with resulting values of 6.32×10^{-6} cm/sec, 1.57×10^{-6} cm/sec, and 3.35×10^{-7} cm/sec. Also, Summit Laboratories performed a Particle Size Distribution (USCS) to determine the Grain Size classification. The laboratory classification confirmed a light brown silty sand (SM).

Visual inspection by Enviro-Pro, PC of the prepared subgrade verified that:

1. Angular or sharp rocks, rocks larger than the specified diameter, and other debris are not present on the surface.
2. There are no soft or yielding areas.

4.0 SURFACE WATER DRAINAGE STRUCTURES

The Soil Erosion & Sedimentation Control Plan for the Infill Expansion of Phase I – Cell I (10.9 Acres) was submitted and approved by Mecklenburg County. The design included the expansion of an existing sediment basin (SB-2) and construction of a new sediment basin (SB-1) in general conformance with the approved construction and erosion control plans. Photographs of both basins have been included in the photograph log in Appendix D.

5.0 AS-BUILT DRAWINGS

An as built drawing performed by Patterson Land Surveying, PA is located in Appendix G. Subgrade elevations were verified on a 100-ft grid. All locations met the minimum permitted subgrade elevations. Appendix H contains a certification that construction was completed in accordance with:

1. The CQA Plan.
2. The conditions of the Permit to Construct.
3. The Requirements of 15A NCAC 13B .0541.
4. Acceptable engineering practices

6.0 MAJOR PROJECT FEATURES

Appendix D consists of pictures of major project features and construction across the 3.2 subgrade footprint expansion.

Appendix A

North Carolina Department of Environment and Natural Resources
Division of Waste Management

Beverly Eaves Perdue, Governor | Dexter R. Matthews, Director | Dee Freeman, Secretary

Doc. ID No. 15292

FACT SHEET
SOLID WASTE PERMIT NUMBER: 60-13-CDLF-1993

FACILITY:	Greenway Waste Solutions at North Meck, LLC, formerly North Mecklenburg C&D Landfill
COUNTY:	Mecklenburg
CITY:	Huntersville
OWNER/	C&D Management Company, LLC
OPERATOR:	Greenway Waste Solutions at North Meck, LLC. 15300 Holbrooks Road Huntersville NC 28078

DESCRIPTION

In accordance with the Solid Waste Management Rules, specifically Rule 15A NCAC 13B .0533(c), the proposed expansion of the Greenway Waste Solutions at North Meck, LLC. solid waste landfill (C&DLF) unit boundary and a substantial volume change in accordance with N.C.G.S.130A-294(b1)(1)) requires a new facility permit. The draft permit reflects the request by Greenway Waste Solutions at North Meck, LLC., formerly North Mecklenburg C&D Landfill to expand the total landfill unit (waste footprint) from 31.1 acres to approximately 34.3 acres. The landfill facility boundary will remain at 129.5 acres. Also, the landfill is proposed to expand by 1,041,000 cubic yards to a total gross capacity of approximately 3,141,000 cubic yards from approximately 2,100,000 cubic yards.

The Service Area, as per the Ordinance and Franchise Agreement to North Mecklenburg Landfill, Inc. (transferred to Greenway Waste Solutions at North Meck, LLC) from the Town of Huntersville states that the population to be served by the landfill is the Town of Huntersville, Mecklenburg County and all counties contiguous to Mecklenburg County. The Ordinance and Franchise Agreement with the Town of Huntersville allows a maximum of 500,000 tons of construction and demolition debris waste to be deposited into the landfill each year. The estimated annual disposal rate is 120,000 tons per year (291 days per year) or 415 tons/day.

The C&DLF landfill property is owned by C&D Management Company, LLC and operated by Greenway Waste Solutions at North Meck, LLC. The facility is located at 15300 Holbrooks Road, Town of Huntersville, Mecklenburg County, North Carolina.

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The Division has determined that the proposed facility plan, engineering plan, construction quality assurance plan, operation plan, closure and post-closure plan, and the water quality

monitoring plan, as identified in the application, satisfy the requirements and intent of the North Carolina Solid Waste Management Rules, codified as 15A NCAC 13B .0533.

PERMIT STRUCTURE

The permit is divided into two parts, the Permit to Construct, and the Permit to Operate, each consist of a list of Approved Documents, and specific conditions for the construction, operation, and monitoring of the landfill units. A copy of the draft Permit to Construct is attached.

PUBLIC COMMENT PERIOD

North Carolina Solid Waste Management Rules require that the public be given an opportunity to comment on a draft permit for a municipal solid waste management facility. This 45-day comment period begins on November 4, 2011 and ends on December 20, 2011 at 5:00 PM. The application and draft permit is available for review during business hours (9 AM- 4 PM, Monday-Friday, by appointment) at the Division of Waste Management, Solid Waste Section, Mooresville Regional Office, 610 East Center Ave. Mooresville, NC 28115.

The administrative record including the application, fact sheet, and draft permit may be viewed online at http://portal.ncdenr.org/web/wm/sw. Enter "Document (Tracker)" then enter "6013" in the box and then click 'Go."

Persons who wish to comment on either this permit or the proposed permit conditions or to object to the permit issuance should submit their comments in writing by December 20, 2011 at 5:00 PM. Comments should be sent to the address shown below and include the permit number. All comments received within the 45-day period will be considered in making the final determinations regarding the permit.

DIVISION CONTACT

Persons who want to receive notice of the final permit decision should register with the division contact.

John Murray, P.E
North Carolina Solid Waste Section
Mooresville Regional office
610 East Center Ave., Suite 301
Mooresville, NC 28115

Phone Number: (704) 663-1699, ext. 2163
Fax Number: (704) 663-6040
Email: john.murray@ncdenr.gov

Storm Water Management Application/Permit
Mecklenburg County Land Use and Environmental Services

Form: #PCO5 (revised 5-26-08)

Application Recvd. Date: _____ Time: _____ Complete Submittal: ☐ Yes ☐ No	Application/Permit Number: 3033P

Name of Development: Infill Expansion - Greenway Waste Solutions of North Meck, LLC
Street Name & Number: 15300 Holbrooks Rd. Original Tax Parcel: 01910102
Total Area of Project (acres): 129.6 Total Disturbed Area (acres): 16.2 % Built Upon: 2.5
Land Development Fee Paid: $ ☐ Amendment to Permit #:
Type of Development: ☒ Commercial ☐ Residential ☐ Mixed Use ☐ Subdivision
Jurisdiction/Town: Huntersville
Zoning Designation: Special Use
Resubmittal: ☐ Yes ☒ No If yes provide notification date that resubmittal was required:
Address Verification Form Attached: ☐ Yes ☐ No

Owner's Name: Greenway Waste of North Meck, LLC
Owner's Address: 10109 West Catawba Ave., Cornelius, NC 28031-5614
Owner's Phone Number: 704-895-0329 Fax:
Owner's Email: rcgilkerson@griffinbrothers.com
Financial Responsible Party (FRP) (must be N.C. Agent): Ron Gilkerson
FRP Address: 10109 West Catawba Ave., Cornelius, NC 28031-5614
FRP Phone Number: 704-895-0329 Fax:
FRP Email: rcgilkerson@griffinbrothers.com
Designer: Brown & Caldwell
Name of Contact Person: Scott L Brown
Designer's Address: 2030 S. Tryon St, Charlotte, NC 28203
Designer's Phone Number: 704-773-6465 Fax: 980-224-8172
Designer's Email: sbrown@cecinc.com

Watershed District Where Project is Located: McDowell
Project Density based on Drainage Area: ☒ Low Density ☐ High Density ☐ N/A
Pollutant Removal Efficiency Required: ☐None ☐85% TSS ☐70% TP ☐LID (Huntersville)
Buffers Required: ☒ Yes ☐ No (Buffers must be delineated on the attached plan as per the Administrative Manual.)
Acknowledge that Volume Control will be provided for the 1-year, 24-hour storm for post-development: ☐ Yes ☐ No ☒ Huntersville
Peak Control Provided: ☐ 10-year, 6-hour ☐ 25-year, 6-hour ☒ Huntersville ☐ Other
Open Space Required: ☐ None ☐ 25% ☐ 17.5% ☐ 15% ☐ 10% ☒ Huntersville
Sewer: ☐ Charlotte-Mecklenburg Utilities ☐ Private Wastewater System ☐ Septic System

Total Phosphorus Mitigation Approved: ☐ Yes ☐ No (If Yes, attach approved and signed copy of #PCO9)
Development/Redevelopment Mitigation Requested: ☐ Yes ☐ No (If Yes, attached approved Form #PCO13)
Open Space Mitigation Approved: ☐ Yes ☐ No (If Yes, attach approved and signed copy of Form #PCO15.)

This permit conveys approval from the permitting entity for the owner or his agent as shown on the approved plan to construct storm water management devices and implement site designs (including undisturbed open space) in accordance with the applicable Post-Construction Storm Water Ordinance and related policies. This permit is valid until the project is complete or three (3) years from issuance of permit, whichever comes first. Maintenance of all storm water management devices installed pursuant to this permit is required into perpetuity. In addition, deed restrictions and protective covenants are required to ensure that subsequent development activities maintain the development (or redevelopment) consistent with approved plans. The information listed on the back of this form must be enclosed along with a completed application form and fee payment in order for a permit application to be considered complete.

Reviewed By: UST Bonnie Fisher, P.E. Tom Hodge Date: 3-27-2012

☒ Approved ☐ Approved with Modifications ☐ Approved with Performance Reservation (attached)

Issued By: Mike Stowell Date: 4-23-12

Appendix B

HUNTER Construction Group Inc.

118 Timber Road,
Mooresville, NC 28115
Tel: (704) 799-7570
Fax: (704) 799-7576

Letter of Transmittal

To:	Civil & Environmental Consultants, Inc	**Job:**	North Mecklenburg Infill
	2030 S. Tryon Street	**Attn:**	Scott Brown
	Charlotte, NC 28203	**Re:**	36” HDPE Pipe Installation

WE ARE SENDING YOU

SUB. AGREE.	PLANS	SHOP DRAWINGS	COPY OF LETTER	CHANGE ORDER	SAMPLES	SPECIFICATIONS	SUBMITTAL
							X

COPIES	DATE	NO.	DESCRIPTION
1	04-26-12		Infill 36” HDPE Pipe Installation
1	04-26-12		ADS Tech Note 5.02
1	04-26-12		Pipe Layout Plan
1	04-26-12		SG&H Calcs
1	04-26-12		Filter Fabric Spec

THESE ARE TRANSMITTED as checked below:

For approval [X] Approved as submitted [ ] Resubmit ____ copies for approval

For your use [ ] Approved as noted [ ] Submit _____ copies for distribution

As requested [ ] Returned for corrections [ ] Return _____ corrected prints

For review and comment _____

REMARKS

04-26-2012

Signature **Date**

HUNTER
Construction Group Inc.

36" HDPE Pipe Installation **April 25th, 2012**

Method for Preventing Pipe Flotation – The flowable fill for the 36 inch HDPE pipes will be installed in accordance with the attached ADS technical note TN 5.02, October 2009. The pipes will be restrained to prevent flotation in the trench due to the addition of the flowable fill. Three steel I-beams laid perpendicular to the trench will be installed to restrain each 20 or 13 linear foot parallel pipe section. Each steel I-beam will be fitted with a saddle that fits across the pipes, and is fully adjustable to accommodate different trench depths. The saddle will prevent both vertical and horizontal displacement of the pipes during the addition of the flowable fill.

Pipe and Backfill Placement – The pipe will be installed in accordance with SG&H 36 inch diameter Corrugated HDPE Pipe Design and Sheet SK-1, 11/3/2009 (attached), ADS recommendations and the approved construction drawings.
The trench excavation will begin on the downstream end of the pipe run at the installed concrete headwall. Excavation will be accomplished utilizing a track hoe with a bucket with "teeth" to the design grade. Excavation will occur in one hundred foot runs. The trench will be excavated to 10 ½ feet in width and to the proper depth in accordance with Sheet SK-1 and the approved construction plans. The trench bottom will then be mechanically compacted and field density tests performed. The field density tests of the trench bottom will be measured to ensure compaction to 95% of maximum standard Proctor density and will be conducted at the frequency indicated below:

<u>Test Frequency 1</u>
For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet of installation, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

<u>Test Frequency 2</u>
Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

118 Timber Road ▪ Mooresville, NC 28115 ▪ 704-799-7570 ▪ 704-799-7576 (fax)

Unsuitable soils or rocks in the trench bottom will be removed in accordance with SG&H 36 in. Diameter Corrugated HDPE Pipe Design and Sheet SK-1, 11/3/2009. In accordance with SG&H SK-1, the soil directly under the invert of the pipes, one foot in width and three inches in depth will be loosened prior to pipe placement. After the pipe is placed in the trench, the joints will be articulated to provide a joint deflection in accordance with the pipe plan layout. All pipe joints will be wrapped in geo-textile fabric and taped to secure the wrap to each joint. The fabric will be a class IV non-woven geotextile fabric in accordance with NCRS – MEFOTG, Section IV Construction Specification 495. After the joints are wrapped with the geotextile fabric and taped, the joint deflection will be measured by a professional land surveyor.

Once the pipe deflection has been recorded, the pipes will be restrained using the steel I-beam and saddle system to prevent pipe flotation. Flowable fill will be installed according to ADS recommendations to the depth shown in SK-1. The placement of flowable fill in the first trench will consist of 80 linear feet of flowable fill placed to design height with the final 20 feet tapering down at an approximate 4:1 slope to the end of the 100 foot trench. All subsequent 100 foot trenches will include placing flowable fill in the previous 20 foot length of the trench and tapering down as previously discussed for the final 20 feet.

To prevent flowable fill from entering the pipe, a pipe plug will be installed in the open end of the pipe and will be removed after the flowable fill has set. Two samples of flowable fill from each trench section will be taken per ASTM D 4832 and tested by a certified testing facility to determine the 28 day compressive strength, which should be between 500 and 1,000 psi.

After the flowable fill has set, un-compacted material will be placed over the pipe in accordance with SG&H SK-1. In those areas where filling will be required to reach final grade, sidefill will be placed on either side of the completed trench in 18 inch lifts. The sidefill areas will be compacted, the soil directly over the trench will not be compacted. The sidefill for those areas that require fill (fill height above non-native, undisturbed soil) will be placed and compacted in accordance with SG&H 36 inch Diameter Corrugated HDPE Pipe Design and Sheet SK-1, 11/3/2009 (attached). Compacted sidefill will be tested to ensure compaction to 95% of maximum standard Proctor density. This testing will be conducted at the following frequency:

<u>Test Frequency 1</u>
For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 lf of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

Test Frequency 2

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Method for Measuring Joint Deflection – Pipe deflection will be required for the majority of joints in the pipe alignment. The pipe deflections are labeled in the attached alignment plan and will be either 1 or 2 degrees. All pipe joints, regardless of deflection will be wrapped in geotechnical fabric and taped to prevent flowable fill from entering the pipes (see pipe and backflow placement). The pipe curve alignment depicting the layout, pipe sizes and deflection angles has been included with this submittal.

To achieve deflection in a pipe joint, the center line of the downstream pipe will be marked on the top at the upstream end of the pipe using a plum bob, level and tape. The upstream pipe will be inserted into the end of the downstream pipe in a straight alignment with coupler per ADS installation guidelines. The center line of the upstream end of the upstream pipe will be marked. The perpendicular pull length will be calculated using the degree of deflection and pipe length, and the end of the upstream pipe will be pulled the appropriate distance and direction to achieve the required deflection angle. All measurements and deflections angles will be recorded in a field book. Nomenclature of joints will be recorded as xR or xL. The x will indicate the joint from the down gradient end of the pipe system moving upwards. The “R” will indicate the right pipe as one looks up gradient and the “L” will indicate the left pipe.

After the pipe has been placed in the trench and the joints have been wrapped with geo-textile fabric and prior to placement of the flowable fill in the pipe trench, pipe joint deflection will be measured by a professional land surveyor. The surveyor will gather horizontal location and elevation information in two locations for each pipe stick. This will enable a CAD drawing to be prepared that accurately depicts the joint deflections by comparing it to the placement of the previous pipe. The surveyor will provide a signed and sealed as-built drawing depicting the pipe deflection and invert elevation at each joint for each of the parallel pipe runs after the installation of the pipe has been completed.

Signature _____

Print Name ____Rob Moss_____

Title _____Project Manager_____

Date _____April 25th, 2012_____

TECHNICAL NOTE

Flowable Fill Backfill for Thermoplastic Pipe

TN 5.02
October 2009

Introduction

The use of flowable fill, also known as controlled low strength material (CLSM), controlled density fill (CDF), and slurry fill, as pipe bedding and backfill material has steadily been increasing. The term “flowable fill” encompasses a variety of fill materials that are used as alternates to compacted granular fill. The materials are comprised of mixtures of sand, Portland cement, Class C or Class F fly ash, and water. In addition, the mix is typically flowable and self-leveling at the time of placement.

Flowable fill is an alternative to conventional soil or stone backfill and has been used for unique applications and installations of pipe for some time. It has the advantage of providing excellent strength quickly while providing an easy and efficient placement system. Flowable fill has proven to be a viable alternative when stone, sand, or other backfills have limited availability or cost prohibits their use. Even with these advantages it is necessary that the fill be controlled and care taken to provide for the proper installation.

Use of Flowable Fill

The following provides some advantages and disadvantages when deciding whether flowable fill should be specified or recommended on a project.

Advantages

- Allows for narrower trench and less disturbance to the native material.
- Eliminates the need for backfill compaction.
- Ensured proper distribution of support around the pipe.
- Reduces of the amount of material excavated on a project.
- Time, personnel and equipment required to install flowable fill are typically less than that required for proper placement and compaction of conventional backfill materials, particularly fine-grained soils.
- Flowable fill may be made on-site using native soil as part of the mix where silty sands exist.
- Time and equipment required for compressive strength testing is often less than that required to test soil compaction.

Disadvantages

- More costly than granular backfill due to the many components required and specialized delivery.
- Improper mix components can cause difficult future excavation if taps or extensions are required.
- Cannot be stockpiled on site like granular backfill. Time saved during the placement of the flowable fill can be wasted waiting on ready-mix delivery.
- Unless precaution is taken, the potential for pipe flotation is high during the installation process.

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Mix Design

The mix design of CLSM for flowable fill is beyond the scope of this document. However, care should be taken to make sure that the mix is designed to provide adequate strength but remain soft enough to be excavated should it be necessary to do so. A suggested range is between 50 psi and 100 psi for the 28 day strength; mixes that have 28-day compressive strengths greater than 100 psi should be avoided due to increased difficulty in future excavation, if needed. The mix design should be laboratory tested prior to installation ensure that the proper results are obtained during field batching. The field mix may also require monitoring and adjustments to maintain the proper mix and properties. These variations in the field mix can be due to many factors including water content, temperature and humidity during placement.

Installation Considerations

Environment

Flowable fill cannot be used in all temperature and weather conditions. It is recommended that the temperature be at least 40˚F and that the soil exposed to the flowable fill be unfrozen. There should be no appreciable precipitation during the first 24 hours after placement.

Joints

For flowable fill applications, the use of a watertight joint is recommended. For other types of joints, precautionary measures should be taken to prevent infiltration. With this type of joint, water can “bleed” through the joint during the fill material curing, facilitating the process. This will depend nearly entirely on the consistency of the mix design. The fine-grained materials in the fill material are not permitted to infiltrate the joint.

Placement of Flowable Fill

Trench excavation should follow normal procedures and meet all OSHA safety regulations. Trench width will be dictated by the native material strength. When acceptable in-situ material exists in the trench, like rock or other high-bearing soils, it is possible that the trench widths may be reduced to within 6-in along each side of the pipe, provided there is enough space to place and properly compact the fill in the pipe haunches. Table 1 depicts typical trench widths for a flowable fill installation. In soft in-situ materials a wider trench width may be necessary. Once the trench is excavated to the proper line and grade, placement of pipe may begin. The pipe should be laid in the trench and joined in accordance with publish recommended installation guidelines.

Table 1
Recommended Trench Widths for Flowable Fill Backfill

Nominal Pipe Diam, in. (mm)	Minimum Trench in. (m)	Nominal Pipe Diam, in. (mm)	Minimum Trench in. (m)
12 (300)	22 (0.6)	36 (900)	59 (1.5)
15 (375)	27 (0.7)	42 (1050)	66 (1.7)
18 (450)	33 (0.8)	48 (1200)	74 (1.9)
24 (600)	42 (1.0)	54 (1350)	82 (2.0)
30 (750)	51 (1.3)	60 (1500)	90 (2.3)

*AASHTO LRFD Section C12.6.6.1, 2006

It is recommended that both an anchoring system and incremental lifts be utilized during installation. Refer to Figure 1 and Table 2 below for lift recommendations. Keep in mind that the fill should be brought up evenly on both sides to prevent unbalanced forces from acting on the pipe. A waiting period should be provided between lifts, as specified by the design engineer. This time is dependent on the mix design as well as ambient temperature and moisture. The mix supplier should be contacted to determine the site-specific waiting period recommended

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between lifts. Compressive strength typically seen with flowable fill is 40-60 psi within one week. NOTE: The use of plasticizers or other add mixtures can greatly affect cure time and final compressive strength. For most construction projects, work can resume 4 to 6 hours after final placement. While it is recommended to place the flowable fill in incremental lifts, it should be noted, one continuous lift may be used provided flotation restraints have been properly designed and installed.

If additional backfill is to be placed over the flowable fill to reach final grade it should not be placed until the flowable fill has reached a minimum compressive strength as determined by the design engineer. Because moisture is beneficial to curing it may be desirable to place a thin layer of soil (6 inches) on top of the flowable fill section for enhanced curing.

Figure 1
Typical Backfill Structure

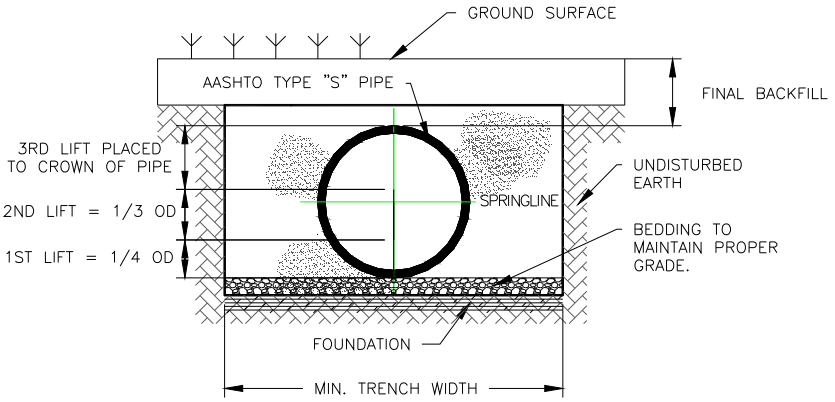


Table 2
Recommended Lift Heights

Nominal Pipe Diam, in. (mm)	1st Lift Height, in. (mm)	2nd Lift Height, in. (mm)
12 (300)	4 (101)	5 (127)
15 (375)	5 (127)	6 (152)
18 (450)	6 (152)	7 (178)
24 (600)	7 (178)	9 (229)
30 (750)	9 (229)	12 (305)
36 (900)	11 (280)	14 (356)
42 (1050)	12 (305)	16 (406)
48 (1200)	14 (356)	18 (457)
54 (1350)	15 (381)	20 (508)
60 (1500)	17 (432)	22 (559)

Anchoring Systems

Probably the greatest concern associated with flowable fill during installation is its tendency to float the pipe. Flotation and misalignment issues are extremely critical and should not be ignored. When backfilling with CLSM, the absence of soil overburden will cause the pipe to float since the pipe weight does not offset the CLSM uplift. Therefore, the pipe must be anchored to keep the intended alignment and grade. There are a number of acceptable methods for anchoring the pipe in the trench. It may be assumed that flowable fill acts as a fluid with a density of 140 - 150 lb/cu ft. prior to stiffening. When properly designed, pipe restraints should account for buoyant forces exerted by the fluid. When the fill hardens, flotation is no longer a concern.

Common methods include the use of dry CLSM placed at intervals along the pipe to hold it down, use of native material at intervals along the pipe to hold it down, or rebar placed in an "X" pattern above the pipe and anchored into the trench sidewall. Additional methods may include a pre-cast concrete swamp weight, or a commercially available screw anchor assembly. Anchor design and spacing shall be determined by the project design engineer. For other restraint options and additional technical information related to floatation, refer to Technical Note 5.05: *Pipe Flotation*.

© ADS 2009

(10) 20' STICKS
2° DEFLECTION

(4) 20' STICKS
STRAIGHT

SEE UPSTREAM
ENLARGEMENT THIS
SHEET

(34) 13' STICKS
2° DEFLECTION

(6) 20' STICKS
2° DEFLECTION

(8) 20' STICKS
1° DEFLECTION

(6) 20' STICKS
STRAIGHT

(12) 20' STICKS
1° DEFLECTION

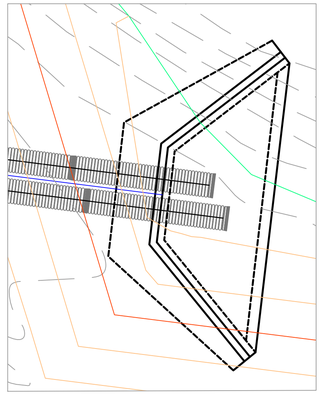
(6) 20' STICKS
2° DEFLECTION

(14) 20' STICKS
STRAIGHT

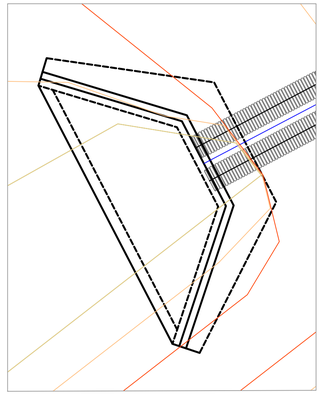
(12) 20' STICKS
1° DEFLECTION

(10)* 20' STICKS
STRAIGHT

SEE DOWNSTREAM
ENLARGEMENT THIS
SHEET



UPSTREAM HEADWALL
ENLARGEMENT
SCALE 1"=10'



DOWNSTREAM HEADWALL
ENLARGEMENT
SCALE 1"=10'

NORTH

SCALE IN FEET
0 30 60

NOTE:

*NUMBER OF PIPE STICKS SHOWN INCLUDE PIPES ON BOTH SIDES OF TRENCH CENTERLINE.

FOR EX. (10) PIPES INDICATE 5 PIPES ON EACH SIDE OF TRENCH CENTERLINE.

36" DIAMETER CORRUGATED HDPE PIPE DESIGN LAYOUT FOR

LANDFILL EXPANSION III, NORTH MECKLENBURG C&D LANDFILL, INC.
MECKLENBURG COUNTY, NORTH CAROLINA.

APRIL 11, 2012

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

NORTH CAROLINA PROFESSIONAL SEAL 028519 ENGINEER PHILLIP A. SHARPE 11-3-09

36 in. Diameter Corrugated HDPE Pipe Design

Project No.: 090206

Project: **Landfill Expansion III, North Mecklenburg**
C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: **3 November 2009**

Pipe Data, provided by Advanced Drainage Systems (ADS), Inc.:

Pipe standard	AASHTO M294
Inside diameter, in.	36
Outside diameter, in.	41.1
Corrugated rib profile/properties:	
Cross-sectional area, in.^{2}/in.	0.403
Moment of Inertia, in.^{4}/in.	0.318
Distance from inside diameter to neutral axis, in.	1.07
Period of profile, in.	5.20
Height of profile, in.	2.54

HDPE Material Design Properties (AASHTO LRFD Bridge Design Specifications (4th Ed.):

Short term modulus of elasticity, ksi	110
Long term modulus of elasticity, ksi	22
Compressive limiting strain	0.0409

Design Data, provided by BP Barber, Inc.:

Total fill height, ft	150
Embankment trash density, pcf	60

This design is based solely on soils data provided by BP Barber and analysis of the pipe behavior for circumferential effects. Design for control of differential longitudinal settlement and other sources of longitudinal stress to prevent damage to the pipe by others.

Backfill Data:

Backfill and flowable fill density, pcf	120
Primary backfill around pipe:	
Flowable fill, 28 day compressive strength, psi	500 - 1,000
Flowable fill, flow consistency per ASTM D 6103, in.	9
Backfill at sides of flowable fill (sidefill):	
USCS (ASTM D 2487) classification	SW, GW, or GP
Minimum density, % of maximum per ASTM D 698	95

SIMPSON GUMPERTZ & HEGER

Engineering of Structures and Building Enclosures

36 in. Diameter Corrugated HDPE Pipe Design

Project No.: 090206

Project: Landfill Expansion III, North Mecklenburg C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: 3 November 2009

NORTH CAROLINA PROFESSIONAL SEAL 028519 ENGINEER PHILIP A. SHARFF 17 JAN 09

Uncompacted zone material: See Project Specifications

Note: ASTM D 2487 materials GC, SC, CL or SM are acceptable.

Dimensions and additional installation criteria See Sheet SK-1

Materials:

1. The 36 in. diameter drain pipes shall be N-12 WT IB pipe per AASHTO M294 manufactured by Advanced Drainage Systems, Inc., Hilliard, OH, or approved equal. The pipe shall have a reinforced bell with a bell tolerance device installed by ADS.

2. The pipe joints shall be watertight in accordance with the requirements of ASTM D 3212.

3. Gaskets shall be supplied by ADS and covered with a removable, protective wrap until just before joint assembly to ensure the gasket is free from debris. A joint lubricant available from ADS shall be applied to the gasket and bell just prior to joint assembly.

4. Flowable fill mix shall consist of cement, sand, fly ash, and water and shall meet the material requirements of this specification (see Sheet 1). Large quantities of entrained air shall not be permitted. Coarse aggregate may also be used, provided material requirements are met.

5. Submit mix design for flowable fill and procedures for anchoring pipe against flotation and other movement during placement of the flowable fill.

Pipe Installation Sequence:

1. The contractor shall submit a plan for all sequences and procedures to be used for placing and backfilling the pipe. No pipe or backfill may be placed prior to receiving the engineer's approval of the backfilling plan. General issues that the backfill plan should address are included below.

2. The contractor is responsible for assuring that all applicable safety standards are complied with in all aspects of the pipe and backfill installation.

3. Pipe shall be installed as indicated on Sheet SK-1.

4. Prepare native soil to allow placement of pipe and flowable fill on a uniform firm surface. No rocks or clumps larger than 1 in. shall be in the bedding beneath the pipe for a minimum depth of 3 in. If native material is determined to be unsuitable by the Engineer, remove to a depth of 6 in. for the full width of the flowable fill zone and replace with the

36 in. Diameter Corrugated HDPE Pipe Design

Project No.: 090206

Project: Landfill Expansion III, North Mecklenburg
C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: 3 November 2009

NORTH CAROLINA PROFESSIONAL SEAL 028519 ENGINEER PHILLIP A. SHARFF

material specified for sidefill and compact to 95% of maximum standard Proctor density, except the material directly beneath the pipe shall be uncompacted; see Step 5.

5. Loosen soil directly under invert of pipe for a width of one-third of the diameter to a depth of 3 in.; see Sheet SK-1.

6. The bottom of the trench excavation shall be kept dry and free of water during preparation of the bedding, installation of the pipe, and installation of the flowable fill.

7. Install pipe and complete joints in accordance with ASTM D 2321 and ADS installation recommendations.

8. Install sidefill and backfill as follows:

   - Place specified sidefill material and flowable fill material around and at sides of pipe.

   - For ease of construction, sidefill and flowable fill may be placed incrementally, i.e., 2 to 3 ft of sidefill material may be placed and compacted (in suitable lift thicknesses to allow compaction to specified level) followed by placement of flowable fill. Alternatively, the contractor may place and compact all sidefill material prior to installing the pipe. The contractor shall submit details of the placing procedures and confirm that the required compaction is achieved for the full height of the sidefill.

   - The flowable fill shall be installed in equal lifts on both sides of and in between the pipe to prevent eccentric loading.

   - Visually monitor the placement of sidefill material. Conduct field density tests at locations and frequency directed by the Engineer.

   - The contractor is responsible for anchoring pipe to resist flotation or other movements while placing flowable fill. Anchoring system must not damage pipe.

   - Pipe shall be thoroughly cleaned and free of foreign matter prior to installation of flowable fill.

   - Place uncompacted embankment material from top of flowable fill to depths and widths shown on Sheet SK-1.

36 in. Diameter Corrugated HDPE Pipe Design

Project No.: 090206

Project: Landfill Expansion III, North Mecklenburg
C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: 3 November 2009

NORTH CAROLINA PROFESSIONAL SEAL 028519 ENGINEER PHILLIP A. SHARFF

- After placing flowable fill, inspect pipe and measure vertical diameter at a minimum of 50 ft intervals along pipeline. Report deflections and any other observations to the engineer.

- If approved by the Engineer, proceed with placement of embankment material, compacting per project specifications.

- After completion of backfill, inspect pipe and re-measure vertical diameter at a minimum of 50 ft intervals along pipeline. Record pipe conditions. Provide a report of deflections and observed pipe conditions to engineer.

9. Connection of the pipe with existing or new structures shall be in accordance with ADS installation recommendations.

10. Upon completion the contractor is responsible for removal of any materials from inside the pipe, including any flowable fill that enters the pipe.

11. A curved pipe alignment may be installed in accordance with ADS maximum allowable pipe bend angle (lateral joint rotation); see ADS corrugated HDPE pipe installation guide. If the proposed pipe alignment exceeds the maximum allowable pipe bend angle, coupling bands, manufactured by ADS may be used to accommodate the curvature. The proposed curved pipe alignment and coupling bands shall be submitted to the engineer for approval prior to manufacturing or installing the pipe.

SIMPSON GUMPERTZ & HEGER

Engineering of Structures and Building Enclosures

36 in. Diameter Corrugated HDPE Pipe Design

Project No.: 090206

Project: **Landfill Expansion III, North Mecklenburg**
C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: **3 November 2009**

NORTH CAROLINA PROFESSIONAL SEAL 028519 ENGINEER PHILIP A. SHARFF

11-3-09

Pipe Maintenance Program:

1. The pipe shall be maintained clear of all debris and inspected periodically for joint leakage or deformation.

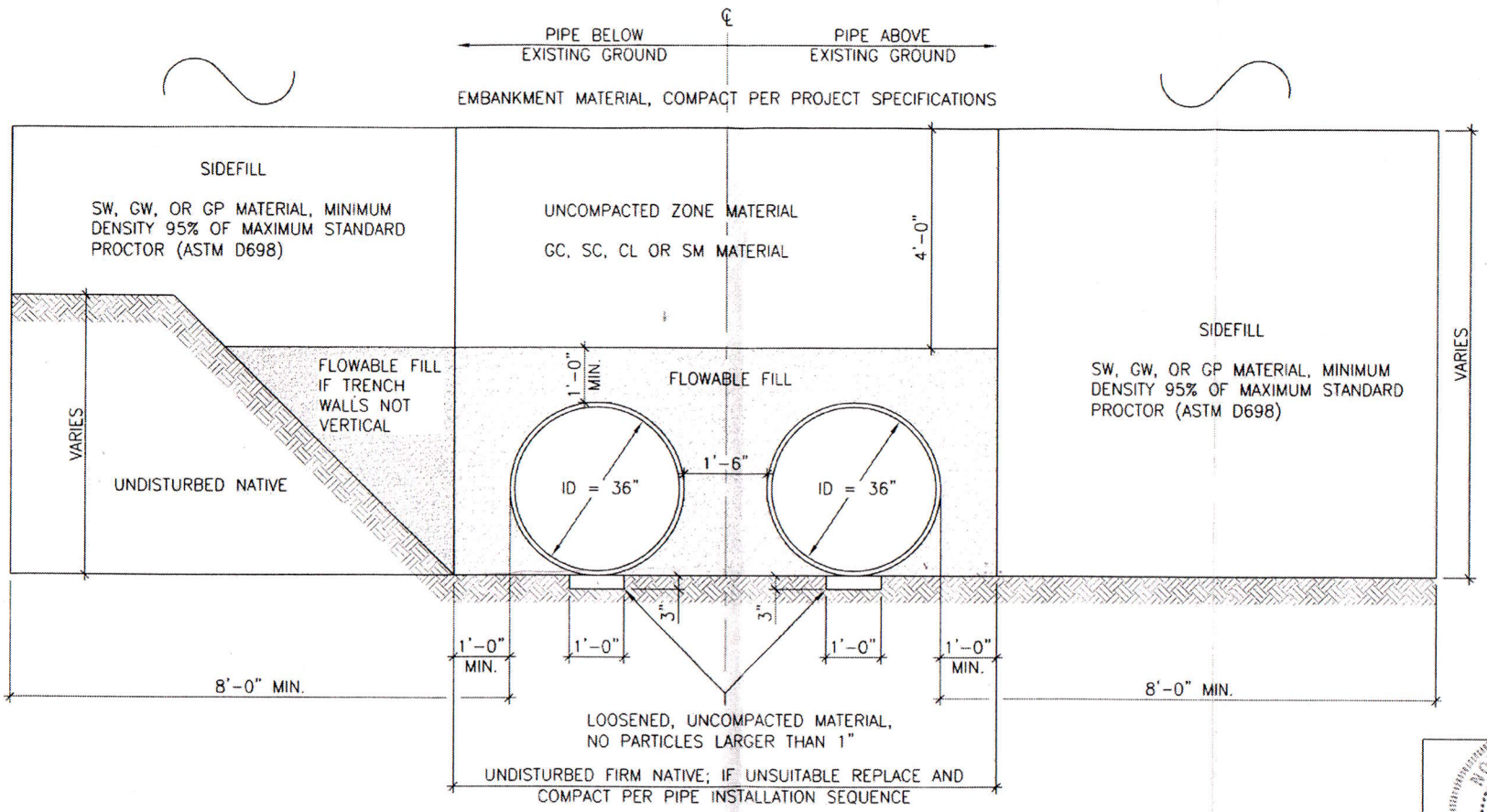
2. Inspection of the piping system shall be performed a minimum of once every five years or after major rain events if debris has accumulated in the pipe. The inspection shall include entry into the piping system by either man entry or using closed circuit television (CCTV) to identify signs of structural distress and/or soil/water infiltration. If structural distress or infiltration is observed a licensed professional engineer should be contacted to evaluate the piping system. Man entry shall only be performed by certified confined space entry personnel.

3. Prior to inspection and maintenance, the piping system shall be thoroughly cleaned by either manual methods or by using a vacuum truck to remove sediment build up. Cleaning shall be performed at the discretion of the individuals responsible for maintenance of the system, but should be scheduled during a dry season. Cleaning shall be performed a minimum of once per year.

I:\BOS\Projects\2009\090206.00-DEEP\WP\001PASharff-Design Specs.090206.00.eac.doc

SIMPSON GUMPERTZ & HEGER INC.
41 Seyon Street, Building 1, Suite 500
Waltham, Massachusetts 02453
main: 781.907.9000 fax: 781.907.9009
www.sgh.com

Boston
Los Angeles
New York
San Francisco
Washington, DC



PIPE BEDDING REQUIREMENTS 36 IN. DIAMETER PIPE

N.T.S.

Notes:
1. Backfill plan must be submitted to and approved by Engineer prior to beginning pipe installation.
2. Maximum fill height is 150 ft above the top of pipe.
3. See technical specifications for design data and requirements for materials, installation, and maintenance.

NORTH CAROLINA PROFESSIONAL SEAL 028519 ENGINEER PHILLIP A. SHARFF
11-3-09
Phillip A. Sharff
North Carolina P.E. #028519

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures
Simpson Gumpertz & Heger Inc. 781.907.9000
41 Seyon Street, Building 1, Suite 500 fax: 781.907.9009
Waltham, Massachusetts 02453 www.sgh.com

Project:	Landfill Expansion III North Mecklenburg C&D Landfill Inc Mecklenburg County, North Carolina
Drawing Title	36 IN. DRAIN PIPE INSTALLATION DETAILS
Proj.	090206.00
Drawn:	DMS
Checked:	TJM
Date:	10/09/09
Drawing No.:	SK-1
Scale:	½" = 1'-0"

DALCO NONWOVENS, LLC

Nonwoven Civil Geotextiles
DALCO 1100

Property	Unit	Test Method	MARV
PHYSICAL			
Grab Tensile	lb	ASTM D-4632	250
Grab Elongation	%	ASTM D-4632	50
Trapezoidal Tear	lb	ASTM D-4533	100
Puncture Resistance	lb	ASTM D-4833	160
Mullen Burst	psi	ASTM D-3786	500
UV Resistance After 500 hrs.	% Strength Retained	ASTM D-4355	70
HYDRAULIC			
Permittivity	sec^-1	ASTM D-4491	1.2
Water Flow Rate	gpm/ft^2	ASTM D-4491	80
Apparent Opening Size	U.S. Sieve	ASTM D-4751	80
PACKAGING			
Roll Width	ft		12.5/15
Roll Length	ft		360/300
Area	yd^2		500

(1). Physical and hydraulic properties reported as minimum average roll values (MARV)
(2). Property values are subject to change without notice.
(3). At the time of manufacturing, handling may change these properties.
(4). AOS reported as maximum average roll value.

HUNTER Construction Group Inc.

118 Timber Road,
Mooresville, NC 28115
Tel: (704) 799-7570
Fax: (704) 799-7576

Letter of Transmittal

To:	Civil & Environmental Consultants, Inc	**Job:**	North Mecklenburg Infill
	2030 S. Tryon Street	**Attn:**	Scott Brown
	Charlotte, NC 28203	**Re:**	Concrete Mix Designs

WE ARE SENDING YOU

SUB. AGREE.	PLANS	SHOP DRAWINGS	COPY OF LETTER	CHANGE ORDER	SAMPLES	SPECIFICATIONS	SUBMITTAL
							X

COPIES	DATE	NO.	DESCRIPTION
1	04-26-12		Concrete Mix Designs (Flowable Fill & Headwall)

THESE ARE TRANSMITTED as checked below:

For approval [X] Approved as submitted [ ] Resubmit ____ copies for approval

For your use [ ] Approved as noted [ ] Submit _____ copies for distribution

As requested [ ] Returned for corrections [ ] Return _____ corrected prints

For review and comment _____

REMARKS

04-26-2012

Signature **Date**

P O Box 23029
Charlotte, NC 28227
Office (704) 971-7676
Fax (704) 545-2398

Date Issued: 4/24/2012

Supplier: Blue Dot Readi Mix

Customer: Griffin Brothers / Hunter Construction

Project: North Mecklenburg Landfill

Usage: 050053 - 500 PSI Flowable Fill Non-Pumpable **Flowable Fill**

Material	Description	ASTM	Volume(CF)	oz/cwt	Weight (lb)
Typel-II Cement	Holcim-Holly Hill	ASTM C-150	0.89		175
Fly Ash F	Pro Ash	ASTM C-618	2.79		400
Fine Aggregate	B&T	ASTM C-33	14.68		2420
City Water	Water	ASTM C-94	6.95		433
Type A Water Reducer	WRDA 79	ASTM C-494	0.03	4.00	
Air Entrainer	Darex II	ASTM C-260	0.02	2.50	
Air			1.64		
			27.00	**TOTAL**	**3428**

Specified F'c:	500 PSI		
Specified Slump:	8.00 to 11.00 in.	Designed Unit Weight:	127 lbs/cu.ft.
Specified Air:	4.5 to 7.5 %	Designed W/C + P Ratio:	0.75
Designed Air:	6.00 %	Designed Volume:	27.00 cu.ft.

NOTES:

Blue Dot has no knowledge or authority regarding where this mix is to be placed. Blue Dot has not been requested to investigate, nor has it been provided with information concerning the soil, subsurface or other enviromental conditions at the project site. Therefore it is the responsibility of the project architect/engineer, and/or contractor to insure that the above mix parameters of compressive strength, water cement ratio, cement content, and air content, are appropriate for the anticipated soil, subsurface and other environmental conditions at the project site. (ie. ACI-318 sections 4.1-4.3, and the local Building Codes).

This Submittal has been prepared by Blue Dot for the above client and project only. It is not to be used or reproduced by the client or any third party for any other project without the written permission of Blue Dot. Blue Dot may use admixtures or procedures not listed above to control the mixture during Hot or Cold weather, for pumping, long hauls, or other special applications, unless restricted in writing by the client.

COMMENTS:

P O Box 23029
Charlotte, NC 28227
Office (704) 971-7676
Fax (704) 545-2398

Date Issued: 4/24/2012

Supplier: Blue Dot Readi Mix

Customer: Griffin Brothers / Hunter Construction

Project: North Mecklenburg Landfill

Usage: 506150 - 5000 PSI FA 67 Stone AE **Headwall**

Material	Description	ASTM	Volume(CF)	oz/cwt	Weight (lb)
Typel-II Cement	Holcim-Holly Hill	ASTM C-150	3.31		650
Fly Ash F	Pro Ash	ASTM C-618	0.98		140
Coarse Aggregate	Pineville #57/67 Stone	ASTM C-33	10.83		1975
Fine Aggregate	B&T	ASTM C-33	6.01		990
City Water	Water	ASTM C-94	4.49		280
Type A Water Reducer	WRDA 79	ASTM C-494	0.03	4.00	
Air Entrainer	Darex II	ASTM C-260	0.01	1.25	
Air			1.34		
			27.00	**TOTAL**	**4035**

Specified F'c:	5000 PSI		
Specified Slump:	3.00 to 5.00 in.	Designed Unit Weight:	149.4 lbs/cu.ft.
Specified Air:	3.5 to 6.5 %	Designed W/C + P Ratio:	0.35
Designed Air:	5.00 %	Designed Volume:	27.00 cu.ft.

NOTES:

Blue Dot has no knowledge or authority regarding where this mix is to be placed. Blue Dot has not been requested to investigate, nor has it been provided with information concerning the soil, subsurface or other enviromental conditions at the project site. Therefore it is the responsibility of the project architect/engineer, and/or contractor to insure that the above mix parameters of compressive strength, water cement ratio, cement content, and air content, are appropriate for the anticipated soil, subsurface and other environmental conditions at the project site. (ie. ACI-318 sections 4.1-4.3, and the local Building Codes).

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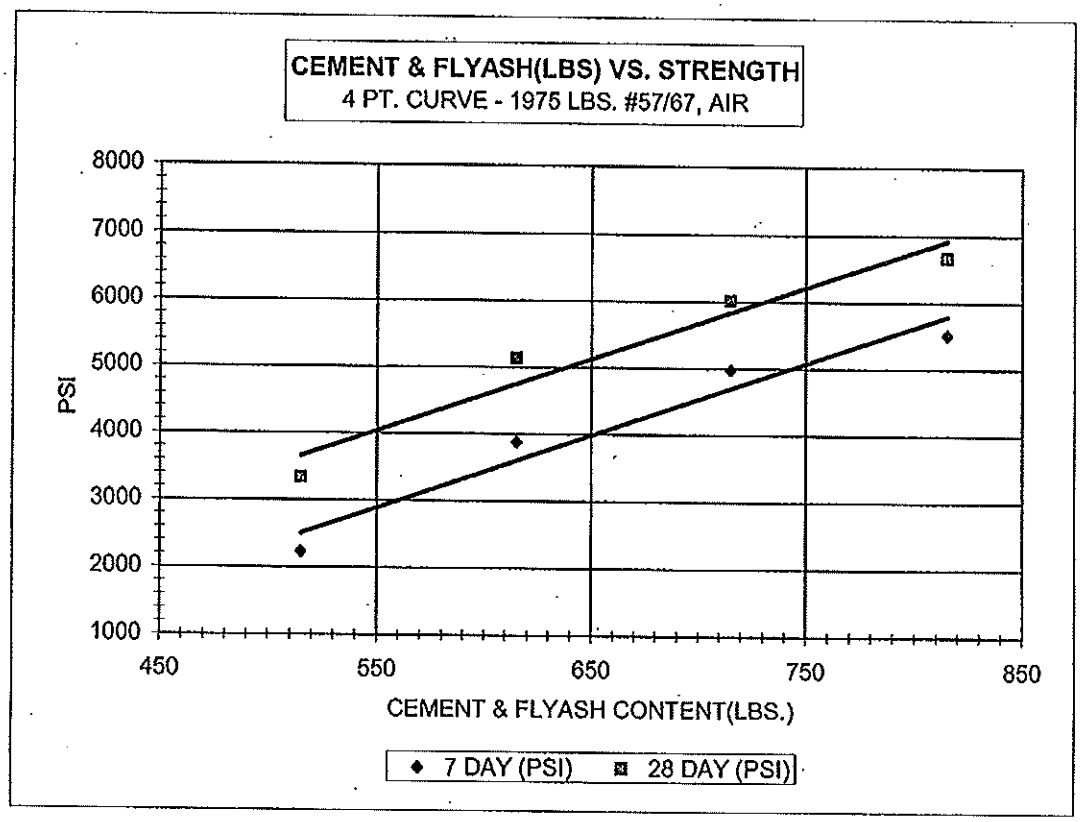
COMMENTS:



TO PRODUCE ONE CUBIC YARD OF CONCRETE WITH SSD MATERIALS

AS SUMMARIZED BY S&ME

			MIX 1	MIX 2	MIX 3	MIX 4
CEMENT		LBS.	375	475	575	675
FLYASH		LBS.	140	140	140	140
COARSE AGG. 1	#57/67	LBS.	1975	1975	1975	1975
COARSE AGG. 2		LBS.				
FINE AGGRGATE	2S	LBS.	1240	1156	1073	989
WATER		LBS.	290	290	290	290
W.R.A.	WR91	OZS.	21	25	29	33
A.E. AGENT	AIR30	OZS.	4.3	5.8	5.2	5.9
SLUMP RANGE		INS.	3-5	3-5	3-5	3-5
ACTUAL SLUMP		INS.	5	5	4.75	5
AIR RANGE		%	4-6%	4-6%	4-6%	4-6%
ACTUAL AIR		%	4	4.5	4.25	4.75
7 DAY COMPRESSIVE STRENGTH			2230	3875	4975	5510
28 DAY COMPRESSIVE STRENGTH			3340	5125	6020	6670

* SUFFICIENT TO ENTRAIN 4-6%

PDF created with pdfFactory Pro trial version www.pdffactory.com

Holcim

Material Certification Report

Material:	Portland Cement	Test Period:	18-Jun-2011
Type:	I-II(MH) (C 150)	To:	19-Jun-2011

Certification

Holcim cement meets the specifications of ASTM C 150 for Type I-II(MH) cement. This material complies with AASHTO M 85 specifications for Type I-II(MH) cement.

General Information

Supplier:	Holcim (US) Inc.	Source Location:	Holly Hill Plant
Address:	200 Safety Street, Highway 453 Holly Hill, SC 29059		200 Safety Street, Highway 453 Holly Hill, SC 29059
Telephone:	803-496-2995	Contact:	Scott Poaps
Date Issued:	14-Jul-2011		

The following information is based on average test data during the test period. The data is typical of cement shipped by Holcim; individual shipments may vary.

Tests Data on ASTM Standard Requirements

Chemical			Physical		
Item	Limit[A]	Result	Item	Limit[A]	Result
SiO_2 (%)	-	20.4	Air Content (%)	12 max	6
Al_2O_3 (%)	6.0 max	4.9	Blaine Fineness (m^2/kg)	260 min 430 max	405
Fe_2O_3 (%)	6.0 max	3.8			
CaO (%)	-	63.6			
MgO (%)	6.0 max	1.4	Autoclave Expansion (%) (C 151)	0.80 max	-0.09
SO_3 (%)[C]	3.0 max	3.1	Compressive Strength MPa (psi):		
Loss on Ignition (%)	3.0 max	1.5			
Insoluble Residue (%)	0.75 max	0.18	3 days	10.0 (1450) min	29.6 (4300)
CO_2 (%)	-	-	7 days	17.0 (2470) min	36.9 (5350)
Limestone (%)	5.0 max	-			
$CaCO_3$ in Limestone (%)	70 min	-	Initial Vicat (minutes)	45-375	135
Inorganic Processing Addition	5.0 max	0.9			
Potential Phase Compositions[D]:			Mortar Bar Expansion (%) (C 1038)		0.004
C_3S (%)	-	58			
C_2S (%)	-	14	Heat of Hydration: 7 days, kJ/kg (cal/g)[B]	-	367 (88)
C_3A (%)	8 max	6			
C_4AF (%)	-	11			
$C_3S + 4.75C_3A$ (%)	100 max	86.5			

Tests Data on ASTM Optional Requirements

Chemical			Physical		
Item	Limit[A]	Result	Item	Limit[A]	Result
Equivalent Alkalies (%)	0.60 max	0.54			

Notes:

[A] Dashes in the limit / result columns mean Not Applicable.

[B] Test result represents most recent value and is provided for information only. Analysis of Heat of Hydration has been carried out by CTLGroup, Skokie, IL.

[C] It is permissible to exceed the specification limit assuming ASTM C 1038 Mortar Bar Expansion does not exceed 0.020 %.

[D] Adjusted per Annex A1.6 of ASTM C150 and AASHTO M85.

This data may have been reported on previous mill certificates. It is typical of the cement being currently shipped.

Meets standard requirement for Moderate Heat

Silo 18
6/18/2011
Grind 169-170

Additional Data

By _____

Quality Manager

CTL | THOMPSON

Chemical and Physical Analysis of Fly Ash

Developed For: *Separation Technologies, LLC*
101 Hampton Avenue
Needham, MA 02494

CTL Ticket: *11248*	Plant of Origin: *ST Roxboro*	Sample Date Range: *08/29/2011*
CTL Project: *15165*	Sample ID:	to: *09/07/2011*
Report Date: *10/19/2011*	Docket: -	Date Received: *09/16/2011*

Chemical Composition (%)

(by Wyoming Analytical Laboratories, Inc.)

			ASTM C 618-08A Specifications	
			Class F	Class C
Total Silica, Aluminum, Iron:	*90.6*		70.0 Min	50.0 Min
Silicon Dioxide:		*56.5*		
Aluminum Oxide:		*28.5*		
Iron Oxide:		*5.5*		
Sulfur Trioxide:	*0.1*		5.0 Max	5.0 Max
Calcium Oxide:	*1.0*			
Moisture Content:	*0.0*		3.0 Max	3.0 Max
Loss on Ignition:	*2.5*		6.0 Max	6.0 Max

Physical Test Results

		ASTM C 618-08A Specifications	
		Class F	Class C
Fineness, Retained on #325 Sieve (%):	*30.1*	34 Max	34 Max
Strength Activity Index (%)			
Ratio to Control @ 7 Days:	*79.7*		
Ratio to Control @ 28 Days:	*87.8*	75 Min	75 Min
Water Requirement, % of Control:	*97.1*	105 Max	105 Max
Soundness, Autoclave Expansion (%):	*-0.05*	0.8 Max	0.8 Max
Density Mg/m^3:	*2.13*		

Comments: *Meets Class F, ASTM C 618 and AASHTO M 295*

COLORADO REGISTERED PROFESSIONAL ENGINEER ORVILLE R. WERNER II 14540 10/19/2011

CTL | Thompson Materials Engineers, Inc.

Orville R. Werner II, P.E.

22 Lipan Street | Denver, Colorado 80223 | Telephone: 303-825-0777 Fax: 303-893-1568

This test report relates only to the items tested and shall not be reproduced, except in full, without written approval of CTL Thompson, Inc.

