Prepared for:

Coble Sandrock, Inc.
5833 Foster Store Road
Liberty, North Carolina 27298

JEI PROJECT NO. 419.00, TASK 22

COBLE'S SANDROCK, INC.
ALAMANCE COUNTY, NORTH CAROLINA
CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL

VOLUME II
APPLICATION FOR
PERMIT TO CONSTRUCT
PHASE 3

APPROVED
DIVISION OF WASTE MANAGEMENT
SOLID WASTE SECTION
DATE 02/19/2009 BY
DIN 4862

SEPTEMBER 2007
REV. MARCH 2008
REV. MAY 2008

Prepared by:

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FIGURES

Figure 1	Future Tonnage Projection

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DRAWINGS

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Drawing FP-02	Facility Plan – Final Contours
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Drawing EP-01	Engineering Plans – Existing Conditions
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Appendix I	Stability Analyses
Appendix II	Erosion and Sediment Control Calculations
Appendix III	Design Hydrogeologic Report
Appendix IV	Construction Specifications
Appendix V	Property Deeds
Appendix VI	Franchise Agreement
Appendix VII	Material Reclamation Info
Appendix VIII	Waste Screening Forms
Appendix IX	Post Closure Inspection Forms
Appendix X	Fire Department Letter
Appendix XI	Health & Safety Plan

GENERAL

Coble's Sandrock, Inc. requests a permit to construct a new 5-year phase (Phase 3) for its construction and demolition debris (C&D) landfill. Joyce Engineering, Inc. (JEI) has prepared this permit application on behalf of Coble's Sandrock and presents the following information in support of this request.

A. FACILITY PLAN (.0537)

Facility Plan Drawings (FP-01 through FP-02) provide the information required in Section .0537(d).

1. Waste Stream

Types of Waste Specified for Disposal: Only construction/demolition debris will be accepted at the C&D landfill, and only land clearing/inert debris (LCID) will be accepted in permitted LCID areas. Construction and demolition debris is defined in NC General Statutes as waste or debris resulting solely from construction, remodeling, repair, or the demolition of pavement, buildings, or other structures. LCID is waste that is generated from land clearing activities.

Disposal Rates:	2005	55,405 tons of C&D waste
	2004	59,041 tons of C&D waste
	2003	65,000 tons of C&D waste
	2002	34,404 tons of C&D waste
	2001	36,012 tons of C&D waste

The Franchise Agreement for Coble's Sandrock limits the waste acceptance rate to 600 tons per day. Assuming a 5.5 day work week, this is the equivalent of 171,600 tons per year. Based on the current growth rate, Coble's Sandrock is expected to reach this ceiling in the year 2023.

Service Area: The Alamance County Franchise Agreement, which is provided in Appendix VI, limits the service area to be served by the Coble's Sandrock Landfill to customers within 25 miles from the site. Existing customers outside the 25-mile service limitation are grandfathered under the Franchise Agreement and Coble's Sandrock may continue to accept wastes from these customers. Coble's Sandrock may also accept waste from new customers outside the 25-mile service area to replace existing customers outside the service area; however, first priority in terms of disposal capacity is to be given to waste generated within Alamance County.

The 25-mile radius area includes almost all of Alamance County, and approximately half of Orange, Chatham, Randolph, and Guilford Counties, and small portions of Rockingham and Caswell Counties. The North Carolina State Demographics Department estimated populations of the above-listed counties in 2004 to be: Alamance (137,126), Orange (120,965), Chatham (55,000), Randolph (135,805), Guilford (434,693). Therefore the population within a 25 mile area of Coble's Sandrock, assuming 50% of Orange, Chatham, Randolph and Guilford Counties, was approximately 510,000 in 2004.

The average population growth rate for the five counties listed is approximately 1.5% per year (from NC State Demographics Department). At that rate, the population within 25 miles of Coble's Sandrock will be approximately 568,000 by the year 2011, and 754,000 by the year 2030.

Segregation Management Procedures: Recyclable material will be segregated from the waste stream and temporarily stored in containers or stockpiles prior to being removed from the site. Recyclable material may include wood, metals, concrete, plastic, cardboard, and other materials identified as appropriate for recycling. Approximately 70 cubic yards of metal material is removed from the site weekly and taken to D.H. Griffin Wrecking Co. Inc. Cardboard is stored in a 40-yard container that is removed from the site by Federal Paper Board when full. Coble's Sandrock deconstructs mobile trailer homes at the working face of the C&D landfill. Identified C&D waste material removed from the deconstruction process is placed into the landfill. Material reclamation information is provided in Appendix VII.

The locations of the mobile trailer home deconstruction area and the recyclables storage areas follow the location of the working face as it progresses across the landfill.

Equipment: Coble Sandrock proposes to operate the following equipment at the C&D landfill:

- Front End Track Loaders (2)
- Grapple Track Hoe (1)
- Bucket Track Hoe (1)
- Electric Magnet Track Hoe (1)
- Cat Compactor (1)
- Rex Compactors (2)
- Pans – TX 14 y (2)
- Rubber Tire Loader (1)
- Screener (1)
- Grinder (1)
- 60 y Container (3)
- 40' Steel Trailer (2)
- Road Tractor (1)
- Off Road Truck (1)

Additional equipment may be added, depending on the actual quantity of waste accepted.

2. Landfill Capacity

Overall Facility Life

The available air space for waste and intermediate cover material for the entire facility is 6,935,903 cy. Assuming that 10% of that volume will be taken up with soil material, 6,242,313 cy are available for waste material. If an in-place waste density of 1050 lbs/cy is used, the remaining tonnage capacity of the landfill is 3,277,214 tons. The in-place waste density stated above is within the typical range of densities measured for C&D debris.

The annual tonnages received by Coble's Sandrock over the last five years are: 36,012 tons (2001); 34,404 tons (2002); 65,000 tons (2003); 59,041 tons (2004) and 55,405 tons (2005). To show the expected air space consumption for the life of the facility, a best-fit line was applied to these data points and projected out until the Franchise Agreement limit for daily tonnage was reached (See Figure 1). The Franchise Agreement for Coble's Sandrock limits the waste acceptance rate to 600 tons per day. Assuming a 5.5 day work week, this is the equivalent of 171,600 tons per year. Based on the current growth rate, Coble's Sandrock is expected to reach this ceiling in the year 2023. From 2023 on, it is assumed that Coble's Sandrock will accept 171,600 tons per year. At this projected rate, the landfill will run out of space in the year 2030.

Overall Facility Soil Balance

The base grading plan, including access roads, for the entire remaining facility yields a net 1,537,784 cy of cut. Approximately 325,871 cy of soil will be needed for final cap (3 feet thick) construction. The total volume of air space available for waste and intermediate soil covers is 6,935,903 cy. Assuming 10% of the volume will be taken up with soil material, 693,590 cy of soil will be needed for intermediate cover material. Subtracting the estimated soil requirements from the calculated available cut material leaves an excess of 518,323 cy of soil.

Numerous soil borings have been completed on the site. A summary of soils testing performed on various borings is presented in Table 2 of Appendix III. Laboratory testing indicates that the near-surface soils have remolded permeabilities on the order of 10^{-7} cm/sec, and are therefore suitable for use as cover material.

Phase 3 Life

To evaluate the air space requirement for a new 5-year phase, a best-fit line was applied to tonnage data from the past five years and projected forward through 2011 (See Figure 1). The projected total tonnage for the next 5-year phase is 440,130 tons (See Figure 1). Assuming an in-place waste density of 1050 lbs per cubic yard, the required air space for waste for the 5-year phase is 836,250 cubic yards. Also, assuming that a 6-inch lift of cover soil will be placed on the working face once per week, an additional 10% (83,625 cubic yards) of air space will be required. Therefore, the total air space required, not including the intermediate or final cap, is 919,875 cubic yards.

Using Autodesk Land Desktop 2006, the total gross capacity is 969,089 cy (818,363 cy for waste; 81,836 cy for intermediate cover; and 68,890 cy for final cover). Since the design volume for waste is 98% of the volume for waste required for a 5-yr duration (818,363 cy / 836,250 cy), the life of the phase is estimated to be 98% of 5 years, or 4.9 years. The final cover volume was calculated, assuming 3.5' of soil over an area of 12.2 acres. The 3.5' includes placing 6" on top of the last intermediate cover layer to establish the 12" intermediate layer.

The base grading plan for Phase 3 results in 150,200 cubic yards (net) of cut. The cut material will be stockpiled for use as weekly cover and final cover. The weekly cover required for Phase 3 is estimated to be 81,836 cubic yards and the final cover volume is 68,890 cubic yards. The estimated soil shortage of 526 cubic yards will be acquired by borrowing from areas onsite, adjacent to the Phase 3 expansion.

3. Special Engineering Features

Containment and Environmental Control Systems

Cap System:

The cap system is described from bottom to top in the following paragraphs.

Infiltration Barrier: An infiltration barrier will consist of an 18-inch low-permeability soil layer compacted to achieve a hydraulic conductivity no greater than 1 x 10^{-5} cm/sec. The 18-inch low permeability soil barrier may be replaced with a geosynthetic clay layer (GCL), as discussed in the Engineering Plan of this report. The low-permeability soil barrier, or the GCL, will lie directly above an intermediate soil cover layer of at least 12 inches in thickness.

Erosion Control Components (Protective Layer and Erosion Layer): A protective layer consisting of at least 18 inches of local soil will be placed on top of the infiltration barrier. The erosion and protective layers will not be heavily compacted so that vegetative growth will be promoted. Soil tests will be conducted prior to seeding to determine if amendments to the soil are needed to establish a healthy stand of vegetation.

Vegetative Cover: After placement of the erosion layer, the area that has been closed will be seeded with a grass mixture. Mulch and erosion control matting will be used as needed to further minimize erosion.

Gas Management System:

To relieve pressure beneath the low permeability cap, a system of passive vents will be installed as shown on Drawing EP-06.

B. ENGINEERING PLAN (.0539)

Engineering Plan Drawings (EP-01 through EP-10) provide the information required in Section .0539.

Summary of Facility Design

Subgrade and Foundation:

For the subgrade stability and settlement calculations conservative assumptions were made for soil characteristics. These assumptions were based on the soil lab data available, as summarized in Table 2 of Appendix III. During construction, as part of the CQA process, lab testing will be performed to verify that the soils used meet or exceed the assumed values. The assumed soil characteristics are listed below.

Soil	
Dry Unit Weight (lbs/cf):	100
Moisture Content (%):	16.5
Moist Unit Weight (lbs/cf):	120
Saturated Unit Weight (lbs/cf):	130
Friction Angle:	20°
Cohesion:	0

Waste	
Max. Height (ft):	120*
Moist Unit Weight (lbs/cf):	75

* This value was determined by subtracting the lowest base grade elevation of Phase 3 (576 see EP-02) from the maximum grade of Phase 3 (696 see EP-06).

The subgrade of the landfill consists of the underlying soils and controlled fill components (berms and embankments). The underlying materials that will serve as the foundation for the landfill are predominantly sandy silts and silty sands. Controlled fill will be placed in uniform lifts and compacted to within 95% of the soil's maximum dry density as determined by a Standard Proctor Test (ASTM D698). The excavation grades are shown on Drawing EP-02.

A land surveyor licensed in North Carolina will verify that the dimensions and elevations of the subgrade are in accordance with the approved plans. Settlement and bearing capacity analyses have been conducted to demonstrate that the subgrade will support the loads of the landfill and maintain required separation from groundwater and bedrock. The anticipated maximum total settlement is estimated to be 0.84 inches. Supporting calculations are included in Appendix I-A.

The bearing capacity of the subgrade was evaluated to determine if the subgrade material could bear the weight of the landfill without enduring shear failure. The results of the bearing capacity analyses indicate a minimum factor of safety of 13.4 using the Vesic Equation. For the purposes of the bearing capacity calculation, a single subgrade layer is used for the calculation. Considering the conservative values used for the soil parameters (friction angle of 20 deg) it can reasonably be assumed that any subsurface layers would possess at least the assumed strength characteristics. Additionally, the high factor of safety indicates that the underlying soil can easily support the weight of the landfill. Supporting calculations are in Appendix I-B.

Deep-seated rotational and translational failures were analyzed for the northeastern final slope and underlying layers (Phase 3A). The analyses indicate a minimum factor of safety of 2.45 in the static condition, and 1.77 during a seismic event. Supporting calculations are in Appendix I-C.

Final Cover System

Final grading contours and cover details for Phase 3 are shown on Drawing EP-06. Final contours have been designed with post-settlement surface slopes of at least five percent on top of the cell. Cross-sections of the proposed closure cap are provided on Drawing EP-10. The following components are proposed from bottom to top as shown on the details:

a. Intermediate Cover - Local soil will be placed over the daily cover soil to provide at least 12 inches of intermediate cover and a uniform base for construction of the cap.

Passive Gas Vents – Passive gas vents will be installed at a frequency of one per acre. Areas of the landfill that will be overlapped by waste from future phases of the landfill may not have vents installed. Examples of such vents are shown, shaded gray, on Drawing EP-06. A typical passive gas vent is detailed on Drawing EP-06. Passive venting of landfill gasses will protect the integrity of the cap by preventing excessive pressure buildup beneath the cap.

b. Infiltration Barrier - The infiltration barrier is proposed to consist of either (1) 18 inches of compacted soil with a permeability no greater than $1x10^{-5}$ cm/sec; or (2) a geosynthetic clay liner. This layer will be constructed over the intermediate soil layer. In the case of soil, the permeability requirement will be achieved using construction specifications developed prior to construction, and verified with laboratory test data. Installation and testing requirements for the cap are provided in the CQA Plan (Section C).

c. Protective/Erosion Layer - A layer consisting of at least 18 inches of local soil will be placed above the infiltration barrier to provide a protective cover. Compaction of the layer will be limited to about 90 percent (plus or minus three percent) of the Standard Proctor maximum dry density so that the vegetation can develop a strong root system.

d. Vegetation - After placement of the protective/erosion layer, the area will be seeded. Seeding will be accomplished in accordance with the "North Carolina Erosion and Sediment Control Planning and Design Manual," and the approved E&S Plan.

Additional information on the design, construction, maintenance and probable cost of the final cover system can be found in the Closure and Post-Closure Plan, Section E of this Application.

Erosion and Sediment Control Plan

The erosion and sediment control plan for Phase 3 has been submitted to the Division of Land Quality under separate cover. The erosion and sediment control plans are included in this volume as Drawings EP-06, 07, 08 and 10. Supporting calculations and correspondence with Land Quality are included in Appendix II.

TECHNICAL REFERENCES

ASCE "Seminar on Waste Containment and Final Closure Systems" Reference Manual (1995).

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McBean, Edward A. et al, Solid Waste Landfill Engineering and Design, Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1995.

North Carolina Sedimentation Control Commission, N.C. Department of Natural Resources and Community Development, N.C. Agricultural Extension Service, Erosion and Sediment Control Planning and Design Manual, December 1, 1993.

Richardson, G.N, et al., RCRA Subtitle D (258) Seismic Guidance for Municipal Solid Waste Landfill Facilities, EPA Publication EPA/600/R-95/051, 1995.

Soil Mechanics, Design Manual 7.01 Revalidated by Change 1, Naval Facilities Engineering Command, Alexandria, Virginia, September 1986.

Tan, Chia K. et al, Engineering Manual for Shallow Foundations, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, 1991.

U.S. Soil Conservation Service, Technical Release 55: Urban Hydrology for Small Watersheds, June 1986.

Waste Containment and Final Closure Systems, ASCE Seminar Design Manual, American Society of Civil Engineers.

C. CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN (.0541)

Purpose:

This plan addresses the construction quality assurance (CQA) procedures and requirements to be employed during construction of the project. All parties involved in the project should obtain a copy of this plan from the OWNER or ENGINEER. They should also obtain copies of any supplemental CQA documents prepared specifically for the project.

The overall goals of the CQA program are to ensure that proper construction techniques and procedures are employed, and to verify that the materials used meet the requirements of the Specifications provided in Appendix IV. Additionally, the program shall identify and define problems that may occur during construction, allowing corrective activities to be implemented in a timely manner. At the completion of the work, the program requires the certifying ENGINEER(s) to prepare certification reports indicating that the facility has been constructed in accordance with the design standards and specifications.

Responsibilities and authorities:

OWNER: The OWNER is the owner of the solid waste permit, and bears the ultimate responsibility for the facility; the OWNER may or may not also be the Operator of the facility. The OWNER shall contract and manage the CONTRACTOR(s), and the CQA consultant(s) and laboratories. For this project, Coble's Sandrock, Inc. is the OWNER, Operator and primary CONTRACTOR.

ENGINEER: The ENGINEER is the official representative of the OWNER, and is responsible for the preparation of the CQA Plan. The ENGINEER is also responsible for the interpretation of those documents and for the resolution of technical matters that may arise during construction. For this project, the ENGINEER is Joyce Engineering, Inc. of Greensboro, North Carolina.

CQA Consultant: The CQA Consultant is independent from the OWNER, CONTRACTOR(s), Manufacturer, and Installer, that is responsible for observing, testing, and documenting activities related to the Quality Assurance of the earthwork and geosynthetic components at the site. The CQA Consultant reports to the ENGINEER. The CQA Consultant is also responsible for issuing a certification report, sealed by a registered Professional Engineer, licensed in the State of North Carolina.

Soils CQA Laboratory: The Soils CQA Laboratory is independent from the OWNER, CONTRACTOR(s), and Supplier, responsible for performing the required laboratory testing of the project earthwork components.

CONTRACTOR: The CONTRACTOR has the primary responsibility for ensuring that the work is performed in accordance with the Permit Drawings. Other responsibilities include the performance of all construction activities at the site including site facilities, administration, material purchasing, procurement, supervision, Construction Quality Control, installation, and subcontracting. The CONTRACTOR is responsible for the protection of completed work until it

is accepted by the OWNER. The CONTRACTOR is also responsible for informing the OWNER and Quality Assurance Consultants of the scheduling and occurrence of all construction activities.

Surveyor: The Surveyor is responsible for establishing and maintaining lines and grades and temporary benchmarks throughout all relevant areas of the construction site. The Surveyor shall issue Record Drawing(s) certified by a Professional Land Surveyor, licensed in the State of North Carolina. The Surveyor must also conduct his/her tasks in compliance with the requirements of survey control and location coordinates in accordance with the Rules 15A NCAC 13B .0540 (3) and (4).

Meetings:

A pre-construction meeting will be conducted prior to beginning construction of the initial cell. The meeting will include a discussion of the construction management organization, respective duties during construction, and periodic reporting requirements for test results and construction activities. Periodic construction progress meetings will be held as necessary to address issues that arise during construction. All meetings will be documented, and meeting minutes will be included in the CQA Report.

Soils Index Testing:

Material Evaluation/Verification Testing: Pre-construction material evaluations shall be performed on samples from potential sources to ascertain their acceptability as construction materials. Evaluation tests are to be performed by the CQA laboratory. Test reports shall verify compliance with or deviation from applicable ASTM standards as outlined in Table 1 of this Plan.

Construction Quality Evaluation Testing

Construction quality evaluation shall be performed on all components of earthwork construction at the frequencies shown in Table 1.

Structural Fill

Structural fill material will be used for construction of earthen embankments, such as for the roads or sediment basin. Placement of the structural fill material will be done in accordance with the specification included in Appendix IV.

Lab testing will be performed at a frequency of 1/10,000 cubic yards to establish a moisture/density relationship for the given soil, and to allow the field instrument (nuclear gauge) to be properly calibrated. Field measurements of moisture and density will be made at a frequency of 5/acre with a nuclear gauge to ensure that adequate compaction is being achieved. An acceptable test for soils used in structural or "controlled fill" applications shall be defined as one which meets or exceeds the specified minimum density within the specified moisture range. If there is any question as to the classification of the tested soil, and hence the appropriateness of

a given moisture-density plot, a "one-point" Standard Proctor compaction test shall be performed for comparison with the available plots. The optimum moisture content and maximum dry density extrapolated from the one-point test result must fall on or near the plotted line of optimums for the classification of a soil to be confirmed. For controlled fill, the reference maximum dry density can be adjusted to accommodate the one-point data. At a frequency of 1/acre density and moisture tests will be performed in the field by the sand cone and drive cylinder methods for density, and direct heating (for moisture). These tests will verify the accuracy of the nuclear gauge testing.

Soil Cap

For placement of the infiltration barrier, lab and field testing will be performed as described for the placement of structural fill, but for each lift of soil. Soil will be placed in six inch lifts. In addition, a hydraulic conductivity test will be performed at a frequency of 1/acre/lift to verify that the maximum hydraulic conductivity of $1x10^{-5}$ cm/sec is being achieved. The field measurements of moisture and density, will not be used to determine a pass or fail for the material, but will be used as a guide to expedite construction by increasing the likelihood of passing hydraulic conductivity tests. Each time a passing hydraulic conductivity test is performed ($<1x10^{-5}$ cm/sec) the moisture and density of the soil will be plotted. The moisture/density plots of all the passing tests will form a "window" or "zone" that can be used as a benchmark for the desired moisture and density. Ultimately, the hydraulic conductivity tests will always determine the pass/fail status of the soil.

Landfill Base Grade

Soil samples from the constructed base of new landfill cells will be taken at a frequency of 1/acre and analyzed for soil classification per the Unified Soil Classification System to verify that only the following soil types are present in the upper two feet: SC, SM, ML, CL, MH, or CH.

Visual Observations

Construction evaluation testing shall consist of visual observations of the work. Evaluation of the construction work shall include the following:

- Observations and documentation of the water content, clod size and other physical properties of the soil during processing, placement and compaction;
- Observation and documentation of each compacted lift's ability to accept and bond to subsequent lifts;
- Observation and documentation of the thickness of compacted and loosely placed lifts;
- Observation and documentation of the performance of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc…); and
- Observation and documentation of the effectiveness of the procedures used to prevent desiccation and/or freezing of completed lifts and layers.

Lift Bonding

It is important to bond lifts together to the greatest extent possible. Bonding of lifts is enhanced by:

- Ensuring that the surface of the previously compacted lift (or subgrade) is rough before placing the new lift of soil;
- Adding moisture to the previously compacted lift (or subgrade); and
- Using a fully penetrating footed roller.

Evaluation of lift bonding in soil liner and similar applications shall be done by using test pits or auger holes to visually observe the lift interfaces. Alternatively, Shelby tubes pushed through the lift interfaces can be visually inspected for proper lift bonding.

Documentation:

The CQA Consultant shall document the activities associated with the construction of the earth material components of the project. Such documentation shall include, as a minimum, daily reports of construction activities and a summary technical report on the construction project.

Construction Monitoring:

Construction of earth material components of the project shall be monitored and documented by a CQA consultant. All soils laboratory testing shall be performed and documented by an independent testing laboratory working under the direction of the CQA consultant. Written daily documents shall include a record of observations, test data sheets, identification of problems encountered during construction, corrective measures taken, weather conditions, and personnel and equipment on site.

Certification Reports:

The CQA report will contain the results of all the construction quality assurance and construction quality control testing including documentation of any failed test results, descriptions of procedures used to correct the improperly installed material, and results of all retesting performed. The CQA report will contain as-built drawings noting any deviation from the approved engineering plans and will also contain a comprehensive narrative including, but not limited to, daily reports from the project engineer, a series of color photographs of major project features, and documentation of proceedings of all progress and troubleshooting meetings.
For construction of each cell, the CQA report will be submitted:

(1) after completion of landfill construction in order to qualify the constructed C&DLF unit for a permit to operate;

(2) after completion of construction of the cap system in accordance with the requirements of Rule .0543; and

The CQA report must bear the seal of the project engineer and a certification that construction was completed in accordance with:
(A) the CQA plan,
(B) the conditions of the permit to construct,
(C) the requirements of Rule .0541, and
(D) acceptable engineering practices.

D. OPERATION PLAN (.0542)

The Operation drawings requirement is intended to be satisfied by the Engineering Plans (EP-01 through EP-10). The landfill owner will build and operate Phase 3 of the landfill according to this set of drawings. Additional drawings and operations plans will be prepared for future phases as development of those phases is needed.

1. Waste Acceptance and Disposal

Only construction/demolition and land clearing/inert debris is proposed for disposal at the landfill in their respective permitted areas. Construction and demolition debris is defined in NC General Statutes as waste or debris resulting solely from construction, remodeling, repair, or the demolition of pavement, buildings, or other structures. Land clearing and inert debris includes waste such as stumps, trees, limbs, leaves, brush, grass, brick, block and untreated wood. The landfill owner or operator will notify the Division of Waste Management (Division) within 24 hours of attempted disposal of any waste the C&DLF is not permitted to receive, including waste from outside the area the landfill is permitted to serve.

Recyclable material will be segregated from the waste stream and temporarily stored in containers or stockpiles prior to being removed from the site. Recyclable material may include wood, metals, concrete, plastic, cardboard, and other materials identified as appropriate for recycling. Approximately 70 cubic yards of metal material is removed from the site weekly and taken to D.H. Griffin Wrecking Co. Inc. Cardboard is stored in a 40-yard container that is removed from the site by Federal Paper Board when full. Coble's Sandrock deconstructs mobile trailer homes at the working face of the C&D landfill. Identified C&D waste material removed from the deconstruction process is placed into the landfill.

The locations of the mobile trailer home deconstruction area and the recyclables storage areas follow the location of the working face as it progresses across the landfill.

2. Wastewater Treatment Sludge

Wastewater treatment sludge will not be accepted for disposal. Wastewater treatment sludge may be accepted, with the approval of the Division, for utilization as a soil conditioner and incorporated into or applied onto the vegetative growth layer. The wastewater treatment sludge will neither be applied at greater than agronomic rates nor to a depth greater than six inches.

3. Waste Exclusions

The following wastes will not be disposed of in the landfill:

(1) Containers such as tubes, drums, barrels, tanks, cans, and bottles unless they are empty and perforated to ensure that no liquid, hazardous or municipal solid waste is contained therein,

(2) Garbage as defined in G.S. 130A-290(a)(7),

(3) Hazardous waste as defined in G.S. 130A-290(a)(8), to also include hazardous waste from conditionally exempt small quantity generators,

(4) Industrial solid waste unless a demonstration has been made and approved by the Division that the landfill meets the requirements of Rule .0503(2)(d)(ii)(A),

(5) Liquid wastes,

(6) Medical waste as defined in G.S. 130A-290(a)(18),

(7) Municipal solid waste as defined in G.S. 130A-290(a)(18a),

(8) Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761,

(9) Radioactive waste as defined in G.S. 104E-5(14),

(10) Septage as defined in G.S. 130A-290(a)(32),

(11) Sludge as defined in G.S. 130A-290(a)(34),

(12) Special wastes as defined in G.S. 130A-290(a)(40),

(13) White goods as defined in G.S. 130A-290(a)(44), and

(14) Yard trash as defined in G.S. 130A-290(a)(45),

(15) The following wastes cannot be received if separate from C&DLF waste: lamps or bulbs including but not limited to halogen, incandescent, neon or fluorescent; lighting ballast or fixtures; thermostats and light switches; batteries including but not limited to those from exit and emergency lights and smoke detectors; lead pipes; lead roof flashing; transformers; capacitors; and copper chrome arsenate (CCA) and creosote treated woods.

(16) Waste accepted for disposal in a C&DLF unit must be readily identifiable as C&D waste and must not have been shredded, pulverized, or processed to such an extent that the composition of the original waste cannot be readily ascertained except as specified in Subparagraph (17) of this Paragraph.
(17) C&D waste that has been shredded, pulverized or otherwise processed may be accepted for disposal from a facility that has received a permit from an authorized regulatory authority which specifies such activities are inspected by the authority, and whose primary purpose is recycling and reuse of the C&D material. A waste screening plan and waste acceptance plan must be made available to the Division upon request.

(18) The owner or operator will not knowingly dispose any type or form of C&D

waste that is generated within the boundaries of a unit of local government that by ordinance:

(A) Prohibits generators or collectors of C&D waste from disposing that type or form of C&D waste.

(B) Requires generators or collectors of C&D waste to recycle that type or form of C&D waste.

(19) Friable asbestos

4. Cover Material Requirements

Waste will be covered with six inches of earthen material when the waste disposal area exceeds one-half acre and at least once weekly. Cover will be placed at more frequent intervals if necessary to control disease vectors, fires, odors, blowing litter, and scavenging. A notation of the date and time of the cover placement will be recorded in the operating record.

Areas which will not have additional wastes placed on them for three months or more, but where final termination of disposal operations has not occurred, will be covered and stabilized with vegetative ground cover or other stabilizing material.

Mulch generated from excavated LCID material may be used as a soil amendment for cover soil.

5. Spreading and Compacting Requirements

The open waste disposal area will be kept as small as is feasible. Waste will be compacted as densely as practical into cells. Windblown litter is not anticipated to be a significant problem at the C&D landfill due to the heavy, bulky nature of this waste type. Prompt compaction of the waste at the working face will be conducted to minimize litter. Wind fence will be used as necessary to minimize windblown trash. At the conclusion of each operating day, all windblown material resulting from the operation will be collected and disposed of by the owner and operator.

6. Disease Vector Control

On-site populations of disease vectors will be prevented or controlled using techniques appropriate for the protection of human health and the environment.

7. Air Criteria and Fire Control

The landfill will not violate any applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the U.S. EPA Administrator pursuant to Section 110 of the Clean Air Act, as amended.

No open burning of solid waste, except for the approved burning of land clearing debris generated on-site or debris from emergency clean-up operations, will occur. Prior to any burning, a request will be sent to the Division for review. A notation of the date of approval and

the name of the Division personnel who approved the burning will be included in the operating record.

If a fire occurs at the waste disposal area, the waste will be removed or segregated from other waste in the disposal area if possible. Following segregation, the situation will be reevaluated to determine whether emergency personnel should be notified.

If necessary, the Snow Camp and/or E.M. Holt Volunteer Fire Departments will be called to render assistance and provide support in fighting any fires that occur at this site. A letter from the fire department is included as Appendix X, along with contact information.

Fire extinguishers will be carried on each piece of landfill equipment on site, and will be used for small, localized fires. Equipment operators will be trained in the use of these extinguishers. A small stockpile of soil will be maintained near the working face to be used for extinguishing small surface fires that are too large to control with the fire extinguishers carried on the landfill equipment. Water in sedimentation ponds and nearby creeks can be used by firefighters to extinguish larger fires.

Fires and explosions that occur at the landfill will be verbally reported to the Division within 24 hours and written notification will occur within 15 days. Written notification will include the suspected cause of fire or explosion, the response taken to manage the incident, and the action(s) to be taken to prevent the future occurrence of fire or explosion.

8. Access and Safety Requirements

Access to the facility is controlled through a single access road. A metal gate prevents access after operating hours. Traffic moves from the entrance gate to the landfill via a gravel haul road that extends approximately 0.25 mile from the facility entrance. The entrance is planned to remain at its present location. The gravel haul roads may be rerouted as needed to access the proposed C&D expansion area.

In accordance with G.S. 130A-309.25, an individual trained in landfill operations will be on duty at the site while the facility is open for public use and at all times during active waste management operations to ensure compliance with operational requirements.

The access road to the site and access roads to monitoring locations is of all-weather construction and maintained in good condition.

Access roads will be watered periodically, as needed, to minimize dust.

A sign providing information on disposal procedures, the hours during which the site is open for public use, the permit number and other pertinent information specified in the permit conditions is posted at the site entrance. Liquids and hazardous and municipal solid waste are listed on a sign as excluded wastes.

Traffic signs or markers are provided as necessary to promote an orderly traffic pattern to and from the discharge area and to maintain efficient operating conditions.

No removal of solid waste from the landfill will occur unless indicated in the operations plan as a recycling procedure. The general public will not be allowed to remove material from the working face.

9. Erosion and Sediment Control

Adequate sediment control measures will be used to prevent sediment from leaving the facility, and to prevent excessive on-site erosion of the landfill. Vegetative cover will be established on all competed areas of the landfill.

10. Drainage Control and Water Protection

Surface water will be diverted from the operational area and will not be impounded over or in waste. Waste will not be disposed of in water. The landfill will not cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act, including the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to Section 402. The landfill will not cause the discharge of a nonpoint source of pollution to waters of the United States, including wetlands, that violates any requirement of an area-wide or State-wide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act, as amended.

11. Survey for Compliance

Within 60 days of the permittee's receipt of the Division's written request, the permittee will cause to be conducted a survey of active or closed portions of unit or units at the facility in order to determine whether operations are being conducted in accordance with the approved design and operational plans. The permittee will report the results of such survey, including a map produced by the survey, to the Division within 90 days of receipt of the Division's request. The survey will be performed by a registered land surveyor duly authorized under North Carolina law to conduct such activities.

12. Operating Record and Recordkeeping

The owner and operator will record and retain at the facility, or in an alternative location near the facility, the following information:
(A) records of random waste inspections, monitoring results, certifications of training, and training procedures required by Rule .0544 of this Section;
(B) amounts by weight of solid waste received at the facility to include, consistent with G.S. 130A-309.09D, county of generation;
(C) any demonstration, certification, finding, monitoring, testing, or analytical data required by Rules .0544 through .0545 of this Section;
(D) any closure or post-closure monitoring, testing, or analytical data as required by Rule .0543 of this Section;
(E) any cost estimates and financial assurance documentation required by Rule .0546 of this Section;

(F) notation of date and time of placement of cover material; and
(G) all audit records, compliance records and inspection reports.

All information contained in the operating record will be furnished to the Division according to the permit or upon request, or be made available for inspection by the Division.

The operating record will also include:
(A) A copy of the approved operation plan required by this Rule and the engineering plan required by Rule .0539 of this Section;
(B) A copy of the current Permit to Construct and Permit to Operate; and
(C) The Monitoring Plan, in accordance with Rule .0544 of this Section, included as appendices to the Operation Plan.

E. CLOSURE & POST-CLOSURE CARE PLAN (.0543)

CLOSURE

1. Description of Cap System:

The cap system to be used is designed to minimize infiltration and erosion. The cap system will consist of:

- A low-permeability infiltration layer of at least 18 inches with a permeability not greater than 1.0×10^{-5} cm/sec;
- An erosion layer that contains a minimum of 18 inches of earthen material that is capable of sustaining native plant growth.

Construction of the cap system will conform to the plans prepared in accordance with Rule .0540 of this Section and the following requirements:

(A) post-settlement surface slopes will be a minimum of five percent and a maximum of 33 percent; and
(B) a gas venting or collection system will be installed below the low-permeability barrier to minimize pressures exerted on the barrier.

Procedures for Cap Installation
The construction of the cap will be in accordance with the specifications provided in Appendix IV.

2. Closure Area

The maximum closure area during Phase 3 of the landfill is 25.1 acres.

3. Waste Inventory

The projected total tonnage in place at the end of Phase 3 is approximately 865,280 tons. This amount includes the tonnages from Phase 1 and Phase 2 in addition to the tonnage from Phase 3, which is estimated to be 440,131 tons (See Figure 1).

4. Schedule

As discussed in the Facility Plan, Phase 3 has a projected operating life of approximately 4.9 years. Thus, closure of the entire landfill is not anticipated until 2013, assuming waste disposal in Phase 3 begins in 2008. Prior to beginning final closure, Coble's Sandrock will notify the Division that a notice of intent to close the facility has been placed in the operating record. An itemized list of closure milestones and a proposed schedule follow. Closure activities are proposed to begin within 30 days of final receipt of waste. Construction of the closure cap is to be completed within 180 days following the initiation of closure activities. The total length of the proposed closure period is 210 days following the final receipt of waste.

Approximate closure milestones are shown below.

Proposed Closure Milestones and Schedule

Milestone	**Proposed Schedule from the Date of Final Receipt of Waste**
Testing of borrow sources	Within 6 months prior to closure
Grading of intermediate cover	Within 30 to 60 days
Placement of soil cap	30 to 150 days
Final inspection of cap by P.E.	150 to 180 days
Construction of stormwater controls	90 to 180 days
Seeding and mulching	150 to 180 days
Preparation of survey plat	180 to 210 days
Submittal of closure certification	180 to 210 days

5. Cost Estimate for Closure

Closure Cost Estimate for Largest Area (25 Acres) To Be Closed At Once

Component	Qnty	Unit	Unit Cost ($)	Total ($)
Mobilization	1	LS	$5,000	$5,000
18" Clay (10^-5 cm/sec)	60,500	CY	$3.50	$211,750
18" Vegetative Soil	60,500	CY	$3.50	$211,750
Seeding/Revegetation	25	ACRE	$1,500	$37,500
Survey	1	LS	$5,000	$5,000
			Subtotal:	$471,000
Engineering/CQA (~5%)				$23,550
Contingency (~5%)				$23,550
			TOTAL	**$518,100**

6. Closure Certification

A professional engineer, registered in the State of North Carolina, will verify that the closure has been completed in accordance with the Closure Plan. The contents of the signed Certification Report will be as described below.

Certification Reports:

The CQA report will contain the results of all the construction quality assurance and construction quality control testing including documentation of any failed test results, descriptions of procedures used to correct the improperly installed material, and results of all retesting performed. The CQA report will contain as-built drawings noting any deviation from the approved engineering plans and will also contain a comprehensive narrative including, but not limited to, daily reports from the project engineer, a series of color photographs of major project features, and documentation of proceedings of all progress and troubleshooting meetings. The CQA report will be submitted after completion of construction of the cap system in accordance with the requirements of Rule .0543. The CQA report must bear the seal of the project engineer and a certification that construction was completed in accordance with the CQA Plan and acceptable engineering practices.

7. Deed Recordation

Following closure, the owner or operator will record a notation on the deed to the landfill facility property at the local county Register of Deeds office, or some other instrument that is normally

examined during title search, and notify the Division that the notation has been recorded and a copy has been placed in the operating record. The notation on the deed shall in perpetuity notify any potential purchaser of the property that the land has been used as a C&D landfill unit or facility and its use is restricted under the closure plan approved by the Division.

POST CLOSURE

Post-closure activities will be conducted at the landfill for a period of 30 years following closure of the landfill. The length of the period can be increased or decreased in accordance with Division directives.

1. Contact

Coble's Sandrock, Inc. will handle questions and/or problems which might occur during the post-closure care period.

CONTACT PERSON:	Mr. Kent Coble
OWNER:	Mr. Kent Coble
ADDRESS:	5833 Foster Store Road Liberty, North Carolina 27298
PHONE NUMBER:	(336) 565-4750
FAX:	(336) 565-4752

2. Security

Access to the site will be controlled by the use of barriers and gates at roadway entrances. These control devices will be maintained throughout the post-closure care period, and inspected as part of the monthly inspection program. All barriers and gates will be clearly marked with signs stating the name and nature of the facility and the person to contact in case of emergency or breach of security.

3. Post-Closure Maintenance

Post-closure maintenance and monitoring will be conducted at the landfill for a period of 30 years after final closure. The Division may decrease the length of the post-closure period if the owner or operator demonstrates that the reduced period is sufficient to protect human health and the environment, and the Division approves this demonstration. The period might be increased by the Division if the Division determines that the lengthened period is necessary to protect human health and the environment. Monitoring will include semi-annual sampling of groundwater and surface water, quarterly gas monitoring, and quarterly inspection of the final cover and monitoring and control systems. Maintenance needs identified through the monitoring program will be initiated no later than 60 days after the discovery, and within 24 hours if a danger or eminent threat to human health or the environment is indicated. Minor cap maintenance may be deferred until there is a sufficient amount of work to justify the mobilization of equipment and personnel.

Soil will be added to the cap as necessary to correct the effects of settlement and subsidence of the soil cap and to prevent run-on and run-off from eroding the final cap.

Stormwater control devices, surveyed benchmarks, groundwater monitoring wells, surface water monitoring/sampling gauges and LFG wells will be protected and maintained.

Vegetation will be mowed twice per year, fertilized once every three years and re-seeded (as necessary) once every three years.

The security fencing, gates, and access roads will be maintained and repaired, as necessary.

4. Inspection Plan

Routine inspections will be conducted throughout the post-closure care period. These inspections will be carried out quarterly unless problems are detected that indicate that more frequent visits are warranted. Potential impacts to the public and environment will be considered in determining the inspection frequency. Items to be included in the monthly inspection will be as follows:

- Access and security control,
- Stormwater management,
- Erosion and sediment control,
- Gas management,
- Groundwater and landfill gas monitoring systems, and
- Vector control.

The quarterly inspections will be carried out by someone properly trained and knowledgeable about landfills, such as the landfill owner, operator or engineering consultant. The results of the inspections will be documented. Please see Appendix IX for an example Post Closure Inspection Form. If inspections indicate that repairs are necessary, repairs will be initiated as soon as practicable.

In addition to the routine quarterly inspections, special inspections will be performed and documented after events which may likely cause damage to the integrity of the landfill cover, such as heavy rainfall events. Inspection may also be necessary following written or verbal complaints, vandalism or fires. Following special inspections, any necessary repairs will be initiated as soon as practicable.

Records of all inspections will be kept in the operating record.

5. Post-Closure Land Use

The primary land use for the site after closure of the landfill will be open dormant green space.

6. Post-Closure Cost Estimate

An estimate of post-closure care costs is provided on the following page. All costs are given in 2007 dollars.

Annual Post Closure Care Cost Estimate

ITEM	UNIT	QUANTITY	UNIT COST	ANNUAL COST
INSPECTIONS/ RECORD KEEPING	per trip	4	$500	**$2,000**
MONITORING				
Explosive gases (quarterly)	per trip	4	$750	$3,000
Groundwater/Surfacewater (semi-annually)				
Sampling	per trip	2	$2,000	$4,000
Analysis	per trip	2	$1,600	$3,200
Reporting	per trip	2	$3,000	$6,000
Subtotal				**$16,200**
ROUTINE MAINTENANCE				
Mowing (Twice Annually)	acre	25	$100	$5,000
Fertilizing	acre	3.0	$100	$300
Reseeding	acre	3.0	$1,000	$3,000
Vector and Rodent Control	acre	25	$25.0	$625
Subtotal				**$8,925**
WELL MAINTENANCE				
Groundwater Wells	lump sum	1	$1,000	$1,000
Gas Detection Probes	lump sum	1	$500	$500
Subtotal				**$1,500**
CAP REPAIR	lump sum	1	$5,000	**$5,000**
TOTAL OF ABOVE ITEMS				**$33,625**
ENGINEERING	-	-	3%	$1,009
CONTINGENCY	-	-	5%	$1,681
TOTAL ANNUAL POST-CLOSURE COST (IN 2007 DOLLARS)				**$36,315**

Notes:

1. All costs include labor by a third party.
2. Water quality monitoring costs are estimated.
3. Cost for groundwater wells assumes maintenance of each well during the period.
4. Cost for the gas probes assumes maintenance of each probe during the period.

F. MONITORING PLANS (.0544)

1. Ground-water Monitoring Plan

The Groundwater Monitoring Plan for this facility is presented in Appendix III, Section 2.B of this volume. The results of groundwater sampling will be compared to 15A NCAC 02L (NC-2L) groundwater standards. For parameters with no listed NC-2L standard, the results will be compared to the NC-DENR Groundwater Protection Standard (GPS).

Groundwater sampling will be conducted by professional environmental technicians trained in all aspects of groundwater sampling protocols relevant to this site and in accordance with common professional standards and practices. Proper safety precautions must be observed when collecting groundwater samples. Refer to the site-specific Health and Safety Plan (HASP) for this facility included as Appendix XI of this volume. These guidelines should be used to guide and complement the judgment of an experienced professional.

2. Surface Water Monitoring Plan

A description of the surface water sampling points for this facility, sampling frequency, and required analytical parameters are presented in Appendix III, Section 2.B.4 of this volume. The results of surface water sampling will be compared to 15A NCAC 02B (NC-2B) surface water standards contingent upon the classification of Pawpaw Creek. For parameters with no listed NC-2B standard, the NC-2L standard or GPS will be used, as appropriate.

2.1 Surface Water Sampling Procedures

Surface water sampling will be conducted by professional environmental technicians trained in all aspects of surface water sampling protocols relevant to this site and in accordance with common professional standards and practices. Proper safety precautions must be observed when collecting surface water samples. Refer to the site-specific Health and Safety Plan (HASP) for this facility included as Appendix XI of this volume. These guidelines should be used to guide and complement the judgment of an experienced professional.

The following procedures and precautions should be considered when collecting surface water samples.

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample. Samples shall be custody-sealed during long-term storage or shipment.
- A clean pair of new, non-powdered, disposable gloves will be worn each time a different location is sampled and the gloves should be donned immediately prior to sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.
- Collected samples are in the custody of the sampler or sample custodian until the samples are relinquished to another party.
- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179),

and/or International Air Transportation Association (IATA) hazardous materials shipping requirements found in the current edition of IATA's Dangerous Goods Regulations.

- Documentation of field sampling is done in a bound logbook.
- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.

2.2 Sample Handling and Preservation Requirements

1. Surface water samples will typically be collected either by directly filling the container from the surface water body being sampled or by decanting the water from a collection device such as a scoop, bailer, or other device.

2. During sample collection, if transferring the sample from a collection device, make sure that the device does not come in contact with the sample containers.

3. Place the sample into appropriate, labeled containers. Samples collected for VOC analysis must not have any headspace (see item 5. below). All other sample containers must be filled with an allowance for ullage.

4. All samples requiring preservation must be preserved as soon as practically possible, ideally immediately at the time of sample collection, prior to departure for the field investigation.

5. Surface water samples for VOC analysis must be collected in 40 ml glass vials with Teflon® septa. The vial may be either preserved with concentrated hydrochloric acid or they may be unpreserved. Preserved samples have a two week holding time, whereas, unpreserved samples have only a seven day holding time. In the great majority of cases, the preserved vials are used to take advantage of the extended holding time. In some situations, however, it may be necessary to use the unpreserved vials. For example, if the surface water sample contains a high concentration of dissolved calcium carbonate, there may be an effervescent reaction between the hydrochloric acid and the water, producing large numbers of fine bubbles. This will render the sample unacceptable. In this case, unpreserved vials should be used and arrangements must be confirmed with the laboratory to ensure that they can accept the unpreserved vials and meet the shorter sample holding times. The samples should be collected with as little agitation or disturbance as possible. The vial should be filled so that there is a reverse or convex meniscus at the top of the vial and absolutely no bubbles or headspace should be present in the vial after it is capped. After the cap is securely tightened, the vial should be inverted and tapped on the palm of one hand to see if any undetected bubbles are dislodged. If a bubble or bubbles are present, the vial should be topped off using a minimal amount of sample to re-establish the meniscus. Care should be taken not to flush any preservative out of the vial during topping off.

2.3 Quality Control

Equipment blanks should be collected if equipment is field cleaned and re-used on-site or if necessary to document that low-level contaminants were not introduced by pumps, bailers or other sampling equipment. Trip blanks should accompany all samples collected for VOC analyses.

2.4 Records

Field notes, recorded in a bound field logbook, will be generated by sampling personnel. The field notes shall be kept and maintained in a secure location for as long as the site is active or in post-closure care. Data collected and recorded in the field notes shall include:

- Time, date, site name, and sample location ID;
- Names of field sampling personnel;
- Weather, site conditions, or other factors that may affect the samples; and
- Field parameters, such as pH, temperature, conductivity, and/or turbidity.

2.5 Equipment Selection Considerations

The physical location of the investigator when collecting a sample may dictate the equipment to be used. If surface water samples are required, direct dipping of the sample container into the stream is desirable. Collecting samples in this manner is possible when sampling from accessible locations such as stream banks or by wading or from low platforms, such as small boats or piers. Wading or streamside sampling from banks, however, may cause the re-suspension of bottom deposits and bias the sample. Wading is acceptable if the stream has a noticeable current (is not impounded), and the samples are collected while facing upstream. If the stream is too deep to wade, or if the sample must be collected from more than one water depth, or if the sample must be collected from an elevated platform (bridge, pier, etc.), supplemental sampling equipment must be used. To collect a surface water sample from a water body or other surface water conveyance, a variety of methods can be used:

- Dipping Using Sample Container
- Scoops
- Peristaltic Pumps
- Submersible Pumps
- Discrete Depth Samplers
- Bailers
- Buckets

Regardless of the method used, precautions should be taken to insure that the sample collected is representative of the water body or conveyance. These methods are discussed in the following sections.

<u>Dipping Using Sample Container</u>

A sample may be collected directly into the sample container when the surface water source is accessible by wading or other means. The sampler should face upstream if there is a current and collect the sample without disturbing the bottom sediment. The surface water sample should

always be collected prior to the collection of a sediment sample at the same location. The sampler should be careful not to displace the preservative from a pre-preserved sample container, such as the 40-ml VOC vial.

Scoops

Scoops provide a means of collecting surface water samples from surface water bodies that are too deep to access by wading and access from a bank or platform is not feasible. A stainless steel scoop is preferred. The scoop may be used directly to collect and transfer a surface water sample to the sample container, or it may be attached to an extension in order to access the selected sampling location. Scoops typically have a limited reach of about eight-ten feet, and if samples from distances too far to access using this method are needed, a mobile platform, such as a boat may be required.

Bailers

Disposable bailers may also be used for surface water sampling if the study objectives do not necessitate a sample from a discrete interval in the water column. A closed-top bailer with a bottom check-valve is sufficient for many studies. As the bailer is lowered through the water column, water is continually displaced through the bailer until the desired depth is reached, at which point the bailer is retrieved. This technique may not be successful where strong currents are found or where the water is very shallow.

3. Gas Control Plan

To protect public health and safety in the vicinity of the landfill, gas produced by the decomposition of refuse will be controlled and monitored during the operational, closure, and post- closure periods. A gas management plan and gas monitoring program will be implemented for the purpose of maintaining the concentration of methane gas below the following regulatory levels:

- The concentration of methane gas generated is not to exceed 25 percent of the lower explosive limit (LEL) for methane in on-site structures (excluding gas control or recovery system components); and

- The concentration of methane gas is not to exceed the LEL for methane at the facility property boundary.

The landfill gas management plan is currently proposed to include monitoring, and passive gas venting in the landfill. Other remedial measures will be implemented as needed to mitigate a potential gas migration problem.

General

Gas monitoring at the Coble's Sandrock C&D Landfill will be performed during the active life of the landfill and throughout the post-closure care period. Quarterly monitoring will be

conducted at all subsurface gas detection probes (See Drawing MP-01 – Monitoring Network for proposed locations of gas probes and a typical probe construction detail).

Four gas probe locations are proposed GP-01 through GP-04. The probe locations were chosen to adequately surround areas where waste will be in place and where potential receptors are nearby. GP-01, for example, will ensure that no gas is migrating from Phase 3B, or any other portion of the landfill, to the structure on the property adjacent and to the west of Phase 3B. GP-02 will ensure gas is not migrating off the landfill property to the west of Phase 2B, GP-03 will ensure that gas is not migrating off the landfill property to the northeast of Phase 3A, and GP-04 will ensure that gas is not migrating off the landfill property to the southeast of Phase 3A. No probes are proposed directly to the north of the landfill since the property line in this direction is a perennial stream, Poppaw Creek, which will serve as a barrier for subsurface methane migration.

Additional gas detection probes will be installed on the site as additional phases are constructed. Proposed probe locations will be field engineered after the site is graded so that optimum locations can be selected. Sufficient numbers of gas probes will be installed to adequately monitor each phase. Construction records for the gas probes will be submitted to the Division upon completion.

Upon final closure, passive landfill gas vents will be installed along with the final cover system to allow release of gas to the atmosphere. These vents will be installed at a density of approximately one per acre of cap surface area.

Sampling and Analysis

The required monitoring will be completed by a properly trained Coble's Sandrock, Inc. employee or consultant. The portable equipment to be used will be designed for the detection of combustible gases or vapors. It will be calibrated in accordance with the manufacturer's instructions and indicate the percentage of LEL or methane.

The standard operating procedure for this type of monitoring is as follows:

- Calibrate the monitoring equipment in accordance with the manufacturer's instructions.

- Measure and record the undisturbed probe pressure/vacuum. This requires connecting the pressure gauge to a labcock valve, quick connect, or other valve device, and then opening the valve to measure the pressure.

- Leak check the entire sample train. This is done by sealing the end of the monitoring hose and verifying that air does not leak into the sample train, either through stoppage of the pump or maintaining a complete seal.

- Purge the probe casing (piping). Based on probe casing volume and sample pump flow rate, determine the pumping time to pump just over two probe volumes from the casing using the sample pump. The objective is to monitor soil gas from void spaces

surrounding the probe screened interval.

- Read and record the stabilized concentration of methane.

- If the methane reading continually increases as the probe is pumped, the initial concentration after purging is recorded because the objective is to record the conditions of the gas around the probe rather than gases that can be pulled to the probe via the pumping process.

- Keep monitoring results in the landfill operating record.

The personnel performing the LFG migration monitoring and data evaluation will be knowledgeable of the factors that may influence migration. This will ensure that the monitoring effort will be thorough and that potential problems can quickly be identified and corrected. The following are several factors that monitoring personnel will remain aware of and/or make visual observations of:

- Distressed vegetation, signs of stunted growth, wilting, color changes, death during the growing season, and bare spots;
- Increased "rotten egg" odors around the landfill, indicating the presence of hydrogen sulfide, a common trace constituent found in landfill gas; and
- Air bubbles permeating through standing water outside the limits of waste that may be from gas laterally migrating and finding its way to the surface.
- Development of surrounding areas, such as placing impermeable ground covers (i.e., paved parking areas, building slabs), can force landfill gas to remain underground and promote lateral migration. Additionally, off-site structures and utilities can provide enclosed areas in which landfill gas may collect and pose a safety hazard;
- Heavy irrigation or rainfall that saturates the soil may provide an impermeable barrier to landfill gas causing lateral migration;
- Excavation activities such as utility trenches may cause landfill gas to escape through the adjacent soils and into the excavation. The landfill gas may accumulate to explosive levels or displace oxygen within the excavation. Both possibilities compromise safety;
- Surface cracks or settlement can cause uncontrolled venting of landfill gas or air intrusion into the landfill that could reduce landfill gas quality (decrease methane concentration) or increase the potential for a landfill fire;
- Barometric pressure, wind, and temperature can affect the net pressure of landfill gas present. At a lower barometric pressure, more landfill gas will tend to escape through the cover or the surrounding surface; and
- Snow or frozen ground cover, as with saturated soil, can reduce surface permeability and increase lateral migration of landfill gas.

Results of the monitoring program will be reviewed by a party designated by Coble's Sandrock, Inc. who is knowledgeable in the area of landfill gas hazards and control systems and is familiar with the terrain and local site conditions.

Safety Precautions

During landfill gas monitoring events, special attention will be placed on areas and probes with methane concentrations approaching or exceeding the regulatory limits. Excessive concentrations of combustible gases in structures (i.e., 25% LEL or greater) shall be cause for immediate evacuation of any structure that is staffed. Entry into the building should be prohibited until the concentrations are maintained at satisfactory levels. The source of the gas, or gas migration pathway, shall be investigated to determine appropriate courses of action to prevent the reoccurrence of the event. As a general rule, maintaining a good air flow in the space and good ventilation will help prevent potential gas build-up situations. In addition, methane concentrations in areas that are usually closed off, such as closets and equipment service areas, can be managed with a louvered door and through-the-wall vents.

Record Keeping

The operator records the date, time, location, and sampling personnel, at the time of sampling, in addition to the concentration of combustible gases. The records will be maintained in the landfill operating record.

On-site Structures

Gas monitoring will also be conducted in any confined space requiring the entry of personnel for maintenance or inspection. The monitoring will take place prior to entry by personnel in accordance with OSHA regulations.

Gas Detection Probes

Gas monitoring in detection probes will consist of attaching the monitoring device to each tubing within the probes, and recording both the initial concentration and steady state concentration of combustible gases. SWANA guidelines for purging wells and other monitoring procedures shall be followed.

Equipment

A portable combustible gas monitor, measuring the concentration of combustible gases in units of percent of lower explosive limit, shall be used to conduct gas monitoring. Lower explosive limit (LEL) means the lowest percent by volume of a mixture of combustible gas in air that will propagate a flame at 25 degrees Celsius and atmospheric pressure. The gas monitoring device shall be calibrated using the manufacturer's calibration kit and procedure before the monitoring activities begin.

Response to Detected Combustible Gases

The regulatory action levels for combustible gas monitoring in gas detection probes are 100% LEL at the facility boundary and 25% LEL in on-site structures. Following a non-compliant reading, Coble's Sandrock, Inc. will notify the North Carolina Department of Environment, Health, and Natural Resources, Solid Waste Section in writing and will take immediate steps to ensure safety and protection of human health.

At a minimum, the following actions will be taken if the methane concentration exceeds 25% of the LEL in any structure:

- Put out all smoking materials and turn off all ignition sources;
- Evacuate all personnel;
- Vent the structure;
- Do not allow personnel to reenter the building, except to perform gas monitoring, until the results of additional monitoring indicate that methane concentrations are sustained or stabilized below 25% LEL;
- Begin continuous monitoring within the structure; and
- Undertake an assessment to determine the origin and pathways of the gas migration.

Within seven days of detection, the monitoring results, actions taken and actions proposed to resolve the problem will be placed in the Operating Record. Within 60 days of detection, Coble's Sandrock, Inc. will develop and implement a landfill gas remediation plan for the combustible gas releases and notify the Division that the plan has been implemented. The plan will describe the nature and extent of the problem and the proposed remedy.

4. Waste Acceptability Program

Random Selection

Random selection of vehicles to be inspected will be made on a regular basis. At least one vehicle per week will be randomly selected, at the working face, by the personnel conducting the inspection. A random truck number and time will be selected (e.g., the tenth load after 10:00 a.m.) on the day of inspections.

Record Keeping

Appropriate forms indicating the results of each inspection will be completed. Please see Appendix VIII for an example Waste Inspection Form. All reports and resulting correspondence will be maintained at the facility office for the life of the landfill and during the post-closure period.

Training

Inspections will be supervised by the operator or by support personnel trained to identify and manage municipal solid waste, and hazardous and liquid waste.

Location

Inspections will be conducted in or near the working face of the landfill.

Contingency/Action Plan

The following contingency/action plan details the procedure currently used at Coble's Sandrock for conducting random waste inspections:

1) Upon weigh-in, drivers are asked about the contents of their load and sign an invoice stating that they are not discharging hazardous materials, liquid wastes or any other unacceptable materials into the landfill. Although all loads are visually inspected upon weigh-in, the complete contents of a load cannot be determined until the load is discharged by the driver and pushed back by Coble's Sandrock.

2) The dumped material is examined for safety hazards and waste excluded by the operating permit which include:

- Municipal solid waste (MSW);
- Containers labeled hazardous;
- Excessive or unusual moisture;
- Biomedical (red bag) waste;
- Powders, dusts, smoke, vapors, or chemical odors;
- Sludges, pastes, slurries, or bright colors (such as dyes); and
- Unauthorized waste
- Tires.

Loads that include large closed containers will be handled carefully to avoid possible rupturing of the containers.

3) Take the following actions as appropriate:

- Incorporate acceptable waste into working face.
- Haul MSW to a transfer facility or to a MSW landfill for disposal.
- If necessary, hold suspected unauthorized waste for identification by on-site personnel and confirmation by others, such as a contract laboratory or regulator.
- Interview driver and hauler to identify the source of waste in the load.
- Hold rejected hazardous or liquid waste for generator, or
- Arrange for hazardous or liquid waste collection by licensed collector.

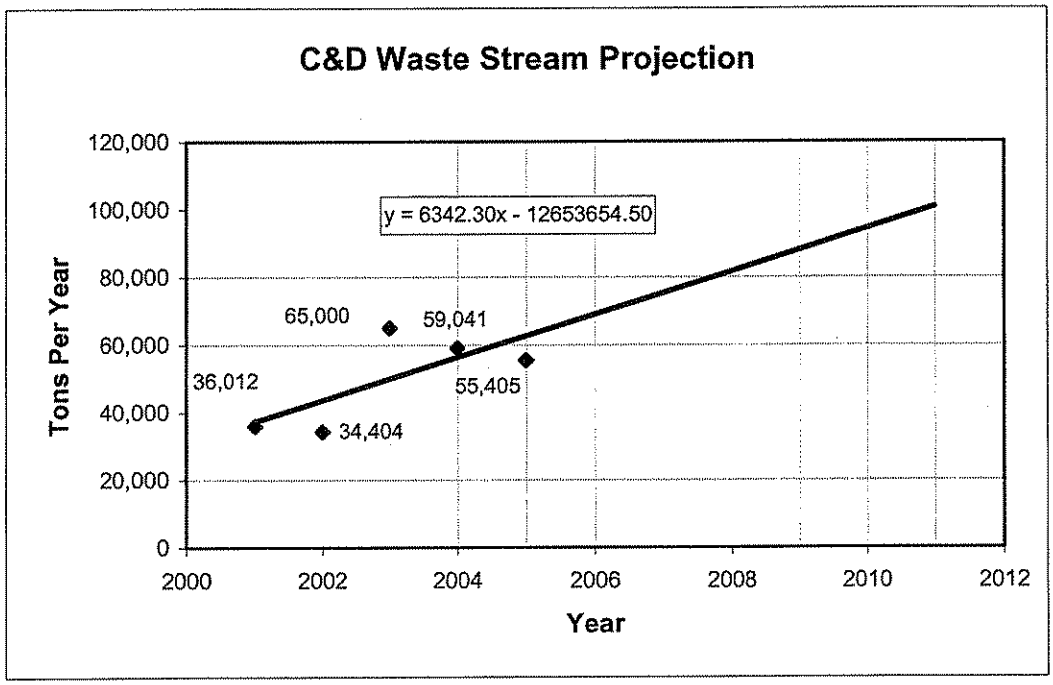
4) Document Actions:

a) Record Inspection.
b) Retain Reports.
c) Report hazardous liquid, or PCB wastes to Solid Waste Section - NCDENR.

5) Should any materials be discharged into the landfills that are unacceptable, Coble's Sandrock may impose a clean-up fee to cover the cost of properly disposing of the unacceptable waste.

6) Should the unacceptable materials pose an immediate threat to the health and safety of individuals, the area will be secured. The material/wastes shall be handled by a licensed handler of hazardous waste and disposed of at a facility licensed to accept that material. The appropriate officials will be notified.

(End)



Estimation of Required Air Space for 5-Year Phase

		Rqd Air Space (cy)		
	Projected Tons	Waste	Soil Cover	Total
2007	75,342	143,149	14,315	157,464
2008	81,684	155,199	15,520	170,719
2009	88,026	167,250	16,725	183,975
2010	94,369	179,300	17,930	197,230
2011	100,711	191,351	19,135	210,486
				919,874 **total**

1 cy	*	2000 lbs
1050 lbs		1 ton

Assume 10% of total
air space taken up with soil

Evaluation of Design Air Space

Phase 3 volume, not including intermediate or final soil cover
= 900,200 cy. (AutoCAD generated)

Estimated Phase 3 lifetime: 4.9 years

Estimation of Required Air Space for 5-Year Phase

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1050 lbs		1 ton

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Evaluation of Design Air Space

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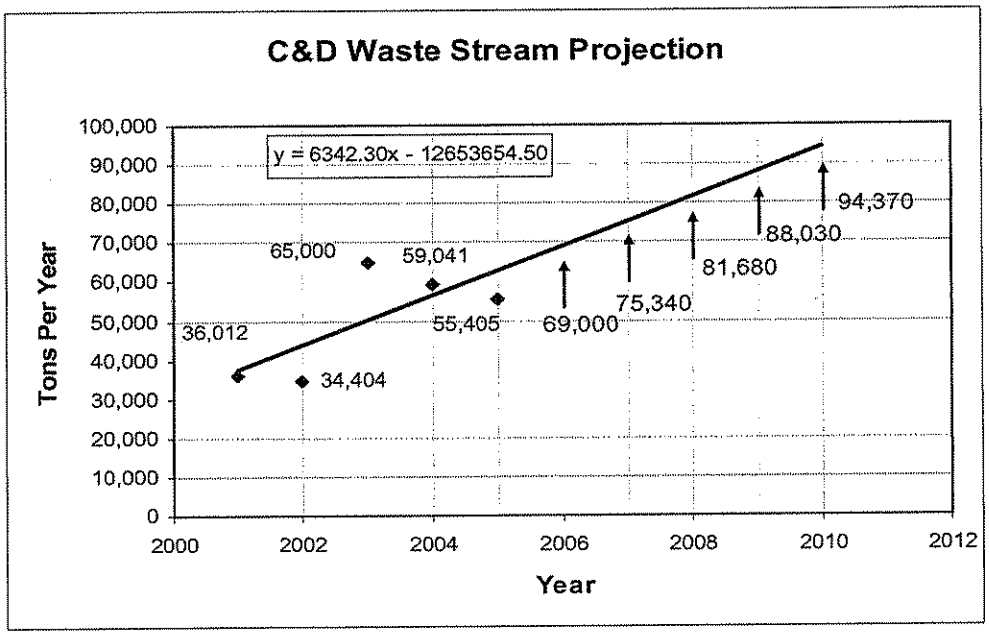


Estimation of Required Air Space for 5-Year Phase

		Rqd Air Space (cy)		
	Projected Tons	Waste	Soil Cover	Total
2006	68,999	115,229	12,803	128,032
2007	75,342	125,820	13,980	139,801
2008	81,684	136,412	15,157	151,569
2009	88,026	147,004	16,334	163,338
2010	94,369	157,595	17,511	175,106
				757,845 **Total**

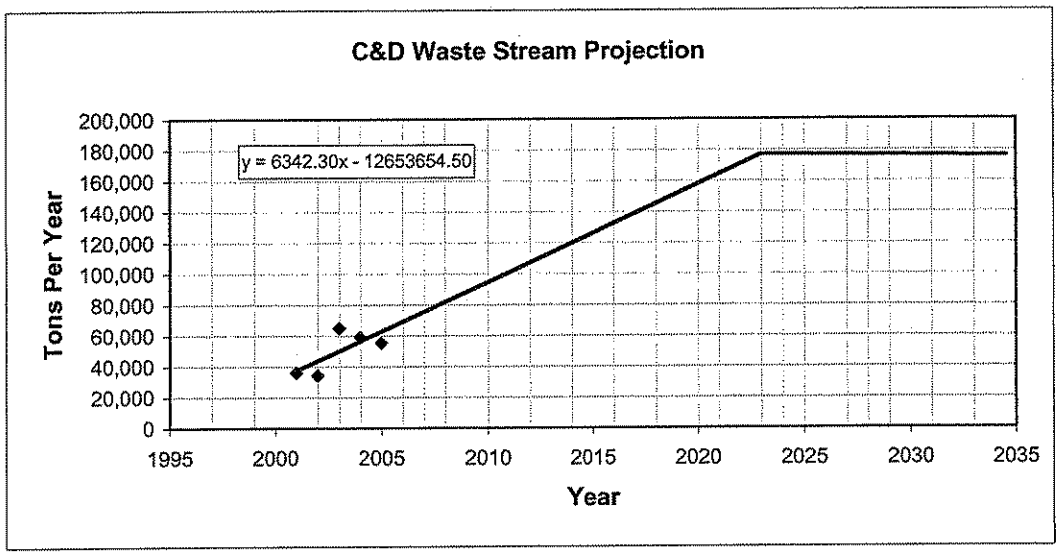
1 cy	*	2000 lbs
1200 lbs		1 ton

Assume 10% of total air space taken up with soil

Evaluation of Design Air Space

Phase 3A volume, not including intermediate or final soil cover = 436,513 cy. (AutoCAD generated)

An additional 321,332 cy is required from Phase 3B.



Year	Annual Tons	Annual Air Space Used (cy)	Cumulative Tons	Cummulative Air Space Used (cy)	
2007	75,342	143,149	75,342	143,150	
2008	81,684	155,199	157,026	298,349	
2009	88,026	167,250	245,052	465,599	
2010	94,369	179,300	339,421	644,899	
2011	100,711	191,351	440,131	836,250	Phase 3
2012	107,053	203,401	547,185	1,039,651	
2013	113,395	215,451	660,580	1,255,102	
2014	119,738	227,502	780,318	1,482,603	
2015	126,080	239,552	906,398	1,722,155	
2016	132,422	251,602	1,038,820	1,973,758	Phase 4
2017	138,765	263,653	1,177,585	2,237,411	
2018	145,107	275,703	1,322,691	2,513,114	
2019	151,449	287,753	1,474,141	2,800,867	
2020	157,792	299,804	1,631,932	3,100,671	
2021	164,134	311,854	1,796,066	3,412,525	Phase 5
2022	170,476	323,905	1,966,542	3,736,430	
2023	171,600	326,040	2,138,142	4,062,470	
2024	171,600	326,040	2,309,742	4,388,510	
2025	171,600	326,040	2,481,342	4,714,550	
2026	171,600	326,040	2,652,942	5,040,590	Phase 6
2027	171,600	326,040	2,824,542	5,366,630	
2028	171,600	326,040	2,996,142	5,692,670	
2029	171,600	326,040	3,167,742	6,018,710	
2030	109,472	207,997	3,277,214	6,226,707	Phase 7

TABLE 1 - SOIL TESTING METHODS AND FREQUENCIES

Test Method	Structural Fill		Test Pad		Soil Cap	Intermediate Soil Layer	Protective Soil Layer
	Index	Construction	Index	Construction	Construction	Index	Index
Particle Size Analysis of Soils ASTM D422	One/Material	1/10,000 CY	One/Material	One/TP	1/10,000 CY	NA	NA
Unified Soil Classification System ASTM D2487	One/Material	1/10,000 CY	One/Material	One/TP	1/10,000 CY	NA	NA
Moisture Content of Soil Lab Method ASTM D2216	One/Material	1/10,000 CY	One/Material	5/Lift	1/10,000 CY	NA	NA
Atterberg Limits ASTM D4318	NA	NA	One/Material	One/TP	1/10,000 CY	NA	NA
Specific Gravity ASTM D854	One/Material**	NA	One/Material**	One/TP	1/10,000 CY	One/Material**	One/Material**
Standard Proctor ASTM D698	One/10,000 CY delivered	NA	One/Material	One/TP	1/10,000 CY	One/Material	One/Material
In-place Density by Sand Cone ASTM D1556	NA	1 of every 10 analyzed by ASTM D2922	NA	1/Lift	1 of every 10 analyzed by ASTM D2922	NA	NA
In-place Density by Drive Cylinder ASTM D2937	NA	1 of every 10 analyzed by ASTM D2922	NA	5/Lift	5/Lift/Acre	NA	NA
In-place Density by Nuclear Method ASTM D2922	NA	4/Lift/Acre	NA	5/Lift	5/Lift/Acre	NA	NA
In-place Moisture by Nuclear Method ASTM D3017	NA	4/Lift/Acre	NA	5/Lift	5/Lift/Acre	NA	NA
Soil Moisture By Direct Heating ASTM D4959	NA	1 of every 10 analyzed by ASTM D3017	NA	1/Lift	1 of every 10 analyzed by ASTM D3017	NA	NA
Undisturbed Hydraulic Conductivity ASTM D5084	NA	NA	NA	1/Lift***	1/Lift/Acre***	NA	NA
Laboratory Compacted Hydraulic Conductivity ASTM D5084	NA	NA	One/Material	NA	One/Material	NA	NA
Triaxial Compression on Cohesive Soil ASTM D4767	One/50,000 CY delivered*	NA	NA	NA	One/Material*	One/Material*	One/Material*
Two-Stage Field Permeameter ASTM D6391	NA	NA	NA	One/TP	NA	NA	NA

*Minimum internal friction angle of 20 degrees, unless otherwise approved by the engineer

**Minimum unit weight of 120pcf, unless otherwise approved by the engineer

*** If a permeability test result fails to meet the permeability requirements, two additional samples shall be taken in the vicinity of the failed sample, and replicate tests conducted. If the replicate tests pass, the section represented by the samples shall be considered as having passed. If either of the replicate tests fail, then the section shall be considered as having failed and shall be removed, replaced and retested.

GLOBAL STATIC AND SEISMIC SLOPE STABILITY

OBJECTIVE

The objective of this calculation is to analyze the stability of the Coble's Sandrock C&D Landfill. This analysis will determine the factors of safety for deep-seated translational and rotational failures. Factors of safety exceeding 1.5 for static conditions and 1.0 for seismic conditions are considered acceptable. The cross section analyzed is Section B-B', shown on EP-09, and in the drawing enclosed. This section represents worst case for stability for Phase 3 because it cuts through the maximum waste height, perpendicular to the steepest slope (3:1).

SOFTWARE & METHODOLOGY

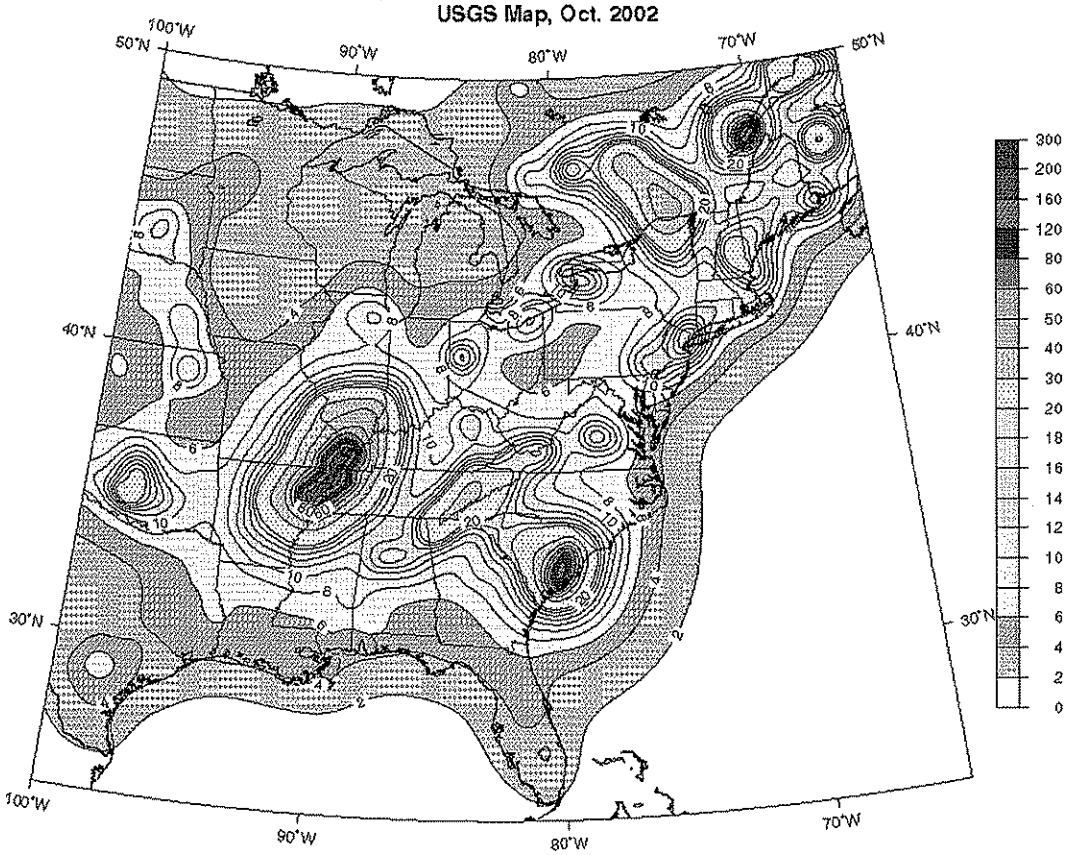
The software program used to calculate slope stability FS within this analysis is entitled, "XSTABL" version 5.206, compiled by Interactive Software Designs, Inc. of Moscow, Idaho. It is a version of "PC STABL 5M" written by Purdue University for the Indiana Department of Highways.

The program uses limit equilibrium techniques to determine a FS for each given input cross-section and corresponding data file. XSTABL will calculate FS for both rotational and translational failure surfaces within each cross-section in terms of both static and seismic conditions based upon slope geometry, a phreatic surface and the shear strength parameters of waste and soils. The software is used to analyze both static and seismic conditions.

Seismic Analysis

A shear wave accelerating through the landfill will produce horizontal and vertical accelerations and stresses within the layers in and beneath the landfill, producing a slope stability FS that is less than a corresponding slope stability FS governed by static conditions. The shear wave acceleration is modeled within the stability analysis by inputting a coefficient, k_y, that is some fraction of gravity. The peak acceleration for the site is estimated to be 0.10 g which is taken from the "Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years.

Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
USGS Map, Oct. 2002



Rankine Method

The Rankine method is a technique used within XSTABL to locate the most critical ***translational*** failure surface within each cross-section. This method was used for both static and seismic conditions.

Characteristics of the Rankine Method include:

- The ability to single out a confined zone that may represent a potentially weak layer.
- Generating passive and active portions of the failure surface at angles dependent on the shear strength of the surrounding soil unit;
- Satisfies both vertical force and moment equilibrium for each slice and overall horizontal force equilibrium for the entire wedge;

- Applicable to any shape of failure surface;
- Considers all interslice shear forces to be horizontal (no interslice shear force); and
- Produces a FS that is considerably lower than methods that satisfies all conditions of equilibrium for each slice.

Janbu's Method

The Simplified Janbu Method was utilized for analyzing the most critical ***rotational*** failure surface for each cross section, considering static and seismic conditions. This method uses the method of slices to determine the stability of the slide mass. The simplified procedure assumes that there are no inter-slice shear forces. Janbu's method satisfies vertical force equilibrium for each slice, as well as overall horizontal force equilibrium for the entire slide mass.

SOIL & WASTE PARAMETERS

Construction & Demolition Debris Strength Parameters
The shear strength values for C&D waste were estimated to be:

γ: Moist Unit weight of waste = 75 pcf
γ_S: Saturated Unit weight waste = 100 pcf
c': Cohesion = 0 psf
Φ': Friction angle = 41 degrees

Structural Fill and Cover Soil Strength
γ: Moist Unit weight of constructed soil layers = 120 pcf
γ_S: Saturated Unit weight of constructed soil layers = 130 pcf
c': Cohesion = 0 psf
Φ': Friction angle = 20 degrees

Foundation Soil Strength
γ: Moist Unit weight of foundation Sand = 120 pcf
γ_S: Saturated Unit weight of foundation Sand = 130 pcf
c': Cohesion = 0 psf
Φ': Friction angle = 20 degrees

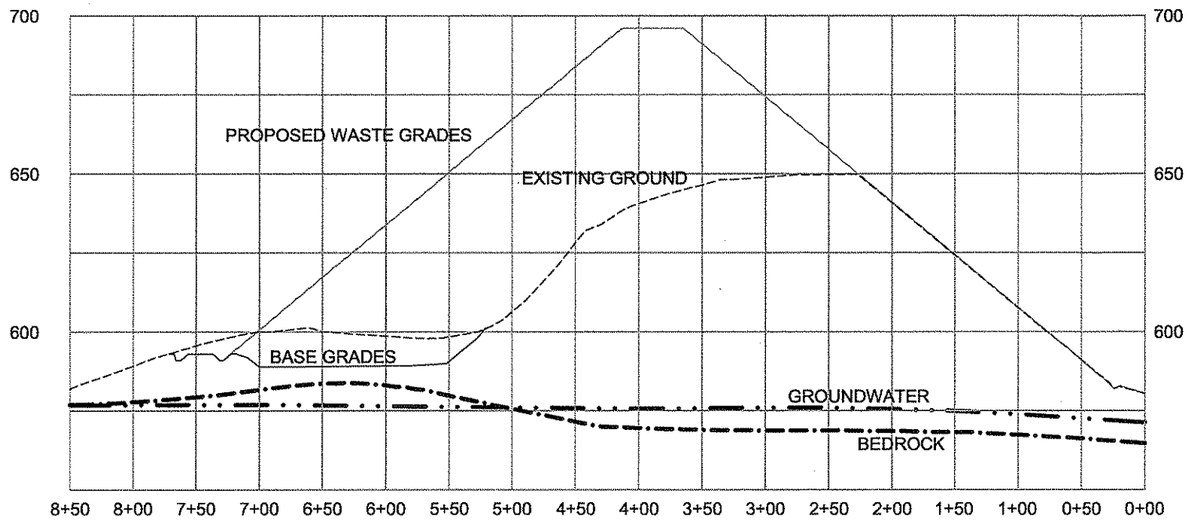
RESULTS & OUTPUT

Factors of safety (FS) were calculated for the final slope condition for Phases 3. The XSTABL software package calculated FS, expressing the ratio of resisting to driving forces, for each failure surface considering static and seismic conditions. The XSTABL slope stability software output data are attached. Below is a summary of the analysis files and results.

	File	Failure Type	Static/Seismic	FS
Cross Section B-B'	SXN_B	Rotational	Static	1.62
	SXN_BB	Translational	Static	2.10
	SXN_BZ	Rotational	Seismic	1.16
	SXN_BBZ	Translational	Seismic	1.48

CONCLUSIONS

Considering rotational and translational failure surfaces, it was the rotational surfaces that produced the lowest FS for the each case. Factors of Safety calculated within this stability analysis comply with industry excepted standards. All ***deep-seated*** translational and rotational analyses provided a static and seismic factor of safety greater than 1.5 and 1.0, respectfully. **In conclusion, the proposed Coble's Sandrock C&D Landfill will be structurally stable under static and seismic conditions.**



SECTION THROUGH B-B'

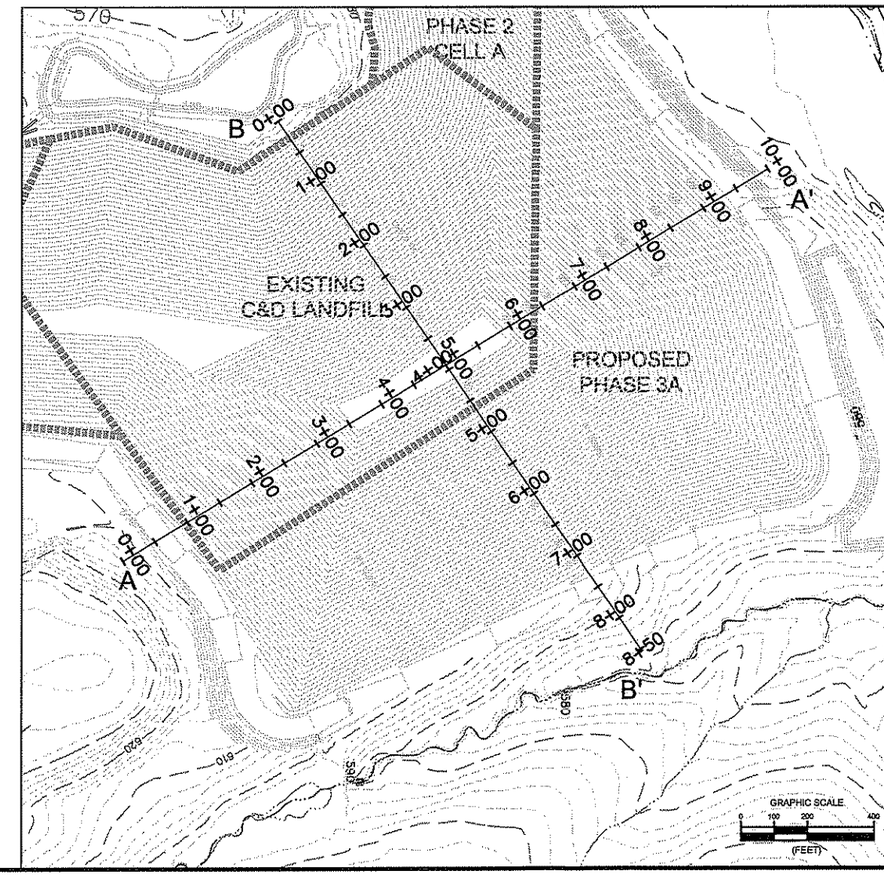
SCALE VERT: 1'=40'
HORIZ: 1'=100'

SOIL LAYER PARAMETERS	STRENGTH		UNIT WEIGHT	
	COHESION (PSF)	FRICTION ANGLE (DEGREES)	MOIST (PCF)	SAT. (PCF)
④ COVER SOIL	0	20	120	130
③ WASTE MASS (C&D)	0	41	75	100
② STRUCTURAL FILL SOIL (DEPTH VARIES)	0	20	120	130
① EXISTING GROUND SOIL	0	20	120	130
GW - GROUND WATER				

SEISMIC PARAMETERS

HORIZONTAL COEFFICIENT

0.10



NO	BY	CK	APP
1	SC	EA	EA

DATE	REVISIONS AND RECORD OF ISSUE
3/3/08	REVISED SOILS PROPERTIES

DESIGNED SC
DRAWN RB
CHECKED EA
APPROVED EA
DATE 06/15/07

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JOYCE ENGINEERING, INC.
2211 WEST MEADOWVIEW ROAD
GREENSBORO, NC 27407
PHONE: (336) 323-0022

COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

ENGINEERING PLANS
STABILITY ANALYSIS

PROJECT NO. 419.22

SCALE AS SHOWN

DRAWING NO.

