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**PERMANENT PUMP STATION B
CONSTRUCTION PERMIT APPLICATION
RESPONSES TO THE FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION
LETTER DATED JANUARY 22, 1998**

Prepared for:

Hillsborough County
Solid Waste Management Department
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Prepared by:

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February 5, 1998
File No. 0995029.13

SCS ENGINEERSFebruary 5, 1998
File No. 0995029.13Mr. Kim B. Ford, P.E.
Florida Department of Environmental Protection
Southwest District
3804 Coconut Palm Drive
Tampa, Florida 33619D.E.P.
FEB - 6 1998
SOUTHWEST DISTRICT
TAMPA

Subject: Response to Florida Department of Environmental Protection's letter dated January 22, 1998, regarding the Southeast County Landfill (SCLF), Pump Station B Construction, Pending Permit No. 35435-001-SC, Hillsborough County, Florida

Dear Mr. Ford:

On behalf of the Hillsborough County Solid Waste Management Department (HCSWMD), SCS Engineers (SCS) has reviewed the referenced letter from the Florida Department of Environmental Protection (FDEP). We believe the following responses address the questions raised by the FDEP. Each of the FDEP's comments is restated in bold below, followed by our response.

1. **FDEP Statement 1** - Please provide one complete set of plans, and specifications which describe all materials and coatings sampling and testing as required by F.A.C. 62-701.400(7), including but not limited to conformance testing by a laboratory reporting to the professional engineer in charge of construction quality assurance.

Response - A revised complete set of plans will be provided under separate cover. Attachment 1 contains the complete set of project specifications.

2. **FDEP Statement 2** - Due to the possibility of an extreme amount of rainfall concurrent with initially opening Phase V or VI, please describe how leachate will be removed as it is generated with only one pump operating continuously at 75 gpm. Five (5) inches of rainfall into Phase VI would produce 3,740,000 gallons of leachate, however, one pump will only remove 108,000 gallons in 24 hours. If the one pump in use fails, what procedures will be implemented to ensure continuous leachate removal and minimal downtime? What is the maximum downtime that might occur due to pump failure? When Phase V is open, how will its leachate be prevented from entering Phase VI?

Response - Pump: In the event of pump failure, we estimate that the HCSWMD can replace the submersible pump with the backup pump within 4 hours. As previously stated, the selected pump is capable of removing up to a maximum of 200 gallons per minute (gpm) (288,000 in 24 hours, if the site were to generate that much).



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In addition the HCSWMD will continue to incorporate measures to minimize leachate generation at the SCLF. The leachate reduction measures will include the use of a rain tarp over the inactive areas of Phases V and VI, and the use of soil covers (intermediate and temporary final). Prior to the beginning of the initial lifts (Lift 7A and 7B) in Phases V and VI, the HCSWMD will place a rain tarp (8 to 20 mil thick) over the inactive areas. As filling progresses, the tarp will be removed in sections as needed. The stormwater runoff from the tarped areas will be conveyed into the SCLF stormwater management system.

Phases V and VI Leachate Separation: To begin landfilling in Phases V and VI the following sequence will be followed. Please refer to the attached Figure No. 1, page 6.

- Install Permanent Pump Station B (PPS-B) in Phase VI. Since the leachate collection and removal system (LCRS) in Phases V and VI currently is not tied to any active landfilling Phase, the HCSWMD is planning to use Temporary Pump Station No. 4 and PPS-B to discharge stormwater via force main into the 16-inch diameter HDPE drainage pipe.
- If necessary, make modifications to the LCRS, depending on the results of the LCRS assessment in Phases V and VI.
- Concurrent with the LCRS modifications, extend the PPS-B 18-inch access pipes to the SCLF perimeter berm.
- When the previous steps are completed, Phase V will be activated as follows:
 - Cap the 16-inch diameter HDPE stormwater inlet No. 1 in Phase V.
 - To prevent any leachate in Phase V from entering into the LCRS of Phase VI, close LCRS valves No. 1, 2, and 3. The LCRS valve No. 5 will remain closed.
 - LCRS valve No. 4 into the existing Temporary Pump Station No. 4 (TPS-4) will remain open. The leachate from Phase V will be collected in TPS-4 from which the leachate will be pumped to the existing Permanent Pump Station "A" (PPS-A). The leachate in PPS-A will be pumped via the existing force main to the main leachate pump station, from which the leachate is pumped to the 575,000 gallons leachate storage tank.
 - Connect the LCRS between Phases V and III by constructing a trench through the interior lined berm. Shown as Trench No. 1 on Figure No. 1.

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- Begin placement of refuse Lift 7A in Phase V.
- Since the LCRS in Phase VI is still not tied to Phases III and IV, and isolated from Phase V, PPS-B will continue to pump stormwater from Phase VI into the 16-inch diameter HDPE drainage inlet No. 2.
- When Lift 7A in Phase V is completed, Phase VI will be activated as follows:
 - Cap the 16-inch diameter HDPE stormwater inlet No. 2 in Phase VI.
 - Open LCRS valves No. 1, 2, and 3. At this point, the temporary pump stations 3, 4, and 5 as well as PPS-B, will pump leachate to PPS-A.
 - Connect the LCRS between Phases VI, III, and IV by constructing trenches through the interior lined berm. Shown as Trenches No. 2 through No. 6 on Figure No. 1.
- Begin placement of refuse Lift 7B in Phase VI. Continue refuse filling over Phases V and VI with Lifts 7C, 7D, and 7E.
- Concurrent with filling of Lift 7E Phase VI Cell G, remove the existing temporary leachate pump stations No. 3 and No. 4 in Phase VI.

3. **FDEP Statement 3** - Based on actual data and previous site investigations, what filling sequence or other operational condition is required to cause the Phase VI vault/sump to settle to the landfill's lowest point. What is the total settlement expected for the vault/sump? Please provide an evaluation of dewatering and/or surcharging the area in the vicinity of the vault to induce settlement to the lowest point. Upon completion of the vault/sump, how will the maximum one foot of hydraulic head continue to be maintained for the landfill?

Response - Filling Sequence: In order for Phase VI to become the lowest point in the SCLF, SCS recommends that the HCSWMD continue with the filling sequence as presented in Appendix E of the Operation Permit Renewal Application dated August 22, 1994 by SCS. Phase VI is calculated to become the lowest point in the SCLF sometime after the completion of Lift 7 (see Attachment 2).

Total Settlement: The total settlement expected over the life of the SCLF is 8 to 10 feet in the areas with the thickest phosphatic clays. This settlement was estimated by Ardaman and Associates, Inc. (Ardaman) in their Hydrogeological Investigation dated February 1983 (Section 6.4.1). As recommended by Ardaman, in September 1992 the HCSWMD placed 4 to 8 feet of sand over Phases V and VI to begin the initial consolidation process in those Phases. Since preloading the area, the phosphatic clays in Phase VI have settled from elevation

121.5 ± to elevation 116.8 ± (total of 4.7 feet). Additional settlement will continue to occur as the waste filling progresses.

Dewatering Phosphatic Clays: Clay dewatering is a process typically used to accelerate the initial settlement of a given clay layer. Since the initial settlement of the phosphatic clays in Phase VI already occurred, the dewatering process offers no benefit at this time. Additionally, dewatering of the phosphatic clays would require full penetration of the clay layer which would have a negative impact to the performance of the SCLF liner. The use of dewatering is not recommended at this time.

Surcharging: The maximum settlement amount is a function of the load placed on the phosphatic clays. However, the settlement time is a function of the phosphatic clays characteristics (see Attachment 2). Therefore, increasing the load intensity (i.e. surcharging) at this time will not accelerate the settlement process. Surcharging is not recommended. SCS recommends that the HCSWMD continue operating under their normal filling sequence. Under the current operation sequence, waste filling in Phases V and VI will begin sometime late in 1998 or early 1999 depending on the actual waste receipts.

One-Foot Hydraulic Head: In August 22, 1994, the HCSWMD submitted the Operation Permit Renewal Application by SCS. From August 1994 through August 1995, extensive discussions of head over the liner at the SCLF was provided to the FDEP and the Hillsborough County Environmental Protection Commission (EPC). The discussions included several meetings with representatives from the HCSWMD, SCS, FDEP, and EPC. These discussions resulted in the preparation of a Leachate Management Plan (LMP) for the SCLF. The HCSWMD and SCS were under the understanding that the development of the LMP resolved the one-foot hydraulic head issue as it relates to the SCLF.

The LMP outlines the monitoring and head over the liner performance criteria for the SCLF. The performance criteria established leachate depth goals which allow for a maximum depth of up to 30 inches over the SCLF liner. Subsequently, the LMP was approved by the FDEP and was made part of the permit by Specific Condition No. 17. Any proposed modifications to the LCRS in Phases V and VI will be made to achieve continued compliance with the goals of the LMP.

As previously stated, by providing free flow into the vault, the PPS-B will allow for the maximum performance of the LCRS. Any future improvements into the LCRS of Phases V and VI will not have an adverse impact on the performance of PPS-B.

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4. **FDEP Statement 4** - Please provide the graded filter media calculations and specifications.

Response - Attachment 3 contains the calculations for the graded filter media.

Please do not hesitate to call if you have any questions. .

Very truly yours,

Larry E. Ruiz

Larry E. Ruiz
Senior Project Engineer

Robert B. Gardner
Robert B. Gardner, P.E.
Vice President

SCS ENGINEERS

LER/RBG:kas
attachments

cc: Patricia V. Berry, HCSWMD
Robert Butera, FDEP
Paul Schipfer, EPC

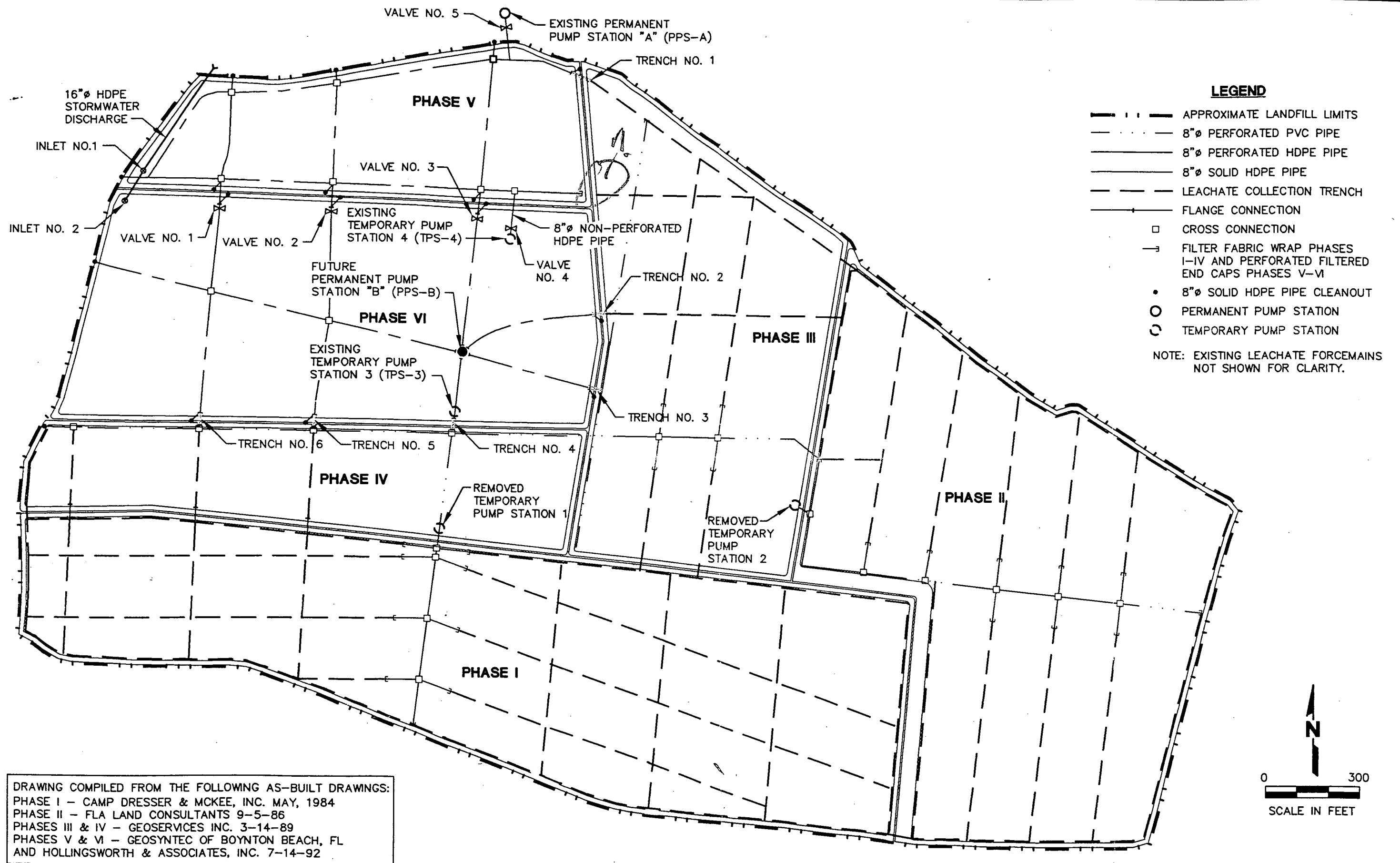


Figure 1. Leachate Collection System, Southeast County Landfill.