Vulcan Materials Company

Product Quality Summary Report

Plant 110-Pineville

Product	005 #5 Stone	057 NC #57	067 NC #67	078 NC #78M	511 Washed Screenings
Specification	005-NC #5	NC #57	NCDOT 67	NCDOT 78M	Washed Screenings
2" (50mm)	100.0				
1 1/2" (37.5mm)	100.0				
1" (25mm)	92.0	100.0	100.0		
3/4" (19mm)	43.8	93.0	93.1	100.0	
1/2" (12.5mm)	12.4	53.7	54.1	100.0	
3/8" (9.5mm)	5.5	33.8	34.1	92.6	100.0
#4 (4.75mm)		6.1	6.2	22.7	96.3
#8 (2.36mm)		2.4	2.4	3.9	68.6
#16 (1.18mm)					45.3
#30 (0.6mm)					31.4
#50 (0.3mm)					21.0
#100 (0.15mm)					10.8
#200 (75um)					5.08

B&T Sand Company

DATE SAMPLE TAKEN: 25-Jun-11	PLANT: Lexington, SC
DATE GRADATION RUN: 25-Jun-11	SOURCE: Pit
SAND: (River) (Pit) (Masonry) C-33 Concrete Sand (Manufactured)	OTHER:
SAMPLED FROM: *Pit*	

SPECIFICATIONS & % PASSING

SIEVE	WT. RET.	% RET.	% PASS	ASTM C-33	SC DOT FA-10	NC DOT 2-S	ASTM C-144 (MASONRY)
1/2	0.0	0.00	100.0				
3/8	0.0	0.00	100.0	100	100	100	
4	2.3	0.46	99.5	95-100	96-100	95-100	100
8	12.3	2.5	97.5	80-100	75-100	80-100	95-100
16	115.6	23.1	76.9	50-85	55-98	45-95	70-100
30	356.2	71.2	28.8	25-60	25-75	25-75	40-75
50	440.2	88.0	12.0	5-30	5-30	8-30	10-35
100	465.3	93.0	7.0	0-10	0-9	0.5-10	2-15
200	500.3	#####	0.0		0-3	0-3	0-5
PAN	500.3						
F.M.:	2.78						

ASTM C-117 Percent Finer than #200:

TESTED BY: *B&T Sand Co 5960 Edmond Hwy, Lexington, S.C.29073*

REMARKS:

REPORT OF
SPECIFIC GRAVITY AND ABSORPTION OF FINE AGGREGATE
(ASTM C 128)

Project Name: B&T Sand Company Lab Assignment No. 1808

MACTEC Project Number: 6670-08-0601.01 Date Received: 2/13/08

Sample No.: S-167 Sample Source/Location: QC-7

Material Description: Washed Concrete Sand Material Source: B&T Sand Company

CRITERIA:

Sample Number		Test 1	Test 2	Average
Wt. of Oven Dry Spec. (gm)	A	498.5	498.4	-----
Wt of Pyc. Filled with water (gm)	B	1260.02	1260.96	-----
Wt. Of Pyc. + Spec. + Water (gm)	C	1570.11	1571.11	-----
Temperature °C	T	23.3	23.3	-----
SSD Wt. of Spec.	S	500.0	500.0	-----
Bulk SG (dry), S_d	A/(B+S-C)	2.625	2.625	2.625
Bulk SG (SSD), S_s	S/(B+S-C)	2.633	2.634	2.634
App. SG	A/(B+A-C)	2.646	2.648	2.647
Absorption %	[(S-A)/A] x 100	0.30	0.32	0.31

David C. Butts, III

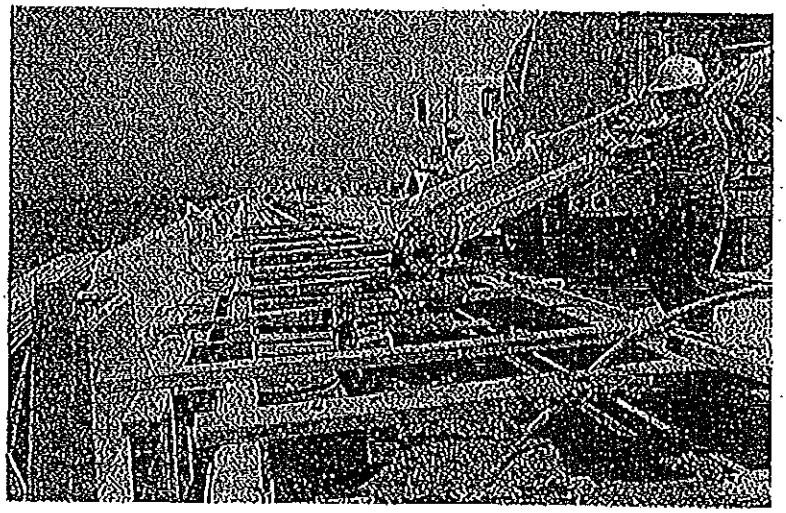
AASHTO R18

Concrete

PRODUCT INFORMATION

WRDA® 79

Water-Reducing and Retarding Admixture ASTM C 494, Type A and Type D



Description

WRDA® 79 is an aqueous solution of modified lignosulfonates containing a catalyst which promotes more complete hydration of portland cement. It does not contain calcium chloride. WRDA 79 is manufactured under rigid control which provides uniform, predictable performance. It is supplied as a dark brown, low viscosity liquid, ready-to-use as received. One Liter weighs approximately 1.18 kg (one gal weighs approx. 9.9 lbs).

Uses

WRDA 79 makes a workable mix and yields a stronger, less permeable and more durable concrete. It is used in ready mix plants, job site plants and concrete pavers, for normal weight and light weight concrete, in block, precast and prestressed concrete plants.

Chemical Action

WRDA 79 is a chemical admixture meeting the requirements of Specification for Chemical Admixtures for Concrete, ASTM Designation: C 494 as a Type A and as a Type D admixture.

As a dispersing agent, WRDA 79 lessens the natural interparticle attraction between cement grains in water. It does this by colloidal action, by adsorption on the cement particles thus reducing their tendency to clump together and makes the mix more workable with less water. As a cement catalyst, WRDA 79 effects a more complete hydration of the cement, beginning immediately after the cement and water come together at the lower additions of WRDA 79 or immediately after a period of designed and controlled hydration at the higher additions. WRDA 79 increases the gel content of the concrete, the paste or binder that "glues" the concrete aggregates together. The increased gel content adds to the water retention and internal cohesiveness of the mix, reducing bleeding and segregation as it increases workability and placeability.

GRACE
Construction Products

Addition Rates

WRDA 79 will meet the requirements of ASTM C 494 as a Type A or as a Type D admixture thus providing water reduction with no retardation through mild to extended initial retardation as job conditions require. After a period of initial retardation at the higher addition rates, hydration continues rapidly and completely.

The amount of WRDA 79 to be used will range from 190 to 625 mL/100 kg (3 to 10 fl oz/ 100 lbs) of cementitious materials depending upon job requirements.

Compatibility with Other Admixtures

WRDA 79 is compatible with all air-entraining admixtures. By combining the separate effects of air entrainment and dispersion, the water requirement of concrete may be reduced up to 20%.

Each admixture should be added separately. WRDA 79 contains no calcium chloride but is compatible in concrete with calcium chloride. Again each admixture should be added separately.

Dispensing Equipment

A complete line of accurate, automatic dispensing equipment is available. WRDA 79 may be added to the concrete mix on the sand or in the water.

Packaging

WRDA 79 is available in bulk, delivered by metered tank trucks, and 210 L (55 gal) drums. It will freeze at about -2°C (28°F) but will return to full strength after thawing and thorough mechanical agitation.

Specifications

Concrete shall be designed in accordance with Standard Recommended Practice for Selecting Proportions for Concrete, ACI 211.

The water-reducing admixture shall be WRDA 79 as manufactured by Grace Construction Products, or approved equal. The admixture shall not contain calcium chloride. It shall meet the requirements of Specification for Chemical Admixtures for Concrete ASTM Designation C 494 as a Type A admixture or as a Type D admixture when used at an addition rate of 190 to 625 mL/100 kg (3 to 10 fl oz/ 100 lbs) of cement. Certification of compliance shall be made available on request.

The admixture shall be delivered as a ready-to-use liquid product and shall require no mixing at the batching plant or job site.

web Visit our web site at: www.graceconstruction.com printed on recycled paper

W. R. Grace & Co. - Conn. 62 Whittemore Avenue Cambridge, MA 02140

WRDA is a registered trademark of W. R. Grace & Co.-Conn.

[illegible]

This product may be covered by patents or patent applications. Copyright 1993, W. R. Grace & Co.-Conn. Printed in U.S.A. [illegible]

GRACE
Construction Products

Grace Construction Products

W.R. Grace & Co. - Conn.
62 Whittemore Avenue
Cambridge, MA 02140-1692

T 617-876-1400

www.graceconstruction.com

1/18/2012

Dave Melson
Blue Dot Readi Mix
9104 Northfield Drive
Fort Mill, South Carolina 29716

Project Name: general production
Product Selected: WRDA® 79

This is to certify that the WRDA 79, a Water-Reducing and Retarding Admixture, as manufactured and supplied by Grace Construction Products, W.R. Grace & Co. - Conn., is formulated to comply with the Specifications for Chemical Admixtures for Concrete, ASTM: C494, Type A, D, AASHTO: M194, Type A, D.

WRDA 79 does not contain calcium chloride or chloride containing compounds as a functional ingredient. Chloride ions may be present in trace amounts contributed from the process water used in manufacturing.

The foregoing is in addition to and not in substitution for our standard Conditions of Sale attached.

G. Terry Harris

G. Terry Harris
Technical Services Manager

GRACE

DAREX® II AEA

Air-entraining admixture

ASTM C260

Product Description

Darex® II AEA is an air-entraining admixture which generates a highly stable air void system for increased protection against damage from freezing and thawing, severe weathering, or de-icer chemicals. Darex II AEA is a complex mixture of organic acid salts in an aqueous solution specifically formulated for use as an air-entraining admixture for concrete and is manufactured under rigid control which provides uniform, predictable performance. It is supplied ready-to-use and does not require pre-mixing with water. Darex II AEA is a dark brown liquid. One gallon weighs 8.7 lbs (1.04 kg/L). Darex II AEA complies to ASTM C260 *Standard Specifications for Air-Entraining Admixtures for Concrete.*

Uses

Darex II AEA is used in ready-mix, block, and concrete products plants to improve air entrainment stability. It is particularly effective in maintaining air content during longer haul times. Darex II AEA performs well in conventional concrete and is effective in plasticizing mixes and with slag, lightweight, or manufactured aggregates which tend to produce harsh concrete.

Darex II AEA entrains air effectively with microsilica concrete and with fly ash concrete.

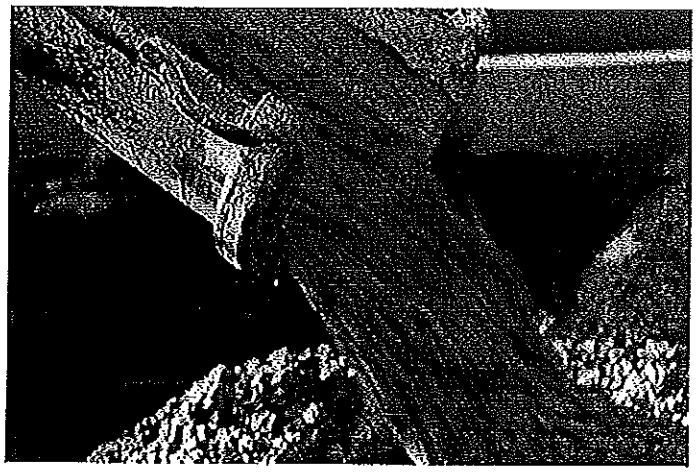
Performance

By agitation of concrete mixers, Darex II AEA disperses and generates millions of discrete semi-microscopic bubbles throughout the concrete composite. Once thoroughly mixed, the concrete contains a stable network of bubbles which act much like ball bearings increasing mobility, or plasticity, of the concrete. This aids workability to the mix and permits a reduction of water with no loss of slump. Placeability is improved. Bleeding, segregation and green shrinkage are minimized.

Through the purposeful entrainment of air, Darex II AEA markedly increases the durability of concrete to all exposures.

Product Advantages

- Air stability makes it particularly useful for longer transit times
- Produces excellent air void systems in concretes that are traditionally difficult to air entrain



Addition Rates

There is no standard addition rate for Darex II AEA. The amount to be used will depend upon the amount of air required under job conditions, usually in the range of 4 to 7%. Typical factors which might influence the amount of air entrained are temperature, cement, sand gradation, and use of extra fine materials such as fly ash. Typical Darex II AEA addition rates generally range from ½ to 5 fl oz/100 lbs (30 to 320 mL/100 kg) of cement.

The air-entraining efficiency of Darex II AEA becomes even greater when used with water-reducing and set-retarding agents. This may allow a reduction of up to ⅔ in the amount of Darex II AEA required for the specified air content.

Mix Adjustment

Entrained air results in increased yields with a consequent decrease in the cement content of the placed concrete. This condition calls for a mix adjustment, usually accomplished by reducing the fine aggregate content. This is in addition to the reduction in water content brought about by the increase in plasticity.

Compatibility with Other Admixtures and Batch Sequencing

Darex II AEA is compatible with most Grace admixtures as long as they are added separately to the concrete mix. In general, it is recommended that Darex II AEA be added to the concrete mix near the beginning of the batch sequence for optimum performance, preferably by "dribbling" on the sand. Different sequencing may be used if local testing shows better performance. Please see Grace Technical Bulletin TB-0110, *Admixture Dispenser Discharge Line Location and Sequencing for Concrete Batching Operations* for further recommendations. Darex II AEA should not be added directly to heated water.

Pretesting of the concrete mix should be performed before use, and as conditions and materials change in order to assure compatibility, and to optimize dosage rates, addition times in the batch sequencing and concrete performance. Please consult your Grace representative for guidance.

Packaging & Handling

Darex II AEA is available in bulk, delivered by metered tank trucks, totes and drums. **Darex II AEA will freeze at about 30°F (-1°C), but its air-entraining properties are completely restored by thawing and thorough mechanical agitation.**

Dispensing Equipment

A complete line of accurate dispensing equipment is available. These dispensers can be located to discharge into the water line, the mixer, or on the sand.

Specifications

Concrete shall be air entrained concrete, containing 4 to 7% entrained air. The air contents in the concrete shall be determined by the pressure method (ASTM Designation C231), gravimetric method (ASTM Designation C138) or volume metric method (ASTM Designation C173). The air-entraining admixture shall be Darex II AEA as manufactured by Grace Construction Products, or equal. The air-entraining admixture shall be added at the concrete mixer or batching plant at approximately ½ to 5 fl oz/100 lbs (30 to 320 mL/100 kg) of cement, or in such quantities as to give the specified air contents.

www.graceconstruction.com

North American Customer Service: 1-877-4AD-MIX1 (1-877-423-6491)

Darex is a registered trademark of W. R. Grace & Co.–Conn.

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the users' consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W. R. Grace & Co.–Conn., 62 Whittemore Avenue, Cambridge, MA 02140. In Canada, Grace Canada, Inc., 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

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www.graceconstruction.com

1/18/2012

Dave Melson
Blue Dot Readi Mix
9104 Northfield Drive
Fort Mill, South Carolina 29716

Project Name: general production
Product Selected: Darex® II AEA

This is to certify that the Darex II AEA, a Air-Entraining Agent, as manufactured and supplied by Grace Construction Products, W.R. Grace & Co. – Conn., is formulated to comply with the Specifications for Chemical Admixtures for Concrete, ASTM: C260, AASHTO: M154.

Darex II AEA does not contain calcium chloride or chloride containing compounds as a functional ingredient. Chloride ions may be present in trace amounts contributed from the process water used in manufacturing.

The foregoing is in addition to and not in substitution for our standard Conditions of Sale attached.

G. Terry Harris
Technical Services Manager

National Ready Mixed Concrete Association

NRMCA

Certificate of Conformance For Concrete Production Facilities

THIS IS TO CERTIFY THAT

Harrisburg Plant, Harrisburg, NC

Bluedot Readi-Mix, LLC

has been inspected by the undersigned licensed professional engineer for conformance with the requirements of the *Check List for Ready Mixed Concrete Production Facilities.* As of the inspection date, the facilities met the requirements for production by

Truck Mixing with Automatic Batching and Recordings of Cementitious Materials, Aggregate, Water, and Chemical Admixtures

NORTH CAROLINA PROFESSIONAL SEAL 028919 7/7/11 ENGINEER GODWIN Q. ASHEUEDA

Signature of Licensed Professional Engineer

June 04, 2011	*June 04, 2013*
Inspection Date	Certification Expiration Date

This company will maintain these facilities in compliance with the *Check List* requirements and will correct promptly any deficiencies which develop.

Signature of Company Official	Title of Company Official

NOTICE: The Check List indicates only that plant facilities are satisfactory for the production of concrete when properly operated. Conformance of the concrete itself with specification requirements must be verified by usual inspection methods in accordance with sales agreements.

This certificate is issued by the National Ready Mixed Concrete Association on verification that the production facility conforms to the requirements of the NRMCA Certification of Ready Mixed Concrete Production Facilities, QC3. Unauthorized reproduction or misuse of this certificate may result in legal action.

Plant ID #: 833248

Certification ID #: 13320

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National Ready Mixed Concrete Association 900 Spring Street • Silver Spring • Maryland 20910

HUNTER Construction Group Inc.

118 Timber Road,
Mooresville, NC 28115
Tel: (704) 799-7570
Fax: (704) 799-7576

Letter of Transmittal

To:	Civil & Environmental Consultants, Inc	**Job:**	North Mecklenburg Infill
	2030 S. Tryon Street	**Attn:**	Scott Brown
	Charlotte, NC 28203	**Re:**	36” HDPE Pipe Installation

WE ARE SENDING YOU

SUB. AGREE.	PLANS	SHOP DRAWINGS	COPY OF LETTER	CHANGE ORDER	SAMPLES	SPECIFICATIONS	SUBMITTAL
							X

COPIES	DATE	NO.	DESCRIPTION
1	04-26-12		Infill 36” HDPE Pipe Installation
1	04-26-12		ADS Tech Note 5.02
1	04-26-12		Pipe Layout Plan
1	04-26-12		SG&H Calcs
1	04-26-12		Filter Fabric Spec

☐ APPROVED ☐ NOT APPROVED
☐ APPROVED AS CORRECTED
☒ REVISE AND RESUBMIT
☐ RESUBMIT FOR RECORD COPY

Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

BY: BPStrohman
DATE: 1 May 2012
SIMPSON GUMPERTZ & HEGER INC.
41 Seyon St., Building 1, Suite 500
Waltham, MA 02453

THESE ARE TRANSMITTED as checked below:

For approval [X] Approved as submitted [ ] Resubmit ____ copies for approval

For your use [ ] Approved as noted [ ] Submit _____ copies for distribution

As requested [ ] Returned for corrections [ ] Return _____ corrected prints

For review and comment _____

REMARKS

04-26-2012

Signature **Date**

Provide a sketch showing I-beam/saddle system including dimensions and quantities of all members and components. During on-site field monitoring of pipe installation, CEC field engineer shall verify I-beams are not deflecting the HDPE pipes.

HUNTER
Construction Group Inc.

Submit calculations showing the I-beams will prevent flotation and that beam deflection of the pipe between I-beams will not result in reverse slope in the pipe. Otherwise place CLSM in lifts per ADS recommendations.

36" HDPE Pipe Installation **April 25th, 2012**

Method for Preventing Pipe Flotation – The flowable fill for the 36 inch HDPE pipes will be installed in accordance with the attached ADS technical note TN 5.02, October 2009. The pipes will be restrained to prevent flotation in the trench due to the addition of the flowable fill. Three steel I-beams laid perpendicular to the trench will be installed to restrain each 20 or 13 linear foot parallel pipe section. Each steel I-beam will be fitted with a saddle that fits across the pipes, and is fully adjustable to accommodate different trench depths. The saddle will prevent both vertical and horizontal displacement of the pipes during the addition of the flowable fill.

Pipe and Backfill Placement – The pipe will be installed in accordance with SG&H 36 inch diameter Corrugated HDPE Pipe Design and Sheet SK-1, 11/3/2009 (attached), ADS recommendations and the approved construction drawings.
The trench excavation will begin on the downstream end of the pipe run at the installed concrete headwall. Excavation will be accomplished utilizing a track hoe with a bucket with "teeth" to the design grade. Excavation will occur in one hundred foot runs. The trench will be excavated to 10 ½ feet in width and to the proper depth in accordance with Sheet SK-1 and the approved construction plans. The trench bottom will then be mechanically compacted and field density tests performed. The field density tests of the trench bottom will be measured to ensure compaction to 95% of maximum standard Proctor density and will be conducted at the frequency indicated below:

<u>Test Frequency 1</u>
For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet of installation, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

<u>Test Frequency 2</u>
Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe ~~and at different elevations~~. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

118 Timber Road ▪ Mooresville, NC 28115 ▪ 704-799-7570 ▪ 704-799-7576 (fax)

Unsuitable soils or rocks in the trench bottom will be removed in accordance with SG&H 36 in. Diameter Corrugated HDPE Pipe Design and Sheet SK-1, 11/3/2009. In accordance with SG&H SK-1, the soil directly under the invert of the pipes, one foot in width and three inches in depth will be loosened prior to pipe placement. After the pipe is placed in the trench, the joints will be articulated to provide a joint deflection in accordance with the pipe plan layout. All pipe joints will be wrapped in geo-textile fabric and taped to secure the wrap to each joint. The fabric will be a class IV non-woven geotextile fabric in accordance with NCRS – MEFOTG, Section IV Construction Specification 495. After the joints are wrapped with the geotextile fabric and taped, the joint deflection will be measured by a professional land surveyor.

Once the pipe deflection has been recorded, the pipes will be restrained using the steel I-beam and saddle system to prevent pipe flotation. Flowable fill will be installed according to ADS recommendations to the depth shown in SK-1. The placement of flowable fill in the first trench will consist of 80 linear feet of flowable fill placed to design height with the final 20 feet tapering down at an approximate 4:1 slope to the end of the 100 foot trench. All subsequent 100 foot trenches will include placing flowable fill in the previous 20 foot length of the trench and tapering down as previously discussed for the final 20 feet.

To prevent flowable fill from entering the pipe, a pipe plug will be installed in the open end of the pipe and will be removed after the flowable fill has set. Two samples of flowable fill from each trench section will be taken per ASTM D 4832 and tested by a certified testing facility to determine the 28 day compressive strength, which should be between 500 and 1,000 psi.

After the flowable fill has set, un-compacted material will be placed over the pipe in accordance with SG&H SK-1. In those areas where filling will be required to reach final grade, sidefill will be placed on either side of the completed trench in 18 inch lifts. The sidefill areas will be compacted, the soil directly over the trench will not be compacted. The sidefill for those areas that require fill (fill height above non-native, undisturbed soil) will be placed and compacted in accordance with SG&H 36 inch Diameter Corrugated HDPE Pipe Design and Sheet SK-1, 11/3/2009 (attached). Compacted sidefill will be tested to ensure compaction to 95% of maximum standard Proctor density. This testing will be conducted at the following frequency:

and at different elevations.

Test Frequency 1

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 lf of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

Provide how long the CLSM must cure prior to initiating backfill, based on suppliers recommendations.

Test Frequency 2

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Method for Measuring Joint Deflection – Pipe deflection will be required for the majority of joints in the pipe alignment. The pipe deflections are labeled in the attached alignment plan and will be either 1 or 2 degrees. All pipe joints, regardless of deflection will be wrapped in geotechnical fabric and taped to prevent flowable fill from entering the pipes (see pipe and backflow placement). The pipe curve alignment depicting the layout, pipe sizes and deflection angles has been included with this submittal.

To achieve deflection in a pipe joint, the center line of the downstream pipe will be marked on the top at the upstream end of the pipe using a plum bob, level and tape. The upstream pipe will be inserted into the end of the downstream pipe in a straight alignment with coupler per ADS installation guidelines. The center line of the upstream end of the upstream pipe will be marked. The perpendicular pull length will be calculated using the degree of deflection and pipe length, and the end of the upstream pipe will be pulled the appropriate distance and direction to achieve the required deflection angle. All measurements and deflections angles will be recorded in a field book. Nomenclature of joints will be recorded as xR or xL. The x will indicate the joint from the down gradient end of the pipe system moving upwards. The “R” will indicate the right pipe as one looks up gradient and the “L” will indicate the left pipe.

After the pipe has been placed in the trench and the joints have been wrapped with geo-textile fabric and prior to placement of the flowable fill in the pipe trench, pipe joint deflection will be measured by a professional land surveyor. The surveyor will gather horizontal location and elevation information in two locations for each pipe stick. This will enable a CAD drawing to be prepared that accurately depicts the joint deflections by comparing it to the placement of the previous pipe. The surveyor will provide a signed and sealed as-built drawing depicting the pipe deflection and invert elevation at each joint for each of the parallel pipe runs after the installation of the pipe has been completed.

Signature _____

Print Name ____Rob Moss_____

Title _____Project Manager_____

Date _____April 25th, 2012_____

TECHNICAL NOTE

Flowable Fill Backfill for Thermoplastic Pipe

TN 5.02
October 2009

Introduction

The use of flowable fill, also known as controlled low strength material (CLSM), controlled density fill (CDF), and slurry fill, as pipe bedding and backfill material has steadily been increasing. The term "flowable fill" encompasses a variety of fill materials that are used as alternates to compacted granular fill. The materials are comprised of mixtures of sand, Portland cement, Class C or Class F fly ash, and water. In addition, the mix is typically flowable and self-leveling at the time of placement.

Flowable fill is an alternative to conventional soil or stone backfill and has been used for unique applications and installations of pipe for some time. It has the advantage of providing excellent strength quickly while providing an easy and efficient placement system. Flowable fill has proven to be a viable alternative when stone, sand, or other backfills have limited availability or cost prohibits their use. Even with these advantages it is necessary that the fill be controlled and care taken to provide for the proper installation.

Use of Flowable Fill

The following provides some advantages and disadvantages when deciding whether flowable fill should be specified or recommended on a project.

Advantages

- Allows for narrower trench and less disturbance to the native material.
- Eliminates the need for backfill compaction.
- Ensured proper distribution of support around the pipe.
- Reduces of the amount of material excavated on a project.
- Time, personnel and equipment required to install flowable fill are typically less than that required for proper placement and compaction of conventional backfill materials, particularly fine-grained soils.
- Flowable fill may be made on-site using native soil as part of the mix where silty sands exist.
- Time and equipment required for compressive strength testing is often less than that required to test soil compaction.

Disadvantages

- More costly than granular backfill due to the many components required and specialized delivery.
- Improper mix components can cause difficult future excavation if taps or extensions are required.
- Cannot be stockpiled on site like granular backfill. Time saved during the placement of the flowable fill can be wasted waiting on ready-mix delivery.
- Unless precaution is taken, the potential for pipe flotation is high during the installation process.

Each truck load of CLSM shall be tested in the field per ASTM D6103 and show conformance to specified flow consistency of 9 in.

© ADS 2009

Mix Design

The mix design of CLSM for flowable fill is beyond the scope of this document. However, care should be taken to make sure that the mix is designed to provide adequate strength but remain soft enough to be excavated should it be necessary to do so. A suggested range is between 50 psi and 100 psi for the 28 day strength; mixes that have 28-day compressive strengths greater than 100 psi should be avoided due to increased difficulty in future excavation, if needed. The mix design should be laboratory tested prior to installation ensure that the proper results are obtained during field batching. The field mix may also require monitoring and adjustments to maintain the proper mix and properties. These variations in the field mix can be due to many factors including water content, temperature and humidity during placement.

Installation Considerations

Environment

Flowable fill cannot be used in all temperature and weather conditions. It is recommended that the temperature be at least 40˚F and that the soil exposed to the flowable fill be unfrozen. There should be no appreciable precipitation during the first 24 hours after placement.

Joints

For flowable fill applications, the use of a watertight joint is recommended. For other types of joints, precautionary measures should be taken to prevent infiltration. With this type of joint, water can “bleed” through the joint during the fill material curing, facilitating the process. This will depend nearly entirely on the consistency of the mix design. The fine-grained materials in the fill material are not permitted to infiltrate the joint.

Placement of Flowable Fill

Trench excavation should follow normal procedures and meet all OSHA safety regulations. Trench width will be dictated by the native material strength. When acceptable in-situ material exists in the trench, like rock or other high-bearing soils, it is possible that the trench widths may be reduced to within 6-in along each side of the pipe, provided there is enough space to place and properly compact the fill in the pipe haunches. Table 1 depicts typical trench widths for a flowable fill installation. In soft in-situ materials a wider trench width may be necessary. Once the trench is excavated to the proper line and grade, placement of pipe may begin. The pipe should be laid in the trench and joined in accordance with publish recommended installation guidelines.

Table 1
Recommended Trench Widths for Flowable Fill Backfill

Nominal Pipe Diam, in. (mm)	Minimum Trench in. (m)	Nominal Pipe Diam, in. (mm)	Minimum Trench in. (m)
12 (300)	22 (0.6)	36 (900)	59 (1.5)
15 (375)	27 (0.7)	42 (1050)	66 (1.7)
18 (450)	33 (0.8)	48 (1200)	74 (1.9)
24 (600)	42 (1.0)	54 (1350)	82 (2.0)
30 (750)	51 (1.3)	60 (1500)	90 (2.3)

*AASHTO LRFD Section C12.6.6.1, 2006

It is recommended that both an anchoring system and incremental lifts be utilized during installation. Refer to Figure 1 and Table 2 below for lift recommendations. Keep in mind that the fill should be brought up evenly on both sides to prevent unbalanced forces from acting on the pipe. A waiting period should be provided between lifts, as specified by the design engineer. This time is dependent on the mix design as well as ambient temperature and moisture. The mix supplier should be contacted to determine the site-specific waiting period recommended

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between lifts. Compressive strength typically seen with flowable fill is 40-60 psi within one week. NOTE: The use of plasticizers or other add mixtures can greatly affect cure time and final compressive strength. For most construction projects, work can resume 4 to 6 hours after final placement. While it is recommended to place the flowable fill in incremental lifts, it should be noted, one continuous lift may be used provided flotation restraints have been properly designed and installed.

If additional backfill is to be placed over the flowable fill to reach final grade it should not be placed until the flowable fill has reached a minimum compressive strength as determined by the design engineer. Because moisture is beneficial to curing it may be desirable to place a thin layer of soil (6 inches) on top of the flowable fill section for enhanced curing.

Figure 1
Typical Backfill Structure

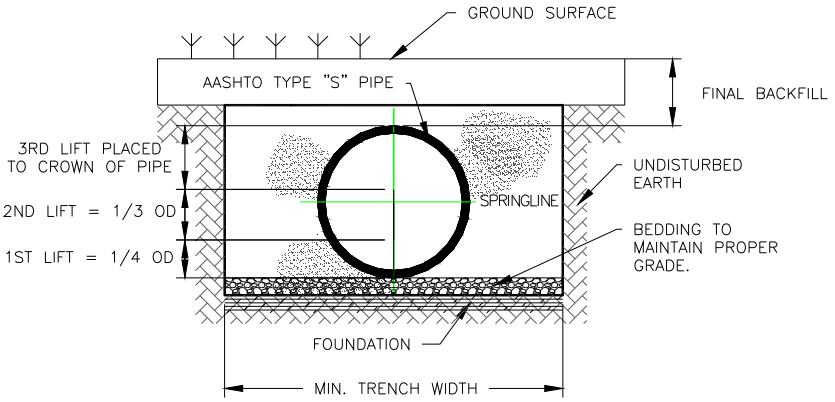

Table 2
Recommended Lift Heights

Nominal Pipe Diam, in. (mm)	1st Lift Height, in. (mm)	2nd Lift Height, in. (mm)
12 (300)	4 (101)	5 (127)
15 (375)	5 (127)	6 (152)
18 (450)	6 (152)	7 (178)
24 (600)	7 (178)	9 (229)
30 (750)	9 (229)	12 (305)
36 (900)	11 (280)	14 (356)
42 (1050)	12 (305)	16 (406)
48 (1200)	14 (356)	18 (457)
54 (1350)	15 (381)	20 (508)
60 (1500)	17 (432)	22 (559)

Anchoring Systems

Probably the greatest concern associated with flowable fill during installation is its tendency to float the pipe. Flotation and misalignment issues are extremely critical and should not be ignored. When backfilling with CLSM, the absence of soil overburden will cause the pipe to float since the pipe weight does not offset the CLSM uplift. Therefore, the pipe must be anchored to keep the intended alignment and grade. There are a number of acceptable methods for anchoring the pipe in the trench. It may be assumed that flowable fill acts as a fluid with a density of 140 - 150 lb/cu ft. prior to stiffening. When properly designed, pipe restraints should account for buoyant forces exerted by the fluid. When the fill hardens, flotation is no longer a concern.

Common methods include the use of dry CLSM placed at intervals along the pipe to hold it down, use of native material at intervals along the pipe to hold it down, or rebar placed in an "X" pattern above the pipe and anchored into the trench sidewall. Additional methods may include a pre-cast concrete swamp weight, or a commercially available screw anchor assembly. Anchor design and spacing shall be determined by the project design engineer. For other restraint options and additional technical information related to floatation, refer to Technical Note 5.05: *Pipe Flotation*.

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For the initial 100 ft run of pipe demonstrate that fabric / tape system will effectively preclude leakage of flowable fill or bleed water into pipe. (We are not convinced that duct tape will hold and suggest considering mechanical clamps.)

DALCO NONWOVENS, LLC

Nonwoven Civil Geotextiles
DALCO 1100

Property	Unit	Test Method	MARV
PHYSICAL			
Grab Tensile	lb	ASTM D-4632	250
Grab Elongation	%	ASTM D-4632	50
Trapezoidal Tear	lb	ASTM D-4533	100
Puncture Resistance	lb	ASTM D-4833	160
Mullen Burst	psi	ASTM D-3786	500
UV Resistance After 500 hrs.	% Strength Retained	ASTM D-4355	70
HYDRAULIC			
Permittivity	sec^-1	ASTM D-4491	1.2
Water Flow Rate	gpm/ft^2	ASTM D-4491	80
Apparent Opening Size	U.S. Sieve	ASTM D-4751	80
PACKAGING			
Roll Width	ft		12.5/15
Roll Length	ft		360/300
Area	yd^2		500

(1). Physical and hydraulic properties reported as minimum average roll values (MARV)
(2). Property values are subject to change without notice.
(3). At the time of manufacturing, handling may change these properties.
(4). AOS reported as maximum average roll value.

HUNTER Construction Group Inc.

118 Timber Road,
Mooresville, NC 28115
Tel: (704) 799-7570
Fax: (704) 799-7576

Letter of Transmittal

To:	Civil & Environmental Consultants, Inc	**Job:**	North Mecklenburg Infill
	2030 S. Tryon Street	**Attn:**	Scott Brown
	Charlotte, NC 28203	**Re:**	Concrete Mix Designs

WE ARE SENDING YOU

SUB. AGREE.	PLANS	SHOP DRAWINGS	COPY OF LETTER	CHANGE ORDER	SAMPLES	SPECIFICATIONS	SUBMITTAL
							X

COPIES	DATE	NO.	DESCRIPTION
1	04-26-12		Concrete Mix Designs (Flowable Fill & Headwall)

Reviewed Flowable Fill Submittal Only - Concrete Headwall Not Included in SGH Scope.

☐ APPROVED ☐ NOT APPROVED
☒ APPROVED AS CORRECTED
☐ REVISE AND RESUBMIT
☐ RESUBMIT FOR RECORD COPY

Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

BY: BPStrohman
DATE: 1 May 2012
SIMPSON GUMPERTZ & HEGER INC.
41 Seyon St., Building 1, Suite 500
Waltham, MA 02453

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For review and comment _____

REMARKS

04-26-2012

Signature **Date**

P O Box 23029
Charlotte, NC 28227
Office (704) 971-7676
Fax (704) 545-2398

Date Issued: 4/24/2012

Supplier: Blue Dot Readi Mix

Customer: Griffin Brothers / Hunter Construction

Project: North Mecklenburg Landfill

Usage: 050053 - 500 PSI Flowable Fill Non-Pumpable **Flowable Fill**

Material	Description	ASTM	Volume(CF)	oz/cwt	Weight (lb)
Typel-II Cement	Holcim-Holly Hill	ASTM C-150	0.89		175
Fly Ash F	Pro Ash	ASTM C-618	2.79		400
Fine Aggregate	B&T	ASTM C-33	14.68		2420
City Water	Water	ASTM C-94	6.95		433
Type A Water Reducer	WRDA 79	ASTM C-494	0.03	4.00	
Air Entrainer	Darex II	ASTM C-260	0.02	2.50	
Air			1.64		
			27.00	**TOTAL**	**3428**

Specified F'c:	500 PSI		
Specified Slump:	8.00 to 11.00 in.	Designed Unit Weight:	127 lbs/cu.ft.
Specified Air:	4.5 to 7.5 %	Designed W/C + P Ratio:	0.75
Designed Air:	6.00 %	Designed Volume:	27.00 cu.ft.

NOTES:

Blue Dot has no knowledge or authority regarding where this mix is to be placed. Blue Dot has not been requested to investigate, nor has it been provided with information concerning the soil, subsurface or other enviromental conditions at the project site. Therefore it is the responsibility of the project architect/engineer, and/or contractor to insure that the above mix parameters of compressive strength, water cement ratio, cement content, and air content, are appropriate for the anticipated soil, subsurface and other environmental conditions at the project site. (ie. ACI-318 sections 4.1-4.3, and the local Building Codes).

This Submittal has been prepared by Blue Dot for the above client and project only. It is not to be used or reproduced by the client or any third party for any other project without the written permission of Blue Dot. Blue Dot may use admixtures or procedures not listed above to control the mixture during Hot or Cold weather, for pumping, long hauls, or other special applications, unless restricted in writing by the client.

COMMENTS:

P O Box 23029
Charlotte, NC 28227
Office (704) 971-7676
Fax (704) 545-2398

Date Issued: 4/24/2012

Supplier: Blue Dot Readi Mix

Customer: Griffin Brothers / Hunter Construction

Project: North Mecklenburg Landfill

Usage: 506150 - 5000 PSI FA 67 Stone AE **Headwall**

Material	Description	ASTM	Volume(CF)	oz/cwt	Weight (lb)
Type I-II Cement	Holcim-Holly Hill	ASTM C-150	3.31		650
Fly Ash F	Pro Ash	ASTM C-618	0.98		140
Coarse Aggregate	Pineville #57/67 Stone	ASTM C-33	10.83		1975
Fine Aggregate	B&T	ASTM C-33	6.01		990
City Water	Water	ASTM C-94	4.49		280
Type A Water Reducer	WRDA 79	ASTM C-494	0.03	4.00	
Air Entrainer	Darex II	ASTM C-260	0.01	1.25	
Air			1.34		
			27.00	**TOTAL**	**4035**

Specified F'c:	5000 PSI		
Specified Slump:	3.00 to 5.00 in.	Designed Unit Weight:	149.4 lbs/cu.ft.
Specified Air:	3.5 to 6.5 %	Designed W/C + P Ratio:	0.35
Designed Air:	5.00 %	Designed Volume:	27.00 cu.ft.

NOTES:

Blue Dot has no knowledge or authority regarding where this mix is to be placed. Blue Dot has not been requested to investigate, nor has it been provided with information concerning the soil, subsurface or other enviromental conditions at the project site. Therefore it is the responsibility of the project architect/engineer, and/or contractor to insure that the above mix parameters of compressive strength, water cement ratio, cement content, and air content, are appropriate for the anticipated soil, subsurface and other environmental conditions at the project site. (ie. ACI-318 sections 4.1-4.3, and the local Building Codes).

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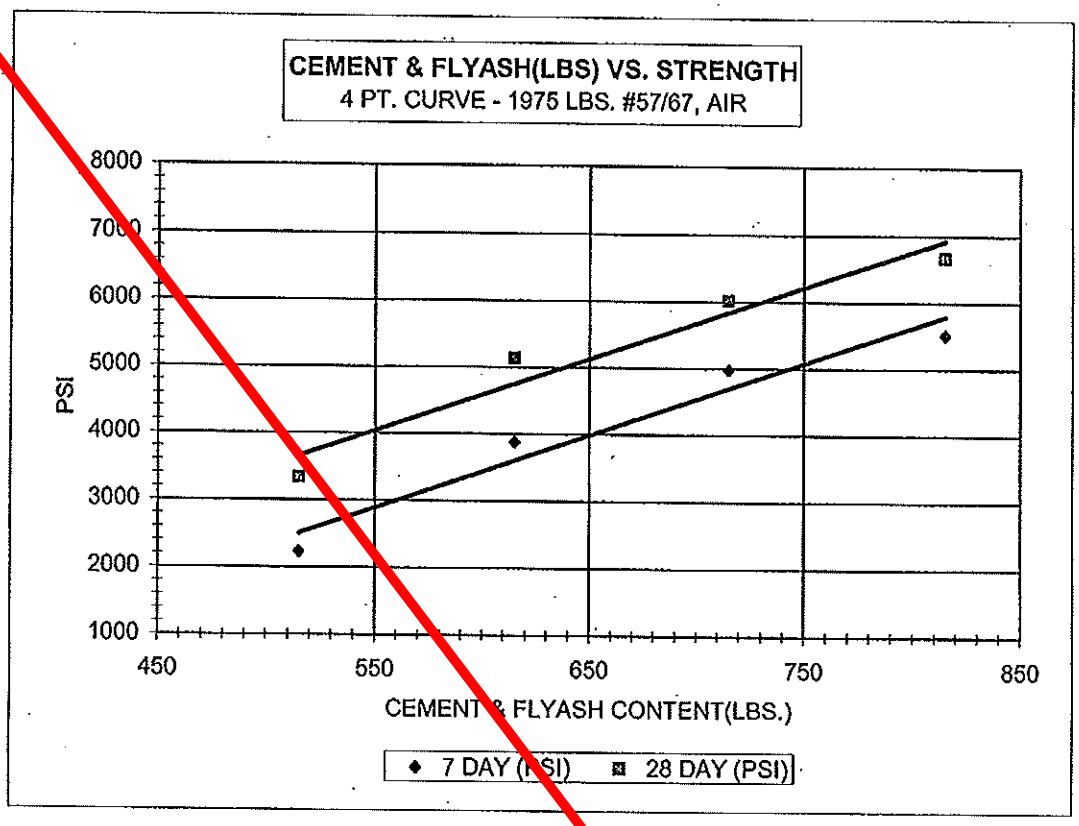
COMMENTS:



TO PRODUCE ONE CUBIC YARD OF CONCRETE WITH SSD MATERIALS

AS SUMMARIZED BY S&ME

			MIX 1	MIX 2	MIX 3	MIX 4
CEMENT		LBS.	375	475	575	675
FLYASH		LBS.	140	140	140	140
COARSE AGG. 1	#57/67	LBS.	1975	1975	1975	1975
COARSE AGG. 2		LBS.				
FINE AGGRGATE	2S	LBS.	1240	1156	1073	989
WATER		LBS.	290	290	290	290
W.R.A.	WR91	OZS.	21	25	29	33
A.E. AGENT	AIR30	OZS.	4.3	5.8	5.2	5.9
SLUMP RANGE		INS.	3-5	3-5	3-5	3-5
ACTUAL SLUMP		INS.	5	5	4.75	5
AIR RANGE		%	4-6%	4-6%	4-6%	4-6%
ACTUAL AIR		%	4	4.5	4.25	4.75
7 DAY COMPRESSIVE STRENGTH			2230	3875	4975	5510
28 DAY COMPRESSIVE STRENGTH			3340	5125	6020	6670

* SUFFICIENT TO ENTRAIN 4-6%

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HUNTER Construction Group Inc.

118 Timber Road,
Mooresville, NC 28115
Tel: (704) 799-7570
Fax: (704) 799-7576

Letter of Transmittal

To:	Civil & Environmental Consultants, Inc	**Job:**	North Mecklenburg Infill
	2030 S. Tryon Street	**Attn:**	Scott Brown
	Charlotte, NC 28203	**Re:**	36” HDPE Pipe Installation

WE ARE SENDING YOU

SUB. AGREE.	PLANS	SHOP DRAWINGS	COPY OF LETTER	CHANGE ORDER	SAMPLES	SPECIFICATIONS	SUBMITTAL
							X

COPIES	DATE	NO.	DESCRIPTION
1	05-14-12		Infill 36” HDPE Pipe Installation
1	05-14-12		ADS Tech Note 5.02
1	05-14-12		Pipe Layout Plan
1	05-14-12		SG&H Calcs
1	05-14-12		Filter Fabric Spec
1	05-14-12		Anchor Data

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For review and comment _____

REMARKS

05-14-2012

Signature **Date**

HUNTER
Construction Group Inc.

36" HDPE Pipe Installation **May 10th, 2012**

Method for Preventing Pipe Flotation – The pipes will be restrained to prevent flotation in the trench due to the addition of the flowable fill. After the 12 inch X 12 inch X 4 inch borrow material pipe supports are formed and the pipe installed in the trench, the HDPE pipe will be secured to the trench bottom using a commercially available screw anchor assembly. These tie-down systems are commonly used to secure manufactured homes, and a cut sheet has been included with the submittal. To alleviate pipe deflections due to point loads from the tie-down straps, a wood 4"X4"will be installed on top of the pipe, parallel to the pipe for the entire length of each pipe stick. The screw anchor assembly straps will be installed over the 4"x4" to secure the wood and pipe. This is intended to more evenly distribute the load from the straps across the full length of each pipe stick. The uplift calculation for the pipe has been attached and shown below:

$U = (A_{disp} * \delta_{CLSM})$

Where,

A_{disp} = Area of pipe displaced by CLSM, ft^2

δ_{CLSM} = Unit weight of CLSM, lb/ft^3

U = Uplift due to CLSM, lb/ft

			Uplift Force (lbs/ft)*		
Outside Pipe Diameter (in)	Pipe Area (ft^2)	CLSM Unit Weight (lb/ft^3)	CLSM to top of pipe (lbs/ft)	CLSM to springline of pipe (lbs/ft)	CLSM to bottom quarter of pipe (lbs/ft)
42	9.6	127	1221.9	610.9	238.3

In addition, the flowable fill will be placed in two lifts. The first lift, poured to the springline of the pipe will be allowed to set for 4 hours prior to the installation of the next lift. The straps, which have a breaking strength of 4725.0 lbs will be installed every seven linear feet along the length of the HDPE pipe. This spacing is based on flowable fill installation to the springline of the pipe and the calculation for this spacing is shown below:

	Spacing along Pipe Run (ft)		
Anchor Breaking Strength (lbs)	CLSM to top of pipe (lbs/ft)	CLSM to springline of pipe (lbs/ft)	CLSM to bottom quarter of pipe (lbs/ft)
4725.0	3.9	7.7	19.8

Once the flowable fill has been placed to the top of the pipe, the straps will be cut, and the lumber will be removed from the top of pipe. The flowable fill will then be placed over the top of pipe to match the thickness shown in detail SK-1.

Pipe and Backfill Placement – The pipe will be installed in accordance with SG&H 36 inch diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012 (attached), ADS recommendations and the approved construction drawings. The trench excavation will begin on the downstream end of the pipe run at the installed concrete headwall. Excavation will be accomplished utilizing a track hoe with a bucket with "teeth" to the design grade. Excavation will occur in one hundred foot runs. The trench will be excavated to 10 ½ feet in width and to the proper depth in accordance with Sheet SK-1 and the approved construction plans. The trench bottom will then be mechanically compacted and field density tests performed. The field density tests of the trench bottom will be measured to ensure compaction to 95% of maximum standard Proctor density and will be conducted at the frequency indicated below:

<u>Test Frequency 1</u>

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet of installation, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

<u>Test Frequency 2</u>

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Unsuitable soils or rocks in the trench bottom will be removed in accordance with SG&H 36 in. Diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012. In accordance with SG&H SK-1, four inches of flowable fill will be required under the HPDE pipe. To accomplish this, 12 inch X 12 inch X 4 inch high compacted soil mounds using the borrow material will be constructed under the HDPE pipe at five foot intervals. These compacted soil mounds will act as spacers between the pipe bottom and the trench.

After the pipe is placed in the trench on the support mounds, the joints will be articulated to provide a joint deflection in accordance with the pipe plan layout. All pipe joints will be wrapped in geo-textile fabric and taped to secure the wrap to each joint. The fabric will be a class IV non-woven geotextile fabric in accordance with NCRS – MEFOTG, Section IV Construction Specification 495. After the joints are wrapped with the geotextile fabric and taped, the joint deflection will be measured by a professional land surveyor.

Once the pipe deflection has been recorded, the pipes will be restrained using the screw anchor system to prevent pipe flotation. Flowable fill will be installed according to ADS recommendations to the depth shown in SK-1. The placement of flowable fill in the first trench will consist of the first lift of flowable fill placed to the springline of the HDPE pipe at the downstream end with the fill tapering down at the

upstream end of the 100 foot trench section. Additional lifts will be installed until the fill matches the depth shown in SK-1.

To prevent flowable fill from entering the pipe, a pipe plug will be installed in the open end of the pipe and will be removed after the flowable fill has set. Two samples of flowable fill from each trench section will be taken per ASTM D 4832 and tested by a certified testing facility to determine the 28 day compressive strength, which should be between 500 and 1,000 psi. Each truck load of CLSM shall be tested in the field per ASTM D6103 and show conformance to the specified slump result of 9 inches.

Visual inspection of the pipe joints will occur after the placement of the flowable fill in order to ensure that flowable fill or excessive water leakage into the pipe joints is not occurring. Photographs of the joints and installation will be taken before and after the filling of each trench section.

After the flowable fill has set approximately 3-4 hours according to the manufacturer, un-compacted material will be placed over the pipe in accordance with SG&H SK-1. In those areas where filling will be required to reach final grade, sidefill will be placed on either side of the completed trench in 18 inch lifts. The sidefill areas will be compacted, the soil directly over the trench will not be compacted. The sidefill for those areas that require fill (fill height above non-native, undisturbed soil) will be placed and compacted in accordance with SG&H 36 inch Diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012 (attached).

Compacted sidefill will be tested to ensure compaction to 95% of maximum standard Proctor density. This testing will be conducted at the following frequency:

<u>Test Frequency 1</u>

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 lf of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

<u>Test Frequency 2</u>

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Method for Measuring Joint Deflection – Pipe deflection will be required for the majority of joints in the pipe alignment. The pipe deflections are labeled in the attached alignment plan and will be either 1 or 2 degrees. All pipe joints, regardless of deflection will be wrapped in geotechnical fabric and taped to prevent flowable fill from entering the pipes (see pipe and backflow placement). The pipe curve alignment depicting the layout, pipe sizes and deflection angles has been included with this submittal.

To achieve deflection in a pipe joint, the center line of the downstream pipe will be marked on the top at the upstream end of the pipe using a plum bob, level and tape. The upstream pipe will be inserted into the end of the downstream pipe in a straight alignment with coupler per ADS installation guidelines. The center line of the

upstream end of the upstream pipe will be marked. The perpendicular pull length will be calculated using the degree of deflection and pipe length, and the end of the upstream pipe will be pulled the appropriate distance and direction to achieve the required deflection angle. All measurements and deflections angles will be recorded in a field book. Nomenclature of joints will be recorded as xR or xL. The x will indicate the joint from the down gradient end of the pipe system moving upwards. The "R" will indicate the right pipe as one looks up gradient and the "L" will indicate the left pipe.

After the pipe has been placed in the trench and the joints have been wrapped with geo-textile fabric and prior to placement of the flowable fill in the pipe trench, pipe joint deflection will be measured by a professional land surveyor. The surveyor will gather horizontal location and elevation information in two locations for each pipe stick. This will enable a CAD drawing to be prepared that accurately depicts the joint deflections by comparing it to the placement of the previous pipe. The surveyor will provide a signed and sealed as-built drawing depicting the pipe deflection and invert elevation at each joint for each of the parallel pipe runs after the installation of the pipe has been completed.

Method for Measuring Pipe Deflection - Pipe deflection will be measured to ensure conformance with ADS guidelines. A pipe mandrel will be pulled through the pipe no less than 30 days after the installation of the HDPE pipe. According to the attached ADS technical note TN-5.07, maximum allowable deflection for the pipe is 5% of the base diameter of the HDPE pipe. Therefor a mandrel dimension of 33.06 inches in diameter will be pulled for the test (see table 1 in TN-5.07).

Signature _____

Print Name ____Rob Moss_____

Title _____Project Manager_____

Date _____May 10th, 2012_____

TECHNICAL NOTE

Flowable Fill Backfill for Thermoplastic Pipe

TN 5.02
October 2009

Introduction

The use of flowable fill, also known as controlled low strength material (CLSM), controlled density fill (CDF), and slurry fill, as pipe bedding and backfill material has steadily been increasing. The term “flowable fill” encompasses a variety of fill materials that are used as alternates to compacted granular fill. The materials are comprised of mixtures of sand, Portland cement, Class C or Class F fly ash, and water. In addition, the mix is typically flowable and self-leveling at the time of placement.

Flowable fill is an alternative to conventional soil or stone backfill and has been used for unique applications and installations of pipe for some time. It has the advantage of providing excellent strength quickly while providing an easy and efficient placement system. Flowable fill has proven to be a viable alternative when stone, sand, or other backfills have limited availability or cost prohibits their use. Even with these advantages it is necessary that the fill be controlled and care taken to provide for the proper installation.

Use of Flowable Fill

The following provides some advantages and disadvantages when deciding whether flowable fill should be specified or recommended on a project.

Advantages

- Allows for narrower trench and less disturbance to the native material.
- Eliminates the need for backfill compaction.
- Ensured proper distribution of support around the pipe.
- Reduces of the amount of material excavated on a project.
- Time, personnel and equipment required to install flowable fill are typically less than that required for proper placement and compaction of conventional backfill materials, particularly fine-grained soils.
- Flowable fill may be made on-site using native soil as part of the mix where silty sands exist.
- Time and equipment required for compressive strength testing is often less than that required to test soil compaction.

Disadvantages

- More costly than granular backfill due to the many components required and specialized delivery.
- Improper mix components can cause difficult future excavation if taps or extensions are required.
- Cannot be stockpiled on site like granular backfill. Time saved during the placement of the flowable fill can be wasted waiting on ready-mix delivery.
- Unless precaution is taken, the potential for pipe flotation is high during the installation process.

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Mix Design

The mix design of CLSM for flowable fill is beyond the scope of this document. However, care should be taken to make sure that the mix is designed to provide adequate strength but remain soft enough to be excavated should it be necessary to do so. A suggested range is between 50 psi and 100 psi for the 28 day strength; mixes that have 28-day compressive strengths greater than 100 psi should be avoided due to increased difficulty in future excavation, if needed. The mix design should be laboratory tested prior to installation ensure that the proper results are obtained during field batching. The field mix may also require monitoring and adjustments to maintain the proper mix and properties. These variations in the field mix can be due to many factors including water content, temperature and humidity during placement.