P:\Coble's Sandrock\Engineering\419.00.T22 Permit to Construct\FEO\Revised Documents\Appendix I Stability\Global XSTABL\Stability.dwg

XSTABL File: SXN_B 3-03-08 10:55

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*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*        Copyright (C) 1992 - 2002      *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.206                 96 - 1932 *
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Problem Description : COBLE

SEGMENT BOUNDARY COORDINATES
---

8 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	582.0	95.0	592.8	1
2	95.0	592.8	115.0	594.0	2
3	115.0	594.0	121.0	592.0	2
4	121.0	592.0	124.0	592.1	2
5	124.0	592.1	130.0	594.0	2
6	130.0	594.0	436.8	696.0	4
7	436.8	696.0	485.8	697.0	4
8	485.8	697.0	623.2	650.0	4

10 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	130.0	594.0	140.0	594.1	2
2	140.0	594.1	436.8	694.0	3
3	436.8	694.0	485.8	695.0	3
4	485.8	695.0	623.2	648.0	3

5	140.0	594.1	150.0	589.0	2
6	150.0	589.0	297.0	590.0	2
7	297.0	590.0	328.0	601.0	2
8	328.0	601.0	407.0	632.0	1
9	407.0	632.0	515.0	648.0	1
10	515.0	648.0	600.0	650.0	1

ISOTROPIC Soil Parameters
---

4 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	130.0	.0	20.00	.000	.0	1
2	120.0	130.0	.0	20.00	.000	.0	0
3	75.0	100.0	.0	41.00	.000	.0	0
4	120.0	130.0	.0	20.00	.000	.0	0

1 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 2 coordinate points

****
PIEZOMETRIC SURFACE
****

Point No.	x-water (ft)	y-water (ft)
1	.00	576.00
2	623.20	575.50

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

1600 trial surfaces will be generated and analyzed.

40 Surfaces initiate from each of 40 points equally spaced
along the ground surface between x = 20.0 ft
and x = 150.0 ft

Each surface terminates between x = 300.0 ft
and x = 600.0 ft

Unless further limitations were imposed, the minimum elevation
at which a surface extends is y = .0 ft

20.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined
within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED JANBU METHOD * * * * *

The 10 most critical of all the failure surfaces examined
are displayed below - the most critical first

Failure surface No. 1 specified by 21 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	126.67	592.94
2	145.40	585.94
3	164.59	580.29
4	184.13	576.03
5	203.92	573.18

6	223.87	571.75
7	243.87	571.75
8	263.82	573.18
9	283.62	576.03
10	303.16	580.29
11	322.34	585.94
12	341.08	592.94
13	359.26	601.26
14	376.80	610.87
15	393.62	621.70
16	409.61	633.71
17	424.71	646.83
18	438.82	661.00
19	451.89	676.14
20	463.85	692.17
21	466.68	696.61

** Corrected JANBU FOS = 1.617 ** (Fo factor = 1.042)

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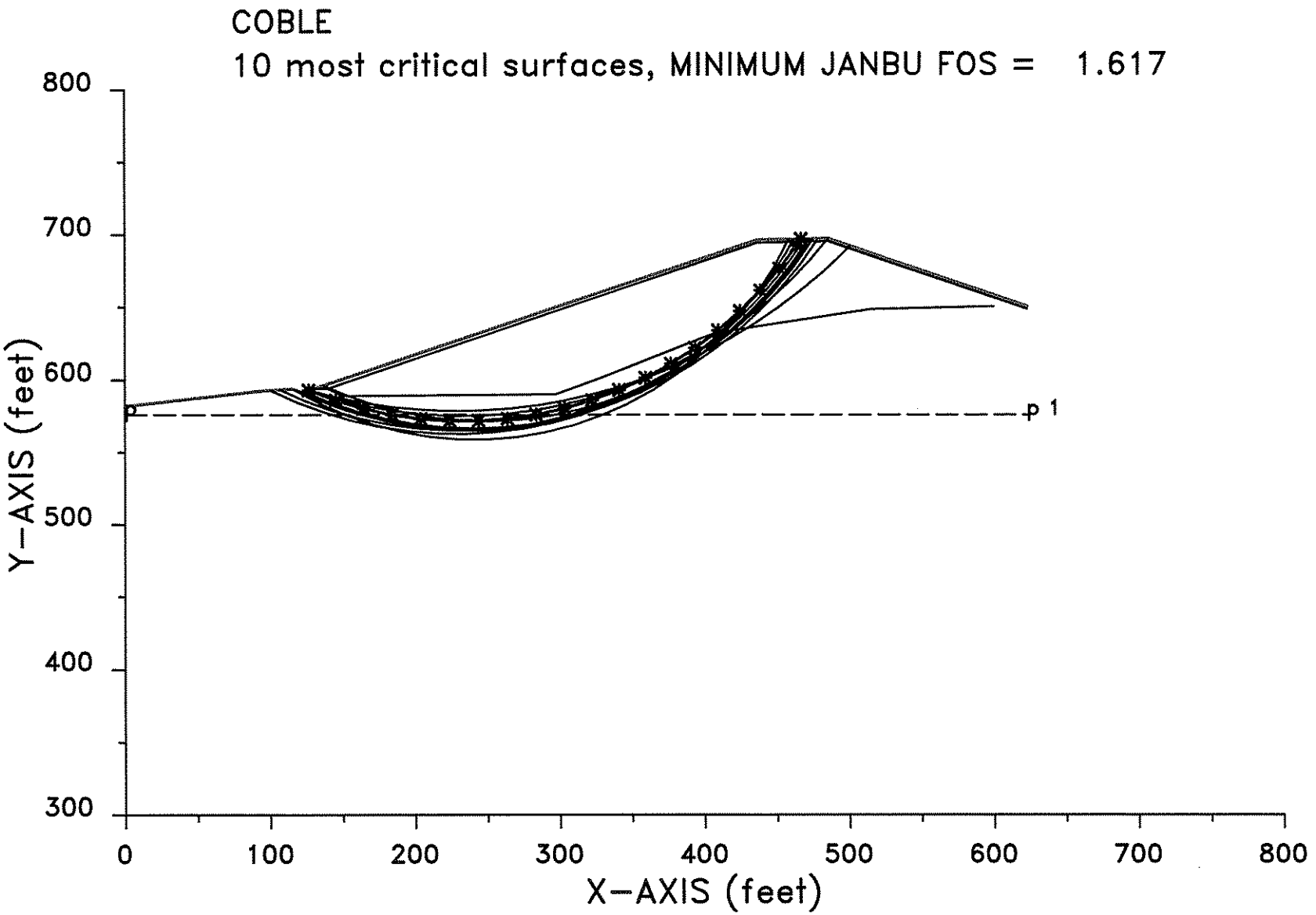

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8 SURFACE boundary segments

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1	.0	582.0	95.0	592.8	1
2	95.0	592.8	115.0	594.0	2
3	115.0	594.0	121.0	592.0	2
4	121.0	592.0	124.0	592.1	2
5	124.0	592.1	130.0	594.0	2
6	130.0	594.0	436.8	696.0	4
7	436.8	696.0	485.8	697.0	4
8	485.8	697.0	623.2	650.0	4

10 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	130.0	594.0	140.0	594.1	2
2	140.0	594.1	436.8	694.0	3
3	436.8	694.0	485.8	695.0	3
4	485.8	695.0	623.2	648.0	3

5	140.0	594.1	150.0	589.0	2
6	150.0	589.0	297.0	590.0	2
7	297.0	590.0	328.0	601.0	2
8	328.0	601.0	407.0	632.0	1
9	407.0	632.0	515.0	648.0	1
10	515.0	648.0	600.0	650.0	1

ISOTROPIC Soil Parameters
---

4 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	130.0	.0	20.00	.000	.0	1
2	120.0	130.0	.0	20.00	.000	.0	0
3	75.0	100.0	.0	41.00	.000	.0	0
4	120.0	130.0	.0	20.00	.000	.0	0

1 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 2 coordinate points

****
PIEZOMETRIC SURFACE
****

Point No.	x-water (ft)	y-water (ft)
1	.00	576.00
2	623.20	575.50

A critical failure surface searching method, using a random technique for generating sliding BLOCK surfaces, has been specified.

The active and passive portions of the sliding surfaces are generated according to the Rankine theory.

1600 trial surfaces will be generated and analyzed.

3 boxes specified for generation of central block base

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

Length of line segments for active and passive portions of sliding block is 14.0 ft

Box no.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Width (ft)
1	138.0	594.0	142.0	594.0	2.0
2	148.0	589.0	152.0	589.0	2.0
3	285.0	590.0	305.0	590.0	2.0

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED JANBU METHOD * * * * *

The 10 most critical of all the failure surfaces examined are displayed below - the most critical first

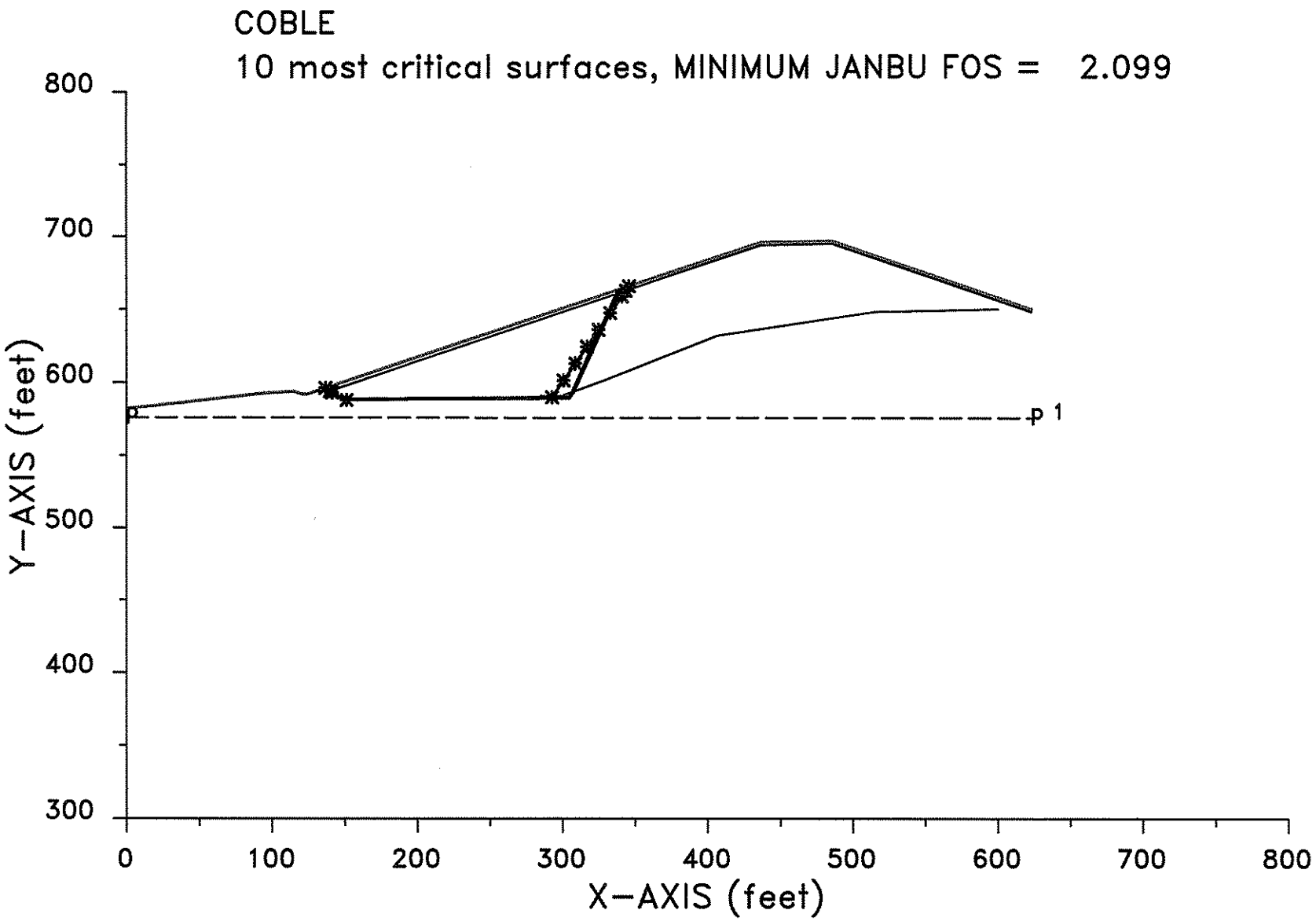
Failure surface No. 1 specified by 14 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	136.84	596.27
2	139.94	594.10
3	140.51	593.84
4	141.45	593.18
5	151.38	588.07
6	292.83	589.97
7	300.86	601.44
8	308.89	612.91
9	316.92	624.38
10	324.95	635.84
11	332.98	647.31
12	341.01	658.78

13	343.73	662.67
14	345.91	665.78

** Corrected JANBU FOS = 2.099 ** (Fo factor = 1.050)

SXN_BB 3-03-08 10:57



XSTABL File: SXN_BBZ 3-03-08 11:01

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*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
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*  Ver. 5.206                96 - 1932  *
*****************************************
```

Problem Description : COBLE

SEGMENT BOUNDARY COORDINATES
---

8 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	582.0	95.0	592.8	1
2	95.0	592.8	115.0	594.0	2
3	115.0	594.0	121.0	592.0	2
4	121.0	592.0	124.0	592.1	2
5	124.0	592.1	130.0	594.0	2
6	130.0	594.0	436.8	696.0	4
7	436.8	696.0	485.8	697.0	4
8	485.8	697.0	623.2	650.0	4

10 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	130.0	594.0	140.0	594.1	2
2	140.0	594.1	436.8	694.0	3
3	436.8	694.0	485.8	695.0	3
4	485.8	695.0	623.2	648.0	3

5	140.0	594.1	150.0	589.0	2
6	150.0	589.0	297.0	590.0	2
7	297.0	590.0	328.0	601.0	2
8	328.0	601.0	407.0	632.0	1
9	407.0	632.0	515.0	648.0	1
10	515.0	648.0	600.0	650.0	1

ISOTROPIC Soil Parameters
---

4 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	130.0	.0	20.00	.000	.0	1
2	120.0	130.0	.0	20.00	.000	.0	0
3	75.0	100.0	.0	41.00	.000	.0	0
4	120.0	130.0	.0	20.00	.000	.0	0

1 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 2 coordinate points

****
PIEZOMETRIC SURFACE
****

Point No.	x-water (ft)	y-water (ft)
1	.00	576.00
2	623.20	575.50

A horizontal earthquake loading coefficient
of .100 has been assigned

A vertical earthquake loading coefficient
of .000 has been assigned

A critical failure surface searching method, using a random technique for generating sliding BLOCK surfaces, has been specified.

The active and passive portions of the sliding surfaces are generated according to the Rankine theory.

1600 trial surfaces will be generated and analyzed.

3 boxes specified for generation of central block base

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

Length of line segments for active and passive portions of sliding block is 14.0 ft

Box no.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Width (ft)
1	138.0	594.0	142.0	594.0	2.0
2	148.0	589.0	152.0	589.0	2.0
3	285.0	590.0	305.0	590.0	2.0

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED JANBU METHOD * * * * *

The 10 most critical of all the failure surfaces examined are displayed below - the most critical first

Failure surface No. 1 specified by 14 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	136.84	596.27
2	139.94	594.10
3	140.51	593.84
4	141.45	593.18

5	151.38	588.07
6	292.83	589.97
7	300.86	601.44
8	308.89	612.91
9	316.92	624.38
10	324.95	635.84
11	332.98	647.31
12	341.01	658.78
13	343.73	662.67
14	345.91	665.78

** Corrected JANBU FOS = 1.484 ** (Fo factor = 1.050)

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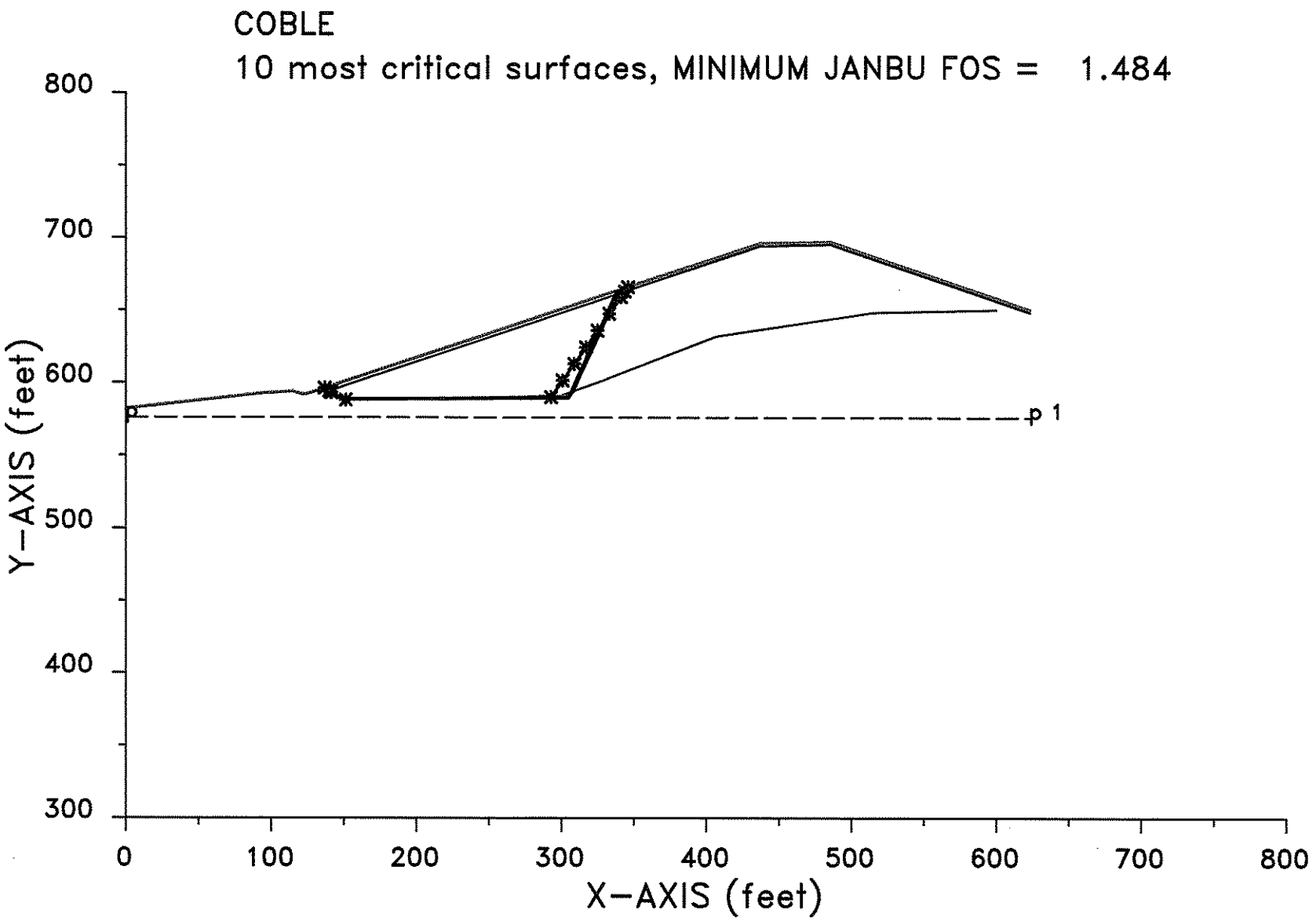

XSTABL File: SXN_BZ 3-03-08 10:59

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*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
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*  Ver. 5.206                 96 - 1932 *
*****************************************
```

Problem Description : COBLE

SEGMENT BOUNDARY COORDINATES
---

8 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	582.0	95.0	592.8	1
2	95.0	592.8	115.0	594.0	2
3	115.0	594.0	121.0	592.0	2
4	121.0	592.0	124.0	592.1	2
5	124.0	592.1	130.0	594.0	2
6	130.0	594.0	436.8	696.0	4
7	436.8	696.0	485.8	697.0	4
8	485.8	697.0	623.2	650.0	4

10 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	130.0	594.0	140.0	594.1	2
2	140.0	594.1	436.8	694.0	3
3	436.8	694.0	485.8	695.0	3
4	485.8	695.0	623.2	648.0	3

5	140.0	594.1	150.0	589.0	2
6	150.0	589.0	297.0	590.0	2
7	297.0	590.0	328.0	601.0	2
8	328.0	601.0	407.0	632.0	1
9	407.0	632.0	515.0	648.0	1
10	515.0	648.0	600.0	650.0	1

ISOTROPIC Soil Parameters
---

4 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	120.0	130.0	.0	20.00	.000	.0	1
2	120.0	130.0	.0	20.00	.000	.0	0
3	75.0	100.0	.0	41.00	.000	.0	0
4	120.0	130.0	.0	20.00	.000	.0	0

1 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 2 coordinate points

****
PIEZOMETRIC SURFACE
****

Point No.	x-water (ft)	y-water (ft)
1	.00	576.00
2	623.20	575.50

A horizontal earthquake loading coefficient
of .100 has been assigned

A vertical earthquake loading coefficient
of .000 has been assigned

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

1600 trial surfaces will be generated and analyzed.

40 Surfaces initiate from each of 40 points equally spaced
along the ground surface between x = 20.0 ft
and x = 150.0 ft

Each surface terminates between x = 300.0 ft
and x = 600.0 ft

Unless further limitations were imposed, the minimum elevation
at which a surface extends is y = .0 ft

20.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED JANBU METHOD * * * * *

The 10 most critical of all the failure surfaces examined
are displayed below - the most critical first

Failure surface No. 1 specified by 21 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	126.67	592.94
2	145.40	585.94
3	164.59	580.29
4	184.13	576.03
5	203.92	573.18
6	223.87	571.75
7	243.87	571.75
8	263.82	573.18
9	283.62	576.03
10	303.16	580.29
11	322.34	585.94
12	341.08	592.94
13	359.26	601.26
14	376.80	610.87
15	393.62	621.70
16	409.61	633.71
17	424.71	646.83
18	438.82	661.00
19	451.89	676.14
20	463.85	692.17
21	466.68	696.61

** Corrected JANBU FOS = 1.158 ** (Fo factor = 1.042)

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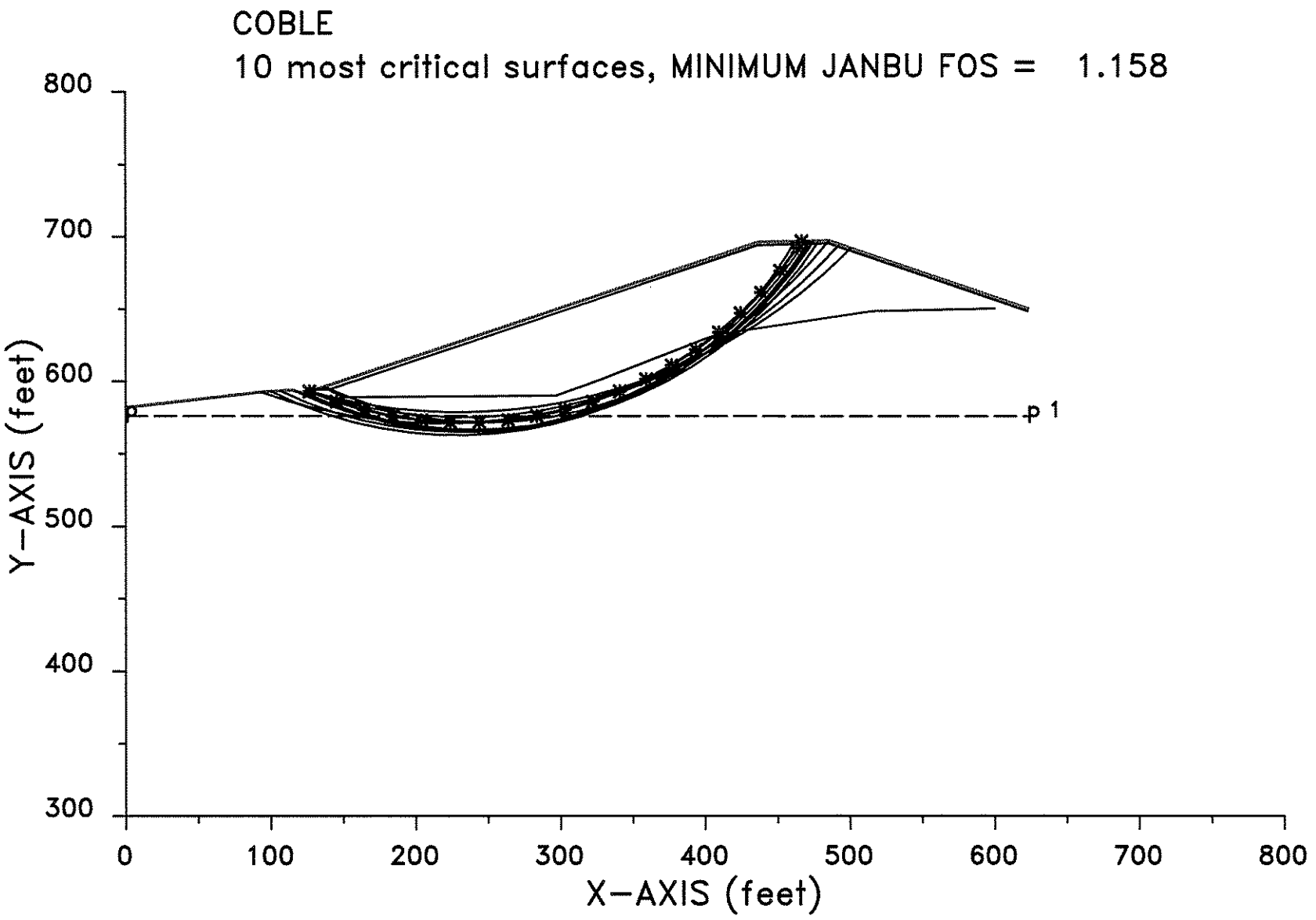

BEARING CAPACITY

OBJECTIVE

To determine the bearing capacity of the subgrade material beneath the proposed Cobles Sandrock C&D Landfill.

METHODOLOGY

The surface beneath the landfill must be able to bear the weight of the landfill without enduring shear failure or excessive settlement.

For this calculation a waste thickness of 120 feet will be used. This value was determined by subtracting the lowest base grade elevation of Phase 3 (576 see EP-02) from the maximum grade of Phase 3 (696 see EP-06).

The soil material strata beneath the landfill consist of silty sand, sandy silt, and bedrock. Strength parameters of the foundation soils from NAVFAC Design Manual 7.2, 1986, will be used to estimate the necessary Vesic bearing capacity factors utilized in the Vesic's General Bearing Capacity Equation. The following table lists the friction angles for the foundation soils based on the subsurface investigation described in the Hydrogeologic Report:

USCS GROUP	SOIL TYPE	FRICTION ANGLE
ML	Sandy Silt	32
SM	Silty Sand	34

The internal friction angle of the foundation soils was assumed to be **20** degrees for the purpose of this calculation. This is extremely conservative in that the strength used represents a total stress analysis, assuming that the landfill is built quickly relative to the ability of the foundation soils to dissipate excess pore pressures resulting from the loading, when in reality, the opposite can be expected to happen. An additional conservative assumption is that the foundation soil has **no cohesion**.

An average unit weight of 75 pcf will be used in the analysis for the unit weight of the C&D waste.

A factor of safety (FS) will be calculated comparing the total anticipated applied load to the estimated ultimate load that the foundation soils can support.

SUMMARY TABLE

Component	Thickness (ft)	Cohesion (psf)	Internal Friction Angle (degrees)	Unit Weight (pcf)
Foundation Soils	-----	0	20	120
Solid Waste	120*		41	75
Vesic Bearing Capacity Factors**	___	Nc = 14.83	Nq = 6.40	Nγ = 5.39

* Use a conservative maximum waste vertical height of 120-ft.
**Vesic Bearing Capacity Factors were taken from Table 4 below.

BEARING CAPACITY CALCULATION

The excavation for the base of the landfill is a maximum of approximately 10 feet beneath the existing surface. The friction angle, 20 degrees, was assumed and the unit weight of the foundation soils, 120 pcf, was assumed based on on-site borings. A vertical pressure and a horizontal base are assumed, therefore, the following equation does not include the inclination, ground and base factors.

$$q_{ult} = cN_c S_c d_c + qN_q S_q d_q + 0.5\gamma B N_\gamma S_\gamma d_\gamma \text{ (Vesic Equation)}$$

Where:

q_{ult} = ultimate bearing capacity of the subgrade material, (psf).

c = a cohesion of 0 psf was used in the analysis. This assumption is conservative.

γ = unit weight of the foundation soil = 120 pcf.

B = width of the rectangular foundation = 550-feet.

L = length of the rectangular foundation = 650-feet.

D_f = depth of embedment for a footing in a standard bearing capacity analysis = 10-feet.

$q = \gamma D_f$, soil pressure around footing, not applicable for surface footings.

N_c, N_q, N_γ = bearing capacity factors which are a function of the foundation soil's internal angle of friction, use a ϕ of 20° and see Summary Table to obtain factors:

$N_c = 14.83$, $N_q = 6.40$, $N_\gamma = 5.39$

S_c, S_q, S_γ = Shape Factors for use in the Vesic bearing capacity equation,

$S_c = 1 + (N_q / N_c) \times (B/L) = 1.36$

$S_q = 1 + (B/L)\tan\phi = 1.31$

$S_\gamma = 1 - 0.4(B/L) = 0.66$

d_c, d_q, d_γ = Depth Factors for use in the Vesic bearing capacity equation,

$d_c = 1 + 0.4(D/B)$ for $D/B<=1$,
$= 1.007$

$d_q = 1 + 2\tan\phi(1-\sin\phi)^2(D/B) = 1.006$

$d_\gamma = 1$

$q_{ult} = cN_c S_c d_c + qN_q S_q d_q + 0.5\gamma B N_\gamma S_\gamma d_\gamma$

$q_{ult} = 0 + [(120 * 10) * 6.4 * 1.31 * 1.006] + [0.5 * 120 * 550 * 5.39 * 0.66 * 1]$

q_{ult} = 10,121 psf + 117,394 psf = 127,515 psf or **63.75** tsf

The total applied load from the maximum waste thickness is:

q = (unit weight of waste)(maximum waste thickness) + (unit weight of Final Cover System)(Final Cover System thickness {12" intermediate, 18" infiltration barrier, 18" vegetative layer})

$$q = \underbrace{(75 \text{ pcf} * 120 \text{ ft})}_{\text{Waste}} + \underbrace{(120 \text{ pcf} * 4.0 \text{ ft})}_{\text{Final Cover}}$$

q = 9,480 psf or 4.74 tsf

Bearing Capacity Factor of Safety, FS

$$FS = \frac{q\ \text{ultimate}}{q} = \frac{63.75\ \text{tsf}}{4.74\ \text{tsf}} = \mathbf{13.45}$$

CONCLUSION

The bearing capacity of the in-situ soils beneath the landfill was calculated using a conservative maximum waste thickness of **120**-ft. The applied stress was then calculated to be **4.74** tons per square foot (tsf) including final cover system soil components. The bearing capacity of the underlying foundation soils was estimated to be **63.75** tsf.

The resulting FS of **13.45** indicates that the insitu soil has an adequate safety factor against bearing capacity failure for the conditions analyzed.

REFERENCES

1) Terzaghi & Peck, **"Soil Mechanics in Engineering Practice"**, John Wiley and Sons, 1967.

2) Das, Braja, M., **"Principles of Geotechnical Engineering"**, PWS Publishers, 1985.

3) Vesic, Aleksander S., **"Analysis of Ultimate Loads of Shallow Foundations"**, Journal of the Soil Mechanics and Foundations Division, January 1973.

4) Sowers, **"Settlement of Waste Disposal Fills"**, paper for Law Engineering.

5) Landva, A.O. & Clark, J.I. **"Geotechnics of Waste Fill"**, Geotechnics of Waste Fill - Theory and Practice, ASTM STP 1070, Arvid Landva, G. David Knowles, Editors, American Society for Testing of Materials, Philadelphia, 1990.

ENGINEERING, INC.

Project:	Cobles Sandrock		
Project Number:	419.22		
Calculated By:	SJC	Date:	02/08/08
Revised By:		Date:	
Checked By:		Date:	
Subject:	Bearing Capacity		
Sheet:	5 of 5		

Bearing Capacity Factors
(Excerpt Taken From Reference 3, Table 4)

Table 4.—Bearing Capacity Factors

ϕ (1)	N_c (2)	N_q (3)	N_γ (4)	N_q/N_c (5)	tan ϕ (6)
0	5.14	1.00	0.00	0.20	0.00
1	5.38	1.09	0.07	0.20	0.02
2	5.63	1.20	0.15	0.21	0.03
3	5.90	1.31	0.24	0.22	0.05
4	6.19	1.43	0.34	0.23	0.07
5	6.49	1.57	0.45	0.24	0.09
6	6.81	1.72	0.57	0.25	0.11
7	7.16	1.88	0.71	0.26	0.12
8	7.53	2.06	0.86	0.27	0.14
9	7.92	2.25	1.03	0.28	0.16
10	8.35	2.47	1.22	0.30	0.18
11	8.80	2.71	1.44	0.31	0.19
12	9.28	2.97	1.69	0.32	0.21
13	9.81	3.26	1.97	0.33	0.23
14	10.37	3.59	2.29	0.35	0.25
15	10.98	3.94	2.65	0.36	0.27
16	11.63	4.34	3.06	0.37	0.29
17	12.34	4.77	3.53	0.39	0.31
18	13.10	5.26	4.07	0.40	0.32
19	13.93	5.80	4.68	0.42	0.34
20	14.83	6.40	5.39	0.43	0.36
21	15.82	7.07	6.20	0.45	0.38
22	16.88	7.82	7.13	0.46	0.40
23	18.05	8.66	8.20	0.48	0.42
24	19.32	9.60	9.44	0.50	0.45
25	20.72	10.66	10.88	0.51	0.47
26	22.25	11.85	12.54	0.53	0.49
27	23.94	13.20	14.47	0.55	0.51
28	25.80	14.72	16.72	0.57	0.53
29	27.86	16.44	19.34	0.59	0.55
30	30.14	18.40	22.40	0.61	0.58
31	32.67	20.63	25.99	0.63	0.60
32	35.49	23.18	30.22	0.65	0.62
33	38.64	26.09	35.19	0.68	0.65
34	42.16	29.44	41.06	0.70	0.67
35	46.12	33.30	48.03	0.72	0.70
36	50.59	37.75	56.31	0.75	0.73
37	55.63	42.92	66.19	0.77	0.75
38	61.35	48.93	78.03	0.80	0.78
39	67.87	55.96	92.25	0.82	0.81
40	75.31	64.20	109.41	0.85	0.84
41	83.86	73.90	130.22	0.88	0.87
42	93.71	85.38	155.55	0.91	0.90

Table 4.—*Continued*

(1)	(2)	(3)	(4)	(5)	(6)
43	105.11	99.02	186.54	0.94	0.93
44	118.37	115.31	224.64	0.97	0.97
45	133.88	134.88	271.76	1.01	1.00
46	152.10	158.51	330.35	1.04	1.04
47	173.64	187.21	403.67	1.08	1.07
48	199.26	222.31	496.01	1.12	1.11
49	229.93	265.51	613.16	1.15	1.15
50	266.89	319.07	762.89	1.20	1.19

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	A	B	C	D	E	F	G	H	I	J
1										
2										
3	**Subsurface Conditions**									
4										
5	Conditions encountered at P-24 are used:									
6										
7	Depth [ft]									
8	0		Ground Surface							
9	8		BASE GRADE							
10										
11		Layer 1	Material =	SM	Blowcounts = 13/ft					
12	16									
13		Layer 2								
14	18		Material =	PWR	Blowcounts = 49/ft					
15	BEDROCK									
16										
17										
18	**Foundation Type**									
19										
20	Assume a foundation of approximately 550' x 650'									
21	B=550'									
22	L=650'									
23										
24										
25	**Schmertmann Method**									
26										
27	Immediate settlement of cohesionless soil will be due to the combined effects of volume									
28	distortion and primary compression. The Schmertmann method offers a procedure to									
29	calculate settlement resulting from the combined effects of volume distortion and									
30	compression in soil deposits that have not been pre-compressed.									
31										
32	$\Delta S_n = (\varepsilon_{v,avg})(\Delta z_n) = \Delta p(I_v / E_s)(\Delta z_n)$									
33										
34										
35	where :									
36										
37	ΔS_n = Settlement in layer "n"									
38	$\varepsilon_{v,avg}$ = Average vertical strain in layer "n"									
39										
40	Δz_n = Thickness of layer "n"									
41	Δp = Net foundation bearing pressure imposed onto the soil									
42										
43	I_v = Strain influence factor for the soil beneath th e foundation									
44	E_s = Modulus of elasticity for layer "n"									
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										
61										

JOYCE ENGINEERING, INC

	A	B	C	D	E	F	G	H	I	J
62	**Loading**									
63					*Landfill Loading*					
64		Density (pcf)	Depth (ft)		Δp					
65	Cover Soil	120	4		8,520					
66	Waste	75	120							
67	Foundation	120	varies							
68										
69	Layer	Layer Thickness Δz (ft)	Depth to Center (ft)		Blow Count (N)	Multiplier[1]	E_s (psf)[1]	I_v[2]	ΔS_n (ft)	
70	1	8	4	.004B	13	4	104000	0.1	0.0655	
71										
72	2	2	9	.009B	49	4	392000	0.1	0.0043	
73										
74										
75								sum (ft)	0.0699	
76								**sum (in)**	**0.8386**	
77										
78	1) From Figure 1 (below)									
79	2) From Figure 2 (below)									
80										
81	**Figure 1**									

JEI: =H70*(I70/G70)*B70

JEI: =(B65*C65)+(B66*C66) - (B67*8)

JEI: =F70*E70*2000

Table 10-2 Values of E_s Related to Soil Type

Soil Type	Approximate Value for E_s (kgf/cm², 0.1 MPa, ton/ft²) In terms of N	In terms of q_c
Sand–silt mixture	$4N$	$1.5q_c$
Fine to medium sands, fine–medium–coarse sands	$7N$–$10N$ (relating to density and compactness)	$2q_c$–$3q_c$ (relating to density and compactness)
Sand–gravel mixtures	$12N$	$4q_c$

Figure 2

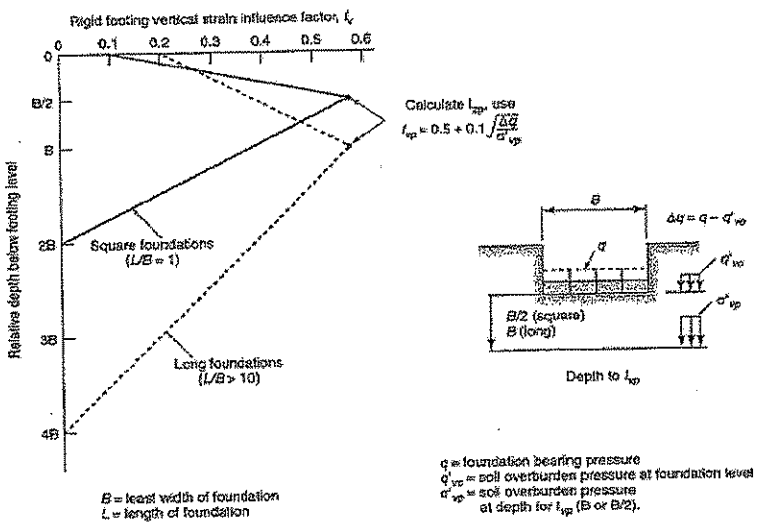


Figure 10-2 Strain influence factors for use with Schmertmann method to estimate settlement of foundations on sand.

References

McCarthy, D.F. Essentials of Soils Mechanics and Foundations: Basic Geotechnics, 1998

DEMO ENGINEERS

LOG OF BORING P-24

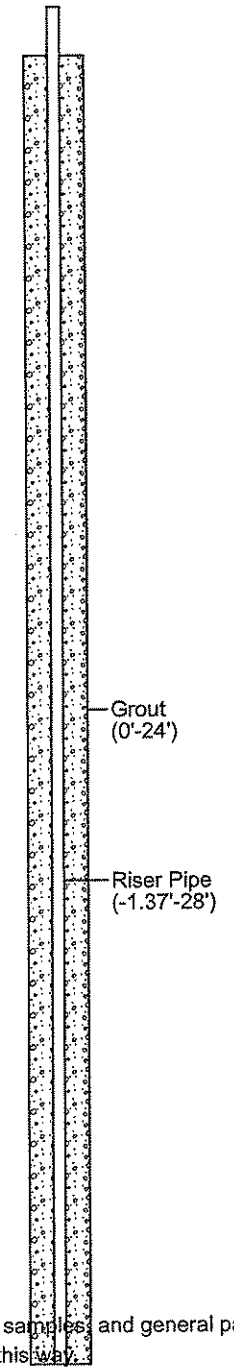
Coble's Sandrock
C&D Permit Application
Alamance County, NC

JEI Project No. 419.00,Task 19

Date Started	: 03/22/05	Drilling Company	: SAEDACCO
Date Completed	: 03/24/05	Northing Coord.	: 801640.1465480
Hole Diameter	: 8.25-inch/6.25-inch	Easting Coord.	: 1843019.3592300
Drilling Method	: HSA/Downhole Hammer	Survey By	: Tritech Civil Env., P.C.
Sampling Method	: Split Spoons/Cuttings	Logged By	: David Y. Reedy II

Well: P-24
Elev.: 613.89

Depth in Feet	Surf. Elev. 612.52	Blow Count		USCS	DESCRIPTION
0	612				SILTY SAND - dark gray clayey sand
1	611				
2	610				Color changes to tan
3	609				
4	608				
5	607	6			
6	606	11 10 13	85		
7	605				
8	604			SM	
9	603				
10	602	6 6			Orange and white clayey sand with thin zones of green silt (1 to 2 inches thick)
11	601	7 8	85		
12	600				
13	599				
14	598				
15	597	17 22 27	85		White clayey sand with abundant quartz pebbles and iron staining, dry
16	596	50/3			PARTIALLY WEATHERED ROCK - white clayey sand with abundant quartz pebbles
17	595			PWR	*Auger refusal at 18 feet*
18	594			BR	BEDROCK - light tan weathered granitic cuttings, coarse sand to small pebble size cuttings
19					



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 03/24/05
Hole Diameter(s)	: 8.25-inch/6.25-inch
Drilling Method(s)	: Hollow Stem Augers
Company Rep.	: Robert Miller
Drilling Method(s)	: Downhole Hammer
Company Rep.	: Robert Miller

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 1.37-feet

WELL SCREEN

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

GRAVEL PACK

Type	: DSI # 1 Sand

WELL SCREEN SEAL

Type	: 3/8" Bentonite chips

ANNULUS SEAL

Type	: No. 1 Portland grout

1. Drilling performed with a Gus Pech GP-1100E utilizing 4.25-inch ID hollow stem augers to auger refusal. Boring was continued utilizing 6.25-inch downhole hammer.

2. Solid triangle represents water level at time of drilling (26.76 feet below TOC). Open triangle represents water level ~24 hours after well construction (26.44 feet below TOC). Solid square represents water level 11 days after well construction (26.04 feet below TOC).

For this demonstration version, the number of contacts, samples, and general parameter data points are limited to 5, 5, and 10. The full version does not limit the data this way.

08-27-2007 ...oble's Sandrock\Engineering\419.00.T22 Permit to Construct\Appendix I Stability\Settlement\P-24 bore log.b.

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1.0 PROJECT DESCRIPTION

The site is located in south central Alamance County, North Carolina, approximately 8 miles south-southwest of Burlington. The facility is owned by Coble's Sandrock, Inc., and will be operated by the owner. Under Permit No. 01-05, Coble's Sandrock, Inc., was granted site suitability by the North Carolina Department of Environment and Natural Resources (NCDENR) for 39.60 acres of C&D waste disposal. An additional 114.4 acres has been approved for development as a solid waste management facility.

The proposed Phase 3 Expansion will consist of the construction of two new cells—Phase 3A a 6.3 acre area to the east of Phase 2A, and Phase 3B a 5.8 acre area to the south of Phase 2B. This erosion and sediment control plan is for the Proposed Phase 3 Expansion.

2.0 EXISTING SITE CONDITIONS

The facility is located on the west side of Foster Store Road and east of West Greensboro-Chapel Hill Road in south-central Alamance County, North Carolina. Access to the site will be through an existing entrance road off of Foster-Store Road. The entire facility property encompasses approximately 160 acres, and includes a permitted C&D landfill, a closed LCID landfill, an active LCID landfill, a pond, open fields used for cattle gazing, and wooded areas. The northern and western sides of the property are bounded by Poppaw Creek

3.0 ADJACENT AREAS

The site is bounded to the north and west by Poppaw Creek: Foster Store Road bounds the property to the east. Properties adjacent to the site are generally rural farmland.

4.0 SOIL

According to the soil survey map for Alamance County, North Carolina, (USDA Natural Resources Conservation Service, 1998), the surficial soils at the site belong to the Helena group. These soils are characteristic of Piedmont uplands where poor to moderate drained soils with a coarse sandy loam surface layer predominate on gently sloping to sloping land

Soil Stockpiling

Surplus soil from the grading shown on the attached plans will be stockpiled on the Coble's Sandrock, Inc. property to the south of the graded areas. The stockpile will stabilized according to section 7.0 – Vegetative Stabilization, and silt fence will be used around the perimeter of the stockpile area prior to stabilization.

5.0 CRITICAL EROSION AREAS

The most critical erosion area will be the surface of the disposal area during landfilling operations. The active face of disposed waste will be covered with compacted soil on a weekly

basis. When the waste has reached the height of the perimeter berm, runoff from the covered portions of the landfill will flow to the stormwater conveyance channels adjacent to the access roads. If grass has not yet been established on covered portions of the landfill, then there is a significant potential for the covered areas to be eroded and for sediment to be carried in the runoff. To minimize the potential for erosion, covered areas that are temporarily inactive will be seeded within 30 working days or 120 calendar days after placement of the soil cover, whichever period is shorter. Stormwater channels at the perimeter of the waste disposal area will convey flow to the on-site sediment basins to minimize the potential impact of sediment leaving the disposal area.

6.0 EROSION AND SEDIMENT CONTROL MEASURES

All vegetative practices and erosion and sediment control features shall be constructed and maintained in accordance with the North Carolina Erosion and Sediment Control Planning and Design Manual (NCESCPDM). Design of the features is in accordance with NCESCPDM and the requirements of the NC Department of Environment, Health and Natural Resources, Division of Waste Management. The features are designed to control runoff resulting from the 25-year frequency storm. Supporting design calculations are attached. Plan-view drawings with details are also provided.

6.1 Sediment Basin (Reference NCESCPDM 6.61)

A new permanent sediment basin, SB-1, is proposed to receive flow from the northeastern and eastern portions of the landfill. Flow from the northwest, west and south sides of the landfill will be directed to an existing permanent sediment basin that is sufficiently large to handle the flow.

6.2 Temporary Stormwater Diversion Berms (Reference NCESCPDM 6.20)

Inactive portions of the cells that have not received waste will be separated from the active area by the use of temporary diversion berms to segregate uncontaminated and contaminated runoff. As waste filling progresses, the diversion berms will be relocated to allow for continued filling within the cell. As subsequent portions of the cell are opened in the planned sequence, uncontaminated stormwater will be diverted around the active portions of the cells for collection and removal.

6.3 Silt Fence (Reference NCESCPDM 6.62)

Silt fences will be provided at the locations shown on the drawings to minimize the transport of sediments off-site during construction. The silt fence may be removed following stabilization of the contributing drainage areas in accordance with NCESCPDM 6.62.

6.4 Grass-Lined Channels (Reference NCESCPDM 6.30)

Grass-lined channels will be constructed at the locations shown on the drawings to direct stormwater runoff to either the existing sediment basin or the proposed sediment basin. Temporary liners will be provided as needed to protect against erosive velocities in the channels.

6.5 Rip-Rap Lined Channels (Reference NCESCPDM 6.31)

Rip-rap-lined channels will be constructed at the locations shown on the drawings to direct stormwater runoff to the existing sediment basin or the proposed sediment basin.

6.6 Slope Drains (Reference NCESCPDM 6.32)

Slope drains will be used as shown on the drawings to prevent formation of erosion rills from concentrated flow on steep slopes.

6.7 Outlet Protection (Reference NCESCPDM 6.41)

Outlet protection will be used at the outlets of all slope drains and culverts to dissipate energy and prevent erosion.

7.0 VEGETATIVE STABILIZATION

Vegetative cover shall be re-established within 15 working days or 30 calendar days (whichever is shorter), following completion of any phase of grading; permanent groundcover for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction or development.

8.0 MAINTENANCE

The sediment basins shall be inspected regularly during land disturbing activities and after each significant rainfall. Sediment shall be removed, and the basin restored to its original dimensions when sediment accumulates to one-half the design depth. The embankments, spillways, and outlets shall be inspected regularly for signs of piping and settlement. Repairs shall be made immediately. The riser and pool area shall be kept free of trash and other debris.

Diversion berms shall be inspected weekly and after each significant rainfall. Accumulated sediment shall be removed immediately from the flow area, and diversion berms repaired promptly.

Grass-lined channels shall be checked after every rainfall while grass in the channel is being established. After grass is established, the channel shall be checked after each heavy rainfall event, and repairs made immediately. Accumulated sediment shall be removed as necessary to maintain the design capacity of the channel. Grass that is lining the channel shall be kept in a healthy and vigorous condition at all times.

Sediment fences shall be inspected at least once a week and after each rainfall. Repairs shall be made immediately. Sediment deposits shall be removed as needed to provide adequate storage volume for the next rainfall event, and to reduce pressure on the fence. Fencing materials and sediment deposits shall be removed, and the area brought to grade following stabilization of upgradient disturbed areas.

9.0 CONSTRUCTION SEQUENCE

1. Obtain plan approval and other applicable permits.

2. Install temporary diversions, silt fence and temporary sediment traps for Phase 3A grading activities.

3. Install sediment basin and permanent stormwater diversion channels for Phase 3A.

4. Grade access roads and base of landfill. Stockpile excess soil.

5. Stabilize the site as areas are brought to finish grade. Provide ground cover on exposed slopes within 21 calendar days following completion of any phase of grading and permanent ground cover for all disturbed areas within 15 working days or 90 calendar days (whichever period is shorter) following completion of construction or development.

6. Begin landfilling activities after all required approvals are obtained from the regulatory authorities.

7. Prior to the end of landfilling activities for Phase 3A, install temporary diversions, silt fence and temporary sediment traps for Phase 3B.

8. Install permanent stormwater diversion channels for Phase 3B.

9. Grade access roads and base of landfill. Stockpile excess soil.

10. Stabilize the site as areas are brought to finish grade. Provide ground cover on exposed slopes within 21 calendar days following completion of any phase of grading and permanent ground cover for all disturbed areas within 15 working days or 90 calendar days (whichever period is shorter) following completion of construction or development.

[END]

SCS Type II Rainfall Data
25 Yr 24 Hr Storm

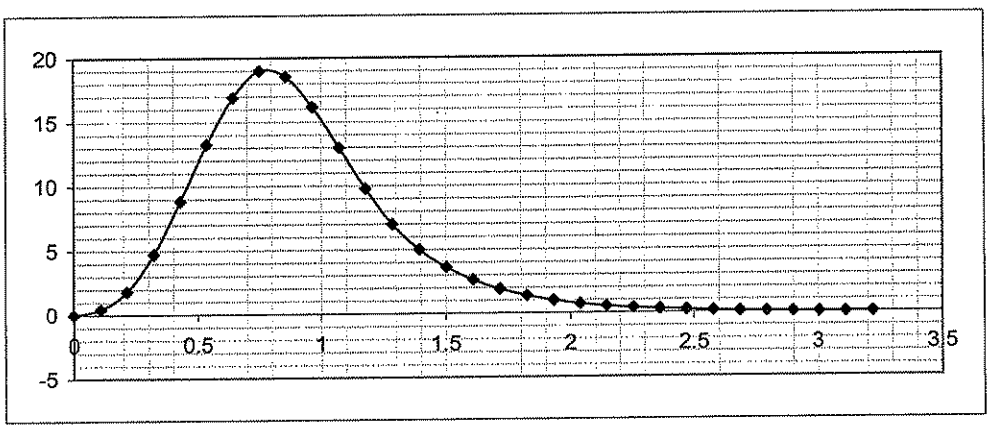
Time (hr)	Inches per time step	Inches per hour	Inches Cumulative
0	0	0	0
0.5	0.024	0.048	0.024
1	0.024	0.048	0.048
1.5	0.025	0.05	0.073
2	0.026	0.052	0.099
2.5	0.027	0.054	0.126
3	0.028	0.056	0.154
3.5	0.03	0.06	0.184
4	0.031	0.062	0.215
4.5	0.032	0.064	0.247
5	0.034	0.068	0.281
5.5	0.036	0.072	0.317
6	0.038	0.076	0.355
6.5	0.04	0.08	0.395
7	0.043	0.086	0.438
7.5	0.047	0.094	0.485
8	0.051	0.102	0.536
8.5	0.056	0.112	0.592
9	0.062	0.124	0.654
9.5	0.07	0.14	0.724
10	0.081	0.162	0.805
10.5	0.104	0.208	0.909
11	0.133	0.266	1.042
11.5	0.219	0.438	1.261
12	1.691	3.382	2.952
12.5	0.32	0.64	3.272
13	0.166	0.332	3.438
13.5	0.118	0.236	3.556
14	0.085	0.17	3.641
14.5	0.089	0.178	3.73
15	0.07	0.14	3.8
15.5	0.061	0.122	3.861
16	0.056	0.112	3.917
16.5	0.05	0.1	3.967
17	0.047	0.094	4.014
17.5	0.043	0.086	4.057
18	0.04	0.08	4.097
18.5	0.038	0.076	4.135
19	0.036	0.072	4.171
19.5	0.033	0.066	4.204
20	0.032	0.064	4.236
20.5	0.031	0.062	4.267
21	0.029	0.058	4.296
21.5	0.029	0.058	4.325
22	0.026	0.052	4.351
22.5	0.026	0.052	4.377
23	0.025	0.05	4.402
23.5	0.024	0.048	4.426
24	0.024	0.048	4.45

Drainage Area Information		
Area (ac)	15.7	
Area mi^2	0.024531	
CN	50	
S	10	"1000/CN-10"
Tp (hr)	0.537	"Time to peak= (1.11d^.8(S+1)^.7)/(1900s^.5)
d (ft)	2621	"distance to divide"
s (%)	10	"average slope"
D (hr)	0.107	"duration time step of unit hydrograph"
Qp (1 in RO)	22.09	"peak flow for 1 inch of runoff, =484*area(mi^2)/Tp"

Unit Hydrograph 0.5 Hr Time Step	
T (hr)	Q (cfs)
0	0
0.5	12
1	15
1.5	4
2	1
2.5	0.2
3	0

SCS Curvilinear Unit Hydrograph For Timestep "D"			
t/Tp	Q/Qp	t (hr)	Q (cfs)
0	0	0	0
0.2	0.1	0.107	2.209262
0.4	0.31	0.215	6.848711
0.6	0.66	0.322	14.58113
0.8	0.93	0.430	20.54613
1	1	0.537	22.09262
1.2	0.93	0.645	20.54613
1.4	0.78	0.752	17.23224
1.6	0.56	0.860	12.37187
1.8	0.39	0.967	8.616121
2	0.28	1.075	6.185933
2.2	0.207	1.182	4.573172
2.4	0.147	1.290	3.247615
2.6	0.107	1.397	2.36391
2.8	0.077	1.505	1.701132
3	0.055	1.612	1.215094
3.2	0.04	1.720	0.883705
3.4	0.029	1.827	0.640686
3.6	0.021	1.935	0.463945
3.8	0.015	2.042	0.331389
4	0.011	2.150	0.243019
4.2	0.009	2.257	0.198834
4.4	0.006	2.365	0.132556
4.6	0.004	2.472	0.08837
4.8	0.002	2.580	0.044185
5	0	2.687	0

Time	1/5 RO	1/5 RO	1/5 RO	1/5 RO	1/5 RO	Total
0	0					0
0.1074	0.441852	0				0.441852
0.2148	1.369742	0.441639	0			1.811381
0.3222	2.916225	1.36908	0.441639	0		4.726944
0.4296	4.109227	2.914816	1.36908	0.441639	0	8.834761
0.537	4.418523	4.10724	2.914816	1.36908	0.441639	13.2513
0.6444	4.109227	4.416387	4.10724	2.914816	1.36908	16.91675
0.7518	3.446448	4.10724	4.416387	4.10724	2.914816	18.99213
0.8592	2.474373	3.444782	4.10724	4.416387	4.10724	18.55002
0.9666	1.723224	2.473177	3.444782	4.10724	4.416387	16.16481
1.074	1.237187	1.722391	2.473177	3.444782	4.10724	12.98478
1.1814	0.914634	1.236588	1.722391	2.473177	3.444782	9.791573
1.2888	0.649523	0.914192	1.236588	1.722391	2.473177	6.995872
1.3962	0.472782	0.649209	0.914192	1.236588	1.722391	4.995163
1.5036	0.340226	0.472553	0.649209	0.914192	1.236588	3.612769
1.611	0.243019	0.340062	0.472553	0.649209	0.914192	2.619035
1.7184	0.176741	0.242901	0.340062	0.472553	0.649209	1.881466
1.8258	0.128137	0.176655	0.242901	0.340062	0.472553	1.360309
1.9332	0.092789	0.128075	0.176655	0.242901	0.340062	0.980483
2.0406	0.066278	0.092744	0.128075	0.176655	0.242901	0.706654
2.148	0.048604	0.066246	0.092744	0.128075	0.176655	0.512324
2.2554	0.039767	0.04858	0.066246	0.092744	0.128075	0.375412
2.3628	0.026511	0.039747	0.04858	0.066246	0.092744	0.273829
2.4702	0.017674	0.026498	0.039747	0.04858	0.066246	0.198746
2.5776	0.008837	0.017666	0.026498	0.039747	0.04858	0.141329
2.685	0	0.008833	0.017666	0.026498	0.039747	0.092744
2.7924		0	0.008833	0.017666	0.026498	0.052997
2.8998			0	0.008833	0.017666	0.026498
3.0072				0	0.008833	0.008833
3.1146					0	0
3.222						0



		Time (hrs)	2	4	6	8	10	12	14	16	18	20	22	24	
		Precip (in/hr)	0.052	0.062	0.076	0.102	0.162	3.382	0.17	0.112	0.08	0.064	0.052	0.048	
		Cum Precip (in)	0.099	0.215	0.355	0.536	0.805	2.952	3.641	3.917	4.097	4.236	4.351	4.45	
		Cum RO (in)	0.050	0.108	0.178	0.268	0.403	1.476	1.821	1.959	2.049	2.118	2.176	2.225	
		delta RO (in)	0.013	0.016	0.019	0.026	0.041	0.846	0.043	0.028	0.020	0.016	0.013	0.012	
Unit Hydrograph															
T	Q	Time (hr)	DT4	DT8	DT12	DT16	DT20	DT24	DT28	DT32	DT36	DT40	DT44	DT48	Total RO (cfs)
0	0	0													0.000
0.5	12	0.5													0.144
1	15	1													0.324
1.5	4	1.5	0												0.378
2	1	2	0.156												0.404
2.5	0.2	2.5	0.195												0.421
3	0	3	0.052												0.437
		3.5	0.013	0											0.460
		4	0.0026	0.186											0.483
		4.5	0	0.2325											0.501
		5		0.062											0.524
		5.5		0.0155	0										0.554
		6		0.0031	0.228										0.585
		6.5		0	0.285										0.617
		7			0.076										0.655
		7.5			0.019	0									0.707
		8			0.0038	0.306									0.768
		8.5			0	0.3825									0.838
		9				0.102									0.922
		9.5				0.0255	0								1.027
		10				0.0051	0.486								1.168
		10.5				0	0.6075								1.408
		11					0.162								1.781
		11.5					0.0405	0							2.567
		12					0.0081	10.146							12.115
		12.5					0	12.6825							15.117
		13						3.382							6.901
		13.5						0.8455	0						3.460
		14						0.1691	0.51						2.056
		14.5						0	0.6375						1.523
		15							0.17						1.333
		15.5							0.0425	0					1.123
		16							0.0085	0.336					0.986
		16.5							0	0.42					0.886
		17								0.112					0.807
		17.5								0.028	0				0.745
		18								0.0056	0.24				0.687
		18.5								0	0.3				0.643
		19									0.08				0.607
		19.5									0.02	0			0.568
		20									0.004	0.192			0.535
		20.5									0	0.24			0.514
		21										0.064			0.491
		21.5										0.016	0		0.473
		22										0.0032	0.156		0.450
		22.5										0	0.195		0.427
		23											0.052		0.414
		23.5											0.013	0	0.399
		24											0.0026	0.144	0.390
		24.5											0	0.18	0.243
		25												0.048	0.063
		25.5												0.012	0.014
		26												0.0024	0.002
		26.5												0	0.000

Existing Sed Basin
Hydrograph Routing

Basin surface area and volume at design high water elevation were measured using Autocad. The surface area at the design high water elevation is 20,212 ft^2 and the volume is 67,596 ft^3. It is shown below that the design high water elevation will not be exceeded during the 25 year 24 hour storm event, modeled with a storm hydrograph developed using the SCS Type II unit hydrograph and the drainage basin parameters, as shown on attached sheets.

Weir Flow	Qw=2.3*L*H^3/2	
Design High Water Height (ft) Above Riser =	1.5	Basin Volume Beneath Design High Water
L=	2*3.14*Radius	67,596 ft^3
Radius=	2'	
Max Weir Flow (cfs) at High Water=	53.07	

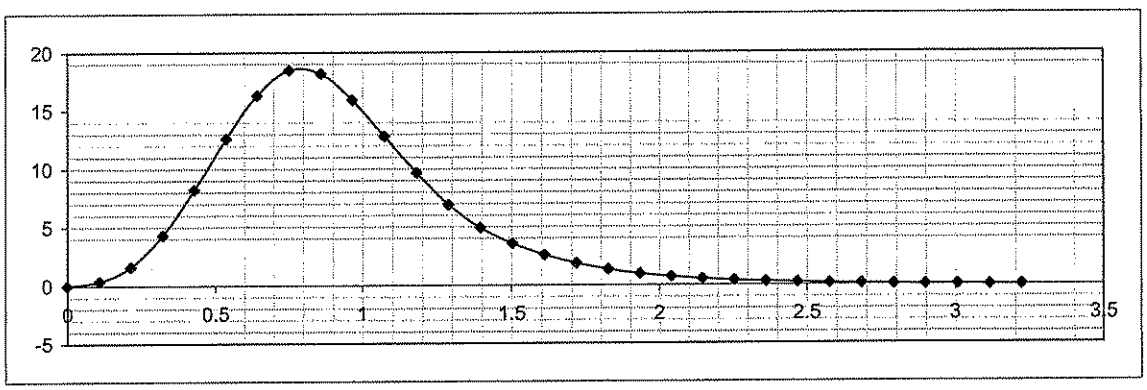
Time (hr)	Total RO (cfs)	Total Volume Into Basin (ft^3)	Total Volume Into Basin (ft^3) Cumulative	Required Volume (ft^3) Through Riser During Time Interval For Design High Water Elev. (1.5' Head) Not To Be Exceeded	Required Flow Rate (cfs) Through Riser During Time Interval To Ensrue Design High Water Elev. (1.5' Head) Is Not Exceeded
0	0.000	0	0	0	0.00
0.5	0.144	259	259	0	0.00
1	0.324	583	842	0	0.00
1.5	0.378	680	1,523	0	0.00
2	0.404	726	2,249	0	0.00
2.5	0.421	759	3,008	0	0.00
3	0.437	787	3,795	0	0.00
3.5	0.460	827	4,622	0	0.00
4	0.483	870	5,492	0	0.00
4.5	0.501	902	6,394	0	0.00
5	0.524	943	7,337	0	0.00
5.5	0.554	996	8,333	0	0.00
6	0.585	1,053	9,386	0	0.00
6.5	0.617	1,111	10,497	0	0.00
7	0.655	1,180	11,677	0	0.00
7.5	0.707	1,273	12,950	0	0.00
8	0.768	1,383	14,333	0	0.00
8.5	0.838	1,508	15,841	0	0.00
9	0.922	1,659	17,500	0	0.00
9.5	1.027	1,849	19,349	0	0.00
10	1.168	2,103	21,452	0	0.00
10.5	1.408	2,535	23,986	0	0.00
11	1.781	3,206	27,192	0	0.00
11.5	2.567	4,621	31,813	0	0.00
12	12.115	21,806	53,619	0	0.00
12.5	15.117	27,211	80,831	13,235	7.35
13	6.901	12,421	93,252	12,421	6.90
13.5	3.460	6,229	99,481	6,229	3.46
14	2.056	3,701	103,182	3,701	2.06
14.5	1.523	2,741	105,922	2,741	1.52
15	1.333	2,400	108,322	2,400	1.33
15.5	1.123	2,022	110,344	2,022	1.12
16	0.986	1,776	112,119	1,776	0.99
16.5	0.886	1,595	113,714	1,595	0.89
17	0.807	1,452	115,166	1,452	0.81
17.5	0.745	1,340	116,506	1,340	0.74
18	0.687	1,237	117,743	1,237	0.69
18.5	0.643	1,157	118,899	1,157	0.64
19	0.607	1,093	119,992	1,093	0.61
19.5	0.568	1,023	121,015	1,023	0.57
20	0.535	962	121,977	962	0.53
20.5	0.514	925	122,902	925	0.51
21	0.491	883	123,785	883	0.49
21.5	0.473	851	124,636	851	0.47
22	0.450	810	125,447	810	0.45
22.5	0.427	768	126,215	768	0.43
23	0.414	746	126,960	746	0.41
23.5	0.399	719	127,679	719	0.40
24	0.390	701	128,381	701	0.39
24.5	0.243	438	128,818	438	0.24
25	0.063	113	128,931	113	0.06
25.5	0.014	26	128,957	26	0.01
26	0.002	4	128,961	4	0.00
26.5	0.000	0	128,961	0	0.00

Drainage Area Information		
Area (ac)	11	
Area mi^2	0.017188	
CN	50	
S	10	"1000/CN-10"
Tp (hr)	0.440	"Time to peak= (1.11d^.8(S+1)^.7)/(1900s^.5)
d (ft)	2044	"distance to divide"
s (%)	10	"average slope"
D (hr)	0.088	"duration time step of unit hydrograph"
Qp (1 in RO)	18.89	"peak flow for 1 inch of runoff, =484*area(mi^2)/Tp"

Unit Hydrograph 0.5 Hr Time Step	
T (hr)	Q (cfs)
0	0
0.5	12
1	15
1.5	4
2	1
2.5	0.2
3	0

SCS Curvilinear Unit Hydrograph For Timestep "D"			
t/Tp	Q/Qp	t (hr)	Q (cfs)
0	0	0	0
0.2	0.1	0.088	1.888553
0.4	0.31	0.176	5.854513
0.6	0.66	0.264	12.46445
0.8	0.93	0.352	17.56354
1	1	0.440	18.88553
1.2	0.93	0.529	17.56354
1.4	0.78	0.617	14.73071
1.6	0.56	0.705	10.57589
1.8	0.39	0.793	7.365355
2	0.28	0.881	5.287947
2.2	0.207	0.969	3.909304
2.4	0.147	1.057	2.776172
2.6	0.107	1.145	2.020751
2.8	0.077	1.233	1.454186
3	0.055	1.321	1.038704
3.2	0.04	1.410	0.755421
3.4	0.029	1.498	0.54768
3.6	0.021	1.586	0.396596
3.8	0.015	1.674	0.283283
4	0.011	1.762	0.207741
4.2	0.009	1.850	0.16997
4.4	0.006	1.938	0.113313
4.6	0.004	2.026	0.075542
4.8	0.002	2.114	0.037771
5	0	2.202	0

Time	1/5 RO	1/5 RO	1/5 RO	1/5 RO	1/5 RO	Total
0	0					0
0.1074	0.377711	0				0.377711
0.2148	1.170903	0.441639	0			1.612541
0.3222	2.49289	1.36908	0.441639	0		4.303608
0.4296	3.512708	2.914816	1.36908	0.441639	0	8.238242
0.537	3.777105	4.10724	2.914816	1.36908	0.441639	12.60988
0.6444	3.512708	4.416387	4.10724	2.914816	1.36908	16.32023
0.7518	2.946142	4.10724	4.416387	4.10724	2.914816	18.49183
0.8592	2.115179	3.444782	4.10724	4.416387	4.10724	18.19083
0.9666	1.473071	2.473177	3.444782	4.10724	4.416387	15.91466
1.074	1.057589	1.722391	2.473177	3.444782	4.10724	12.80518
1.1814	0.781861	1.236588	1.722391	2.473177	3.444782	9.658799
1.2888	0.555234	0.914192	1.236588	1.722391	2.473177	6.901583
1.3962	0.40415	0.649209	0.914192	1.236588	1.722391	4.926531
1.5036	0.290837	0.472553	0.649209	0.914192	1.236588	3.56338
1.611	0.207741	0.340062	0.472553	0.649209	0.914192	2.583757
1.7184	0.151084	0.242901	0.340062	0.472553	0.649209	1.85581
1.8258	0.109536	0.176655	0.242901	0.340062	0.472553	1.341708
1.9332	0.079319	0.128075	0.176655	0.242901	0.340062	0.967013
2.0406	0.056657	0.092744	0.128075	0.176655	0.242901	0.697033
2.148	0.041548	0.066246	0.092744	0.128075	0.176655	0.505269
2.2554	0.033994	0.04858	0.066246	0.092744	0.128075	0.369639
2.3628	0.022663	0.039747	0.04858	0.066246	0.092744	0.26998
2.4702	0.015108	0.026498	0.039747	0.04858	0.066246	0.19618
2.5776	0.007554	0.017666	0.026498	0.039747	0.04858	0.140046
2.685	0	0.008833	0.017666	0.026498	0.039747	0.092744
2.7924		0	0.008833	0.017666	0.026498	0.052997
2.8998			0	0.008833	0.017666	0.026498
3.0072				0	0.008833	0.008833
3.1146					0	0
3.222						0



		Time (hrs)	2	4	6	8	10	12	14	16	18	20	22	24	
		Precip (in/hr)	0.052	0.062	0.076	0.102	0.162	3.382	0.17	0.112	0.08	0.064	0.052	0.048	
		Cum Precip (in)	0.099	0.215	0.355	0.536	0.805	2.952	3.641	3.917	4.097	4.236	4.351	4.45	
		Cum RO (in)	0.050	0.108	0.178	0.268	0.403	1.476	1.821	1.959	2.049	2.118	2.176	2.225	
		delta RO (in)	0.013	0.016	0.019	0.026	0.041	0.846	0.043	0.028	0.020	0.016	0.013	0.012	
Unit Hydrograph															
T	Q	Time (hr)	DT4	DT8	DT12	DT16	DT20	DT24	DT28	DT32	DT36	DT40	DT44	DT48	Total RO (cfs)
0	0	0													0.000
0.5	11	0.5													0.132
1	15	1													0.312
1.5	3.5	1.5	0												0.360
2	0.75	2	0.143												0.382
2.5	0.2	2.5	0.195												0.399
3	0	3	0.0455												0.414
		3.5	0.00975	0											0.435
		4	0.0026	0.1705											0.457
		4.5	0	0.2325											0.474
		5		0.05425											0.495
		5.5		0.011625	0										0.524
		6		0.0031	0.209										0.554
		6.5		0	0.285										0.584
		7			0.0665										0.620
		7.5			0.01425	0									0.669
		8			0.0038	0.2805									0.727
		8.5			0	0.3825									0.793
		9				0.08925									0.872
		9.5				0.019125	0								0.972
		10				0.0051	0.4455								1.105
		10.5				0	0.6075								1.331
		11					0.14175								1.686
		11.5					0.030375	0							2.421
		12					0.0081	9.3005							11.223
		12.5					0	12.6825							14.886
		13						2.95925							6.368
		13.5						0.634125	0						3.110
		14						0.1691	0.4675						1.932
		14.5						0	0.6375						1.428
		15							0.14875						1.262
		15.5							0.031875	0					1.060
		16							0.0085	0.308					0.930
		16.5							0	0.42					0.837
		17								0.098					0.761
		17.5								0.021	0				0.704
		18								0.0056	0.22				0.649
		18.5								0	0.3				0.607
		19									0.07				0.574
		19.5									0.015	0			0.537
		20									0.004	0.176			0.505
		20.5									0	0.24			0.486
		21										0.056			0.464
		21.5										0.012	0		0.447
		22										0.0032	0.143		0.426
		22.5										0	0.195		0.403
		23											0.0455		0.392
		23.5											0.00975	0	0.378
		24											0.0026	0.132	0.368
		24.5											0	0.18	0.234
		25												0.042	0.054
		25.5												0.009	0.011
		26												0.0024	0.002
		26.5												0	0.000

SB-1
Hydrograph Routing

Basin surface area and volume at design high water elevation were measured using Autocad. The surface area at the design high water elevation is 27,024 ft^2 and the volume is 93,053 ft^3. It is shown below that the design high water elevation will not be exceeded during the 25 year 24 hour storm event, modeled with a storm hydrograph developed using the SCS Type II unit hydrograph and the drainage basin parameters, as shown on attached sheets.

Weir Flow	Qw=2.3*L*H^3/2	
Design High Water Height (ft) Above Riser =	1	Basin Volume Beneath Design High Water
L=	2*3.14*Radius	93,053 ft^3
Radius=	2'	
Max Weir Flow (cfs) at High Water=	28.89	

Time (hr)	Total RO (cfs)	Total Volume Into Basin (ft^3)	Total Volume Into Basin (ft^3) Cumulative	Required Volume (ft^3) Through Riser During Time Interval For Design High Water Elev. (1.5' Head) Not To Be Exceeded	Required Flow Rate (cfs) Through Riser During Time Interval To Ensrue Design High Water Elev. (1.5' Head) Is Not Exceeded
0	0.000	0	0	0	0.00
0.5	0.132	238	238	0	0.00
1	0.312	562	799	0	0.00
1.5	0.360	647	1,446	0	0.00
2	0.382	687	2,133	0	0.00
2.5	0.399	718	2,851	0	0.00
3	0.414	745	3,595	0	0.00
3.5	0.435	782	4,377	0	0.00
4	0.457	823	5,200	0	0.00
4.5	0.474	854	6,054	0	0.00
5	0.495	892	6,946	0	0.00
5.5	0.524	943	7,888	0	0.00
6	0.554	996	8,885	0	0.00
6.5	0.584	1,051	9,936	0	0.00
7	0.620	1,116	11,052	0	0.00
7.5	0.669	1,204	12,255	0	0.00
8	0.727	1,309	13,564	0	0.00
8.5	0.793	1,427	14,991	0	0.00
9	0.872	1,570	16,561	0	0.00
9.5	0.972	1,749	18,311	0	0.00
10	1.105	1,989	20,300	0	0.00
10.5	1.331	2,396	22,695	0	0.00
11	1.686	3,034	25,729	0	0.00
11.5	2.421	4,358	30,088	0	0.00
12	11.223	20,201	50,289	0	0.00
12.5	14.886	26,795	77,084	0	0.00
13	6.368	11,462	88,546	0	0.00
13.5	3.110	5,598	94,144	1,091	0.61
14	1.932	3,478	97,622	3,478	1.93
14.5	1.428	2,570	100,192	2,570	1.43
15	1.262	2,272	102,463	2,272	1.26
15.5	1.060	1,908	104,371	1,908	1.06
16	0.930	1,674	106,045	1,674	0.93
16.5	0.837	1,506	107,551	1,506	0.84
17	0.761	1,370	108,922	1,370	0.76
17.5	0.704	1,266	110,188	1,266	0.70
18	0.649	1,168	111,357	1,168	0.65
18.5	0.607	1,092	112,449	1,092	0.61
19	0.574	1,033	113,482	1,033	0.57
19.5	0.537	967	114,449	967	0.54
20	0.505	909	115,358	909	0.50
20.5	0.486	874	116,232	874	0.49
21	0.464	835	117,067	835	0.46
21.5	0.447	804	117,871	804	0.45
22	0.426	767	118,638	767	0.43
22.5	0.403	725	119,362	725	0.40
23	0.392	705	120,068	705	0.39
23.5	0.378	680	120,747	680	0.38
24	0.368	663	121,410	663	0.37
24.5	0.234	421	121,831	421	0.23
25	0.054	96	121,927	96	0.05
25.5	0.011	21	121,948	21	0.01
26	0.002	4	121,952	4	0.00
26.5	0.000	0	121,952	0	0.00

ENGINEERING, INC.

Job_____
Job No.____Sheet No.___of___
Calculated by_____Date_____
Checked by_____Date_____
Subject_____Scale_____

Temporary Sediment Trap Design Calculations

***Length and Width Design Dimensions are Shown on Drawings**

ST-1

Parameters		Requirements		Design	
Disturbed Area Draining to Trap 'A_d' (acres)=	2.67			Max Pool Depth (ft)=	4
Total Area Draining to Trap 'A_t' (acres)=	3.06	Surface Area (sf),= .01xQ=	3,466	Surface Area (sf)=	3,570
Runoff coeff. 'c'=	0.4	Storage Capacity (cf),= 1800 cf/dist. acre=	4,806	Volume (cf) = .4*SA*max pool depth=	5,712
Rainfall Intensity 'i' (in/hr)=	6.5			Weir Length (ft)=	8
Peak Flow -10yr 'Q' (cfs)= c*i*A_t	8.0				

ST-2

Parameters		Requirements		Design (*Dimensions shown on Drawings)	
Disturbed Area Draining to Trap 'A_d' (acres)=	2.61			Max Pool Depth (ft)=	2
Total Area Draining to Trap 'A_t' (acres)=	4.56	Surface Area (sf),= .01xQ=	5,164	Surface Area (sf)=	6,440
Runoff coeff. 'c'=	0.4	Storage Capacity (cf),= 1800 cf/dist. acre=	4,698	Volume (cf) = .4*SA*max pool depth=	5,152
Rainfall Intensity 'i' (in/hr)=	6.5			Weir Length (ft)=	12
Peak Flow -10yr 'Q' (cfs)= c*i*A_t	11.9				

ST-3

Parameters		Requirements		Design (*Dimensions shown on Drawings)	
Disturbed Area Draining to Trap 'A_d' (acres)=	0.17			Max Pool Depth (ft)=	2
Total Area Draining to Trap 'A_t' (acres)=	0.19	Surface Area (sf),= .01xQ=	215	Surface Area (sf)=	923
Runoff coeff. 'c'=	0.4	Storage Capacity (cf),= 1800 cf/dist. acre=	306	Volume (cf) = .4*SA*max pool depth=	738
Rainfall Intensity 'i' (in/hr)=	6.5			Weir Length (ft)=	6
Peak Flow -10yr 'Q' (cfs)= c*i*A_t	0.5				

ST-4

Parameters		Requirements		Design (*Dimensions shown on Drawings)	
Disturbed Area Draining to Trap 'A_d' (acres)=	0.18			Max Pool Depth (ft)=	2
Total Area Draining to Trap 'A_t' (acres)=	0.405	Surface Area (sf),= .01xQ=	459	Surface Area (sf)=	717
Runoff coeff. 'c'=	0.4	Storage Capacity (cf),= 1800 cf/dist. acre=	324	Volume (cf) = .4*SA*max pool depth=	574
Rainfall Intensity 'i' (in/hr)=	6.5			Weir Length (ft)=	6
Peak Flow -10yr 'Q' (cfs)= c*i*A_t	1.1				

ENGINEERING, INC.

Job_____ _____
Job No.____Sheet No.___of___
Calculated by_____Date_____
Checked by_____Date_____
Subject_____Scale_____

Sediment Basin Design Calculations

***Length and Width Design Dimensions are Shown on Drawings**

Existing Sediment Basin

Parameters		Requirements		Design (*Dimensions shown on Drawings)	
Total Area Draining to Basin (acres)	15.70	Surface Area (sf),= .01xQ=	17,250	Surface Area (sf) AutoCAD computed=	20,212
Peak Flow 'Q' (cfs)*see written calc sheet	39.60	Storage Capacity (cf),= 1800 cf/acre=	28,260	Volume (cf), (AutoCAD computed)	67,596

SB-1

Parameters		Requirements		Design (*Dimensions shown on Drawings)	
Total Area Draining to Basin (acres)	11.00	Surface Area (sf),= .01xQ=	11,770	Surface Area (sf) AutoCAD computed=	27,024
Peak Flow 'Q' (cfs)*see written calc sheet	27.02	Storage Capacity (cf),= 1800 cf/acre=	19,800	Volume (cf), (AutoCAD computed)	93,053

Rock Dam Calculations

***Length and Width Design Dimensions are Shown on Drawings**

RD-1

Parameters		Requirements		Design	
Disturbed Area Draining to Rock Dam 'A_d' (acres)=	1.41			Max Pool Depth (ft)=	2
Total Area Draining to Trap 'A_t' (acres)=	10.00	Surface Area (sf),= 435 x Q10=	11,310	Surface Area (sf)=	11,320
Runoff coeff. 'c'=	0.4	Storage Capacity (cf),= 3600 cf/dist. acre=	5,076	Volume (cf) = .4*SA*max pool depth=	9,056
Rainfall Intensity 'i' (in/hr)=	6.5			Weir Length (ft)=	169
Peak Flow -10yr 'Q' (cfs)= c*i*A_t	26.0				

Design Criteria

Primary Spillway	stone
Max Drainage Area	10 acres
Min Sediment Storage Volume	3600 CF per dist. Acre
Min Surface Area	435 SF per cfs of Q10 peak inflow
Min Depth	3.5 feet, 1.5 feet excavated below grade
Max Height	weir elevation 6 feet above grade
Dewatering Mechanism	stone spillway
Baffles Required	3

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Land Resources
Land Quality Section

James D. Simons, PG, PE
Director and State Geologist

Michael F. Easley, Governor
William G. Ross Jr., Secretary

October 18, 2006

LETTER OF APPROVAL WITH MODIFICATIONS

Coble's Sandrock, Inc.
Attention: Mr. Kent Coble
5833 Foster Store Road
Liberty, NC 27298-9581

RE:	Project Name:	Coble Sandrock – Phase 3
	Project ID:	Alama 2006-050
	County:	Alamance
	River Basin:	Cape Fear Stream Classification: Other
	Submitted By:	Joyce Engineering, Inc.
	Date Received by LQS:	October 12, 2006
	Plan Type:	Revised Submittal

Dear Mr. Coble:

This office has reviewed the subject erosion and sedimentation control plan. We find the plan to be acceptable with modifications and hereby issue this letter of Approval With Modifications. The Modifications Required for Approval are listed on the attached page. This plan approval shall expire three (3) years following the date of approval, if no land-disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0129.

Please be advised that Title 15A NCAC 4B .0118(a) requires that a copy of the approved erosion control plan be on file at the job site. Also, you should consider this letter to give the Notice required by G.S. 113A-61.1(a) of our right of periodic inspection to insure compliance with the approved plan.