ATTACHMENT 1
SPECIFICATIONS

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SOUTHEAST COUNTY LANDFILL PERMANENT PUMP STATION B

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02950	Geogrid
<u>DIVISION 3 - CONCRETE</u>	
03410	Precast Concrete
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SECTION 02220 - EXCAVATION, BACKFILL, FILL, AND GRADING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this section includes excavating, trenching, shoring, transporting, stockpiling, placing, backfilling, compacting, grading, disposing materials, field testing, and quality control/quality assurance laboratory services required for the completion of all earthwork as shown on the Drawings and as specified herein, and in accordance with the provisions of the Contract for the Continuing Construction and Operation of the Southeast County Landfill, Contract/RFP No. C-206-89, and all documents referenced there in.
- B. Where referenced, conduct earthwork in conformance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 1991 edition.

1.02 DEFINITIONS

- A. **DRAWINGS** - The drawings or plans which show the character and scope of the Work to be performed and which have been prepared or approved by the ENGINEER. The Drawings are titled "Southeast County Landfill Phase VI Permanent Pump Station B Construction".
- B. **SPECIFICATIONS** - Those portions of the Contract Documents consisting of written technical descriptions of material, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.
- C. **CONTRACT DOCUMENTS** - Includes the Bidding Documents, Agreement, Addendas, Drawings, Specifications, and current CONTRACTOR's Contract relating to operation and construction of the Southeast County Landfill (Contract No. RFP No. C-206-89), and all documents referenced there in.
- D. **CONTRACTOR** - Waste Management Inc. of Florida.
- E. **COUNTY** - Hillsborough County Solid Waste Management Department.
- F. **ENGINEER** - SCS Engineers, U.S. Highway 301 North, Suite 700, Tampa, Florida, 33619.

1.03 RESPONSIBILITIES

- A. Excavation, backfilling, sampling, and testing shall be performed by the CONTRACTOR only when the COUNTY or ENGINEER are present. A written notification shall be submitted to the ENGINEER a minimum of 24-hours prior to the CONTRACTOR performing any work. The CONTRACTOR shall be reimbursed for down-time costs incurred in the event a representative of the COUNTY or ENGINEER is not present for pre-approved scheduled work. Conversely, the CONTRACTOR shall reimburse the COUNTY or ENGINEER for down-time costs incurred in the event pre-approved scheduled work is not performed by the CONTRACTOR (with the exception of weather delays).
- B. Health and Safety:
 - 1. The CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. The CONTRACTOR shall take all necessary precautions for the safety of all employees on the work site and other persons who may be affected by the work.
 - 2. The CONTRACTOR shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons and property or to protect them from damage, injury or loss. CONTRACTOR shall erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection.
 - 3. The CONTRACTOR shall designate a responsible member of its organization as on-site health and safety officer whose duty shall be the prevention of accidents at the site.

1.04 SUBMITTALS

- A. Health and Safety Plan: The CONTRACTOR shall submit a Health and Safety Plan for this work which includes, as a minimum:
 - 1. The name of CONTRACTOR's on-site health and safety officer.
 - 2. Safety procedures in the vicinity of excavations, trenches, and structures.
 - 3. Response procedures to emergencies.
- B. Excavation Plan: The CONTRACTOR shall provide a detailed construction plan for excavation and backfilling of phosphatic clay beneath the area of the work. The CONTRACTOR shall conduct test borings of the phosphatic clay in the area of construction to verify field conditions. The Excavation Plan and test boring results shall be submitted to the ENGINEER for review prior to starting construction activities, and shall, as a minimum, include the following:

1. A description of addressing safety issues in consideration of OSHA, Federal, State, and local safety requirements for excavations of this type.
 2. Methods for the following activities shall be described:
 - a. Excavation and slope stabilization.
 - b. Stockpiling of materials.
 - c. Shoring and Trenching (if necessary).
 - d. Dewatering.
 - e. Backfilling.
 3. A description of the low-ground pressure equipment being used for excavation activities, such as Caterpillar E120B, or ENGINEER approved equivalent.
 4. Controls for stormwater runoff and erosion control explaining how stormwater runoff will be diverted from entering into excavated areas.
 5. A schedule describing the sequence of construction activities, which includes, as a minimum:
 - a. Excavation (including a contingency plan if clays are not consolidated as estimated).
 - b. Geogrid placement and backfill.
 - c. Geotextile placement and 6" gravel cover.
 - d. Placement of precast vault.
 - e. Pipe connections.
 - f. Gravel backfill to the top of surrounding phosphatic clay.
 - g. Placement of sand backfill.
 - h. Completion of gravel backfill.
 - i. Geotextile placement over top of gravel.
 - j. Completion of sand backfill.
- C. Sand and Coarse Sand: The CONTRACTOR shall submit laboratory testing results for the sand and coarse sand. Results shall be submitted to and reviewed for completeness by the ENGINEER prior to material being incorporated into the project. Data required shall include, as a minimum, the following;
1. Name of supplier.
 2. Two permeability tests (ASTM D5084).
 3. Two gradation tests (ASTM D422).
- D. Stone, Granite Rock, and Gravel: The CONTRACTOR shall submit a material sample and laboratory testing results for the stone, granite rock, and gravel. The sample and testing results shall be submitted to and reviewed for

completeness by the ENGINEER prior to material being incorporated into the project. Data required shall include, as a minimum, the following;

1. Name of supplier.
 2. Written verification of stone mineral content (i.e., quartz or granite).
 3. Los Angeles abrasion test results and soundness test results.
 4. One gradation test (ASTM D422).
- E. As-Built Survey: Horizontal and vertical topographic information depicting the actual grades, lengths, elevations and quantities of constructed items. Include the location and elevation of the top of each corner for the concrete vault and the location and invert elevations for pipes entering the vault, and for the pipes at termination.
1. Drawings shall be plotted on sheets measuring 24 inches by 36 inches and in a scale similar to the Contract Drawings. If multiple sheets are required, each sheet must include match lines.
 2. All survey information shall reference the coordinate system as depicted in the Contract Drawings, and include a north arrow and scale designation.
 3. Contour intervals of 1 foot, with index contours at every fifth contour.
 4. Submit to the ENGINEER computer disks containing the as-built record drawing in AutoCAD® (version 12) or at a scale of 1:1. Prior to reducing data to electronic media, CONTRACTOR shall coordinate with ENGINEER on the layering system to be used for the computer files.
 5. Contour lines shall be polylines with a width of zero, and an elevation (z-coordinate) assigned according to the elevation of the contour line.
 6. Submit certificate signed by registered surveyor ensuring that elevations and locations of improvements are in conformance with the Contract Documents, or if not in conformance, certify as to variances from the Contract Documents.

1.05 EXISTING SITE CONDITIONS

- A. Damage to property caused directly or indirectly, in whole or in part, by the CONTRACTOR shall be restored to the original condition by the CONTRACTOR at no cost to the COUNTY.

PART 2 - PRODUCTS

2.01 SAND

- A. Sand shall be clean and free from organic and deleterious materials. Sand may be obtained on site and used upon the approval of the ENGINEER.

2.02 COARSE SAND

- A. The coarse sand used as backfill in the area of the PPS-B concrete vault shall be clean and free from organic and deleterious materials and have the following gradation, commonly referred to as 6/20 sand:

<u>Seive No.</u>	<u>Minimum Percentage Retained on Seive</u>
6	0.3
8	4.7
12	21.4
16	67.2
18	87.3
20	95.7
25	98.5
30	99.2
40	99.7
50	99.9

2.03 STONE

- A. The stone used as backfill in the area of the PPS-B concrete vault shall consist of crushed angular granite and shall be free from any limestone or deleterious materials. The gravel size shall conform to Florida Department of Transportation (FDOT) gradation Size Number 57.

2.04 GRANITE ROCK

- A. The granite rock used as backfill in the area of the PPS-B concrete vault shall consist of crushed angular granite and shall be free from any limestone or deleterious materials. The gravel size shall conform to Florida Department of Transportation (FDOT) gradation Size Number 4.

2.05 GRAVEL

- A. The gravel used as backfill in the area of the leachate collection pipes shall be composed of naturally occurring, rounded river rock that is evenly graded and free of sand, roots, vegetation, and other non-mineral debris or injurious coatings of any kind. The gravel size shall conform to Florida Department of Transportation (FDOT) Size Number 5 of Coarse Aggregate.

PART 3 - EXECUTION

3.01 GENERAL EXCAVATION

- A. Layout all excavations, structures, and piping, and establish elevations as shown on the Drawings. Perform all other layout work required. Layout work shall be performed by a licensed land surveyor registered in the State of Florida.
- B. During construction, shape and drain excavation. Maintain ditches and berms to provide drainage and control erosion at all times. Protect graded areas against the action of elements prior to acceptance of work. Re-establish grade where settlement, washouts, or erosion damage occurs. Damaged areas shall be repaired at no additional cost to the COUNTY.
- C. Excavated sand or soils not used for backfill shall be removed from the vicinity of the excavation and disposed of as directed by the ENGINEER as described in Part 3.06 of this section.
- D. The phosphatic clays shall be excavated in cuts not to exceed 12 inches each in depth, maintaining side slopes as noted in 3.01(E), this Section.
- E. At no time will the slopes of any excavation be steeper than 2 horizontal to 1 vertical (2:1).
- F. When excavation has reached prescribed depths, the ENGINEER and COUNTY shall be notified to allow for inspection. If materials and conditions are not satisfactory to the ENGINEER, the ENGINEER will issue instructions as to the procedures to be followed to satisfactorily complete the contract within its intended scope.
- G. If the bottom of any excavation is beyond the limits as shown on the Drawings or as directed by the ENGINEER, it shall be backfilled at the CONTRACTOR's expense with ENGINEER approved material.
- H. Excavation into the phosphatic clay area shall be maintained well drained. The CONTRACTOR shall be responsible for dewatering during excavation and construction.
- I. Excavated soil stockpiles shall not exceed 5 feet in height in areas underlain by phosphatic clay. Stockpiles shall be located a sufficient distance from the excavation so as not to induce slope failure into the excavation.
- J. Excavation shall be a continuous operation through completion. The CONTRACTOR shall not leave any phosphatic clay excavations, boreholes, or trenches open overnight. All open holes shall be backfilled to the top of the phosphatic clay layer or covered, at the ENGINEER's direction, with acceptable material prior to leaving the site. Excavation of the phosphatic clay shall not begin if weather conditions show a high probability of significant rainfall.

- K. All excavations shall conform to the Health and Safety Plan submitted under part 1.04(A), this Section.
- L. Excavation equipment shall be kept a minimum of 5 feet from the edge of cut slopes. All other equipment shall be kept a minimum of 15 feet from the edge of cut slopes to protect against slope failure into the excavation. Heavy equipment used during construction and excavation shall have a maximum ground pressure of 5 psi and have a minimum track width of 20 inches.

3.02 HORIZONTAL ACCESS PIPES

- A. Trenching operations shall proceed with due caution and protection of the existing leachate collection and removal system.
- B. Excavate trench for horizontal access pipe as indicated on the Drawings and in such a manner as will give suitable room for laying the pipe within the trenches. The CONTRACTOR shall render the bottom of the excavations firm and dry. Excavations shall be approved by the ENGINEER prior to backfilling.
- C. Place geotextile into completed trench.
- D. Place bedding gravel in accordance with FDOT Standard Specifications (1991) Section 125-4.4 for Class B Bedding. Gravel shall be shaped to conform to the shape of the outside of the pipe.
- E. After the installation of the horizontal access pipe is complete, the remaining gravel backfill may be placed.
- F. Upon completing the placement of gravel, the geotextile shall be brought together and sewn in a manner which packs the gravel and prevents the gravel pack from sagging after the sewing operation is complete.
- G. Pipe excavations shall be backfilled with the previously excavated soils. Backfill shall be placed in 8-inch loose lifts and compacted with mechanical tampers suitable for this purpose.
- H. Special care shall be taken during the placing and compacting of the backfill to protect the integrity of the pipe.
- I. Observe specific pipe manufacturer's recommendations regarding methods of backfilling and compaction.
- J. Excavation equipment shall be kept a minimum of 5 feet from the edge of cut slopes. All other equipment shall be kept a minimum of 15 feet from the edge of cut slopes to protect against slope failure into the excavation. Heavy equipment used over pipe trenching shall have a maximum ground pressure of 5 psi and have a minimum track width of 20 inches.

3.03 VAULT

- A. Excavation for the vault shall proceed with due caution and protection of the existing leachate collection and removal system.
- B. At no time shall any equipment enter the excavation. As the vault is being placed, failure of the soil overburden may result in persons or equipment sinking into the phosphatic clay. Inspection of the phosphatic clay shall not include the use of heavy equipment.
- C. Backfilling shall proceed immediately after placement of the vault. Gravel shall be placed around the perimeter of the vault to approximately the same elevation in 12-inch lifts. Sand backfill shall be placed in two-foot (24") lifts.

3.04 COMPACTION REQUIREMENTS

- A. The sand shall be placed loosely.
- B. The gravel shall be placed to achieve a firm and unyielding surface.

3.05 GRADING

- A. All backfilled and/or regraded slopes shall be uniformly dressed to the grades shown on the Drawings.
- B. The ENGINEER reserves the right to make adjustments or revisions in lines or grades as the work progresses in order to incorporate any surplus fill materials at the end of the project while still achieving the intent of the grading plan.