Installation Considerations

Environment

Flowable fill cannot be used in all temperature and weather conditions. It is recommended that the temperature be at least 40˚F and that the soil exposed to the flowable fill be unfrozen. There should be no appreciable precipitation during the first 24 hours after placement.

Joints

For flowable fill applications, the use of a watertight joint is recommended. For other types of joints, precautionary measures should be taken to prevent infiltration. With this type of joint, water can “bleed” through the joint during the fill material curing, facilitating the process. This will depend nearly entirely on the consistency of the mix design. The fine-grained materials in the fill material are not permitted to infiltrate the joint.

Placement of Flowable Fill

Trench excavation should follow normal procedures and meet all OSHA safety regulations. Trench width will be dictated by the native material strength. When acceptable in-situ material exists in the trench, like rock or other high-bearing soils, it is possible that the trench widths may be reduced to within 6-in along each side of the pipe, provided there is enough space to place and properly compact the fill in the pipe haunches. Table 1 depicts typical trench widths for a flowable fill installation. In soft in-situ materials a wider trench width may be necessary. Once the trench is excavated to the proper line and grade, placement of pipe may begin. The pipe should be laid in the trench and joined in accordance with publish recommended installation guidelines.

Table 1
Recommended Trench Widths for Flowable Fill Backfill

Nominal Pipe Diam, in. (mm)	Minimum Trench in. (m)	Nominal Pipe Diam, in. (mm)	Minimum Trench in. (m)
12 (300)	22 (0.6)	36 (900)	59 (1.5)
15 (375)	27 (0.7)	42 (1050)	66 (1.7)
18 (450)	33 (0.8)	48 (1200)	74 (1.9)
24 (600)	42 (1.0)	54 (1350)	82 (2.0)
30 (750)	51 (1.3)	60 (1500)	90 (2.3)

*AASHTO LRFD Section C12.6.6.1, 2006

It is recommended that both an anchoring system and incremental lifts be utilized during installation. Refer to Figure 1 and Table 2 below for lift recommendations. Keep in mind that the fill should be brought up evenly on both sides to prevent unbalanced forces from acting on the pipe. A waiting period should be provided between lifts, as specified by the design engineer. This time is dependent on the mix design as well as ambient temperature and moisture. The mix supplier should be contacted to determine the site-specific waiting period recommended

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between lifts. Compressive strength typically seen with flowable fill is 40-60 psi within one week. NOTE: The use of plasticizers or other add mixtures can greatly affect cure time and final compressive strength. For most construction projects, work can resume 4 to 6 hours after final placement. While it is recommended to place the flowable fill in incremental lifts, it should be noted, one continuous lift may be used provided flotation restraints have been properly designed and installed.

If additional backfill is to be placed over the flowable fill to reach final grade it should not be placed until the flowable fill has reached a minimum compressive strength as determined by the design engineer. Because moisture is beneficial to curing it may be desirable to place a thin layer of soil (6 inches) on top of the flowable fill section for enhanced curing.

Figure 1
Typical Backfill Structure

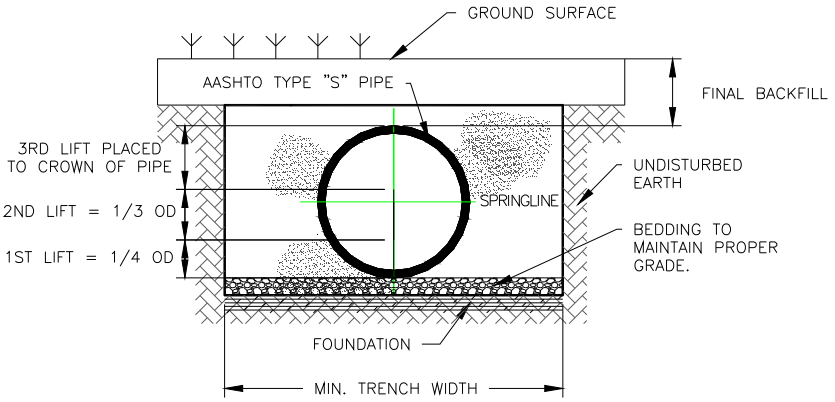

Table 2
Recommended Lift Heights

Nominal Pipe Diam, in. (mm)	1st Lift Height, in. (mm)	2nd Lift Height, in. (mm)
12 (300)	4 (101)	5 (127)
15 (375)	5 (127)	6 (152)
18 (450)	6 (152)	7 (178)
24 (600)	7 (178)	9 (229)
30 (750)	9 (229)	12 (305)
36 (900)	11 (280)	14 (356)
42 (1050)	12 (305)	16 (406)
48 (1200)	14 (356)	18 (457)
54 (1350)	15 (381)	20 (508)
60 (1500)	17 (432)	22 (559)

Anchoring Systems

Probably the greatest concern associated with flowable fill during installation is its tendency to float the pipe. Flotation and misalignment issues are extremely critical and should not be ignored. When backfilling with CLSM, the absence of soil overburden will cause the pipe to float since the pipe weight does not offset the CLSM uplift. Therefore, the pipe must be anchored to keep the intended alignment and grade. There are a number of acceptable methods for anchoring the pipe in the trench. It may be assumed that flowable fill acts as a fluid with a density of 140 - 150 lb/cu ft. prior to stiffening. When properly designed, pipe restraints should account for buoyant forces exerted by the fluid. When the fill hardens, flotation is no longer a concern.

Common methods include the use of dry CLSM placed at intervals along the pipe to hold it down, use of native material at intervals along the pipe to hold it down, or rebar placed in an "X" pattern above the pipe and anchored into the trench sidewall. Additional methods may include a pre-cast concrete swamp weight, or a commercially available screw anchor assembly. Anchor design and spacing shall be determined by the project design engineer. For other restraint options and additional technical information related to floatation, refer to Technical Note 5.05: *Pipe Flotation*.

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NORTH CAROLINA PROFESSIONAL SEAL 028519 ENGINEER PHILLIP A. SHARFF

5-10-12
Sheets 1-5

36 in. Diameter Corrugated HDPE Pipe Design

Project No.: 090206

Project: **Landfill Expansion III, North Mecklenburg**
C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: **3 November 2009**
Revised 7 May 2012

Pipe Data, provided by Advanced Drainage Systems (ADS), Inc.:

Pipe standard	AASHTO M294
Inside diameter, in.	36
Outside diameter, in.	41.1
Corrugated rib profile/properties:	
Cross-sectional area, in.^{2}/in.	0.403
Moment of Inertia, in.^{4}/in.	0.318
Distance from inside diameter to neutral axis, in.	1.07
Period of profile, in.	5.20
Height of profile, in.	2.54

HDPE Material Design Properties (AASHTO LRFD Bridge Design Specifications (4th Ed.):

Short term modulus of elasticity, ksi	110
Long term modulus of elasticity, ksi	22
Compressive limiting strain	0.0409

Design Data, provided by BP Barber, Inc.:

Total fill height, ft	150
Embankment trash density, pcf	60

This design is based solely on soils data provided by Civil & Environmental Consultants, Inc. and analysis of the pipe behavior for circumferential effects. Design for control of differential longitudinal settlement and other sources of longitudinal stress to prevent damage to the pipe by others.

Backfill Data:

Backfill and flowable fill density, pcf	120
Primary backfill around pipe:	
Flowable fill, 28 day compressive strength, psi	500 - 1,000
Flowable fill, flow consistency per ASTM D 6103, in.	9

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36 in. Diameter Corrugated HDPE Pipe Design

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C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: **3 November 2009**
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Backfill at sides of flowable fill (sidefill):	
USCS (ASTM D 2487) classification	SM
Minimum density, % of maximum per ASTM D 698	95
Uncompacted zone material:	See Project Specifications
Note: ASTM D 2487 materials GC, SC, CL or SM are acceptable.	
Dimensions and additional installation criteria	See Sheet SK-1

Materials:

1. The 36 in. diameter drain pipes shall be N-12 WT IB pipe per AASHTO M294 manufactured by Advanced Drainage Systems, Inc., Hilliard, OH, or approved equal. The pipe shall have a reinforced bell with a bell tolerance device installed by ADS.

2. The pipe joints shall be watertight in accordance with the requirements of ASTM D 3212.

3. Gaskets shall be supplied by ADS and covered with a removable, protective wrap until just before joint assembly to ensure the gasket is free from debris. A joint lubricant available from ADS shall be applied to the gasket and bell just prior to joint assembly.

4. Flowable fill mix shall consist of cement, sand, fly ash, and water and shall meet the material requirements of this specification (see Sheet 1). Large quantities of entrained air shall not be permitted. Coarse aggregate may also be used, provided material requirements are met.

5. Submit mix design for flowable fill and procedures for anchoring pipe against flotation and other movement during placement of the flowable fill.

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36 in. Diameter Corrugated HDPE Pipe Design

Project No.: 090206

Project: Landfill Expansion III, North Mecklenburg
C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: 3 November 2009
Revised 7 May 2012

Pipe Installation Sequence:

1. The contractor shall submit a plan for all sequences and procedures to be used for placing and backfilling the pipe. No pipe or backfill may be placed prior to receiving the engineer's approval of the backfilling plan. General issues that the backfill plan should address are included below.

2. The contractor is responsible for assuring that all applicable safety standards are complied with in all aspects of the pipe and backfill installation.

3. Pipe shall be installed as indicated on Sheet SK-1.

4. Prepare native soil to allow placement of pipe and flowable fill on a uniform firm surface. No rocks or clumps larger than 1 in. shall be in the bedding beneath the pipe for a minimum depth of 3 in. If native material is determined to be unsuitable by the Engineer, remove to a depth of 6 in. for the full width of the flowable fill zone and replace with the material specified for sidefill and compact to 95% of maximum standard Proctor density, except the material directly beneath the pipe shall be uncompacted; see Step 5.

5. The bottom of the trench excavation shall be kept dry and free of water during preparation of the bedding, installation of the pipe, and installation of the flowable fill.

6. Placed compacted mounds of SM material, spaced at 5 ft on center along the pipe length.

7. Install pipe and complete joints in accordance with ASTM D 2321 and ADS installation recommendations.

8. Install sidefill and backfill as follows:

   - Place specified sidefill material and flowable fill material around and at sides of pipe.

   - For ease of construction, sidefill and flowable fill may be placed incrementally, i.e., 2 to 3 ft of sidefill material may be placed and compacted (in suitable lift thicknesses to allow compaction to specified level) followed by placement of flowable fill. Alternatively, the contractor may place and compact all sidefill material prior to installing the pipe. The contractor shall submit details of the

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placing procedures and confirm that the required compaction is achieved for the full height of the sidefill.

- The flowable fill shall be installed in equal lifts on both sides of and in between the pipe to prevent eccentric loading.
- Visually monitor the placement of sidefill material. Conduct field density tests at locations and frequency directed by the Engineer.
- The contractor is responsible for anchoring pipe to resist flotation or other movements while placing flowable fill. Anchoring system must not damage pipe.
- Pipe shall be thoroughly cleaned and free of foreign matter prior to installation of flowable fill.
- Place uncompacted embankment material from top of flowable fill to depths and widths shown on Sheet SK-1.
- After placing flowable fill, inspect pipe and measure vertical diameter at a minimum of 50 ft intervals along pipeline. Report deflections and any other observations to the engineer.
- If approved by the Engineer, proceed with placement of embankment material, compacting per project specifications.
- After completion of backfill, inspect pipe and re-measure vertical diameter at a minimum of 50 ft intervals along pipeline. Record pipe conditions. Provide a report of deflections and observed pipe conditions to engineer.

9. Connection of the pipe with existing or new structures shall be in accordance with ADS installation recommendations.

10. Upon completion the contractor is responsible for removal of any materials from inside the pipe, including any flowable fill that enters the pipe.

11. A curved pipe alignment may be installed in accordance with ADS maximum allowable pipe bend angle (lateral joint rotation); see ADS corrugated HDPE pipe installation

36 in. Diameter Corrugated HDPE Pipe Design

Project No.: 090206

Project: Landfill Expansion III, North Mecklenburg
C&D Landfill, Inc., Mecklenburg County, North Carolina

Date: 3 November 2009
Revised 7 May 2012

guide. If the proposed pipe alignment exceeds the maximum allowable pipe bend angle, coupling bands, manufactured by ADS may be used to accommodate the curvature. The proposed curved pipe alignment and coupling bands shall be submitted to the engineer for approval prior to manufacturing or installing the pipe.

Pipe Maintenance Program:

1. The pipe shall be maintained clear of all debris and inspected periodically for joint leakage or deformation.

2. Inspection of the piping system shall be performed a minimum of once every five years or after major rain events if debris has accumulated in the pipe. The inspection shall include entry into the piping system by either man entry or using closed circuit television (CCTV) to identify signs of structural distress and/or soil/water infiltration. If structural distress or infiltration is observed a licensed professional engineer should be contacted to evaluate the piping system. Man entry shall only be performed by certified confined space entry personnel.

3. Prior to inspection and maintenance, the piping system shall be thoroughly cleaned by either manual methods or by using a vacuum truck to remove sediment build up. Cleaning shall be performed at the discretion of the individuals responsible for maintenance of the system, but should be scheduled during a dry season. Cleaning shall be performed a minimum of once per year.

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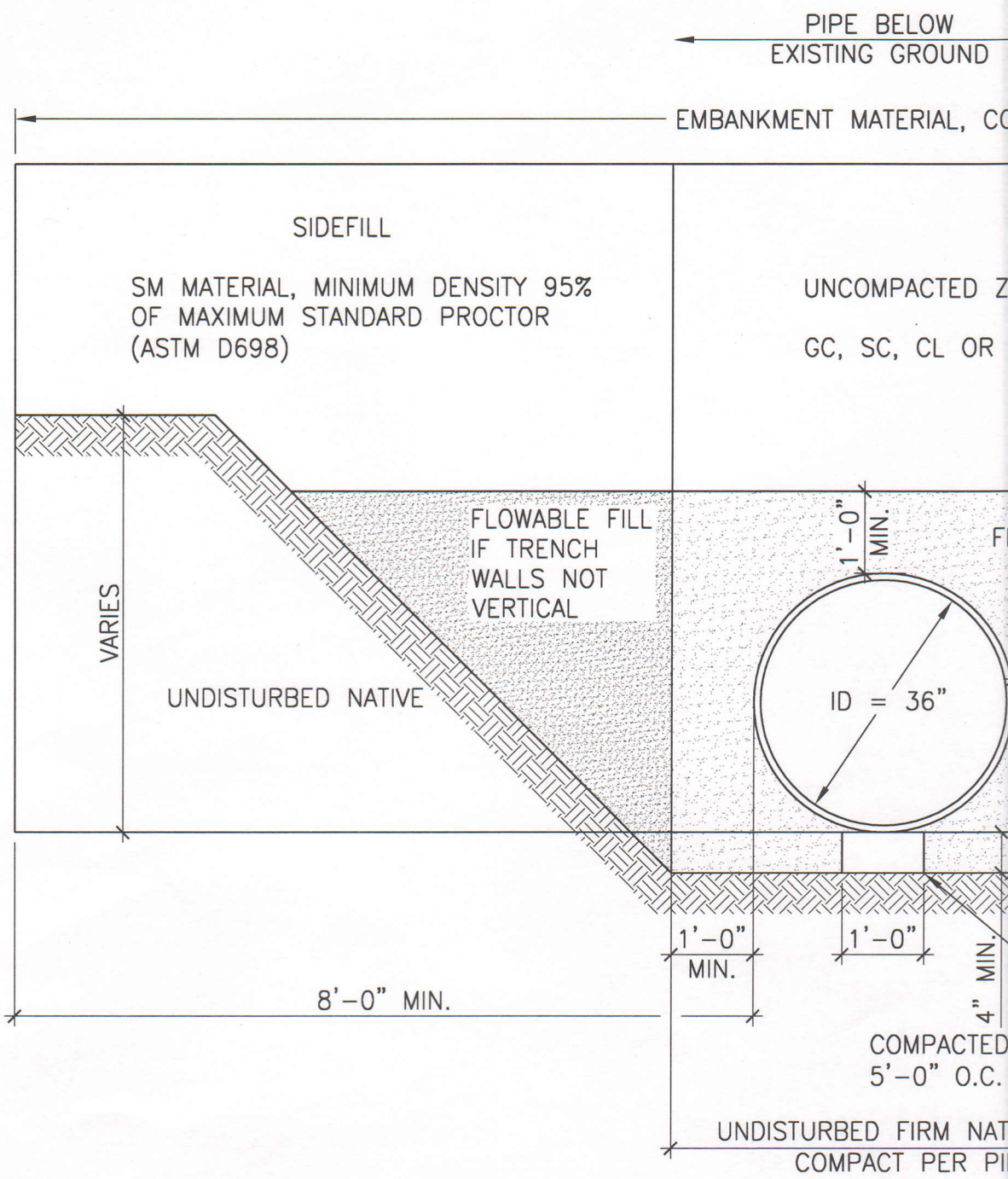
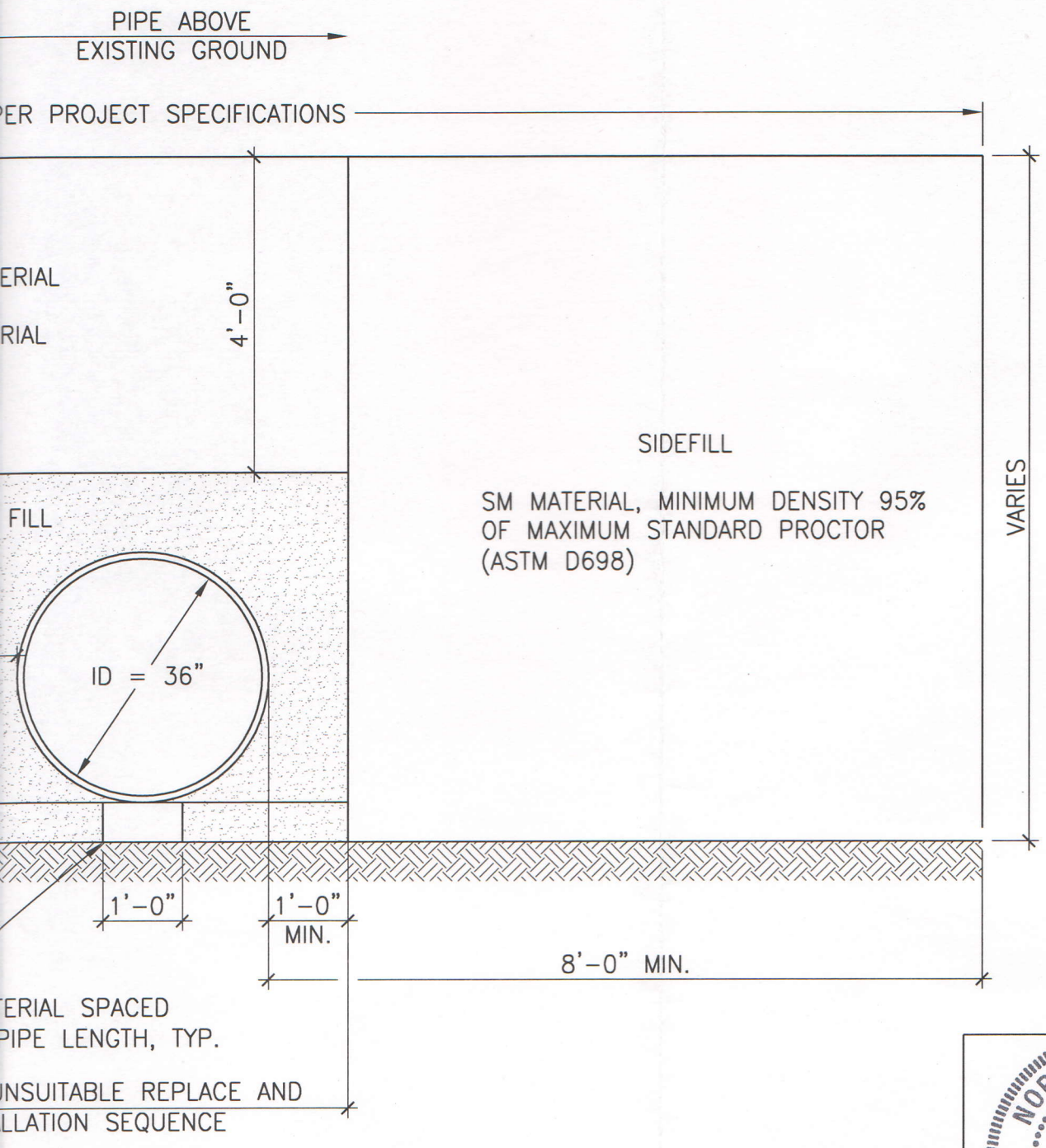


PIPE BEDDING REQUIRE

Notes:

1. Backfill plan must be submitted to and approved by Engineer prior to beginning pipe installation.
2. Maximum fill height is 150 ft above the top of pipe.
3. See technical specifications for design data and requirements for materials, installation, and maintenance.



S 36 IN. DIAMETER PIPE

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 028519 ENGINEER PHILLIP A. SHARFF

5-10-12

Phillip A. Sharff
North Carolina P.E. #028519

SIMPSON GUMPERTZ & HEGER

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Project: Landfill Expansion III
North Mecklenburg C&D Landfill Inc
Mecklenburg County, North Carolina

Drawing Title: 36 IN. DRAIN PIPE INSTALLATION DETAILS

Proj.	Drawn:	Checked:	Date:
090206.01	DMS	BPS	05/10/12

Drawing No.: **SK-1**

Scale: ½" = 1'-0"

(10) 20' STICKS
2° DEFLECTION

(4) 20' STICKS
STRAIGHT

SEE UPSTREAM
ENLARGEMENT THIS
SHEET

(34) 13' STICKS
2° DEFLECTION

(6) 20' STICKS
2° DEFLECTION

(8) 20' STICKS
1° DEFLECTION

(6) 20' STICKS
STRAIGHT

(12) 20' STICKS
1° DEFLECTION

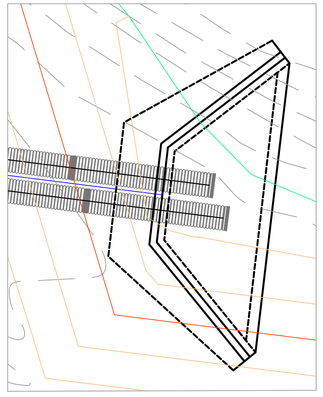
(6) 20' STICKS
2° DEFLECTION

(14) 20' STICKS
STRAIGHT

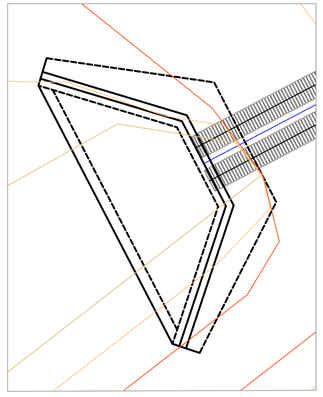
(12) 20' STICKS
1° DEFLECTION

(10)* 20' STICKS
STRAIGHT

SEE DOWNSTREAM
ENLARGEMENT THIS
SHEET



UPSTREAM HEADWALL
ENLARGEMENT
SCALE 1"=10'



DOWNSTREAM HEADWALL
ENLARGEMENT
SCALE 1"=10'

NORTH

SCALE IN FEET
0 30 60

NOTE:

*NUMBER OF PIPE STICKS SHOWN INCLUDE PIPES ON BOTH SIDES OF TRENCH CENTERLINE.

FOR EX. (10) PIPES INDICATE 5 PIPES ON EACH SIDE OF TRENCH CENTERLINE.

36" DIAMETER CORRUGATED HDPE PIPE DESIGN LAYOUT FOR

LANDFILL EXPANSION III, NORTH MECKLENBURG C&D LANDFILL, INC.
MECKLENBURG COUNTY, NORTH CAROLINA.

APRIL 11, 2012

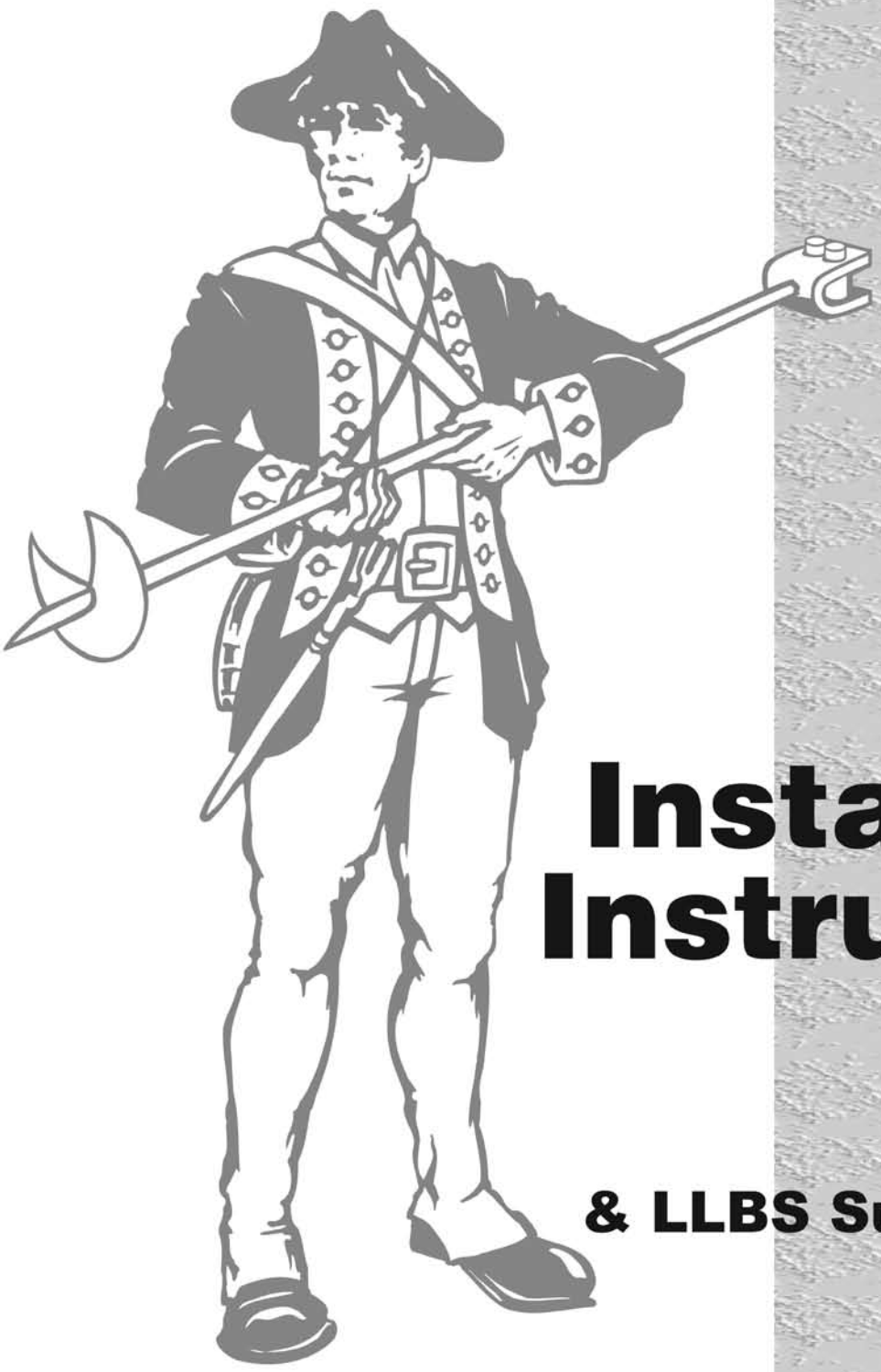
DALCO NONWOVENS, LLC

Nonwoven Civil Geotextiles
DALCO 1100

Property	Unit	Test Method	MARV
PHYSICAL			
Grab Tensile	lb	ASTM D-4632	250
Grab Elongation	%	ASTM D-4632	50
Trapezoidal Tear	lb	ASTM D-4533	100
Puncture Resistance	lb	ASTM D-4833	160
Mullen Burst	psi	ASTM D-3786	500
UV Resistance After 500 hrs.	% Strength Retained	ASTM D-4355	70
HYDRAULIC			
Permittivity	sec^-1	ASTM D-4491	1.2
Water Flow Rate	gpm/ft^2	ASTM D-4491	80
Apparent Opening Size	U.S. Sieve	ASTM D-4751	80
PACKAGING			
Roll Width	ft		12.5/15
Roll Length	ft		360/300
Area	yd^2		500

(1). Physical and hydraulic properties reported as minimum average roll values (MARV)
(2). Property values are subject to change without notice.
(3). At the time of manufacturing, handling may change these properties.
(4). AOS reported as maximum average roll value.

Minute Man anchors,® inc.



Installation Instructions

For Anchors, Frame Ties, Steel Piers & LLBS Support System

305 West King St.
East Flat Rock, North Carolina 28726

Minute Man anchors®, Inc.

LIMITED WARRANTY

Minute Man Anchors, Inc. warrants its product is free from defects in materials and workmanship at the time of installation when properly installed in accordance with the installation instructions. THE FOREGOING WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY LIABILITY IS EXPRESSLY LIMITED TO AN AMOUNT EQUAL TO THE PURCHASE PRICE PAID, AND ALL CLAIMS FOR SPECIAL, INCIDENTAL AND CONSEQUENTIAL DAMAGES ARE HEREBY EXCLUDED. Minute Man does not assume any other liability or obligation in connection with the sale or use of this product.

If the product is defective at the time of delivery or installation and you give prompt notice to Minute Man no later than thirty (30) days of attempted installation of the defect, Minute Man, at its option, will replace the product at no cost or refund the full amount of the purchase price, provided the defective product is returned to Minute Man with proof of purchase at the address set forth below. PRODUCT REPLACEMENT OR REFUND IS YOUR SOLE AND EXCLUSIVE REMEDY.

This warranty extends only to the distributor and original installer of the product and does not cover a defect resulting from abuse, misuse, neglect, repairs, any use not in conformity with the printed instructions or installation by unauthorized personnel.

This warranty gives you specific legal rights, and you may also have other legal rights which vary from state to state. Some states do not allow limitations on implied warranties or special, incidental or consequential damages, so the foregoing limitations may not apply to you.

If you have a claim under this warranty, please contact our CUSTOMER SERVICE department (have model and type numbers available):

CUSTOMER SERVICE
Toll Free In the U.S. 1-800-438-7277
1-828-692-0256

OR WRITE TO:
Minute Man- Customer Service
305 West King Street
East Flat Rock, NC 28726

To our knowledge, the information provided in and by the independent, professional engineers' reports and certifications and obtained from other independent sources contained in the installation instructions and product manuals is accurate. However, Minute Man Anchors, Inc. cannot assume any liability whatsoever for the accuracy or completeness thereof. Final determination of the suitability of any information or material for the use contemplated is the sole responsibility of the user. Specifications are subject to change without notice. The load ratings established in the report are not valid in any application where the use of the product would overload any structural member of the home or foundation,

To Our Customers:

These Installation Instructions are provided as a source of reference and installation information.

Minute-Man Anchors, Inc., having pioneered anchoring for the manufactured home industry, continues in our efforts to provide new and innovative products. In so doing, we are committed to the highest quality made materials, workmanship and total customer satisfaction.

If you are a longtime Minute-Man customer, “Thank You” for your continued trust and patronage. If you are a new customer, “Welcome!” we look forward to serving you in this ever growing industry.

Questions?

Regardless of your level of association with the Manufactured Housing market, if you have questions or we may be of service, please contact our office.

1-800-438-7277
FAX: (828) 692-0258

You can also find further information at our website:
www.minutemanproducts.com

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Note: Prior to installation, refer to any local, state and federal regulations, to assure proper compliance.

Soil test probe the anchor location in order to match the soil classification with the proper anchor.

Note: Prior to installation, refer to any local, state and federal regulations, to assure proper compliance. Soil test probe the anchor location in order to match the soil classification with the proper anchor.

Minute Man anchors®, Inc.

ANCHOR INSTALLATION

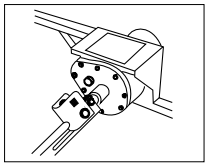
There are two basic methods of installing anchors, each equally effective in properly securing manufactured homes to the ground.

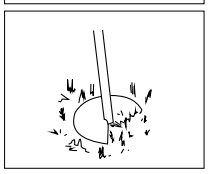
CAUTION: *The installation of anchors with a drive machine is a two person operation.*

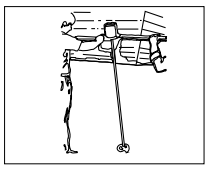
Warning: Before ground anchor installation, determine that the anchor locations around home will not be close to any underground electrical cables, water lines or sewer piping. Failure to determine the location of electrical cables may result in serious personal injury.

MACHINE INSTALLATION

In this method, the anchor is turned to full depth into the ground by an anchor drive machine.

1. 
Attach anchor to machine.

2. 
Placed anchor in proper position in line with strap and machine.

3. 
Anchor should be installed at a slight angle as shown to assure head being positioned behind future skirting.

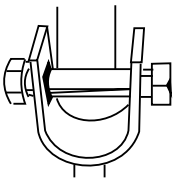
MANUAL INSTALLATION

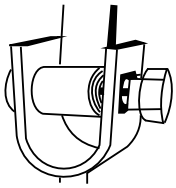
A hole is dug to a depth of approximately ½ the length of the anchor, in the proper position as explained under machine installation.

After the hole is dug to ½ the length of the anchor, then the anchor is turned into the ground by hand, using a rod or length of pipe for leverage or by machine.

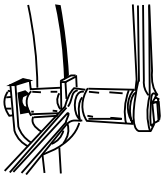
After anchor is installed full depth, earth is repacked, six inches at a time.

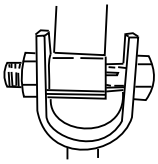
PROPER TENSIONING OF STRAP TO ANCHOR HEAD

1. 
Insert bolt into head; attach nut loosely. Insert strap in slot of 5/8” bolt until strap is flush with far side of bolt.

2. 
Bend strap 90° and take at least three complete turns on bolt until strap is taut.

3. Bolt is turned with 15/16” socket wrench, or adjustable wrench, on hex head. With square hole in anchor head, hold bolt under tension while repositioning wrench: Place open-end wrench on 5/8” square shoulders of bolt. Align square shoulders of bolt with square hole in anchor head.



4. 
Holding hex head of bolt in position, tighten nut to draw square shoulders into square hole. Shoulders are now in locking position; continue to tighten nut. Tensioning device is now in locked, secure position.

Note: The tensioning bolt can be inserted in the head from either side.

Notice: In areas of severe cold weather, where possible damage could occur from frost heave, the homeowner should be prepared to adjust tension on the straps to take up slack.

Soil Classification and Bearing Capacity

TABLE TO § 3285.202

Soil classification		Soil description	Allowable soil bearing pressure (psf) [1]	Blow count ASTM D 1586–99	Torque probe [3] value [4] (inch-pounds)-
Classification number	ASTM D 2487–00 or D 2488–00 (incorporated by reference, see § 3285.4)				
1		Rock or hard pan	4000+		
2	GW, GP, SW, SP, GM, SM.	Sandy gravel and gravel; very than dense and/or cemented sands; course gravel/cobbles; preloaded silts, clays and coral.	2000	40+	More than 550.
3	GC, SC, ML, CL	Sand; silty sand; clayey sand; silty gravel; medium dense course sands; sandy gravel; and very stiff silt, sand clays.	1500	24–39	351–550.
4A	CG, MH [2]	Loose to medium dense sands; firm to stiff clays and silts; alluvial fills.	1000	18–23	276–350.
4B	CH, MH [2]	Loose sands; firm clays; alluvial fills	1000	12–17	175–275.
5	OL, OH, PT	Uncompacted fill; peat; organic clays	Refer to 3285.202(e)	0–11	Less than 175.

Notes:

[1] The values provided in this table have not been adjusted for overburden pressure, embedment depth, water table height, or settlement problems.

[2] For soils classified as CH or MH, without either torque probe values or blow count test results, selected anchors must be rated for a 4B soil.

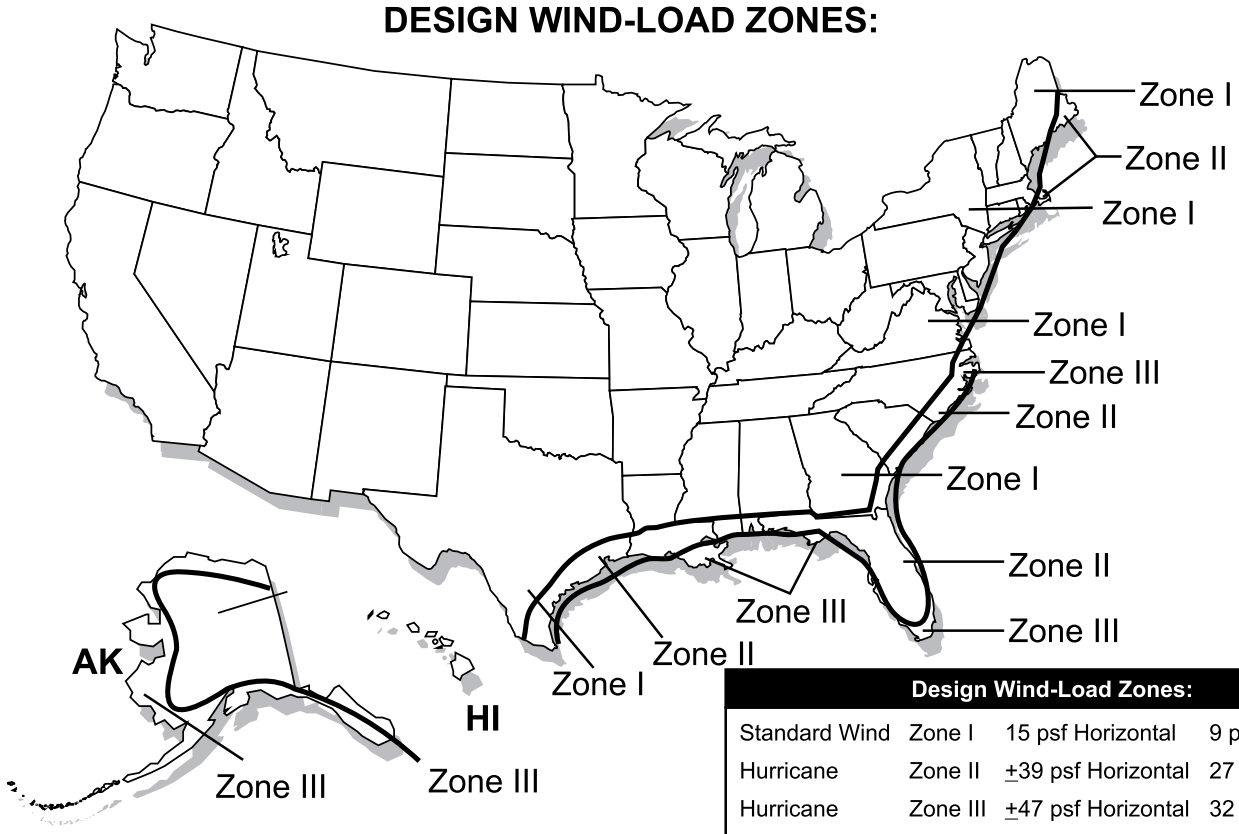
[3] The torque test probe is a device for measuring the torque value of soils to assist in evaluating the holding capacity of the soil in which the ground anchor is placed. The shaft must be of suitable length for the full depth of the ground anchor.

[4] The torque value is a measure of the load resistance provided by the soil when subject to the turning or twisting force of the probe.

(f) If soil appears to be composed of peat, organic clays, or uncompacted fill, or appears to have unusual conditions, a registered professional geologist, registered professional engineer, or registered architect must determine the soil classification and maximum soil bearing capacity.

Source: Manufactured Home Construction and Safety Standards - Part 3285.202

DESIGN WIND-LOAD ZONES:



Design Wind-Load Zones:			
Standard Wind	Zone I	15 psf Horizontal	9 psf uplift*
Hurricane	Zone II	±39 psf Horizontal	27 psf uplift
Hurricane	Zone III	±47 psf Horizontal	32 psf uplift
			*net uplift

Note: psf: pounds per square foot

Source: Manufactured Home Construction and Safety Standards- Part 3280.305

Note: Prior to installation, refer to any local, state and federal regulations, to assure proper compliance.
Soil test probe the anchor location in order to match the soil classification with the proper anchor.

Soil Classification Chart

for Minute Man Anchors

Soil Class	Torque Probe Values	Recommended Minute Man Anchors & Stabilizers
1	NA	Cross Drive or Rock Anchor
2	551 Inch Pounds Up	4430 DH 4636 DH 636 DH 4450 DH 4430 EZDH 4636 EZDH 636 EZDH GW-2 12" Stabilizer Plate Nu-Concept Stabilizer Cap
3	351 to 550 Inch Pounds	4430 DH 4636 DH 636 DH 4450 DH 4430 EZDH 4636 EZDH 636 EZDH GW-2 12" Stabilizer Plate Nu-Concept Stabilizer Cap
4A	276 to 350 Inch Pounds	4636 DH 4450 DH 650 DH 4636 EZDH 12" Stabilizer Plate 17" Stabilizer Plate
4B	175 TO 275 Inch Pounds	760 DH 860 DH 1060 DH 17" Stabilizer Plate
5	Less Than 175 Inch Pounds	Call Minute Man Anchors 800-438-7277

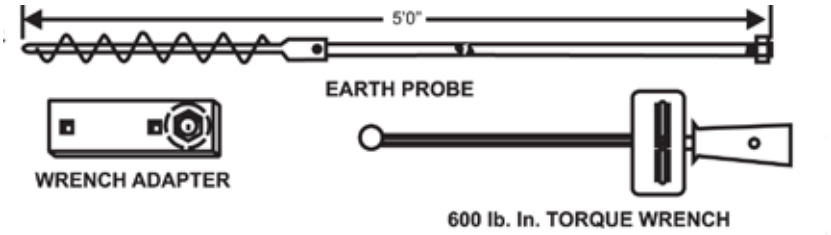
Note:

Each state, county, municipality may require a specific anchor from the groups shown for each soil classification. Check local regulations before installation.

Test soil with soil probe and torque wrench at the anchor location in order to match the proper anchor with soil soil classification.

A stabilizer plate or certified stabilizing device must be used with DH anchors when the anchors are used to resist lateral loads.

Soil Test Probe and Torque Wrench



Warning: *Before ground anchor installation or probing, determine that the anchor or probe locations around the home will not be close to any underground utilities. Failure to determine the location of electrical lines may result in serious personal injury.*

Instructions

1. Place tip of probe into ground where the anchor is to be located. Using a 15/16" hex socket with a ratchet, breaker bar, or electric drive machine, turn soil probe in a clockwise direction.
2. Rotate probe into the soil to a depth equal to the length of the recommended anchor to be installed.
3. To determine the soil classification:
   a) Place wrench adapter onto torque wrench.
   b) Insert hex portion of wrench adapter onto the top of the probe.
   c) Support probe shaft with one hand while turning the probe steadily with the torque wrench.
   Do not exceed 600 inch pounds when turning!
   d) Read torque value while turning torque wrench and probe clockwise.
   e) Use Minute Man Anchors' Soil Classification Chart to cross reference probe readings and match the anchor model with the proper soil class at the site.

Following is a list of Minute-Man Anchors with an allowable working load equal to or exceeding 3,150 lbs. and are capable of withstanding a 50% overload (4,725 lbs. total). Stabilizer devices must be used with anchors when anchors are used to resist horizontal forces. HUD Part 3280.506(f)

ITEM #	MARK	MODEL	DESCRIPTION	USE IN SOIL TYPE
1071	MMA-2	650-DH 5/8”	6” DISC, 50” ANCHOR	2,3,4(a)
1101	MMA-4	650-DH 3/4	6” DISC, 50” ANCHOR	2,3,4(a)
1131	MMA-28	636-DH 3/4	6” DISC, 36” ANCHOR	2,3
1241	MMA-30	4430-DH 5/8	DOUBLE 4” DISC, 30” ANCHOR	2,3
1271	MMA-6	4430-DH 3/4	DOUBLE 4” DISC, 30” ANCHOR	2,3
1349	MMA-35	36-XDH	36” CROSS DRIVE ANCHOR	1
1350	MMA-8	48-XDH	48” CROSS DRIVE ANCHOR	1
1390	MMA-BR	24 BA	BARB ROCK ANCHOR	1
1287	MMA-86	860-DH 3 /4	8” DISC, 60” ANCHOR	4(b) (Fla.)
1288	MMA-71	1060-DH 3/4	10” DISC, 60” ANCHOR	4(b)
1291	MMA-75	760-DH 3/4	7” DISC, 60” ANCHOR	2,3,4(a),4(b)
1346	MMA-52	4636-DH 3/4	4” & 6” DISC, 36” ANCHOR	2,3,4(a)
1284	MMA-55	4450-DH 3/4	DOUBLE 4” DISC, 50” ANCHOR	2,3,4(a)
1282	MMA-50	4442-DH 3/4	DOUBLE 4" DISC, 42" ANCHOR	2,3
1312	MMA-57	4636 NU 7/8	4” & 6” DISC, NU CONCEPT CAP	2,3,4(a)
1592	MMA-92	4430-EZDH 3/4	DOUBLE 4” DISC, 30” EZ ANCHOR	2,3
1593	MMA-93	4636-EZDH 3/4	4” DISC, 6” DISC, 36” EZ ANCHOR	2,3,4
1594	MMA-94	636-EZDH 3/4	6” DISC, 36” EZ ANCHOR	2,3
1596	MMA-96	650-EZDH 3/4	6” DISC, 50” EZ ANCHOR	2,3
2390	MMA-18	THDH	DOUBLE HEAD TENSION DEVICE	SLAB
2391	MMA-18	THDHLS	DH TENSION DEVICE W/LAG	SLAB
1450	MMA-14	210-PDH	WET CONCRETE ANCHOR	SLAB
1445	MMA-42	210-JDH	SWIVEL HEAD WET CONCRETE ANCHOR	SLAB
1321	MMA	G W1	G W 1 ROCK ANCHOR	1
1322	MMA	G W2	G W 2 SOIL ANCHOR	2,3
2200	MMA-SD2A		STABILIZER- 12”	2,3,4(a)
2202	MMA-SD2		STABILIZER- 17”	FLA. 2,3,4(a),4(b)
2211	N C1		NU CONCEPT STABILIZER CAP	2,3,4(a)
2691	MMA-29	FCIIW/S	FRAME CLAMP II W/STRAP	
2820	MMA-31	FRAME TIE	LONGITUDINAL FRAME TIE-8 BOLT	FLA.
2822	MMA-34	FRAME TIE	LONGITUDINAL FRAME TIE-4 BOLT	
2700	MMA-32	BUC/WS	BUCKLE W/STRAP	
2801	MMA-33	FCII (LOCKING)	LOCKING FRAME CLAMP II	
2704	MMA-71	CT/WS	CORNER TIE W/STRAP	
2706	MMA-71-C	CT/WS	CORNER TIE W/STRAP	
2709	MMA-71-C	CT/WS	CORNER TIE W/ REG. STRAP	
2010	MMA	SBN	STRAP BOLT & NUT	

Revised 10/27/10

ROD M. HUDGINS, JR. P.E.
P.O. BOX 5070
ASHEVILLE, N.C.28813-5070

October 1, 2008

Minute Man Products
305 West King Street
East Flat Rock, NC 28726

Dear Sir,
I have analyzed design drawings, physical testing reports, and installation instructions for the Minute Man Products listed as follows:

650 5/8 DH	4636 3/4 DH	GW 2	100 DH
650 3/4 DH	4636 7/8 NC	XDH	MMAS (Seal)
760 3/4 DH	4636 3/4 EZDH	48 XDH	SBN (Bolt & Nut)
636 5/8 DH	4430 3/4 EZDH	24 BA	Pivot Clip W/S
636 3/4 DH	636 3/4 EZDH	210 JDH	FCII W/S
4450 3/4 DH	650 3/4 EZDH	210 PDH	BUC W/S
4430 5/8 DH		THDH	MMA SD2
4430 3/4 DH		THDH LS	MMA SD2A
			NC 2 (Stab. cap)

CT W/S Corner Tie MMA 71 & MMA 71C	Longitudinal Frame Tie MMA 31 & 34
LLBS Longitudinal & Lateral Bracing System	Locking FCII MMA 33
MMSPP Longitudinal Stabilizing System	EZ Support Tube System

My analysis of the physical test reports defines the breaking strength of each of these anchors and their component to be in excess of 4,725 pounds. The strapping meets federal specifications QQ-S-781H for type 1 class B, Grade 1 strapping. The strapping also meets with ANSI 225.1 standards and ASTM D3953-91 standards. The strapping is 1 ¼" x .035 minimum, zinc coated G60 & G90 galvanized steel. Listed products comply with HUD Code 3285 Standards.

On file are testing reports of direct withdrawal strength of these anchors. These test evaluate the anchorage strength of Minute Man Anchors installed resisting an axial and 45 degree angle applied withdrawal load. For the anchors listed on pages 10 and 11, the average holding power meets and / or exceeds the required minimum of 4,725 pounds when installed in accordance with manufacturer instructions in the soil type and class shown.

The LLBS Bracing System was tested for Wind Zones I, II, & III.

NORTH CAROLINA
PROFESSIONAL
4672
11/10/08
ENGINEER
ROD M. HUDGINS, JR.

"SUGGESTED RECOMMENDATIONS WHEN USING CRIMPING SEALS"

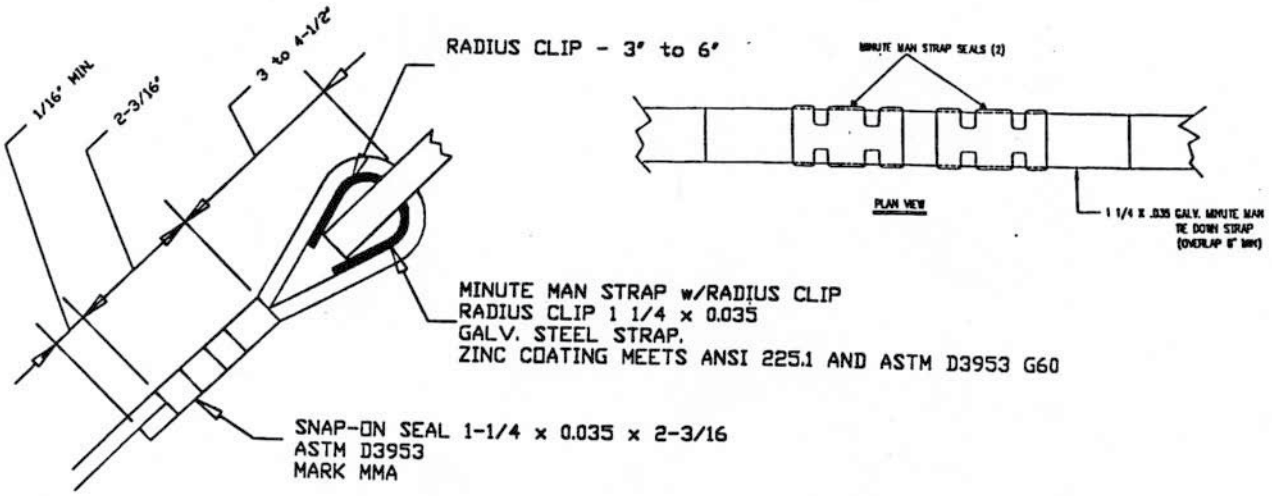
1. The strap must be identified "MINUTE MAN ANCHORS INC. **CERTIFIED ANSI 225.1** AND **ASTM D3953."**

2. WHEN EXTENDING OR SPLICING TWO STRAPS, OVER LAP APPROX. 6", USE TWO SEALS FULLY CRIMPING EACH SEAL TWICE TO BOTH STRAPS.

3. WHEN STRAPPING TO AN APPLIANCE SUCH AS SLOT IN A VERTICLE TIE OR A HOOK OR A BUCKLE WE SUGGEST THAT YOU USE A SHORT PIECE OF STRAP (RADIUS CLIP) BENT 180 degrees IN DIRECT CONTACT WITH THE APPLIANCE. (This will act as a cushion, reinforce and prevent sharp bends in the strap.) NEXT INSERT THE STRAP BENDING IT OVER 180 degrees BACK TO THE STRAP. USING ONE SEAL, PLACE BOTH STRAPS INTO SEAL AND CRIMP TWICE.

4. SEALS MUST ALWAYS BE CRIMPED TWICE.

5. PLEASE NOTE: TWO SEALS REQUIRED WHEN SPLICING TWO STRAPS. ONE SEAL WHEN BENDING 180 degrees.



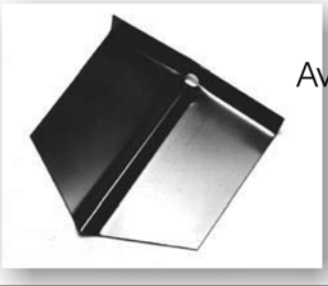
SINGLE DISK ANCHORS

650, 636, 760, 1060 DH Anchor

DOUBLE DISK ANCHORS

4430, 4636 DH Anchor

STABILIZERS



Available Painted Black or Galvanized as required in Florida

DRIVE ANCHORS

36X And 48X Cross Drive Anchors

24" Barbed Rock Anchor

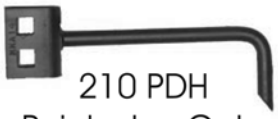
CONCRETE ANCHORS

THDHLS

THDH

210 JDH
W/Swivel Head

210 DH



210 PDH
Painted or Galv.

E-Z ANCHORS (Patented)

4430, 4636, 636, 650, DH Anchor
6650, 8860 VDH Anchor

NU-CONCEPT ANCHOR

Patented

Packaged 16 to a box and includes Grad #5 bolts and nuts.
Total Weight: 25 lbs.

N C 1 Swivel Stabilizer Cap

Full view of anchor with cap and with cap attached

Anchor w/cap attached

Item#	Description
1311	4636 7/8" DH
1312	4636 7/8" DH W/Cap
2211	NU Concept Cap

All Anchors Available Painted or Galvanized

Nu-Concept Drive Adapter

Galvanized Steel Strapping

Corner Tie W/Strap

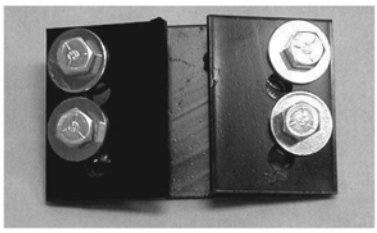
Buckle W/Strap

Frame Clamp II W/Strap

Locking Frame Clamp II

Several different strap lengths available

Longitudinal Frame Tie



Available w/4 bolts for Wind Zone I and w/8 bolts for Wind Zone III
Use with corner tie strap for end ties.

