File on eDOCs ____ (Yes) ____ No
Site Name Sinclair Refinery
Site No. 902003
County Allegany
Town Wellsville
Foilable ____ Yes ____ No
File Name Documents / Reports
Scanned & eDOC ____
report. H0902003. 1992-06. Final_Design-CELA_AND_Surface_soils.

ARCO

Final Design For CELA and Refinery Surface Soil Remediation Sinclair Refinery Site Wellsville, New York

June 1992

Prepared by

EBASCO

An ENSERCH® Engineering and Construction Company

VOLUME I OF II

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DIVISION II - TECHNICAL SPECIFICATION

FOR

CENTRAL ELEVATED LANDFILL AREA AND REFINERY SURFACE SOIL REMEDIATION

Prepared by

EBASCO SERVICES INCORPORATED

JUNE 1992

CLIENT: ATLANTIC RICHFIELD COMPANY
LOS ANGELES, CALIFORNIA

PROJECT: SINCLAIR LANDFILL
CELA AND REFINERY
SURFACE SOIL REMEDIATION

LOCATION: WELLSVILLE, ALLEGANY COUNTY
NEW YORK

TECHNICAL SPECIFICATIONS

DIVISION 2 - SITEWORK

APPROVED BY: K Ramachandran

P.E. NO. 051943
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NEW YORK, NEW YORK

Revision	Prepared By	Reviewed By	Approved By	Date	Pages Affected
0	D Simpadion	V. Ford.	K Ramachandran	1-28-92	ALL
1	S Chadwick	V. Ford	K Ramachandran	5-8-92	02040-2 02225-4
2	S Chadwick	V. Ford	K Ramachandran	6-24-92	02225-4

APPROVED BY: _____
DAVID A. CHRISTENSEN
(PROJECT MANAGER - ARCO)

See USEPA approval letter from Carole Petersen
APPROVED BY: to David A. Christensen dated December 6, 1991 and May 29, 1992
UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY

TECHNICAL SPECIFICATION

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Division 3 thru 10
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SECTION 02000
INTRODUCTION

The Sinclair Refinery Site consists of the refinery area, approximately 90 acres in size and the landfill site, about 13 acres in size. The Sinclair Refinery Site is located in Allegany County in southwestern New York State, approximately ten miles north of the New York-Pennsylvania border and about one mile south of downtown Wellsville. The landfill site occupies the southermost portion of the 103-acre Sinclair Oil Refinery property. It is an area bounded by the northerly-flowing Genesee River to the north, east and south, and on the west, an abandoned rail line separates the landfill from the former refinery grounds.

Internally, the landfill site consists of two sub-sites; a 7-acre landfilled area to the north, referred to as the Central Elevated Landfill Area (CELA), and an approximately 1.2-acre landfilled area to the south, referred to as the South Landfill Area (SLA). It is estimated that 145,000 cubic yards of refinery wastes was contained in the CELA and approximately 14,500 cubic yards was excavated from the SLA and placed on the SLA storage area.

The CELA is wooded and covered with vegetation. A number of rusted and corroding 55-gallon drums, many of which are empty, are located on the landfill surface. A small pool of oil, probably the remains of a lagoon, is located on top of the landfill. A chain link fence partially restricts access to the landfill from the roadway, and access from the river bank is unrestricted.

The topography of the site is generally sloping toward the Genesee River. There is little relief throughout the site with elevations ranging from 1495 to 1515 feet above mean sea level.

In July 1982, EPA and NYDEC entered into a Cooperative Agreement to undertake a Remedial Investigation (RI) and Feasibility Study (FS) at the Sinclair Refinery Site. The RI was divided into two phases: Phase I was a detailed characterization of the landfill portion and reconnaissance of the refinery portion of the site. The Phase II RI was focused on the refinery portion of the site where additional data requirements were identified.

The USEPA signed a Record of Decision (ROD) on September 30, 1985, officially selecting a remedy for the landfill portion of the site. The USEPA also signed a Record of Decision (ROD) on September 30, 1991, officially selecting a remedy for the refinery portion of the site. The overall remediation for both portions of the site consists of the following measures:

1) Removal and off-site disposal of drums found on the surface of the Central Elevated Landfill Area.

2) Excavation of the wastes from the South Landfill Area.

3) Filling of the excavated SLA area with clean fill.

4) Consolidation of the excavated South Landfill Area wastes onto the Central Elevated Landfill Area.

5) RCRA capping of the consolidated wastes on the Central Elevated Landfill Area.

6) Partial Genesee River Channelization to protect the landfill from erosion and flood inundation from the Genesee River.

7) Erection of a fence to secure the entire Landfill Site.

8) Excavation of surface soils in excess of 25 ppm arsenic and 1000 ppm lead to a depth of one (1) foot and consolidation into the CELA.

9) On-site treatment of excavated soil to comply with RCRA Land Disposal Restriction (LDR) regulatory levels.

10) Consolidation of the treated soil into the Central Elevated Landfill Area (CELA).

11) Backfilling the excavated area with six (6) inches of clean soil followed by six (6) inches of top soil and revegetation of the disturbed areas.

12) Long-term surface water, groundwater, and soil-gas monitoring.

13) Treatment of contaminated groundwater in the refinery portion of the site.

The work covered by this contract document is only for Items 1, 4, 5, 7, 8, 9, 10 and 11 above.

The Contractor shall perform all work stated in the Contract. The Contract consists of all work described by the specification sections and shown on the drawings, plus all provisions, conditions, terms, and requirements found in the proposal package, along with any addendum, modifications, amendments or changes issued to the Contract.

The Contractor is advised that the work will be performed on a hazardous waste site as identified on the National Priorities List (NPL). This listing was established pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980

(CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Contingency Plan (NCP). The Contractor is responsible for developing a Site Specific Health and Safety Plan (SSHSP) for his operations or adopting the Project Health and Safety Plan Including Contingency Plan for this Contract. The Contractor shall implement this plantaking precautions necessary to protect the public and work force personnel from potential hazards. The Contractor shall utilize personnel with approved hazardous waste training.

A Consent Decree between ARCO and the USEPA for the landfill portion of the site was signed on August 18, 1988 and subsequently entered in the United States District Court for the Western District of New York. All work performed shall comply with the requirements of that Consent Decree.

END OF SECTION

SECTION 02040

DUST AND VAPOR CONTROL

PART 1 - GENERAL

The work required under this Section includes furnishing all plant, labor, materials and equipment and performing all operations required for providing dust and vapor control as specified herein.

PART 2 - REQUIRED WORK

2.1 The Contractor shall be responsible for providing all dust and vapor control measures.

2.1.1 Dust Control

Dust control measures shall be implemented during CELA and refinery surface soil remediation. Control levels for the implementation of Dust Control are derived from NYSDEC Requirements that fugitive dust emission from site operations shall not exceed 150 micrograms per cubic meter of air. An airborne dust monitor (total DM) shall be used to obtain real-time dust readings (15 minute averaging time). The Contractor shall keep a log of real time dust readings.

2.1.1.1 Dust control shall consist of furnishing water supply, required equipment, additives, accessories and incidentals, and carrying out proper and efficient measures wherever and as often as necessary to reduce dust nuisance, and to prevent dust originating from construction operations from causing damage to open fields and dwellings, or causing a nuisance to persons during the completion of the Contract, as required by the Construction Manager or his designee.

2.1.1.2 All equipment used for application of water shall be equipped with a positive means of shut-off.

2.1.1.3 Mobile units with a minimum combined capacity of 5,000 gallons shall be available for applying water for dust control at all times while work is in progress.

2.1.1.4 To conserve water, the Contractor may use chemical additives in dust-control water. The use, location of application, amount and type of additives proposed for use by the Contractor shall be subject to acceptance by the Construction Manager or his designee and the EPA.

2.1.2 Vapor Control

Vapor Control measures shall be implemented during CELA remediation when perimeter monitoring indicates organic vapor or hydrogen sulfide (H_2S) concentrations of 5 ppm above background (15 minute averaging time) are reached at the downwind fence line shown on Drawing AR-14. An FID or PID shall be used to obtain continuous organic vapor readings whenever landfill waste is being disturbed, while an H_2S monitor, such as an MSA361, will be used to monitor for H_2S concurrently with the PID or FID.

2.1.2.1 Selection of the vapor control mechanisms rests with the Contractor, and it is subject to acceptance by the Construction Manager and the USEPA. These may include, but are not limited to, vapor suppressant foams, synthetic membrane covers, soil covering and/or work suspension.

2.1.2.2 The control measure(s) employed must be sufficient to reduce the downwind fence line concentration of vapor to less than 5 ppm above background (15-minute duration) as defined in the HASP.

END OF SECTION

SECTION 02060

SITE PREPARATION

PART 1 - GENERAL

This Section includes furnishing all plant, labor, equipment and material to perform all preparatory work shown on the Contract Drawings and as specified herein.

PART 2 - WORK REQUIRED

2.1 The work under this section shall consist of the removal and disposal of drums (see Section 02090 - Drum Handling, Characterization and Disposition, for requirements) within the limits of clearing and grubbing indicated on the Contract Drawings (AR-12). Removal and disposal of geomembrane covers, wiring, instrumentation, demolition of the Test Fill, removal and disposal of settlement plates and decommissioning of the existing wells indicated on the Contract Drawings (AR-12) as well as protection of the utility pole located within the CELA cap shown on Contract Drawing AR-15 and as described herein shall also be within the scope of work of this section.

PART 3 - EQUIPMENT

Prior to starting work, a list of all equipment, tools, machines, including their sizes, capabilities and operating speeds, to be used in the performance of the work shall be submitted to the Construction Manager or his designee for acceptance. All items shall be maintained in safe and satisfactory working condition at all times.

PART 4 - EXECUTION

4.1 All work shall be conducted in a manner to prevent damage to the structures which are to remain and to maintain or improve the aesthetics of the site.

4.2 The Contractor shall handle contaminated material in a manner that will protect site personnel, the public, and the environment in accordance with all applicable Federal, state, and local laws and regulations.

4.3 The Contractor shall maintain all work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to others. Dust control shall be performed as the work proceeds and wherever a dust nuisance or hazard occurs. Refer to Section 02040 for dust control requirements.

4.4 The Contractor shall decontaminate all equipment prior to removal from the site in accordance with the Project Health and Safety Plan of this Contract.

4.5 The Contractor shall remove drums within the limits of clearing and grubbing indicated on the Contract Drawings (AR-13, AR-18) in accordance with the requirements of Section 02090 - Drum Handling Characterization and Disposition and Section 02095 - Off Site Transportation and Off-Site Disposal of Drums.

4.6 The geomembrane (PVC) covers over the Test Fill and SLA storage areas shall be removed, cut into pieces of suitable size and disposed of within the Area for Demolished Material indicated on the Contract Drawings (AR-12).

4.7 The wiring for Test Fill Instrumentation shall be removed, rolled and disposed of within the Area for Demolished Material indicated on the Contract Drawings (AR-12).

4.8 Multiplexer boxes for Test Fill instrumentation shall be removed, decontaminated by wiping and stored at the Site Facilities area indicated on the Contract Drawings (AR-12).

4.9 The Contractor shall demolish the Test Fill and remove the HDPE liners, PVC piping, settlement plates, etc. and place the recovered items within the Area for Demolished Material indicated on the Contract Drawings (AR-12).

4.10 Prior to Test Fill demolition, the Contractor shall decommission the Fluid Detection wells (4 total) and Monitoring wells (15 total) by filling them with grout.

The following decommissioning procedure shall be used:

1. Wear appropriate health and safety equipment as outlined in the Project Health and Safety Plan Including Contingency Plan of this Contract.

2. Use a cement-bentonite-potable water grout mix (ratio of one, 94 pound bag of Portland Type I cement: 3-5 pounds of bentonite: 6 gallons of water) to backfill the bottom 10 feet of the well.

3. Cut the well 6 inches below the rough graded surface.

4.11 Piezometers installed within the Test Fill shall not be removed.

4.12 Wick drains, installed within the test fill shall not be removed. However, wick drains encountered during excavation shall be cut flush with the rough graded surface.

PART 5 - PROTECTION OF EXISTING UTILITIES

5.1 The Contractor shall determine the locations of existing utilities in the project area. Potential contacts for locally known utilities are shown on the Contract Drawings (AR-15 and AR-23). However, the Contractor shall verify all such information in the field and shall assume all liability for damage to all utilities whether or not identified on the Contract Drawings. The Contractor shall contact the Wellsville Utility Coordinator (Telephone 716-593-1780) and all potentially affected utilities prior to starting any construction activity. It shall be the Contractor's responsibility to take whatever measures are necessary to prevent damage to utilities.

5.2 The Contractor shall provide permanent protection to the section of the utility pole between the existing ground and the bottom of the CELA cap located within the cap boundary shown on Contract Drawing AR-14.

5.2.1 The protection shall consist of a polyethylene (PE) pipe surrounding the pole and filling the annular space between the pole and the pipe with sand. Material properties of the PE pipe and sand shall be as described in paragraphs 7.11 and 7.10 of Section 02220 - CELA Closure respectively.

END OF SECTION

SECTION 02090
DRUM HANDLING, CHARACTERIZATION AND DISPOSITION

PART 1 - GENERAL

This section discusses the requirements for field screening, mapping, logging, segregation, removal, opening and characterization, staging, shredding, consolidation and loading of drums deposited on the surface of the CELA.

PART 2 - REQUIRED WORK

Furnish all labor, materials, equipment and incidentals required to document, remove, test, stage, handle, on-site transport and load the drums on the CELA containing various amounts of waste material. Drums consisting of metal containers greater than 5 gallons in size and containing waste, which are completely or partially exposed at ground surfaces within the CELA and which meet the criteria for being intact as specified in Figure 02090-1, Drum Removal Flow Chart, shall be handled and disposed of at an off-site location according to Section 02095.

Drums requiring off-site disposal shall be disposed of according to waste-specific characteristics. The contents of the drums shall be characterized as outlined in the Sampling and Analysis Plan (SAP) to meet the compatibility requirements for bulking and disposal. Based on the results of the Remedial Investigation (SMC Martin, March 14, 1985), the materials in the drum are not expected to be RCRA listed wastes. The compatibility testing will determine/confirm the expected contents of the drums. Therefore, these materials will be sent to an off-site RCRA Subtitle C landfill if they meet the treatment standards for RCRA characteristic wastes, and do not contain free liquids. Other means of treatment and disposal, such as neutralization, precipitation, solidification or incineration, may also be utilized depending on the waste-specific and TSDF-specific requirements.

Those drums not requiring handling/disposal, including those which are not intact but contain waste material, shall be shredded on-site to a maximum shaving size of 1 inch wide by 3 feet long, spread out uniformly across the surface and compacted with the CELA and SLA soils. The remaining parts of this specification pertain to those intact drums requiring handling/off-site disposal. The procedures described herein specify the minimum requirements necessary to properly handle and dispose of drums.

PART 3 - PROTECTION

3.1 The regulatory requirements governing transportation of hazardous materials, administrative requirements and methods of disposal of hazardous wastes and all other applicable Federal,

DRUM REMOVAL PROGRAM FLOW CHART

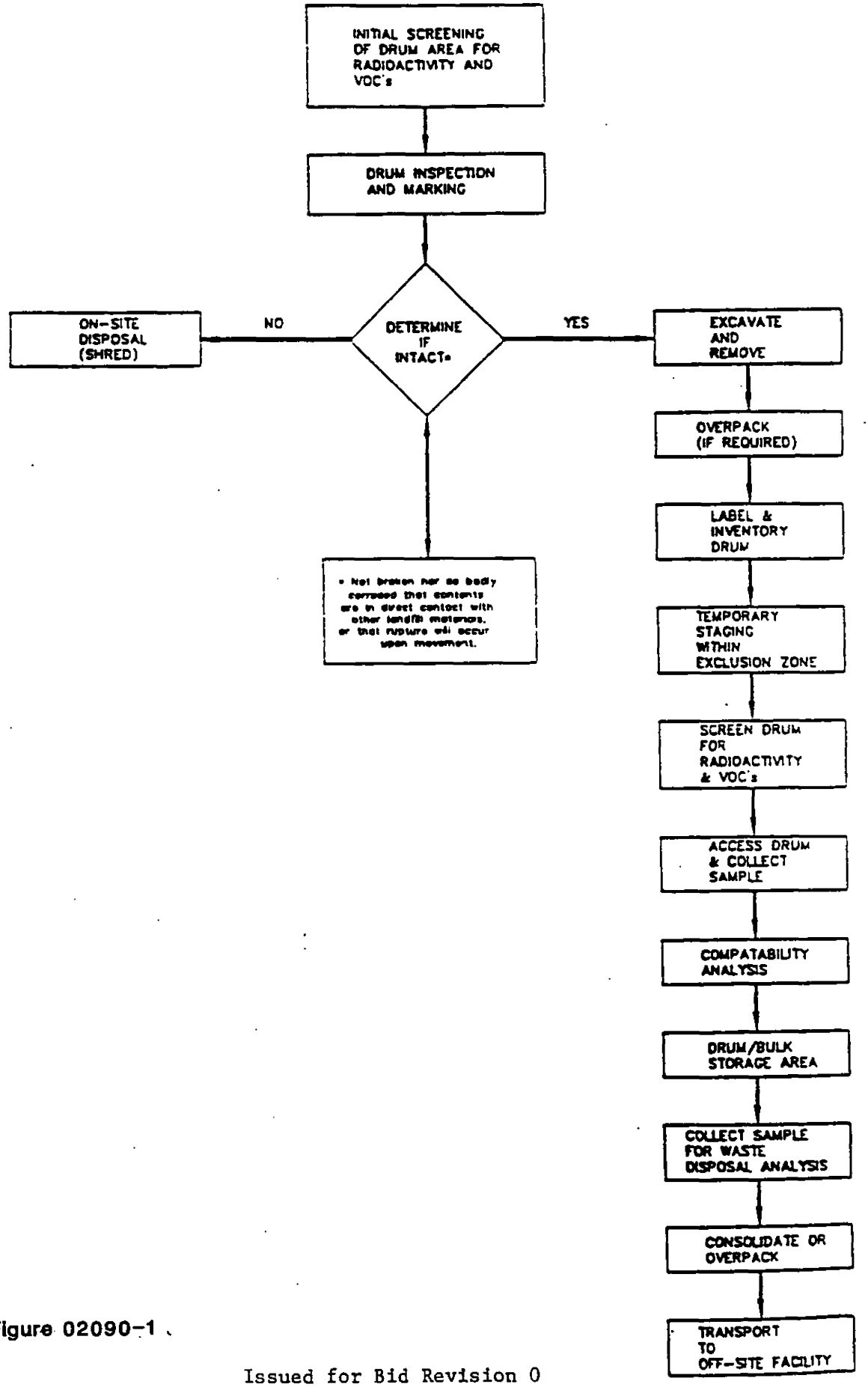


Figure 02090-1

State or local laws, codes and ordinances which govern or regulate hazardous wastes shall apply to the performance of the scope of work detailed in this Section.

3.2 At all times during the transport or handling of drums, personal protection gear and safety equipment shall be worn or used as required by the Site-Specific Health and Safety Plan (SSHSP).

3.3 All handling, on-site transport, and sampling of drums containing waste will be conducted utilizing self-contained breathing apparatus with Level B chemical resistant clothing and splash covers. Respiratory requirements when working within or adjacent to drums containing wastes shall be implemented in accordance with the SSHSP.

3.4 Continuous air monitoring for organic vapors and explosive atmosphere, in accordance with the Site Specific Health and Safety Plan, shall be conducted during all drum handling and sampling operations.

PART 4 - MATERIAL AND EQUIPMENT

4.1 Remote drum handling equipment shall consist of a grappler equipped backhoe or front end loader. Drum transportation shall be with front end loaders or forklifts fitted with modified carrying platforms.

4.2 Alternate methods of segregating, lifting or loading drums may be used subject to prior acceptance by the Construction Manager.

4.3 Portions of equipment that contact drums shall be of non-ferrous metals or contact portions shall be coated or lined to preclude spark generation. Removal of drum bung or ring shall be performed with non-sparking tools.

4.4 All handling and transport equipment shall be equipped with full frontal and side splash and explosion shields. Class ABC fire extinguishers shall be fitted to the body of each piece of equipment.

4.5 All equipment shall be maintained in first class condition. The ignition, manifold and exhaust components shall be maintained to prevent backfiring or generation of sparks within the exhaust gases.

4.6 Material and equipment required for sampling drummed wastes are as follows:

(1) Personnel protection equipment as specified SSHSP.

(2) Sample containers.

(3) Sample identification labels.

(4) Chain-of-custody data sheets.

(5) Glass sampling thief.

(6) Remotely operated, pneumatic ram or check key device.

(7) One gallon covered cans half-filled with absorbent (for offsite shipment only).

(8) Nonsparking tools.

(9) All mechanical equipment with grounding feature.

PART 5 - LABORATORY

The Contractor shall utilize a laboratory capable of performing the analyses specified for the waste compatibility and characterization tests. An offsite laboratory may be acceptable if the transportation of samples would not contribute to any delay of the construction processes. Acceptability of an off-site laboratory will require USEPA approval.

PART 6 - DOCUMENTATION

6.1 The Contractor shall provide all manpower, equipment, and material required to identify and preserve any potential evidence (labels, documents etc.) that could establish or aid in establishing the identity of the party or parties responsible for the presence of the drums' wastes at the site. This may include but is not limited to logging, mapping and photographic documentation to record original location of drums prior to removing.

6.2 The Contractor shall label all drums from the landfill area prior to removal to the on-site storage area in order to facilitate future identification and sampling. The Contractor shall also maintain a log of the number of drums accounted and verified and record the appropriate information concerning each drum (i.e., capacity, material of construction, present condition, label information, existing markings, etc.). The Contractor shall supply all labels.

PART 7 - DRUM ACCESS AND SAMPLING

7.1 Care shall be exercised in the opening of drums. All drums are to be considered hazardous to sampling personnel no matter how they are labeled and shall not be opened for sampling unless proper safety procedures are followed. Gases may be released, or pressurized liquids may be expelled, therefore a drum shall not be

moved or opened unless it has been ascertained that the drum is structurally sound. Drums shall not be moved or opened unless an external/gross gamma scan is negative. Additional safe drum opening procedures are detailed in the Project Sampling and Analysis Plan.

7.2 Drums shall be sampled in the designated Exclusion Zone in accordance with the SAP. Drums which potentially may be under internal pressure, as evidenced by bulging, shall be sampled in place.

7.3 For each group of drums characterized on-site by testing to contain like constituents, one sample or composite for every three drums, shall be analyzed.

7.4 Before removal from the surface of the landfill and the drum segregation area, any suspicious looking drums, or drums labelled as containing hazardous materials (explosives, etc.) shall be clearly marked for special handling. Maximum care and caution shall be exercised when opening drums containing materials of an unknown origin.

7.5 All drums shall be grounded prior to sampling. If the bung can be removed, sampling of contained liquids shall be performed by a glass thief, which shall be broken after sampling and discarded within the drum. A drum that cannot be sampled as above, shall be safely accessed with a hydraulic penetrating device operated remotely. All openings shall be plugged after completion of sampling. Sampling openings into pressurized drums shall be plugged and the bung holes fitted with pressure venting caps set at 5 psi release.

7.6 Drum samples shall not be fixed with any preservative.

7.7 If a material specifically identified in the Department of Transportation (DOT) Hazardous Material Table (49 CFR 172.101) is known to be contained in a sample, that sample shall be transported as prescribed therein.

7.8 All information concerning the sample's general field characteristics (such as field measurements, spot tests, pH, field and other observations, e.g., physical state, viscosity, fuming, layering, coloring, whether the substance is aqueous or non-aqueous, etc.) shall be recorded in the master log. The field characterization should be conducted according to the accepted Sampling and Analysis Plan.

PART 8 - WASTE SAMPLE ANALYSIS

8.1 All activities, including quality assurance, shall be consistent with procedures specified in "Enforcement Considerations for Evaluation of Uncontrolled Hazardous Waste Disposal Sites by Contractors (USEPA, National Enforcement Investigation Center, April 1980)."

8.2 The testing and analytical procedures to be used on the drummed materials shall be conducted in conformance with the Code of Federal Regulations, EPA and state methods for chemical analysis of water and waste, and test methods for evaluating solid waste and American Society of Testing and Materials.

8.3 The guidelines for field screening drums for radioactivity are as follows:

(1) As site personnel approach drums, they shall monitor for gross ionizing radiation contamination with a calibrated general survey Geiger-Muller counter. If measurements indicate readings of less than 0.1 millirem per hour (mr/hr), additional screening for gamma, beta and alpha shall be performed using appropriate monitoring instruments. These radiation screening surveys shall be conducted prior to the commencement of drum sampling.

(2) Should any of the radiation monitoring detect radiation levels at or above 0.1 mr/hr over background, the Site Health and Safety Officer is to be notified immediately.

(3) If radiation monitoring detects radiation levels at or above 1 mr/hr, special handling and transport requirements will be implemented to shield and protect site operations personnel.

(4) Waste material determined to be radioactive will be kept separate from non radioactive waste. However compatible radioactive wastes shall be bulked together for disposal.

(5) All samples taken shall be analyzed for compatibility according to the accepted SAP.

8.4 The Contractor shall perform Compatibility testing of wastes to meet the requirements of the approved disposal facility which shall include, as a minimum, the following tests:

- Radiation Screening
- pH
- Water Reactivity
- Oxidation/Reduction (Redox) Potential

- Water/Hexane Solubility
- Flammability
- Specific Gravity
- Qualitative organic and inorganic spot tests including, but not limited to, cyanide, sulfide and organic peroxide
- Actual bench scale compatibility blending
- PCB Screening and Analysis shall be conducted on all waste samples. Composite samples obtained from similar compatible wastes, which are to be used for PCB screening and analysis, shall not be made up from more than 5 individual waste sources. Should levels of PCBs be detected by Aroclor Chromatographic standard matching, at 10 ppm or greater, each waste container should then be analyzed individually to determine the source(s) of PCB's.

8.5 Once it has been determined that the waste materials are compatible, and they have been subsequently blended, the Contractor shall perform whatever waste disposal analysis is required by the approved disposal facility. The Contractor shall be prepared to conduct, as a minimum, the following analyses on the bulked compatible and individual incompatible wastes:

- Ignitability Analysis (as per RCRA)
- Reactivity Analysis (as per RCRA)
- Toxicity Characteristic Leaching Procedure (TCLP) Analysis (as per RCRA)
- Corrosivity Analysis (as per RCRA)
- PCB/Pesticide Analysis
- Cyanides
- BTU Heat Value
- Water Content
- Solid Content
- Chlorides
- USEPA Target Compound List (TCL) Analysis
- Density

The Contractor shall describe the sample procedures and the appropriate analysis methods in the approved Sampling and Analysis Plan.

PART 9 - DRUM REMOVAL AND STAGING

9.1 All handling, moving and transport of drums shall be by use of mechanical equipment only. No drums shall be handled manually. All equipment shall be dedicated to the site until the completion of the work. Equipment shall be decontaminated prior to removal from site.

9.2 The Contractor shall take all steps necessary to identify and preserve any potential evidence (labels, documents, etc.) that could establish or aid in establishing the identity of the party or parties responsible for the presence of drums' wastes at the site. This shall include, but is not limited to, notifying the Construction Manager, and providing logging, mapping and photographic documentation to record original location of drums prior to removing.

9.3 The Contractor shall eliminate or stabilize any hazardous conditions from drums which are smoking, smoldering, excessively hot or burning prior to their removal from the CELA surface. A grappler equipped backhoe or front end loader shall be used to remove drums from the landfill. The guidelines for the drum removal and staging are presented below:

(1) Determine drum conditions, i.e., bulged drum, etc.

(2) Extreme care shall be exercised when working adjacent to potentially pressurized drums.

(3) Should movement of a pressurized drum be unavoidable, handling shall be by a grappler unit constructed for explosive containment. The bulged drum shall be moved only as far as necessary to allow seating on firm ground or shall be carefully overpacked.

(4) All drums removed from the surface of the landfill shall be kept inside the Exclusion Zone for sampling, testing and securing prior to being moved to the drum storage area.

(5) Personnel involved in handling and transporting of drummed waste shall work in teams containing no fewer than two people. Visual contact shall be maintained between members of the working team at all times. All team members shall be able to communicate between themselves and with the Industrial Hygienist or the Health and Safety Specialist by two-way radio during all times on the work site.

(6) Removed drums shall be transported to the drum storage area, approved by the Construction Manager, and staged by a forklift.

(7) The drum storage area shall be bermed and lined and covered with a geomembrane. The bermed area shall be sufficient to contain at least 10% of the volume of the drums. The area shall be provided with pallets on which to place the drums. Drums shall not be stacked more than two high and pallets or other necessary techniques

shall be used for stabilization in stacking. Groups of drums shall be provided with sufficient corridor space to allow for free movement of equipment required for handling of drums or sufficient space to prevent contact or mixing of incompatible chemicals. The larger of the two distances shall be provided as the minimum clearance.

The storage area shall be sized on the basis of the volume storage requirement stated above, 2 foot diameter drums, and the clearance requirements. The size, location, construction and maintenance of the drum storage area shall be the responsibility of the Contractor and subject to the Construction Manager's acceptance. The containment system for storage of drums shall comply with 40 CFR 264.175.

(8) It is the responsibility of the Contractor to prepare bulk shipments for off-site disposal of the drums held in the drum storage area to prepare based upon the results of the compatibility testing.

(9) Drums which have been subject to on-site bulking and repack operations shall be loaded by grappler into transport equipment and placed in the drum staging area. Removal of any drums to the drum storage area shall be with the acceptance of the Construction Mana- ger. Residues, where possible, shall be transferred to repack containers prior to movement.

(10) The Contractor is responsible for loading the stored drums or bulked material to the waste hauler's trucks for ultimate off-site disposal in accordance with Section 02095.

PART 10 - SPILL PREVENTION AND RESPONSE

10.1 Handling of drummed waste shall be, at all times, conducted in a controlled and safe manner which will minimize damage to structurally sound drums, or overpacks. If during transport or handling, leakage or spillage of waste occurs, the drums shall immediately be placed within an overpack unit. An adequate supply of overpack units shall be provided at the staging area, at areas of existing drums and along all site roadways. The supply shall be sufficient to ensure that no interruptions of field work are experienced while awaiting delivery of additional overpacks.

10.2 In the event of a spill, the drum handling team shall immediately have all personnel evacuated from the immediate spill area.

Personnel trained in spill response procedures shall isolate and contain the spill. Where possible, spilled waste material and materials such as, but not limited to, soils and sorbents which have become contaminated by contact with spilled material shall be collected and placed in repack containers for ultimate disposal.

PART 11 - PREPARATION AND TRANSPORTATION OF DRUMS

The Contractor should be prepared to provide all transportation preparation and services including, but not limited to, the following:

(1) Overpacking and/or repacking any non-compatible waste in Federal DOT approved containers.

(2) Solidification or addition of various adsorbent materials to prepare waste for disposal and/or transportation.

(3) Proper EPA/DOT labeling and identification of drummed waste for shipment.

(4) Loading of properly prepared drums consistent with Federal DOT regulations on trucks for off-site disposal.

(5) Loading of bulked waste on the waste hauler's trucks bound for disposal.

(6) Preparation of required documentation including truck weighing for transporting waste over the road. (The Contractor shall prepare all necessary waste manifests for signature by ARCO, or its designated representative.)

(7) Maintenance of a master off-site transport log for any waste shipments from the site.

(8) Ensuring that all trucks are properly prepared (i.e., proper sealing and lining of trailer to prevent leaking, placarding of trailer, documentation, etc.).

(9) Decontamination of all equipment and the Contractor's vehicles on site prior to their removal.

(10) Providing a decontamination station for removing contaminated material from all vehicles and equipment leaving the work area. As a minimum, this shall include a high pressure wash area and wash residues collection system for equipment and vehicles for use after the mud and/or dirt has been cleaned from the equipment.

(11) Any vehicle used for transportation of drums that, in the opinion of the Construction Manager is unfit, will be denied access to the site.

END OF SECTION

SECTION 02095
OFF-SITE TRANSPORTATION AND OFF-SITE DISPOSAL OF DRUMS

PART 1 - GENERAL

The work specified under this Section shall involve off-site transportation and disposal of drums requiring removal in accordance with Section 02090 - Drum Handling Characterization and Disposition. These drums are located throughout the CELA.

PART 2 - APPLICABLE REGULATIONS

2.1 The Contractor shall ensure that all operations in the loading and hauling of contaminated materials are in compliance with the Federal and State Departments of Transportation (DOT) regulations, 40 CFR Parts 262 and 264, "Revised Procedures for Implementing Off-Site Response Actions", (EPA OSWER Directive Number 9834.11, November 13, 1987), New York State Department of Environmental Conservation (NYSDEC) Regulations and all local requirements and any other applicable requirements.

2.2 Hazardous waste material transportation and disposal regulations shall include, but not be limited to:

(1) U.S. Code of Federal Regulations, 49 CFR 171 through 179.

(2) USEPA, 1986, "Drum Handling Practices at Hazardous Waste Sites, EPA/600/2-86/013.

(3) Federal Resource Conservation and Recovery Act (RCRA), as amended, and including the Land Disposal Restrictions (LDRs).

(4) NYSDEC: Hazardous Waste Material Transportation and Drum Handling Regulation.

(5) USEPA: 40 CFR 263.

(6) OSHA Standards.

(7) Posted weight limitations on roads and bridges.

(8) "Off-Site Policy: RFA or Equivalent Investigation Requirement at RCRA Treatment and Storage Facilities," EPA Memorandum from J.W. Porter to Waste Management Division Directors, January 4, 1988.

PART 3 - SUBMITTALS

3.1 As part of the Material Handling Plan (MHP) of this Contract, the Contractor shall provide to the Construction Manager a program for the proposed transportation and disposal of drums. The Contractor shall also submit with the MHP letters of commitment from the properly licensed and insured waste haulers and the treatment, disposal or recovery facility to haul and accept shipments. The letters shall indicate agreement to handle and accept the specified estimated quantities of material and types during the time period specified in the project schedule and any time extension as deemed necessary. Any deviations from the proposed list of transporter(s) and disposer(s) shall be submitted to the Construction Manager for acceptance and shall become the responsibility of the Contractor at no additional cost to ARCO.

3.2 As part of the bidding documents, the Contractor shall submit to the Construction Manager the proposed list of treatment storage and disposal (TSD) or recovery facilities, with the facility's assurance (in writing) that to their best knowledge, they will be open for business during the contract duration.

PART 4 - EQUIPMENT

The Contractor shall utilize appropriate vehicles and operating practices to prevent spillage or leakage of contaminated material from occurring enroute.

PART 5 - FACILITIES

The Contractor shall provide, install and maintain temporary loading facilities required for completion of material handling activities. The location and design of such facilities shall be included in the Material Handling Plan and be submitted to the Construction Manager for acceptance.

PART 6 - TRANSPORTATION

6.1 Manifests: The Contractor shall organize and maintain the material shipment records/manifests required by the Federal Resource Conservation and Recovery Act (RCRA) (Public Law 94-580), the State of New York and the state where the treatment/disposal facility is located. The manifests will be signed by ARCO, or its designated representative.

6.2 The Contractor shall coordinate the schedule for truck arrival and material deliveries at the disposal site to meet the approved project schedule. The schedule shall be compatible with the availability of equipment and personnel for material handling operations.

6.3 All vehicles leaving the Exclusion Zone (EZ) shall be decontaminated at the Contamination Reduction Zone (CRZ). The Contractor shall visually inspect all vehicles to ensure that soil does not adhere to its wheels or undercarriage after decontamination.

6.4 The Contractor shall periodically inspect all routes that the vehicles take from the job site to the treatment/disposal facility to ensure that no leakage or tracking of mud has occurred.

6.5 The Contractor shall not deliver waste to any facility other than the disposal facility(ies) listed on the shipping manifest.

6.6 The Contractor shall coordinate vehicle inspection and recording of quantities leaving the site with the Construction Manager. These quantities shall be verified with recorded quantities at the disposal facility(ies). If any deviation between the two weight records occurs, the matter is to be reported immediately to the Construction Manager.

6.7 The Contractor shall be held responsible for any and all actions necessary to remedy situations involving material spilled in transit or mud and dust tracked off-site. This cleanup shall be accomplished at the Contractor's expense.

6.8 The Contractor shall be responsible for inspecting the access routes for road conditions, overhead clearance, and weight restrictions.

6.9 The Contractor shall ensure that trucks are protected by properly covering and lining them and by decontaminating them as required prior to any use other than hauling the same type of contaminated materials.

6.10 The Contractor shall only use the transporter(s) identified in his bid for the performance of work. Any use of substitute or additional transporters must have previous written approval from the Construction Manager and shall be at no additional cost to ARCO. Transporters shall be certified by EPA and New York State to transport hazardous waste.

6.11 The Contractor shall not combine contaminated materials from other projects with material from the Sinclair Refinery Site Landfill.

6.12 ARCO, or its designated representative, will provide a hazardous waste generator identification number and will sign the manifest.

PART 7 - OFF-SITE DISPOSAL

7.1 The Contractor shall use only the treatment, disposal, and recovery facility(ies) identified in his bid for the performance of the work. Substitutions or additions shall not be permitted without prior written acceptance by the Construction Manager, and if accepted, shall be with no extra cost to ARCO.

7.2 The Contractor shall be responsible for acceptance of the specific material at an approved treatment, disposal, or recovery facility, for ensuring that the facility is properly permitted including RCRA treatment, storage and disposal permits, to accept and handle the stated material, and that the facility provides the stated treatment and disposal, treatment or disposal services.

7.3 Drums requiring off-site disposal shall be disposed of according to waste-specific characteristics. The contents of the drums shall be characterized as outlined in the Sampling and Analysis Plan (SAP) to meet the compatibility requirements for bulking and disposal. Based on the results of the Remedial Investigation (SMC Martin, March 14, 1985), the materials contained in the drums are not expected to be RCRA listed wastes. The compatibility testing will determine/confirm the expected contents of the drums. Therefore, these materials will be sent to an off-site RCRA Subtitle C landfill if they meet the Best Demonstrated Available Technology (BDAT) Treatment Standards for RCRA characteristic wastes, and do not contain free liquids. Other means of treatment and disposal, such as neutralization, precipitation, solidification or incineration, may also be utilized, depending on the waste-specific and TSDF-specific requirements.

7.4 This letter of commitment will be used by the Construction Manager to evaluate the acceptability of the Contractor's proposed facility(ies) in accordance with "Revised Procedures for Implementig Off-Site Response Actions" (EPA OSWER Directive Number 9834.11, November 13, 1987) and "Off-Site Policy: RFA or Equivalent Investigation Requirement at RCRA Treatment and Storage Facilities" (EPA Memorandum from J.W. Porter, January 4, 1988). Briefly, the Directive describes procedures for response actions under CERCLA or Section 7003 of RCRA involving the off-site treatment, storage, or disposal of CERCLA waste. The memorandum states that, as an interim measure, the policy has been revised to include all, not just land disposal, Subtitle C facilities.

7.5 The Construction Manager reserves the right to contact and visit the disposal facilities and regulatory agencies to verify the agreement to accept the stated material and to verify any other information provided. This does not in any way relieve the Contractor of his responsibilities under this Contract.

7.6 In the event that the identified and accepted facility(ies) ceases to accept the stated materials or the facility(ies) ceases operations, it is the Contractor's responsibility to locate an alternate approved and permitted facility(ies) for accepting materials. The Contractor is responsible for making the necessary arrangements to utilize the facility(ies), and the alternate facility(ies) must be accepted in writing by the Construction Manager in the same manner and with the same requirements as for the original facility(ies). This shall be accomplished at no extra cost to ARCO.

PART 8 - RECORDKEEPING

The Contractor shall obtain manifest forms, obtain material code numbers, and complete the shipment manifest records as required by the appropriate regulatory agencies for verifying the material type (Code No.) and quantity of each load in units of volume and weight. The manifests will be signed by ARCO or its designated representative. Copies of each manifest shall be submitted to the Construction Manager within two (2) business days following shipment, and within two (2) business days after notification of receipt of the disposal facility. Any manifest discrepancies shall be reported immediately to the Construction Manager and be resolved by the Contractor.

END OF SECTION

SECTION 02110

SITE CLEARING AND GRUBBING

PART 1 - GENERAL

The work required under this Section includes furnishing all plant, labor, equipment, and materials for performing all operations required for clearing and grubbing the Central Elevated Landfill Area (CELA) and the refinery areas at the Sinclair Refinery Site as shown on the Contract Drawings (AR-13, AR-18, AR-23 and AR-24).

1.1 Definitions

1.1.1 Clearing: Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring within the areas to be cleared.

1.1.2 Grubbing: Grubbing shall consist of the removal and disposal of stumps, roots larger than 1-1/2 inches in diameter, and matted roots and decayed matter to a depth not less than 12 inches below original ground in the designated grubbing areas.

1.2 Dust Control: The Contractor shall comply with dust control requirements specified in Section 02040 - Dust and Vapor Control, of the Specifications.

PART 2 - REQUIRED WORK

2.1 Clearing: Clearing shall consist of the removal of all trees (cut just above ground surface), brush, logs, limb wood, rubbish, and all other obstructions on the surface of the original ground within the limits of clearing shown on the Contract Drawings, except such trees and vegetation as may be directed by the Construction Manager or his designee to be left standing. Trees directed to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches to the heights directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with a tree-wound paint approved by the Construction Manager. Trees and vegetation to be left standing shall be protected from damage incident to clearing, and construction operations by the erection of barriers or by such other means as the circumstances require.

2.2 Disposal of materials from clearing: Material from clearing shall be disposed of off-site, in accordance with all applicable laws and regulations, or, at the discretion of the Contractor, shall be chipped and stockpiled on site outside the cap, in an area to be designated by the Construction Manager.

The stockpile shall be covered with plastic until placement of top soil on the cap at which time it may be used as mulch.

2.3 Grubbing: The Contractor shall grub areas within the limits of clearing and grubbing for the slurry wall designated on Contract Drawing AR-18. Elsewhere, grubbing shall be limited to locations where the gas vent layer is less than 12 inches above the existing grade of the CELA surface. Areas where the CELA is excavated more than 12 inches shall not be grubbed.

2.4 Disposal of materials from grubbing: Roots, stumps and other debris from grubbing shall be chipped and placed at a location approved by the Construction Manager, or, at the discretion of the Contractor, shall be chipped and spread uniformly under the area to be capped.

END OF SECTION

SECTION 02168

SOIL-BENTONITE CUTOFF WALL

PART 1 - GENERAL

1.1 Scope of Work

1.1.1 The Scope of Work for the design and construction of the cutoff wall, herein referred to as Work, shall include but not be limited to:

1. Clearing and grubbing as per Section 02110 and Contract Drawing AR-18

2. Providing a layout of the cutoff wall, including surveying and survey control;

3. Providing the bentonite and water slurry, including mixing, storage, pumping, testing of the slurry, and maintaining the required physical properties of the slurry during construction;

4. Excavating a slurry trench and maintaining the trench stability and the bentonite and water slurry levels;

5. Mixing the soil-bentonite backfill to the required consistency and placing the mixture in the slurry trench and meeting the performance requirements of this section;

6. Cleaning and restoring the site and facilities to meet project requirements, including the disposal of hydrated and potentially contaminated soil-bentonite slurry, spoil, contaminated soil, rock, and other materials encountered during trench excavation;

7. Maintaining the safety and operation of the site during construction;

8. Providing water and electrical service hook-up;

9. Providing an in-place soil-bentonite cutoff wall as per Contract Drawings AR-18, AR-19 and AR-20 and meeting all the performance characteristics of this section including Tables 02168-1 and 2. Although substantial information is provided herein, the Contractor is responsible for meeting these performance characteristics; and

10. Removing and disposing of drums encountered during the work in accordance with specification Section 02090 and 02095.