North Carolina's Sedimentation Pollution Control Program is performance-oriented, requiring protection of existing natural resources and adjoining properties. If, following the commencement of this project, it is determined that the erosion and sedimentation control plan is inadequate to meet the requirements of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statute 113A-51 through 66), this office may require revisions to the plan and implementation of the revisions to insure compliance with the Act.

MODIFICATIONS REQUIRED FOR APPROVAL

Project Name: Coble Sandrock – Phase 3
Project ID: Alama 2006-050
County: Alamance

1. Approval is granted for cell construction, as shown on plans, only. Any material transported off-site must be covered under a Mining Permit issued by this office.

Acceptance and approval of this plan is conditioned upon your compliance with Federal and State water quality laws, regulations, and rules. In addition, local city or county ordinances or rules may also apply to this land-disturbing activity. This approval does not supersede any other permit or approval.

Please be aware that your project will be covered by the enclosed NPDES General Stormwater Permit NCGO1000 (Construction Activities). You should first become familiar with all of the requirements for compliance with the enclosed general permit.

Please note that this approval is based in part on the accuracy of the information provided in the Financial Responsibility Form, which you have provided. You are requested to file an amended form if there is any change in the information included on the form. In addition, it would be helpful if you notify this office of the proposed starting date for this project. Please notify us if you plan to have a preconstruction conference.

Your cooperation is appreciated.

Sincerely,

Shannon Leonard
Assistant Regional Engineer
Land Quality Section

SL/ls

Enclosures: Certificate of Approval
Modifications Required for Approval
NPDES Permit
Planning and Design Manual Instructions

cc: Joyce Engineering, Inc.
WSRO – DWQ
WSRO File

CERTIFICATE OF PLAN APPROVAL

The posting of this certificate certifies that an erosion and sedimentation control plan has been approved for this project by the North Carolina Department of Environment and Natural Resources in accordance with North Carolina General Statute 113A - 57 (4) and 113A - 54 (d) (4) and North Carolina Administrative Code, Title 15A, Chapter 4B.0107 (c). This certificate must be posted at the primary entrance of the job site before construction begins and until establishment of permanent groundcover as required by North Carolina Administrative Code, Title 15A, Chapter 4B.0127 (b).

COBLE SANDROCK - PHASE 3 / ALAMANCE COUNTY

Project Name and Location ALAMA-2006-050

10/18/2006

Date of Plan Approval

WITH MODIFICATIONS

NCDENR

Sharon Leonard

ASST. **Regional Engineer**

Prepared for:

Coble's Sandrock, Inc.
5833 Foster Store Road
Liberty, North Carolina 27298

JEI PROJECT NO. 419.00, TASK 27

COBLE'S SANDROCK, INC.
ALAMANCE COUNTY, NORTH CAROLINA
CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL

Permit No. 01-05

PERMIT TO CONSTRUCT
Appendix 3

PHASE 3 DESIGN HYDROGEOLOGIC REPORT

NOVEMBER 2007

Prepared by:

Joyce Engineering, Inc.
2211 West Meadowview Road, Suite 101
Greensboro, North Carolina 27407
(336) 323-0092

COBLE'S SANDROCK
CONSTRUCTION AND DEMOLITION DEBRIS
LANDFILL EXPANSION
Permit No. 01-05

PERMIT TO CONSTRUCT
Appendix 3

PHASE 3 DESIGN HYDROGEOLOGIC REPORT

NOVEMBER 2007

Prepared by:

JOYCE
ENGINEERING, INC.
2211 West Meadowview Road, Suite 101
Greensboro, North Carolina 27407

NORTH CAROLINA LICENSED SEAL 1349 GEOLOGIST G. VAN NESS BURBACH

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

Reviewed by: Michelle M. Brown

Certification Statements:

We certify that the Water Quality Monitoring Plan included in this report, when implemented, will be effective in providing early detection of any release of hazardous constituents to the uppermost aquifer, so as to be protective of public health and the environment.

We certify that all borings which intersect the water table on this site have either (1) been constructed and maintained as permanent monitoring wells in accordance with 15A NCAC 02C.0108, or (2) will be upgraded to meet these requirements before construction of the propose waste cells, or (3) they will be permanently abandoned.

COBLE'S SANDROCK C&D LANDFILL
PHASE 3 *DESIGN HYDROGEOLOGIC REPORT*

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COBLE'S SANDROCK C&D LANDFILL
PHASE 3 *DESIGN HYDROGEOLOGIC REPORT*

1 INTRODUCTION

In accordance with the NC Solid Waste Management Rules (NCSWMR) § .0538, Coble's Sandrock is submitting this *Design Hydrogeologic Report* as part of our *Permit to Construct* Application, for two new waste disposal areas (Phase 3A and Phase 3B) at the Coble's Sandrock Construction and Demolition Debris (C&D) Landfill in Alamance County, North Carolina (Permit # 01-05). The purpose of this Hydrogeologic Report is to: (A) provide adequate information to demonstrate compliance with the vertical separation and foundation standards set forth in § .0538 (items 2 and 5); and (B) to provide hydrogeologic characterization of the uppermost aquifer for the proposed new phases of the landfill in order to design an effective water quality monitoring system.

The facility consists of approximately 154 acres in Alamance County, one half mile east of Kimesville, North Carolina and approximately eight miles south of Burlington, North Carolina. The 154 acres includes the currently permitted 39.6 acres plus an adjacent expansion area of 114.4 acres. The existing C&D facility has been in operation since 1998 on the currently permitted 39.6 acres previously approved for site suitability. It includes a total of 12.86 acres approved for waste disposal, which is made up of Phase 1 (7.0 acres), Phase 2A (1.1 acres), and Phase 2B (4.76 acres). The proposed 114.4 acre expansion property is contiguous with and south and east of the currently permitted facility, and includes two proposed new waste cells, Phase 3A (6.3 acres) and Phase 3B (5.6 acres). Use of the word "site" during the following discussions includes all 154 acres within the property boundaries of the proposed facility. The site location is shown on Drawing H-1. Property boundaries, surrounding topography, and locations of the existing Phases 1, 2A, and 2B and the proposed Phases 3A and 3B are shown on Drawing H-2.

1.A Vertical Separation and Subgrade Requirements

This report provides adequate information to demonstrate compliance with the vertical separation and foundation standards set forth in § .0538 (items 2 and 5). This report demonstrates that the proposed new waste cells (Phase 3A and Phase 3B) will meet all vertical separation conditions from both the seasonal high water table (Section 2.E.3) and bedrock (Section 2.F.2). This report also presents a discussion of subgrade requirements in Section 2.I.

1.B Hydrogeologic Investigations and Water Quality Monitoring

Section 2 of this report provides details of the hydrogeologic investigations that have been conducted on this site, especially in the vicinity of the proposed new waste cells (Phase 3A and Phase 3B). These investigations establish the monitorability of the groundwater at this site. Section 2.B presents the Water Quality Monitoring Plan for the site.

2 DESIGN HYDROGEOLOGIC REPORT

2.A Regional and Site Hydrogeology

2.A.01 Local and Regional Hydrogeology

The study site is located within the Carolina Slate Belt in the central Piedmont physiographic and geological province. A 1:250,000-scale *Geologic Map of Region G* (Carpenter, P. A., 1982) showing relevant geological features was included as Appendix DH-5 in the *Site Hydrogeologic Report* (Volume 1, Section 2) dated June 2007. Geologic unit designations and descriptions used in this report are defined in *The Central Piedmont* (Butler and Secor, 1991). The Carolina Slate Belt is made up of metamorphosed sediments, volcanics, and intrusive igneous rocks. The *Geologic Map of Region G* shows the site is underlain by a felsic intrusive complex. The map legend describes the complex as white to gray, fine- to coarse-grained, massive to foliated, metamorphosed bodies of assemblages of intimately associated felsic intrusive rock types. The rock types vary from granite, granodiorite, quartz diorite, to quartz monzonite. Narrow mafic dikes are common within the felsic intrusive units. This region is also characterized by regional- and small-scale Mesozoic diabase dikes. Most of the dikes are near-vertical in dip and trend north-south to northwest-southeast and are characterized by plagioclase, augite and olivine (Ragland, 1991).

2.A.02 Field Observations

The site is located in the Piedmont physiographic province on a group of knolls and valleys. The northeast-flowing Poppaw Creek is located along the northern facility property line. Two primary drainages (small, intermittent creeks) transect the site and flow into Poppaw Creek. One of the drainages flows west-southwest across the southern half of the site and has a 2- to 4-acre man-made pond at its upstream limit in the southeastern corner proposed site property. The other drainage flows north-northwest, roughly parallel to the eastern site boundary, and is fed by outflow from a small pond located on the site property and by two smaller, spring-fed drainages which flow into it from off the site property to east. These streams and ponds are shown on Drawing H-2.

The rock seen in float and/or large outcrop, as well as rock core from this site was predominantly medium-grained biotite-muscovite granite. Foliation has been observed locally at an outcrop near Phase 3B; otherwise, observed granite was massive, with very little to no observed structure or foliation. No diabase dikes have been observed at the site, but some mafic meta-volcanic dikes do exist, most of which have been observed near the existing C&D Landfill. During the original site plan investigation (Trigon, 1998), Trigon located one meta-volcanic dike that strikes N 125° W under Phase I. Two similar features with a similar strike may exist under the site's Land Clearing and Inert Debris (LCID) Landfill, as noted by Trigon. Photographs of some of these features were included as Appendix DH-6 in the *Site Hydrogeologic Report* (Volume 1, Section 2) dated June 2007.

Other meta-volcanic dikes have been detected in recent field investigations. One such dike is located eighteen feet due west of monitoring well MW-1 and trends N 45° E. The dike has an approximate two-foot wide surface exposure and visibly extends ninety-three feet. Another dike is located 135 ft due south of MW-3 and trends N 45° E. Its surface exposure is approximately 6 ft wide and visibly extends 60 ft. Other smaller dikes cut across the surface at similar trends. The observed material

that makes up these dikes is highly weathered, highly fractured, fine-grained mafic rock that appears to be meta-volcanic in origin. It weathers to a soft, yellow to black rock.

The orientation of many first and second order stream segments may have been determined by geomorphological development of slopes draining to Poppaw Creek, rather than by fracture control. Because of this, the utility of topographic fracture-trace analyses is limited. A Rose diagram that was included as Appendix DH-8 in the *Site Hydrogeologic Report* (Volume 1, Section 2) dated June 2007 shows that apparent fracture-trace orientations are generally random.

Of the rock exposures found on site, only one appears to be in place. That outcrop, located near Phase 3B, consists of a weathered schist with a foliation of N44°W 72°NE. No fractures were identified in the outcrop. The strike and dip of fractures found in rock core taken at the site could not be determined as the core was not oriented, nor were there any pervasive fabric features that would allow for this determination. Generally, the fractures within the granite were great in number and appear to be randomly oriented.

Diabase dikes in this region typically create fracture zones in the country rock adjacent to their contacts. These fracture zones are limited in their horizontal/lateral extent, and are often characterized to be about 1/10 of the thickness of the dike, occurring on both sides of the feature. Although no diabase dikes have been observed on site, the small meta-volcanic dikes are expected to act in a similar way, and it is likely that there are many random fracture orientations associated with the rock adjacent to the dikes. One rock core (P-26) encountered meta-volcanic material, which was highly-fractured with vertical to nearly horizontal dips, and voids of up to 1.5 feet; however, the metavolcanic rock was less weathered than the granitic rock encountered in most cores and had a higher rock-quality designation.

2.A.03 Borings, Wells, and Piezometers

Installation of borings (including soil borings, rock cores, monitoring wells, and piezometers) on this site has occurred over several years of site development. Following is a historical summary of the boring installations for the whole site, and then a summary of the borings in the vicinities of the two proposed waste cells, Phase 3A and Phase 3B. A summary of all boring data is included as Table 1. Available boring logs from the site were included as Appendices DH-1 and DH-2 in the *Site Hydrogeologic Report* (Volume 1, Section 2) dated June 2007.

2.A.03.1 1997-1998 Borings

A site suitability study titled *Construction and Demolition Landfill Permit Application Siting Requirements* was performed by Trigon Engineering Consultants, Inc. and submitted to the Solid Waste Section on December 16, 1997, for the 39.6 acres where the current C&D Landfill operates. During the 1997 investigation, three monitoring wells (MW-1, MW-2, and MW-4) and eight piezometers (P-1, P-2, P-2A, P-3, P-4, P-5, P-6, and P-7) were installed, and piezometer P-1 was converted to upgradient monitoring well MW-3. Six soil borings (B-1, B-2, B-3, B-4, B-4A, and B-5) and three rock cores (C-1, C-2, and C-3) were also advanced in 1997. Two temporary wells (TW-1 and TW-2) were installed in borings from which rock core samples were obtained in June and

July 1998 for additional site characterization. Trigon did not produce boring logs for piezometers P-1 through P-7, but reported depth to bedrock and other parameters in tables in their 1997 permit application. Piezometers P-2 and P-2A were abandoned in order to construct Phase 1, and piezometers P-6 and P-7 were abandoned in order to construct Phase 2B.

2.A.03.2 2002-2003 Borings

The original field activities for current expansion were performed in January and February 2002 and consisted of installing ten piezometers (P-15, P-16, P-17, P-18, P-19S, P-19D, P-20, P-21, P-22, and P-23) and one monitoring well (MW-5). In addition, MW-7 was installed in December 2002. A *Construction Plan Application* for Phase 2 of the Coble's Sandrock Construction and Demolition Landfill was prepared and submitted by Joyce Engineering, Inc. on June 18, 2002. After April 2003, MW-3 was replaced with MW-6 (formerly P-3) as the upgradient background well. Well MW-5 was added to the compliance network before the April 2002 sampling event, but was replaced by MW-7 before the November 2003 sampling event at the request of the Solid Waste Section.

2.A.03.3 2005-2007 Borings

A second phase of field activities for the expansion was performed between March and September 2005 and consisted of installing three piezometers (P-24, P-25, and P-26), four hand-augered piezometers (P-27, P-28, P-29, and P-30), and four monitoring wells (MW-8, MW-9, MW-10S, and MW-10D). A third phase of field activities for the expansion was performed between January and March 2007 and consisted of installing eight piezometers (P-31, P-32, P-33, P-34, P-35, P-36, P-37, and P-38).

2.A.03.4 Phase 3A Borings

There are 6 active wells/piezometers and one abandoned rock boring within the 6.3 acre footprint of Phase 3A, and there are 6 active piezometers and two abandoned soil/rock borings within the compliance area (200 feet from the edge of the footprint). In addition, there are 6 active or abandoned wells or piezometers between 200-300 feet from the Phase 3A boundary. The borings in the vicinity of Phase 3A are listed in the table on the following page.

2.A.03.4 Phase 3B Borings

There are 5 active and 1 abandoned piezometers within the 5.6 acre Phase 3B footprint, plus one at the edge of the footprint. There are two existing piezometers, one abandoned piezometer, and three abandoned soil/rock borings within the 200-foot compliance area for Phase 3B, plus one abandoned piezometer between 200-300 feet of the Phase 3B boundary. All of the borings in the vicinity of Phase 3B are listed in the table on the following page.

Borings in the Vicinity of Phase 3A

Boring ID	Type	Location Relative to Phase 3A	Status
MW-1	Monitoring Well	Inside Footprint	Active
MW-2	Monitoring Well	Compliance Area (< 200')	Active
MW-3	Monitoring Well	Inside Footprint	Active
MW-4	Monitoring Well	> 200' & < 300'	Active
MW-8	Monitoring Well	Compliance Area (< 200')	Active
MW-9	Monitoring Well	Compliance Area (< 200')	Active
MW-10S	Monitoring Well	Compliance Area (< 200')	Active
MW-10D	Monitoring Well	Compliance Area (< 200')	Active
P-19S	Piezometer	> 200' & < 300'	Active
P-19D	Piezometer	> 200' & < 300'	Active
P-24	Piezometer	> 200' & < 300'	Active
P-25	Piezometer	Compliance Area (< 200')	Active
P-26	Piezometer (w/ Rock Core)	Inside Footprint	Active
P-31	Piezometer	Inside Footprint	Active
P-32	Piezometer (w/ Rock Core)	Inside Footprint	Active
P-33	Piezometer	Inside Footprint	Active
P-2	Piezometer	> 200' & < 300'	Abandoned
P-2A	Piezometer	> 200' & < 300'	Abandoned
TW-1	Piezometer (w/ Rock Core)	> 200' & < 300'	Abandoned
B-1	Soil Boring	Compliance Area (< 200')	Abandoned
C-1	Rock Core	Compliance Area (< 200')	Abandoned
C-2	Rock Core	Inside Footprint	Abandoned

Borings in the Vicinity of Phase 3B

Boring ID	Type	Location Relative to Phase 3B	Status
P-4	Piezometer	Inside Footprint	Active
P-5	Piezometer	Inside Footprint	Active
P-6	Piezometer	> 200' & < 300'	Abandoned
P-7	Piezometer	Compliance Area (< 200')	Abandoned
P-16	Piezometer	Compliance Area (< 200')	Active
P-20	Piezometer	Compliance Area (< 200')	Active
P-35	Piezometer	Inside Footprint	Active
P-36	Piezometer	Inside Footprint	Active
P-37	Piezometer (w/ Rock Core)	Inside Footprint	Active
P-38	Piezometer	Edge of Footprint	Active
TW-2	Piezometer (w/ Rock Core)	Inside Footprint	Abandoned
B-4	Soil Boring	Compliance Area (< 200')	Abandoned
B-5	Soil Boring	Compliance Area (< 200')	Abandoned
C-3	Rock Core	Compliance Area (< 200')	Abandoned

2.A.04 Soil Testing

The typical weathering profile for the site consists of several feet of unconsolidated saprolite, grading into several feet of partially-weathered rock (PWR), which grades into competent fractured bedrock. Split-spoon samples were typically obtained from borings at a minimum of every 5 feet through the saprolite zone, and where possible, through the PWR zone. Most of the soil testing data is from split-spoon or undisturbed (Shelby-tube) samples from the saprolite zone; however, some split-spoon samples from the PWR zone yielded enough sample to run the analyses. In general, the results from the saprolite and PWR zones were similar. The laboratory analytical reports for soil samples from the site were included as Appendix DH-9 in the *Site Hydrogeologic Report* (Volume 1, Section 2) dated June 2007. These data are summarized in Table 2.

2.A.04.1 Saprolite Zone

Split-spoon samples and auger cuttings of saprolite material are generally described in boring logs as silty sands (SM in USCS classification). Silts (ML), clays (CL), and sandy clays (SC) were noted in numerous borings as minor units that were generally found above the water table; however, these soils appear to be discontinuous in nature and their hydraulic characteristics are indistinguishable from the other saprolite materials.

Laboratory soils classifications of split-spoon samples, composite samples, and undisturbed (Shelby tube) samples from the saprolite zone were defined as silty sand (SM), sandy silt (ML), elastic silt (MH), clayey sands (SC), or sandy lean clay (CL) (Table 2). The average total porosity for the saprolite unit, as determined by laboratory testing of Shelby Tube samples, is approximately 0.38. Specific yield values for samples collected in the saprolite unit were calculated using the percent sand, silt, and clay, based on the Wentworth Soil Classification System from the grain size distribution graphs for each sample (Table 2). The relative percentages of sand, silt and clay for each sample were applied to Johnson's (1967) *Textural Classification Triangle for Unconsolidated Material* to obtain approximate specific yield values. An approximate value for effective porosity of the saprolite aquifer is assumed to be 0.21 (21%) based on the average of values provided on Table 2. Average permeability for the saprolite from the values in Table 2 is approximately 3×10^{-5} centimeters per second (cm/sec). Hydraulic conductivities are expected to be on the order of 10^{-4} cm/sec, based on slug test data from piezometers P-19S and P-34, which are screened within saprolite (Table 3).

2.A.04.2 PWR Zone

Laboratory soils classifications of split-spoon samples collected from the PWR unit were defined as clayey sand (CS) or silty sand (SM) (Table 2; Appendix DH-2) and its hydraulic properties are very similar to those of the saprolite unit. The laboratory-derived effective porosity as determined from a sample from MW-8 was approximately 0.28 (28%), which is within the range of values determined for the saprolite unit (Table 2). With depth through the weathering profile, effective porosities are expected to decrease (Harned and Daniel, 1989).

The PWR is relatively indistinguishable from the saprolite unit based on its soil classification and hydraulic properties. Hydraulic conductivities of the upper parts of the PWR unit are estimated to

be similar to those estimated by slug tests in saprolite wells performed during the current investigation. Hydraulic conductivities are expected to be on the order of 10^{-4} to 10^{-5} cm/sec (Table 3).

2.A.04.3 Hydraulic Conductivities from Slug Tests

Following rigorous well development, aquifer testing was performed on many of the monitoring wells and piezometers. The purpose of the testing was to assess the values of horizontal hydraulic conductivity at various locations within the saprolite, PWR, and bedrock potions of the aquifer at the site. In situ rising and falling-head tests (slug tests) were chosen for the assessment due to the relatively low well yields noted during well installation and development. Well MW-5 and piezometers P-16, P-17, P-19S, P-19D, P-21, and P-22 were tested in February-March 2002. Well MW-9 and piezometers P-18 and P-25 were tested in September 2005. Piezometers P-31, P-32, P-33, P-34, P-35, P-36, P-37, and P-38 were tested in February 2007.

Prior to slug testing, the monitoring wells were opened and groundwater levels were allowed to equilibrate. Water level measurements were then collected using an electric water level probe referenced to a point on the top of casing. For the 2002 and 2005 slug tests, a pressure transducer was lowered into the well casing and placed approximately one foot from the bottom of the well and the transducer was connected to an *In-Situ SE 1000C* data logger. For the 2007 slug tests, individual *In-Situ Mini-Troll* data loggers were placed into the well casing and set 1-3 feet above the bottom of the well. A polyvinyl chloride (PVC) slug measuring five feet in length or disposable bailers were used to displace water inside the wells.

For the tests using the PVC slug, the first portion of the test was a falling-head test that measured the rate water levels fell back to static after the introduction of the slug. The data logger recorded water level data from the transducer at logarithmic time intervals. Data from the transducer/data logger were verified with hand held water level readings. Falling-head tests were terminated after water levels had recovered to within 95% of their pre-test level. A rising-head test was performed on each well after the falling-head test was completed. In some cases, only rising-head tests were performed after the water level had equilibrated. The rising-head test was conducted by initiating a new logarithmic recording step on the data logger simultaneous with the removal of the PVC slug. The data were verified with hand held water-level readings, and the test was terminated after water levels had recovered to within 95% of the pre-test level. For tests using a bailer, the first test performed was the rising-head test after a volume of water was removed from the well, after which the falling-head test was performed after returning the full bailer to the well.

In situ rising- and falling-head tests provide a quantitative estimate of horizontal hydraulic conductivity (K) and a qualitative estimate of aquifer anisotropy in water-bearing units. The slug test data were analyzed using the Bouwer and Rice (1976 and 1989) equation, which is applicable to fully or partially penetrating wells in unconfined or confined aquifers. Aquifer thicknesses of 7.6-50.0 feet were assumed for all aquifers based upon information supplied on the boring logs. A packing porosity of 25% was assumed for the well filter pack. For the 2002 and 2005 slug tests, computer software produced by Starpoint Software, Inc. was used in the analysis and plotting of the data. For the 2007 slug tests, an Excel-based spreadsheet published by the United States Geological

Survey (USGS, Halford and Kuniansky, 1998) was used in the analysis and plotting of the data. The individual data points and computer plots of time versus water level change are presented in the Site Hydrogeologic Report for the site (Volume 1, Section 2) dated June 2007 . A summary of the results of all aquifer testing performed at the site is presented in Table 3. Data from P-31 were not usable due to non-linear recovery, possibly a result of well-skin effects. Data from P-32 and P-33 were poor due to rapid recharge and resulting low initial drawdown; however, the results were consistent with other data, and so they are included in Table 3.

Hydraulic conductivities estimated by slug tests in fractured bedrock wells are in the range of 10^{-4} to 10^{-6} cm/sec, with a geometric mean of 5×10^{-5} cm/sec and an arithmetic mean of 2×10^{-4} cm/sec (Table 3). The geometric and arithmetic means of slug tests in the saprolite and PWR units are 1.0×10^{-4} cm/sec and 1.5×10^{-4} cm/sec, respectively. The standard deviations for the bedrock values and the saprolite/PWR values are 1.7×10^{-4} cm/sec and 2.9×10^{-4} cm/sec, respectively. These data indicate considerable overlap between values of hydraulic conductivity in the bedrock and saprolite/PWR units such that the overall hydrologic regime is not expected to differ significantly between the units. Hydraulic conductivities of the fractured bedrock unit are somewhat more variable, and the variation appears to reflect local variations in fracture intensity.

2.A.05 Other Studies (Geophysics)

At the request of the Solid Waste Section, JEI performed a magnetometer survey on April 10-20, 2005 to locate metavolcanic and diabase dikes across the site. A report detailing the event and results was included as Appendix DH-7 in the *Site Hydrogeologic Report* (Volume 1, Section 2) dated June 2007. In general, the survey located a few small areas of elevated magnetic field strength that may represent metavolcanic dikes. The most pronounced of these are located in the west-central part of the site between piezometers P-16 and P-5 and in the north-northeast portion of the site. These areas of elevated magnetic field strengths are considered to be too weak to represent diabase. This is consistent with earlier interpretations of dikes observed on this site (Section 2.A.02).

2.A.06 Stratigraphy

Three subsurface hydrogeologic units for the site are defined in this section: saprolite, PWR, and bedrock. Properties of the units described herein allow description of a general conceptual model of groundwater flow in the vicinity of the site. The conceptual model appears to be best supported by the hydrogeologic data from this site is a model in which these three hydrogeologic units have gradational boundaries, are highly connected, and have similar hydrogeologic properties such that, for all practical purposes, they act as a single, unconfined aquifer.

The typical profile for the site consists of several feet of unconsolidated saprolite, grading into several feet of PWR, which grades into competent fractured bedrock; however, there are some areas where PWR is relatively thin to absent. A few borings encountered saprolite interlayered with PWR. The interface between partially weathered rock and unweathered bedrock is generally unclear, with rock core showing substantial weathering at depths of 40-50 feet of more. RQD's, fracture counts, and descriptions of rock core from site borings (Table 4) confirm this.

Estimates of hydraulic conductivity, effective porosity, and preferred flow directions assigned to the units are made with reference to the laboratory test results presented in Table 2, the slug tests presented in Table 3, and drilling information contained in Table 1. The locations of hydrogeologic cross sections showing the three stratigraphic units are shown on Drawing H-3 and the cross sections are presented in Drawings H-4a, H-4b, and H-4c.

2.A.06.1 Saprolite Hydrogeologic Unit

The saprolite unit is continuous across the site, except for areas where grading activities have removed it, such as in the vicinity of piezometer P-31. The majority of the area beneath the current landfill and the proposed new Phases is underlain by a relatively thin layer of saprolite. The water table occurs within the saprolite unit over some portions of the site; however, the saprolite unit is considered to represent a minor hydrogeologic unit for the area around the proposed disposal areas, as most of the groundwater flow appears to be through the PWR or bedrock zones. Saprolite is the uppermost hydrogeologic unit along the northern facility boundary, as demonstrated in wells MW-5 and MW-8 and piezometers P-19S and P-34. Saprolite is also the uppermost hydrogeologic unit along the proposed southern boundary, as demonstrated by piezometers P-17 and P-22 and hand auger piezometers P-27, P-28, P-29, and P-30. Saprolite is the uppermost hydrogeologic unit in the topographic depression near piezometer P-20. All of the borings drilled during this investigation, except P-31, encountered this unit, although there were distinct and unpredictable differences in the thickness of this unit across the site. Split-spoon samples and auger cuttings of this material are generally described in boring logs as silty sands (SM). Silts (ML), clays (CL), and sandy clays (SC) were noted in numerous borings as minor units that were generally found above the water table; however, these soils appear to be discontinuous in nature and their hydraulic characteristics are indistinguishable from the other saprolite materials.

2.A.06.2 Partially Weathered Rock Hydrogeologic Unit

The PWR unit is defined as the zone between saprolite and bedrock that has blow counts of at least 50 over 6 inches during standard penetration tests (SPTs), before auger refusal has been encountered. The PWR unit appears to be discontinuous across the site. Five borings (P-16, P-17, P-19D, P-23, and P-34) were advanced into bedrock without encountering the PWR unit. PWR is similar in composition to the silty sands and sandy silts that overly it. Laboratory soils classifications of split-spoon samples collected from this unit were defined as clayey sand or silty sand (Table 2). The PWR is relatively indistinguishable from the saprolite unit based on its soil classification and hydraulic properties.

2.A.06.3 Fractured Bedrock Hydrogeologic Unit

Depth to bedrock ranges from approximately 5 to 40 feet below ground surface and the average depth to bedrock is approximately 17 feet below ground surface. Some localized zones near or along the drainages are characterized by bedrock that is relatively shallow, between 5 and 10 feet below ground surface. The top of the fractured bedrock unit is normally defined by auger refusal with a typical truck-mounted hollow-stem auger drilling rig. Alternatively, bedrock can be defined by blow-counts of 50 blows or greater per 0.2 feet from SPTs. In borings where both auger refusal and SPT data were available, there was strong agreement between these methods. In the Piedmont

geologic setting, the boundaries between saprolite, PWR, and bedrock are typically gradational and discontinuous. It is not unusual to encounter zones within the PWR that produce auger refusal and/or high blow counts that are horizontally or vertically limited in extent and underlain by softer, more weathered material. In these cases, true bedrock may be deeper than indicated by auger refusal or SPTs. A top of bedrock map based on available boring data from the site is presented in Drawing H-5.

In the boring for piezometer P-32, auger refusal was encountered at 9 feet and the SPT seemed to confirm bedrock. The driller switched to an air hammer to advance a few feet farther before starting to core. Drilling seemed too soft to be competent bedrock, so the driller advanced to 15 feet before beginning to core. The first run of core recovered almost no cohesive rock, and only very small, highly weathered rock fragments. Cohesive rock was not encountered until 21 feet, and that was still highly weathered, with a rock quality designation (RQD) of only 38%. Based on the core data, the depth to bedrock in P-32 was set at 21 feet for mapping purposes (Drawing H-5), and the shallower auger refusal was considered to be a spatially limited, perched hard rock layer.

Similar conditions were encountered in the boring for piezometer P-33. Auger refusal was encountered at 5 feet; however, a STP did not confirm bedrock, with a blow count of 50 blows over 3 inches. The driller switched to the air hammer and encountered relatively soft drilling to the total depth of the boring (35'). This appears to be another case of a perched hard rock layer causing auger refusal; however, no core was obtained from this boring, so an alternate depth to true bedrock could not be determined. Nearby borings encountered auger refusal much deeper than 5 feet. The boring for MW-1, which is less than 100 feet west of P-33, was successfully augered to 33.6 feet with no auger refusal, and the boring for P-26, which is approximately 200 feet northeast of P-33 reached auger refusal at 25 feet. If the shallow auger refusal at P-33 represents true bedrock, it is an isolated pinnacle rising at least 20 feet above the bedrock encountered in surrounding borings. No bedrock depth was assigned to this boring for mapping purposes (Drawing H-5).

The fractured bedrock is the uppermost hydrogeologic unit in two locations within the proposed facility boundary. One of those areas is in the southern and central parts of the proposed Phase 3A waste cell, as indicated by piezometers P-24, P-25, and P-31 (Drawing H-5). Groundwater levels in monitoring wells MW-10S and MW-10D and piezometer P-26 indicate that the water table transitions from fractured bedrock to PWR and saprolite in the northern portion of the proposed Phase 3A cell. Fractured bedrock is also the uppermost hydrogeologic unit near the center of the proposed facility, where there is a topographic and bedrock high running from the location of P-21 to the location of P-15 (Drawing H-5).

Although previous investigations characterized bedrock at the site as highly competent, recent rock cores indicate that bedrock is highly fractured and weathered to a depth of at least 50 feet bgs. Rock core data, including percent recovery and rock quality designations (RQDs), are summarized in Table 4. Because of the highly-fractures bedrock, groundwater flow through this unit is predicted to be similar to the saprolite and PWR units. Effective porosity of bedrock is typically expected to be one percent or less (Heath, 1989), but at this site it is expected to be higher due to the highly

fractured nature of the bedrock. In areas where meta-volcanic dikes are in contact with the granite, the fracture intensity is predicted to be much greater.

2.A.07 Water Table Data

Wells and piezometers were surveyed to at least the following levels of accuracy: the horizontal location to the nearest 0.1 foot; the vertical control for the ground surface elevation to the nearest 0.01 foot; and the vertical control on the top of the inner PVC well casing to the nearest 0.01 foot. Survey data were presented as Appendix DH-3 in the *Site Hydrogeologic Report* (Volume 1, Section 2), dated June 2007. Groundwater levels were measured for existing site monitoring wells and piezometers during periodic site visits. The measurements were collected using a decontaminated electric water level meter. The surveyed point on the top of the well casing was used as reference, and the measurements were recorded to within 0.01 foot. Historic summaries of the depth to groundwater measurements and static groundwater elevations for all wells and piezometers are included in Tables 5a and 5b, respectively.

2.A.07.1 Seasonal High Water Table (March 2007)

The groundwater elevation data were used to construct a groundwater potentiometric surface map, and to infer groundwater flow directions in the area. Water levels measured on March 6, 2007 were used to prepare a groundwater surface contour map for the site (Drawing H-6). Generally, seasonal high water tables occur in the Spring with lower water tables observed in the Fall; therefore, the March 2007 groundwater elevations are representative of typical seasonal high water tables.

2.A.07.02 Long-term Seasonal High Water Table

Observed water table elevation data and calculations of the long-term seasonal high water levels for the site wells are presented in Table 6. Drawing H-7 depicts long-term seasonal high groundwater level contours based on the data in Table 6. Following is an explanation of how these calculations were performed.

At the time design base grades for the C&D area were finalized, only limited seasonal groundwater data were available for the site piezometers installed in 2005 and 2007; therefore, predictions of the seasonal range of water levels for the site were based primarily on the recorded ranges of available measurements from site monitoring wells installed between 1997 and 2002.

Historical precipitation data for Burlington, NC between 1950 and 2004 are presented in Table 7. These data demonstrate annual precipitation ranging from 30.29 to 65.07 inches per year. The mean annual precipitation over the entire historical record is 44.88 inches per year with a standard deviation of 6.56 inches per year. The mean precipitation over the last three years for which data has been compiled (2002-2005) was 47.77 inches per year, which is above the historical mean. Also, the highest annual precipitation ever recorded occurred in 2003. These precipitation data suggest that maximum groundwater levels determined from water level measurements between 2002 and 2005 should include the highest water levels to be reasonably expected at this site. Since most of the wells used to determine the seasonal high water table for the site were installed in January 2002 or earlier,

the water level measurements obtained for the 2002-2005 period are more than sufficient to accurately determine seasonal high water tables.

Seasonal high water table elevations for wells and piezometers installed in 2005 and earlier, as shown in Table 6, were calculated in the following manner. Appropriate adjustment factors to predict the seasonal high water table from the August 2, 2005 water level data were determined by comparing the maximum water level observed for the period 2002-2005 to the August 2005 level for each well for which we had adequate data. We then computed an average difference between the 2002-2005 maximum and the August 2005 levels for two subsets of wells: 1) wells screened in saprolite or PWR; and 2) wells screened in fractured bedrock. Rounding these averages up to the nearest ¼ foot gave us adjustment factors of 2.25 feet for saprolite/PWR wells and 3.25 feet for bedrock wells. Adjusted high water elevations were calculated by adding 2.25 feet to the August 2, 2005 groundwater elevation for any well screened in saprolite and/or PWR or by adding 3.25 to the August 2, 2005 groundwater elevation for any well screened in bedrock. If the maximum historic groundwater elevation (including data back to 1997) for any well was higher than the adjusted groundwater elevation, the maximum historic groundwater elevation was used as the seasonal high. If the adjusted groundwater elevation was higher than ground surface for any well, the ground surface elevation was used.

For the piezometers installed in 2007, an adjustment based on March 6, 2007 groundwater elevations was calculated in the following manner. The difference between the water elevations observed on March 6, 2007 and the seasonal high water table determined for earlier wells in Table 6 were calculated for all wells with both values. The average of these differences (2.15 feet) was added to the March 6, 2007 water elevations for the piezometers installed in 2007. These values are also shown in Table 6.

2.A.08 Horizontal and Vertical Groundwater Flow

2.A.08.1 Hydrogeologic Testing

Following rigorous well development, aquifer testing was performed on many of the monitoring wells and piezometers. The purpose of the testing was to assess the values of horizontal hydraulic conductivity at various locations within the saprolite, PWR, and bedrock potions of the aquifer at the site. In situ rising and falling-head tests (slug tests) were chosen for the assessment due to the relatively low well yields noted during well installation and development. Well MW-5 and piezometers P-16, P-17, P-19S, P-19D, P-21, and P-22 were tested in February-March 2002. Well MW-9 and piezometers P-18 and P-25 were tested in September 2005. Piezometers P-31, P-32, P-33, P-34, P-35, P-36, P-37, and P-38 were tested in February 2007.

Prior to slug testing, the monitoring wells were opened and groundwater levels were allowed to equilibrate. Water level measurements were then collected using an electric water level probe referenced to a point on the top of casing. For the 2002 and 2005 slug tests, a pressure transducer was lowered into the well casing and placed approximately one foot from the bottom of the well and the transducer was connected to an *In-Situ SE 1000C* data logger. For the 2007 slug tests, individual *In-Situ Mini-Troll* data loggers were placed into the well casing and set 1-3 feet above the bottom of

the well. A PVC slug measuring five feet in length or disposable bailers were used to displace water inside the wells.

For the tests using the PVC slug, the first portion of the test was a falling-head test that measured the rate water levels fell back to static after the introduction of the slug. The data logger recorded water level data from the transducer at logarithmic time intervals. Data from the transducer/data logger were verified with hand held water level readings. Falling-head tests were terminated after water levels had recovered to within 95% of their pre-test level. A rising-head test was performed on each well after the falling-head test was completed. In some cases, only rising-head tests were performed after the water level had equilibrated. The rising-head test was conducted by initiating a new logarithmic recording step on the data logger simultaneous with the removal of the PVC slug. The data were verified with hand held water-level readings, and the test was terminated after water levels had recovered to within 95% of the pre-test level. For tests using a disposable bailer, the first test performed was the rising-head test after a volume of water was removed from the well, after which the falling-head test was performed by returning the full bailer to the well.

In situ rising- and falling-head tests provide a quantitative estimate of horizontal hydraulic conductivity (K) and a qualitative estimate of aquifer anisotropy in water-bearing units. The slug test data were analyzed using the Bouwer and Rice (1976 and 1989) equation, which is applicable to fully or partially penetrating wells in unconfined or confined aquifers. Aquifer thicknesses of 7.6-50.0 feet were assumed for all aquifers based upon information supplied on the boring logs. A packing porosity of 25% was assumed for the well filter pack. For the 2002 and 2005 slug tests, computer software produced by Starpoint Software, Inc. was used in the analysis and plotting of the data. For the 2007 slug tests, an Excel-based spreadsheet published by the United States Geological Survey (USGS, Halford and Kuniansky, 1998) was used in the analysis and plotting of the data. The individual data points and computer plots of time versus water level change were presented as Appendix DH-4 in the *Site Hydrogeologic Report* (Volume 1, Section 2) dated June 2007. A summary of the results of all aquifer testing performed at the site is presented in Table 3. Data from P-31 were not usable due to non-linear recovery, possibly a result of well-skin effects. Data from P-32 and P-33 were poor due to rapid recharge and resulting low initial drawdown; however, the results were consistent with other site data, so they are included in Table 3.

2.A.08.2 Site Groundwater Flow Regime

The surficial aquifer beneath the site occurs within saprolite, PWR, and bedrock. Generally, the saprolite and PWR units are relatively thin (5 to 40 feet thick) in the area in and around the proposed cells. The saprolite and PWR are expected to behave as a relatively isotropic, porous medium, whereas groundwater flow in the bedrock is primarily through fractures; however, the bedrock is highly fractured and well connected to the overlying units so they are expected to behave as a single aquifer. The groundwater potentiometric surface, based on water level readings taken on March 6, 2007, is shown on Drawing H-6. Groundwater flow directions conform to the potentiometric surface, with flow perpendicular to the contours.

2.A.08.3 Horizontal Gradient and Velocity Calculations

Horizontal hydraulic gradients for the proposed C&D disposal areas were calculated using five groundwater flow line segments indicated on the groundwater surface contour map (Drawing H-6). Average linear groundwater flow velocities were calculated using the following modified Darcy equation:

$$\mathbf{V = Ki/n}$$

where **V** = average linear velocity (feet per day), **K** = hydraulic conductivity (ft/day), **i** = horizontal hydraulic gradient, and **n** = effective porosity. An effective porosity of **n** = 0.21 (21%) was assumed based on average effective porosities for saprolite and PWR determined by laboratory analysis of soil samples (Table 2). The average gradients (**i**) were determined for each flow path shown on Drawing H-6. The geometric mean of the hydraulic conductivities of all slug test conducted on the site (**K** = 6.96×10^{-5} cm/sec) was used for groundwater flow calculations for the site.

The above equation makes the simplifying assumptions of a homogeneous, isotropic aquifer in a porous medium. Groundwater flow velocities were calculated using saprolite and PWR data because the site's uppermost aquifer is primarily in those hydrogeologic units. An average linear groundwater flow velocity was calculated across areas where bedrock is the surficial aquifer because rock cores have shown that bedrock is highly fractured to the point that groundwater flow is expected to behave relatively similar to the unconsolidated hydrogeologic units. Also, aquifer tests conducted on bedrock wells and piezometers showed similar range of values for hydraulic conductivity. Groundwater flow velocities within the fractured bedrock aquifer are likely to be variable.

Data and calculations for the horizontal gradients are presented in Table 8. The calculated horizontal gradients from five flow line segments across the site range from 0.02 to 0.05 feet/foot. Calculated linear groundwater velocities ranged from approximately 8.4 to 15.5 feet/year.

2.A.08.4 Vertical Gradient Calculations

Two nested well pairs (MW-10S and MW-10D and P-19S and P-19D) were used to measure vertical hydraulic gradients. Wells MW-10S and MW-10D are located east of the proposed disposal area, adjacent to a tributary of Poppaw Creek. Piezometers P-19S and P-19D are located downgradient of the proposed disposal area near Poppaw Creek, at the northern boundary of the site. Calculations were performed using water levels measured on several different dates. Vertical gradients were calculated using the vertical distance between the screen midpoints. A summary of vertical gradient data is presented in Table 9. Table 9 also includes historic data from a third well pair, P-2 and P-2A, which were abandoned prior to construction of Phase 1 of the landfill.

Vertical gradients calculated for well pairs MW-10S and MW-10D and P-19S and P-19D suggest seasonal fluctuations with groundwater discharge in spring and groundwater recharge in summer near the surface water features. The relatively small vertical gradients observed at all the well pairs at this site, along with the seasonal fluctuations between positive and negative gradients, give strong

support to the proposition that the bedrock and saprolite/PWR portions of the aquifer are strongly connected and behave as a single aquifer.

2.A.09 Groundwater Contour Maps

Drawing H-6 depicts the static groundwater surface based on March 2007 water level measurements. Generally, seasonal high water tables occur in the Spring with lower water tables observed in the fall; therefore, the March 2007 groundwater elevations are representative of typical seasonal high water tables.

Observed water table elevation data and calculations of the long-term seasonal high water levels for the site wells are presented in Table 6. Drawing H-7 depicts long-term seasonal high groundwater level contours based on the data in Table 6. For an explanation of how these calculations were performed, refer to Section 2.A.07.

2.A.10 Boring Location Map

Drawings H-2, H-3, H-5, H-6, H-7, and H-8 show the locations of all borings, wells, and piezometers on this site.

2.A.11 Wells and Surface Water Intakes

Well WW-1 is the only water supply well located within the proposed facility boundary. The well is associated with a former dwelling and is currently being used for water level data only and is not used as a water source. The well will be removed and abandoned prior to violation of the buffers specified in NCSWMR §.0503(2)(f)(ii).

There are several residences along Foster Store Road (east of the site) that obtain water from individual water supply wells that are within 500 feet of the proposed facility boundary. The closest of these wells is less than 100 feet from the proposed facility boundary; however, none of the dwellings or water wells are within 500 feet of the proposed waste disposal areas. All of the residences and wells along Foster Store Road are upgradient of the proposed facility.

There are also residences with water supply wells along Alamance Church Road (west of the site), two of which are approximately 470-480 feet from the western facility boundary. None of the dwellings or their water wells are within 500 feet of the proposed waste disposal areas. Although these residences are generally down-gradient of the site, they are not downgradient of the proposed Phase 3A or 3B waste disposal units.

The site is not located within a critical water supply watershed, or in the watershed of a stream classified WS-I, or in water sheds of other water bodies for which no new landfills are allowed in accordance with 15A-NCAC-2B.0020. There are no known surface water intakes within a one-mile radius of the site.

All available boring logs, construction records, and development records for borings, monitoring wells, and piezometers on the site were included as Appendices DH-1 and DH-2 in the *Site*

Hydrogeologic Report (Volume 1, Section 2) dated June 2007. The construction data for all borings are summarized in Table 1.

2.A.12 Other Hydrogeologic Considerations

There are no hydrogeologic considerations that need to be addressed which have not been addressed in other sections of this report.

2.B GROUNDWATER MONITORING PLAN

2.B.1 Introduction and Purpose

This plan shall replace any previous groundwater monitoring plans that may have been submitted for Coble's Sandrock C&D Landfill. This Groundwater Monitoring Plan will serve as a guidance document for collecting and analyzing groundwater and surface water samples, managing the associated analytical results, and monitoring for potential releases to the uppermost aquifer from the Coble's Sandrock C&D Landfill. The plan complies with NCSWMR § .0540, which specifies the requirements for groundwater and surface water monitoring at C&D landfills. The plan also addresses the specific issues addressed in the Solid Waste Section's January 1995 policy memorandum (*Re: Sampling and Analysis Requirements, Construction and Demolition Landfills and Closed Sanitary Landfills*).

2.B.2 Groundwater Monitoring Network

The groundwater monitoring network is designed to monitor for potential releases to the uppermost aquifer at the proposed site. The boring log and well completion details for all of the existing groundwater monitoring wells are included as Appendices DH-1 and DH-2 in the *Site Hydrogeologic Report* (Volume 1, Section 2) dated June 2007. A summary of well construction specifications, well status, and the role of each well in the proposed monitoring plan is provided in Table 10.

2.B.2.1 Background and Compliance Monitoring Wells

Monitoring well MW-6 (formerly P-3) is proposed to remain as the upgradient background monitoring well for the facility. This well was installed during site characterization activities in August 1997. Although installed as a piezometer, it was constructed to meet the requirements for a long term monitoring point. A protective casing was added to this well during field activities performed in January 2002. This well replaced MW-3 as the facility background well before the November 2003 sampling event. Monitoring wells MW-2, MW-4, and MW-7 are proposed to remain as downgradient compliance wells. Wells MW-2 and MW-4 were installed during the original permitting activities in 1997. Well MW-7 replaced MW-5, at the request of the Solid Waste Section, before the November 2003 sampling event. Newly installed monitoring wells MW-8 and MW-10S are proposed to become additional downgradient compliance wells. MW-9 will need to be abandoned for construction of a proposed sediment basin; therefore, piezometer P-19S will be converted to compliance well to replace MW-9. Wells MW-1 and MW-3 will be abandoned for the construction of the proposed Phase 3A disposal area. Well MW-5 will continue to be used for the collection of groundwater level data. In addition, a new monitoring well, MW-11, will be installed northwest of the proposed Phase 3B disposal area prior to any waste being received into Phase 3B.

Thus, the proposed compliance network will include the following eight wells: MW-2, MW-4, MW-7, MW-6 (background), MW-8, MW-10S, P-19S, and MW-11. The proposed monitoring well network is shown on Drawing H-8.

2.B.2.2 Installation and Maintenance of Groundwater Monitoring Network

Monitoring wells MW-2, MW-4, and MW-6 were installed by Trigon Engineering Consultants, Inc. between March and August 1997 as part of the permitting activities for the initial waste cell. Well construction activities are discussed in the December 1997 submittal titled *Construction and Demolition Landfill Permit Application Siting Requirements*. Monitoring well MW-7 was installed by JEI on December 19, 2002, at the request of the Solid Waste Section. Wells MW-8, MW-9, and MW-10S were installed by JEI between March 21 and 25, 2005, as part of Phase 3 permitting activities. The wells were constructed according to specifications for monitoring wells codified in 15A NCAC Subchapter 2C, Section .0100, and according to draft guidance document *North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities* (March 1995). Piezometer P-19S was installed by JEI in January 2002 and meets the requirements for a permanent monitoring well in accordance with 15A NCAC Subchapter 2C, Section .0100.

A new monitoring well, MW-11, will be installed northwest of the proposed Phase 3B disposal area to serve as an additional down-gradient monitoring point for Phase 3B. The well will be installed approximately 400 feet north of piezometer P-16 in accordance with 15A NCAC Subchapter 2C, Section .0100. MW-11 will be installed and developed, and background data will be collected prior to any waste being received into Phase 3B.

The facility monitoring wells will be used and maintained in accordance with design specifications throughout the life of the monitoring program. Routine monitoring well maintenance will include inspection and correction/repair of well identification tags, cement pads, well caps and locks, and access to the wells. Should it be determined that the background or a compliance monitoring well no longer provides samples that are representative of the quality of groundwater passing the relevant point of compliance, the Solid Waste Section will be notified. The owner will re-evaluate the monitoring network, and recommendations will be made for modifying, rehabilitating, abandoning, or installing replacement or additional monitoring wells, as appropriate.

2.B.3 Groundwater Monitoring

Groundwater samples from the facility will be collected and analyzed for the constituents listed in Appendix I of 40 CFR Part 258, plus mercury, chloride, manganese, sulfate, iron, alkalinity, and total dissolved solids. In addition, field analyses for temperature, pH, and specific conductivity will be performed for each sample. The laboratory analytical results and field parameters will be submitted to the Solid Waste Section at least semiannually. Any exceedances of the NC 2L Drinking Water Standards will be identified in the semiannual submittals.

2.B.3.1 *Establishment of Background Data*

A minimum of four independent groundwater samples will be collected from any new compliance wells prior to the start of disposal operations in their respective areas at the proposed C&D facility. These data will be evaluated statistically to determine background concentrations for each well.

2.B.3.2 *Groundwater Sampling Methodology*

Groundwater samples will be collected in accordance with 15A NCAC 13B .1630 through .1633 and guidance provided in the *Draft North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities; Solid Waste Section, Division of Solid Waste Management; Department of Environment, Health and Natural Resources* (March 1995). Details of well purging, sample withdrawal, and decontamination methods, as well as chain-of-custody procedures are outlined below.

Static water elevations and the total well depth will be measured to the nearest 0.01 of a foot in each well prior to the sampling of each well. An electronic depth meter will be used for the measurements. This device is lowered into the well and emits an audible tone when water is reached. The distance from the top of the well casing to the water surface and to the bottom of the well will be measured using the tape attached to the probe. Reference elevations of the proposed wells have been obtained from a North Carolina registered land surveyor.

A low-yield well (one that is incapable of yielding three well volumes within a reasonable time) will be purged so that water is removed from the bottom of the screened interval. Low-yield wells will be evacuated to dryness once. As soon as the well recharges or within 24 hours, the first sample will be field tested for pH, temperature, and specific conductance. Samples will then be collected and containerized in the order of the parameters' volatilization sensitivity (i.e., volatile organics then total metals).

A high-yield well (one that is capable of yielding more than three well volumes during continuous purging) will be purged so that water is drawn down from the uppermost part of the water column to ensure that fresh water from the formation will move upward in the screen. At no time will a well be evacuated to dryness if the recharge rate causes the formation water to vigorously cascade down the sides of the screen, which could cause an accelerated loss of volatiles.

A minimum of three well volumes will be evacuated from high-yield wells prior to sampling. A well volume is defined as the water contained within the well casing and pore spaces of the surrounding filter pack. The well volume will be calculated using the following formulas:

$$V_c = (d_c^2/4) \times 3.14 \times h_w \times 7.48 \text{ gallons/cubic foot}$$
$$V_c \text{ (gallons)} = 0.163 \times h_w$$

where:

V_c = volume in the well casing

d_c = casing diameter in feet (d_c = 0.167 for a 2-inch well)

h_w = height of the water column (i.e., well depth minus depth to water)

Each well will be evacuated (purged) and sampled with a disposable bailer. The bailer will be lowered gently into the well to minimize the possibility of causing degassing of the water. All equipment used for sampling will be handled in such a manner to ensure that the equipment remains decontaminated prior to use. In between wells and following completion of the field sampling, the electronic depth meter will be decontaminated. Clean disposable gloves will be worn by sampling personnel.

The upgradient/background well will be sampled first, followed by the downgradient wells. The order of sampling of the downgradient wells will be evaluated each sampling event to provide a sequence going from less contaminated to more contaminated, if applicable, based on the previous sampling event.

Field measurements of temperature, pH, and specific conductance will be made before and after sample collection as a check on the stability of the water sampled over time. The direct reading equipment used at each well will be calibrated according to the manufacturer's specifications prior to each sampling event. Groundwater samples will be collected and containerized in the order of the volatilization sensitivity (i.e., VOCs first, followed by the metals).

Pre-preserved sample containers will be supplied by the laboratory. The VOC vials will be filled in such a manner that no headspace remains after filling. Immediately upon collection, all samples will be placed in coolers on ice where they will be stored prior to/and during transit to the laboratory.

In between wells and following completion of the field sampling, the electronic depth meter will be decontaminated using the following procedure.

1) Phosphate-free soap and distilled water wash;
2) Distilled water rinse;
3) Air dry.

Samples collected will be properly containerized, packed into pre-cooled coolers, and either hand-delivered or shipped via overnight courier to the laboratory for analysis. The chain-of-custody program will allow for tracing of possession and handling of samples from the time of field collection through laboratory analysis. The chain-of-custody program will include sample labels and seals, field logs, and chain-of-custody record, and laboratory log.

Labels sufficiently durable to remain legible when wet will contain the following information:

- Job and sample identification number;
- Monitoring well number or other location;
- Date and time of collection;
- Name of collector;
- Parameter to be analyzed; and
- Preservative, if applicable.

The shipping container will be sealed to ensure that the samples have not been disturbed during transport to the laboratory. The tape is labeled with instructions to notify the shipper if the seal is broken prior to receipt at the laboratory. If the sample cannot be analyzed because of damage or disturbance, whenever possible, the damaged sample will be replaced during the same compliance period.

The field log will contain sheets documenting the following information:

- Identification of the well;
- Well depth;
- Static water level depth;
- Presence of immiscible layers, odors or other indications of potential contamination;
- Well yield-high or low;
- Purge volume (given in gallons or number of bailers);
- Time well was purged;
- Date and time of collection;
- Well sampling sequence;
- Types of sampling containers used and sample identification numbers;
- Preservative used;
- Field analysis data and methods;
- Field observations on sampling event;
- Name of collector(s);
- Internal temperature of shipping container at the time of sample placement; and
- Climatic conditions including air temperatures.

The chain-of-custody record is required to establish the documentation necessary to trace sample possession from time of collection to time of receipt at destination. A chain-of-custody record will accompany each individual shipment. The record will contain the following information:

- Sample destination and transporter;
- Sample identification numbers;
- Signature of collector;
- Date and time of collection;
- Sample type;
- Identification of well;
- Number of sample containers in shipping container;
- Parameters requested for analysis;
- Signature of person(s) involved in the chain of possession;
- Inclusive dates of possession; and
- Internal temperature of shipping container upon opening in laboratory (noted by the laboratory).

A copy of the completed chain-of-custody sheet will accompany the shipment and will be returned to the shipper with the analytical results. The chain of custody record will also be used as the analysis request sheet.

A field/equipment blank will be collected and analyzed during each sampling event to verify that the sample collection and handling processes have not affected the integrity of the field samples. The field/equipment blank will be prepared in the field from lab pure water (Type II reagent grade water) supplied by the laboratory. One field/equipment blank will be prepared for each sampling event. The field/equipment blank will be generated by exposing the lab pure water to the sampling environment and sampling equipment/media in the same manner as actual field samples being collected. The lab will provide appropriate sample containers for generation of the field/equipment blank(s). The field/equipment blank will be subjected to the same analysis(es) as the groundwater samples. As with all other samples, the time(s) of the field/equipment blank collection will be recorded so that the sampling sequence is documented. The field/equipment blank monitors for contamination from the sampling equipment/media, or from cross-contamination that might occur between samples and sample containers as they are opened and exposed to the sampling environment.

Whenever groundwater samples are being collected for volatiles analysis, a trip blank will be generated by the laboratory prior to shipment of sampling containers and coolers to the field. The same lab pure water as above shall be used. The trip blank shall be transported with the empty sampling containers to the field, but will not be opened at any time prior to analysis at the laboratory. The trip blank will accompany the groundwater samples in the cooler(s) back to the laboratory and will be analyzed by the same volatile methods as the associated field samples. The trip blank monitors for potential cross-contamination that might occur between samples or that may be a result of the shipping environment.

Detectable levels of contaminants found in the field/equipment blanks or trip blanks will not be used to correct the groundwater data, but will be noted accordingly. Contaminants present in trip blanks or field/equipment blanks at concentrations within an order of magnitude of those observed in the corresponding groundwater samples may be cause for resampling.

2.B.3.3 Sample Analysis Requirements

2.B.3.3.1 Analytical Requirements

Analysis of groundwater and surface water samples from the facility will be conducted by a laboratory certified by the NCDENR. Analyses will be performed in accordance with U.S. EPA SW 846 methods. Both groundwater and surface water samples will be analyzed for the constituents listed in Appendix I of 40 CFR Part 258, plus mercury, chloride, manganese, sulfate, iron, alkalinity, and total dissolved solids. In addition, field analyses for temperature, pH, and specific conductance will be performed for each sample. Table 11 includes a table of all Appendix I and Appendix II constituents with their respective analytical methods, CAS numbers, NCDENR Solid Waste Section Limits, and 15A NCAC 2L groundwater standards.

2.B.3.3.2 Reporting and Record Keeping

The laboratory analytical results will be submitted to the Solid Waste Section at least semiannually. The following measurements, analytical data, calculations, and other relevant groundwater monitoring records will be kept throughout the active life of the facility and the post-closure care period:

- Records of all groundwater quality data;
- Associated sample collection field logs and measurements, such as static water level measured in compliance wells at the time of sample collection; and
- Notices and reports of NC 2L exceedances, reporting or data error, missing data, etc.

2.B.3.3.3 Well Abandonment

All recently installed piezometers or pre-existing wells at the site that are not used for permanent monitoring will be properly abandoned in accordance with the procedures for permanent abandonment, as described in 15A NCAC 2C Rule .0113(a)(2). The piezometers and wells will be progressively abandoned as necessary to complete construction activities. The remaining piezometers will be used to supplement groundwater elevation data.

Wells/piezometers to be permanently abandoned will be abandoned in accordance with the procedures defined in 15A NCAC 02C.0113. All borings within the footprint of the proposed waste disposal areas will be completely overdrilled to the full depth of the boring prior to filling with bentonite grout, and the level of grout will not exceed in height the elevation of the proposed base grade. Bentonite grout is defined as a mixture of at least 5% bentonite and Portland cement. Grout will be placed in the borings from the bottom upward using a tremie-pipe method.

Other wells that will potentially interfere with clearing and construction activities but that are not within the waste footprint will be abandoned in place without overdrilling. Any surface casing and/or concrete pad will be removed, and the well casing will be cut off below grade. Bentonite grout will placed in the well from the bottom upward using a tremie-pipe method so that it overflows and covers the top of the cut-off casing.

Inactive supply well WW-1 will be permanently abandoned before construction of any waste cell that would produce a violation of buffers specified in NCSWMR § .0503(2)(f)(ii). The abandonment will be performed in conformance with NCSWMR § .0113(a)(2).

2.B.4 Surface Water Monitoring

Two surface water monitoring points are proposed for the facility, as shown on Drawing H-8. Surface water point SW-1 is located to monitor water quality in Poppaw Creek, shortly after it enters the site. The sample location is at the property line near the northwest edge of the site.

Surface water monitoring point SW-2 will serve as a downstream monitoring point. Samples from this point will be collected at a location approximately 350 feet northeast of the proposed Phase 3

disposal area near the northeastern corner of the site and where a small tributary that flows adjacent to the eastern property boundary discharges into Poppaw Creek.

The surface water will be sampled for the constituents, as outlined above, that are required for C&D landfills and the locations will be monitored at least semiannually during the life of the facility. The results of the analysis of the surface water data will be submitted to the Solid Waste Section semiannually with the groundwater data.

2.B.5 Ability to Effectively Monitor Releases from Proposed C&D Areas

No known or potential sources of significant contamination have been identified within 2000 feet of the property boundary. There are no known conditions, physical or hydrogeologic, which will interfere with the effective monitoring of the proposed C&D cells. The proposed Water Quality Monitoring Plan, when implemented, will be effective in providing early detection of any release of hazardous constituents to the uppermost aquifer, so as to be protective of public health and the environment.

2.C POINT OF COMPLIANCE

The relevant point of compliance is defined in accordance with NCSWMR § .0544.b.1.B as a point no more than 250 feet from the edge of waste and no less than 50 feet within the facility boundary, whichever is closer to the waste. Along most of the western edge of the proposed and existing waste cells, and along a small area on the northern side of the cells, the relevant point of compliance is defined by the points 50 feet from the facility boundary. For the rest of the area around the proposed and existing waste cells, the relevant point of compliance is defined by the points 250 feet from the edge of waste. A line representing all the relevant points of compliance for this site is depicted on Drawing H-8. All proposed and existing monitoring wells are located within the relevant points of compliance line.

2.D ROCK CORES

Rock core has been obtained from a total of nine borings on the site. Three rock cores borings C-1, C-2, and C-3 were advanced in 1997, and rock cores were obtained from the borings for TW-1 and TW-2 in 1998. In 2002, rock core was obtained from the boring for P-21. Rock core was obtained from boring P-26 in 2005 and from borings P-27 and P-32 in 2007. Rock core data, including percent recovery and rock quality designations (RQDs), are summarized in Table 4.

In the most recent investigations (2005-2007), three boreholes (P-26, P-32, and P-37) were chosen for rock coring. P- 26 and P-32 were within the footprint of proposed Phase 3A, and P-37 is within the footprint of Phase 3B. Approximately 23.5 feet of rock core was obtained from the P-26 borehole, and 15 feet of rock core was obtained from each of the borings for P-32 and P-37. A tricone bit or air hammer was used to advance the borings below the auger refusal depth before beginning the core runs. All rock core was obtained using 2-inch NQ core barrels. An experienced JEI geologist was present to observe the drilling and rock coring, log the boreholes, and evaluate the cores.

The interface between partially weathered rock and unweathered bedrock is generally unclear, with rock core showing substantial weathering at depths of 30-55 feet. RQD's, fracture counts, and descriptions of rock core from site borings (Table 4) confirm this. The strike and dip of fractures found in rock core taken at the site could not be determined, as the core was not oriented, nor were there any pervasive fabric features that would allow for this determination. Generally, the fractures within the granite were great in number and randomly oriented. One rock core (P-26) encountered metavolcanic material, which was highly-fractured with vertical to nearly horizontal dips, and voids of up to 1.5 feet; however, the metavolcanic rock was less weathered than the granitic rock encountered in most cores and had a higher rock-quality designation.

2.E GROUNDWATER CONTOUR MAPS

2.E.01 Seasonal High Water Table (March 2007)

Drawing H-6 depicts the static groundwater surface based on March 2007 water level measurements. Generally, seasonal high water tables in this region occur in the Spring with lower water tables observed in the fall; therefore, the March 2007 groundwater elevations are representative of typical seasonal high water tables.

2.E.02 Long-term Seasonal High Water Table

Observed water table elevation data and calculations of the long-term seasonal high water levels for the site wells are presented in Table 6. Drawing H-7 depicts long-term seasonal high groundwater level contours based on the data in Table 6. For an explanation of how these calculations were performed, refer to Section 2.A.07.

2.E.03 Vertical Separation from Seasonal High Water Table

NCSWMR § .0540.2.ba requires that the C&D landfill units be constructed so that the post-settlement bottom of waste is a minimum of 4 feet above the seasonal high water table. The proposed Phase 3A and Phase 3B base grades are shown relative to the long-term seasonal high water table on Drawing H-7, and in cross sections in Drawings H-4a, b, and c. The proposed base grades are designed to be a minimum of 4 feet above the long-term seasonal high water table, which is more protective than NCSWMR § 0.0540 requires.

2.F BEDROCK CONTOUR MAP

2.F.01 Depth to Bedrock

Depth to bedrock ranges from approximately 5 to 40 feet below ground surface and the average depth to bedrock is approximately 17 feet below ground surface. Some localized zones near or along the drainages are characterized by bedrock that is relatively shallow, between 5 and 10 feet below ground surface. A top of bedrock map based on available boring data from the site is presented in Drawing H-5. For more detailed explanation see Section 2.A.06 of this report.

2.F.02 Vertical Separation from Bedrock

NCSWMR § .0540.2.a requires that the C&D landfill units be constructed so that the post-settlement bottom of waste is a minimum of 4 feet above the bedrock datum plane contours. The proposed Phase 3A and Phase 3B base grades are shown relative to the bedrock contours on Drawing H-5, and in cross sections in Drawings H-4a, b, and c. The proposed base grades are designed to be a minimum of 4 feet above the bedrock contours.

2.G HYDROGEOLOGIC CROSS SECTIONS

Hydrogeologic cross sections showing the three hydrogeologic units and both the seasonal high water table and the long-term seasonal high water table are presented in Drawings H-4a, H-4b, and H-4c. These drawings also include the proposed base grades for the Phase 3A and Phase 3B waste cells. The locations of the cross-sections are shown on Drawing H-3.

2.H GROUNDWATER FLOW REGIME

The surficial aquifer beneath the site occurs within saprolite, PWR, and bedrock. The saprolite and PWR are expected to behave as a relatively isotropic, porous medium; whereas, groundwater flow in the bedrock is primarily through fractures; however, the bedrock is highly fractured and well connected to the overlying units so they are expected to behave as a single aquifer. The groundwater potentiometric surface, based on water level readings taken on March 6, 2007, is shown on Drawing H-6. Data and calculations for the horizontal gradients and flow velocities are presented in Table 8. The calculated horizontal gradients from five flow line segments across the site range from 0.02 to 0.05 feet/foot. Calculated linear groundwater velocities ranged from approximately 8.4 to 15.5 feet/year. For a more detailed discussion of the groundwater flow regime, see Section 2.A.08 of this report.

2.I SOILS UNDERLYING WASTE

NCSWMR § .0540.2.b requires that the upper two feet of soils separating the base of waste from the bedrock and/or groundwater consist of fine-grained soils falling into the classifications SC, SM, ML, CL, MH, or CH per the United Soil Classification System (USCS). These soils can either be in-situ or modified soils.

2.I.01 Phase 3A

The proposed Phase 3A base grades will require excavation into the PRW unit, removing most saprolite that currently exists in the area. Laboratory sieve analyses of soil from split spoon samples in the PWR unit in the Phase 3A footprint (borings P-31, P-32, and P-33) returned USCS classifications of silty sand (SM) or sandy clay (SC) (Table 2). This indicates that the PWR in this area is adequate to meet the requirements of NCSWMR § .0540.2.b. After the area has been excavated to base grades, a licensed geologist will inspect the subgrade to insure that these conditions are met. If necessary, native soil can be augmented to obtain the required soil characteristics.

2.I.02 Phase 3B

Proposed base grades for Phase 3B will require filling to obtain the required separations from groundwater and bedrock; therefore, the soils that will make up the upper two feet below the base grades will be fill material that will be selected to meet the requirements of NCSWMR § .0540.2.b. Laboratory sieve analyses of soil from split spoon and Shelby tube samples in the Phase 3A footprint (borings P-35, P-36, P-37, and P-38) returned USCS classifications of sandy clay (SC) or silty sand (SM) (Table 2). This indicates that there is adequate fine-grained material in the vicinity. A licensed geologist will inspect the subgrade to insure that these conditions are met.

2.J Monitoring Well/Piezometer Certification

All borings which intersect the water table on this site have either (1) been constructed and maintained as permanent monitoring wells in accordance with 15A NCAC 02C.0108, or (2) will be upgraded to meet these requirements before construction of the propose Phase 3A and Phase 3B waste cells, or (3) they will be permanently abandoned. For a geologist's certification and seal, see the signature page at the front of this report. Well/piezometer construction was also performed in accordance with the standards described in the *RCRA Technical Enforcement Guidance Document* (1986) and the *Draft North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities* (1995).

Wells/piezometers to be permanently abandoned will be abandoned in accordance with the procedures delineated in 15A NCAC 02C.0113. All borings within the footprint of the proposed waste disposal areas will be completely overdrilled to the full depth of the boring prior to filling with cement or bentonite grout, and the level of grout will not exceed in height the elevation of the proposed base grade. For details on abandonment procedures, see Section 2.B.3.3.3 of this report.

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TABLE 1
Boring, Piezometer, and Well Completion Summary
Coble's Sandrock Construction and Demolition Landfill

PIEZOMETER OR WELL ID	DATE INSTALLED	CASING DIAM.	WELL ELEVATIONS		TOTAL DEPTH DRILLED		TOP OF BEDROCK		SCREENED INTERVAL				WATER TABLE				LITHOLOGY OF SCREENED INTERVAL	COMMENTS
			GROUND SURFACE	TOC					DEPTH BGS		ELEV. MSL		MIN.	MAX.	MIN.	MAX.		
		inches	feet above MSL		DEPTH BGS	ELEV. MSL	DEPTH BGS	ELEV. MSL	from	to	from	to	DEPTH TOC	DEPTH TOC	ELEV. MSL	ELEV. MSL		
MW-1	03/25/97	2	600.46	602.46	33.60	566.86	>33.6	<566.86	18.10	33.10	582.36	567.36	35.55	30.98	566.91	571.48	Saprolite/PWR	---
MW-2	03/28/97	2	580.31	582.31	22.00	558.31	>22.0	<558.31	5.00	20.00	575.31	560.31	17.53	11.95	564.78	570.36	Saprolite/PWR	Compliance Well
MW-3 (P-1)	03/31/97	2	610.23	613.05	57.00	553.23	21.50	588.73	37.00	57.00	573.23	553.23	39.18	32.75	573.87	580.30	Bedrock	---
MW-4	04/01/97	2	580.64	582.64	21.30	559.34	>21.3	<559.34	6.30	21.30	574.34	559.34	16.61	12.90	566.03	569.74	Saprolite/PWR	Compliance Well
MW-5	01/18/02	2	575.21	577.41	15.00	560.21	15.00	560.21	5.00	15.00	570.21	560.21	9.52	6.49	567.89	570.92	Saprolite/PWR	---
MW-6 (P-3)	08/05/97	2	652.76	652.56	41.00	611.76	16.00	636.76	21.00	41.00	631.76	611.76	30.78	17.99	621.78	634.57	Bedrock	Background Well
MW-7	12/19/02	2	581.08	583.33	13.50	567.58	13.50	567.58	3.50	13.50	577.58	567.58	12.44	6.85	570.89	576.48	Saprolite/PWR	Compliance Well
MW-8	03/21/05	2	571.50	574.26	20.00	551.50	>20.0	<551.50	5.00	20.00	566.50	551.50	18.66	5.42	555.60	568.84	Saprolite/PWR	Compliance Well
MW-9	03/21/05	2	586.43	589.09	37.50	548.93	37.50	548.93	22.50	37.50	563.93	548.93	24.30	19.38	564.79	569.71	PWR	---
MW-10S	03/22/05	2	589.62	592.46	21.50	568.12	5.00	584.62	6.50	21.50	583.12	568.12	9.43	7.91	583.03	584.55	Bedrock	Compliance Well
MW-10D	03/25/05	2	589.90	592.76	64.00	525.90	5.00	584.90	54.00	64.00	535.90	525.90	9.79	6.81	582.97	585.95	Bedrock	---
P-2	08/05/97	2	575.61	578.86	21.60	554.01	12.00	563.61	11.60	21.60	564.01	554.01	9.20	-1.44	569.66	570.25	Bedrock	Abandoned
P-2A	08/05/97	2	574.86	578.96	50.00	524.86	12.00	562.86	40.00	50.00	534.86	524.86	9.28	8.30	569.68	570.06	Bedrock	Abandoned
P-4	08/05/97	2	628.56	631.88	62.00	566.56	32.00	596.56	42.00	62.00	586.56	566.56	29.93	22.32	601.95	609.56	Bedrock	---
P-5	08/05/97	2	611.26	611.91	61.50	549.76	15.00	596.26	41.50	61.50	569.76	549.76	45.53	4.00	566.38	607.91	Bedrock	---
P-6	08/05/97	2	602.93	606.06	61.00	541.93	15.00	587.93	41.00	61.00	561.93	541.93	59.01	19.13	547.05	586.93	Bedrock	Abandoned
P-7	08/05/97	2	617.90	621.51	56.50	561.40	8.00	609.90	36.50	56.50	581.40	561.40	26.03	22.06	595.48	599.45	Bedrock	Abandoned
P-15	01/17/02	2	649.07	651.22	50.00	599.07	17.00	632.07	40.00	50.00	609.07	599.07	41.85	35.92	609.37	615.30	Bedrock	---
P-16	01/18/02	2	609.85	612.05	41.00	568.85	5.00	604.85	26.00	41.00	583.85	568.85	17.88	7.10	594.17	604.95	Bedrock	---
P-17	01/18/02	2	643.78	646.28	36.00	607.78	22.00	621.78	21.00	36.00	622.78	607.78	20.42	4.79	625.86	641.49	Saprolite/Bedrock	---
P-18	01/30/02	2	652.16	651.76	34.00	618.16	34.00	618.16	19.00	34.00	633.16	618.16	26.09	18.67	625.67	633.09	PWR	---
P-19S	01/31/02	2	569.18	572.18	10.00	559.18	>10.0	<559.18	4.00	10.00	565.18	559.18	7.80	4.53	564.38	567.65	Saprolite	Compliance Well
P-19D	01/31/02	2	569.65	571.85	60.00	509.65	10.00	559.65	45.00	60.00	524.65	509.65	7.48	3.41	564.37	568.44	Bedrock	---
P-20	01/29/02	2	638.81	641.11	30.00	608.81	30.00	608.81	15.00	30.00	623.81	608.81	15.94	4.27	625.17	636.84	Saprolite/PWR	---
P-21	01/30/02	2	665.67	668.42	62.50	603.17	44.00	642.67	47.50	62.50	618.17	603.17	49.50	38.42	618.92	630.00	Bedrock	---
P-22	1/17/2002	2	627.90	629.90	10.00	617.90	10.00	617.90	4.00	10.00	623.90	617.90	11.29	2.26	618.61	627.64	Saprolite/PWR	---
P-23	01/17/02	2	637.87	640.37	41.00	596.87	27.00	610.87	31.00	41.00	606.87	596.87	31.62	22.22	608.75	618.15	Bedrock	---
P-24	03/24/05	2	612.52	613.89	38.00	574.52	18.00	594.52	28.00	38.00	584.52	574.52	29.95	26.04	583.94	587.85	Bedrock	---
P-25	03/24/05	2	616.37	617.81	38.00	578.37	14.00	602.37	28.00	38.00	588.37	578.37	23.75	19.59	594.06	598.22	Bedrock	---
P-26	03/28/05	2	594.27	597.13	52.00	542.27	25.00	569.27	37.00	52.00	557.27	542.27	29.91	26.71	567.22	570.42	Bedrock	---
P-27	04/04/05	2	625.25	627.45	4.50	620.75	>4.5	<620.75	2.50	4.50	622.75	620.75	5.95	2.45	621.50	625.00	Saprolite	---
P-28	04/04/05	2	610.36	613.15	4.00	606.36	>4.0	<606.36	2.00	4.00	608.36	606.36	5.50	3.28	607.65	609.87	Saprolite	---
P-29	04/04/05	2	617.31	619.49	5.00	612.31	>5.0	<612.31	3.00	5.00	614.31	612.31	4.27	2.67	615.22	616.82	Saprolite	---
P-30	04/04/05	2	634.75	637.49	4.00	630.75	>4.0	<630.75	2.00	4.00	632.75	630.75	3.18	3.13	634.31	634.36	Saprolite	---
P-31	01/29/07	2	607.00	608.56	44.00	563.00	15.00	592.00	15.00	40.00	592.00	567.00	21.56	21.56	587.00	587.00	Bedrock	---
P-32	01/30/07	2	598.10	600.35	40.00	558.10	21.0 *	577.1 *	15.00	40.00	583.10	558.10	24.30	24.30	576.05	576.05	Bedrock	---
P-33	01/31/07	2	595.50	597.68	35.00	560.50	--- *	--- *	15.00	35.00	580.50	560.50	24.10	24.10	573.58	573.58	PWR/Bedrock	---
P-34	01/31/07	2	626.80	629.73	23.00	603.80	23.00	603.80	8.00	23.00	618.80	603.80	6.92	6.92	622.81	622.81	Saprolite	---
P-35	02/02/07	2	613.90	616.33	30.00	583.90	17.50	596.40	10.00	30.00	603.90	583.90	9.94	9.94	606.39	606.39	PWR/Bedrock	---
P-36	02/01/07	2	623.10	624.84	30.00	593.10	14.00	609.10	10.00	30.00	613.10	593.10	4.66	4.66	620.18	620.18	PWR/Bedrock	---
P-37	02/05/07	2	611.90	613.61	30.00	581.90	15.00	596.90	10.00	30.00	601.90	581.90	6.50	6.50	607.11	607.11	PWR/Bedrock	---
P-38	01/31/07	2	628.80	631.33	45.00	583.80	33.00	595.80	20.00	40.00	608.80	588.80	19.74	19.74	611.59	611.59	PWR/Bedrock	---
B-1	03/24/97	---	589.00	---	18.90	570.10	>18.9	<570.10	---	---	---	---	na	na	na	na	---	Abandoned
B-2	04/01/97	---	622.00	---	18.90	603.10	>18.9	<603.10	---	---	---	---	na	na	na	na	---	Abandoned
B-3	03/27/97	---	628.00	---	19.00	609.00	>19.0	<609.00	---	---	---	---	na	na	na	na	---	Abandoned
B-4	04/01/97	---	608.00	---	10.50	597.50	10.50	597.50	---	---	---	---	na	na	na	na	---	Abandoned
B-4A	04/01/97	---	---	---	10.00	---	10.00	---	---	---	---	---	na	na	na	na	---	Abandoned
B-5	03/27/97	---	615.00	---	18.60	596.40	>18.6	<596.40	---	---	---	---	na	na	na	na	---	Abandoned
C-1	07/29/97	---	579.00	---	55.40	523.60	45.40	533.60	---	---	---	---	na	na	na	na	---	Abandoned
C-2	07/29/97	---	616.00	---	48.50	567.50	38.50	577.50	---	---	---	---	na	na	na	na	---	Abandoned
C-3	08/01/97	---	604.00	---	23.10	580.90	13.10	590.90	---	---	---	---	na	na	na	na	---	Abandoned
TW-1	06/12/98	2	578.00	---	22.60	555.40	13.20	564.80	17.60	22.60	560.40	555.40	na	na	na	na	Bedrock	Abandoned
TW-2	07/29/98	2	609.00	---	29.50	579.50	8.50	600.50	14.50	29.50	594.50	579.50	na	na	na	na	Bedrock	Abandoned
WW-1	na	24	622.83	625.20	23.00	599.83	>23	<599.83	na	na	na	na	18.35	8.80	---	---	Saprolite	---

NOTES:

1. All elevations are referenced to mean sea level (MSL.); depths are referenced to below ground surface (BGS) or top of casing (TOC).
2. na = data not available or not applicable
3. The installation date and details for well WW-1 are unknown.
4. Well MW-5 and piezometers P-15, P-16, P-17, P-18, P-19S, P-19D, P-20, P-21, P-22, and P-23 were installed by Joyce Engineering, Inc. in January 2002.
5. Monitoring well MW-7 was installed by Joyce Engineering, Inc.on December 19, 2002.
6. Wells MW-8, MW-9, MW-10S, MW-10D and piezometers P-24, P-25, and P-26 were installed by by Joyce Engineering, Inc. in March 2005.
7. Piezometers P-27, P-28, P-29, and P-30 were installed using hand-augers by Joyce Engineering, Inc. on April 4, 2005.
8. Wells MW-1, MW-2, MW-3, MW-4, MW-6 (P-3) and piezometers P-4, P-5, P-6, and P-7 were installed by Trigon Engineering Consultants, Inc. between March and August 1997.
9. Piezometers P-2, P-2A, P-3 (now MW-6), P-4, P-5, P-6, and P-7 were installed using an air-hammer by Trigon Engineering Consultants in 1997, so depth to bedrock is not based on auger refusal.
11. No boring logs are available for Piezometers P-2, P-2A, P-3 (now MW-6), P-4, P-5, P-6, and P-7. Depth to Bedrock was reported by Trigon in their 1997 report.
12. No survey information is available for B-1, B-2, B-3, B-4, B-5, C-1, C-2, C-3, TW-1, and TW-2, so elevations are considered approximate.

* - See Text for explanation of bedrock depths in P-32 and P-33.