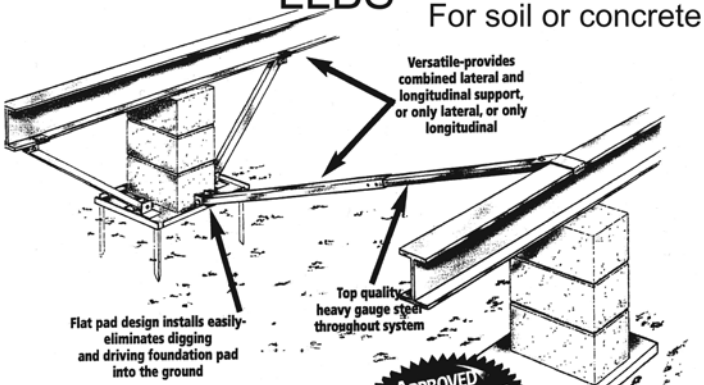
Eye Anchors

Available in various sizes

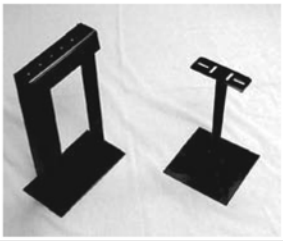
The Minute Man Foundation System for All Wind Zones Saves Time & Money!

LLBS

For soil or concrete



Minute Man's superior design outperforms other brands in so many ways:



AWNING ANCHORS

Item#	Description	Item#	Description
6010	Z bar Awning Anchor	6031	18" Long Buckle Anchor
6020	H bar Awning Anchor	6040	30" Short Buckle Anchor
6030	18" Short Buckle Anchor		

TECHNICAL NOTE

Post-Installation Deflection Testing for HDPE Pipe

TN 5.07
January 2010

Introduction

An important feature of any flexible pipe is its ability to deflect, or oval, under load without distress. Deflection allows the load to be transferred from the pipe to the surrounding backfill. The result is flexible pipe can withstand very high loads as a relatively light structure. This technical bulletin discusses acceptable levels of deflection for corrugated high density polyethylene (HDPE) pipe and methods that are commonly used to evaluate deflection.

Flexible pipe – including HDPE pipe – will conform to soft areas or voids that might remain in an improperly compacted backfill. Thus, flexible pipe provides an important indicator of the quality of backfill placement very soon after pipe installation. An inspector will know within just a few days if a flexible pipe has been installed correctly, usually allowing problems to be corrected while the contractor is still on site and before the system is put into use.

Flexible pipe *must* deflect in order to mobilize the strength of the surrounding backfill. The logical questions a specifier may have are; how much deflection is acceptable and how can deflection be evaluated?

Acceptable Deflection

According to current thermoplastic design procedures, deflection is defined as a service limit. For purposes of design, the designer, considering all site conditions, will set this service limit in order to perform a proper design evaluation. Deflection in excess of the service limit assigned by the engineer does not necessarily result in strength limits being exceeded, i.e. system failure. For more information on service and strength limit states, see the structures section of the Drainage Handbook. When testing for allowable deflection limits, the base inside diameter should be used when establishing mandrel sizing. According to ASTM polyethylene pipe "designed for 7.5 % deflection …can be expected to perform satisfactorily when installed in accordance with Practice D 2321 and deflection is measured in not less than 30 days following completion of installation."[1] The base inside diameter accounts for the allowable undersizing and manufacturing tolerances and is calculated using equation 1. Base diameter is calculated in a manner identical to that used for other HDPE pipe. Table 1 lists the inside diameters that result from common testing limits of 5% and 7½% deflection.

Equation 1
Base Inside Diameter[1]

$$I.D._{base} = I.D._{design} - \sqrt{\left(I.D._{tolerance}\right)^2 + \left(Out.of.Round_{tolerance}\right)^2}$$

Where:
$I.D._{base}$= Base Inside Diameter
$I.D._{design}$ = Inside diameter as specified by manufacture
$I.D._{tolerance}$ = 1.0% undersize per ASTM F 2306
Out of Round $_{tolerance}$ = 3% manufacturing tolerance consistent with manner used for other HDPE.

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Table 1
Base Inside Diameters for HDPE Pipe

Nominal Pipe Diameter (in.)	Base Inside Diameter (in.)	Base Inside Diameter with 5% Deflection (in.)	Base Inside Diameter with 7.5% Deflection (in).
4	3.86	3.67	3.57
6	5.81	5.52	5.37
8	7.65	7.27	7.08
10	9.59	9.11	8.87
12	11.63	11.05	10.76
15	14.51	13.78	13.42
18	17.45	16.58	16.14
24	23.22	22.06	21.48
30	29.05	27.60	26.87
36	34.80	33.06	32.19
42	40.09	38.09	37.08
48	46.09	43.79	42.64
54	51.47	48.90	47.61
60	57.62	54.74	53.30

Evaluating Deflection

All pipes regardless of material must be installed correctly so that it the system performs as designed. Inspection during installation is the most efficient way to ensure the installation will be done according to design and that deflection will remain within acceptable limits. However, if inspection is not possible or the quality of the installation is still in doubt, deflection can be a reasonable indicator of the quality of the installation. Visual inspections, videotaping, and mandrel tests are the most common ways to evaluate deflection.

It is important to understand that deflection may be easily seen even if the pipe is deflected within acceptable limits. Deflection exceeding service limits should not be cause for alarm until the magnitude and cause is understood.

Visual Inspections

Visual inspection is by far the most accurate evaluation method for pipes 30-inch and greater in diameter. Inspectors can enter these larger pipes and take measurements. For smaller pipes, a visual inspection from the pipe end (lamping) can alert the inspector to possible problems. Lamping is usually limited to runs that are no longer than about 100 feet. For longer runs, video may need to be employed to provide a qualitative inspection.

Videotape Inspections

Video, or closed circuit television (CCTV), inspections are a common way to evaluate pipe, especially when the pipe is too small or the environment too hazardous for an individual to enter. This type of inspection can only yield qualitative information and, because of the type of equipment often used, the view is often somewhat distorted. If an area of concern is identified, more information will need to be obtained to determine how much deflection exists and the reasons for it.

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Mandrel Tests

Mandrels are devices that are pulled through the pipe to determine if the deflection is acceptable. They are pre-set with the minimum allowable inside diameter from Table 1. If the mandrel can be pulled through the pipe, deflection is considered acceptable. Mandrels are not able to provide quantitative information. Thus a pipe that is deflected only slightly more than allowable would appear in a mandrel test to be the same as a pipe that is deflected much more.

A significant problem with mandrel testing is that the mandrel is a simple go/no-go device that might not pass through the pipe for a variety of reasons unrelated to deflection. A pipe with some debris in the bottom, a fitting that protrudes slightly into the pipe interior or slight misalignment at the joint can all cause a mandrel test 'failure,' even if deflection is acceptable.

Mandrels can also be extremely cumbersome and time-consuming to handle. To get a larger mandrel to the pipe, it may have to be disassembled to get it through a manhole opening, and then reassembled before putting it into use.

Because of the limits inherent to this method, mandrels should be considered a last resort to evaluating the installation. If it is thought to be necessary, any mandrel used should always have an odd number of fins. A mandrel with fewer fins, five instead of seven or nine, decreases the likelihood of catching debris or other interior protrusions that are not representative of actual pipe deflection.

Laser Ring Video

The use of video recording in conjunction with projecting a laser ring on to the ID of the pipe is a relatively new technology. The technology is extremely interesting and would allow for the collection of an immense amount of data. As is with most new technology; application in the field tends to yield sporadic and at times erroneous results; the laser ring is no exception. The system needs to be calibrated properly, and at times these calibrations are done manually during inspection. Debris still may cause the system to take false readings, and depending on the equipment, the mounting of the laser may obstruct the video from recording a full 360-degree view of the pipe line. For these reasons and others not listed, this technology is still under evaluation and has not been approved for wide use by any major approval body.

Scheduling Evaluations

Most deflection in flexible pipes occurs within a few days after the pipe has been installed. It has been demonstrated that, for HDPE pipe, the majority of the maximum deflection a pipe will experience will occur within the first thirty days.

In most installations, checking a portion of the system will yield adequate information about the entire site. Generally, an evaluation of 10% of the overall project or those areas of most concern will provide a good indication of the overall installation quality.

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Summary

The best way to ensure proper installation and good pipe performance of any pipe is to provide inspection during installation. This is good practice for pipe of all types. However, visual inspections, video inspections, and mandrel tests can be used to check the pipe behavior after installation. Visual inspections where the inspector actually enters the pipe yield the most information. Other test methods provide limited information, but will identify areas of the system that may need a more thorough investigation.

Note: ADS products are solely intended for the conveyance of fluids. Access into this product for maintenance, inspection, repair, or other reason should be done in strict accordance with OSHA recommendations for confined space entry.

[1] ASTM F 894, *"Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe"*

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ATN507
© ADS 2007

HUNTER Construction Group Inc.

118 Timber Road,
Mooresville, NC 28115
Tel: (704) 799-7570
Fax: (704) 799-7576

Letter of Transmittal

To:	Civil & Environmental Consultants, Inc	**Job:**	North Mecklenburg Infill
	2030 S. Tryon Street	**Attn:**	Scott Brown
	Charlotte, NC 28203	**Re:**	36” HDPE Pipe Installation

WE ARE SENDING YOU

SUB. AGREE.	PLANS	SHOP DRAWINGS	COPY OF LETTER	CHANGE ORDER	SAMPLES	SPECIFICATIONS	SUBMITTAL
							X

COPIES	DATE	NO.	DESCRIPTION
1	05-14-12		Infill 36” HDPE Pipe Installation
1	05-14-12		ADS Tech Note 5.02
1	05-14-12		Pipe Layout Plan
1	05-14-12		SG&H Calcs
1	05-14-12		Filter Fabric Spec
1	05-14-12		Anchor Data

☐ APPROVED ☐ NOT APPROVED
☐ APPROVED AS CORRECTED
☒ REVISE AND RESUBMIT
☐ RESUBMIT FOR RECORD COPY

Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

BY: BPStrohman
DATE: 18 May 2012
SIMPSON GUMPERTZ & HEGER INC.
41 Seyon St., Building 1, Suite 500
Waltham, MA 02453

THESE ARE TRANSMITTED as checked below:

For approval [X] Approved as submitted [ ] Resubmit ____ copies for approval

For your use [ ] Approved as noted [ ] Submit _____ copies for distribution

As requested [ ] Returned for corrections [ ] Return _____ corrected prints

For review and comment _____

REMARKS

05-14-2012

Signature **Date**

In a separate submittal, provide a sketch showing the anchor system including geometry, dimensions, and quantities of all members and components. Provide all dimensions relative to the bottom and sides of the pipe trench. During on-site field monitoring of pipe installation, CEC field engineer shall verify anchor system is not deflecting the HDPE pipes.

HUNTER
Construction Group Inc.

36" HDPE Pipe Installation **May 10th, 2012**

Method for Preventing Pipe Flotation – The pipes will be restrained to prevent flotation in the trench due to the addition of the flowable fill. After the 12 inch X 12 inch X 4 inch borrow material pipe supports are formed and the pipe installed in the trench, the HDPE pipe will be secured to the trench bottom using a commercially available screw anchor assembly. These tie-down systems are commonly used to secure manufactured homes, and a cut sheet has been included with the submittal. To alleviate pipe deflections due to point loads from the tie-down straps, a wood 4"X4"will be installed on top of the pipe, parallel to the pipe for the entire length of each pipe stick. The screw anchor assembly straps will be installed over the 4"x4" to secure the wood and pipe. This is intended to more evenly distribute the load from the straps across the full length of each pipe stick. The uplift calculation for the pipe has been attached and shown below:

$U = (A_{disp} * \delta_{CLSM})$

Where,

A_{disp} = Area of pipe displaced by CLSM, ft^2

δ_{CLSM} = Unit weight of CLSM, lb/ft^3

U = Uplift due to CLSM, lb/ft

			Uplift Force (lbs/ft)*		
Outside Pipe Diameter (in)	Pipe Area (ft^2)	CLSM Unit Weight (lb/ft^3)	CLSM to top of pipe (lbs/ft)	CLSM to springline of pipe (lbs/ft)	CLSM to bottom quarter of pipe (lbs/ft)
42	9.6	127	1221.9	610.9	238.3

In addition, the flowable fill will be placed in two lifts. The first lift, poured to the springline of the pipe will be allowed to set for 4 hours prior to the installation of the next lift. The straps, which have a breaking strength of 4725.0 lbs will be installed every seven linear feet along the length of the HDPE pipe. This spacing is based on flowable fill installation to the springline of the pipe and the calculation for this spacing is shown below:

	Spacing along Pipe Run (ft)		
Anchor Breaking Strength (lbs)	CLSM to top of pipe (lbs/ft)	CLSM to springline of pipe (lbs/ft)	CLSM to bottom quarter of pipe (lbs/ft)
4725.0	3.9	7.7	19.8

The strap spacing should not be calculated based on the strap's ultimate breaking strength. Need to include a minimum safety factor of 1.5 in the design calculations.

Submit calculations showing that the pipe beam bending deflection will not result in reverse slope of the pipe. The pipe diametrical deflection must be relieved after the first lift of CLSM has cured. This will require that the pipe diametrical deflection is considered when determining the bottom of trench elevation to ensure the pipe is located at the intended elevation to maintain the desired pipe slope. Consult pipe manufacturer for guidance calculating pipe beam bending deflection and pipe diametrical deflection.

118 Timber Road ▪ Mooresville, NC 28115 ▪ 704-799-7570 ▪ 704-799-7576 (fax)

Once the flowable fill has been placed to the top of the pipe, the straps will be cut, and the lumber will be removed from the top of pipe. The flowable fill will then be placed over the top of pipe to match the thickness shown in detail SK-1.

Pipe and Backfill Placement – The pipe will be installed in accordance with SG&H 36 inch diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012 (attached), ADS recommendations and the approved construction drawings. The trench excavation will begin on the downstream end of the pipe run at the installed concrete headwall. Excavation will be accomplished utilizing a track hoe with a bucket with "teeth" to the design grade. Excavation will occur in one hundred foot runs. The trench will be excavated to 10 ½ feet in width and to the proper depth in accordance with Sheet SK-1 and the approved construction plans. The trench bottom will then be mechanically compacted and field density tests performed. The field density tests of the trench bottom will be measured to ensure compaction to 95% of maximum standard Proctor density and will be conducted at the frequency indicated below:

<u>Test Frequency 1</u>

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet of installation, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

<u>Test Frequency 2</u>

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Unsuitable soils or rocks in the trench bottom will be removed in accordance with SG&H 36 in. Diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012. In accordance with SG&H SK-1, four inches of flowable fill will be required under the HPDE pipe. To accomplish this, 12 inch X 12 inch X 4 inch high compacted soil mounds using the borrow material will be constructed under the HDPE pipe at five foot intervals. These compacted soil mounds will act as spacers between the pipe bottom and the trench.

After the pipe is placed in the trench on the support mounds, the joints will be articulated to provide a joint deflection in accordance with the pipe plan layout. All pipe joints will be wrapped in geo-textile fabric and taped to secure the wrap to each joint. The fabric will be a class IV non-woven geotextile fabric in accordance with NCRS – MEFOTG, Section IV Construction Specification 495. After the joints are wrapped with the geotextile fabric and taped, the joint deflection will be measured by a professional land surveyor.

Once the pipe deflection has been recorded, the pipes will be restrained using the screw anchor system to prevent pipe flotation. Flowable fill will be installed according to ADS recommendations to the depth shown in SK-1. The placement of flowable fill in the first trench will consist of the first lift of flowable fill placed to the springline of the HDPE pipe at the downstream end with the fill tapering down at the

upstream end of the 100 foot trench section. Additional lifts will be installed until the fill matches the depth shown in SK-1.

To prevent flowable fill from entering the pipe, a pipe plug will be installed in the open end of the pipe and will be removed after the flowable fill has set. Two samples of flowable fill from each trench section will be taken per ASTM D 4832 and tested by a certified testing facility to determine the 28 day compressive strength, which should be between 500 and 1,000 psi. Each truck load of CLSM shall be tested in the field per ASTM D6103 and show conformance to the specified slump result of 9 inches.

Visual inspection of the pipe joints will occur after the placement of the flowable fill in order to ensure that flowable fill or excessive water leakage into the pipe joints is not occurring. Photographs of the joints and installation will be taken before and after the filling of each trench section.

CLSM will have low stiffness after only 3-4 hours and cannot take backfill load - no additional backfill should be placed for 24 hours.

After the flowable fill has set approximately 3-4 hours according to the manufacturer, un-compacted material will be placed over the pipe in accordance with SG&H SK-1. In those areas where filling will be required to reach final grade, sidefill will be placed on either side of the completed trench in 18 inch lifts. The sidefill areas will be compacted, the soil directly over the trench will not be compacted. The sidefill for those areas that require fill (fill height above non-native, undisturbed soil) will be placed and compacted in accordance with SG&H 36 inch Diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012 (attached). Compacted sidefill will be tested to ensure compaction to 95% of maximum standard Proctor density. This testing will be conducted at the following frequency:

Test Frequency 1

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 lf of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

Test Frequency 2

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Method for Measuring Joint Deflection – Pipe deflection will be required for the majority of joints in the pipe alignment. The pipe deflections are labeled in the attached alignment plan and will be either 1 or 2 degrees. All pipe joints, regardless of deflection will be wrapped in geotechnical fabric and taped to prevent flowable fill from entering the pipes (see pipe and backflow placement). The pipe curve alignment depicting the layout, pipe sizes and deflection angles has been included with this submittal.

To achieve deflection in a pipe joint, the center line of the downstream pipe will be marked on the top at the upstream end of the pipe using a plum bob, level and tape. The upstream pipe will be inserted into the end of the downstream pipe in a straight alignment with coupler per ADS installation guidelines. The center line of the

upstream end of the upstream pipe will be marked. The perpendicular pull length will be calculated using the degree of deflection and pipe length, and the end of the upstream pipe will be pulled the appropriate distance and direction to achieve the required deflection angle. All measurements and deflections angles will be recorded in a field book. Nomenclature of joints will be recorded as xR or xL. The x will indicate the joint from the down gradient end of the pipe system moving upwards. The "R" will indicate the right pipe as one looks up gradient and the "L" will indicate the left pipe.

After the pipe has been placed in the trench and the joints have been wrapped with geo-textile fabric and prior to placement of the flowable fill in the pipe trench, pipe joint deflection will be measured by a professional land surveyor. The surveyor will gather horizontal location and elevation information in two locations for each pipe stick. This will enable a CAD drawing to be prepared that accurately depicts the joint deflections by comparing it to the placement of the previous pipe. The surveyor will provide a signed and sealed as-built drawing depicting the pipe deflection and invert elevation at each joint for each of the parallel pipe runs after the installation of the pipe has been completed.

Method for Measuring Pipe Deflection - Pipe deflection will be measured to ensure conformance with ADS guidelines. A pipe mandrel will be pulled through the pipe no less than 30 days after the installation of the HDPE pipe. According to the attached ADS technical note TN-5.07, maximum allowable deflection for the pipe is 5% of the base diameter of the HDPE pipe. Therefor a mandrel dimension of 33.06 inches in diameter will be pulled for the test (see table 1 in TN-5.07).

Specification Item 8, sub-bullets 8 and 10 require inspection of the pipe and pipe deflection measurements: 1) after placement of the flowable fill and 2) after completion of backfilling the landfill.

Signature _____

Print Name ____Rob Moss_____

Title _____Project Manager_____

Date _____May 10th, 2012_____

HUNTER Construction Group Inc.

118 Timber Road,
Mooresville, NC 28115
Tel: (704) 799-7570
Fax: (704) 799-7576

Letter of Transmittal

To:	Civil & Environmental Consultants, Inc	**Job:**	North Mecklenburg Infill
	2030 S. Tryon Street	**Attn:**	Scott Brown
	Charlotte, NC 28203	**Re:**	36” HDPE Pipe Installation

WE ARE SENDING YOU

SUB. AGREE.	PLANS	SHOP DRAWINGS	COPY OF LETTER	CHANGE ORDER	SAMPLES	SPECIFICATIONS	SUBMITTAL
							X

COPIES	DATE	NO.	DESCRIPTION
1	05-22-12		Infill 36” HDPE Pipe Installation
1	05-22-12		ADS Tech Note 5.02
1	05-22-12		Pipe Layout Plan
1	05-22-12		SG&H Calcs
1	05-22-12		Filter Fabric Spec
1	05-22-12		Screw-Anchor Figure 1
1	05-22-12		Anchor Data

THESE ARE TRANSMITTED as checked below:

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As requested [ ] Returned for corrections [ ] Return _____ corrected prints

For review and comment _____

REMARKS

05-22-2012

Signature **Date**

HUNTER
Construction Group Inc.

36" HDPE Pipe Installation **May 22th, 2012**

Method for Preventing Pipe Flotation – The pipes will be restrained to prevent flotation in the trench due to the addition of the flowable fill. After the 12 inch X 12 inch X 4 inch compacted borrow material or flowable fill pre-formed block pipe supports are formed and the pipe installed in the trench, the HDPE pipe will be secured to the trench bottom using a commercially available screw anchor assembly. These tie-down systems are commonly used to secure manufactured homes, and a cut sheet has been included with the submittal.

The uplift calculation for the pipe has been attached and shown below:

$U = (A_{disp} * \delta_{CLSM})$

Where,

A_{disp} = Area of pipe displaced by CLSM, ft^2

δ_{CLSM} = Unit weight of CLSM, lb/ft^3

U = Uplift due to CLSM, lb/ft

			Uplift Force (lbs/ft)*		
Outside Pipe Diameter (in)	Pipe Area (ft^2)	CLSM Unit Weight (lb/ft^3)	CLSM to top of pipe (lbs/ft)	CLSM to springline of pipe (lbs/ft)	CLSM to bottom quarter of pipe (lbs/ft)
42	9.6	127	1221.9	610.9	238.3

In addition, the flowable fill will be placed in three lifts. The first lift, poured to the springline of the pipe will be allowed to set for 3-4 hours prior to the installation of the next lift. The straps, which have a breaking strength of 4725.0 lbs (3,150 lbs, working load) will be installed every five linear feet along the length of the HDPE pipe. This spacing is based on flowable fill installation to the springline of the pipe and the calculation for this spacing is shown below:

118 Timber Road ▪ Mooresville, NC 28115 ▪ 704-799-7570 ▪ 704-799-7576 (fax)

	Spacing along Pipe Run (ft)		
Anchor Breaking Strength (lbs)	CLSM to top of pipe *	CLSM to springline of pipe*	CLSM to bottom quarter of pipe *
4750.0	2.6	5.2	13.3
*Includes safety factor of 1.5			

There is a potential for both pipe bending beam deflection and diametrical deflection due to the buoyancy of the pipe and the pressure applied by the tie-down straps. To reduce pipe deflection due to point loads from the tie-down straps, 4”X4” timbers will be installed on top of the pipe, parallel to the pipe for the entire length of each pipe. The screw anchor assembly straps will be installed over the 4”x4” to secure the wood and pipe (see figure 1). This will evenly distribute the load from the straps across the full length of each pipe stick.

The timber strapped to the top of the pipe has a greater resistance to the bending beam deflection caused by pipe flotation, so the timber bending beam deflection has been used to calculate the beam deflection of the pipe. This calculation assumes flowable fill is placed to the springline of the pipe, strap spacing every five linear feet, and no bending resistance from the pipe itself.

The bending beam calculation for the timber pipe support is shown below:
Maximum deflection $= 5\ q\ L^3 / E\ I\ 384$

Where

q = load (buoyance force, lbs/in)

L = beam length (distance between straps, in)

E = Modulus of Elasticity (lbs/in^2)

I = Moment of Inertia (in^4)

Bending Beam Deflection of 3.5 in X 3.5 in Timber Supports				
Distance between straps (in)	Upward Force (lbs/in) - CLSM to springline of pipe	Modulus of Elasticity (lbs/in^2)*	Moment of Inertia (in^4)	Deflection (in)
60	50.9	1600000	12.5	0.007
*Information provided by Southern Pine Council				

It is not anticipated that a deflection of this magnitude will have a negative effect on the slope or placement of the pipe in the trench.
According to ADS and ASTM, polyethylene pipe will perform acceptably with up to 7.5% deflection. By adding CLSM to the springline of the pipe and strap spacing

every five linear feet, the diametrical deflection will be less than 7.5% or 2.6 in, see below:

Diametric Pipe Deflection			
Pipe Stiffness ($lbs*in^2$)*	Upward Force (lbs/in) - CLSM to springline of pipe	Calculated Deflection (in)	Allowable Deflection (in)*
22	50.9	2.3	2.6
*Information provided by ADS			

After the first lift has set 3-4 hours, flowable fill will be placed to the top of the pipe and allowed to set for an additional 3-4 hours. After setting, the straps will be cut, and the lumber will be removed from the top of pipe. The flowable fill will then be placed over the top of pipe to match the thickness shown in detail SK-1.

Pipe and Backfill Placement – The pipe will be installed in accordance with SG&H 36 inch diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012 (attached), ADS recommendations and the approved construction drawings. The trench excavation will begin on the downstream end of the pipe run at the installed concrete headwall. Excavation will be accomplished utilizing a track hoe with a bucket with “teeth” to the design grade. Excavation will occur in one hundred foot runs. The trench will be excavated to 10 ½ feet in width and to the proper depth in accordance with Sheet SK-1 and the approved construction plans. The trench bottom will then be mechanically compacted and field density tests performed. The field density tests of the trench bottom will be measured to ensure compaction to 95% of maximum standard Proctor density and will be conducted at the frequency indicated below:

<u>Test Frequency 1</u>

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet of installation, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

<u>Test Frequency 2</u>

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Unsuitable soils or rocks in the trench bottom will be removed in accordance with SG&H 36 in. Diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012. In accordance with SG&H SK-1, four inches of flowable fill will be required under the HPDE pipe. To accomplish this, 12 inch X 12 inch X 4 inch high compacted soil mounds using the borrow material will be constructed under the HDPE pipe at five foot intervals. These compacted soil mounds will act as spacers between the pipe bottom and the trench.

After the pipe is placed in the trench on the support mounds, the joints will be articulated to provide a joint deflection in accordance with the pipe plan layout. All pipe joints will be wrapped in geo-textile fabric and taped to secure the wrap to each joint. The fabric will be a class IV non-woven geotextile fabric in accordance with NCRS – MEFOTG, Section IV Construction Specification 495. After the joints are wrapped with the geotextile fabric and taped, the joint deflection will be measured by a professional land surveyor.

Once the pipe deflection has been recorded, the pipes will be restrained using the screw anchor system to prevent pipe flotation. Flowable fill will be installed according to ADS recommendations to the depth shown in SK-1. The placement of flowable fill in the first trench will consist of the first lift of flowable fill placed to the springline of the HDPE pipe at the downstream end with the fill tapering down at the upstream end of the 100 foot trench section. Additional lifts will be installed until the fill matches the depth shown in SK-1.

To prevent flowable fill from entering the pipe, a pipe plug will be installed in the open end of the pipe and will be removed after the flowable fill has set. Two samples of flowable fill from each trench section will be taken per ASTM D 4832 and tested by a certified testing facility to determine the 28 day compressive strength, which should be between 500 and 1,000 psi. Each truck load of CLSM shall be tested in the field per ASTM D6103 and show conformance to the specified slump result of 9 inches.

Visual inspection of the pipe joints will occur after the placement of the flowable fill in order to ensure that flowable fill or excessive water leakage into the pipe joints is not occurring. Photographs of the joints and installation will be taken before and after the filling of each trench section.

After the last lift of flowable fill has set approximately 24 hours, un-compacted material will be placed over the pipe in accordance with SG&H SK-1. In those areas where filling will be required to reach final grade, sidefill will be placed on either side of the completed trench in 18 inch lifts. The sidefill areas will be compacted, the soil directly over the trench will not be compacted. The sidefill for those areas that require fill (fill height above non-native, undisturbed soil) will be placed and compacted in accordance with SG&H 36 inch Diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012 (attached). Compacted sidefill will be tested to ensure compaction to 95% of maximum standard Proctor density.

This testing will be conducted at the following frequency:

Test Frequency 1

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 lf of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

Test Frequency 2

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Method for Measuring Joint Deflection – Pipe deflection will be required for the majority of joints in the pipe alignment. The pipe deflections are labeled in the attached alignment plan and will be either 1 or 2 degrees. All pipe joints, regardless of deflection will be wrapped in geotechnical fabric and taped to prevent flowable fill from entering the pipes (see pipe and backflow placement). The pipe curve alignment depicting the layout, pipe sizes and deflection angles has been included with this submittal.

To achieve deflection in a pipe joint, the center line of the downstream pipe will be marked on the top at the upstream end of the pipe using a plum bob, level and tape. The upstream pipe will be inserted into the end of the downstream pipe in a straight alignment with coupler per ADS installation guidelines. The center line of the upstream end of the upstream pipe will be marked. The perpendicular pull length will be calculated using the degree of deflection and pipe length, and the end of the upstream pipe will be pulled the appropriate distance and direction to achieve the required deflection angle. All measurements and deflections angles will be recorded in a field book. Nomenclature of joints will be recorded as xR or xL. The x will indicate the joint from the down gradient end of the pipe system moving upwards. The “R” will indicate the right pipe as one looks up gradient and the “L” will indicate the left pipe.

After the pipe has been placed in the trench and the joints have been wrapped with geo-textile fabric and prior to placement of the flowable fill in the pipe trench, pipe joint deflection will be measured by a professional land surveyor. The surveyor will gather horizontal location and elevation information in two locations for each pipe stick. This will enable a CAD drawing to be prepared that accurately depicts the joint deflections by comparing it to the placement of the previous pipe. The surveyor will provide a signed and sealed as-built drawing depicting the pipe deflection and invert

elevation at each joint for each of the parallel pipe runs after the installation of the pipe has been completed.

Method for Measuring Pipe Deflection - Pipe diametric deflection will be measured to ensure conformance with ADS guidelines. A pipe mandrel will be pulled through the pipe no less than 30 days after the installation of the HDPE pipe. According to the attached ADS technical note TN-5.07, maximum allowable deflection for the pipe is 7.5% of the base diameter of the HDPE pipe. A mandrel dimension of 33.06 inches in diameter will be pulled for the test (see table 1 in TN-5.07). The mandrel test for vertical deflection will be ran twice - 24 hours after the final lift of flowable fill has been installed, and again not less than 30 days after the backfill of the pipe with un-compacted fill.

Signature _____

Print Name ____Rob Moss_____

Title _____Project Manager_____

Date _____May 22th, 2012_____

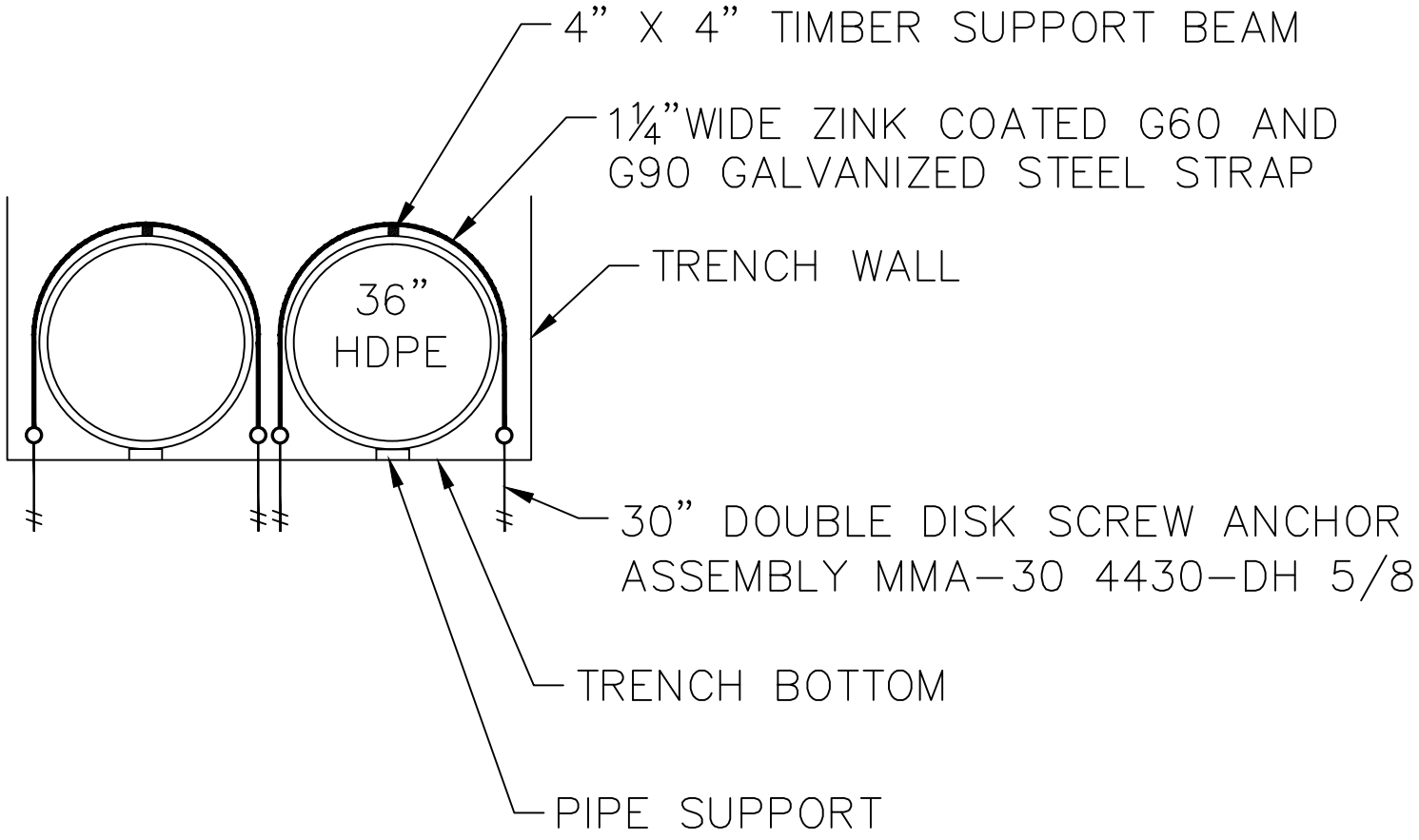

FIG. 1 SCREW ANCHOR TIE DOWN SYSTEM

HUNTER Construction Group Inc.

118 Timber Road,
Mooresville, NC 28115
Tel: (704) 799-7570
Fax: (704) 799-7576

Letter of Transmittal

To:	Civil & Environmental Consultants, Inc	**Job:**	North Mecklenburg Infill
	2030 S. Tryon Street	**Attn:**	Scott Brown
	Charlotte, NC 28203	**Re:**	36” HDPE Pipe Installation

WE ARE SENDING YOU

SUB. AGREE.	PLANS	SHOP DRAWINGS	COPY OF LETTER	CHANGE ORDER	SAMPLES	SPECIFICATIONS	SUBMITTAL
							X

COPIES	DATE	NO.	DESCRIPTION
1	05-22-12		Infill 36” HDPE Pipe Installation
1	05-22-12		ADS Tech Note 5.02
1	05-22-12		Pipe Layout Plan
1	05-22-12		SG&H Calcs
1	05-22-12		Filter Fabric Spec
1	05-22-12		Screw-Anchor Figure 1
1	05-22-12		Anchor Data

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As requested [ ] Returned for corrections [ ] Return _____ corrected prints

For review and comment _____

☐ APPROVED ☐ NOT APPROVED
☒ APPROVED AS CORRECTED
☐ REVISE AND RESUBMIT
☐ RESUBMIT FOR RECORD COPY

Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

BY: BPStrohman
DATE: 25 May 2012
SIMPSON GUMPERTZ & HEGER INC.
41 Seyon St., Building 1, Suite 500
Waltham, MA 02453

REMARKS

05-22-2012

Signature **Date**

HUNTER
Construction Group Inc.

36" HDPE Pipe Installation **May 22th, 2012**

Method for Preventing Pipe Flotation – The pipes will be restrained to prevent flotation in the trench due to the addition of the flowable fill. After the 12 inch X 12 inch X 4 inch compacted borrow material or flowable fill pre-formed block pipe supports are formed and the pipe installed in the trench, the HDPE pipe will be secured to the trench bottom using a commercially available screw anchor assembly. These tie-down systems are commonly used to secure manufactured homes, and a cut sheet has been included with the submittal.

The uplift calculation for the pipe has been attached and shown below:

$U = (A_{disp} * \delta_{CLSM})$

Where,

A_{disp} = Area of pipe displaced by CLSM, ft^2

δ_{CLSM} = Unit weight of CLSM, lb/ft^3

U = Uplift due to CLSM, lb/ft

			Uplift Force (lbs/ft)*		
Outside Pipe Diameter (in)	Pipe Area (ft^2)	CLSM Unit Weight (lb/ft^3)	CLSM to top of pipe (lbs/ft)	CLSM to springline of pipe (lbs/ft)	CLSM to bottom quarter of pipe (lbs/ft)
42	9.6	127	1221.9	610.9	238.3

In addition, the flowable fill will be placed in three lifts. The first lift, poured to the springline of the pipe will be allowed to set for 3-4 hours prior to the installation of the next lift. The straps, which have a breaking strength of 4725.0 lbs (3,150 lbs, working load) will be installed every five linear feet along the length of the HDPE pipe. This spacing is based on flowable fill installation to the springline of the pipe and the calculation for this spacing is shown below:

118 Timber Road ▪ Mooresville, NC 28115 ▪ 704-799-7570 ▪ 704-799-7576 (fax)

	Spacing along Pipe Run (ft)		
Anchor Breaking Strength (lbs)	CLSM to top of pipe *	CLSM to springline of pipe*	CLSM to bottom quarter of pipe *
4,725 lbs. ~~4750.0~~	2.6	5.2	13.3
*Includes safety factor of 1.5			

Install 2" wide x 2" deep x 4" long blocks on top of 4" x 4" timbers at strap locations.

There is a potential for both pipe bending beam deflection and diametrical deflection due to the buoyancy of the pipe and the pressure applied by the tie-down straps. To reduce pipe deflection due to point loads from the tie-down straps, 4"X4" timbers will be installed on top of the pipe, parallel to the pipe for the entire length of each pipe. The screw anchor assembly straps will be installed over the 4"x4" timbers and 2" x 2" x 4" blocks to secure the wood and pipe (see figure 1). This will evenly distribute the load from the straps across the full length of each pipe stick.

The timber strapped to the top of the pipe has a greater resistance to the bending beam deflection caused by pipe flotation, so the timber bending beam deflection has been used to calculate the beam deflection of the pipe. This calculation assumes flowable fill is placed to the springline of the pipe, strap spacing every five linear feet, and no bending resistance from the pipe itself.

The bending beam calculation for the timber pipe support is shown below:
Maximum deflection = 5 q L^3 / E I 384

L^4

Where

q = load (buoyance force, lbs/in)

L = beam length (distance between straps, in)

E = Modulus of Elasticity (lbs/in^2)

I = Moment of Inertia (in^4)

Bending Beam Deflection of 3.5 in X 3.5 in Timber Supports				
Distance between straps (in)	Upward Force (lbs/in) - CLSM to springline of pipe	Modulus of Elasticity (lbs/in^2)*	Moment of Inertia (in^4)	Deflection (in)
60	50.9	1600000	12.5	~~0.007~~ 0.42 in.
*Information provided by Southern Pine Council				

It is not anticipated that a deflection of this magnitude will have a negative effect on the slope or placement of the pipe in the trench.
According to ADS and ASTM, polyethylene pipe will perform acceptably with up to 7.5% deflection. By adding CLSM to the springline of the pipe and strap spacing

every five linear feet, the diametrical deflection will be less than 7.5% or 2.6 in, see below:

Diametric Pipe Deflection			
Pipe Stiffness ($lbs*in^2$)*	Upward Force (lbs/in) - CLSM to springline of pipe	Calculated Deflection (in)	Allowable Deflection (in)*
22	50.9	2.3	2.6
*Information provided by ADS			

This 2.3 in. does not consider vertical deflection from the installation of 150 ft of fill above the pipe, which we estimate as 1 in. based on our pipe analyses. See revisions to address the excess deflections.

~~After the first lift has set 3-4 hours, flowable fill will be placed to the top of the pipe and allowed to set for an additional 3-4 hours.~~ After setting, the straps will be cut, and the lumber will be removed from the top of pipe. The flowable fill will then be placed over the top of pipe to match the thickness shown in detail SK-1.

Pipe and Backfill Placement – The pipe will be installed in accordance with SG&H 36 inch diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012 (attached), ADS recommendations and the approved construction drawings. The trench excavation will begin on the downstream end of the pipe run at the installed concrete headwall. Excavation will be accomplished utilizing a track hoe with a bucket with "teeth" to the design grade. Excavation will occur in one hundred foot runs. The trench will be excavated to 10 ½ feet in width and to the proper depth in accordance with Sheet SK-1 and the approved construction plans. The trench bottom will then be mechanically compacted and field density tests performed. The field density tests of the trench bottom will be measured to ensure compaction to 95% of maximum standard Proctor density and will be conducted at the frequency indicated below:

<u>Test Frequency 1</u>

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet of installation, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

<u>Test Frequency 2</u>

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

After the first lift of flowable fill has set 3-4 hours, knock the 2" x 2" x 4" blocks out from under straps to allow the pipe to reround. It is likely a gap from the pipe rerounding will form between the pipe wall and the first lift of flowable fill. Fill the gap with flowable fill and allow to set for an additional 3-4 hours. After gap sets, shim between the straps and the 4"x4" timbers as needed to re-engage the straps and place flowable fill to the top of the pipe and allow to set for an additional 3-4 hours.

Unsuitable soils or rocks in the trench bottom will be removed in accordance with SG&H 36 in. Diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012. In accordance with SG&H SK-1, four inches of flowable fill will be required under the HPDE pipe. To accomplish this, 12 inch X 12 inch X 4 inch high compacted soil mounds using the borrow material will be constructed under the HDPE pipe at five foot intervals. These compacted soil mounds will act as spacers between the pipe bottom and the trench.

After the pipe is placed in the trench on the support mounds, the joints will be articulated to provide a joint deflection in accordance with the pipe plan layout. All pipe joints will be wrapped in geo-textile fabric and taped to secure the wrap to each joint. The fabric will be a class IV non-woven geotextile fabric in accordance with NCRS – MEFOTG, Section IV Construction Specification 495. After the joints are wrapped with the geotextile fabric and taped, the joint deflection will be measured by a professional land surveyor.

Once the pipe deflection has been recorded, the pipes will be restrained using the screw anchor system to prevent pipe flotation. Flowable fill will be installed according to ADS recommendations to the depth shown in SK-1. The placement of flowable fill in the first trench will consist of the first lift of flowable fill placed to the springline of the HDPE pipe at the downstream end with the fill tapering down at the upstream end of the 100 foot trench section. Additional lifts will be installed until the fill matches the depth shown in SK-1.

To prevent flowable fill from entering the pipe, a pipe plug will be installed in the open end of the pipe and will be removed after the flowable fill has set. Two samples of flowable fill from each trench section will be taken per ASTM D 4832 and tested by a certified testing facility to determine the 28 day compressive strength, which should be between 500 and 1,000 psi. Each truck load of CLSM shall be tested in the field per ASTM D6103 and show conformance to the specified slump result of 9 inches.

Visual inspection of the pipe joints will occur after the placement of the flowable fill in order to ensure that flowable fill or excessive water leakage into the pipe joints is not occurring. Photographs of the joints and installation will be taken before and after the filling of each trench section.

After the last lift of flowable fill has set approximately 24 hours, un-compacted material will be placed over the pipe in accordance with SG&H SK-1. In those areas where filling will be required to reach final grade, sidefill will be placed on either side of the completed trench in 18 inch lifts. The sidefill areas will be compacted, the soil directly over the trench will not be compacted. The sidefill for those areas that require fill (fill height above non-native, undisturbed soil) will be placed and compacted in accordance with SG&H 36 inch Diameter Corrugated HDPE Pipe Design, May 8, 2012 and Sheet SK-1, May 9, 2012 (attached). Compacted sidefill will be tested to ensure compaction to 95% of maximum standard Proctor density.

This testing will be conducted at the following frequency:

Test Frequency 1

For the first 400 linear feet of pipe, conduct field density tests at a frequency of at least four tests for each 100 lf of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in the first 400 linear feet, evaluate compaction procedures and continue to conduct four tests every 100 linear feet until no test failures occur for 16 consecutive tests. After meeting the forgoing requirements, move to Test Frequency 2.

Test Frequency 2

Conduct field density tests at a frequency of at least four tests every 200 linear feet of pipe installed. Select locations randomly and include tests on both sides of the pipe and at different elevations. If any individual test fails, remove and/or re-compact and re-test the lift until it passes. If two or more individual tests (including re-tests) fail in any 16 consecutive tests, revert to Test Frequency 1.

Method for Measuring Joint Deflection – Pipe deflection will be required for the majority of joints in the pipe alignment. The pipe deflections are labeled in the attached alignment plan and will be either 1 or 2 degrees. All pipe joints, regardless of deflection will be wrapped in geotechnical fabric and taped to prevent flowable fill from entering the pipes (see pipe and backflow placement). The pipe curve alignment depicting the layout, pipe sizes and deflection angles has been included with this submittal.

To achieve deflection in a pipe joint, the center line of the downstream pipe will be marked on the top at the upstream end of the pipe using a plum bob, level and tape. The upstream pipe will be inserted into the end of the downstream pipe in a straight alignment with coupler per ADS installation guidelines. The center line of the upstream end of the upstream pipe will be marked. The perpendicular pull length will be calculated using the degree of deflection and pipe length, and the end of the upstream pipe will be pulled the appropriate distance and direction to achieve the required deflection angle. All measurements and deflections angles will be recorded in a field book. Nomenclature of joints will be recorded as xR or xL. The x will indicate the joint from the down gradient end of the pipe system moving upwards. The “R” will indicate the right pipe as one looks up gradient and the “L” will indicate the left pipe.

After the pipe has been placed in the trench and the joints have been wrapped with geo-textile fabric and prior to placement of the flowable fill in the pipe trench, pipe joint deflection will be measured by a professional land surveyor. The surveyor will gather horizontal location and elevation information in two locations for each pipe stick. This will enable a CAD drawing to be prepared that accurately depicts the joint deflections by comparing it to the placement of the previous pipe. The surveyor will provide a signed and sealed as-built drawing depicting the pipe deflection and invert

elevation at each joint for each of the parallel pipe runs after the installation of the pipe has been completed.

Method for Measuring Pipe Deflection - Pipe diametric deflection will be measured to ensure conformance with ADS guidelines. A pipe mandrel will be pulled through the pipe no less than 30 days after the installation of the HDPE pipe. According to the attached ADS technical note TN-5.07, maximum allowable deflection for the pipe is 7.5% of the base diameter of the HDPE pipe. A mandrel dimension of 33.06 inches in diameter will be pulled for the test (see table 1 in TN-5.07). The mandrel test for vertical deflection will be ran twice - 24 hours after the final lift of flowable fill has been installed, and again not less than 30 days after the backfill of the pipe with un-compacted fill.

Signature _____

Print Name ____Rob Moss_____

Title _____Project Manager_____

Date _____May 22th, 2012_____

Appendix C

Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 5/1/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion		
LOCATION:	Huntersville, NC	PROJECT NO:	111-370.001
PLANS AND SPECS:	North Meck Infill Expansion	WEATHER:	Sunny
ISSUED DATE:	5/1/12	TEMP. RANGE (°F)	85

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:	Robb Moss	SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	

WORK PERFORMED SINCE CEC'S LAST VISIT? NO YES (describe)

Yes, installation of headwall footer, additional erosion control measures.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Pre-construction meeting, site walk

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

None

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

ADS representatives – Brad Sund and ,Shawn Coombs, Rob Moss from Hunter Construction, Todd Gingerich from CEC and Ron Gilkerson from Greenway Waste Solutions of North Meck, LLC. present at pre-construction meeting. Scott Brown from CEC participated via phone. Discussion of installation procedures including tie-down recommendations for pipe. ADS provided power point presentation depicting installation and tie-down examples for HDPE pipe.

ATTACHMENTS

Pre-con Sign-in Sheet

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

N/A

APPROVED BY

FIELD REP: TMG DATE: 5/1/2012 CEC MANAGER: Scott L B DATE: 5/1/2012

This document is draft until reviewed and approved by a Project Manager

NOTICE: Our firm's professionals are represented onsite solely to observe operations of the contractor identified to form opinions about the adequacy of those operations and to report those opinions to our client. The presence and activities of our field representative do not relieve the contractor from its obligation to meet contractual requirements. The contractor retains sole responsibility for site safety and the methods operations and sequences of construction.

May 1st, 2012

North Meck Landfill Infill 36" HPDE Pipe Installation – Pre-construction Meeting

Attendance Sign-in Sheet

Name	Company	Phone	Email
Brad Sund	ADS	704-507-4524	brad.sund@ads-pipe.com
Shawn Coombs	ADS	704 451 8844	shawn.coombs@ads-pipe.com
ROB MOSS	HUNTER CONST	704-297-9298	RMOSS@HUNTERCONSTRUCTIONGROUP.COM
Todd Gingerich	CEC Inc	980-224-8104	tgingerich@cecinc.com
RON GILHERSON	Griffin Brothers	704-895-0329	rcgilherson@griffinbrothers.com

Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 5/11/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Sunny
ISSUED DATE:		TEMP. RANGE (°F)	75

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Robb Moss

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

The downstream pre-cast headwall has been completed with the exception of the apron. First one hundred twenty feet of trench has been excavated, with both rows of 36" HDPE pipe installed, joints wrapped, and tied down with anchors and strapping. Trench and pipe were prepared for the addition of flowable fill.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Addition of flowable fill to trench. Arrived on-site at 9:30 AM. Representatives from Hunter Construction, Ron Gilkerson were present at site. Pumper truck with remotely operated pumper spout was set up at 10:00 AM waiting on first truck of flowable fill. First concrete truck arrived at 10:30 AM, flowable will was pumped to the upstream 30' of pipe trench section with no issue. Second concrete truck arrived at 11:00 AM, flowable fill was pumped to the downstream 30' of the pipe trench section with no issue. Third concrete truck arrived at 11:15 AM, flowable fill was pumped to center section of pipe run trench. Anchor straps on second and third pipe section from the upstream end, both sides, began to slip and joint between second and third pipe section on both sides rose in the trench approximately 6 inches. Three additional concrete trucks arrive and pump to downstream section, with level approaching springline of the pipe. Flowable fill trucks for the rest of the day were called off. A visual inspection of the pipe from each end of the pipe runs was conducted, and the flotation of the pipe was clearly evident. There was no evidence of flowable fill entering the wrapped joints.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

Anchor straps on second and third pipe section from the upstream end, both sides, began to slip and joint between second and third pipe section on both sides rose in the trench approximately 6 inches. Pipe flotation was observed.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

The displaced pipe sections will be removed, the trench re-excavated and pipes re-installed for flowable fill at a later date. Additional strapping, in accordance with the technical specifications, will be installed. Also, additional care will be taken during the pumping of the flowable fill to spread the fill over a larger area in the trench, thus preventing large displacement and pressure differences against the pipe and trench walls.

ATTACHMENTS

Photos included in project photo log

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

Civil & Environmental Consultants, Inc.

Date _____

APPROVED BY

FIELD REP: TMG DATE: 5-11-12 CEC MANAGER: Scott L B DATE: 5-11-12

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Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 5/17/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Sunny
ISSUED DATE:		TEMP. RANGE (°F)	73

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Robb Moss, Chuck

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

After displacement of first 120' section of pipes by flowable fill and rainwater, all pipe was removed from trench. 100' of pipe was re-installed and strapped and trench was prepped for addition of flowable fill. Strapping was increased from original installation on 5/11, each pipe was individually strapped at an interval +/- every 5 lf. Concrete apron for downstream headwall was installed at 9:00 AM this morning.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Arrived at site at 9:30 AM, three loads of flowable fill added to the strapped pipe and trench. Finishing work for downstream headwall apron.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

No unexpected observations, no movement of pipes or trench wall due to flowable fill addition.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

Pipe installation will continue in 60' trench sections. Pipe strapping will be installed at same interval as witnessed today.

ATTACHMENTS

Photos included in project photo log.

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 5/17/12 CEC MANAGER: Scott L B DATE: 5/17/12

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Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 5/18/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Sunny
ISSUED DATE:		TEMP. RANGE (°F)	72

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

The trench excavation was extended and pipe placed in the trench to 180 lf from headwall. The trench was prepped, support blocks installed, and pipe was strapped and prepared for addition of flowable fill (CSLM).

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Pipe trenching, strapping and addition of CLSM was ongoing. Cured CLSM support blocks were on site and being used to raise the pipe 4" above the bottom of the trench. A pallet of these blocks was present at the site, the blocks appeared to be the correct dimension and of good quality. Screw anchors were being installed using an electric driver with a gas generator. Five truck loads of CLSM were placed prior to 12:00 PM. A total of ten truck loads of fill were scheduled to be placed by the end of the work day. Joel Patterson was on-site providing stake-out survey and checking as-built information on the installed pipe. The final lift of the CLSM pour was completed for the first 2 pipe lengths adjacent to the downstream headwall (1' above top of pipe) after the straps were cut and the wood timbers removed.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

A pipe deflection was apparent at the joint between the 5th and 6th pipe above the downstream headwall. This deflection was measured to be 1.3 degrees at the joint. The plan deflection of that joint was 1 degree. The pipe alignment will be adjusted upstream to gain back this slight difference in placement.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

Pipe strapping was installed at 5' spacing which was adequate to prevent pipe flotation. Spread tests for the flowable fill loads were conducted at the manufacturer, but will be conducted by Summit testing at the site for future placement of flowable fill. Summit was on-site collecting samples for trench bottom field density tests – at an interval of one test every 20 linear ft of trench. All field density tests collected so far yielded compaction levels above the 95% specification.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 5/18/12 CEC MANAGER: Scott L B DATE: 5/18/12

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Date _____

Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 5/24/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Partly Cloudy
ISSUED DATE:		TEMP. RANGE (°F)	83

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

The trench excavation was extended and pipe placed in the trench to 350 lf from the downstream headwall. The trench was prepped, support blocks installed, and pipe was strapped and prepared for addition of flowable fill (CSLM). Several loads of CLSM were poured before 9:00 AM. Platipus™ Anchors were installed on approximately 40 lf of pipe, at the upstream end of the pipe run. These anchors were used when the ¾" Minuteman™ Anchors augers (largest size) would not penetrate the ground, even with the assistance of the equipment mounted drill.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Approximately eight loads of CLSM were placed today, starting and 8:30 AM and ending around 12:00 PM. Track hoe excavation of the trench was on-going, as was the installation of the Platipus™ Anchors. The anchor "bits" were being installed with the use of a jack hammer and three laborers. The downstream 200 lf of pipe run was completely covered with CLSM by 12:00 P.M. Patterson Surveying was present, providing the contractor with stake-out and as-built survey information on the pipe. Summit Engineering was present and testing trench bottom samples for compaction, and testing each load of CLSM for spread.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

The installation of the Platipus™ anchors was very slow-going due to the presence of weathered rock in the trench bottom. During the installation of the 7th load of CLSM, the downstream most Platipus ™ anchor pulled free from the trench bottom when CLSM reached the springline of the pipe. Although the anchor pulled free, field survey data showed that the pipe did not significantly rise off of the bottom of the trench. CLSM was not installed upstream of the pulled anchor, but will resume in the morning after the first lift has set up overnight.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

A spread test for each flowable fill load was conducted at the site, and the reports and results will be distributed to CEC and the owner. All field density tests collected so far yielded compaction levels above the 95% specification. The Platipus™ Anchors will continue to be utilized to prevent flotation of the pipe.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

Civil & Environmental Consultants, Inc.