1.1.2 The Contractor shall furnish all labor, supervision, tools, equipment, and materials for constructing the cutoff wall using the slurry trench method of construction in accordance with this Section. The Contractor shall construct the cutoff wall to the alignment, grade, depth, and sections as defined in this Section and as shown on the Contract Drawings. The Contractor shall be responsible for the alignment continuity (AR-19), width, depth, and permeability of the completed cutoff wall.

1.1.3 The cutoff wall shall form a low permeability barrier to the flow of the ground water and other material floating on or potentially dissolved in the ground water. A low permeability barrier is defined as a barrier having an equivalent long-term saturated hydraulic conductivity (coefficient of saturated permeability) of 1×10^{-7} cm/sec or less. The cutoff wall shall be constructed in the slurry trench using a soil-bentonite backfill which is composed of a bentonite slurry blended with select materials excavated from the trench and from an off-site borrow area proposed by the Contractor and accepted by the Construction Manager. The Contractor shall initiate sampling of borrow area in accordance with Quality Assurance Project Plan and submit the results to the Construction Manager for review and acceptance.

1.1.4 The Contractor, and any subcontractors retained for work on the cutoff wall, shall arrange, secure, and pay for all required construction permits, inspections, construction, and environmental monitoring as required for the Work unless otherwise provided for by the Owner in writing.

1.1.5 The Work specified shall be subject to the requirements of the documents cited herein. The Contractor shall be responsible for all the requirements specified herein unless indicated otherwise by the Owner. In the event of a conflict between these Specifications and the referenced standards, these Specifications shall govern. The requirements of the regulatory orders take precedence over conflicting requirements in cited documents.

1.1.6 Further definition of the site and subsurface conditions is contained in reports authored by various companies and agencies including: Ebasco Services, Inc. (Ebasco), SMC Martin, Inc., Bechtel Environmental, Inc., and the USEPA. References are listed in Section 1.3 of this specification. ARCO and Ebasco make no warranty, expressed or implied, of the site and subsurface conditions or the potential impact of subsurface conditions on the Contractor's performance or schedule. The above mentioned reports can be reviewed, by appointment, at the offices of:

Mr. David A. Christensen
Project Manager
Atlantic Richfield Company
ARCO Plaza
515 South Flower Street
Los Angeles, California 90071
(213) 486-3622

Mr. Thomas Granger
Vice President
Ebasco Environmental
160 Chubb Avenue
Lyndhurst, New Jersey 07071-3586
(201) 460-6197

Soil boring logs and grain size distribution analysis results of the soil in the central elevated landfill area are attached to this specification for Contractor's convenience (Attachment 1). The Contractor may conduct additional soil borings, at no additional cost to the Owner, to supplement the data in these documents. The Contractor is responsible for the collection and interpretation of these data.

1.2 Definitions

Whenever the following terms are used in this Section, or the Contract Drawings the intent and meaning of the terms shall be interpreted as defined below. If conflicts develop between this Section and the Contract Drawings, this Section shall govern.

1. Backfill: Backfill is earth or other materials used to replace material removed during construction operations. For slurry walls, the backfill is soil-bentonite.

2. Bentonite: Bentonite is a natural clay whose principal mineral constituent is sodium montmorillonite.

3. Contract Drawings: Drawings prepared by the Engineer to complete the Scope of Work.

4. Contractor: The firm, including its subcontractors and suppliers, which enters into a contract with the Owner to perform the Work described in these Specifications.

5. Field Engineer: The Engineer responsible for selected monitoring and testing; observing, evaluating, and documenting geotechnical conditions encountered during construction; and conducting other evaluations and investigations as requested by the Owner/Construction Manager.

6. Ground Water: Ground water denotes all water below the existing ground surface within the work area.

7. Mixing Area: The area in which all mixing and blending of soil and bentonite slurry shall take place. After mixing, the blended materials will be transported to the slurry trench. There may be more than one mixing area on the site.

8. Owner/Construction Manager: Atlantic Richfield Company (ARCO)/Ebasco Services Inc;/Owner's authorized field respentative.

9. Select Materials: Materials excavated from the trench and/or obtained from an off-site borrow area and suitable for use in the backfill.

10. Slurry: The slurry is a stable colloidal thixotropic suspension of powdered bentonite mixed in water, which is also referred to as bentonite slurry.

11. Slurry Method of Excavation: The slurry method of excavation consists of excavating a vertical side wall trench in the overburden and/or fill while at the same time keeping the trench filled with slurry. The basic purpose of the slurry is to provide support for the walls of the trench.

12. Soil-Bentonite Backfill: The blended mixture of bentonite slurry and select materials excavated from the trench and select materials obtained from a designated borrow area.

13. Soil-Bentonite Slurry Trench Cutoff: A soil-bentonite slurry trench cutoff is a trench excavated in the existing overburden and/or fill by the slurry method of excavation and backfilled with a soil-bentonite backfill to form a low-permeability barrier. The soil-bentonite slurry trench cutoff is referred to herein as the cutoff wall.

14. Specifications: Technical Specifications, Section 02168, 02110, 02090, 02095, 02040, 02060, 02220, 02210.

15. Spoil: Refuse material removed from an excavation.

16. Superintendent: A person under direction of the Contractor who supervises construction.

17. Surface Water: Surface water is used to denote all waters that enter the work area above the existing ground from either natural or artificial sources.

18. Work: Work shall include labor, materials, equipment and supervising services necessary to complete the contract.

19. Working Pad: The working pad is the surface on which the equipment shall operate to construct the cutoff wall.

20. Common Fill: The Common Fill is the excavated dike materials stockpiled on the site and suitable for use in the working pad.

1.3 References

1.3.1 All work shall be performed in compliance with the Specifications unless otherwise approved in writing by the Owner.

1.3.2 Tests performed on the specified materials shall conform to the American Petroleum Institute (API) and the American Society for Testing and Materials (ASTM) standards referenced below:

1. API Specifications:

   a. Specification 13A-90, "Specification for Oil Well Drilling Fluid Materials"; and

   b. Recommended Practice 13B-1-90, "Recommended Practice for Standard Procedure for Testing Drilling Fluids".

2. ASTM Specifications:

   a. ASTM C 143-90, "Standard Test Method for Slump of Cement Concrete";

   b. ASTM D 422-63, (Reapproved 1990), "Standard Method for Particle-Size Analysis of Soils";

   c. ASTM D 698-78, (Reapproved 1990), "Standard Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. Rammer and 12-in. Drop";

   d. ASTM D 1140-54, (Reapproved 1990), "Standard Test Method for the Amount of Material Finer than the NO. 200 Sieve";

   e. ASTM D 1556-90, "Standard Test Method for Density of Soil in Place by the Sand-Cone Method";

   f. ASTM D 2922-81, (Reapproved 1990), "Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)";

   g. ASTM D 3017-88, "Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)":

h. ASTM D 4016-81, (Reapproved 1988), "Standard Test Method for Viscosity of Chemical Grouts by the Brookfield Viscometer";

i. ASTM D 4380-84, "Standard Test Method for Density of Bentonitic Slurries";

j. ASTM D 4318-84, "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils":

k. ASTM D 4944-89, "Standard Test Method for Field Determination of Water (Moisture) Content of Soil by The Calcium Carbide Gas Pressure Tester Method"; and

l. ASTM D 5084-90, "Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter".

3. EPA Standards:

EPA 430/9-73-007	Processes, procedures and methods to control pollution resulting from all construction activity.
EPA 160.1	Total Dissolved Solids

4. Other:

a. BAT™ testing will be performed in accordance with manufacturer's recommended testing specifications.

1.3.3 Documents which provide information on the project site conditions include the following:

1. Bechtel Environmental, Inc., Statement of Work - For the Implementation of Remedial Measures for the Sinclair Landfill, Wellsville, Allegany County, New York, September 1988;

2. Ebasco Services Inc., Design Basis Report for Landfill Remediation, Sinclair Refinery Site, Wellsville, New York, July 1989;

3. Ebasco Services Inc., Landfill Field Investigation Report, Sinclair Refinery Site, Wellsville, New York, July 1989;

4. Ebasco Services Inc., Remedial Investigation Report for the Sinclair Refinery Site, Wellsville, New York, March 1991;

5. Ebasco Services Inc., Draft Geotechnical Report, Landfill Remediation, Sinclair Refinery, Wellsville, New York, April 1991;

6. Ebasco Services Inc., Subsurface Investigation Slurry Wall Alignment Confirmation Study, Wellsville, New York June 1991;

7. GoeSyntec Consultants, Draft Laboratory Testing Report Volume I for Mix Design and Component Compatibility Soil-Bentonite Slurry Trench Cutoff Wall, Sinclair Refinery, Wellsville, New York, July 1991;

8. GeoSyntec Consultants, Draft Laboratory Testing Report Volume II for Mix Design and Component Compatibility Soil-Bentonite Slurry Trench Cutoff Wall, Sinclair Refinery, Wellsville, New York, August 1991;

9. GeoSyntec Consultants, Laboratory Testing Report for Subsurface Clay Used for Key of Soil-Bentonite Slurry Trench Cutoff Wall, Sinclair Refinery, Wellsville, New York, August 1991;

10. SMC Martin Inc., Phase I Remedial Investigation, Sinclair Refinery Site, Wellsville, New York, Volume 1 of 2 (published and Volume 2 of 2 (not published), Draft, March 1985;

11. SMC Martin Inc., Feasibility Study for Sinclair Landfill Site, Wellsville, New York, August 1985;

12. U.S. Environmental Protection Agency - Region II, Record of Decision, Sinclair Refinery Site Landfill, 30 September 1985; and

13. U.S. Environmental Protection Agency, Consent Decree for the Remedial Design/Remedial Action Activities, 18 May 1989.

14. Project Health and Safety Plan Including Contingency Plan, Sinclair Refinery Site CELA Remediation, Wellsville, New York, June 1991.

15. Quality Assurance Project Plan, Sinclair Refinery Site, CELA Remediation, Wellsville, New York, June 1991.

1.4 General Work Conditions and Materials

1.4.1 Work and materials included in this project shall be in accordance with the latest regulations of legally constituted public authorities having jurisdiction at the project site. The Contract Drawings and Specifications shall not be interpreted as allowing Work activities to be undertaken which are not in conformance with requirements of the regulations.

1.4.2 Where construction details are not shown or noted on the Construction Drawings, the Contractor shall notify the Construction Manager. The Construction Manager shall provide sufficient construction details to the Contractor to allow the Work to proceed.

1.4.3 The Contractor shall cooperate with the Construction Manager and Field Engineer and shall permit free and safe access to the site during all phases of the Work.

1.4.4 No substitution of equipment or materials shall be made by the Contractor without acceptance by the Construction Manager.

1.4.5 Quality and craftsmanship of the Work is subject to the approval of the Owner, Construction Manager, and Regulatory Agencies.

1.4.6 All Work on the project site shall be conducted in a safe and orderly manner.

1.4.7 The Contractor shall be responsible for disposing of hazardous waste, trash, and debris, generated during conduct of the Work at the site. Disposal shall be in a safe, and acceptable manner, in accordance with applicable laws and ordinances as prescribed by authorities having jurisdiction. Visually contaminated soil encountered during slurry trench excavation shall be disposed of on the CELA in a location identified by the Construction Manager. The trash, waste material, and debris generated by the Contractor during execution of the Work, as well as the stripped vegetative materials, shall be disposed of off site by the Contractor.

PART 2 - SUBMITTALS AND QUALIFICATIONS

2.1 Submittals

2.1.1 The Contractor shall submit, for review and acceptance by the Construction Manager, a complete description of the operational procedures, which will be used to perform the Work. These descriptions shall include procedures for:

1. material and equipment storage;
2. site maintenance;
3. slurry mixing (including mix design), storing, transporting, and testing;

4. slurry wall excavation;

5. slurry trench stability maintenance;

6. backfill mixing and placement;

7. contaminated and spent slurry disposal upon termination of the project;

8. disposal of trash, waste material, and debris generated by the Contractor during execution of the Work; and

9. equipment decontamination.

2.1.2 Prior to beginning the Work, the Contractor shall submit a proposed quality assurance program for the Work in conformance with requirements of these Specifications and the Quality Assurance Project Plan. Any verification testing work performed by the Field Engineer does not release the Contractor of the obligation to perform the quality assurance work indicated in these specifications unless so approved by the Owner. The proposed quality assurance program shall be submitted to the Construction Manager for review and acceptance.

2.1.3 Prior to beginning the Work, the Contractor shall submit a list of the make and model of the equipment proposed to be used for the Work. The list shall include excavation equipment; slurry mixing, storing, and transporting equipment; trench bottom cleaning equipment; backfill mixing equipment; compaction equipment; and other tools and appurtenances indigenous to the Work. This list shall be submitted to the Construction Manager for review and acceptance.

2.1.4 Prior to beginning the Work, the Contractor shall submit documents which certify the properties of bentonite, additives (if any), mixing water, and other materials requiring certification which are proposed for use on the project. Contractor shall also provide documentation certifying the chemical compatibility of the soil-bentonite mix with site waste or floating product. A chemical analysis of the floating product is provided in Appendix F. Also, results of testing performed by ARCO are available for the Contractors use, review and acceptance. The documents shall be submitted to the Construction Manager for review and acceptance. At the request of the Construction Manager, the Contractor shall furnish samples of the certified materials in sufficient quantity to allow independent quality assurance (QA) verification testing.

2.2 Qualifications

2.2.1 The Contractor shall submit evidence of experience and competence in soil-bentonite slurry trench cutoff wall construction as described herein. The evidence shall: 1) demonstrate that the Contractor has a minimum of 5 years experience in cutoff wall construction, and 2) contain a list of typical soil-bentonite backfill projects which have been completed including three recently completed projects whose Owner and Field Engineer may be contacted. The evidence shall also demonstrate that the Contractor has experience and qualified personnel to complete the Work using sufficient and appropriate equipment.

2.2.2 If, in the opinion of the Construction Manager, the safety, quality, or progress of the Work is impaired by a shortage of the Contractor's qualified personnel, the Contractor shall assign additional qualified personnel to the Work that are acceptable to the Construction Manager.

2.2.3 The Contractor shall designate, for approval by the Field Engineer, a Superintendent who will supervise the construction. The Superintendent shall be at the project site at all times during construction and shall be authorized to speak and act on behalf of the Contractor. The Contractor shall submit evidence that the Superintendent is experienced in the type of work specified herein.

PART 3 - PRODUCTS

3.1 Materials

3.1.1 Bentonite used in preparing the bentonite slurry shall be evaluated based on the results of the Contractor's laboratory testing program. The bentonite delivered for use at the site shall be a pulverized, high-swelling, natural sodium bentonite in accordance with API Standard 13A-90 "Specification for Oil-Well Drilling-Fluid Materials". If bentonite other than the type specified is to be used, the Contractor shall receive acceptance from the Construction Manager prior to its use. All bentonite used must be tested in accordance with these Specifications. The bentonite shall be protected from moisture and contaminants in transit to and in storage at the site.

3.1.2 Water from the local potable water supply system shall be used in preparing the bentonite slurry. The water shall be clean and free from deleterious amounts of oil, salts, and organic matter. The total dissolved solids shall be less than 500 ppm and the pH shall be greater than or equal to 7. If water from sources other than those listed above is proposed for use, the Contractor shall receive acceptance from the Construction Manager prior to use. All sources of water must be tested in accordance with this Section. The Contractor shall identify the source of the water

supply and perform the chemical analyses. The Contractor shall submit the results of these tests to the Construction Manager for review and acceptance prior to use at the site.

3.1.3 The slurry shall consist of a stable colloidal suspension of bentonite and water and shall be controlled in accordance with API Standard 13B-90, "Standard Procedure for Testing-Drilling Fluids". The freshly hydrated bentonite slurry shall have properties within the following limits when the slurry is completely hydrated:

a. Bentonite: greater than 2 percent (by weight);

b. Density: greater than 65 lb/ft^3 (1,041 kg/m^3);

c. Viscosity: 35 to 45 Marsh seconds;

d. Filtrate Loss less than 30 ml in 30 min. @ 100 psi;

e. pH: between 7 and 10; and

f. Temperature: greater than 35°F

The bentonite slurry as used for trench stabilization shall have properties in the trench within the following limits when the slurry is in the trench:

a. Density: 65 to 85 lb/ft^3 (1,041 to 1,346 kg/m^3);

b. Viscosity: 35 to 55 Marsh seconds; and

3.1.4 The Contractor may be permitted or instructed by the Construction Manager at any time to add weighting materials or stabilizing materials to increase the density of the slurry in the trench within the above limits to provide for stability of the trench excavation. When so instructed, the Contractor shall respond as quickly as practical considering conditions in the work area. Any changes from the specified properties required to meet the intent of these Specifications shall be reviewed and accepted by the Construction Manager prior to implementation.

3.1.5 The Contractor shall maintain the properties of the slurry in the trench by approved additives, recirculation, desanding or replacement. Additives such as dispersants, plugging agents, and/or softeners may be added to the water or bentonite so as to permit proper workability of the slurry and efficient use of the bentonite. Additives to the bentonite slurry shall be reviewed by the Construction Manager for acceptance prior to use.

3.1.6 The soil-bentonite material placed as backfill in the trench shall consist of a mixture of select excavated soils from the alignment of the trench, soils obtained from a specified off-site

borrow area and bentonite slurry. The blended backfill material shall be free of roots, orgnanic soil, lumps, stones, trash, debris, or other deleterious materials. The backfill shall be thoroughly mixed using proportions indicated in these Specifications, or approved equivalent, and shall not contain unmixed pockets of slurry or soil. At all times the backfill density shall be at least 15 lb/ft^3 (240 kg/m^3) greater than the slurry density. The slump of the well-mixed backfill shall range from 3 to 6 in. (7.6 to 15.2 cm). This requirement may be varied by the Construction Manager in order to improve the integrity of the cutoff wall. The backfill shall consist of soils well-graded between the following gradation limits:

Sieve Size	Percent Passing (by weight in percent)
3/8"	65 to 100
No. 40	30 to 80
No. 200	25 to 50

Maximum Size of Aggregate: 4 in. (10.2 cm)

Any change in materials or changes in the amounts of the materials in the backfill blend shall be reviewed by the Construction Manager for acceptance.

3.1.7 The Contractor shall use the Common Fill defined in paragraph 1.2.20, crushed stone as per paragraph 7.10.1 of Section 02220, or any other suitable material approved by the Construction Manager to construct the Working Pad required for construction of the soil-bentonite cutoff wall.

3.1.8 The top of the cutoff wall shall be checked for any free water or surface depressions after the soil-bentonite slurry has settled. Free water shall be removed and fresh soil-bentonite slurry added to fill in depressions. The specified top of the trench elevation shall be obtained prior to final capping. The slurry trench shall not be capped until the soil-bentonite slurry backfill has sufficiently settled according to specification 5.2.20. This will minimize further consolidation from the capping materials and equipment. Clay material used for capping shall be placed in compacted lifts not exceeding 12 in. (30 cm). Each lift shall be compacted to a minimum density of 90 percent of the maximum dry unit weight, as determined by the Standard Proctor Test ASTM D698.

3.2 Equipment

3.2.1 The Contractor shall provide a slurry plant which includes a suitable mixer capable of producing a colloidal suspension of bentonite and water, an agitating sump, pumps, and necessary

valves, hoses, supply lines, and small tools to provide an adequate supply of bentonite slurry to the cutoff trench excavation. The Contractor shall use the approved water source for slurry mixing. The Contractor shall obtain the necessary valves, hoses, and other necessary items to bring water from the approved source to the slurry preparation and mixing area. The mixer used in preparing the slurry shall be a high-speed colloidal-type mixer (or other approved type) capable of achieving complete dispersion of bentonite and additives. The mixer shall be capable of continually mixing the slurry to provide a uniform and thoroughly blended slurry. No hand mixing of the slurry will be allowed. Mixing in the trench will not be allowed.

3.2.2 The Contractor shall provide storage of the slurry in above-ground tanks or in excavated on-site pits. The storage facilities shall be of sufficient size to accommodate the trench excavation rate and to allow complete hydration of the bentonite before mixing with additives. The storage facilities shall be equipped with a circulation system for agitation of the slurry and shall have adequate capacity to provide fully hydrated slurry in the event that a substantial loss of slurry occurs from the trench through pervious zones or for other reasons.

3.2.3 The Contractor shall provide equipment for excavating the slurry trench consisting of either a dragline, a backhoe, or a special slurry trench clamshell so that the required width of the trench can be carried to its final depth of cut continuously along the trench alignment to depths greater than 50 ft (15 m). The equipment shall be capable of excavating the minimum required width trench in a single pass of the excavating tool. Special chopping tools or similar equipment may be used to accomplish the required excavation if accepted by the Construction Manager. Air lift pumps and slurry desanders shall be used as necessary to clean the trench bottom and the slurry in accordance with these Specifications.

3.2.4 The Contractor shall provide equipment for mixing the soil-bentonite backfill which is capable of thoroughly mixing the backfill materials into a homogenous mass meeting the desired gradation and required properties. The equipment may be any suitable type of earthmoving or grading equipment, such as bulldozers, disk harrows, and blade graders or mechanical blenders. Equipment for placing the backfill into the trenches shall consist of backhoe, clamshell, front-end loader and/or bulldozer.

PART 4 - QUALITY ASSURANCE/VERIFICATION TESTING

4.1 Construction Monitoring and Testing

4.1.1 Quality Assurance (QA) of all phases of construction of the soil-bentonite slurry cutoff wall shall be the responsibility of the Contractor. Verification testing as shown on Table 02168-2

will be performed by the Field Engineer. The Contractor shall provide the necessary labor and equipment to assist the Field Engineer in performing this verification testing. All QA testing shall be referenced to the trench station (or baseline station) at which the test was conducted or at which the sample was obtained.

QA tests and QA testing frequencies shall be selected at the discretion of the Field Engineer; however, the type of QA testing and the minimum QA and testing frequencies are provided in Table 02168-1 at the end of these Specifications. Minimum verification testing requirements and testing frequencies are provided in Table 02168-2 at the end of this Section. The Contractor shall notify the Field Engineer prior to conducting tests and shall inform the Construction Manager of the QA test results as soon as the results are available. The Field Engineer reserves the right to conduct check tests as deemed necessary. The Contractor shall provide full cooperation and assistance in obtaining samples for a check test and during the conduct of a check list.

4.1.2 The Contractor shall allow sufficient time during the excavation cycle for the Field Engineer to observe and sample the soil as it is removed from the trench. The elevations of the bottom of the finished trench and backfill shall be measured by sounding to within 0.2 ft (0.06 m) and recorded at a minimum 20 ft (6 m) interval along the alignment from the point of excavation to the point of backfill placement. When the bottom of the trench has been keyed into suitable material, the bottom of the trench shall be checked for excessive sediment prior to backfilling. Excessive sediment shall be removed using appropriate equipment prior to backfill placement.

4.1.3 The Contractor shall continuously test and control the mixing and placing of the bentonite slurry in order to maintain the slurry properties within the limits specified in Section 2.1.3 of these Specifications. Material and workmanship shall, at all stages of manufacture and preparation of the bentonite slurry, be subject to the Field Engineer's monitoring.

4.1.4 The Contractor shall be responsible for documenting the location, verticality, depth, and continuity of the trench. The depth and verticality of the trench shall be checked prior to the placement of the backfill. The criteria for trench depth and verticality are summarized in Table 02168-1 of this Section. The depth and verticality of the trench shall be documented by the Contractor and submitted to the Field Engineer for review and acceptance.

4.1.5 The Contractor shall provide the Field Engineer with the labor required:

1. to assist in evaluating the elevation of the working platform;

2. to evaluate the depth and elevation of the trench bottom;

3. to evaluate the verticality of the trench;

4. to probe the bottom of the trench under the observation of the Field Engineer; and

5. to assist in the execution of the duties and responsibilities of the Field Engineer.

The Field Engineer reserves the right to make any measurement deemed necessary to monitor and evaluate the actual condition of the cutoff wall. The Contractor shall cooperate with the Field Engineer and provide assistance in these measurements, without the right to claim for delays.

4.1.6 The Contractor shall be responsible for obtaining all materials and providing all Quality Assurance (QA) testing of the materials required to complete the Work as described below.

1. The Contractor shall submit manufacturer QA certificates for each truckload of bentonite received at the site. At a minimum, the manufacturer QA certificates shall state that the bentonite complies with API Specification 13A-90, as last revised. Upon receipt of each shipment of the bentonite at the site,
any defective material found to be contaminated or otherwise not in accordance with the specifications contained herein shall be replaced by the Contractor free of charge FOB the site. The defective material shall be removed from the site by the Contractor.

2. The Contractor shall submit manufacturer QA certificates for each truckload of additives received at the site. At a minimum, the manufacturer QA certificates shall state that the additives comply with stated characteristics.

3. The Contractor shall submit test results for the water to be used for the cutoff wall construction. The Contractor shall submit the test results to the Field Engineer for review and acceptance prior to using the water for cutoff wall construction. The water shall be chemically tested once prior to the start of construction and once each time the source changes if the source change is accepted by the Field Engineer. The water shall be tested for pH, total petroleum hydrocarbon, and total dissolved solids.

4. The Contractor shall test the freshly mixed bentonite-water slurry viscosity and unit weight properties at a minimum frequency of twice daily. The pH and filtrate property testing shall be conducted at a minimum frequency of three times weekly. The bentonite slurry in the trench shall be

tested at a minimum frequency of twice daily for viscosity, and unit weight. The bentonite slurry samples shall be obtained at the bottom of the trench near the point of excavation. Results of all tests shall be submitted to the Field Engineer for review and acceptance.

5. The Contractor shall conduct slump testing and gradation testing of the soil-bentonite backfill at a minimum frequency of once per 500 yd^3 (382 m^3) of backfill.

6. The Contractor shall obtain samples from the base of the trench at 100 ft (30 m) intervals along the trench alignment. If the underlying stratum of low permeability soil (clay layer) is encountered at a depth of less than 50 ft (15 m), Atterberg Limits shall be performed on the clay at a minimum frequency of once every 500 ft (150 m). All samples should be submitted to the Field Engineer for visual observation and acceptance, then preserved in a sample jar and archived.

7. The Contractor shall obtain Shelby tube samples of the completed soil-bentonite slurry wall at a minimum frequency of 1 sample per 1,000 yd^3 (765 m^3) of wall. Laboratory permeability tests shall be performed on the Shelby tube samples. Guidelines for conducting the laboratory tests are provided in ASTM D 5084. Results of the laboratory permeability test shall be submitted to the Field Engineer within ten days of the analysis for review and acceptance.

8. The Field Engineer representative shall perform in-situ permeability testing of the completed wall using the BAT™ system at a frequency of 1 test for every 5,000 yd^3 (3,822 m^3) of completed wall. The in-situ permeability testing of the cutoff wall shall be conducted within three months of the cutoff wall completion. The results shall be submitted to the Field Engineer for review and acceptance.

Test results performed in accordance with the requirements of this Section shall be recorded on data forms acceptable to the Field Engineer and available for the Field Engineer's review at all times. The test results shall be submitted weekly.

4.1.7 The Owner or Field Engineer shall have the authority to reject all materials and workmanship not conforming to the Contract Drawings and/or Specifications. The Contractor shall promptly replace rejected materials and repair rejected workmanship at the Contractor's expense. If the Field Engineer, through oversight or otherwise, has accepted materials or workmanship which do no conform to the Contract Drawings and/or Specifications, the same material, no matter in what stage of work completion, may be later rejected by the Field Engineer. If the material or workmanship is rejected, the Contractor shall replace and rework the material at no additional cost to the Owner.

PART 5 - EXECUTION

5.1 Site Work

5.1.1 The area shown on Contract Drawing (AR-18) shall be cleared and grubbed for the full width shown on the drawing. This area shall be known as the Working Pad. The Working Pad shall be kept free of ponded water for the duration of the Work. The stripped material shall be disposed or stockpiled as directed by the Field Engineer. At locations where ponded water exists, the Contractor shall place crushed stone and refuse material from trench excavation, according to Specification 5.2.24 page 02168-22, over the area required for his operations to a height of at least 6 inches above the free standing water level as shown on Contract Drawing AR-20. If the ponded water is hydraulically connected to the ground water table, to maintain the stability of the trench, the Contractor should either increase the height of the working platform or decrease (pump out) the water level so that the level of slurry in the slurry trench can be maintained a minimum of 2 ft above the water level.

5.1.2 If required and accepted by the Field Engineer, common fill shall be placed on the Working Pad to stabilize the subgrade. The fill shall be placed and compacted in layers on the Working Pad. The thickness of the layers as measured loose shall not exceed 12 in. (30 cm). Compaction of the fill shall be accomplished with vibratory or rubber-tired equipment. The Contractor shall propose the equipment, lift thickness and procedures to achieve a field dry unit weight of 95 percent of standard maximum laboratory dry unit weight (ASTM D 698). The Contractor shall submit the fill and the compaction procedures to the Construction Manager for review and acceptance prior to the hauling of fill material.

If alternate forms of subgrade stabilization are required, the Contractor shall submit a list of proposed methods to the Field Engineer for review and acceptance.

5.1.3 During the course of construction, the Contractor shall maintain the Working Pad in a condition so as not to impair the construction operations. These operations include excavating the slurry trench, maintaining quality of the soil-bentonite backfill, maintaining access to the trench for observations and measurements, and providing trafficability of vehicles associated with the Work. Any deterioration of the Working Pad shall be promptly repaired by the Contractor so as not to delay the work.

5.1.4 The Contractor shall be familiar with the surface water drainage patterns of the site. The Contractor shall provide and maintain a drainage system consisting of berms, ditches, sumps, and pumps as required to direct and remove surface runoff from the area so that surface runoff does not flow into the Genesee River, the slurry trench, the soil-bentonite backfill mixing area, or the soil

stockpile. The Contractor shall prepare an erosion and sediment control plan in accordance with Section 02485, Seeding and Erosion Protection, Part. 4.4.

5.1.5 The Contractor shall provide temporary runoff diversion leading to a collection pond(s). The collection pond(s) shall be located within the slurry wall boundary and shall be constructed in accordance with Section 02210. The Contractor shall sample and analyze the runoff contained within the pond prior to discharge. The collected runoff discharge requirements shall be in accordance with the limits specified in Section 02210.

5.1.6 The Contractor shall be responsible to contain, within the work area, any spillage of slurry or runoff containing bentonite. The Contractor shall promptly clean up a spillage of slurry and dispose of it as directed by the Field Engineer.

5.2 Cutoff Wall Construction

5.2.1 The cutoff wall shall be constructed to the elevations, lines, grades, and cross-sections as shown on the Contract Drawings (AR-19 and AR-20).

5.2.2 The maximum total depth of the slurry trench cutoff wall shall not exceed 50 ft. (15 m) as measured from the top of the working platform. If the underlying stratum of low permeability soil (clay layer) is encountered at a depth of 47 ft (14 m) or less, the bottom of the slurry trench cutoff wall shall be keyed a minimum of 3 ft (0.9 m) into the clay layer. If the clayer is encountered at a depth between 47 and 50 ft (14 m and 15 m), the bottom of the slurry trench cutoff wall shall be at a depth not to exceed 50 ft (15 m). In no case shall the cutoff wall be keyed into a clay layer at an elevation higher than the approximate elevation of the top of the clay layer as identified on the Contract Drawing AR-19.

5.2.3 During construction of the trench, samples of the underlying stratum of low permeability soil (clay layer) shall be recovered and returned to the ground surface for visual examination. After examination, the Construction Manager will judge the necessity for extending the trench beyond 3 ft below the elevations of the clay layer shown on the Contract Drawings. After the trench excavation reaches the required elevation and is cleaned, the Construction Manager will measure and document the actual depth of the cutoff, prior to backfilling.

5.2.4 The width of the cutoff wall shall be a minimum of 2 ft (0.6 m) for its entire depth. The width of the excavating equipment shall be at least 2 ft (0.6 m). Should the Contractor elect to construct a wider cutoff, all additional costs for excavation, disposal and material procurement associated with the additional

width shall be at the Contractor's expense. The width of the excavating tool shall not be wider than 2.5 ft (0.8 m) unless accepted by the Construction Manager prior to construction.

5.2.5 The cutoff wall shall be constructed along the horizontal alighment shown on the Conract Drawings. Deviation of more than 2 ft (0.6 m) from the alignment along any length indicated on the Contract Drawings shall not be made without prior written acceptance by the Field Engineer. The vertical alignment of the cutoff wall shall not deviate by more than 2 percent of its full depth.

5.2.6 The bentonite slurry shall be prepared by mixing the specified bentonite with specified water in an approved mixer that achieves complete dispersion of the bentonite particules. The bentonite slurry shall be allowed to hydrate completely before mixing with any additives. This may be accomplished by maintaining high-speed circulation until hydration is complete, or by storing and circulating the slurry in the above ground tank or below ground pits. Complete hydration is defined as the stabilization of the slurry viscosity and fluid loss properties. The bentonite slurry shall be stored under essentially constant circulation until used. Circulation may cease for short periods when construction activities are not in progress.

5.2.7 The excavation shall begin at the location specified by the Field Engineer. Excavation of the slurry trench shall be accomplished by backhoe or other equipment reviewed and accepted by the Field Engineer. The equipment shall excavate continuously along the alignment of the trench from the starting point to the finishing point. Pre-augering, chiseling, or other suitable methods shall be used when necessary to remove in situ materilas. Use of such methods shall be submitted to the Field Engineer for review and acceptance and shall be included in the contract unit prices.

5.2.8 Bentonite slurry shall be introduced into the trench at the beginning of the excavation and shall be maintained at a level no more than 2 ft (0.6 m) below the top of the trench and at least 2 ft (0.6 m) above the highest ground water level throughout the entire excavating and backfilling-operation. The Contractor shall maintain the stability of the excavated trench at all times. To assure this criterion the Contractor shall have personnel, equipment, and materials available to raise the slurry level to an appropriate elevation at all times during conduct of the work. This shall include weekends and holidays.

5.2.9 The soil excavated from the trench shall be placed on the Working Pad or loaded in trucks for hauling to the excavated backfill mixing area for mixing and blending. The excavated soil shall be placed a minimum of 10 ft (3 m) from the edge of the trench to maintain trench stability. The Contractor shall maintain the stability of the excavated trench at all times. To assure this

criterion, the Field Engineer may require that a distance of more than 10 ft (3 m) be maintained. Debris, logs, or bulk organic materials which are excavated from the trench shall not be placed in the soil-bentonite mixing area and shall be treated as waste. The Contractor shall dispose of all excavation related wastes in a location accepted by the Field Engineer. Should an emergency event occur (e.g., if there is a potential for flash flooding of the cutoff wall slurry trench area or there is an eminent danger of trench sidewall instability), the contractor shall immediately backfill the trench with excavated material and/or backfill the trench with no quality assurance or quality assurance verification. Any areas of the trench backfilled with non-specification backfill material or backfilled without the required quality assurance and quality assurance verification measures, will be re-excavated in accordance with this Section at a later time when the potential emergency event hazard has been mitigated.

5.2.10 The Contractor shall allow time during the excavation cycle for monitoring of the work by the Field Engineer and for any related verification investigation. The Contractor shall provide: 1) a suitable means to access the trench for measuring trench depth; 2) the necessary labor to assist the Field Engineer in measuring the depth of the trench and of collecting samples; and 3) a suitable depth measuring device with prominant markers at 1 ft (0.3 m) intervals.

5.2.11 Should the desired properties of the bentonite slurry in the trench be altered during excavation for any reason, the Contractor shall add fresh bentonite slurry with appropriate approved additives to the trench to re-establish the desired properties. The density of the slurry in the trench shall be at least 15 lb/ft^3 (240 kg/m^3) less than the density of the soil-bentonite backfill.

5.2.12 When the bottom of the cutoff has been reached, the bottom shall be checked for lumps of soil, logs, or other debris. The Contractor shall remove any such material using the excavation equipment or other similar devices. The depth of the cutoff wall will be verified by the Field Engineer. Upon completion of excavation, and prior to backfill placement, loose material in excess of 1 ft (0.3 m) in thickness shall be removed from the bottom of the trench with excavation tools, or other suitable means. If the properites of the slurry are not in accordance with the Specification, this slurry shall be removed from the trench and replaced with fresh slurry. As an alternative to replacement with fresh slurry, the existing slurry may be reconditioned by desanding and establish slurry properties in accordance with these Specifications.

5.2.13 The excavated and select borrow soil shall be mixed with new or recycled bentonite slurry. The addition of water during mixing and blending will not be permitted. Mixing shall be accomplished on the surface of the Working Pad, or in an area designated by the Field Engineer. Mixing shall be accomplished by track-mounted earth-moving equipment, such as a dozer or front-end loader, or other equipment, as approved by the Field Engineer. The blade on the earthmoving equipment must be free to rotate so that the bottom of one end of the blade can be positioned higher or lower than the bottom of the other end of the blade to enhance mixing and minimize damage to the Working Pad. Mixing should continue until the soil-bentonite backfill is a homogenous mixture with a composition and consistency in accordance with these Specifications. The backfill shall not contain unmixed pockets of slurry or soil. The maximum size of clay soil lumps permitted in the backfill shall be 4 in. (10 cm). Backfill mixing shall be far enough away from the trench-excavation to avoid spillage into the trench prior to complete mixing.

5.2.14 No soil-bentonite backfill shall be placed in the trench until that portion of the trench and backfill are accepted by the Field Engineer. The backfill shall be placed in an approved slurry trench using a construction method so as not to trap any pockets of slurry within the backfill. Backfill shall not be dropped in the trench. Placement of backfill shall begin at the point of start of trench excavation and proceed in the direction of the excavation. Cleaning of the trench will be performed whenever necessary, as required by the Field Engineer, and at the beginning of each shift prior to resuming the backfilling operation. Cleaning of the trench shall include removal of sediments and residue from the bottom of the trench and removal of sand on the leading face of the backfill by removing the toe of the leading face and allowing the face to slide down.

5.2.15 Backfilling the trench shall not start until the length of the trench is twice the excavated approved depth. Placement of backfill in the first section shall be done by lowering the bucket of the excavating equipment to the bottom of the trench and discharging the backfill directly on the bottom of the trench at the starting point of excavation. This method of placement shall be continued by discharging backfill directly on top of previously placed backfill until the level of the backfill reaches the top of the trench in the first section and the backfill has formed a slope from the bottom of the trench to the top of the trench. Backfill placement will, however, have to be coordinated with excavation activities in order to maintain the specified distance from the toe of the backfill and the portion of the trench being excavated and cleaned. Alternately, a starter trench may be utilized beyond the limits of the Work. The starter trench must be of sufficient length to permit a backfill surface to form below the slurry surface before the toe of the backfill reaches the cutoff wall alignment.

5.2.16 Continued placement of the backfill shall be performed by pushing additional backfill with the blade of a dozer or front-end loader directly on top of the trench, so as to advance the slope of the backfill along the trench. Free-dropping of the backfill through the slurry will not be permitted.

5.2.17 The consistency of the backfill shall be such that the slope of backfill is between 5H:1V and 10H:1V. Unless otherwise accepted by the Field Engineer, a distance of not les than 20 ft (6 m) and not more than 150 ft (45 m), shall be maintained between the toe of the advancing slope of the backfill and the portion of the trench being excavated and cleaned.

5.2.18 Soil-bentonite backfill shall not be placed if the average 30°F air temperature is less than 30°F. Frozen soil-bentonite backfill shall not be placed in the trench.

5.2.19 The top of the cutoff wall during construction is defined as the top of the Working Pad. The soil-bentonite backfill shall be placed and maintained to the top of the Working Pad. If during the course of construction the level of the backfill settles more than 2 ft (0.6 m) below the top of the trench area, the Contractor shall place additional backfill to the top of the Working Pad. If during the course of construction more than 2 ft (0.6 m) of free water or slurry form on top of the soil-bentonite backfill, the Contractor shall remove the free water or slurry and place additional soil-bentonite backfill to the top of the Working Pad.

5.2.20 The cutoff wall or portions thereof, shall not be capped until the soil-bentonite backfill has been allowed to settle under its own weight for approximately 8 hours after placement. No capping material shall be placed on the cutoff wall or any portion thereof, until it is accepted by the Field Engineer. The slurry wall shall be capped with an 18 inch thick clay layer. The clay shall be placed within one week of backfill placement in the area. The clay shall be compacted in 12 in. (30 cm) lifts over the slurry backfill cap. Compaction shall be obtained with approved equipment to a dry unit weight of 90 percent of the laboratory determined Proctor maximum dry unit weight by ASTM D 698.

5.2.21 Vertical alignment of the cutoff wall trench shall not deviate more than 2% of the full wall depth in any direction transverse to the horizontal wall.

5.2.22 When temperature is less than 32°F for more than 3 hours, suitable cover shall be placed to prevent freezing.

5.2.23 Should an area be encountered where the slurry trench cutoff wall reaches a depth of 50 ft (15 m) and is not keyed into the clay layer, the location of one of the six planned open-well

piezometers will be adjusted, if necessary, to locate it near this area. The planned piezometers locations are shown on Contract Drawing AR-14 titled "CELA Cap Plan". The actual constructed locations of the piezometers will be shown on the record drawings which will be issued after the completion of the CELA area remediation.

5.2.24 No refinery waste or material containing petroleum products shall be used in the construction of the slurry trench cutoff wall working platform.

5.3 Cleanup and Restoration

5.3.1 Prior to any construction or transportation equipment leaving the site, the equipment shall be subjected to thorough cleaning and decontamination.

5.3.2 All construction equipment and vehicles coming in contact with contaminated soils or with waste materials on the site shall be steam-cleaned on-site before leaving the site. Hand tools or other small pieces of equipment may be decontaminated by washing with a solution of biodegradable soap solution (i.e., Alcanox™ solution) followed by a thorough rinsing with potable water. Water from the local potable water supply system shall be used for all steam cleaning, equipment rinsing, and decontamination procedures. Following decontamination of the equipment, contact between the equipment and the waste materials or contaminated soils on-site or the ground shall be limited by storing above ground and by avoiding contact with wastes on the site. The Contractor shall control the washing and rinsing water and dispose of these waste waters in a manner approved by the Construction Manager.

5.3.3 After completion of the cutoff wall construction, the Contractor shall completely remove any remaining excavated material, slurry, or backfill from the Working Pad. The Working Pad shall be restored to a condition satisfactory to the Field Engineer.