TABLE 2
Summary of Laboratory Soils Test Data
Coble's Sandrock Construction and Demolition Landfill

BORING NUMBER	HYDROGEOLOGIC UNIT	SAMPLE DEPTH (feet)	SAMPLE TYPE	USCS CLASSIFICATION	USCS SYMBOL	NATURAL MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY	GRADATION RESULTS (% passing)												USDA SOIL CLASSIFICATION SYSTEM		ASTM SOIL CLASSIFICATION SYSTEM		WENTWORTH SOIL CLASSIFICATION SYSTEM		ATTERBERG LIMITS			POROSITY (percent)	EFFECTIVE POROSITY (percent)	PERMEABILITY (cm/sec)
									1'	3/4'	1/2'	3/8"	#4	#10	#20	#40	#60	#100	#140	#200	PERCENT SILT	PERCENT CLAY	PERCENT SILT	PERCENT CLAY	PERCENT SILT	PERCENT CLAY	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX			
B-1	Saprolite	0-7	Bag	Sandy Clayey Silt	ML	17.5	101.0	---	100	100	100	100	99	94	---	80	---	68	---	67	50.00	13.00	45.5	21.5	47	18	42	30	12	39.8	12	1.70E-07
B-1	Saprolite	0-10	---	Sandy Silt	ML	---	---	---	100	100	100	100	99	94	---	64	---	38	---	35	27.50	2.00	31	4	30	3	---	---	---	---	24	---
B-2	Saprolite	0-5	---	Sandy Silt	ML	---	---	---	100	100	100	100	100	99	---	75	---	44	---	42	36.50	1.00	40	2	38.5	2	---	---	---	---	26	---
B-3	Saprolite	0-15	---	Sandy Silt	ML	---	---	---	100	100	100	100	100	98	---	58	---	32	---	31	27.00	0.50	28	3	27.5	2	---	---	---	---	29	---
B-5	Saprolite	0-10	---	Sandy Silt	ML	---	---	---	100	100	100	100	100	96	---	71	---	49	---	47	34.00	8.00	36.5	10.5	35.5	9.5	---	---	---	---	20	---
MW-1	Saprolite	0-7	Bag	Sandy Silt	ML	27.3	101.4	---	100	100	100	100	100	96	---	85	---	49	---	47	27.50	9.50	36	11	33	10.5	49	40	9	38	20	---
MW-2	Saprolite	0-10	---	Sandy Silt	ML	27.3	---	---	100	100	100	100	100	99	---	75	---	49	---	48	30.50	11.00	35	13	32.5	12.5	---	---	---	---	18	---
MW-3	Saprolite	0-10	---	Sandy Silt	ML	---	---	---	100	100	100	100	99	92	---	46	---	22	---	21	16.50	1.00	19	2	18.5	1.5	---	---	---	32.6	33	---
MW-4	Saprolite	0-10	---	Sandy Silt	ML	---	---	---	100	100	100	100	100	92	---	51	---	29	---	28	20.50	2.00	24.5	3.5	22.5	3	---	---	---	---	30	---
MW-4	Saprolite	11-12.5	Undisturbed	Sandy Silt	ML	14.2	111.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	31	NP	NP	32.6	---	2.30E-05
UD-1	---	0.5-2.5	Undisturbed	---	---	31.6	85.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	49.9	---	5.10E-06
P-15	Saprolite	5-7	Split Spoon	Silty Clayey Sand	SC-SM	---	---	---	100	100	100	100.0	99.0	89.5	---	58.8	---	42.9	---	35.2	---	---	---	---	---	---	26	19	7	---	---	---
P-17	Saprolite	5-7	Split Spoon	Elastic Silt	MH	---	---	---	100	100	100	100.0	100.0	99.2	---	94.3	---	92.0	---	90.2	---	---	---	---	---	---	62	36	26	---	---	---
P-19S	Saprolite	4-6	Undisturbed	Silty Sand	SM	27.2	99.0	---	100	100	100	98.4	95.5	90.7	---	56.7	---	39.0	---	32.5	---	---	---	---	---	---	31	23	8	39.4	---	7.74E-08
P-20	Saprolite/PWR	20-22	Split Spoon	Silty Sand	SM	---	---	---	100	100	100	100.0	99.1	84.8	---	40.3	---	25.2	---	18.3	---	---	---	---	---	---	27	27	0	---	---	---
P-21	Saprolite	2-10	Bulk	Sandy Lean Clay	CL	---	108.4	---	100	100	100	100.0	100.0	97.0	---	89.0	---	83.7	---	78.4	---	---	---	---	---	---	42	24	18	35.4	---	8.76E-08
P-23	Saprolite	0-2	Split Spoon	Sandy Elastic Silt	MH	---	---	---	100	100	100	100.0	100.0	95.7	---	77.6	---	71.2	---	67.2	---	---	---	---	---	---	60	32	28	---	---	---
MW-8	Saprolite	2-6	Composite	Sandy Lean Clay	CL	---	---	---	100	100	100	100.0	99.3	98.3	---	90.3	---	---	---	65.1	30.72	32.46	26.27	38.87	27.55	36.24	44	18	26	---	3.2	---
MW-8	PWR	15-22	Composite	Clayey Sand	SC	---	---	---	100	100	100	100.0	99.1	93.1	---	59.8	---	---	---	27.3	21.65	3.73	21.19	6.07	20.54	5.09	35	19	16	---	28	---
P-24	Saprolite	5-12	Composite	Clayey Sand	SC	---	---	---	100	100	100	99.4	97.5	90.0	---	64.3	---	---	---	42.1	27.08	16.12	22.9	19.24	23.02	17.64	38	19	19	---	12	---
P-31	PWR	6	Split Spoon	Silty Sand	--/SM	3.8	---	2.73	100	100	100	100	94.9	72.5	48.5	34.9	28.1	---	19.6	16.9	---	---	---	---	---	---	NP	NP	NP	---	---	---
P-32	PWR	10	Split Spoon	Silty Sand	--/SM	6.3	---	2.76	100	100	100	100	98.3	91.4	78.3	67.9	58.8	---	47.6	43.8	---	---	---	---	---	---	NP	NP	NP	---	---	---
P-33	Saprolite/PWR	6	Split Spoon	Clayey Sand	CL/SC	9.9	---	---	100	100	100	100	99.6	89.8	71.2	56.0	45.2	---	33.5	30.1	22.84	7.18	---	---	---	---	31	19	12	---	---	---
P-34	Saprolite	10	Split Spoon	Elastic Silt w/ Sand	MH/MH	61.9	---	---	100	100	100	100	100	97.7	91.8	86.5	82.3	---	76.5	47.2	42.78	28.25	---	---	---	---	54	36	18	---	---	---
P-35	Saprolite	2-4	Undisturbed	Sandy Lean Clay	CL/CL	28.6	---	2.8	100	100	100	100	99.9	91.2	80.7	70.1	63.6	---	56.2	53.7	25.38	30.80	---	---	---	---	46	20	26	---	---	9.20E-07
P-36	Saprolite/PWR	5	Split Spoon	Silty Sand	ML/SM	7.7	---	2.71	100	100	100	99.5	95.9	79.4	56.9	43.5	36.3	---	26.8	23.5			---	---	---	---	30	25	5	---	---	---
P-37	Saprolite	2-4	Undisturbed	Clayey Sand	CL/SC	19.2	---	---	100	100	100	99.7	99.0	93.4	79.9	65.9	54.6	---	41.1	37.3	20.65	17.09	---	---	---	---	49	22	27	---	---	1.60E-04
P-38	Saprolite	10	Split Spoon	Clayey Sand	CL/SC	13.8	---	---	100	100	100	100	95.5	76.0	57.4	45.4	38.1	---	29.8	27.0	21.63	9.91	---	---	---	---	41	22	19	---	---	---
P-38	PWR	25	Split Spoon	Clayey Sand	CL/SC	9.9	---	---	100	100	95.5	92.9	87.7	80.7	65.5	54.2	46.5	---	37.5	34.3	---	---	---	---	---	---	47	16	28	---	---	---

NOTES:

1. na = not applicable
2. NP = non-plastic
3. --- = no data available
4. Soils analysis performed by Trigon Engineering Consultants, Inc. and Geotechnics
5. NP = Non-Plastic material; therefore, Atterberg Limits not available.
6. The USDA Soil Classification System sets a grain size boundary for sand and silt at 0.05 mm and for silt and clay at 0.002 mm.
7. The ASTM Soil Classification System sets a grain size boundary for sand and silt at 0.075 mm and for silt and clay at 0.005 mm.
8. The Wentworth Soil Classification System sets a grain size boundary for sand and silt at 0.0625 mm and for silt and clay at 0.0039 mm.
9. The grain size distribution from the Wentworth Soil Classification System was plotted on the Textural Classification Triangle developed by A.I. Johnson (1967) to determine specific yield, which is considered approximately equivalent to effective porosity, and recorded on the table above.
10. Effective porosity values were calculated assuming that all material greater than 0.0625 mm is sand size. There is a minor amount of material larger than sand in each sample provided.
11. The porosity values provided are an average of "Before Test" and "After Test" porosity values provided on the porosity data sheets in Appendix DH-9.

For P-31 through P-38:
1st USCS Symbol from Atterberg Limits Pages
2nd USCS Symbol & Classification from Sieve Analysis

Joyce Engineering, Inc.
September 2007

TABLE 3
Summary of Slug Test Data
Coble's Sandrock C and D Landfill

Table 2a. Saprolite and Partially Weathered Rock (PWR) Wells

WELL AND PIEZOMETER IDENTIFICATION	SATURATED AQUIFER THICKNESS VALUE (feet)	SCREEN LENGTH (feet)	WELL DIAMETER (inches)	SLUG TEST TYPE	HYDRAULIC CONDUCTIVITY K (cm/s)	SCREENED LITHOLOGY
MW-1	---	15	2	Rising	1.85E-04	Saprolite/PWR
MW-2	---	15	2	Rising	1.66E-04	Saprolite/PWR
MW-4	---	15	2	Rising	7.60E-04	Saprolite/PWR
MW-5	9.45	10	2	Rising	3.53E-05	Saprolite/PWR
MW-9	15.86	15	2	Falling	1.11E-04	PWR
MW-9	15.86	15	2	Rising	9.18E-05	PWR
P-18	9.81	15	2	Rising	7.45E-05	PWR
P-19S	7.61	6	2	Falling	1.27E-04	Saprolite
P-19S	7.61	6	2	Rising	1.61E-04	Saprolite
P-20	27.91	15	2	Falling	8.60E-05	PWR
P-20	27.91	15	2	Rising	9.64E-05	PWR
P-22	8.32	6	2	Falling	6.02E-05	Saprolite/PWR
P-22	8.32	6	2	Rising	2.66E-05	Saprolite/PWR
P-34	22.87	15	2	Falling	1.98E-04	Saprolite
P-34	22.87	15	2	Rising	1.60E-04	Saprolite
P-38	23.87	20	2	Falling	1.77E-05	PWR
				Geometric Mean:	**9.97E-05**	**cm/sec**
				Arithmetic Mean:	**1.47E-04**	**cm/sec**
				Std. Dev.	**1.73E-04**	**cm/sec**

Table 2b. Bedrock Wells

WELL AND PIEZOMETER IDENTIFICATION	SATURATED AQUIFER THICKNESS VALUE (feet)	SCREEN LENGTH (feet)	WELL DIAMETER (inches)	SLUG TEST TYPE	HYDRAULIC CONDUCTIVITY K (cm/s)	SCREENED LITHOLOGY
TW-1	---	5	2	Rising	1.27E-04	Bedrock
TW-2	---	15	2	Rising	1.40E-04	Bedrock
P-16	50	15	2	Falling	6.92E-06	Bedrock
P-16	50	15	2	Rising	1.88E-06	Bedrock
P-17	50	15	2	Falling	8.25E-04	Saprolite/Bedrock
P-17	50	15	2	Rising	3.17E-04	Saprolite/Bedrock
P-19D	50	15	2	Falling	1.49E-05	Bedrock
P-19D	50	15	2	Rising	2.16E-06	Bedrock
P-21	50	15	2	Falling	2.82E-05	Bedrock
P-21	50	15	2	Rising	1.58E-05	Bedrock
P-25	50	10	2	Rising	2.43E-04	Bedrock
P-32	19.01	17.51	2	Rising	2.55E-06	Bedrock
P-33	14.76	12.26	2	Rising	2.10E-05	PWR/Bedrock
P-35	23.58	20	2	Falling	5.95E-05	PWR/Bedrock
P-35	23.58	20	2	Rising	5.99E-05	PWR/Bedrock
P-36	30.02	20	2	Falling	7.35E-04	PWR/Bedrock
P-36	30.02	20	2	Rising	8.86E-04	PWR/Bedrock
P-37	26.15	20	2	Falling	1.10E-04	PWR/Bedrock
P-37	26.15	20	2	Rising	1.11E-04	PWR/Bedrock
				Geometric Mean:	**5.14E-05**	**cm/sec**
				Arithmetic Mean:	**1.95E-04**	**cm/sec**
				Std. Dev.	**2.90E-04**	**cm/sec**

Geometric Mean of all Tests:	**6.96E-05**	**cm/sec**

NOTES:

1. --- = data not available
2. Aquifer analysis for MW-1, -2, and -4 were performed by Trigon Engineering Consultants, Inc. on May 14, 1998.
3. Aquifer analysis for TW-1and TW-2 were performed by Trigon Engineering Consultants, Inc. on June 23, 1998.
4. Aquifer analysis for MW-5, P-16, -17, -19S, -19D, -21, and -22were performed by Joyce Engineering, Inc. between February 5-18, 2002.
5. Aquifer analysis for MW-9, P-18 and P-25 were performed by Joyce Engineering, Inc. on September 16, 2005.
6. Aquifer analysis for P-20, P-31, P-32, P-33, P-34, P-35, P-36, & P-37 were performed by Joyce Engineering, Inc. on February 12-14, 2007.
7. Results for P-31 were unusable due to non-linear recovery.

TABLE 4
Summary of Rock Core Data
Coble's Sandrock Construction and Demolition Landfill

BORING LOCATION	CORED INTERVAL (feet)	% RECOVERY	% RQD	ROCK TYPE	COMMENTS
C-1	45.4-50.4	91	61	Granite	C-1, C-2 and C-3 were cored in July and August 1997 by Trigon Engineering Consultants, Inc. using an NQ wire-line rock coring device on a Mobil B-61 rig.
	50.4-55.4	100	100	Granite	
C-2	38.5-43.5	98	86	Granite	
	43.5-48.5	100	90	Granite	
C-3	13.1-18.1	98	85	Granite	
	18.1-23.1	100	90	Granite	
TW-1	13.2-17.5	85	---	Granite	TW-1 and TW-2 were cored between June and July 1998 by Trigon Engineering Consultants, Inc.
	17.5-22.6	80	86	Granite	
TW-2	8.5-13.5	93	90	Meta-volcanic	
	13.5-18.5	97	100	Meta-volcanic	
	18.5-23.5	84	98	Meta-volcanic	
	23.5-28.5	100	100	Meta-volcanic	
P-21	44-50	82	38	Granite	P-21 was cored in February 2002 by Bedford Well Drilling, Inc. using an NQ wire-line rock coring device on a Ingersoll-Rand A-300 rig.
P-26	25-30	85	28	Granite	
	30-35	70	36	Granite	
	35-40	38	0	Meta-volcanic	P-26 was cored in March 2005 by SAEDACCO using an NQ rock coring device on a Gus Pech GP-1100E rig.
	40-45	94	62	Granite	
	45-48.5	95	43	Granite	
P-32	16-21	7	0	Granite	P-32 and P-37 were cored in January-February 2007 by SAEDACCO using an NQ rock coring device on a Gus Pech GP-1100E rig.
	21-26	85	38	Granite	
	26-31	95	70	Granite	
P-37	16-21	95	86	Granite	
	21-26	94	82	Granite	
	26-31	43	80	Granite	

NOTES: RQD = Rock Quality Designator.

TABLE 5a
Summary of Depth to Groundwater Data
Coble's Sandrock C and D Landfill

Well / Piezometer	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10S	MW-10D	WW-1	P-4	P-5	P-6	P-7	P-8
TOC Elevation	602.46	582.31	613.05	582.64	577.41	652.56	583.33	574.26	589.09	592.46	592.76	625.20	631.88	610.99	606.06	621.51	477.45
Initial	---	---	---	---	12.38	---	6.85	11.43	38.38	11.45	26.45	na	---	---	---	---	---
24 hr *	---	---	---	---	---	---	na	5.91	21.91	8.38	6.60	na	---	---	---	---	---
7 day *	---	---	---	---	6.65	---	na	4.15	18.62	6.83	6.81	na	---	---	---	---	---
4/20/2000	32.87	12.50	33.14	13.57	---	N/A	---	---	---	---	---	---	23.26	6.60	21.93	23.00	9.38
8/15/2000	34.25	15.34	34.82	14.56	---	25.14	---	---	---	---	---	---	---	9.04	25.78	24.09	10.91
10/15/2000	33.16	13.76	34.80	13.83	---	N/A	---	---	---	---	---	---	26.84	8.05	24.90	23.39	10.03
11/30/2000	34.37	15.44	35.58	15.60	---	25.26	---	---	---	---	---	---	28.55	9.98	27.75	25.10	10.90
4/10/2001	30.98	12.59	34.38	13.58	---	25.39	---	---	---	---	---	---	23.93	6.97	21.27	22.93	9.36
12/11/2001	35.18	17.00	37.15	16.43	---	30.78	---	---	---	---	---	---	29.69	10.53	28.84	25.93	10.86
2/1/2002	---	---	---	---	6.93	---	---	---	---	---	---	---	---	---	---	---	---
2/5/2002	---	---	---	---	7.38	---	---	---	---	---	---	---	---	---	---	---	---
2/13/2002	---	---	---	---	7.75	---	---	---	---	---	---	---	---	---	---	---	---
2/18/2002	---	---	---	---	7.94	---	---	---	---	---	---	---	---	---	---	---	---
3/6/2002	---	---	---	---	7.67	---	---	---	---	---	---	---	---	---	---	---	---
3/22/2002	---	---	---	---	7.38	---	---	---	---	---	---	---	---	---	---	---	---
4/2/2002	---	---	---	---	7.42	---	---	---	---	---	---	---	---	---	---	---	---
4/30/2002	34.29	14.47	36.96	14.43	8.09	28.62	---	---	---	---	---	---	28.04	9.09	27.32	24.15	10.77
5/20/2002	---	---	---	---	8.35	---	---	---	---	---	---	---	---	---	---	---	---
6/25/2002	---	---	---	---	9.52	---	---	---	---	---	---	---	---	---	---	---	---
7/29/2002	---	---	---	---	8.46	---	---	---	---	---	---	---	---	---	---	---	---
8/23/2002	---	---	---	---	9.34	---	---	---	---	---	---	---	---	---	---	---	---
10/4/2002	---	---	---	---	8.23	---	---	---	---	---	---	---	---	---	---	---	---
11/21/2002	31.86	11.95	34.58	12.90	6.96	26.24	---	---	---	---	---	---	24.54	5.73	20.32	22.06	9.32
12/19/2002	---	---	---	---	7.08	---	6.85	---	---	---	---	---	---	---	---	---	---
4/29/2003	30.80	13.13	33.35	13.80	7.09	19.16	8.95	---	---	---	---	---	24.73	7.25	---	---	9.58
7/10/2003	---	---	---	---	7.02	---	8.79	---	---	---	---	---	---	---	---	---	---
11/11/2003	33.97	14.93	34.51	15.17	7.82	20.03	10.89	---	---	---	---	---	26.64	7.96	---	---	9.97
4/20/2004	33.92	13.87	34.13	14.81	7.55	22.43	9.70	---	---	---	---	---	24.84	7.58	---	---	9.71
10/19/2004	34.60	14.39	35.44	14.73	7.11	23.96	10.03	---	---	---	---	---	26.75	7.50	---	---	9.96
4/4/2005	---	---	---	---	6.49	---	8.00	5.42	19.38	7.91	6.81	8.80	---	---	---	---	---
4/19/2005	33.56	13.62	34.51	14.48	6.65	21.91	8.79	6.02	19.56	8.12	7.03	13.85	23.45	4.79	---	---	9.64
8/2/2005	---	---	---	---	7.34	---	10.72	6.29	20.85	8.12	8.51	16.37	---	---	---	---	---
10/20/2005	35.30	16.79	36.72	16.21	8.29	26.91	12.09	---	---	---	---	---	28.48	8.43	---	---	11.94
4/27/2006	34.62	12.95	---	13.30	---	28.10	10.56	---	---	---	---	---	27.55	7.11	---	---	9.61
10/11/2006	34.55	15.09	35.46	14.35	7.30	28.11	11.56	7.23	21.17	8.51	9.14	---	---	---	---	---	---
3/6/2007	32.50	12.64	33.44	13.62	6.28	19.30	8.60	5.48	19.60	7.80	7.70	---	24.34	4.80	---	---	9.68

Well / Piezometer	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16	P-17	P-18	P-19S	P-19D	P-20	P-21	P-22	P-23
TOC Elevation	477.90	476.05	481.92	---	625.50	625.50	651.22	612.05	646.28	651.76	572.18	571.85	641.11	668.42	629.90	640.37
Initial	---	---	---	---	---	---	50.60	30.90	19.82	32.66	5.52	Dry	26.40	64.56	3.97	35.71
24 hr *	---	---	---	---	---	---	41.08	na	na	25.12	5.08	42.04	12.93	48.50	3.44	31.04
7 day *	---	---	---	---	---	---	40.62	12.63	19.26	24.78	5.39	5.59	12.99	48.43	2.86	30.60
4/20/2000	10.91	5.45	8.93	N/I	N/I	N/I	---	---	---	---	---	---	---	---	---	---
8/15/2000	12.01	8.62	10.82	N/I	N/I	N/I	---	---	---	---	---	---	---	---	---	---
10/15/2000	11.32	7.07	8.56	4.93	12.34	DRY	---	---	---	---	---	---	---	---	---	---
11/30/2000	11.85	8.79	9.89	5.73	11.40	DRY	---	---	---	---	---	---	---	---	---	---
4/10/2001	10.72	5.45	8.52	---	9.49	DRY	---	---	---	---	---	---	---	---	---	---
12/11/2001	12.42	10.03	9.27	---	13.91	DRY	---	---	---	---	---	---	---	---	---	---
2/1/2002	---	---	---	---	---	---	40.82	12.73	17.99	24.78	5.08	42.04	12.62	48.38	2.75	30.25
2/5/2002	---	---	---	---	---	---	40.94	13.71	17.88	24.82	5.37	5.59	12.99	48.43	3.18	30.31
2/13/2002	---	---	---	---	---	---	40.96	12.65	17.45	24.27	5.23	4.88	12.14	48.11	3.13	30.10
2/18/2002	---	---	---	---	---	---	40.98	13.86	17.26	24.12	5.39	5.04	11.99	48.07	3.79	30.13
3/6/2002	---	---	---	---	---	---	41.03	12.57	16.99	24.35	5.15	4.78	12.38	48.07	3.55	30.16
3/22/2002	---	---	---	---	---	---	41.07	11.69	16.18	23.89	4.91	4.51	11.44	48.15	3.43	29.96
4/2/2002	---	---	---	---	---	---	40.69	11.61	15.48	23.82	4.97	4.64	10.70	48.03	3.58	29.66
4/30/2002	12.02	8.03	10.62	---	12.57	DRY	40.63	15.70	15.40	24.23	5.74	5.43	11.76	47.90	8.39	30.03
5/20/2002	---	---	---	---	---	---	40.75	16.48	16.02	24.49	6.09	5.79	12.86	47.97	9.64	30.42
6/25/2002	---	---	---	---	---	---	41.12	17.13	18.24	25.16	7.80	7.26	14.24	48.61	10.72	31.13
7/29/2002	---	---	---	---	---	---	41.43	17.22	19.88	25.69	6.07	6.09	15.29	49.50	4.43	31.36
8/23/2002	---	---	---	---	---	---	41.65	17.88	20.42	26.09	7.70	7.48	15.94	49.26	11.29	31.62
10/4/2002	---	---	---	---	---	---	41.85	16.64	19.97	25.88	6.25	6.17	15.69	49.41	4.49	31.31
11/21/2002	10.71	5.75	8.46	---	8.34	18.59	40.20	7.73	14.51	23.57	4.53	3.41	9.61	47.36	2.60	27.73
12/19/2002	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4/29/2003	11.20	5.91	9.48	---	9.84	DRY	37.06	11.71	6.81	21.95	4.77	4.47	7.42	40.98	2.83	22.87
7/10/2003	---	---	---	---	---	---	36.31	11.92	6.99	---	4.87	4.61	4.27	39.12	2.26	22.22
11/11/2003	11.66	---	10.34	---	10.39	DRY	36.17	14.42	10.10	21.03	5.40	4.84	5.04	38.42	2.85	24.40
4/20/2004	11.58	---	9.51	---	9.82	DRY	35.92	11.12	6.68	20.25	5.14	4.66	5.94	40.84	3.58	25.00
10/19/2004	11.68	---	10.40	---	10.29	DRY	37.18	13.44	7.02	---	5.03	4.71	7.02	42.51	3.74	26.22
4/4/2005	---	---	---	---	---	---	36.24	7.10	4.79	19.27	4.91	4.17	6.81	40.67	2.50	23.72
4/19/2005	11.31	---	9.83	---	7.59	DRY	36.00	8.93	5.45	18.67	4.99	4.40	6.38	40.29	3.27	---
8/2/2005	---	---	---	---	---	---	36.95	13.70	12.95	20.97	5.37	5.15	9.42	43.07	3.07	27.41
10/20/2005	12.80	---	---	---	---	---	38.05	14.99	15.46	22.26	6.52	6.40	12.22	45.27	5.55	29.21
4/27/2006	---	---	---	---	---	---	38.90	13.20	13.37	23.65	4.08	4.30	12.17	46.75	3.15	---
10/11/2006	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
3/6/2007	11.12	---	---	---	---	---	---	8.20	9.64	23.58	5.00	4.02	6.32	42.50	2.66	26.88

Well / Piezometer	P-24	P-25	P-26	P-27	P-28	P-29	P-30	P-31	P-32	P-33	P-34	P-35	P-36	P-37	P-38
TOC Elevation	613.89	617.81	597.13	627.45	613.15	619.49	637.49	608.56	600.35	597.68	629.73	616.33	624.84	613.61	631.33
Initial	26.76	20.70	Dry	5.95	3.28	4.27	3.13	dry	30.10	25.30	---	---	9.00	---	---
24 hr *	26.44	20.13						21.61	26.56	25.07	8.42	9.50	---	---	22.40
7 day *	26.04	19.59	26.71					21.45	25.00	24.98	7.16	11.12	4.91	8.09	---
4/4/2005	26.04	19.59	26.71	5.95	3.28	4.27	3.13	---	---	---	---	---	---	---	---
4/19/2005	26.37	20.01	26.99	2.45	3.52	2.67	3.18	---	---	---	---	---	---	---	---
8/2/2005	29.06	21.85	28.84	5.40	3.54	2.70	dry	---	---	---	---	---	---	---	---
10/20/2005	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4/27/2006	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
10/11/2006	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
3/6/2007	---	21.28	---	---	---	---	---	21.56	24.30	24.10	6.92	9.94	4.66	6.50	19.74

All values represent depth to static groundwater level measured in feet below top of casing (TOC).

TOC Elevation is in feet above mean sea level.

* 24-hour and 7-day water levels are not all exactly 24-hours or 7-days after well installation, data presented here are the closest data available.

TABLE 5b
Summary of Groundwater Elevation Data
Coble's Sandrock C and D Landfill

Well / Piezometer	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10S	MW-10D	WW-1	P-4	P-5	P-6	P-7	P-8
TOC Elevation	602.46	582.31	613.05	582.64	577.41	652.56	583.33	574.26	589.09	592.46	592.76	625.20	631.88	610.99	606.06	621.51	477.45
Initial	---	---	---	---	565.03	---	576.48	562.83	550.71	581.01	566.31	---	---	---	---	---	---
24 hr	---	---	---	---	---	---	---	568.35	567.18	584.08	586.16	---	---	---	---	---	---
7 day	---	---	---	---	570.76	---	---	570.11	570.47	585.63	585.95	---	---	---	---	---	---
4/20/2000	569.59	569.81	579.91	569.07	---	---	---	---	---	---	---	---	608.62	604.39	584.13	598.51	468.07
8/15/2000	568.21	566.97	578.23	568.08	---	627.42	---	---	---	---	---	---	---	601.95	580.28	597.42	466.54
10/15/2000	569.30	568.55	578.25	568.81	---	---	---	---	---	---	---	---	605.04	602.94	581.16	598.12	467.42
11/30/2000	568.09	566.87	577.47	567.04	---	627.30	---	---	---	---	---	---	603.33	601.01	578.31	596.41	466.55
4/10/2001	571.48	569.72	578.67	569.06	---	627.17	---	---	---	---	---	---	607.95	604.02	584.79	598.58	468.09
12/11/2001	567.28	565.31	575.90	566.21	---	621.78	---	---	---	---	---	---	602.19	600.46	577.22	595.58	466.59
2/1/2002	---	---	---	---	570.48	---	---	---	---	---	---	---	---	---	---	---	---
2/5/2002	---	---	---	---	570.03	---	---	---	---	---	---	---	---	---	---	---	---
2/13/2002	---	---	---	---	569.66	---	---	---	---	---	---	---	---	---	---	---	---
2/18/2002	---	---	---	---	569.47	---	---	---	---	---	---	---	---	---	---	---	---
3/6/2002	---	---	---	---	569.74	---	---	---	---	---	---	---	---	---	---	---	---
3/22/2002	---	---	---	---	570.03	---	---	---	---	---	---	---	---	---	---	---	---
4/2/2002	---	---	---	---	569.99	---	---	---	---	---	---	---	---	---	---	---	---
4/30/2002	568.17	567.84	576.09	568.21	569.32	623.94	---	---	---	---	---	---	603.84	601.90	578.74	597.36	466.68
5/20/2002	---	---	---	---	569.06	---	---	---	---	---	---	---	---	---	---	---	---
6/25/2002	---	---	---	---	567.89	---	---	---	---	---	---	---	---	---	---	---	---
7/29/2002	---	---	---	---	568.95	---	---	---	---	---	---	---	---	---	---	---	---
8/23/2002	---	---	---	---	568.07	---	---	---	---	---	---	---	---	---	---	---	---
10/4/2002	---	---	---	---	569.18	---	---	---	---	---	---	---	---	---	---	---	---
11/21/2002	570.60	570.36	578.47	569.74	570.45	626.32	---	---	---	---	---	---	607.34	605.26	585.74	599.45	468.13
12/19/2002	---	---	---	---	570.33	---	576.48	---	---	---	---	---	---	---	---	---	---
4/29/2003	571.66	569.18	579.70	568.84	570.32	633.40	574.38	---	---	---	---	---	607.15	603.74	---	---	467.87
7/10/2003	---	---	---	---	570.39	---	574.54	---	---	---	---	---	---	---	---	---	---
11/11/2003	568.49	567.38	578.54	567.47	569.59	632.53	572.44	---	---	---	---	---	605.24	603.03	---	---	467.48
4/20/2004	568.54	568.44	578.92	567.83	569.86	630.13	573.63	---	---	---	---	---	607.04	603.41	---	---	467.74
10/19/2004	567.86	567.92	577.61	567.91	570.30	628.60	573.30	---	---	---	---	---	605.13	603.49	---	---	467.49
4/4/2005	---	---	---	---	570.92	---	575.33	568.84	569.71	584.55	585.95	616.40	---	---	---	---	---
4/19/2005	568.90	568.69	578.54	568.16	570.76	630.65	574.54	568.24	569.53	584.34	585.73	611.35	608.43	606.20	---	---	467.81
8/2/2005	---	---	---	---	570.07	---	572.61	567.97	568.24	584.34	584.25	608.83	---	---	---	---	---
10/20/2005	567.16	565.52	576.33	566.43	569.12	625.65	571.24	---	---	---	---	---	603.40	602.56	---	---	465.51
4/27/2006	567.84	569.36	---	569.34	---	624.46	572.77	---	---	---	---	---	604.33	603.88	---	---	467.84
10/11/2006	567.91	567.22	577.59	568.29	570.11	624.45	571.77	567.03	567.92	583.95	583.62	---	---	---	---	---	
3/6/2007	569.96	569.67	579.61	569.02	571.13	633.26	574.73	568.78	569.49	584.66	585.06	---	607.54	606.19	---	---	467.77

Well / Piezometer	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16	P-17	P-18	P-19S	P-19D	P-20	P-21	P-22	P-23
TOC Elevation	477.90	476.05	481.92	---	625.50	625.50	651.22	612.05	646.28	651.76	572.18	571.85	641.11	668.42	629.90	640.37
Initial	---	---	---	---	---	---	600.62	581.15	626.46	619.10	566.66	Dry	614.71	603.86	625.93	604.66
24 hr	---	---	---	---	---	---	610.14			626.64	567.10	529.81	628.18	619.92	626.46	609.33
7 day	---	---	---	---	---	---	610.60	599.42	627.02	626.98	566.79	566.26	628.12	619.99	627.04	609.77
4/20/2000	466.99	470.60	472.99	---	---	---	---	---	---	---	---	---	---	---	---	---
8/15/2000	465.89	467.43	471.10	---	---	---	---	---	---	---	---	---	---	---	---	---
10/15/2000	466.58	468.98	473.36	---	613.16	---	---	---	---	---	---	---	---	---	---	---
11/30/2000	466.05	467.26	472.03	---	614.10	---	---	---	---	---	---	---	---	---	---	---
4/10/2001	467.18	470.60	473.40	---	616.01	---	---	---	---	---	---	---	---	---	---	---
12/11/2001	465.48	466.02	472.65	---	611.59	---	---	---	---	---	---	---	---	---	---	---
2/1/2002	---	---	---	---	---	---	610.40	599.32	628.29	626.98	567.10	529.81	628.49	620.04	627.15	610.12
2/5/2002	---	---	---	---	---	---	610.28	598.34	628.40	626.94	566.81	566.26	628.12	619.99	626.72	610.06
2/13/2002	---	---	---	---	---	---	610.26	599.40	628.83	627.49	566.95	566.97	628.97	620.31	626.77	610.27
2/18/2002	---	---	---	---	---	---	610.24	598.19	629.02	627.64	566.79	566.81	629.12	620.35	626.11	610.24
3/6/2002	---	---	---	---	---	---	610.19	599.48	629.29	627.41	567.03	567.07	628.73	620.35	626.35	610.21
3/22/2002	---	---	---	---	---	---	610.15	600.36	630.10	627.87	567.27	567.34	629.67	620.27	626.47	610.41
4/2/2002	---	---	---	---	---	---	610.53	600.44	630.80	627.94	567.21	567.21	630.41	620.39	626.32	610.71
4/30/2002	465.88	468.02	471.30	---	612.93	---	610.59	596.35	630.88	627.53	566.44	566.42	629.35	620.52	621.51	610.34
5/20/2002	---	---	---	---	---	---	610.47	595.57	630.26	627.27	566.09	566.06	628.25	620.45	620.26	609.95
6/25/2002	---	---	---	---	---	---	610.10	594.92	628.04	626.60	564.38	564.59	626.87	619.81	619.18	609.24
7/29/2002	---	---	---	---	---	---	609.79	594.83	626.40	626.07	566.11	565.76	625.82	618.92	625.47	609.01
8/23/2002	---	---	---	---	---	---	609.57	594.17	625.86	625.67	564.48	564.37	625.17	619.16	618.61	608.75
10/4/2002	---	---	---	---	---	---	609.37	595.41	626.31	625.88	565.93	565.68	625.42	619.01	625.41	609.06
11/21/2002	467.19	470.30	473.46	---	617.16	606.91	611.02	604.32	631.77	628.19	567.65	568.44	631.50	621.06	627.30	612.64
12/19/2002	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4/29/2003	466.70	470.14	472.44	---	615.66	---	614.16	600.34	639.47	629.81	567.41	567.38	633.69	627.44	627.07	617.50
7/10/2003	---	---	---	---	---	---	614.91	600.13	639.29		567.31	567.24	636.84	629.30	627.64	618.15
11/11/2003	466.24	---	471.58	---	615.11	---	615.05	597.63	636.18	630.73	566.78	567.01	636.07	630.00	627.05	615.97
4/20/2004	466.32	---	472.41	---	615.68	---	615.30	600.93	639.60	631.51	567.04	567.19	635.17	627.58	626.32	615.37
10/19/2004	466.22	---	471.52	---	615.21	---	614.04	598.61	639.26	---	567.15	567.14	634.09	625.91	626.16	614.15
4/4/2005	---	---	---	---	---	---	614.98	604.95	641.49	632.49	567.27	567.68	634.30	627.75	627.40	616.65
4/19/2005	466.59	---	472.09	---	617.91	---	615.22	603.12	640.83	633.09	567.19	567.45	634.73	628.13	626.63	---
8/2/2005	---	---	---	---	---	---	614.27	598.35	633.33	630.79	566.81	566.70	631.69	625.35	626.83	612.96
10/20/2005	465.10	---	---	---	---	---	613.17	597.06	630.82	629.50	565.66	565.45	628.89	623.15	624.35	611.16
4/27/2006	---	---	---	---	---	---	612.32	598.85	632.91	628.11	568.10	567.55	628.94	621.67	626.75	---
10/11/2006	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
3/6/2007	466.78	---	---	---	---	---	---	603.85	636.64	628.18	567.18	567.83	634.79	625.92	627.24	613.49

Well / Piezometer	P-24	P-25	P-26	P-27	P-28	P-29	P-30	P-31	P-32	P-33	P-34	P-35	P-36	P-37	P-38
TOC Elevation	613.89	617.81	597.13	627.45	613.15	619.49	637.49	608.56	600.35	597.68	629.73	616.33	624.84	613.61	631.33
Initial	587.13	597.11	Dry	621.50	609.87	615.22	634.36	Dry	570.25	572.38			615.84		
24 hr	587.45	597.68	---	---	---	---	---	586.95	573.79	572.61	621.31	606.83			608.93
7 day	587.85	598.22	570.42	---	---	---	---	587.11	575.35	572.70	622.57	605.21	619.93	605.52	
4/4/2005	587.85	598.22	570.42	621.50	609.87	615.22	634.36	---	---	---	---	---	---	---	---
4/19/2005	587.52	597.80	570.14	625.00	609.63	616.82	634.31	---	---	---	---	---	---	---	---
8/2/2005	584.83	595.96	568.29	622.05	609.61	616.79	---	---	---	---	---	---	---	---	---
10/20/2005	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4/27/2006	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
10/11/2006	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
3/6/2007	---	596.53	---	---	---	---	---	587.00	576.05	573.58	622.81	606.39	620.18	607.11	611.59

All values represent elevation of static groundwater level measured in feet above mean sea level.

* 24-hour and 7-day water levels are not all exactly 24-hours or 7-days after well installation, data presented here are the closest data available.

TABLE 6
Summary of Estimated Long-Term Seasonal High Groundwater Elevations
Coble's Sandrock C and D Landfill

Piezometer or Well ID	Ground Surface Elevation	Maximum Groundwater Elevation	08/02/05 Groundwater Elevations	Seasonal High Adjustment for 08/02/05 Levels	08/02/05 Groundwater Elevation + Seasonal High Adjustment	03/07/07 Groundwater Elevations	Seasonal High Adjustment for 03/06/07 Levels	03/06/07 Groundwater Elevation + Seasonal High Adjustment	Estimated Seasonal High Groundwater Elevation
MW-1	600.26	571.48	567.85	2.25	570.10	569.96	---	---	571.48
MW-2	580.31	570.36	566.91	2.25	569.16	569.67	---	---	570.36
MW-3	610.23	580.30	578.60	3.25	581.85	579.61	---	---	581.85
MW-4	580.64	569.74	567.69	2.25	569.94	569.02	---	---	569.94
MW-5	575.21	570.92	570.07	2.25	572.32	571.13	---	---	572.32
MW-6	652.86	634.57	627.69	3.25	630.94	633.26	---	---	634.57
MW-7	580.83	576.48	572.61	2.25	574.86	574.73	---	---	576.48
MW-8	571.50	568.84	567.97	2.25	570.22	568.78	---	---	570.22
MW-9	586.43	569.71	568.24	2.25	570.49	569.49	---	---	570.49
MW-10D	589.90	585.95	584.25	3.25	587.50	584.66	---	---	587.50
MW-10S	589.62	584.55	584.34	3.25	587.59	585.06	---	---	587.59
P-4	628.56	609.56	604.66	3.25	607.91	607.54	---	---	609.56
P-5	611.26	607.91	605.55	3.25	608.80	606.19	---	---	608.80
P-6	602.93	586.93	586.93	3.25	590.18	---	---	---	590.18
P-7	617.90	599.45	599.42	3.25	602.67	---	---	---	602.67
P-15	649.07	615.30	614.27	3.25	617.52	---	---	---	617.52
P-16	609.85	604.95	598.35	3.25	601.60	603.85	---	---	604.95
P-17	643.78	641.49	633.33	2.25	635.58	636.64	---	---	641.49
P-18	652.16	633.09	630.79	2.25	633.04	628.18	---	---	633.09
P-19D	569.65	568.44	566.70	3.25	569.95	567.18	---	---	569.65
P-19S	569.18	567.65	566.81	2.25	569.06	567.83	---	---	569.18
P-20	638.81	636.84	631.69	2.25	633.94	634.79	---	---	636.84
P-21	665.67	630	625.35	3.25	628.60	625.92	---	---	630.00
P-22	627.90	627.64	626.83	2.25	629.08	627.24	---	---	569.18
P-23	637.87	618.15	612.96	3.25	616.21	613.49	---	---	618.15
P-24	612.52	587.85	584.83	3.25	588.08	---	---	---	588.08
P-25	616.37	598.22	595.96	3.25	599.21	596.53	---	---	599.21
P-26	594.27	570.42	568.29	3.25	571.54	---	---	---	571.54
P-27	625.25	625.00	622.05	2.25	624.30	---	---	---	625.00
P-28	610.36	609.87	609.61	2.25	611.86	---	---	---	610.36
P-29	617.31	616.82	616.79	2.25	619.04	---	---	---	617.31
P-30	634.75	634.36	<630.75	2.25	633.00	---	---	---	634.36
P-31	607.00	---	---	---	---	587.00	2.15	589.15	589.15
P-32	598.10	---	---	---	---	576.05	2.15	578.20	578.20
P-33	595.50	---	---	---	---	573.58	2.15	575.73	575.73
P-34	626.80	---	---	---	---	622.81	2.15	624.96	624.96
P-35	613.90	---	---	---	---	606.39	2.15	608.54	608.54
P-36	623.10	---	---	---	---	620.18	2.15	622.33	622.33
P-37	611.90	---	---	---	---	607.11	2.15	609.26	609.26
P-38	628.80	---	---	---	---	611.59	2.15	613.74	613.74
WW-2	622.83	616.40	608.83	2.25	611.08		---	---	616.40

3.25 = Seasonal High Adjustment Factor for bedrock wells based on 08/02/05 groundwater data.

2.25 = Seasonal High Adjustment Factor for saprolite/PWR wells based on 08/02/05 groundwater data.

2.15 = Seasonal High Adjustment Factor for new wells based on 03/06/07 groundwater data.

624.96 = Seasonal High Groundwater Elevation and source.

NOTES:

The groundwater elevation with the seasonal high adjustment was used as the estimated seasonal high groundwater elevation, except for the following scenarios:

(a.) If the estimated seasonal high groundwater elevations were above ground surface, the ground surface elevation was used as the seasonal high value; or

(b.) If the maximum recorded groundwater elevation for a well or piezometer was greater than the groundwater elevation with the seasonal high adjustment, the maximum recorded groundwater elevation was used as the seasonal high value.

TABLE 7
Summary of Precipitation Data for Burlington, North Carolina
Coble's Sandrock C and D Landfill

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1950	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.50 x	0.00
1951	0.00 z	1.88	3.21	4.43	0.06 z	1.56 o	2.63	1.11 u	0.00 z	0.00 z	0.00 z	0.00 z	12.15
1952	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	1.57	3.39	3.67	8.63
1953	4.48	4.79	4.54	3.21	2.11	3.84	2.80	1.45	3.99	0.27	0.54	4.80	36.82
1954	6.68	1.50	5.54	2.50	3.72	2.63	4.78	4.00	0.66	7.45	5.14	3.04	47.64
1955	1.94	3.98	2.43	4.33	2.96	2.49	6.28	5.36	5.07	4.32	2.33	0.33	41.82
1956	1.51	5.92	3.03	3.53	2.22	2.77	4.65	4.56	6.84	4.51	2.32	3.01	44.87
1957	3.66	5.89	3.01	3.79	1.66	4.00	3.68	6.13	6.87	2.27	5.44	2.33	48.73
1958	4.66	3.61	2.67	5.55	5.16	4.10	3.94	6.81	1.52	1.95	2.02	4.37	46.36
1959	2.62	3.28	2.89	4.98	2.85	1.68	5.81	5.75	3.91	7.33	3.25	3.10	47.45
1960	3.95	5.61	5.97	4.16	3.99	1.08	6.20	4.94	3.99	2.35	0.65	2.34	45.23
1961	1.81	5.13	5.68	4.07	5.56	4.53	3.32	7.62	0.65	1.32	1.88	5.82	47.39
1962	6.58	4.26 a	4.55	2.47 a	2.76	7.11	5.14	3.12	3.89	0.78	5.63	3.71	50.00
1963	2.59	3.23	5.68	2.50	1.56	1.87	3.76	2.71	7.66	0.39	5.84	2.30	40.09
1964	4.15	4.55	2.38	3.38	0.88	4.51	4.89	6.24	3.60	5.33	1.70	3.51	45.12
1965	1.81	2.58	4.39	3.45	1.22	8.12	11.56	3.42	3.03	3.11	1.48	0.34	44.51
1966	4.99	4.97	1.30	1.36	5.72	1.04	1.52	3.27	4.63	3.10	1.88	2.54	36.32
1967	1.83	3.37	1.59	1.76	4.62	2.94	4.02	7.89	2.50	0.85	1.21	6.57	39.15
1968	4.00	0.67	4.32	2.06	4.98	2.24	4.49	3.25	0.10	2.71	4.37	3.35	36.54
1969	1.68	3.67	3.87	5.48	4.22	6.76	4.74	3.19	4.06	1.15	0.80	3.98	43.60
1970	1.79	3.50	4.21	3.87	3.10	3.02	5.34	5.16	1.30	6.50	3.70	2.91	44.40
1971	1.70	3.63	3.86	2.86	5.83	2.16	3.41	5.19	3.68	8.74	2.67	1.66	45.39
1972	1.78	4.42	2.42	2.03	5.01	5.04	4.81	3.40	7.52	3.93	5.54	4.57	50.47
1973	2.98	3.39	5.27	4.96	4.52	7.42	4.18	2.31	2.52	1.95	0.96	5.95	46.41
1974	5.09	3.39	3.42	2.14	8.75	5.55	1.67	6.29	8.55	0.82	2.05	4.96	52.68
1975	6.54	3.64	8.29	1.19	2.96	1.46	8.73	4.56	8.61	1.70	2.31	2.72	52.71
1976	3.15	1.54	2.00	0.47	4.31	4.99	1.07	1.88	2.75	4.95	2.35	3.82	33.28
1977	2.69	1.77	3.79	1.38	2.68	6.43	1.45	2.93	5.76	5.24	2.56	3.01	39.69
1978	8.43	1.19	4.07	6.51	6.84	4.14	5.25	7.51	1.56	1.95	2.59 a	4.43	54.47
1979	5.86	4.96	3.76	2.98	5.85	7.20	3.70	3.60	7.54	2.50	3.81	1.15	52.91
1980	4.43	1.82	5.69	2.79	3.86	8.17	4.53	2.58	4.18	4.56	2.62	1.58	46.81
1981	1.04	4.52	2.91	1.55	3.67	3.36	8.50	4.67	2.72	5.13	0.45	3.95	42.47
1982	5.13	5.81	1.66	4.21	6.23	10.16	3.43	1.55	1.94	4.74	2.88	4.64	52.38
1983	1.86	4.08	5.06	7.59	5.61	2.59	0.79	1.99	2.63	3.44	5.02	6.95	47.61
1984	4.72	6.85	7.22	3.50	4.39	2.92	8.64	2.20	0.66	2.98	1.76	2.62	48.46
1985	4.07	5.18	1.36	0.68	4.47	1.18	9.63	10.19	0.07	2.92	8.86	1.86	50.47
1986	0.96	1.51	2.44	2.65	2.45	1.14	4.11	6.05 a	1.05	2.48	4.24	4.34	33.42
1987	4.22 b	3.45	3.18	6.76 a	1.47	1.06	4.48	2.65	7.66	1.19	3.72	3.25	43.09
1988	2.70	1.27	1.55	3.17	4.87	0.00 z	3.02	3.01	4.02	2.63	3.94	0.86	31.04
1989	1.67	6.63 a	7.87	3.39	3.87	6.65	5.35	5.95	2.53	3.00	2.46	2.58	51.95
1990	4.63	3.28	2.57 a	1.98	7.52	0.89	2.48	3.85 a	0.16	7.78	2.21	3.93	41.28
1991	5.00	1.93	5.61	2.58 a	2.72	2.29 a	6.32	4.38	4.68	1.21	0.40	3.03	40.15
1992	3.70	3.10	2.90	3.16	3.38	6.75	2.49	3.57	1.97	5.42	4.88	3.01	44.33
1993	3.89	3.59	8.50 a	4.59	3.33	1.60	7.36	2.93	3.17	1.14	3.73	2.29	46.12
1994	4.77 a	2.39	5.92	2.42	1.10 a	1.37 a	6.44	4.67	0.80	1.17	1.55	0.75	33.35
1995	4.94	3.21	3.57 a	0.70	3.52	12.00	4.97	5.06	1.67	6.84	4.03	0.94	51.45
1996	2.63 e	1.86 b	5.32 a	2.18 c	5.79	1.43	2.94	7.19	11.73	4.25	3.06	3.84	52.22
1997	2.84 b	2.62	3.14	5.77	1.46	5.15 a	5.02	1.35	4.22	2.07 b	3.26	2.97 c	39.87
1998	6.23	5.63	6.52	4.82	4.57	2.23	0.80	0.36	4.38	1.50	1.31	4.90	43.25
1999	5.22	1.77 a	3.21	4.24	2.50	1.26	4.29	3.56 a	12.80	2.37	2.12	1.86	45.20
2000	3.60 d	2.08	3.64	3.83	1.04 b	3.51	3.53 a	5.90 a	5.16	0.02	1.99	1.69	35.99
2001	2.17	2.60	5.02 a	3.02	3.27 a	2.02 d	4.28 a	1.25	3.66	0.78	0.15	2.07	30.29
2002	4.58 b	0.98	3.92 a	0.69 a	1.75 a	1.82	3.14 a	2.58 a	6.47	9.80	5.07	3.81 c	44.61
2003	2.32 e	2.97 b	7.10 a	6.86	8.47	8.39	7.65 a	9.26 c	5.49	2.50 a	1.43	2.63 b	65.07
2004	1.45 b	1.57 b	1.33 a	2.37 a	3.76	3.75 a	6.39 c	6.20	5.23 d	1.58 a	2.43 f	2.39 u	33.63

Period of Record Statistics													
MEAN	3.61	3.42	4.06	3.34	3.87	3.94	4.61	4.34	4.07	3.22	2.88	3.17	44.88
S.D.	1.71	1.55	1.82	1.66	1.86	2.64	2.24	2.13	2.83	2.31	1.73	1.50	6.56
SKEW	0.48	0.28	0.58	0.50	0.54	0.99	0.76	0.55	0.93	0.96	0.89	0.31	0.13
MAX	8.43	6.85	8.50	7.59	8.75	12.00	11.56	10.19	12.80	9.80	8.86	6.95	65.07
MIN	0.96	0.67	1.30	0.47	0.88	0.89	0.79	0.36	0.07	0.02	0.15	0.33	30.29
NO YRS	52	53	53	53	52	51	53	52	52	53	52	52	50

Notes:
1. Data taken from the Southeast Regional Climate Center web page (http://www.dnr.state.sc.us/climate/sercc/index.html).
2. File last updated on Jan 14, 2005.
3. Provisional data after September 2004.
4. The following identifiers were used to represent incomplete data: a = 1 day missing, b = 2 days missing, c = 3 days missing, etc., and z = 26 or more days missing.
5. Long-term means based on columns; thus, the monthly row may not sum (or average) to the long-term annual value.
6. Individual months not used for annual or monthly statistics if more than 5 days are missing.
7. Individual years not used for annual statistics if any month in that year has more than 5 days missing.

TABLE 8
Hydraulic Gradients and Linear Flow Velocities
Coble's Sandrock C and D Landfill

FLOW SEGMENT	HYDRAULIC CONDUCTIVITY (K, cm/s)	EFFECTIVE POROSITY (n, %)	SEGMENT LENGTH (feet)	FLOW DIRECTION	03/06/07 Groundwater Elevations			
					Elevation (ft, AMSL)	Gradient (i) (ft/ft)	Velocity (V) (cm/sec)	Velocity (V) (ft/yr)
i_1	6.96E-05	21%	1557	NW	625.00 570.00	0.035	1.17E-05	12.11
i_2	6.96E-05	21%	1103	NW	630 580	0.045	1.50E-05	15.54
i_3	6.96E-05	21%	651	WNW	620 595	0.038	1.27E-05	13.16
i_4	6.96E-05	21%	752	SSW	630 610	0.027	8.81E-06	9.11
i_5	6.96E-05	21%	1023	W	635 610	0.024	8.09E-06	8.38
					Averages:	**0.034**	**1.13E-05**	**11.66**

NOTES:

1. The hydraulic conductivity (**K**) is taken from the geometric mean of **K** estimated from slug tests (see Table 2).
2. The effective porosity (**n**) is taken from the average **n** determined by laboratory analysis of soil samples (see Table 3)
3. The horizontal hydraulic gradient (**i**) is the change in groundwater elevation divided by the segment length.
4. The groundwater flow velocity (**V**) is calculated based on the modified Darcy equation: **V=Ki/n**.

TABLE 9
Summary of Vertical Gradients
Coble's Sandrock C and D Landfill

Vertical Gradient Calculations for Paired Wells & Piezometers

Well ID	Top Screen	Bottom Screen	Mid. Screen	GW Elev. 08/07/97	GW Elev. 08/14/97	GW Elev. 11/12/97	GW Elev. 02/05/02	GW Elev. 02/13/02	GW Elev. 02/18/02	GW Elev. 03/06/02	GW Elev. 03/22/02	GW Elev. 04/02/02	GW Elev. 04/30/02	GW Elev. 05/20/02	GW Elev. 06/25/02	GW Elev. 07/29/02	GW Elev. 08/23/02
MW-10S	583.12	568.12	575.62	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-10D	535.90	525.90	530.90	---	---	---	---	---	---	---	---	---	---	---	---	---	---
diff.	---	---	44.72	---	---	---	---	---	---	---	---	---	---	---	---	---	---
V. Grad.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P-19S	565.18	559.18	562.18	---	---	---	566.81	566.95	566.79	567.03	567.27	567.21	566.44	566.09	564.38	566.11	564.48
P-19D	524.65	509.65	517.15	---	---	---	566.26	566.97	566.81	567.07	567.34	567.21	566.42	566.06	564.59	565.76	564.37
diff.	---	---	45.03	---	---	---	-0.55	0.02	0.02	0.04	0.07	0.00	-0.02	-0.03	0.21	-0.35	-0.11
V. Grad.	---	---	---	---	---	---	**-0.0122**	**0.0004**	**0.0004**	**0.0009**	**0.0016**	**0.0000**	**-0.0004**	**-0.0007**	**0.0047**	**-0.0078**	**-0.0024**
P-2	564.01	554.01	559.01	570.01	569.66	570.25	---	---	---	---	---	---	---	---	---	---	---
P-2A	534.86	524.86	529.86	570.01	569.68	570.06	---	---	---	---	---	---	---	---	---	---	---
diff.	---	---	29.15	0.00	0.02	-0.19	---	---	---	---	---	---	---	---	---	---	---
V. Grad.	---	---	---	**0.0000**	**0.0007**	**-0.0065**	---	---	---	---	---	---	---	---	---	---	---

GW Elev. 10/04/02	GW Elev. 11/21/02	GW Elev. 04/29/03	GW Elev. 07/10/03	GW Elev. 11/11/03	GW Elev. 04/20/04	GW Elev. 10/19/04	GW Elev. 04/04/05	GW Elev. 04/19/05	GW Elev. 08/02/05	GW. Elev. 09/23/05	GW. Elev. 4/27/06	GW. Elev. 10/11/06	GW. Elev. 03/06/07	AVG.	ST. DEV.	Well ID
---	---	---	---	---	---	---	584.55	584.34	584.34	583.03	---	583.95	584.66	---	---	MW-10S
---	---	---	---	---	---	---	585.95	585.73	584.25	582.97	---	583.62	585.06	---	---	MW-10D
---	---	---	---	---	---	---	1.40	1.39	-0.09	-0.06	---	-0.33	0.40	0.45	0.77	diff.
							0.0313	**0.0311**	**-0.0020**	**-0.0013**	**---**	**-0.0074**	**0.0089**	**0.0101**	**0.0172**	V. Grad.
565.93	567.65	567.41	567.31	566.78	567.04	567.15	567.27	567.19	566.81	564.76	568.10	---	567.18	---	---	P-19S
565.68	568.44	567.38	567.24	567.01	567.19	567.14	567.68	567.45	566.70	564.82	567.55	---	567.83	---	---	P-19D
-0.25	0.79	-0.03	-0.07	0.23	0.15	-0.01	0.41	0.26	-0.11	0.06	-0.55	---	0.65	0.03	0.31	diff.
-0.0056	**0.0175**	**-0.0007**	**-0.0016**	**0.0051**	**0.0033**	**-0.0002**	**0.0091**	**0.0058**	**-0.0024**	**0.0013**	**-0.0122**	**---**	**0.0144**	**0.0008**	**0.0069**	V. Grad.
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	P-2
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	P-2A
---	---	---	---	---	---	---	---	---	---	---	---	---	---	-0.06	0.12	diff.
---	---	---	---	---	---	---	---	---	---	---	---	---	---	**-0.0019**	**0.0040**	V. Grad.

diff. = difference between shallow and deep wells.
Vert. Grad. = vertical hydraulic gradient = (Deep GW Elev. - Shallow GW Elev.)/(Deep mid-screen elev. - shallow mid-screen elev.)
Positive Vertical Gradient indicates upward flow of groundwater.

NOTE: P-2 & P-2A have been abandonded.

TABLE 10
Proposed Water Quality Monitoring Plan
Coble's Sandrock C D Landfill

PIEZOMETER OR WELL IDENTIFICATION	DATE INSTALLED	CASING DIAMETER (inches)	WELL ELEVATIONS		TOTAL DEPTH DRILLED		TOP OF BEDROCK		SCREENED INTERVAL				LITHOLOGY OF SCREENED INTERVAL	COMMENTS
			GROUND SURFACE	T.O.C.	DEPTH	ELEV.	DEPTH	ELEV.	DEPTH B.G.S.		ELEVATION (feet M.S.L.)			
			feet above M.S.L.		feet B.G.S.	feet M.S.L.	feet B.G.S.	feet M.S.L.	from	to	from	to		
MW-1	03/25/97	2	600.46	602.46	33.6	566.86	>33.6	<566.86	18	33	582.36	567.36	Saprolite/PWR	To Be Abandoned
MW-2	03/28/97	2	580.31	582.31	22.0	558.31	>22.0	<558.31	5	20	575.31	560.31	Saprolite/PWR	Compliance Well
MW-3 (P-1)	03/31/97	2	610.23	613.05	57	553.23	21.5	588.73	37	57	573.23	553.23	Bedrock	To Be Abandoned
MW-4	04/01/97	2	580.64	582.64	21.3	559.34	>21.3	<559.34	6.3	21.3	574.34	559.34	Saprolite/PWR	Compliance Well
MW-5	01/18/02	2	574.91	577.41	15	559.91	15	559.91	5	15	569.91	559.91	Saprolite/PWR	Water Level Only
MW-6 (P-3)	08/05/97	2	652.76	652.56	41	611.76	16	636.76	21	41	631.76	611.76	Bedrock	Compliance Well
MW-7	12/19/02	2	581.08	583.33	13.5	567.58	13.5	567.58	3.5	13.5	577.58	567.58	Saprolite/PWR	Compliance Well
MW-8	03/21/05	2	571.50	574.26	20	551.50	>20	<551.50	5	20	566.50	551.50	Saprolite/PWR	Compliance Well
MW-9	03/21/05	2	586.43	589.09	37.5	548.93	37.5	548.93	22.5	37.5	563.93	548.93	PWR	To Be Abandoned
MW-10S	03/22/05	2	589.62	592.46	21.5	568.12	5	584.62	6.5	21.5	583.12	568.12	Bedrock	Compliance Well
MW-10D	03/25/05	2	589.90	592.76	64	525.90	5	584.90	54	64	535.90	525.90	Bedrock	Water Level Only
P-2	08/05/97	2	575.61	578.86	21.6	554.01	12	563.61	11.6	21.6	564.01	554.01	Bedrock	Abandoned
P-2A	08/05/97	2	574.86	578.96	50	524.86	12	562.86	40	50	534.86	524.86	Bedrock	Abandoned
P-4	08/05/97	2	628.56	631.88	62	566.56	32	596.56	42	62	586.56	566.56	Bedrock	To Be Abandoned
P-5	08/05/97	2	611.26	611.91	61.5	549.76	15	596.26	41.5	61.5	569.76	549.76	Bedrock	To Be Abandoned
P-6	08/05/97	2	602.93	606.06	61	541.93	15	587.93	41	61	561.93	541.93	Bedrock	Abandoned
P-7	08/05/97	2	617.90	621.51	56.5	561.40	8	609.90	36.5	56.5	581.40	561.40	Bedrock	Abandoned
P-15	01/17/02	2	649.07	651.22	50	599.07	17	632.07	40	50	609.07	599.07	Bedrock	Water Level Only
P-16	01/18/02	2	609.85	612.05	41	568.85	5	604.85	26	41	583.85	568.85	Bedrock	Water Level Only
P-17	01/18/02	2	643.78	646.28	36	607.78	22	621.78	21	36	622.78	607.78	Saprolite/Bedrock	Water Level Only
P-18	01/30/02	2	652.16	651.76	34	618.16	34	618.16	19	34	633.16	618.16	PWR	Water Level Only
P-19S	01/31/02	2	569.18	572.18	10	559.18	>10	<559.18	4	10	565.18	559.18	Saprolite	Compliance Well
P-19D	01/31/02	2	569.65	571.85	60	509.65	10	559.65	45	60	524.65	509.65	Bedrock	Water Level Only
P-20	01/29/02	2	638.81	641.11	30	608.81	30	608.81	15	30	623.81	608.81	Saprolite/PWR	Water Level Only
P-21	01/30/02	2	665.67	668.42	62.5	603.17	23	642.67	47.5	62.5	618.17	603.17	Bedrock	Water Level Only
P-22	1/17/2002	2	627.90	629.90	10	617.90	10	617.90	4	10	623.90	617.90	Saprolite/PWR	Water Level Only
P-23	01/17/02	2	637.87	640.37	41	596.87	27	610.87	31	41	606.87	596.87	Bedrock	Water Level Only
P-24	03/24/05	2	612.52	613.89	38	574.52	18	594.52	28	38	584.52	574.52	Bedrock	To Be Abandoned
P-25	03/24/05	2	616.37	617.81	38	578.37	14	602.37	28	38	588.37	578.37	Bedrock	To Be Abandoned
P-26	03/28/05	2	594.27	597.13	52	542.27	25	569.27	37	52	557.27	542.27	Bedrock	To Be Abandoned
P-27	04/04/05	2	625.25	627.45	4.5	620.75	>4.5	<620.75	2.5	4.5	622.75	620.75	Saprolite	Water Level Only
P-28	04/04/05	2	610.36	613.15	4	606.36	>4	<606.36	2	4	608.36	606.36	Saprolite	Water Level Only
P-29	04/04/05	2	617.31	619.49	5	612.31	>5	<612.31	3	5	614.31	612.31	Saprolite	Water Level Only
P-30	04/04/05	2	634.75	637.49	4	630.75	>4	<630.75	2	4	632.75	630.75	Saprolite	Water Level Only
P-31	01/29/07	2	607.00	608.56	44.00	563.00	15.00	592.00	15.00	40.00	592.00	567.00	Bedrock	To Be Abandoned
P-32	01/30/07	2	598.10	600.35	40.00	558.10	21.0 *	577.1 *	15.00	40.00	583.10	558.10	Bedrock	To Be Abandoned
P-33	01/31/07	2	595.50	597.68	35.00	560.50	--- *	--- *	15.00	35.00	580.50	560.50	PWR/Bedrock	To Be Abandoned
P-34	01/31/07	2	626.80	629.73	23.00	603.80	23.00	603.80	8.00	23.00	618.80	603.80	Saprolite	Water Level Only
P-35	02/02/07	2	613.90	616.33	30.00	583.90	17.50	596.40	10.00	30.00	603.90	583.90	PWR/Bedrock	To Be Abandoned
P-36	02/01/07	2	623.10	624.84	30.00	593.10	14.00	609.10	10.00	30.00	613.10	593.10	PWR/Bedrock	To Be Abandoned
P-37	02/05/07	2	611.90	613.61	30.00	581.90	15.00	596.90	10.00	30.00	601.90	581.90	PWR/Bedrock	To Be Abandoned
P-38	01/31/07	2	628.80	631.33	45.00	583.80	33.00	595.80	20.00	40.00	608.80	588.80	PWR/Bedrock	To Be Abandoned
B-1	03/24/97	---	589.00	---	18.9	570.10	>18.9	<570.10	---	---	---	---	---	Abandoned
B-2	04/01/97	---	622.00	---	18.9	603.10	>18.9	<603.10	---	---	---	---	---	Abandoned
B-3	03/27/97	---	628.00	---	19	609.00	>19.0	<609.00	---	---	---	---	---	Abandoned
B-4	04/01/97	---	608.00	---	10.5	597.50	10.5	597.50	---	---	---	---	---	Abandoned
B-4A	04/01/97	---	---	---	10	---	10.0	---	---	---	---	---	---	Abandoned
B-5	03/27/97	---	615.00	---	18.6	596.40	>18.6	<596.40	---	---	---	---	---	Abandoned
C-1	07/29/97	---	579.00	---	55.4	523.60	45.4	533.60	---	---	---	---	---	Abandoned
C-2	07/29/97	---	616.00	---	48.5	567.50	38.5	577.50	---	---	---	---	---	Abandoned
C-3	08/01/97	---	604.00	---	23.1	580.90	13.1	590.90	---	---	---	---	---	Abandoned
TW-1	06/12/98	2	578.00	---	22.6	555.40	13.2	564.80	17.6	22.6	560.40	555.40	Bedrock	Abandoned
TW-2	07/29/98	2	609.00	---	29.5	579.50	8.5	600.50	14.5	29.5	594.50	579.50	Bedrock	Abandoned
WW-1	na	24	622.83	625.20	23	599.83	>23	<599.83	na	na	na	na	Saprolite	Water Level Only - To be abandonded eventually.
MW-11	not yet	2			30				10	30			PWR/Bedrock	Compliance Well To be installed prior to construction of Phase 3B

NOTES:

1. All elevations are referenced to mean sea level (M.S.L.); depths are referenced to below ground surface (B.G.S.).
2. Unless otherwise noted, ground surface elevations were calculated by subtracting measured stick-up heights from surveyed T.O.C. elevations.
3. Elevations for P-8, P-9, P-10, P-11, P-12, and P-13 are approximate based on approximate ground surface elevations as determined on topographic map..
4. na = not available
5. B.G.S. = below ground surface
6. T.O.C. = top of casing
7. PWR = partially weathered rock
8. The installation date and details for well WW-1 are unknown.
9. Wells MW-1, MW-2, MW-3, MW-4, MW-6 (P-3) and piezometers P-4, P-5, P-6, and P-7 were installed by Trigon Engineering Consultants, Inc. between March and August 1997.
10. Piezometers P-8, P-9, P-10, and P-12 were installed by Joyce Engineering, Inc. on April 11, 2000.
11. Piezometers P-12, P-13, and P-14 were installed by Joyce Engineering, Inc. on September 11, 2000.
12. Well MW-5 and piezometers P-15, P-16, P-17, P-18, P-19S, P-19D, P-20, P-21, P-22, and P-23 were installed by Joyce Engineering, Inc. in January 2002.
13. Monitoring well MW-7 was installed by Joyce Engineering, Inc.on December 19, 2002.
14. Wells MW-8, MW-9, MW-10S, MW-10D and piezometers P-24, P-25, and P-26 were installed by by Joyce Engineering, Inc. in March 2005.
15. Piezometers P-27, P-28, P-29, and P-30 were installed by Joyce Engineering, Inc. on April 4, 2005.
16. Elevations for B-1 through B-5, C-1 through C-3, and TW-1 through TW-2 are approximate.
17. Data for MW-11 are anticipated values since the well has not yet been installed.

TABLE 11
Water Quality Anlaytical Requirements
(NC Appendix I and II Constituents)

CAS Number	Name	Other Names	2L Std.	GWP* Std.	SWSL**	SW ID	App. I or App. II
7440-36-0	Antimony	Antimony	NE	1.4	6	13	I
7440-38-2	Arsenic	Arsenic	50	NE	10	14	I
7440-39-3	Barium	Barium	2000	NE	100	15	I
7440-41-7	Beryllium	Beryllium	NE	4	1	23	I
7440-43-9	Cadmium	Cadmium	1.75	NE	1	34	I
7440-47-3	Chromium	Chromium	50	NE	10	51	I
7440-48-4	Cobalt	Cobalt	NE	2	10	53	I
7440-50-8	Copper	Copper	1000	NE	10	54	I
7439-92-1	Lead	Lead	15	NE	10	131	I
7440-02-0	Nickel	Nickel	100	NE	50	152	I
7782-49-2	Selenium	Selenium	50	NE	10	183	I
7440-22-4	Silver	Silver	17.5	NE	10	184	I
7440-28-0	Thallium	Thallium	NE	0.28	5.5	194	I
7440-62-2	Vanadium	Vanadium	NE	25	25	209	I
7440-66-6	Zinc	Zinc	1050	NE	10	213	I
7439-97-6	Mercury	Mercury	1.05	NE	0.2	132	II
7440-31-5	Tin	Tin	NE	NE	100	195	II
630-20-6	1,1,1,2-Tetrachloroethane	Ethane, 1,1,1,2-tetrachloro-	NE	1.3	5	190	I
71-55-6	1,1,1-Trichloroethane; Methylchloroform	Ethane, 1,1,1-trichloro-	200	NE	1	200	I
79-34-5	1,1,2,2-Tetrachloroethane	Ethane, 1,1,2,2-tetrachloro-	0.17	0.17	3	191	I
79-00-5	1,1,2-Trichloroethane	Ethane, 1,1,2-trichloro-	NE	0.6	1	202	I
75-34-3	1,1-Dichloroethane; Ethylidene chloride	Ethane, 1,1-dichloro-	70	NE	5	75	I
75-35-4	1,1-Dichloroethylene; 1,1-Dichloroethene;	Ethene, 1,1-dichloro-	7	NE	5	77	I
96-18-4	1,2,3-Trichloropropane	Propane, 1,2,3-trichloro-	0.005	0.018	1	206	I
96-12-8	1,2-Dibromo-3-chloropropane; DBCP	Propane, 1,2-dibromo-3-chloro-	0.025	NE	13	67	I
106-93-4	1,2-Dibromoethane; Ethylene dibromide; EDB	Ethane, 1,2-dibromo-	0.0004	NE	1	68	I
107-06-2	1,2-Dichloroethane; Ethylene dichloride	Ethane, 1,2-dichloro-	0.38	NE	1	76	I
78-87-5	1,2-Dichloropropane	Propane, 1,2-dichloro-	0.51	NE	1	82	I
591-78-6	2-Hexanone; Methyl butyl ketone	2-Hexanone	280	280	50	124	I
108-10-1	4-Methyl-2-pentanone; Methyl isobutyl ketone	2-Pentanone, 4-methyl-	NE	560	100	147	I
67-64-1	Acetone	2-Propanone	700	NE	100	3	I
75-05-8	Acetonitrile; Methyl cyanide	Acetonitrile	NE	42	55	4	I
71-43-2	Benzene	Benzene	1	NE	1	16	I
74-97-5	Bromochloromethane; Chlorobromethane	Methane, bromochloro-	NE	0.6	3	28	I
75-27-4	Bromodichloromethane; Dichlorobromomethane	Methane, bromodichloro-	0.56	0.56	1	29	I
75-25-2	Bromoform; Tribromomethane	Methane, tribromo-	4.43	NE	3	30	I
75-15-0	Carbon disulfide	Carbon disulfide	700	700	100	35	I
56-23-5	Carbon tetrachloride	Methane, tetrachloro-	0.269	NE	1	36	I
108-90-7	Chlorobenzene	Benzene, chloro-	50	NE	3	39	I
75-00-3	Chloroethane; Ethyl chloride	Ethane, chloro-	2800	2800	10	41	I
67-66-3	Chloroform; Trichloromethane	Methane, trichloro-	70	NE	5	44	I
156-59-2	cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	Ethene, 1,2-dichloro-,(Z)-	70	NE	5	78	I
10061-01-5	cis-1,3-Dichloropropene	1-Propene, 1,3-dichloro-, (Z)-	0.19	0.2	1	86	I
124-48-1	Dibromochloromethane; Chlorodibromomethane	Methane, dibromochloro-	0.41	0.41	3	66	I
100-41-4	Ethylbenzene	Benzene, ethyl-	550	NE	1	110	I
74-83-9	Methyl bromide; Bromomethane	Methane, bromo-	NE	NE	10	136	I
74-87-3	Methyl chloride; Chloromethane	Methane, chloro-	2.6	2.6	1	137	I
78-93-3	Methyl ethyl ketone; MEK; 2-Butanone	2-Butanone	4200	NE	100	141	I
74-88-4	Methyl iodide; Iodomethane	Methane, iodo-	NE	NE	10	142	I
74-95-3	Methylene bromide; Dibromomethane	Methane, dibromo-	NE	NE	10	139	I
75-09-2	Methylene chloride; Dichloromethane	Methane, dichloro-	4.6	NE	1	140	I
95-50-1	o-Dichlorobenzene; 1,2-Dichlorobenzene	Benzene, 1,2-dichloro-	24	NE	5	69	I
106-46-7	p-Dichlorobenzene; 1,4-Dichlorobenzene	Benzene, 1,4-dichloro-	1.4	NE	1	71	I
100-42-5	Styrene	Benzene, ethenyl-	100	NE	1	186	I
127-18-4	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	Ethene, tetrachloro-	0.7	NE	1	192	I
108-88-3	Toluene	Benzene, methyl-	1000	NE	1	196	I
156-60-5	trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	Ethene, 1,2-dichloro-,(E)-	100	NE	5	79	I
10061-02-6	trans-1,3-Dichloropropene	1-Propene, 1,3-dichloro-, (E)-	0.19	0.2	1	87	I
110-57-6	trans-1,4-Dichloro-2-butene	2-Butene, 1,4-dichloro-, (E)-	NE	NE	100	73	I
79-01-6	Trichloroethylene; Trichloroethene	Ethene, trichloro-	2.8	NE	1	201	I
75-69-4	Trichlorofluoromethane; CFC-11	Methane,trichlorofluoro-	2100	NE	1	203	I
108-05-4	Vinyl acetate	Acetic acid, ethenylester	NE	88	50	210	I
75-01-4	Vinyl chloride; Chloroethene	Ethene, chloro-	0.015	NE	1	211	I
1330-20-7	Xylene (total)	Benzene, dimethyl-	530	NE	5	346	I
563-58-6	1,1-Dichloropropene	1-Propene, 1,1-dichloro-	NE	NE	5	85	II
95-94-3	1,2,4,5-Tetrachlorobenzene	Benzene, 1,2,4,5-tetrachloro-	NE	NE	10	189	II
120-82-1	1,2,4-Trichlorobenzene	Benzene, 1,2,4-trichloro-	70	70	10	199	II
142-28-9	1,3-Dichloropropane; Trimethylene dichloride	Propane, 1,3-dichloro-	NE	NE	1	83	II
130-15-4	1,4-Naphthoquinone	1,4-Naphthalenedione	NE	NE	10	149	II
134-32-7	1-Naphthylamine	1-Naphthalenamine	NE	NE	10	150	II
594-20-7	2,2-Dichloropropane; Isopropylidene chloride	Propane, 2,2-dichloro-	NE	NE	15	84	II
58-90-2	2,3,4,6-Tetrachlorophenol	Phenol, 2,3,4,6-tetrachloro-	210	210	10	193	II
93-76-5	2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid	Acetic acid, (2,4,5-trichlorophenoxy)-	NE	NE	2	188	II
95-95-4	2,4,5-Trichlorophenol	Phenol, 2,4,5-trichloro-	NE	350	10	204	II
88-06-2	2,4,6-Trichlorophenol	Phenol, 2,4,6-trichloro-	NE	NE	10	205	II
94-75-7	2,4-D; 2,4-Dichlorophenoxyacetic acid	Acetic acid, (2,4-dichlorophenoxy)-	70	NE	2	59	II
120-83-2	2,4-Dichlorophenol	Phenol, 2,4-dichloro-	NE	NE	10	80	II
105-67-9	2,4-Dimethylphenol; m-Xylenol	Phenol, 2,4-dimethyl-	140	140	10	95	II
51-28-5	2,4-Dinitrophenol	Phenol, 2,4-dinitro-	NE	NE	50	99	II
121-14-2	2,4-Dinitrotoluene	Benzene, 1-methyl-2,4-dinitro-	NE	NE	10	100	II
87-65-0	2,6-Dichlorophenol	Phenol, 2,6-dichloro-	NE	NE	10	81	II
606-20-2	2,6-Dinitrotoluene	Benzene, 2-methyl-1,3-dinitro-	NE	NE	10	101	II
53-96-3	2-Acetylaminofluorene; 2-AAF	Acetamide, N-9H-fluoren-2-yl-	NE	NE	20	6	II
91-58-7	2-Chloronaphthalene	Naphthalene, 2-chloro-	NE	NE	10	47	II
95-57-8	2-Chlorophenol	Phenol, 2-chloro-	0.36	NE	10	48	II
91-57-6	2-Methylnaphthalene	Naphthalene, 2-methyl-	14	28	10	145	II
91-59-8	2-Naphthylamine	2-Naphthalenamine	NE	NE	10	151	II
91-94-1	3,3'-Dichlorobenzidine	[1,1'-Biphenyl]-4,4'-diamine,3,3'-dichloro-	NE	NE	20	72	II
119-93-7	3,3'-Dimethylbenzidine	[1,1'-Biphenyl]-4,4'-diamine,3,3'-dimethyl-	NE	NE	10	94	II
56-49-5	3-Methylcholanthrene	Benz[j]aceanthrylene,1,2-dihydro-3-methyl-	NE	NE	10	138	II
72-54-8	4,4'-DDD	Benzene 1,1'-(2,2-dichloroethylidene)bis[4-chloro-	0.14	0.14	0.1	60	II
72-55-9	4,4'-DDE	Benzene, 1,1'-(dichloroethenylidene)bis[4-chloro-	NE	NE	0.1	61	II
50-29-3	4,4'-DDT	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro-	0.1	0.1	0.1	62	II
534-52-1	4,6-Dinitro-o-cresol; 4,6-Dinitro-2-methylphenol	Phenol, 2-methyl-4,6-dinitro-	NE	NE	50	98	II
92-67-1	4-Aminobiphenyl	[1,1'-Biphenyl]-4-amine	NE	NE	20	11	II

TABLE 11
Water Quality Anlaytical Requirements
(NC Appendix I and II Constituents)

CAS Number	Name	Other Names	2L Std.	GWP* Std.	SWSL**	SW ID	App. I or App. II
101-55-3	4-Bromophenyl phenyl ether	Benzene, 1-bromo-4-phenoxy-	NE	NE	10	31	II
7005-72-3	4-Chlorophenyl phenyl ether	Benzene, 1-chloro-4-phenoxy-	NE	NE	10	49	II
99-55-8	5-Nitro-o-toluidine	Benzenamine, 2-methyl-5-nitro-	NE	NE	10	157	II
57-97-6	7,12-Dimethylbenz[a]anthracene	Benz[a]anthracene, 7,12-dimethyl-	NE	NE	10	93	II
83-32-9	Acenaphthene	Acenaphthylene, 1,2-dihydro-	80	80	10	1	II
208-96-8	Acenaphthylene	Acenaphthylene	210	210	10	2	II
98-86-2	Acetophenone	Ethanone, 1-phenyl-	NE	NE	10	5	II
107-02-8	Acrolein	2-Propenal	NE	3.5	53	7	II
107-13-1	Acrylonitrile	2-Propenenitrile	NE	NE	200	8	II
309-00-2	Aldrin	1,4:5,8-Dimethanonaphthalene,1,2,3,4,10,10 -hexachloro-1,4,4a,5,8,8a-hexahydro-(1,4,4a,5,8,8a)-	NE	NE	0.05	9	II
107-05-1	Allyl chloride	1-Propene, 3-chloro-	NE	NE	10	10	II
319-84-6	alpha-BHC	Cyclohexane,1,2,3,4,5,6-hexachloro-,(1a,2a,3β,4a,5□,6□)-	NE	0.006	0.05	24	II
120-12-7	Anthracene	Anthracene	2100	2100	10	12	II
56-55-3	Benzo[a]anthracene; Benzanthracene	Benz[a]anthracene	0.048	0.048	10	17	II
50-32-8	Benzo[a]pyrene	Benzo[a]pyrene	0.0048	0.0048	10	21	II
205-99-2	Benzo[b]fluoranthene	Benz[e]acephenanthrylene	0.048	0.048	10	18	II
191-24-2	Benzo[ghi]perylene	Benzo[ghi]perylene	210	210	10	20	II
207-08-9	Benzo[k]fluoranthene	Benzo[k]fluoranthene	0.48	0.48	10	19	II
100-51-6	Benzyl alcohol	Benzenemethanol	NE	3500	20	22	II
319-85-7	beta-BHC	Cyclohexane,1,2,3,4,5,6-hexachloro-,(1a,2□,3a,4□,5a,6□)-	NE	0.019	0.05	25	II
108-60-1	Bis(2-chloro-1-methylethyl) ether; 2,2'-Dichlorodiisopropyl ether; DCIP, See footnote 4	Propane, 2,2'-oxybis[1-chloro-	NE	NE	10	46	II
111-91-1	Bis(2-chloroethoxy)methane	Ethane, 1,1'-[methylenebis(oxy)]bis [2-chloro-	NE	NE	10	42	II
111-44-4	Bis(2-chloroethyl)ether; Dichloroethyl ether	Ethane, 1,1'-oxybis[2-chloro-	0.031	0.031	10	43	II
117-81-7	Bis(2-ethylhexyl) phthalate	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl)ester	NE	NE	15	111	II
85-68-7	Butyl benzyl phthalate; Benzyl butyl phthalate	1,2-Benzenedicarboxylicacid, butyl phenylmethyl ester	100	NE	10	32	II
57-74-9	Chlordane	4,7-Methano-1H-indene,1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-	0.1	NE	0.5	339	II
510-15-6	Chlorobenzilate	Benzeneacetic acid, 4-chloro-(4-chlorophenyl)--hydroxy-, ethyl ester	NE	NE	10	40	II
126-99-8	Chloroprene	1,3-Butadiene, 2-chloro-	NE	NE	20	50	II
218-01-9	Chrysene	Chrysene	4.79	5	10	52	II
57-12-5	Cyanide	Cyanide	70	NE	10	58	II
319-86-8	delta-BHC	Cyclohexane,1,2,3,4,5,6-hexachloro-,(1a,2a,3a,4□,5a,6□)-	NE	0.019	0.05	26	II
2303-16-4	Diallate	Carbamothioic acid,bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester	NE	NE	10	63	II
53-70-3	Dibenz[a,h]anthracene	Dibenz[a,h]anthracene	0.0047	0.0047	10	64	II
132-64-9	Dibenzofuran	Dibenzofuran	28	28	10	65	II
75-71-8	Dichlorodifluoromethane; CFC 12	Methane,dichlorodifluoro-	1400	NE	5	74	II
60-57-1	Dieldrin	2,7:3,6-Dimethanonaphth[2,3-b]oxirene,3,4,5,6,9,9-hexachloro -1a,2,2a,3,6,6a,7,7a-octahydro-,(1aa,2□,2aa,3□,6□,6aa,7□,7aa)-	0.0022	0.0022	0.075	88	II
84-66-2	Diethyl phthalate	1,2-Benzenedicarboxylicacid, diethyl ester	5000	NE	10	90	II
60-51-5	Dimethoate	Phosphorodithioic acid,O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester	NE	NE	20	91	II
131-11-3	Dimethyl phthalate	1,2-Benzenedicarboxylicacid, dimethyl ester	NE	NE	10	96	II
84-74-2	Di-n-butyl phthalate	1,2-Benzenedicarboxylic acid, dibutyl ester	700	NE	10	33	II
117-84-0	Di-n-octyl phthalate	1,2-Benzenedicarboxylicacid, dioctyl ester	140	140	10	168	II
88-85-7	Dinoseb; DNBP; 2-sec-Butyl-4,6-dinitrophenol	Phenol, 2-(1-methylpropyl)-4,6-dinitro-	NE	7	1	102	II
122-39-4	Diphenylamine	Benzenamine, N-phenyl-	NE	NE	10	103	II
298-04-4	Disulfoton	Phosphorodithioic acid,O,O-diethyl S-[2-(ethylthio)ethyl]ester	0.28	0.28	10	104	II
959-98-8	Endosulfan I	6,9-Methano-2,4,3-benzodiox-athiepin,6,7,8,9,10,10 -hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide,	NE	NE	0.1	105	II
33213-65-9	Endosulfan II	6,9-Methano-2,4,3-benzodioxathiepin,6,7,8,9,10,10 -hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide,(3a,5aa,6□,9□,9aa)-	42	42	0.1	106	II
1031-07-8	Endosulfan sulfate	6,9-Methano-2,4,3-benzodioxathiepin,6,7,8,9,10,10 -hexachloro-1,5,5a,6,9,9a-hexahydro-, 3,3-dioxide	NE	NE	0.1	107	II
72-20-8	Endrin	2,7:3,6-Dimethanonaphth[2,3-b]oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aa,2□,2a□,3a,6a,6a□,7□,7aa)-	2	2.1	0.1	108	II
7421-93-4	Endrin aldehyde	1,2,4-Methenocyclo-penta[cd]pentalene-5-carboxaldehyde,2,2a,3,3,4,7 -hexachlorodecahydro-(1a,2□,2a□,4□,4a□,5□,6a□,6b□,7R*)-	2.1	2.1	0.1	109	II
97-63-2	Ethyl methacrylate	2-Propenoic acid, 2-methyl-, ethyl ester	NE	NE	10	112	II
62-50-0	Ethyl methanesulfonate	Methanesulfonic acid,ethyl ester	NE	NE	20	113	II
52-85-7	Famphur	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl]-O, O-dimethyl ester	NE	NE	20	114	II
206-44-0	Fluoranthene	Fluoranthene	280	280	10	115	II
86-73-7	Fluorene	9H-Fluorene	280	NE	10	116	II
58-89-9	gamma-BHC; Lindane	Cyclohexane,1,2,3,4,5,6-hexachloro-,(1a,2a,3□,4a,5a,6□)-	0.2	NE	0.05	27	II
76-44-8	Heptachlor	4,7-Methano-1H-indene,1,4,5,6,7,8,8-heptachloro- 3a,4,7,7a-tetrahydro-	0.0078	NE	0.05	117	II
1024-57-3	Heptachlor epoxide	2,5-Methano-2H-indeno[1,2-b]oxirene,2,3,4,5,6,7,7 -heptachloro-1a,1b,5,5a,6,6a, -hexahydro-,(1aa,1b□,2a,5a,5a□,6□,6aa)	0.0038	NE	0.075	118	II
118-74-1	Hexachlorobenzene	Benzene, hexachloro-	0.02	NE	10	119	II
87-68-3	Hexachlorobutadiene	1,3-Butadiene,1,1,2,3,4,4-hexachloro-	NE	0.44	10	120	II
77-47-4	Hexachlorocyclopentadiene	1,3-Cyclopentadiene,1,2,3,4,5,5-hexachloro-	NE	50	10	121	II
67-72-1	Hexachloroethane	Ethane, hexachloro-	NE	NE	10	122	II
1888-71-7	Hexachloropropene	1-Propene, 1,1,2,3,3,3-hexachloro-	NE	NE	10	123	II
193-39-5	Indeno(1,2,3-cd)pyrene	Indeno[1,2,3-cd]pyrene	0.0479	0.047	10	125	II
78-83-1	Isobutyl alcohol	1-Propanol, 2-methyl-	NE	NE	100	126	II
465-73-6	Isodrin	1,4,5,8-Dimethanonaphthalene,1,2,3,4,1 0,10-hexachloro-1,4,4a,5,8,8a hexahydro-(1a,4a,4a□,5□,8□,8a□)-	NE	NE	20	127	II
78-59-1	Isophorone	2-Cyclohexen-1-one,3,5,5-trimethyl-	36.8	36.8	10	128	II