Date **5/24/2012**

APPROVED BY

FIELD REP: TMG DATE: 5/24/12 CEC MANAGER: Scott L B DATE: 5/24/12

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PIPE AS-BUILT

NORTH MECK LANDFILL

CONTRACTOR SIGNATURE Chuck Fulp DATE

PATTERSON LAND SURVEYING, PA
P.O. Box 5010 Mooresville, NC 28117

SURVEYOR SIGNATURE
DATE 5/25/12

HORIZONTAL ALIGNMENT (0.40 MAXIMUM)				VERTICAL ALIGNMENT (0.30 MAXIMUM)					
STATION	LEFT	RIGHT	TOLERANCE: YES/NO	LEFT	RIGHT	DESIGN ELEV	DIFF. IN ELEV LEFT	DIFF. IN ELEV RIGHT	TOLERANCE: YES/NO
0+00			YES	676.00	676.00	676.00	0.00	0.00	YES
0+20			YES	676.51	676.38	676.34	0.17	0.04	YES
0+40			YES	676.74	676.87	676.69	0.05	0.18	YES
0+60			YES	677.24	677.17	677.03	0.21	0.14	YES
0+80			YES	677.58	677.51	677.38	0.20	0.13	YES
1+00			YES	677.83	677.96	677.74	0.09	0.23	YES
1+20			YES	678.05	678.02	678.08	0.03	0.06	YES
1+40			YES	678.32	678.34	678.43	0.11	0.09	YES
1+60			YES	678.67	678.57	678.77	0.10	0.20	YES
1+80	0.40	0.40	YES	678.95	678.96	679.12	0.17	0.16	YES
2+00	0.27	0.40	YES	679.21	679.21	679.48	0.27	0.27	YES
2+20	0.08	0.37	YES	679.62	679.77	679.82	0.20	0.05	YES
2+40	0.05	0.04	YES	679.94	679.96	680.17	0.23	0.21	YES
2+60	0.08	0.17	YES	680.21	680.21	680.51	0.30	0.30	"
2+80	0.10	0.08	"	680.61	680.59	680.86	0.25	0.27	"
3+00	0.06	0.11	"	681.16	681.21	681.22	0.06	0.01	"
3+20	0.11	0.17	"	681.74	681.69	681.57	+0.17	+0.12	"
3+40	0.10	0.12	"	682.21	682.22	681.92	+0.29	+0.30	"
3+60	0.15	0.14	"	682.51	682.57	682.27	+0.24	+0.30	"
3+80	0.05	0.06	"			682.62			
4+00						682.96			
4+20						683.31			
4+40						683.66			
4+60						684.01			
4+80						684.36			
5+00						684.70			
5+20						685.06			
5+40						685.41			
5+60						685.76			
5+80						686.10			
6+00						686.44			
6+20						686.79			
6+40						687.14			
6+60						687.49			
6+80						687.84			
7+00						688.18			

NORTH CAROLINA PROFESSIONAL SEAL L-3717 LAND SURVEYOR JOEL H. PATTERSON III

Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 5/29/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Partly Cloudy with Light Rain
ISSUED DATE:		TEMP. RANGE (°F)	79

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

Pipe was installed in the trench to 500 lf from the downstream headwall, additional Platipus anchors were installed and flowable fill placed over the top of the 200 lf closest to the downstream headwall.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

CLSM was placed in the downstream section of pipe to cover the installed pipe starting 200 lf from the downstream headwall and working upstream. CLSM placed to approximately 550 lf from downstream headwall, total of 100 yards of CLSM placed today. Rock drill machine "John Henry" was being utilized to drill holes for the Platipus Anchors. Alternate tie-down straps (nylon webbing) was used, in place of Platipus anchor tie-down straps which were not available. Summit Engineering was on-site performing soil and concrete testing. Patterson Surveying was on-site providing construction staking and as-built surveying services.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

Alternate tie-down straps (nylon webbing) was used, in place of Platipus anchor tie-down straps which were not available. Thirteen foot sections of pipe will installed at 740 lf from the downstream headwall. Although the supplier, Ferguson pipe, did not have this length of pipe in stock, ADS will ship the required pipe from an Ohio plant location.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

At the current pace of installation, it was estimated that the thirteen foot pipe sections will be required in the next two days.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 5/29/12 CEC MANAGER: Scott L B DATE: 5/29/12

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PIPE AS-BUILT

NORTH MECK LANDFILL

CONTRACTOR SIGNATURE Chuck Felp DATE

PATTERSON LAND SURVEYING, PA
P.O. Box 5010 Mooresville, NC 28117

SURVEYOR SIGNATURE
DATE 5/31/12

NORTH CAROLINA PROFESSIONAL SEAL L 3717 LAND SURVEYOR JOEL M. PATTERSON

	HORIZONTAL ALIGNMENT (0.40 MAXIMUM)			VERTICAL ALIGNMENT (0.30 MAXIMUM)						
STATION	LEFT	RIGHT	TOLERANCE: YES/NO	LEFT	RIGHT	DESIGN ELEV	DIFF. IN ELEV LEFT	DIFF. IN ELEV RIGHT	TOLERANCE: YES/NO	PIPE COVER
0+00			YES	676.00	676.00	676.00	0.00	0.00	YES	HEADWALL
0+20			YES	676.51	676.38	676.34	0.17	0.04	YES	1.17
0+40			YES	676.74	676.87	676.69	0.05	0.18	YES	1.20
0+60			YES	677.24	677.17	677.03	0.21	0.14	YES	1.18
0+80			YES	677.58	677.51	677.38	0.20	0.13	YES	1.15
1+00			YES	677.83	677.96	677.74	0.09	0.23	YES	1.25
1+20			YES	678.05	678.02	678.08	0.03	0.06	YES	1.42
1+40			YES	678.32	678.34	678.43	0.11	0.09	YES	1.31
1+60			YES	678.67	678.57	678.77	0.10	0.20	YES	1.40
1+80	0.40	0.40	YES	678.95	678.96	679.12	0.17	0.16	YES	1.13
2+00	0.27	0.40	YES	679.21	679.21	679.48	0.27	0.27	YES	1.10
2+20	0.08	0.37	YES	679.62	679.77	679.82	0.20	0.05	YES	1.17
2+40	0.05	0.04	YES	679.94	679.96	680.17	0.23	0.21	YES	1.31
2+60	0.08	0.17	YES	680.21	680.21	680.51	0.30	0.30	YES	1.56
2+80	0.10	0.08	YES	680.61	680.59	680.86	0.25	0.27	YES	1.07
3+00	0.06	0.11	YES	681.16	681.21	681.22	0.06	0.01	YES	1.11
3+20	0.11	0.17	YES	681.74	681.69	681.57	0.17	0.12	YES	1.31
3+40	0.10	0.12	YES	682.21	682.22	681.92	0.29	0.30	YES	1.28
3+60	0.15	0.14	YES	682.51	682.57	682.27	0.24	0.30	YES	1.56
3+80	0.05	0.06	YES	682.83	682.85	682.62	0.21	0.23	"	1.59
4+00	0.15	0.20	"	683.11	683.13	682.96	0.15	0.17	"	1.47
4+20	0.07	0.15	"	683.57	683.56	683.31	0.26	0.25	"	1.40
4+40	0.06	0.19	"	683.88	683.94	683.66	0.22	0.28	"	1.40
4+60	0.25	0.29	"	683.84	684.29	684.01	0.17 -	0.28	"	1.40
4+80	0.21	0.25	"	684.20	684.52	684.36	0.16 -	0.16	"	1.27
5+00	0.26	0.29	"	684.58	684.85	684.70	0.12 -	0.15	"	1.33
5+20	0.22	0.25	"	684.90	685.11	685.06	0.16 -	0.05	"	
5+40	0.15	0.22	"	685.30	685.42	685.41	0.11 -	0.01	"	
5+60	0.03	0.18	"	685.79	685.72	685.76	0.03	0.04 -	"	
5+80	0.30	0.23	"	686.22	686.25	686.10	0.12	0.15	"	
6+00	0.30	0.30	"	686.64	686.64	686.44	0.20	0.20	"	
6+20	0.02	0.21	"	686.93	686.94	686.79	0.14	0.15	"	
6+40	0.02	0.28	"	687.17	687.27	687.14	0.03	0.13	"	
6+60						687.49				
6+80						687.84				
7+00						688.18				

Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 6/4/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Overcast
ISSUED DATE:		TEMP. RANGE (°F)	82

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

Pipe was installed in the trench to 760 lf from the downstream headwall, additional Platipus and screw-type auger anchors were installed and flowable fill placed over the top of the 500 lf closest to the downstream headwall. Auger anchors were used when soil conditions allowed.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

CLSM was placed in the downstream section of pipe to cover the installed pipe up to 600 lf from the downstream headwall and working upstream. CLSM placed in trench to approximately 780 lf from downstream headwall, slightly more than of 200 yards of CLSM placed today. Auger screw anchors were installed using skid steer mounted drill rig. Summit Engineering was on-site performing soil testing. Patterson Surveying was on-site providing construction staking and as-built surveying services.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

Four twenty foot sections of pipe were installed starting at 740 lf from the downstream headwall. The twenty foot sticks were installed instead of the thirteen foot sticks (per construction plans), which have not yet arrived on-site from the manufacturer. The surveyor verified that the alignment is consistent with the construction plans.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

Thirteen foot sticks will be delivered to the site in the afternoon, according to ADS.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 6/4/12 CEC MANAGER: Scott L B DATE: 6/4/12

This document is draft until reviewed and approved by a Project Manager

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Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 6/5/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Overcast
ISSUED DATE:		TEMP. RANGE (°F)	71

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

Pipe was installed in the trench to 825 lf from the downstream headwall, additional screw-type auger anchors were installed and flowable fill placed over the top of the 600 lf closest to the downstream headwall. Auger anchors were used when soil conditions allowed.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

CLSM was placed in the downstream section of pipe to cover the installed pipe up to 700 lf from the downstream headwall and working upstream. CLSM placed in trench to approximately 825 lf from downstream headwall, slightly more than 150 yards of CLSM placed today. Auger screw anchors were installed using skid steer mounted drill rig. The screw augers were not able to be installed starting at station 8+25 due to presence of rock. "John Henry" rock drill used to pre-drill pilot holes for the Platipus™ anchors. The trench sidewalls were marked with orange paint to indicate 1' of cover over the top of the installed pipe. Summit testing was not present onsite. Patterson survey was not present onsite.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

Twenty foot sections of pipe were installed to 820 lf from the downstream headwall. The twenty foot sticks were installed instead of the thirteen foot sticks (per construction plans). Sixteen of the thirteen foot sticks were delivered at 10:30 AM.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

The surveyor verified that the alignment is consistent with the construction plans, and that no additional thirteen foot sticks will be required to reach the headwall.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 6/5/12 CEC MANAGER: Scott L B DATE: 6/5/12

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Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 6/8/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Sunny
ISSUED DATE:		TEMP. RANGE (°F)	83

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

Pipe was installed in the trench to 950 lf from the downstream headwall, additional screw-type auger anchors were installed and flowable fill placed over the top of the 750 lf closest to the downstream headwall. Auger anchors were used when soil conditions allowed. Thirteen foot pipe sticks were installed in the trench.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

CLSM was placed in the downstream section of pipe to cover the installed pipe up to 750 lf from the downstream headwall and working upstream. CLSM placed in trench to approximately 925 lf from downstream headwall. Auger screw anchors were installed using skid steer mounted drill rig. The trench sidewalls were marked with orange paint to indicate 1' of cover over the top of the installed pipe. Summit testing was not present onsite. Patterson survey was present onsite and provided staking to station 1000.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

Thirteen foot sticks were secured in trench but moved slightly when CLSM was added to the trench. The shorter pipe sticks appeared to be more susceptible to lateral shifting from the concrete displacement. Patterson survey verified that the sticks shifted 0.15' maximum, within tolerances.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

No additional thirteen foot sticks will be required to reach the headwall.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 6/8/12 CEC MANAGER: Scott L B DATE: 6/8/12

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PIPE AS-BUILT

NORTH MECK LANDFILL

CONTRACTOR SIGNATURE _____ DATE _____

PATTERSON LAND SURVEYING, PA
P.O. Box 5010 Mooresville, NC 28117

SURVEYOR SIGNATURE
DATE 6/19/12

NORTH CAROLINA PROFESSIONAL SEAL L-3717 LAND SURVEYOR JOEL H. PATTERSON II

	HORIZONTAL ALIGNMENT (0.40 MAXIMUM)			VERTICAL ALIGNMENT (0.30 MAXIMUM)						
STATION	LEFT	RIGHT	TOLERANCE: YES/NO	LEFT	RIGHT	DESIGN ELEV	DIFF. IN ELEV LEFT	DIFF. IN ELEV RIGHT	TOLERANCE: YES/NO	PIPE COVER
0+00			YES	676.00	676.00	676.00	0.00	0.00	YES	Headwall
0+20			YES	676.51	676.38	676.34	0.17	0.04	YES	1.17
0+40			YES	676.74	676.87	676.69	0.05	0.18	YES	1.20
0+60			YES	677.24	677.17	677.03	0.21	0.14	YES	1.18
0+80			YES	677.58	677.51	677.38	0.20	0.13	YES	1.15
1+00			YES	677.83	677.96	677.74	0.09	0.23	YES	1.25
1+20			YES	678.05	678.02	678.08	0.03	0.06	YES	1.42
1+40			YES	678.32	678.34	678.43	0.11	0.09	YES	1.31
1+60			YES	678.67	678.57	678.77	0.10	0.20	YES	1.40
1+80	0.40	0.40	YES	678.95	678.96	679.12	0.17	0.16	YES	1.13
2+00	0.27	0.40	YES	679.21	679.21	679.48	0.27	0.27	YES	1.10
2+20	0.08	0.37	YES	679.62	679.77	679.82	0.20	0.05	YES	1.17
2+40	0.05	0.04	YES	679.94	679.96	680.17	0.23	0.21	YES	1.31
2+60	0.08	0.17	YES	680.21	680.21	680.51	0.30	0.30	YES	1.56
2+80	0.10	0.08	YES	680.61	680.59	680.86	0.25	0.27	YES	1.07
3+00	0.06	0.11	YES	681.16	681.21	681.22	0.06	0.01	YES	1.11
3+20	0.11	0.17	YES	681.74	681.69	681.57	0.17	0.12	YES	1.31
3+40	0.10	0.12	YES	682.21	682.22	681.92	0.29	0.30	YES	1.28
3+60	0.15	0.14	YES	682.51	682.57	682.27	0.24	0.30	YES	1.56
3+80	0.05	0.06	YES	682.83	682.85	682.62	0.21	0.23	YES	1.59
4+00	0.15	0.20	YES	683.11	683.13	682.96	0.15	0.17	YES	1.47
4+20	0.07	0.15	YES	683.57	683.56	683.31	0.26	0.25	YES	1.40
4+40	0.06	0.19	YES	683.88	683.94	683.66	0.22	0.28	YES	1.40
4+60	0.25	0.29	YES	683.84	684.29	684.01	0.17	0.28	YES	1.46
4+80	0.21	0.25	YES	684.20	684.52	684.36	0.16	0.16	YES	1.27
5+00	0.26	0.29	YES	684.58	684.85	684.70	0.12	0.15	YES	1.33
5+20	0.22	0.25	YES	684.90	685.11	685.06	0.16	0.05	YES	1.43
5+40	0.15	0.22	YES	685.30	685.42	685.41	0.11	0.01	YES	1.48
5+60	0.03	0.18	YES	685.79	685.72	685.76	0.03	0.04	YES	1.19
5+80	0.30	0.23	YES	686.22	686.25	686.10	0.12	0.15	YES	1.33
6+00	0.30	0.30	YES	686.64	686.64	686.44	0.20	0.20	YES	1.31
6+20	0.02	0.21	YES	686.93	686.94	686.79	0.14	0.15	YES	1.34
6+40	0.02	0.28	YES	687.17	687.27	687.14	0.03	0.13	YES	1.04
6+60	0.09	0.05	YES	687.40	687.53	687.49	0.09	0.04	YES	1.01
6+80	0.05	0.07	YES	687.86	687.86	687.84	0.02	0.02	YES	1.13
7+00	0.08	0.30	YES	688.29	688.31	688.18	0.11	0.13	YES	1.32

PIPE AS-BUILT

NORTH MECK LANDFILL

CONTRACTOR SIGNATURE _____ DATE _____

PATTERSON LAND SURVEYING, PA
P.O. Box 5010 Mooresville, NC 28117

SURVEYOR SIGNATURE _____
DATE 4/19/12

NORTH CAROLINA PROFESSIONAL SEAL L-3717 LAND SURVEYOR JOEL N. PATTERSON III

HORIZONTAL ALIGNMENT (0.40 MAXIMUM)				VERTICAL ALIGNMENT (0.30 MAXIMUM)						
STATION	LEFT	RIGHT	TOLERANCE: YES/NO	LEFT	RIGHT	DESIGN ELEV	DIFF. IN ELEV LEFT	DIFF. IN ELEV RIGHT	TOLERANCE: YES/NO	PIPE COVER
7+20	0.23	0.27	YES	688.46	688.54	688.53	0.07	0.01		
7+40	0.30	0.30	YES	688.85	688.87	688.88	0.03	0.01		1.17
7+60	0.03	0.22	YES	688.23	689.25	689.22	0.01	0.03		
7+80	0.07	0.17	YES	689.60	689.61	689.57	0.03	0.04		
8+00	0.05	0.06	YES	689.82	689.79	689.92	0.10	0.13		
8+20	0.28	0.32	YES	690.11	690.17	690.27	0.16	0.10		
8+40	0.18	0.16	YES	690.59	690.56	690.62	0.03	0.06		
8+60	0.15	0.23	YES	690.76	690.76	690.96	0.20	0.20		
8+80	0.27	0.27	YES	691.21	691.24	691.31	0.10	0.07		
9+00	0.25	0.13	YES	691.79	691.69	691.66	0.13	0.03		
9+20	0.27	0.23	YES	692.29	692.28	692.00	0.29	0.28		
9+40	0.08	0.11	YES	692.62	692.58	692.35	0.27	0.23		
9+60	0.25	0.02	YES	692.95	692.98	692.70	0.25	0.28		
9+80	0.18	0.09	YES	693.35	693.35	693.05	0.30	0.30		
10+00	0.04	0.14	YES	693.55	693.70	693.40	0.15	0.30		
10+20	0.19	0.21	YES	693.96	693.96	693.75	0.21	0.21		
10+40	0.09	0.20	YES	694.07	694.10	694.07	0.01	0.03		
10+60						694.44				
10+80						694.80				

Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 6/20/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Sunny
ISSUED DATE:		TEMP. RANGE (°F)	85

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

All pipe has been installed to within 20' of upstream headwall, and covered with CLSM. A section, approximately 600' in length near the upstream headwall has been covered with soil. A small section of sidefill along the west side of this fill has been compacted, approximately 200' in length. The trench for the footer to the upstream headwall was excavated and filled with water.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Additional fill was being placed on the pipe with earth moving equipment near the center of the installed drainage pipe. There was no compaction equipment (roller) operating. The footer trench was pumped out dry during the visit. Summit testing was not present onsite. Patterson survey was not present onsite. Rebar work for the footer excavation was on-going.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

The upstream headwall footer excavation was full of water; a pump was being used to drain the trench by pumping water into the newly installed pipes.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

Patterson survey will be placing markers onsite to identify the limits of the trench box for the compaction of the added fill, landfill operators (Greenway Waste Solutions of North Meck, Inc.) were conducting the grading operations and are aware of the restrictions regarding compaction over the newly installed pipe.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 6/20/12 CEC MANAGER: Scott L B DATE: 6/20/12

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Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 6/25/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Sunny
ISSUED DATE:		TEMP. RANGE (°F)	82

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

All pipe has been installed to within 20' of upstream headwall, and covered with CLSM. All pipe with the exception of the upstream most 100' have been backfilled with soil. Survey stakes have been placed to mark the centerline of the trench. Sections of the backfill adjacent to the pipe trench have been compacted for most of the length of the pipes. The footer for the upstream headwall has been poured.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Summit testing was present onsite performing field density tests on the backfill for the trench sidefill. Patterson survey was not present onsite. Rebar work for the headwall was on-going, headwall forms were being installed. The footer and headwall trench were being pumped out to remove standing water.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

There was a breach in the silt fence near the downstream headwall near the lower sediment basin adjacent to the creek.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

Summit testing will perform field density tests all day today and tomorrow prior to additional lifts of fill in the sidefill area. Owner was notified of the silt fence issue and will repair.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 6/25/12 CEC MANAGER: Scott L B DATE: 6/25/12

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Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 6/27/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Sunny
ISSUED DATE:		TEMP. RANGE (°F)	83

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

All pipe has been installed to the forms for the upstream headwall. 20' section of pipe adjacent to the headwall has not been covered with CLSM. All pipes with the exception of the upstream most 100' have been backfilled with soil. Survey stakes have been placed to mark the centerline of the trench. Sections of the backfill adjacent to the pipe trench have been compacted for most of the length of the pipes. The forms for the upstream headwall were partially installed; rebar reinforcement for the upstream headwall was partially installed.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Summit testing was present onsite performing field density tests on the backfill for the trench sidefill. Patterson survey was not present onsite. Rebar work for the headwall was on-going, headwall forms were being installed. The footer and headwall trench were being pumped out to remove standing water.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

There was a breach in the silt fence near the downstream headwall near the lower sediment basin adjacent to the creek, same issue as previously noted.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

Summit testing will perform field density tests all day today and tomorrow prior to additional lifts of fill in the sidefill area. Owner was notified again of the silt fence issue and will repair today. Headwall should be poured by the end of the week, then apron excavated and apron rebar installed early next week. Final pours for apron concrete and remainder of flowable fill will most likely take place on Tuesday or Wednesday of next week.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 6/27/12 CEC MANAGER: Scott L B DATE: 6/27/12

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Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 6/29/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Sunny
ISSUED DATE:		TEMP. RANGE (°F)	79

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

The forms and rebar has been formed for the upstream headwall pour. Pump truck was onsite preparing for the pour this morning.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

The pump truck and 3 truckloads of 5,000 psi concrete were brought in for the pouring of the headwall. Rebar was in place, and the pipe was protruding through the form for the headwall.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

The pump truck began to pump concrete into the forms for the center portion of the headwall. The upstream face of the headwall forms began to tilt out at the toe. Concrete pumping was stopped, and the form was pushed back into place using mechanical equipment and lumber. The form was able to be shifted back so that the face of the form was offset approximately 1" from the original position. Although the rebar remained in the original location within the forms, this will result in additional 1" of concrete along the face of the headwall. Some of the concrete was able to enter the pipes, due to the gap between the form and the end of the pipe. Filter fabric was wrapped around the pipe end in the forms to reduce the amount of concrete that could enter the pipe.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

The headwall forms will be removed by the end of the day, so that excess concrete that was able to enter the ends of the pipes can be removed. Equipment and concrete grout may be required to remove the excess concrete and provide a clean finish on the headwall. The apron excavation apron rebar installation will be completed early next week. Final pours for apron concrete and remainder of flowable fill will most likely take place on Tuesday or Thursday of next week (Wednesday the 4th is a holiday).

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 6/29/12 CEC MANAGER: Scott L B DATE: 6/29/12

This document is draft until reviewed and approved by a Project Manager

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contractor from its obligation to meet contractual requirements. The contractor retains sole responsibility for site safety and the methods operations and sequences of construction.

Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 7/11/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Partly Cloudy
ISSUED DATE:		TEMP. RANGE (°F)	84

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

Upstream headwall has been finished and rip rap placed between headwall and wetland area. Excavation around the downstream headwall has taken place.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Excavation for the downstream headwall connection to the existing creek. Survey stake out of this connection.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

The excavation for the channel that will connect the downstream headwall to the existing creek will need to be shifted slightly to avoid the existing well, and to keep the haul road intact in this area. Patterson Surveying had painted orange location markings for the top of bank and the toe of slope for this drainage channel connection in a location that would preserve the haul road and the well, provide 15-20' of bottom width on the channel and 2:1 channel side slopes.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

After consultation with the contractor and surveyor, the work was temporarily halted so that owner direction (Ron Gilkerson) could be provided for the drainage channel connection between the downstream headwall and the existing creek. In a phone call later that afternoon, the contractor was released by the owner to complete the excavation in accordance with the orange painted markings. The haul road was to be lowered in elevation and shifted to allow for a less severe slope along the drainage channel. The existing well would be protected and the haul road access maintained.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 7/11/2012 CEC MANAGER: Scott L B DATE: 7/11/2012

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Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date 7/12/2012

PROJECT INFORMATION

PROJECT NAME:	North Meck Infill Expansion Pipe		
LOCATION:	North Meck Landfill	PROJECT NO:	111-370.001
PLANS AND SPECS:	Erosion Control / Construction Plans / Specs	WEATHER:	Cloudy with Drizzle
ISSUED DATE:		TEMP. RANGE (°F)	81

PERSONNEL

CEC FIELD REP:	Todd Gingerich	CEC PROJ. MANAGER:	Scott Brown
CLIENT:	Greenway Waste Solutions of North Meck, LLC	CLIENT CONTACT:	Ron Gilkerson
CONSTRUCTION MANAGER:		SUPERVISOR:	
CONTRACTORS:	Hunter Construction	SUPERVISOR:	Chuck Fulp, West Hunter

WORK PERFORMED SINCE CEC'S LAST VISIT? YES (describe)

Additional excavation around the downstream headwall has taken place. Excavation along the sediment basin adjacent to the existing headwall was underway.

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Excavation for the downstream headwall connection to the existing creek. Excavation of the north sediment basin.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

Excavation of the haul road should be minimized. Also, adjusting the slopes form 1:1 to 2:1 along the well should be completed.

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

The haul road was to be lowered in elevation and shifted to allow for a less severe slope along the drainage channel, after consultation with the owner, the contract was told to proceed without additional excavation or alteration to the haul road. The existing well would be protected (owner would provide the protection if required) and the haul road access maintained. The north sediment basin was being shifted to allow for haul road access around the upstream headwall.

ATTACHMENTS

None

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

None

APPROVED BY

FIELD REP: TMG DATE: 7/12/12 CEC MANAGER: Scott L B DATE: 7/12/12

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PIPE AS-BUILT

NORTH MECK LANDFILL

CONTRACTOR SIGNATURE _____ DATE _____

PATTERSON LAND SURVEYING, PA
P.O. Box 5010 Mooresville, NC 28117

SURVEYOR SIGNATURE _____
DATE 8/3/12

HORIZONTAL ALIGNMENT (0.40 MAXIMUM)				VERTICAL ALIGNMENT (0.30 MAXIMUM)						
STATION	LEFT	RIGHT	TOLERANCE: YES/NO	LEFT	RIGHT	DESIGN ELEV	DIFF. IN ELEV LEFT	DIFF. IN ELEV RIGHT	TOLERANCE: YES/NO	PIPE COVER
7+20	0.23	0.27	YES	688.46	688.54	688.53	0.07	0.01	YES	1.27
7+40	0.30	0.30	YES	688.85	688.87	688.88	0.03	0.01	YES	1.17
7+60	0.03	0.22	YES	688.23	689.25	689.22	0.01	0.03	YES	1.17
7+80	0.07	0.17	YES	689.60	689.61	689.57	0.03	0.04	YES	1.07
8+00	0.05	0.06	YES	689.82	689.79	689.92	0.10	0.13	YES	1.03
8+20	0.28	0.32	YES	690.11	690.17	690.27	0.16	0.10	YES	1.00
8+40	0.18	0.16	YES	690.59	690.56	690.62	0.03	0.06	YES	1.03
8+60	0.15	0.23	YES	690.76	690.76	690.96	0.20	0.20	YES	1.07
8+80	0.27	0.27	YES	691.21	691.24	691.31	0.10	0.07	YES	1.03
9+00	0.25	0.13	YES	691.79	691.69	691.66	0.13	0.03	YES	1.21
9+20	0.27	0.23	YES	692.29	692.28	692.00	0.29	0.28	YES	1.52
9+40	0.08	0.11	YES	692.62	692.58	692.35	0.27	0.23	YES	1.27
9+60	0.25	0.02	YES	692.95	692.98	692.70	0.25	0.28	YES	1.59
9+80	0.18	0.09	YES	693.35	693.35	693.05	0.30	0.30	YES	1.77
10+00	0.04	0.14	YES	693.55	693.70	693.40	0.15	0.30	YES	1.87
10+20	0.19	0.21	YES	693.96	693.96	693.75	0.21	0.21	YES	1.47
10+40	0.09	0.20	YES	694.07	694.10	694.07	0.01	0.03	YES	1.47
10+60	0.19	0.17	YES	694.63	684.61	694.44			YES	1.06
10+80	0.08	0.05	YES	694.88	694.85	694.80				

NORTH CAROLINA PROFESSIONAL SEAL L-3717 LAND SURVEYOR JOHN H. PATTERSON III

Appendix D

Photo Number: 1

Description:

Sediment basin 1, looking east, taken March 30

Photo Number: 2

Description:

Sediment basin 1, looking east, taken March 30

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on: 3/20/12

Photo Number: 3

Description:

Sediment basin 2, looking east, taken March 30.

Photo Number: 4

Description:

Sediment basin 2, looking west, taken March 30.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name:	GWSNM
Project Number:	111-370
Author:	Scott Brown
Photographs Taken on:	3/20/12

Photo Number: 5

Description:

Ditch connecting Sediment basins 1 and 2, looking west. Picture taken March 30.

Photo Number: 6

Description:

Sediment Basin 2, looking east. March 30.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on: 3/20/12

Photo Number: 7

Description:

Ditch connecting SB-1 and SB-2, looking west. April 4.

Photo Number: 8

Description:

Ditch connecting SB-1 and SB-2. April 8.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name:	GWSNM
Project Number:	111-370
Author:	Scott Brown
Photographs Taken on:	4/4/12 & 4/8/12

Photo Number: 9

Description:

SB-1, looking southeast. April 24.

Photo Number: 10

Description:

Downstream headwall for infill pipe — footer, looking north. SB-2. May 1.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on: 4/24/12 & 5/1/12

Photo Number: **11**

Description:

Downstream headwall for infill pipe. Looking north. May 1.

Photo Number: **12**

Description:

Downstream headwall for infill pipe. Looking towards SB-2. May 1.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on: 5/1/12

Photo Number: 13

Description:

Downstream headwall for infill pipe. Looking east. May 5.

Photo Number: 14

Description:

Downstream headwall for infill pipe. Looking east. May 5.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name:	GWSNM
Project Number:	111-370
Author:	Scott Brown
Photographs Taken on:	5/5/12

Photo Number: 15

Description:

Pouring headwall for downstream end of infill pipe. May 7.

Photo Number: 16

Description:

Pouring headwall for downstream end of infill pipe. May 7.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on: 5/7/12

Photo Number: **17**

Description:

Trench and pipe for first 120 lf of pipe and trench, strapped down to trench.

Downstream headwall almost complete with the exception of the apron. Taken 5/11/12

Photo Number: **18**

Description:

Excavation of footer for headwall apron turn-down. 5/11/12

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Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 19

Description:

Trench and pipe—looking downstream. 5/11/12

Photo Number: 20

Description:

Trench and pipe—looking downstream. 5/11/12

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 21

Description:

Pumping—first ruck of flowable fill into upstream portion of first trench. 10:30 AM 5/11/12

Photo Number: 22

Description:

Pumping—second truck of flowable fill into down-stream section. 11:00 AM

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name:	GWSNM
Project Number:	111-370
Author:	Scott Brown
Photographs Taken on:	

Photo Number: 23

Description:

Pumping of third truck of flowable fill into center section of first 120' trench section. Flotation on 2 upstream pipe sections starting to occur. 11:15 AM 5/11/12

Photo Number: 24

Description:

Flotation of on upstream pipe sections after 3 additional trucks added to trench. 1:30 PM 5/11/12

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 25

Description:

Arrived onsite at 9:30 AM, pipe installed in trench looking upstream from headwall. Strapping increased and each pipe strapped individually. 5-17-12

Photo Number: 26

Description:

First truck of flowable fill pumped downstream section adjacent to headwall. Some portion of this first pumping, included headwall apron concrete (aggregate, 5,000 psi). This occurred on the most downstream 10' of pipe length adjacent to the headwall. 5-17-12

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 27

Description:

Downstream headwall apron poured at 9:00 AM. 5-17-12.

Photo Number: 28

Description:

Pumping at center of trench. 5-17-12.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 29

Description:

Flowable fill against head-wall to top of pipe. 5-17-12.

Photo Number: 30

Description:

Flowable fill support blocks — cured for three days. 5-18-12

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 31

Description:

Downstream flowable fill after 24 hour set , support a person walking. Addition of CLSM to upstream section. 180 LF installed. 5-18-12

Photo Number: 32

Description:

Driving screw anchors with electric driver. Installation of support blocks. 5-18-12

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 32

Description:

Removal of wood timbers, and placement of final lift of CLSM over top of pipe. 5-18-12

Photo Number: 33

Description:

Installation of Platipus anchors, pipe in trench to 350' from downstream headwall. 5-24-12

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 34

Description:

Installation of Platipus Anchors, 350 lf from downstream headwall. 5-24-12.

Photo Number: 35

Description:

Spread test for each concrete truck load. 5-24-12.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 36

Description:

Installed Platipus Anchors. 5-24-12

Photo Number: 37

Description:

CLSM to top of pipe, to 300 lf from headwall, 5-24-12

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 38

Description:

Addition of flowable fill to 1' above installed pipe, 200 lf from downstream headwall. 5-29-12

Photo Number: 39

Description:

Platipus and tie down straps, installed 450 lf from downstream headwall.

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: **40**

Description:

Pipe in trench to 550 lf from downstream head-wall. 5-29-12

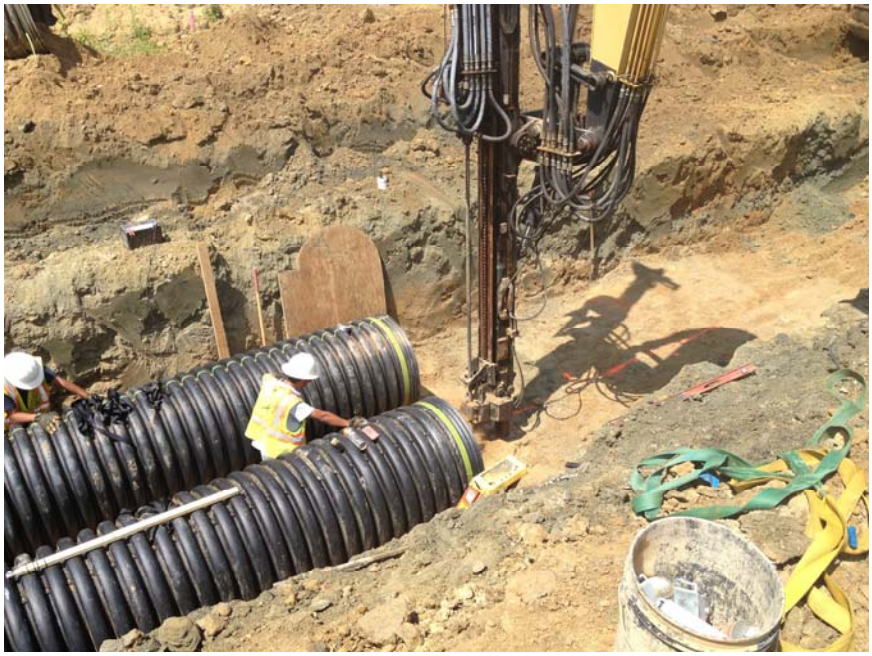

Photo Number: **41**

Description:

"John Henry" drill machine, used to bore hole for Plati-pus anchor. 5-29-12

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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 42

Description:

Installation of auger tie-down with skid steer mounted drill at 760'. 6-4-2012

Photo Number: 43

Description:

Installation of auger tie-down with skid steer mounted drill at 760'. 6-4-2012

Civil & Environmental Consultants, Inc.
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Ph: 980-224-8124 Toll Free: 855-859-9932
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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 44

Description:

CLSM installed from station 500 to 760. Top cover placed from 500 to 600. 6-4-2012

Photo Number: 45

Description:

CSLM installed at 700. Auger tie-down assemblies and platipus tie-downs used. 6-4-2012

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Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 46

Description:

Pipe being strapped in trench to 825 feet from downstream headwall. Using auger type screw anchor tie-downs and straps. 6-5-12

Photo Number: 47

Description:

Pipe tie-down installation using Platipus anchors, rock refusal for screw anchors. "John Henry" rock drill rig. 6-5-12

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Ph: 980-224-8124 Toll Free: 855-859-9932
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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 48

Description:

Placement of flowable fill to cover pipe at 700'. Orange paint markings on trench wall indicate 1' level above top of pipe. 6-5-12

Photo Number: 49

Description:

Newly installed flowable fill a 700' 6-5-12

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Ph: 980-224-8124 Toll Free: 855-859-9932
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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 50

Description:

Newly installed flowable fill to one foot above top of pipe, 6-5-12

Photo Number: 51

Description:

Pipe installed to 825, flow-albe fill covered pipe to 700, 6-5-12

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Ph: 980-224-8124 Toll Free: 855-859-9932
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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: **52**

Description:

Pipe covered with CLSM to 750. 6-8-2012

Photo Number: **53**

Description:

Pipe covered with CLSM from downstream headwall looking upstream. 6-8-2012

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Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 54

Description:

Pipe installed in trench to 950. Securing pipe with screw anchor augers. 6-8-2012

Photo Number: 55

Description:

Survey stake, trench work at 925. 6-8-2012

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Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 56

Description:

Installation of trench at 950, addition of CLSM at 850. 6-8-2012

Photo Number: 57

Description:

Installation of CLSM at 825. 6-8-2012

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Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: **58**

Description:

Excavation underway for upstream headwall footer. Water was being pumped from trench. Pipe and flowable fill installed to within 20' of headwall. 6-20-12.

Photo Number: **59**

Description:

CLSM has been installed and fill placed over upper section of pipe run. 6-20-12.

Civil & Environmental Consultants, Inc.
Charlotte, NC
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Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: **60**

Description:

Installation of fill over trench and CLSM at center section of pipe run, looking south.

Photo Number: **61**

Description:

Installation of fill over trench and CLSM at center section of pipe run, looking south. Area on left of box has been compacted. 6-20-2012.

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 62

Description:

Fill has not yet been placed over lover section of CLSM trench, lower 400'. 6-20-2012.

Photo Number: 63

Description:

Installation of fill over trench and CLSM at center section of pipe run, looking north from downstream headwall. 6-20-2012.

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 64

Description:

Erosion control berm on south side of landfill, looking east from downstream headwall area. 6-20-2012.

Photo Number: 65

Description:

Erosion control pond, riser and baffles, looking west from east end of landfill. 6 -20-2012.

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 66

Description:

Upstream headwall footer trench, stone in place, water has been pumped out. 6-20-2012.

Photo Number: 67

Description:

Upstream headwall footer trench, stone in place, water has been pumped out. 6-20-2012.

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: **68**

Description:

Infill area brought to sub-grade, looking south. Stakes mark the centerline of the box, area on right side of picture has been compacted. 6-25-12

Photo Number: **69**

Description:

Downstream section of in-fill, brought to subgrade, looking upstream. Stakes mark the centerline of the trench. Summit testing was performing density tests on the backfill in this picture. 6-25-2012.

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 70

Description:

Upper 100' of infil pipe, cover yet to be placed on flowable fill. Upstream headwall under construction. 6-25-12

Photo Number: 71

Description:

Upper 100' of infil pipe, cover yet to be placed on flowable fill. Upstream headwall under construction. 6-25-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 72

Description:

Upstream headwall under construction. 6-25-12

Photo Number: 73

Description:

Upstream headwall under construction. 6-25-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 73

Description:

Sediment control basin adjacent to upstream headwall. 6-25-12

Photo Number: 74

Description:

Sediment basin adjacent to downstream headwall. 6-25-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 75

Description:

Sediment control basin adjacent to upstream headwall. Washout occurring. 6-25-12

Photo Number: 76

Description:

Silt fence breach adjacent to downstream headwall near sediment basin. Washout occurring. 6-25-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 77

Description:

Forming the upstream headwall. Rebar installation. 6-27-12

Photo Number: 78

Description:

Forming the upstream headwall. Rebar installation. 6-27-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 79

Description:

Forming the upstream headwall. Rebar installation. 6-27-12

Photo Number: 80

Description:

Downstream headwall, looking upstream. Compaction has occurred on both sides of the box.. 6-27-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: **81**

Description:

Starting the upstream headwall pour at 6:15 AM. 6-29-12

Photo Number: **82**

Description:

Forms in place for up-stream headwall pour. 6-29-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 83

Description:

Bracing of the form for upstream headwall pour, front face shifted out at the toe. 6-29-12

Photo Number: 84

Description:

Adding concrete to wingwall on upstream pour, rebar visible. Vibrator in use to remove air pockets. 6-29-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: **85**

Description:

Adding concrete to head-wall to top of forms. 6-29-12

Photo Number: **86**

Description:

Adding concrete to wingwall on upstream pour, trowel finish of the top of wall. 6-29-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 87

Description:

Completed upstream headwall. 7-11-12

Photo Number: 88

Description:

Upstream headwall with rip rap. 7-11-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 89

Description:

Completed upstream headwall. Flow fill exposed, ready for cover. 7-11-12

Photo Number: 90

Description:

Upstream headwall with rip rap, looking north away from pipe inverts and concrete apron. 7-11-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: **91**

Description:

Excavation for down-stream headwall. Orange paint markings for channel excavation in foreground. 7-11-12

Photo Number: **92**

Description:

Excavation for down-stream headwall. 7-11-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 93

Description:

Excavation for down-stream headwall. Haul road maintained. 7-11-12

Photo Number: 94

Description:

Excavation for down-stream headwall. 7-11-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Photo Number: 95

Description:

Excavation for down-stream headwall. Haul road maintained but has been lowered from 7-11-12. 7-12-12

Photo Number: 96

Description:

Excavation for down-stream headwall. 7-12-12

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of North Meck
Infill Construction

Client Name: GWSNM
Project Number: 111-370
Author: Scott Brown
Photographs Taken on:

Appendix E

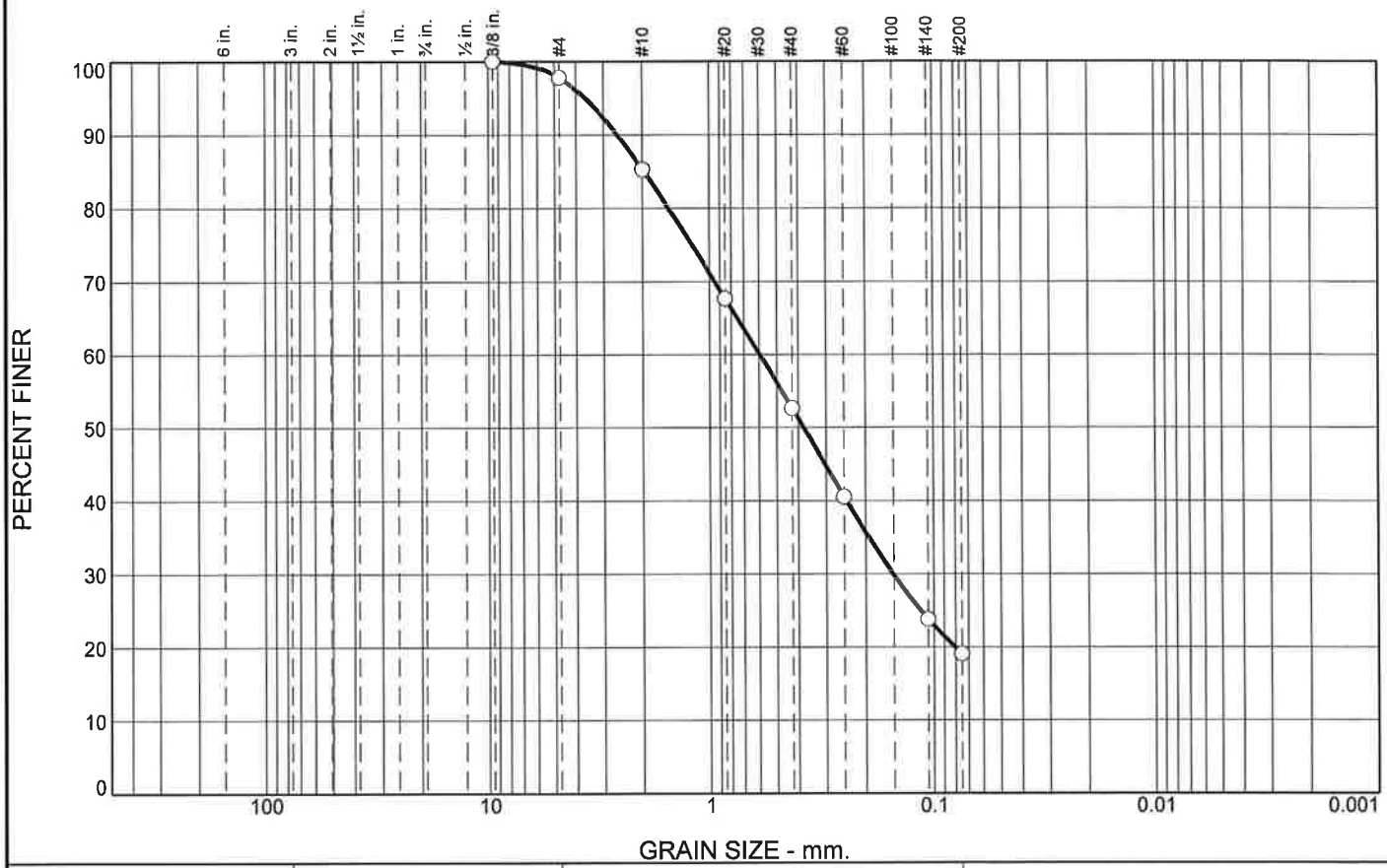
SUMMIT
LABORATORIES

Summary of Laboratory Testing
Standard Proctor Tests, ASTM D 698

Project Name: North Meck. Landfill Infill
Huntersville, NC
Client: Griffin Bros. Companies
Project Number: C-2398-12
Date Tested: 04-13-12

Sample ID	Date Reported	Max. Dry Density (pcf)	Optimum Moisture (%)
SS-1	04-13-12	119.7	12.1
SS-2	04-13-12	118.7	11.5
SS-3	04-13-12	120.0	12.5
SS-4	04-13-12	104.6	19.4
SS-5	04-13-12	110.3	17.8
SS-6	04-13-12	111.4	16.6
SS-7	04-13-12	107.0	19.9
SS-8	04-13-12	122.1	12.2
BP-1	05-02-12	122.5	11.3
BP-2	05-02-12	120.8	12.7
BP-3	05-02-12	127.0	10.
BP-4	05-02-12	126.5	10.5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.3	12.4	32.7	33.5	19.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	97.7		
#10	85.3		
#20	67.7		
#40	52.6		
#60	40.5		
#140	23.8		
#200	19.1		

* (no specification provided)

Material Description

Light-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.6030 D_{85}= 1.9724 D_{60}= 0.5942
D_{50}= 0.3785 D_{30}= 0.1517 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Location: BP-1

Date: 05-02-2012

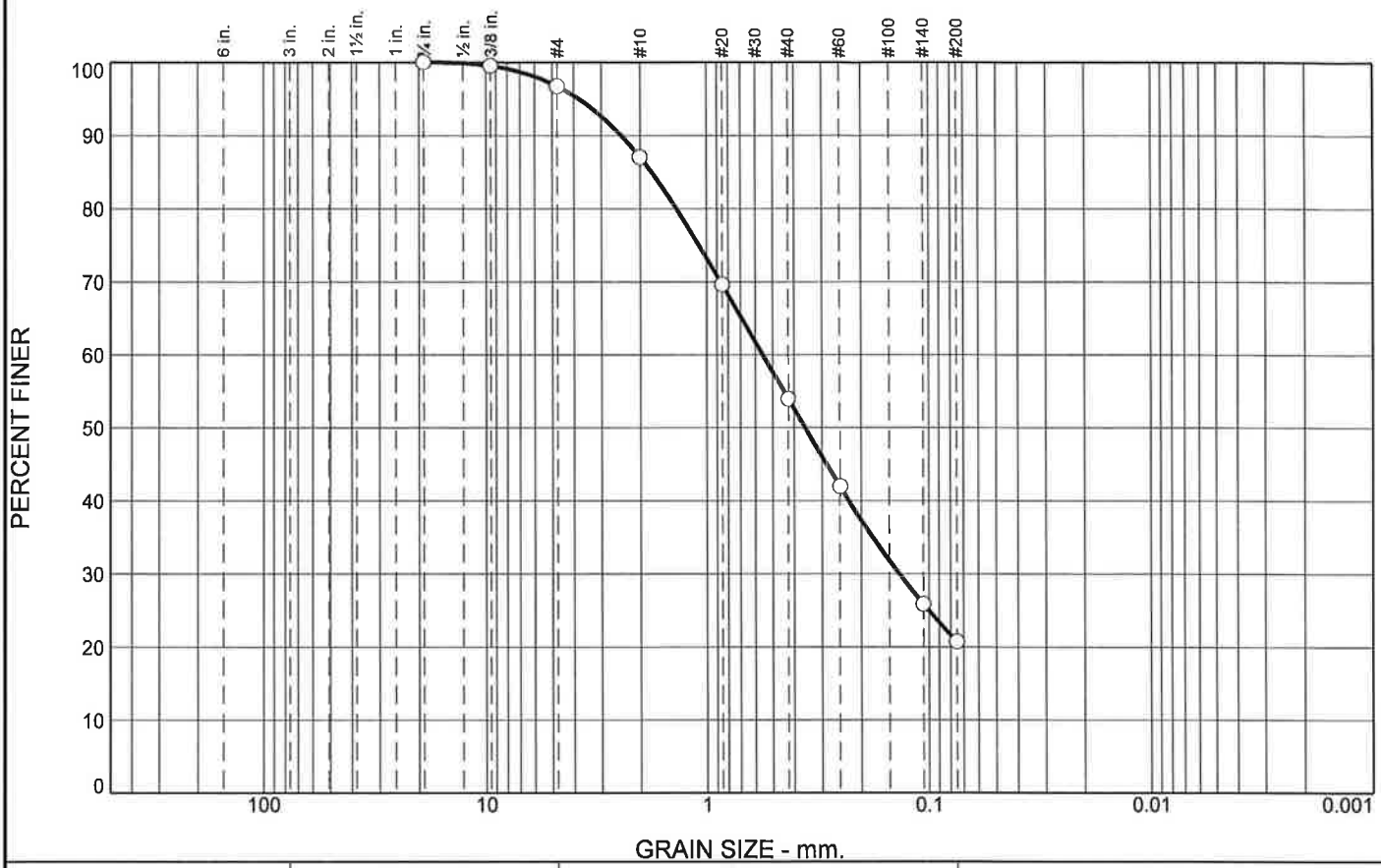
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.3	9.7	33.0	33.3	20.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	99.5		
#4	96.7		
#10	87.0		
#20	69.6		
#40	54.0		
#60	42.0		
#140	25.9		
#200	20.7		

* (no specification provided)

Material Description

Light-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.4337 D_{85}= 1.7768 D_{60}= 0.5537
D_{50}= 0.3571 D_{30}= 0.1359 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Location: BP-2

Date: 05-02-2012

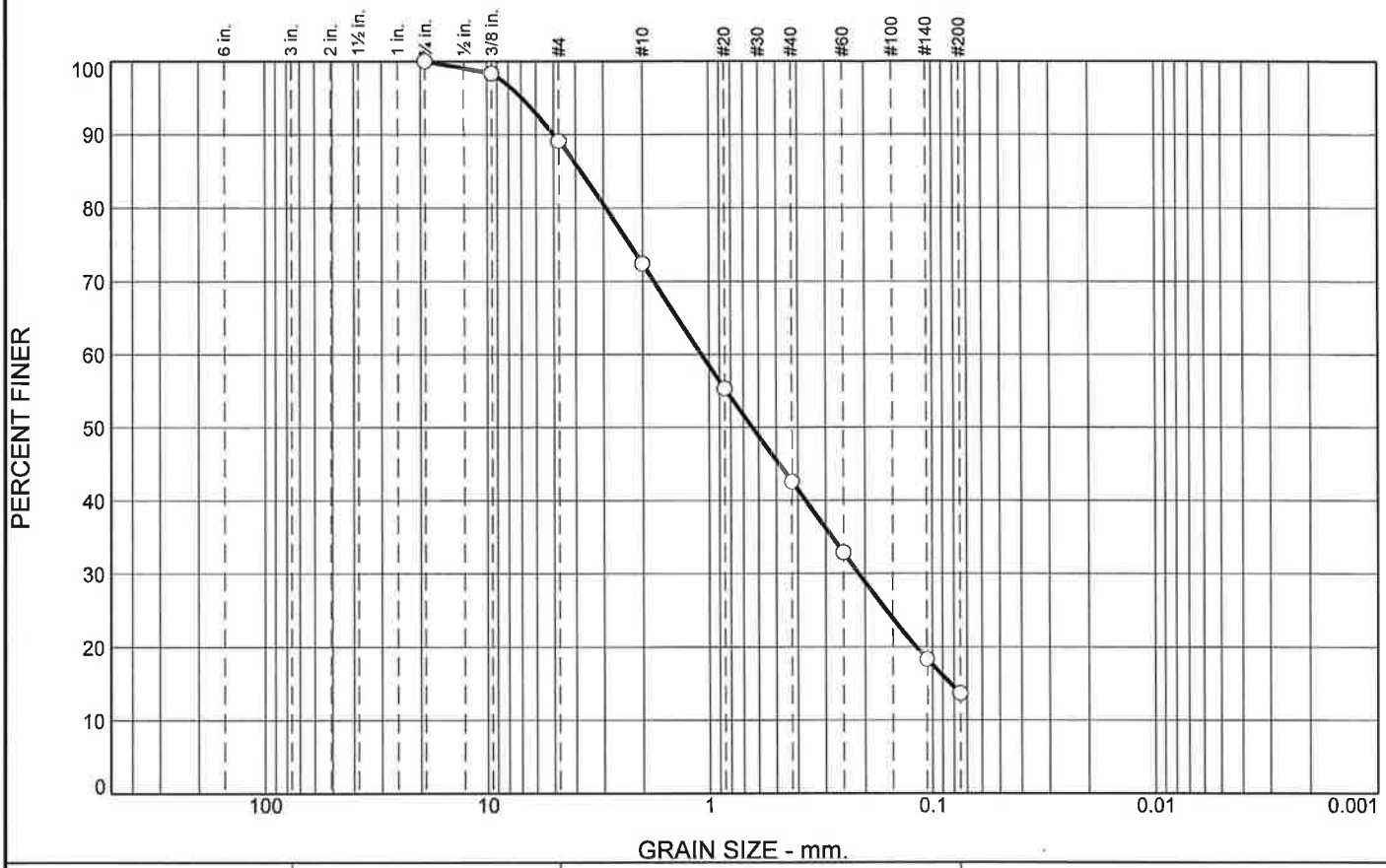
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.9	16.7	29.8	29.0	13.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	98.3		
#4	89.1		
#10	72.4		
#20	55.3		
#40	42.6		
#60	32.9		
#140	18.4		
#200	13.6		