5.3.4 The Contractor shall remove from the mixing plant area, the mixing areas, and the access roads, any excess or spilled slurry, excavation spoil, or backfill material. The Contractor shall remove all equipment, temporary structures, and debris incidental to his operations at the site. The mixing plant area, the mixing area, and the access roads shall be restored to a condition satisfactory to the Field Engineer.

5.3.5 Excess trench excavation materials shall be disposed of in the on-site landfill below the CELA cap. Bentonite slurry that has been potentially contaminated with chemicals or petroleum products from the site shall also be disposed of in the on-site landfill.

Table 02168-1

Quality Assurance Testing Program
Soil-Bentonite Slurry Trench Cutoff Wall
Landfill Remediation
Sinclair Refinery, Wellsville, New York

Items	Test	Testing Method	Minimum Frequency of Testing	Requirements
Material:				
- water	pH	ASTM D 4972	per water source or as changes occur	≥ 7
	Total Dissolved Solid	USEPA 160.1	per water source or as changes occur	< 500 ppm
- bentonite	Manufactured QA Certificate	API Standard 13 A	per truck load	Premium grade sodium montmorillonite
- additives	Manufactured QA Certificate	As per Manufacturer Specifications	per truck load	As per Manufacturer Requirements
Fresh Slurry	Density	API Standard 13 B	2 tests per day	65 lb/ft³ (1,040 kg/m³)
	Viscosity	API Standard 13 B	2 tests per day	35-45 March seconds
	Filtrate	API Standard 13 B	3 tests per week	Less than 30 mil in 30 min. at 100 psi
	pH	API Standard 13 B	3 tests per week	7-10
Borrow Material	Atterberg	ASTM D 4318	Every 1000 yd³ (765m³)	*TBD
	#200 Sieve	ASTM D1140	Every 1000 yd³ (765m³)	*TBD
Slurry in Trench	Density	API Standard 13 B	2 times per day	65-85 lb/ft³ (1,040-1,350 kg/m³)
	Viscosity	API Standard 13 B	2 times per day	35-55 March seconds
Backfill	Slump Test	ASTM C 143	Every 500 yd³ (382 m³)	3-6 inches (8-15 cm)
	Density	ASTM D 4380	Every 500 yd³ (382 m³)	> than slurry by 15 lb/ft³ (240 kg/m³)
	Permeability (Shelby)	ASTM D 5084	Every 1000 yd³ (765 m³)	< 10^{-7} cm/sec
	Sieve Analysis	ASTM D 422	Every 500 yd³ (382 m³)	Sieve Size — % Passing By Weight
				3/8 in. — 65 to 100
				No. 40 — 30 to 80
				No. 200 — 25 to 50
	Slope	Measured by Contractor	at any time	5H:1V to 10H:1V
	Distance	Measured by Contractor	at any time	20 ft - 150 ft (6 - 45 m)
	Clay Clod Size	Measured by Contractor	at any time	4 in. max
	Aggregate Size	Measured by Contractor	at any time	4 in. max

* TBD = To be determined based upon the Contractor's proposed soil-bentonite backfill design mix and approved by the Construction Manager.

Table 02168-1 (Cont'd)

Quality Assurance Testing Program
Soil-Bentonite Slurry Trench Cutoff Wall
Landfill Remediation
Sinclair Refinery, Wellsville, New York

Items		Test	Testing Method	Minimum Frequency of Testing	Requirements
Key	No Clay layer encountered (50 ft deep trench) (15 m)	Depth Sampling	Measured by Contractor	Every 20 ft (6 m) Every 100 ft (30 m) of Linear trench	No key is required Minimum 1 lb (0.5 kg) of material, visual classification with sample to be archived.
Key	Clay layer encountered at or below 47 ft (14 m)	Depth Sampling	Measured by Contractor	Every 20 ft (6 m) Every 100 ft (30 m) of Linear trench	Maximum of 3 ft (0.9 m) into clay layer Minimum 1 lb (0.5 kg) of material, visual classification with sample to be archived
		Atterberg Limits	ASTM D 4318	Every 500 ft (152 m) of Linear trench	In the SC, ML, CL or CH classes of the Unified Soil Classification System
Key	Clay layer encountered above 47 ft (14 m)	Depth Sampling	Measured by Contractor	Every 20 ft (6 m) Every 100 ft (30 m) of Linear trench	Minimum of 3 ft (0.9 m) into clay layer Minimum 1 lb (0.5 kg) of material, visual classification with sample to be archived
		Atterberg Limits	ASTM D 4318	Every 500 ft (152 m) of Linear trench	In the SC, ML, CL or CH classes of the Unified Soil Classification System
Trench	Verticality	Measured by Contractor	Every 100 ft (30 m)		Vertical slope less than 2%
Cap		Thickness Density/Moisture Content	Measured by Contractor ASTM D 698 and ASTM D 2922 and D 3017 or ASTM D 1556 and D 4944	Every 300 ft (90 m) Every 250 yd^3 (191 m^3)	18 in. (46 cm) Each lift compacted to a minimum of 90% Standard Proctor, optimum moisture content ±3%.
		Permeability	ASTM D5084	Every 500 yd^3 (382 m^3)	<1.0 x 10^{-5} cm/sec

* TBD = To be determined.

Table 02168-2

Quality Assurance Verification Testing Program
Soil-Bentonite Slurry Trench Cutoff Wall
Landfill Remediation
Sinclair Refinery, Wellsville, New York

Items		Test	Testing Method	Minimum Frequency of Testing	Requirements
Fresh Slurry		Density Viscosity Filtrate pH	API Standard 13 B API Standard 13 B API Standard 13 B API Standard 13 B	1 test per week 1 test per week 1 test per week 1 test per week	65 lb/ft³ (1,041 kg/m³) 35-45 Marsh seconds <30 ml in 30 minutes at 100 psi 7-10
Slurry in Trench		Density Viscosity	API Standard 13 B API Standard 13 B	1 test per week 1 test per week	65-84 lb/ft³ (1,040 kg/m³) 35-55 Marsh seconds
Backfill		Density Slump test Permeability Sieve Analysis	ASTM D 4380 ASTM C 143 BAT™ ASTM D 422'	Every 2,000 yd³ (1,529 m³) Every 2,000 yd³ (1,529 m³) Every 5,000 yd³ (3,822 m³) Every 2,000 yd³ (1,529 m³)	>slurry density by 15 lb/ft³ (240 kg/m³) 3 to 6 in. (8 to 15 cm) $\leq 10^{-7}$ cm/sec * Sieve Size — % Passing By Weight 3/8 in. — 65 to 100 No. 40 — 30 to 80 No. 200 — 25 to 50
Key	No Clay layer encountered (50 ft deep trench) (15 m)	Depth	Measured by Field Engineer	Every 100 ft (30 m)	No key is required Vertical slope less than 2%
Key	Clay layer encountered at or below 47 ft (14m)	Depth	Measured by Field Engineer	Every 100 ft (30 m)	Maximum of 3 ft (0.9 m) into clay layer Vertical slope less than 2%
Key	Clay layer encountered above 47 ft (14m)	Depth	Measured by Field Engineer	Every 100 ft (30 m)	Minimum of 3 ft (0.9 m) into clay layer Vertical slope less than 2%
Trench		Verticality	Measured by Field Engineer	Every 300 ft (90 m)	Vertical slope less than 2%

Table 02168-2 (Cont'd)

Quality Assurance Verification Testing Program
Soil-Bentonite Slurry Trench Cutoff Wall
Landfill Remediation
Sinclair Refinery, Wellsville, New York

Items	Test	Testing Method	Minimum Frequency of Testing	Requirements
Cap	Thickness	Measured by Field Engineer	Every 300 ft (90 m)	18 in. (46 cm)
	Density/Moisture Content	ASTM D 698 and ASTM D 2922 and D3017 or ASTM D 1556 and D 4944	Every 500 yd^3 (382 m^3)	Each lift compacted to a minimum of 90% Standard Proctor, optimum moisture content ±3%.
	Permeability	ASTM D 5084	Every 500 yd^3 (382 m^3)	<1.0 x 10^{-5} cm/sec

* TBD = To be determined

ATTACHMENT 1

Appendix A

SOIL BORING LOGS AND
GRAIN SIZE DISTRIBUTION ANALYSIS RESULTS
FROM 1988 SITE INVESTIGATION

BECHTEL ENVIRONMENTAL, INC.

(FOR LOCATIONS OF BORINGS AND MONITORING WELLS
SEE DRAWING AR-19)

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 1

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 768341; E 675044	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-8-88	8-8-88	Pat Bennett		4" ID	140/30"	22.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1498.3	▽ 16.7/1481.6	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	18 50 2"			4.3			1498.3 1498.1				SANDY SILT, roots, brown (Topsoil)	
							1495.8				SAND and GRAVEL (GM), brown, moist (Fill)	
											GRAVELLY SILTY SAND (SW), gray	
SS-02	12 26 19							5				
							1491.3				SANDY GRAVEL (GM), gray, moist, very dense (Alluvium)	
SS-03	28 38 50							10				
SS-04	3 4 7			25.0			1482.8	15			SILTY SAND (SM), fine to medium grained, gray, wet	
ST-01												Groundwater encountered during drilling at 16.7 feet
SS-05	4 6 6							20				
SS-06	12 14 15						1477.3				SANDY GRAVEL (GM), gray, saturated	
							1476.3				BOTTOM OF HOLE AT 22 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 2

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 768250; E 675149	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-8-88	8-8-88	Pat Bennett		4" ID	140/30"	20.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1499.4	▽ 8.5/1490.9	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	4 18 25			10.3			1499.4 1499.2 1498.4				SANDY SILT, roots, brown (Topsoil) GRAVELLY SILTY SAND (SM), brown (Fill)	
ST-01											SANDY SILT (ML) with GRAVEL, gray, moist	
SS-02	2 3 2						1495.4	5			SANDY GRAVEL (GM), gray, saturated (Alluvium)	
ST-02								▽				
SS-03	6 11 17							10				Groundwater encountered during drilling at 8.5 feet
SS-04	10 12 15			13.4								
SS-05	11 13 29							15			color changes to brown at 15.5 feet	
SS-06	10 26 27						1479.4	20			BOTTOM OF HOLE AT 20 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO.: TB 2

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 3

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 768154; E 675263	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-8-88	8-8-88	Pat Bennett		4" ID	140/30"	18.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1500.1	8.3/1491.8	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
							1500.1					
SS-01	4 10 17						1499.9				SANDY SILT, roots, brown (Topsoil)	
											GRAVELLY SILTY SAND (SM), brown, moist	one piece of slag noticed
SS-02	6 6 9											
SS-03	4 3 3						1495.6	5			SAND (SM), gray, moist to wet	
SS-04	4 6 6											
SS-05	5 6 12										some GRAVEL below 8 feet, oily, wet	Groundwater encountered during drilling at 8.3 feet
							1490.1	10				
SS-06	6 14 17										SANDY GRAVEL (GM), gray, wet	
SS-07	16 24 20			12.4								
SS-08	20 17 20							15				
SS-09	30 30 27											
							1482.1				BOTTOM OF HOLE AT 18 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO. TB 3

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 4

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 768140; E 675434	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-5-88	8-6-88	Pat Bennett		4" ID	140/30"	18.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1499.6	8.0/1491.6	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	6 8 9						1499.6 1499.4 1498.7				SILTY SAND with GRAVEL, roots, brown (Topsoil)	
											SAND and GRAVEL (GM) with slag, mottled brown and black (Random Fill)	
											SILTY SAND (SM), brown, moist	
											color changes to brownish-gray	
SS-02	4 10 14			16.2			1493.6	5			SAND and GRAVEL (GW-GM), gray, well graded, maximum size - 1.5 inches	
												Groundwater encountered during drilling at 8.0 feet (8-6-88)
SS-03	10 13 17							10			trace of oil, smell of petroleum	
SS-04	10 17 28							15				
SS-05	22 21 17						1481.6				color changes to brown at 17.5 feet BOTTOM OF HOLE AT 18 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO. TB 4

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 5

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 768111; E 675530	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-5-88	8-5-88	Pat Bennett		4" ID	140/30"	20.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1500.7	▽ 9.7/1491.0	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE "N" BLOWS	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	4 14 16						1500.7 1500.5 1499.7				SANDY SILT, roots, moist, brown (Topsoil)	
							1498.2				SILTY SAND and GRAVEL (SM), brown and black coal slag (Random Fill)	
											SANDY SILT (ML) with GRAVEL, brown, moist, maximum size - 1 inch	
SS-02	13 13 11							5			SAND and GRAVEL (GW-GM), brown, moist	
											color changes to gray, saturated	
SS-03	5 6 8							▽ 10				Groundwater encountered during drilling at 9.7 feet
							1486.7				SANDY GRAVEL (GM), gray, saturated	
SS-04	19 32 34							15				
											color changes to brown, SAND and GRAVEL, well graded	
SS-05	9 17 27			12.8			1480.7	20			BOTTOM OF HOLE AT 20 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO.: TB 5

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 6

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 768067; E 675653	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-5-88	8-5-88	Pat Bennett		4" ID	140/30"	20.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1500.1	▼ 8.8/1491.3	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	5 7 8						1500.1 1499.8				SILTY SAND with GRAVEL, dark brown (Topsoil)	
											GRAVELLY SAND (SM) with trace of SILT, brown, moist	
SS-02	8 8 12			12.6			1494.6	5			SAND and GRAVEL (GP-GM), gray, sub-angular to sub-round, maximum size - 1 inch, moist (Alluvium)	
								▽				Groundwater encountered during drilling at 8.8 feet
SS-03	11 14 15			13.2				10			saturated	
SS-04	17 23 44							15			maximum size increases to 1.5 inches	
SS-05	19 24 29						1480.1	20			color changes to brown BOTTOM OF HOLE AT 20 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 7

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 768018; E 675783	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-4-88	8-4-88	Pat Bennett		4" ID	140/30"	30.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1497.7	▼ /	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
							1497.7					
SS-01	8 24 12						1497.5				SANDY SILT, roots, dark brown (Topsoil)	
											SANDY GRAVEL (GM) with trace of SILT, moist, brown, sub-angular to sub-round, maximum size 6 inches	
SS-02	11 14 14							5			color changes to gray at 6 feet	
SS-03	8 17 15							10			maximum size decreases to 1.5 inches, saturated	
							1483.7					
SS-04	6 6 6			28.0	NP			15			SILT (ML), gray, medium dense, wet, non-plastic	
SS-05	3 4 5						1478.4					
ST-01		2.50						20			CLAYEY SILT (ML), gray, wet	
							1475.2					
SS-06	3 4 5			35.2	29	4		25			SILT (ML), gray, with trace of CLAY	
							1470.2					
SS-07	2 3 4	1.00		35.8	37	11					CLAYEY SILT (ML), gray, moist, medium dense	
							1467.7	30			BOTTOM OF HOLE AT 30 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO.: TB 7

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 8

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 767905; E 675817	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-4-88	8-4-88	Pat Bennett		4" ID	140/30"	20.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1498.8	▽ 8.0/1490.8	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	8 15 15						1498.8					
							1498.6				SANDY SILT, roots, dark brown, moist (Topsoil)	
											SANDY GRAVEL (GW-GM), brown, moist, maximum size - 6 inches, large flat or sub-rounded pieces (Alluvium) maximum size decreases to 3 inches below 2 feet, medium dense	
SS-02	7 9 12			9.9				5				One broken piece of red brick (0.5 inch size) noticed in SS-02
								▽				Groundwater encountered during drilling at 8.0 feet
SS-03	6 8 11							10			saturated, maximum size reduces to 1.5 inches	
SS-04	13 34 42			11.6				15				
SS-05	12 17 32						1478.8	20			BOTTOM OF HOLE AT 20 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO. TB 8

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB 9

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 767770; E 675786	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-4-88	8-4-88	Pat Bennett		4" ID	140/30"	20.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1496.9	5.5/1491.4	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	8 12 9						1496.9 1496.7				SANDY SILT, moist (Topsoil)	
											SANDY GRAVEL (GP-GM) with trace of SILT, brown, moist, medium dense, maximum size - 1 inch (Alluvium)	
SS-02	8 8 10			15.9				5			saturated at 5 feet	Groundwater encountered during drilling at 5.5 feet
											dense, maximum size increases to 1.5 inches. sub-angular to sub-round	
SS-03	13 21 19							10			color changes to gray	
SS-04	20 22 32							15				
SS-05	21 32 39						1476.9	20			color changes to brown at 19.5 feet, GRAVEL becomes more angular	
											BOTTOM OF HOLE AT 20 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO. TB 9

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB10

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 767631; E 675730	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-4-88	8-4-88	Pat Bennett		4" ID	140/30"	20.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1497.8	▽ 6.0/1491.8	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	1 3 4			12.8			1497.8				SILTY SAND (SM), brown, moist, with trace of small GRAVELS, loose	
ST-01				14.3			1495.3				GRAVEL and SAND (GM) with trace of silt, mottled brown and gray, moist (Alluvium)	
SS-02	8 8 10			10.8				5			wet at 6 feet	Groundwater encountered during drilling at 6.0 feet
							1490.8				SANDY GRAVEL (GW-GM), wet, sub-angular to round, well graded, dense, maximum size - 1.5 inches (visual observation from auger returns)	
SS-03	9 16 19							10				
SS-04	9 13 14						1481.8	15				
							1480.3				SAND (SM), fine to coarse, brown, saturated, medium dense	
SS-05	26 29 38										SANDY GRAVEL (GW), well graded, brown, saturated, maximum size - 1.5 inches	
							1477.8	20			BOTTOM OF HOLE AT 20 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO.: TB10

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB11

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 767969; E 675807	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-5-88	8-5-88	Pat Bennett		4" ID	140/30"	20.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1499.6	▽ 12.5/1487.1	Da Min Ho

SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	11 13 17						1499.6 1499.3				SANDY SILT with trace of GRAVEL, dark brown, moist (Topsoil)	
											SANDY GRAVEL (GP-GM), brown, moist, dense, maximum size - 1.5 inches, sub-angular to sub-rounded	
SS-02	50 3"							5			boulder encountered	
SS-03	10 22 17			16.1				10			color changes to gray, saturated	
								▽				Groundwater encountered during drilling at 12.5 feet
SS-04	15 18 18			11.6				15				
											SAND and GRAVEL	
SS-05	12 18 17						1479.9					
							1479.6	20			SANDY SILT (ML), gray, wet	
											BOTTOM OF HOLE AT 20 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO.: TB11

SOIL BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
ARCO	19386.004	1 OF 1	TB12

SITE	COORDINATES	ANGLE FROM HORIZONTAL
Wellsville, NY	N 767183; E 675235	Vertical

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	SAMPLE HAMMER WEIGHT/FALL	TOTAL DEPTH
8-3-88	8-3-88	Pat Bennett		4" ID	140/30"	20.0

GROUND EL.	DEPTH/EL. GROUND WATER	LOGGED BY:
1499.1	▽ 5.9/1493.2	Da Min Ho

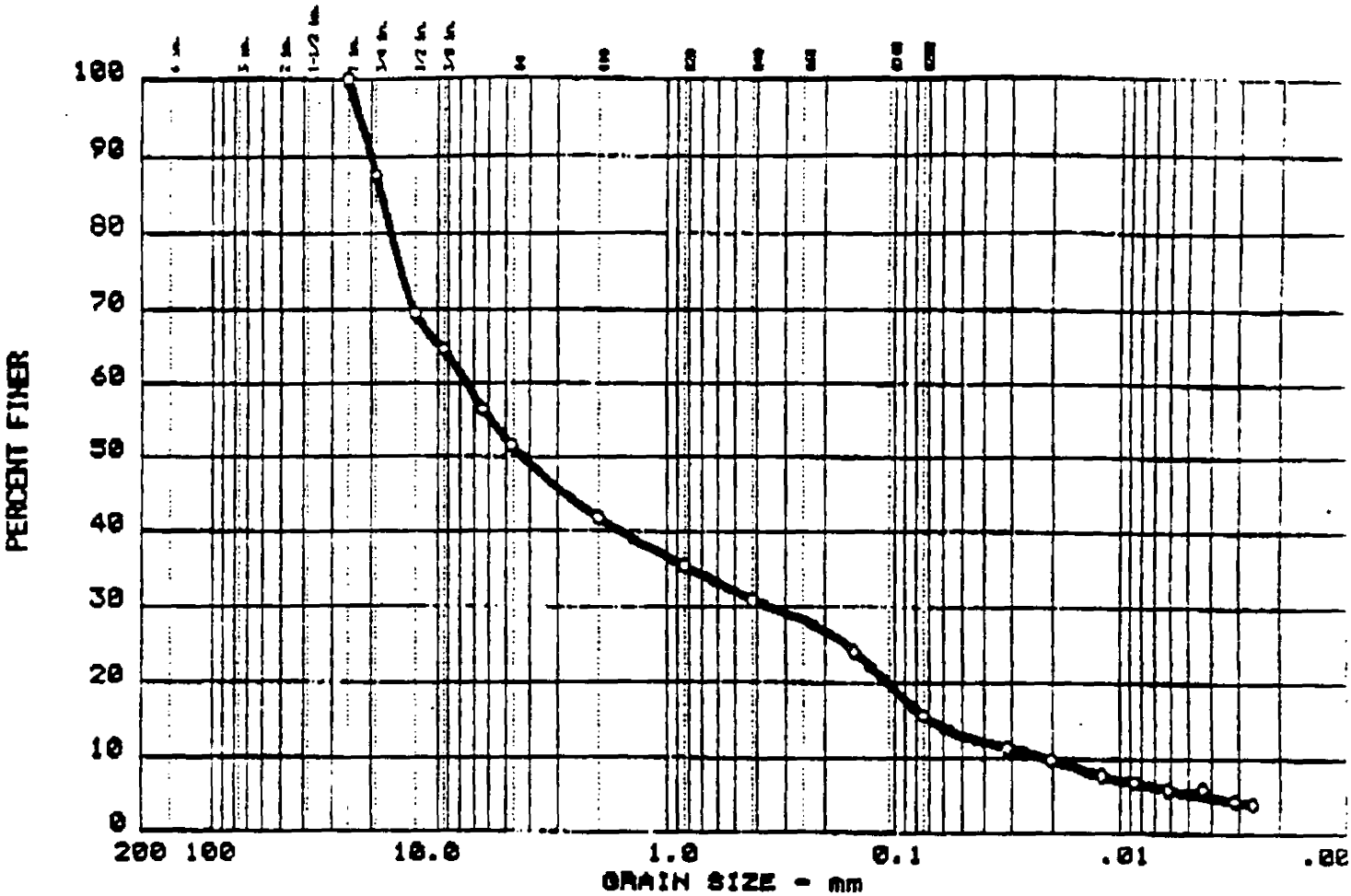
SAMP. TYPE AND NO.	SAMPLE BLOWS "N"	POCKET PENE. TSF	DRY DENSITY PCF	LABORATORY TEST DATA WC	LL	PL	ELEVATION	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, CHARACTER OF DRILLING, ETC
SS-01	39 14 50						1499.1				SILTY SAND and GRAVEL (GP-GM), brown, moist, GRAVEL is semi-angular to semi-round, very dense at surface	
SS-02	3 4 10			13.6				5			maximum size - 3 inches (obeserved from auger returns)	Groundwater encountered during drilling at 5.9 feet
							1491.6				SAND and GRAVEL (GM) with trace of SILT, moist to wet, brown, well graded	
SS-03	8 22 31							10			saturated	
SS-04	11 31 34							15				
SS-05	4 16 39						1479.1	20			BOTTOM OF HOLE AT 20 FEET	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Wellsville, NY

HOLE NO.: TB12

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	2	0.0	48.4	36.0	10.3	5.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o			18.05	7.44	4.23	0.348	0.0686	0.0212	0.77	350.8

MATERIAL DESCRIPTION	USCS	AASHTO
o GRAVEL AND SAND, LITTLE SILT, TR. CLAY	GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
o Location: BORING #1 SAMPLE #1 0'-1'

Date: 8-22-88

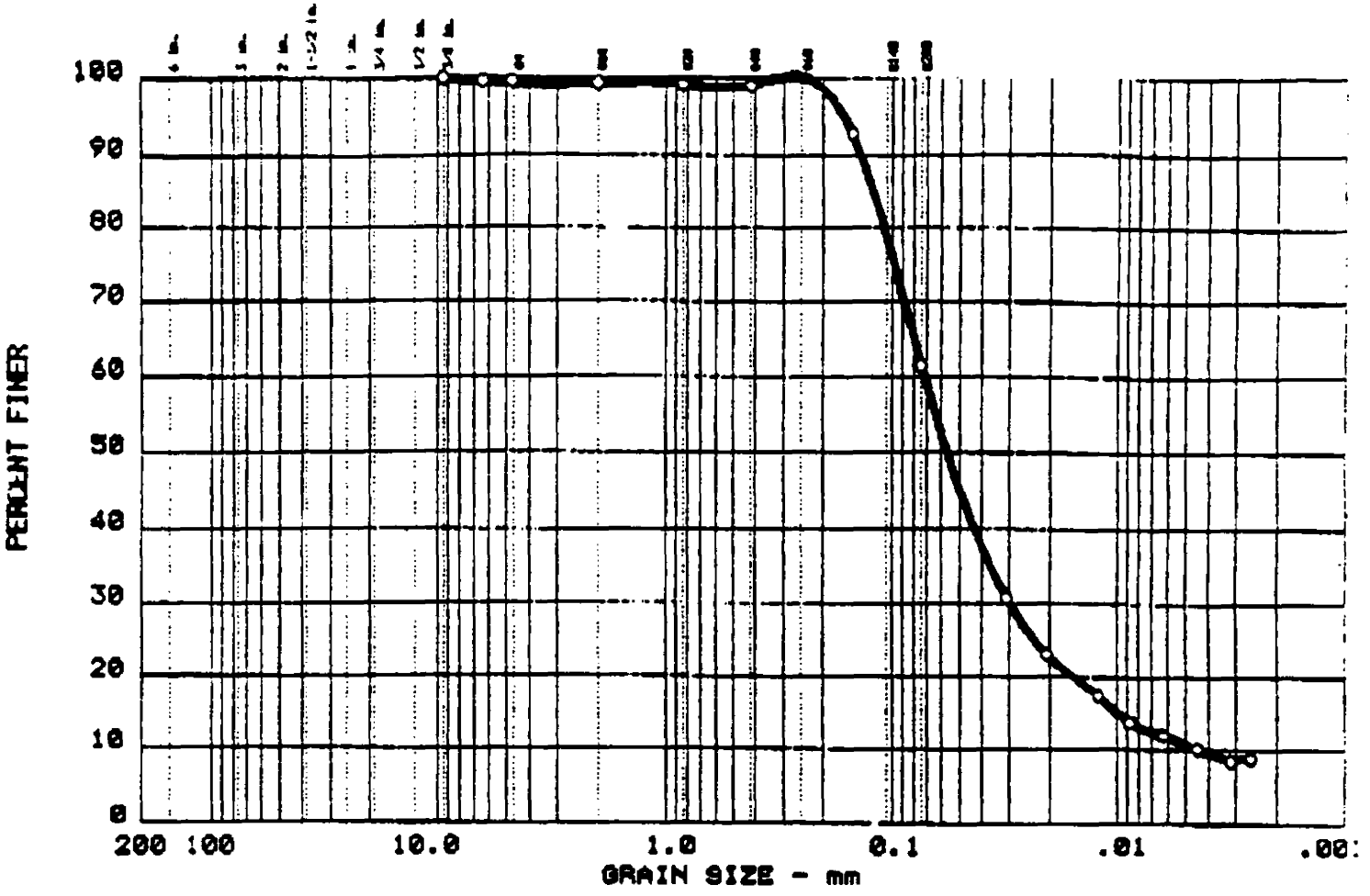
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=4.3%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	3	0.0	0.7	37.7	50.9	10.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.12		0.06	0.030	0.0099	0.0044	2.84	16.4

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT AND SAND, LITTLE CLAY, TR. GRAVEL	ML	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #1 SAMPLE #4 15'-16.5'

Date: 8-22-88

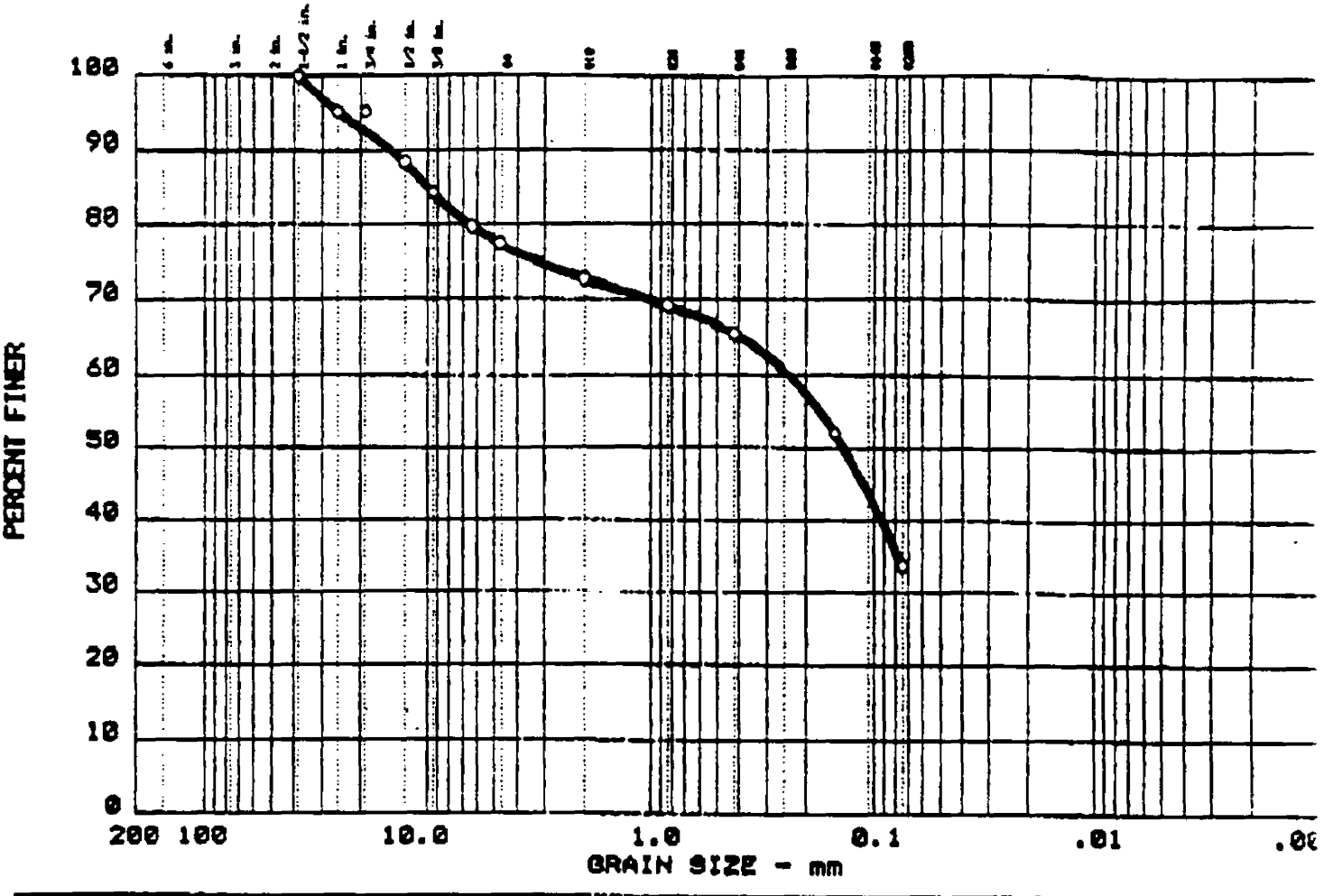
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=25%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	19	0.0	22.6	43.6	33.7	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			10.00	0.24	0.13					

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND SOME SILT SOME GRAVEL	SM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #2 SAMPLE #1 3"-1' &1'-2'

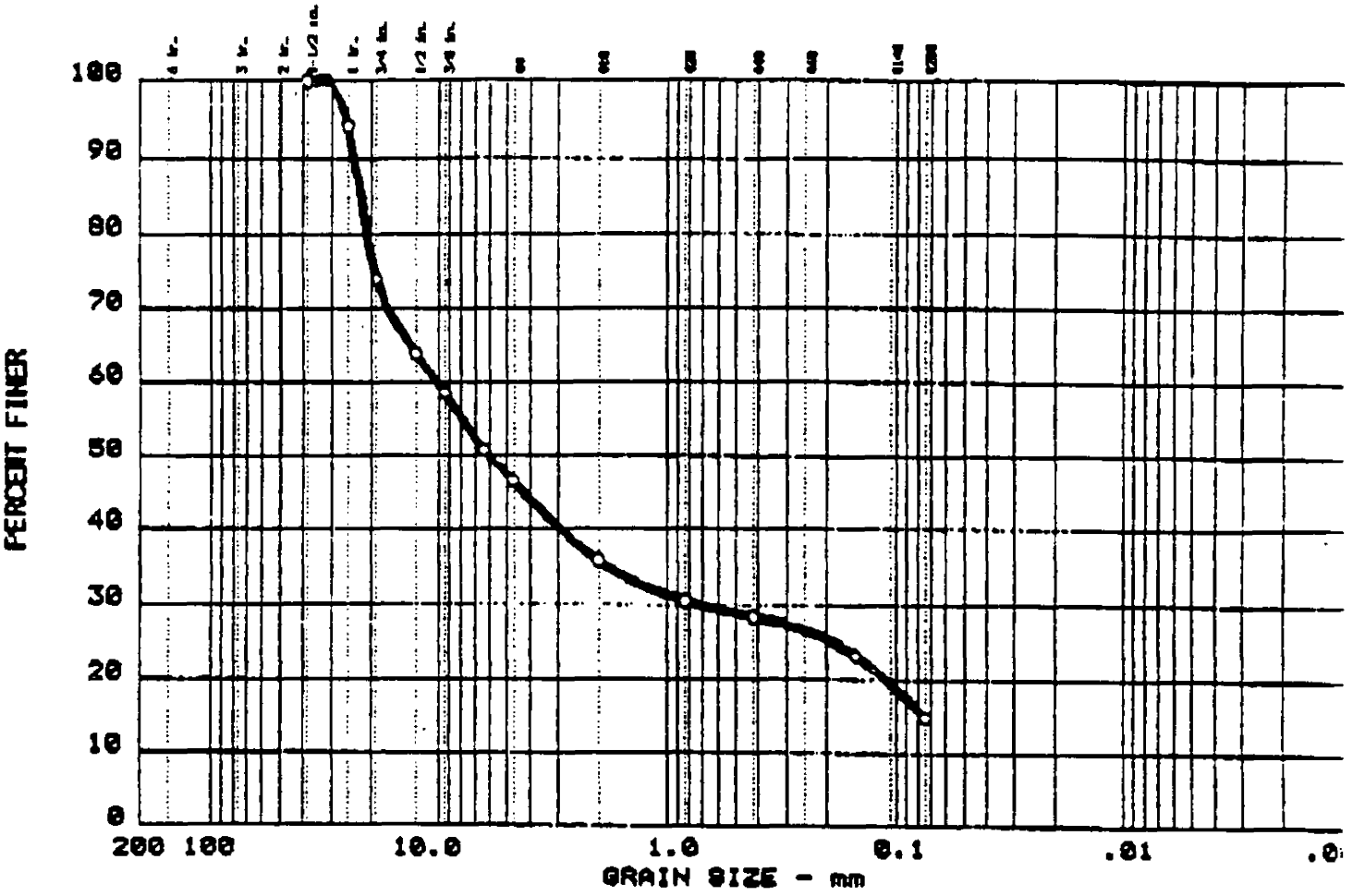
Date: 8-22-88

Remarks:
SPLIT SPOON SAMPLE
N.W.C.=10.3%

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	10	0.0	53.7	31.4	14.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o			22.23	10.28	6.05	0.719	0.0745			

MATERIAL DESCRIPTION	USCS	AASHTO
o GRAVEL SOME SAND LITTLE SILT	GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
o Location: BORING #2 SAMPLE #4 10'-12'

Date: 8-22-88

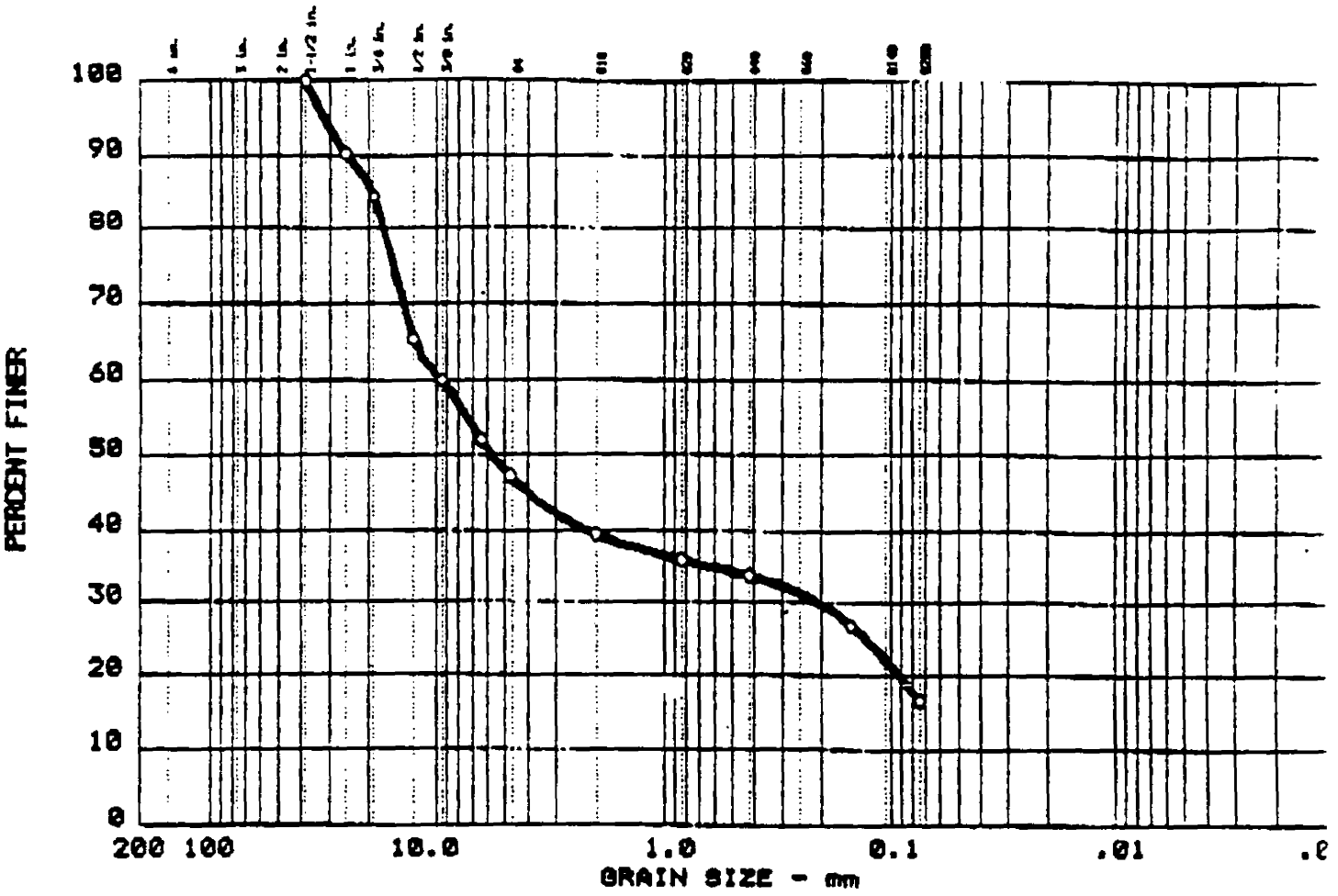
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=13.4%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	16	0.0	52.7	30.7	16.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			19.39	9.50	5.66	0.208				

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND LITTLE SILT	GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #3 SAMPLE #7 12'-14'

Date: 8-22-88

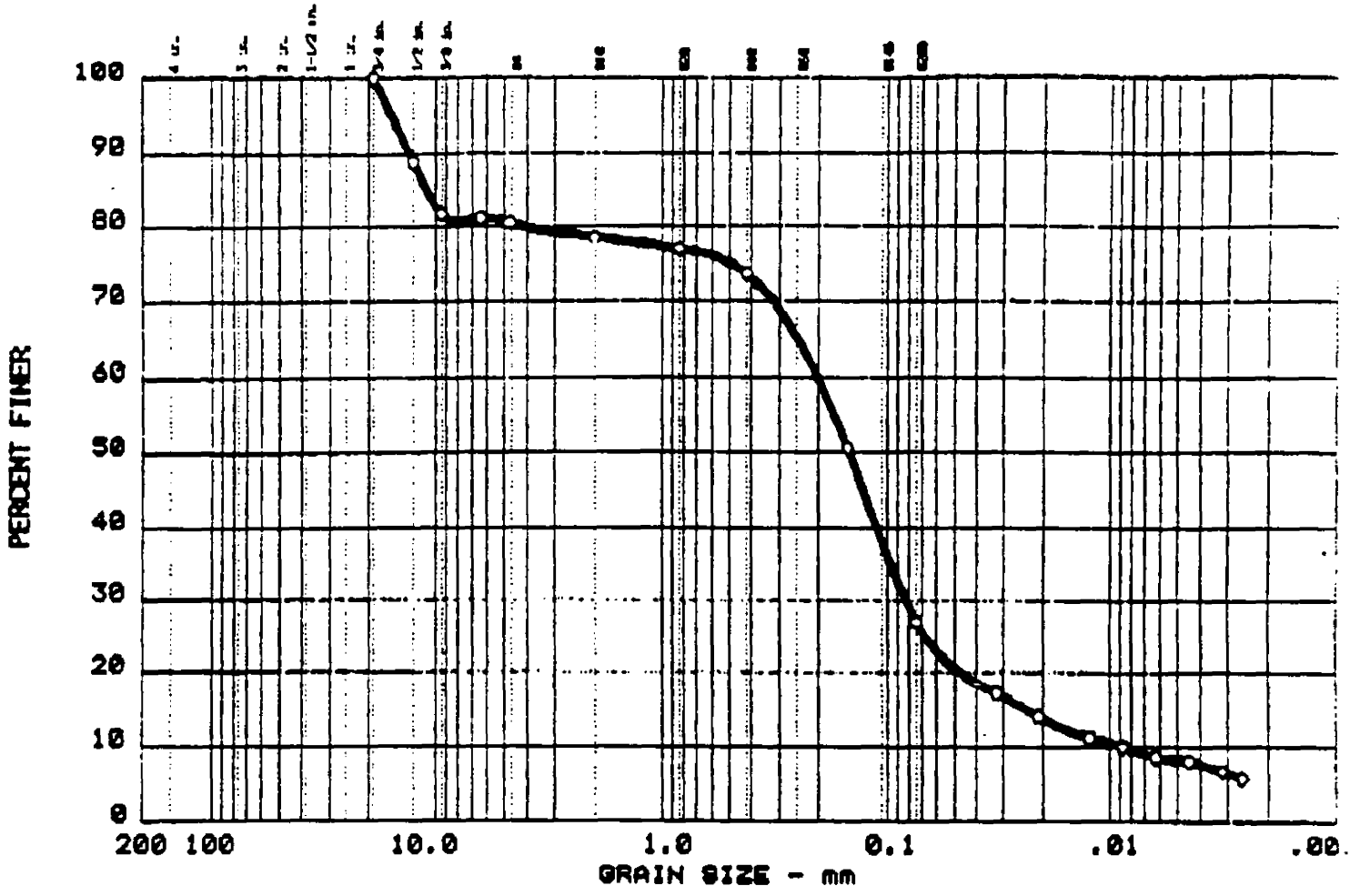
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=12.4%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	1	0.0	19.5	53.5	18.6	8.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			11.09	0.20	0.15	0.083	0.0236	0.0085	4.01	23.8