3.06 DISPOSAL OF PHOSPHATIC CLAY AND SURPLUS OR UNSUITABLE SOILS

- A. No materials shall be removed from the site or disposed of by the CONTRACTOR except as directed by the ENGINEER or COUNTY.
- B. CONTRACTOR shall coordinate disposal activities with the ENGINEER. Materials shall be placed in an area of sufficient distance from excavations so as to not create a surcharge loading adjacent to any excavation, and within the limits and to the fill heights as directed by the ENGINEER or COUNTY.
- C. Suitable excavated material, as directed by the ENGINEER, may be used for fill or backfill.

- END OF SECTION -

SECTION 02940 - GEOTEXTILE

Part 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this section includes the manufacture, testing, and installation of geotextile as shown on the Drawings and as specified herein, in accordance with provisions of the Contract Documents.

1.02 SUBMITTALS

- A. Submit prequalification test reports, manufacturer's data, specifications, installation instructions, roll dimensions, and geotextile approval form.
- B. Copies of evaluation reports provided by manufacturers demonstrating that properties for the materials comply with specification requirements.
- C. ENGINEER's approval shall be obtained prior to the use of any materials in the project.

1.03 PROTECTION AND STORAGE

- A. Each roll of material shall have a manufacturer's identification label. Each roll shall be labeled to provide product identification adequate for inventory and quality control purposes. The label shall provide as a minimum the manufacturer's name, product identification, lot number, roll number, and roll dimensions. Rolls shall be labeled as per ASTM D 4873, Guide for Identification, Storage, and Handling of Geotextiles.
- B. Materials shall be shipped and stored in rolls furnished at the manufacturing facility to prevent exposure of the geotextile to ultraviolet light, precipitation, moisture, mud, dirt, dust, puncture, or other damaging conditions.
- C. Rolls of geotextiles should not be stacked upon one another to the extent that deformation of the core occurs and outdoor storage should not be allowed to exceed six months. For storage more than six months, a temporary enclosure shall be constructed or they should be moved to within an enclosed facility. If stored outdoors, they shall be elevated from the ground and protected with a waterproof cover.

Part 2 - PRODUCTS

2.01 GEOTEXTILE

- A. Material shall be a non-woven, needle-punched polypropylene or polyester geotextile as manufactured by Advanced Drainage Systems, Polyfelt, Amoco, Synthetic Industries, or ENGINEER approved equivalent conforming to the following properties:

<u>Characteristics</u>	<u>Specifications</u>	<u>Test Method</u>
Weight, oz/yd ²	> 8	ASTM D 5261
Thickness, mils	> 105	ASTM D 5199
Permittivity, sec ⁻¹	> 1.2	ASTM D 4491
Apparent Opening Size, Sieve #	< 70	ASTM D 4751
Grab Strength, lbs	> 230	ASTM D 4632
Puncture Strength, lbs	> 100	ASTM D 4833
Mullen Burst Strength, psi	> 380	ASTM D 3786
Trapezoidal Tear Strength, lbs	> 8	ASTM D 4533

Part 3 - EXECUTION

3.01 GENERAL

- A. Geotextile shall be tested during manufacturing for the compliance with the following minimum test frequencies shall be observed:

<u>Property</u>	<u>Test Method</u>	<u>Minimum Frequency</u>
Weight per Unit Area	ASTM D 5261	1/100,000 sf
Thickness	ASTM D 5199	1/100,000 sf
Grab Strength	ASTM D 4632	1/100,000 sf
Puncture Resistance	ASTM D 4833	1/100,000 sf
Mullen Burst Strength	ASTM D 3786	1/100,000 sf
Trapezoidal Tear Strength	ASTM D 4533	1/100,000 sf

The surface where the geotextile is to be placed shall be smoothly graded and free of debris, depressions, holes, or obstructions which may damage the material.

- B. Geotextiles shall be installed in accordance with the manufacturer's recommendations. No equipment shall be allowed to operate on the geotextile, and any tears or damage to the geotextile shall be repaired prior to placement of sand-cement riprap, or rocks. The surface of the geotextile shall be kept relatively clean and free of debris during installation.
- C. Overlap between geotextile panels shall be as recommended by manufacturer for application. Anchoring pins or staples shall not be used.

- D. Geotextile sheets shall be joined by sewing. Sewing shall be accomplished by a chain-stitching sewing machine. The thread shall be polymeric thread which complies with geotextile manufacturer's recommendations and is a color which contrasts with the color of the geotextile. The seam shall be folded a minimum of 4 inches to one side ("J") seam and be secured with a double row of stitches. There shall be no horizontal seams on slopes unless approved by the ENGINEER.
- E. The CONTRACTOR shall place all cover materials in such a manner to prevent damage to the materials, slippage of the underlying layers, and excessive tensile stresses in the materials.

3.03 REPAIRS

- A. Any geotextile damaged during placement shall be replaced or repaired at the CONTRACTOR'S expense. A geotextile patch shall be placed over damaged areas and shall extend a minimum of 12 inches beyond the perimeter of the tear or damage. Patches shall be secured in place by sewing or thermal bonding. If thermal bonding is conducted, care shall be taken to prevent excessive heat damage to the high density polyethylene pipes and to the surrounding material. The CONTRACTOR shall be responsible for the documentation of repairs describing location and type of repair. Repair documentation shall be submitted to the COUNTY or ENGINEER.

3.04 GEOTEXTILE EXPOSURE FOLLOWING PLACEMENT

- A. Exposure of geotextiles to the elements between lay down and cover shall be limited to a maximum of 30 days to minimize ultraviolet damage. Any geotextile exposed to sunlight for more than 30 days shall be removed and replaced with new material at the CONTRACTOR'S expense.

- END OF SECTION -

SECTION 02950 - GEOGRID

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this section includes subgrade preparation, placement, and installation as required for the completion of the geogrid as shown on the Drawings and as specified herein, in accordance with provisions of the Contract Documents.

1.02 QUALIFICATIONS

- A. Manufacturer Qualifications: A qualified Manufacturer shall be a company, corporation, or firm regularly engaged in the development and manufacturer of geogrids with a history of successful production of geogrid for a minimum period of 3 years. The geogrid shall be manufactured by a single Manufacturer. The Manufacturer shall submit written information on the following:
 - 1. Quality Control procedures for production or a Quality Control Procedures Manual. Sampling procedures, test frequencies, and methods shall be defined. The Manufacturer shall, at a minimum, comply with the quality control specification for this project.
 - 2. Verification that the Manufacturer has successfully supplied geogrid during the last 3 years. The Manufacturer shall submit written information as follows:
 - a. Name and location of project and date of installation.
 - b. Contact name and phone number for each project.
 - c. Geogrid type and surface area of geogrid installed.

1.03 SUBMITTALS

- A. Thirty days prior to the delivery of the geogrid to the site the following information shall be submitted to the ENGINEER for review:
 - 1. Manufacturer's Qualification.
 - 2. Installation Plan.
 - 3. Sample Warranties.
 - 4. Geogrid Resin Information & Quality Control Certificates.
 - 5. Geogrid Manufacturer Material Information & Quality Control Certificates.
 - 6. Loading, unloading, and storage equipment recommendations.
 - 7. A list indicating correlation between the Manufacturers Quality Control Certificates and individual geogrid rolls.

- B. Roll Certification: Written on company letterhead, roll certification shall be provided for each roll of geogrid, including roll identification number, and the results of quality assurance/quality control testing performed by the manufacturer. At a minimum, the following tests shall be performed at a frequency of one per 44,000 square feet:

<u>TEST</u>	<u>PROCEDURE</u>
Mass/Unit Area	ASTM D 5261
Wide Width Tensile Strength (5% strain strength and ultimate strength)	ASTM D 4595 (each direction)

- C. Warranty: The Manufacturer shall warranty the geogrid material for a period of not less than 20 years. The CONTRACTOR shall warranty workmanship for a period of not less than 1 year from the date of final acceptance.
- D. Record Drawings: The CONTRACTOR shall submit a layout drawing reflecting as-built conditions and related installation details (i.e., panel layout, penetrations) of the actual geogrid system. The layout record drawings shall:
1. Be at the same scale as the Contract Drawings, and use applicable drafting standards including a border identifying the project.
 2. Indicate the installed field panel and seam number, configuration, dimensions, and geogrid penetrations.
 3. Include the installed area, in square feet, with surveyed coordinates of the location for the limits of installed geogrid.
 4. Include a topographic survey reflecting the installed elevation of the upper geogrid, signed and sealed by a professional surveyor in the State of Florida. The survey shall include spot elevations taken a minimum of every 50 feet.

PART 2 - PRODUCTS

2.01 GEOGRID

- A. Material shall be manufactured by Tensar, TC Mirafi, or ENGINEER approved equivalent and at a minimum, meet the following properties:

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>VALUE</u>
Mass/Unit Area	ASTM D 5261	30 oz/yd ²
Wide Width Tensile Strength (at 5% strain)	ASTM D 4595	5,700 lb/ft

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

- A. The geogrid shall be packaged and shipped by manufacturer in a manner to protect the integrity of the geogrid from damage.

- B. Each roll shall be delivered to the site bearing markings which provide: the roll and manufacturer's lot number, type, length and width of the material; and the proper direction to unroll the material to facilitate layout and positioning in the field.
- C. The CONTRACTOR shall provide transportation, labor, and handling for delivery of the geogrid to and from the project location. Special transportation or handling requirements required for the geogrid shall be provided by the CONTRACTOR.
- D. The equipment for transportation, handling, loading and unloading the geogrid shall be of sufficient size and capacity to safely and efficiently handle geogrid materials without damage occurring. The type, size and capacity shall be according to Manufacturer requirements.
- E. The geogrid shall not be stored or unloaded in areas which will impair the operations of the landfill facility or cause damage.
- F. Storage and protection requirements of the materials shall be provided by the CONTRACTOR in accordance with manufacturer's recommendations.

3.02 GEOGRID INSTALLATION

- A. Geogrid shall be laid at the proper elevation and alignment as shown on the Drawings.
- B. Overlap, joints, and repairs shall be in accordance with manufacturer's recommendations.

3.03 BACKFILL

- A. Backfill material shall be placed as shown on the Drawings and in a manner which prevents the geogrids position from changing.
- B. No vehicles, including trucks or 3- and 4-wheeled ATV's are allowed on the geogrid once it is placed until the 2 foot layer of sand has been placed on top of the geogrid. If ruts are created in the backfill during construction, they shall be filled with additional soil rather than blading adjacent material into the rut.

3.04 FINAL ACCEPTANCE

- A. The CONTRACTOR shall retain ownership and responsibility for the geogrid until final acceptance by the COUNTY.
- B. Final acceptance of the geogrid by the COUNTY will occur when:
 - 1. Installation activities are completed.

2. Documentation of installation is completed and the CONTRACTOR's final report is submitted to, and approved by the ENGINEER.
3. Documents presented in Part 1.03, this Section have been submitted to the ENGINEER and approved.

- END OF SECTION -

SECTION 03410 - PRECAST CONCRETE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this section includes the casting, delivery, and installation required for the completion of the concrete vault as shown on the Drawings and as specified herein, in accordance with provisions of the Contract Documents.

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise indicated, materials, workmanship and practices shall be in accordance with the current editions of the following standards.
 - 1. Standard Building Code.
 - 2. ACI 318, Building Code Requirements for Reinforced Concrete.
 - 3. PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products.
 - 4. ACI Detailing Manual SP-66
 - 5. CRSI Manual of Standard Practice MSP-2-01.

1.03 SUBMITTALS

- A. Fabrication shall not begin until the following information has been submitted and reviewed to the satisfaction of the ENGINEER:
 - 1. Quality Control: Verification demonstrating that the plant and production methods meet the requirements of PCI MNL 116.
 - 2. Drawings: Complete fabrication and erection drawings, signed and sealed by a Professional Engineer registered in the State of Florida. Include the bending list, steel placement drawing, and location of lifting lugs.
 - 3. Manufacturer's data sheets shall be submitted on the following:
 - 1. Waterstops.
 - 2. Grout.
 - 3. Coating.

4. Compressive strength specimen test results (i.e., cylinder breaks).

PART 2 - PRODUCTS

2.01 CONCRETE

- A. Cement shall be Portland cement Type II.
- B. Aggregates. The aggregates, fine and coarse, other than lightweight aggregate shall conform to ASTM C 33. Lightweight aggregates, fine and coarse, shall conform to ASTM C 330. Aggregates shall be free of deleterious substances causing reactivity with oxidized hydrogen sulfide. Both types of aggregate shall be graded in a manner so as to produce a homogenous concrete mix. The materials are to be accurately weighted at a central batching facility for mixing.
- C. Minimum compressive strength of concrete used for vault shall be 5,500 psi at 28 days.

2.02 DEFORMED REINFORCING BARS

- A. Deformed billet-steel bars conforming to ASTM A 615, Grade 60, including Supplemental Requirements S1.
- B. Bars shall be coated with epoxy coating by Master Builders Concrese 1170, or ENGINEER approval equal.

2.03 GROUT

- A. Grout shall be a water-proof non-shrink type.

2.05 COATINGS

- A. Both the interior and exterior surfaces of the vault shall be coated with one of the following and applied in accordance with manufacturer's recommendations:
 - 1. Industrial Concrete Sealer by Burke.
 - 2. StoProtective Epoxy Coating No. CR646 by StoPoxxy.
 - 3. Concrese No. 3042 by Master Builders Technologies.
 - 4. ENGINEER approved equivalent.