* (no specification provided)

Material Description

Light-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 5.0124 D_{85}= 3.7865 D_{60}= 1.0817
D_{50}= 0.6389 D_{30}= 0.2135 D_{15}= 0.0832
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Location: BP-3

Date: 05-02-2012

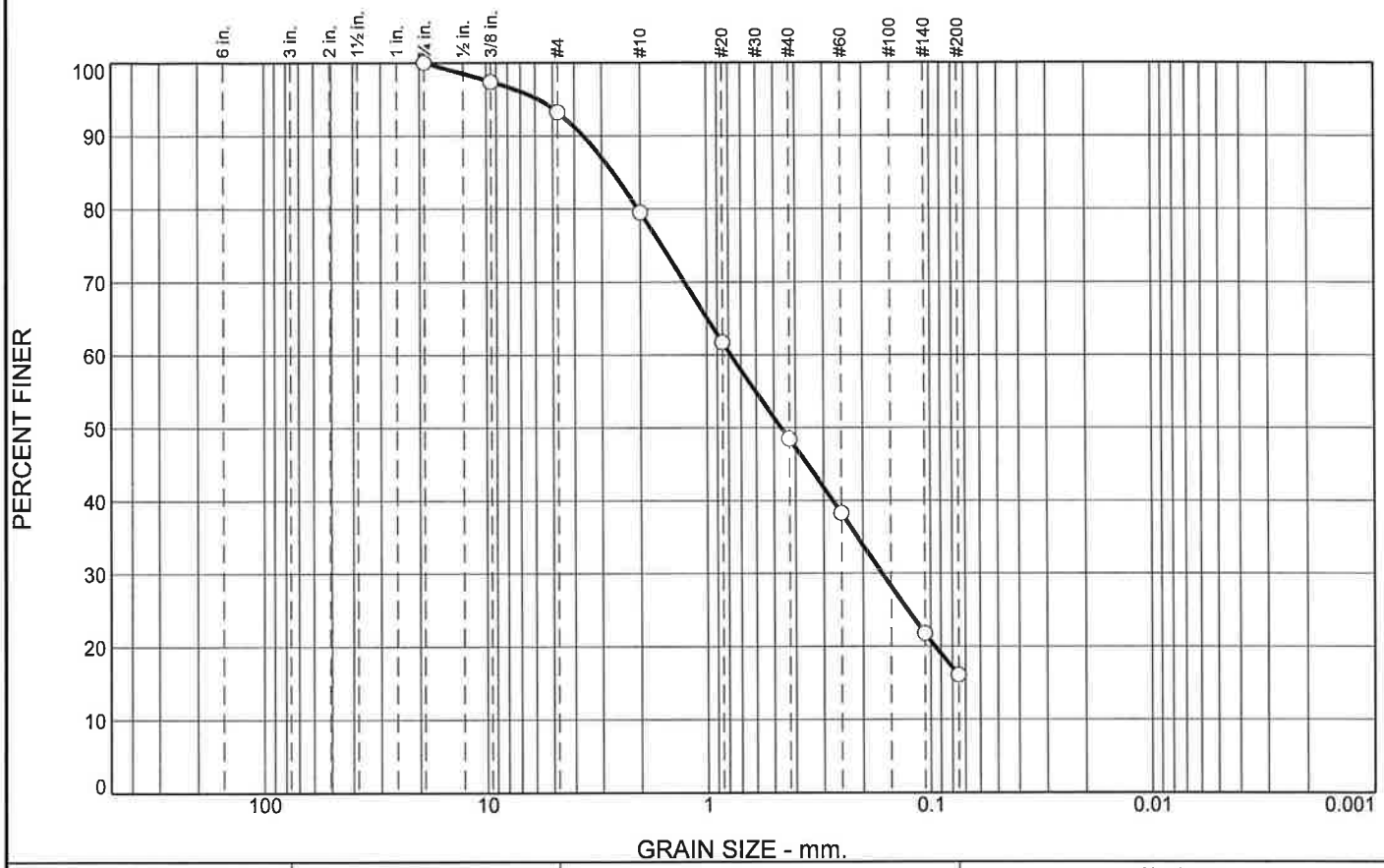
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.7	13.8	31.1	32.3	16.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	97.4		
#4	93.3		
#10	79.5		
#20	61.7		
#40	48.4		
#60	38.2		
#140	21.7		
#200	16.1		

* (no specification provided)

Material Description

Tan-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 3.6365 D_{85}= 2.6691 D_{60}= 0.7797
D_{50}= 0.4630 D_{30}= 0.1650 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Location: BP-4

Date: 05-02-2012

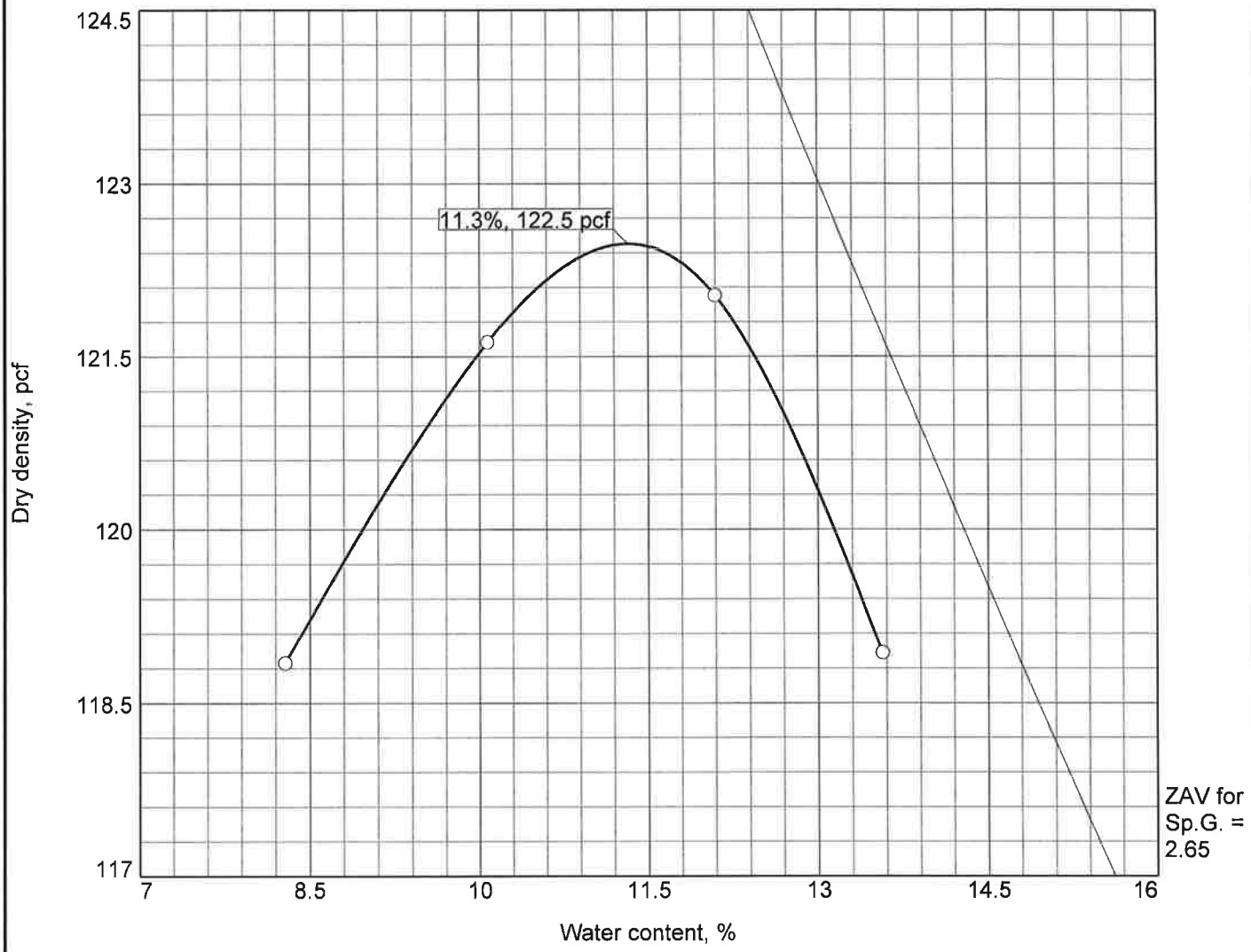
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 122.5 pcf Optimum moisture = 11.3 %	Light-Brown Silty Sand

Project No. C-2398-12 **Client:** Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
○ **Location:** BP-1

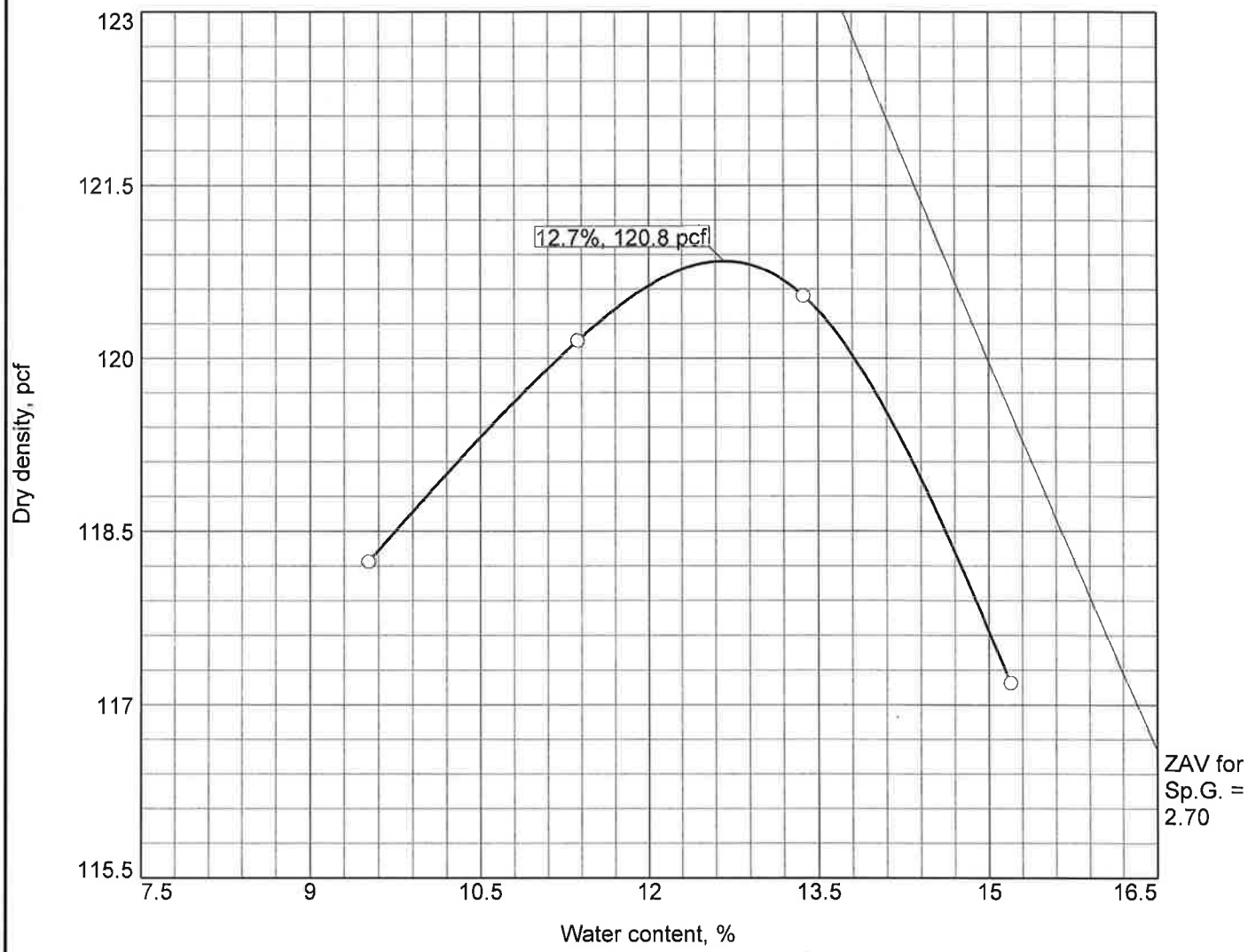
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 120.8 pcf Optimum moisture = 12.7 %	Light-Brown Silty Sand

Project No. C-2398-12 **Client:** Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
○ **Location:** BP-2

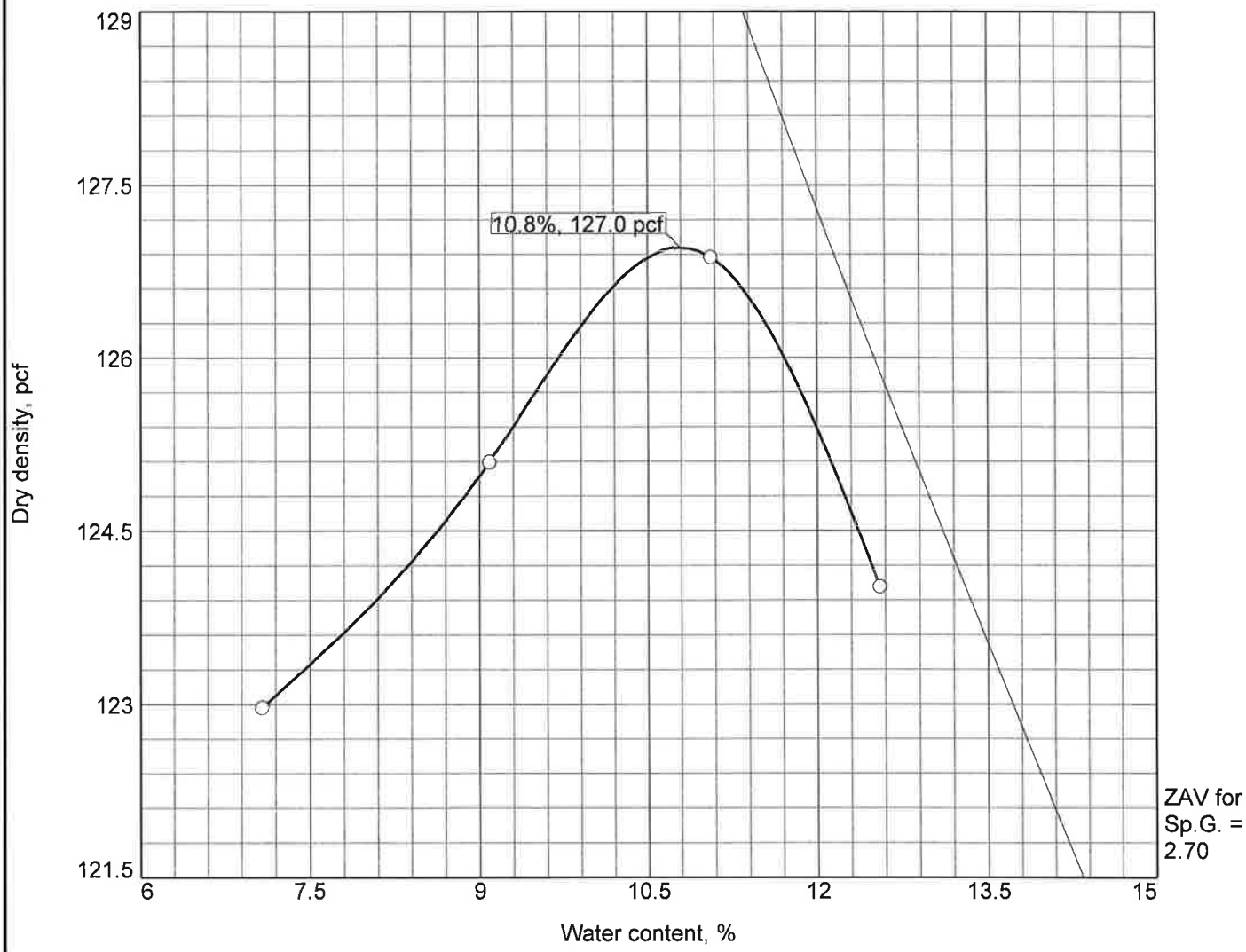
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 127.0 pcf Optimum moisture = 10.8 %	Light-Brown Silty Sand

Project No. C-2398-12 **Client:** Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
○ **Location:** BP-3

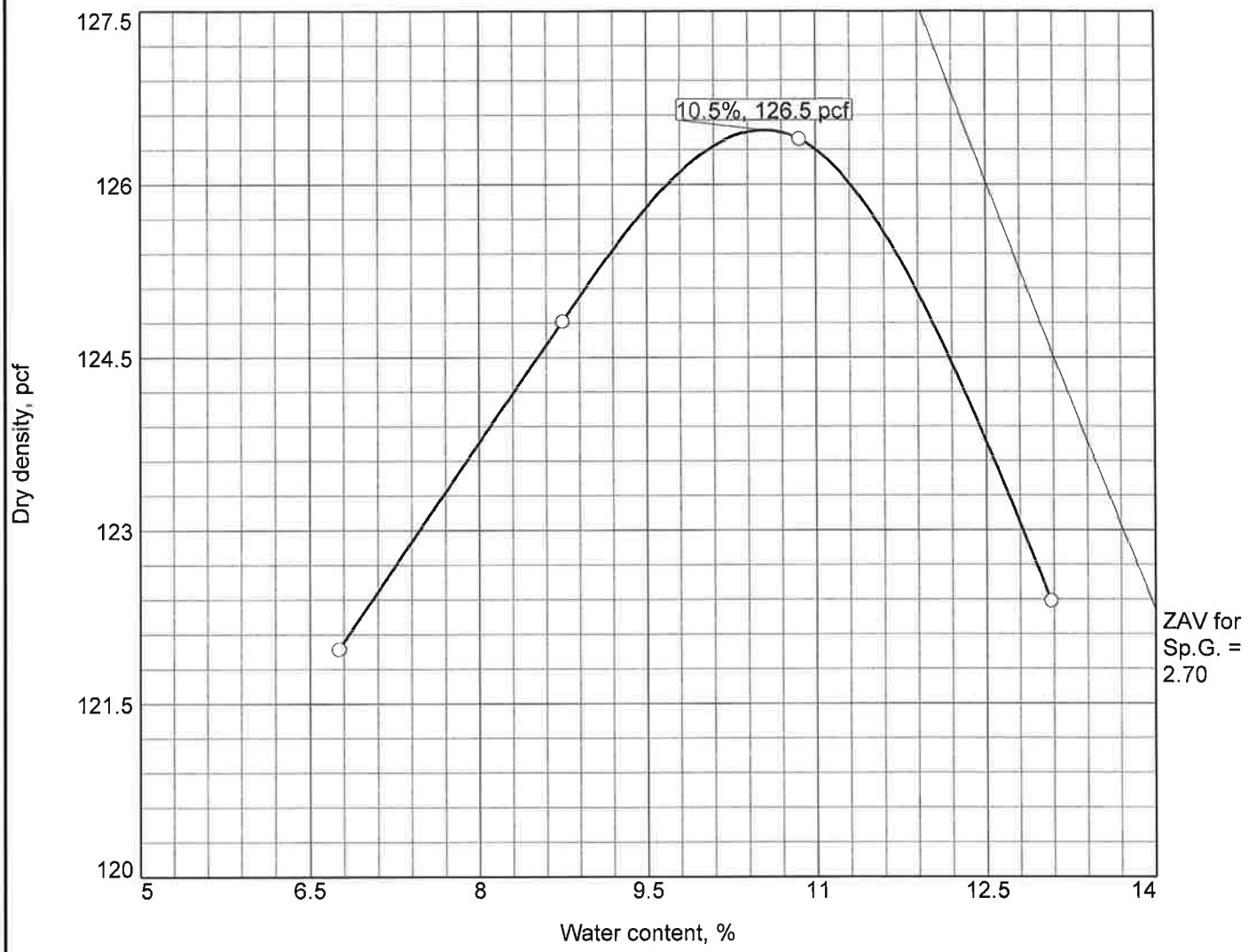
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 126.5 pcf Optimum moisture = 10.5 %	Tan-Brown Silty Sand
Project No. C-2398-12 **Client:** Griffin Bros. Companies **Project:** North Meck. Landfill Infill Huntersville, NC ○ **Location:** BP-4	**Remarks:**
Summit Engineering **Ft. Mill, South Carolina**	**Figure**

SUMMIT
ENGINEERING • LABORATORY • SURVEYING

FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 17MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL/PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following resultes were determined:

FD-1) Front Left Joint of Section 1 FG 96.9% Passed

FD-2) Front Right Joint of Section 1 FG 98.9%. Passed

FD-3) Rear Left Joint of Section 1 FG 97.1% Passed

FD-4) Rear Right Joint of Section 1 FG 96.5% Passed

FD-5) Front Left Joint of Section 2 FG 99.1% Passed

FD-6) Rear Right Joint of Section 2 FG 96.6% Passed

Contractor is continuing to lay pipe and excavate foundation for drainage pipe. Density testing indicated that in-place soils meet the required 95% for compaction.

Further testing will be required tomorrow at 8a.m. 18May12.

SIGNED (SUMMIT) Charles D. Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

P.O. Box 7384, Charlotte, North Carolina 28241 Telephone 704.504.1717 Fax 704.504.1125 www.summit-ecs.com

SUMMIT
ENGINEERING·LABORATORY·SURVEYING

FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 18MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL/PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following resultes were determined:

FD-7) Front Left joint of section 3 FG 95.6% Passed

FD-8) Rear Right Joint of Section 3 FG 99.7% Passed

FD-9) Front Left Join of Section 4 FG 97.0% Passed

FD-10) Rear Right Joint of Section 4 FG 98.4% Passed

Contrator is continuing to lay pipe and excavate foundation for drainage pipe. Density testing indicated that in-place soils meet the required 95% for compaction. Blue dot arrived on site at 10a.m. delivering 2500psi flowable fill. Spread test was performed on delivered samples at 30, 60 and 80yds and were noted to be at 7.5, 8.5 and 8 inches respectively. Further testing will be required tomorrow at 10a.m. 19May12.

SIGNED (SUMMIT) Charles D Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

P.O. Box 7384, Charlotte, North Carolina 28241 Telephone 704.504.1717 Fax 704.504.1125 www.summit-ecs.com

SUMMIT
ENGINEERING • LABORATORY • SURVEYING

FIELD REPORT

PROJECT NAME: North Meck. Co. Landfill	PROJECT #: C-2398-12
PROJECT LOCATION: Huntersville	SUMMIT REPRESENTATIVE: V. Fallica / Duane Elkins
DATE: 5-19-12	PRESENT AT SITE: Ron Gulkerson
CLIENT/CONTRACTOR: Hunter Const.	TRIPS: 1
WORK PERFORMED: FDT	TOTAL TIME:

Summit reps on site as requested to preform FDT on the following Locations

- FD	11	Sub grade	(Base of pipe)	Pass	100 %
- FD	12	"	"	Pass	99 %
- FD	13	"	"	Pass	100 %
- FD	14	"	"	Pass	100 %

SURVEY CONTROL: Location per. Contractor

RETURN VISIT REQUIRED: YES/NO DATE TIME RETURN:

SIGNED (SUMMIT)

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

SUMMIT
ENGINEERING • LABORATORY • SURVEYING

FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 21 MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL/PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following resultes were determined:

FD-15) Front Left Joint of Section 7 FG 96.0% Passed

FD-16) Front Right Joint of Section 7 FG 95.8% Passed

Contractor has been delayed in laying pipe due to the inability to place current anchors into dense soils.

Ron with NMCL will contact Summit when further testing is required.

SIGNED (SUMMIT) Charles D. Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED) _____

P.O. Box 7384, Charlotte, North Carolina 28241 Telephone 704.504.1717 Fax 704.504.1125 www.summit-ecs.com

SUMMIT
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FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 23MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following resultes were determined:

FD-17) Front Left Joint of Section 8 FG 99.1% Passed

FD-18) Front Right Joint of Section 8 FG 97.1% Passed

FD-19) Front Left of Joint of Section 9 FG 99.3% Passed

FD-20) Front Right Joint of Section 9 FG 97.7% Passed

Contractor is continuing to lay pipe and will require additional testing tomorrow 24th of May 2012.

SIGNED (SUMMIT) Charles D Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

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SUMMIT
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FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 24MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL/PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following resultes were determined:

FD-21) Front Left Joint of Section 10 FG 96.7% Passed

FD-22) Front Right Joint of Section 10 FG 97.4% Passed

FD-23) Front Left of Joint of Section 11 FG 96.7% Passed

FD-24) Front Right Joint of Section 11 FG 96.8% Passed

Contractor is continuing to lay pipe and will require additional testing tomorrow 24th of May 2012.

SIGNED (SUMMIT) Charles D. Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

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FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 28MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL/PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following results were determined:

FD-27) Front Left Joint of Section 13 FG 97.8% Passed

FD-28) Front Right Joint of Section 13 FG 97.2% Passed

FD-29) Front Left of Joint of Section 14 FG 96.7% Passed

FD-30) Front Right Joint of Section 14 FG 96.2% Passed

Contractor is continuing to lay pipe and will require additional testing tomorrow 29th of May 2012.

SIGNED (SUMMIT) Charles D Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

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SUMMIT
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FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 29MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIORFIELD TECHNICIAN
☐ PROFESSIONALPROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following results were determined:

FD-31) Front Left Joint of Section 15 FG 97.7% Passed

FD-31) Front Right Joint of Section 15 FG 96.8% Passed

Contractor is continuing to lay pipe and will require additional testing tomorrow 30th of May 2012.

SIGNED (SUMMIT) Charles D Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

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FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 30MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL/PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following results were determined:

FD-33) Front Left Joint of Section 16 FG 96.5% Passed

FD-34) Front Right Joint of Section 16 FG 96.0% Passed

Contractor is continuing to lay pipe and will require additional testing tomorrow 31st of May 2012.

SIGNED (SUMMIT) Charles D. Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

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SUMMIT
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FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 31MAY12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL/PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following results were determined:

FD-35) Front Left Joint of Section 17 FG 95.5% Passed

FD-36) Front Right Joint of Section 17 FG 96.2% Passed

FD-37) Front Left Joint of Section 18 FG 96.5% Passed

FD-38) Front Right Joint of Section 18 FG 95.8% Passed

Contractor is continuing to lay pipe and will require additional testing tomorrow 1st of June 2012.

SIGNED (SUMMIT) Charles D Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

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SUMMIT
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FIELD REPORT

PROJECT NAME: NORTH MECKLENBURG COUNTY	PROJECT #: C-2398-12
PROJECT LOCATION: CONCORD, NC	SUMMIT REPRESENTATIVE: CHARLES MURPHY
DATE: 01 JUNE 12	PRESENT AT SITE: RON GILKERSON
CLIENT/CONTRACTOR: NMCL, HUNTER	MILEAGE: 1 TRIP
WORK PERFORMED: FDT	TOTAL TIME:
☐ FIELD TECHNICIAN	☐ SENIOR FIELD TECHNICIAN
☐ PROFESSIONAL/PROJECT MANAGER	☐ ENGINEER

As requested, Summit Representative reported to the above site referenced to perform density testing of in-place soils for the foundation of drainage pipe at the NMCL. The following results were determined:

FD-39) Front Left Joint of Section 19 FG 96% Passed

FD-40) Front Right Joint of Section 19 FG 96.5% Passed

Contractor is continuing to lay pipe and will require additional testing tomorrow 4 th of June 2012.

SIGNED (SUMMIT) Charles D Murphy

SIGNED (CLIENT/CONTRACTOR IF REQUIRED)

P.O. Box 7384, Charlotte, North Carolina 28241 Telephone 704.504.1717 Fax 704.504.1125 www.summit-ecs.com

SUMMIT

North Mecklenburg Landfill
Field Density Testing Summary Worksheet
Summit Job Number: C-2398-12

Date	Test No.	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	% Compaction	Specified % Compaction	PASS or FAIL	Elevation (ft)	Location
5/17/2012	FD-1	122.1	20.5	101.3	19.4	104.6	97	95	PASS	FG	See Attached Diagram
	FD-2	126.0	21.8	103.4	19.4	104.6	99	95	PASS	FG	See Attached Diagram
	FD-3	120.0	18.1	101.6	19.4	104.6	97	95	PASS	FG	See Attached Diagram
	FD-4	121.8	20.6	101.0	19.4	104.6	97	95	PASS	FG	See Attached Diagram
	FD-5	125.1	20.7	103.6	19.4	104.6	99	95	PASS	FG	See Attached Diagram
	FD-6	122.1	20.8	101.1	19.4	104.6	97	95	PASS	FG	See Attached Diagram
5/18/2012	FD-7	126.6	18.9	106.5	16.6	111.4	96	95	PASS	FG	See Attached Diagram
	FD-8	125.0	12.7	110.9	16.6	111.4	100	95	PASS	FG	See Attached Diagram
	FD-9	122.7	13.5	108.1	16.6	111.4	97	95	PASS	FG	See Attached Diagram
	FD-10	123.9	13.1	109.6	16.6	111.4	98	95	PASS	FG	See Attached Diagram
5/19/2012	FD-11	132.1	20.7	109.4	17.2	109.0	100+	95	PASS	FG	See Attached Diagram
	FD-12	130.1	20.0	108.4	17.2	109.0	99	95	PASS	FG	See Attached Diagram
	FD-13	129.8	17.9	110.1	17.2	109.0	100+	95	PASS	FG	See Attached Diagram
	FD-14	128.9	16.9	110.3	17.2	109.0	100+	95	PASS	FG	See Attached Diagram
5/21/2012	FD-15	124.5	16.4	107.0	16.6	111.4	96	95	PASS	FG	See Attached Diagram
	FD-16	125.4	17.5	106.7	16.6	111.4	96	95	PASS	FG	See Attached Diagram
5/23/2012	FD-17	132.0	11.0	118.9	12.5	120.0	99	95	PASS	FG	See Attached Diagram
	FD-18	129.6	11.2	116.5	12.5	120.0	97	95	PASS	FG	See Attached Diagram
	FD-19	131.7	10.6	119.1	12.5	120.0	99	95	PASS	FG	See Attached Diagram
	FD-20	130.8	11.6	117.2	12.5	120.0	98	95	PASS	FG	See Attached Diagram
5/24/2012	FD-21	130.2	12.4	115.8	12.1	119.7	97	95	PASS	FG	See Attached Diagram
	FD-22	130.8	12.2	116.5	12.1	119.7	97	95	PASS	FG	See Attached Diagram
	FD-23	129.6	12.0	115.7	12.1	119.7	97	95	PASS	FG	See Attached Diagram
	FD-24	130.2	12.4	115.9	12.1	119.7	97	95	PASS	FG	See Attached Diagram
5/28/2012	FD-25	130.8	10.6	118.2	12.7	120.8	98	95	PASS	FG	See Attached Diagram
	FD-26	129.6	10.4	117.4	12.7	120.8	97	95	PASS	FG	See Attached Diagram
	FD-27	128.7	10.2	116.8	12.7	120.8	97	95	PASS	FG	See Attached Diagram
	FD-28	128.4	10.5	116.2	12.7	120.8	96	95	PASS	FG	See Attached Diagram
5/29/2012	FD-29	131.4	10.2	119.3	12.2	122.1	98	95	PASS	FG	See Attached Diagram
	FD-30	130.5	10.4	118.2	12.2	122.1	97	95	PASS	FG	See Attached Diagram
5/30/2012	FD-31	127.8	10.3	115.8	12.5	120.0	97	95	PASS	FG	See Attached Diagram
	FD-32	126.9	10.1	115.2	12.5	120.0	96	95	PASS	FG	See Attached Diagram
5/31/2012	FD-33	128.1	11.7	114.7	12.5	120.0	96	95	PASS	FG	See Attached Diagram
	FD-34	126.9	9.9	115.5	12.5	120.0	96	95	PASS	FG	See Attached Diagram
	FD-35	128.4	10.2	116.5	12.7	120.8	96	95	PASS	FG	See Attached Diagram
	FD-36	127.8	10.5	115.7	12.7	120.8	96	95	PASS	FG	See Attached Diagram
6/1/2012	FD-37	123.9	17.1	105.9	17.8	110.3	96	95	PASS	FG	See Attached Diagram
	FD-38	124.8	17.3	106.4	17.8	110.3	96	95	PASS	FG	See Attached Diagram

SUMMIT

North Mecklenburg Landfill
Field Density Testing Summary Worksheet
Summit Job Number: C-2398-12

Date	Test No.	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	% Compaction	Specified % Compaction	PASS or FAIL	Elevation (ft)	Location
6/4/2012	FD-39	130.5	11.1	117.5	12.5	120.0	98	95	PASS	FG	See Attached Diagram
	FD-40	131.1	11.4	117.7	12.5	120.0	98	95	PASS	FG	See Attached Diagram
6/5/2012	FD-41	129.9	11.6	116.4	12.5	120.0	97	95	PASS	FG	See Attached Diagram
	FD-42	128.7	11.4	115.5	12.5	120.0	96	95	PASS	FG	See Attached Diagram
6/7/2012	FD-43	131.1	12.2	116.8	12.7	120.8	97	95	PASS	FG	See Attached Diagram
	FD-44	129.9	12.0	116.0	12.7	120.8	96	95	PASS	FG	See Attached Diagram
6/11/2012	FD-45	118.8	18.5	100.3	19.4	104.6	96	95	PASS	FG	See Attached Diagram
	FD-46	120.3	17.6	102.3	19.4	104.6	98	95	PASS	FG	See Attached Diagram
6/13/2012	FD-47	124.2	16.7	106.4	17.8	110.3	96	95	PASS	FG	See Attached Diagram
	FD-48	125.1	16.8	107.1	17.8	110.3	97	95	PASS	FG	See Attached Diagram

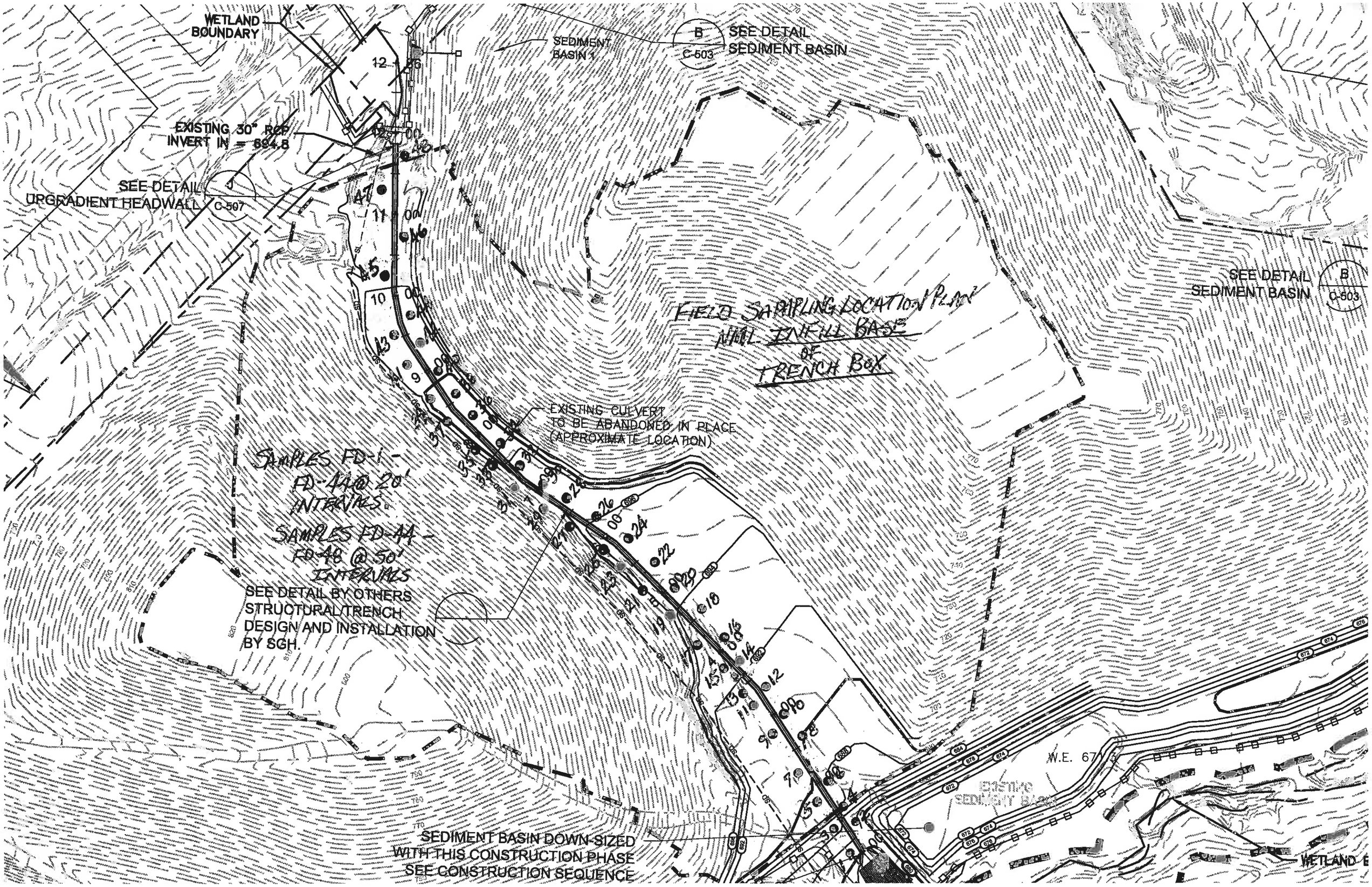
Signature: Charles Murphy Date: 6/15/12

SUMMIT

North Mecklenburg Landfill
Field Density Testing Summary Worksheet
Summit Job Number: C-2398-12

Date	Test No.	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	% Compaction	Specified % Compaction	PASS or FAIL	Elevation (ft)	Location
6/20/2012	FD-1	133.2	12.2	118.8	11.4	119.2	100	95	PASS	-2	End of Old Drainage Line
	FD-2	133.8	12.9	118.5	11.4	119.2	99	95	PASS	-2	40' from End of Old Drainage Line
	FD-3	132.9	13.8	116.8	11.4	119.2	98	95	PASS	-2	80' from End of Old Drainage Line
	FD-4	135.0	14.0	118.4	11.4	119.2	99	95	PASS	-2	120' from End of Old Drainage Line

Signature: Chuck Murphy Date: 6/20/12

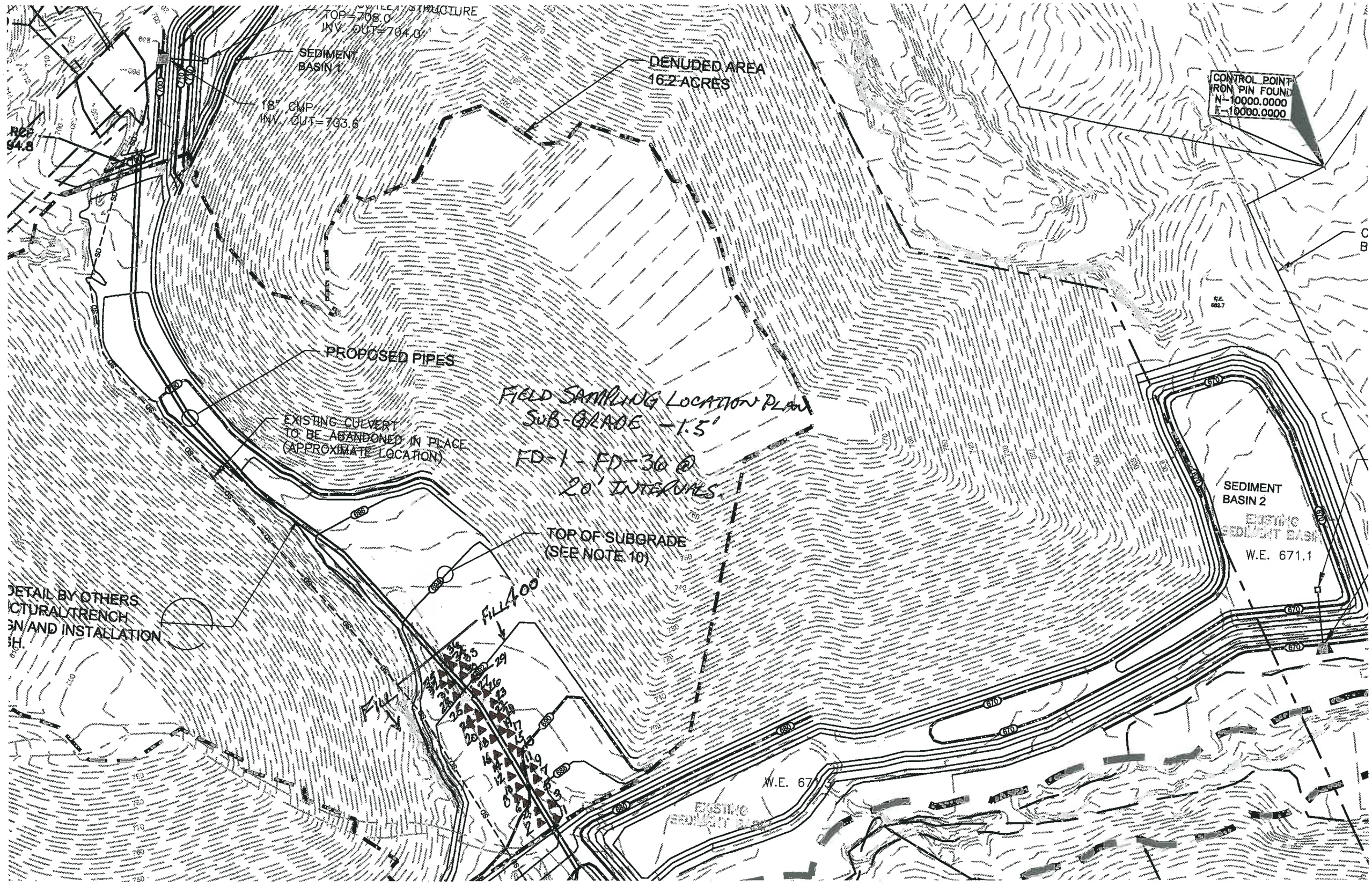

WETLAND BOUNDARY
SEDIMENT BASIN 1
B
C-503
SEE DETAIL
SEDIMENT BASIN
EXISTING 30" RCP
INVERT IN = 694.8
SEE DETAIL
J
UPGRADIENT HEADWALL
C-507
SEE DETAIL
SEDIMENT BASIN
B
C-503
FIELD SAMPLING LOCATION PLAN
NAL INFILL BASE
OF
TRENCH BOX
EXISTING CULVERT
TO BE ABANDONED IN PLACE
(APPROXIMATE LOCATION)
SAMPLES FD-1 -
FD-44 @ 20'
INTERVALS.
SAMPLES FD-44 -
FD-48 @ 50'
INTERVALS
SEE DETAIL BY OTHERS
STRUCTURAL/TRENCH
DESIGN AND INSTALLATION
BY SGH.
W.E. 67
EXISTING
SEDIMENT BASIN
SEDIMENT BASIN DOWN-SIZED
WITH THIS CONSTRUCTION PHASE
SEE CONSTRUCTION SEQUENCE
WETLAND

SUMMIT

North Mecklenburg Landfill
Field Density Testing Summary Worksheet
Summit Job Number: C-2398-12

Date	Test No.	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	% Compaction	Specified % Compaction	PASS or FAIL	Elevation (ft)	Location
6/25/2012	FD-1	129.0	9.1	118.3	11.4	119.2	99	95	PASS	-1	See Attached Diagram
	FD-2	127.8	10.2	116.0	11.4	119.2	97	95	PASS	-1	See Attached Diagram
	FD-3	129.6	11.7	116.0	11.4	119.2	97	95	PASS	-1	See Attached Diagram
	FD-4	130.2	12.3	115.9	11.4	119.2	97	95	PASS	-1	See Attached Diagram
	FD-5	130.5	8.0	120.8	11.4	119.2	100+	95	PASS	-1	See Attached Diagram
	FD-6	130.8	11.2	117.6	11.4	119.2	99	95	PASS	-1	See Attached Diagram
	FD-7	127.8	10.7	115.5	11.4	119.2	97	95	PASS	-1	See Attached Diagram
	FD-8	128.4	12.9	113.8	11.4	119.2	95	95	PASS	-1	See Attached Diagram
	FD-9	130.8	13.3	115.5	11.4	119.2	97	95	PASS	-1	See Attached Diagram
	FD-10	128.7	10.7	116.3	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-11	129.9	12.3	115.7	11.4	119.2	97	95	PASS	-1	See Attached Diagram
	FD-12	131.7	12.3	117.3	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-13	127.8	9.3	116.9	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-14	129.6	11.6	116.2	11.4	119.2	97	95	PASS	-1	See Attached Diagram
	FD-15	130.8	10.4	118.5	11.4	119.2	99	95	PASS	-1	See Attached Diagram
	FD-16	128.4	9.4	117.4	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-17	131.7	10.2	119.5	11.4	119.2	100+	95	PASS	-1	See Attached Diagram
	FD-18	127.8	11.6	114.5	11.4	119.2	96	95	PASS	-1	See Attached Diagram
	FD-19	129.6	11.4	116.3	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-20	130.8	10.7	118.1	11.4	119.2	99	95	PASS	-1	See Attached Diagram
	FD-21	129.3	11.8	115.6	11.4	119.2	97	95	PASS	-1	See Attached Diagram
	FD-22	130.8	11.9	116.8	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-23	130.2	11.4	116.9	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-24	129.6	11.0	116.8	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-25	129.0	10.8	116.4	11.4	119.2	98	95	PASS	-1	See Attached Diagram
	FD-26	125.1	16.8	107.1	16.4	107.6	100	95	PASS	-1	See Attached Diagram
	FD-27	122.7	16.1	105.6	16.4	107.6	98	95	PASS	-1	See Attached Diagram
	FD-28	122.4	17.4	104.3	16.4	107.6	97	95	PASS	-1	See Attached Diagram
	FD-29	123.3	17.0	105.4	16.4	107.6	98	95	PASS	-1	See Attached Diagram
	FD-30	122.1	17.3	104.1	16.4	107.6	97	95	PASS	-1	See Attached Diagram
	FD-31	122.1	17.8	103.7	16.4	107.6	96	95	PASS	-1	See Attached Diagram
	FD-32	123.3	17.3	105.1	16.4	107.6	98	95	PASS	-1	See Attached Diagram
	FD-33	122.7	17.1	104.8	16.4	107.6	97	95	PASS	-1	See Attached Diagram
	FD-34	121.8	16.8	104.3	16.4	107.6	97	95	PASS	-1	See Attached Diagram
	FD-35	123.0	17.8	104.4	16.4	107.6	97	95	PASS	-1	See Attached Diagram
	FD-36	122.1	17.3	104.1	16.4	107.6	97	95	PASS	-1	See Attached Diagram

Signature: Charles J. Murphy Date: 6/25/12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INV. OUT=704.0
SEDIMENT BASIN 1
18" CMP
INV. OUT=703.6
DENUDED AREA
16.2 ACRES
CONTROL POINT
IRON PIN FOUND
N=10000.0000
E=10000.0000
PROPOSED PIPES
EXISTING CULVERT
TO BE ABANDONED IN PLACE
(APPROXIMATE LOCATION)
FIELD SAMPLING LOCATION PLAN
SUB-GRADE -1.5'
FD-1 - FD-36 @
20' INTERVALS.
TOP OF SUBGRADE
(SEE NOTE 10)
FILL 400'
FILL
DETAIL BY OTHERS
STRUCTURAL TRENCH
DESIGN AND INSTALLATION
SEDIMENT BASIN 2
W.E. 671.1
W.E. 682.7
W.E. 671.3

SUMMIT

North Mecklenburg Landfill
Field Density Testing Summary Worksheet
Summit Job Number: C-2398-12

Date	Test No.	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	% Compaction	Specified % Compaction	PASS or FAIL	Elevation (ft)	Location
6/27/2012	FD-1	132.0	12.2	117.7	11.4	119.2	99	95	PASS	SG	See Attached Diagram
	FD-2	130.8	11.8	117.0	11.4	119.2	98	95	PASS	SG	See Attached Diagram
	FD-3	130.2	12.0	116.3	11.4	119.2	98	95	PASS	SG	See Attached Diagram
	FD-4	131.1	9.9	119.3	11.4	119.2	100+	95	PASS	SG	See Attached Diagram
	FD-5	132.3	10.1	120.1	11.4	119.2	100+	95	PASS	SG	See Attached Diagram
	FD-6	127.8	10.7	115.4	11.4	119.2	97	95	PASS	SG	See Attached Diagram
	FD-7	127.8	11.8	114.3	11.4	119.2	96	95	PASS	SG	See Attached Diagram
	FD-8	126.9	10.2	115.1	11.4	119.2	97	95	PASS	SG	See Attached Diagram
	FD-9	129.3	10.0	117.5	11.4	119.2	99	95	PASS	SG	See Attached Diagram
	FD-10	128.7	11.2	115.7	11.4	119.2	97	95	PASS	SG	See Attached Diagram
	FD-11	123.0	12.0	109.8	14.4	112.5	98	95	PASS	SG	See Attached Diagram
	FD-12	123.6	12.7	109.7	14.4	112.5	98	95	PASS	SG	See Attached Diagram
	FD-13	124.5	12.9	110.3	14.4	112.5	98	95	PASS	SG	See Attached Diagram
	FD-14	123.6	12.7	109.7	14.4	112.5	98	95	PASS	SG	See Attached Diagram
	FD-15	125.4	12.4	111.5	14.4	112.5	99	95	PASS	SG	See Attached Diagram
	FD-16	125.1	14.9	108.8	14.4	112.5	97	95	PASS	SG	See Attached Diagram
6/29/2012	FD-17	128.7	9.1	118.0	12.5	120.0	98	95	PASS	SG	See Attached Diagram
	FD-18	129.6	10.3	117.6	12.5	120.0	98	95	PASS	SG	See Attached Diagram
	FD-19	129.3	11.7	115.7	12.5	120.0	96	95	PASS	SG	See Attached Diagram
	FD-20	130.8	8.3	120.8	12.5	120.0	100+	95	PASS	SG	See Attached Diagram
	FD-21	129.6	9.8	118.1	12.5	120.0	98	95	PASS	SG	See Attached Diagram
	FD-22	128.7	11.4	115.6	12.5	120.0	96	95	PASS	SG	See Attached Diagram
	FD-23	130.5	12.7	115.8	12.5	120.0	96	95	PASS	SG	See Attached Diagram
	FD-24	129.9	11.8	116.2	12.5	120.0	97	95	PASS	SG	See Attached Diagram
	FD-25	121.5	11.9	108.5	17.8	110.3	98	95	PASS	SG	See Attached Diagram
	FD-26	122.7	11.0	110.6	17.8	110.3	100+	95	PASS	SG	See Attached Diagram
	FD-27	122.4	14.8	106.6	17.8	110.3	97	95	PASS	SG	See Attached Diagram
	FD-28	123.6	14.5	107.9	17.8	110.3	98	95	PASS	SG	See Attached Diagram
	FD-29	123.0	13.9	108.0	17.8	110.3	98	95	PASS	SG	See Attached Diagram
	FD-30	122.7	13.2	108.4	17.8	110.3	98	95	PASS	SG	See Attached Diagram
	FD-31	123.3	14.3	107.8	17.8	110.3	98	95	PASS	SG	See Attached Diagram
	FD-32	123.0	12.0	109.8	17.8	110.3	100	95	PASS	SG	See Attached Diagram
	FD-33	123.6	13.5	108.9	17.8	110.3	99	95	PASS	SG	See Attached Diagram
	FD-34	122.4	13.0	108.3	17.8	110.3	98	95	PASS	SG	See Attached Diagram
	FD-35	132.3	12.1	118.0	12.5	120.0	98	95	PASS	SG	See Attached Diagram
	FD-36	130.8	12.7	116.1	12.5	120.0	97	95	PASS	SG	See Attached Diagram
	FD-37	131.7	11.8	117.8	12.5	120.0	98	95	PASS	SG	See Attached Diagram
	FD-38	130.8	12.4	116.4	12.5	120.0	97	95	PASS	SG	See Attached Diagram

SUMMIT

North Mecklenburg Landfill
Field Density Testing Summary Worksheet
Summit Job Number: C-2398-12

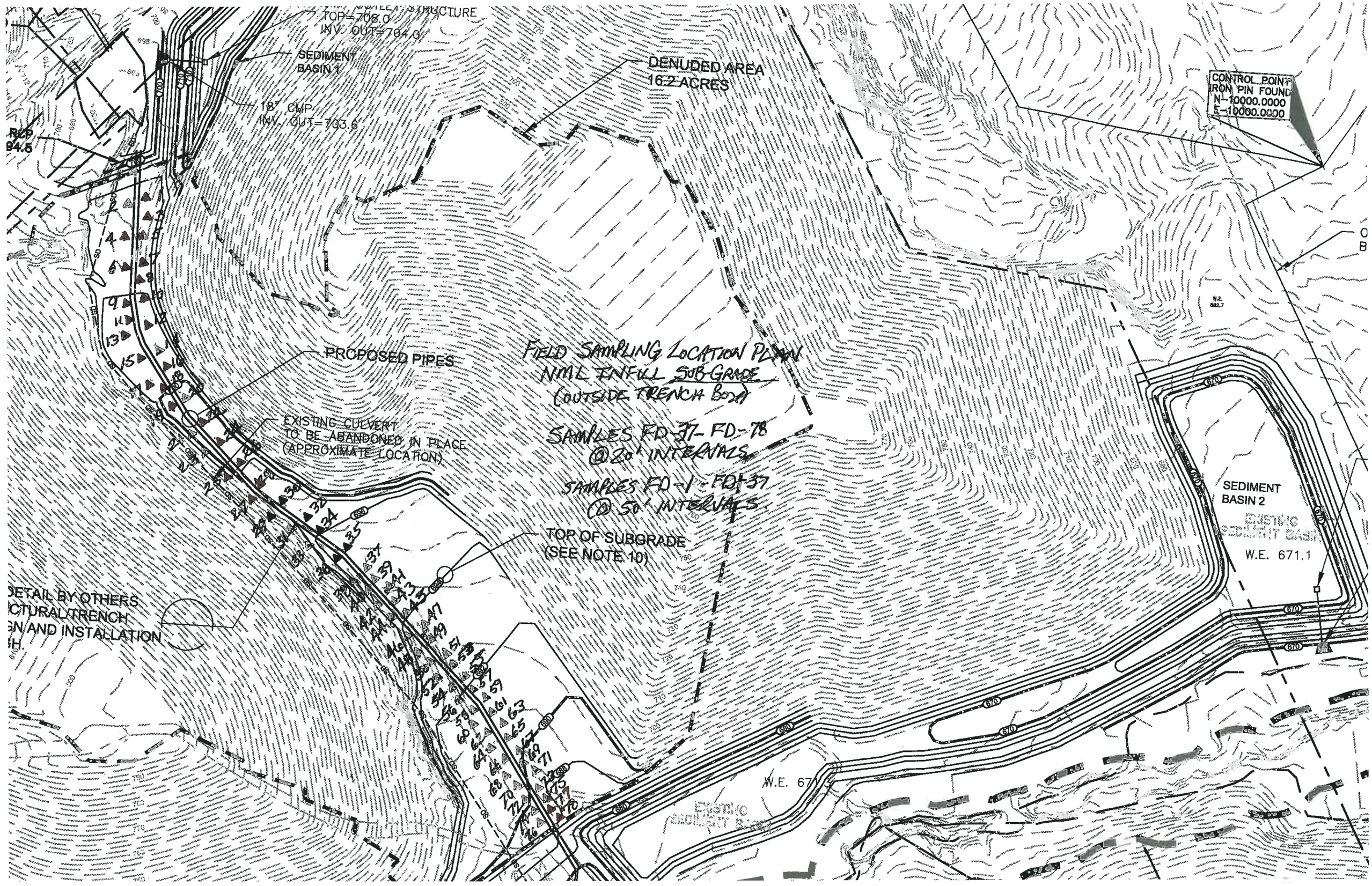
Date	Test No.	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	% Compaction	Specified % Compaction	PASS or FAIL	Elevation (ft)	Location
6/29/2012	FD-39	132.3	12.6	117.5	12.5	120.0	98	95	PASS	SG	See Attached Diagram
	FD-40	131.4	12.3	117.0	12.5	120.0	98	95	PASS	SG	See Attached Diagram
	FD-41	132.0	12.4	117.4	12.5	120.0	98	95	PASS	SG	See Attached Diagram
	FD-42	130.8	12.2	116.5	12.5	120.0	97	95	PASS	SG	See Attached Diagram
7/2/2012	FD-43	126.6	18.1	107.2	15.4	109.5	98	95	PASS	SG	See Attached Diagram
	FD-44	124.5	17.4	106.1	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-45	128.4	19.3	107.6	15.4	109.5	98	95	PASS	SG	See Attached Diagram
	FD-46	125.7	17.5	107.0	15.4	109.5	98	95	PASS	SG	See Attached Diagram
	FD-47	126.3	18.7	106.4	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-48	124.5	17.5	106.0	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-49	124.5	17.7	105.7	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-50	123.6	17.1	105.6	15.4	109.5	96	95	PASS	SG	See Attached Diagram
	FD-51	123.0	17.0	105.1	15.4	109.5	96	95	PASS	SG	See Attached Diagram
	FD-52	124.2	17.5	105.7	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-53	122.4	14.8	106.6	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-54	123.6	16.8	105.8	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-55	123.0	16.4	105.7	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-56	122.7	15.1	106.6	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-57	123.3	15.9	106.4	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-58	123.0	15.7	106.3	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-59	123.6	16.0	106.6	15.4	109.5	97	95	PASS	SG	See Attached Diagram
	FD-60	122.4	16.5	105.1	15.4	109.5	96	95	PASS	SG	See Attached Diagram
	FD-61	123.3	15.5	106.8	15.4	109.5	98	95	PASS	SG	See Attached Diagram
	FD-62	119.7	19.8	99.9	18.6	104.5	96	95	PASS	SG	See Attached Diagram
	FD-63	121.8	19.4	102.0	18.6	104.5	98	95	PASS	SG	See Attached Diagram
	FD-64	120.9	19.7	101.0	18.6	104.5	97	95	PASS	SG	See Attached Diagram
	FD-65	122.1	20.1	101.7	18.6	104.5	97	95	PASS	SG	See Attached Diagram
	FD-66	121.2	19.6	101.3	18.6	104.5	97	95	PASS	SG	See Attached Diagram
	FD-67	121.5	19.7	101.5	18.6	104.5	97	95	PASS	SG	See Attached Diagram
	FD-68	121.8	19.8	101.7	18.6	104.5	97	95	PASS	SG	See Attached Diagram
	FD-69	123.0	20.1	102.5	18.6	104.5	98	95	PASS	SG	See Attached Diagram
	FD-70	123.9	19.6	103.6	18.6	104.5	99	95	PASS	SG	See Attached Diagram
	FD-71	124.5	19.5	104.2	18.6	104.5	100	95	PASS	SG	See Attached Diagram
	FD-72	123.0	19.7	102.7	18.6	104.5	98	95	PASS	SG	See Attached Diagram
	FD-73	122.7	20.1	102.2	18.6	104.5	98	95	PASS	SG	See Attached Diagram
	FD-74	123.6	20.6	102.5	18.6	104.5	98	95	PASS	SG	See Attached Diagram
	FD-75	124.2	21.2	102.5	18.6	104.5	98	95	PASS	SG	See Attached Diagram
	FD-76	122.1	20.6	101.2	18.6	104.5	97	95	PASS	SG	See Attached Diagram

SUMMIT

North Mecklenburg Landfill
Field Density Testing Summary Worksheet
Summit Job Number: C-2398-12

Date	Test No.	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	% Compaction	Specified % Compaction	PASS or FAIL	Elevation (ft)	Location
7/2/2012	FD-77	123.0	20.2	102.3	18.6	104.5	98	95	PASS	SG	See Attached Diagram
	FD-78	121.8	20.0	101.5	18.6	104.5	97	95	PASS	SG	See Attached Diagram

Signature: Charles J Murphy Date: 7/4/12


TOP=708.0
INV. OUT=704.0
SEDIMENT BASIN 1
18" CMP
INV. OUT=703.6
RCP
94.5
DENUDED AREA
16.2 ACRES
CONTROL POINT
IRON PIN FOUND
N=10000.0000
E=10000.0000
PROPOSED PIPES
EXISTING CULVERT
TO BE ABANDONED IN PLACE
(APPROXIMATE LOCATION)
TOP OF SUBGRADE
(SEE NOTE 10)
DETAIL BY OTHERS
CTURAL/TRENCH
GN AND INSTALLATION
GH.
FIELD SAMPLING LOCATION PLAN
NMC INFILL SUB-GRADE
(OUTSIDE TRENCH BOX)
SAMPLES FD-37- FD-78
@20' INTERVALS
SAMPLES FD-1 - FD-37
@ 50' INTERVALS
SEDIMENT BASIN 2
W.E. 671.1
W.E. 682.7
W.E. 67

Appendix F

ENVIRO-PRO
PROFESSIONAL CORPORATION

August 6, 2012

Mr. Ron Gilkerson
Griffin Brothers Companies
19109 W. Catawba Avenue, Suite 200
Cornelius, North Carolina 28031-5613

RE: North Mecklenburg Landfill – Infill Area
15300 Holbrooks Road
Huntersville, North Carolina
Project No. EP-1442

Dear Mr. Gilkerson:

On July 3, 2012 I performed a visual inspection of the cleared subgrade within the planned 3.2 acre Infill landfilling area at the subject facility. No significant geological features such as bedrock outcrops were exposed on the cleared subgrade area. The subgrade soils appeared to be sandy silts to silty sands.