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND LITTLE GRAVEL LITTLE SILT TRACE CLAY	SM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #4 SAMPLE #2(1/2) 5'-6'

Date: 8-22-88

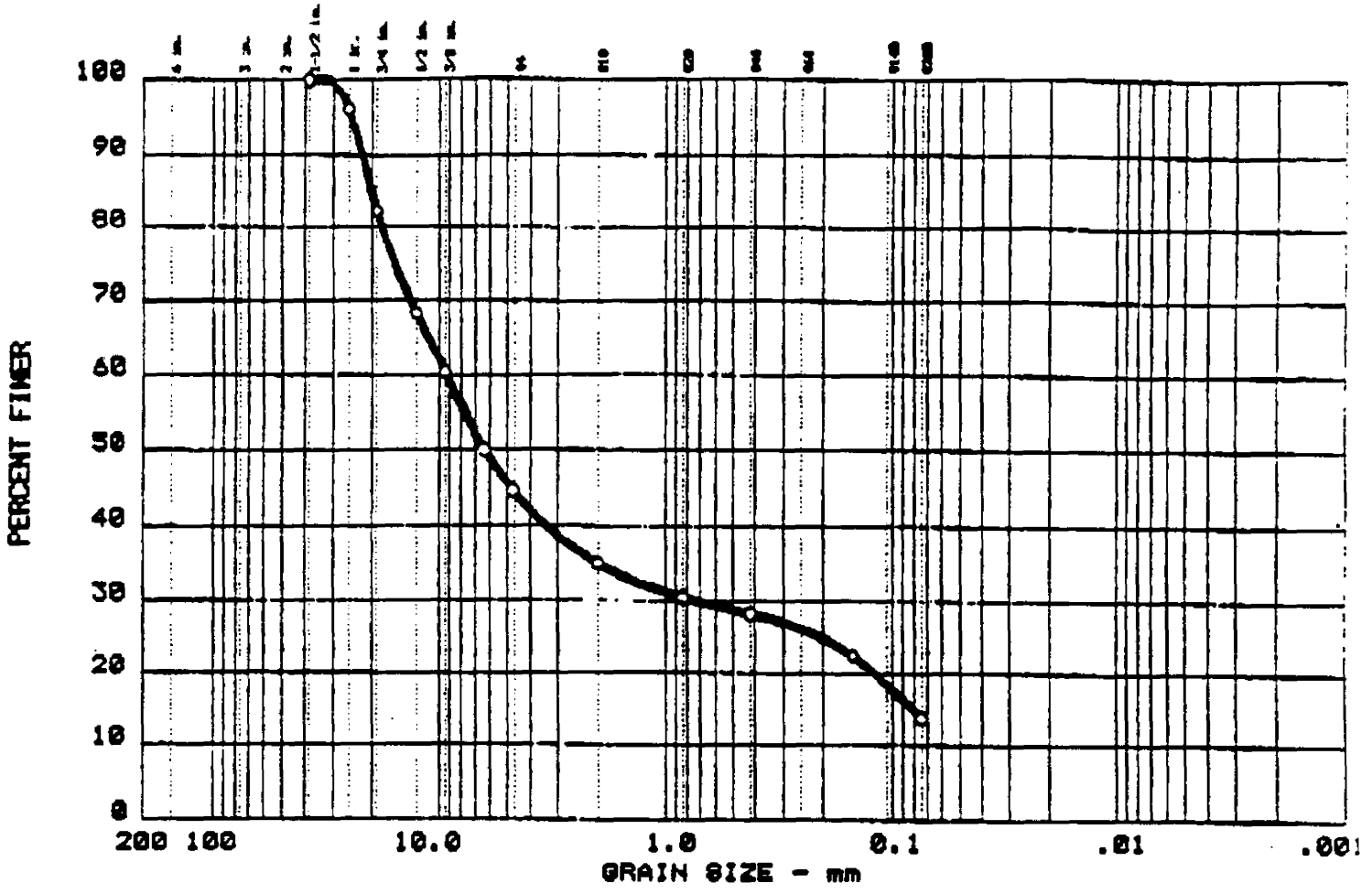
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=16.2%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	18	0.0	55.2	31.0	13.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			20.11	9.38	6.27	0.745	0.0087			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND LITTLE SILT	GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #5 SAMPLE #5 18.5'-20'

Remarks:
SPLIT SPOON SAMPLE
N.W.C.=12.8%

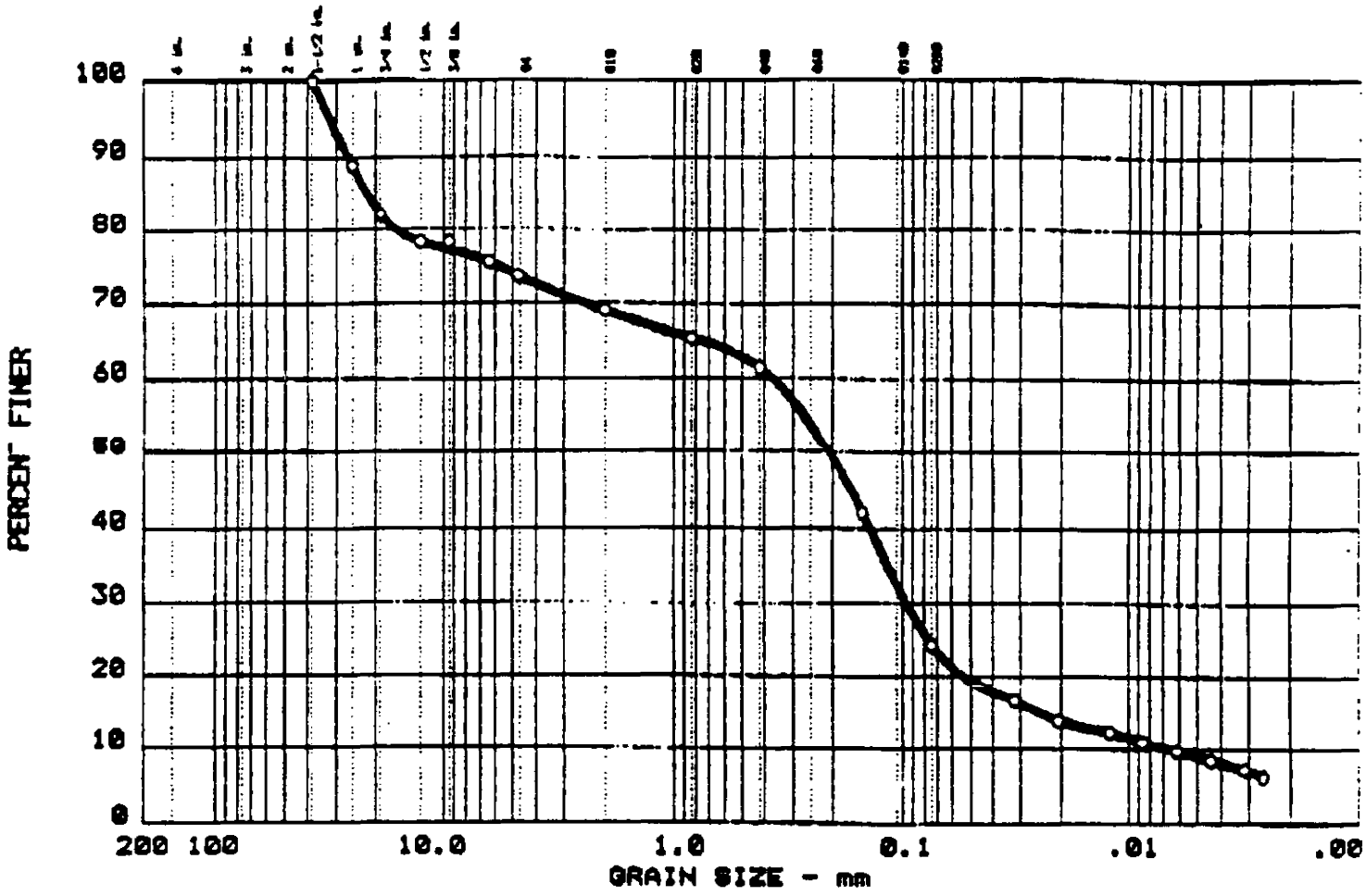
Date: 8-22-88

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	8	0.0	26.3	49.4	15.4	8.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		4	21.80	0.37	0.21	0.095	0.0245	0.0067	3.72	55.0

	MATERIAL DESCRIPTION	USCS	AASHTO
○	SAND, SOME GRAVEL, LITTLE SILT, TR. CLAY	SM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #6 SAMPLE #2(1/2) 5'-5.5'

Date: 8-22-88

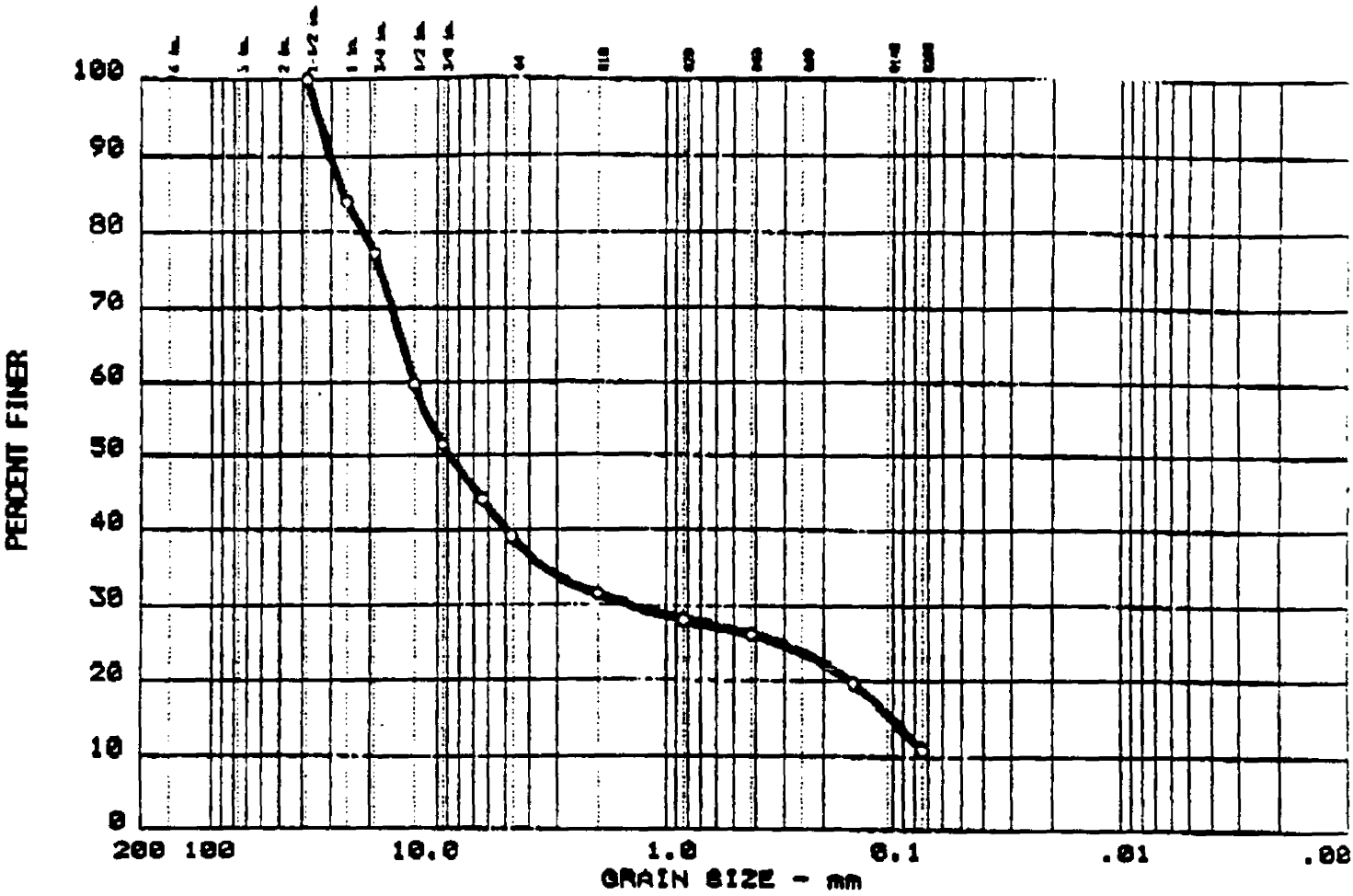
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=12.6%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 8

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	17	0.0	61.0	28.1	10.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o			26.27	12.72	8.80	1.411	0.0999			

MATERIAL DESCRIPTION	USCS	AASHTO
o GRAVEL SOME SAND LITTLE SILT	GP-GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
o Location: BORING #6 SAMPLE #3 10'-11.5'

Date: 8-22-88

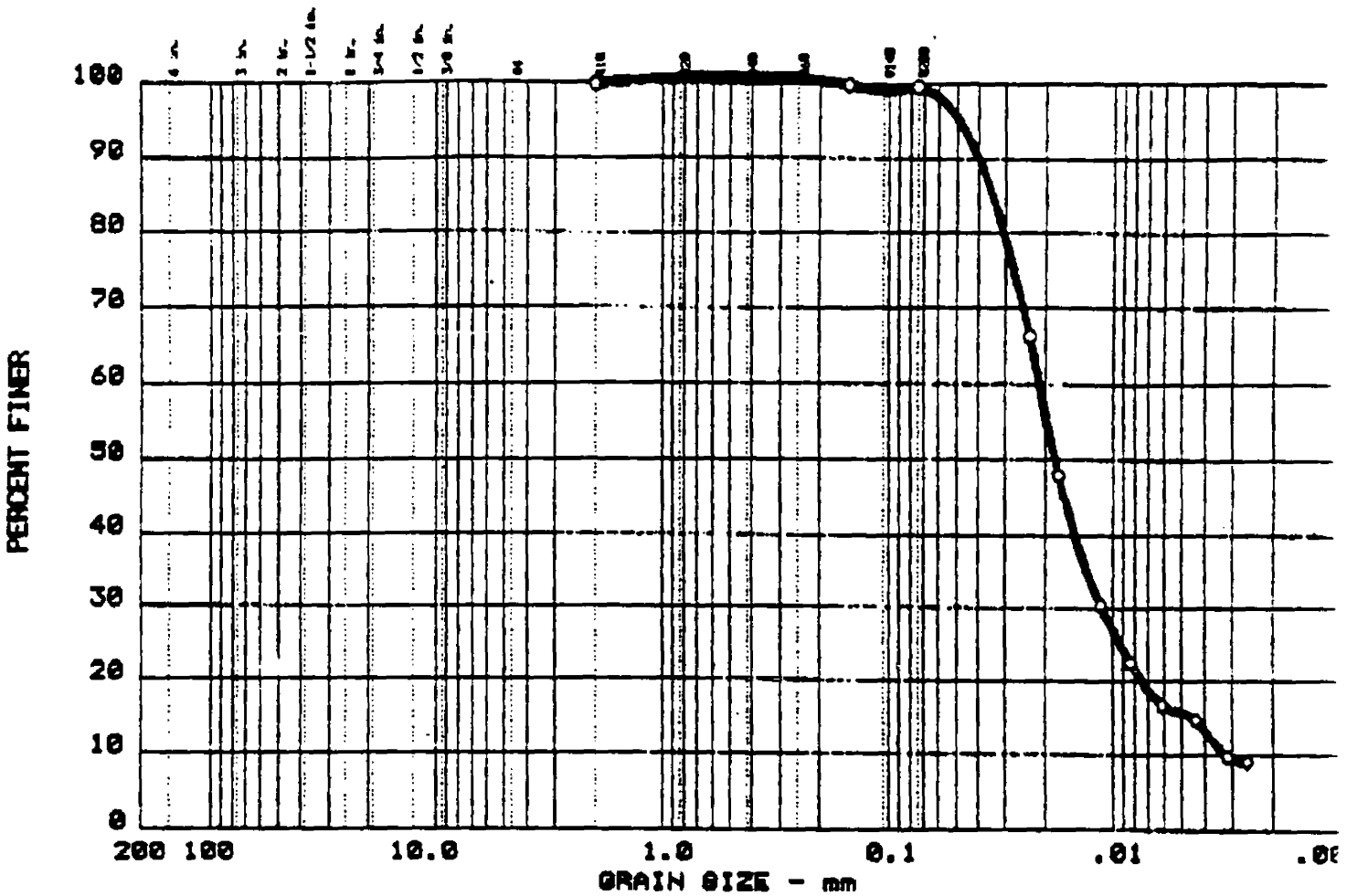
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=13.2%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 9

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	1	0.0	0.0	0.3	84.1	15.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	NP	NP			0.02	0.011	0.0045	0.0032	1.82	6.6

MATERIAL DESCRIPTION	USCS	AASHTO
o SILT LITTLE CLAY TRACE SAND	ML	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
o Location: BORING #7 SAMPLE #4 15'-16.5'

Date: 8-22-88

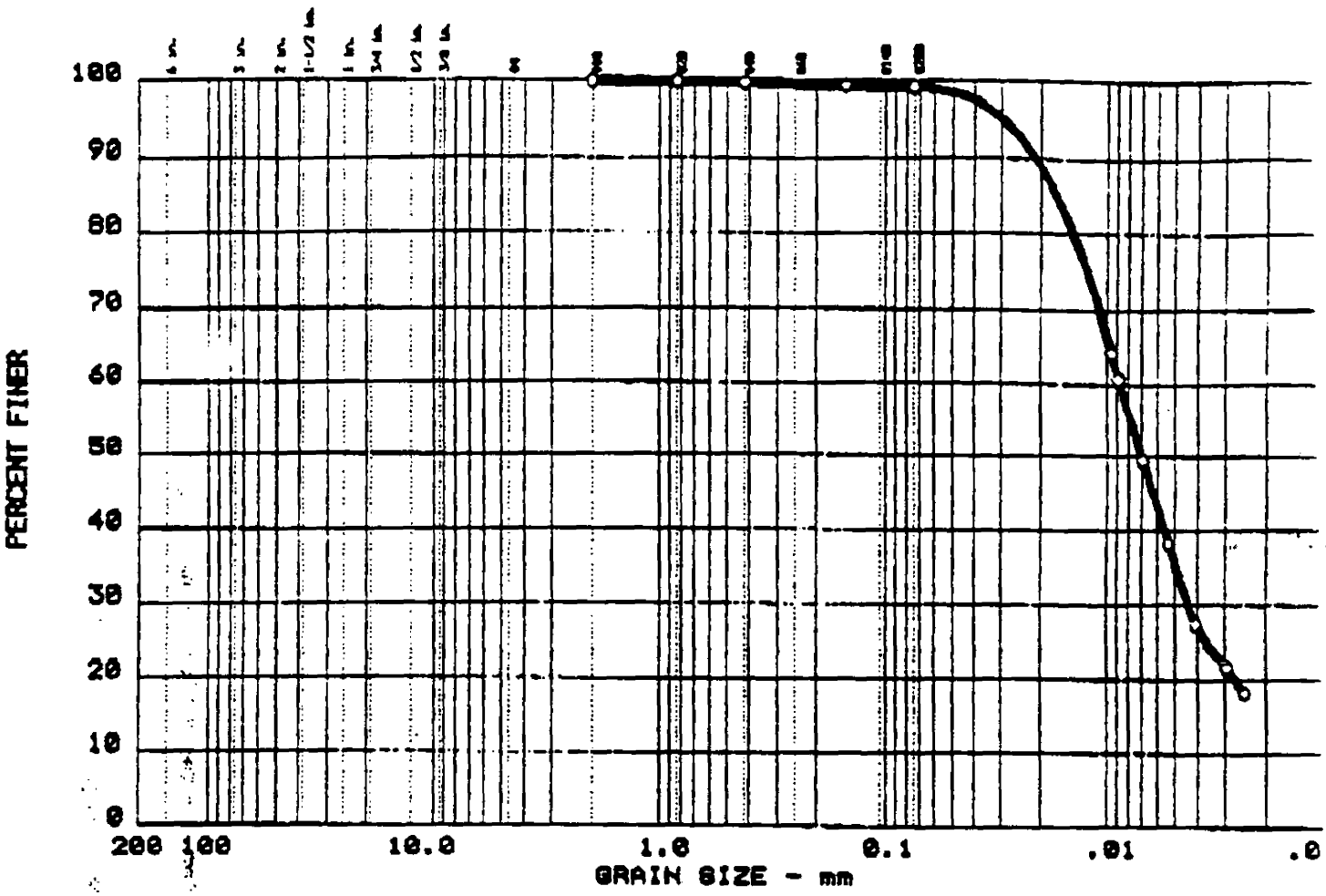
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=28%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 10

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	7	0.0	0.0	0.7	64.1	35.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	29	4			0.01	0.004				

MATERIAL DESCRIPTION	USCS	AASHTO
o CLAYEY SILT, TR. SAND	ML	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
o Location: BORING #7 SAMPLE #6 23.5'-25'

Date: 8-22-88

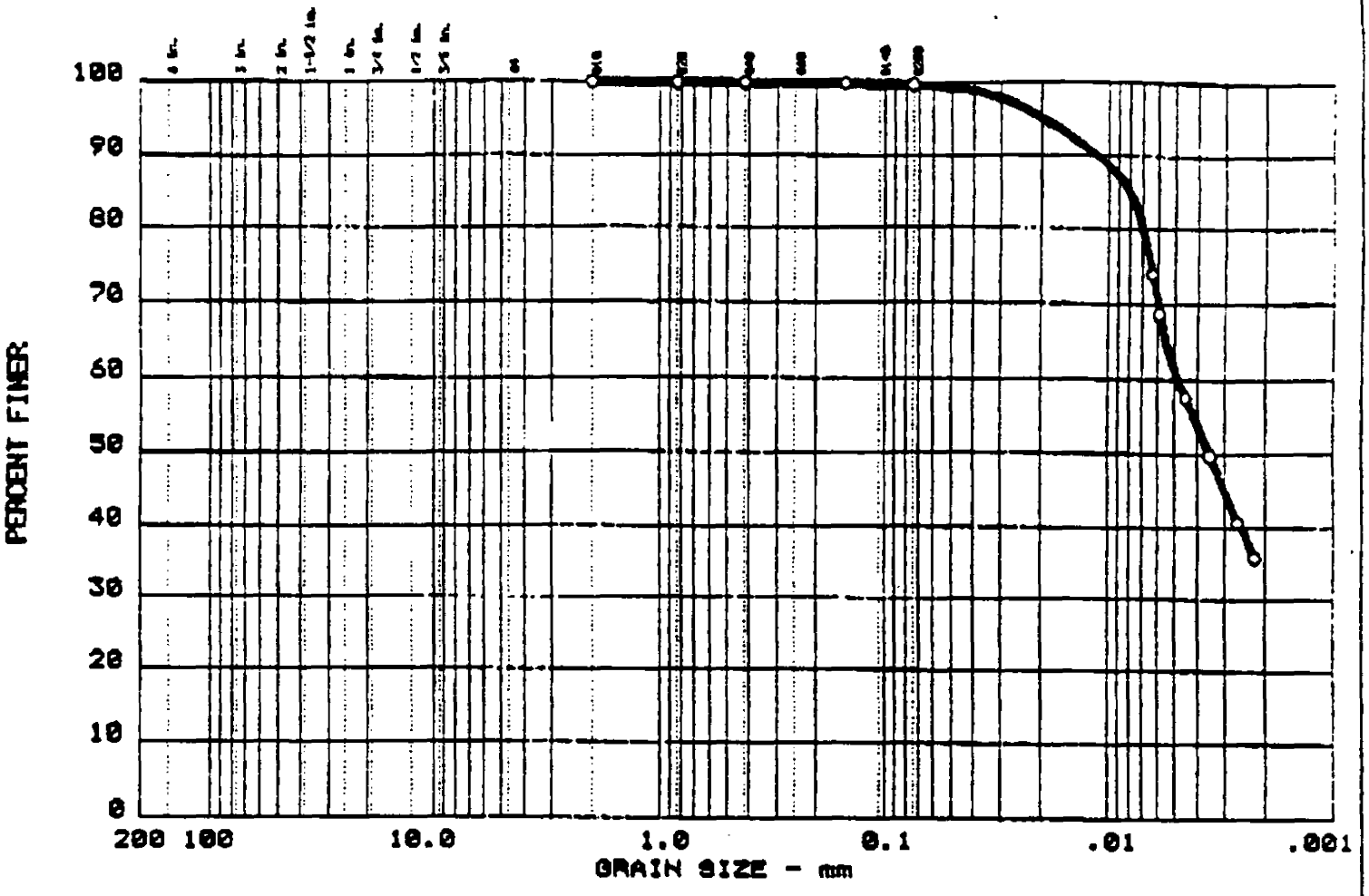
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=35.2%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 10

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	6	0.0	0.0	0.3	39.0	60.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	37	11			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILTY CLAY, TR. SAND	ML	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #7 SAMPLE #7 28.5'-30'

Date: 8-22-88

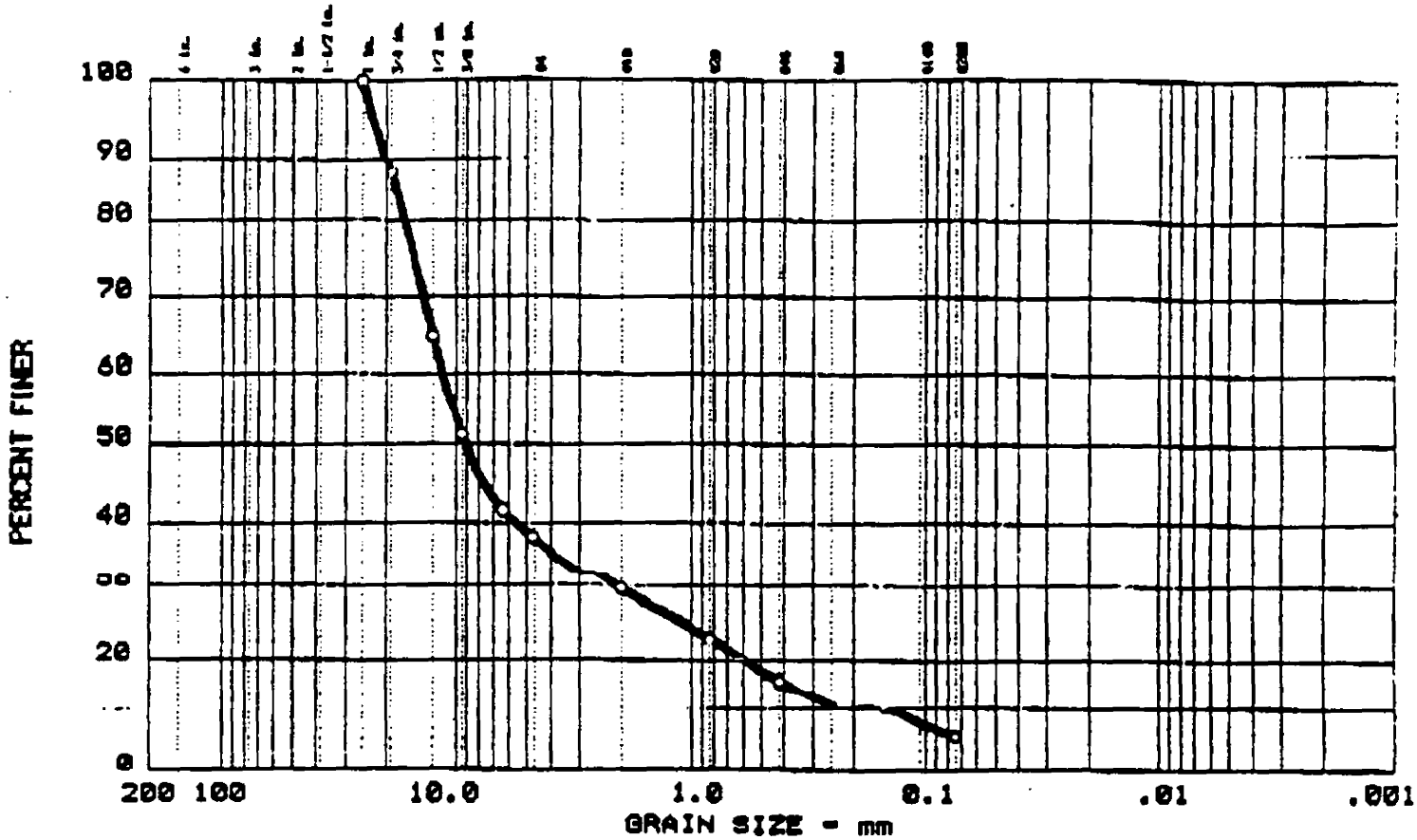
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=35.8%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 12

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	13	0.0	61.9	32.3	5.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			18.39	11.56	9.17	2.077	0.3144	0.1404	2.66	82.3

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND TRACE SILT	GW-GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #8 SAMPLE #2 5'-6.5'

Date: 8-22-88

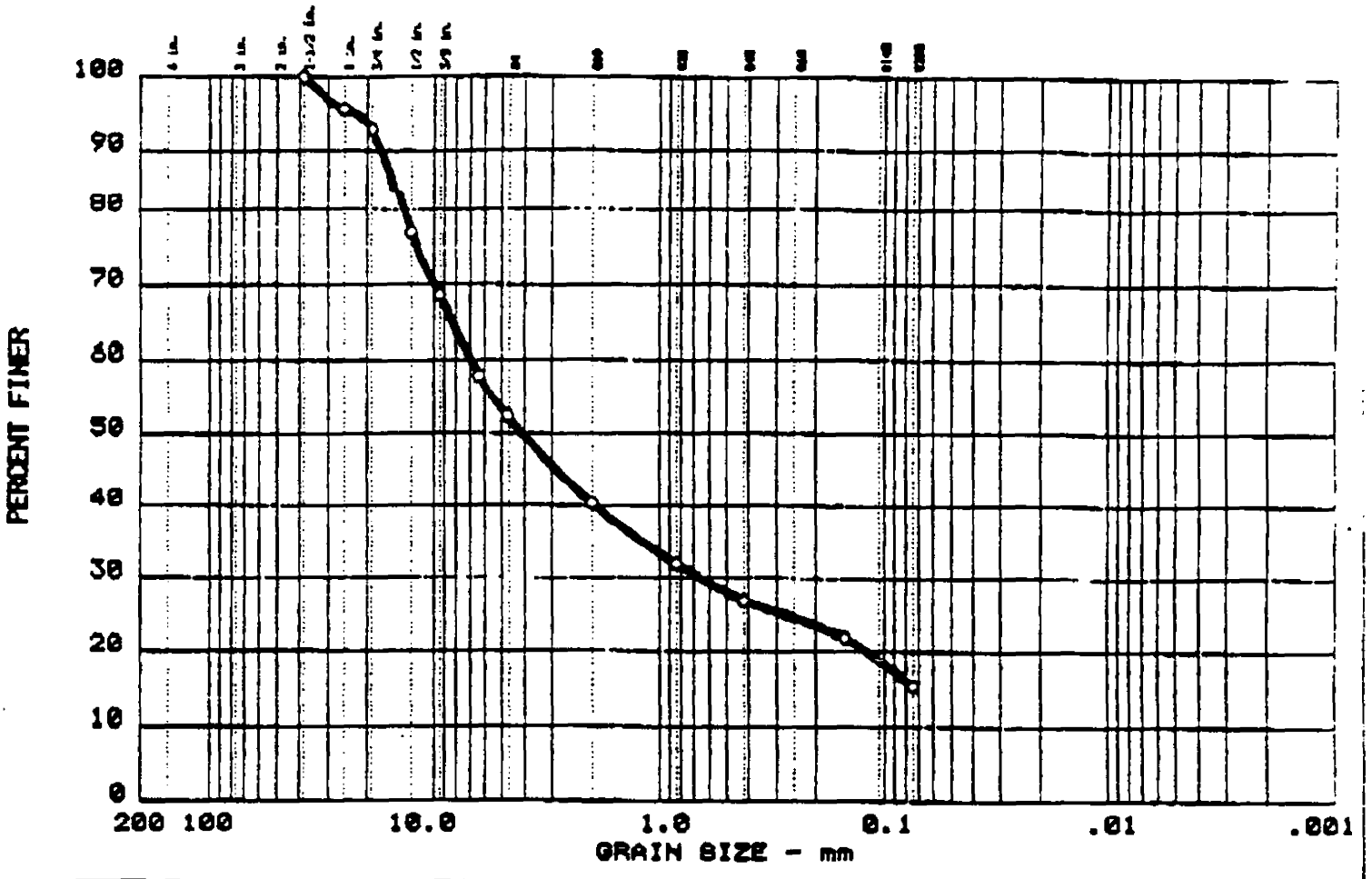
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=9.9%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 13

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	14	0.0	47.4	37.1	15.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			15.31	6.92	4.83	0.661				

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL AND SAND LITTLE SILT	GM	

Project No.: BD 86-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #8 SAMPLE #4 15'-16.5'

Date: 8-22-86

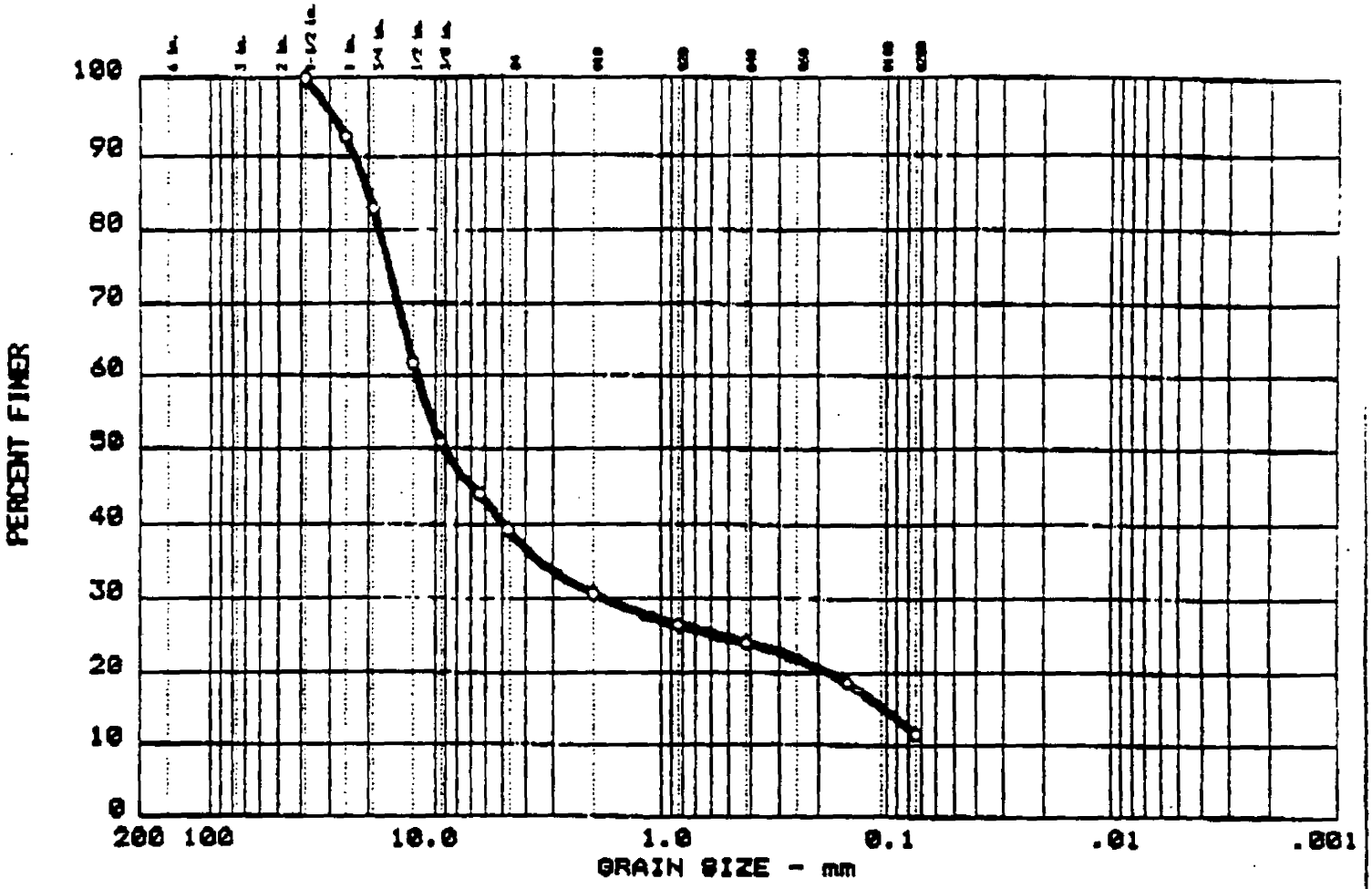
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=11.6%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. I4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	15	0.0	60.8	27.7	11.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o			19.93	12.23	9.17	1.768	0.1017			

MATERIAL DESCRIPTION	USCS	AASHTO
o GRAVEL SOME SAND LITTLE SILT	GP-GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
o Location: BORING #9 SAMPLE #2 5'-6.5'

Date: 8-22-88

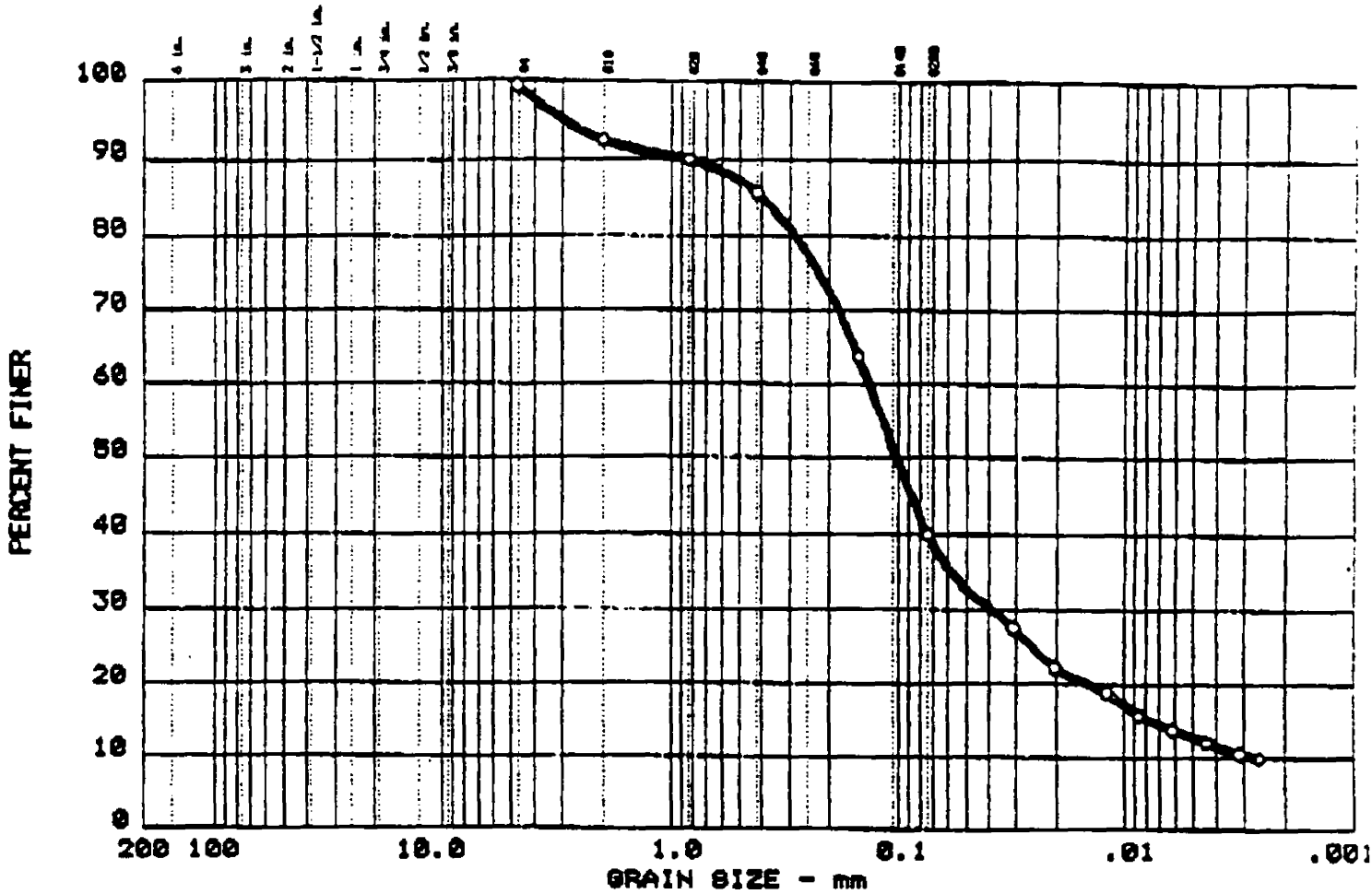
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=15.9%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 15

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	5	0.0	0.6	59.5	27.2	12.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.40	0.13	0.10	0.039	0.0076			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND, SOME SILT, LITTLE CLAY, TR. GRAVEL	SM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #10 SAMPLE #1 0'-1.5'