TABLE 11
Water Quality Anlaytical Requirements
(NC Appendix I and II Constituents)

CAS Number	Name	Other Names	2L Std.	GWP* Std.	SWSL**	SW ID	App. I or App. II
120-58-1	Isosafrole	1,3-Benzodioxole, 5-(1-propenyl)-	NE	NE	10	129	II
143-50-0	Kepone	1,3,4-Metheno-2H-cyclobuta-[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-	NE	NE	20	130	II
108-39-4	m-Cresol; 3-Methylphenol	Phenol, 3-methyl-	35	35	10	345	II
541-73-1	m-Dichlorobenzene; 1,3-Dichlorobenzene	Benzene, 1,3-dichloro-	NE	NE	5	70	II
99-65-0	m-Dinitrobenzene	Benzene, 1,3-dinitro-	NE	NE	20	97	II
126-98-7	Methacrylonitrile	2-Propenenitrile, 2-methyl-	NE	NE	100	133	II
91-80-5	Methapyrilene	1,2,Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-	NE	NE	100	134	II
72-43-5	Methoxychlor	Benzene, 1,1'-(2,2,2,trichloroethylidene)bis [4-methoxy-	35	NE	1	135	II
80-62-6	Methyl methacrylate	2-Propenoic acid, 2-methyl-, methyl ester	NE	NE	30	143	II
66-27-3	Methyl methanesulfonate	Methanesulfonic acid,methyl ester	NE	NE	10	144	II
298-00-0	Methyl parathion; Parathion methyl	Phosphorothioic acid,O,O-dimethyl	NE	NE	10	146	II
99-09-2	m-Nitroaniline; 3-Nitroaniline	Benzenamine, 3-nitro-	NE	NE	50	153	II
91-20-3	Naphthalene	Naphthalene	21	NE	10	148	II
98-95-3	Nitrobenzene	Benzene, nitro-	NE	NE	10	156	II
55-18-5	N-Nitrosodiethylamine	Ethanamine, N-ethyl-N-nitroso-	NE	NE	20	160	II
62-75-9	N-Nitrosodimethylamine	Methanamine, N-methyl-N-nitroso-	0.0007	0.0007	10	161	II
924-16-3	N-Nitrosodi-n-butylamine	1-Butanamine, N-butyl-N-nitroso-	NE	NE	10	162	II
86-30-6	N-Nitrosodiphenylamine	Benzenamine, N-nitroso-N-phenyl-	NE	NE	10	163	II
621-64-7	N-Nitrosodipropylamine; N-Nitroso-N-dipropylamine; Di-n-propylnitrosamine	1-Propanamine, N-nitroso-N-propyl-	NE	NE	10	164	II
10595-95-6	N-Nitrosomethylethalamine	Ethanamine, N-methyl-N-nitroso-	NE	NE	10	165	II
100-75-4	N-Nitrosopiperidine	Piperidine, 1-nitroso-	NE	NE	20	166	II
930-55-2	N-Nitrosopyrrolidine	Pyrrolidine, 1-nitroso-	NE	NE	10	167	II
126-68-1	O,O,O-Triethyl phosphorothioate	Phosphorothioic acid,O,O,O-triethyl ester	NE	NE	10	207	II
297-97-2	O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	Phosphorothioic acid,O,O-diethyl O-pyrazinyl ester	NE	NE	20	89	II
95-48-7	o-Cresol; 2-Methylphenol	Phenol, 2-methyl-	NE	35	10	56	II
88-74-4	o-Nitroaniline; 2-Nitroaniline	Benzenamine, 2-nitro-	NE	NE	50	154	II
88-75-5	o-Nitrophenol; 2-Nitrophenol	Phenol, 2-nitro-	NE	NE	10	158	II
95-53-4	o-Toluidine	Benzenamine, 2-methyl-	NE	NE	10	197	II
60-11-7	p-(Dimethylamino)azobenzene	Benzenamine, N,N-dimethyl-4-(phenylazo)-	NE	NE	10	92	II
56-38-2	Parathion	Phosphorothioic acid,O,O-diethyl-O-(4-nitrophenyl) ester	NE	NE	10	169	II
106-47-8	p-Chloroaniline	Benzenamine, 4-chloro-	NE	NE	20	38	II
59-50-7	p-Chloro-m-cresol; 4-Chloro-3-methylphenol	Phenol, 4-chloro-3-methyl-	NE	NE	20	45	II
106-44-5	p-Cresol; 4-Methylphenol	Phenol, 4-methyl-	3.5	3.5	10	344	II
608-93-5	Pentachlorobenzene	Benzene, pentachloro-	NE	NE	10	171	II
82-68-8	Pentachloronitrobenzene	Benzene,pentachloronitro-	NE	NE	20	172	II
87-86-5	Pentachlorophenol	Phenol, pentachloro-	0.29	NE	25	173	II
62-44-2	Phenacetin	Acetamide, N-(4-ethoxyphenyl)	NE	NE	20	174	II
85-01-8	Phenanthrene	Phenanthrene	210	NE	10	175	II
108-95-2	Phenol	Phenol	300	NE	10	177	II
298-02-2	Phorate	Phosphorodithioic acid,O,O-diethyl S-[(ethylthio)methyl]ester	1.4	1.4	10	178	II
100-01-6	p-Nitroaniline; 4-Nitroaniline	Benzenamine, 4-nitro-	NE	NE	20	155	II
100-02-7	p-Nitrophenol; 4-Nitrophenol	Phenol, 4-nitro-	NE	NE	50	159	II
1336-36-3	Polychlorinated biphenyls; PCBs	1,1'-Biphenyl,chloro derivatives	NE	0.5	2	170	II
106-50-3	p-Phenylenediamine	1,4-Benzenediamine	NE	NE	10	176	II
23950-58-5	Pronamide	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-	NE	NE	10	179	II
107-12-0	Propionitrile; Ethyl cyanide	Propanenitrile	NE	NE	150	180	II
129-00-0	Pyrene	Pyrene	210	210	10	181	II
94-59-7	Safrole	1,3-Benzodioxole, 5-(2-propenyl)-	NE	NE	10	182	II
93-72-1	Silvex; 2,4,5-TP	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-	50	NE	2	185	II
18496-25-8	Sulfide	Sulfide	NE	NE	1000	187	II
99-35-4	sym-Trinitrobenzene	Benzene, 1,3,5-trinitro-	NE	NE	10	208	II
8001-35-2	Toxaphene	Toxaphene	0.031	NE	1.5	198	II

*** GWP = Groundwater Protection**
**** SWSL = Solid Waste Section Limit**

CAS numbers that begin with "SW" are not real CAS numbers, instead this represents the Solid Waste Section's ID number
All units are in (ug/L) unless noted.
NE = Not Established

North Carolina Department of Environment and Natural Resources
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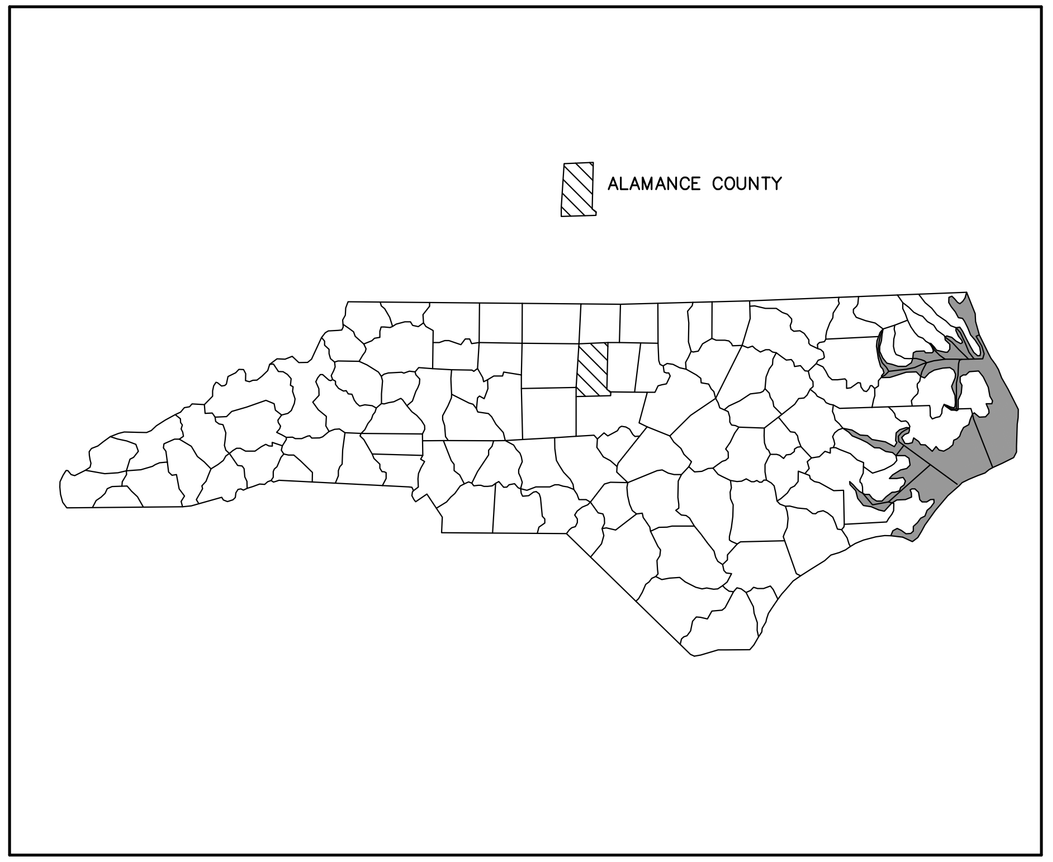
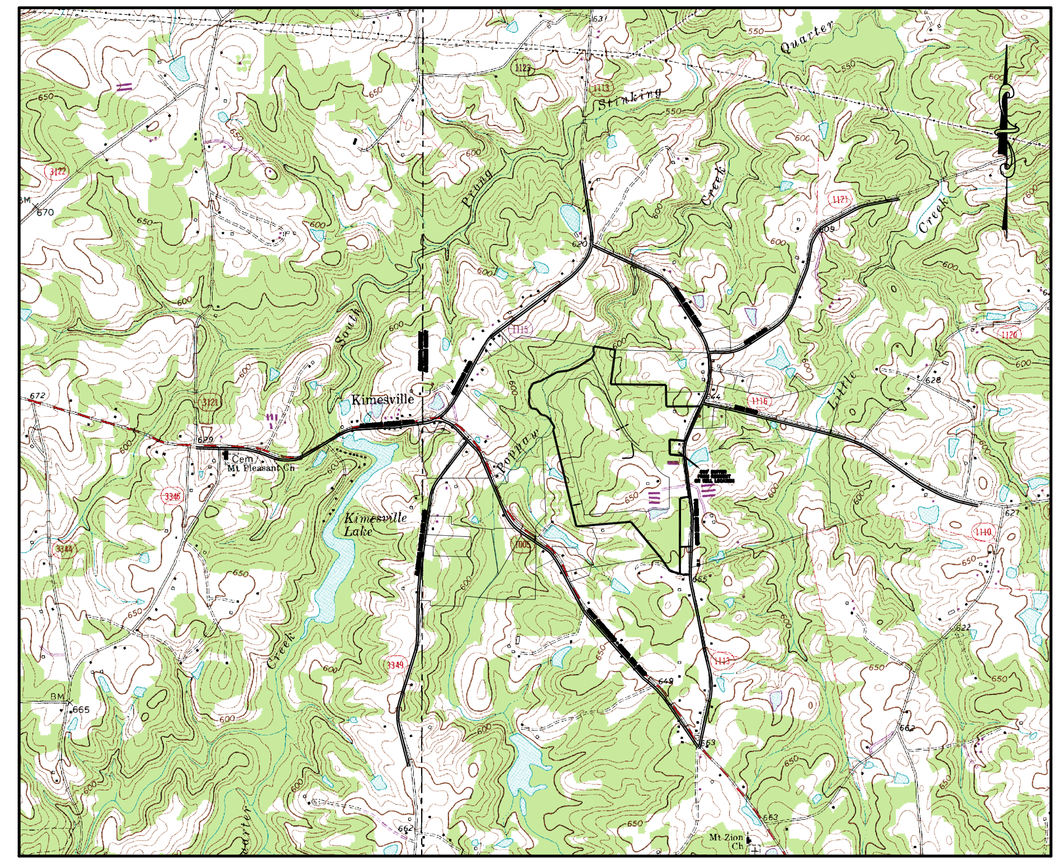
Downloaded off DENR Constituent Look-up Tables on 8/14/07
http://www.wastenotnc.org/sw/swenvmonitoringlist.asp?GROUP=Appendix&NAME=%&CAS_NUM=%



NORTH CAROLINA

COUNTY LOCATION MAP
N.T.S.



LOCATION MAP

APPROXIMATE SCALE: 1"=2000'

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- SEGMENT USED FOR GRADIENT CALCULATIONS (i_1)
- PIEZOMETER LOCATION AND IDENTIFICATION (P–1)
- GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION (MW–10)
- BORING LOCATIONS AND IDENTIFICATION (B–5)
- CORING LOCATION AND IDENTIFICATION (C–3)
- HAND AUGER PIEZOMETER LOCATION (P–28)
- RESIDENTIAL WELL LOCATION (WW–1)
- PROPOSED MONITORING WELL (MW-11)
- CORING LOCATION WITH TEMPORARY WELL (TW–2)
- SURFACE WATER MONITORING PLAN (SMP–1)

GENERAL NOTES:

1. COORDINATE SYSTEM FOR ALL DIGITAL MAPPING IS NC83F.
2. VICINITY MAP REFERENCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE FOR KIMESVILLE, NORTH CAROLINA, 1982.

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

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CHECKED VB
APPROVED VB
DATE 08/30/07

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COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

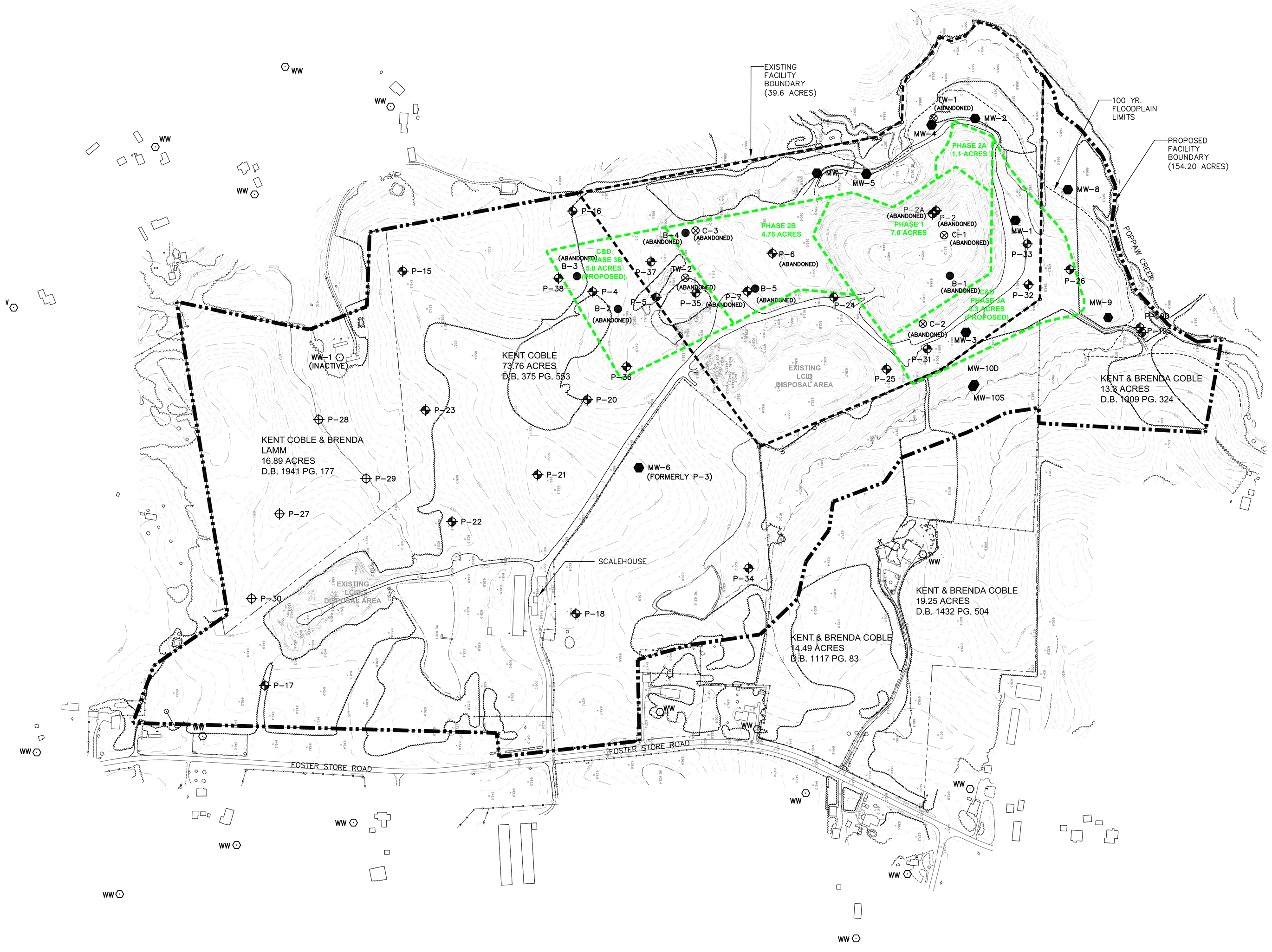
DRAWING INDEX, NOTES
LEGENDS, AND ABBREVIATIONS

PROJECT NO.
419.00.27

SCALE
N.T.S.

DRAWING NO.
H–1

L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 8-07\H-01 - INDEX.dwg



LEGEND

- PROPOSED FACILITY BOUNDARY
- CURRENT PERMITTED FACILITY BOUNDARY
- EXISTING 10 FT CONTOUR
- EXISTING 2 FT CONTOUR
- PROPOSED BASE GRADE CONTOUR
- STREAM
- TREELINE
- ACCESS ROAD
- EXISTING ROAD
- UTILITY POLE
- FENCE
- CELL BOUNDARY
- PIEZOMETER LOCATION AND IDENTIFICATION — P-1
- GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION — MW-10
- BORING LOCATIONS AND IDENTIFICATION — B-5
- CORING LOCATION AND IDENTIFICATION — C-3
- HAND AUGER PIEZOMETER LOCATION — P-28
- RESIDENTIAL WELL LOCATION — WW-1
- CORING LOCATION WITH TEMPORARY WELL — TW-2

GRAPHIC SCALE
0 100 200 400
(FEET)

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

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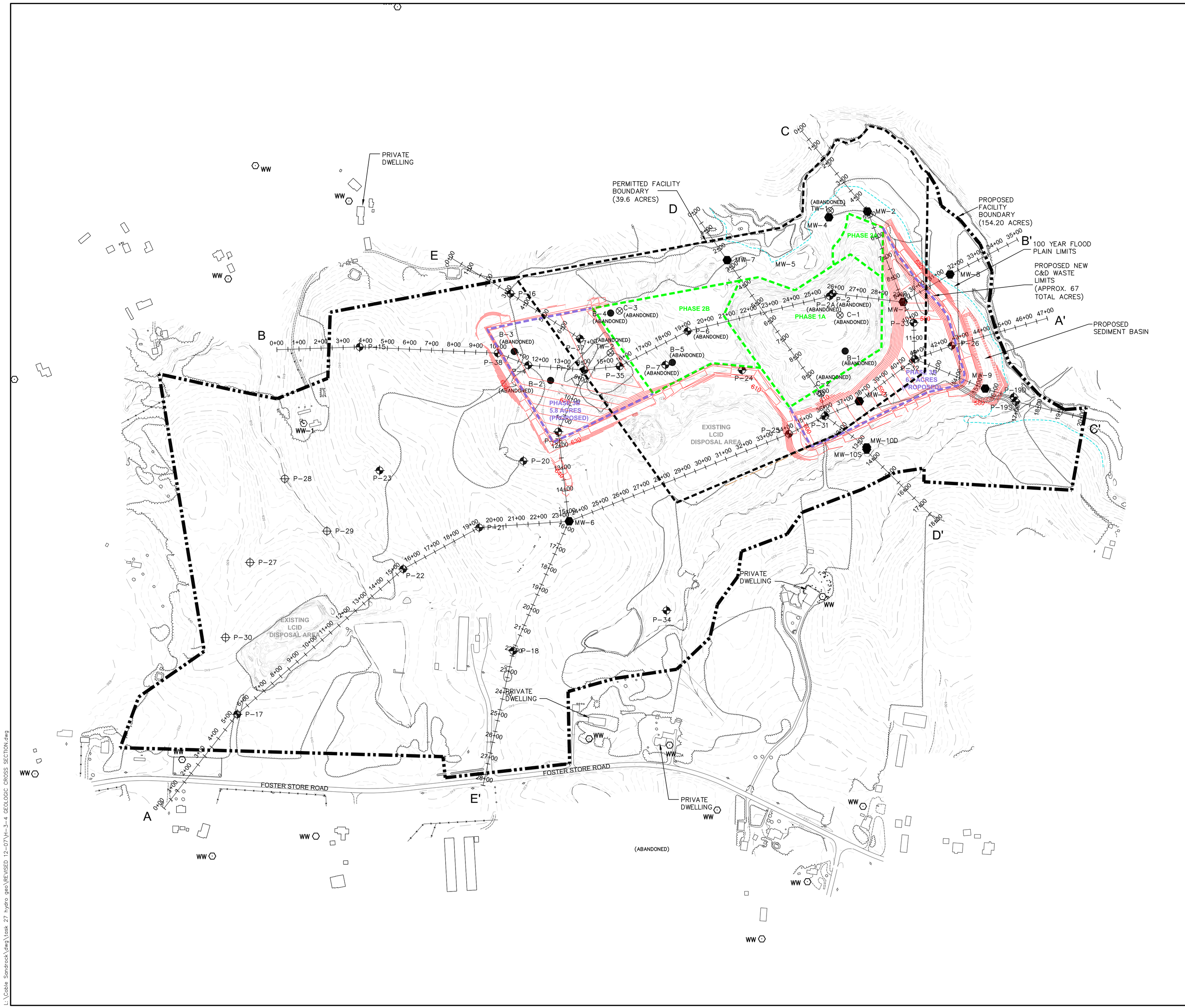
EXISTING CONDITIONS MAP WITH BORING AND WELL LOCATIONS

PROJECT NO.
419.00.27

SCALE
1"=200'

DRAWING NO.
H-2

L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 8-07\H-02-EXIST COND.dwg



LEGEND

EXISTING 2' CONTOURS	
EXISTING 10' CONTOURS	
PROPOSED SUBGRADE	
EXISTING CELL BOUNDARIES	
PROPOSED CELL BOUNDARIES	
PIEZOMETER LOCATION AND IDENTIFICATION	P-1
GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION	MW-10
BORING LOCATIONS AND IDENTIFICATION	B-5
CORING LOCATION AND IDENTIFICATION	C-3
HAND AUGER PIEZOMETER LOCATION	P-28
RESIDENTIAL WELL LOCATION	WW-1
CORING LOCATION WITH TEMPORARY WELL	TW-2

NOTES

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. BEDROCK SURFACE CONTOUR INTERVAL = 5 FEET.

GRAPHIC SCALE
0 100 200 400
(FEET)

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

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COBLE'S SANDROCK, INC.
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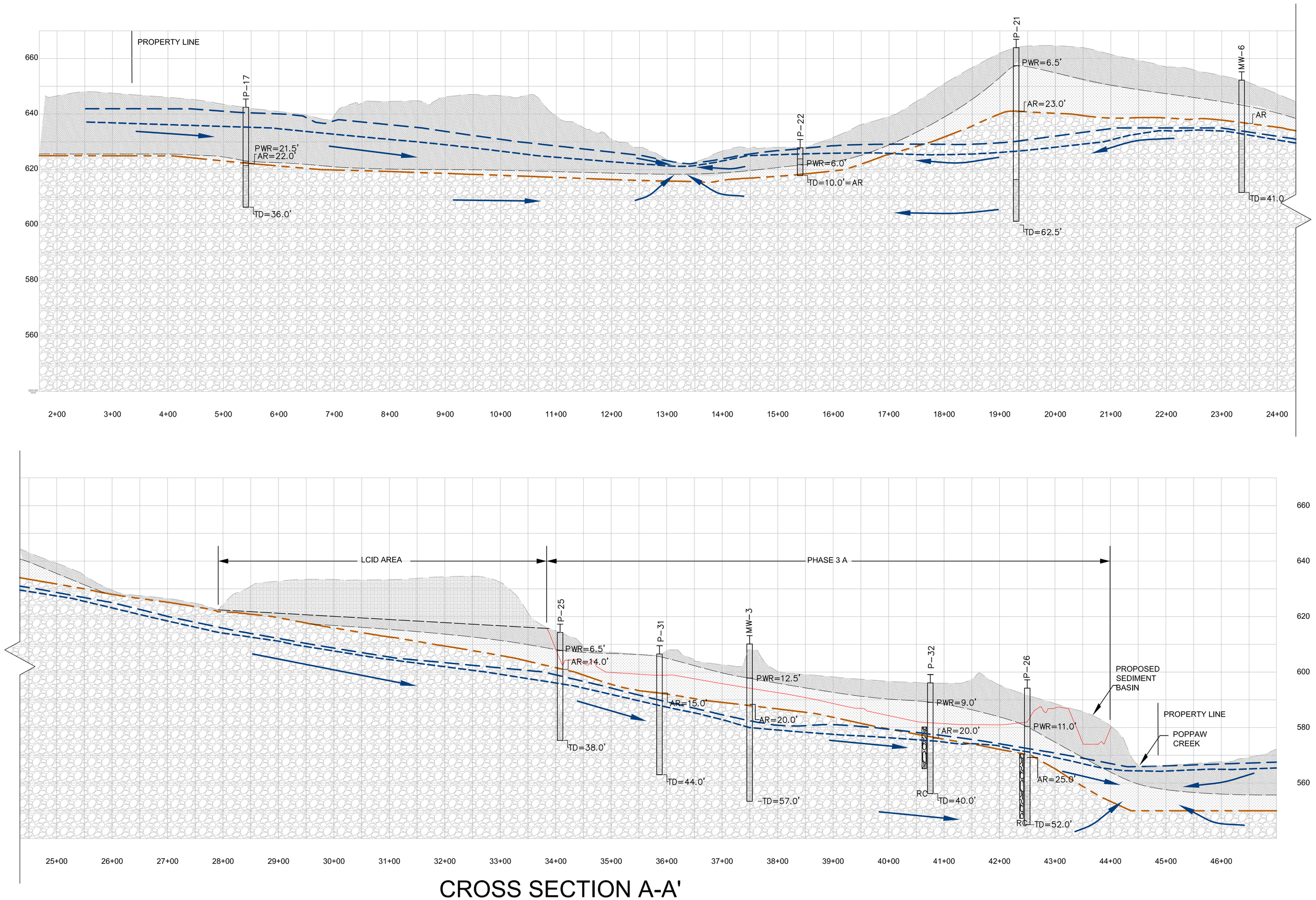
HYDROGEOLOGIC CROSS-SECTIONS-
LINES OF SECTION

PROJECT NO.
419.00.27

SCALE
1"=200'

DRAWING NO.
H-3

L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 12-07\H-3-4 GEOLOGIC CROSS SECTION.dwg



CROSS SECTION A-A'

WASTE

SAPROLITE

PARTIALLY WEATHERED ROCK

BEDROCK

PROPOSED SUBGRADE

LONG-TERM SEASONAL HIGH WATER TABLE

SEASONAL HIGH WATER TABLE (MARCH 6, 2007)

PARTIALLY WEATHERD ROCK

BEDROCK

APPROX BASE OF WASTE

TOP OF GROUND

GROUNDWATER FLOW DIRECTION

MONITORING WELL MW-6

BORING B-10

PIEZOMETER P-10

P-12 — OBSERVATION WELL IDENTIFICATION

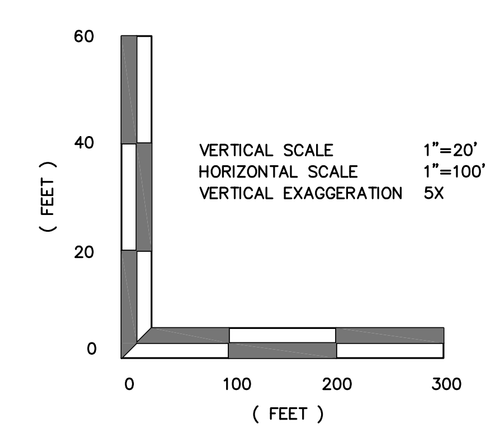
AR — AUGER REFUSAL OR ESTIMATED TOP OF BEDROCK

RC — ROCK CORE INTERVAL

SCREENED INTERVAL

TD=45.0 — TOTAL DEPTH IN FEET

SCALE



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KIMESVILLE, NORTH CAROLINA

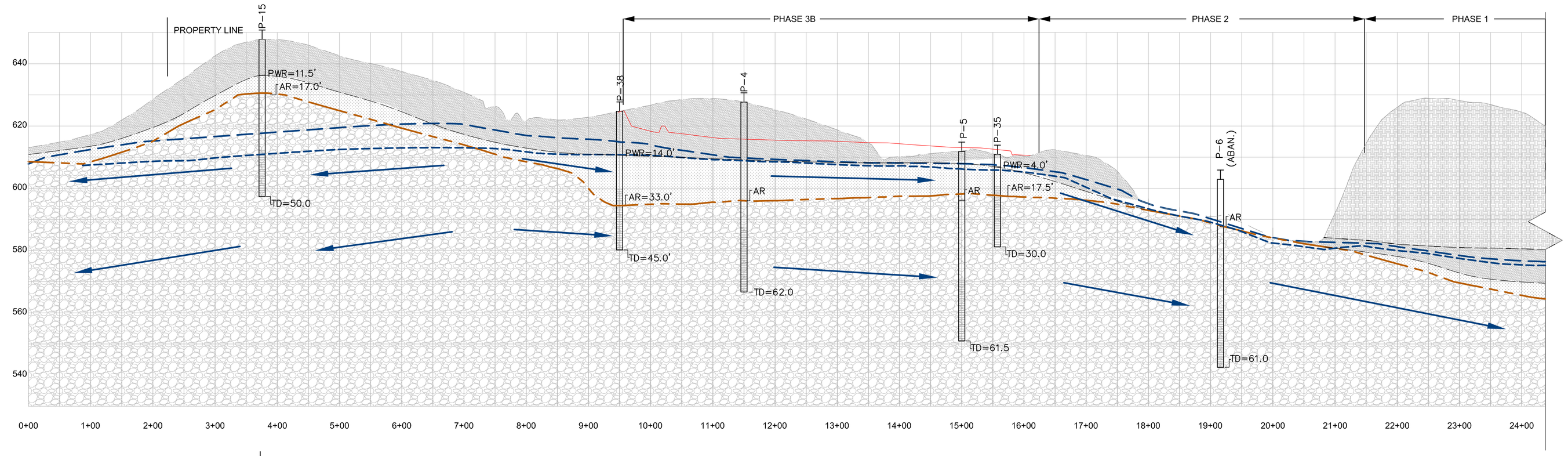
HYDROGEOLOGIC CROSS-SECTION
A-A'

PROJECT NO.
419.27

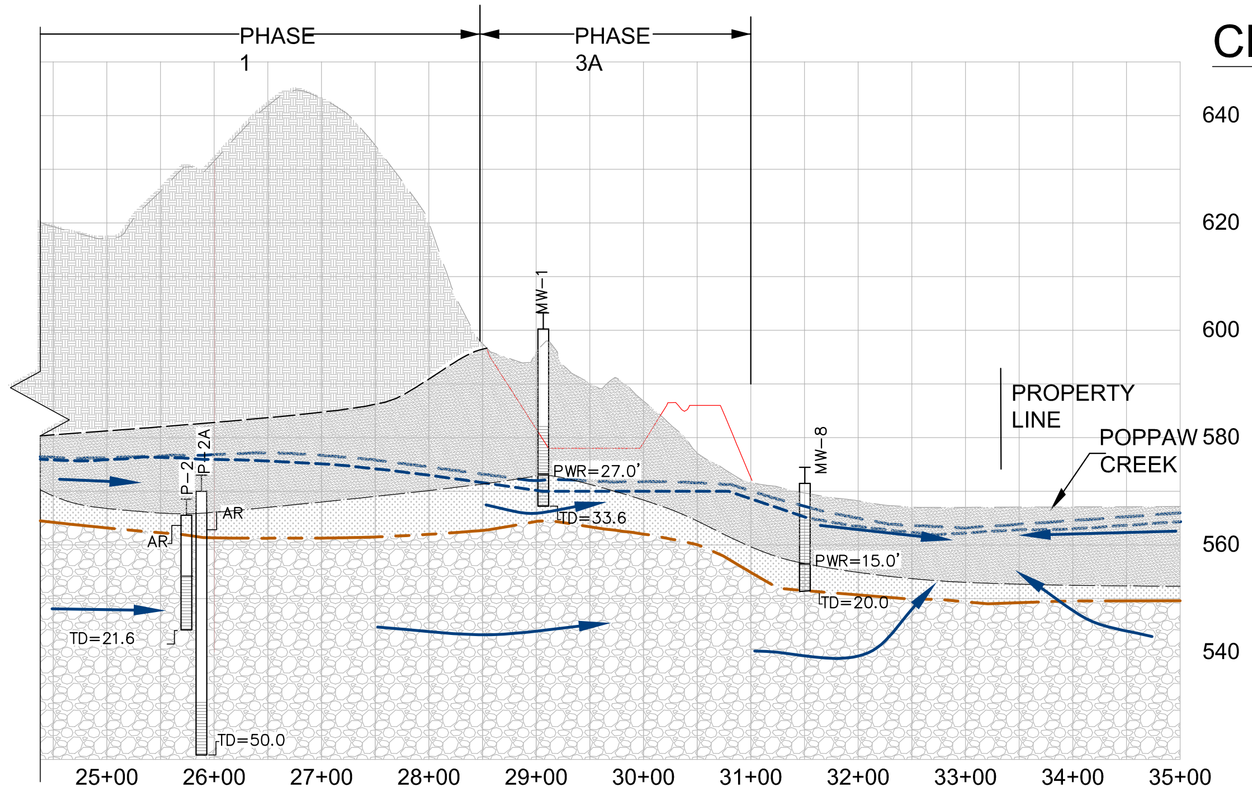
SCALE
1"=200'

DRAWING NO.
H-4A

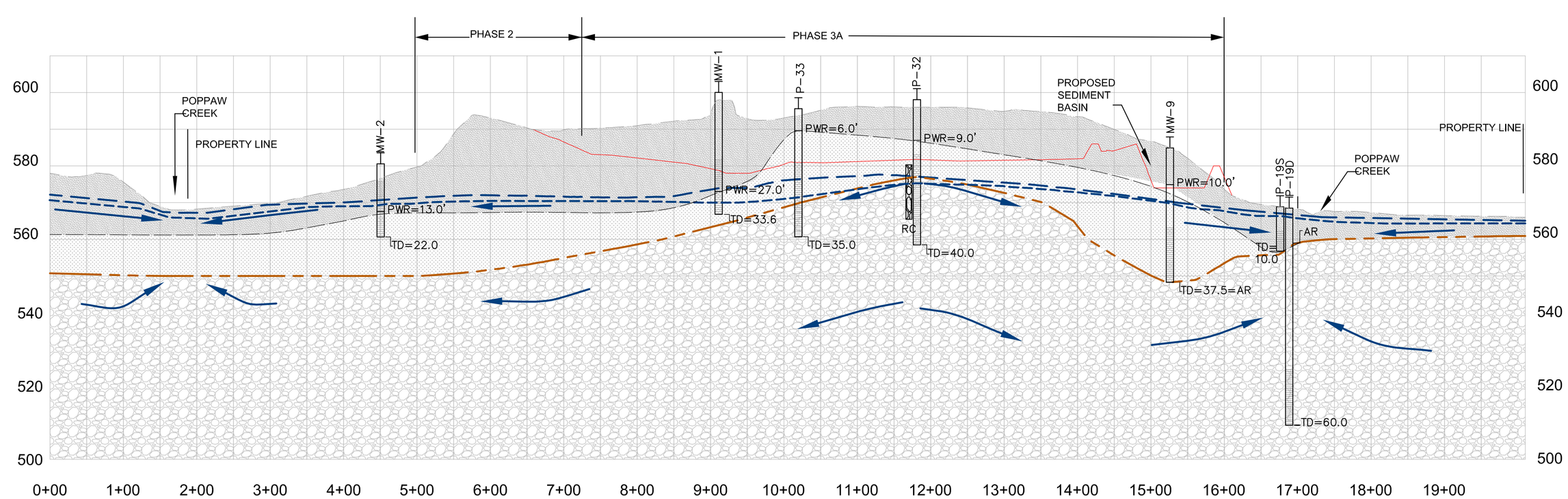
L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 12-07\H-3-4 GEOLOGIC CROSS SECTION.dwg



CROSS SECTION B-B'



CROSS SECTION C-C'



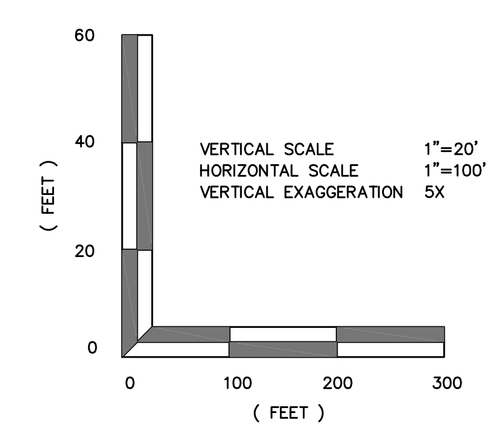
WASTE
SAPROLITE
PARTIALLY WEATHERED ROCK
BEDROCK

PROPOSED SUBGRADE
LONG-TERM SEASONAL HIGH WATER TABLE
SEASONAL HIGH WATER TABLE (MARCH 6, 2007)
PARTIALLY WEATHERD ROCK
BEDROCK
APPROX BASE OF WASTE
TOP OF GROUND
GROUNDWATER FLOW DIRECTION

MONITORING WELL MW-6
BORING B-10
PIEZOMETER P-10

P-12 — OBSERVATION WELL IDENTIFICATION
AR — AUGER REFUSAL OR ESTIMATED TOP OF BEDROCK
RC — ROCK CORE INTERVAL
SCREENED INTERVAL
TD=45.0 — TOTAL DEPTH IN FEET

SCALE



VERTICAL SCALE 1"=20'
HORIZONTAL SCALE 1"=100'
VERTICAL EXAGGERATION 5X

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KIMESVILLE, NORTH CAROLINA

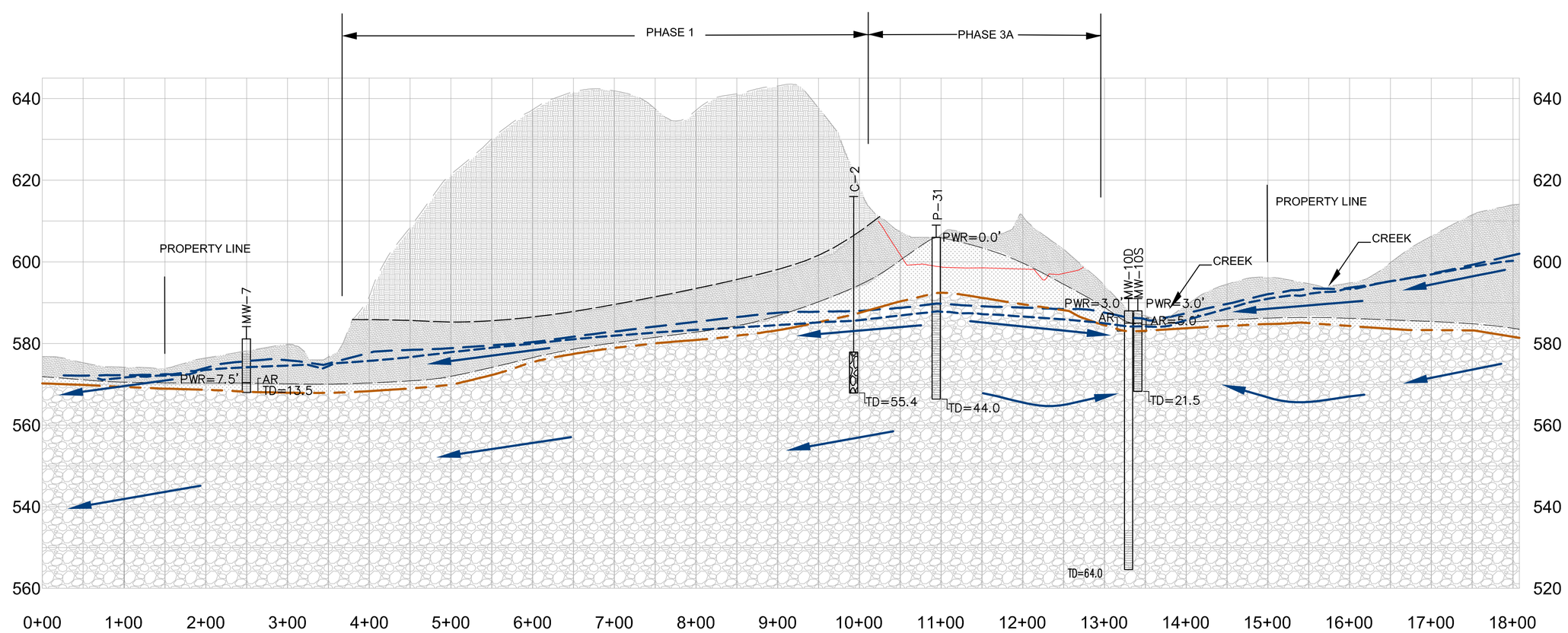
HYDROGEOLOGIC CROSS-SECTIONS
B-B' AND C-C'

PROJECT NO.
419.27

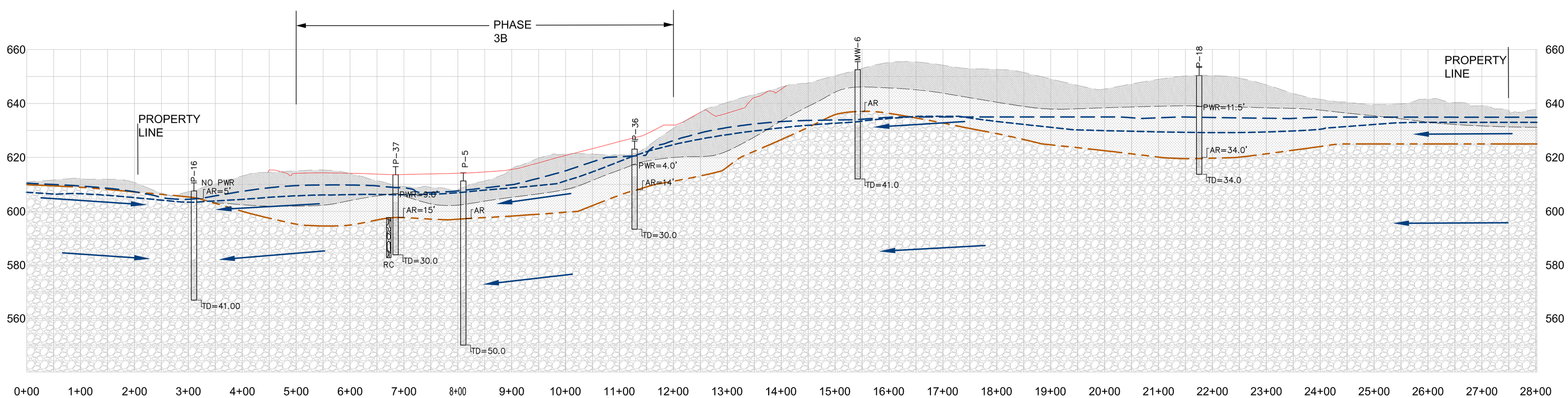
SCALE
1"=200'

DRAWING NO.
H-4B

L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 12-07\H-3-4 GEOLOGIC CROSS SECTION.dwg

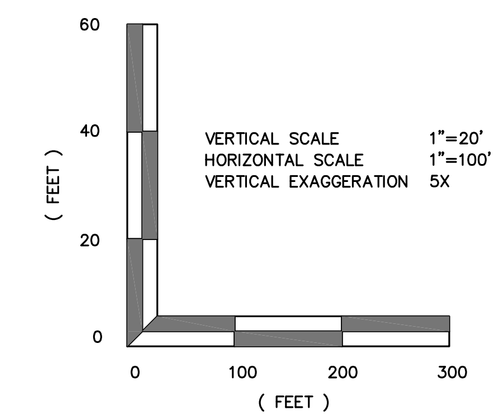


CROSS SECTION D-D'



CROSS SECTION E-E'

SCALE

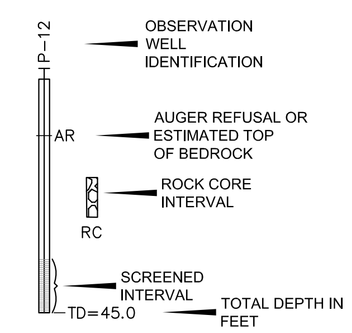


VERTICAL SCALE 1"=20'
HORIZONTAL SCALE 1"=100'
VERTICAL EXAGGERATION 5X

WASTE
SAPROLITE
PARTIALLY WEATHERED ROCK
BEDROCK

PROPOSED SUBGRADE
LONG-TERM SEASONAL HIGH WATER TABLE
SEASONAL HIGH WATER TABLE (MARCH 6, 2007)
PARTIALLY WEATHERD ROCK
BEDROCK
APPROX BASE OF WASTE
TOP OF GROUND
GROUNDWATER FLOW DIRECTION

MONITORING WELL MW-6
BORING B-10
PIEZOMETER P-10



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KIMESVILLE, NORTH CAROLINA

HYDROGEOLOGIC CROSS-SECTIONS
D-D' AND E-E'

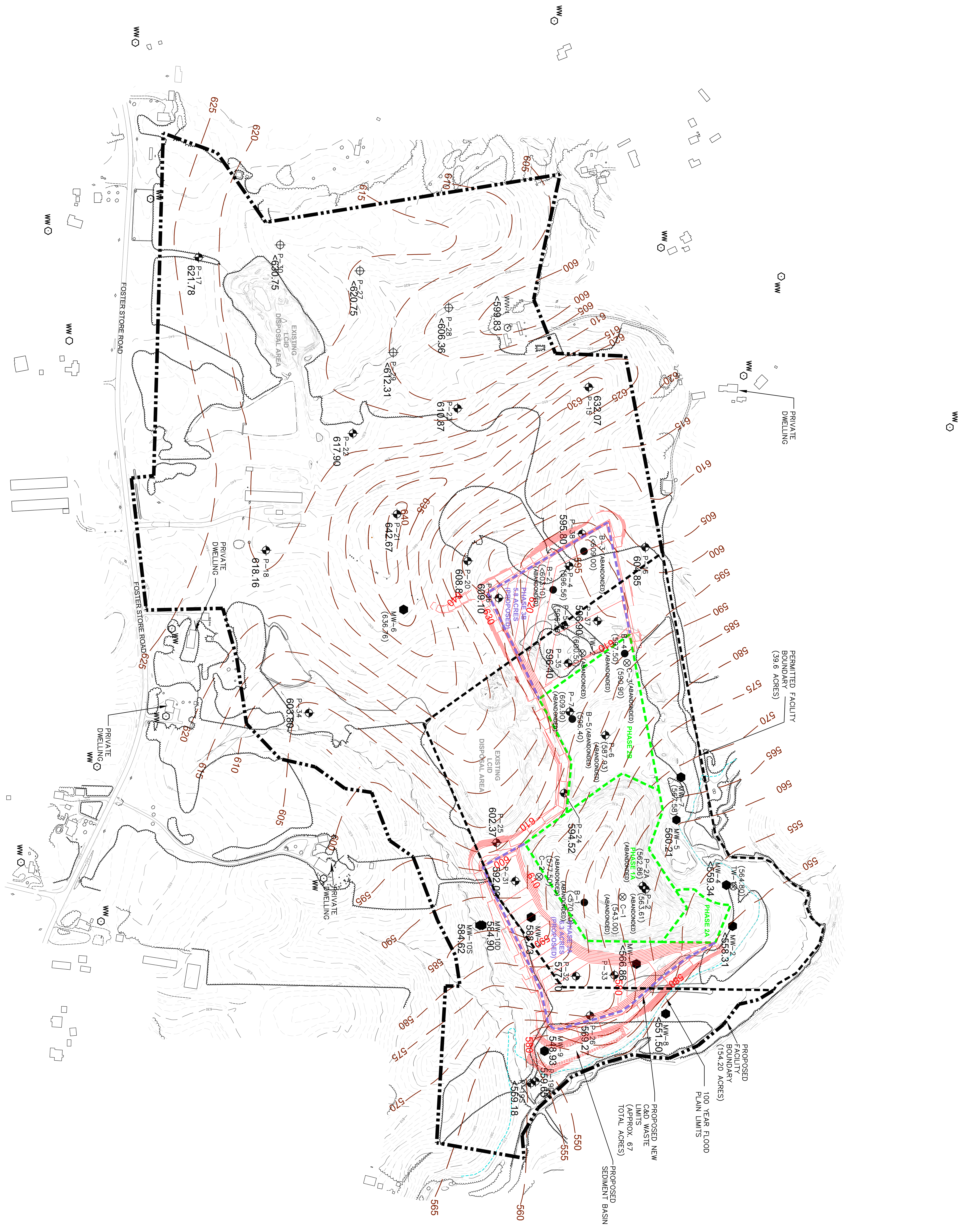
PROJECT NO.
419.27

SCALE
1"=200'

DRAWING NO.
H-4C

L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 12-07\H-3-4 GEOLOGIC CROSS SECTION.dwg

L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 8-07\H-5 BEDROCK MAP.dwg



LEGEND

EXISTING 2' CONTOURS	
EXISTING 10' CONTOURS	
BEDROCK CONTOURS	
PROPOSED BASE GRADES	
EXISTING CELL BOUNDARY	
PROPOSED CELL BOUNDARY	
PIEZOMETER LOCATION AND IDENTIFICATION	P-1
GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION	MW-10
BORING LOCATIONS AND IDENTIFICATION	B-5
CORING LOCATION AND IDENTIFICATION	C-3
HAND AUGER PIEZOMETER LOCATION	P-28
RESIDENTIAL WELL LOCATION	WW-1
CORING LOCATION WITH TEMPORARY WELL	TW-2
BEDROCK ELEVATION BASED ON AUGER REFUSAL OR BLOW COUNT >50/.2'	596.90
MAXIMUM BEDROCK ELEVATION BASED ON AUGER REFUSAL NOT REACHED.	<603.10
ESTIMATED BEDROCK ELEVATION FOR BORINGS NOT ADVANCED WITH AUGERS, OR DATA DISCOUNTED DUE TO LACK OF SURVEY DATA.	(596.26)

NOTES

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. BEDROCK SURFACE CONTOUR INTERVAL = 5 FEET.

GRAPHIC SCALE
0 100 200 400
(FEET)

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COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

BEDROCK ELEVATIONS

PROJECT NO. 419.00.27

SCALE 1"=200'

DRAWING NO. H-5

DESIGNED VB
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APPROVED VB
DATE 08/30/07

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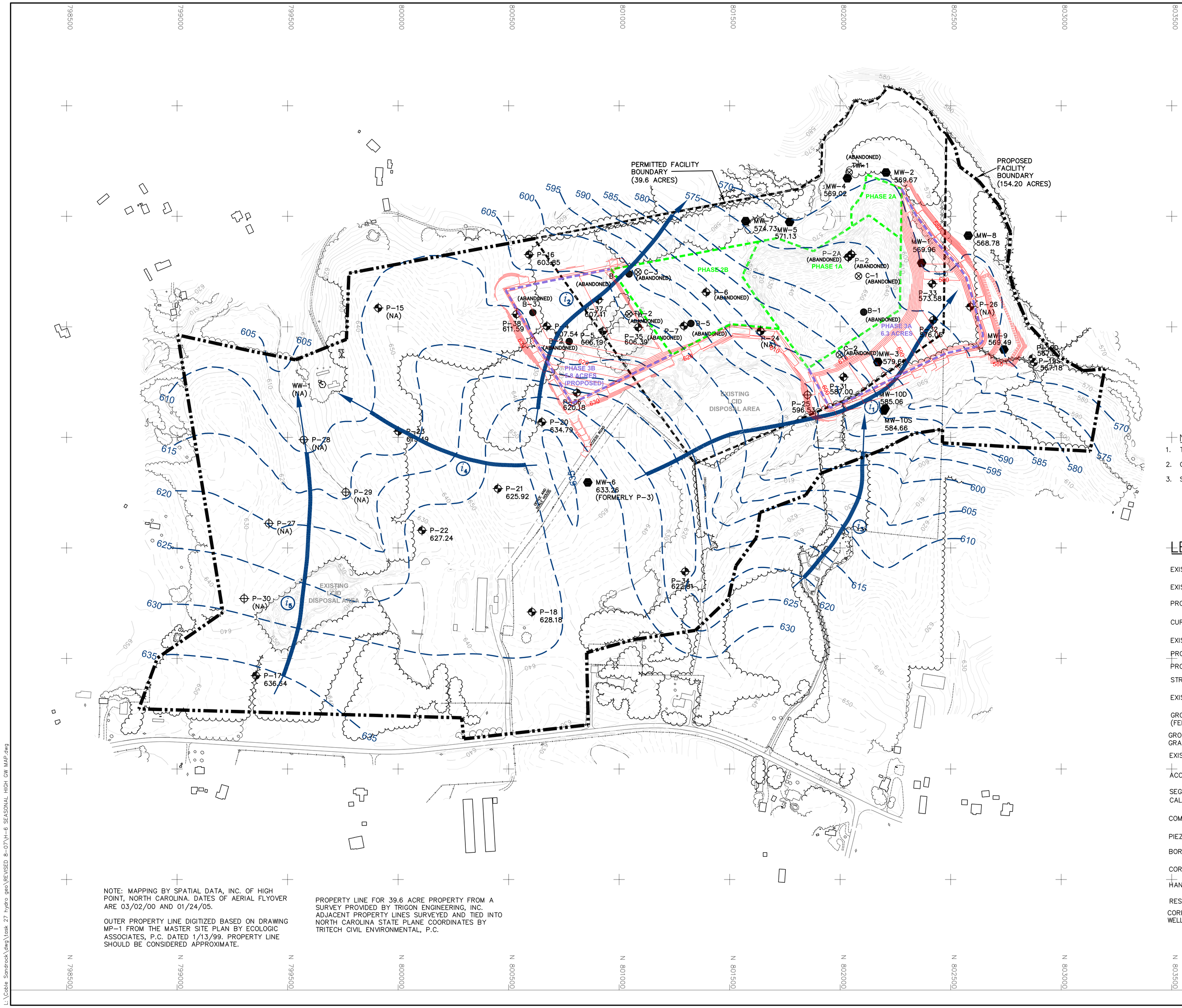

NOTE: MAPPING BY SPATIAL DATA, INC. OF HIGH POINT, NORTH CAROLINA. DATES OF AERIAL FLYOVER ARE 03/02/00 AND 01/24/05.

OUTER PROPERTY LINE DIGITIZED BASED ON DRAWING MP-1 FROM THE MASTER SITE PLAN BY ECOLOGIC ASSOCIATES, P.C. DATED 1/13/99. PROPERTY LINE SHOULD BE CONSIDERED APPROXIMATE.

PROPERTY LINE FOR 39.6 ACRE PROPERTY FROM A SURVEY PROVIDED BY TRIGON ENGINEERING, INC. ADJACENT PROPERTY LINES SURVEYED AND TIED INTO NORTH CAROLINA STATE PLANE COORDINATES BY TRITECH CIVIL ENVIRONMENTAL, P.C.

NOTES:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. GROUNDWATER SURFACE CONTOUR INTERVAL = 5 FEET.
3. STATIC WATER LEVELS MEASURED ON MARCH 6, 2007.

LEGEND

- EXISTING 10 FT. CONTOUR
- EXISTING 2 FT. CONTOUR
- PROPOSED FACILITY BOUNDARY
- CURRENT PERMITTED FACILITY BOUNDARY
- EXISTING CELL BOUNDARY
- PROPOSED CELL BOUNDARY
- PROPOSED BASE GRADES
- STREAM
- EXISTING TREELINE
- GROUNDWATER SURFACE CONTOURS (FEET ABOVE SEA LEVEL) — 625
- GROUNDWATER FLOW DIRECTION WITH GRADIENT CALCULATION SEGMENT
- EXISTING ROAD
- ACCESS ROAD
- SEGMENT USED FOR GRADIENT CALCULATIONS — i_2
- COMPLIANCE WELL LOCATION — MW-1
- PIEZOMETER LOCATION — P-5
- BORING LOCATION — B-5
- CORING LOCATION — C-3
- HAND AUGER PIEZOMETER LOCATION — P-28
- RESIDENTIAL WELL LOCATION — WW-1
- CORING LOCATION WITH TEMPORARY WELL — TW-2

GRAPHIC SCALE
0 100 200 400
(FEET)

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COBLE'S SANDROCK
KIMESVILLE, NORTH CAROLINA

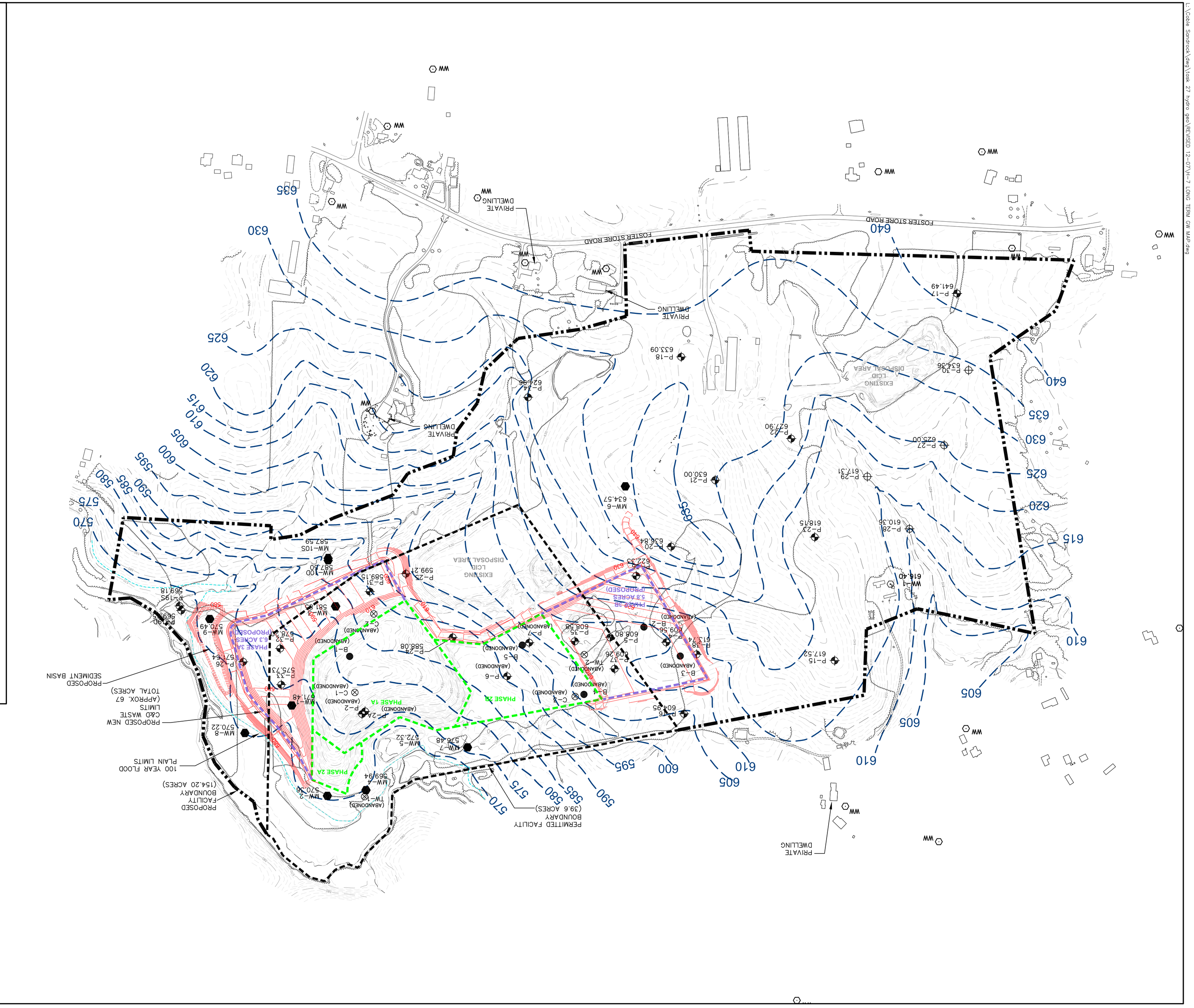
SEASON HIGH WATER TABLE CONTOUR MAP– MARCH 6, 2007

PROJECT NO.
419.00.27

SCALE
1"=200'

DRAWING NO.
H–6

L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 8-07\H-6 SEASONAL HIGH GW MAP.dwg



L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 12-07\H-7 LONG TERM GW MAP.dwg

NOTES

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. GROUNDWATER SURFACE CONTOUR INTERVAL = 5 FEET.

GRAPHIC SCALE (FEET)

0 100 200 400

LEGEND

- EXISTING 2' CONTOURS
- EXISTING 10' CONTOURS
- LONG-TERM SEASONAL HIGH WATER TABLE CONTOURS
- SUBGRADE CONTOURS
- EXISTING CELL BOUNDARIES
- PROPOSED CELL BOUNDARIES
- PIEZOMETER LOCATION AND IDENTIFICATION — P-1
- GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION — MW-10
- BORING LOCATIONS AND IDENTIFICATION — B-5
- CORING LOCATION AND IDENTIFICATION — C-3
- HAND AUGER PIEZOMETER LOCATION — P-28
- RESIDENTIAL WELL LOCATION — WW-1
- CORING LOCATION WITH TEMPORARY WELL — TW-2

COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

LONG-TERM SEASONAL HIGH WATER TABLE CONTOUR MAP WITH PROPOSED BASE GRADES

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APPROVED	VB
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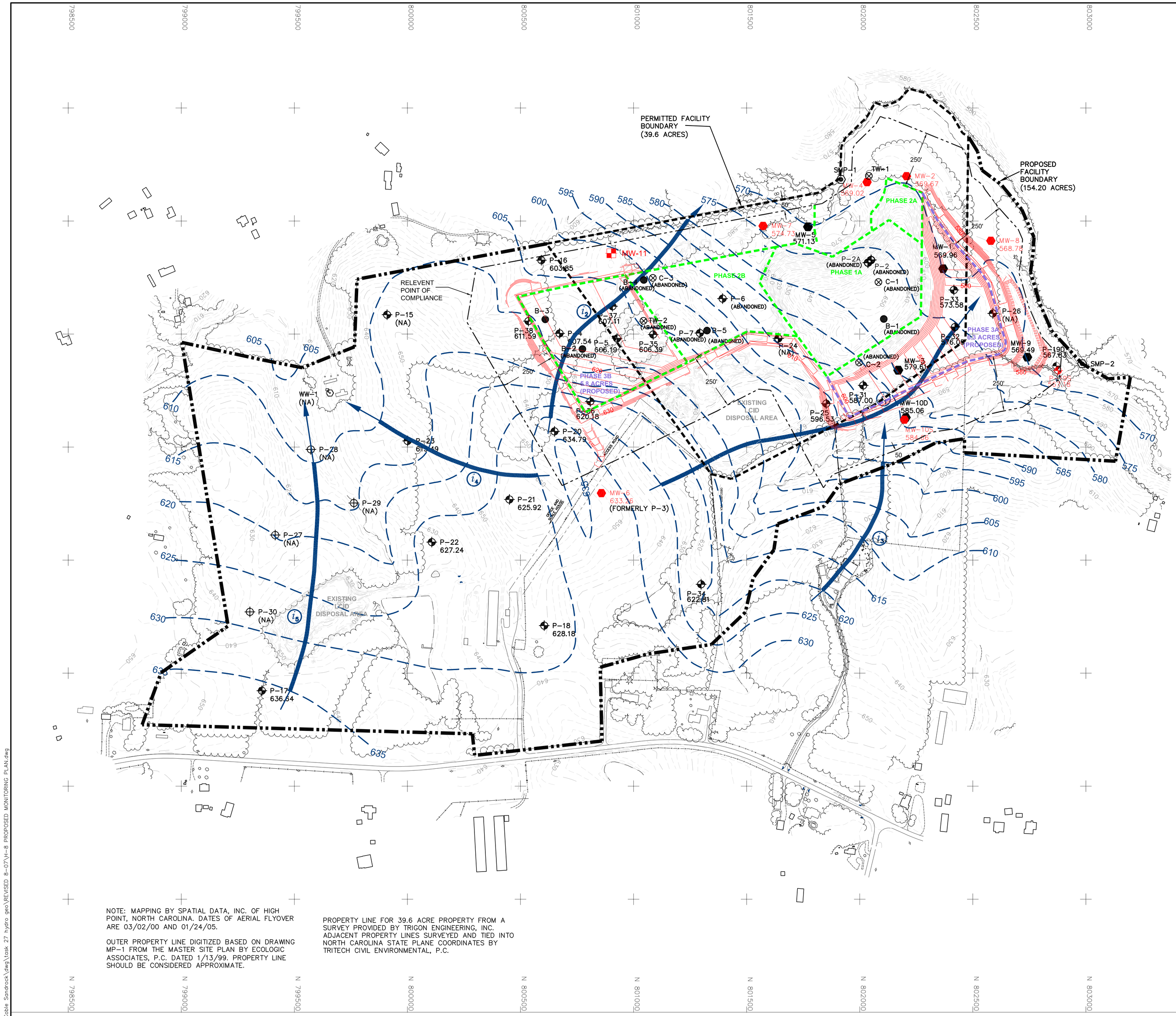
DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

PROJECT NO. 419.00.27

SCALE 1"=200'

DRAWING NO. H-7



NOTES:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. GROUNDWATER SURFACE CONTOUR INTERVAL = 5 FEET.
3. STATIC WATER LEVELS MEASURED ON MARCH 6, 2007.

LEGEND

- EXISTING 10 FT. CONTOUR
- EXISTING 2 FT. CONTOUR
- PROPOSED FACILITY BOUNDARY
- PERMITTED FACILITY BOUNDARY
- CELL BOUNDARY
- STREAM
- EXISTING TREELINE
- GROUNDWATER SURFACE CONTOURS (FEET ABOVE SEA LEVEL) — 625
- GROUNDWATER FLOW DIRECTION WITH GRADIENT CALCULATION SEGMENT
- EXISTING ROAD
- ACCESS ROAD
- SEGMENT USED FOR GRADIENT CALCULATIONS — i_2
- COMPLIANCE WELL LOCATION — MW-8
- MONITORING WELL LOCATION — MW-1
- PIEZOMETER LOCATION — P-5
- BORING LOCATION — B-5
- CORING LOCATION — C-3 OR TW-2
- HAND AUGER PIEZOMETER LOCATION — P-28
- RESIDENTIAL WELL LOCATION — WW-1
- PROPOSED MONITORING WELL — MW-11
- SURFACE WATER MONITORING POINT — SMP-1

GRAPHIC SCALE
0 100 200 400
(FEET)

NOTE: MAPPING BY SPATIAL DATA, INC. OF HIGH POINT, NORTH CAROLINA. DATES OF AERIAL FLYOVER ARE 03/02/00 AND 01/24/05.

OUTER PROPERTY LINE DIGITIZED BASED ON DRAWING MP-1 FROM THE MASTER SITE PLAN BY ECOLOGIC ASSOCIATES, P.C. DATED 1/13/99. PROPERTY LINE SHOULD BE CONSIDERED APPROXIMATE.

PROPERTY LINE FOR 39.6 ACRE PROPERTY FROM A SURVEY PROVIDED BY TRIGON ENGINEERING, INC. ADJACENT PROPERTY LINES SURVEYED AND TIED INTO NORTH CAROLINA STATE PLANE COORDINATES BY TRITECH CIVIL ENVIRONMENTAL, P.C.

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

DESIGNED VB
DRAWN CADD/RFB
CHECKED VB
APPROVED VB
DATE 08/30/07

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COBLE'S SANDROCK
KIMESVILLE, NORTH CAROLINA

WATER QUALITY MONITORING PLAN

PROJECT NO. 419.00.27

SCALE 1"=200'

DRAWING NO. H-8

L:\Coble Sandrock\dwg\task 27 hydro geo\REVISED 8-07\H-8 PROPOSED MONITORING PLAN.dwg

SECTION 02100

SITE PREPARATION AND RESTORATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site Protection

B. Clearing

C. Grubbing

D. Removal and Disposal of Debris

E. Site Restoration

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable code(s) for disposal of debris.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 SITE PROTECTION

A. Protect benchmarks from damage or displacement.

B. Protect Owner's property and adjoining properties from damage due to construction activities. Use barricades, coverings, and warning signs as appropriate.

C. Contractor is responsible for correcting any damage caused by construction activities. Make repairs to the satisfaction of the Owner or other parties having jurisdiction. All costs for repairs will be borne by the Contractor.

D. If required by law, prepare a new erosion and sediment control plan for proposed disturbances due to clearing and grading activities outside the limits of construction shown on the drawings. Submit the erosion and sediment control plan to regulatory

authorities for approval, and pay required review fees. Obtain approval for the submitted plan before initiating clearing activities in the affected area.

3.02 CLEARING

A. Clear and grade areas required for access to site and execution of Work.

B. Remove from the site trees, brush, shrubs, downed timber, undergrowth, deadwood, rubbish, and other vegetation and incidental structures to allow for new construction.

C. Remove all trees, stumps, and roots within ten (10) feet of any proposed structure or pipeline.

D. Stumps of trees remaining in place shall be left no more than four (4) inches above original grade.

E. Clearing shall be bound to areas within the limits of construction needed to execute the Work.

F. With the exception of areas that are disturbed in accordance with an erosion and sediment control permit obtained under the provisions of paragraph 3.01.D, do not disturb other areas outside the limits of construction shown on the Contract Drawings.

3.03 GRUBBING

A. Grub areas within a 10-foot zone bordering all proposed structures and pipelines.

B. In areas to be cleared, remove all stumps, roots ½-inch or larger, organic material, and debris to a depth of approximately one foot below existing grade, or one foot below the proposed subgrade elevation, whichever is lower.

C. Remove grassy vegetation in a manner that maximizes the separation of vegetative cover and topsoil or subsoil. Dispose the removed grassy cover separately at the active landfill facility as directed by facility personnel.

D. Use hand methods for grubbing inside the drip lines of trees which are to remain.

E. Clean up debris resulting from site clearing operations continuously with the progress of the Work.

F. Stockpile topsoil material on site in areas designated by the facility personnel.

G. Keep pavement and areas adjacent to site clean and free from mud, dirt, and debris.

3.04 REMOVAL AND DISPOSAL OF DEBRIS

A. Unless otherwise noted, trees within the construction limits shall become the property of the Contractor and shall be removed from the site or disposed on-site as approved by facility personnel.

B. Remove other debris, rock, and extracted plant life from the site or dispose on-site as approved by facility personnel.

C. Removal and disposal of debris, rock and extracted plant life shall be accomplished at no additional cost to the Owner.

D. Burning of land clearing debris generated onsite will be permitted as stated in Rule .0542(i)(2) of the NCDENR Solid Waste Management Regulations. Prior to any burning a request must be sent to the Division for review. Upon approval a notation of the date of approval and the name of the Division personnel who approved the burning must be included in the operating record. No burning will be allowed within 100 feet of waste disposal areas or site access roads.

E. Contractor shall obtain and comply with all required permits.

3.05 SITE RESTORATION

A. At the end of the construction period, the Contractor shall restore to existing grade those areas disturbed by construction activities that lie beyond the limits of construction shown on the Drawings and that are outside the borrow area. Areas to be filled shall be nominally compacted as may be achieved with construction equipment, and permanently seeded in accordance with the requirements of Section 02936.

END OF SECTION

SECTION 02227

SOIL PROTECTIVE LAYER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction of the soil protective layer for the landfill cap.

PART 2 PRODUCTS

2.01 FILL MATERIAL

A. Construct soil protective layer using on-site soil free of frozen soil, stones greater than two inches in maximum diameter, debris, organic matter and any other deleterious substances.

B. Use the most permeable material available in the borrow area that meets the requirements of paragraph 2.01 A. of this Section.

C. Material shall have a unit weight greater than or equal to 120pcf and internal friction angle greater than or equal to 20 degrees as determined by the triaxial test (ASTM D 4767), unless otherwise approved by the engineer.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Place and spread soil protective layer material in a manner that avoids operation of the equipment directly on the geotextile fabric if applicable. The Contractor shall maintain a minimum of 6” of soil between the equipment and the geotextile fabric.

B. Do not damage the underlying geotextile fabric if applicable.

C. Low pressure dozers (less than 15 psi), or other equipment as approved by the ENGINEER, shall be used for spreading and grading the soil protective layer.

D. Provide compaction by tracking the material in place by moving a cleated dozer up and down the slope.

E. Place material in one lift to minimize the potential for damage to the underlying liner materials.

F. Construct a 4-foot thick traffic surface to support haul trucks delivering material to the work area.

G. Do not push the soil protective layer material down the slopes. Begin placement at the bottom and work the material up the slope when working on top of geosynthetics.

3.02 QUALITY ASSURANCE

A. Field inspection will be performed under provisions of Section 01410.

B. Perform Standard Proctor Test (ASTM D 698) on the material being used and use engineering judgement to determine if the material is suitable for use. Conduct continuous visual inspection of materials to ensure that proper soils are being used.

3.03 PROTECTION OF FINISHED WORK

A. Any portion of the protective soil layer that is damaged shall be reworked to meet the specifications, or removed and replaced with conforming material.

B. Make repairs at no additional cost to the OWNER.

END OF SECTION 02227

SECTION 02228

STRUCTURAL FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Controlled structural fill for the landfill subgrade, if necessary, and embankments for the proposed sediment basin and fill for road.

1.02 RELATED SECTIONS

1.03 REFERENCES

A. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

B. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

E. ASTM D4959 – Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.

F. ASTM D2922 – Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

G. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

H. ASTM D2937 - Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.

I. ASTM D2487 - Test Method for Classification of Soils for Engineering Purposes.

J. ASTM D4767 – Standard Test Method for Consolidated – Undrained Triaxial Compression Test on Cohesive Soils.

1.04 SUBMITTALS

A. Submit one seventy-five (75) pound bag of each soil type proposed to be used as structural fill to the CQA Consultant at least four weeks prior to beginning fill operations. Submittals shall include one seventy-five (75) pound sample of each soil type from each proposed borrow source.

B. Proposed fill material shall be approved by the CQA Consultant prior to use.

C. Testing of soil samples shall be paid for by the Contractor.

D. Identify proposed borrow sources with the sample submissions.

1.05 CONSTRUCTION QUALITY CONTROL AND CONSTRUCTION QUALITY ASSURANCE CQC/CQA)

A. Acceptance by the Engineer of structural fill shall be dependent on the Soils CQA Consultant satisfying all pertinent requirements of the CQA Plan during the course of the work and test results showing that all requirements of this Section have been met.

B. Supporting data for CQA purposes shall be obtained by field and laboratory testing to be conducted by the soils CQA Consultant.

C. Field and laboratory testing conducted by the CQA Consultant will be done at the Owner's expense.

PART 2 PRODUCTS

2.01 FILL MATERIAL

A. Fill material shall consist of on-site or off-site borrow area soil free of topsoil, roots, stumps, brush, vegetation, and other deleterious material.

B. General fill material shall have a maximum size aggregate of six inches with no more than 25% retained on the No. 4 sieve. The top two (2) feet of landfill base grade fill material shall have a maximum size aggregate of two inches with no more than 25% retained on the No. 4 sieve.

C. Fill material shall have a unit weight greater than or equal to 120pcf and internal friction angle greater than or equal to 20 degrees as determined by the triaxial test (ASTM D4767), unless otherwise approved by the engineer.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Prepare areas to receive structural fill in accordance with Section 02100, Site Preparation.

B. Where subgrade requires undercutting, limit cut slopes to 1 vertical to 3 horizontal.

C. Grade areas to receive fill to a uniform surface. Scarify surface if directed by the Engineer.

D. Eliminate ruts, hummocks, or other uneven features.

E. Proofroll the subgrade with a loaded tandem-axle dump truck having a minimum weight of 20 tons or other similar rubber-tired equipment.

F. Make at least two passes in each direction with the proofrolling equipment.

G. Remove and replace any soft, saturated or yielding areas indicated by pumping or rutting.

H. Replace soil that has been removed with structural fill material in accordance with the requirements of this Section (Section 02228).

I. Where unsuitable soil was removed, compact the structural fill material to at least 95% of the maximum dry density as determined by ASTM D698 to a depth of at least 12 inches.

J. Dry or wet the subgrade at the discretion of the CQA Consultant to establish a subgrade with an acceptable moisture content.

K. Do not construct structural fill layer until the subgrade has been approved by the CQA Consultant.

L. Where structural fill is to be placed on hillsides with slopes steeper than 3H:1V, the fill shall be benched into the existing hillside. Benches shall be a minimum of twelve feet wide, and shall be cut at approximately every twenty feet of vertical height.

3.02 CONSTRUCTION

A. Construct project features to the lines and grades shown on the Drawings.

B. Place fill material in lifts no greater than 9 inches thick prior to compaction.

C. Compact fill material to a minimum dry density of 95% of the maximum dry density determined from the Standard Proctor Test (ASTM D698).

D. Moisture must be maintained between two (2) percent below to four (4) percent above the optimum moisture content.

E. Fill material in place which does not meet the density requirements shall be recompacted or removed and reworked to meet density objectives.

F. Do not place or compact fill material during sustained period of temperatures below 32° F.

G. Employ a professional land surveyor licensed in North Carolina to conduct a topographic survey of the top of the structural fill layer and prepare a survey drawing showing contours at maximum two-foot intervals.

H. Furnish the Engineer with three copies of the topographic survey drawing. This drawing shall become part of the Record Drawings required by this contract.

3.03 PROTECTION OF WORK

A. Protect the finished surface from erosion, desiccation, or other damage.

B. Develop a contingency plan for responding to construction deficiencies due to inclement weather, defective materials, and construction inconsistent with the Contract Specifications. The plan shall provide a methodology for selecting and implementing corrective action.

C. Portions of the structural fill damaged due to exposure shall be reworked to meet the Specifications or, at the discretion of the Engineer, removed and replaced with conforming material at no additional cost to the Owner.

3.04 REMEDIAL MAINTENANCE

A. Maintain structural fill in an undisturbed state until covered or otherwise protected from damage.

B. In the event of slides, sloughing, or erosion in any part of the Work, remove the disturbed material from the damaged area and rebuild such portion as directed by the Engineer.

C. Removal of material and repair of damaged areas shall be performed by the Contractor at no additional cost to the Owner.

3.05 QUALITY ASSURANCE

A. Field inspection and testing will be performed under provisions of Section 01410.

B. Conduct continuous visual inspection of materials to ensure that proper soils are being used.

C. Testing for strength and stress-strain relationships will be conducted on soils used as structural fill in accordance with ASTM D4767. Frequency: A minimum of one test per 50,000 cubic yards of loose material delivered.

D. Testing for moisture-density relationship will be conducted on soils used as structural fill in accordance with ASTM D698. Frequency: A minimum of one test per 10,000 cubic yards of loose material delivered or change in material.

E. Testing of the in-place structural fill will include moisture content tests in accordance with ASTM D3017. Frequency: Four tests per acre per lift. A minimum of every tenth test completed in accordance with ASTM D3017 shall also be tested in accordance with ASTM D4959.

F. Testing of the in-place structural fill will include density tests in accordance with ASTM D2922. Frequency: Four tests per acre per lift. A minimum of every tenth sample tested in accordance with ASTM D 2922 shall also be tested in accordance with either the sand cone method (ASTM D 1556) or the drive cylinder method (ASTM D 2937).

G. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

H. The horizontal and vertical location of all test locations will be recorded. A drawing will be prepared showing all test locations.

I. Backfill test holes with the soil cap layer material, repair, and compact test locations using the same equipment approved for the soil cap layer construction.

J. The CQA Representative will record the horizontal and vertical locations of all tests and prepare a drawing showing the test locations.

END OF SECTION 02228

SECTION 02229

LOW-PERMEABILITY SOIL LAYER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction of the 18-inches thick low-permeability soil layer for the landfill cap.

1.02 SOIL LAYER PERFORMANCE

A. The maximum allowable coefficient of permeability of the low-permeability soil layer is 1.0×10^{-5} cm/sec. This criterion will be strictly enforced.