Three bulk soil samples (Subgrade Sample #1, Subgrade Sample #2, and Subgrade Sample #3) were collected from the subgrade area and were submitted to Summit Laboratories in Fort Mill, South Carolina on July 5, 2012. Three bulk soil samples (Borrow Sample #1, Borrow Sample #2, and Borrow Sample #3) were also obtained from the soil borrow pit and submitted to Summit at the same time. Permeability testing was performed on the remolded soil samples. The soil samples tested were all classified as SM (silty sands) confirming my field observations. Calculated permeabilities for the three Subgrade soil samples were 2.12 x 10-5, 4.43 x 10-4, and 6.77 x 10-5cm/sec, respectively. Calculated permeabilities for the Borrow soil samples were 6.32 x 10-6, 1.57 x 10-6, and 3.35 x 10-7cm/sec, respectively. These results indicate that the final landfill cover material will have a much lower permeability than the subgrade material. A copy of Summit's laboratory test results are included in the attached Appendix.

Please contact me at (803) 547-4955 if you have any questions concerning this reported information.

Sincerely,
ENVIRO-PRO, P.C.

Thomas H. Bolyard

NORTH CAROLINA LICENSED SEAL GEOLOGIST THOMAS H. BOLYARD

Thomas H. Bolyard, P.G.
Senior Hydrogeologist

2646 Farmlake Lane • Fort Mill, SC 29708 • (803) 547-4955 • Fax (803) 548-2233

SUMMIT
ENGINEERING·LABORATORY·SURVEYING

July 27, 2012

Mr. Ron Gilkerson
Griffin Bros. Companies
19109 W Catawba Avenue, Suite 200
Cornelius, NC 28031-5611

Subject: **Laboratory Permeability Test Results**
North Mecklenburg Landfill Infill Project
Huntersville, NC
SUMMIT Project No. C-2398-12

Dear Mr. Gilkerson:

SUMMIT Engineering and Construction Services Inc. **(SUMMIT)** has completed the requested laboratory testing on the three (3) borrow soil samples and three (3) subgrade soil samples submitted to the lab by a Griffin Bros. representative. Permeability testing was performed on the remolded samples at approximately 95% maximum dry density and optimum moisture content of the standard proctor curve. In addition, USCS classifications were assigned to the soil samples. The following ASTM tests were performed:

- *ASTM D 5084 - Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeater*
- *ASTM D 698 – Laboratory Compaction Characteristics of Soil Using Standard Effort*
- *ASTM D 2487 – Classification of Soils for Engineering Purposes (USCS)*

The results of the laboratory testing are summarized on the attached Compaction Test Reports (proctors), Permeability Test Reports (hydraulic conductivity), and Particle Size Distribution (USCS).

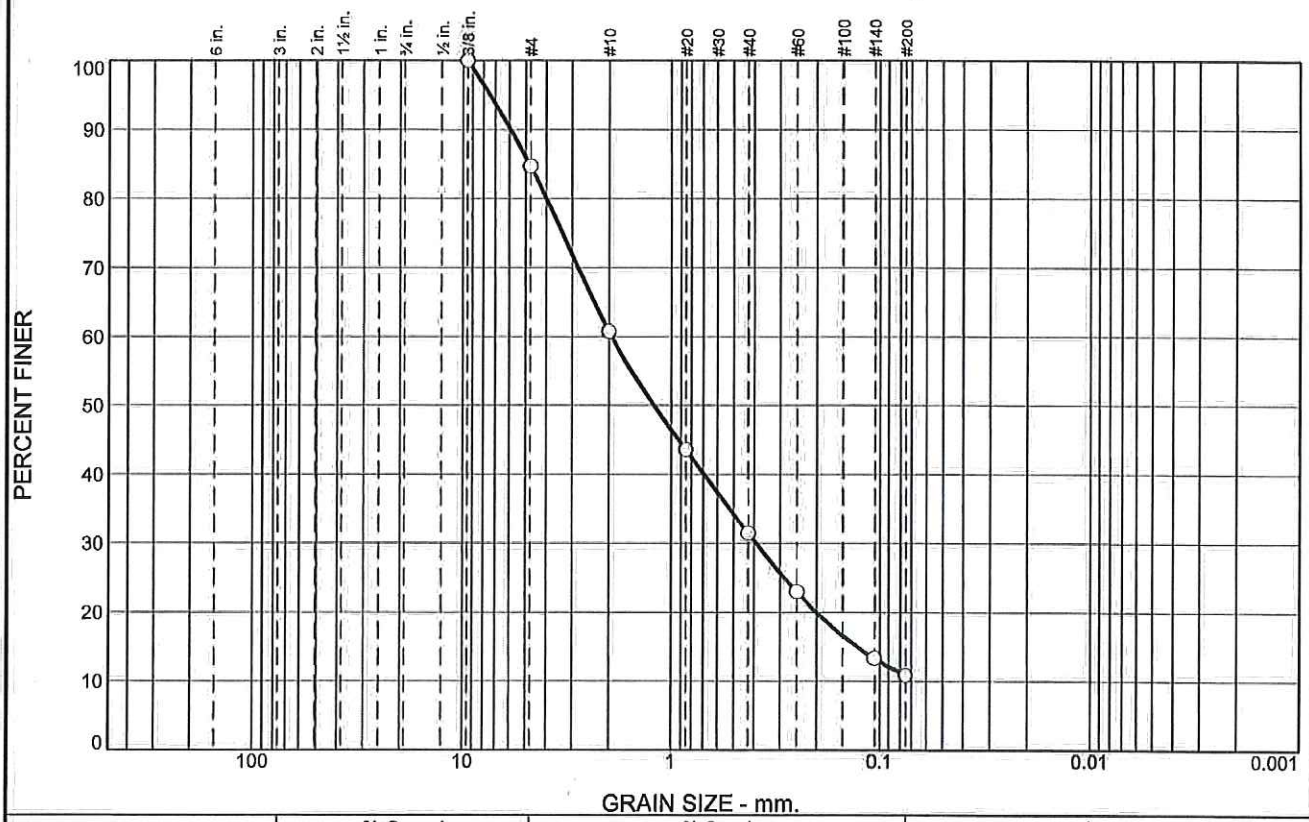
SUMMIT appreciates the opportunity to provide our professional services to you on this project. If you have any questions concerning the information in this report or if we can provide any additional information, please contact me.

Respectfully Submitted,
SUMMIT ENGINEERING AND CONSTRUCTION SERVICES, INC.

Mimi S. Hourani
Laboratory Services Manager

Enclosures: Perm. Report (18 pages)
Proctor (6 pages)
Grain Size (6 pages)

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.3	24.0	29.2	20.6	10.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	84.7		
#10	60.7		
#20	43.6		
#40	31.5		
#60	22.9		
#140	13.3		
#200	10.9		

* (no specification provided)

Material Description

Light-Brown Poorly Graded sand with Silt and Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 5.9098 D_{85}= 4.7989 D_{60}= 1.9421
D_{50}= 1.2146 D_{30}= 0.3898 D_{15}= 0.1288
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Location: Subgrade Sample #1

Date: 07-19-2012

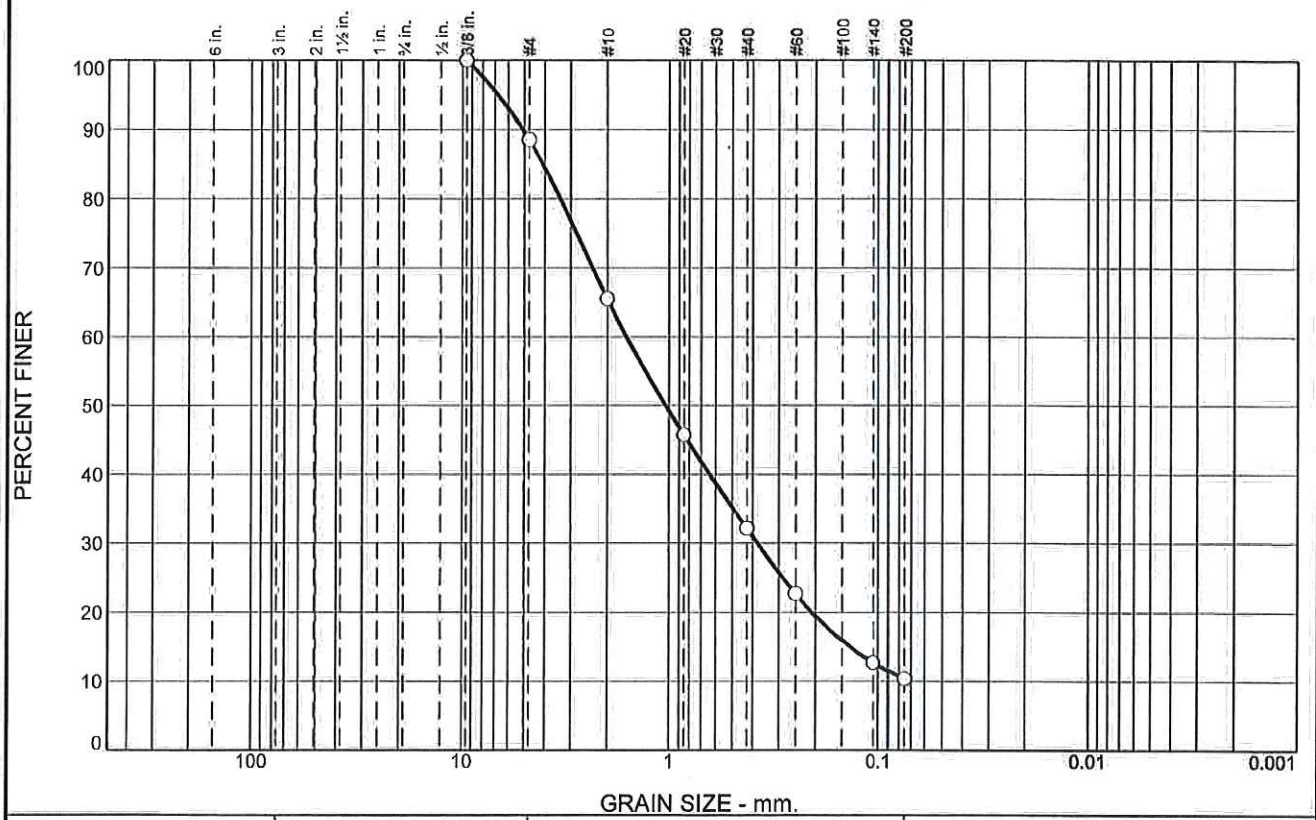
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.5	22.9	33.4	21.9	10.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	88.5		
#10	65.6		
#20	45.7		
#40	32.2		
#60	22.7		
#140	12.7		
#200	10.3		

* (no specification provided)

Material Description

Light-Brown Poorly Graded Sand with Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 5.0926 D_{85}= 4.0772 D_{60}= 1.6100
D_{50}= 1.0411 D_{30}= 0.3790 D_{15}= 0.1376
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Location: Subgrade Sample #2

Date: 07-19-2012

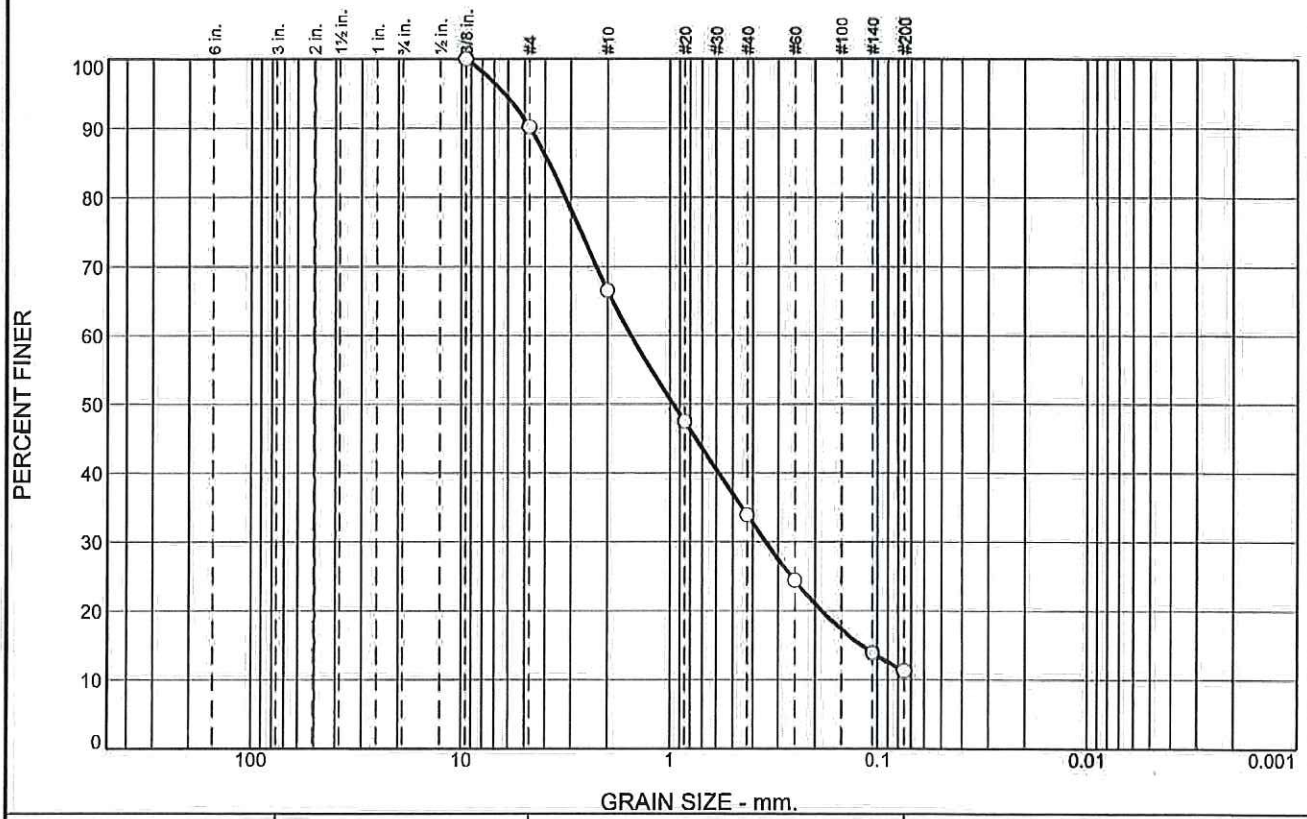
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.8	23.7	32.6	22.6	11.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	90.2		
#10	66.5		
#20	47.5		
#40	33.9		
#60	24.4		
#140	13.9		
#200	11.3		

* (no specification provided)

Material Description

Light-Brown Poorly Graded Sand with Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 4.7038 D_{85}= 3.8203 D_{60}= 1.5405
D_{50}= 0.9645 D_{30}= 0.3454 D_{15}= 0.1202
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Location: Subgrade Sample #3

Date: 07-19-2012

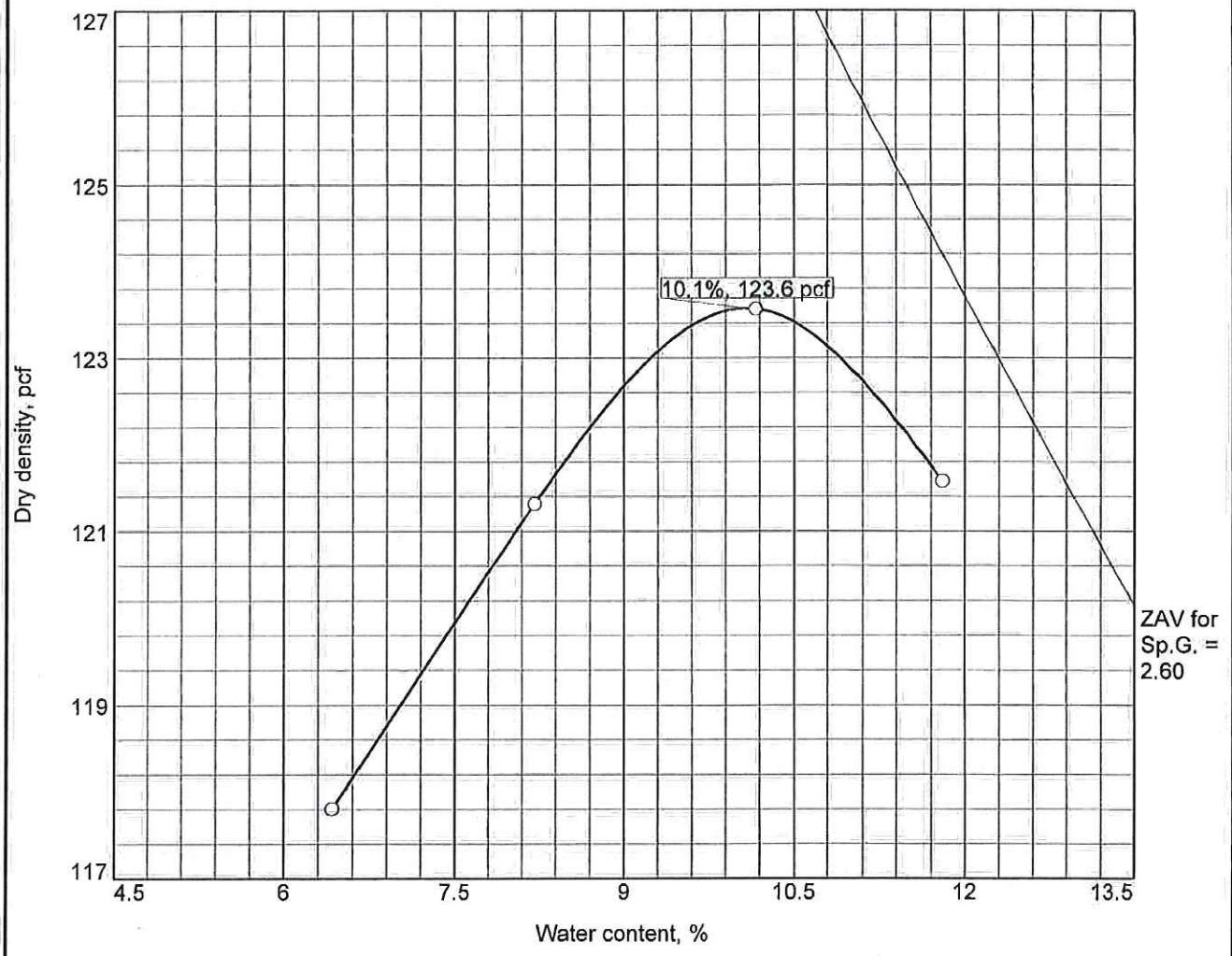
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

COMPACTION TEST REPORT

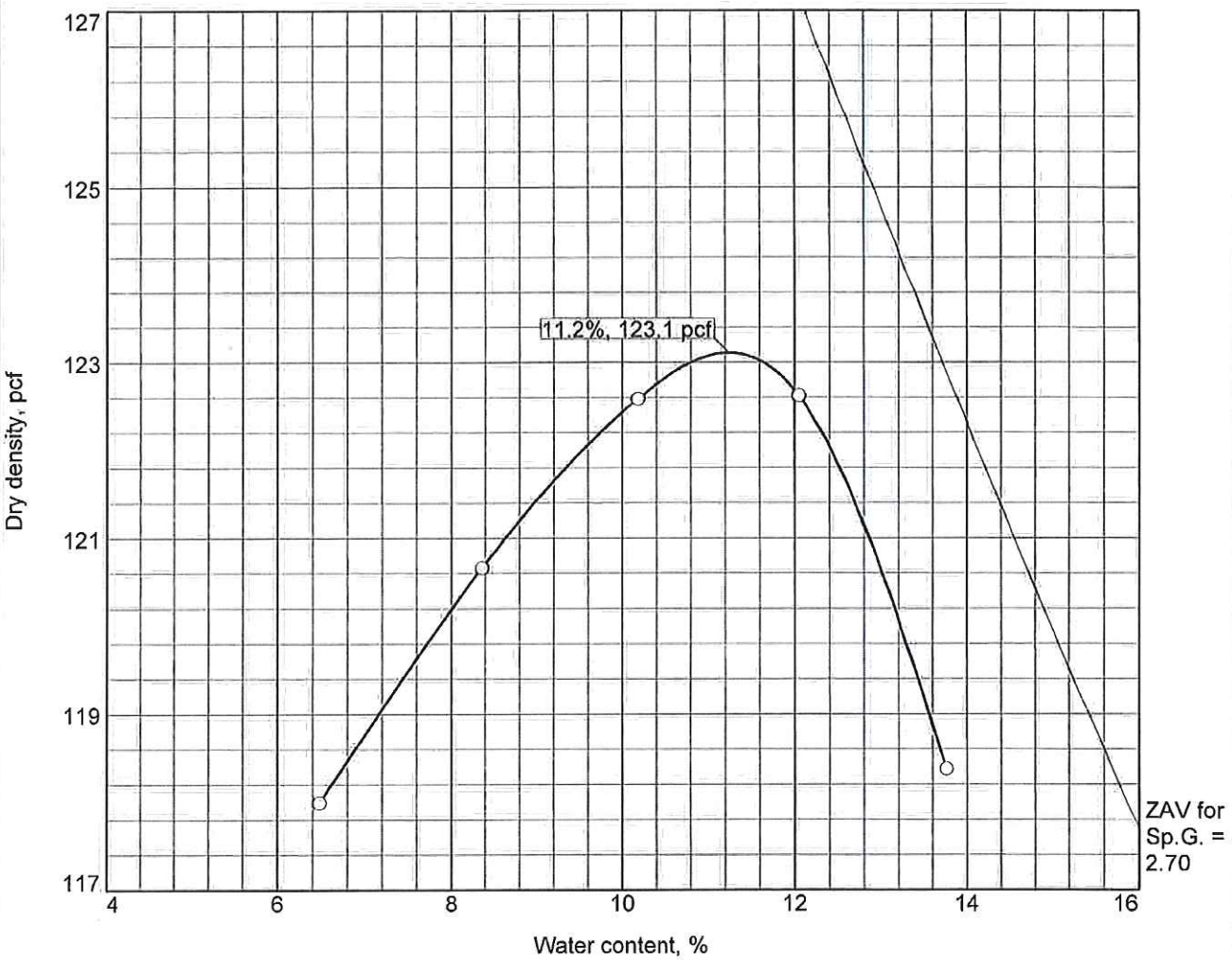


Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SP-SM	A-1-b			NV	NP	15.3	10.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 123.6 pcf Optimum moisture = 10.1 %	Light-Brown Poorly Graded sand with Silt and Gravel
Project No. C-2398-12 **Client:** Griffin Bros. Companies **Project:** North Meck. Landfill Infill Huntersville, NC ○ **Location:** Subgrade Sample #1	**Remarks:**
Summit Engineering **Ft. Mill, South Carolina**	**Figure**

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SP-SM	A-1-b			NV	NP	11.5	10.3

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 123.1 pcf Optimum moisture = 11.2 %	Light-Brown Poorly Graded Sand with Silt

Project No. C-2398-12 **Client:** Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
○ **Location:** Subgrade Sample #2

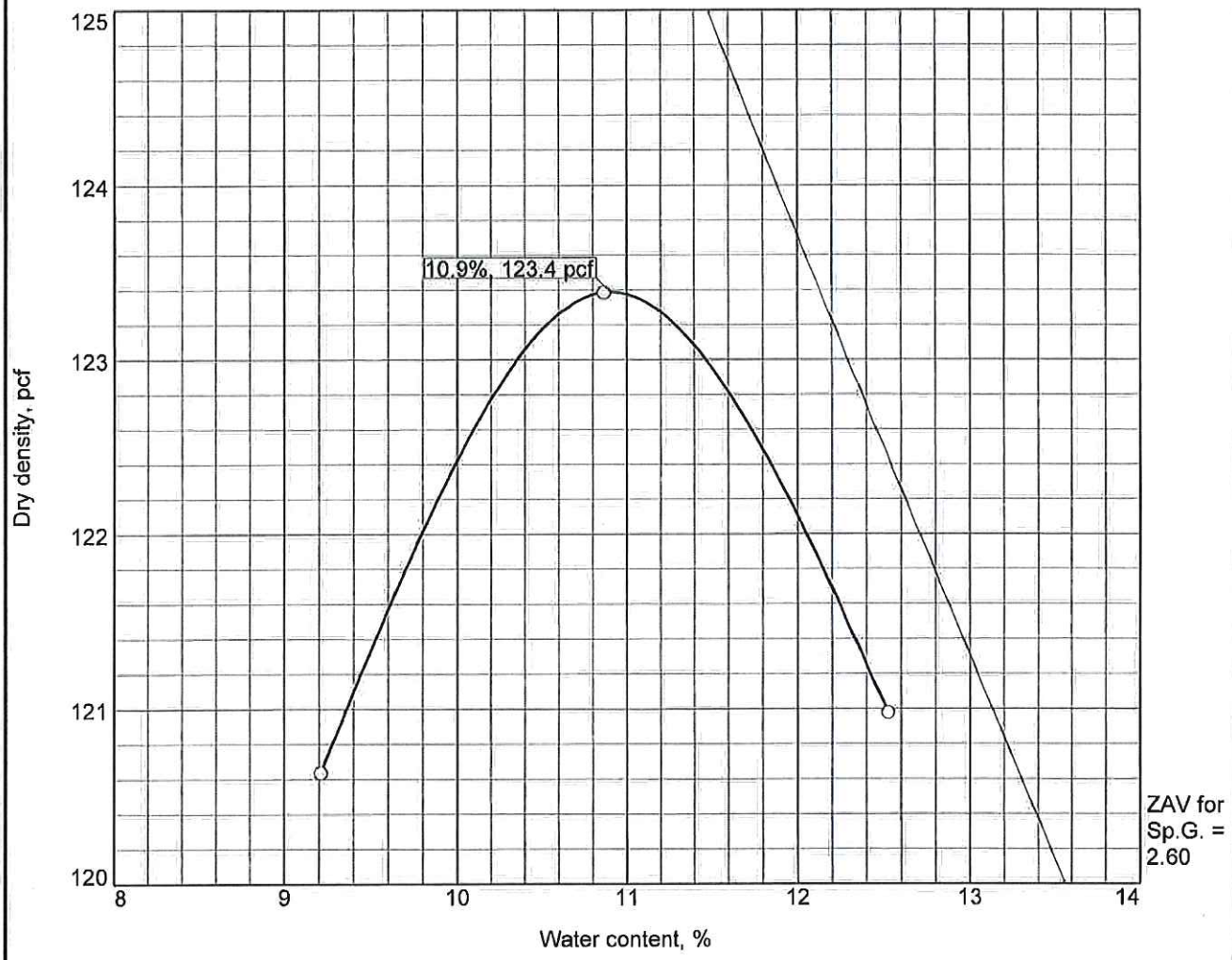
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SP-SM	A-1-b			NV	NP	9.8	11.3

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 123.4 pcf Optimum moisture = 10.9 %	Light-Brown Poorly Graded Sand with Silt
Project No. C-2398-12 **Client:** Griffin Bros. Companies **Project:** North Meck. Landfill Infill Huntersville, NC o **Location:** Subgrade Sample #3	**Remarks:**
Summit Engineering **Ft. Mill, South Carolina**	**Figure**

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.63
Specimen Diameter (cm): 7.27
Dry Unit Weight (pcf): 116.8
Moisture Before Test (%): 10.2
Moisture After Test (%): 15.2

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	77.0	
Test Pressure(psi):	71.0	
Back Pressure(psi):	70.0	
Diff. Head (psi):	1.0	
Flow Rate (cc/sec):	8.40 x 10^-3	
Perm. (cm/sec):	2.12 x 10^-5	

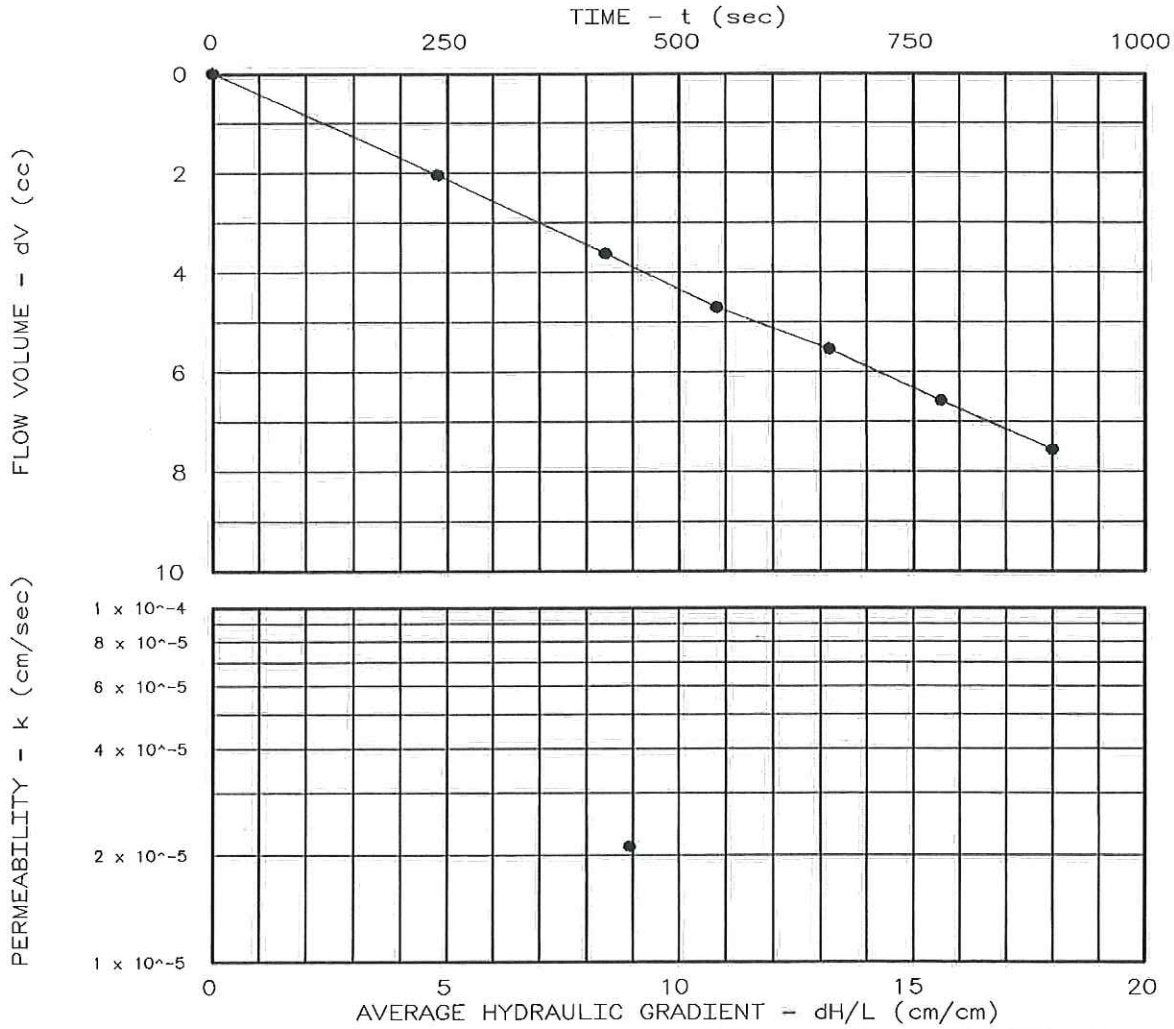
SAMPLE DATA:

Sample Identification: Subgrade Sample #1

Visual Description: Light-Brown Poorly Graded Sand with Silt and Gravel

Remarks:

Maximum Dry Density (pcf): 123.6
Optimum Moisture Content (%): 10.1
ASTM(D698)
Percent Compaction: 94.5%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: North Meck. Landfill Infill
Location: Huntersville, NC
Date: 07-26-2012

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: C-2398-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	North Meck. Landfill Infill
File No.:	
Project Location:	Huntersville, NC
Project No.:	C-2398-12
Sample Identification:	Subgrade Sample #1
Lab No.:	
Description:	Light-Brown Poorly Graded Sand with Silt and Gravel
Sample Type:	Remolded
Max. Dry Dens.:	123.6
Method (D1557/D698):	D698
Opt. Water Content:	10.1
Date:	07-26-2012
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:		After test:	
Diameter:	1	2	1	2
Top:	2.864 in	in	2.864 in	in
Middle:	in	in	in	in
Bottom:	in	in	in	in
Average:	2.86 in	7.27 cm	2.86 in	7.27 cm

Length:	1	2	3	1	2	3
	3.005 in	in	in	3.005 in	in	in
Average:	3.01 in	7.63 cm		3.01 in	7.63 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.60		
Wet Wt. & Tare:	654.02		683.63
Dry Wt. & Tare:	593.48		593.48
Tare Wt.:	0.00		0.00
Moisture Content:	10.2 %		15.2 %
Dry Unit Weight:	116.8 pcf	94.5 % of max	116.8 pcf
Porosity:	0.2805		0.2805
Saturation:	68.0 %		101.3 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 1 Panel No.: 1 Positions: 1

Run Number:	1	2
Cell Pressure:	77.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	7/24/12	9:46:00	0	71.0	70.0	5.00	5.00	0.00
	7/24/12	9:50:00	240	71.0	70.0	7.04	2.96	1.00
R						7.04	2.96	
R						5.00	5.00	
	7/24/12	9:53:00	420	71.0	70.0	6.58	3.42	1.00
R						6.58	3.42	
R						5.00	5.00	
	7/24/12	9:55:00	540	71.0	70.0	6.08	3.92	1.00
R						6.08	3.92	
R						5.00	5.00	
	7/24/12	9:57:00	660	71.0	70.0	5.84	4.16	1.00
R						5.84	4.16	
R						5.00	5.00	
	7/24/12	9:59:00	780	71.0	70.0	6.04	3.96	1.00
R						6.04	3.96	
R						5.00	5.00	
	7/24/12	10:01:00	900	71.0	70.0	5.98	4.02	1.00

Test Pressure = 71.0 psi Differential Head = 1.0 psi, 68.1 cm H2O
Gradient = 8.928E 00 Flow rate = 8.397E-03 cc/sec R squared = 0.99943
Permeability, K22.8° = 2.263E-05 cm/sec, K20° = 2.117E-05 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.64
Specimen Diameter (cm): 7.27
Dry Unit Weight (pcf): 116.7
Moisture Before Test (%): 10.5
Moisture After Test (%): 14.9

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	77.0	
Test Pressure(psi):	71.0	
Back Pressure(psi):	70.1	
Diff. Head (psi):	0.9	
Flow Rate (cc/sec):	1.64×10^{-1}	
Perm. (cm/sec):	4.43×10^{-4}	

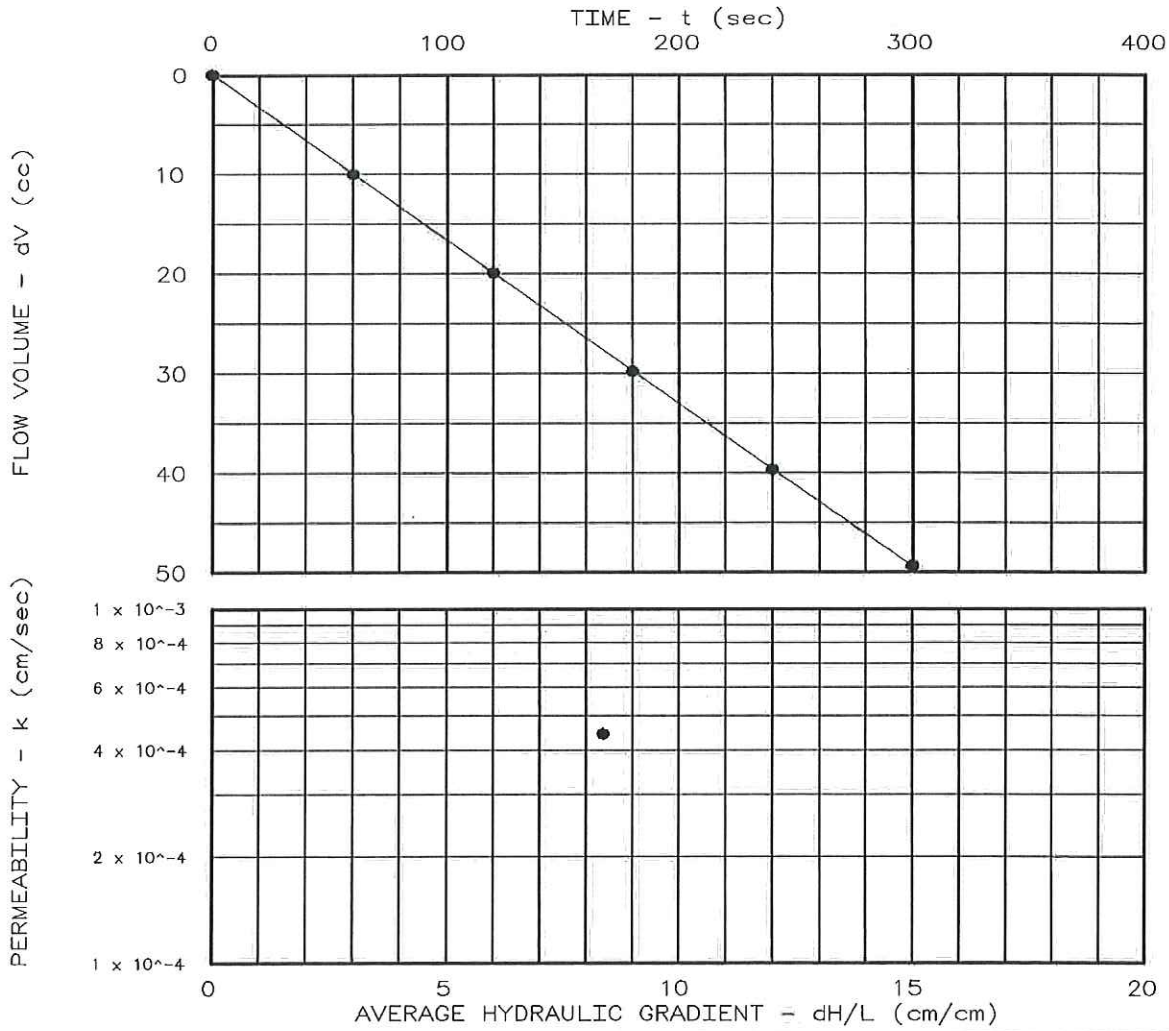
SAMPLE DATA:

Sample Identification: Subgrade Sample #2

Visual Description: Light-Brown Poorly Graded Sand with Silt

Remarks:

Maximum Dry Density (pcf): 123.1
Optimum Moisture Content (%): 11.2
ASTM(D698)
Percent Compaction: 94.8%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: North Meck. Landfill Infill
Location: Huntersville, NC
Date: 07-26-2012

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: C-2398-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	North Meck. Landfill Infill
File No.:	
Project Location:	Huntersville, NC
Project No.:	C-2398-12
Sample Identification:	Subgrade Sample #2
Lab No.:	
Description:	Light-Brown Poorly Graded Sand with Silt
Sample Type:	Remolded
Max. Dry Dens.:	123.1
Method (D1557/D698):	D698
Opt. Water Content:	11.2
Date:	07-26-2012
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.862 in	in		2.862 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.86 in	7.27 cm		2.86 in	7.27 cm	
Length:	1	2	3	1	2	3
	3.007 in	in	in	3.007 in	in	in
Average:	3.01 in	7.64 cm		3.01 in	7.64 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.60		
Wet Wt. & Tare:	654.89		680.90
Dry Wt. & Tare:	592.66		592.66
Tare Wt.:	0.00		0.00
Moisture Content:	10.5 %		14.9 %
Dry Unit Weight:	116.7 pcf	94.8 % of max	116.7 pcf
Porosity:	0.2809		0.2809
Saturation:	69.9 %		99.1 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 2 Panel No.: 1 Positions: 1

Run Number:	1	2
Cell Pressure:	77.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	7/24/12	9:39:00	0	71.0	70.0	0.00	10.00	0.00
	7/24/12	9:40:00	60	71.0	70.0	10.00	0.00	1.00
R						10.00	0.00	
R						0.00	10.00	
	7/24/12	9:41:00	120	71.0	70.0	9.90	0.10	1.00
R						9.90	0.10	
R						0.00	10.00	
	7/24/12	9:42:00	180	71.0	70.0	9.86	0.14	1.00
R						9.86	0.14	
R						0.00	10.00	
	7/24/12	9:43:00	240	71.0	70.0	9.90	0.10	1.00
R						9.90	0.10	
R						0.00	10.00	
	7/24/12	9:44:00	300	71.0	70.0	9.66	0.34	1.00

Test Pressure = 71.0 psi Differential Head = 0.9 psi, 63.9 cm H2O
Gradient = 8.362E 00 Flow rate = 1.645E-01 cc/sec R squared = 0.99998
Permeability, K22.8° = 4.740E-04 cm/sec, K20° = 4.434E-04 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.42
Specimen Diameter (cm): 7.27
Dry Unit Weight (pcf): 120.5
Moisture Before Test (%): 10.8
Moisture After Test (%): 13.7

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	77.0	
Test Pressure(psi):	71.0	
Back Pressure(psi):	70.1	
Diff. Head (psi):	0.9	
Flow Rate (cc/sec):	2.64×10^{-2}	
Perm. (cm/sec):	6.77×10^{-5}	

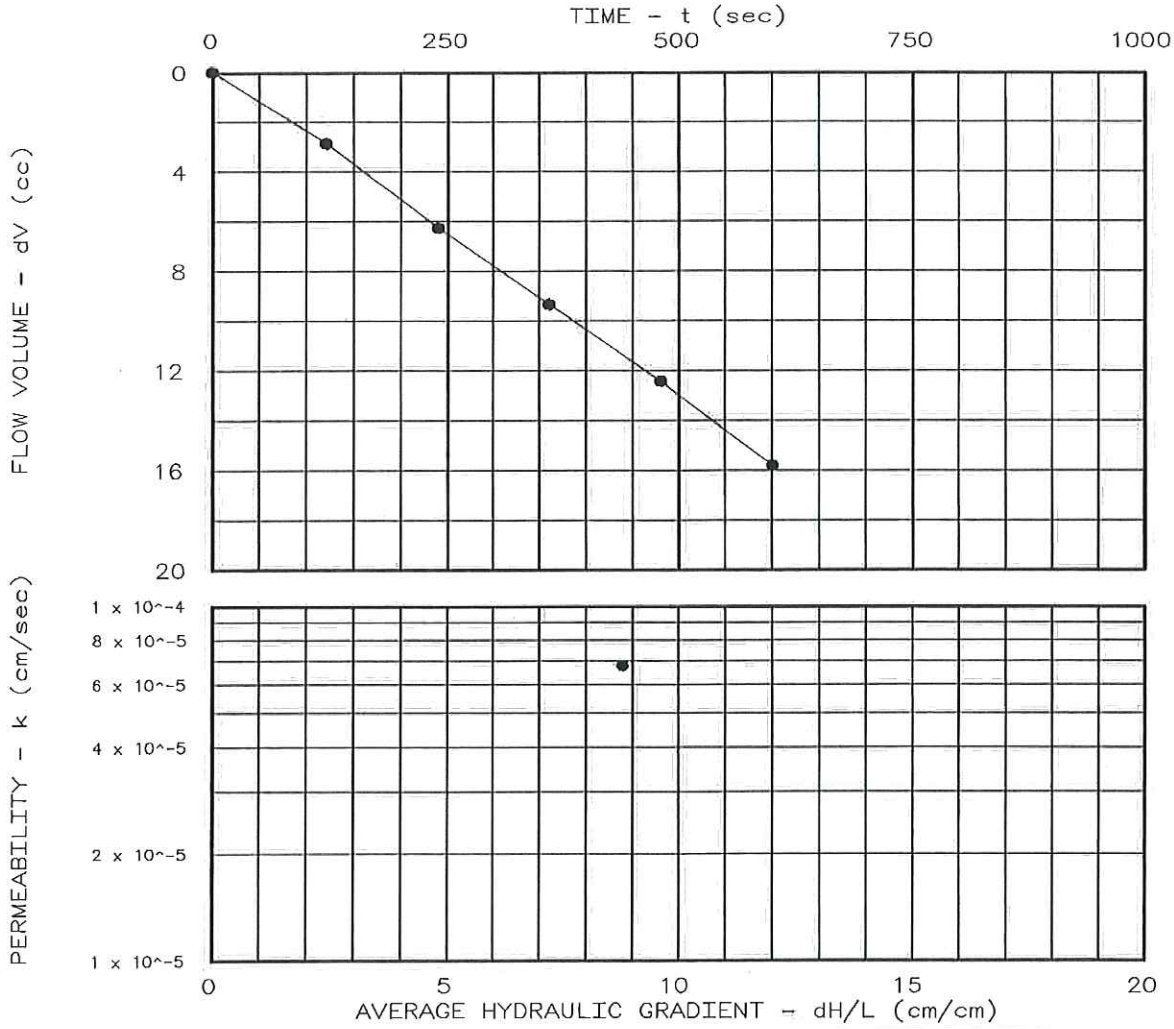
SAMPLE DATA:

Sample Identification: Subgrade Sample #3

Visual Description: Light-Brown Poorly Graded Sand with Silt

Remarks:

Maximum Dry Density (pcf): 123.4
Optimum Moisture Content (%): 10.9
ASTM(D698)
Percent Compaction: 97.6%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: North Meck. Landfill Infill
Location: Huntersville, NC
Date: 07-26-2012

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: C-2398-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	North Meck. Landfill Infill
File No.:	
Project Location:	Huntersville, NC
Project No.:	C-2398-12
Sample Identification:	Subgrade Sample #3
Lab No.:	
Description:	Light-Brown Poorly Graded Sand with Silt
Sample Type:	Remolded
Max. Dry Dens.:	123.4
Method (D1557/D698):	D698
Opt. Water Content:	10.9
Date:	07-26-2012
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.861 in	in		2.861 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.86 in	7.27 cm		2.86 in	7.27 cm	
Length:	1	2	3	1	2	3
	2.922 in	in	in	2.922 in	in	in
Average:	2.92 in	7.42 cm		2.92 in	7.42 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.65		
Wet Wt. & Tare:	658.25		675.20
Dry Wt. & Tare:	594.09		594.09
Tare Wt.:	0.00		0.00
Moisture Content:	10.8 %		13.7 %
Dry Unit Weight:	120.5 pcf	97.6 % of max	120.5 pcf
Porosity:	0.2717		0.2717
Saturation:	76.7 %		97.0 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 1 Panel No.: 1 Positions: 1

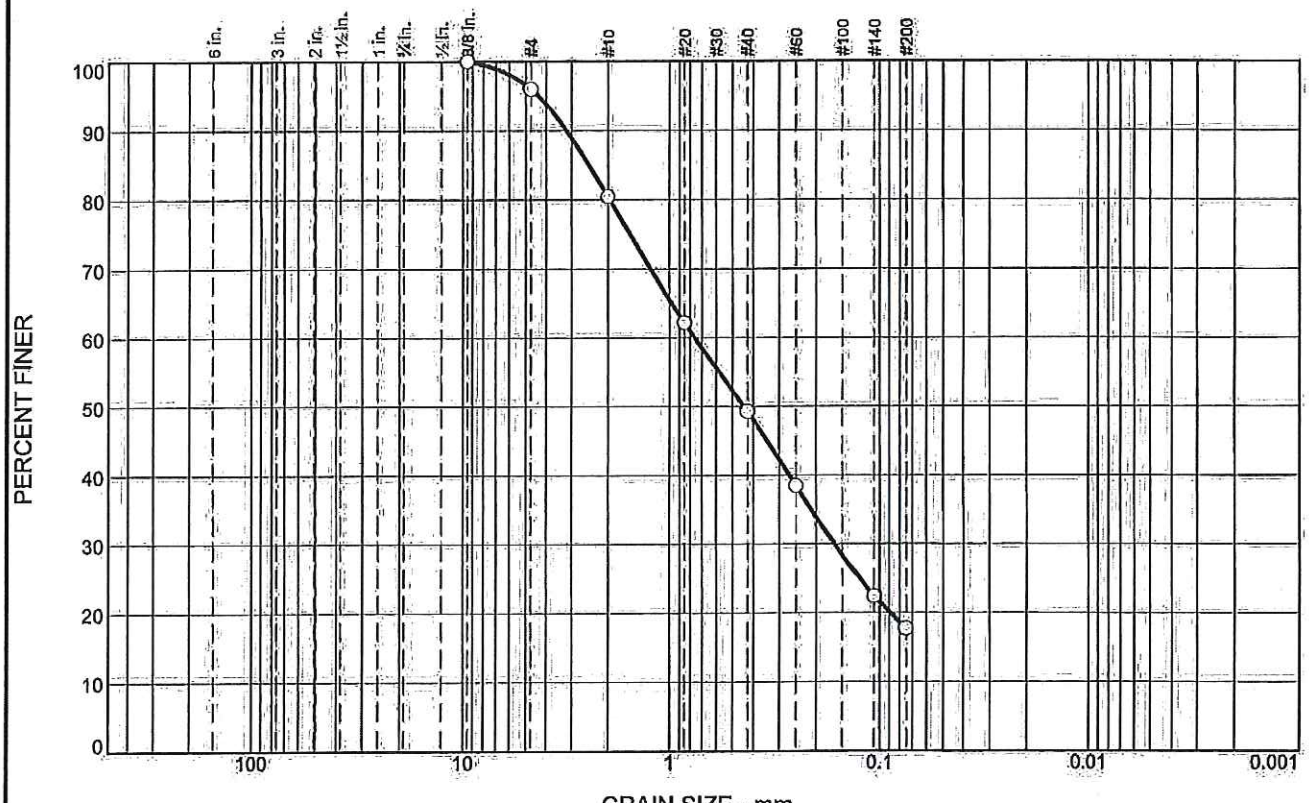
Run Number:	1	2
Cell Pressure:	77.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	7/26/12	11:46:00	0	71.0	70.0	5.00	5.00	0.00
	7/26/12	11:48:00	120	71.0	70.0	7.86	2.14	1.00
R						7.86	2.14	
R						5.00	5.00	
	7/26/12	11:50:00	240	71.0	70.0	8.40	1.60	1.00
R						8.78	1.22	
R						5.00	5.00	
	7/26/12	11:52:00	360	71.0	70.0	7.70	2.30	1.00
R						7.70	2.30	
R						5.00	5.00	
	7/26/12	11:54:00	480	71.0	70.0	8.08	1.92	1.00
R						8.08	1.92	
R						5.00	5.00	
	7/26/12	11:56:00	600	71.0	70.0	8.38	1.62	1.00