Date: 8-22-88

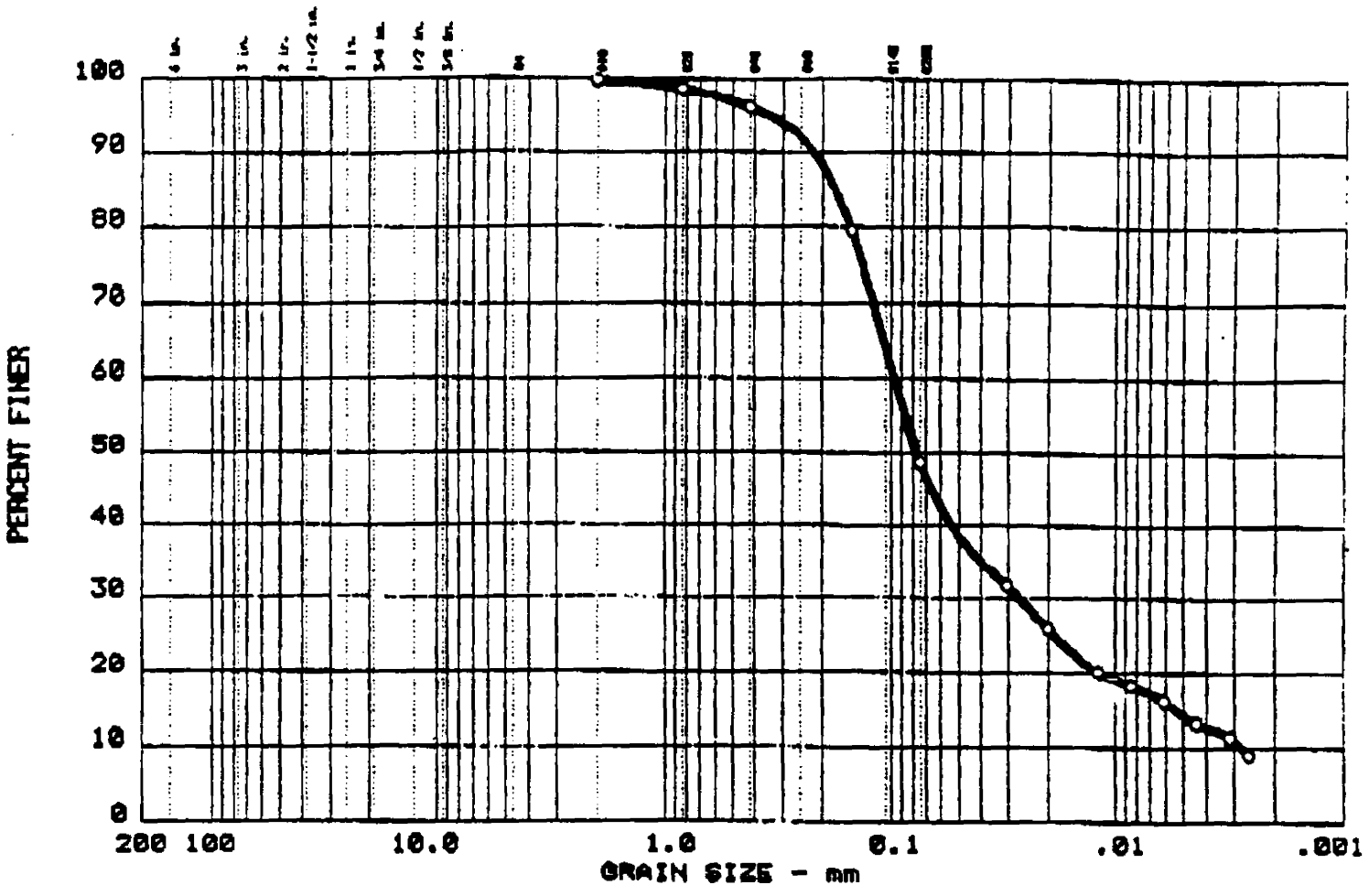
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=15.6%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 16

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	4	0.0	0.0	51.4	34.3	14.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.18	0.10	0.08	0.027	0.0053	0.0028	2.72	35.1

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND, SOME SILT, LITTLE CLAY	SM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #10 TEST #1 2'-2.5'

Date: 8-22-88

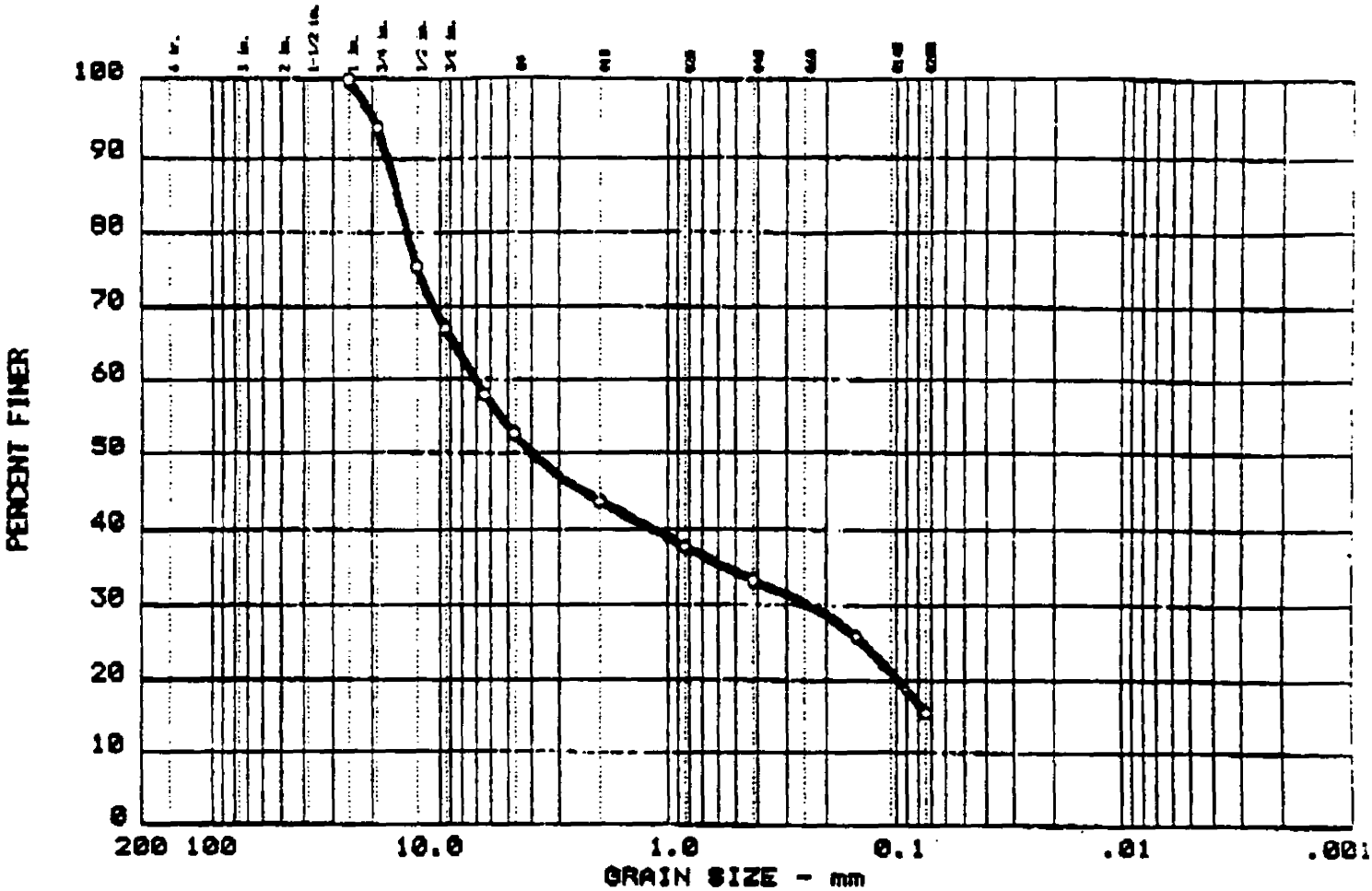
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=15.3%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 17

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	20	0.0	47.4	37.1	15.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o			15.56	7.01	3.94	0.235				

	MATERIAL DESCRIPTION	USCS	AASHTO
o	GRAVEL AND SAND LITTLE SILT	SM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
o Location: BORING #18 SAMPLE #2 5'-6.5'

Remarks:
SPLIT SPOON SAMPLE
N.W.C.=10.8%

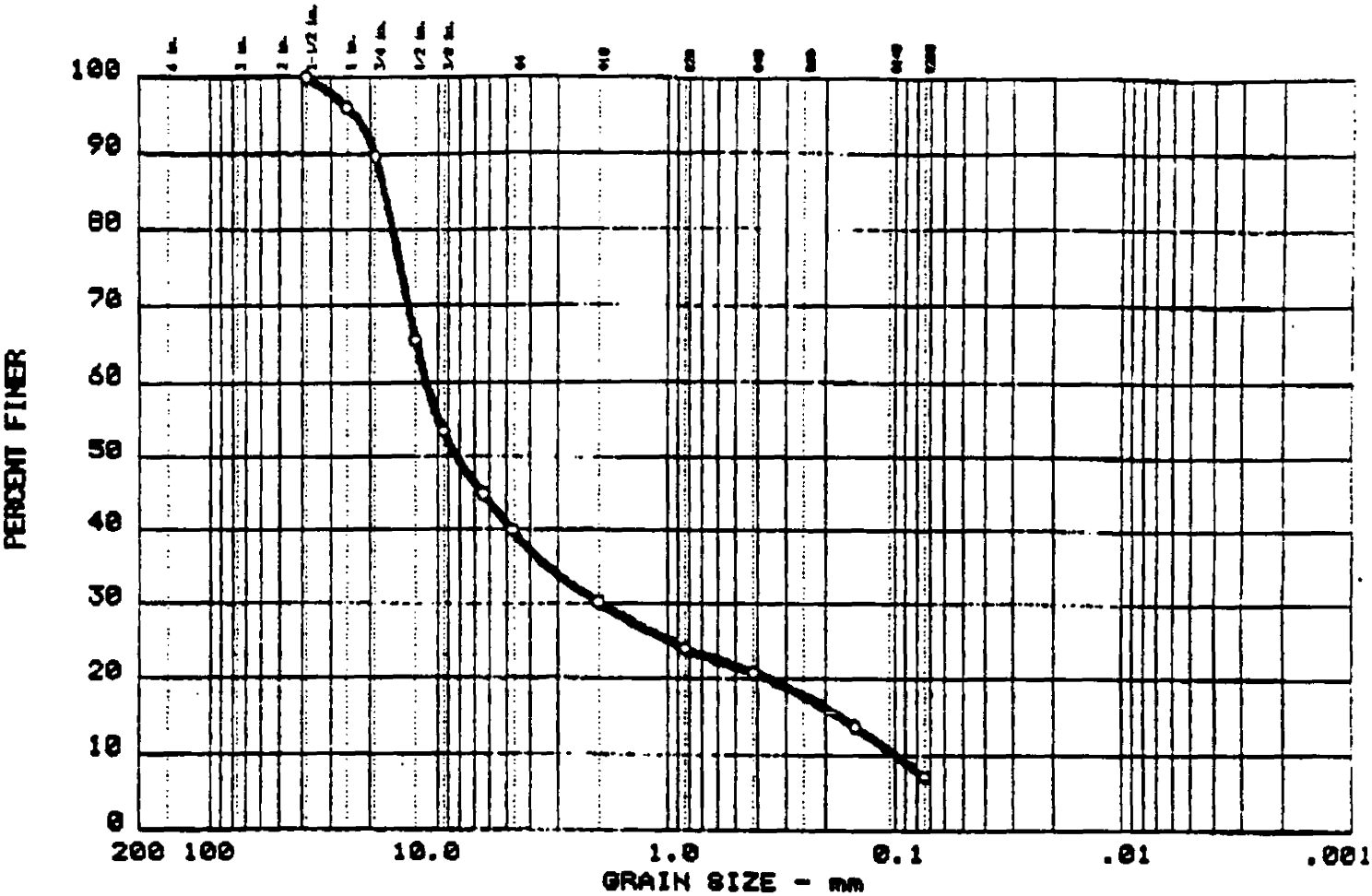
Date: 8-22-88

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 18

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	9	0.0	60.1	32.7	7.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			17.36	11.34	8.30	1.968	0.1734	0.0986	3.46	114.9

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND TRACE SILT	GP-GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #11 SAMPLE #3 10'-11'

Date: 6-22-88

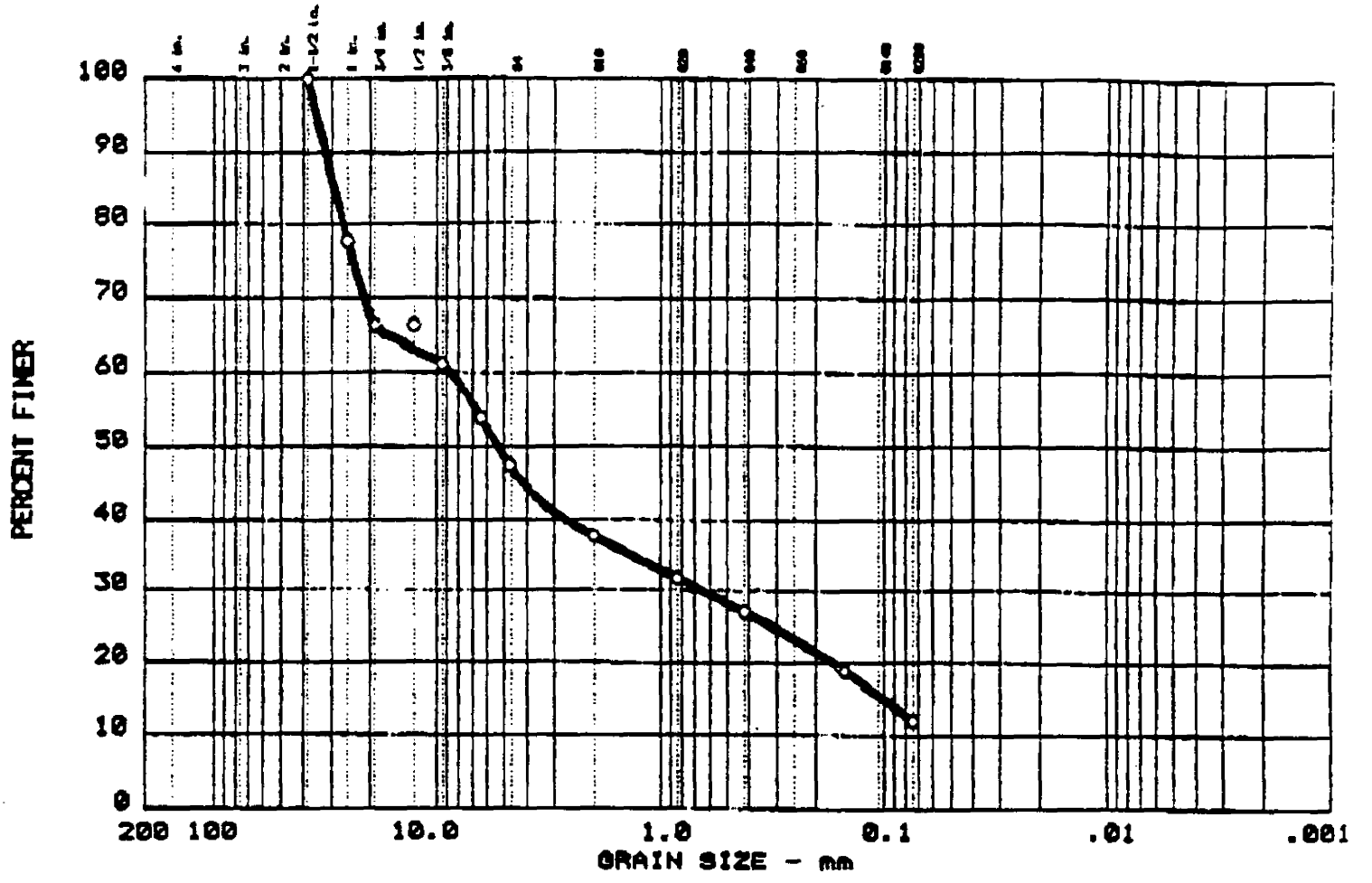
Remarks:
SPLIT SPOON SAMPLE
N.W.C.=16.1%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 19

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	11	0.0	52.5	35.6	11.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			29.17	8.61	5.31	0.646	0.1000			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL AND SAND LITTLE SILT	SP-SM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
○ Location: BORING #12 SAMPLE #2 5'-6.5'

Remarks:
SPLIT SPOON SAMPLE
N.W.C.=13.6%

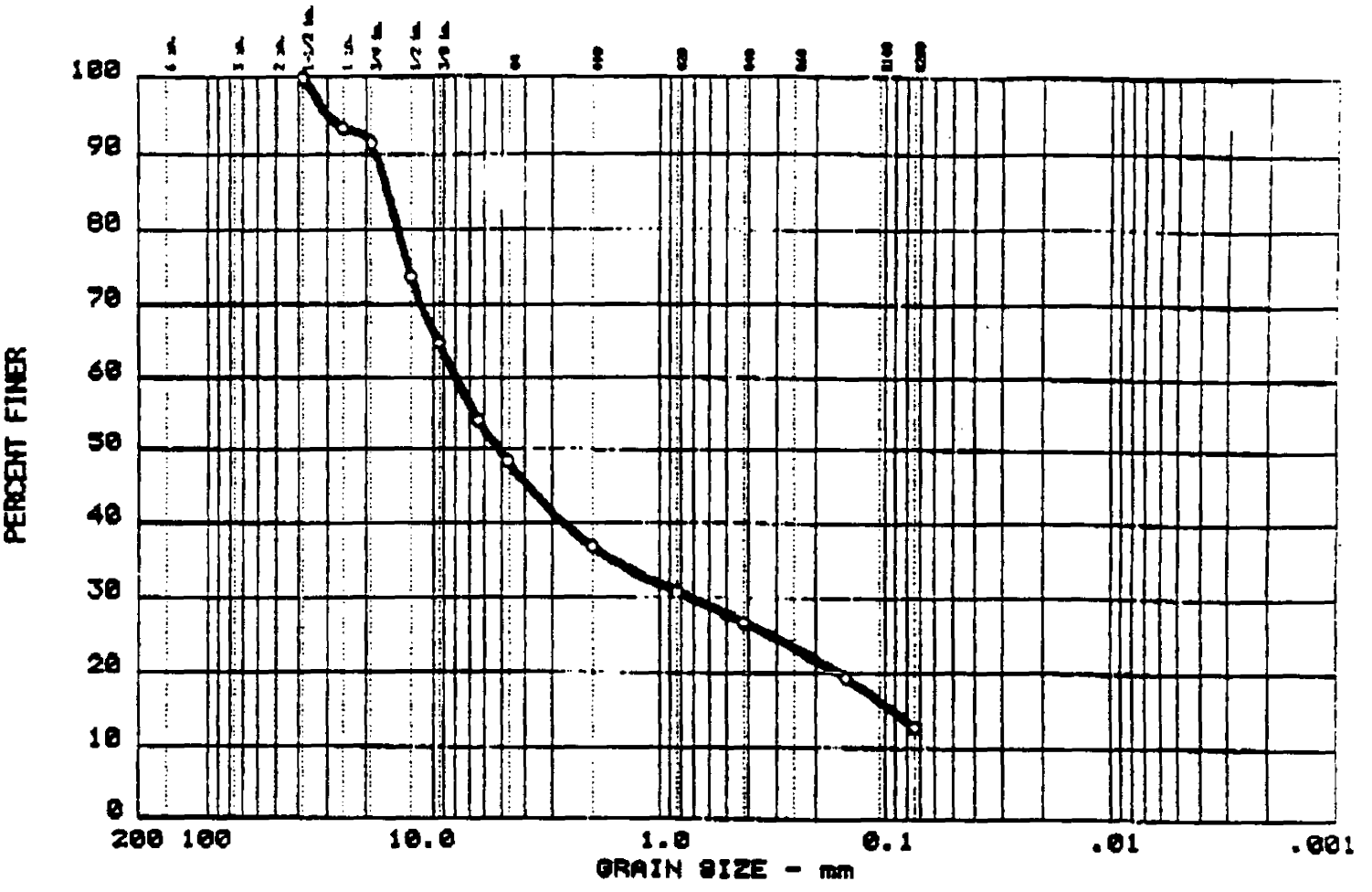
Date: 6-22-88

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 20

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	12	0.0	51.6	35.7	12.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o			16.03	7.94	5.19	0.724	0.0923			

MATERIAL DESCRIPTION	USCS	AASHTO
o GRAVEL AND SAND LITTLE SILT	GM	

Project No.: BD 88-63
Project: FORMER SINCLAIR REFINERY, WELLSVILLE, N.Y.
o Location: BORING #11 SAMPLE #4 15'-16.5'

Date: 8-22-88

Remarks:
SPLIT SPOON SAMPLE
N.W.C.=11.6%

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

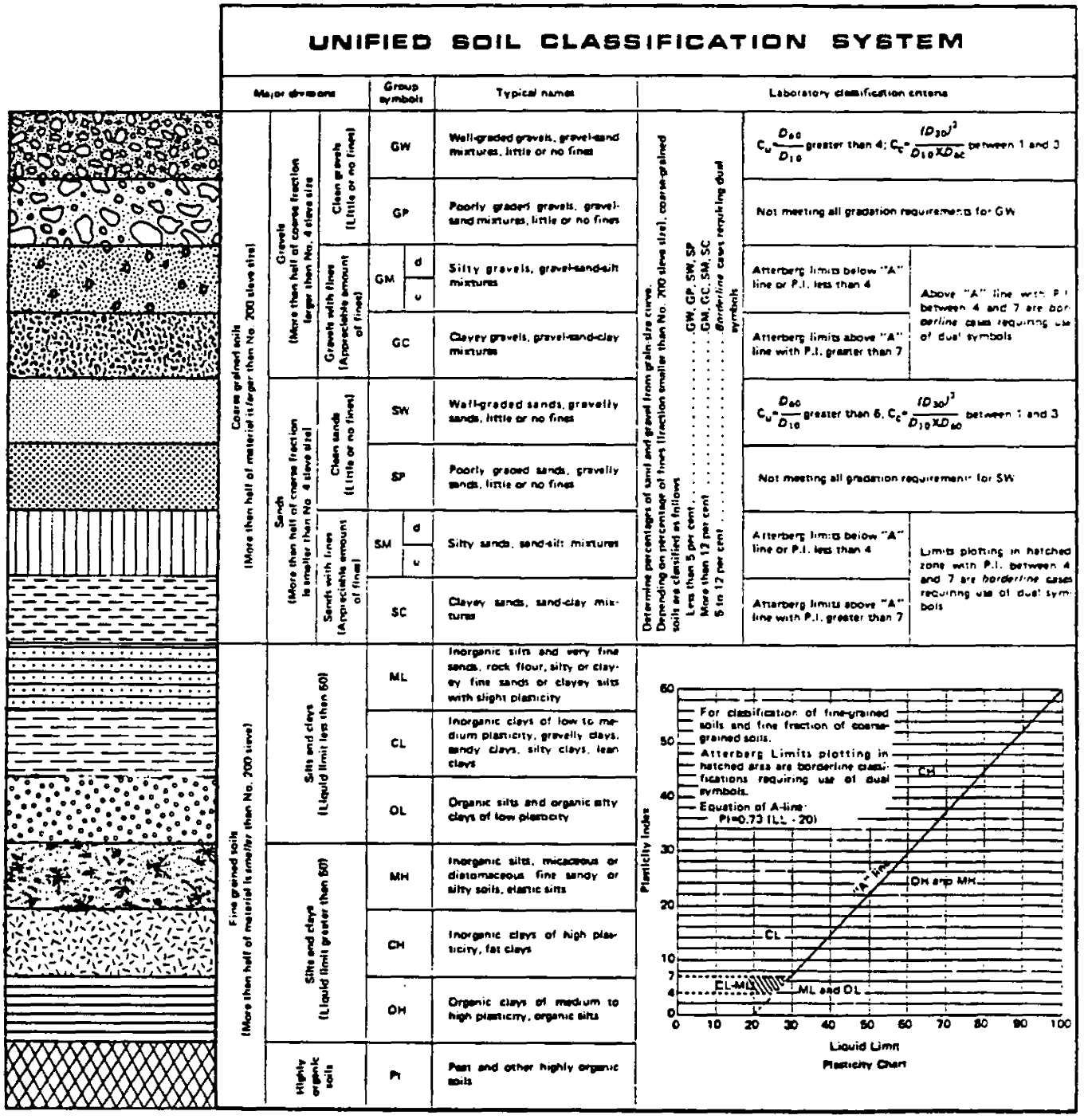
Fig. No. 21

Appendix B

BORING LOGS AND
GRAIN SIZE DISTRIBUTION ANALYSIS RESULTS
FROM 1988-1989 SITE INVESTIGATION

EBASCO SERVICES, INC.

SOIL BORING KEY



UNIFIED SOIL CLASSIFICATION SYSTEM

Major divisions			Group symbols	Typical names	Laboratory classification criteria
Coarse grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 — Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7 — Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 — Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7 — Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
Fine grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
Highly organic soils			Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

- Less than 5 per cent ..... GW, GP, SW, SP
- More than 12 per cent ..... GM, GC, SM, SC
- 5 to 12 per cent ..... *Borderline* cases requiring dual symbols

Other Soil Boring notes:

"HNU" - Photoionization Detector
"OVA" - Flame Ionization Detector
"BZ" - Breathing Zone

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-69
Location: N767933.78 E675285.45
Project Number: 8169
Field Geologist: M. NOBLET
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Drilling Method: 8" OD HOLLOW STEM AUGER

Project: SINCLAIR REFINERY SITE
Date Started: 11-14-88 Date Completed: 11-14-88
Elevation: 1510.0' GW Depth: 11 FT.
Driller: EMPIRE SOILS

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0							
	1	2 4 4	50%		SM (Fill)	0'-1' - Brown SILT and very fine SAND, moist		HNu= 2ppm in BZ. Level B operations.
	2	5				1'-2' - Dark brown silty SAND and GRAVEL, moist		
	3	2 2 3	13%		GM (Fill)	2'-4' - SAME		
	4	3						
	5	1 2 3	13%		GM/GC (Fill)	4'-6' - Dark brown silty SAND and GRAVEL, little yellowish brown clay, moist		
	6	3						
	7	3 1 2	0%			6'-8' - No Recovery		
	8	3						
	9	3 3 3	38%		ML/CL (Fill)	8'-9' - Dark gray and brown clayey SILT, moist,(sludge)		at 8-10' ss HNu= 50ppm LEL (BZ)= 1%
	10	3				9'-10' - Dark brown to black clayey SILT, moist,(sludge)		
	11	3 4 4	50%		ML/CL (Fill)	10'-12' - Dark brown to black clayey SILT, saturated,(sludge)		at 10-12' ss HNu= 50ppm
	12	3						
	13							12'-14'- Shelby Tube
	14							
	15	8 12 12	100%		GM	14'-16' - Tan to olive gray SILT, SAND and GRAVEL, moist		LEL >100% Operations shut down - hole grouted.
	16	12						
	17					TOTAL DEPTH = 16 FT.		
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							

Notes: No samples, taken for laboratory analyses
H & S Logbook #7; ss = Split Spoon; BZ = Breathing Zone
LEL = Lower Explosive Limit; All LEL measurements taken in borehole (BH).

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-70
Location: N767964.62 E 675560.22
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 11-18-88 Date Completed: 11-18-88
Field Geologist: R. BURNS
Elevation: 1502.2' GW Depth: NA
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0	2	17%		SM/FILL	0'-2' - Dark brown coarse to fine SAND, some silt, little(-) gravel, angular	0900 11-18-88	at 0-2' ss HNu= 0ppm
	1	6						
	2	5						
		7						
	3	7	42%		SM/FILL	2'-4' - Yellowish brown coarse to fine SAND, some silt, little coarse to fine gravel, angular	0904 11-18-88	at 2-4' ss HNu= 0ppm
		15						
	4	4						
		4						
	5	2	17%		SW/ WASTE	4'-6' - Brown and black coarse to fine SAND (ash waste)	0911 11-18-88	
		2						
	6	2						
		1						
	7	3	17%		CL/ WASTE	6'-7' - Black silty CLAY, very wet (waste), (sludge)	0914 11-18-88	6'-8'- Water on outside of spoon.
		1			ML/ WASTE	7'-8' - Gray clayey SILT (sludge)		
	8	2						
		2						
	9	2	25%		SP/ WASTE	8'-9' - Gray fine SAND, some(+) silt 9'-10' - Black coarse to fine SAND, little(-) fine gravel, little silt (waste?)	0923 11-18-88	at 8-10' ss HNu= 20ppm
		21						
	10	13						
		9						
	11	12	17%			10'-12' - Dark gray coarse to fine SAND, some coarse to fine gravel, angular, some silt, very wet	0929 11-18-88	
		31						
	12	9						
		8						
	13	12	63%		GP	12'-14' - Dark gray coarse to fine GRAVEL, little coarse to fine sand	0935 11-18-88	12-14'- Sample oily. Oil on outside of spoon. HNu= 10ppm; LEL= 13%; ss
		8						
	14	8						
		7						
SL-AB 70-02	15	20	33%		GM	14'-16' - Gray coarse to fine GRAVEL some coarse to fine sand, some silt	1005 11-18-88	Geotech sample at 14-16' ss HNu= 10ppm LEL= 10%
		13						
	16	23						
		29						
	17							
	18							
	19							
SL-AB 70-03	20	25	63%		GM	19'-21' - Dark gray and yellowish brown coarse to fine GRAVEL, little coarse to fine sand, little(-) silt, very wet	1017 11-18-88	Geotech sample HNu= 0ppm
		39						
	21	35						
		44						
	22					TOTAL DEPTH = 21 Ft.		
	23							
	24							
	25							
	26							
	27							
	28							

Notes: H & S Logbook #7; ss = Split Spoon; LEL = Lower Explosive Limit. All measurements of LEL taken in borehole (BH).

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-71
Location: N767732.62 E675718.22
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 11-15-88 Date Completed: 11-15-88
Field Geologist: M. NOBLET
Elevation: 1502.8' GW Depth: 13 Ft.
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0	1	67%					
	1	1			ML/ WASTE	0'-2' - Dark brown to black clayey SILT, moist		at 0-2' ss HNu= 2ppm
		1						
	2	8						
		5	13%			2'-4' - Brown to black clayey SILT, little sand, little gravel, moist		Oil Staining
	3	4			ML/ WASTE			
		2						
	4	2						
		1	42%			4'-5' - SAME		
	5	1						
		1			SM	5'-6' - Gray fine silty SAND, moist		
	6	3						
		7	42%			6'-7.5' - SAME		
	7	13						
		17			GM/SM	7.5'-8' - Tan to olive gray silty SAND and GRAVEL, moist		
	8	8						
	9							
	10							
	11							
	12							
SL-AB 71-01		5	33%		GM/SM	12'-14' - Tan to olive gray silty SAND and GRAVEL, red mottling, saturated	1600 11-15-88	Cuttings HNu= 10ppm LEL= 9%
	13	22						
		25						
	14	27						
	15							
	16							
	17							
SL-AB 71-02		17	67%		GM/SM	17'-19' - Tan to olive gray silty SAND and GRAVEL, saturated	1610 11-15-88	LEL= 2%
	18	42						
		50						
	19	53						
						TOTAL DEPTH = 19 FT.		
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							

Notes: H & S Logbook #7; ss = Split Spoon; LEL = Lower Explosive Limit. All measurements of LEL taken in borehole.

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-72

Location: N767905.83 E675464.97

Project: SINCLAIR REFINERY SITE

Project Number: 8169

Date Started: 11-17-88 Date Completed: 11-17-88

Field Geologist: R. BURNS

Elevation: 1509.8' GW Depth: NA

Sampling Method: 2" OD SPLIT SPOON SAMPLER

Driller: EMPIRE SOILS

Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0							
	1	2 8 16	50%		FILL SM/ WASTE	0'-0.5' - Top Soil 0.5'-2' - Black medium to fine SAND, some silt, moist (ash waste)	1145 11-17-88	at 0-2' ss HNu= 10ppm
	2	16						
	3	7 6	21%		ML/ WASTE	2'-4' - Black SILT, trace gravel (sludge)	1149 11-17-88	at 2-4' ss HNu= 7ppm
	4	4 2						
	5		100%				1201 11-17-88	4'-6'- Shelby Tube LEL= 10%
	6							
SL-AB 72-01	7	WOH WOH WOH	54%		ML/ WASTE	6'-8' - Black SILT, very moist (sludge)	1204 11-17-88	* at 6-8' ss; HNu= 500ppm; LEL= >100% Stop operations and vent.
	8	WOH WOH						
	9	WOH WOH 3	42%		ML/WAST	8'-10' - SAME	1237 11-17-88	at 8-10' ss; HNu= 5ppm; LEL= 20%
	10	2						
	11	1 2	79%			10'-11' - SAME 11'-12' - Tannish gray CLAY and SILT	1240 11-17-88	LEL= >100% Stop operations and grout hole.
	12	3 3			CL			
SL-AB 71-01	13					TOTAL DEPTH = 12 FT.		
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							

Notes: WOH = Weight of Hammer; H & S Logbook #7; ss = Split Spoon; LEL = Lower Explosive Limit. All LEL measurements are taken in borehole (BH). '*' - Venting of borehole allowed to LEL to decrease to operational levels. If it doesn't decrease, the operation is haulted and the BH is grouted.

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-73
Location: N767837.85 E675603.34
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 11-17-88 Date Completed: 11-17-88
Field Geologist: R. BURNS
Elevation: 1510.1' GW Depth: NA
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0							
	1	5 23 16	75%		SW/ WASTE	0'-2' - Black coarse to fine SAND (waste ash)	1506 11-17-88	at 0-2' SS HNu = 3 ppm
	2	14						
	3	4 4 2	17%		SW/ WASTE	2'-4' - SAME	1512 11-17-88	at 2-4' SS HNu = 2 ppm
	4	2						
	5	2 2 2	8%		SW/ WASTE	4'-6' - Same, little silt	1521 11-17-88	
	6	1						
	7	1 1 1	17%		ML/ WASTE	6'-8' - Gray SILT, some black ash	1527 11-17-88	Bottom of spoon appears to be at or near the Waste/Natural soil interface; at 6-8' LEL = 100% (let vent 20 min.) *SS - HNu = 70ppm
	8	1						
	9					TOTAL DEPTH = 8 FT.		
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							

Notes: SS = Split spoon; H & S Logbook #12
'*' - The split spoon had been opened for several minutes before measurement.

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-74
Location: N767819.21 E675400.09
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 11-16-88 Date Completed: 11-17-88
Field Geologist: M. NOBLET/R. BURNS
Elevation: 1510.9' GW Depth:
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0							
		1	50%			0'-2' - Black SILT, moist		
	1	3			ML/	(waste ash), (sludge)		
		3			WASTE			
	2	3						
								2'-4'- Shelby Tube
	3							
	4							
		2	0%			4'-6' - No Recovery		
	5	2						
		2						
	6	1						
SL-AB		2	67%		ML/	6'-8' - SAME		Sample is saturated
74-01	7	1			WASTE			with oil.
		1						
	8	1						
SL-AB								
74-02	9							8'-10'- Shelby Tube
	10							
		1	50%		ML/	10'-11' - Black clayey SILT, very	0820 11-17-88	at 10-12' ss; HNu=
	11	1			WASTE	moist (waste)		200ppm; LEL= 3%
		1				11'-12' - Black SILT, little(+) fine		
	12	3				sand (waste)		
SL-AB			75%				0835 11-17-88	12'-14'- Shelby Tube
74-03	13							Bottom of tube is in
								natural material
	14							LEL in BH is >100%.
						TOTAL DEPTH = 14 FT.		Operations shut down
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							

Notes: H & S Logbook #7; ss = Split Spoon; LEL = Lower Explosive Limit.
All LEL measurements are taken in borehole (BH).

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-75
Location: N767714.91 E675328.81
Project: SINCLAIR REFINERY SITE
Project Number: 8306
Date Started: 11-10-88 Date Completed: 11-11-88
Field Geologist: M. CONTOS
Elevation: 1509.5' GW Depth:
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0							
	1	3 7 5	21%		ML/FILL	0'-2' - Brown SILT, some wood	1520 11-10-88	Sample is oily. HNu = 5.0 PPM
	2	8						
	3	2 8 9	0%			2'-4' - No Recovery	1523 11-10-88	Oily liquid in spoon. HNu = 4.5 PPM
	4	3						
	5	5 1	0%			4'-6' - No Recovery	1530 11-10-88	HNu = 4.0 PPM
	6	1 1						
	7	WOH/24"	13%		ML/ WASTE	6'-8' - Black SILT and wood (waste), saturated, (sludge)	1540 11-10-88	Sample is saturated with oil. HNu = 1.9 PPM
	8							
SL-AB 75-01	9	1 1 1/12"	38%		ML/ WASTE	8'-10' -Black Silt, sludge (waste)	1550 11-10-88	HNu = 5.0 PPM sample is oily.
	10							
SL-AB 75-02	11						1615 11-10-88	10'-12.5' - Shelby Tube
	12							
	13							
	14							
	15	19 19 14	71%		ML GW	14-14.5' -Black Silt, wet, (sludge) 14.5'-16' - Dark gray and brown SAND and GRAVEL, dry	1625 11-10-88	HNu = 5.0 PPM 14-14.5' sample is oily
	16	18						
	17	5 17 13	46%		GW	16'-18' - SAME, moist	1630 11-10-88	HNu = 5.0 PPM
	18	17						
	19							
	20							
SL-AB 75-03	21	29 18 18	58%		GW	20'-22' - Olive brown coarse SAND and GRAVEL, some silt, wet	0900 11-11-88	Sample is oily. HNu = 3.0 PPM LEL = 5.6%
	22	86						
	23							
	24							
	25							
SL-AB 75-04	26	32 38 25	58%		GW	25'-27' - Olive gray coarse SAND and coarse to fine GRAVEL, some silt	0925 11-11-88	HNu = 5.0 PPM on upper recovery; bot. recovery = 2.0 ppm
	27	28						
	28					TOTAL DEPTH = 27 FT.		

Notes: H & S Logbook #10; LEL = Lower Explosive Limit. All LEL measurements are taken in borehole (BH).

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-76
Location: N767726.03 E675450.29
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 11-15-88 Date Completed: 11-15-88
Field Geologist: M. NOBLET
Elevation: 1509.5' GW Depth:
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0	2	21%					
	1	2			ML/FILL	0'-2' - Brown clayey SILT, some brick fragments, moist		0-2' ss; HNu= 2ppm Level 1B operations.
	2	2 3						
	3	2 3	8%		CL/FILL	2'-4' - Dark brown to black silty CLAY, some wood fragments		Sample is saturated with oil. 2-4' ss HNu= 2ppm; LEL= 10%
	4	4 6						
	5	3 2	13%		ML/ WASTE	4'-6'-Black Silt, (sludge)		Sample is saturated with oil. ss; HNu= 10ppm
	6	.5 .5						
SL-AB 76-01	7	.5 .5	25%			6'-8' - SAME		Sample is saturated with oil. 6-8' ss HNu= 100ppm; LEL= 10%
	8	.5 WOH	58%			8'-10' - SAME		Sample is saturated with oil. 8-10' ss HNu= 75ppm
	9	WOH 2						
	10	2						
	11	2	67%		SM	10'-11' - SAME 11'-12' - Dark gray fine SAND, some silt, moist	0820 11-17-88	Sample is saturated with oil. 10-12' ss HNu= 150ppm
	12	4 5						
	13	14 20	50%		GM	12'-14' - Tan to olive gray SILT, SAND and GRAVEL, moist	0835 11-17-88	Oil staining at 12-14' ss; HNu= 1-2ppm; LEL= 100% Operations shut down.
	14	16				TOTAL DEPTH = 14 FT.		
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							

Notes: H & S Logbook #7; ss = Split Spoon; BZ = Breathing Zone; LEL = Lower Explosive Limit.
All LEL measurements are taken in borehole (BH).

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-77
Location: N767618.65 E675605.88
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 11-16-88 Date Completed: 11-16-88
Field Geologist: M. NOBLET
Elevation: 1511.5' GW Depth: 19 Ft.
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0	2	13%					
	1	2			CL/FILL	0'-2' - Dark brown silty CLAY,		at 0-2' ss HNu= 0.4ppm
		2						
	2	2						
		2	46%			2'-3' - SAME		
	3	3						
		3			CL/ML	3'-4' - White silty CLAY, moist		
	4	3			WASTE			
	5							4'-6' - Shelby Tube
	6							
		1	33%			6'-8' - Mottled white to dark brown		Bottom 1" is oil
	7	2				silty CLAY		stained.
		2						
	8	3						
	9							8'-10' - Shelby Tube
	10							
		1	17%			10'-12' - Dark brown to black SILT,		Oil staining
	11	2			ML/	moist, (sludge)		
		1			WASTE			
	12	2						
		3	42%			12'-13.5' - SAME		at 12-14' ss
	13	4			ML/	13.5'-14' - Brown to dark gray SILT,		HNu= 70ppm
		4			WASTE	moist		OVA= 180ppm
	14	4						
		2	17%			14'-16' - Dark gray fine silty SAND,		
	15	2			SM	moist		
		4						
	16	5						
		8	25%			16.5'-18' - Tan to olive gray silty		Oil staining
	17	16			GM	SAND and GRAVEL, moist		
		27						
	18	20						
	19							
	20							
		8	50%			20'-22' - SAME, saturated		Oil stained
	21	9						No elevated readings
		9						after hitting ground
	22	22						water.
	23							
	24							
	25							
SL-AB		18	50%			25'-27' - SAME	1110 11-16-88	
77-01	26	22						
		40						
	27	40						
	28							

Notes: H & S Logbook #7; ss = Split Spoon

Ebasco Services, Inc. Log of Boring

Boring Number: SL-A8-77
Location: N767618.65 E675605.88
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 11-16-88 Date Completed: 11-16-88
Field Geologist: M. NOBLET
Elevation: 1511.5' GW Depth: 19 Ft.
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Pro-file	USCS Class	Material Description	Collection Time	Collection Date	Comments
	28								
	29								
	30								
SL-A8		24	75%			30'-32' - Tan to olive gray silty			
77-02	31	47			GM	SAND and GRAVEL, saturated			
		44							
	32	37							
	33								
	34								
	35								
SL-A8			58%		GM	35'-37' - SAME			
77-03	36								
	37								
						TOTAL DEPTH = 37 FT.			
	38								
	39								
	40								
	41								
	42								
	43								
	44								
	45								
	46								
	47								
	48								
	49								
	50								
	51								
	52								
	53								
	54								
	55								
	56								

Notes: H & S Logbook #7; ss = Split Spoon

Sheet: 2 of 2

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-78
Location: N767490.10 E675333.34
Project: SINCLAIR REFINERY SITE
Project Number: 8306
Date Started: 11-10-88 Date Completed: 11-10-88
Field Geologist: M. CONTOS
Elevation: 1510.2' GW Depth: 18'
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0	3	8%		ML/FILL	0'-2' - Very light brown silty CLAY, slightly cohesive, little dark brown silt	0845 11-10-88	HNu = Background
	1	6						
		9						
	2	8						
		7	25%		ML/FILL	2'-4' - Brown silty CLAY, slightly cohesive, little dark brown silt	0848 11-10-88	HNu = Background
	3	7						
		9						
	4	4						
		4	54%			4'-4.5' - SAME	0900 11-10-88	Sample is oily.
	5	3			WASTE	4.5'-6' - Black silty sludge (waste) high plasticity		HNu = 1.4 PPM
		3						
	6	2						
		2	79%			6'-6.5' - Brown to light brown CLAY, slightly cohesive	0910 11-10-88	Sample is saturated with oil.
	7	3						
		3				6.5'-8' - Black silty sludge (waste) high plasticity		HNu = 3.4 PPM
	8	2						
		1	67%			8'-10' - Black silty sludge (waste) brown mottling top 2"	0925 11-10-88	HNu = 4.0 PPM = top recovery; bottom recovery = 2.6ppm sample is oily
	9	1						
		2						
	10	2						
		2	58%			10'-12' - SAME, decreasing plasticity with depth	0930 11-10-88	HNu = 2.2 PPM
	11	3						
		3						
	12	4						
		2			WASTE	12'-14' - Brown to dark gray SILT (waste)	0945 11-10-88	HNu = 2.2 PPM
	13	3						
		5						
	14	9						
		33	71%			14'-14.5' - SAME	0950 11-10-88	HNu = >10.0 PPM
	15	22				14.5'-16' - Black GRAVEL and SAND, little silt, wet		Oily
		20			GP			
	16	17						
		28	50%		GP	16'-18' - SAME, saturated	1005 11-10-88	HNu = >10.0 PPM
	17	10						Oily
		15						
	18	12						
	19							
	20							
SL-AB 78-01		14	58%		GP	20'-22' - Dark gray and yellow brown GRAVEL and SAND, little silt, saturated	1020 11-10-88	Sample is oily. HNu = Background LEL = 5.6%
	21	30						
		20						
	22	22						
	23							
	24							
	25							
SL-AB 78-02		50	67%		GP	25'-27' - Yellow brown SAND and GRAVEL, little silt, saturated gravel subrounded	1035 11-10-88	HNu = 2.0 PPM
	26	35						
		34						
	27	52						
						TOTAL DEPTH = 27 FT.		
	28							

Notes: H & S Logbook #10; LEL = Lower Explosive Limit. All LEL measurements are taken in borehole (BH).