1.03 REFERENCES

A. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

B. ASTM D1140 – Standard Test Method for Amount of Material in Soils Finer than the No. 200 Sieve.

C. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

D. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

E. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

F. ASTM D4959 – Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.

G. ASTM D2922 – Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.

I. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

J. ASTM D2937 - Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.

K. ASTM D5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

L. ASTM D2487 - Test Method for Classification of Soils for Engineering Purposes.

M. ASTM D2216 – Laboratory Determination of Water (Moisture) Content of Soil and Rock.

N. ASTM D2167 – Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

1.04 SUBMITTALS

A. Submit one seventy-five (75) pound bag of each soil type proposed to be used for the low-permeability soil layer to the CQA firm at least four weeks prior to beginning fill operations. Submittals shall include one seventy-five (75) pound sample of each soil type from each proposed borrow source.

B. Proposed fill material shall be approved by the ENGINEER prior to use.

C. Testing of soil samples shall be paid for by CONTRACTOR.

D. Identify proposed borrow sources with the sample submissions.

1.05 CONSTRUCTION QUALITY CONTROL AND CONSTRUCTION QUALITY ASSURANCE CQC/CQA)

A. Acceptance by the ENGINEER of the low-permeability soil layer shall be dependent on the Soils CQA Consultant determining that all requirements of the CQA Plan and this Section have been met.

B. Supporting data for CQA purposes shall be obtained by field and laboratory testing to be conducted by the soils CQA firm.

C. Field and laboratory testing conducted by the CQA firm will be done at the OWNER'S expense.

D. ENGINEER will administer the CQA Program.

PART 2 PRODUCTS

2.01 FILL MATERIAL

A. Fill material shall be obtained from borrow sources of clayey soils which meet specification requirements.

B. Fill material shall be clayey soil, classified according to the United Soil Classification System as SC, CL, CH, SM, ML, or MH (ASTM D2487).

C. Material shall have a unit weight greater than or equal to 120pcf and internal friction angle greater than or equal to 20 degrees as determined by the triaxial test (ASTM D4767), unless otherwise approved by the engineer.

D. Fill material shall be reasonably free of nodules or other deleterious substances, and shall not contain particles larger than two (2) inches.

E. Maximum amount of fill material allowed to be retained on No. 4 sieve: 15 percent.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Subgrade shall consist of intermediate cover material placed in accordance with Section 02224.

B. Employ a professional land surveyor licensed in North Carolina to conduct a topographic survey of the subgrade.

3.02 CONSTRUCTION

A. Spread the low-permeability soil layer material immediately after dumping using mechanical equipment or other means.

B. Prior to compaction, mix the soil material by disc-harrow or another method to achieve homogenous consistency.

C. The loose lift thickness shall not exceed the effective depth of compaction for the equipment used.

D. Limit each lift to a maximum 6 inches compacted material.

C. The moisture-density curve for the proposed material will be supplied to the CONTRACTOR as a preliminary guide in controlling moisture to achieve the required degree of compaction.

D. Final compaction criteria (including moisture content, density) shall be determined based on the results of the Test Pad (ref. Section 02218).

C. Thoroughly compact each lift and satisfy moisture and density controls before placing a subsequent lift. Successive lifts shall not be placed until the previous lift is accepted by the ENGINEER or CQA Representative.

H. If the moisture content is outside the acceptable range, rework the material by scarifying the compacted soil, wetting or drying the soil as required, and recompacting the soil.

I. Compact lifts using an appropriately heavy, properly ballasted, deep penetrating foot compactor. The deep penetrating feet shall have a minimum length of 7 inches and shall be subject to approval of the ENGINEER. Vibrating rollers and rubber-tired rollers shall not be used for compaction of clayey soil.

J. Provide a minimum of four passes with the compactor regardless of whether the lift meets density specifications. A pass is considered to be one trip of the compacting equipment over the lift and back to the starting point by a single drum roller or one trip across the lift surface from one end to the other if the compacting equipment has front and back compacting rollers.

K. Use vibratory plate compactors or other suitable equipment in areas not accessible to larger rollers or compactors.

L. Avoid desiccation and crusting of the lift surface.

M. If drying of the lift surface occurs before placement of the next lift, scarify this area to a sufficient depth to mix with moist materials, or sprinkle with water and scarify at the direction of the ENGINEER.

N. At the transition between bottom and side slopes, compact perpendicular to the face of the slope.

O. Scarify the surface of the underlying lift a minimum of 2 inches prior to compaction of each subsequent lift to facilitate bonding of the lifts.

P. Compact soil material to a minimum dry density and moisture content determined from the Test Pad results. Where the measured density/moisture content of the in-place material does not meet the requirements, the soil layer shall be reworked as necessary to meet density/moisture content objectives.

Q. The CONTRACTOR may modify the compaction and moisture content to fit site conditions and material requirements if he can demonstrate that all design parameters can be satisfied as determined by the ENGINEER. The demonstration shall be done at the CONTRACTOR'S expense. Compaction procedures e.g., equipment type, number of passes, etc., shall be in accordance with the Test Pad results.

R The maximum allowable coefficient of permeability of the low-permeability soil layer shall be 1.0×10^{-5} cm/sec. If representative permeability tests indicate that the compacted layer does not meet permeability requirements, the layer shall be reworked regardless of density/moisture content.

S. Avoid placing or compacting soil during sustained periods with air temperature below 32° F.

T. Avoid placing fill material on frozen subgrade. If soil freezes or ices, remove the affected section, scarify and recompact at the discretion of the ENGINEER.

U. Seal completed lifts at the end of each day's activities by rolling with rubber tired rollers or a smooth drum roller and sprinkle with water as needed.

V. Provide a low-permeability soil layer having a minimum thickness of 1.50 feet throughout the layer. This criterion will be strictly enforced. The thickness of the soil layer on the side slopes is measured perpendicular to the slope face.

W. Promptly backfill sample penetrations with a hand-tamped mixture of one part bentonite and three parts soil.

X. Roll the surface of the low-permeability soil layer with a smooth drum. Provide a smooth finished surface free of rocks, organics, and voids.

Y. The completed low-permeability soil layer shall be true to grade, with deviations of no more than 0.1 feet from the proposed elevations shown on the Contract Drawings.

3.03 PROTECTION OF WORK

A. Protect the finished surface from erosion, desiccation, or other damage.

B. Develop a contingency plan for responding to construction deficiencies due to inclement weather, defective materials, and construction inconsistent with the Contract Documents. The plan shall provide a methodology for selecting and implementing corrective action.

C. Portions of the low-permeability soil layer damaged due to exposure shall be reworked to meet the Specifications or, at the discretion of the ENGINEER, removed and replaced with conforming material at no additional cost to the OWNER.

D. Payment for the low-permeability soil layer will not be made until it has been covered with the overlying material and protected from damage.

3.04 REMEDIAL MAINTENANCE

A. Maintain the low-permeability soil layer in an undisturbed state until covered and protected from damage.

B. In the event of slides, sloughing, or erosion in any part of the Work, remove the disturbed material from the damaged area and rebuild such portion as directed by the ENGINEER.

C. Removal of material and repair of damaged areas shall be performed by the CONTRACTOR at no additional cost to the OWNER.

3.05 QUALITY ASSURANCE

A. The moisture content/dry density/permeability relationship for the proposed fill material will be supplied to the CONTRACTOR as a preliminary guide in controlling moisture to achieve the required degree of compaction. The CONTRACTOR is encouraged to conduct additional testing of the soil as needed to further define the moisture content/dry density/permeability performance of the soil.

B. If an alternate borrow material is proposed/required, the CONTRACTOR shall perform a borrow evaluation to determine the moisture content/dry density/permeability relationship of the material. The results of the borrow evaluation shall be submitted to the ENGINEER for approval prior to material placement.

C. Final compaction criteria (including moisture content, compactive effort and density) shall be determined based on the results of the Test Pad (ref Section 02218).

D. Sieve analyses will be conducted on soils used to construct the low-permeability soil layer in accordance with ASTM D 422 and ASTM D 1140. Frequency: A minimum of one test per 10,000 cubic yards of loose material delivered.

E. Testing for Atterberg limits will be conducted on soils used to construct the low-permeability soil layer in accordance with ASTM D 4318. Frequency: A minimum of one test per 10,000 cubic yards of loose material delivered.

F. Regardless of source, testing for moisture-density relationship will be conducted on soils used to construct the low-permeability soil layer in accordance with ASTM D698. Frequency: A minimum of one test per 10,000 cubic yards of loose material delivered.

G. Testing of the in-place low-permeability soil layer will include moisture content tests in accordance with ASTM D3017. Frequency: Five tests per acre per lift. A minimum of

every tenth test completed in accordance with ASTM D3017 shall also be tested in accordance with ASTM D4959. All soil samples should be tested by direct oven drying (ASTM D2216) to aid in identifying and significant, systematic calibration errors.

H. Testing of the in-place low-permeability soil layer will include density tests in accordance with the nuclear method (ASTM D 2922) or the drive cylinder method (ASTM D 2937). Frequency: Five tests per acre per lift. A minimum of every tenth sample tested in accordance with ASTM D2922/ASTM D2937 shall also be tested in accordance with either the sand cone method (ASTM D1556) or rubber balloon method (ASTM D2167).

I. Permeability testing of the in-place low-permeability soil layer will be conducted in accordance with ASTM D 5084. Frequency: One test per acre per lift.

J. If a permeability test result fails to meet the permeability requirements, two additional samples shall be taken in the vicinity of the failed sample, and replicate tests conducted. If the replicate tests pass, the section represented by the samples shall be considered as having passed. If either of the replicate tests fail, then the section shall be considered as having failed and shall be removed, replaced and retested.

K. Plug all test holes using a mixture of 50% soil and 50% bentonite.

L. The CQA Representative will record the horizontal and vertical locations of all tests and prepare a drawing showing the test locations.

END OF SECTION 02229

SECTION 02936

SEEDING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Preparation of subsoil.

B. Placing topsoil material.

C. Fertilizing.

D. Temporary seeding.

E. Permanent seeding.

F. Mulching.

1.02 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.03 MAINTENANCE DATA

A. Submit maintenance data for continuing Owner maintenance.

B. Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

C. The sediment basins shall be inspected regularly during land disturbing activities and after each significant rainfall. Sediment shall be removed, and the basin restored to its original dimensions when sediment accumulates to one-half the design depth. The embankments, spillways, and outlets shall be inspected regularly for signs of piping and settlement. Repairs shall be made immediately. The riser and pool area shall be kept free of trash and other debris.

D. Diversion berms shall be inspected weekly and after each significant rainfall. Accumulated sediment shall be removed immediately from the flow area, and diversion berms repaired promptly.

E. Grass-lined channels shall be checked after every rainfall while grass in the channel is being established. After grass is established, the channel shall be cleaned out as necessary to maintain the design capacity of the channel. Grass that is lining the channel shall be kept in a healthy and vigorous condition at all times.

F. Sediment fences shall be inspected at least once a week and after each rainfall. repairs shall be made immediately. Sediment deposits shall be removed as needed to provide adequate storage volume for the next rainfall event, and to reduce pressure on the fence. Fencing materials and sediment deposits shall be removed, and the area brought to grade following stabilization of upgradient disturbed areas.

1.04 DELIVERY, STORAGE AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging will not be acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

D. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

E. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil Material: Excavated from site and free of weeds.

2.02 ACCESSORIES

A. Mulching material: Oat or wheat straw, dry, free from weeds and other matter detrimental to plant life.

B. Lime: Lime shall comply with applicable North Carolina state laws and shall be delivered in unopened bags or other convenient standard containers, each fully labeled with the manufacturer's guaranteed analysis. Lime shall be ground limestone containing not less than 85 percent total carbonates, and shall be ground to such fineness that 90 percent by weight will pass through a No. 20 mesh sieve (0.85 mm)

and 50 percent by weight will pass through a No. 100 mesh sieve (0.15 mm).

C. Fertilizer: Fertilizer shall comply with applicable North Carolina state laws and shall be delivered in unopened bags or other convenient standard container, each fully labeled with the manufacturer's guaranteed analysis. Fertilizer shall contain not less than 10 percent nitrogen, 10 percent available phosphoric acid and 10 percent water soluble potash (N-P-K, 10-10-10). Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be acceptable and shall be immediately removed from the job site.

PART 3 EXECUTION

3.01 GENERAL

A. Areas where topsoil material is to be placed and areas to be seeded include all areas disturbed during construction which are not to be paved.

B. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove weeds, and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 3 inches where topsoil material is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.03 PLACING TOPSOIL MATERIAL

A. Place topsoil material during dry weather and on dry unfrozen subgrade 2 to 3 weeks prior to sowing seed.

B. Spread topsoil material over area to be seeded. Finished thickness of topsoil material shall be 3 inches minimum after settling and nominal compaction caused by spreading equipment.

C. Grade to eliminate rough, low, or soft areas, and to ensure positive drainage.

D. Rake topsoil material and remove roots, vegetable matter, rocks, clods, and other non-organic material.

3.04 FERTILIZER AND LIME

A. Apply lime and fertilizer according to soil tests, or apply lime at the rate of 90 lbs./1000 sq.ft. and fertilizer at the rate of 20 lbs./1000 sq.ft.

B. Mix thoroughly into upper 4 inches of topsoil.

C. Lightly water to aid the dissipation of fertilizer and lime.

3.05 SEEDBED PREPARATION

A. Prepare seedbed to a depth of 4 to 6 inches.

B. Remove loose rocks, roots and other obstructions so that they will not interfere with the establishment and maintenance of vegetation.

3.06 TEMPORARY SEEDING

A. Provide temporary seeding on any cleared, unvegetated, or sparsely vegetated soil surface where vegetative cover is needed for less than one year or when seeding dates will prevent the establishment of vegetative cover if permanent seeding is attempted.

B. Seed in accordance with the following schedule and application rates:

TEMPORARY SEEDING RECOMMENDATIONS FOR LATE WINTER & EARLY SPRING

Seeding Mixture Species	Rate (lb/acre)
Rye (grain)	120
Annual Lespedeza (kobe in piedmont and coastal plain, korean in mountains)	50

Omit Annual Lespedeza when duration of temporary cover is not to extend beyond June.

Seeding Dates

Mountains -	above 2500 ft: February 15 - May 15
	below 2500 ft: February 1 - May 1
Piedmont -	January 1 - May 1
Coastal Plain -	December 1 - April 15

Soil Amendments

Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

Mulch

Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance

Refertilize if growth is not fully adequate. Reseed, refertilize and mulch immediately following erosion or other damage.

TEMPORARY SEEDING RECOMMENDATIONS FOR SUMMER

Seeding Mixture Species	Rate (lb/acre)
German Millet	40

In the Piedmont and mountains, a small-stemmed sundangrass may be substituted at a rate of 50lbs/acre.

Seeding Dates

Mountains -	May 15 - August 15
Piedmont -	May 1 – August 15
Coastal Plain -	April 15 – August 15

Soil Amendments

Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

Mulch

Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance

Refertilize if growth is not fully adequate. Reseed, refertilize and mulch immediately following erosion or other damage.

TEMPORARY SEEDING RECOMMENDATIONS FOR FALL

Seeding Mixture Species	Rate (lb/acre)
Rye (grain)	120

Seeding Dates

Mountains -	August 15 – December 15
Piedmont -	August 15 – December 30
Coastal Plain -	August 15 – December 30

Soil Amendments

Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 1,000 lb/acre 10-10-10 fertilizer.

Mulch

Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance

Repair and refertilize damaged areas immediately. Topdress with 50 lb/acre of nitrogen in March. If it is necessary to extend temporary cover beyond June 15, overseed with 50 lb/acre Kobe (Piedmont and Coastal Plain) or Korean (Mountains) Lespedeza in late February or early March

3.08 PERMANENT SEEDING

A. Seed in accordance with the following schedule and application rates:

PERMANENT SEEDING

Seeding Dates	Seeding Mixture Species	Rate (lbs./acre)
January 1-April 15	Tall Fescue	80
	Sericia Lespedeza	30
	Rye (grain)	40
April 15-June 15	Tall Fescue	80
	Sericia Lespedeza	30
	Bermudagrass	15
	German Millet	10

B. Compact seeded areas by means of a roller or other approved equipment immediately after sowing.

C. Mulch with 3-inch straw applied at the rate of 4,000 lbs/acre. Anchor straw by tacking with asphalt, netting, or roving, or by crimping with a mulch-anchoring tool or disk set nearly straight.

D. Refertilize in the second year unless growth is fully adequate. Reseed, refertilize, and mulch damaged areas immediately. A 10% retainage of the permanent seeding line item will be withheld from the final payment until a final project walkthrough is conducted during the first Spring following construction with the Contractor, Owner and Engineer.

END OF SECTION 02936

SECTION 13315

GEOSYNTHETIC CLAY LINER (GCL)

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnishing and installing the geosynthetic clay liner for the composite liner.

1.02 RELATED WORK

A. Section 01410 – Quality Assurance

B. Section 02229 – Low-Permeability Soil Cap

1.03 SUBMITTALS

A. The CONTRACTOR shall furnish prior to placement of the GCL:

1. Conceptual description of the proposed plan for placement of the GCL panels over the area of installation.

2. GCL manufacturer's MQC Plan for documenting compliance to Paragraph 2.01 and 2.02 of this Section.

B. At the ENGINEER'S request the CONTRACTOR shall furnish:

1. A representative sample of the GCL proposed for use on this project.

2. A project reference list for the GCL(s) consisting of the principal details of at least 10 projects totaling at least 10 million square feet in size.

C. Upon shipment, the CONTRACTOR shall furnish the GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications that the materials supplied for the project are in accordance with the requirements of this specification.

D. As installation proceeds, the CONTRACTOR shall submit certificates of subgrade acceptance signed by the CONTRACTOR and CQA Consultant for each area covered by the GCL.

1.04 QUALIFICATIONS

A. GCL Manufacturer must have produced at least 10 million square feet of GCL, with at least 8 million square feet installed.

B. The GCL Installer must either have installed at least 1 million square feet of GCL, or must provide to the ENGINEER satisfactory evidence through similar experience in the installation of other types of geosynthetics that the GCL will be installed in a competent, professional manner.

1.05 CONSTRUCTION QUALITY ASSURANCE (CQA)

A. Acceptance by the ENGINEER of the installed GCL shall be dependent on the Geosynthetic CQA Consultant determining that all requirements of this Section (Section 13315) have been met.

B. Field observations conducted by the CQA Consultant will be done at the OWNER'S expense.

C. ENGINEER will administer the CQA Program.

PART 2 PRODUCTS

2.01 MATERIALS

A. The GCLs shall consist of a layer of natural sodium bentonite clay encapsulated between two geotextiles and shall comply with all of the criteria listed in this Section. Prior to using an alternate GCL, the CONTRACTOR must furnish independent test results demonstrating that the proposed alternate material meets all requirements of this specification section. The CONTRACTOR must obtain prior approval of the alternative GCL by the ENGINEER.

B. Reinforced GCL must be used on slopes greater than 10H:1V. Unreinforced GCL may be used on areas of the site not exceeding 10H:1V in steepness, or as approved by the ENGINEER.

C. Acceptable GCL products are Bentomat ST, Claymax 200R, as manufactured by CETCO, 1350 West Shure Drive, Arlington Heights, Illinois 60004 USA (847-392-5800); Bentofix NS, Bentofix NW as manufactured by Fluid Systems, Inc., 1245 Corporate Boulevard, Aurora, Illinois 60504 USA (864-467-1495) or an Engineer approved equal.

D. The GCL(s) and their components shall have properties that meet or exceed CETCO's certified properties for Bentomat "ST" (reinforced GCL) and Claymax "200R" (unreinforced GCL):

Bentomat "ST"

Material Property	Test Method	Test Frequency (ft^2)	Required Values
Bentonite Swell Index	ASTM D 5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss	ASTM D 5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area	ASTM D 5993	40,000 ft^2	0.75 lb/ft^2 min.
GCL Grab Strength	ASTM D 4632	200,000 ft^2	90 lbs MARV
GCL Peel Strength	ASTM D 4632	40,000 ft^2	15 lbs min.
GCL Index Flux	ASTM D 5887	Weekly	$1x10^{-8}$ $m^3/m^2/sec$ max.
GCL Permeability	ASTM D 5887	Weekly	$5x10^{-9}$ cm/sec max.
GCL Hydrated Internal Shear Strength	ASTM D 5321	Periodic	500 psf (24 kPa) typical

Claymax "200R"

Material Property	Test Method	Test Frequency (ft^2)	Required Values
Bentonite Swell Index	ASTM D 5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss	ASTM D 5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area	ASTM D 5993	40,000 ft^2	0.75 lb/ft^2 min.
GCL Grab Strength	ASTM D 4632	200,000 ft^2	100 lbs MARV
GCL Peel Strength	ASTM D 4632	N/A	N/A
GCL Index Flux	ASTM D 5887	Weekly	$1x10^{-8}$ $m^3/m^2/sec$ max.
GCL Permeability	ASTM D 5887	Weekly	$5x10^{-9}$ cm/sec max.
GCL Hydrated Internal Shear Strength	ASTM D 5321	Periodic	50 psf (24 kPa) typical

E. The acceptable dimensions of full-size GCL panels shall be 150 feet in length and 15 feet in width.

F. A 6-inch (150 mm) overlap guideline shall be imprinted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible, permanent ink.

G. The minimum required interface friction angles between the geosynthetic clay liner and the low-permeability soil liner is 18 degrees for the unreinforced Claymax 200R on the slopes less than 10H:1V and, 26 degrees for the Bentomat ST placed on the slopes steeper than 10H:1V, or as otherwise approved by the ENGINEER.

H. Use an independent laboratory to conduct tests (ASTM D5321) to verify interface friction angles. The testing laboratory shall be accredited to conduct ASTM D5321 in accordance with the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI – LAP) at the time of testing. Provide verification of accreditation to the ENGINEER prior to testing. The CONTRACTOR is responsible for paying for all interface friction tests.

I. Interface friction angle testing between the geosynthetic clay liner (non-woven geotextile) and the low-permeability soil liner : Use normal loads of 500 psf, 2500 psf, and 5000 psf, and a shear rate of 0.04 in/min. Compact soil to 95% of the maximum dry density (standard effort) at a moisture content 5% above optimum. Conduct the test in the wet condition.

J. The specimen shall be a minimum of 12 inches square and shall be from the same run or lot number as the material to be placed.

K. Prepare a test report that addresses complete test details, procedures, and results. Submit report to the ENGINEER at least 4 weeks prior to placement

2.02 PRODUCT QUALITY DOCUMENTATION

A. The GCL manufacturer shall provide the CONTRACTOR or other designated party with manufacturing QA/QC certifications for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL manufacturer and shall include:

1. Manufacturer's certification for the bentonite clay used in GCL production, demonstrating compliance with the parameters swell index, fluid loss and bentonite mass/area shown in CETCO's current Technical Data Sheets TR404bm and/or TR404cm.

Property	**Test**	**Standard**	**Unit**	**Value**
Swell index	ASTM D5890	Minimum	M1	24
Fluid loss	ASTM D5891	Minimum	Ml	18
Bentonite mass/ Area	ASTM D5993	Minimum	Lb/ft^2	0.75

2. GCL lot and roll numbers supplied for the project (with corresponding shipping information).

2.03 PRODUCT LABELING

A. Prior to shipment, the GCL manufacturer shall label each roll, identifying:

1. Product identification information (manufacturer's name and address, brand name, product code).
2. Lot number and roll number.
3. Roll length, width, and weight.

2.04 PACKAGING

A. The GCL shall be wound around a rigid core having a diameter sufficient to facilitate handling. The core should be sufficiently strong to prevent collapse during transit.

B. All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet (UV) light.

2.05 ACCESSORY BENTONITE

A. The granular bentonite or bentonite sealing compound used for seaming, penetration sealing and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL manufacturer.

PART 3 EXECUTION

3.01 SHIPPING AND HANDLING

A. Handling and storage of the GCL are the responsibility of the CONTRACTOR.

B. A visual inspection of each roll shall be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and set aside for further inspection. The packaging should be repaired prior to being placed in storage.

C. The party responsible for unloading the GCL should contact the manufacturer prior to shipment to ascertain the appropriateness of proposed unloading methods and equipment.

3.02 STORAGE

A. Storage of the GCL rolls is the responsibility of the CONTRACTOR. Select a storage area at the job site that is away from high traffic areas and is level, dry, and well-drained.

B. Store rolls in a manner that prevents sliding or rolling from the stacks. Stack rolls at a height no higher than the lifting apparatus can be safely operated (typically no higher than four).

C. Cover all stored GCL materials and the accessory bentonite with a plastic sheet or tarpaulin until their installation.

D. Preserve the integrity and legibility of the labels during storage.

3.03 EARTHWORK

A. Earthen surface upon which the GCL is to be installed shall be prepared and compacted in accordance with the project specifications and drawings. The surface shall be smooth, firm, unyielding, and free of vegetation, construction debris, wood, rocks, void spaces, ice, abrupt elevation changes, standing water, cracks larger than one-quarter inch in width, and any other matter that could damage the GCL.

B. Subgrade surfaces consisting of granular soils or gravel may not be acceptable due to their large void fraction and puncture potential. Subgrade soils should possess a particle size distribution such that at least 80 percent of the soil is finer than a #60 sieve (0.2 mm), or as approved by the ENGINEER.

C. Immediately prior to GCL deployment, grade the subgrade to fill in all voids and cracks, and then smooth-roll to provide the best practical surface for the GCL. At the completion of this activity, no wheel ruts, footprints or other surface irregularities shall exist in the subgrade. All protrusions extending more than one-half inch from the surface shall either be removed, crushed or pushed into the surface with a smooth-drum compactor.

D. The Installer shall certify acceptance of the subgrade before GCL placement.

E. It shall be the Installer's responsibility thereafter to indicate to the ENGINEER any change in condition of the subgrade to be out of compliance with any of the requirements of this Section.

F. At the top of sloped areas of the job site, an anchor trench for the GCL shall be excavated in accordance with the project Drawings. The trench shall be excavated and approved by the CQA Consultant prior to GCL placement. No loose soil shall be allowed at the bottom of the trench, and no sharp corners or protrusions shall exist anywhere within the trench.

3.04 GCL PLACEMENT

A. Deliver GCL rolls to the working area of the site in their original packaging. Prior to deployment, carefully remove the packaging without damaging the GCL. The orientation of the GCL shall be in accordance with the manufacturer's recommendations.

B. Equipment that could damage the GCL shall not be allowed to travel directly on the GCL. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before GCL placement continues.

C. Care shall be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary slip sheet or rub sheet may be used to reduce friction damage during placement.

D. The GCL shall be placed so that seams are parallel to the direction of the slope. Seams should be located at least 3 feet from the toe of slopes steeper than 4H:1V.

E. All GCL panels should lie flat on the underlying surface, with no wrinkles or folds.

F. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, a geomembrane, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project ENGINEER, CQA Consultant, or GCL supplier should be consulted for specific guidance if premature hydration occurs.

3.05 ANCHORAGE

A. In accordance with the Drawings, the end of the GCL roll shall be placed in an anchor trench at the top of the slope. The front edge of the trench should be rounded so as to eliminate sharp corners. Remove loose soil from the bottom of the trench.

3.06 SEAMING

A. The GCL seams are constructed by overlapping their adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris. Supplemental bentonite is required in accordance with paragraph 3.06.D if the GCL has one or more non-woven needlepunched geotextiles.

B. The minimum dimension of the longitudinal overlap shall be 6 inches. End-of-roll overlapped seams should be similarly constructed, but the minimum overlap shall measure 24 inches.

C. Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent runoff from entering the overlap zone.

D. For all GCL products other than Bentomat ST, bentonite-enhanced seams shall be constructed between the overlapping adjacent panels described above. The underlying edge of the longitudinal overlap shall be exposed and a continuous bead of granular sodium bentonite applied along a zone defined by the edge of the underlying panel and the 6-inch line. For all GCL products, including Bentomat ST, a similar bead of granular sodium bentonite shall be applied at the end-of-roll overlap. The bentonite shall be applied at a minimum application rate of one quarter pound per linear foot.

3.07 DETAIL WORK

A. The GCL shall be sealed around penetrations and embedded structures in accordance with the project drawings.

B. Cut GCL using a sharp utility knife.

3.08 DAMAGE REPAIR

A. Repair GCL damaged during installation. Cut a patch to fit over the damaged area. The patch shall be cut to overlap 12 inches around all of the damaged area. Dry bentonite or bentonite mastic should be applied around the damaged area prior to placement of the patch. It may be desirable to use an adhesive to affix the patch in place to prevent displaced during cover placement.

3.09 COVER PLACEMENT

A. Cover soils shall be free of stones or other matter that could damage the GCL. Cover soils shall be approved by the project ENGINEER with respect to particle size, uniformity, and chemical compatibility. Cover soils with high concentrations of calcium (e.g., limestone, dolomite) are not acceptable.

B. Soil cover shall be placed over the GCL using construction equipment that minimizes stresses on the GCL. A minimum thickness of 1 foot of cover shall be maintained between the equipment tires/tracks and the GCL at all times during the covering process. For frequently traveled areas, a minimum thickness of 2 feet is required.

C. Soil cover shall be placed in a manner that prevents the soil from entering the GCL overlap zones. Cover soil shall be pushed up slopes, not down slopes, to minimize tensile forces on the GCL.

D. Although direct vehicular contact with the GCL is to be avoided, lightweight, low ground pressure vehicles (such as 4-wheel all-terrain vehicles) may be used to facilitate the installation of geosynthetic material to be placed over the GCL. The GCL Supplier or CQA Engineer should be contacted for specific recommendations on appropriate procedures in this situation.

E. When a textured geomembrane is to be installed over the GCL, a temporary slip sheet or rub sheet should be used to minimize friction during placement, and to enable the textured geomembrane to be more easily moved into final position.

3.10 RECORDS AND QUALITY ASSURANCE

A. The installation of the GCL will be monitored by a CQA Consultant provided by the OWNER. The purpose of CQA activities is to document the installation of the GCL. Refer to the CQA Plan. The following records shall be kept:

Roll Placement Checklist

Repair Checklist

General Photographic Record of installation

Record Drawing indicating work progress each day of installation

B. Do not cover GCL until all repairs have been properly logged.

END OF SECTION 13315

SECTION 13900

LANDFILL GAS MIGRATION MONITORING PROBE (BOUNDARY PROBE)

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Supply all equipment, materials and labor needed to install the boundary probes as specified herein and as indicated on the Drawings.

PART 2 MATERIALS

2.01 PIPE AND FITTINGS

A. All pipe and fittings shall be rigid PVC Schedule 40 as indicated on the Drawings.

2.02 AGGREGATE

A. The gravel pack shall be crushed, natural stone or crushed slag, meeting the North Carolina Department of Transportation (NCDOT) Standard Specifications for No. 57 stone.

2.03 BENTONITE SLURRY MIX

A. Coarse-ground, granulized bentonite from an approved source is to be mixed thoroughly with potable water at a ratio of five (5) gallons of water to every 50 pounds of bentonite.

PART 3 EXECUTION

3.01 DRILLING

A. Boundary probe boreholes are to be a minimum four (4) inch diameter and drilled to the depth shown on the Drawings. The CONTRACTOR must use dry drilling equipment; wet rotary drilling equipment may not be used. All borings shall be made with hollow stem auger drilling equipment.

B. The boring depths shown on the Drawings are estimated and may be adjusted in the field by the ENGINEER or GEOLOGIST. Two reasons limiting depth might be as follows:

1. If water is encountered in a boring, the CONTRACTOR may be directed to cease drilling beyond the point at which it was encountered. If wet conditions remain, the boring may be terminated and the length of perforated pipe adjusted by the ENGINEER or GEOLOGIST, or the well may be relocated. If wet conditions cease (e.g. due to trapped water layer), then drilling will continue to the design depth.

2. If bedrock is encountered in a boring, the CONTRACTOR may be directed to cease drilling beyond the point at which it was encountered. The boring may be terminated and the length of perforated pipe adjusted by the ENGINEER or GEOLOGIST, or the well may be relocated.

3.02 BACKFILLING

A. Backfilling of the boundary probe shall commence immediately after drilling is completed and the well piping has been installed in the borehole. Backfill materials shall be installed as indicated on the Drawings and as approved by the ENGINEER.

B. The gravel pack shall be poured or scooped through the screen at a rate that will not endanger the integrity of the well casing.

C. All bentonite seals shall be hydrated per Section 2.03.A. No more than one gallon of potable water shall be poured at a time with no less than a five minute increment between each pouring.

D. Soil/bentonite plug shall be backfilled as per the material specifications. The CONTRACTOR shall soak each lift prior to filling the next one.

E. Soil backfill shall be rodded in the boring to provide even distribution and compaction.

F. Steel casing shall extend above the surface of the protective concrete pad as shown on the Drawings. A lockable cap shall be provided and installed on the steel casing. The protective concrete pad shall be placed around the protective steel casing at ground surface as shown on the Drawings.

3.03 BORING LOGS

A. Detailed boring and probe construction logs will be kept. The logs will, at a minimum document total boring depth, probe construction materials and depths, groundwater depth and soil information. An example log is included on the following page.

END OF SECTION 13900

DEMO ENGINEERS

LOG OF BORING BP-1

Boundary Probe Installation

JEI Project No. ,Task

Date Started	:	Drilling Company	:
Date Completed	:	Northing Coord.	:
Hole Diameter	:	Easting Coord.	:
Drilling Method	:	Survey By	:
Sampling Method	:	Logged By	:

Well:
Elev.:

Depth in Feet	USCS	DESCRIPTION
0	PT	ORGANIC, brown, >50% wood mulch
5	SC	CLAYEY SAND, reddish-brown, loose, dry
10	SM	SILTY SAND, light brown, dry
15		
20		
25	ML	SILT, yellow-light brown, dry
30		
35	ML	SANDY SILT, yellowish-orange, moist, slight plasticity, sand appeared to be part of saprolitic material
40		
45		

Well Construction Information

WELL CONSTRUCTION
Date Compl. :
Hole Diameter(s) :
Drilling Method(s) :
Company Rep. :
WELL CASING :
Material :
Diameter :
Joints :
Approx. Csg. Stickup:
WELL SCREEN :
Material :
Diameter :
Joints :
Opening :
GRAVEL PACK :
Type :
WELL SCREEN SEAL
Type :

For this demonstration version, the number of contacts, samples, and general parameter data points are limited to 5, 5, and 10. The full version does not limit the data this way.

05-21-2008

SECTION 13910

PASSIVE LANDFILL GAS VENT

PART 1 GENERAL

1.01 SCOPE OF APPLICATION

A. Supply all equipment, materials and labor needed to install the passive landfill gas (LFG) vents as specified herein and as indicated on the Drawings.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

2. ASTM C702 - Standard Practice for Reducing Field Samples of Aggregate to Testing Size.

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

4. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes.

5. ASTM D2488 - Standard Practice for Description of Soils (Visual-Manual Procedure).

6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).

7. ASTM 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.03 SUBMITTALS

A. Submit to the ENGINEER Certificates of Compliance on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of pipe and appurtenances furnished.

B. The CONTRACTOR shall submit to the ENGINEER samples of all well backfill materials furnished.

C. The CONTRACTOR shall keep detailed well logs and construction diagrams for all wells drilled, including the total depth of the well, the static water level, depth, thickness, and description of soil or waste strata, (including dates from any readable material), and the occurrence of any water bearing zones. Well logs shall be submitted to the ENGINEER.

1.04 SITE CONDITIONS

A. Obstructions and saturated conditions are sometimes encountered when drilling in a landfill, many of which can be drilled through. The CONTRACTOR is expected to make reasonable effort to drill through obstructions and saturated conditions and will be paid for offset re-drilling and boring abandonment only if prior approval is granted in writing by OWNER. CONTRACTOR will be paid for abandonment of abandoned hole and for well installation at new location.

PART 2 PRODUCTS

2.01 AGGREGATE

A. Gravel pack shall be NCDOT No. 57 stone.

2.02 BENTONITE

A. Bentonite shall be pelletized sodium bentonite.

2.03 SOLID WALL PIPE

A. All pipe and fittings shall be rigid HDPE or PVC (Schedule 80) pipe.

2.04 PERFORATED/SLOTTED PIPE

A. Perforations in vent piping shall be 1/2-inch spaced 90 degrees around the circumference of the pipe, and 6-inches on center along the pipe.

PART 3 EXECUTION

3.01 DRILLING

A. LFG vents must be installed prior deployment of any geosynthetics or construction of a low-permeable soil layer. LFG vents are to be 30-inch diameter, drilled to a minimum of 80 percent of the total waste depth. CONTRACTOR must use dry drilling equipment; wet rotary drilling equipment may not be used. All borings shall be made with bucket type augers.

B. The boring depths may be adjusted in the field by the ENGINEER. Two reasons limiting depth might be as follows:

1. If water is encountered in a boring, the CONTRACTOR may be directed to drill beyond the point at which it was encountered. If wet conditions remain, the boring may be terminated and the length of perforated pipe adjusted by the ENGINEER, or the well may be relocated. If wet conditions cease (e.g. due to trapped water layer), then drilling will continue to the design depth.

2. Base grades are estimated.

C. As soon as drilling is completed, a safety screen shall be placed over the top of the bore. This screen shall stay in place until backfilling is within 4 feet of the surface. Safety screen size should be large enough to accommodate all backfill materials and any tools used during backfill yet not large enough for any human to accidentally fall through.

D. The bore for the well shall be straight and the well pipe shall be installed in the center of the bore hole. The CONTRACTOR will take all tension off of the pipe by mechanical means and center the pipe in the middle of the borehole before starting to backfill.

E. PVC vent pipe shall be solvent cemented and lag bolted.

3.02 BACKFILLING

A. Backfilling of the well shall commence immediately after well drilling is completed and the well piping has been installed in the borehole. Backfill materials shall be installed as indicated on the Drawings and as approved by the ENGINEER.

B. Gravel pack shall be poured or scooped through the screen at a rate that will not endanger the integrity of the well casing.

C. The bentonite seal shall be hydrated with 5 gallons of potable water.

D. Soil backfill shall be rodded in the boring to provide even distribution and compaction.

3.05 DISPOSAL

A. Proper disposal of refuse from well drilling operations shall be the CONTRACTOR'S responsibility.

END OF SECTION 13910

SECTION 01410

QUALITY ASSURANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inspection and Testing Laboratory Services for Quality Assurance.

1.02 INSPECTION AND TESTING LABORATORY SERVICES FOR QUALITY ASSURANCE

A. OWNER will appoint, employ, and pay for services of a CQA firm (CQA Consultant) to conduct inspection and testing for quality assurance purposes.

B. Quality assurance refers to measures taken by the CQA Consultant on behalf of the OWNER to assess whether the Work is in compliance with the Contract Documents.

C. On behalf of the OWNER, the CQA Consultant will conduct inspections, tests, and other services specified in individual specification subsections that address quality assurance requirements. No adjustments to the Contract Time will be granted for any quality assurance activities of the CQA Consultant, including testing.

D. Reports will be submitted by the CQA firm to the ENGINEER, indicating observations and results of tests and indicating compliance or noncompliance with Contract Documents.

E. Re-testing required because of non-conformance to specified requirements shall be conducted by the same CQA firm on instructions by the ENGINEER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION 01410

SECTION 02218

TEST PAD

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction of a trial section of compacted soil layer to meet the requirements specified in Section 02229.

1.02 TEST PAD PERFORMANCE

A. The maximum allowable coefficient of permeability of the constructed test pad shall be 1×10^{-5} cm/sec. This criterion will be strictly enforced.

1.03 REFERENCES

A. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

B. ASTM D1140 – Standard Test Method for Amount of Material in Soils Finer than the No. 200 Sieve.

C. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

D. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

E. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

F. ASTM D4959 – Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.

G. ASTM D2922 – Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.

E. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

J. ASTM D2937 – Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.

K. ASTM D5084 – Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

L. ASTM D2487 – Test Method for Classification of Soils for Engineering Purposes.

M. ASTM D2216 – Laboratory Determination of Water (Moisture) Content of Soil and Rock.

N. ASTM D2167 – Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

1.04 SUBMITTALS

A. Submit one seventy-five (75) pound bag of each soil type proposed to be used as cap material to the CQA firm at least four weeks prior to beginning fill operations. Submittals shall include one seventy-five (75) pound sample of each soil type from each proposed borrow source.

B. Proposed fill material shall be approved by the ENGINEER prior to use.

C. Testing of soil samples shall be paid for by CONTRACTOR.

D. Identify proposed borrow sources with the sample submissions.

1.05 CONSTRUCTION QUALITY CONTROL AND CONSTRUCTION QUALITY ASSURANCE (CQC/CQA)

A. Acceptance by the ENGINEER of the test pad shall be dependent on the Soils CQA Consultant satisfying all requirements of the CQA Plan during the course of the work and test results showing that all requirements of this Section or Section 02229 have been met.

B. Supporting data for CQA purposes shall be obtained by field and laboratory testing to be conducted by the soils CQA firm.

C. Field and laboratory testing conducted by the CQA firm will be done at the OWNER'S expense.

D. ENGINEER will administer the CQA Program.

PART 2 PRODUCTS

2.01 MATERIALS

A. Borrow materials for the test pad shall be tested and approved in accordance with procedures outlined in the CQA Plan and this Section.

B. Material to be used in constructing the test pad shall be as specified in Section 02229.

PART 3 EXECUTION

3.01 GENERAL

A. Allow sufficient time for testing of the test pad prior to construction of the compacted soil layer.

B. Provide test pad a minimum of 50 foot wide x 150 foot long constructed using the same construction methods, equipment, and material to be used for the 18-inch low permeability soil layer.

C. The location of the test pad shall be selected by the CONTRACTOR and approved by the ENGINEER.

D. The test pad may be constructed as part of the compacted soil cap. If constructed as part of the compacted soil cap, all materials and associated testing shall be in accordance with Specification Section 02229.

E. Construct lifts not exceeding six inches compacted thickness unless otherwise approved in writing by the ENGINEER.

F. Inspect each lift. Do not place a subsequent lift until the previous lift is approved by the ENGINEER or CQA Representative.

G. If the source for the soil cap material changes, or the properties of the material from the borrow source change significantly as determined by the CQA representative or ENGINEER, construct a new test pad at least 50-feet wide x 150-feet long using the new material.

H. If tests indicate that the compacted material fails to meet the design criteria, remove and reconstruct the test pad at no additional cost to the OWNER.

I. Do not begin construction of the landfill low permeability soil cap until the test pad has been completed and approved in writing by the ENGINEER.

J. Compact lifts using an appropriately heavy, properly ballasted, deep penetrating foot compactor. The deep penetrating feet shall have a minimum length of 7 inches and shall be subject to approval of the ENGINEER. Vibrating rollers and rubber-tired rollers shall not be used for compaction of clayey soil.

K. Provide a minimum of four passes with the compactor regardless of whether the lift meets density specifications. A pass is considered to be one trip of the compacting equipment over the lift and back to the starting point by a single drum roller or one trip across the lift surface from one end to the other if the compacting equipment has front and back compacting rollers.

L. Use vibratory plate compactors or other suitable equipment in areas not accessible to larger rollers or compactors.

M. Avoid desiccation and crusting of the lift surface.

N. Scarify the surface of the underlying lift a minimum of 2 inches prior to compaction of each subsequent lift to facilitate bonding of the lifts.

3.02 QUALITY ASSURANCE

A. The moisture content/dry density/permeability relationship for the proposed cap material will be provided to the CONTRACTOR as a preliminary guide in controlling moisture and achieving the required degree of compaction. The CONTRACTOR shall conduct additional testing of the soil to further define the moisture content/dry density/permeability performance of the soil, and shall submit compaction curves (moisture content and density) for the proposed cap material to the ENGINEER for approval prior to material placement.

B. If an alternate borrow material is proposed/required, the CONTRACTOR shall perform a borrow evaluation to determine the moisture content/dry density/permeability relationship of the material. The results of the borrow evaluation shall be submitted to the ENGINEER for approval prior to material placement.

C. Final criteria for construction of the compacted soil cap (including moisture content, compactive effort, and density) shall be determined based on the results of the Test Pad.

D. Sieve analyses will be conducted on soils used to construct the test pad in accordance with ASTM D 422. Frequency: A minimum of one analysis per test pad.

E. Testing for Atterberg limits will be conducted on soils used to construct the test pad in accordance with ASTM D 4318. Frequency: A minimum of one analysis per test pad.

F. Moisture Content of the in-place compacted soil will be measured by nuclear methods in accordance with ASTM D3017. Frequency: Five tests per lift. A minimum of every

fifth test completed in accordance with ASTM D3017 shall also be tested in accordance with ASTM D4959. All soil samples should be tested by direct oven drying (ASTM D2216) to aid in identifying and significant, systematic calibration errors.

G. Density of the in-place compacted soil will be measured by nuclear methods in accordance with ASTM D2922 or the drive cylinder method (ASTM D2937). Frequency: Five tests per lift. A minimum of every fifth test completed in accordance with ASTM D2922 or ASTM D2937 will also be tested by the sand cone method (ASTM D1556) or rubber balloon method (ASTM D2167).

H. Permeability testing of the in-place test pad will be conducted in accordance with ASTM D 5084 at a frequency of one test per lift. Conduct tests using a confining pressure of 5 psi and a hydraulic gradient of 10.

I. If a permeability test result fails to meet the permeability requirements, two additional samples shall be taken in the vicinity of the failed sample, and replicate tests conducted. If the replicate tests pass, the section represented by the samples shall be considered as having passed. If either of the replicate tests fail, then the section shall be considered as having failed and shall be removed, replaced and retested.

J. Backfill test holes with the soil cap layer material, repair and compact test locations using the same equipment approved for the soil cap layer construction.

K. The CQA Representative will record the horizontal and vertical locations of all tests and prepare a drawing showing the test locations.

END OF SECTION

SECTION 02224

INTERMEDIATE SOIL LAYER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction of the intermediate soil layer for the landfill cap.

PART 2 PRODUCTS

2.01 FILL MATERIAL FOR THE INTERMEDIATE SOIL LAYER

A. Fill material shall consist of on-site soil free of frozen soil, stones greater than two inches in maximum diameter, debris, organic matter, clay balls, and any other deleterious substances.

B. Material shall have a unit weight greater than or equal to 120pcf and internal friction angle greater than or equal to 20 degrees as determined by the triaxial test (ASTM D4767), unless otherwise approved by the engineer.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Construct the intermediate soil layer as shown on the Drawings.

B. Place material in lifts no greater than six (6) inches compacted depth.

C. Do not push the intermediate soil layer material down the slopes. Begin placement at the bottom and work the material up the slope.

D. The finished thickness of the intermediate soil layer shall be 12 inches minimum.

3.02 QUALITY ASSURANCE

A. Perform Standard Proctor Test (ASTM D 698) on the material being used and use engineering judgement to determine if the material is suitable for use. Conduct continuous visual inspection of materials to ensure that proper soils are being used.

3.03 PROTECTION OF FINISHED WORK

A. Protect the intermediate soil layer from desiccation, flooding and freezing. Subgrades found to have desiccation cracks greater than one-half inch in width or depth, or which exhibit swelling, heaving, or other similar conditions shall replaced or reworked to remove these defects. Any portion of the intermediate soil layer that is damaged shall be reworked to meet the specifications, or removed and replaced with conforming material.

B. Make repairs at no additional cost to the OWNER.

END OF SECTION 02224

BOOK 1074 PAGE 0958

FILED

BOOK 1074 PAGE 958

'97 APR 23 P1:39

NANCY S. PUGH
REGISTER OF DEEDS
ALAMANCE COUNTY, NC

ALAMANCE COUNTY NC 04/23/97
9
$1.00

STATE OF NORTH CAROLINA

Real Estate Excise Tax

Excise Tax $1.00

Recording Time, Book and Page

Tax Lot No. ..... Parcel Identifier No. .....

Verified by ..... County on the ..... day of ....., 19.....

by .....

Mail after recording to .....

(prepared without benefit of title examination)

This instrument was prepared by PATTERSON & WHITE (John K. Patterson)

Brief description for the Index

NORTH CAROLINA GENERAL WARRANTY DEED

THIS DEED made this 16th day of April, 19 97, by and between

GRANTOR	GRANTEE
GIJSBERTUS F. VAN STAVEREN, Divorced and DEANNA MARIE COBLE, Divorced	KENT LEE COBLE and wife, BRENDA LAMM COBLE 5833 Foster Store Road Liberty, NC 27289

Enter in appropriate block for each party: name, address, and, if appropriate, character of entity, e.g. corporation or partnership.

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in the City of ....., Patterson Township, Alamance County, North Carolina and more particularly described as follows:

A certain tract or parcel of land in Patterson Township, Alamance County, North Carolina, adjoining Devoe C. Euliss, Kent L. Coble, Poppaw Creek, and Gijs Van Staveren and Deanna C. Van Staveren and described as follows:

BEGINNING at a new iron pipe, corner with Kent L. Coble; running thence with Kent L. Coble N. 57 deg. 00' 00" W. 1,293.39 feet to a stone control corner; thence again with Kent L. Coble S. 55 deg. 00' 00" W. 177.02 feet to a new iron pin; thence along Poppaw Creek the following courses and distances: N. 75 deg. 28' 40" W. 135.50 feet to a point; thence N. 80 deg. 53' 58" W. 55.04 feet to a point; thence N. 28 deg. 35' 12" W. 54.04 feet to a point; thence N. 04 deg. 22' 29" W. 61.61 feet to a point; thence N. 13 deg. 37' 16" W. 51.45 feet to a point; thence S. 76 deg. 22' 48" W. 51.45 feet to a point; thence N. 69 deg. 19' 52" W. 94.67 feet to a point; thence N. 22 deg. 49' 42" W. 100.12 feet to a point; thence N. 32 deg. 06' 52" W. 57.17 feet to a point; thence N. 37 deg. 45' 47" E. 122.11 feet to a point; thence N. 49 deg. 27' 06" E. 103.08 feet to a point; thence N. 46 deg. 43' 36" E. 90.70 feet to a point in the center line of Poppaw Creek and the line of Devoe C. Euliss; thence with the line of Devoe C. Euliss S. 87 deg. 14' 54" E. 900.00 feet to an existing iron pipe, corner with Gijsbertus Van Staveren and Deanna C. Van Staveren; running thence with Gijsbertus Van Staveren and Deanna C. Van Staveren S. 33 deg. 16' 30" E. 487.25 feet to a new iron pipe; thence S. 22 deg. 31' 29" E. 559.16 feet to a new iron pipe; thence S. 35 deg. 14' 46" E. 161.02 feet to a new iron pipe; thence S. 15 deg. 59' 06" W. 97.38 feet to the BEGINNING, CONTAINING 19.819 ACRES, more or less, as shown on a final plat of the property of Gijs Van Staveren and wife, Deanna C. Van Staveren, as surveyed by Ray Barnes, Registered Land

N. C. Bar Assoc. Form No. 3 © 1976, Revised © 1977 — James Williams & Co., Inc., Box 127, Yadkinville, N. C. 27055
Printed by Agreement with the N. C. Bar Assoc. – 1981

(Description continued on reverse side hereof)

BOOK 1074 PAGE 0959

Surveyor, December 2, 1993, plat of which is recorded in Plat Book _____, Page _____, of the Alamance County Registry.

The above described property is to be added to and become a part of the property of Kent Lee Coble and wife, Brenda Lamm Coble.

This coveyance is subject to a Deed of Trust in favor of D. Willard Phillippie dated August 30, 1993. However the Grantors agree to make all remaining payments due on said note and deed of trust to D. Willard Phillippie.

The property hereinabove described was acquired by Grantor by instrument recorded in .....

.....

A map showing the above described property is recorded in Plat Book ..... page.....

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions hereinafter stated. Title to the property hereinabove described is subject to the following exceptions:

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal, or if corporate, has caused this instrument to be signed in its corporate name by its duly authorized officers and its seal to be hereunto affixed by authority of its Board of Directors, the day and year first above written.

USE BLACK INK ONLY

(Corporate Name)

By: ---

---President

ATTEST:

---Secretary (Corporate Seal)

Gijsbertus van Staveren (SEAL)
GIJSBERTUS F. VAN STAVEREN

Deanna Marie Coble (SEAL)
DEANNA MARIE COBLE

---(SEAL)

---(SEAL)

SEAL-STAMP
KAREN S. MILLS NOTARY PUBLIC ALAMANCE COUNTY, N.C.

Use Black Ink

NORTH CAROLINA, Alamance County.

I, a Notary Public of the County and State aforesaid, certify that Gijsbertus F. Van Staveren, Divorced ---------- Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 21 day of April, 1997.

My commission expires: Sep. 22, 1998 Karen S. Mills Notary Public

---

SEAL-STAMP
MICHELLE DELGADO HORN NOTARY PUBLIC ALAMANCE COUNTY, N.C.

Use Black Ink

NORTH CAROLINA, Alamance County.

I, a Notary Public of the County and State aforesaid, certify that Deanna Marie Coble, Divorced, personally came before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 16th day of April, 1997.

My commission expires: 9-26-98 Michelle DelGado Horn Notary Public

---

The foregoing Certificate(s) of Karen S Mills + Michelle DelGado Horn N P of the governmental units designated is/are certified to be correct. This instrument and this certificate are duly registered at the date and time and in the Book and Page shown on the first page hereof.

NADINE S. FUQUA REGISTER OF DEEDS FOR Alamance COUNTY

By Barbara Wilson Deputy/~~Assistant~~ - Register of Deeds

N. C. Bar Assoc. Form No. 3 © 1976, Revised © 1977 — James Williams & Co., Inc., Box 127, Yadkinville, N. C. 27055
Printed by Agreement with the N. C. Bar Assoc. - 1981

Book 1941 Page 177
Alamance County, NC
Recorded 08/21/2003 12:19:42pm
No 9999-00089569 1 of 2 pages
Excise Tax: $140.00
Muriel W Tarpley, Register of Deeds

NORTH CAROLINA
GENERAL WARRANTY DEED

Tax Map No. 1-18-40
Excise Tax $140.00

Mail after recording to **Vernon, Vernon, Wooten, Brown, Andrews & Garrett, P.A., 36 Court Square SW, Graham, North Carolina 27253.**
This instrument was prepared by James Hunt Johnson, Attorney.

THIS DEED made this 21st day of August, 2003 by and between

GRANTOR

GREGG RAY PHILLIPS, unmarried

GRANTEE

KENT LEE COBLE and wife BRENDA LAMM COBLE
5833 Foster Store Rd.
Liberty, N.C. 27298

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land described as follows:

A tract of land in Patterson Township, Alamance County, N.C. adjoining Lafoy R. Curl and Ruth Shoffner Curl, Kent Lee Coble and Brenda Lamm Coble, and Kenneth Frank Johnson and being described as follows:

BEGINNING at the southwest corner of Kent Lee Coble, et ux (Deed Book 842 page 4); thence with the line of Coble, South 88 deg. 08' 23" East 1131.93 ft. to an existing axle (passing over irons located at 165.05 ft., 231.24 ft., 586.64 ft. and 149 ft. from the beginning point); thence again with Coble, South 33 deg. 18' 35" East 344.50 ft. to an existing iron pin and South 36 deg. 00' 23" East 383.43 ft. to an existing iron pin, corner of Kenneth Frank Johnson; thence with Johnson, South 80 deg. 43' 33" West 1271.08 ft. to an existing iron pin, corner of Curl; thence with Curl the following courses and distances: North 12 deg. 17' 31" East 351.71 ft. to an existing set stone; North 11 deg. 07' 12" East 193.34 ft. to an existing angle iron; North 21 deg. 54' 22' West 248.23 ft. to an existing iron pin; North 87 deg. 52' 17"

Workflow 9999-00089569

West 299.04 ft. to an existing set stone; and North 10 deg. 38' 11" West 66.03 ft. to the POINT OF BEGINNING, containing 16.894 acres, more or less, as shown on a survey entitled "Kent Lee Coble and Brenda Lamm Coble," by Tritech Civil Environmental, PC, dated August 5, 2003.

Save and except:

A tract of land in Patterson Township, Alamance County, N.C. adjoining George Soots, L. R. Curl and others and being described as follows:

BEGINNING at an iron wagon box, a corner with George Soots; thence with the said Soots' line, South 15 deg. 40' West 230 ft. to an iron stake, a corner with L. R. Curl; thence a new line with said Curl, North 18 deg. 04' West 248.6 ft. to an iron stake in George Soots' line; thence with the said Soots' line, South 83 deg. 54' East 140 ft. to the BEGINNING and containing .36 acre more or less. This description was obtained from a survey made by J. Mark McAdams, surveyor, April 30, 1956.

This being the same property conveyed to George Soots by deed filed in Book 246, page 5 of the Alamance County Registry.

The property herein above described was acquired by Grantor by instrument recorded in Book 929, page 217.

A map showing the above described property is recorded in Plat Book , page .

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions hereinafter stated.

Title to the property herein above described is hereby conveyed subject to all valid and subsisting restrictions, reservations, covenants, conditions, rights of ways and easements properly of record, if any and current year ad valorem taxes.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal the day and year first above written.

Grantor:

Gregg Ray Phillips (SEAL)
Gregg Ray Phillips, unmarried

STATE OF NORTH CAROLINA
COUNTY OF ALAMANCE

I, J H Johnson, a Notary Public of the County and State aforesaid, certify that Gregg Ray Phillips, unmarried, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this the 21st day of August, 2003.

My Commission Expires: 4-08-06

Notary Public

J H JOHNSON NOTARY PUBLIC ALAMANCE COUNTY, NC

State of North Carolina Alamance County
The foregoing certificate(s) of J. H. Johnson
A Notary (Notaries) Public of the Designated Governmental units is (are) certified to be correct
This the 21st day of August 20 03
MICHAEL W. FOGLEY Debra Chandler
Register of Deeds By Assistant/Deputy

f:\data\wpwin\opin2003\coble.kent

17.00
(2)

NORTH CAROLINA

ALAMANCE COUNTY

THIS DEED, made and entered into this 10th day of October, 1970, by and between A. B. COBLE, widower, M. R. COBLE and wife, ALMA COBLE, T. C. COBLE and wife CATHERINE COBLE, J. P. KIMREY and wife DEWELL COBLE KIMREY, all of the County of Alamance and State of North Carolina, parties of the first part; and KENT L. COBLE and wife, BRENDA E. COBLE of the County of Alamance and State of North Carolina, parties of the second part;

W I T N E S S E T H :

That the said parties of the first part, in consideration of the sum $30,500.00 to them paid by the said parties of the second part, the receipt of which is hereby acknowledged, have bargained and sold and by these presents do bargain, sell, and convey unto the said parties of the second part, and their heirs and assigns a certain tract or parcel of land lying and being in the County of Alamance and State of North Carolina, in Patterson Township and more particularly described as follows:

TRACT NO. I:

A certain tract or parcel of land in Patterson Township, Alamance County, State of North Carolina, and described as follows:

BEGINNING at a rock and a Black Jack in Iseleys line; thence S. 3½ deg. W. 161 rds. to a gum tree; thence N. 34½ deg. W. 241 rds. to a gum tree on the bank of the creek near a branch; thence N. 55 deg. E. 15 rds. to a rock; thence S. 57 deg. E. 78 rds. to a rock; thence N. 86 deg. E. 35 rds. to a willow oak near a spring; thence S. 57 deg. E. 38 rds. to the BEGINNING, containing 72 acres, more or less and being the same property as described in deed dated August 7, 1907 and recorded in Deed Book 98, at Page 578 of the Alamance County Registry.

TRACT NO. II:

A certain tract or parcel of land in Patterson Township, Alamance County, State of North Carolina, adjoining the lands of W. J. Coble and others and bounded as follows:

BEGINNING at the old Black corner on the bank of a branch at the creek 12 or 15 feet from a solid rock on a gum tree; thence S. 9 deg. E. 29 chs. 44 links to a stone 4 poles north of the old Staley line and corner with Nannie Black; thence S. 86½ deg. E. 66 poles 18

Real Estate Excise Tax 30.50
STATE OF NORTH CAROLINA
OCT 14 1970
R.S. 10705

links to a stone on the South side of a branch, corner with said Nannie Black in E. M. Alexander line; thence N. 38 deg. W. 35 chs. with said Alexander line to the BEGINNING, containing 25 acres, more or less. This being the same property as that conveyed by Mary J. Alexander to W. J. Coble by deed recorded in Book 98 at Page 575 of the Alamance County Registry.

EXCEPT from the foregoing described tracts is that one acre tract sold by W. J. Coble and wife, Sallie A. Coble to Miss Mattie B. Holt by deed dated October 24, 1955 and recorded in Deed Book 239 at Page 53 of the Alamance County Registry. Also excepted from the foregoing described tracts is that agreement between W. J. Coble, et. al. and J. P. Kimrey, et. al. establishing a boundry line and recorded in Deed Book 129 at Page 39 of the Alamance County Registry.

To have and to hold the aforesaid tracts or parcels of land, together with all privileges and appurtenances thereunto belonging, to them the said parties of the second part and their heirs and assigns in fee simple forever.

And the said parties of the first part do covenant that they are seized of said lands in fee and have the right to convey the same in fee simple, that the same are free and clear of all incumbrances and that they will warrant and defend the title herein conveyed against the lawful claims of all persons whomsoever.

IN TESTIMONY WHEREOF, said parties of the first part have hereunto set their hands and seals the day and year first above written.

A B Coble (SEAL)
A. B. Coble

M R. Coble (SEAL)
M. R. Coble

Alma Coble (SEAL)
Alma Coble

T. C. Coble (SEAL)
T. C. Coble

Catherine Coble (SEAL)
Catherine Coble

J P Kimrey (SEAL)
J. P. Kimrey

Dewell Coble Kimrey (SEAL)
Dewell Coble Kimrey

BOOK 375 PAGE 555

NORTH CAROLINA

ALAMANCE COUNTY

I, Barbara B. Harris, a Notary Public of said County, do hereby certify that A. B. COBLE, widower, M. R. COBLE and wife, ALMA COBLE, T. C. COBLE and wife, CATHERINE COBLE, J. P. KIMREY and wife, DEWELL COBLE KIMREY, all of the County of Alamance, personally appeared before me this day and acknowledged the due execution of the foregoing deed.

Witness my hand and official seal, this 10th day of October, 1970.

Barbara B. Harris
NOTARY PUBLIC

My Commission Expires:
3/25/71

STATE OF NORTH CAROLINA, COUNTY OF ALAMANCE

The foregoing certificate(s) of Barbara B Harris a Notary (or ~~Notaries~~) Public of the governmental units designated is (are) certified to be correct.

Filed for registration on the 12 day of Oct., 1970, at 11:45 o'clock A M.

and duly recorded in the Office of the Register of Deeds of this County in Book of Deeds No. 375 Dupl page 553

D. B. PARIS, Register of Deeds 10-14-70 By Mae Singer Deputy

BOOK 1074 PAGE 0958

FILED

BOOK 1074 PAGE 958

'97 APR 23 P1:39

NANCY S. PUGH
REGISTER OF DEEDS
ALAMANCE COUNTY, NC

ALAMANCE COUNTY NC 04/23/97
$1.00
STATE OF NORTH CAROLINA
Real Estate Excise Tax

Excise Tax # 100

Recording Time, Book and Page

Tax Lot No. ..... Parcel Identifier No. .....

Verified by ..... County on the ..... day of ....., 19.....

by .....

Mail after recording to .....

(prepared without benefit of title examination)

This instrument was prepared by PATTERSON & WHITE (John K. Patterson)

Brief description for the Index

NORTH CAROLINA GENERAL WARRANTY DEED

THIS DEED made this 16th day of April, 19 97, by and between

GRANTOR	GRANTEE
GIJSBERTUS F. VAN STAVEREN, Divorced and DEANNA MARIE COBLE, Divorced	KENT LEE COBLE and wife, BRENDA LAMM COBLE 5833 Foster Store Road Liberty, NC 27289

Enter in appropriate block for each party: name, address, and, if appropriate, character of entity, e.g. corporation or partnership.

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in the City of ....., Patterson Township, Alamance County, North Carolina and more particularly described as follows:

A certain tract or parcel of land in Patterson Township, Alamance County, North Carolina, adjoining Devoe C. Euliss, Kent L. Coble, Poppaw Creek, and Gijs Van Staveren and Deanna C. Van Staveren and described as follows:

BEGINNING at a new iron pipe, corner with Kent L. Coble; running thence with Kent L. Coble N. 57 deg. 00' 00" W. 1,293.39 feet to a stone control corner; thence again with Kent L. Coble S. 55 deg. 00' 00" W. 177.02 feet to a new iron pin; thence along Poppaw Creek the following courses and distances: N. 75 deg. 28' 40" W. 135.50 feet to a point; thence N. 80 deg. 53' 58" W. 55.04 feet to a point; thence N. 28 deg. 35' 12" W. 54.04 feet to a point; thence N. 04 deg. 22' 29" W. 61.61 feet to a point; thence N. 13 deg. 37' 16" W. 51.45 feet to a point; thence S. 76 deg. 22' 48" W. 51.45 feet to a point; thence N. 69 deg. 19' 52" W. 94.67 feet to a point; thence N. 22 deg. 49' 42" W. 100.12 feet to a point; thence N. 32 deg. 06' 52" W. 57.17 feet to a point; thence N. 37 deg. 45' 47" E. 122.11 feet to a point; thence N. 49 deg. 27' 06" E. 103.08 feet to a point; thence N. 46 deg. 43' 36" E. 90.70 feet to a point in the center line of Poppaw Creek and the line of Devoe C. Euliss; thence with the line of Devoe C. Euliss S. 87 deg. 14' 54" E. 900.00 feet to an existing iron pipe, corner with Gijsbertus Van Staveren and Deanna C. Van Staveren; running thence with Gijsbertus Van Staveren and Deanna C. Van Staveren S. 33 deg. 16' 30" E. 487.25 feet to a new iron pipe; thence S. 22 deg. 31' 29" E. 559.16 feet to a new iron pipe; thence S. 35 deg. 14' 46" E. 161.02 feet to a new iron pipe; thence S. 15 deg. 59' 06" W. 97.38 feet to the BEGINNING, CONTAINING 19.819 ACRES, more or less, as shown on a final plat of the property of Gijs Van Staveren and wife, Deanna C. Van Staveren, as surveyed by Ray Barnes, Registered Land

(Description continued on reverse side hereof)

N. C. Bar Assoc. Form No. 3 © 1976. Revised © 1977 — James Williams & Co., Inc., Box 122, Yadkinville, N. C. 27055
Printed by Agreement with the N. C. Bar Assoc. – 1981

Surveyor, December 2, 1993, plat of which is recorded in Plat Book _____, Page _____, of the Alamance County Registry.

The above described property is to be added to and become a part of the property of Kent Lee Coble and wife, Brenda Lamm Coble.

This coveyance is subject to a Deed of Trust in favor of D. Willard Phillippie dated August 30, 1993. However the Grantors agree to make all remaining payments due on said note and deed of trust to D. Willard Phillippie.

The property hereinabove described was acquired by Grantor by instrument recorded in .....

.....

A map showing the above described property is recorded in Plat Book ..... page.....

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions hereinafter stated. Title to the property hereinabove described is subject to the following exceptions:

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal, or if corporate, has caused this instrument to be signed in its corporate name by its duly authorized officers and its seal to be hereunto affixed by authority of its Board of Directors, the day and year first above written.

_____ (Corporate Name)

By: _____

_____ President

ATTEST:

_____ Secretary (Corporate Seal)

USE BLACK INK ONLY

Gijsbertus F. Van Staveren (SEAL)
GIJSBERTUS F. VAN STAVEREN

Deanna Marie Coble (SEAL)
DEANNA MARIE COBLE

_____ (SEAL)

_____ (SEAL)

KAREN S. MILLS NOTARY PUBLIC ALAMANCE COUNTY, N.C. SEAL-STAMP

NORTH CAROLINA, Alamance County.

I, a Notary Public of the County and State aforesaid, certify that Gijsbertus F. Van Staveren, Divorced Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 21 day of April, 19 97.

Use Black Ink

My commission expires: Sep. 22, 1998. Karen S. Mills Notary Public

MICHELLE DELGADO HORN NOTARY PUBLIC ALAMANCE COUNTY, N.C. SEAL-STAMP

NORTH CAROLINA, Alamance County.

I, a Notary Public of the County and State aforesaid, certify that Deanna Marie Coble, Divorced, personally came before me this day and acknowledged the execution of the foregoing instrument.

Witness my hand and official stamp or seal, this 11th day of April, 19 97.

Use Black Ink

My commission expires: 9-26-98 Michelle DelGado Horn Notary Public

The foregoing Certificate(s) of Karen S. Mills + Michelle DelGado Horn N P of the governmental units designated is/are certified to be correct. This instrument and this certificate are duly registered at the date and time and in the Book and Page shown on the first page hereof.

NADINE S. FUQUA REGISTER OF DEEDS FOR Alamance COUNTY

By Barbara Wilson Deputy/~~Assistant~~ Register of Deeds

N. C. Bar Assoc. Form No. 3 © 1976. Revised © 1977 — James Williams & Co., Inc., Box 127, Yanceyville, N. C. 27055
Printed by Agreement with the N. C. Bar Assoc. 1981

BOOK 1117 PAGE 0083

FILED

BOOK 1117 PAGE 83

'97 OCT 10 A8:34

NADINE S. FUQUA
REGISTER OF DEEDS
ALAMANCE COUNTY, NC

Excise Tax NO TAXABLE CONSIDERATION

Recording Time, Book and Page

Tax Lot No. ..... Parcel Identifier No. .....

Verified by ..... County on the ..... day of ....., 19.....

by .....

Mail after recording to .....

(prepared without benefit of title examination)

This instrument was prepared by PATTERSON & WHITE (John K. Patterson)

Brief description for the Index

NORTH CAROLINA GENERAL WARRANTY DEED

THIS DEED made this 26 day of September, 19 97, by and between

GRANTOR	GRANTEE
DEANNA MARIE COBLE, UNMARRIED	KENT LEE COBLE and wife, BRENDA LAMM COBLE 5833 Foster Store Road Liberty, NC 27289

Enter in appropriate block for each party: name, address, and, if appropriate, character of entity, e.g. corporation or partnership.

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in the City of ....., Patterson Township, Alamance County, North Carolina and more particularly described as follows:

A certain tract or parcel of land in Patterson Township, Alamance County, North Carolina, adjoining Foster Store Road, James J. Burke, Kent L. Coble, Gijsbertus F. Van Staveren, and more particularly described as follows:

BEGINNING at an iron stake in the western margin of Foster Store Road, a corner with James J. Burke; running thence with James J. Burke N. 80 deg. 09' 51" W. 209.71 feet to an iron stake; thence S. 03 deg. 53' 59" E. 40.14 feet to an iron stake; thence with Kent L. Coble N. 83 deg. 56' 05" W. 396.27 feet to an iron; thence N. 89 deg. 44' 14" W. 578.52 feet to an existing iron rod in stone; thence N. 16 deg. 01' 01" E. 97.33 feet to an iron; thence N. 35 deg. 13' 30" W. 161.04 feet to an iron; thence N. 22 deg. 31' 29" W. 356.83 feet to a new iron pin; thence a new line with Gijsbertus F. Van Staveren N. 86 deg. 44' 32" E. 522.77 feet to a new iron pin in the center line of a road; thence along the center line of the road S. 56 deg. 32' 49" E. 194.75 feet to a new iron pin; thence N. 86 deg. 58' 18" E. 104.38 feet to a new iron pin; thence N. 58 deg. 35' 08" E. 104.85 feet to a new iron pin; thence N. 76 deg. 50' 38" E. 142.45 feet to a new iron pin; thence S. 84 deg. 53' 20" E. 94.41 feet to a new iron pin; thence S. 64 deg. 11' 14" E. 164.11 feet to a new iron pin; thence S. 43 deg. 41' 08" E. 157.81 feet to a new iron pin; thence S. 59 deg. 17' 26" E. 169.79 feet to a new iron pin in the center line of the road in the western margin of Foster Store Road; running thence along the western margin of Foster Store Road S. 27 deg. 26' 50" W. 93.48 feet to a point not set; thence S. 25 deg. 34' 13" W. 95.22 feet to a point not set; thence S. 19 deg. 31' 46" W. 93.30 feet to a point not set; thence S. 14 deg. 42' 24" W. 74.94 feet to the BEGINNING, CONTAINING 16.31 ACRES, more or less, as shown on a plat of a boundary survey for Kent L. Coble and wife, Brenda L. Coble, by Moore and Ellis, Registered Land Surveyors, dated February 20, 1997.

N. C. Bar Assoc. Form No. 3 © 1976. Revised © 1977 — James Williams & Co., Inc., Box 127, Yadkinville, N. C. 27055
Printed by Agreement with the N. C. Bar Assoc. - 1981

BOOK 1117 PAGE 0084

This conveyance is subject to a Deed of Trust in favor of D. Willard Phillippie and wife, Agnes Phillippie, dated August 30, 1993, recorded in the Alamance County Registry in Book 842 at Page 7.

The property hereinabove described was acquired by Grantor by instrument recorded in .....

.....

A map showing the above described property is recorded in Plat Book ..... page .....

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions hereinafter stated.
Title to the property hereinabove described is subject to the following exceptions:

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal, or if corporate, has caused this instrument to be signed in its corporate name by its duly authorized officers and its seal to be hereunto affixed by authority of its Board of Directors, the day and year first above written.

USE BLACK INK ONLY

..... (Corporate Name)

By: .....

..... President

ATTEST:

.....

..... Secretary (Corporate Seal)

Deanna Marie Coble (SEAL)
DEANNA MARIE COBLE

..... (SEAL)

..... (SEAL)

..... (SEAL)

SEAL KAREN S. MILLS NOTARY PUBLIC ALAMANCE COUNTY, N.C.

Use Black Ink

NORTH CAROLINA, Alamance County.

I, a Notary Public of the County and State aforesaid, certify that Deanna Marie Coble, unmarried ..... Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 26 day of September, 1997.

My commission expires: Sep. 22, 1998 Karen S. Mills Notary Public

SEAL-STAMP

Use Black Ink

NORTH CAROLINA, ... County.

I, a Notary Public of the County and State aforesaid, certify that .....,

personally came before me this day and acknowledged that ..... he is ..... Secretary of ..... a North Carolina corporation, and that by authority duly given and as the act of the corporation, the foregoing instrument was signed in its name by its ..... President, sealed with its corporate seal and attested by ..... as its ..... Secretary.

Witness my hand and official stamp or seal, this ..... day of ....., 19.....

My commission expires: .... Notary Public

The foregoing Certificate(s) of Karen S. Mills Nty Alm Co NC

.....

.....

is/are certified to be correct. This instrument and this certificate are duly registered at the date and time and in the Book and Page shown on the first page hereof.

NADINE S. FUQUA
..... REGISTER OF DEEDS FOR Alamance COUNTY

By Sheeby Williams Deputy/~~Assistant~~ - Register of Deeds

10.00

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BOOK 1309 PAGE 0324

ALAMANCE COUNTY NC
10

07/13/1999

$16.00

STATE OF NORTH CAROLINA

Real Estate Excise Tax

Excise Tax: $16.00

FILED

BOOK 1309 PAGE 324

'99 JUL 13 P3:26

NADINE S. FUQUA
REGISTER OF DEEDS
ALAMANCE COUNTY, NC

Recording Time, Book and Page

Tax Map No. _____ Parcel Identifier No. _____

Mail after recording to Vernon, Vernon, Wooten, Brown, Andrews & Garrett, P.A., 36 Court Square SW, Graham, North Carolina 27253.

This instrument was prepared by Jill Starling Britt, Attorney.

NORTH CAROLINA
GENERAL WARRANTY DEED

THIS DEED made this 9th day of July, 1999 by and between

GRANTOR

DEVOE C. EULISS, unmarried

GRANTEE

KENT L. COBLE and BRENDA L. COBLE,
husband and wife

5833 Foster Store Road
Liberty, North Carolina 27298

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land described as follows:

SEE THE ATTACHED EXHIBIT "A" WHICH IS HEREBY INCORPORATED BY REFERENCE.

The property hereinabove described was acquired by Grantor by instrument recorded in Book 394, Page 770 and Book 394, Page 772.

A map showing the above described property is recorded in Plat Book 20, Page 53.

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomever except for the exceptions hereinafter stated.

Title to the property hereinabove described is hereby conveyed subject to all valid and subsisting restrictions, reservations, covenants, conditions, rights of ways and easements properly of record, if any and current year ad valorem taxes.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal the day and year first above written.

Devoe C. Euliss (SEAL)
DEVOE C. EULISS

STATE OF NORTH CAROLINA
COUNTY OF ALAMANCE

I, DEVOE C EULISS, a Notary Public of the County and State aforesaid, certify that DEVOE C. EULISS personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this the 9th day of July, 1999.

My Commission Expires:
9-23-2002

Hazel Holmes Bowman
Notary Public
Alamance County, NC

State of North Carolina Alamance County
The foregoing certificate of Hazel Holmes Bowman
A Notary (Notaries) Public of the Designated Governmental units is (are) certified to be correct
This the 13th day of July 1999
NADINE S. FUQUA Carla J. Tucker
Register of Deeds By ~~Assistant~~/Deputy

f:\wp60\deed99\coble.a04

1200

EXHIBIT "A"

A tract of land in Patterson Township, Alamance County, N.C. adjoining the lands of Donald Smith, Muzette L. Linnens, Talton E. Stafford, Barbara Euliss Johnson and others and bounded as follows:

BEGINNING at a rock, a corner with Barbara Euliss Johnson and Donald Smith's northwest corner; thence with the said Smith's line, South 8° 37' West 670.50 ft. to a rock, a corner with Muzette L. Linnens; thence with the said Linnens' line, North 83° 53' West 1405.0 ft. to a point in Poppaw Creek (iron stake on east side of creek in this line 25 ft. from corner; thence down creek the following courses and distances: North 68° 03' East 138.28 ft.; thence North 50° 24' East 230.94 ft.; thence North 69° 34' East 167.30 ft.; thence South 76° 56' East 155.25 ft.; thence North 79° 04' East 158.95 ft.; thence North 59° 54' east 254.53 ft.; thence North 28° 14' East 94.77 ft.; thence North 06° 23' East 100.35 ft. to a point in the creek, a corner with Barbara Euliss Johnson; thence South 74° 38' East 378.0 ft. to the **BEGINNING, CONTAINING 12.67 acres**, more or less, as shown on the Plat of the Property of W. A. Euliss Heirs Farm which is recorded in **Plat Book 20 at page 53** of the Alamance County Registry, to which reference is hereby made.

This being the same property conveyed to Devoe C. Euliss by Order filed in Book 394 at page 770 and Report filed in Book 394 at page 772, both recorded on April 25, 1973.

BOOK 1432 PAGE 0504

ALAMANCE COUNTY NC 10/12/2000

$950.00

STATE OF NORTH CAROLINA

Real Estate Excise Tax

Excise Tax: $ 950.00

FILED

BOOK 1432 PAGE 504

2000 OCT 12 A 11:21

MURIEL W. TARPLEY
REGISTER OF DEEDS
ALAMANCE COUNTY NC

Recording Time, Book and Page

Tax Map No. _____ Parcel Identifier No. _____

Mail after recording to **Vernon, Vernon, Wooten, Brown, Andrews & Garrett, P.A., 36 Court Square SW, Graham, North Carolina 27253.**

This instrument was prepared by: Jill Starling Britt, Attorney At Law.

NORTH CAROLINA
GENERAL WARRANTY DEED

THIS DEED made this 11th day of October, 2000 by and between

GRANTOR

GIJSBERTUS F. VAN STAVEREN
and wife
CYNTHIA J. VAN STAVEREN

GRANTEE

KENT L. COBLE
and wife
BRENDA L. COBLE
5833 FOSTER STORE RD.
LIBERTY, NC 27298

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land described as follows:

SEE ATTACHED EXHIBIT "A"

The property hereinabove described was acquired by Grantor by instrument recorded in Book 842, Page 4.

A map showing the above described property is recorded in Plat Book , Page .

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomever except for the exceptions hereinafter stated.

Title to the property hereinabove described is hereby conveyed subject to all valid and subsisting restrictions, reservations, covenants, conditions, rights of ways and easements properly of record, if any and current year ad valorem taxes.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal the day and year first above written.

Gijsbertus F. van Staveren (SEAL)
GIJSBERTUS F. VAN STAVEREN

Cynthia J. van Staveren (SEAL)
CYNTHIA J. VAN STAVEREN

STATE OF NORTH CAROLINA
COUNTY OF ALAMANCE

I, Jill Starling Britt, a Notary Public of the County and State aforesaid, certify that Gijsbertus F. Van Staveren and wife Cynthia J. Van Staveren, personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this the 11 day of October, 2000.

My Commission Expires:
9/28/2004

Notary Public

State of North Carolina Alamance County
The foregoing certificate(s) of Jill Starling Britt
A Notary (Notaries) Public of the Designated Governmental units is (are) certified to be correct.
This the 12th day of October, 2000
MURIEL W. TARPLEY
Register of Deeds By Assistant/Deputy

f:\data\wpwin\deed2000\kentcoble

12.00

EXHIBIT "A"

A tract of land in Patterson Township, Alamance County, N.C. adjoining Foster Store Road (St. Rd. 1113), other property of Kent L. Coble and wife Brenda L. Coble, Devoe C. Euliss, James Douglas Smith, Sandra G. Williamson, and being described as follows:

BEGINNING at a new iron pin in the southeast corner of Sandra G. Williamson (DB 1001, page 46) and the western right of way of St. Rd. 1113; thence with the western right of way of St. Rd. 1113, South 27° 54' 49" West 251.89 ft. to a point and South 28° 17' 17" West 109.96 ft. to an existing iron pin; thence with Kent L. and Brenda L. Coble the following courses and distances: North 59° 17' 26" West 169.79 ft. to an iron; North 43° 41' 08" West 157.81 ft. to an iron; North 64° 11' 14" West 164.11 ft. to an iron; North 84° 53' 20" West 94.41 ft. to an iron; South 76° 50' 38" West 142.45 ft. to an iron; South 58° 35' 08" West 104.85 ft. to an iron; South 86° 58' 18" West 104.38 ft. to an iron; North 56° 32' 49" West 194.75 ft. to an iron; thence South 86° 44' 32" West 522.77 ft. to an iron in the line of Kent L. and Brenda L. Coble (DB379, page 950); thence with Coble, North 22° 31' 29" West 202.33 ft. to an iron; thence North 33° 16' 17" West 487.27 ft. to an iron in the line of Devoe C. Euliss (DB 394, page 772); thence with Euliss and James Douglas Smith, South 87° 13' 30" East 1498.90 ft. to an iron; thence with Smith and Williamson, South 05° 43' 27" West 213.18 ft. to an iron; thence South 05° 43' 27" West 190 ft. to an iron; thence South 05° 43' 27" West 10 ft. to a stone, the southwest corner of Williamson; thence with Williamson's south line, South 84° 19' 10" East 10 ft. to an iron; South 84° 19' 10" East 293.39 ft. to an iron; South 84° 19' 10" East 271.95 ft. to an iron pin, the **POINT OF BEGINNING, containing 19.12 acres,** more or less, as shown on the plat entitled "Gijsbertus F. Van Staveren", dated January 13, 1999, by Joseph D. Moore, RLS, Moore Professional Land Surveyors.

This is a portion of the property as conveyed to Gijsbertus F. Van Staveren, et ux, by deed from D. Willard Phillippie and wife Agnes Phillippie, filed in Book 842 at page 4 of the Alamance County Registry.

Alamance County

OFFICE OF THE COUNTY ATTORNEY
124 West Elm Street
Graham, North Carolina 27253
Tel. (336) 228-1312
FAX (336) 570-6788

DAVID I. SMITH
County Attorney
Clerk To The Board

MISTI C. BASS
Assistant County Attorney

September 19, 2005

Ms. Ramona C. O'Bryant
Smith Moore LLP
3001 N. Greene Street, Suite 1400
Greensboro, NC 27401

Re: Coble's Sandrock, Inc.
Consistency Determination

Dear Mona:

I received your letter of August 18, 2005. The County has reviewed existing ordinances that could apply to the Coble's operation on Foster Store Road. Based on our review, the County has concluded that Alamance County has sole jurisdiction over the property upon which Coble's operates and that Coble's current and proposed operations are consistent with all applicable County ordinances.