Test Pressure = 71.0 psi Differential Head = 0.9 psi, 65.2 cm H2O
Gradient = 8.780E 00 Flow rate = 2.637E-02 cc/sec R squared = 0.99957
Permeability, K22.8° = 7.242E-05 cm/sec, K20° = 6.774E-05 cm/sec

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.9	15.6	31.2	31.6	17.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	96.1		
#10	80.5		
#20	62.2		
#40	49.3		
#60	38.5		
#140	22.4		
#200	17.7		

* (no specification provided)

Material Description

Light-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 3.1755 D_{85}= 2.4661 D_{60}= 0.7576
D_{50}= 0.4408 D_{30}= 0.1643 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Location: Borrow Sample #1

Date: 07-06-2012

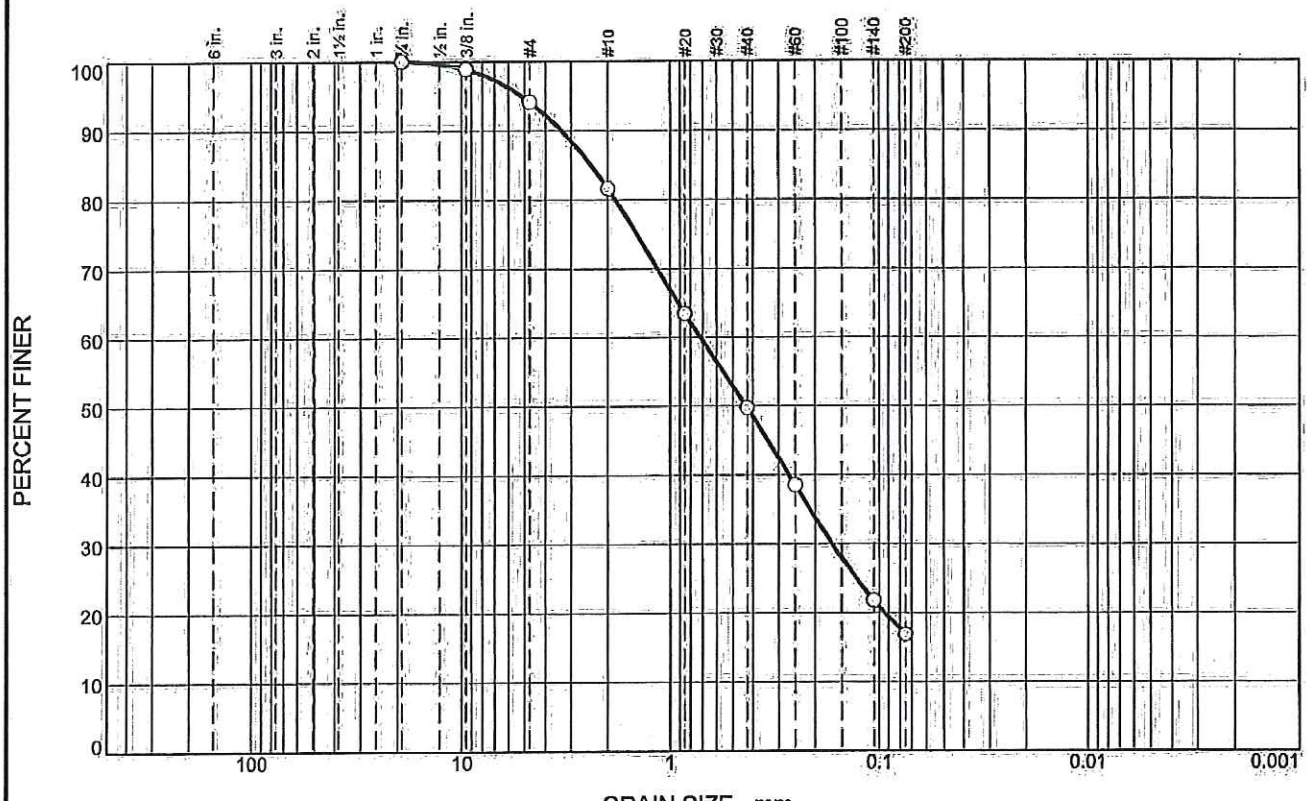
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.8	12.5	31.9	32.9	16.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	98.9		
#4	94.2		
#10	81.7		
#20	63.4		
#40	49.8		
#60	38.5		
#140	21.8		
#200	16.9		

* (no specification provided)

Material Description

Light-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 3.3315 D_{85}= 2.4035 D_{60}= 0.7171
D_{50}= 0.4302 D_{30}= 0.1666 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Location: Borrow Sample #2

Date: 07-06-2012

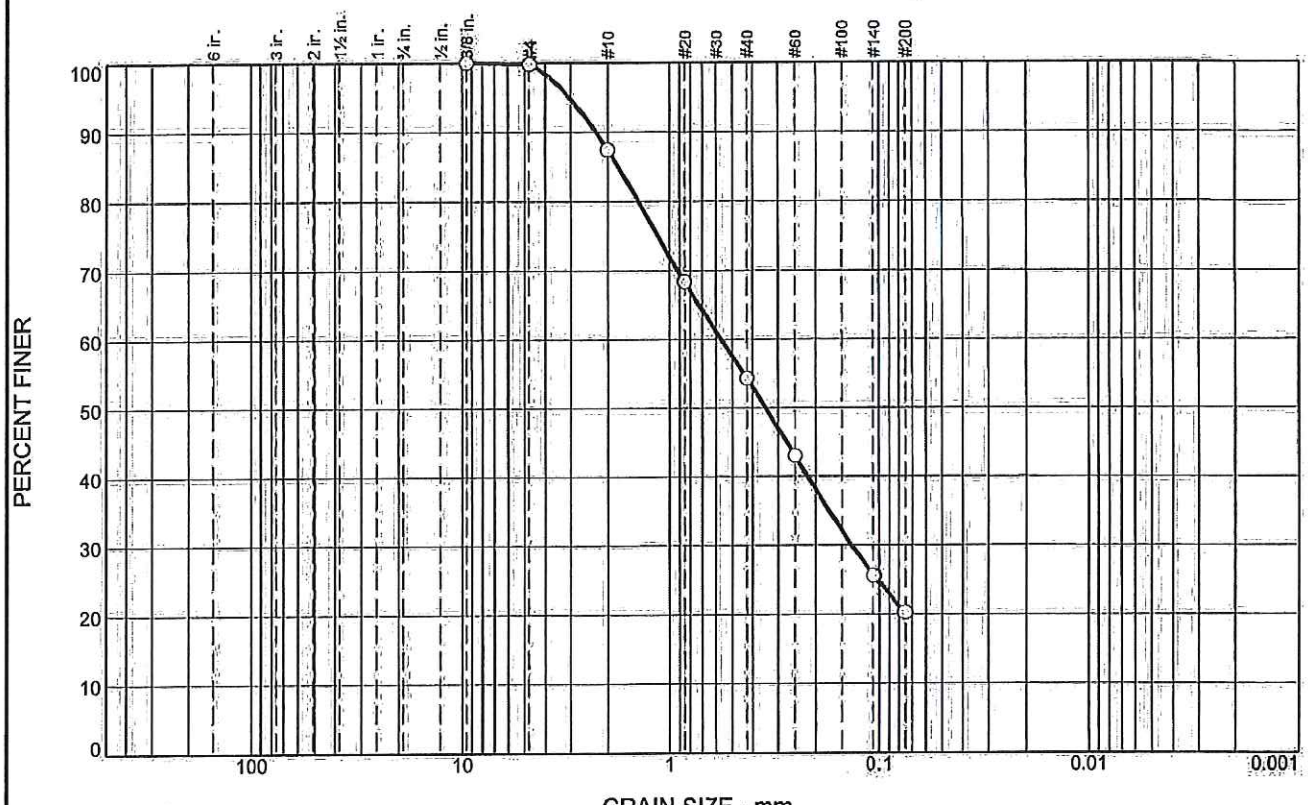
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	12.3	33.2	34.1	20.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	99.8		
#10	87.5		
#20	68.3		
#40	54.3		
#60	43.0		
#140	25.6		
#200	20.2		

* (no specification provided)

Material Description

Light-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.2715 D_{85}= 1.7794 D_{60}= 0.5650
D_{50}= 0.3453 D_{30}= 0.1349 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Location: Borrow Sample #3

Date: 07-06-2012

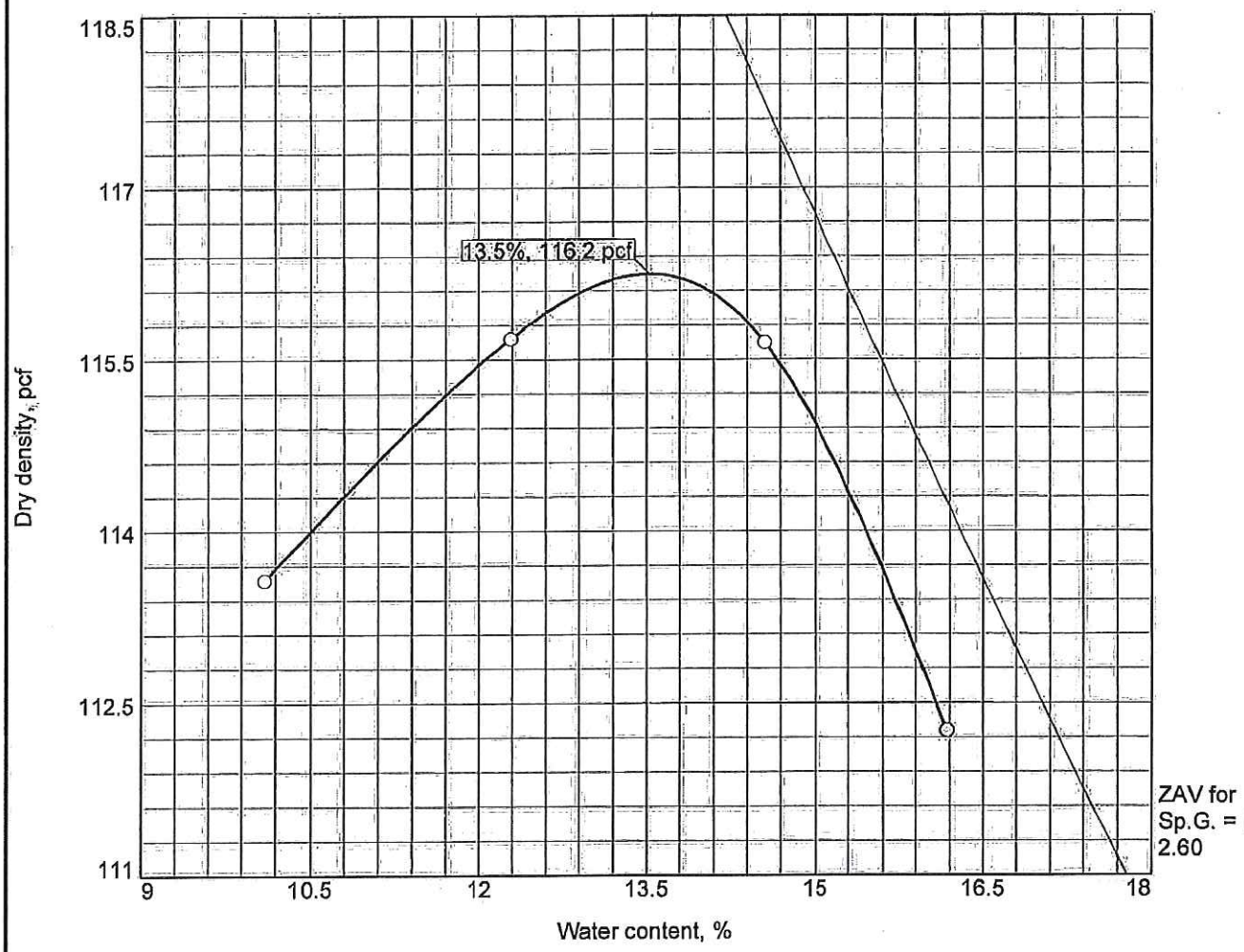
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Project No: C-2398-12 **Figure**

Tested By: Mimi Hourani

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-1-b			NV	NP	3.9	17.7

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 116.2 pcf Optimum moisture = 13.5 %	Light-Brown Silty Sand

Project No. C-2398-12 **Client:** Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
○ **Location:** Borrow Sample #1

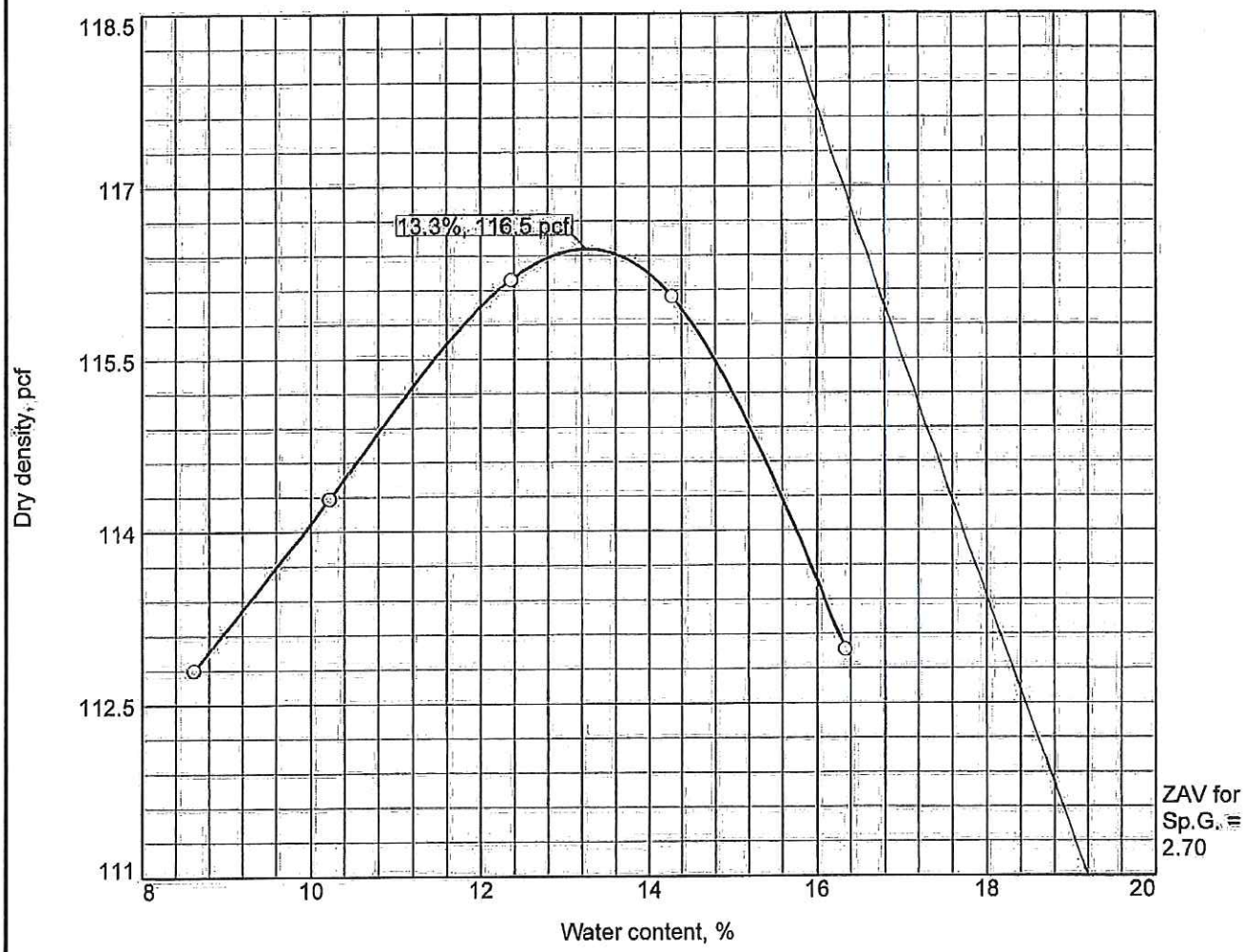
Remarks:
Final Cap Material

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-1-b			NV	NP	5.8	16.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 116.5 pcf Optimum moisture = 13.3 %	Light-Brown Silty Sand

Project No. C-2398-12 **Client:** Griffin Bros. Companies
Project: North Meck. Landfill Infill
Huntersville, NC
Location: Borrow Sample #2

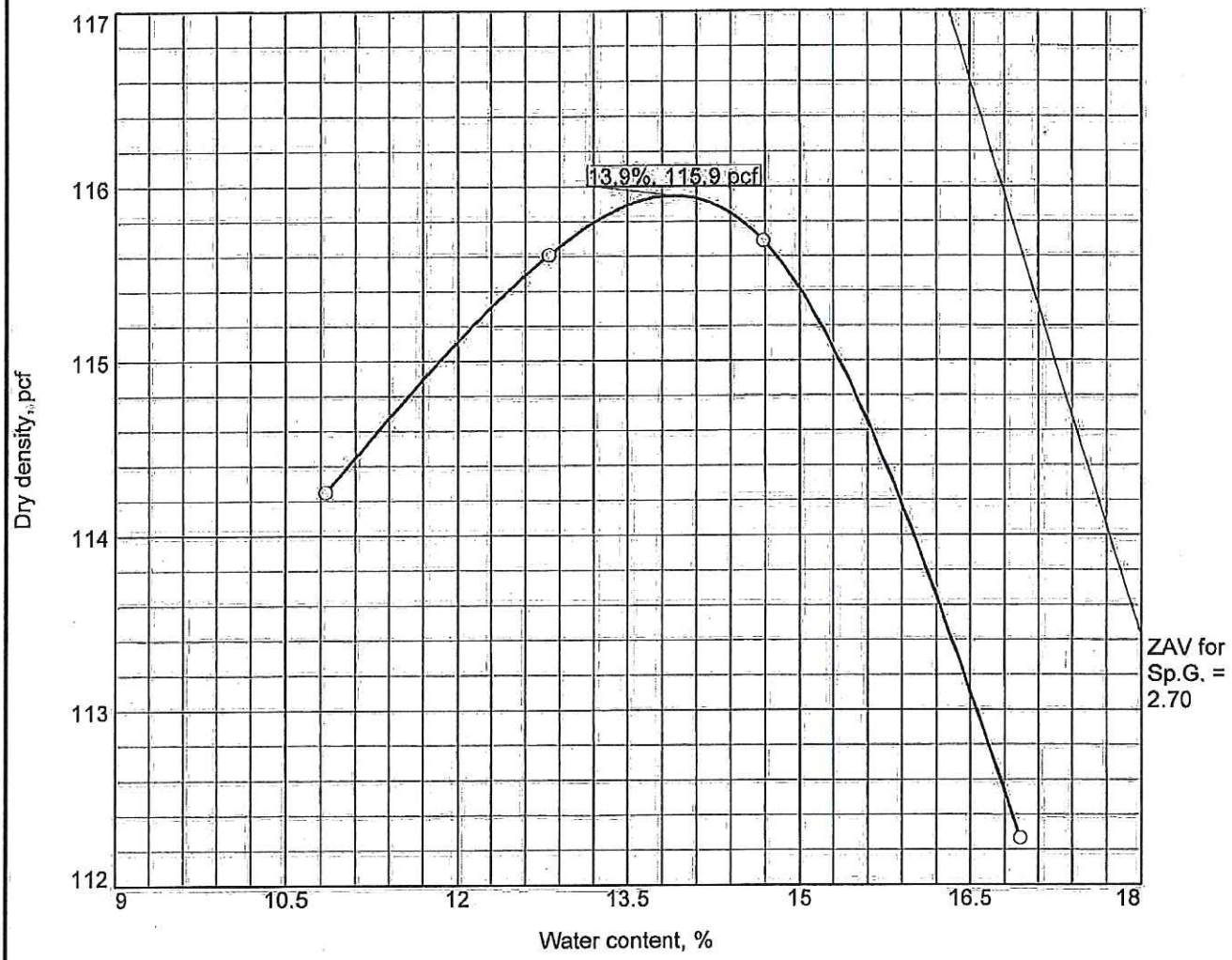
Remarks:
Final Cap Material

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-2-4(0)			NV	NP	0.2	20.2

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 115.9 pcf Optimum moisture = 13.9 %	Light-Brown Silty Sand
Project No. C-2398-12 **Client:** Griffin Bros. Companies **Project:** North Meck. Landfill Infill Huntersville, NC o **Location:** Borrow Sample #3	**Remarks:** Final Cap Material
Summit Engineering **Ft. Mill, South Carolina**	**Figure**

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.31
Specimen Diameter (cm): 7.28
Dry Unit Weight (pcf): 114.4
Moisture Before Test (%): 13.4
Moisture After Test (%): 17.1

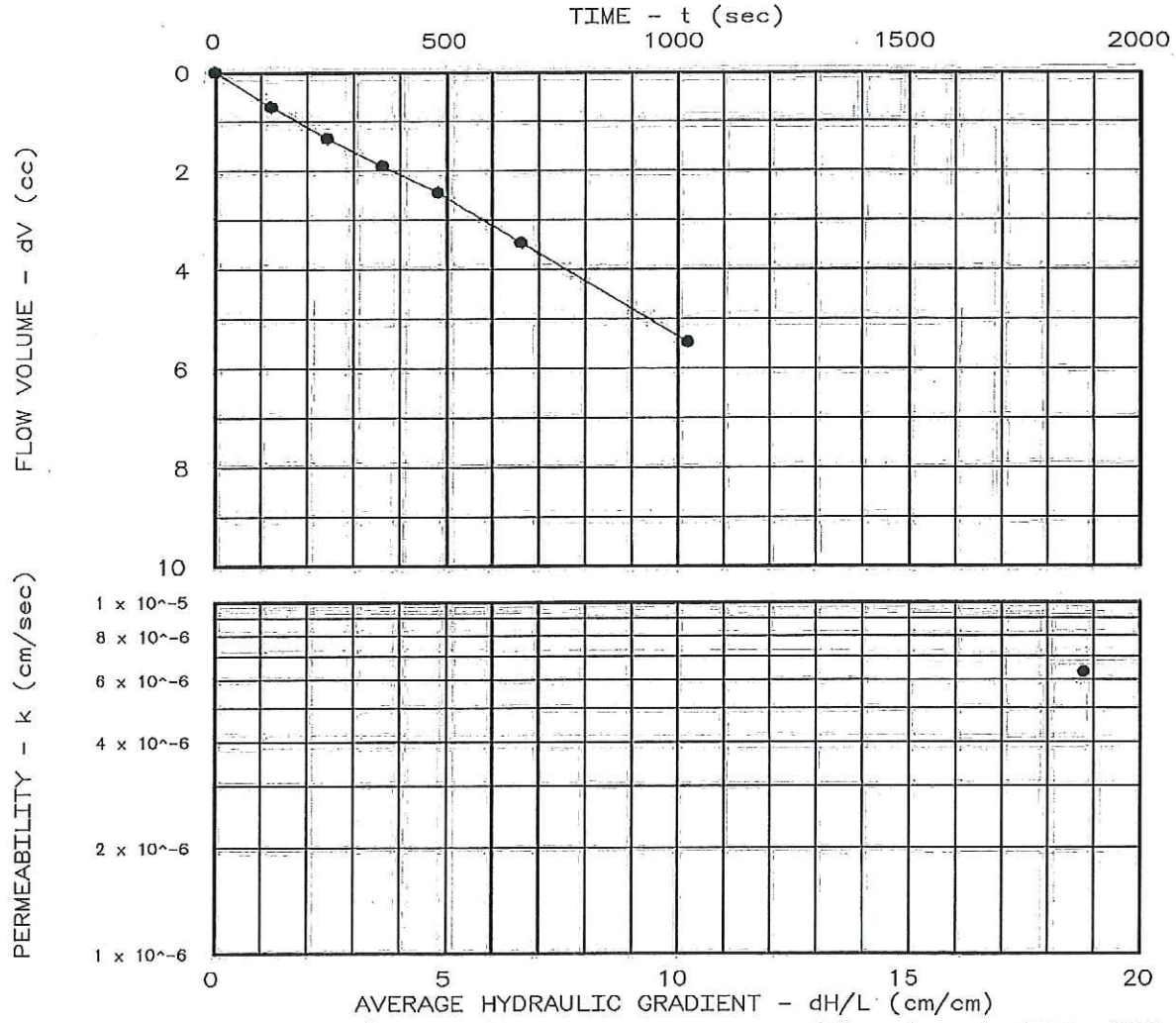
Run Number:	1 ●	2 ▲
Cell Pressure (psi):	80.0	
Test Pressure(psi):	72.0	
Back Pressure(psi):	70.0	
Diff. Head (psi):	2.0	
Flow Rate (cc/sec):	5.28 x 10^-3	
Perm. (cm/sec):	6.32 x 10^-6	

SAMPLE DATA:

Sample Identification: Borrow Sample #1
Final Cap Material
Visual Description: Light-Brown Silty Sand

Remarks:

Maximum Dry Density (pcf): 116.2
Optimum Moisture Content (%): 13.5
ASTM(D698)
Percent Compaction: 98.4%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: North Meck. Landfill Infill
Location: Huntersville, NC
Date: 07-05-2012

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: C-2398-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	North Meck. Landfill Infill
File No.:	
Project Location:	Huntersville, NC
Project No.:	C-2398-12
Sample Identification:	Borrow Sample #1 Final Cap Material
Lab No.:	
Description:	Light-Brown Silty Sand
Sample Type:	Remolded
Max. Dry Dens.:	116.2
Method (D1557/D698):	D698
Opt. Water Content:	13.5
Date:	07-05-2012
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.867 in	in		2.867 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.87 in	7.28 cm		2.87 in	7.28 cm	
Length:	1	2	3	1	2	3
	2.877 in	in	in	2.886 in	in	in
Average:	2.88 in	7.31 cm		2.89 in	7.33 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.70		
Wet Wt. & Tare:	632.32		652.83
Dry Wt. & Tare:	557.60		557.60
Tare Wt.:	0.00		0.00
Moisture Content:	13.4 %		17.1 %
Dry Unit Weight:	114.4 pcf	98.4 % of max	114.0 pcf
Porosity:	0.3215		0.3236
Saturation:	76.4 %		96.4 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 4 Panel No.: 4 Positions: 1

Run Number:	1	2
Cell Pressure:	80.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	OUT	BURET READING-cc IN	OUT	OUTFLOW/ INFLOW RATIO
S	7/ 6/12	15:40:00	0	72.0	70.0	5.00	5.00	0.00
	7/ 6/12	15:42:00	120	72.0	70.0	5.70	4.30	1.00
	7/ 6/12	15:44:00	240	72.0	70.0	6.34	3.66	1.00
	7/ 6/12	15:46:00	360	72.0	70.0	6.90	3.10	1.00
	7/ 6/12	15:48:00	480	72.0	70.0	7.44	2.56	1.00
	7/ 6/12	15:51:00	660	72.0	70.0	8.46	1.54	1.00
R						8.47	1.54	
R						5.00	5.00	
	7/ 6/12	15:57:00	1,020	72.0	70.0	7.00	3.00	1.00

Test Pressure = 72.0 psi Differential Head = 2.0 psi, 137.2 cm H2O
Gradient = 1.878E 01 Flow rate = 5.284E-03 cc/sec R squared = 0.99882
Permeability, K22.8° = 6.755E-06 cm/sec, K20° = 6.319E-06 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.51
Specimen Diameter (cm): 7.28
Dry Unit Weight (pcf): 112.3
Moisture Before Test (%): 13.3
Moisture After Test (%): 17.4

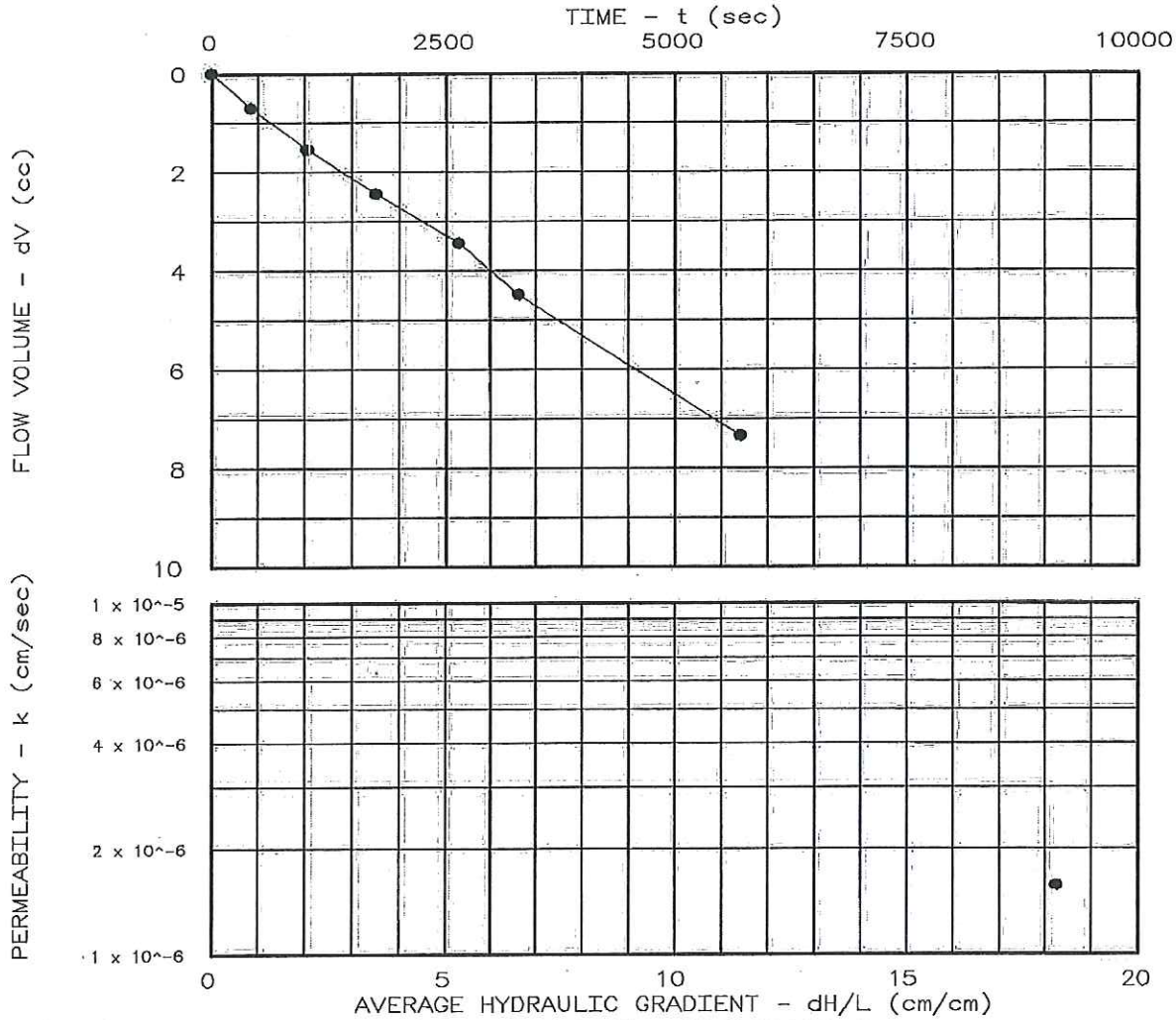
Run Number:	1 ●	2 ▲
Cell Pressure (psi):	80.0	
Test Pressure(psi):	72.0	
Back Pressure(psi):	70.1	
Diff. Head (psi):	1.9	
Flow Rate (cc/sec):	1.27 x 10^-3	
Perm. (cm/sec):	1.57 x 10^-6	

SAMPLE DATA:

Sample Identification: Borrow Sample #2
Final Cap Material
Visual Description: Light-Brown Silty Sand

Remarks:

Maximum Dry Density (pcf): 116.5
Optimum Moisture Content (%): 13.3
ASTM(D698)
Percent Compaction: 96.4%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: North Meck. Landfill Infill
Location: Huntersville, NC
Date: 07-05-2012

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: C-2398-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	North Meck. Landfill Infill
File No.:	
Project Location:	Huntersville, NC
Project No.:	C-2398-12
Sample Identification:	Borrow Sample #2 Final Cap Material
Lab No.:	
Description:	Light-Brown Silty Sand
Sample Type:	Remolded
Max. Dry Dens.:	116.5
Method (D1557/D698):	D698
Opt. Water Content:	13.3
Date:	07-05-2012
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.866 in	in		2.866 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.87 in	7.28 cm		2.87 in	7.28 cm	
Length:	1	2	3	1	2	3
	2.956 in	in	in	2.956 in	in	in
Average:	2.96 in	7.51 cm		2.96 in	7.51 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.70		
Wet Wt. & Tare:	637.17		660.26
Dry Wt. & Tare:	562.37		562.37
Tare Wt.:	0.00		0.00
Moisture Content:	13.3 %		17.4 %
Dry Unit Weight:	112.3 pcf	96.4 % of max	112.3 pcf
Porosity:	0.3335		0.3335
Saturation:	71.8 %		93.9 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 4 Panel No.: 4 Positions: 1

Run Number:	1	2
Cell Pressure:	80.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	7/10/12	10:27:00	0	72.0	70.0	5.00	5.00	0.00
	7/10/12	10:34:00	420	72.0	70.0	5.70	4.30	1.00
	7/10/12	10:44:00	1,020	72.0	70.0	6.54	3.46	1.00
	7/10/12	10:56:00	1,740	72.0	70.0	7.44	2.56	1.00
	7/10/12	11:11:00	2,640	72.0	70.0	8.44	1.56	1.00
R						8.44	1.56	
R						5.00	5.00	
	7/10/12	11:22:00	3,300	72.0	70.0	6.04	3.96	1.00
	7/10/12	12:02:00	5,700	72.0	70.0	8.90	1.10	1.00

Test Pressure = 72.0 psi Differential Head = 1.9 psi, 136.9 cm H2O
Gradient = 1.823E 01 Flow rate = 1.275E-03 cc/sec R squared = 0.99834
Permeability, K22.8° = 1.680E-06 cm/sec, K20° = 1.572E-06 cm/sec

PERMEABILITY TEST REPORT

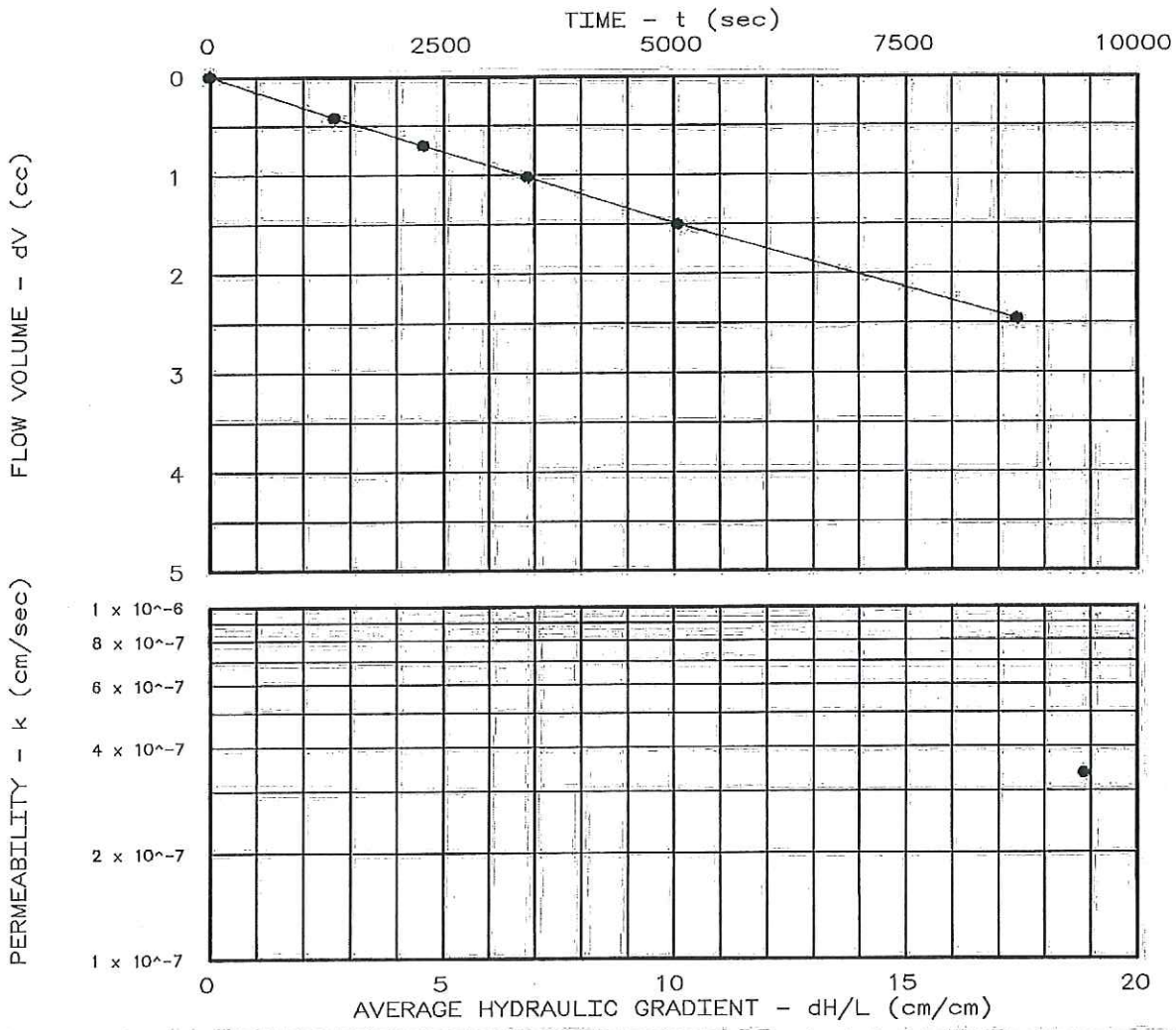
TEST DATA:
Specimen Height (cm): 7.35
Specimen Diameter (cm): 7.28
Dry Unit Weight (pcf): 114.2
Moisture Before Test (%): 13.0
Moisture After Test (%): 16.9

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	80.0	
Test Pressure(psi):	72.0	
Back Pressure(psi):	70.0	
Diff. Head (psi):	2.0	
Flow Rate (cc/sec):	2.82 x 10^-4	
Perm. (cm/sec):	3.35 x 10^-7	

SAMPLE DATA:
Sample Identification: Borrow Sample #3
Final Cap Material
Visual Description: Light-Brown Silty Sand

Remarks:

Maximum Dry Density (pcf): 115.9
Optimum Moisture Content (%): 13.9
ASTM(D698)
Percent Compaction: 98.5%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: North Meck. Landfill Infill
Location: Huntersville, NC
Date: 07-05-2012

Project No.: C-2398-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	North Meck. Landfill Infill
File No.:	
Project Location:	Huntersville, NC
Project No.:	C-2398-12
Sample Identification:	Borrow Sample #3 Final Cap Material
Lab No.:	
Description:	Light-Brown Silty Sand
Sample Type:	Remolded
Max. Dry Dens.:	115.9
Method (D1557/D698):	D698
Opt. Water Content:	13.9
Date:	07-05-2012
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.868 in	in		2.858 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.87 in	7.28 cm		2.86 in	7.26 cm	
Length:	1	2	3	1	2	3
	2.894 in	in	in	2.894 in	in	in
Average:	2.89 in	7.35 cm		2.89 in	7.35 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.70		
Wet Wt. & Tare:	633.10		654.82
Dry Wt. & Tare:	560.27		560.27
Tare Wt.:	0.00		0.00
Moisture Content:	13.0 %		16.9 %
Dry Unit Weight:	114.2 pcf	98.5 % of max	115.0 pcf
Porosity:	0.3227		0.3179
Saturation:	73.7 %		97.7 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 4 Panel No.: 4 Positions: 1

Run Number:	1	2
Cell Pressure:	80.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	7/11/12	14:20:00	0	72.0	70.0	5.20	5.20	0.00
	7/11/12	14:42:00	1,320	72.0	70.0	5.62	4.78	1.00
	7/11/12	14:58:00	2,280	72.0	70.0	5.90	4.50	1.00
	7/11/12	15:17:00	3,420	72.0	70.0	6.22	4.18	1.00
	7/11/12	15:44:00	5,040	72.0	70.0	6.70	3.70	1.00
	7/11/12	16:45:00	8,700	72.0	70.0	7.66	2.74	1.00

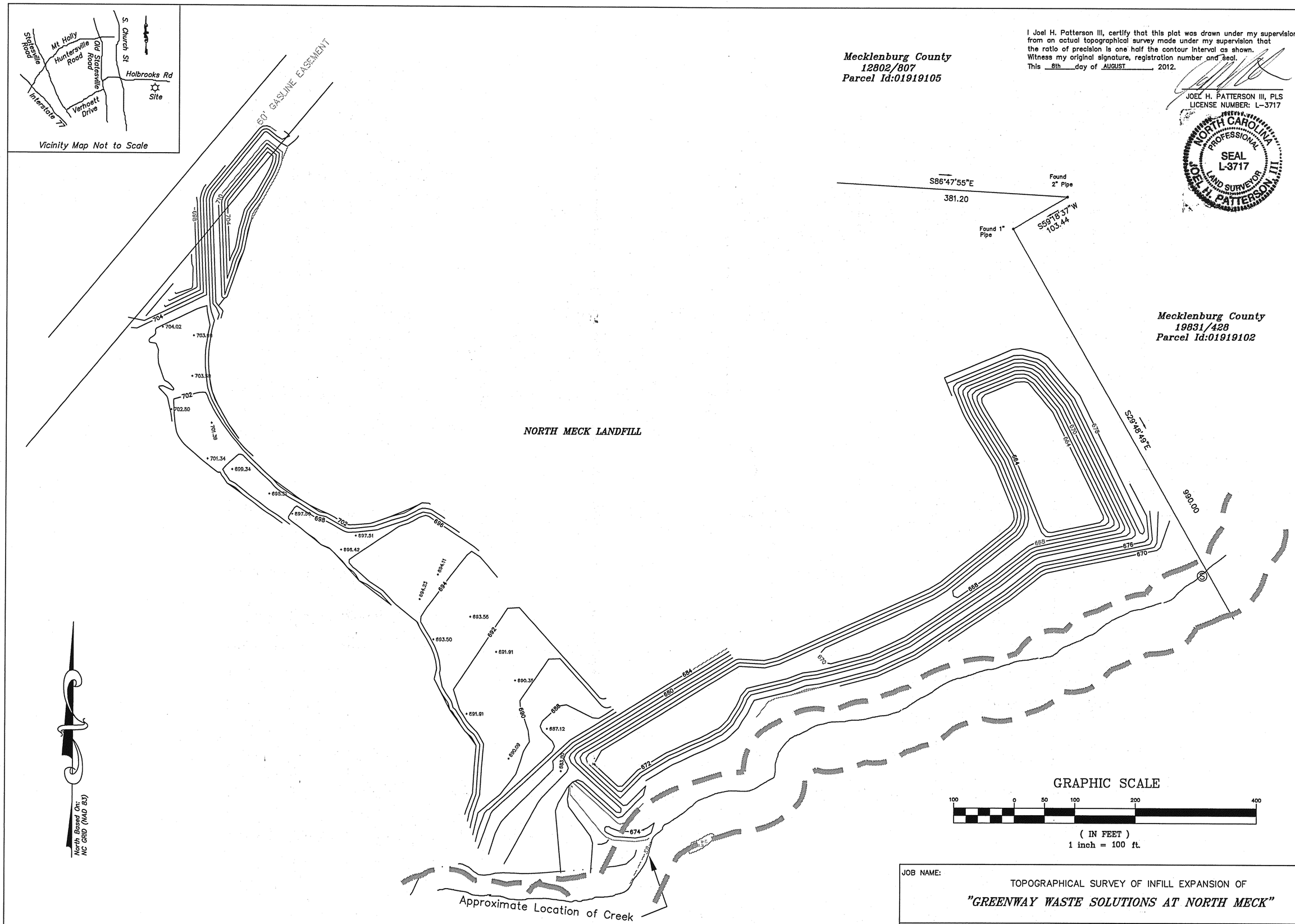
Test Pressure = 72.0 psi Differential Head = 2.0 psi, 138.6 cm H2O
Gradient = 1.885E 01 Flow rate = 2.817E-04 cc/sec R squared = 0.99874
Permeability, K22.8° = 3.586E-07 cm/sec, K20° = 3.354E-07 cm/sec

Appendix G

I Joel H. Patterson III, certify that this plat was drawn under my supervision from an actual topographical survey made under my supervision that the ratio of precision is one half the contour interval as shown.
Witness my original signature, registration number and seal.
This 8th day of AUGUST, 2012.

JOEL H. PATTERSON III, PLS
LICENSE NUMBER: L-3717

NORTH CAROLINA PROFESSIONAL SEAL L-3717 LAND SURVEYOR JOEL H. PATTERSON, III

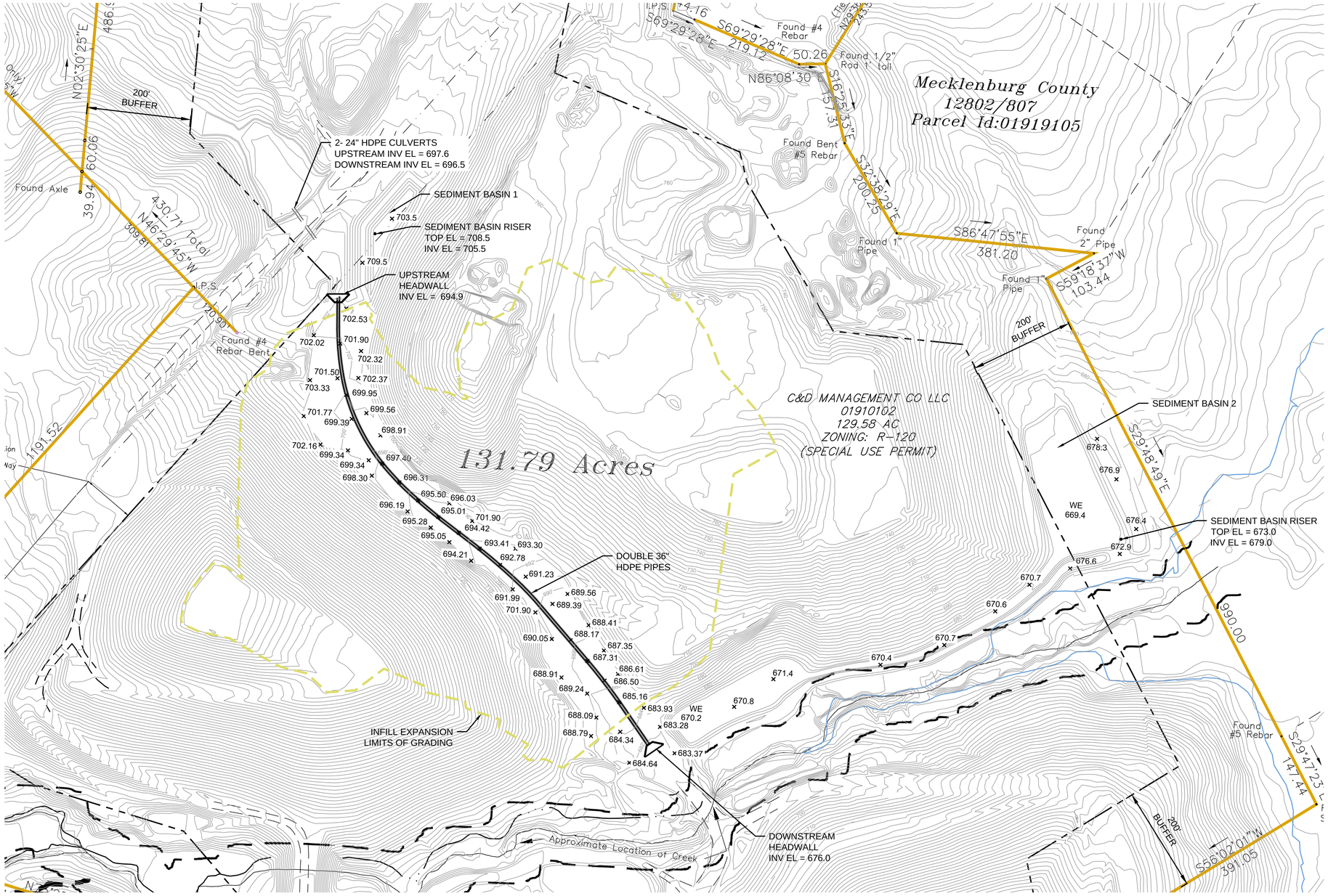


JOB NAME: TOPOGRAPHICAL SURVEY OF INFILL EXPANSION OF *"GREENWAY WASTE SOLUTIONS AT NORTH MECK"*	
LOCATION: MECKLENBURG COUNTY, NORTH CAROLINA	DRAWN BY: JHP / CHECKED BY: JHP
	1" = 100'
OWNER: GREENWAY WASTE SOULTIONS, LLC, 19109 W. CATAWBA AVE. SUITE 200, CORNELIUS, NC 28031-5611	DATE OF FIELD SURVEY: JULY 2012
	DATE OF MAP: AUGUST 8, 2012
	JOB NUMBER: 00905/CERTDRAWING / BOOK NO:

Land Surveying by:
PATTERSON LAND SURVEYING, PA
C-3390
P.O. Box 5010, Mooresville, NC 28117
704/361-0415 * Fax 704/799-8565

REVISION RECORD		
NO	DATE	DESCRIPTION
1	9/24/2012	REVISIONS TO FACILITY MAP - INFILL AREA PIPE INSTALLATION AND GRADING

NORTH



REFERENCE NOTES:

1. EXISTING PROPERTY BOUNDARY INFORMATION BASED UPON SURVEY PROVIDED BY PATTERSON LAND SURVEYING, PA, DATED JULY 9, 2010.
2. EXISTING TOPOGRAPHY BASED UPON MECKLENBURG COUNTY GIS (2005) AND INDEPENDENT MAPPING CONSULTANTS, INC. SURVEY (2012).
3. EXISTING INFILL PIPE AREA TOPOGRAPHY PROVIDED BY PATTERSON LAND SURVEYING, PA, DATED AUGUST 6, 2012.
4. ALL ELEVATIONS SHOWN ARE BASED ON MEAN SEA LEVEL.
5. NO COMPLETE TOPOGRAPHIC SURVEY HAS BEEN PERFORMED AT THIS TIME.
6. OVERALL SITE BOUNDARY ESTABLISHED BY TOWN OF HUNTERSVILLE THROUGH ANNEXATION PROCESS (SEE NOTE 1).
7. WETLANDS BOUNDARY BASED UPON DELINEATION COMPLETED JULY 25, 2009 BY S&ME, INC.
8. STREAM CENTERLINE LOCATION BASED ON SURVEY COMPLETED FEBRUARY 22, 2010 BY PATTERSON LAND SURVEYING, PA.
9. SWIM BUFFER INFORMATION OBTAINED FROM MECKLENBURG COUNTY GIS DATED FEBRUARY 2010.

LEGEND

PROPOSED

- INFILL EXPANSION LIMITS OF GRADING

EXISTING

- 2-FOOT ELEVATION CONTOUR
- 10-FOOT ELEVATION CONTOUR
- FACILITY PLAN LANDFILL BOUNDARY
- SWIM BUFFER
- FLOODPLAIN
- PROPERTY BUFFER LINE
- 676.4 SPOT ELEVATION

SCALE IN FEET
0 100 200

Civil & Environmental Consultants, Inc.
2030 S. Tyron Street - Suite 3E - Charlotte, NC 28203
Ph: 980.224.8104
www.cecinc.com

GREENWAY WASTE SOLUTIONS OF NORTH MECK, LLC
INFILL EXPANSION
MECKLENBURG COUNTY, NC

DRAWN BY:	TMG	CHECKED BY:	SLB	APPROVED BY:	SLB
DATE:	SEP. 2012	DWG SCALE:	1"=100'	PROJECT NO:	111-370.001

EXISTING CONDITIONS
FACILITY MAP

DRAWING NO.: C-101
SHEET 1 OF 1

P:\2011\111-370\-0400\0011\Dwg\Facility\Map\111-370.001Facility\Map2.dwg[C-101] LS(24/09/2012 - lpeterson) - LP, 9/24/2012 3:38 PM

Appendix H

August 8, 2012

John Murray, PE
NC DENR – DWM
610 East Center Avenue, Suite 301
Mooresville, NC 28115
Phone: (704) 235-2163

Dear John:

Subject: Certification North Meck Infill Expansion
Greenway Waste Solutions at North Meck, LLC
Permit No. 60-13
CEC Project No. 111-370.001

Civil & Environmental Consultants, Inc. has verified subgrade elevations on a 100-ft grid of the as-built survey for the 3.2 acre subgrade footprint cell. All point locations met the minimum permitted subgrade elevations. The construction was completed in accordance with:

1. The CQA Plan.
2. The conditions of the Permit to Construct.
3. The Requirements of 15A NCAC 13B .0541.
4. Acceptable engineering practices

Please let me know if you have any questions or comments. I can be reached at (704) 773-6465.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Scott L. Brown, PE
Project Manager

NORTH CAROLINA PROFESSIONAL SEAL 026435 ENGINEER SCOTT L. BROWN

Cc: Mr. Ron Gilkerson

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Charlotte, North Carolina 28203
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E-mail: sbrown@cecinc.com
www.cecinc.com

Austin 855/365-2324
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Cincinnati 800/759-5614
Cleveland 866/507-2324
Columbus 888/598-6808

Detroit 866/380-2324
Export 800/899-3610
Indianapolis 877/746-0749
Nashville 800/763-2326
North Central PA 877/389-1852

Pittsburgh 800/365-2324
Phoenix 877/231-2324