PART 3 - EXECUTION

3.01 FABRICATION

- A. Forms used for precast concrete shall be of metal and sufficiently designed and braced to maintain their alignment under pressures of the concrete during placing.
- B. Joints shall be as shown on the Drawings including waterstops.
- C. Steel reinforcing shall be as indicated on the Drawings and sufficiently tied to withstand any displacement during the pouring operation.
- D. Splices other than lap splices shall not be used. Lap splices shall achieve a minimum overlap length of 40 times the diameter of the bar.
- E. Placing: The concrete shall be handled from the mixer or transport vehicle to the place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss of ingredients, until the approved unit is completed. Maximum elapsed time from batching to placement shall be 2 hours. Concrete shall be placed in layers not over 2 feet deep. Each layer shall be compacted by mechanical internal or external vibrating equipment. Duration of the vibration cycle shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation.
- F. Lifting holes through the vault are not permitted. Equally spaced lifting lugs, rings or non-penetrating lift inserts shall be provided at the time of fabrication.
- G. Curing:
 - 1. For purposes of early reuse of forms, precast concrete may be steam cured after an initial set has taken place. The steam temperature shall not exceed 160°F, and the temperature shall be raised from normal ambient temperatures at a rate not to exceed 40°F per hour.
 - 2. The steam cured unit shall not be removed from the forms until sufficient strength is obtained for the unit to withstand any structural strain to which it may be subjected during the form stripping operation. After the stripping of forms, further curing by means of water spraying or a membrane curing compound may be used, and shall be of a clear or white type, conforming to ASTM C 309.

3.02 TESTS

- A. Five compression specimens representative of each day's work shall be poured in accordance with ASTM C 192. The specimens shall be broken at 3, 7, 14, and 28 days from the pour (with one reserved for a 56 day break) to demonstrate the strength of the concrete. Results shall be submitted to the ENGINEER.

3.03 INSTALLATION

- A. Prior to placement, the CONTRACTOR shall notify the ENGINEER and COUNTY when the vault is ready to be inspected.
- B. The openings to the vault shall be blocked to prevent construction materials from entering throughout the installation activities. The vault shall be cleaned of all construction materials by the CONTRACTOR prior to acceptance by the COUNTY.
- C. The vault shall be suspended in-place and not allowed to transmit a dead load onto the excavated sub-grade until all pipe connections are completed and the backfill is placed up to the elevation corresponding to the top of the surrounding phosphatic clay.
- D. Backfill shall be placed as shown on the Drawings. Backfill material and placement technique shall be in accordance with the requirements of Section 02220.
- E. Place a temporary plastic manhole cover over the top opening of the concrete vault. After backfilling activities, the concrete slab cover shall be placed adjacent to the vault, but not over the opening.

- END OF SECTION -

SECTION 11200 - LEACHATE PUMPS

Part 1 - GENERAL

1.01 GENERAL

- A. The work specified in this section includes the installation of leachate pumps and appurtenances as shown on the Drawings and as specified herein, in accordance with provisions of the Contract Documents.
- B. Pumps and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.
- C. The CONTRACTOR shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the COUNTY of any discrepancy before performing the work.
- D. Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards. Certified test results shall be submitted to the COUNTY.

1.02 SUBMITTALS

- A. Shop Drawings shall be submitted in accordance with the Contract Conditions and Division 1, "GENERAL SPECIFICATIONS" and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cut sheets and schematic diagrams, equipment layout and anchorage, and any other details required to demonstrate that the system has been coordinated and will operate as a unit.
- B. After approval of the Shop Drawings, and not later than 2 weeks prior to the date of final completion, the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.
- C. OPERATING AND MAINTENANCE INSTRUCTIONS
 - 1. The CONTRACTOR shall furnish to the COUNTY five complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and a brief description of all equipment and basic operating features.
 - 2. The CONTRACTOR shall furnish to the COUNTY five complete copies of maintenance instructions listing routine maintenance procedures,

possible breakdowns and repairs, and troubleshooting guides. The instructions shall include simplified diagrams for the system as installed.

3. The CONTRACTOR shall conduct training on the operation of the pump system. The training period shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the Operating and Maintenance Instructions.
4. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form for the wiring and control diagrams, and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted to the COUNTY for approval prior to posting. The instructions shall be posted before acceptance testing of the systems.

D. PERFORMANCE TEST REPORT AND PUMP CURVE

1. Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.
2. A pump characteristic curve for the installed unit shall be submitted by the CONTRACTOR. The curve shall be in accordance with the standards of the Hydraulic Institute showing capacity in gallons per minute, NPSH, Total Dynamic Head (TDH), efficiency, and pumping horsepower from 0 to 110 percent of design capacity.

1.03 MANUFACTURER'S SERVICES

- A. The CONTRACTOR shall obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.04 DELIVERY AND STORAGE

- A. All equipment delivered and placed in storage shall be stored with protection from weather, dirt and dust, and other contaminants.

Part 2 - PRODUCTS

2.01 GENERAL

- A. Pump materials and equipment shall conform to the respective standards and other requirements specified herein.
- B. Miscellaneous fasteners such as bolts, nuts, washers, and all other types of supports necessary for installation of pump-motor assemblies shall be furnished and shall be of 304 stainless steel.

2.02 PUMP CHARACTERISTICS

- A. The CONTRACTOR shall provide two submersible pumps constructed for performance in the corrosive environment of pumping leachate. The CONTRACTOR shall install one of the submersible pumps and provide the second as a back-up. The pump will be a sealed unit with bottom intake and level control sensor. A transmitter mount shall be welded at the center bottom for liquid level control. The unit shall be capable of pumping from 24 inches down to within 10 inches of the sump bottom without any loss of performance or damage to the pump.
- B. The pump must fit through HDPE pipe, 18 inches in diameter, SDR 13.5, and must be able to be moved through the HDPE pipe a distance of at least 1,000 feet. Each pump shall be equipped with a disconnect system. The discharge of the pump will have a welded flange of 304 stainless steel capable of being connected to the flange of a 4-inch diameter SDR 11 HDPE pipe.
- C. The pump shall be a centrifugal submersible EPG SurePump Wheeled Sump Drainer, Model WSD PT 27-1, or an ENGINEER-approved equal. The unit shall come with a 2.0 horsepower submersible electric motor for operation on 230 volts, 3 phase, 60 hertz service with 1100 feet of power cable.
- D. The pump shall have a 3-inch welded flange connection as above and be capable of delivering 150 G.P.M. at 10 feet of TDH. The unit will be fitted with 1100 feet of 4-inch diameter SDR 11 HDPE pipe.
- E. The motor shall be a submersible, hermetically sealed Franklin motor or ENGINEER-approved equal, designed for continuous duty, capable of sustaining up to 120 starts per day. The motor shall be connected to the pump via a motor adaptor and coupling in 304 stainless steel. The three-phase motor shall have thermal protection located in the control panel which is to be manually reset in the event of over-load. The motor leadwire shall be no-splice with waterproof "chemically resistant" insulation and be of the length as shown on the drawings.
- F. Pump Controls shall be EPG's L925 PT PumpMaster three-phase Control Panel or an ENGINEER-approved equal as in Section 16920 of these

Specifications. Pump controls shall be matched to operate with the pump as specified, and as indicated on the Drawings.

- G. The manufacturer shall warrant the units against defects in materials and workmanship for a period of twelve (12) months from the date of installation.

2.03 MATERIALS

- A. Major pump components and fasteners, diffuser chambers and impeller(s) shall be made of 304 stainless steel. Seals are to be made of Teflon™. Each unit shall include a built-in check valve with housing and disc of 304 stainless steel and check valve seat of Teflon. The shaft shall be of 304 stainless steel and rotate on bearings which are product lubricated. The diffuser chambers shall be fitted with Teflon™ impeller seal rings. The impeller(s) shall be closed.

2.04 LEVEL SENSOR

- A. The submersible pressure transmitter level sensor shall have a range of 0 to 11.5 feet with a 4 to 20 mA output signal. Transmitter construction shall be stainless steel body, stainless steel diaphragm and Viton seals with chemical resistant signal cable. The transmitter circuit shall be protected by intrinsically safe barriers.
- B. The system shall be designed to start the pump on a change in liquid level as sensed by the pressure transmitter. The pump will continue to run until the selected level is reached. If the liquid level changes beyond set points, a high and/or low level will be annunciated.
- C. The system shall be environmentally safe. No pumped liquid/compressed air mixture allowed to atmosphere.

Part 3 - EXECUTION

3.01 PUMP INSTALLATION

- A. Pumping equipment and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including but not limited to such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, starters, power supply, and controls.

3.02 PIPING

- A. Installation of pipes shall be as specified in SECTION 15080 "High Density Polyethylene Pipes".

3.03 WIRING

- A. Wiring shall follow manufacturer's instructions and as shall be as indicated on the Drawings.

3.04 PAINTING

- A. Pumps and motors shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer.

3.05 FIELD TESTING AND ADJUSTING EQUIPMENT

- A. Prior to acceptance, an operational test of all pumps, starters, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.
- B. If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

3.06 WARRANTY

- A. The pumps and component parts shall be warranted against defects in material and workmanship for a period of one year from the date pumps are installed at the site and tested satisfactorily to the COUNTY. Defective pumps and parts shall be replaced at no charge to the COUNTY for the duration of the warranty period. All service shall be performed by factory authorized representatives. Replacement parts and components shall be new.

- END OF SECTION -

SECTION 15080 - HIGH DENSITY POLYETHYLENE PIPES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this section includes supplying, fabricating, transporting, storing, quality control/quality assurance laboratory services required for the installation of the High Density Polyethylene (HDPE) horizontal access pipe, drain pipes, and leachate collection pipes as shown on the Drawings and as specified herein, in accordance with provisions of the Contact Documents.

1.02 SUBMITTALS

- A. All product data shall be submitted, to the ENGINEER for approval, at least 14 calendar days prior to installation.
- B. Certification and Test Reports: The CONTRACTOR shall submit to the COUNTY a manufacturer's certification that the HDPE pipe was manufactured from resins in compliance with these Specifications. The certificate shall state the specific resin, its source and the specific information required by ASTM D 1248.
- C. The manufacturer must warrant the pipe to be free from defects in material and workmanship in accordance with ASTM D 3350 and F 714.
- D. Manufacturer instructions for installation of the piping systems, including method of joining pipe sections.
- E. Manufacturer's recommendations for storage, handling, installation, inspection, and repair for the piping systems.
- F. Verification that CONTRACTOR's pipe welding technician has been certified by the manufacturer to conduct heat fusion connections.
- G. Results of hydrostatic tests as presented in Section 3.06, this Section.

PART 2 - PRODUCTS

2.01 HORIZONTAL ACCESS PIPE

- A. Polyethylene pipe resins shall be high performance, high molecular weight, high density polyethylene (HDPE) conforming to ASTM D 1248 (Type III, Class C, Category 5, Grade P34), and ASTM D 3350 (Cell Classification PE 345434C, with material designation of PE 3408). The pipe and fittings shall be manufactured with a minimum of 2 percent carbon black to withstand outdoor exposure without loss

of properties. All HDPE pipe shall meet the requirements of ASTM F 714. The pipe shall be as manufactured by Driscopipe, or ENGINEER approved equal.

- B. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, class, and Standard Dimension Ratio (SDR) of 13.5.
- C. All HDPE pipe and fittings shall be furnished by a single manufacturer who is experienced, reputable, and qualified in the manufacture of the items to be furnished. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same manufacturer's specification as the raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects and shall be identical in color, density, melt index and other physical properties.

PART 3 - EXECUTION

3.01 TRANSPORTATION, HANDLING, AND STORAGE

- A. Transportation: Care shall be taken not to cut, kink or otherwise damage the pipe material during transportation.
- B. Handling:
 - 1. Ropes, fabric or rubber-protected slings and straps shall be used when handling pipe materials.
 - 2. Chains, cables, or hooks inserted into the pipe ends shall not be used. A sling with a spreader bar shall be used for lifting each length of pipe section. Pipe materials shall not be dropped or dragged on rocky or rough ground.
- C. Storage:
 - 1. Pipe materials shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage them.
 - 2. Stacking of the pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions.
 - 3. Where necessary due to ground conditions, the pipe shall be stored on wooden pallets and supported to prevent deformation of the pipe.
- D. Pipe material which is damaged by the CONTRACTOR shall be replaced at no additional cost to the COUNTY.

3.02 EXCAVATION AND BACKFILL

- A. All excavation in the preparation of horizontal access pipe shall be performed in accordance with the requirements of Section 02220 - Excavation, Backfill, Fill and Grading.