Specifically, we have determined the following:

1. Alamance County does have a franchise ordinance applicable to the Coble's operation. The franchise ordinance, which authorizes Alamance County to grant a franchise for the operation of a construction and demolition landfill within County's jurisdiction, was adopted on December 5, 1994. The ordinance that specifically grants a franchise to Coble's for its current operation of the landfill was adopted on September 4, 2001, with an effective date of September 2, 2002. The County recently adopted a franchise, which allows Coble's to continue with its current operation as well as expand the landfill to other parts of Coble's property. The most recent franchise will become effective on September 2, 2007.

2. Alamance County does not have zoning, subdivision or land-use planning ordinances that apply to the property upon which Coble's operates.

3. Coble's operations, as they currently exist and as they propose to expand, are consistent with the County's franchise ordinances.

Recycled Paper

Please let me know if you or the State need any additional information. Thank you for your cooperation in this matter.

Very truly yours,

David I. Smith

DIS/db

ORDINANCE GRANTING A CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL FRANCHISE TO COBLE'S SANDROCK, INC.

WHEREAS, the Board of Commissioners enacted the Alamance County Landfill Franchise Ordinance on December 5, 1994; and

WHEREAS, the Board of Commissioners enacted an Ordinance Granting a Construction and Demolition Debris Landfill Franchise to Coble's Sandrock, Inc. on September 2, 1997; and

WHEREAS, North Carolina General Statutes § 153A-136(a)(3) authorizes counties to regulate the disposal and other disposition of solid wastes by granting franchises to one or more persons for the exclusive right to commercially dispose of solid wastes within the county; and

WHEREAS, the September 4, 2001 Franchise Ordinance has a five (5) year term from its effective date of September 2, 2002; and

WHEREAS, Coble's Sandrock, Inc. ("Coble's") is currently operating a construction and demolition debris landfill within the jurisdiction of Alamance County pursuant to said Ordinance;

WHEREAS, Coble's wishes to move forward with the next phase of its construction and demolition debris landfill pursuant to a new Ordinance Granting a Construction and Demolition Debris Landfill Franchise to Coble's Sandrock, Inc.; and

WHEREAS, the Board of Commissioners desires to grant to Coble's Sandrock, Inc. a franchise for the disposal of construction and demolition debris in Alamance County.

NOW, THEREFORE, THE BOARD OF COMMISSIONERS FOR THE COUNTY OF ALAMANCE DOTH ORDAIN:

Section 1. Pursuant to the Alamance County Landfill Franchise Ordinance and North Carolina General Statutes §§ 130A-294, 153A-121 and 153A-136, Coble's is hereby granted a franchise to proceed with permitting of the next cell and further expansion of its construction and demolition landfill on Foster Store Road in the County of Alamance, as reflected on Exhibit A, and to operate said landfill in Alamance County. Although the total projected life of the landfill is twenty (20) to thirty (30) years, the active landfill cell will utilize no more than fifteen (15) acres of space during the five year term of this franchise and the average daily volume (based on weekday operation) accepted at the landfill will not exceed 600 tons of construction and demolition debris (excluding recycled material).

Section 2. The landfill will continue to be operated as Coble's Sandrock, Inc. Kent and Brenda Coble currently own 100% of the stock in the corporation and will seek approval from the County before the transfer of any ownership interest to anyone other than one of the following immediate family members: Deanna C. Martin, Carey C. Rohrer, and Jennifer C. Gum. Transfer of said stock by any family member to anyone outside the family must be approved by the County.

Section 3. Throughout the term of this new franchise and at Coble's election, Coble's will either (1) maintain a $500,000.00 pollution liability insurance policy, with the County named as an additional insured, or (2) provide $500,000.00 of financial security using a mechanism satisfactory to both the County and Coble's, throughout the life of the landfill. The requirement for financial security will terminate and be returned to Coble's twenty (20) years after the landfill is closed.

Section 4. The population to be served by the landfill will consist primarily of commercial contractors who specialize in construction, demolition, and land-clearing activities and haulers who haul materials generated from such activities. Except as set forth below, the area to be served by the landfill will be limited to a service area of twenty-five (25) miles from the landfill. The County recognizes that Coble's currently accepts waste from customers located more than twenty-five (25) miles from the landfill and these existing customers are hereby grandfathered under this franchise. Coble's has provided to the County a list of existing customers and the twenty-five (25) mile service area limitation shall not apply to and Coble's may continue to accept waste from said entities and their divisions, subsidiaries, affiliates, assigns and successors in interest. Coble's also may accept waste from new customers outside the twenty-five (25) mile service area to replace existing customers outside the twenty-five (25) mile service area. Although Coble's may accept waste from outside the twenty-five (25) mile radius as noted above, Coble's agrees to give first priority in terms of space in the landfill to Alamance County generated waste.

Section 5. Coble's will construct the new landfill cell with a uniform foundation layer free from preferential flow paths. Such a foundation can consist of natural soils or compacted fill located on site. In the event that a soil or rock layer is encountered at the base of the landfill which would serve as a preferential flow path that would alter the ability of the site's groundwater monitoring system to detect contamination in the uppermost significant aquifer, a re-compacted soil layer shall be constructed as follows:

> The affected area will be over excavated a minimum of two feet and replaced with a two-foot thick re-compacted soil layer. Compaction will be a minimum of 95% compaction and the layer will be constructed in four equal lifts.

Section 6. The waste stream that may be accepted by the landfill will be composed of waste or debris resulting from roofing, construction, remodeling, repair, or

demolition operations on pavement, buildings, or other structures. There also will be waste accepted from land-clearing activities such as stumps, trees, limbs, brush grass, and other naturally occurring vegetative matter. Inert debris such as concrete, brick, concrete block, uncontaminated soil, gravel and rock, and wood also will be accepted. Yard waste, including grass, will not be accepted at the landfill. Coble's must monitor the waste offered to the landfill and reject any loads of floor tiles or very old siding and very old roofing shingles that are likely to contain significant levels of asbestos. Other unacceptable wastes include friable asbestos, organic/household wastes, wastes that have been in contact with petroleum, solvents, or chemicals waste containing PCBs, and waste that has been in contact with pesticides or herbicides.

Section 7. The application and fee of $100.00 have been received.

Section 8. The current stated gate rates for the landfill and the stated gate rates that Coble's anticipates will be in effect on or before September 2, 2007, approved by the County, are attached as Exhibit B. Coble's shall give notice of any proposed stated gate rate changes to the County at least sixty (60) days prior to the proposed effective date of the rate changes.

Section 9. This franchise shall have a term of five (5) years, running from the effective date set forth in Section 14 below.

Section 10. Coble's agrees to operate the landfill in accordance with all applicable laws and regulations and comply in all material respects with any permit issued by the State of North Carolina.

Section 11. Coble's will instruct all haulers using the landfill to comply with N.C.G.S. § 20.116(g).

Section 12. Coble's will comply with the Alamance County Recycling Ordinance and will separate recyclable cardboard from the waste received at the landfill.

Section 13. Coble's will pay an annual host fee to the County of One Dollar ($1.00) per ton of waste deposited in the landfill beginning the day the new cell is opened for business. No host fee is required for materials that are recycled and, therefore, not deposited in the landfill. The host fee shall be paid based on the monthly volume of waste deposited in the landfill and shall be paid for each month by the 15th of the following month. The official volume of waste deposited in the landfill shall be based on Coble's annual report filed with the State of North Carolina by August 1 of each year. If the annual report shows a higher volume of waste deposited in the landfill than reflected in earlier payments, then Coble's will pay the host fee for July plus $1.00 per ton for any excess amount reflected in the annual report no later than August 15. If the annual report shows a lesser volume of waste deposited in the landfill than reflected in earlier payments, then Coble's will pay the host fee for July less $1.00 per ton for the lesser amount reflected in the annual report no later than August 15.

Section 14. This ordinance requires readings and approval at two regular meetings of the Board of Commissioners of Alamance County, pursuant to and as required by N.C.G.S. § 153A-46, and will become effective on September 2, 2007.

This 1st day of August, 2005.

Chair

Vice-Chair

Commissioner

Commissioner

Commissioner

Exhibit B

Stated Gate Rates

Current Stated Gate Rates*:

Short-Bed Pickups	$10.00
Standard/Full Size Pickups	15.00
Pickup with Sides	20.00 to 30.00
Utility Trailer	10.00
Single Axle (14' or less)	25.00 to 60.00
Single Axle (15' or over)	75.00
Tandeum Axle	85.00
Tri Axle	95.00
Quad Axle	100.00
Quint Axle	105.00
Trailer 24' or less	120.00
Trailer 25' - 39'	150.00
Trailer 40' or over	75.00
20 yd Container	100.00
25 yd Container	110.00
30 yd Container	120.00
35 yd Container	130.00
40 yd. Container	140.00
Roofing	28.00/ton
Single Wide Mobile Home	250.00
Double Wide Mobile Home	500.00

*All C & D loads are charged an additional $1.75 per ton surcharge

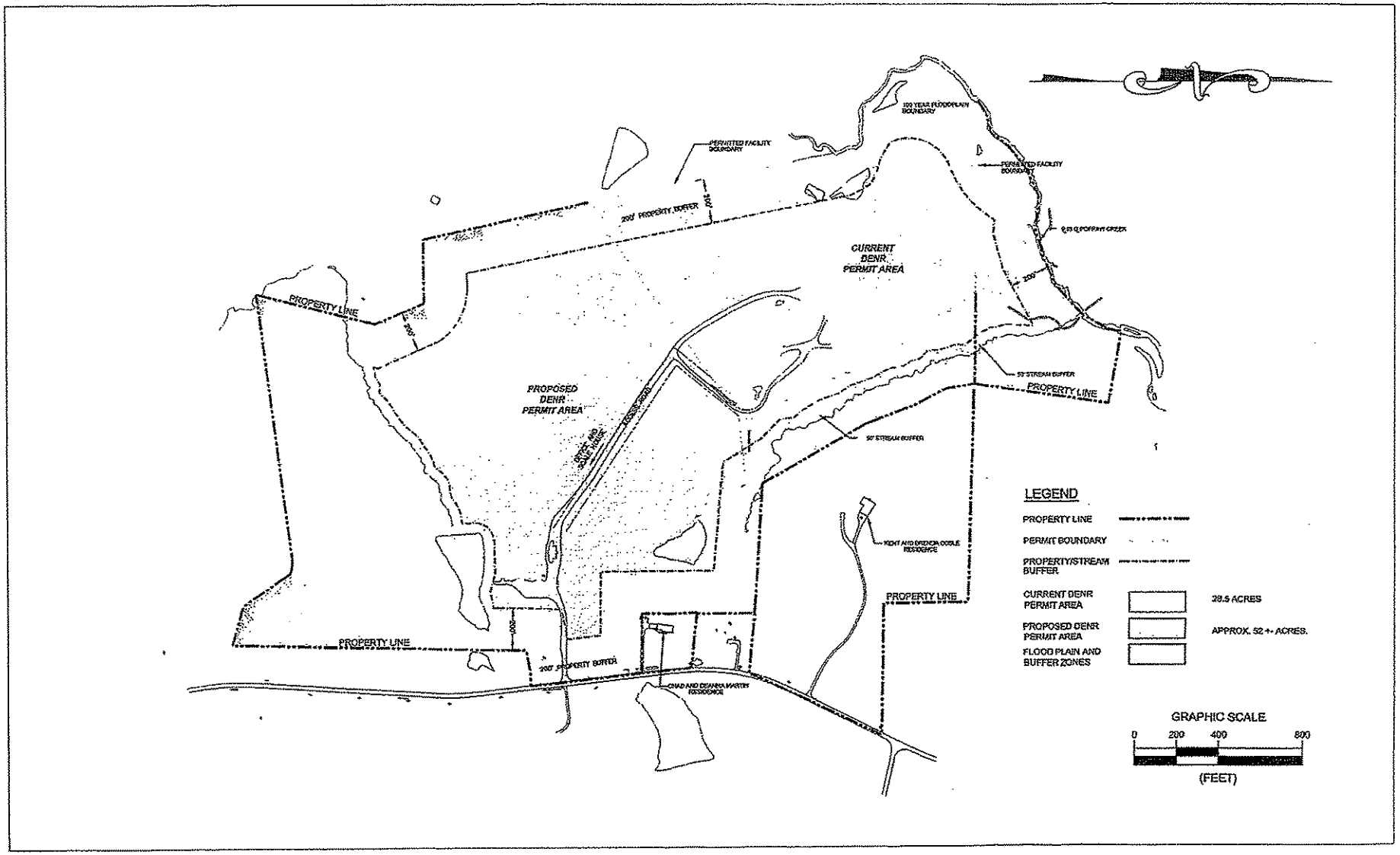
Proposed Gate Rates for September 2005/Anticipated Gate Rates for September 2007*:

Minimum charge	$10.00
All Pickups	4.00 cubic yard
All Single Axle	4.00 cubic yard
Utility Trailer	4.00 cubic yard
Tandeum Axle	85.00
Tri Axle	95.00
Quad Axle	100.00
Quint Axle	105.00
Trailer 24' or less	120.00
Trailer 25' - 39'	150.00
Trailer 40' or over	16.25/ton
16 yd Container	64.00

20 yd Container	100.00
25 yd Container	110.00
30 yd Container	120.00
35 yd Container	130.00
40 yd. Container	140.00
Roofing	26.25/ton
Single Wide	
Mobile Home	300.00
Double Wide	
Mobile Home	500.00

*All C & D loads are charged an additional $1.75 per ton surcharge

Exhibit A


100 YEAR FLOODPLAIN BOUNDARY
PERMITTED FACILITY BOUNDARY
PERMITTED FACILITY BOUNDARY
200' PROPERTY BUFFER
CURRENT DENR PERMIT AREA
PROPERTY LINE
PROPOSED DENR PERMIT AREA
50' STREAM BUFFER
PROPERTY LINE
50' STREAM BUFFER
KENT AND BRENDA OCSILE RESIDENCE
PROPERTY LINE
PROPERTY LINE
200' PROPERTY BUFFER
CHAD AND DEANNA MATTEN RESIDENCE
LEGEND
PROPERTY LINE
PERMIT BOUNDARY
PROPERTY/STREAM BUFFER
CURRENT DENR PERMIT AREA
28.5 ACRES
PROPOSED DENR PERMIT AREA
APPROX. 52 +- ACRES.
FLOOD PLAIN AND BUFFER ZONES
GRAPHIC SCALE
0
200
400
800
(FEET)

D.H. GRIFFIN WRECKING CO., INC.

June 20, 2001

Sent Via Fax (336) 565-4752

Mr. Kent Coble
Coble Sandrock Inc.
5833 Foster Store Road
Liberty, NC 27298

RE: Scrap Metal Reclamation
C&D Landfill, Liberty, NC

Dear Mr. Coble:

Thank you again for giving D. H. Griffin Wrecking Co., Inc. (DHG) the opportunity to provide Coble Sandrock, Inc. with roll-off containers for scrap reclamation. DHG will purchase the material based on the current market value and transportation costs. As you know, DHG is one of the states largest scrap recyclers and we will continue to provide your company with the best service possible.

Sincerely,

D. H. GRIFFIN WRECKING CO., INC.

David H. Deatherage
Senior Estimator

CORPORATE OFFICE:
4700 Hilltop Road (27407) • P.O. Box 7657 • Greensboro, NC 27417-0657
(336) 855-7030 • Fax (336) 855-9309
"If It's Wrecking — Call Us"

FEDERAL WASTE PAPER COMPANY

1763 WEST WEBB AVENUE
BURLINGTON, NC 27215
336-228-0692
Fax: 336-228-0820

June 22, 2001

Mr. Kent Coble
Coble Sandrock Inc.
5833 Foster Store Road
Liberty, NC 27298

Dear Mr. Coble:

Thank you for giving Federal Waste Paper the opportunity to serve you recycling needs. We will be glad to accept the cardboard generated at your facility to the extent that it is recyclable or otherwise acceptable.

We appreciate your business. If you have any questions or additional service needs, please give us a call.

Regards,

Rodney Foust

Rodney Foust
Plant Manager

Greensboro office: 336-275-4047 Fax: 336-272-1846

WILMINGTON
STONE GARDEN
LLC
6955 Market St.,
Wilmington, NC 28411

December 15, 2001

To Whom It May Concern:

I met with a representative of Coble Sand Rock today to discuss the possibility of purchasing mulch from him. My business, Wilmington Stone Garden, is a garden center specializing in the sale of stone, mulches and soils. We would be willing to discuss the purchase of mulch from Coble if the price and quality were competitive with our current vendors.

Thank you.

Nina Brown

Nina Brown

Email: stonegdn@bellsouth.net
Phone: 910-452-1619
Fax: 910-452-7442

D C Connections, Inc.
Randy Cardwell

Post Office Box 339 Alamance, NC 27201

Phone 227-4774

December 18, 2001

TO WHOM IT MAY CONCERN:

I have talked with Kent Coble of Coble's Sandrock, Inc. and am very much interested in his proposed product. The demand for this product would be substantial in this area and I would like to see this project implemented.

Sincerely,

Randy Cardwell

Randy Cardwell

1. Waste Inspection Form

WASTE INSPECTION FORM

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

Waste Name(s) & Address (es)

1. _____
2. _____
3. _____
4. _____
5. _____

Waste Hauler _____

Address _____

Driver's Name _____

Waste Accepted [ ] Rejected [ ] Held [ ]

NOTIFIED: Waste Source [ ] Hauling Management [ ] Site Management [ ]

State [ ] Federal [ ]

Loader Operator: _____

Personnel Conducting the Inspection: _____

_____

1. Supervisor Conducting the Inspection: _____

SIGNATURE: _____

2. Witness: _____

SIGNATURE: _____

3. Driver: _____

SIGNATURE: _____

4. Other: _____

Company: _____ Title: _____

SIGNATURE: _____

DATE: _____ TIME _____ AM [ ] PM [ ]

ADDITIONAL COMMENTS: on the back

CONTAINER INVENTORY

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

Container:

Drum [ ] Metal [ ] Cardboard [ ] Plastic [ ] Other [ ]

Other: _____

Contents:

1. Full [ ] Partially Full [ ] Empty [ ]
2. Crushed [ ] Punctured [ ]
3. Labeled [ ] Hazardous [ ]

Identified: _____

Additional Information:

Container:

Drum [ ] Metal [ ] Cardboard [ ] Plastic [ ] Other [ ]

Other: _____

Contents:

1. Full [ ] Partially Full [ ] Empty [ ]
2. Crushed [ ] Punctured [ ]
3. Labeled [ ] Hazardous [ ]

Identified: _____

Additional Information:

INSPECTION CHECK LIST:(Check all that apply)

(If "YES" Please explain in the space provided below)

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

	YES	NO
1. Powders/Dusts	____	____
Identified: _____		
Unknown	____	____
2. Unacceptable Saturation	____	____
3. Odor/Fumes	____	____
Strong	____	____
Faint	____	____
Describe: _____		
4. Heat	____	____
Item: _____		
5. Battery	____	____
6. Oil	____	____
7. Biomedical	____	____
8. Radioactivity	____	____
9. Ashes/Residue	____	____
10. Sod/Soil	____	____
11. Asbestos (not properly contained)	____	____
12. PCB	____	____
13. Out of County Waste	____	____

Explanation:

2. Refuse/Unidentified Waste Inspection Form

REFUSE/UNIDENTIFIED WASTE INSPECTION FORM

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

REJECTABLE WASTE DESCRIPTION: _____

_____

_____

_____

WASTE: Rejected [ ] Accepted [ ]

NOTIFIED: [ ] Waste Source [ ] Hauling Management [ ] Federal
[ ] Site Management [ ] State

REFUSED WASTE TRANSPORTED BY:

Hauler Address: _____

_____

Destination: _____

_____

ACCEPTED WASTE:

Contained area: _____

Secured by: _____

Lab to complete testing: _____

ADDITIONAL COMMENTS: _____

_____

_____

3. USEPA Hazardous Waste Inspection Decision Tree

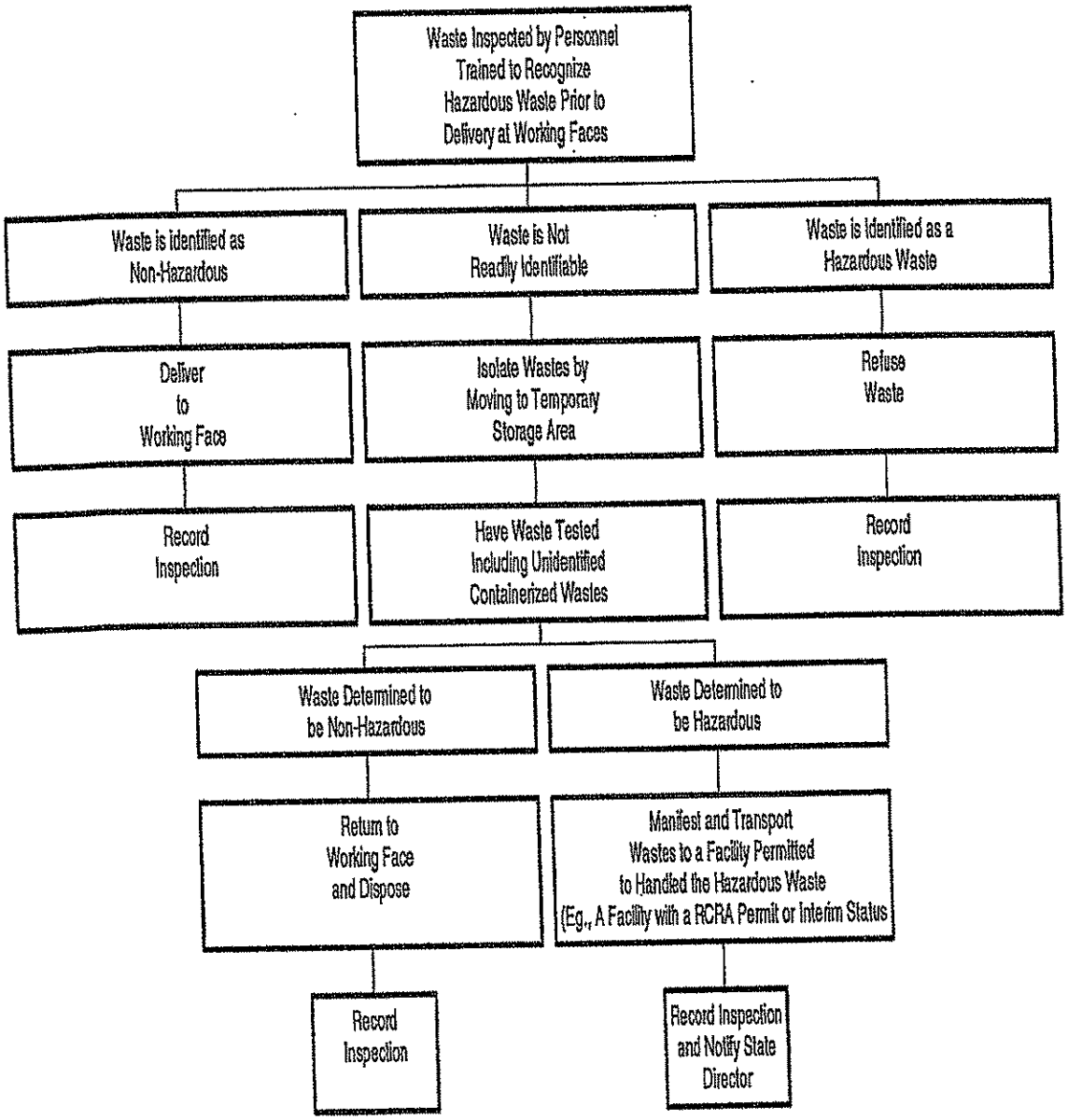


Figure 3-1
Hazardous Waste Inspection Decision Tree
Inspection Prior to Working Face

Source: EPA "Solid Waste Disposal Facility Criteria – Technical Manual". Nov. 1993

1. Post Closure Inspection Record

POST-CLOSURE INSPECTION RECORD

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

---

1. Access and Security Control

- ☐ Is a notice prohibiting the further disposal of waste materials clearly visible at the entrance to the facility?
- ☐ Is the site adequately secured by means of gates, chains, berms, fences or other security measures to prevent unauthorized entry?
- ☐ Are the access roads to and within the site maintained to provide access to the closed disposal area and to all monitoring points?

2. Erosion and Sediment Control

- ☐ Is the vegetation adequate to stabilize the site and prevent erosion?
- ☐ Are the erosion control measures adequate to prevent silt from leaving the site and to prevent excessive on-site erosion?
- ☐ Do the sediment basins require cleaning out, as indicted by the level of sediment buildup?

3. Drainage Control Requirements

- ☐ Are all areas adequately sloped to promote surface water runoff in a controlled manner?
- ☐ Are there areas of observed settlement, subsidence, and/or displacement of the closure cap?
- ☐ Are all drainage channels free of accumulated sediment?

4. Uncontrolled Escape of Leachate or Landfill Gas

- ☐ Are there any leachate seeps observed?
- ☐ Are there any signs of uncontrolled releases of landfill gas?

5. Environmental Monitoring Systems

- ☐ Are all monitoring wells (gas and groundwater) properly maintained? (Note: Complete the Groundwater Monitoring Well Maintenance Record during semi-annual sampling events.)

6. Miscellaneous

- ☐ Are all site benchmarks marked and evident?
- ☐ Do vector control measures appear adequate?

2. Groundwater Monitoring Well Maintenance Record

GROUNDWATER MONITORING WELL MAINTENANCE RECORD

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

---

1. Is surface water diverted away from the well head? _____
2. Is the concrete pad still intact and free of cracks? _____
3. Has surface water runoff undercut the concrete pad? _____
4. Is the outer casing still secure and locked? _____
5. Is the well identification tag present and is it legible? _____

   5a. Does the well identification tag provide the following information:

   - The well identification number? _____
   - Drilling contractor name and registration number? _____
   - Total depth of well? _____
   - Depth to screen? _____
   - A warning that the well is not for water supply and that the ground water may contain hazardous materials? _____

6. Is the grout between the inner and outer well casings all the way to the ground surface?
7. Is the inner casing firmly grouted in place? _____
8. Are the inner and outer casings upright and unobstructed? _____
9. Is water collecting in the outer casing? Does a weep hole need to be bored in the outer casing to provide drainage? _____
10. Is the monitoring well accessible by a four-wheel drive vehicle? _____
11. Have brush and weeds been trimmed so that the well is easy to locate and access?
12. Does the inner well casing have a vented cap? _____
13. Is the monitoring well visible and adequately protected from moving equipment?

March 10, 2008

Mr. Kent Coble
Coble's Sandrock
5833 Foster Store Road
Liberty, North Carolina 27298

RE: FIRE RESPONSE TO COBLE'S SANDROCK C&D LANDFILL

Dear Mr. Coble:

In the event of a fire at the Coble's Sandrock C&D Landfill at 5833 Foster Store Road, our department will respond with adequate manpower and equipment to put out the fire, or if additional resources are necessary we will acquire backup assistance until the fire is extinguished.

Sincerely,

James Allen Crawford Jr.
Deputy Chief
Snow Camp Vol. Fire Dept.

ENGINEERING, INC.

SITE-SPECIFIC
HEALTH & SAFETY PLAN
COBLE'S SANDROCK WASTE MANAGEMENT FACILITY

JEI PROJECT NUMBER 419.00 / TASK NO. 22

MARCH 2008

Prepared by:

JOYCE ENGINEERING, INC.
Boone Bldg., Suite 101
2211 West Meadowview Road
Greensboro, NC 27407
336-323-0093

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SITE-SPECIFIC
HEALTH & SAFETY PLAN
COBLE'S SANDROCK WASTE MANAGEMENT FACILITY

JEI PROJECT NO.: 419.00; Task 22

Coble's Sandrock
5833 Foster Store Road
Liberty, NC 27298

1.0 SITE HISTORY AND DESCRIPTION

1.1 TYPE OF SITE

Municipal Solid Waste Landfill, inactive, Transfer Station

1.2 DESCRIPTION OF SITE

The facility is located south of Burlington at 5833 Foster Store Road off Alamance Church Road.

1.3 SITE FEATURES

The landfill slopes, sediment basins, stream channels, overhead and buried power lines, administrative and maintenance buildings.

1.4 WASTE TYPES

Construction and demolition debris waste (CDD).

1.5 CHEMICAL HAZARDS

There are none known at this time.

1.6 PHYSICAL HAZARDS

Cut or puncture; wood, metal, glass waste, etc. Exposure; hypothermia or heat stress, and sun burn. Trip/Fall; waste, rip-rap, vegetation, and slope faces.

1.7 BIOLOGICAL HAZARDS

Plants and animals such as poison ivy, briars, stinging/biting insects and arachnids; snakes, dogs, and etc.

2.0 SITE ORGANIZATION AND CONTROL

2.1 WORK AREAS IDENTIFIED

Active landfill.

2.2 SITE SECURITY ESTABLISHED

Active landfill facility with gated access.

2.3 SITE ACCESS

Site Location Map (Appendix 1)
Site Sketch (Appendix 2)
Direction to Hospital (Appendix 3)

3.0 JOB ACTIVITIES / WORK PLANS

3.1 TYPES OF ACTIVITIES TO BE PERFORMED

Quarterly Groundwater and Surface Water monitoring events.
Landfill final cover construction and related construction quality assurance monitoring and testing.

3.2 WORK PLANS

As specified in the Groundwater Monitoring Plan, and Construction Quality Assurance Plan. Specified work to be coordinated with the Project Manager.

4.0 EDUCATION AND TRAINING

OSHA 40-hour Health and Safety Training; 8 hour annual refresher course.
Radiation Safety Training:
First Aid:
American Red Cross Standard First Aid and Adult CPR safety training recommended.

5.0 MEDICAL SURVEILLANCE

Special medical monitoring required for working on this Site? _____ yes __X__ no

Types: N/A

Not for regular monitoring or construction CQA activities.
Additional medical surveillance and safety monitoring for chemical hazards by

subcontractors performing remediation work in the solvent pit areas per OSHA regulations may be necessary, to be coordinated with the Project Manager.

6.0 AMBIENT FIELD MONITORING

6.1 FIELD MONITORING EQUIPMENT

Methane in landfill gas is typically associated with aromatic and chlorinated compounds, which have noticeable odors at low concentrations; no monitoring is required.

Determination of appropriate monitoring methods and equipment to insure worker safety is the responsibility of each subcontractor working in this area.

At the first sign of danger from visual, olfactory, safety monitoring equipment or other indication, evacuate to a predetermined safe place and contact the JEI Project Manager. Upgrade level of monitoring and protection as necessary. No smoking or hand-to-mouth activities allowed in work area.

7.0 LEVELS OF PROTECTION

Job Activity: Ground and Surface Water Sampling

Protection Level: boots, nitrile/latex gloves, eye protection (upgrade protection as necessary)

Job Activity: Construction Monitoring or CQA

Protection Level: D; hard hat and hearing protection as needed (upgrade protection as necessary)

Job Activity: Drilling, vent and well installation

Landfill Area:

Protection Level: D; with hard hat and hearing protection (modify/upgrade as necessary)

Personal Protection Equipment Level Lists:

For Level D: Work clothes or coveralls, safety steel toe and shank boots, gloves, eye protection; hard-hat, hearing protection as needed.

For Level D modified: Level D with particle resistant suit (e.g., Tyvek), chemical resistant suit (e.g., Tychem), and/or full or partial face mask respirator rated for dust & vapors present.

8.0. SAFETY EQUIPMENT LIST

8.1 FIRST AID

For minor injuries a first aid kit is in the JEI vehicle. For serious injuries, call 911 and then contact the Joyce Engineering, Inc. Project Manager for further assistance.

8.2 FIRE FIGHTING

JEI vehicle is provided with a fire extinguisher. On-site fire extinguisher is available; coordinate with Owner.

8.3 COMMUNICATIONS

Use "buddy system", verbal, hand signals, and portable phone.

8.4 SANITATION (HAND WASHING, LATRINES, SHOWERS)

No on-site facilities.

Special decontamination and disposal procedures are to be established for each individual remediation project.

9.0 CONTINGENCY PLANS

9.1 SPECIAL FIRST AID OR EVACUATION PROCEDURES

Basic first aid administered by team members.

For serious injuries, contact 911 for EMS, or drive to hospital Emergency Room.

9.2 LOCAL SOURCES OF ASSISTANCE

9.2.1 Emergency Medical

Alamance Regional Medical Center

(336) 538-7000

1240 Huffman Mill Rd,

Burlington, North Carolina 27215

9.2.2 Ambulance/Rescue Squad

EMERGENCY DIAL 911

(336) 685-4927

6610 Humble Rd

Liberty, NC 27298

9.2.3 Fire Department

Kimesville Volunteer Fire Department

EMERGENCY DIAL 911

(336) 685-4927

6610 Humble Rd

Liberty, NC 27298

9.2.4 Local Police

Liberty Police Department

EMERGENCY DIAL 911

(336)-622-9053

451 W. Swannanoa Ave.

Liberty, NC 27298

9.2.5 State Police

EMERGENCY DIAL 911

9.2.6 Job Site (Contact and Phone)

Primary contact:	Secondary contact:
Kent Coble	Brenda Coble
Owner/ Operator	Owner/ Operator
Ofc.: (336)-565-4757	Ofc: (336)-565-4757
Cell: (336)-264-4890	Cell: (336)-264-4890

9.3 NATIONAL OR REGIONAL SOURCES OF ASSISTANCE

9.3.1 Joyce Engineering, Inc.

Greensboro - (336)-323-0092

Richmond - (804)-355-4520

9.3.2 Chemtrec (24 Hours)

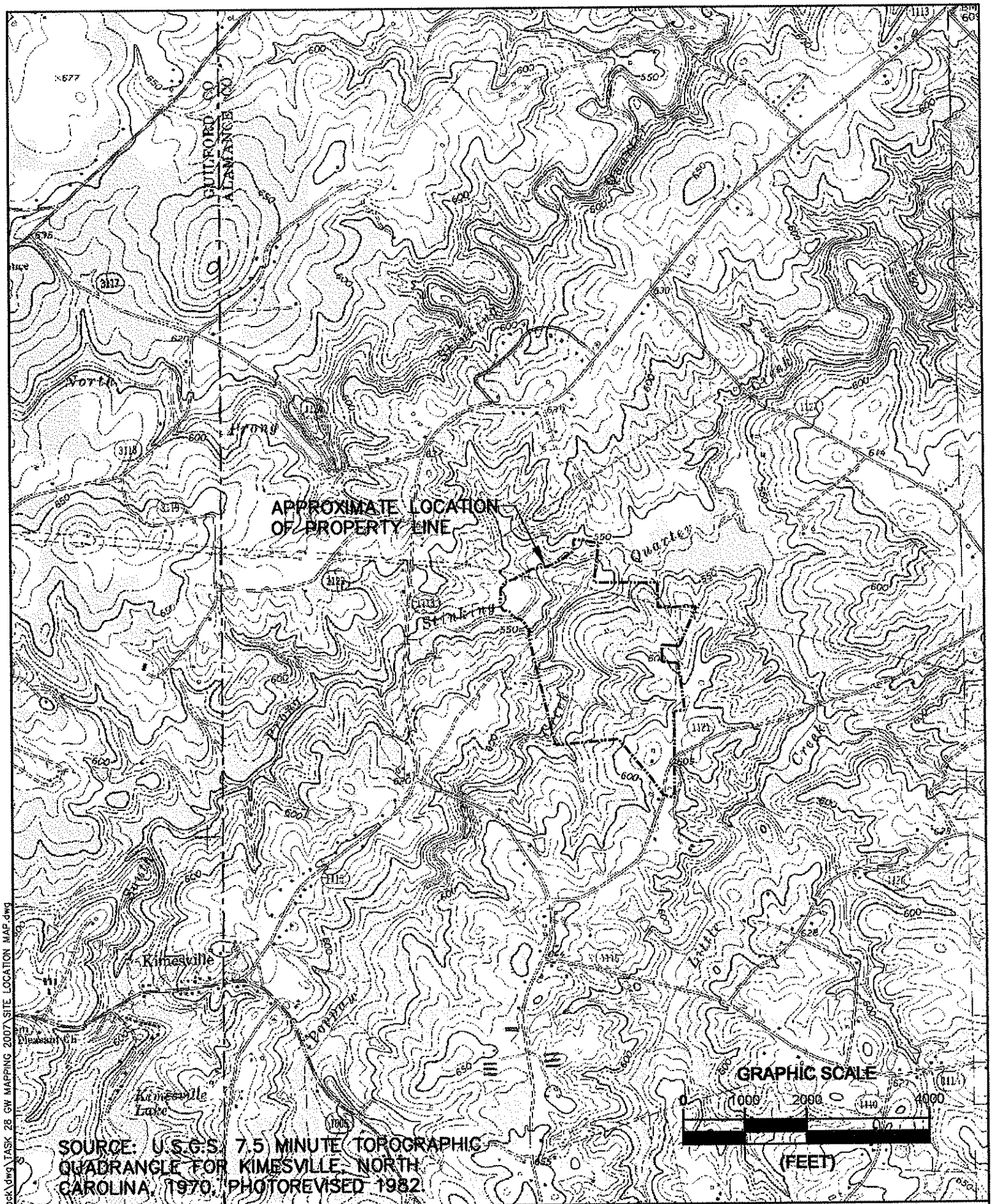
1.800. 424.9300

9.3.3 National Response Center, NRC

1.800. 424.8802 (Oil/Hazardous Substances)

Appendix 1

Site Location Map



SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE FOR KIMESVILLE, NORTH CAROLINA, 1970, PHOTOREVISED 1982.

FIGURE NO. 1	JOYCE ENGINEERING, INC. 2211 WEST MEADOWVIEW ROAD GREENSBORO, N.C. 27407 PHONE: (336) 323-0092	SCALE 1"=2000'	PROJECT NO. 419.28	COBLE'S SANDROCK KIMESVILLE, NORTH CAROLINA SITE LOCATION MAP

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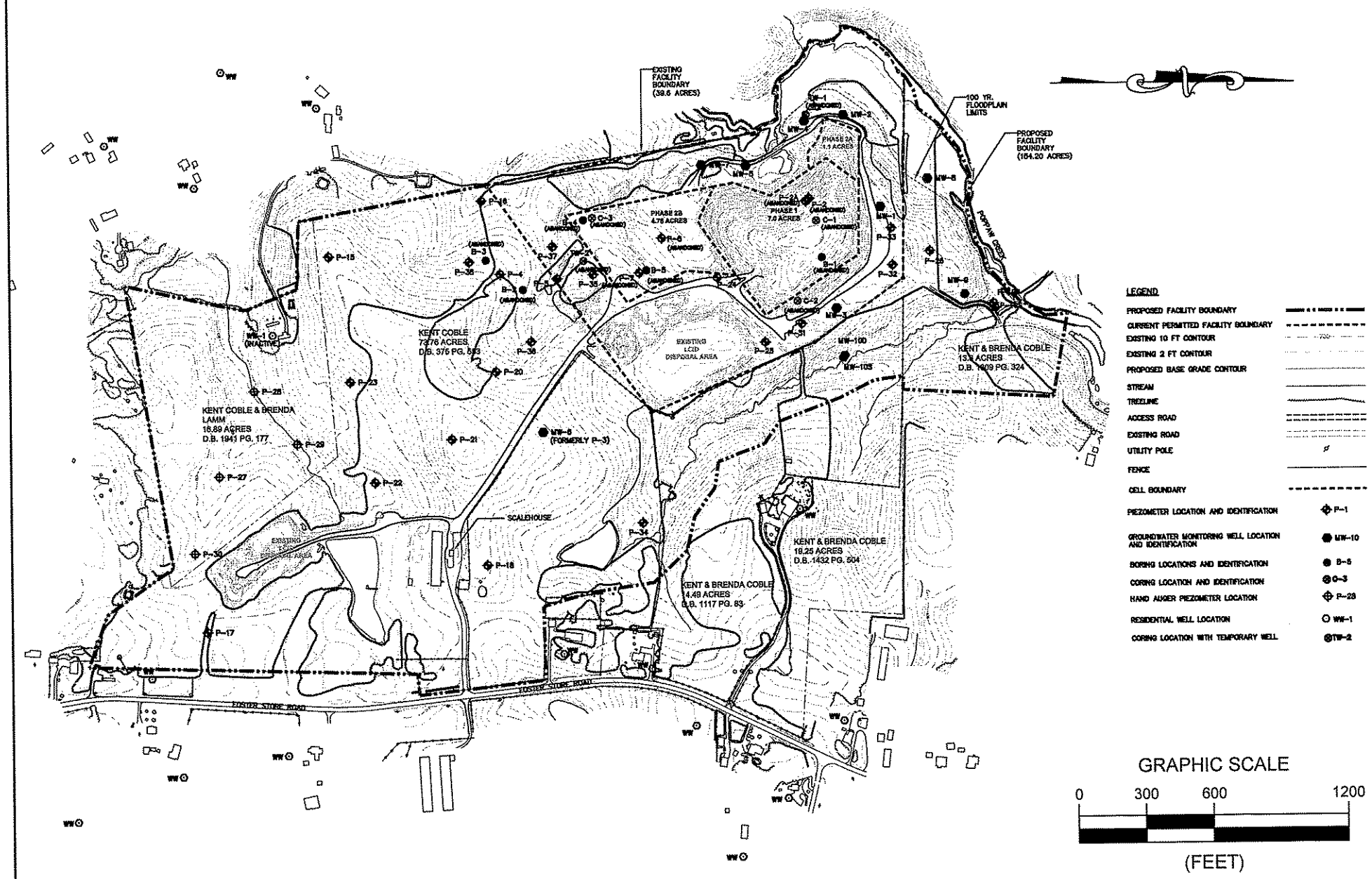
L:\Coble Sandrock\dwg\TASK 28 GW MAPPING 2007\SITE LOCATION MAP.dwg

Appendix 2

Site Layout



DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

JOYCE ENGINEERING, INC.

2211 W. MEADOWVIEW ROAD, SUITE 101
GREENSBORO, NC 27407
PHONE: (336) 323-0092

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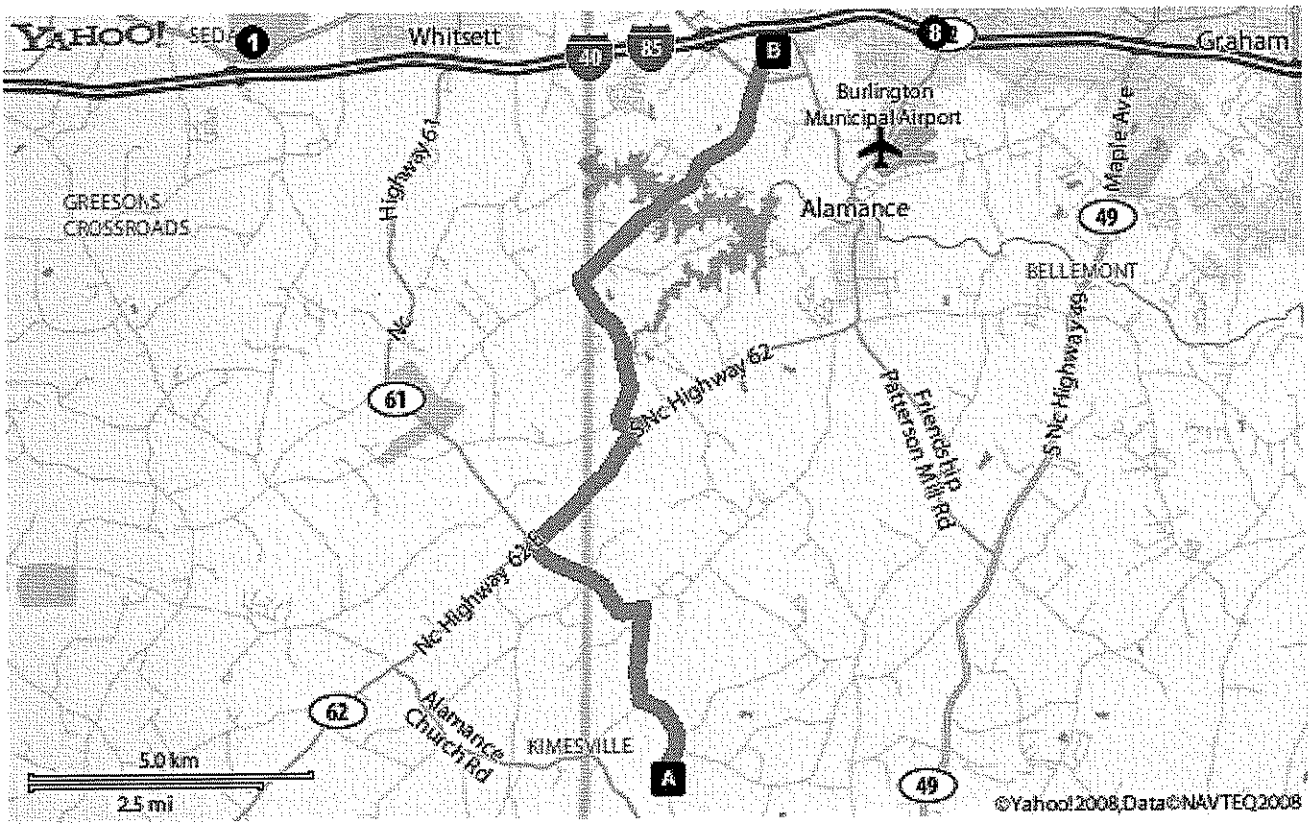
All rights reserved.

SCALE	PROJECT NO.	COBLES SANDROCK, INC KIMESVILLE, NC SITE LAYOUT PLAN	DRAWING NO.
N.T.S.	419.00.28		1

L:\Coble Sandrock\dwg\SITE LAYOUT.dwg

Appendix 3

Directions to Hospital Emergency



1. Starting at 5833 Foster Store Rd, go towards Spanish Oak Hill Rd.
2. Turn right on Kimesville Rd.
3. Turn left on Stafford Mill Rd.
4. Continue on Spoon Rd.
5. Turn right on NC Highway 62 East.
6. Turn left on Brick Church Rd.
7. Turn right on Beaver Creek Rd.
8. Turn right on Huffman Mill Rd.

SITE-SPECIFIC HEALTH & SAFETY PLAN
COBLE'S SANDROCK WASTE MANAGEMENT FACILITY

Daily Tail Gate Meeting Sign-in Sheet

Name	Company	Date	Have you read, understood, and agreed to the HASP?	Questions, Comments, Issues ?

SITE-SPECIFIC HEALTH & SAFETY PLAN
COBLE'S SANDROCK WASTE MANAGEMENT FACILITY

Daily Tail Gate Meeting Sign-in Sheet

Name	Company	Date	Have you read, understood, and agreed to the HASP?	Questions, Comments, Issues ?

SITE-SPECIFIC HEALTH & SAFETY PLAN
COBLE'S SANDROCK WASTE MANAGEMENT FACILITY

Daily Tail Gate Meeting Sign-in Sheet

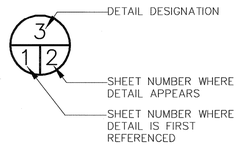
Name	Company	Date	Have you read, understood, and agreed to the HASP?	Questions, Comments, Issues ?

COBLE'S SANDROCK, INC.
ALAMANCE COUNTY, NORTH CAROLINA
APPLICATION FOR
PERMIT TO CONSTRUCT
PHASE 3

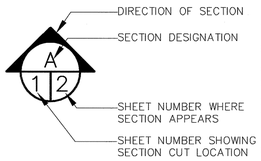
MARCH 2008

INDEX TO DRAWINGS

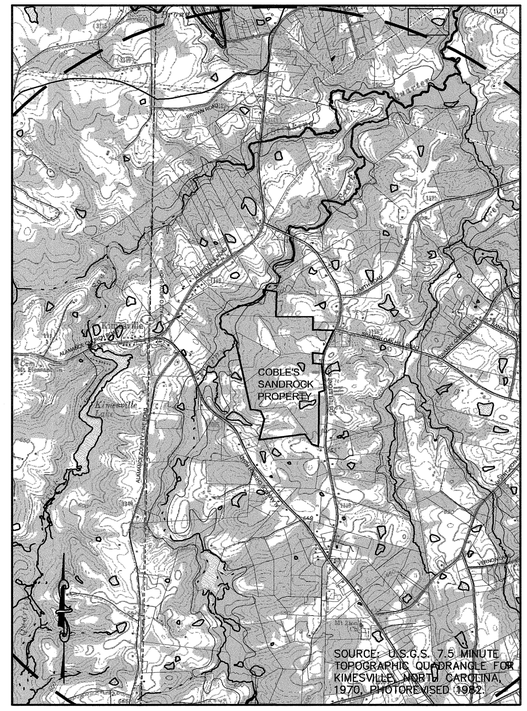
SHEET	DESCRIPTION
	COVER, INDEX AND VICINITY MAP
FP-01	SITE DEVELOPMENT PLAN
FP-02	FINAL CONTOURS
FP-03	SURVEY PLAT
EP-01	EXISTING CONDITIONS
EP-02	BASE GRADING PLAN
EP-03	PHASED GRADING PLANS
EP-04	PHASED GRADING PLANS
EP-05	PHASED GRADING PLANS
EP-06	FINAL GRADING PLAN
EP-07	PHASE 3 FINAL E&S PLAN
EP-08	PHASE 3A E&S PLAN
EP-09	PHASE 3B E&S PLAN
EP-10	CROSS SECTIONS
EP-11	E&S DETAILS
EP-12	SEDIMENT BASIN DETAILS
MP-01	MONITORING NETWORK



DETAIL DESIGNATION



SECTION DESIGNATION



SITE LOCATION MAP

SCALE: 1"=2000'

LEGEND

EXISTING 10 FT. CONTOUR	660
EXISTING 2 FT. CONTOUR	
PROPERTY BOUNDARY	
FACILITY BOUNDARY	
STREAM	
EXISTING TREELINE	
EXISTING ROAD	
COMPLIANCE WELL LOCATION	MW-1
PIEZOMETER LOCATIONS	P-5
BORING LOCATIONS	B-5
CORING LOCATIONS	C-3 OR TW-2
HAND AUGER PIEZOMETER LOCATIONS	P-27
RESIDENTIAL WELL LOCATION	WW-2
PROPERTY BUFFER	
STREAM/WETLANDS BUFFER	

EXISTING TOPOGRAPHY PERFROMED BY AERIAL SURVEY, BY SPATIAL DATA, HIGH POINT, NORTH CAROLINA ON JANUARY 24, 2005

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP
3/10/08	ADDED REVISION DATE	1	SC	EA	EA

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 27446 EVAN E. ANTONIUS 3/17/08

DESIGNED SC
DRAWN CADD/RB
CHECKED EA
APPROVED EA
DATE 08/27/07

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PHONE: (336) 323-0092

COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

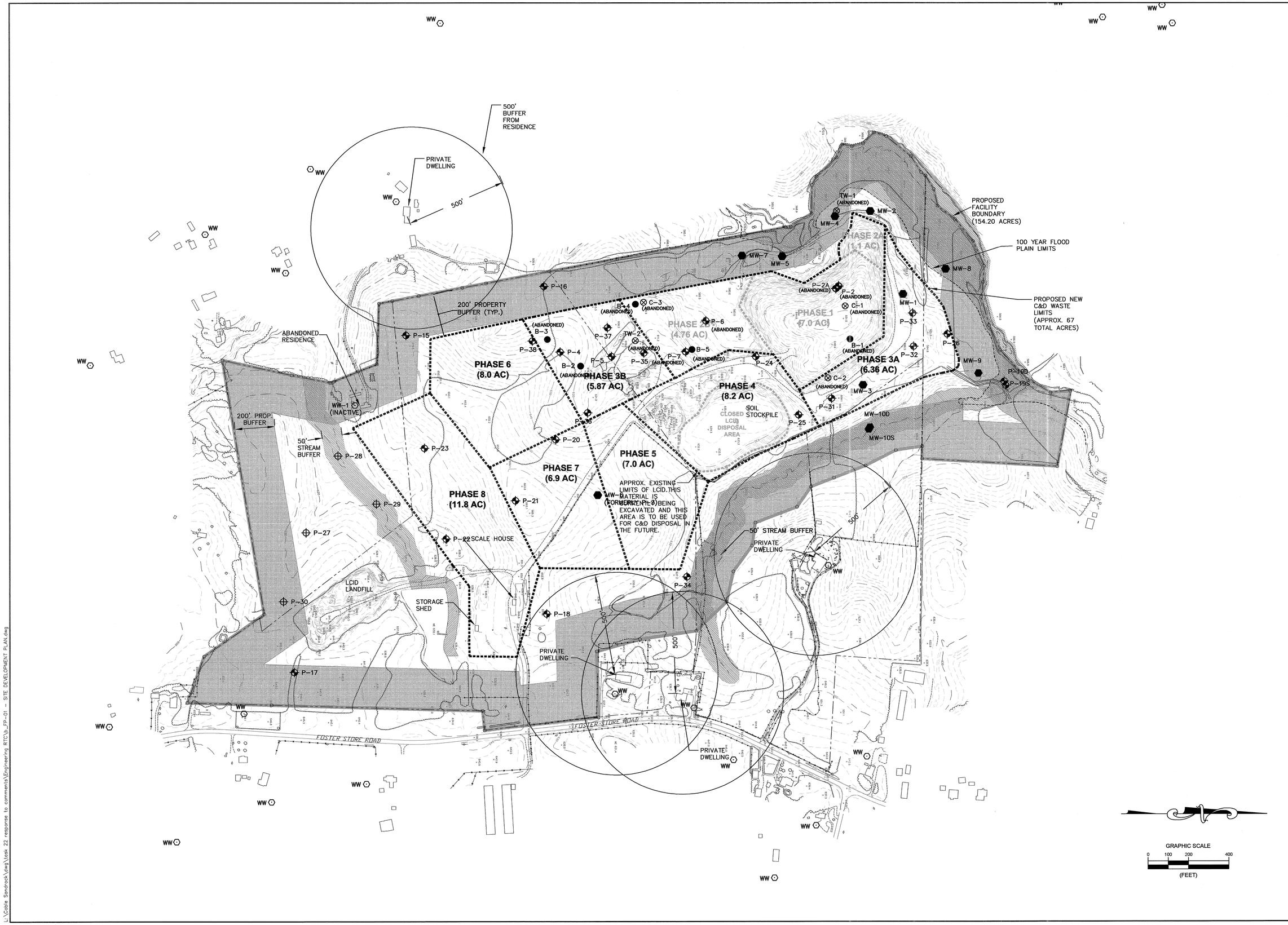
INDEX, NOTES AND LEGEND

PROJECT NO.
419.22

SCALE
AS SHOWN

DRAWING NO.

L:\Coble Sandrock\dwg\task 22 response to comments\Engineering RTC\a_COVER, INDEX AND VICINITY MAP.dwg



NO	BY	CK	APP
1	SC	EA	EA

DATE	REVISIONS AND RECORD OF ISSUE
2/7/08	REVISED PZ & MW CALLOUTS, ADDITIONAL LABELING

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER ELAINE ANN HOWARD
2/11/11

DESIGNED SC
DRAWN CADD/RWH
CHECKED EA
APPROVED EA
DATE 08/27/07

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COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

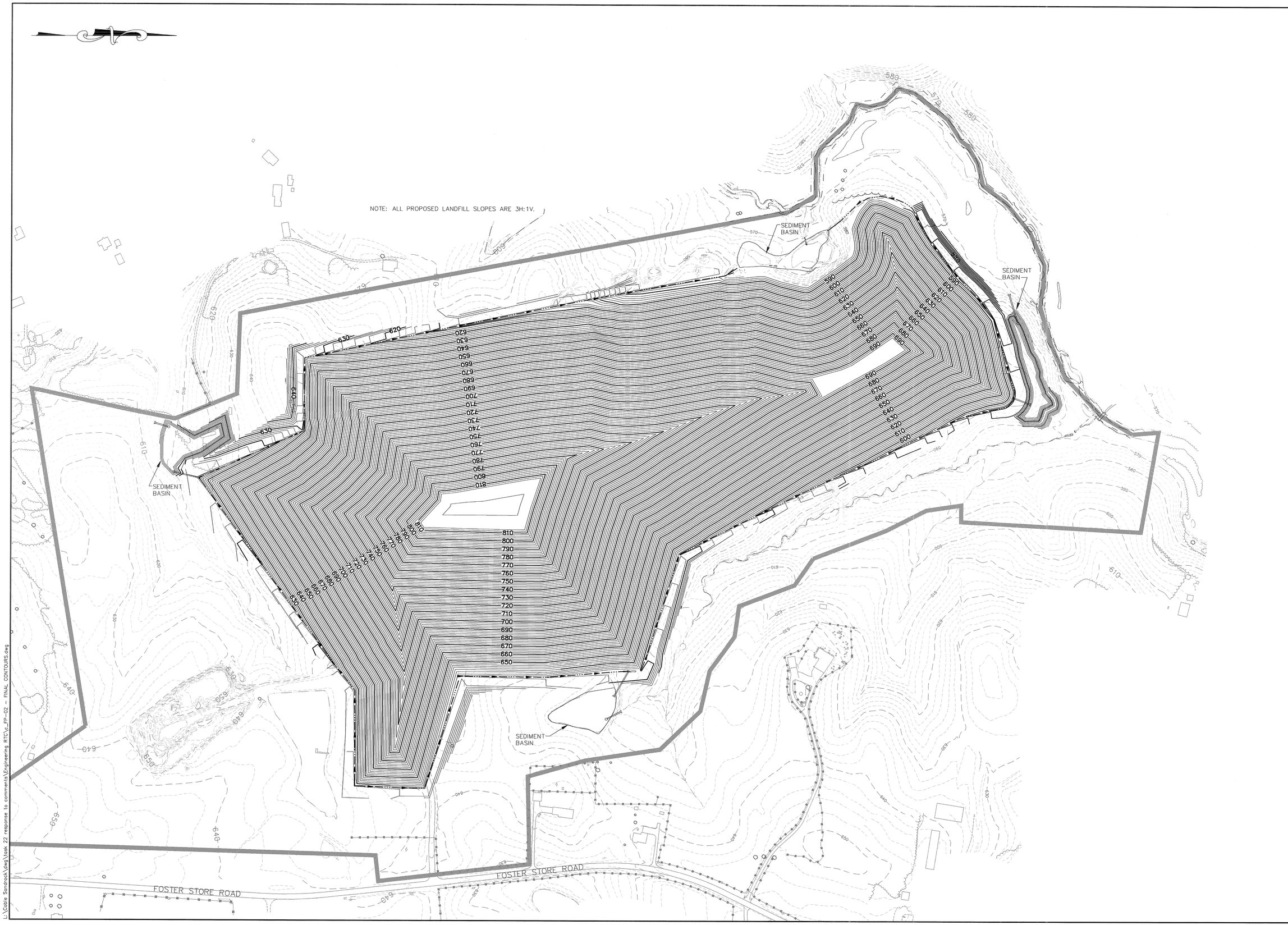
FACILITY PLAN
SITE DEVELOPMENT

PROJECT NO.
419.22

SCALE
1"=200'

DRAWING NO.
FP-01

L:\Coble Sandrock\dwg\task 22 response to comments\Engineering RTC\b_FP-01 - SITE DEVELOPMENT PLAN.dwg



NO	BY	CK	APP
1	SC	EA	EA

DATE	REVISIONS AND RECORD OF ISSUE
2/7/08	POND OUTLETS MADE CONSISTENT

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEERING ELVAN E. ANDREWS 3/19/08

DESIGNED RWH
DRAWN RWH
CHECKED EA
APPROVED EA
DATE 03/30/06

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COBLE'S SANDROCK, INC
ALAMANCE COUNTY, NORTH CAROLINA

FACILITY PLAN
PROPOSED FINAL CONTOURS

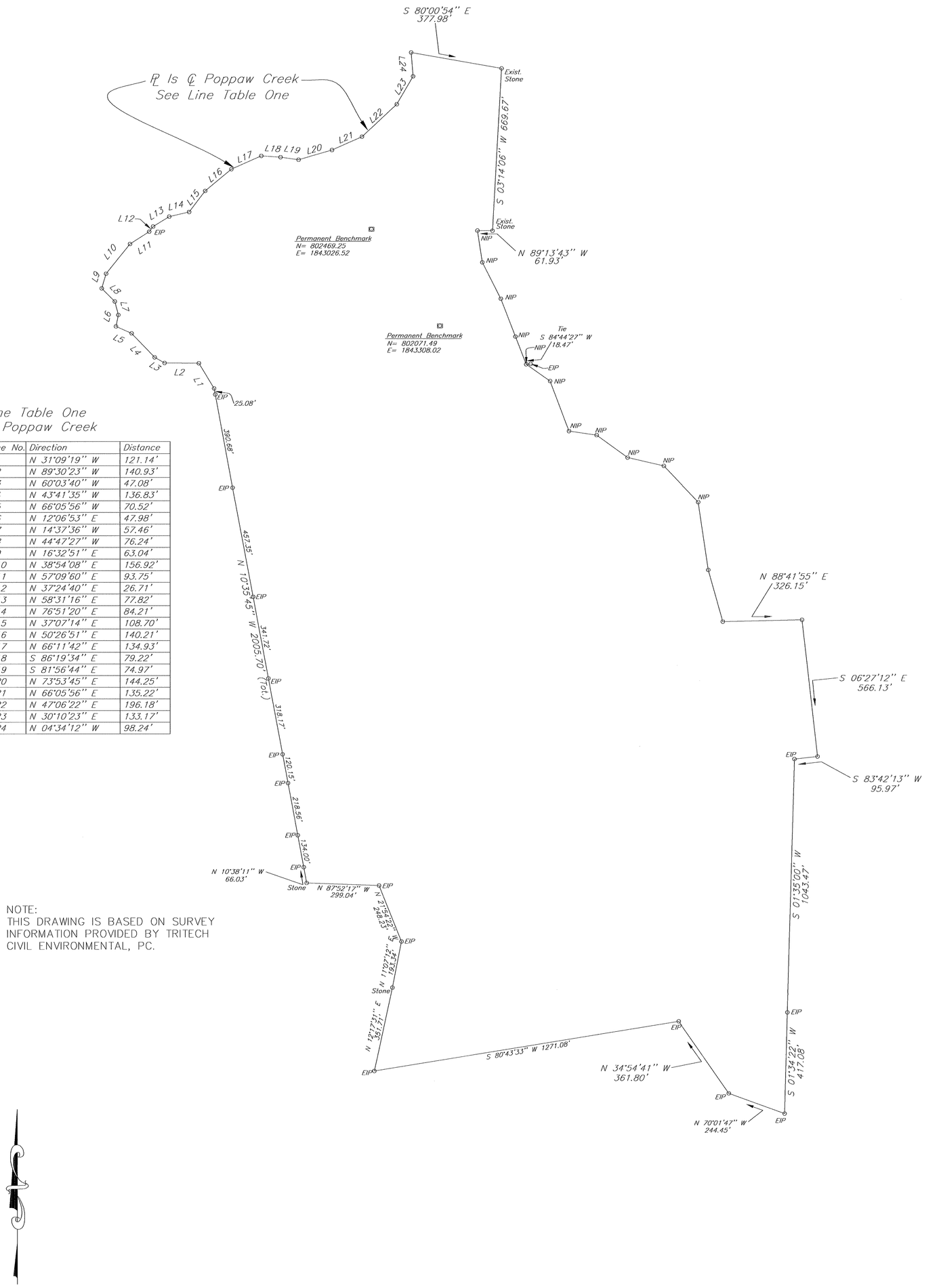
PROJECT NO.
419.18

SCALE
1"=150'

DRAWING NO.
FP-02

L:\Coble Sandrock\dwg\task 22 response to comments\Engineering RTC\c_FP-02 - FINAL CONTOURS.dwg

L:\Coble Sandrock\dwg\task 22 response to comments\Engineering RTC\d_FP-03 - SURVEY PLAT.dwg



Line Table One
℄ Poppaw Creek

Line No.	Direction	Distance
L1	N 31°09'19" W	121.14'
L2	N 89°30'23" W	140.93'
L3	N 60°03'40" W	47.08'
L4	N 43°41'35" W	136.83'
L5	N 66°05'56" W	70.52'
L6	N 12°06'53" E	47.98'
L7	N 14°37'36" W	57.46'
L8	N 44°47'27" W	76.24'
L9	N 16°32'51" E	63.04'
L10	N 38°54'08" E	156.92'
L11	N 57°09'60" E	93.75'
L12	N 37°24'40" E	26.71'
L13	N 58°31'16" E	77.82'
L14	N 76°51'20" E	84.21'
L15	N 37°07'14" E	108.70'
L16	N 50°26'51" E	140.21'
L17	N 66°11'42" E	134.93'
L18	S 86°19'34" E	79.22'
L19	S 81°56'44" E	74.97'
L20	N 73°53'45" E	144.25'
L21	N 66°05'56" E	135.22'
L22	N 47°06'22" E	196.18'
L23	N 30°10'23" E	133.17'
L24	N 04°34'12" W	98.24'

NOTE:
THIS DRAWING IS BASED ON SURVEY INFORMATION PROVIDED BY TRITECH CIVIL ENVIRONMENTAL, PC.

MAP NO. FP-03

SCALE 1"=200'

PROJECT NO. 419.22

COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

FACILITY BOUNDARY PLAT

JOYCE ENGINEERING, INC.
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PHONE: (336) 323-0092

DESIGNED SC
DRAWN CADD/RFB
CHECKED SC
APPROVED EA
DATE 08/27/07

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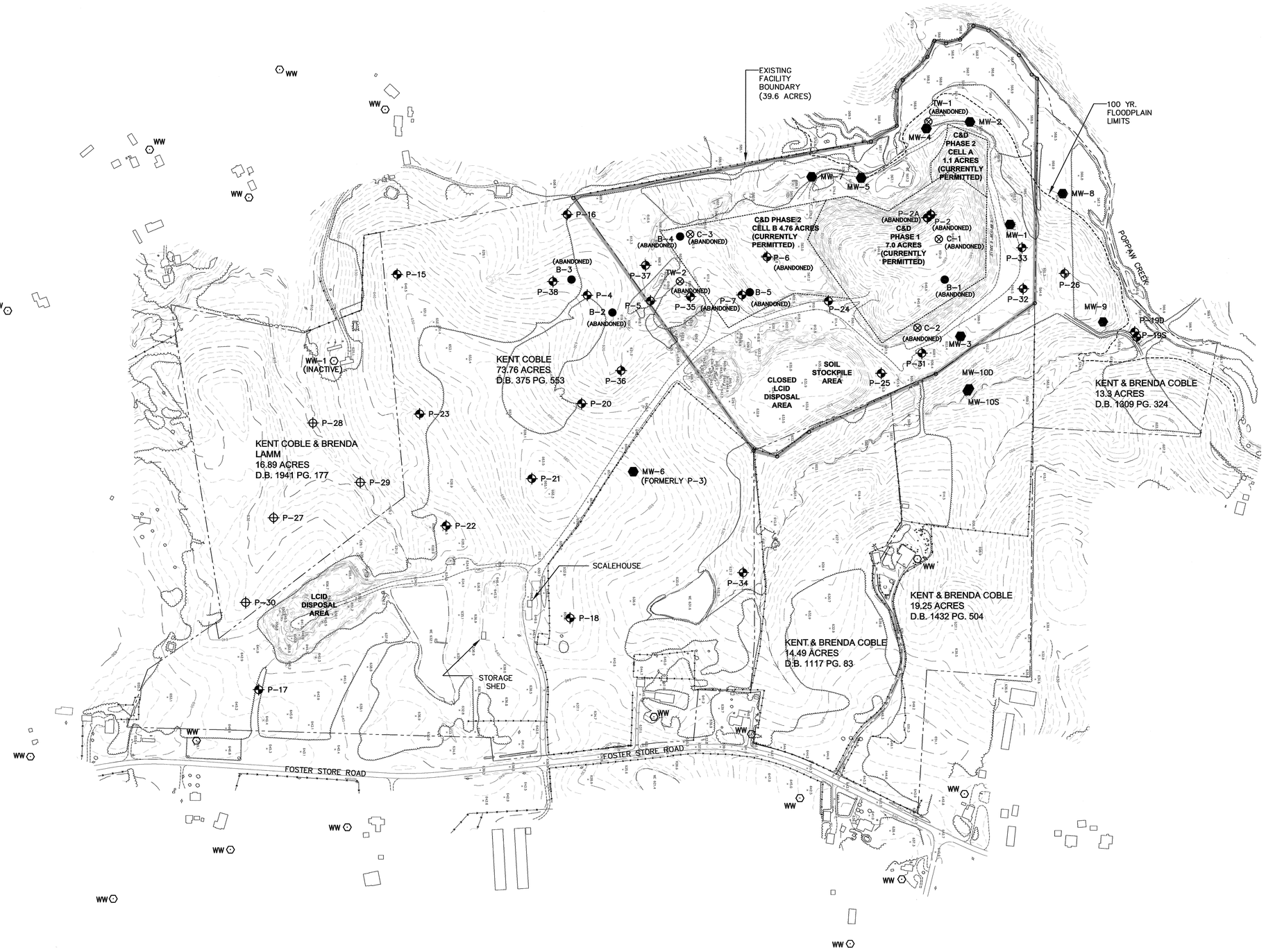
NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER ELAINE E. ANDREWS
3/17/23

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP
3/5/08	RMVD. INTERIOR PROPERTY LINES, ADDED BM CALLOUTS	1	SC	EA	EA



NO	BY	CK	APP
1	SC	EA	EA

REVISIONS AND RECORD OF ISSUE

DATE	
2/7/08	RVSD PZ & MW CALLOUTS, ADDITIONAL LABELING

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER EVAN E. ANDREWS 3/7/08

DESIGNED SC
DRAWN CADD/RB
CHECKED EA
APPROVED EA
DATE 08/27/07

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COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

ENGINEERING PLANS
EXISTING CONDITIONS

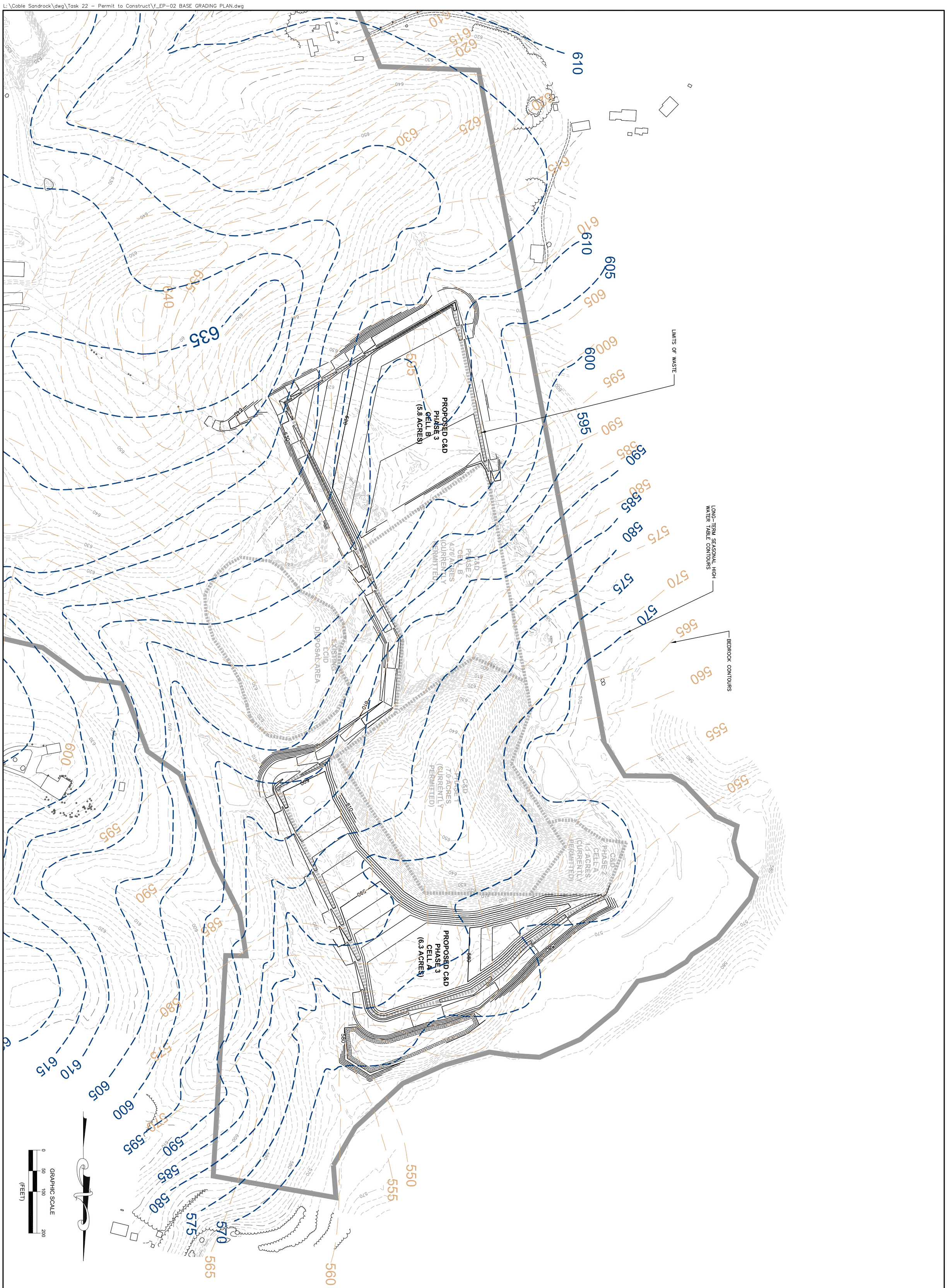
PROJECT NO.
419.22

SCALE
1"=200'

DRAWING NO.
EP-01

L:\Coble Sandrock\dwg\task 22 response to comments\Engineering RTC\e_EP-01- EXIST COND.dwg

L:\Coble Sandrock\dwg\Task 22 - Permit to Construct\f_EP-02 BASE GRADING PLAN.dwg



12/05/07	CHANGED LABEL	1	RFB	VB	VB
DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

COBLES SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

ENGINEERING PLANS

BASE GRADING PLAN

JOYCE ENGINEERING, INC.
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PHONE: (336) 323-0092

DESIGNED SC
DRAWN RB
CHECKED EA
APPROVED EA
DATE 08/27/07

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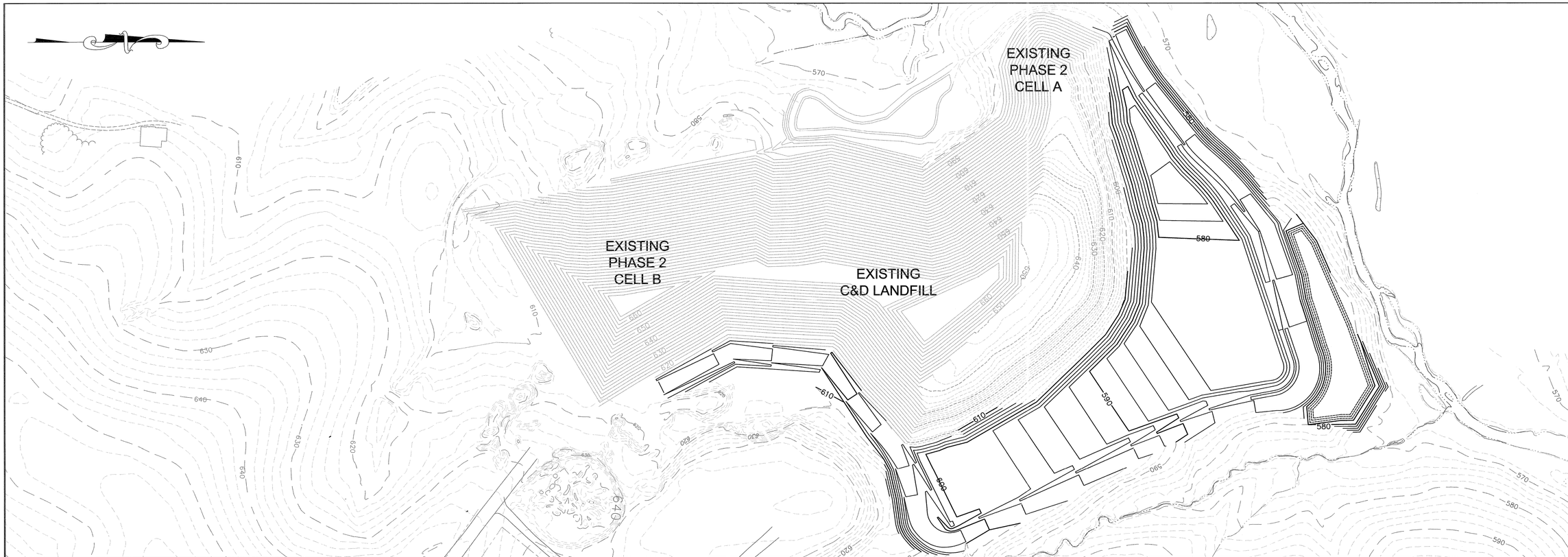
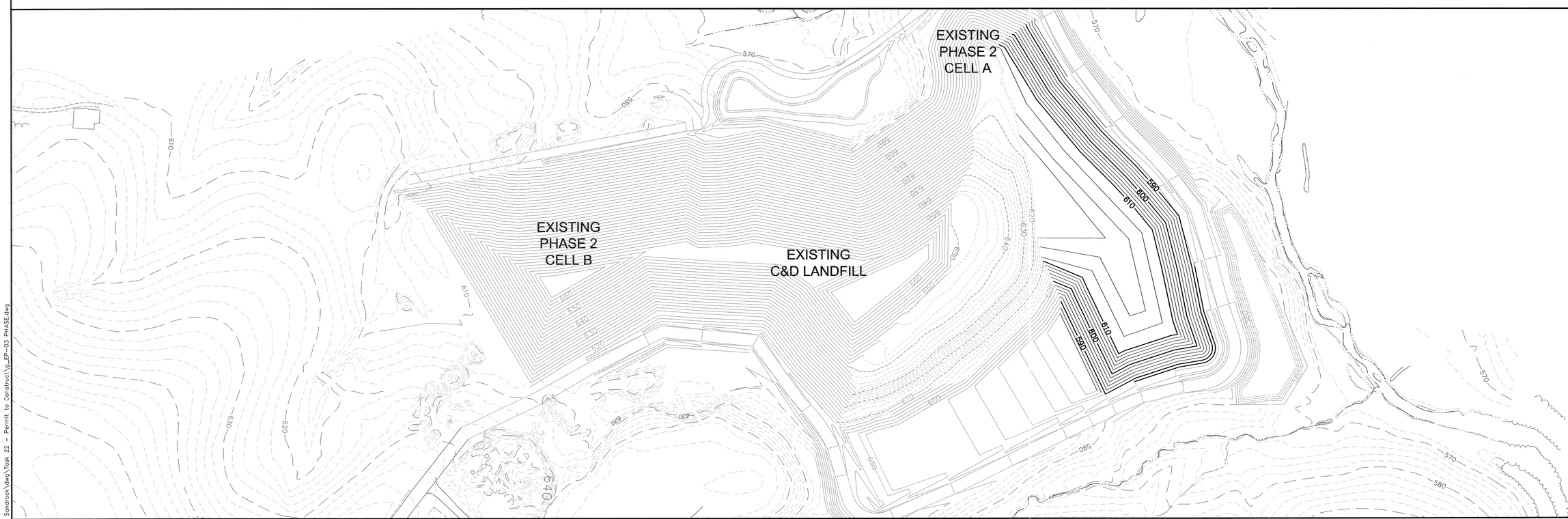
PROJECT NO. 419.22

SCALE 1"=100'

DRAWING NO. EP-02



BEGIN YEAR 1



END YEAR 1–BEGIN YEAR 2

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 27446 EVAN E. ANDREWS 4/12/07

DESIGNED RWH
DRAWN RWH
CHECKED SJC
APPROVED EA
DATE 08/27/07

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COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

ENGINEERING PLANS
PHASED GRADING (YEAR 1)

PROJECT NO.
419.22

SCALE
1"=100'

DRAWING NO.
EP–03

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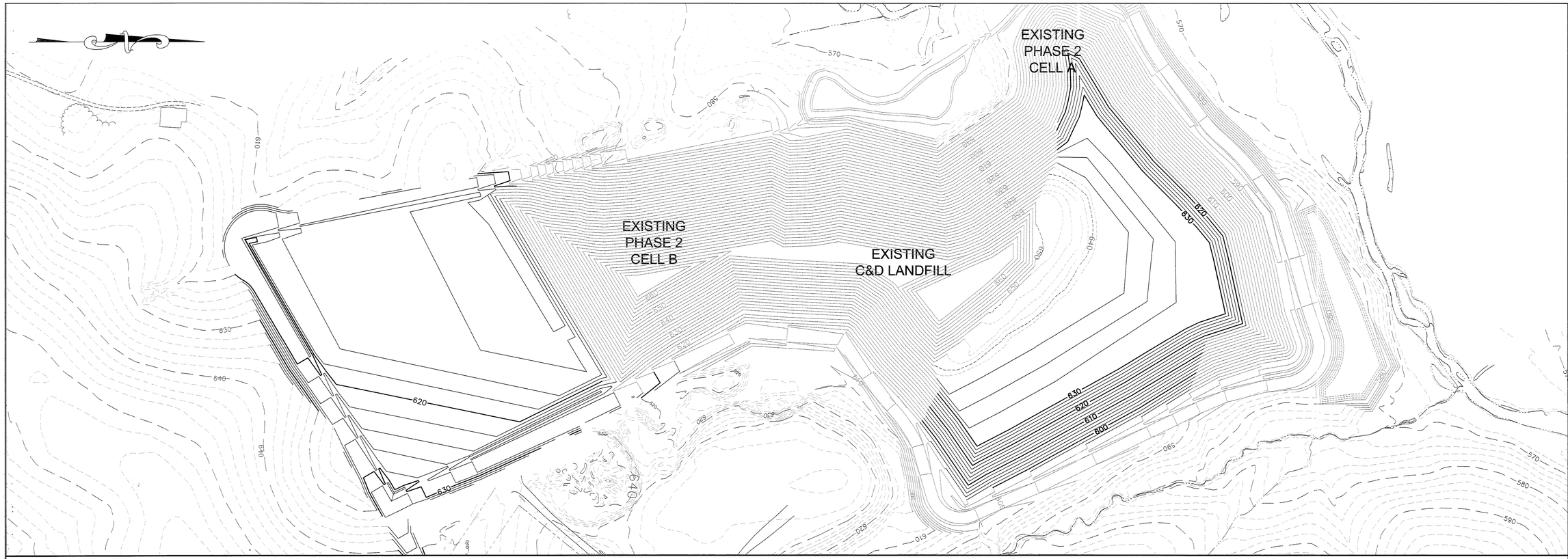
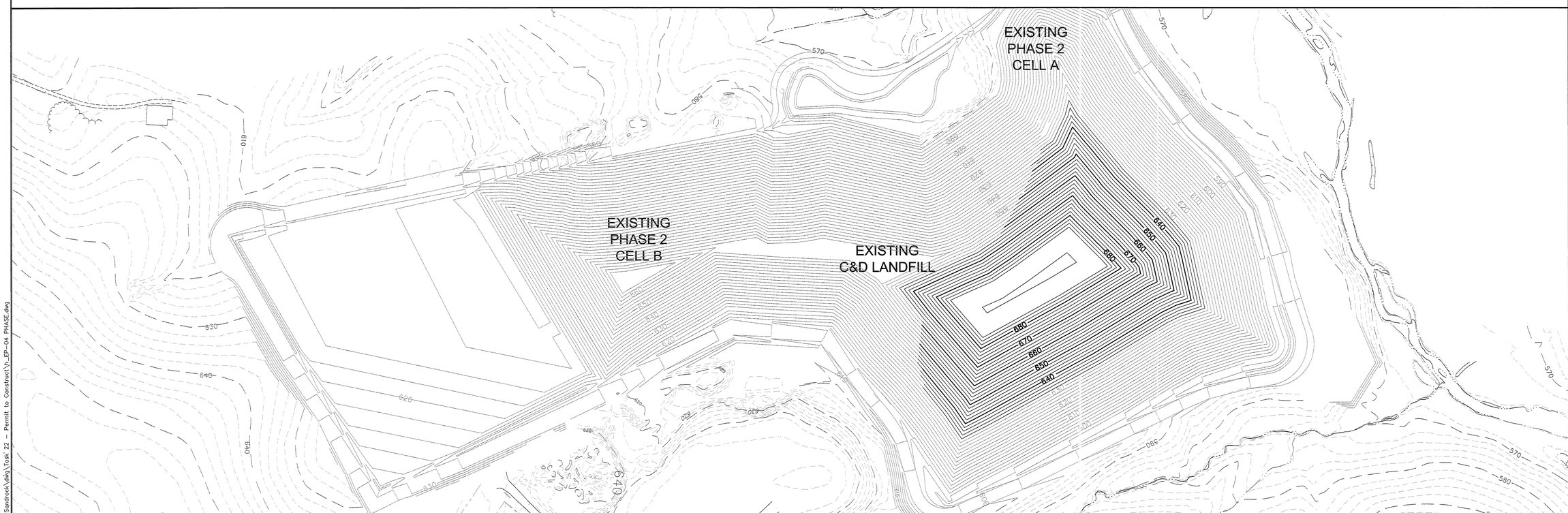