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-96
Location: N767162.40 E675418.99
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 10-27-88 Date Completed: 10-27-88
Field Geologist: R. BURNS
Elevation: 1504.6' GW Depth: 11 FT
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
	0								
SL-AB 96-01	1	12 18 27	63%		GM/DIKE	0'-2' - Yellowish brown coarse to fine SAND, some silt, little(-) coarse to fine gravel	1350	10-27-88	*
	2	49							
SL-AB 96-02	3	38 34	71%		GM	2'-4' - Yellowish brown and brown medium to fine SAND, some silt, little(-) fine gravel	1355	10-27-88	
	4	18 20							
SL-AB 96-03	5	4 13	50%		GM	4'-6' - Brown coarse to fine SAND, some silt, little(-) coarse to fine gravel	1410	10-27-88	Lab Class.- Sand and gravel, little silt (SM)
	6	11 9							
SL-AB 96-04	7	12 9	50%		GM	6'-8' - Dark brown coarse to fine SAND, some clayey silt, little(-) coarse to fine gravel	1415	10-27-88	
	8	10 6							
SL-AB 96-05	9	4 6	17%		GM	8'-10' - Dark brown medium to fine SAND, some(+) clayey silt, little(-) coarse gravel	1425	10-27-88	
	10	9 12							
SL-AB 96-06	11	1 5	46%		GM/DIKE	10'-12' - Yellowish brown coarse to fine SAND, some(+) clayey silt, little coarse to fine gravel, angular, very wet	1428	10-27-88	Contact between Dike and natural soils based on STP. Visually, soils appear the same
	12	19 20							
SL-AB 96-07	13	23 21	58%		GM	12'-14' - Yellowish brown medium to fine SAND, some silty clay, little coarse to fine gravel, angular, very moist	1435	10-27-88	
	14	22 19							
SL-AB 96-08	15	21 18	92%		GM	14'-16' - Yellowish brown coarse to fine SAND, some coarse to fine gravel, angular, little clayey silt	1450	10-27-88	
	16	20 23							
SL-AB 96-09	17	24 26	100%		GM	16'-18' - Brown coarse to fine GRAVEL, some(+) coarse to fine sand, little(+) silt	1455	10-27-88	
	18	50 33							
SL-AB 96-10	19	1 23	63%		GM	18'-19' - Brown coarse to fine SAND and coarse to fine GRAVEL, angular, some(+) silt, very wet	1510	10-27-88	Lab Class.- Gravel and sand, little silt (GM)
	20	43 33				19'-20' - Brown coarse to fine GRAVEL, little silt, very wet			
	21								
	22								
	23					TOTAL DEPTH = 20 FT.			
	24								
	25								
	26								
	27								
	28								

Notes: '*'-No elevated readings on HNu for any of the Split Spoon samples.
H & S Logbook #6; Location: NYS DIKE

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-97
Location: N767245.22 E675497.58
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 10-27-88 Date Completed: 10-27-88
Field Geologist: R. BURNS
Elevation: 1504.3' GW Depth: 12' 3"
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
	0								
SL-AB 97-01	1	9, 13, 17	58%		GM	0'-2' - Dark brown SILT and CLAY some medium to fine sand, little medium to fine gravel, angular, dry	1545	10-27-88	*
	2	11							
SL-AB 97-02	3	23, 21, 12	67%		GM/DIKE	2'-4' - Brown and light brown SILT, some(-) fine sand, little(-) fine gravel, angular, dry	1550	10-27-88	Lab Class.- Silt and sand, some gravel (SM)
	4	12							
SL-AB 97-03	5	3, 29, 12	33%		SM/SC DIKE	4'-6' - Brown clayey SILT, some(+) medium to fine sand, trace fine gravel, angular, dry	1600	10-27-88	
	6	7							
SL-AB 97-04	7	6, 6	25%		ML/DIKE	6'-8' - Dark brown clayey SILT, some(-) fine sand, little fine gravel, angular, moist	1605	10-27-88	
	8	7							
SL-AB 97-05	9	3, 4	75%		SM/DIKE	8'-10' - Dark gray fine SAND, some(+ clayey silt, moist coarse gravel	1610	10-27-88	
	10	2, 3							
SL-AB 97-06	11	1, 11	58%			10'-11' - SAME 11'-12' - Dark gray coarse to fine GRAVEL, some coarse to fine sand, little(-) silt, wet	1615	10-27-88	Contact between Dike and natural soils based on STP. Visually, soils appear the same
	12	21, 43			GM				
SL-AB 97-07	13	5, 19, 19			GM	12'-14' - Dark gray coarse to fine GRAVEL, some coarse to fine sand, little silt, wet	1620	10-27-88	
	14	13							
SL-AB 97-08	15	18, 15, 18	58%		GM	14'-16' - Brownish gray coarse to fine GRAVEL, some(-) coarse to fine sand, little(-) silt	1625	10-27-88	
	16	18							
SL-AB 97-09	17	18, 30, 38	75%		GM	16'-18' - Dark brown coarse to fine SAND, some(-) coarse to fine gravel, little(-) silt	1635	10-27-88	Lab Class.- Sand and gravel, little silt (SP-SM)
	18	38							
SL-AB 97-10	19	39, 50, 33	75%		GM	18' -20' - Dark brown coarse to fine GRAVEL, some(+) coarse to fine sand, little silt, very wet	1650	10-27-88	
	20	30							
	21					TOTAL DEPTH = 20 FT.			
	22								
	23								
	24								
	25								
	26								
	27								
	28								

Notes: * No elevated readings on HNu for any of the Split Spoon samples.
H & S logbook #6; Location: NYS DIKE

Sheet: 1 of 1

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-98
Location: N767315.74 E675564.54
Project: SINCLAIR REFINERY SITE
Project Number: 8306
Date Started: 10-28-88 Date Completed: 10-31-88
Field Geologist: R. BURNS/ M. CONTOS
Elevation: 1504.1' GW Depth: 12' 10"
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
	0								
SL-AB 98-01	1	20 29 60	13%		CL/DIKE	0'-2' - Dark brown SILT and CLAY some(-) fine sand, little gravel	1300	10-28-88	*
	2	62							
SL-AB 98-02	3	90 100 46	29%		GM/DIKE	2'-4' - Dark brown coarse to fine SAND, little(+) clayey silt, little coarse to fine gravel	1310	10-28-88	
	4	47							
SL-AB 98-03	5	10 8 7	92%		SM/GM DIKE	4'-6' - Brown medium to fine SAND, some silt, little coarse to fine gravel	1338	10-28-88	
	6	4							
SL-AB 98-04	7	4 6 18	33%		GM/DIKE	6'-8' - Dark brown medium to fine SAND, some(-) coarse to fine gravel, little(+) silt	1340	10-28-88	
	8	17							
SL-AB 98-05	9	12 43 25	17%		GM	8'-10' - Dark brown coarse to fine GRAVEL, some(-) coarse to fine sand, some silt, wet	1348	10-28-88	
	10	18							
SL-AB 98-06	11	6 19 16	33%		GM	10'-12' - Dark brown coarse to fine GRAVEL, some coarse to fine sand, little(+) silt, very wet	1355	10-28-88	
	12	17							
SL-AB 98-07	13	13 9 12	50%		GM	12'-14' - Dark brown coarse to fine GRAVEL, some(-) coarse to fine sand, little(+) silt, very wet	1402	10-28-88	
	14	18							
SL-AB 98-08	15	30 30 33	25%		GM	14'-16' - Dark brown coarse to fine SAND, some clayey silt, little coarse to fine gravel	1420	10-28-88	Contact between Dike and natural soils based on STP. Visually, soils appear the same.
	16	37							
SL-AB 98-09	17	48 54 49	67%		GM	16'-18' - Dark brown coarse to fine SAND,some(+) coarse to fine gravel, little silt	1425	10-28-88	
	18	61							
SL-AB 98-10	19	34 44 50	83%		SW/SC	18'-20' - Dark brown coarse to fine SAND, some coarse to fine gravel, little clay	0905	10-31-88	
	20	49							
SL-AB 98-11	21	26 40 98	33%		GM	20'-22' - Dark brown coarse to fine SAND, some clayey silt, little fine to coarse gravel	0920	10-31-88	
	22	79							
SL-AB 98-12	23	85 93 85	58%		GM	22'-24' - Dark brown coarse to fine SAND, little coarse to fine gravel, little silt, very compact	0935	10-31-88	
	24	62							
SL-AB 98-13	25	45 73 100/.4	46%		GW	24'-26' - Dark brown coarse to fine SAND and coarse to fine GRAVEL, trace silt, very compact	0955	10-31-88	
	26								
	27								
	28								

Notes: * No elevated readings on HNu for any of the Split Spoon samples.
H & S Logbook #6 for depths 0-18'; Logbook #10 for depths 18-42'.
Location: NYS DIKE

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-98
Location: N767315.74 E675564.54
Project: SINCLAIR REFINERY SITE
Project Number: 8306
Date Started: 10-28-88 Date Completed: 10-31-88
Field Geologist: R. BURNS/ M. CONTOS
Elevation: 1504.1' GW Depth: 12' 10"
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
	28								
SL-AB 98-14	29	40 49 56	42%		GM	28'-30' - Dark brown coarse to fine SAND and fine GRAVEL, trace silt	1025	10-31-88	*
	30	46							
SL-AB 98-15	31	25 49 100/.3'	29%		GM	30'-32' - Dark brown medium to fine SAND, some coarse to fine gravel, trace silt	1045	10-31-88	
	32								
	33							10-31-88	
	34								
SL-AB 98-16	35	16 67 46	21%		GM	34'-36' - Dark brown medium to fine SAND and coarse to fine GRAVEL, trace silt	1115	10-31-88	
	36	42							
SL-AB 98-17	37	38 44 40	21%		GM	36'-38' - Dark brown coarse to fine SAND and coarse to fine gravel, trace silt	1140	10-31-88	
	38	35							
SL-AB 98-18	39	20 17 8	25%		SW	38'-40' - Dark brown coarse to fine SAND, trace silt, trace gravel	1200	10-31-88	
	40	9							
SL-AB 98-19	41				CL	40'-42' - Gray CLAY, trace medium to fine sand, High plasticity	1215	10-31-88	Shelby Tube
	42								
	43					TOTAL DEPTH = 42 FT.			
	44								
	45								
	46								
	47								
	48								
	49								
	50								
	51								
	52								
	53								
	54								
	55								
	56								

Notes: * No elevated readings on HNu for any of the Split Spoon samples.
H & S logbook #10 for depths 18-42'

Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-99
Location: N767407.01 E675653.13
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 10-28-88 Date Completed: 10-28-88
Field Geologist: R. BURNS
Elevation: 1503.8' GW Depth: 10' 4"
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time	Date	Comments
	0								
SL-AB 99-01	1	12 15			GW	0'-2' - Dark gray and brown coarse to fine SAND and coarse to fine GRAVEL, little(+) silt	1028	10-28-88	*
	2	39 38							
SL-AB 99-02	3	36 35			GW	2'-4' - SAME	1033	10-28-88	
	4	36 28							
SL-AB 99-03	5	13 19			GW	4'-6' - SAME	1043	10-28-88	
	6	19 13							
SL-AB 99-04	7	13 19			GW	6'-8' - SAME	1046	10-28-88	Lab Class.- Gravel and sand, little silt (GP-GM)
	8	21 20							
SL-AB 99-05	9	23 45			GW	8'-10' - SAME	1055	10-28-88	
	10	25 13							
SL-AB 99-06	11	18 24			GW	10'-12' - SAME	1107	10-28-88	
	12	19 20							
SL-AB 99-07	13	14 14			GW	12'-14' - SAME	1115	10-28-88	Lab Class.- Gravel, some sand, little silt (GP-GM)
	14	15 18							
SL-AB 99-08	15	3 8			GW	14'-16' - SAME	1120	10-28-88	
	16	11 15							
SL-AB 99-09	17	36 22			GW	16'-18' - SAME	1127	10-28-88	
	18	27 36							
SL-AB 99-10	19	25 26			GW	18'-20' - SAME	1135	10-28-88	
	20	23 11							
	21					TOTAL DEPTH = 20 FT.			
	22								
	23								
	24								
	25								
	26								
	27								
	28								

Notes: Dike/Natural soils interface not detected
* The HNu stopped working. Upon approval from FOL/HSO, activities were continued w/o monitoring except with the CGI. No elevated readings were expected based on AB-96 & AB-97. Location: NYS DIKE

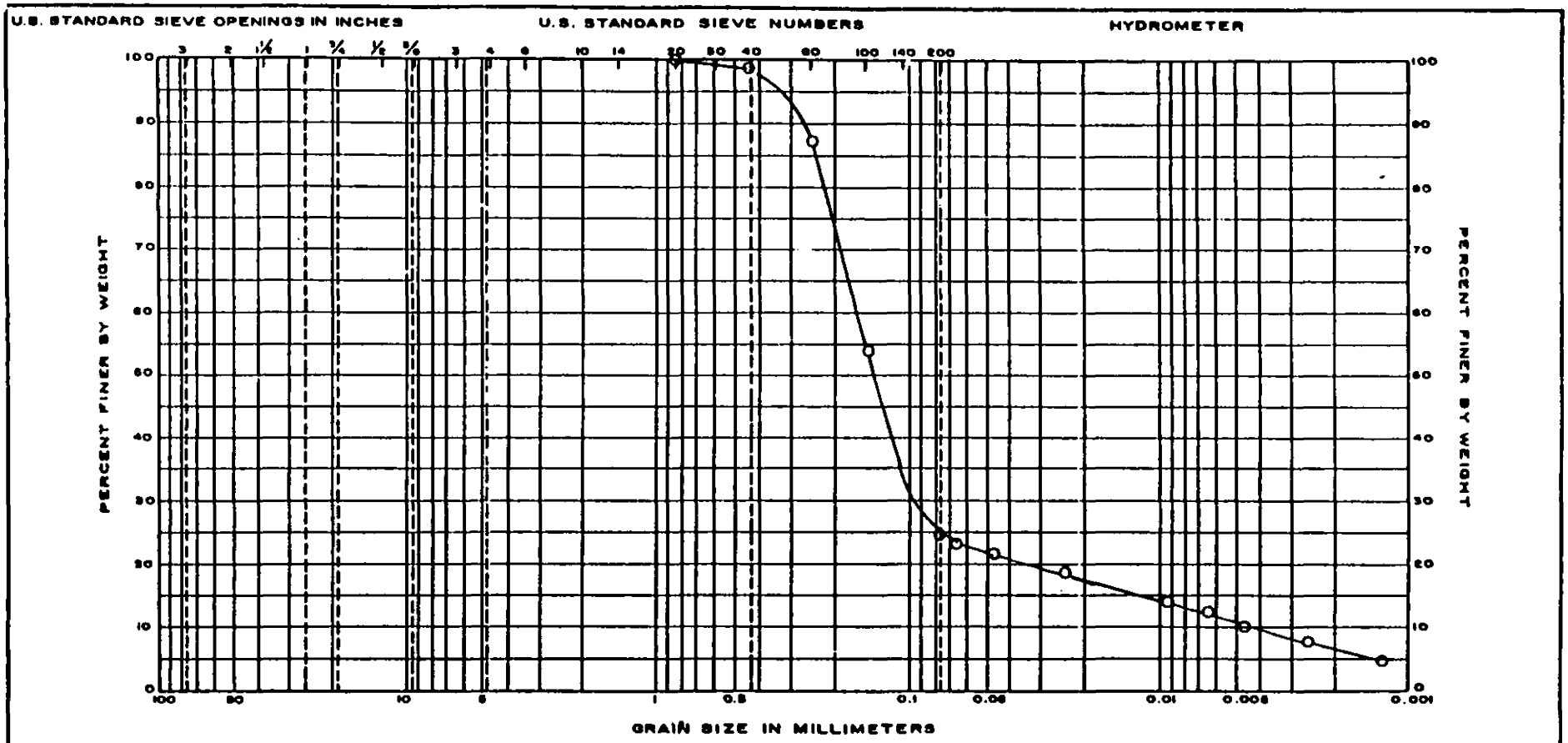
Ebasco Services, Inc. Log of Boring

Boring Number: SL-AB-100
Location: N767504.02 E675727.17
Project: SINCLAIR REFINERY SITE
Project Number: 8169
Date Started: 10-28-88 Date Completed: 10-28-88
Field Geologist: R. BURNS
Elevation: 1502.7' GW Depth: 9' 3"
Sampling Method: 2" OD SPLIT SPOON SAMPLER
Driller: EMPIRE SOILS
Drilling Method: 8" OD HOLLOW STEM AUGER

Sample ID	Depth (feet)	Blows per 6"	Recover %	Profile	USCS Class	Material Description	Collection Time Date	Comments
	0							
SL-AB 100-01	1	11 15 12			GM	0'-2' - Dark gray and brown coarse to fine SAND, some coarse to fine gravel, little silt	0815 10-28-88	at 0-2' HNu = 0ppm
	2	13						
SL-AB 100-02	3	14 11 20			GM	2'-4' - SAME	0820 10-28-88	at 2-4' HNu = 0ppm
	4	9						
SL-AB 100-03	5	5 10 9			GM	4'-6' - SAME	0830 10-28-88	*
	6	8						
SL-AB 100-04	7	10 5 9			GM	6'-8' - SAME	0845 10-28-88	
	8	22						
SL-AB 100-05	9	18 26 28			GM	8'-10' - SAME	0850 10-28-88	Lab Class.- Gravel and sand, little silt (GP-GM)
	10	20						
SL-AB 100-06	11	12 14 13			GM	10'-12' - SAME	0855 10-28-88	
	12	14						
SL-AB 100-07	13	19 19 18			GM	12'-14' - SAME	0900 10-28-88	Lab Class.- Gravel, some sand, little silt (GP-GM)
	14	23						
SL-AB 100-08	15	18 19 26			GM	14'-16' - SAME	0915 10-28-88	
	16	23						
SL-AB 100-09	17	50 55 66			GM	16'-18' - SAME	0920 10-28-88	
	18	100/5"						
SL-AB 100-10	19	45 73 40			GM	18'-20' - SAME	0945 10-28-88	
	20	58				TOTAL DEPTH = 20 FT.		
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							

Notes: Contact between dike and natural soils not detected. HNu not working. Upon approval of FOL & HSO, activities were continued w/o monitoring except with the CGI. No elevated readings were expected based on AB96 & AB97. Location: NYS DIKE.

Sheet: 1 of 1



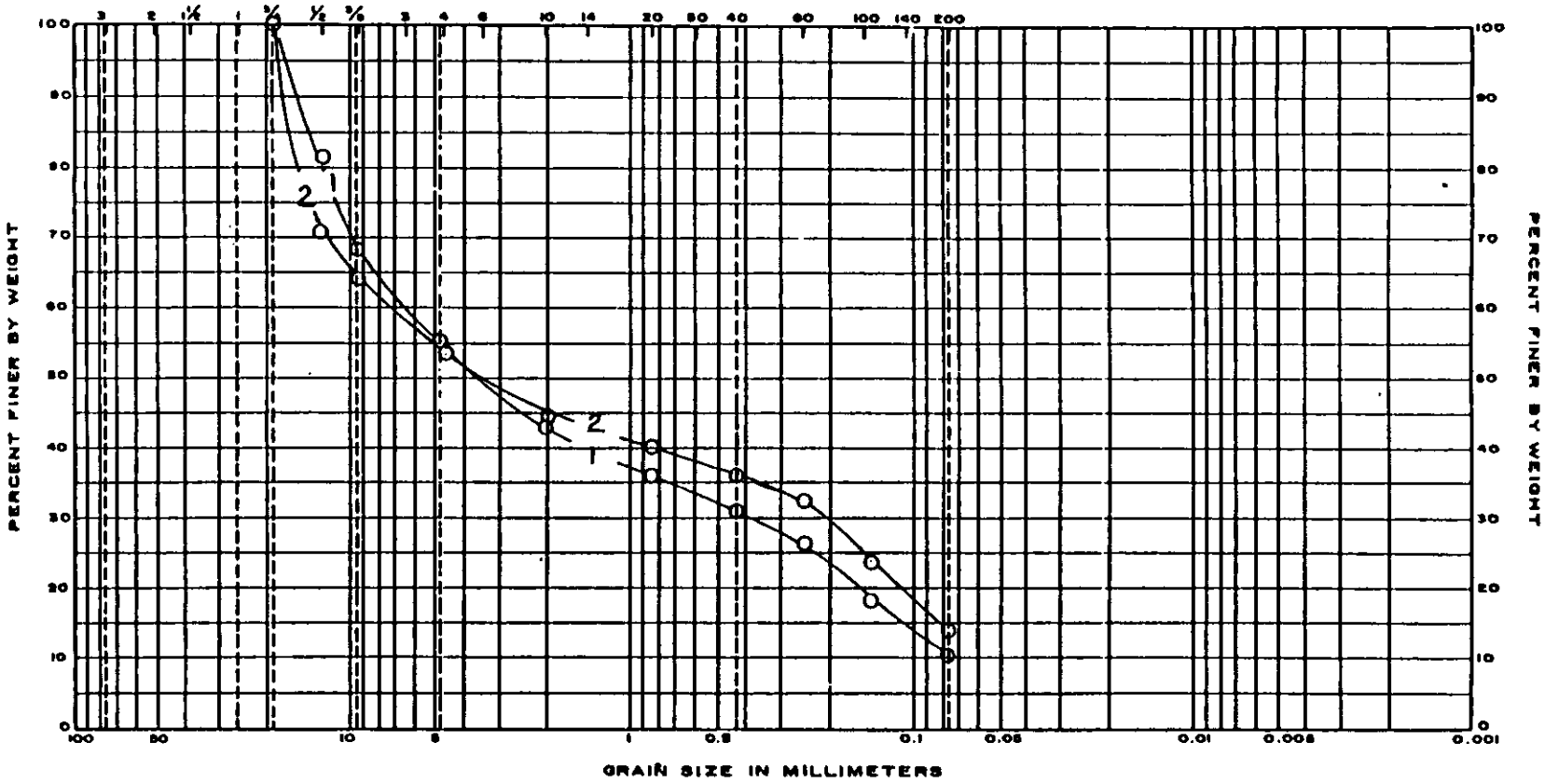
UNIFIED	GRAVEL		SAND			SILT OR CLAY		
	COARSE	FINE	COARSE	MEDIUM	FINE			
AASHO	GRAVEL			SAND		SILT	CLAY	
	COARSE	MEDIUM	FINE	COARSE	FINE			

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS		
					LL	PL	PI
	SL-AB-69		12-14				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT
SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



UNIFIED	GRAVEL			SAND			SILT OR CLAY		
	COARSE		FINE	COARSE	MEDIUM	FINE			
AASHO	GRAVEL			SAND			SILT		CLAY
	COARSE	MEDIUM	FINE	COARSE		FINE			

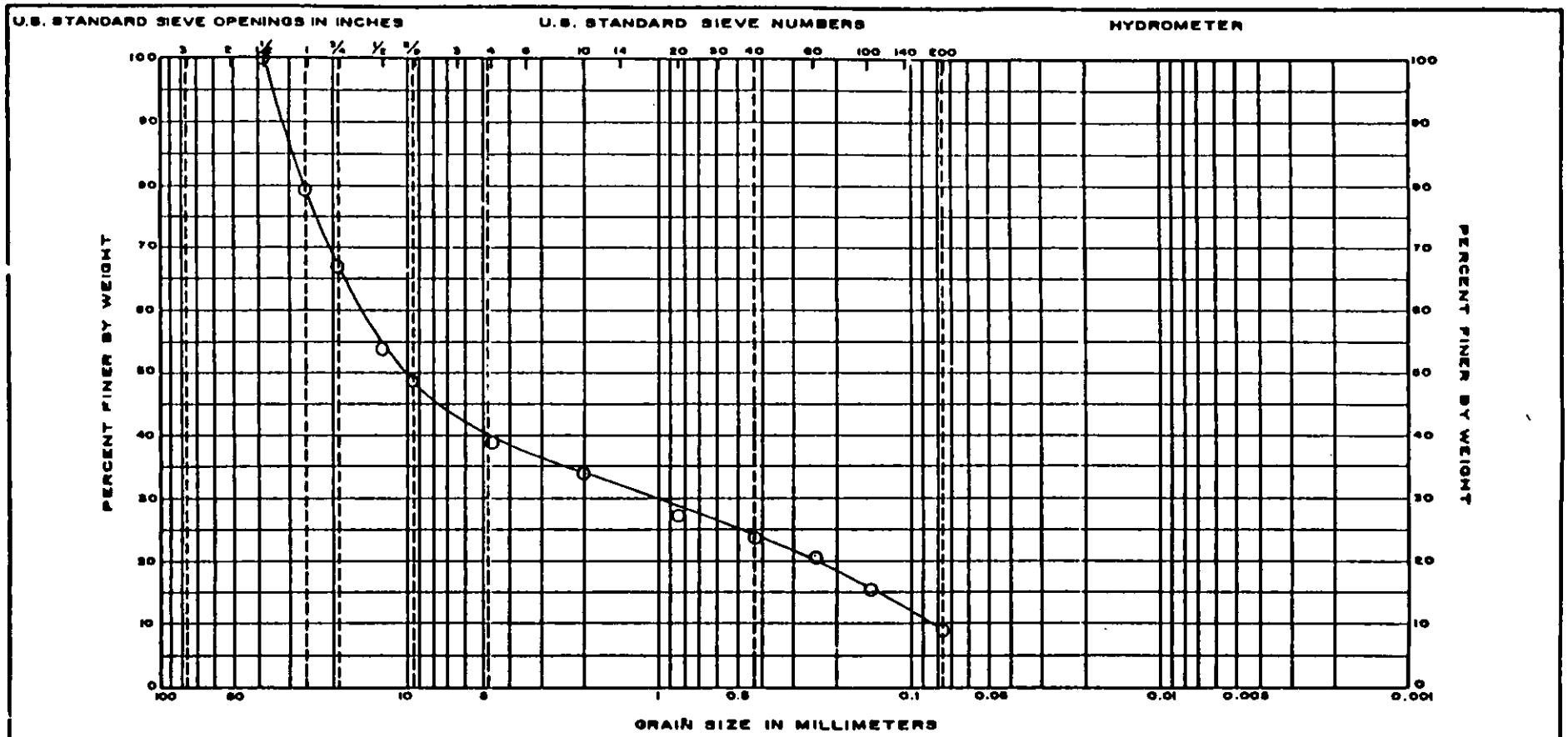
GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
1	SL-AB 70-02		12-14				
2	SL-AB 70-02		14-16				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT

SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



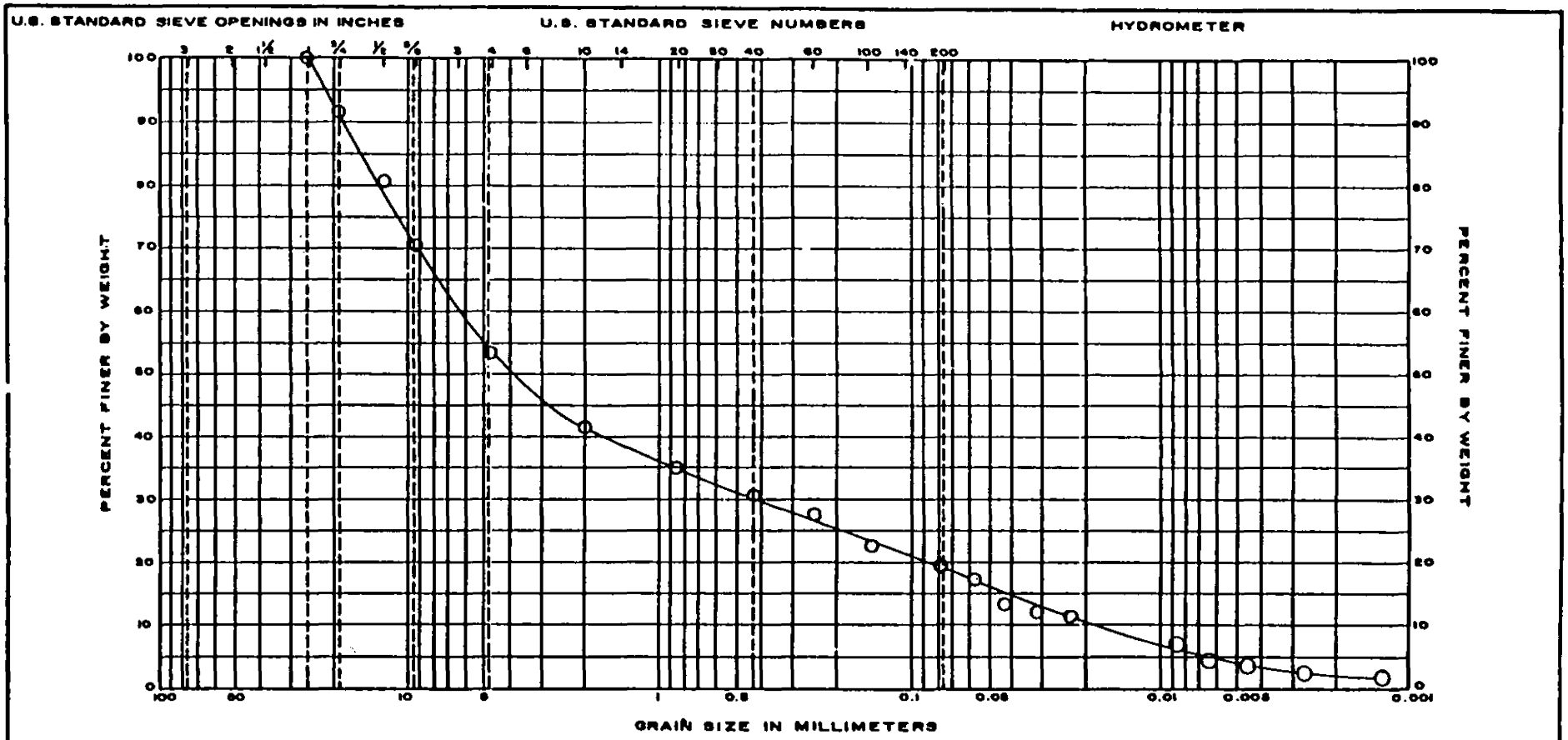
UNIFIED	GRAVEL			SAND			SILT OR CLAY	
	COARSE	FINE		COARSE	MEDIUM	FINE		
AASHO	GRAVEL			SAND			SILT	CLAY
	COARSE	MEDIUM	FINE	COARSE		FINE		

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
	SL-AB 71-01		12-14				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT
SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



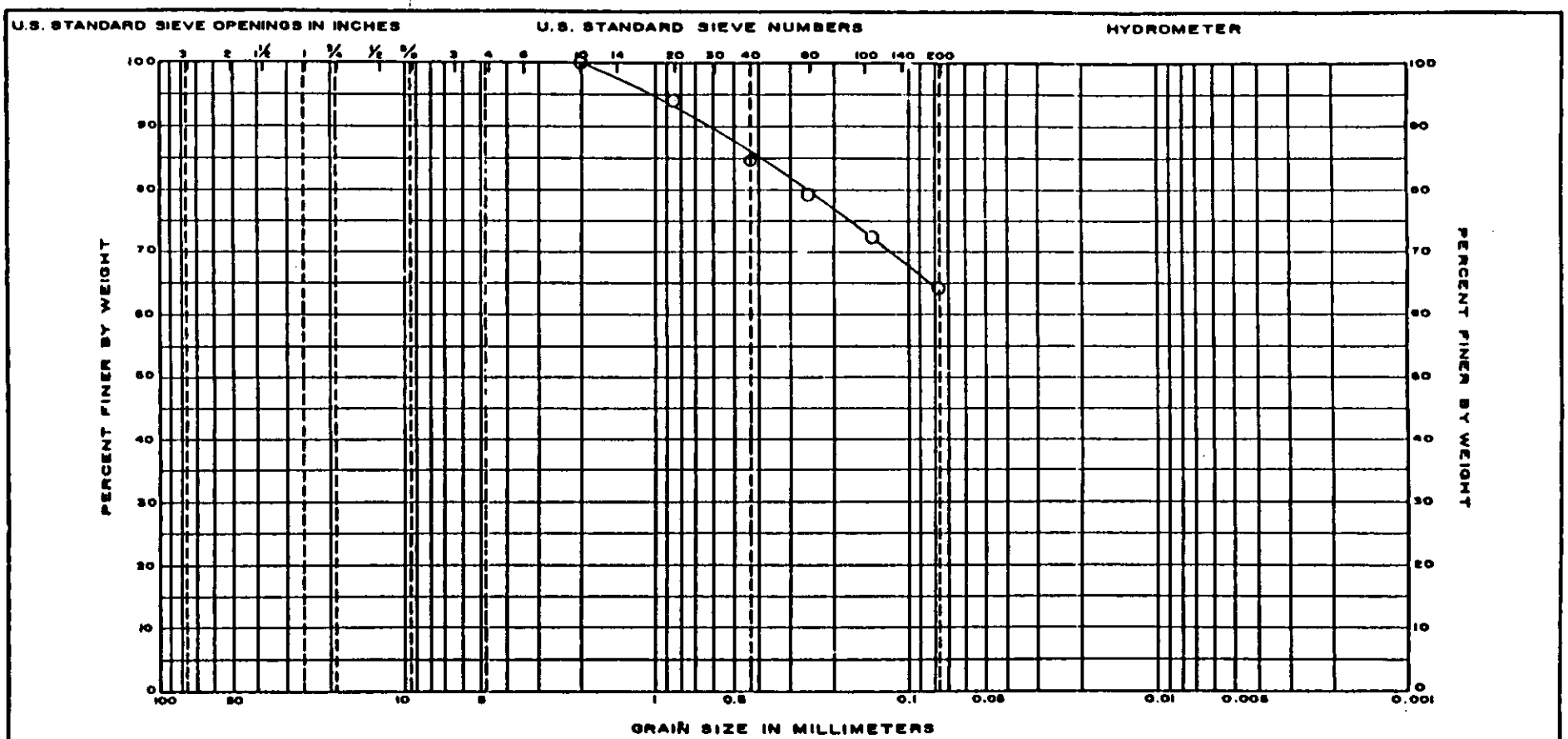
UNIFIED	GRAVEL			SAND			SILT OR CLAY		
	COARSE	FINE		COARSE	MEDIUM	FINE			
AASHO	GRAVEL			SAND			SILT	CLAY	
	COARSE	MEDIUM	FINE	COARSE	FINE				

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
SL-	AB 71-02		17-19				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT
SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



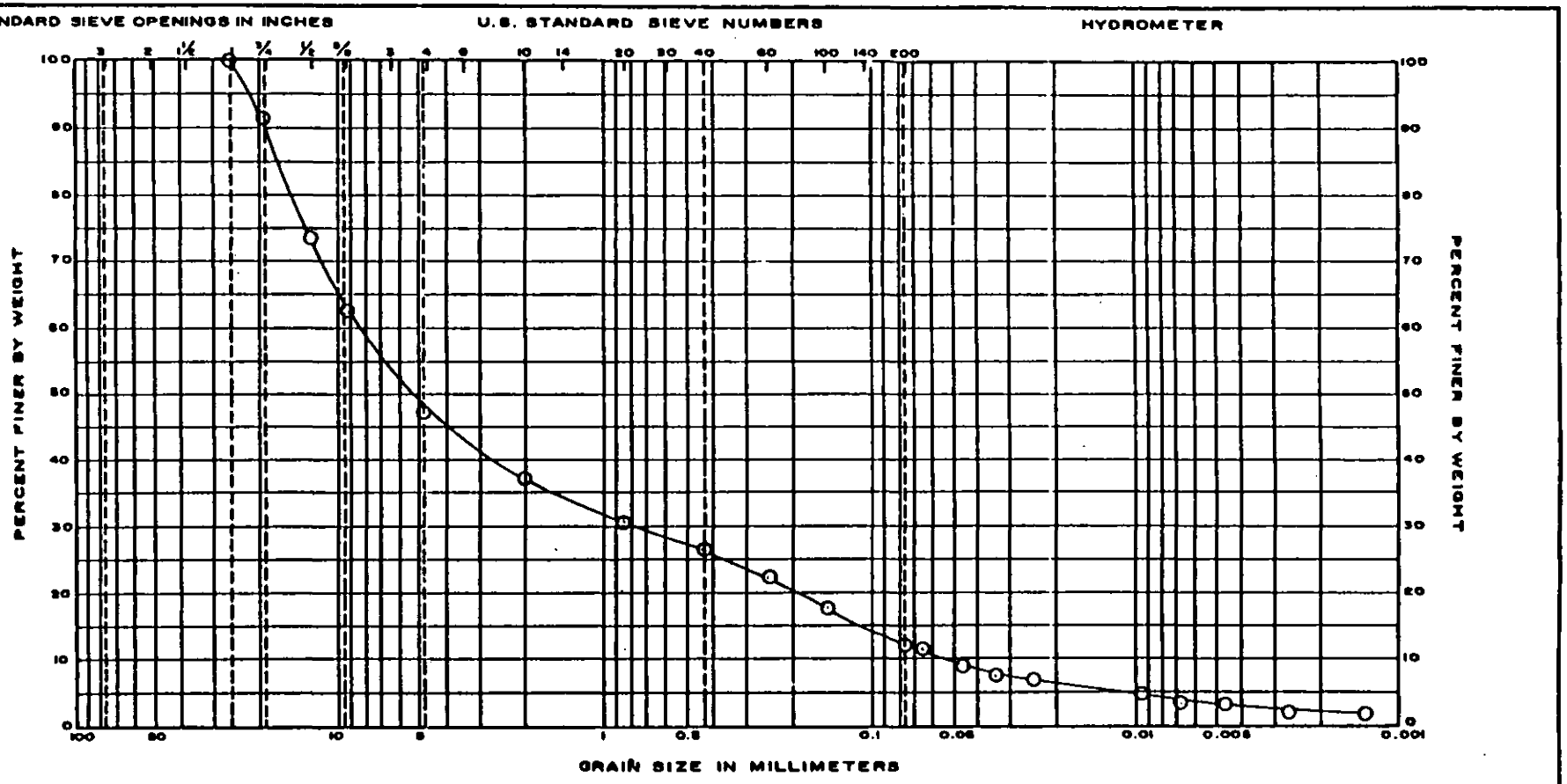
UNIFIED	GRAVEL			SAND			SILT OR CLAY		
	COARSE		FINE	COARSE	MEDIUM	FINE			
AASHO	GRAVEL			SAND			SILT		CLAY
	COARSE	MEDIUM	FINE	COARSE		FINE			

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
	SL-AB-72		4-6				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT
SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



UNIFIED	GRAVEL			SAND			SILT OR CLAY		
	COARSE	FINE		COARSE	MEDIUM	FINE			
AASHO	GRAVEL			SAND			SILT	CLAY	
	COARSE	MEDIUM	FINE	COARSE	FINE				

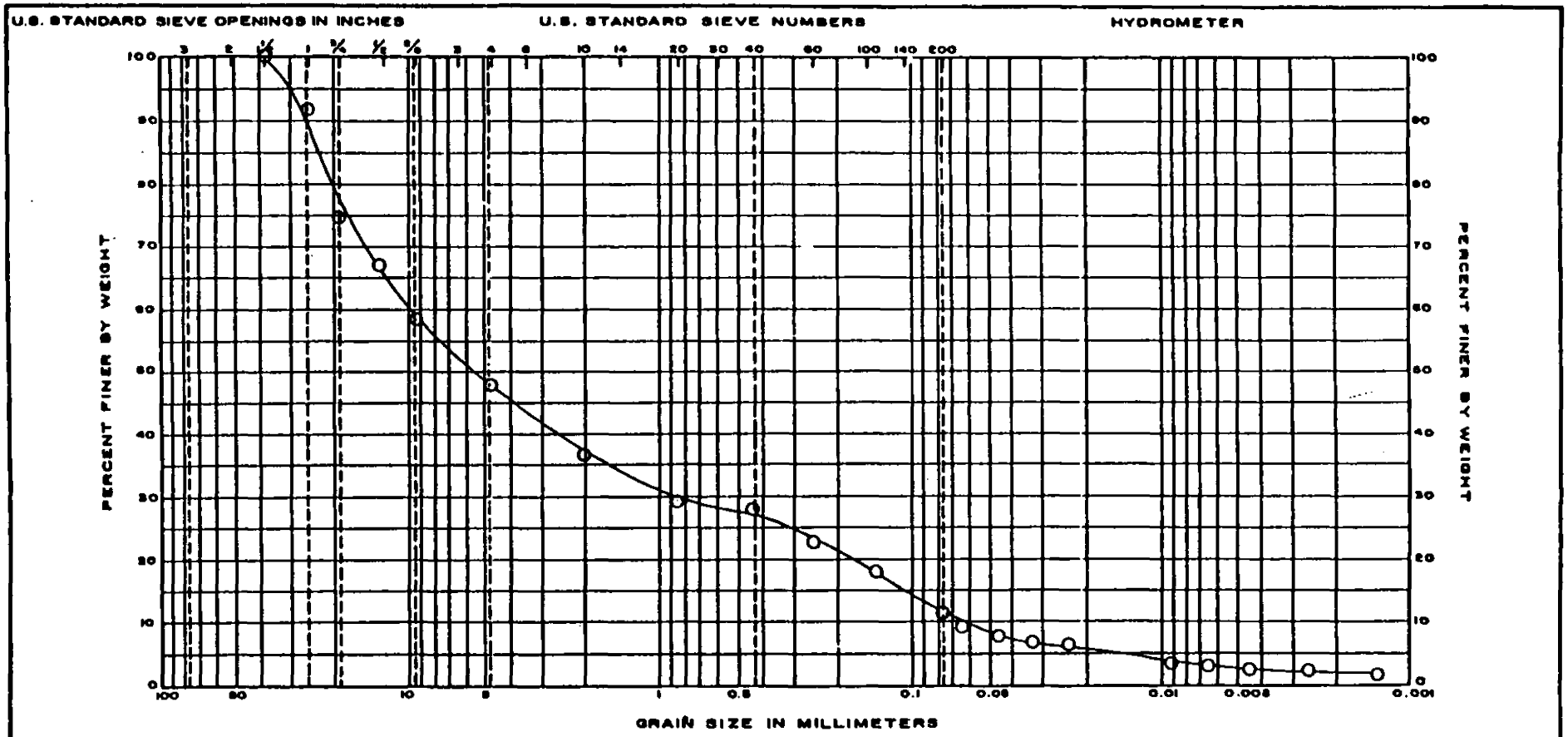
GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
	SL-AB 75-03		20-22				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT

SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



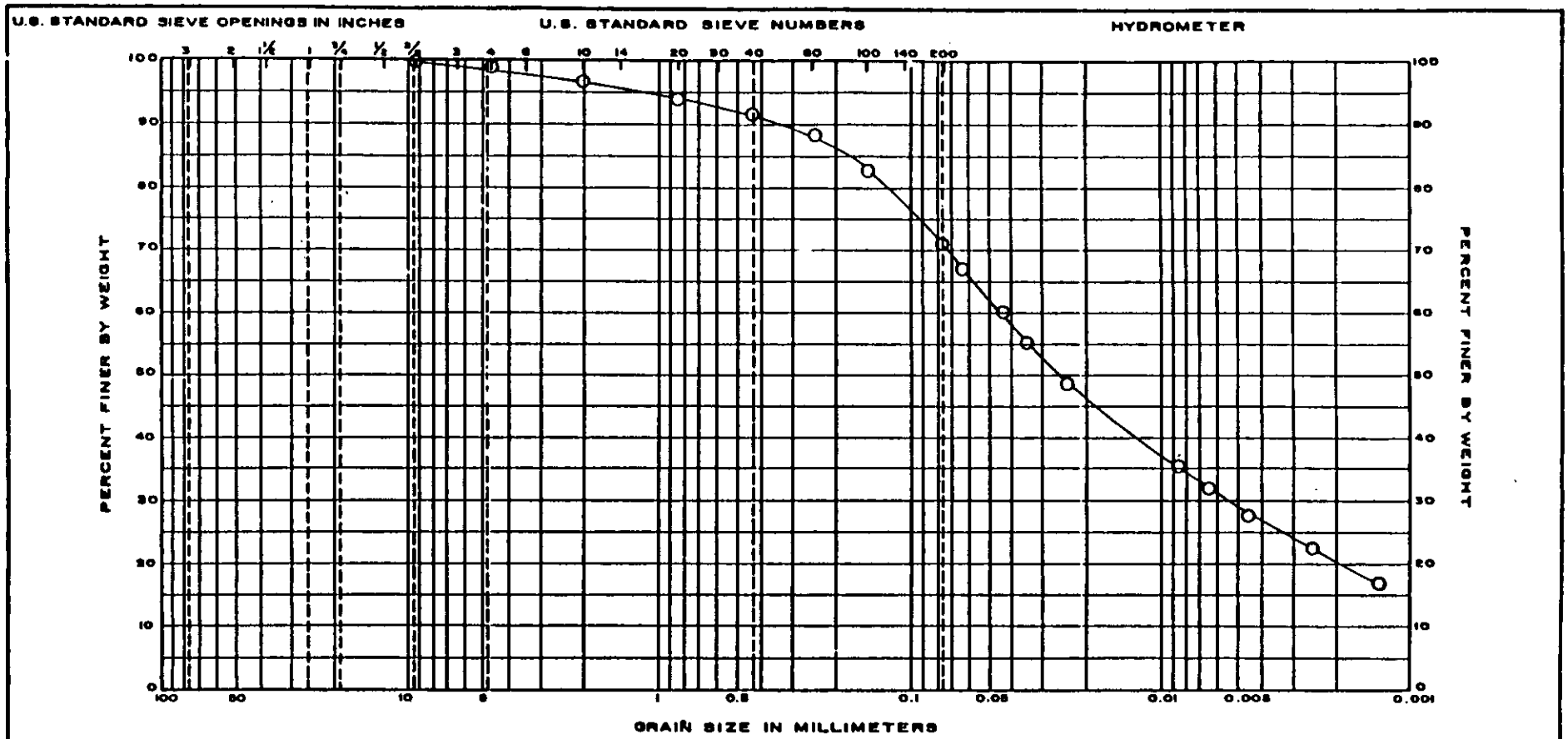
UNIFIED	GRAVEL		SAND			SILT OR CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE		
AASHO	GRAVEL			SAND		SILT	CLAY
	COARSE	MEDIUM	FINE	COARSE	FINE		

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS		
					LL	PL	PI
	SL-AB 75-04		25-27				

PROJECT: ATLANTIC RICHFIELD COMPANY PROJECT
SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



UNIFIED	GRAVEL			SAND			SILT OR CLAY		
	COARSE	FINE		COARSE	MEDIUM	FINE			
AASHO	GRAVEL			SAND			SILT	CLAY	
	COARSE	MEDIUM	FINE	COARSE	FINE				

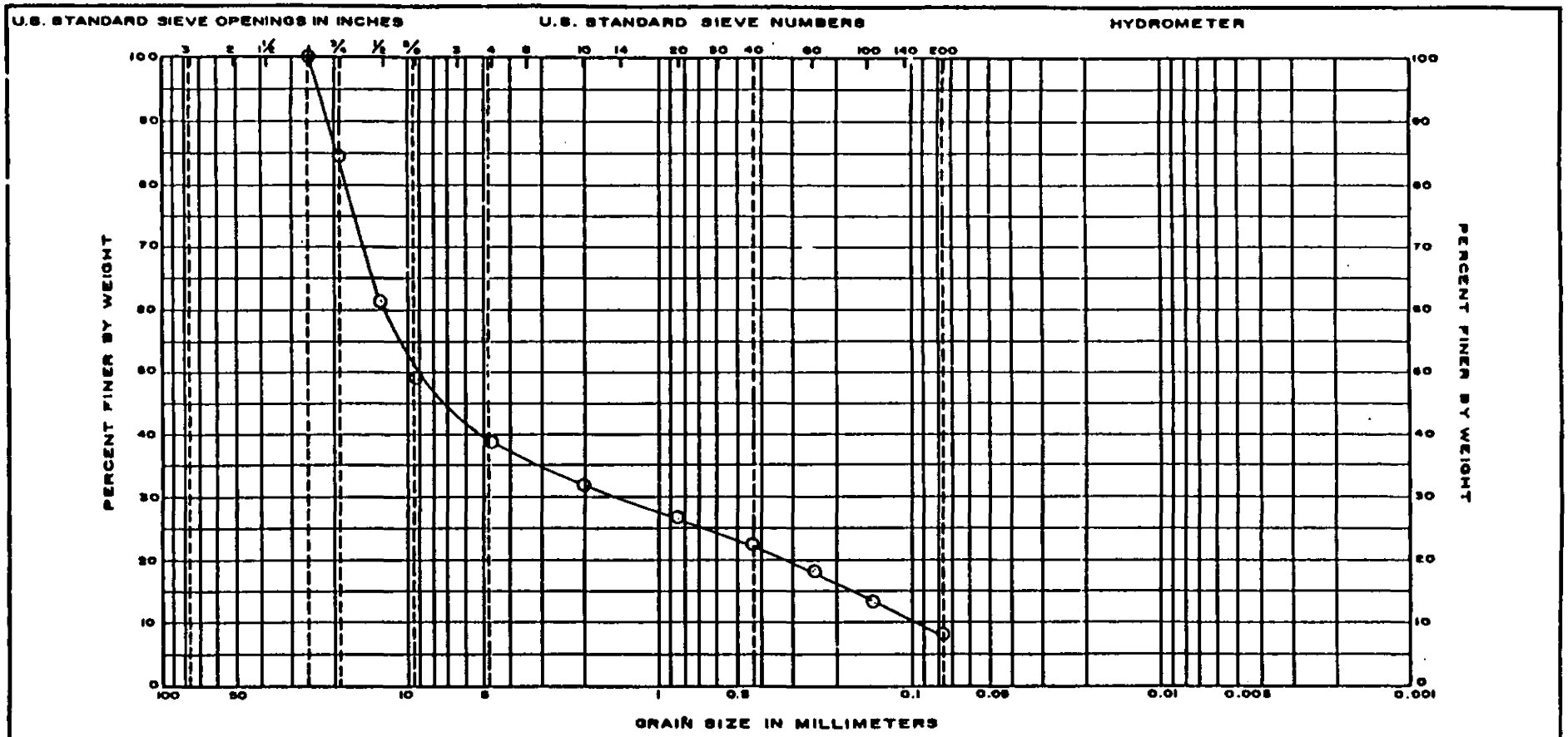
GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS		
					LL	PL	PI
	SL-AB-77		4-6				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT

SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



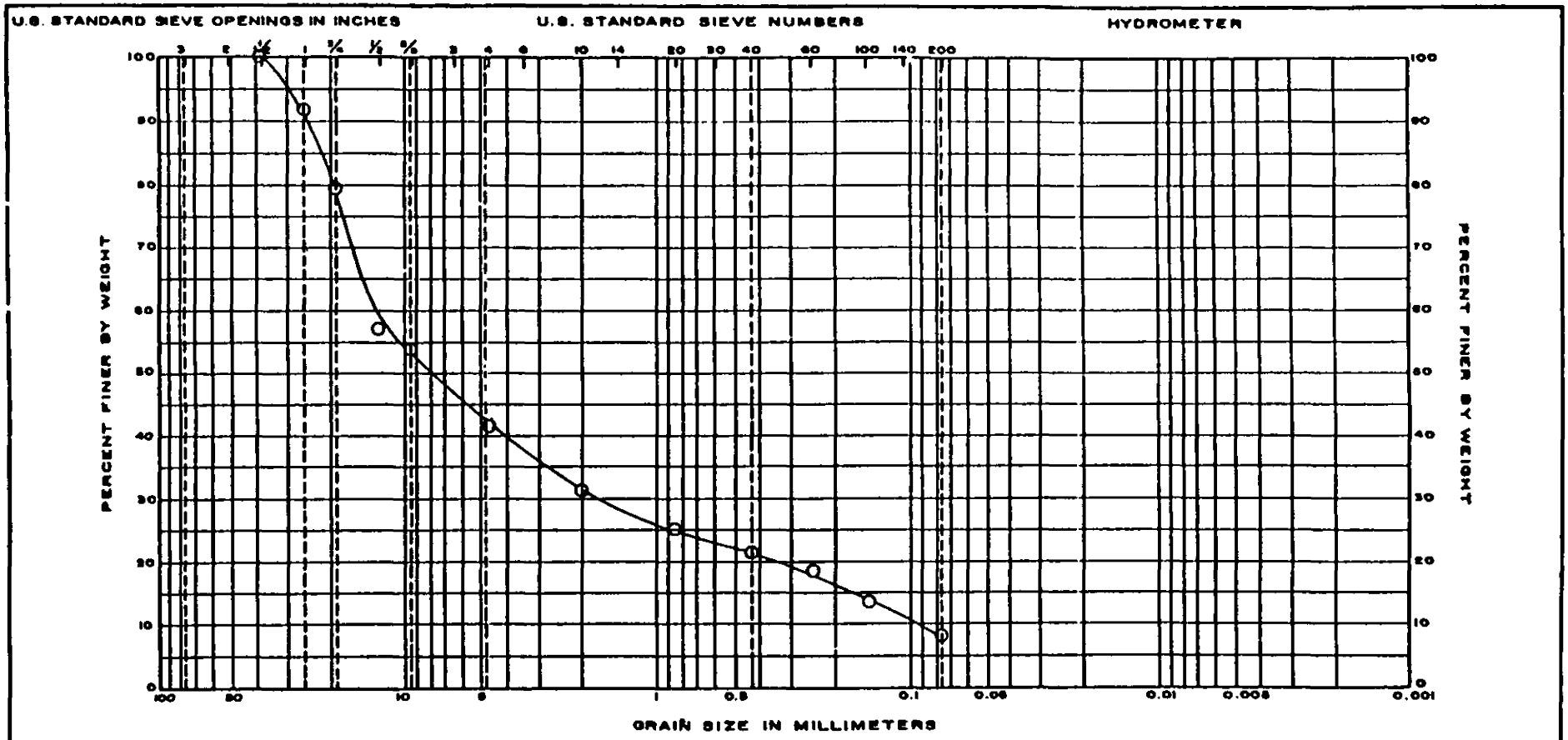
UNIFIED	GRAVEL			SAND			SILT OR CLAY	
	COARSE	FINE		COARSE	MEDIUM	FINE		
AASHO	GRAVEL			SAND			SILT	CLAY
	COARSE	MEDIUM	FINE	COARSE		FINE		

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
	SL-AB 78-01		20-22				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT
SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.



UNIFIED	GRAVEL		SAND			SILT OR CLAY		
	COARSE	FINE	COARSE	MEDIUM	FINE			
AASHO	GRAVEL			SAND		SILT	CLAY	
	COARSE	MEDIUM	FINE	COARSE	FINE			

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
	SL-AB 78-02		25-27				

PROJECT ATLANTIC RICHFIELD COMPANY PROJECT
SINCLAIR REFINERY

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.

EMPIRE
SOILS INVESTIGATIONS INC.

PROJECT: Sinclair Refinery

CLIENT: Ebasco Services, Inc.

DATE: January 17, 1989

PROJECT NO: BD-88-174

REPORT NO: L-1 REVISED 1/17/89

REPORT OF MATERIAL TESTING

Material: A total of fifty-eight (58) separate split spoon samples from the above referenced project. The samples were received via chain of custody record, attached as part of this report, on October 28, 1988 in our laboratory in Hamburg, New York. As directed, eight samples only were tested as follows.

Mechanical Analysis: ASTM D-422(Note #1).

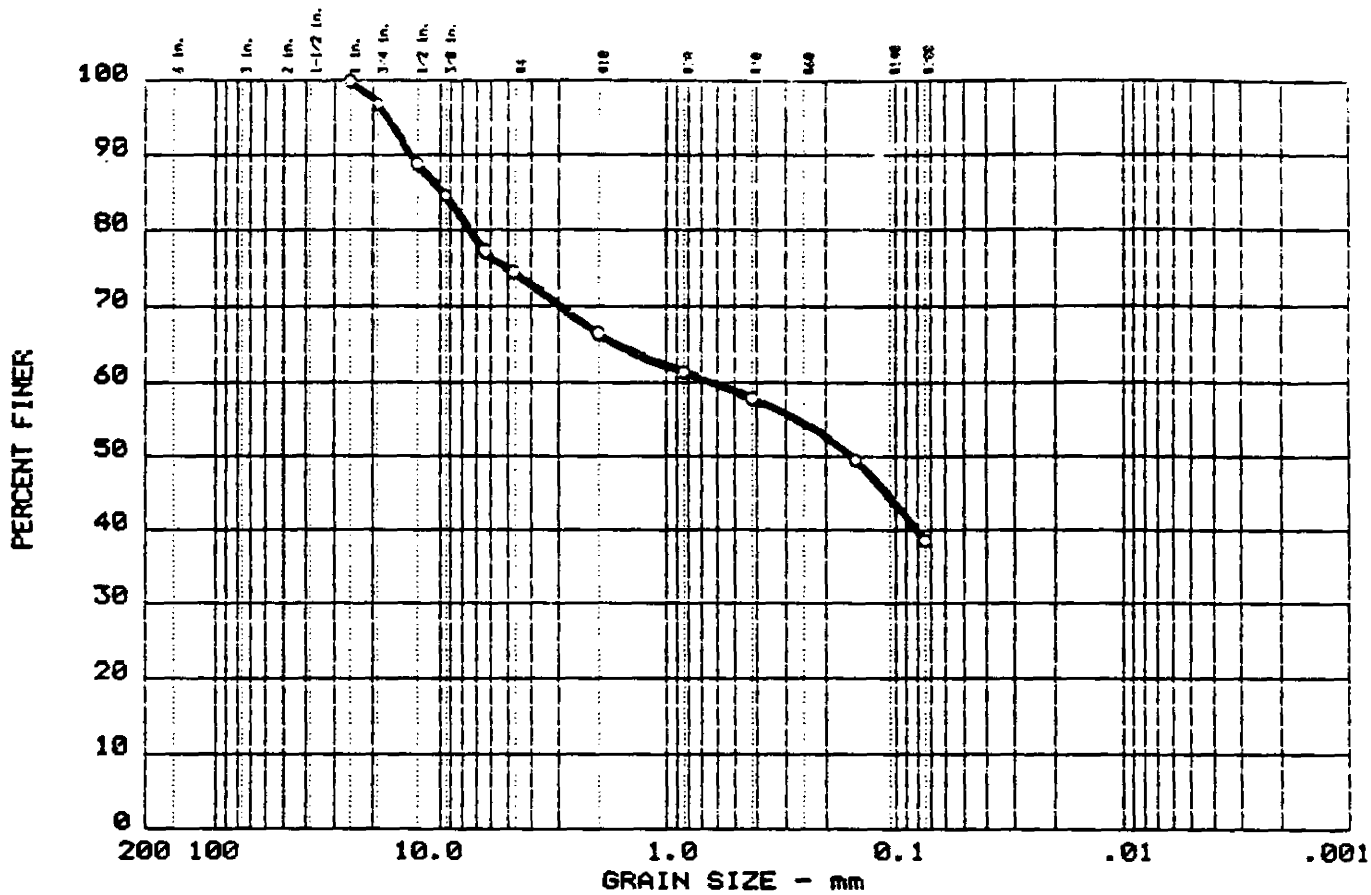
Water Content of Soils - ASTM D-2216.

Sample ID	Component (Percent of Sample) Gravel	Sand	Silt/Clay	Natural Water Content (Percent)
SL-AB96-03	36.8	44.8	18.4	10.0
SL-AB97-02	25.5	36.0	38.5	8.9
SL-AB96-10	51.3	36.7	12.0	15.0
SL-AB97-09	42.8	46.9	10.3	12.6
SL-AB99-04	47.9	40.7	11.4	9.1
SL-AB99-07	54.4	34.9	10.7	12.6
SL-AB100-05	49.4	38.7	11.9	12.6
SL-AB100-08	57.0	32.9	10.1	12.3

Atterberg Limits - ASTM D-4318.

Sample ID	Liquid Limit	Plastic Limit	Plasticity Index	USCS
SL-AB96-03	-	-	NP	SM
SL-AB97-02	-	-	NP	SM
SL-AB96-10	-	-	NP	GM
SL-AB97-09	-	-	NP	SP-SM
SL-AB99-04	-	-	NP	GP-GM
SL-AB99-07	-	-	NP	GP-GM
SL-AB100-05	-	-	NP	GP-GM
SL-AB100-08	-	-	NP	GP-GM

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	5	0.0	25.5	36.0	38.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	NP	NP	9.77	0.63	0.15					

MATERIAL DESCRIPTION	USCS	AASHTO
o SILT AND SAND SOME GRAVEL	SM	

Project No.: BD-88-174
Project: SINCLAIR REFINERY, WELLSVILLE N.Y.
o Location: SAMPLE # SL - AB 97 -02

Date: 11-3-88

GRAIN SIZE DISTRIBUTION TEST REPORT

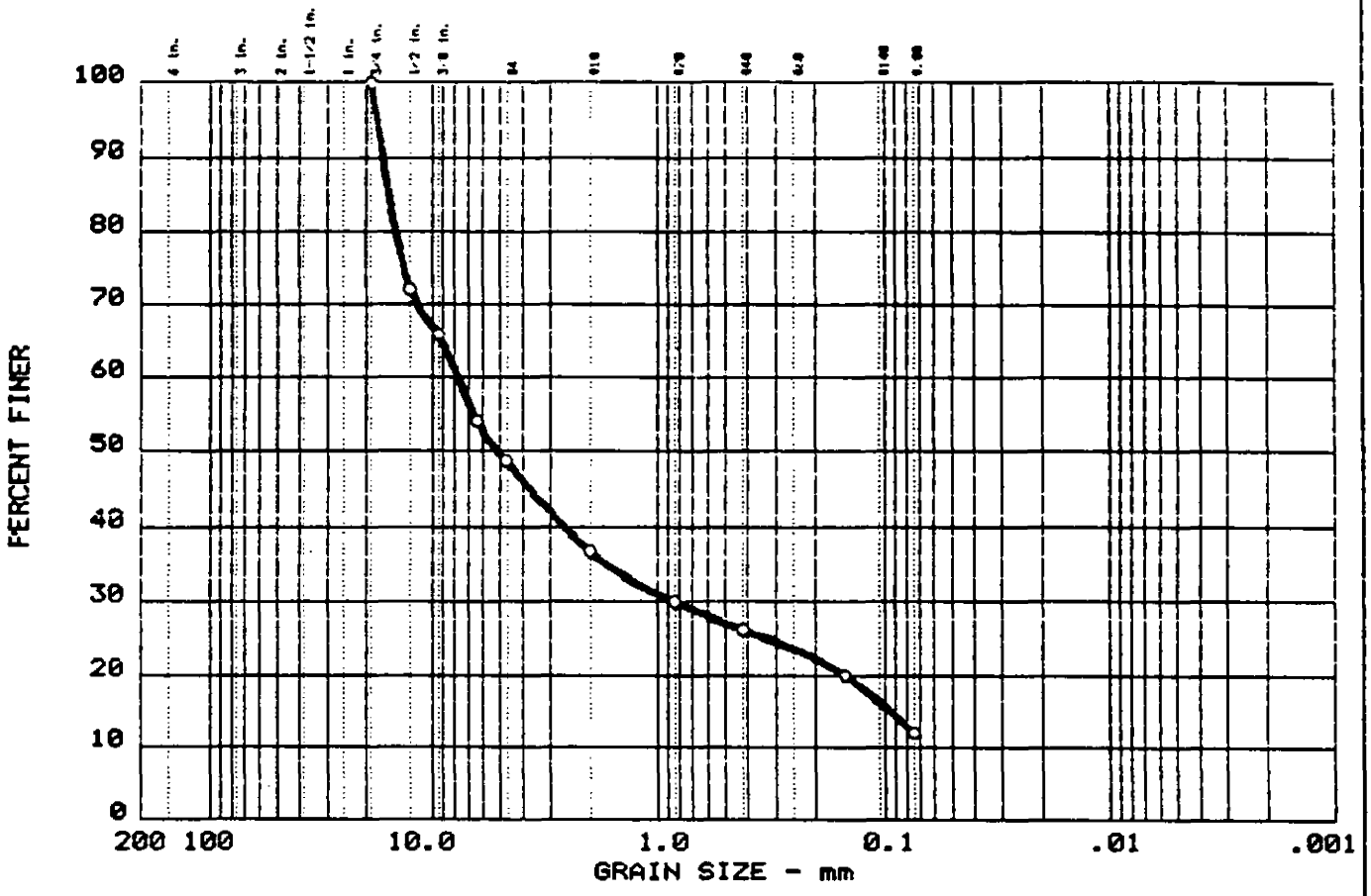
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
SPLIT SPOON SAMPLES RECEIVED VIA CHAIN OF CUSTODY RECORD ATTACHED

N.W.C. = 8.9 %
REPORT NO: L-1B

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	6	0.0	51.3	36.7	12.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	15.81	7.72	5.16	0.837	0.0928			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL AND SAND LITTLE SILT	GM	

Project No.: BD-88-174
Project: SINCLAIR REFINERY, WELLSVILLE N.Y.
○ Location: SAMPLE # SL-AB 96-10

Date: 11-3-88

Remarks:
SPLIT SPOON SAMPLES RECEIVED VIA CHAIN OF CUSTODY RECORD ATTACHED

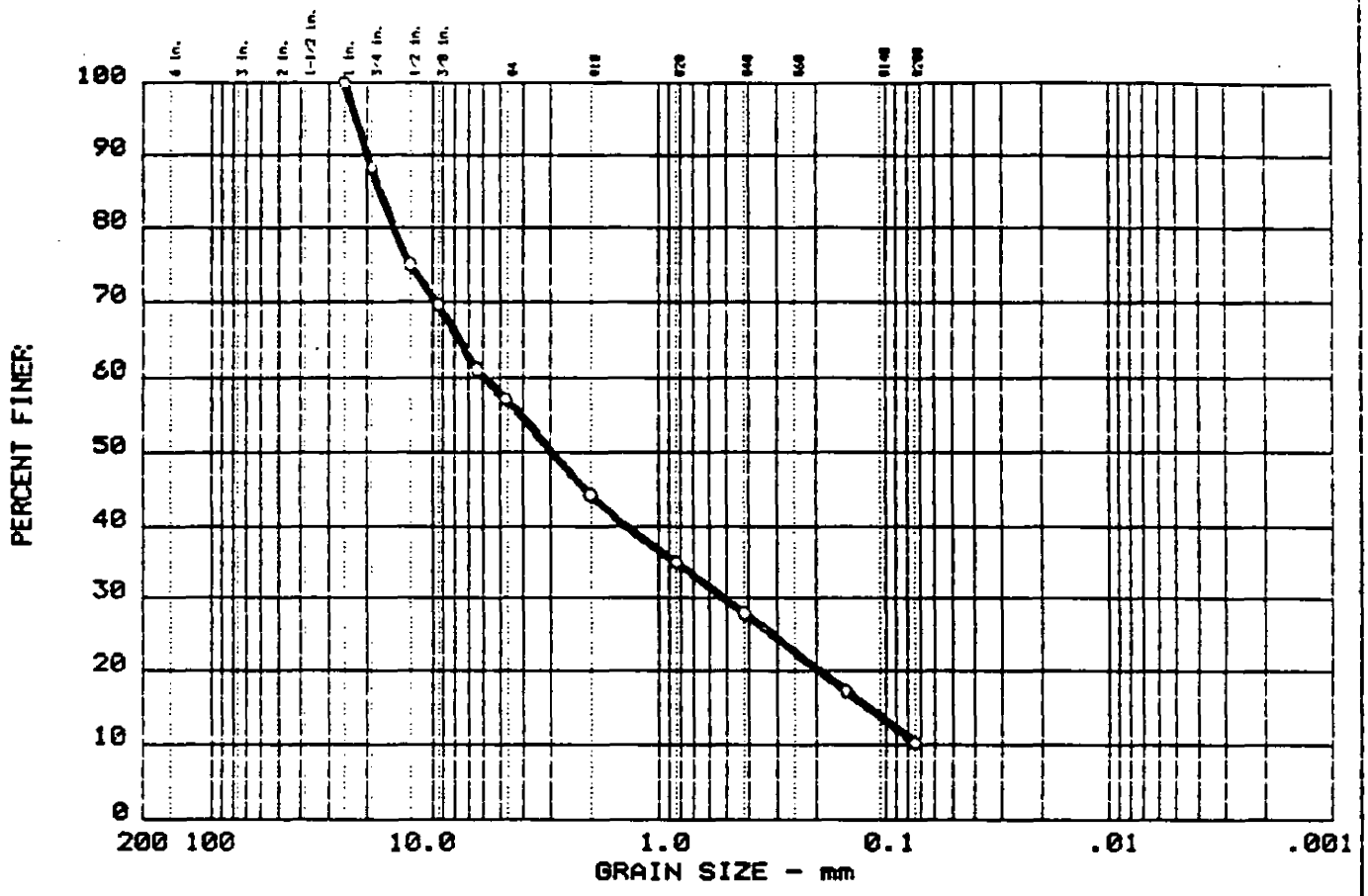
N.W.C. = 15.0 %
REPORT NO: L-1C

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	7	0.0	42.8	46.9	10.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	17.52	5.87	2.91	0.511	0.1171			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND AND GRAVEL LITTLE SILT	SP-SM	

Project No.: BD-88-174
Project: SINCLAIR REFINERY, WELLSVILLE N.Y.
○ Location: SAMPLE # SL -AB97-09

Date: 11-3-88

GRAIN SIZE DISTRIBUTION TEST REPORT

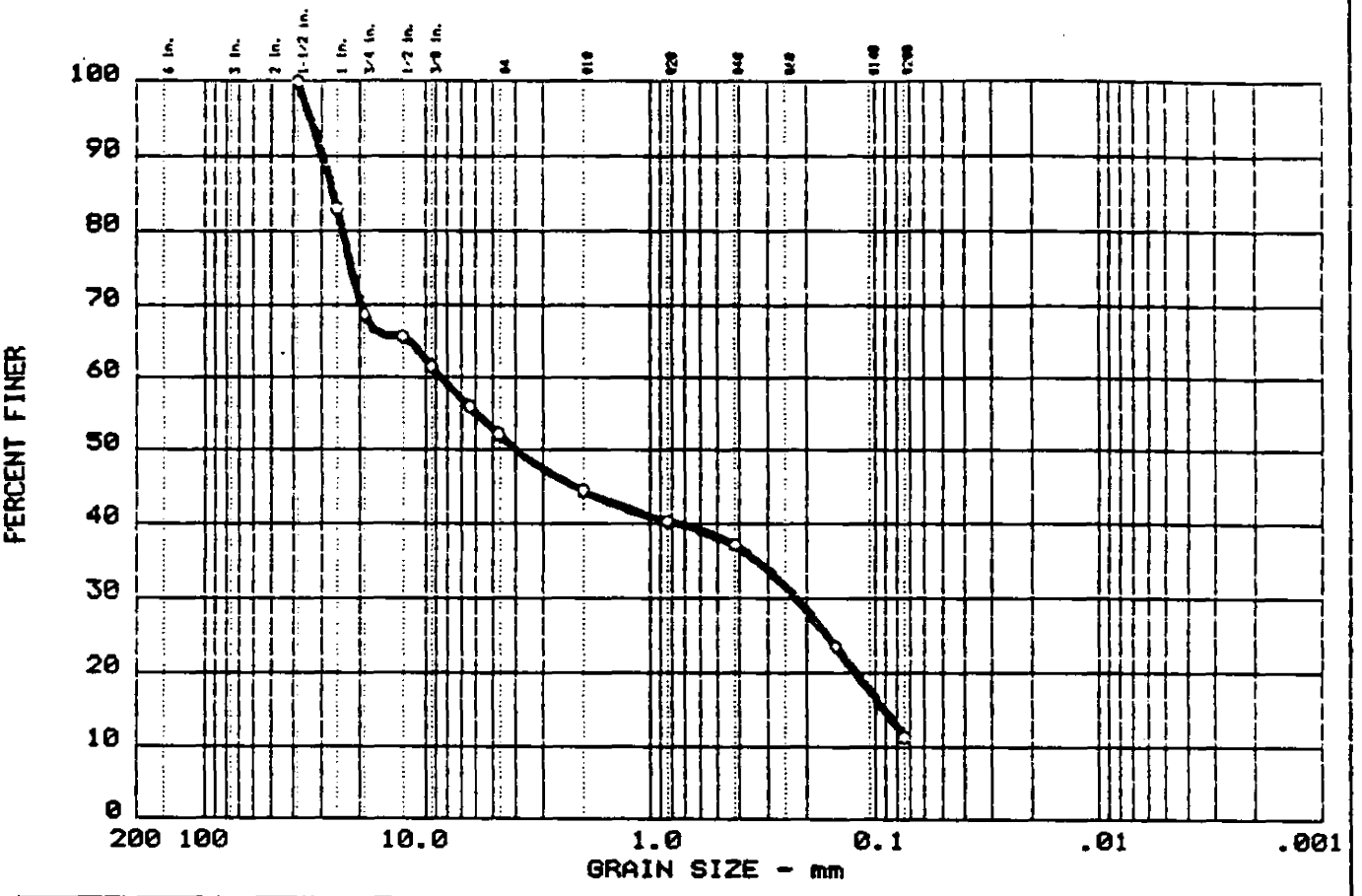
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
SPLIT SPOON SAMPLES RECEIVED VIA CHAIN OF CUSTODY RECORD ATTACHED

N.W.C. = 12.6 %
REPORT NO: L-10

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	B	0.0	47.9	40.7	11.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	26.30	8.61	3.94	0.224	0.0902			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL AND SAND LITTLE SILT	GP-GM	

Project No.: BD-88-174
Project: SINCLAIR REFINERY, WELLSVILLE N.Y.
○ Location: SAMPLE # SL-AB99- 04

Date: 11-3-88

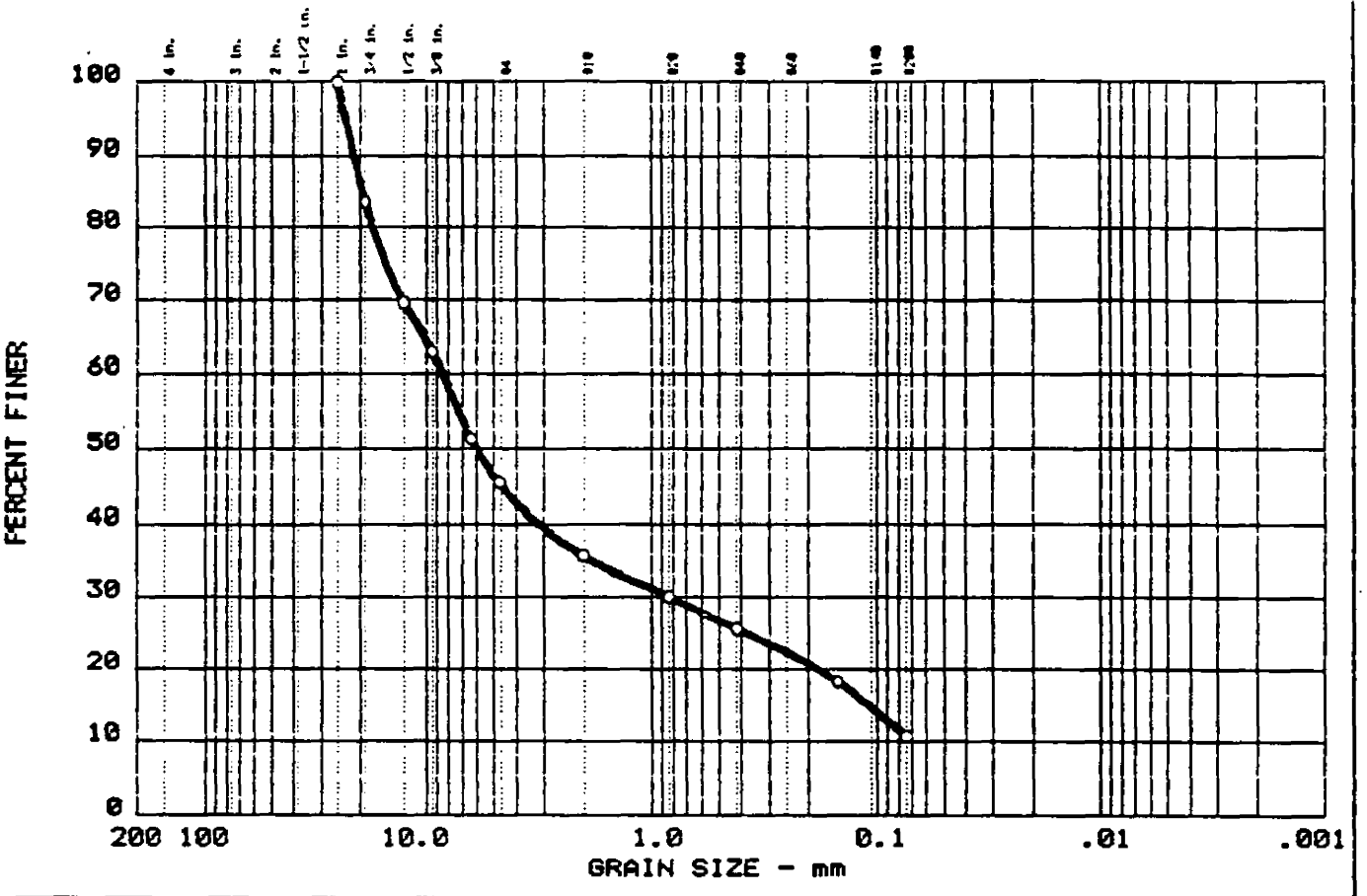
GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
SPLIT SPOON SAMPLES RECEIVED VIA CHAIN OF CUSTODY RECORD ATTACHED
N.W.C. = 9.1 %

REPORT NO: L-1E
Fig. No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	9	0.0	54.4	34.9	10.7	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	19.59	8.54	5.98	0.825	0.1075			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND LITTLE SILT	GP-GM	

Project No.: BD-88-174
Project: SINCLAIR REFINERY, WELLSVILLE N.Y.
○ Location: SAMPLE # SL-AB99-07

Date: 11-3-88

Remarks:
SPLIT SPOON SAMPLES
RECEIVED VIA CHAIN OF
CUSTODY RECORD ATTACHED

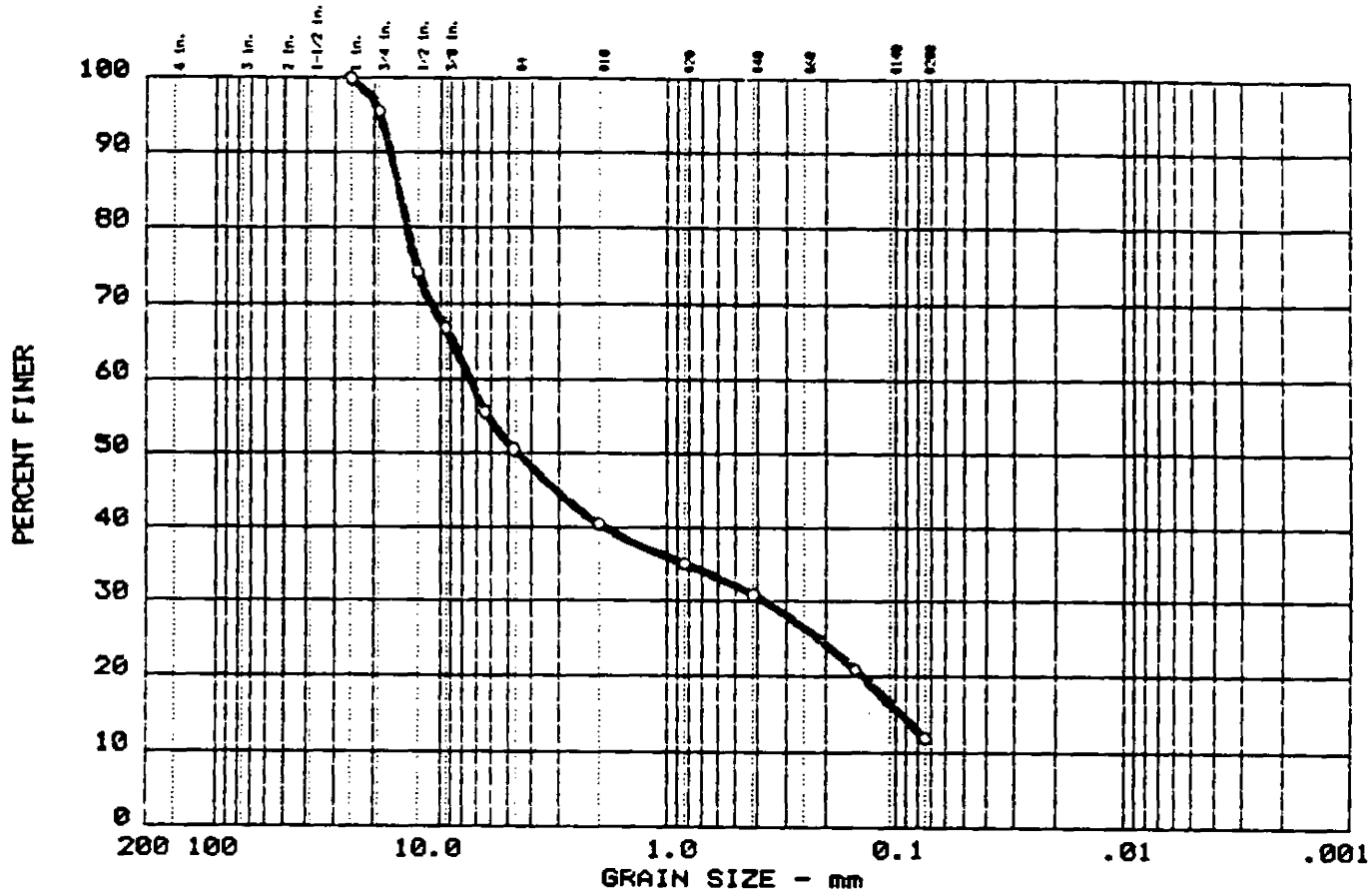
N.W.C. = 12.6 %
REPORT NO: L-1F

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	10	0.0	49.4	38.7	11.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	NP	NP	15.49	7.41	4.57	0.372	0.0933			

MATERIAL DESCRIPTION	USCS	AASHTO
O GRAVEL AND SAND LITTLE SILT	GP-GM	

Project No.: BD-88-174
Project: SINCLAIR REFINERY, WELLSVILLE N.Y.
O Location: SAMPLE # SL-AB100-05

Date: 11-3-88

Remarks:
SPLIT SPOON SAMPLES RECEIVED VIA CHAIN OF CUSTODY RECORD ATTACHED

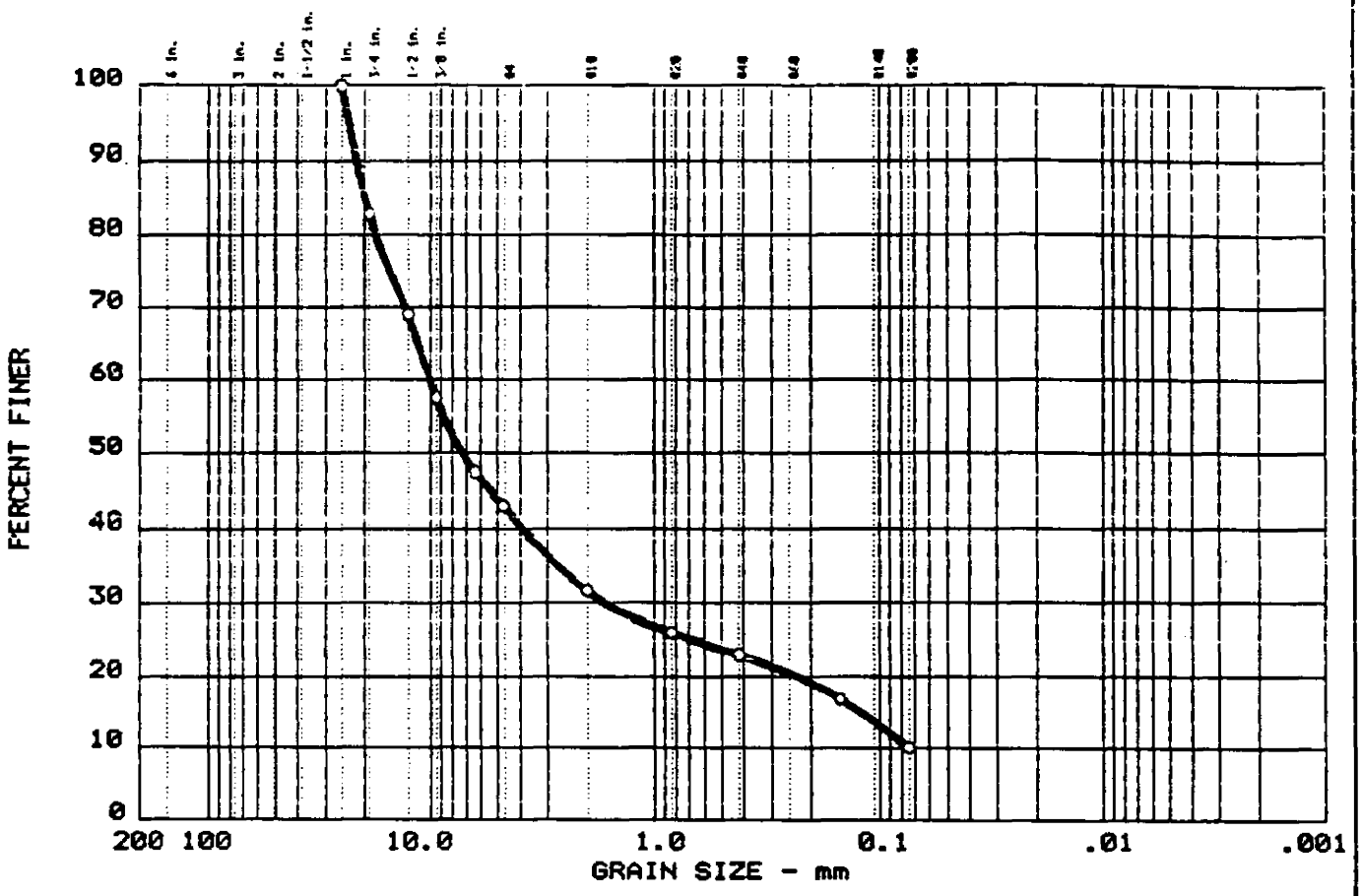
N.W.C. = 12.6 %
REPORT NO: L-1G

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	11	0.0	57.0	32.9	10.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	19.88	10.16	7.19	1.648	0.1180			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND LITTLE SILT	GP-GM	

Project No.: BD-88-174
Project: SINCLAIR REFINERY, WELLSVILLE N.Y.
○ Location: SAMPLE # SL-AB100-08

Date: 11-3-88

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:

SPLIT SPOON SAMPLES RECEIVED VIA CHAIN OF CUSTODY RECORD ATTACHED

N.W.C. = 12.3 %

REPORT NO: L-1H

Fig. No. 8

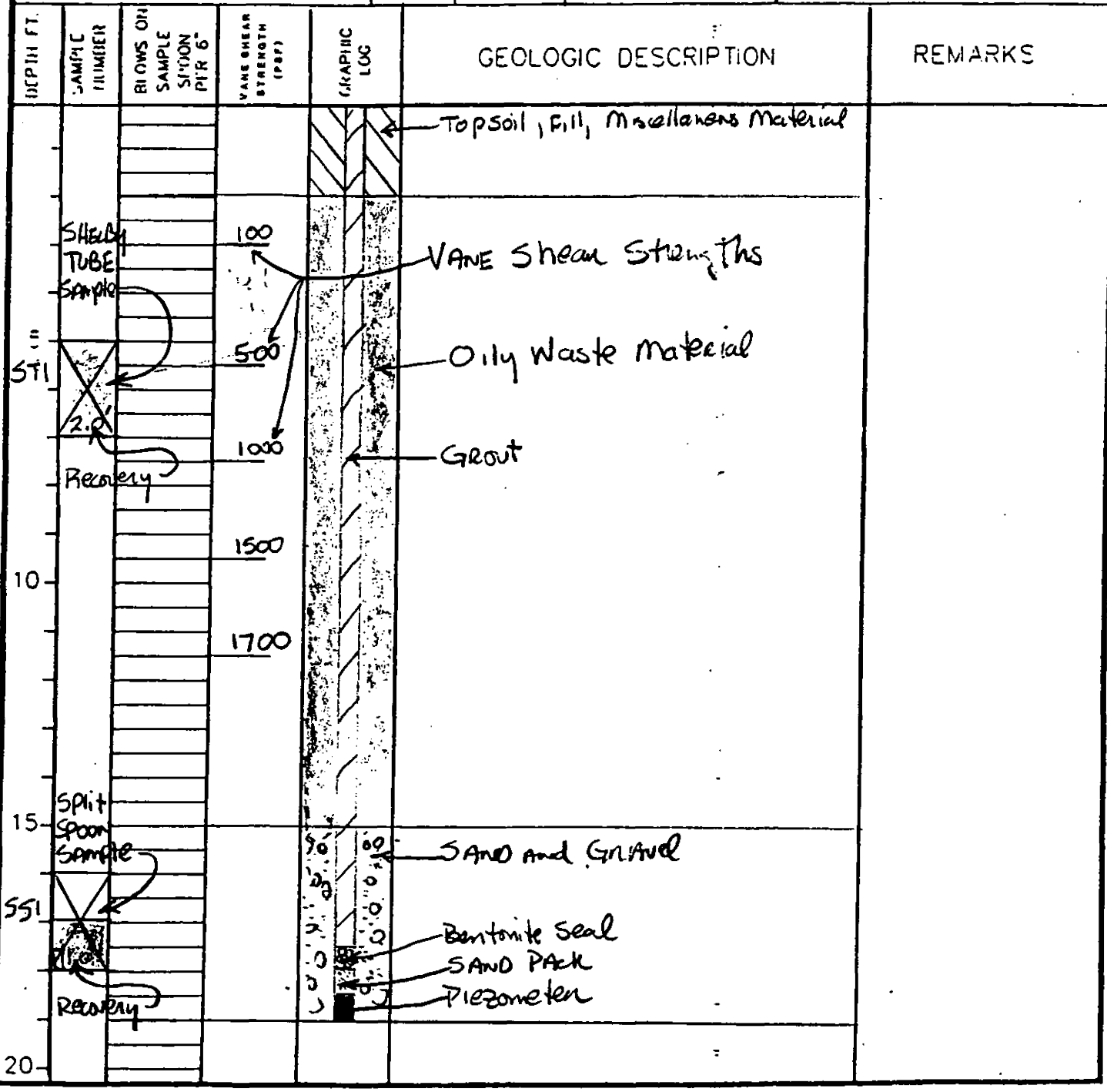
Appendix C

BORING LOGS AND
GRAIN SIZE DISTRIBUTION ANALYSIS RESULTS

EBASCO SERVICES, INC.