3.03 HORIZONTAL ACCESS PIPE

- A. The installation of pipe shall be in accordance with the manufacturer's recommendations.
- B. Upon satisfactory excavation of the pipe trench, pipe bedding shall be constructed as to provide continuous uniform support for the piping.
- C. The interior of all pipes shall be thoroughly cleaned of all foreign material before being lowered in the trench and shall be kept clean during laying operations by means of caps, or other industry-approved methods.
- D. Each pipe shall be carefully examined for damage (i.e., cuts, scratches, gouges) before being laid, and sections of pipe with damage exceeding manufacturer recommendations shall be replaced at CONTRACTOR's expense. Pipe shall be repaired according to manufacturer's recommendations.
- E. Under no circumstances shall pipe be installed in watered-in trenching. No pipe shall be laid when trench or weather conditions are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.
- F. Cutting shall be done with approved mechanical methods in a manner that will not damage the pipe. Pipe shall be firmly and uniformly supported during cutting and fusion activities. Care shall be taken that pipe is not disturbed until joints are cured.
- G. Each pipe section shall be joined in strict conformance with the pipe manufacturer's recommendations using approved equipment. Joining and installation of pipe shall be accomplished by a trained and authorized technician.
- H. The CONTRACTOR shall protect the pipe and workers from the build-up of static electricity, which can be generated in the pipe by friction from the handling of pipe in storage, shipping, and installation. The CONTRACTOR shall minimize the hazard of discharge by following recommendations by the pipe manufacturer, such as applying a film of water to the work surface to drain away the static electricity.
- I. When work is not being performed, the open ends of the pipe shall be closed by fabricated caps, or by other approved means. All caps shall be outside diameter fitting caps. No caps will be allowed that require insertion of the cap into the pipe.

Any sediment or other contaminants allowed to enter pipe by failure to place cap over end shall be removed at CONTRACTOR's expense.

J. The ENGINEER shall be notified prior to pipe being backfilled. The ENGINEER will inspect the following items at this time:

1. All joints.
2. Pipe integrity.
3. Pipe foundation for rocks and foreign material.
4. Proper trench or foundation slope.
5. Trench or foundation contour to ensure the pipe will have uniform and continuous support.

Any pipe which is disturbed or found to be defective after laying shall be taken up and relaid or replaced by the CONTRACTOR.

K. The pipes shall be grouted at the vault connections as shown on the Drawings.

L. The portion of pipe in the vault shall receive endcaps as shown on the Drawings.

M. The termination of the pipes shall be as shown on the Drawings.

3.04 PERFORATIONS

- A. Horizontal Access Pipe: Where indicated on the Drawings, perforations shall be a maximum of 90 degrees apart on the circumference of the pipe, 0.5 inches in diameter and spaced every 6 inches along the length of the pipe.
- B. Leachate Collection Pipe and Drain Pipe: Where indicated on the Drawings, perforations shall be a maximum of 120 degrees apart on the circumference of the pipe, 0.5 inches in diameter, and spaced every 6 inches along the length of the pipe.

3.05 CERTIFICATION OF COMPLETION

- A. Upon completion of the covering operation over the pipe, the CONTRACTOR shall certify the following to the COUNTY:
1. The piping system has been constructed in accordance with the approved project plans and specifications.
 2. The piping system has not been damaged during construction or the backfilling operation.

- END OF SECTION -

Revised April 8, 1998

HIGH DENSITY POLYETHYLENE PIPE

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suitably designed to resist test pressures shall be installed as necessary and prudent.

- C. Equipment: Equipment and personnel for the testing procedures will be furnished by the CONTRACTOR. Water is available onsite for the hydrostatic testing. The CONTRACTOR shall be responsible for cost associated with obtaining and transporting the water. Equipment shall consist of a polyethylene flange adaptor with a HDPE blind flange. HDPE reducers shall be utilized to adapt test flange to size of pipe being tested. Tapped and threaded into the blind flange will be a pressure gauge capable of reading pressures from 0 to 40 psi (graduated in 0.1 psi increments), hydraulic pump, suitable hose and suction pipe as required, graduated containers.
- D. Like sizes of polyethylene piping shall be butt welded together into testing segments not to exceed 1,000 feet. Segments shall be connected to a testing apparatus on one end and fitted with temporary caps on all openings and at the point of transition between solid and perforated pipe.
- E. The segment to be tested should be allowed to reach constant and/or ambient temperature before initiating timing of the test. The test should be performed during a period when the pipe segment will be out of direct sunlight when possible, i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes which will occur during temperature fluctuations.
- F. After all free air is removed from the test section, raise the pressure at a steady rate to the required pressure. The initial test pressure shall be applied and allowed to stand without makeup pressure for a sufficient time to allow for diametric expansion or pipe stretching to stabilize (usually within 2-3 hours). After this stabilizing period, the test section can be returned to the test pressure, the pump turned off, and a final test pressure of 35 pounds per square inch-gauge (psig) for 1 hour.
- G. A leakage test shall be conducted concurrently with the hydrostatic pressure test. Leakage shall be defined as the measured quantity of water that must be supplied from the calibrated graduated cylinder into the pipe to maintain the pressure within 5 psig of the specified test pressure during the pressure test portion the testing. The allowable amount of makeup water for expansion during the pressure test is outlined in Table 15080-1.
- H. If there are no visual leaks or significant pressure drops or leakage during the final test period, the pipeline passes the test. A significant pressure drop is defined as an observable pressure drop of 0.1 psi or greater. Refer to ANSI B 31.8 Appendix N for a general recommended practice and procedure for hydrostatic testing. The ENGINEER shall be notified prior to commencement of the testing procedure and shall be present during the test.

**TABLE 15080-1
ALLOWANCE FOR EXPANSION
(U.S. Gals./ 100 feet of Pipe)**

Nominal Pipe Dia. (in)	TEST DURATION		
	1 Hour	2 Hour	3 Hour
8	0.50	1.00	1.50
18	0.50	1.00	1.50

- I. Test Failure: The following steps shall be performed when a pipe segment fails the test described above:
 - 1. The pipe and all joints shall be inspected for cracks, pinholes, or perforations.
 - 2. All blocked risers and capped ends shall be inspected for leaks.
- J. All pipe and joint leaks shall be repaired by cutting out the leaking area and rewelding the pipe. After all leaks are repaired, a retest shall be performed. This process shall be repeated until a successful test is achieved.

3.07 CERTIFICATION OF COMPLETION

- A. Upon completion of the covering operation over the pipe, the CONTRACTOR shall certify the following to the COUNTY:
 - 1. The piping system has been constructed in accordance with the approved project plans and specifications.
 - 2. The piping system has not been damaged during construction or the backfilling operation.

- END OF SECTION -

SECTION 16010 - GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this section includes labor, material, equipment and services necessary for complete, safe installation in conformity with all applicable codes and authorities having jurisdiction, including temporary light and power, cutting and patching as shown on the Drawings and as specified herein, in accordance with provisions of the Contract Documents.
- B. The work shall include coordinating, furnishing, installing, and testing of the following:
 - 1. Electrical service to the site with coordination of the power company as necessary.
 - 2. Conduit, wire, and field connections for all motors, motor controllers, control devices, control panels, and any packaged equipment furnished.
 - 3. Field wiring for all field-mounted instruments. All conduit, wire, and interconnections between process instrumentation primary elements, transmitters, local indicators and control panels.
 - 4. Lightning and surge protection equipment, wiring, and cables at process instrumentation transmitters.
 - 5. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no additional cost to the COUNTY.

1.02 SUBMITTALS

- A. Shop Drawings shall be submitted in accordance with the Contract Conditions and Division 1 "GENERAL SPECIFICATIONS" and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cut sheets and schematic diagrams, equipment layout and grounding and any other details required to demonstrate that the system has been coordinated and will operate as a unit.
- B. All product data shall be submitted to the ENGINEER for approval, at least 14 calendar days prior to installation. No items nor systems shall be delivered to the site, or installed until approved. After the proposed materials have been

approved, no substitution will be permitted except where approved by the ENGINEER in writing.

- C. After approval of the Shop Drawings and not later than one (1) month prior to the date of acceptance, the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies with current unit prices and sources of supply.
- D. The CONTRACTOR shall furnish to the COUNTY five complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation, and shutdown as noted in Section 15452 - Leachate Pumps.
- E. Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

1.03 MANUFACTURER'S SERVICES

- A. The CONTRACTOR shall obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.04 DELIVERY AND STORAGE

- A. All equipment delivered and placed in storage shall be stored with protection from the weather, dirt and dust, and other contaminants.

1.05 REFERENCES

- A. The National Electrical Code and Publications of the Organizations listed below are included in these specifications by reference. All work shall be manufactured, tested and installed in accordance with the latest issue of such standards.
 - 1. American Society for Testing and Materials (ASTM)
 - 2. Underwriters' Laboratories, Inc. (UL)
 - 3. Insulated Power Cable Engineers Association (IPCEA).
 - 4. National Electrical Manufacturers Association (NEMA).
 - 5. Institute of Electrical and Electronic Engineers (IEEE).
 - 6. American National Standards Institute, Inc. (ANSI)

PART 2 - PRODUCTS

2.01 QUALITY OF MATERIALS

- A. The materials and equipment used shall be new, free from defects and listed by the Underwriters' Laboratories, Inc.

2.02 MATERIALS AND INSTALLATION

- A. All conduits shall be galvanized rigid steel with lock nuts and bushings, with the exception that where specifically allowed by the National Electrical Code and applicable local codes, branch circuit raceways may be Electrical Metallic Tubing (EMT) or PVC Schedule 40. (PVC may be used below grade only). Final connections to motors and other vibrating equipment shall be made with flexible type conduit.
- B. All conduits must be sealed. Each open end of conduit should be properly sealed as per Section 501-5 of the NEC.
- C. Branch circuit conductors shall be THWN Copper No.12, unless otherwise noted. No aluminum shall be permitted. All branch circuits shall be wired with color coded wire.

2.03 ELECTRICAL SERVICE SYSTEM

- A. In general, all electrical equipment, metallic conduit, motor frames, panelboards, etc., shall be grounded with a separate system. The grounding conductor shall run from the main switch ground to all panels and from grounding lugs on each panel to each branch circuit device and fixture in accordance with the specific rules of Article 250 of the NEC. All panels shall have a separate neutral bar isolated from the standard neutral bar for grounding.
- B. The facilities and equipment required to provide all power for construction, lighting, balancing and testing prior to final acceptance of the project shall be provided by the CONTRACTOR.

2.04 NAMEPLATES

- A. The CONTRACTOR shall provide nameplates for disconnect switches, transformers, circuit breakers, panels, cabinets, transformer enclosures, motor controllers, motor control centers and motor control panels.
 - 1. White laminated plastic nameplates with 3/4 inch black lettering shall be provided and attached with fasteners using epoxy cement.

2. The inscription shall be subject to review by the ENGINEER and shall identify the name of the process equipment it serves (i.e. Pump Station B), and the voltage.

2.05 PROTECTION OF WORK

- A. The CONTRACTOR shall protect the work against damage from all causes, provide and maintain protective coverings to exclude dirt, dust, and paint from the equipment and components.
- B. The CONTRACTOR shall thoroughly clean all equipment upon completion of the work. All dust, dirt, paint spatter, stains and discolorations of the factory finish shall be removed. Finishes shall be restored to the original condition.
- C. The CONTRACTOR will repair all damaged equipment, cables, surfaces and finishes equal to new and have such work approved by the ENGINEER before acceptance of the work.
- D. All metallic materials shall be protected against corrosion. Metallic parts exposed to weather shall be given a rust-inhibiting treatment and standard finish by the MANUFACTURER. Aluminum where connected to dissimilar metal shall be protected by approved metals, and zinc-coated in accordance with ASTM A123 or A153 except where other equivalent protective treatment is specifically approved by the ENGINEER. Corrosion-resistant steel shall not be used in this application.

2.06 EXECUTION

- A. Electrical equipment and appurtenances shall be installed as required for proper operation and in accordance with the manufacturer's written instructions. All components required for a complete and operating electrical system shall be provided.

PART 3 - EXECUTION (NOT USED)

- END OF SECTION -

SECTION 16920 - PUMP CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide labor, material, equipment and services necessary for complete, safe installation in conformity with all applicable codes and authorities having jurisdiction, including temporary light and power, cutting and patching and in general as specified herein, as shown on the Drawings, and in accordance with the provisions of the Contract Documents.
- B. The work shall include coordinating, furnishing, installing, and testing of the following: one EPG Companies Inc., U.L. listed, L925 PT 3-phase control panel or ENGINEER-approved equal to operate pump motor and auxiliary equipment in manual or automatic mode.
 - 1. It is the intent of these Specifications that the pump control system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no additional cost to the COUNTY.

1.02 SUBMITTALS

- A. Shop Drawings shall be submitted in accordance with the Contract Conditions and Division 1 "GENERAL SPECIFICATIONS" and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cut sheets and schematic diagrams, equipment layout and grounding and any other details required to demonstrate that the system has been coordinated and will operate as a unit.
- B. All product data shall be submitted to the ENGINEER for approval, at least 14 calendar days prior to installation. No items nor systems shall be delivered to the site, nor installed until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the ENGINEER in writing.
- C. After approval of the Shop Drawings and not later than one (1) month prior to the date of acceptance, the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies with current unit prices and sources of supply.

- D. The CONTRACTOR shall furnish to the COUNTY six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation, and shutdown as noted in Section 15452 - Leachate Pumps.
- E. Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

1.03 MANUFACTURER'S SERVICES

- A. The CONTRACTOR shall obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.04 DELIVERY AND STORAGE

- A. All equipment delivered and placed in storage shall be stored with protection from the weather, dirt and dust, and other contaminants.