END YEAR 2–BEGIN YEAR 3



END YEAR 3 –BEGIN YEAR 4

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 27446 EVAN E. ANDERSON 11/12/07

DESIGNED RWH
DRAWN RWH
CHECKED SJC
APPROVED EA
DATE 08/27/07

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KIMESVILLE, NORTH CAROLINA

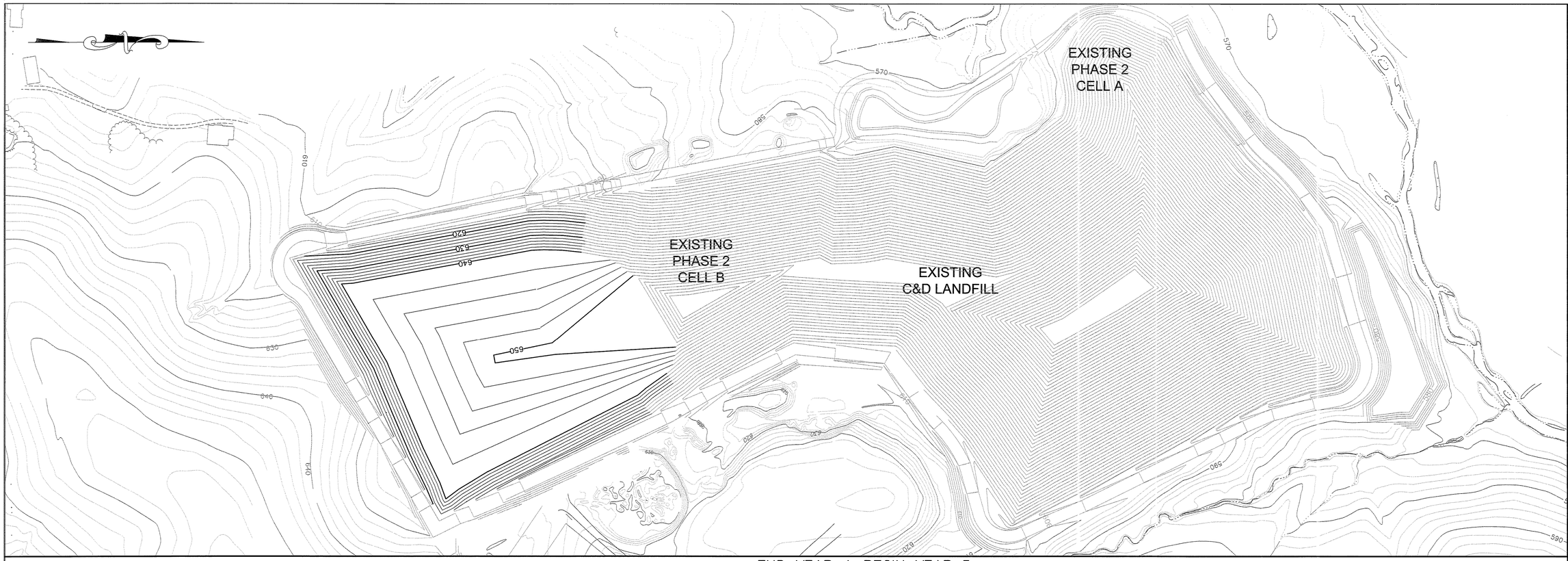
ENGINEERING PLANS
PHASED GRADING (YEARS 2 & 3)

PROJECT NO.
419.22

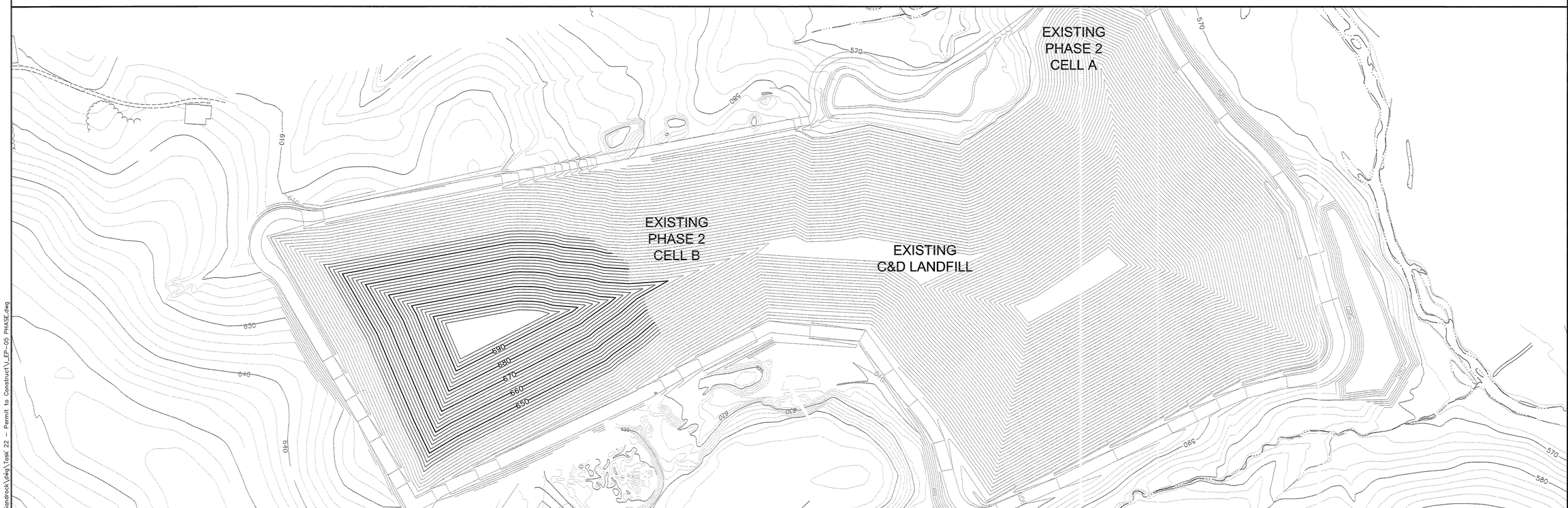
SCALE
1"=100'

DRAWING NO.
EP–04

L:\Coble Sandrock\dwg\Task 22 - Permit to Construct\h_EP-04 PHASE.dwg



END YEAR 4–BEGIN YEAR 5



END YEAR 5

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER EVAN E. ANDERSON 4/2/07

DESIGNED RWH
DRAWN RWH
CHECKED SJC
APPROVED EA
DATE 08/27/07

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KIMESVILLE, NORTH CAROLINA

ENGINEERING PLANS
PHASED GRADING (YEARS 4 & 5)

PROJECT NO.
419.22

SCALE
1"=100'

DRAWING NO.
EP–05

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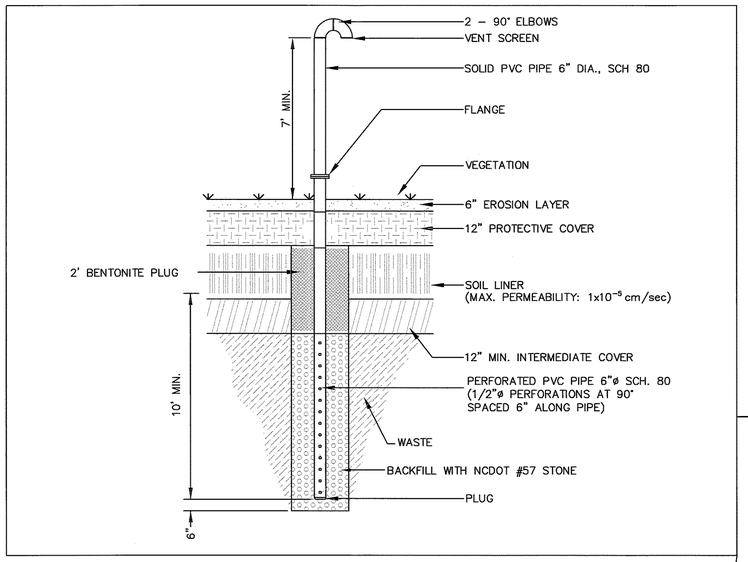
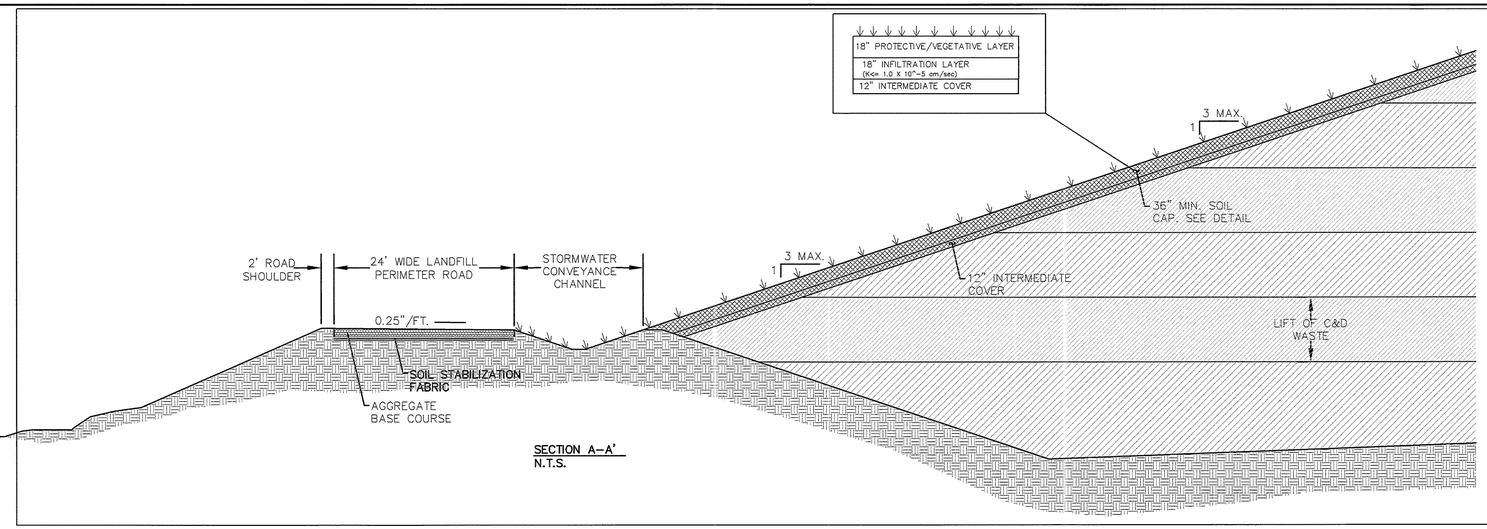
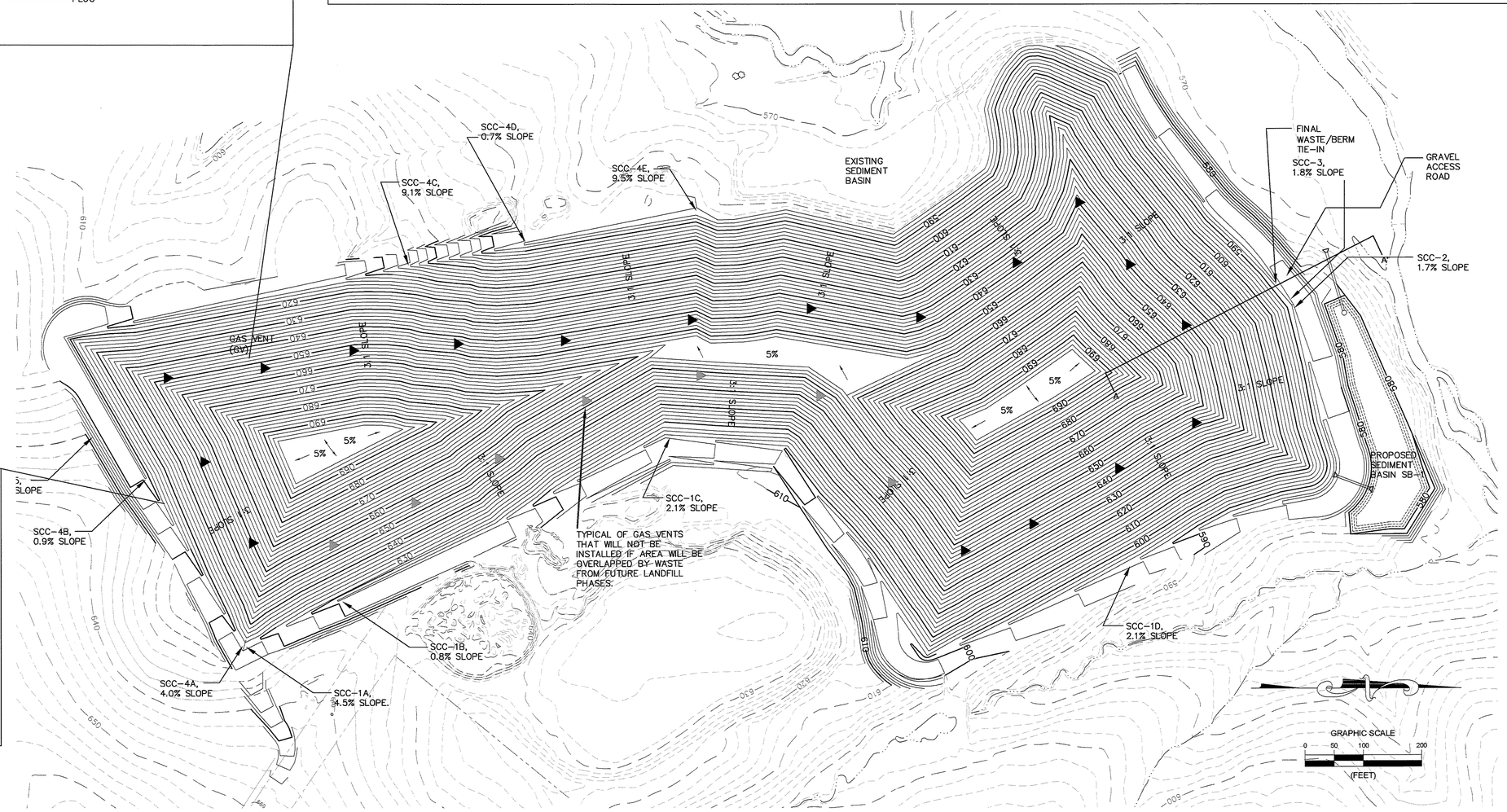
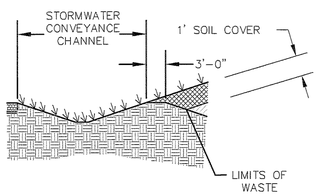


GAS VENT DETAIL



SECTION A–A'
N.T.S.





INTERMEDIATE COVER TIE-IN ALONG SOUTH PORTION OF PHASE 3A AND SOUTH AND EAST PORTION OF PHASE 3B.

NOTE

DESIGN OF INTERMEDIATE COVER TIE-IN WILL ACCOMODATE POTENTIAL FUTURE LANDFILL EXPANSION.

NO	BY	CK	APP
2	SC	EA	EA
1	SC	EA	EA

DATE	REVISIONS AND RECORD OF ISSUE
5/19/08	MODIFIED GAS VENT DETAIL
3/10/08	VENT LOCATIONS REVISED, SHOWED GRASS ON CHNLS

NORTH CAROLINA PROFESSIONAL SEAL 21446 ENGINEER EVAN E. ANDERSON 8/11/08

DESIGNED SC
DRAWN RB
CHECKED EA
APPROVED EA
DATE 08/27/07

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COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

FINAL GRADING PLAN

PROJECT NO.
419.22

SCALE
1"=100'

DRAWING NO.
EP–06

L:\Coble Sandrock\dwg\task 22 response to comments\Engineering RTC\J_EP-06 – FINAL GRADING PLAN.dwg

CONSTRUCTION SEQUENCE:

1. OBTAIN PLAN APPROVAL AND APPLICABLE PERMITS.
2. INSTALL SB-1, TEMPORARY DIVERSIONS, SILT FENCE, AND TEMPORARY SEDIMENT TRAPS FOR PHASE 3A.
3. INSTALL PERMANENT STORMWATER CONVEYANCE CHANNELS FOR PHASE 3A AND GRADE ACCESS ROADS AND BASE OF LANDFILL. STOCKPILE EXCESS SOIL.
4. STABILIZE THE SITE AS AREAS ARE BROUGHT TO FINAL GRADE. PROVIDE GROUND COVER ON EXPOSED SLOPES WITHIN 21 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING AND PERMANENT GROUND COVER FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER PERIOD IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION OR DEVELOPMENT.
5. BEGIN LANDFILLING ACTIVITIES AFTER ALL REQUIRED APPROVALS ARE OBTAINED FROM THE REGULATORY AUTHORITIES.
6. PRIOR TO THE END OF LANDFILLING ACTIVITIES FOR PHASE 3A, INSTALL TEMPORARY DIVERSIONS, SILT FENCE, AND TEMPORARY SEDIMENT TRAPS FOR PHASE 3B.
7. INSTALL PERMANENT STORMWATER CONVEYANCE CHANNELS FOR PHASE 3B.
8. GRADE ACCESS ROADS AND BASEE OF LANDFILL. STOCKPILE EXCESS SOIL.
9. STABILIZE THE SITE AS AREAS ARE BROUGHT TO FINAL GRADE. PROVIDE GROUND COVER ON EXPOSED SLOPES WITHIN 21 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING AND PERMANENT GROUND COVER FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER PERIOD IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION OR DEVELOPMENT.

SEEDING SPECIFICATIONS

FERTILIZER AND LIME

A. APPLY LIME AND FERTILIZER ACCORDING TO SOIL TESTS, OR APPLY LIME AT THE RATE OF 90 LBS/1000 SQ.FT. AND FERTILIZER AT THE RATE OF 20 LBS/1000 SQ.FT.
B. MIX THOROUGHLY INTO UPPER 4 INCHES OF TOPSOIL.
C. LIGHTLY WATER TO AID THE DISSIPATION OF FERTILIZER AND LIME.

SEEDBED PREPARATION

A. PREPARE SEEDBED TO A DEPTH OF 4 TO 6 INCHES.
B. REMOVE LOOSE ROCKS, ROOTS AND OTHER OBSTRUCTIONS SO THAT THEY WILL NOT INTERFERE WITH THE ESTABLISHMENT AND MAINTENANCE OF VEGETATION.

TEMPORARY SEEDING

A. PROVIDE TEMPORARY SEEDING ON ANY CLEARED, UN-VEGETATED, OR SPARSELY VEGETATED SOIL SURFACE WHERE VEGETATIVE COVER IS NEEDED FOR LESS THAN ONE YEAR OR WHEN SEEDING DATES WILL PREVENT THE ESTABLISHMENT OF VEGETATIVE COVER IF PERMANENT SEEDING IS ATTEMPTED.
B. SEED IN ACCORDANCE WITH THE GUIDLINES BELOW:

TEMPORARY SEEDING RECOMMENDATIONS FOR LATE WINTER & EARLY SPRING

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
RYE (GRAIN)	120
ANNUAL LESPEDEZA (KOBE IN PIEDMONT AND COASTAL PLAIN, KOREAN IN MOUNTAINS)	50

OMIT ANNUAL LESPEDEZA WHEN DURATION OF TEMPORARY COVER IS NOT TO EXTEND BEYOND JUNE.

SEEDING DATES
MOUNTAINS – ABOVE 2500 FT: FEB. 15 – MAY 15
BELOW 2500 FT: FEB. 1 – MAY 1
PIEDMONT – JAN. 1 – MAY 1
COASTAL PLAIN – DEC. 1 – APR. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

TEMPORARY SEEDING RECOMMENDATIONS FOR SUMMER

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
GERMAN MILLET	40

IN THE PIEDMONT AND MOUNTAINS, A SMALL-STEMMED SUNDANGRASS MAY BE SUBSTITUTED AT A RATE OF 50 LB/ACRE.

SEEDING DATES
MOUNTAINS – MAY 15 – AUG. 15
PIEDMONT – MAY 1 – AUG. 15
COASTAL PLAIN – APR. 15 – AUG. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

TEMPORARY SEEDING RECOMMENDATIONS FOR FALL

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
RYE (GRAIN)	120

SEEDING DATES
MOUNTAINS – AUG. 15 – DEC. 15
COASTAL PLAIN AND PIEDMONT – AUG. 15 – DEC. 30

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 1,000 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REPAIR AND REFERTILIZE DAMAGED AREAS IMMEDIATELY. TOPDRESS WITH 50 LB/ACRE OF NITROGEN IN MARCH. IF IT IS NECESSARY TO EXTEND TEMPORARY COVER BEYOND JUNE 15, OVERSEED WITH 50 LB/ACRE KOBE (PIEDMONT AND COASTAL PLAIN) OR KOREAN (MOUNTAINS) LESPEDEZA IN LATE FEBRUARY OR EARLY MARCH.

PERMANENT SEEDING

A. SEED IN ACCORDANCE WITH THE FOLLOWING SCHEDULE AND APPLICATION RATES:

Seeding Dates	Seeding Mixture Species	Rate (lbs./acre)
JAN 1–APRIL 15	TALL FESCUE	80
	SERICIA LESPEDEZA	30
	RYE (GRAIN)	40
APRIL 15–JUNE 15	TALL FESCUE	80
	SERICIA LESPEDEZA	30
	BERMUDAGRASS	15
	GERMAN MILLET	10

B. COMPACT SEED AREAS BY MEANS OF A ROLLER OR OTHER APPROVED EQUIPMENT IMMEDIATELY AFTER SOWING.
C. MULCH WITH 3-INCH STRAW APPLIED AT THE RATE OF 4,000 LBS/ACRE. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR ROVING, OR BY CRIMPING WITH A MULCH-ANCHORING TOOL OR DISK SET NEARLY STRAIGHT.
D. REFERTILIZE IN THE SECOND YEAR UNLESS GROWTH IS FULLY ADEQUATE. RESEED, REFERTILIZE, AND MULCH DAMAGED AREAS IMMEDIATELY.

MAINTENANCE

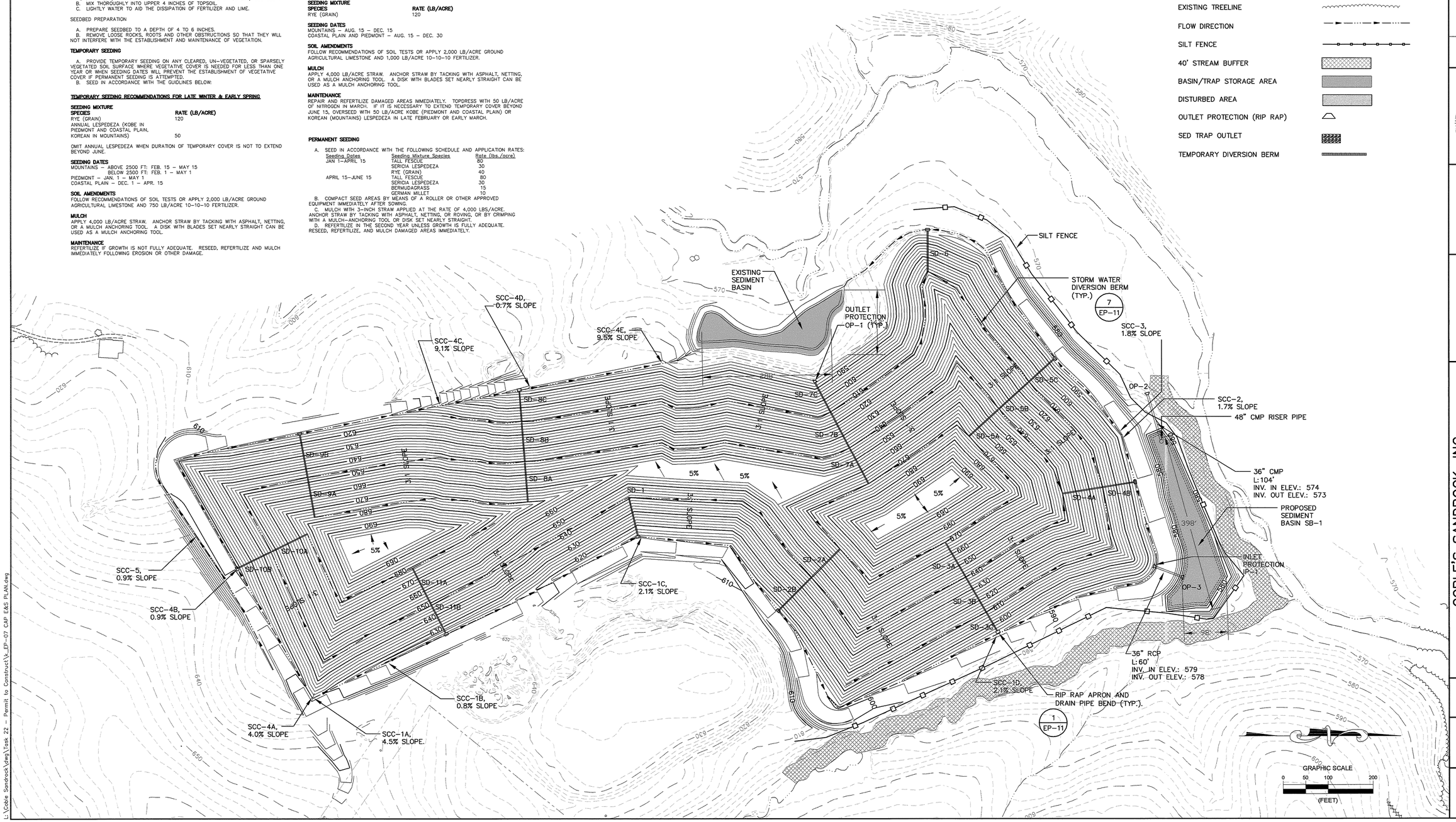
NOTE: MAINTENANCE OF EROSION AND SEDIMENT CONTROL FEATURES, AS DESCRIBED BELOW, IS THE RESPONSIBILITY OF MR. KENT COBLE.

THE SEDIMENT BASINS SHALL BE INSPECTED REGULARLY DURING LAND DISTURBING ACTIVITIES AND AFTER EACH SIGNIFICANT RAINFALL. SEDIMENT SHALL BE REMOVED, AND THE BASIN RESTORED TO ITS ORIGINAL DIMENSIONS WHEN SEDIMENT ACCUMULATES TO ONE-HALF THE DESIGN DEPTH. THE EMBANKMENTS, SPILLWAYS, AND OUTLETS SHALL BE INSPECTED REGULARLY FOR SIGNS OF PIPING AND SETTLEMENT. REPAIRS SHALL BE MADE IMMEDIATELY. THE RISER AND POOL AREA SHALL BE KEPT FREE OF TRASH AND OTHER DEBRIS.

DIVERSION BERMS SHALL BE INSPECTED WEEKLY AND AFTER EACH SIGNIFICANT RAINFALL. ACCUMULATED SEDIMENT SHALL BE REMOVED IMMEDIATELY FROM THE FLOW AREA, AND DIVERSION BERMS REPAIRED PROMPTLY.

GRASS-LINED CHANNELS SHALL BE CHECKED AFTER EVERY RAINFALL WHILE GRASS IN THE CHANNEL IS BEING ESTABLISHED. AFTER GRASS IS ESTABLISHED, THE CHANNEL SHALL BE REMOVED AS NECESSARY TO MAINTAIN THE DESIGN CAPACITY OF THE CHANNEL. GRASS THAT IS LINING THE CHANNEL SHALL BE KEPT IN A HEALTHY AND VIGOROUS CONDITION AT ALL TIMES.

SEDIMENT FENCES SHALL BE INSPECTED AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL. REPAIRS SHALL BE MADE IMMEDIATELY. SEDIMENT DEPOSITS SHALL BE REMOVED AS NEEDED TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAINFALL EVENT, AND TO REDUCE PRESSURE ON THE FENCE. FENCING MATERIALS AND SEDIMENT DEPOSITS SHALL BE REMOVED, AND THE AREA BROUGHT TO GRADE FOLLOWING STABILIZATION OF UPGRADIENT DISTURBED AREAS.



LEGEND

- EXISTING CONTOUR (2') — 660 —
- PROPOSED CONTOUR (2')
- FACILITY BOUNDARY
- STREAM
- EXISTING TREELINE
- FLOW DIRECTION
- SILT FENCE
- 40' STREAM BUFFER
- BASIN/TRAP STORAGE AREA
- DISTURBED AREA
- OUTLET PROTECTION (RIP RAP)
- SED TRAP OUTLET
- TEMPORARY DIVERSION BERM

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER EVAN E. ANDREWS 11/5/07

DESIGNED SC
DRAWN RB
CHECKED EA
APPROVED EA
DATE 05/20/06

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JOYCE ENGINEERING, INC.
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GREENSBORO, NC 27407
PHONE: (336) 323-9092

COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

ENGINEERING PLANS
FINAL PHASE 3 E&S PLAN

PROJECT NO. 419.22

SCALE 1"=100'

DRAWING NO. EP-07

L:\Coble Sandrock\dwg\Task 22 - Permit to Construct\E-EP-07 CAP E&S PLAN.dwg

CONSTRUCTION SEQUENCE:

1. OBTAIN PLAN APPROVAL AND APPLICABLE PERMITS.
2. INSTALL SB-1, TEMPORARY DIVERSIONS, SILT FENCE, AND TEMPORARY SEDIMENT TRAPS FOR PHASE 3A.
3. INSTALL PERMANENT STORMWATER CONVEYANCE CHANNELS FOR PHASE 3A AND GRADE ACCESS ROADS AND BASE OF LANDFILL. STOCKPILE EXCESS SOIL.
4. STABILIZE THE SITE AS AREAS ARE BROUGHT TO FINAL GRADE. PROVIDE GROUND COVER ON EXPOSED SLOPES WITHIN 21 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING AND PERMANENT GROUND COVER FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER PERIOD IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION OR DEVELOPMENT.
5. BEGIN LANDFILLING ACTIVITIES AFTER ALL REQUIRED APPROVALS ARE OBTAINED FROM THE REGULATORY AUTHORITIES.
6. PRIOR TO THE END OF LANDFILLING ACTIVITIES FOR PHASE 3A, INSTALL TEMPORARY DIVERSIONS, SILT FENCE, AND TEMPORARY SEDIMENT TRAPS FOR PHASE 3B.
7. INSTALL PERMANENT STORMWATER CONVEYANCE CHANNELS FOR PHASE 3B.
8. GRADE ACCESS ROADS AND BASEE OF LANDFILL. STOCKPILE EXCESS SOIL.
9. STABILIZE THE SITE AS AREAS ARE BROUGHT TO FINAL GRADE. PROVIDE GROUND COVER ON EXPOSED SLOPES WITHIN 21 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING AND PERMANENT GROUND COVER FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER PERIOD IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION OR DEVELOPMENT.

SEEDING SPECIFICATIONS

FERTILIZER AND LIME

A. APPLY LIME AND FERTILIZER ACCORDING TO SOIL TESTS, OR APPLY LIME AT THE RATE OF 90 LBS/1000 SQ.FT. AND FERTILIZER AT THE RATE OF 20 LBS/1000 SQ.FT.
B. MIX THOROUGHLY INTO UPPER 4 INCHES OF TOPSOIL.
C. LIGHTLY WATER TO AID THE DISSIPATION OF FERTILIZER AND LIME.

SEEDBED PREPARATION

A. PREPARE SEEDBED TO A DEPTH OF 4 TO 6 INCHES.
B. REMOVE LOOSE ROCKS, ROOTS AND OTHER OBSTRUCTIONS SO THAT THEY WILL NOT INTERFERE WITH THE ESTABLISHMENT AND MAINTENANCE OF VEGETATION.

TEMPORARY SEEDING

A. PROVIDE TEMPORARY SEEDING ON ANY CLEARED, UN-VEGETATED, OR SPARSELY VEGETATED SOIL SURFACE WHERE VEGETATIVE COVER IS NEEDED FOR LESS THAN ONE YEAR OR WHEN SEEDING DATES WILL PREVENT THE ESTABLISHMENT OF VEGETATIVE COVER IF PERMANENT SEEDING IS ATTEMPTED.
B. SEED IN ACCORDANCE WITH THE GUIDLINES BELOW:

TEMPORARY SEEDING RECOMMENDATIONS FOR LATE WINTER & EARLY SPRING

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
RYE (GRAIN)	120
ANNUAL LESPEDEZA (KOBE IN PIEDMONT AND COASTAL PLAIN, KOREAN IN MOUNTAINS)	50

OMIT ANNUAL LESPEDEZA WHEN DURATION OF TEMPORARY COVER IS NOT TO EXTEND BEYOND JUNE.

SEEDING DATES
MOUNTAINS – ABOVE 2500 FT: FEB. 15 – MAY 15
BELOW 2500 FT: FEB. 1 – MAY 1
PIEDMONT – JAN. 1 – MAY 1
COASTAL PLAIN – DEC. 1 – APR. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

TEMPORARY SEEDING RECOMMENDATIONS FOR SUMMER

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
GERMAN MILLET	40

IN THE PIEDMONT AND MOUNTAINS, A SMALL-STEMMED SUNDANGRASS MAY BE SUBSTITUTED AT A RATE OF 50 LB/ACRE.

SEEDING DATES
MOUNTAINS – MAY 15 – AUG. 15
PIEDMONT – MAY 1 – AUG. 15
COASTAL PLAIN – APR. 15 – AUG. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

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MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

TEMPORARY SEEDING RECOMMENDATIONS FOR FALL

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
RYE (GRAIN)	120

SEEDING DATES
MOUNTAINS – AUG. 15 – DEC. 15
COASTAL PLAIN AND PIEDMONT – AUG. 15 – DEC. 30

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 1,000 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REPAIR AND REFERTILIZE DAMAGED AREAS IMMEDIATELY. TOPDRESS WITH 50 LB/ACRE OF NITROGEN IN MARCH. IF IT IS NECESSARY TO EXTEND TEMPORARY COVER BEYOND JUNE 15, OVERSEED WITH 50 LB/ACRE KOBE (PIEDMONT AND COASTAL PLAIN) OR KOREAN (MOUNTAINS) LESPEDEZA IN LATE FEBRUARY OR EARLY MARCH.

PERMANENT SEEDING

A. SEED IN ACCORDANCE WITH THE FOLLOWING SCHEDULE AND APPLICATION RATES:

Seeding Dates	Seeding Mixture Species	Rate (lbs./acre)
JAN 1–APRIL 15	TALL FESCUE	80
	SERICIA LESPEDEZA	30
	RYE (GRAIN)	40
APRIL 15–JUNE 15	TALL FESCUE	80
	SERICIA LESPEDEZA	30
	BERMUDAGRASS	15
	GERMAN MILLET	10

B. COMPACT SEED AREAS BY MEANS OF A ROLLER OR OTHER APPROVED EQUIPMENT IMMEDIATELY AFTER SOWING.
C. MULCH WITH 3-INCH STRAW APPLIED AT THE RATE OF 4,000 LBS/ACRE. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR ROVING, OR BY CRIMPING WITH A MULCH-ANCHORING TOOL OR DISK SET NEARLY STRAIGHT.
D. REFERTILIZE IN THE SECOND YEAR UNLESS GROWTH IS FULLY ADEQUATE. RESEED, REFERTILIZE, AND MULCH DAMAGED AREAS IMMEDIATELY.

MAINTENANCE

NOTE: MAINTENANCE OF EROSION AND SEDIMENT CONTROL FEATURES, AS DESCRIBED BELOW, IS THE RESPONSIBILITY OF MR. KENT COBLE.

THE SEDIMENT BASINS SHALL BE INSPECTED REGULARLY DURING LAND DISTURBING ACTIVITIES AND AFTER EACH SIGNIFICANT RAINFALL. SEDIMENT SHALL BE REMOVED, AND THE BASIN RESTORED TO ITS ORIGINAL DIMENSIONS WHEN SEDIMENT ACCUMULATES TO ONE-HALF THE DESIGN DEPTH. THE EMBANKMENTS, SPILLWAYS, AND OUTLETS SHALL BE INSPECTED REGULARLY FOR SIGNS OF PIPING AND SETTLEMENT. REPAIRS SHALL BE MADE IMMEDIATELY. THE RISER AND POOL AREA SHALL BE KEPT FREE OF TRASH AND OTHER DEBRIS.

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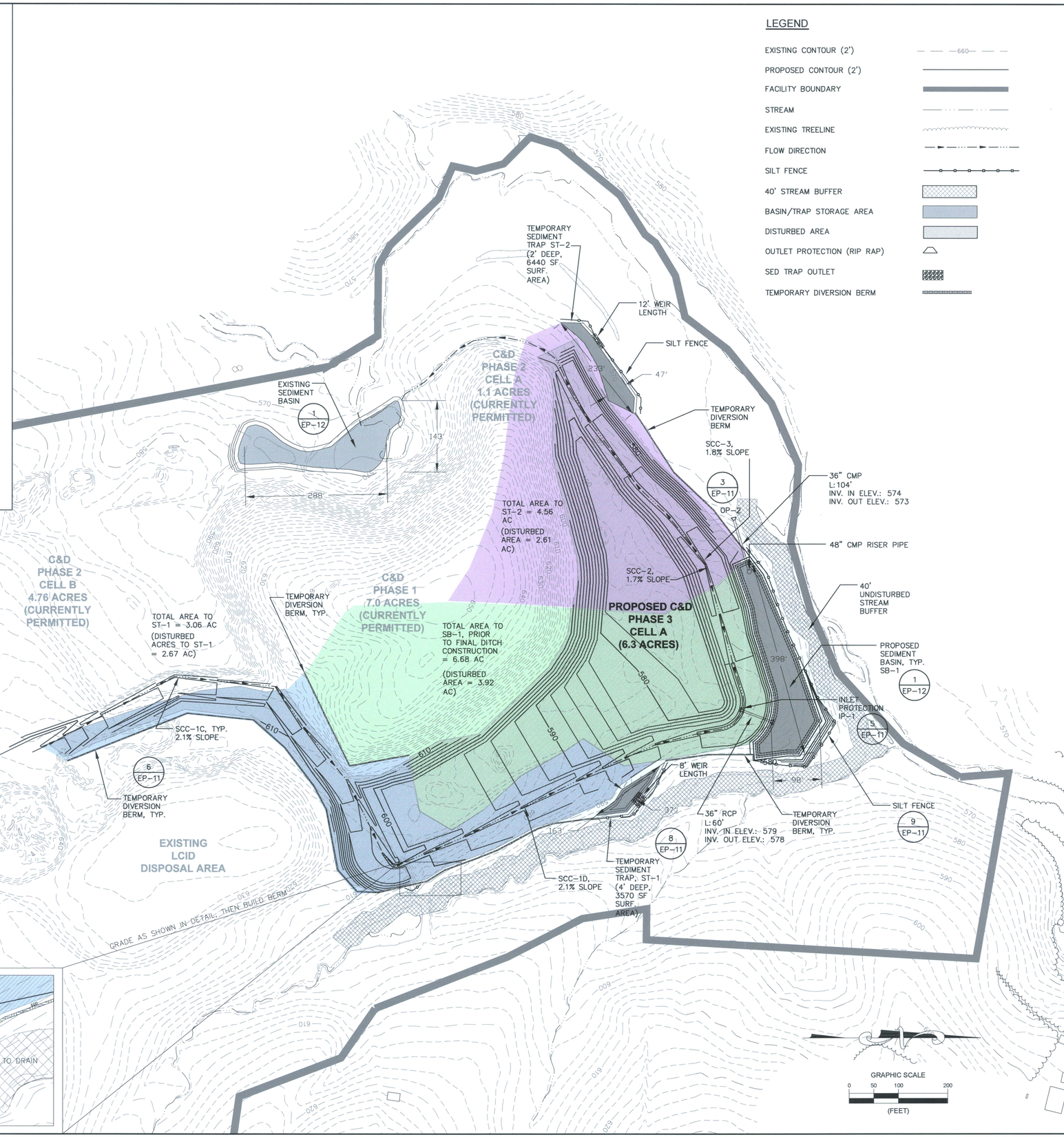

DATE	REVISIONS AND RECORD OF ISSUE	NO BY	CK	APP

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 21446 STEVAN L. MATTHEWS 11/15/07

DESIGNED SC
DRAWN RB
CHECKED EA
APPROVED EA
DATE 8/3/06

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PHONE: (336) 323-0092

COBLES SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

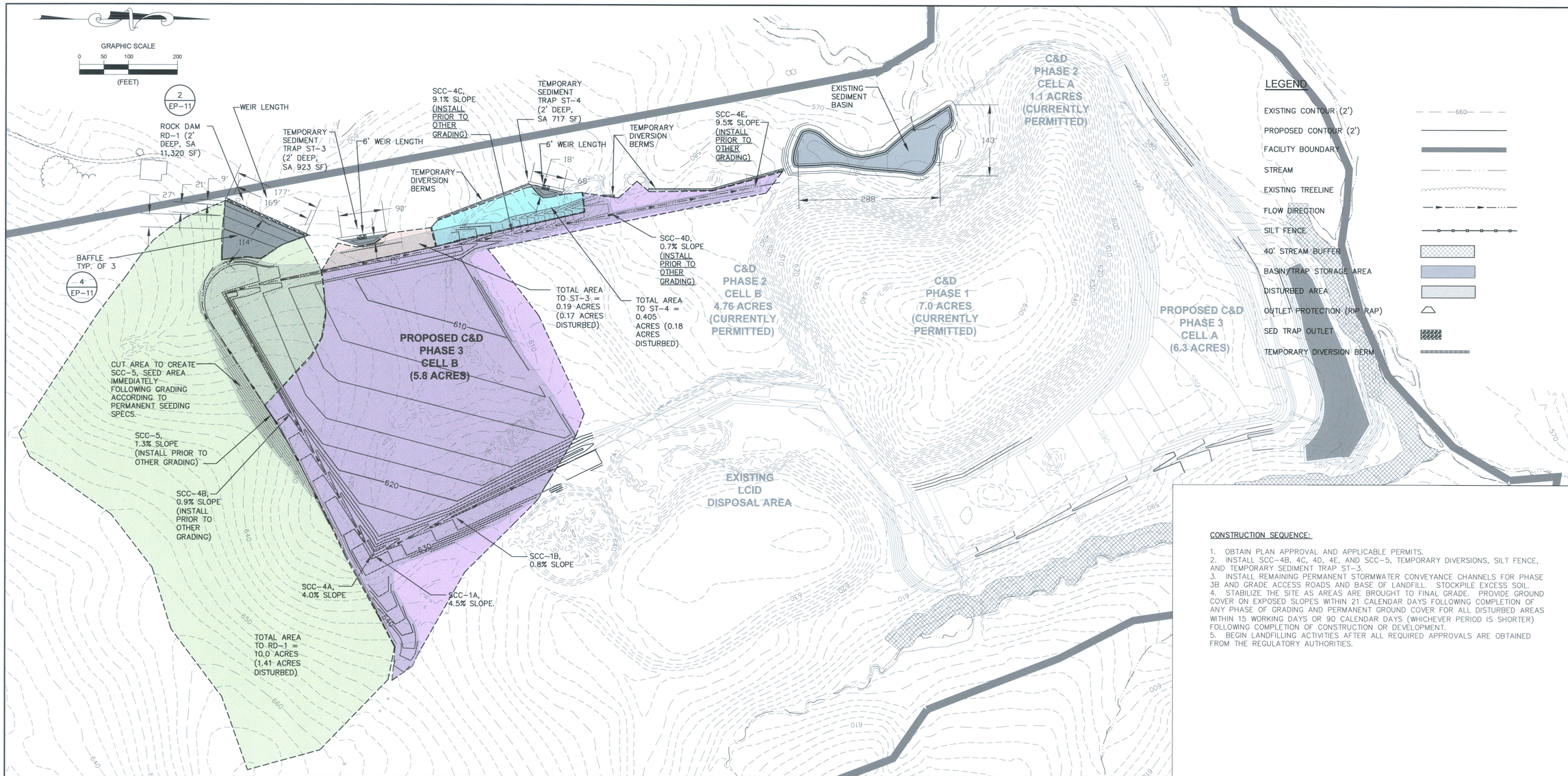
ENGINEERING PLANS
PHASE 3A E&S PLAN

PROJECT NO.
419.22

SCALE
1"=100'

DRAWING NO.
EP-08

L:\Coble Sandrock\dwg\Task 22 – Permit to Construct_EP-08 3A E&S PLAN.dwg



CONSTRUCTION SEQUENCE:

1. OBTAIN PLAN APPROVAL AND APPLICABLE PERMITS.
2. INSTALL SCC-4B, 4C, 4D, 4E, AND SCC-5, TEMPORARY DIVERSIONS, SILT FENCE, AND TEMPORARY SEDIMENT TRAP ST-3.
3. INSTALL REMAINING PERMANENT STORMWATER CONVEYANCE CHANNELS FOR PHASE 3B AND GRADE ACCESS ROADS AND BASE OF LANDFILL. STOCKPILE EXCESS SOIL.
4. STABILIZE THE SITE AS AREAS ARE BROUGHT TO FINAL GRADE. PROVIDE GROUND COVER ON EXPOSED SLOPES WITHIN 21 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING AND PERMANENT GROUND COVER FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER PERIOD IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION OR DEVELOPMENT.
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SEEDING MIXTURE

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TEMPORARY SEEDING RECOMMENDATIONS FOR FALL

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
RYE (GRAIN)	120

SEEDING DATES
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	RYE (GRAIN)	40
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DATE	REVISIONS AND RECORD OF ISSUE	BY	CK	APP

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER EVAN A. YANTHIS

DESIGNED SC
DRAWN RB
CHECKED EA
APPROVED EA
DATE 8/3/06

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GREENSBORO, NC 27407
PHONE: (336) 323-0092

COBLES SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

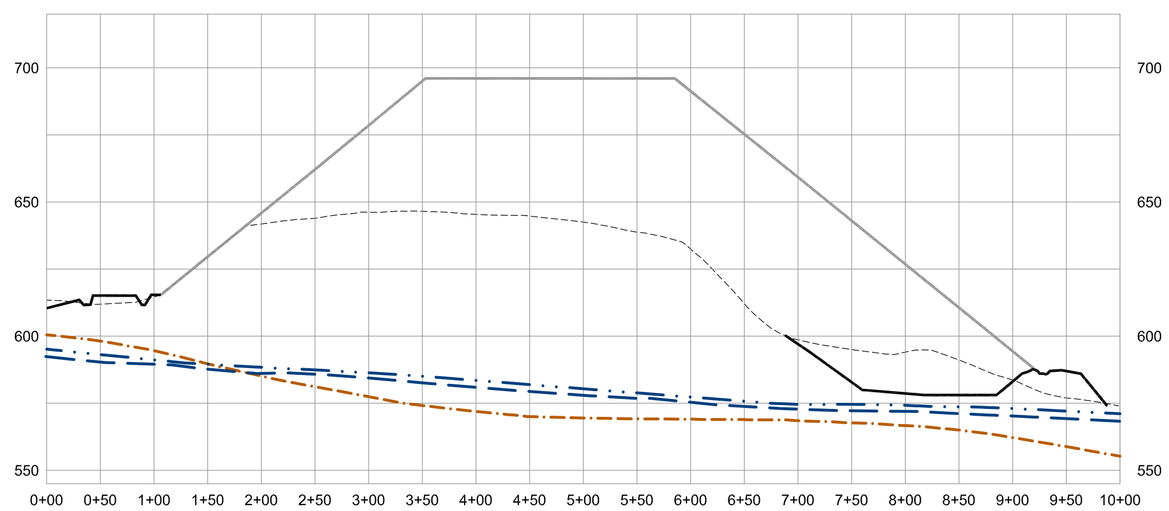
ENGINEERING PLANS
PHASE 3B E&S PLAN

PROJECT NO.
419.22

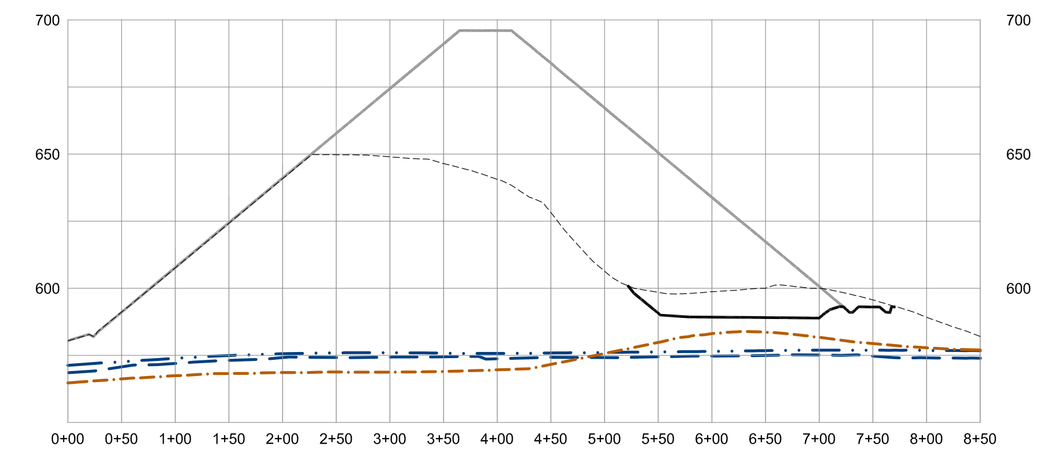
SCALE
1"=100'

DRAWING NO.
EP-09

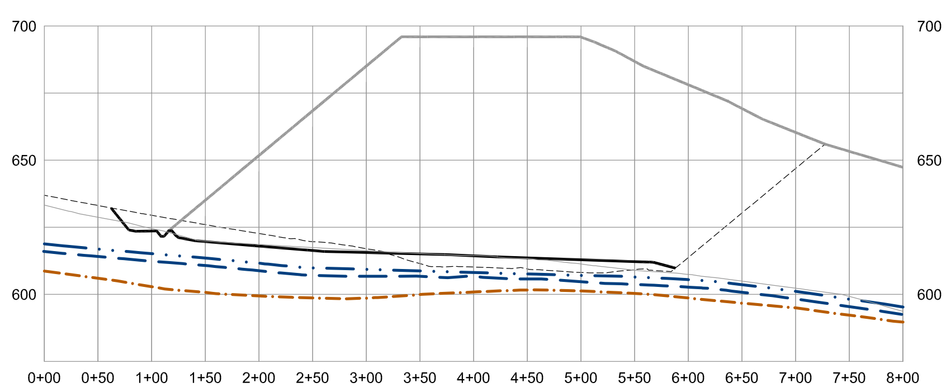
L:\Coble Sandrock\dwg\Task 22 - Permit to Construct\m_EP-09 3B E&S PLAN.dwg



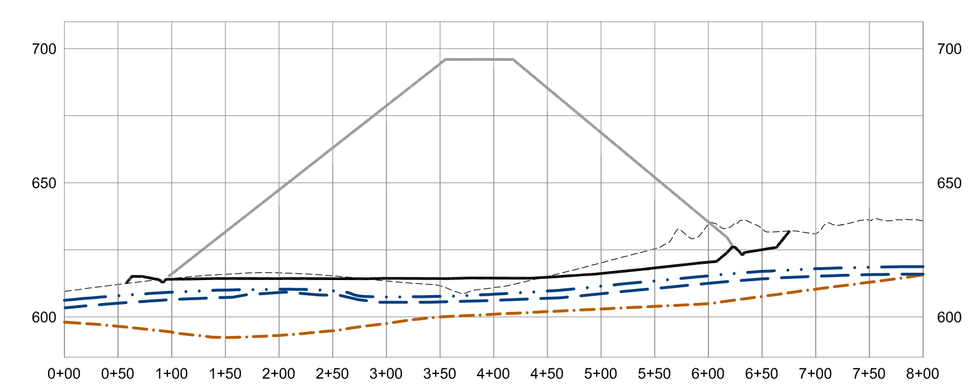
SECTION THROUGH A-A'
SCALE VERT: 1"=40'
HORIZ: 1"=100'



SECTION THROUGH B-B'
SCALE VERT: 1"=40'
HORIZ: 1"=100'

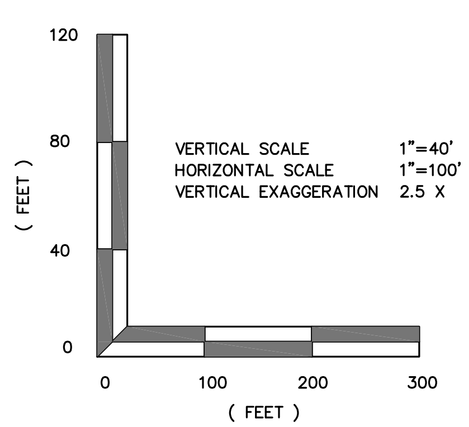


SECTION THROUGH C-C'
SCALE VERT: 1"=40'
HORIZ: 1"=100'



SECTION THROUGH D-D'
SCALE VERT: 1"=40'
HORIZ: 1"=100'

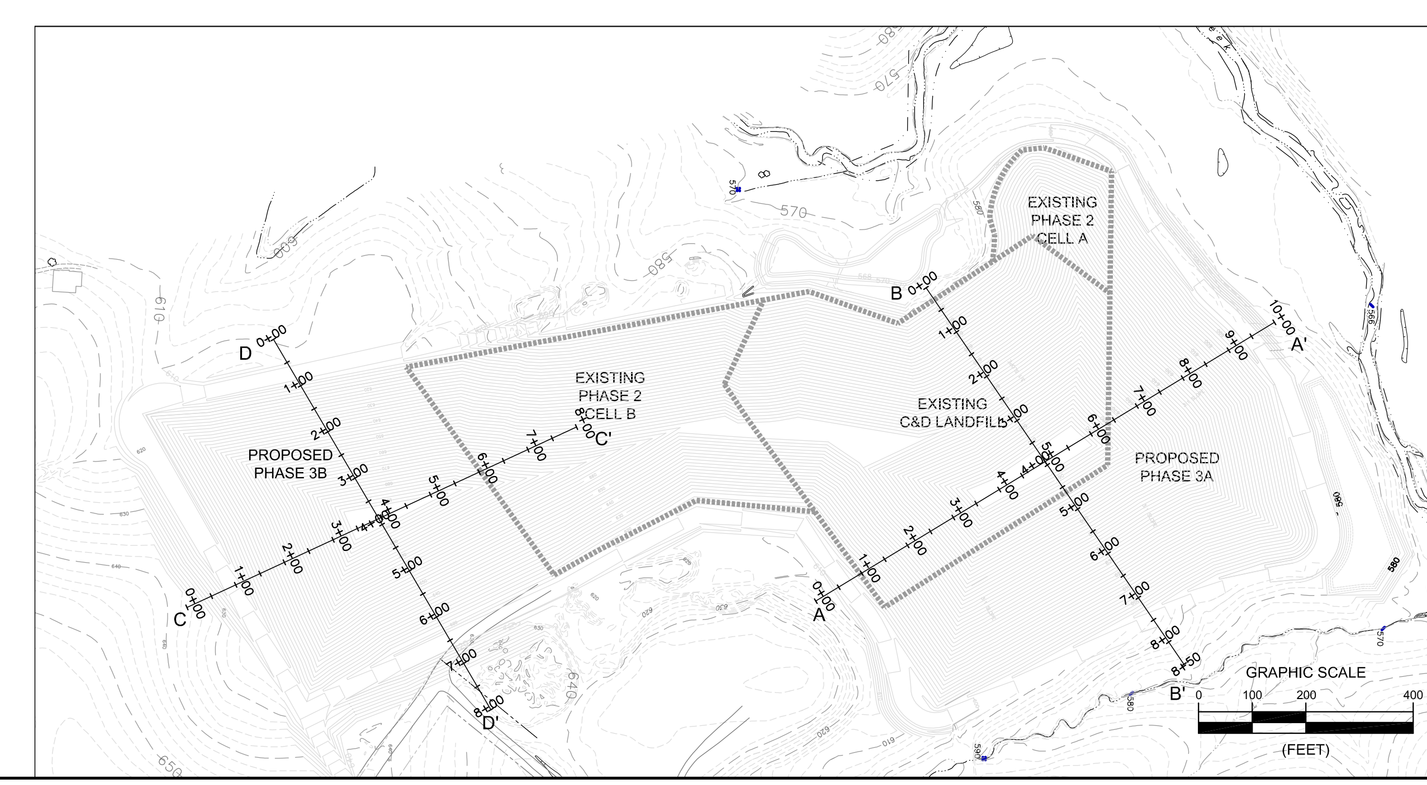
SCALE



VERTICAL SCALE 1"=40'
HORIZONTAL SCALE 1"=100'
VERTICAL EXAGGERATION 2.5 X

LEGEND

EXISTING GROUND	
PROPOSED SUBGRADE	
PROPOSED PHASE 3 CAP	
LONG-TERM SEASONAL HIGH WATER TABLE	
SEASONAL HIGH WATER TABLE (MARCH 6, 2007)	
BEDROCK ELEVATION	



NO	BY	CK	APP
1	RFB	VB	VB

DATE	REVISIONS AND RECORD OF ISSUE
12/05/07	ADDED SEASON HIGH WATER TABLE

DESIGNED SC
DRAWN RB
CHECKED EA
APPROVED EA
DATE 08/27/07

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COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

ENGINEERING PLANS
CROSS SECTIONS

PROJECT NO.
419.22

SCALE
AS SHOWN

DRAWING NO.
EP-10

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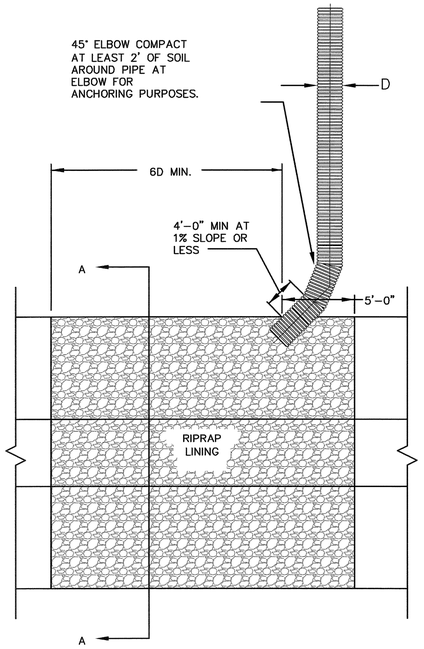
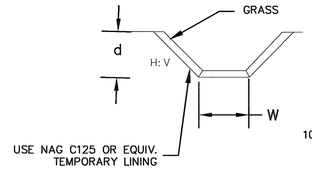
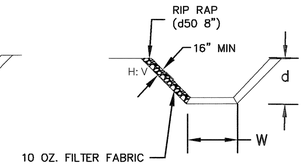
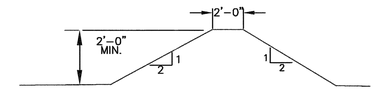


SLOPE DRAIN SCHEDULE

DRAIN	MIN. DIAMETER	RECOMMENDED DIAMETER (D)	LENGTH
SD-1	6.2"	12.0"	87'
SD-2A	4.0"	12.0"	87'
SD-2B	6.6"	12.0"	102'
SD-3A	5.7"	12.0"	87'
SD-3B	8.2"	12.0"	89'
SD-3C	10.1"	12.0"	48'
SD-4A	3.3"	12.0"	87'
SD-4B	5.3"	12.0"	71'
SD-5A	4.1"	12.0"	87'
SD-5B	6.2"	12.0"	87'
SD-5C	8.3"	12.0"	75'
SD-6	4.4"	12.0"	90'
SD-7A	5.8"	12.0"	87'
SD-7B	9.0"	12.0"	89'
SD-7C	10.7"	12.0"	75'
SD-8A	3.3"	12.0"	87'
SD-8B	7.2"	12.0"	88'
SD-8C	9.4"	12.0"	68'
SD-9A	4.9"	12.0"	87'
SD-9B	7.3"	12.0"	97'
SD-10A	3.9"	12.0"	87'
SD-10B	6.5"	12.0"	82'
SD-11A	5.3"	12.0"	90'
SD-11B	7.9"	12.0"	70'

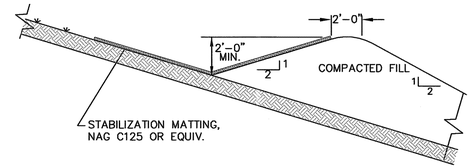






TEMPORARY DIVERSION BERM
N.T.S.
6 EP-08

NOTE
1. SLOPE IN FLOW DIRECTION VARIES BETWEEN 0.5% AND 2.0%

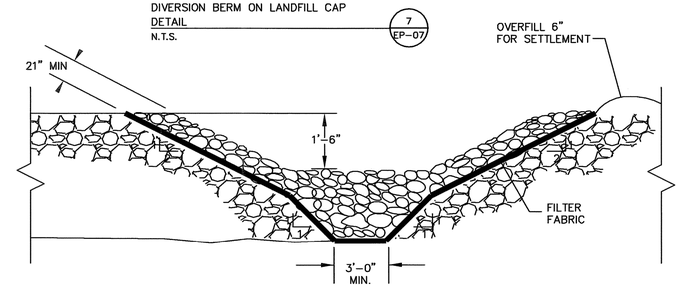


DIVERSION BERM ON LANDFILL CAP DETAIL
N.T.S.
7 EP-07

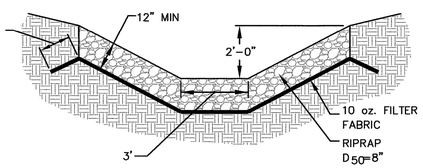
CHANNEL SCHEDULE

SECTION	DEPTH (d)	BOTTOM WIDTH (W)	SLOPE (H:V)	CHANNEL LINING
SCC-1A	2'	3.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)
SCC-1B	2'	3.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)
SCC-1C	2'	3.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)
SCC-1D	2'	3.0'	2:1	RIP RAP (d50 8"), 10 oz. FILTER FABRIC BELOW
SCC-2	2'	3.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)
SCC-3	2'	3.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)
SCC-4A	2'	3.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)
SCC-4B	2'	3.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)
SCC-4C	2'	3.0'	2:1	RIP RAP (d50 8"), 10 oz. FILTER FABRIC BELOW
SCC-4D	2'	3.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)
SCC-4E	2'	3.0'	2:1	RIP RAP (d50 8"), 10 oz. FILTER FABRIC BELOW
SCC-5	2'	2.0'	2:1	GRASS, W/ TEMP. LINING (NAG C125 OR EQUIV.)

STORMWATER CONVEYANCE CHANNEL (SCC)
N.T.S.

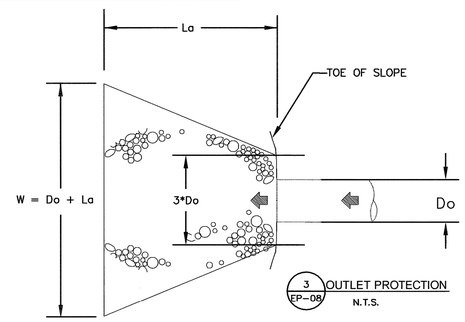


SPILLWAY



SECTION A

1 EP-07 SLOPE DRAINS
N.T.S.



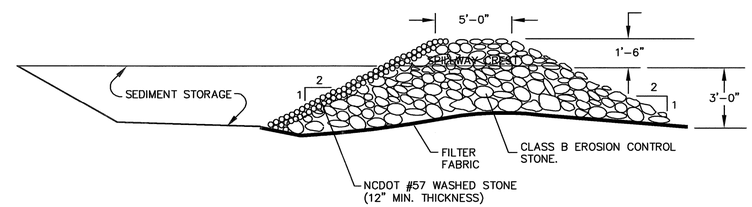
3 EP-08 OUTLET PROTECTION
N.T.S.

OUTLET PROTECTION SCHEDULE

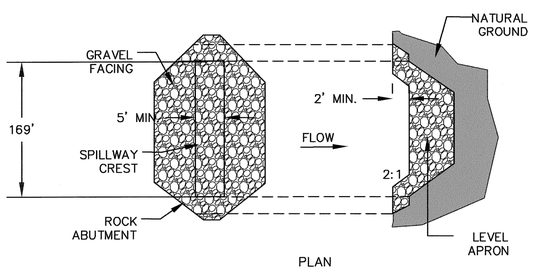
OUTLET	Do (IN)	La (FT)	d_{50} (IN)
OP-1	12"	12'	8.0"
OP-2	36"	20'	8.0"
OP-3	24"	18'	8.0"

NOTES:
1. APRON THICKNESS = 18" MIN.
2. INSTALL FILTER FABRIC BETWEEN THE RIPRAP AND THE SOIL FOUNDATION.

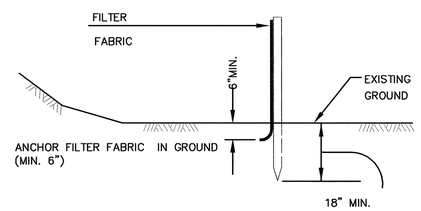
8 EP-08 TEMPORARY SEDIMENT TRAP
N.T.S.



SECTION



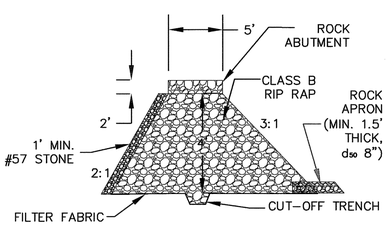
PLAN



SILT FENCE NOTES:
1. POSTS SHALL BE 4" DIA. PINE, 2" DIA. OAK, OR 1.33 LB/L.F. STEEL WITH MAX. LENGTH OF 6 FT.
2. LOCATE SEDIMENT FENCE AS SHOWN ON PLANS, AND AT A SUFFICIENT DISTANCE FROM PROPOSED WORK ACTIVITIES SO THAT IT WILL NOT INTERFERE WITH THE WORK.
3. IF THE SEDIMENT FENCE LOCATION SHOWN ON THE PLANS WILL INTERFERE WITH PROPOSED WORK BY THE CONTRACTOR, OBTAIN ENGINEER'S APPROVAL BEFORE INSTALLING.

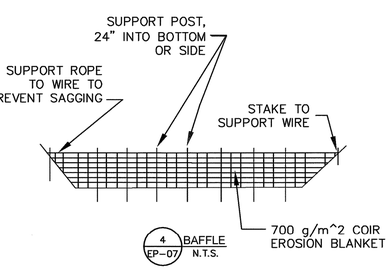
SEDIMENT TRAP SCHEDULE

SEDIMENT TRAP	REQUIRED MIN. SURFACE AREA (SF)	REQUIRED MIN. STORAGE CAPACITY (CF)	DESIGN SURFACE AREA (SF)	VOLUME (CF)	POOL DEPTH (FT)	WEIR LENGTH (FT)
ST-1	3,466	4,806	3,570	5,712	4'	8'
ST-2	5,164	4,698	6,440	5,152	2'	12'
ST-3	215	306	923	738	2'	6'
ST-4	459	324	717	574	2'	6'

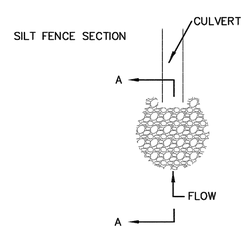


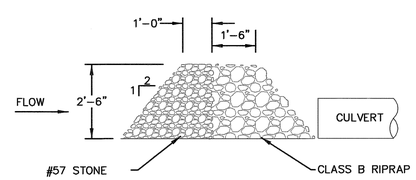
CROSS SECTION

2 EP-07 ROCK DAM
N.T.S.



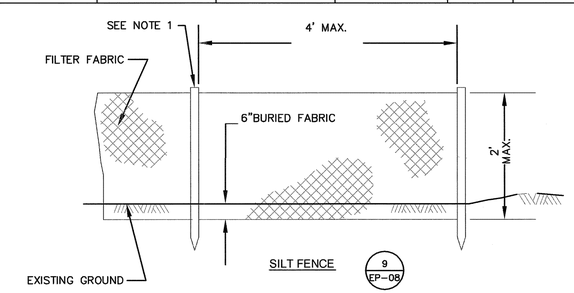
4 EP-07 BAFFLE
N.T.S.





SECTION 'A-A'

5 EP-08 INLET PROTECTION
N.T.S.



SILT FENCE
9 EP-08

NO.	BY	CK.	APP

DATE | REVISIONS AND RECORD OF ISSUE

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DESIGNED SC
DRAWN CADD/RFB
CHECKED EA
APPROVED EA
DATE 05/20/06

JOYCE ENGINEERING, INC.
2301 WEST MEADOWVIEW ROAD
GREENSBORO, NC 27407
PHONE: (336) 323-0092

COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

DETAILS

PROJECT NO. 419.22

SCALE NTS

DRAWING NO. EP-11

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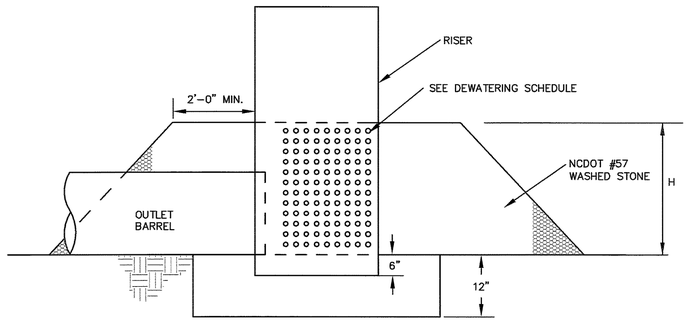
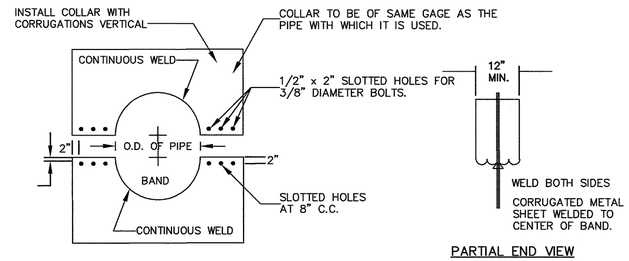


RISER

NOTE: SPACE HOLES THREE INCHES APART IN EACH OUTSIDE PIPE VALLEY IN LOWER HALF OF RISER.

RISER	HOLE SIZE	H (FT)
EX-BASIN	1/2"	1'-6"
SB-1	3/4"	1'-6"

DEWATERING SCHEDULE



PARTIAL END VIEW

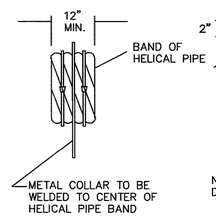
NOTES FOR COLLARS:

1. ALL MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS.
2. UNASSEMBLED COLLARS SHALL BE MARKED BY PAINTING OR TAGGING TO IDENTIFY MATCHING PAIRS.
3. THE LAP BETWEEN THE TWO HALF SECTIONS AND BETWEEN THE PIPE AND CONNECTING BAND SHALL BE CAULKED WITH ASPHALT MASTIC AT TIME OF INSTALLATION.
4. EACH COLLAR SHALL BE FURNISHED WITH TWO 1/2" DIAMETER RODS WITH STANDARD TANK LUGS FOR CONNECTING COLLARS TO PIPE.

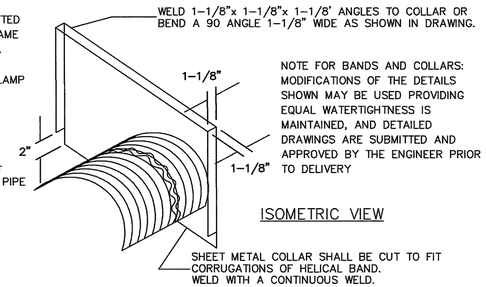
ANNULAR CMP PIPE
ANTI-SEEP COLLAR
N.T.S.

SIZE AND SPACING OF SLOTTED OPENINGS SHALL BE THE SAME AS SHOWN FOR CM COLLAR.

USE RODS AND LUGS TO CLAMP BANDS SECURELY TO PIPE.



END VIEW

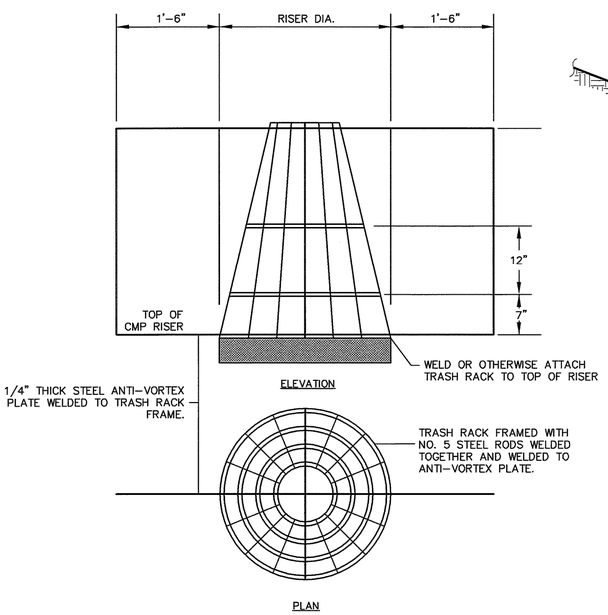


NOTE FOR BANDS AND COLLARS: MODIFICATIONS OF THE DETAILS SHOWN MAY BE USED PROVIDING EQUAL WATERTIGHTNESS IS MAINTAINED, AND DETAILED DRAWINGS ARE SUBMITTED AND APPROVED BY THE ENGINEER PRIOR TO DELIVERY

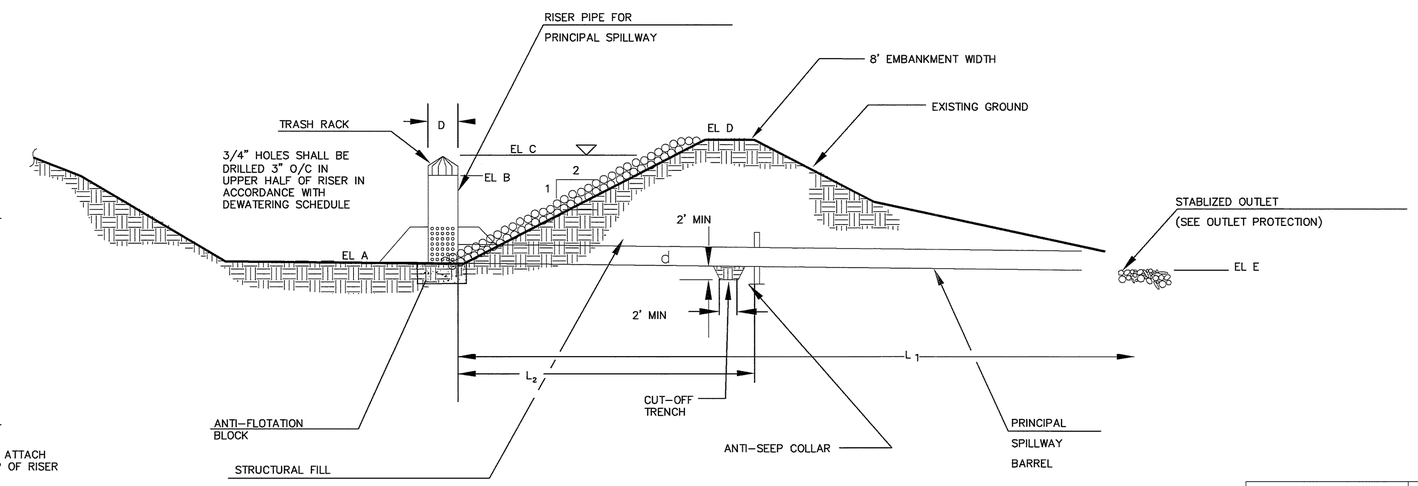
ISOMETRIC VIEW

NOTE: SEE DETAIL FOR ANNULAR PIPE FOR INFORMATION ON FABRICATION DIMENSIONS, MINIMUM GAGES, SLOTTED HOLES, AND NOTES.

HELICAL CMP PIPE
ANTI-SEEP COLLAR
N.T.S.



TYPICAL TRASH RACK
DETAIL
N.T.S.



NOTES

1. SEDIMENT BASIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH NORTH CAROLINA EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL AND PROJECT SPECIFICATIONS.
2. EXCAVATE CUT-OFF TRENCH ALONG CENTERLINE OF EARTH FILL EMBANKMENT. CUT TRENCH TO STABLE SOIL MATERIAL, BUT IN NO CASE LESS THAN 2'-0" DEEP.

1 / EP-08 SEDIMENT BASIN
N.T.S.

	EXIST. BASIN	SB-1
EL A	567	574
EL B	568.5	577
EL C (25-yr HIGH WATER ELEV.)	570	578
EL D	572	580
EL E	566	573
D (IN)	48"	48"
d (IN)	30"	36"
CLEANOUT ELEVATION	567.75	575.5
L_1 (FT.)	30'	104'
L_2 (FT.)	10'	33'
ANTI-FLOTATION BLOCK (FT.)	6.0'x6.0'x1.5'	6.0'x6.0'x1.5'
ANTI-SEEP COLLAR	4.5' x 4.5'	4.5' x 4.5'

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK.	APP.

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER EVAN A. WILLIAMS 11/13/07

DESIGNED SC
DRAWN CADD/RFB
CHECKED EA
APPROVED EA
DATE 05/20/06

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PHONE: (336) 323-0092

COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

SED BASIN DETAILS

PROJECT NO.
419.22

SCALE
NTS

DRAWING NO.
EP-12

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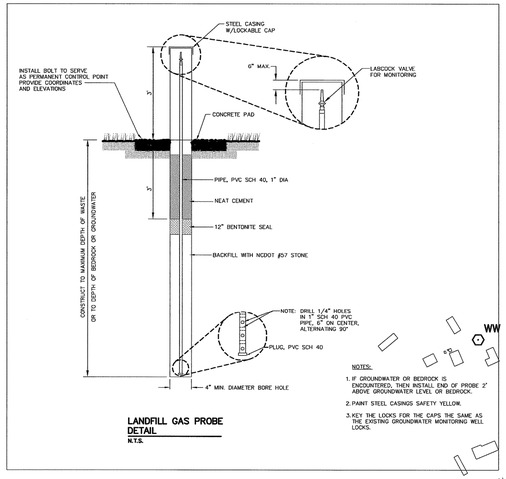
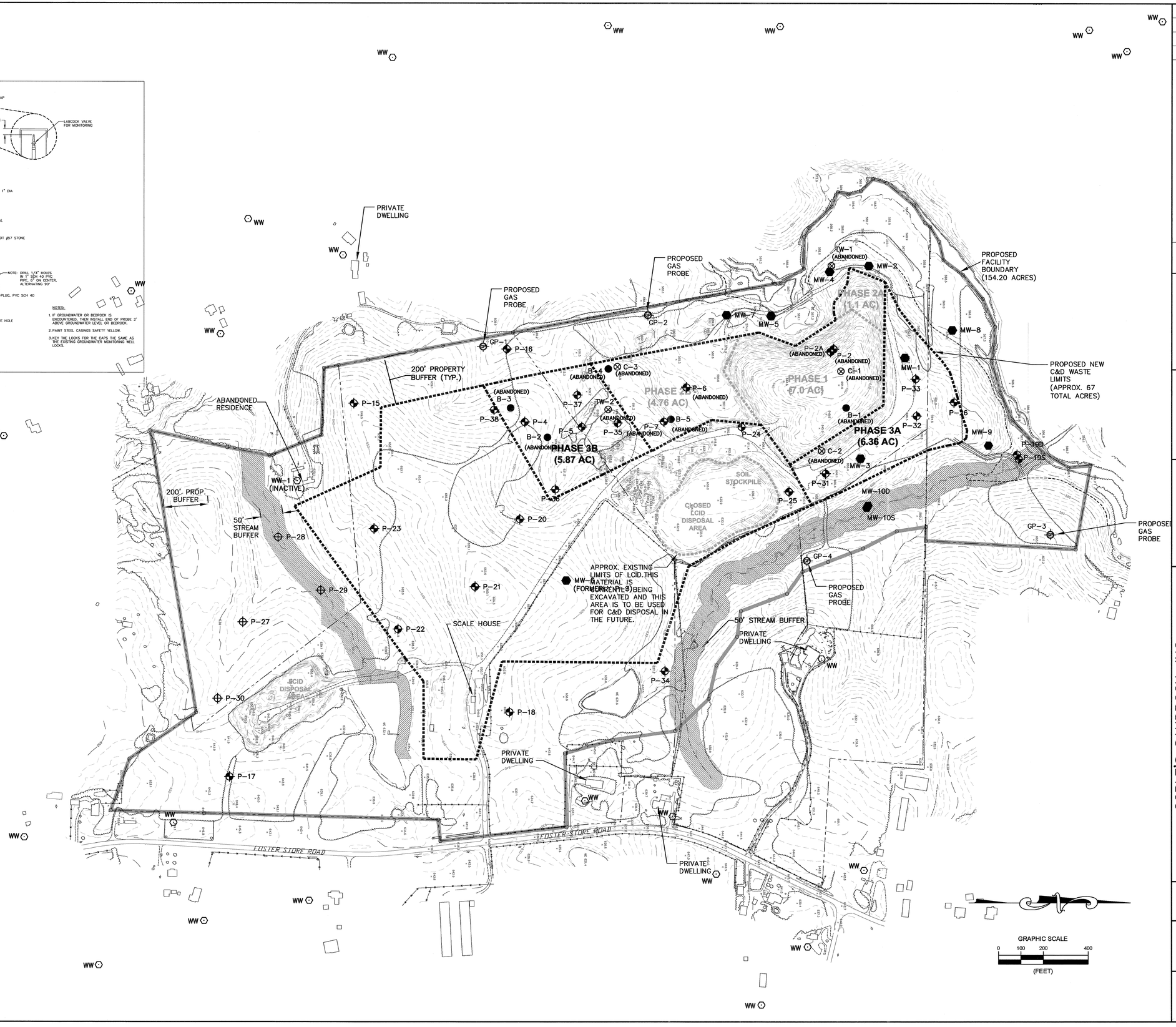


LANDFILL GAS PROBE DETAIL
N.T.S.



NO	BY	CK	APP
1	SC	EA	EA

DATE	REVISIONS AND RECORD OF ISSUE
2/7/08	RVSD PZ & MW CALLOUTS, RVSD & LABELED PROBES

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER ELAINE A. ANDREWS 3/7/13

DESIGNED SC
DRAWN CADD/RWH
CHECKED EA
APPROVED EA
DATE 03/30/06

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COBLE'S SANDROCK, INC.
KIMESVILLE, NORTH CAROLINA

MONITORING NETWORK

PROJECT NO. 419.22

SCALE 1"=200'

DRAWING NO. MP-01

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