1.05 REFERENCES

- A. Materials and installation, as a minimum, shall conform with local and state codes and ordinances. Equipment shall conform to National Electrical Manufacturers Association (NEMA) standards, and the National Electric Code (NEC). Standards of quality workmanship established by any stated codes and ordinances in these specifications or on the drawings shall not be reduced.
- B. The National Electrical Code and Publications of the Organizations listed below are included in these specifications by reference. All work shall be manufactured, tested and installed in accordance with the latest issue of such standards.
 - 1. American Society for Testing and Materials (ASTM)
 - 2. Underwriters' Laboratories, Inc. (UL)
 - 3. Insulated Power Cable Engineers Association (IPCEA).
 - 4. National Electrical Manufacturers Association (NEMA).
 - 5. Institute of Electrical and Electronic Engineers (IEEE).
 - 6. American National Standards Institute, Inc. (ANSI)

PART 2 - PRODUCTS

2.01 QUALITY OF MATERIALS

- A. The materials and equipment used shall be new, free from defects and listed by the Underwriters' Laboratories, Inc.

2.02 PANEL ENCLOSURE

- A. The CONTRACTOR shall provide a NEMA type 4 panel enclosure. The enclosure shall come equipped with an inner door, stainless steel drip shield and tamper resistant latch. The NEMA 4 enclosure shall be finished with polyester urethane paint. There shall be permanently affixed to the interior side of the exterior enclosure door a nameplate containing the following information: voltage, phase, rated horsepower, amps, date built, and location information of the pump and control panel manufacturer.

2.03 CONTROL SYSTEM

- A. The control system will operate from site power of 230 volt, 60 hertz, 3 phase power supply. Pump control components will be sized to operate the pump motor of specified horsepower.
- B. The control panel shall include the following as standard features:
 - 1. A main 40 amp Disconnect Switch with 230 Volt, 12 Amp dual element type fuses.
 - 2. A "Hand-Off-Auto" selector switch will be provided to allow for manual or automatic operation. The selector switch shall be a heavy duty, oil tight, NEMA 4 rated switch mounted on the inner door.
 - 3. The motor starter will be sized to the pump motor horsepower, and shall be equipped with built in single phasing protection and ambient compensated, quick trip adjustable thermal overloads.
 - 4. A motor overload light will indicate motor not running due to overload condition. Light shall be heavy duty, oil tight, NEMA 4 rated with voltage surge suppressor to prolong lamp life.
 - 5. The control transformer will have a fused primary to isolate control circuit from power circuit and for easier and safer field wiring of accessories. It shall lower incoming voltage to 120 Volts.

6. The level control will be EPG Companies Inc., LevelMaster™ Level Control or an ENGINEER-approved equal. The LevelMaster shall be mounted on the inner door. The meter shall have a digital readout and the capability to monitor and maintain pumping operations as well as at least two other level signals. Level control shall be accurate to within 0.1 inch.
 7. The heater with adjustable thermostat will be provided to promote even distribution of heat and elimination of hot spots and condensation. Heater element shall be mounted in the space between the subpanel and the back of the enclosure and provide a minimum of 100 inches square of heating area.
 8. The lightning arrestor shall be grounded, metal to metal, to water strata.
 9. A terminal strip shall be provided for easy connection of external components. Terminal points shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently shown on electrical schematic diagrams.
 - a. An electrical schematic diagram shall be permanently affixed to the interior side of the exterior enclosure door and a copy supplied to the OWNER at start-up. The schematic diagram shall include the rated amperage, voltage, horsepower, and full-load amps for all components. Included on the mylar drawing shall also be the wire code, power schematic, control schematic, physical layout, terminal schedule and detailed parts list identifying each component, manufacturer, and part number in the control panel.
 10. An industrial corrosion inhibitor emitter will be provided that shall protect internal components of the control panel from corrosion for one year.
- C. The level sensor shall be EPG Companies submersible pressure transmitter or ENGINEER-approved equal. It shall have a range of 0 to 11.5 feet with a 4 to 20 MA output signal. Transmitter construction shall be stainless steel body, stainless steel diaphragm and Viton seals with a chemical resistant signal cable. The transmitter circuit shall be protected by intrinsically safe barriers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The control panel, equipment, and appurtenances shall be installed in the position indicated on the drawings as required for proper operation and in accordance with the manufacturer's written instructions. All components, wiring, and connections for power to the system required for a complete and operating pump control system shall be provided.

3.02 PROTECTION OF WORK

- A. The CONTRACTOR shall protect the work against damage from all causes, provide and maintain protective coverings to exclude dirt, dust, and paint from the equipment and components.
- B. The CONTRACTOR shall thoroughly clean all equipment upon completion of the work. All dust, dirt, paint spatter, stains and discolorations of the factory finish shall be removed. Finishes shall be restored to the original condition.
- C. The CONTRACTOR will repair all damaged equipment, cables, surfaces and finishes equal to new and have such work approved by the ENGINEER before acceptance of the work.
- D. All metallic materials shall be protected against corrosion. Metallic parts exposed to weather shall be given a rust-inhibiting treatment and standard finish by the MANUFACTURER.

- END OF SECTION -

ATTACHMENT 2
SETTLEMENT ANALYSIS

CLIENT: Hillsborough	PROJECT: Southeast County Landfill	JOB NO: 0995029.13
SUBJECT: Clay Settlement Calculation	BY: KAS	DATE: Jan. 8, 1998
	CHECKED: LER	DATE: Feb. 4, 1998

OBJECTIVE: Estimate amount and time for clays to settle in Phases IV and VI after the Lift 7 is placed at locations where settlement plates are recorded.

	PPS-B	Phase IV (piezometer location)
GIVEN: Initial Clay Top Elevation:	121.5 ±	121.0 ±
Current Elevation:	116.81	115.88
Bottom Elevation:	105.5 ±	107.5 ±
Initial Clay Thickness:	18.0'	13.5'
Current Waste Thickness:	N/A	20'
Waste Placement Dates:	N/A	7/90 to 11/90 & 6/94 to 5/96
Final Sand Thickness:	3'	3'
Sand Placement Date:	9/92	6/90
Lift 7 Thickness:	46'	46' [170-(121 + 3)]
Sand Density:	120 #/CF	
Waste Density:	74 #/CF	

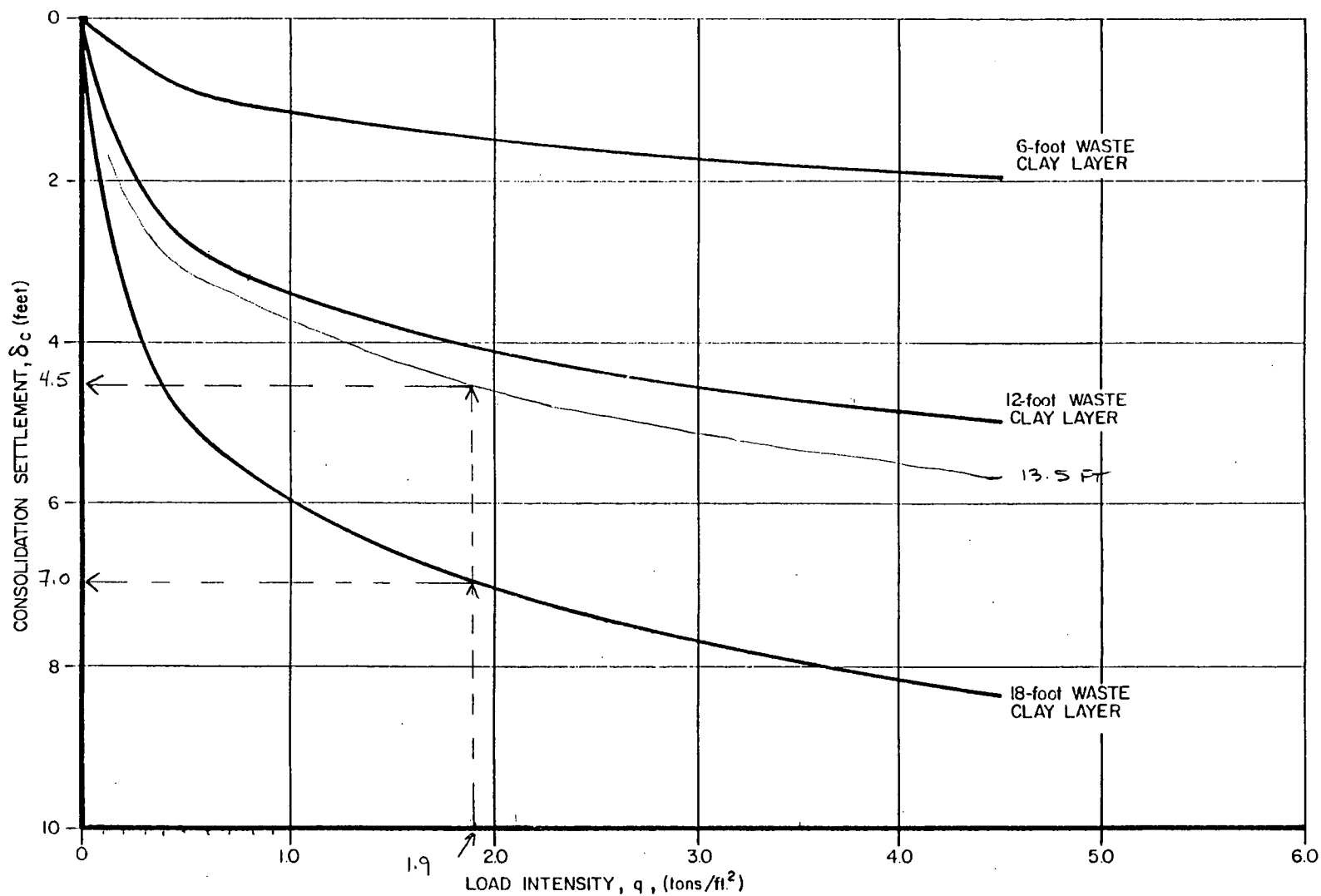
PHASE IV:

1. Load intensity in Phase IV after Lift 7 at piezometer location under waste and sand:
 $(46') \times (74 \text{ \#/CF}) + (3') \times (120 \text{ \#/CF}) = 3,764\text{ \#/SF} = 1.9 \text{ TSF}.$
2. Consolidation settlement under 1.9 TSF for 13.5 feet of clay is 4.5 feet (see attached Figure 6.11).
3. The 4.5 feet from the initial clay elevation in Phase IV of 121.0 is 116.5.
4. Use existing top of clay at piezometer of 115.88 since it's lower.
5. Assume Phase IV will settle an additional 0.5' under Lift 7 to 115.38.

PHASE VI:

1. Load intensity in Phase VI after Lift 7:
 $(46') \times (74 \text{ \#/CF}) + (3') \times (120 \text{ \#/CF}) = 3,764\text{ \#/SF} = 1.9 \text{ TSF}.$
2. Consolidation settlement under 1.9 TSF for 18 feet of clay is 7.0 feet.
3. The 7.0' from the initial clay elevation in Phase VI of 121.5 is 114.5.
4. Phase VI consolidation time (equation, T_v , and C_v from Ardaman 1983):
 $[T_v (H^2)]/C_v = [1.5 (116.81-105.0)^2] / 5 \text{ SF/YR} = 9.6 \text{ years}.$
5. Time may be less since only elevation 115.38 is needed, and not 114.4.

CONCLUSION: Worst case, assume 7 to 9 years after the completion of Lift 7 for PPS-B to be lowest clay surface elevation in the landfill.



VARIATION OF CONSOLIDATION SETTLEMENT WITH LOAD INTENSITY FOR
WASTE PHOSPHATIC CLAY LAYERS OF VARIOUS THICKNESS



Ardaman & Associates, Inc.
Consulting Engineers in Soil Mechanics,
Foundations, and Material Testing

HYDROGEOLOGICAL INVESTIGATION
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

DRAWN BY: T.S. CHECKED BY: J.C. DATE: 1/20/83
FILE NO. 81-159 APPROVED BY: H.C. (Handwritten signature)

ATTACHMENT 3
GRADATION CALCS

SCS ENGINEERS

SHEET 1 OF 2

CLIENT	HILLS CNTY	PROJECT	SELF - PPS-B	JOB NO.	0995029.13
SUBJECT	SOIL FILTER CALCULATIONS			BY	KAD
				CHECKED	2/10
				DATE	2-4-98
				DATE	2-5-98

START W/ KNOWN INFORMATION ON SAND TAILINGS:
(ATTACHMENT 1)

$$\begin{aligned} \checkmark d_{15} &= 0.19 \text{ mm} \\ \checkmark d_{85} &= 0.49 \text{ mm} \end{aligned} \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{SEE ATTACHED GRAIN SIZE DISTRIBUTION GRAPH}$$

SAND FILTER PROFILE:

LANDFILL

SAND TAILINGS (ST) - EXISTING (ATTACH. 1)

COARSE SAND (CS) - 6/20 SAND (ATTACH. 2)

GRAVEL (G) - FOOT TYPE (ATTACH. 3)

ROCK (4) - EXISTING ON-SITE (ATTACH. 3)

CONCRETE

VAULT

① CALCULATE COARSE SAND CRITERIA FOLLOWING US EPA GUIDANCE (ATTACH. 4):

$$\begin{aligned} \checkmark \text{EQ 5.2} - (D_{15})_{CS} &\leq (4 \text{ to } 5)(D_{85})_{ST} \\ &\leq 4(0.49) \text{ to } 5(0.49) \text{ mm} \\ &\leq 1.96 \text{ mm to } 2.45 \text{ mm} \quad (D_{15})_{6/20} = 1.1 \text{ mm} \checkmark \end{aligned}$$

$$\begin{aligned} \checkmark \text{EQ 5.3} - (D_{15})_{CS} &\geq 4(D_{15})_{ST} \\ &\geq 4(0.19 \text{ mm}) \\ 1.1 \text{ mm} &\geq 0.76 \text{ mm} \quad (D_{15})_{6/20} = 1.1 \text{ mm} \therefore \text{OK} \checkmark \end{aligned}$$

$$\begin{aligned} \text{EQ 5.4} - (D_{15})_{G} &\leq 4 \text{ to } 5 (D_{85})_{CS} \quad (D_{85})_{CS} = 1.8 \text{ mm} \\ \text{Range } \begin{cases} 8.8 \\ 7.4 \\ 6.2 \text{ AVG} \end{cases} &\leq 4(2)^{1.8} \text{ to } 5(2)^{1.8} \\ &\leq 8 \text{ mm to } 10 \text{ mm} \quad (D_{15})_{G} = 7.4 \text{ mm} \therefore \text{OK} \\ &\quad 7.2 \text{ TO } 9.0 \quad \text{AVG } 6.2 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{EQ 5.5} - (D_{15})_{G} &\geq 4(D_{15})_{CS} \\ &\geq 4(2)^{1.1} \\ 7.4 \text{ AVG} &\geq 8 \text{ mm} \quad (D_{15})_{G} \approx 8 \therefore \text{O.K.} \\ &\quad 4.4 \end{aligned}$$

SCS ENGINEERS

SHEET 2 OF 2

CLIENT HILLS CNTY	PROJECT SELF - PPS-B	JOB NO. 0995029.13
SUBJECT SOIL FILTER CALC (CONT.)	BY KMS	DATE 2-4-98
	CHECKED JTO	DATE 2-5-98

- ② CHECK SOIL RETENTION BETWEEN NO. 57 & NO. 4 STONE
BY REPEATING:

$$\begin{aligned} \text{EQ 5.2} - (D_{15})_4 &\leq 4 \text{ to } 5 (D_{85})_{57} \\ &\leq 4(18) \text{ to } 5(18) \quad \checkmark \\ &\leq 72 \text{ mm to } 90 \text{ mm} \end{aligned}$$

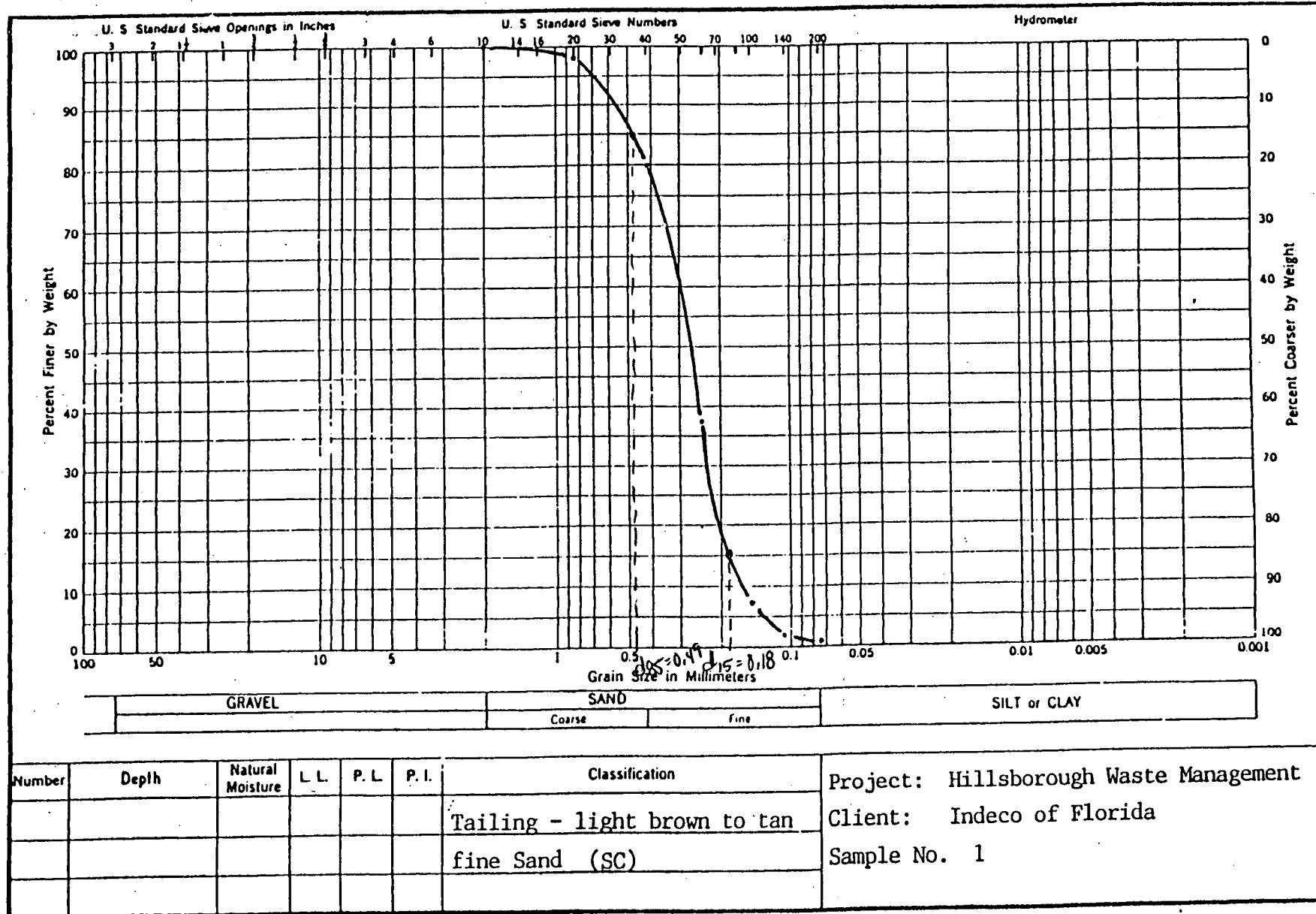
$$\text{ACTUAL } (D_{15})_4 \stackrel{N}{=} 20 \text{ mm} \therefore \text{O.K.}$$

$$\begin{aligned} \text{EQ 5.3} - (D_{15})_4 &\geq 4 (D_{15})_{57} \quad \left. \begin{array}{l} 8.8 \\ 7.4 \text{ avg} \\ 6.6 \end{array} \right\} \checkmark \\ &\geq 4 (7.5) 7.4 \\ 20 &\geq 31.2 \text{ mm} \therefore \text{NOT OK (SEE NOTE)} \\ &\quad 35.2 \rightarrow 26.4 \end{aligned}$$

NOTE: THE HYDRAULIC CONDUCTIVITY BETWEEN THE SOIL LAYERS IS NOT CRITICAL BECAUSE THE LEACHATE WILL REACH THE VAULT THROUGH THE PERFORATED PIPES. THE MORE IMPORTANT CRITERIA IS SOIL RETAINAGE, FOR WHICH THE CHOSEN SOILS APPEAR TO BE ADEQUATE.

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida

(FINEST PARTICLES
FOR SAND TAILINGS)



ATTACHMENT 1
SAND TAILINGS/DRAINAGE SAND @ SITE

✓
d₁₅ = 0.18 mm
✓
d₈₅ = 0.425 mm

STANDARD SAND & SILICA Co.

ATTACH MONT 2



Serving Florida and the Caribbean Since 1945

PRODUCT INFORMATION

GRADE:	6/20	6/20	6/20	20/30	20/30	20/30	25/40	30/40	30/45	30/65	30/65	25/70	30/65	40F	35/100	60/45	40/140	#7	60/140
PLANT:	OCALA	DAV.	LAKE WALES	DAV.	LAKE WALES	OCALA	FLINT PLANT	DAV.	LAKE WALES	LAKE WALES	DAV.	BARBER-GREEN	OCALA	LAKE WALES	DAV.	FLINT PLANT	BARBER-GREEN	FLINT PLANT	FLINT PLANT
% RETAINED ON U.S. 3.36 #6	.3	0	0																
2.36 #8	4.7	.2	1.2	0	0	0		0											
1.69 #12	21.4	4.7	7.2																
1.19 #16	67.2	44.4	36.6	.2	.5	.9	.1	.1	0	0	0	.1	0	0	0	0	0		
1.0 #18	87.3	84.4	66.2																
0.84 #20	95.7	96.2	89.0	24.7	26.5	24.3	6.3	.8	.4	.2	.3	1.1	.1	0	.1	0	0	0	0
(TYPICAL MEAN % RETAINED CUMULATIVE)																			
.71 #25	98.5	98.6	95.5	64.4	53.3	56.6		3.1	1.2	1.0	1.0		.2		.2				
.59 #30	99.2	99.2	98.2	89.6	84.6	83.0	45.5	22.3	10.0	4.0	8.6	10.6	1.6	.3	.7	.4	.1	.1	.1
#35				97.0	97.4	95.5		64.6	44.4	28.5	31.8		13.0		4.6				
#40	99.7	99.6	99.4	98.0	98.8	97.5	88.7	83.2	63.2	38.5	47.9	44.3	24.7	2.7	12.5	7.9	2.8	2.5	.1
#45								93.0	80.3										
#50	99.9	99.8	99.9	99.4	99.9	99.0	97.6	97.6	93.2	79.5	72.0	73.8	53.2	45.3	40.2	36.9*	34.9*	11.0	.4
#60							98.9		97.5	89.8	84.0	83.9	68.6	67.6	61.7	50.4	47.2	20.1	1.8
#70									99.1	94.2	91.0	92.2	78.6	80.8	75.4	64.8*	65.2*	37.7	9.7
#100							99.9		99.9	98.5	98.7	98.2	95.1	95.7	94.6	91.2	92.6	71.8	43.9
#140												99.9		99.7		99.1	99.5	96.4	86.9
#200																		99.7	95.2
EFFECTIVE SIZE:	.94	.92	.82	.58	.55	.54	.41	.37	.31	.25	.22	.22	.17	.17	.16	.15	.15	.12	.09
UNIFORMITY COEFFICIENT:	1.56	1.35	1.43	1.35	1.40	1.45	1.55	1.49	1.65	1.7	2.10	2.00	2.10	1.8	1.82	1.9	1.8	1.80	1.67
A.F.S. GRAIN FINENESS:	10	10	11	19	19	20	26	30	34	39	39	39	48	50	51	56	56	71	93

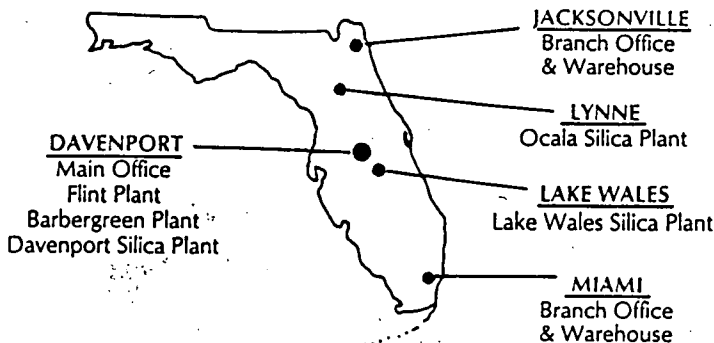
* Standard Sand does not test on this screen. This number was derived mathematically, assuming a curvilinear relationship.

TYPICAL CHEMICAL ANALYSIS SiO₂ by difference.

Silicon dioxide (SiO ₂)	99.59%
Iron oxide (Fe ₂ O ₃)	0.037%
Aluminum oxide (Al ₂ O ₃)	0.28%
Titanium oxide (TiO ₂)	0.0024%
Calcium oxide (CaO)	0.0081%
Magnesium oxide (MgO)	0.0058%
Potassium oxide (K ₂ O)	0.017%
Sodium oxide (Na ₂ O)	0.010%
Chromium oxide (Cr ₂ O ₃)	0.0011%
Clay and Silt	<.5%
Loss on ignition (LOI)	.1 Max
Acid demand value	<1
Moisture content	<.1%
Specific gravity	2.64

Specialty Grades can generally be achieved by blending various amounts of two or more gradations at the individual plant sites.

FACILITY LOCATIONS



MAIN OFFICE
P.O. Box 35
Highway 17-92 North
Davenport, FL 33837
(813) 422-1171
Fax (813) 422-8610

BRANCH OFFICE
600 East 8th Street
Jacksonville, FL 32206
(904) 355-0516
Fax (904) 355-2022

BRANCH OFFICE
4101 N.W. 70th Ave.
Miami, FL 33166
(305) 593-1431 (Dade)
(305) 524-5322 (Broward)
Fax (305) 593-9791

WARNING - THIS PRODUCT CONTAINS CRYSTALLINE SILICA. AVOID BREATHING DUST FROM THIS PRODUCT AS PROLONGED & REPEATED BREATHING CAN CAUSE A PROGRESSIVE LUNG DISEASE CALLED SILICOSIS. THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER REPORTS THERE IS LIMITED EVIDENCE THAT CRYSTALLINE SILICA MAY CAUSE CANCER IN HUMANS. FOLLOW OSHA, MSHA & NIOSH HEALTH STANDARDS FOR SILICA DUST. FOR MORE DETAILED INFORMATION, SEE THE MATERIAL SAFETY DATA SHEET BEFORE USING OR HANDLING THIS PRODUCT.

may contain
 as that
 No. 4 sieve
 the external
 ratio of the
 wall thickness
 for shells, and
 formation will
 of material
 if any coarse
 partment for
 the source of
 using the No.
 exceed 1.75
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TABLE 1. Standard Sizes of Coarse Aggregate

Amounts Finer than Each Laboratory Sieve (Square Openings), weight percent															
Size Number	Nominal Size. Square Openings	4-in. (100- mm)	3½-in. (90- mm)	3-in. (75- mm)	2½-in. (63- mm)	2-in. (50-mm)	1½-in. (37.5- mm)	1-in. (25.0- mm)	¾-in. (19.0- mm)	½-in. (12.5- mm)	¾-in. (9.5- mm)	No. 4 (4.75- mm)	No. 8 (2.36- mm)	No. 16 (1.18- mm)	No. 50 (0.300- mm)
1	3¼ to 1½-in. (90 to 37.5-mm)	100	90 to 100	.....	25 to 60	.....	0 to 15	.....	0 to 5	.....	.....	.....	.....	.....	.....
2	2½ to 1½-in. (63 to 37.5-mm)	.....	.....	100	90 to 100	35 to 70	0 to 15	.....	0 to 5	.....	.....	.....	.....	.....	.....
24	2½ to ¾-in. (63 to 19.0-mm)	.....	.....	100	90 to 100	.....	25 to 60	.....	0 to 10	0 to 5	.....	.....	.....	.....	.....
3	2 to 1-in. (50 to 25.0-mm)	.....	.....	.....	100	90 to 100	35 to 70	0 to 15	.....	0 to 5	.....	.....	.....	.....	.....
357	2-in. to No. 4 (50 to 4.75-mm)	.....	.....	.....	100	95 to 100	.....	35 to 70	.....	10 to 30	.....	0 to 5	.....	.....	.....
4	1½ to ¾-in. (37.5 to 19.0-mm)	.....	.....	.....	.....	100	95	37.5	7.5	.....	2.5	.....	.....	.....	.....
467	1½ to No. 4 (37.5 to 4.75-mm)	.....	.....	.....	.....	100	95 to 100	.....	35 to 70	.....	10 to 30	0 to 5	.....	.....	.....
5	1 to ½-in. (25.0 to 12.5-mm)	.....	.....	.....	.....	.....	100	90 to 100	20 to 55	0 to 10	0 to 5	.....	.....	.....	.....
56	1 to ¾-in. (25.0 to 9.5-mm)	.....	.....	.....	.....	.....	100	90 to 100	40 to 85	10 to 40	0 to 15	0 to 5	.....	.....	.....
57	1-in. to No. 4 (25.0 to 4.75-mm)	.....	.....	.....	.....	.....	100	97	42.5	.....	.....	5	2.5	.....	.....
6	¾ to ¾-in. (19.0 to 9.5-mm)	.....	.....	.....	.....	.....	.....	100	90 to 100	20 to 55	0 to 15	0 to 5	.....	.....	.....
67	¾-in. to No. 4 (19.0 to 4.75-mm)	.....	.....	.....	.....	.....	.....	100	90 to 100	.....	20 to 55	0 to 10	0 to 5	.....	.....
68	¾-in. to No. 8 (19.0 to 2.36-mm)	.....	.....	.....	.....	.....	.....	100	90 to 100	.....	30 to 65	5 to 25	0 to 10	0 to 5	.....
7	½ in. to No. 4 (12.5 to 4.75-mm)	.....	.....	.....	.....	.....	.....	.....	100	90 to 100	40 to 70	0 to 15	0 to 5	.....	.....
78	½-in. to No. 8 (12.5 to 2.36-mm)	.....	.....	.....	.....	.....	.....	.....	100	90 to 100	40 to 75	5 to 25	0 to 10	0 to 5	.....
8	¾-in. to No. 8 (9.5 to 2.36-mm)	.....	.....	.....	.....	.....	.....	.....	.....	100	85 to 100	10 to 30	0 to 10	0 to 5	.....
89	¾-in. to No. 16 (9.5 to 1.18-mm)	.....	.....	.....	.....	.....	.....	.....	.....	100	90 to 100	20 to 55	5 to 30	0 to 10	0 to 5
9	No. 4 to No. 16 (4.75 to 1.18-mm)	.....	.....	.....	.....	.....	.....	.....	.....	.....	100	85 to 100	10 to 40	0 to 10	0 to 5
10	No. 4 to 0 (4.75-mm)	.....	.....	.....	.....	.....	.....	.....	.....	.....	100	85 to 100	.....	.....	.....

NOTE: The above gradations represent the extreme limits for the various sizes indicated, which will be used in determining the suitability for use of coarse aggregate from all sources of supply. For any grade from any one source, the gradation shall be held reasonably uniform and not subject to the extreme percentages of gradation specified above.

ATTACHMENT 3
 FOOT TABLES

901-1.4

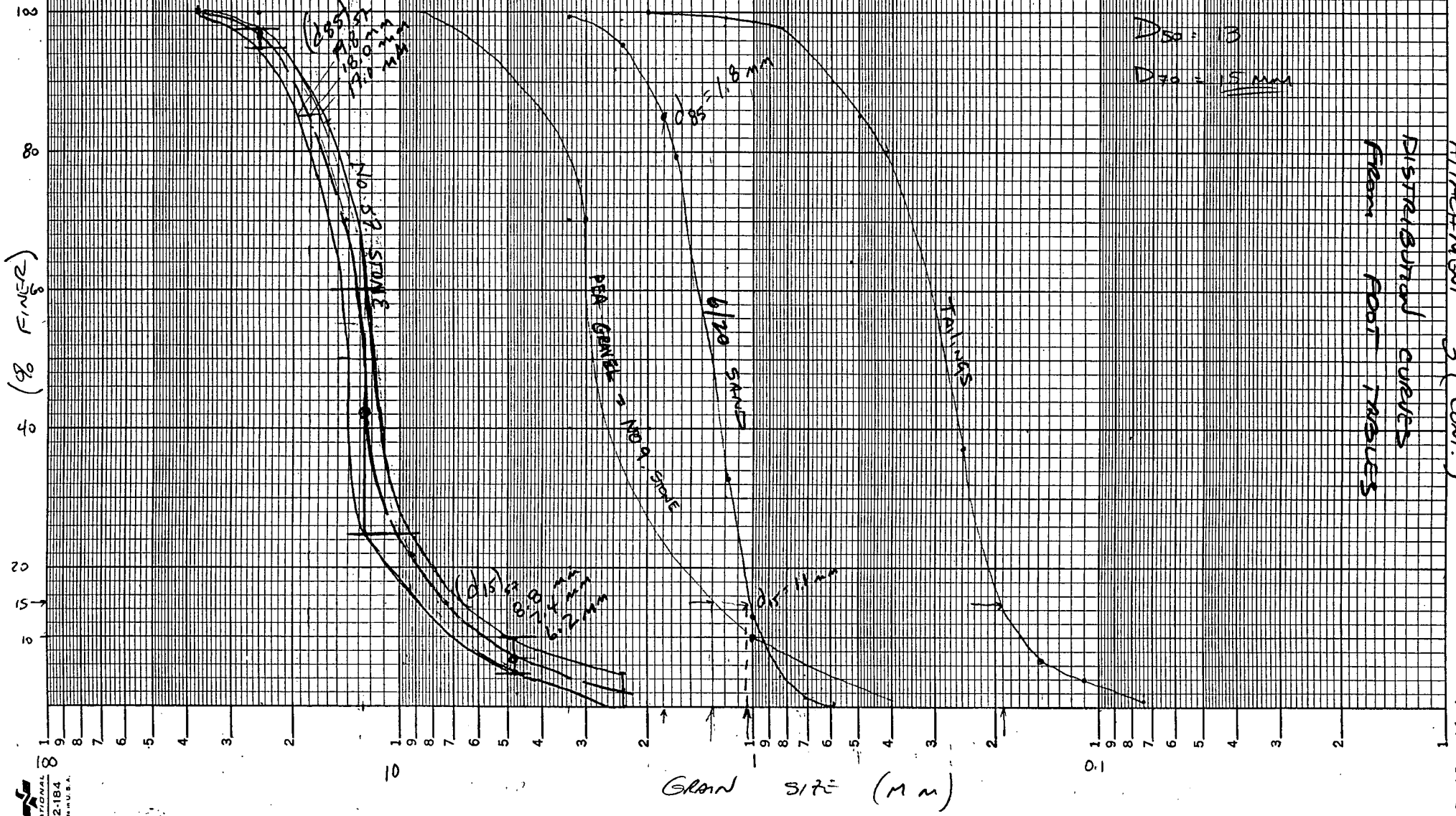
#6
d₁₅ = 10

TAILINGS
d₁₅ =
d₈₅ =

6/20
d₁₅ = 1.1 mm
d₈₅ = 1.8 mm

NO. 9
d₁₅ =

NO 57 STONE
D₁₀ = 6.2 mm
D₁₅ = 7.4 mm
D₂₀ = 8.5 mm
D₈₅ = 18.0 mm
D₅₀ = 13
D₃₀ = 15 mm



ATTACHMENT 3 (CONT.)
DISTRIBUTION CURVES
FROM FOOT TAPLES

ATTACHMENT 4

US EPA GUIDANCE FOR SOIL FILTERS

Table 5.1 Effect of Fines on Hydraulic Conductivity of a Washed Filter Aggregate (from Cedergren, 1989)

Percent Passing No. 100* Sieve	Hydraulic Conductivity (cm/s)
0	0.03 to 0.11
2	0.004 to 0.04
4	0.0007 to 0.02
6	0.0002 to 0.007
7	0.00007 to 0.001

*Opening size is 0.15 mm.

Drainage materials may also be required to serve as filters. For instance, as shown in Fig. 5.2, a filter layer may be needed to protect a drainage layer from plugging. The filter layer must serve three functions:

1. The filter must prevent passage of significant amounts of soil through the filter, i.e., the filter must retain soil.
2. The filter must have a relatively high hydraulic conductivity, e.g., the filter should be more permeable than the adjacent soil layer.
3. The soil particles within the filter must not migrate significantly into the adjacent drainage layer.

Filter specifications vary somewhat, but the design procedures are similar. The determination of requirements for a filter material proceeds as follows:

1. The grain size distribution curve of the soil to be retained (protected) is determined following procedures outlined in ASTM D-422. The size of the protected soil at which 15% is finer ($D_{15, \text{soil}}$) and 85% is finer ($D_{85, \text{soil}}$) is determined.
2. Experience shows that the particles of the protected soil will not significantly penetrate into the filter if the size of the filter at which 15% is finer ($D_{15, \text{filter}}$) is less than 4 to 5 times D_{85} of the protected soil:

$$D_{15, \text{filter}} \leq (4 \text{ to } 5) D_{85, \text{soil}} \quad (5.2)$$

3. Experience shows that the hydraulic conductivity of the filter will be significantly greater than that of the protected soil if the following criterion is satisfied:

$$D_{15, \text{filter}} \geq 4 D_{15, \text{soil}} \quad (5.3)$$

4. To ensure that the particles within the filter do not tend to migrate excessively into the drainage layer, the following criterion may be applied:

$$D_{15, \text{drain}} \leq (4 \text{ to } 5) D_{15, \text{filter}} \quad (5.4)$$

5. Experience shows that the hydraulic conductivity of the drain will be significantly greater than that of the filter if the following criterion is satisfied:

$$D_{15, \text{drain}} \geq 4 D_{15, \text{filter}} \quad (5.5)$$

Filter design is complicated significantly by the presence of biodegradable waste materials, e.g., municipal solid waste, directly on top of the filter. In such circumstances, the usual filter criteria may be modified to satisfy site-specific requirements. Some degree of reduction in hydraulic conductivity of the filter layer may be acceptable, so long as the reduction does not impair the ability of the drainage system to serve its intended function. A laboratory test method to quantify the hydraulic properties of both soil and geotextile filters that are exposed to leachate is ASTM D-1987. However, regardless of specific design criteria, the gradational characteristics of the filter material control the behavior of the filter. CQC/CQA personnel should focus their attention on ensuring that the drainage material and filter material meet the grain-size-distribution requirements set forth in the construction specifications, as well as other specified requirements such as mineralogy of the materials.

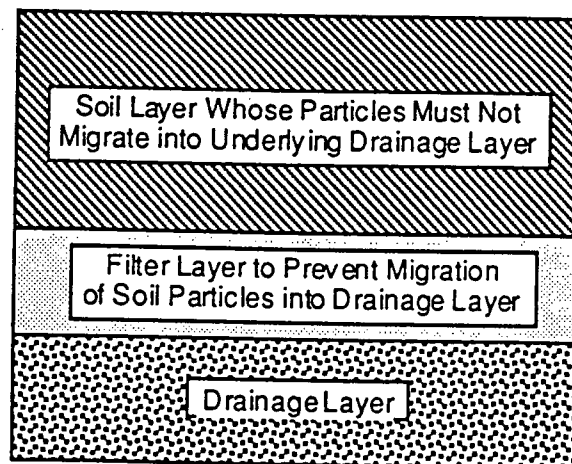


Figure 5.2 - Filter Layer Used to Protect Drainage Layer from Plugging