	TEST BORING LOG	BORING No. LEGEND
PROJECT Welkville Test Fill		SHEET 1 OF
CLIENT ARCO		JOB No. E88-157-200
DRILLING CONTRACTOR EMPIRE		MEAS. PT. ELEV.
PURPOSE		GROUND ELEV.
DRILLING METHOD H.S. Auger	CASING	DATUM
DRILL RIG TYPE Acker		DATE STARTED
GROUNDWATER DEPTH	DIA.	DATE FINISHED
MEASURING POINT	WEIGHT	DRILLER
DATE OF MEASUREMENT	FALL	INSPECTOR

BORING LOG LEGEND



TEST BORING LOG

BORING No. C1-1

PROJECT	Wellsville Test Fire
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. AUGER
DRILL RIG TYPE	ACKER
GROUNDWATER DEPTH	14'
MEASURING POINT	Surface
DATE OF MEASUREMENT	10/17/90

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET	1 OF 2
JOB No.	EB8-157-200
MEAS. PT. ELEV.	—
GROUND ELEV.	—
DATUM	—
DATE STARTED	10/16/90
DATE FINISHED	10/17/90
DRILLER	Fuller
INSPECTOR	WJO

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
0			6730		FILL, ASH, CINDERS	
			3160			
			2560		OILY WASTE	
			1450			
10			530			
			4890			
			1422			
			1911			
15	SS1	8 11 9 9			FIELD VANE REFUSAL @ 15.5' GRAVELLY SAND, widely graded 25-35% gravel, coarse to fine sand, 10-15% fines	Sample Headspace 130ppm
	SS2	5 11 14 12				Sample Headspace 50ppm
20						

	TEST BORING LOG	BORING No. C1-1
PROJECT Wellsville TEST Fill		SHEET 2 OF 2
CLIENT ARCO		JOB No. EBB-157-200

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
						Piezometer No.
21					BOTTOM OF BORING - 20.8'	INSTALLED @ 20.5'

TEST BORING LOG

BORING No. C/-2

PROJECT Welksville Test Fill	SHEET 1 OF 1
CLIENT ARCO	JOB No. E98-157-200
DRILLING CONTRACTOR EMPIRE	MEAS. PT. ELEV.
PURPOSE	GROUND ELEV.
DRILLING METHOD H.S. Auger	DATUM
DRILL RIG TYPE Acker	DATE STARTED 10/17/90
GROUNDWATER DEPTH	DATE FINISHED 10/18/90
MEASURING POINT	DRILLER
DATE OF MEASUREMENT	INSPECTOR

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
					FILL, ASH, CINDERS	
	ST1				OILY WASTE	
10	ST2					
	ST3					
15					GRAVELLY SAND	
					Bottom of Boring - 19.0'	Piezometer No. Installed @ 19.0'
20						

TEST BORING LOG

BORING No. C1-3

PROJECT	Welksville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET 1 OF 1

JOB No. E98-157-200

MEAS. PT. ELEV.

GROUND ELEV.

DATUM

DATE STARTED 10/20/90

DATE FINISHED 10/20/90

DRILLER Ludlow

INSPECTOR M.M.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SECTION PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
10						
15					Bottom of Boring - 14.0'	Piezometer No. 12928 Installed @ 14.0'
20						

TEST BORING LOG

BORING No. C1-4

PROJECT	Welksville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL	-		

SHEET	1 OF
JOB No.	E98-157-200
MEAS. PT. ELEV.	
GROUND ELEV.	
DATUM	
DATE STARTED	10/20/90
DATE FINISHED	10/20/90
DRILLER	Ludlow
INSPECTOR	m.m.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLER PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
10					Bottom of Boring - 11.0'	Piezometer No. 12924 Installed @ 11.0'
15						
20						

TEST BORING LOG

BORING No. C1-5

PROJECT	Welkville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET	1 OF 1
JOB No.	E98-157-200
MEAS. PT. ELEV.	
GROUND ELEV.	
DATUM	
DATE STARTED	10/20/90
DATE FINISHED	10/20/90
DRILLER	Ludlow
INSPECTOR	M.M.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
10					Bottom of Boring - 8.0'	Piezometer No. 12939 Installed @ 8.0'
15						
20						

TEST BORING LOG

BORING No. C2-1

PROJECT	Welksville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET 1 OF 2
JOB No. E99-157-200
MEAS. PT. ELEV.
GROUND ELEV.
DATUM
DATE STARTED 10/17/90
DATE FINISHED 10/18/90
DRILLER LUDLOW
INSPECTOR TPC & MM

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
					TOPSOIL, FILL, PLANT MATERIAL	
			1520		MOIST, GREY/BLACK, MEDIUM STIFF, moderately plastic, silt-like material (WASTE)	
			1230			
			880			
			1450			
			100			
10			160		Same, STRONG Petroleum-like odor	
	SS1	10, 12, 12, 12			FIELD VANE Refusal @ 13.2' medium to fine SAND, some gravel, little silt. SATURATED with Black petroleum-like material.	
15	SS2	12, 14, 15, 16				
	SS3	11, 7, 3, 4				
20	SS4	11, 15				

	TEST BORING LOG	BORING No. C2-1
PROJECT Wellsville TEST FILL		SHEET 2 OF 2
CLIENT ARCO		JOB No. E89-157-200

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
21						Piezometer No. 12925 INSTALLED @ 21.5'
	S55	23 21 42			SAND and Silt, NO STAINING	
23					Refusal @ - 23.0'	

TEST BORING LOG

BORING No. C2-2

PROJECT Wellsville Test Fill	SHEET 1 OF 1
CLIENT ARCO	JOB No. E 88-157-200
DRILLING CONTRACTOR Empire	MEAS. PT. ELEV.
PURPOSE	GROUND ELEV.
DRILLING METHOD H.S. Auger	DATUM
DRILL RIG TYPE Acker	DATE STARTED 10/19/90
GROUNDWATER DEPTH	DATE FINISHED 10/19/90
MEASURING POINT	DRILLER Ludlow
DATE OF MEASUREMENT	INSPECTOR m.m.

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
5	ST1 0.8'					
10	ST2 1.9'					
15						
20					Shelby Tube Refusal @ 18.0' Bottom of Boring	Piezometer No 12933 Installed @ 18.0'

FORM001

TEST BORING LOG

BORING No. C2-3

PROJECT: Welksville Test Fill	SHEET 1 OF 1
CLIENT: ARCO	JOB No. E98-157-200
DRILLING CONTRACTOR: EMPIRE	MEAS. PT. ELEV.
PURPOSE	GROUND ELEV.
DRILLING METHOD: H.S. Auger	DATUM
DRILL RIG TYPE: Acker	DATE STARTED: 10/19/90
GROUNDWATER DEPTH	DATE FINISHED: 10/19/90
MEASURING POINT	DRILLER
DATE OF MEASUREMENT	INSPECTOR

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLER PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
10						
15					Bottom of Boring - 14.5'	Piezometer No. 12932 Installed @ 14.5'
20						

TEST BORING LOG

BORING No. C2-4

PROJECT	Welsville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET	1 OF 1
JOB No.	E99-157-200
MEAS. PT. ELEV.	
GROUND ELEV.	
DATUM	
DATE STARTED	10/19/90
DATE FINISHED	10/19/90
DRILLER	Ludlow
INSPECTOR	M.M.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
10					Bottom of Boring - 11.0'	Piezometer No. 12935 Installed @ 11.0'
15						
20						

FORM001

TEST BORING LOG

BORING No. C2-5

PROJECT Wellsville Test Fill	SHEET 1 OF
CLIENT ARCO	JOB No. E98-157-200
DRILLING CONTRACTOR EMPIRE	MEAS. PT. ELEV.
PURPOSE	GROUND ELEV.
DRILLING METHOD H.S. Auger	DATUM
DRILL RIG TYPE Acker	DATE STARTED 10/20/90
GROUNDWATER DEPTH	DATE FINISHED 10/20/90
MEASURING POINT	DRILLER Ludlow
DATE OF MEASUREMENT	INSPECTOR N.M.M

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
0						
					Bottom of Boring - 7.5'	Piezometer No. 12938 Installed @ 7.5'
10						
15						
20						

TEST BORING LOG

BORING No. C3-1

PROJECT	Welksville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET 1 OF 2
JOB No. E98-157-200
MEAS. PT. ELEV.
GROUND ELEV.
DATUM
DATE STARTED 10/22/90
DATE FINISHED 10/23/90
DRILLER LUDLOW
INSPECTOR M.M.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
			54		MOIST LOAM WITH Debris	
			126		BLACK, SEMI-LIQUID MATERIAL Consistancy of Tooth paste Uniform, NO SOIL MATERIALS Apparent.	
			876			
			915			
10			510			
			3590		SAME, SOME SAND	
			5169			
	SS1	13 12 10 14			FIELD VANE REFUSAL @ 14'	
15					GRAVEL and Sand, Stained with black, oily material	
	SS2	8 9 10 10				
	SS3	14 23 15 13				
20						

	TEST BORING LOG	BORING No. C3-1
PROJECT Wellsville TEST FILL		SHEET 2 OF 2
CLIENT ARCO		JOB No. E88-157-200

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
SA		10 6 6 5	2.0 2.0 2.0		GRAVEL, SAND and silt	Piezometer No. 12927 INSTALLED @ 21.0'
22					Bottom of Boring - 22.0'	

	TEST BORING LOG	BORING No. C3-2
PROJECT Welksville Test Fill		SHEET 1 OF
CLIENT ARCO		JOB No. E98-157-200
DRILLING CONTRACTOR EMPIRE		MEAS. PT. ELEV.
PURPOSE		GROUND ELEV.
DRILLING METHOD H.S. Auger	SAMPLE / CORE / CASING	DATUM
DRILL RIG TYPE Acker — TYPE		DATE STARTED 10/23/90
GROUNDWATER DEPTH — DIA.		DATE FINISHED 10/23/90
MEASURING POINT — WEIGHT		DRILLER Ludlow
DATE OF MEASUREMENT — FALL		INSPECTOR M.M.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLER SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
5						
	ST1					
10						
	ST2					
					SHELBY Tube Refusal @ 13.4'	
15						
					BOTTOM of Boring - 19.0'	Piezometer No. 12929 INSTALLED @ 19.0'
20						

	TEST BORING LOG	BORING No.
PROJECT Welksville Test Fill		SHEET 1 OF C3-3
CLIENT ARCO		JOB No. E98-157-200
DRILLING CONTRACTOR EMPIRE		MEAS. PT. ELEV.
PURPOSE		GROUND ELEV.
DRILLING METHOD H.S. Auger	SAMPLE / CORE / CASING	DATUM
DRILL RIG TYPE Acker	TYPE	DATE STARTED 10/23/90
GROUNDWATER DEPTH	DIA.	DATE FINISHED 10/23/90
MEASURING POINT	WEIGHT	DRILLER Ludlow
DATE OF MEASUREMENT	FALL	INSPECTOR M.M.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
10						
15					Bottom of Boring - 15.0'	Piezometer No. 12931 Installed @ 15.0'
20						

TEST BORING LOG

BORING No. C3-4

PROJECT	Welksville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET	1 OF 1
JOB No.	E98-157-200
MEAS. PT. ELEV.	
GROUND ELEV.	
DATUM	
DATE STARTED	10/24/90
DATE FINISHED	10/24/90
DRILLER	Lwolow
INSPECTOR	M.M.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLER PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
10					Bottom of Boring - 10.0'	Piezometer No. 12940 Installed @ 10.0'
15						
20						

TEST BORING LOG

BORING No. C3-5

PROJECT	Welksville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET 1 OF 1

JOB No. E98-157-200

MEAS. PT. ELEV.

GROUND ELEV.

DATUM

DATE STARTED 10/24/90

DATE FINISHED 10/24/90

DRILLER Ludlow

INSPECTOR - M.M.

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
0						
					Bottom of Boring - 5.0'	Piezometer No. 12941 Installed @ 5.0'
10						
15						
20						

TEST BORING LOG

BORING No. C4-1

PROJECT Welksville Test Fill	SHEET 1 OF 1
CLIENT ARCO	JOB No. E93-157-200
DRILLING CONTRACTOR EMPIRE	MEAS. PT. ELEV.
PURPOSE	GROUND ELEV.
DRILLING METHOD H.S. Auger	DATUM
DRILL RIG TYPE Acker	DATE STARTED 10/22/90
GROUNDWATER DEPTH 14.1'	DATE FINISHED 10/23/90
MEASURING POINT Surface	DRILLER Fuller
DATE OF MEASUREMENT 10/23/90	INSPECTOR WJO

SAMPLE	CORE	CASING	
TYPE			
DIA.			
WEIGHT			
FALL			

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (psf)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
0			596			
			314			
			154			
			278			
10			699			
			931			
			1090			
			1545			
15			828			
	SS1	14 15 20 18			FIELD VANE refusal @ 15.7'	
	SS2	9 9 14 18			Gravelly SAND, saturated with black petroleum-like material	Piezometer No. Installed @ 19.8'
20						

Bottom of Boring - 20.0'

TEST BORING LOG

BORING No. C4-2

PROJECT	Welksville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET	1 OF 1
JOB No.	E98-157-200
MEAS. PT. ELEV.	
GROUND ELEV.	
DATUM	
DATE STARTED	10/24/90
DATE FINISHED	10/24/90
DRILLER	Fuller
INSPECTOR	WJO

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
5	ST1				Oily waste, very loose, nearly liquid	
10	ST2				Oily waste, firmer, soft clay like	
15	ST3				Oily waste, firm	
20						Piezometer No. Installed @ 17.0'

TEST BORING LOG

BORING No. CA-3

PROJECT	Welksville Test Fill
CLIENT	ARCO
DRILLING CONTRACTOR	EMPIRE
PURPOSE	
DRILLING METHOD	H.S. Auger
DRILL RIG TYPE	Acker
GROUNDWATER DEPTH	
MEASURING POINT	
DATE OF MEASUREMENT	

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

SHEET	1 OF 1
JOB No.	E98-157-200
MEAS. PT. ELEV.	
GROUND ELEV.	
DATUM	
DATE STARTED	10/23/90
DATE FINISHED	10/23/90
DRILLER	Fuller
INSPECTOR	NHO

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
10					Oily WASTE	
15					Bottom of Boring - 14.1'	Piezometer No. Installed @ 14.1'
20						

	TEST BORING LOG	BORING No.
PROJECT Welksville Test Fill		SHEET 1 OF CA-4
CLIENT ARCO		JOB No. E88-157-200
DRILLING CONTRACTOR EMPIRE		MEAS. PT. ELEV.
PURPOSE		GROUND ELEV.
DRILLING METHOD H.S. Auger	SAMPLE / CORE / CASING	DATUM
DRILL RIG TYPE Acker	TYPE	DATE STARTED 10/23/90
GROUNDWATER DEPTH	DIA.	DATE FINISHED 10/23/90
MEASURING POINT	WEIGHT	DRILLER
DATE OF MEASUREMENT	FALL -	INSPECTOR

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLER PER 6"	VANE SHEAR STRENGTH (PSF)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
					Bottom of Boring - 9.0'	
10						
15						
20						

TEST BORING LOG

BORING No. CA-5

PROJECT Wellsville TEST Fire	SHEET 1 OF 1
CLIENT ARCO	JOB No. E88-157-200
DRILLING CONTRACTOR EMPIRE	MEAS. PT. ELEV.
PURPOSE	GROUND ELEV.
DRILLING METHOD H.S. Augen	DATUM
DRILL RIG TYPE Acker	DATE STARTED 10/24/90
GROUNDWATER DEPTH	DATE FINISHED 10/24/90
MEASURING POINT	DRILLER
DATE OF MEASUREMENT	INSPECTOR WJO

	SAMPLE	CORE	CASING
TYPE			
DIA.			
WEIGHT			
FALL			

DEPTH FT.	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	GEOLOGIC DESCRIPTION	REMARKS
0					Oily waste	
					Bottom of Boring - 4.0'	Piezometer installed @ 4.0'
10						
15						
20						

FORM001

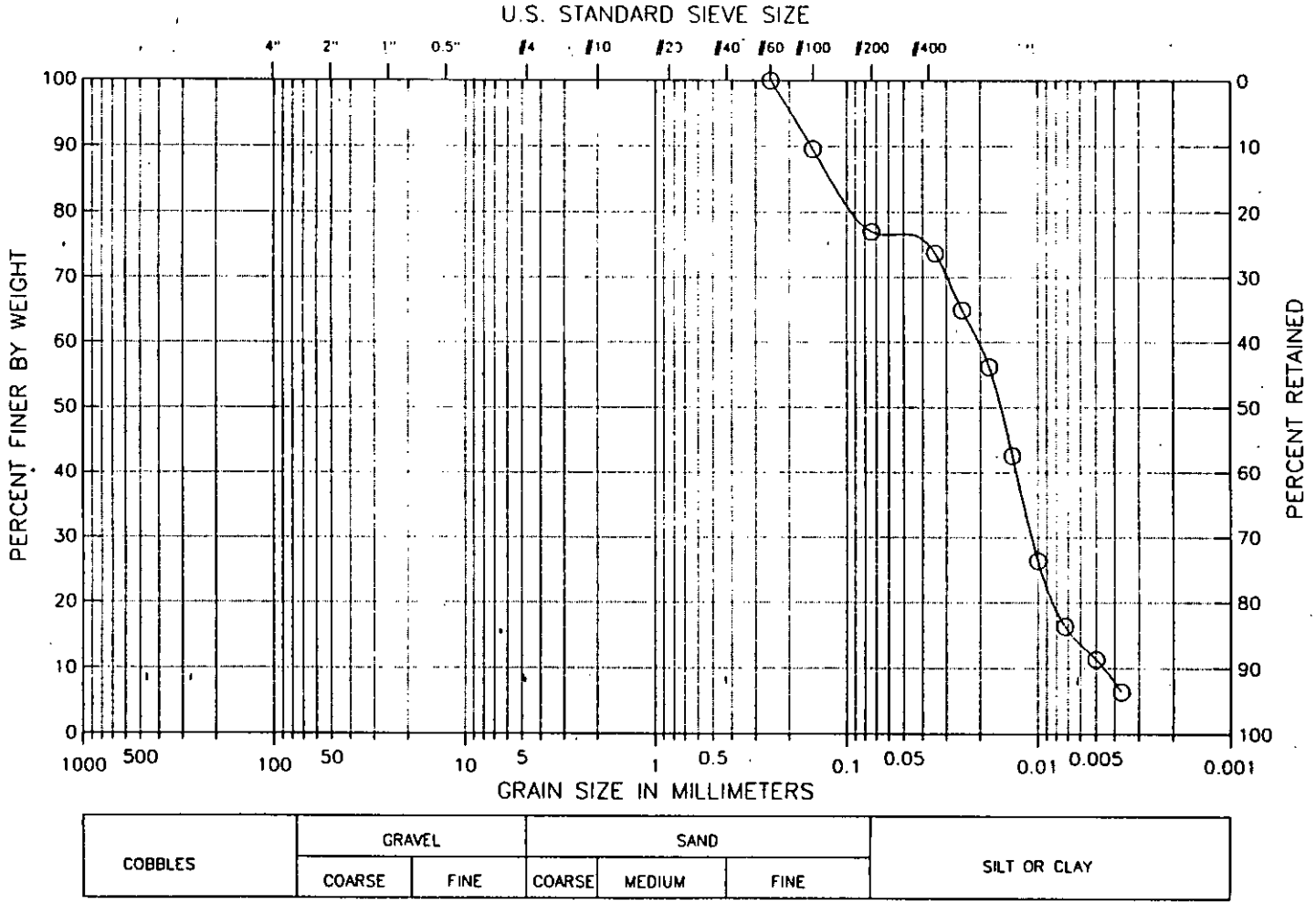
ARCO-Sinclair Refinery Site Landfill Remediation
Combined Particle Size Analysis

Sieve and hydrometer analyses were performed following ASTM-D422. Samples for these tests were taken from the oven-dried samples used for consolidation and strength testing. The oven-dried material was wetted in a 15% solution of hydrogen peroxide and water to remove all organic material. Once the chemical reaction was visibly complete, the samples were again oven dried to remove all hydrogen peroxide. The remaining material was mixed with water and a hydrometer test was performed. Upon completion of the hydrometer test, the entire sample was wet sieved through a No. 200 sieve. Material remaining on the No. 200 sieve was oven dried and then dry sieved.

Atterberg limits were not performed on the treated samples because they had no plasticity. Atterberg limits were not performed on the untreated samples because oven drying would have driven off the organic material leading to a false indication of liquid limit and plastic limit.

Test	Boring	Sample
H1	C3-2	ST2
H2	C4-2	ST1
H3	C4-2	ST1
H4	C4-2	ST2
H5	C4-2	ST2
H6	C3-2	ST2
H7	C2-2	ST1
H8	C3-2	ST2
H9	C1-2	ST2
H10	C4-2	ST2
H11	C3-2	ST2
H12	C3-2	ST1
H13	C3-2	ST1
H14	C1-2	ST2
H15	C1-2	ST2
H16	C4-2	ST1
H17	C4-2	ST3
H18	C4-2	ST3
H19	C4-2	ST3
H20	C1-1	SS1
H21	C1-1	SS3
H22	C1-1	SS3
H23	C2-1	SS1
H24	C2-1	SS2
H25	C2-1	SS3
H26	C2-1	SS5
H27	C3-1	SS1
H28	C3-1	SS2
H29	C3-1	SS3
H30	C3-1	SS4
H31	C4-1	SS1
H32	C4-1	SS2

	Boring No. : C3-2 Sample No: ST-2 Tested by : WJO Filename : H1	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

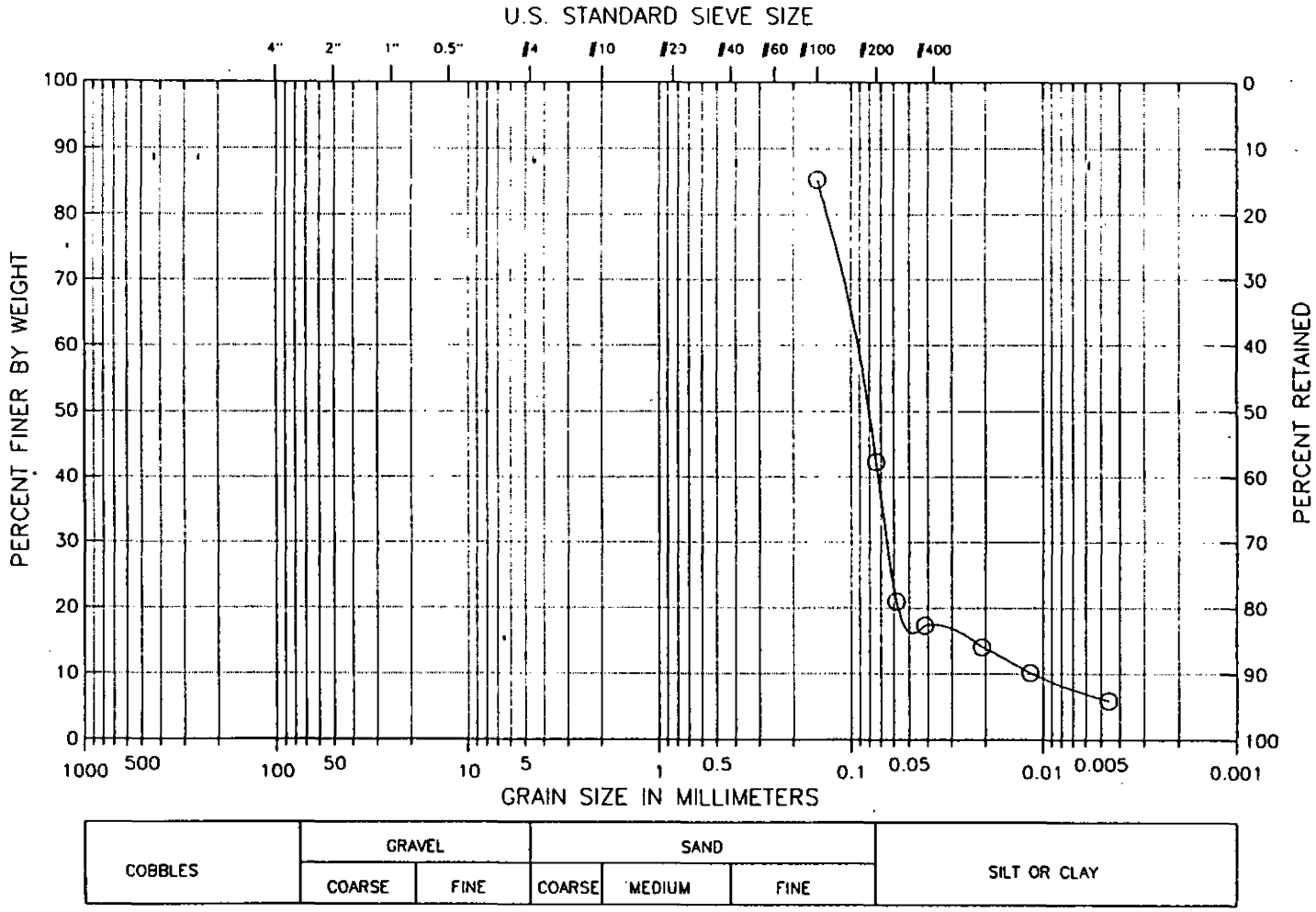


Classification :
(ML) silt with sand
Visual Description :
Oily Waste

Remarks :
Depth 8-10 ft

Figure 1

	Boring No. : C4-2 Sample No: ST-1 Tested by : WJO Filename : H2	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

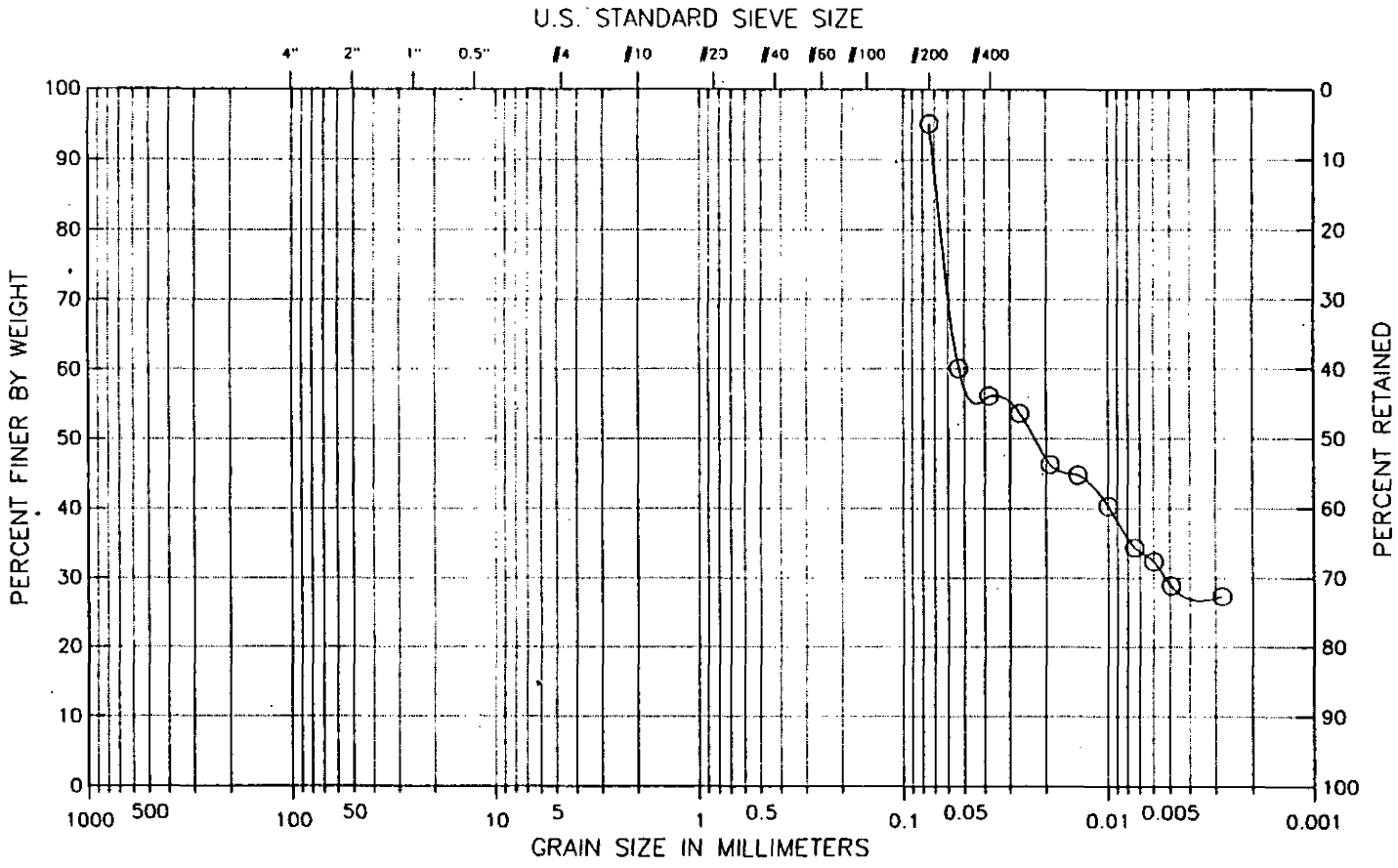


Classification :
(SM) Silty sand
Visual Description :
Oily Waste

Remarks :
Depth 4-6 ft

Figure 2

	Boring No. : C4-2 Sample No: ST-1 Tested by : WJO Filename : H3	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

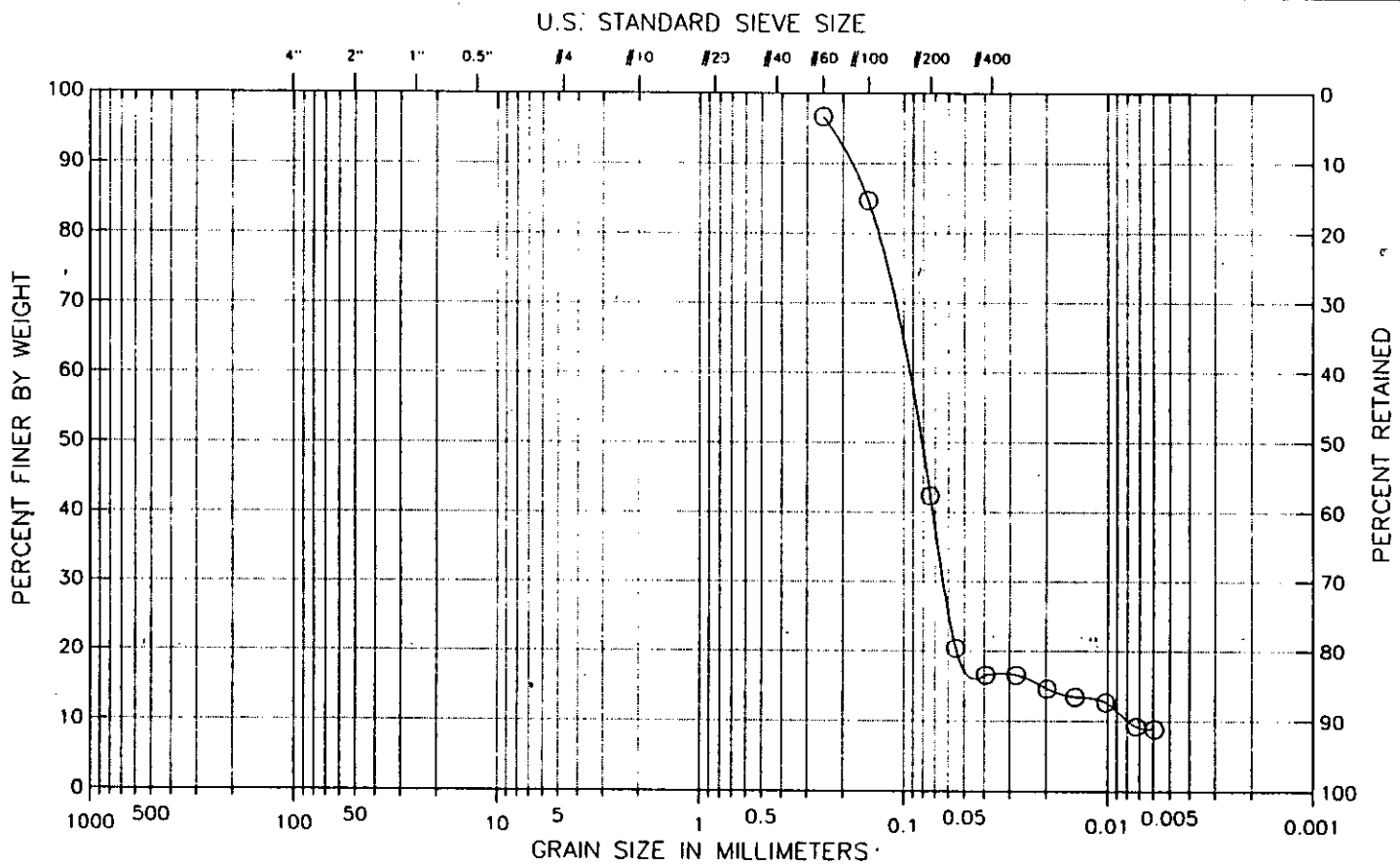


Classification :
(ML) silt
Visual Description :
Oily Waste

Remarks :
Depth 4-6 ft

Figure 3

	Boring No. : C4-2 Sample No: ST-2 Tested by : WJO Filename : H4	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

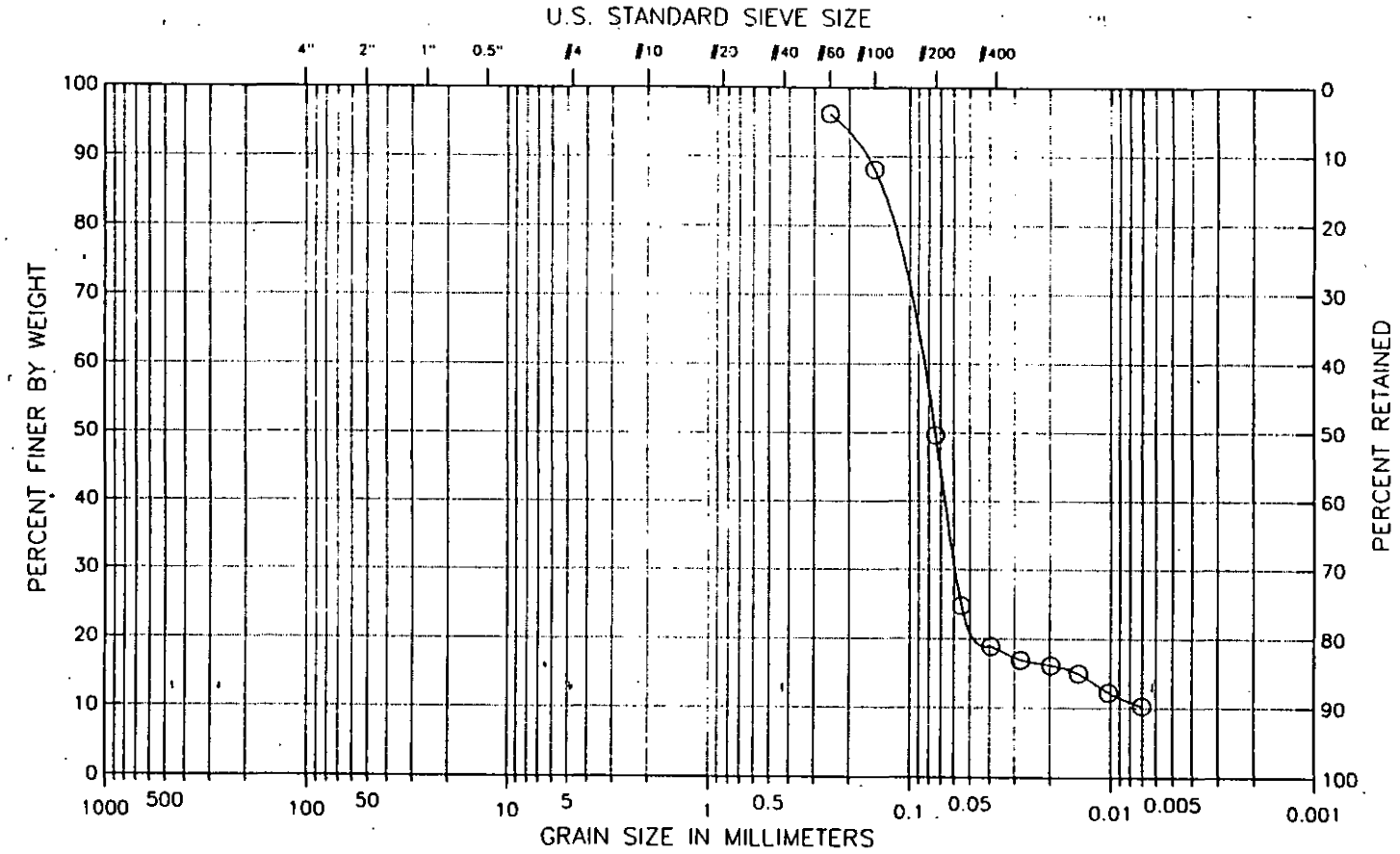


Classification :
(SM) Silty sand
Visual Description :
Oily Waste

Remarks :
Depth 9-11 ft

Figure 4

	Boring No. : C4-2 Sample No: ST-2 Tested by : WJO Filename : H5	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

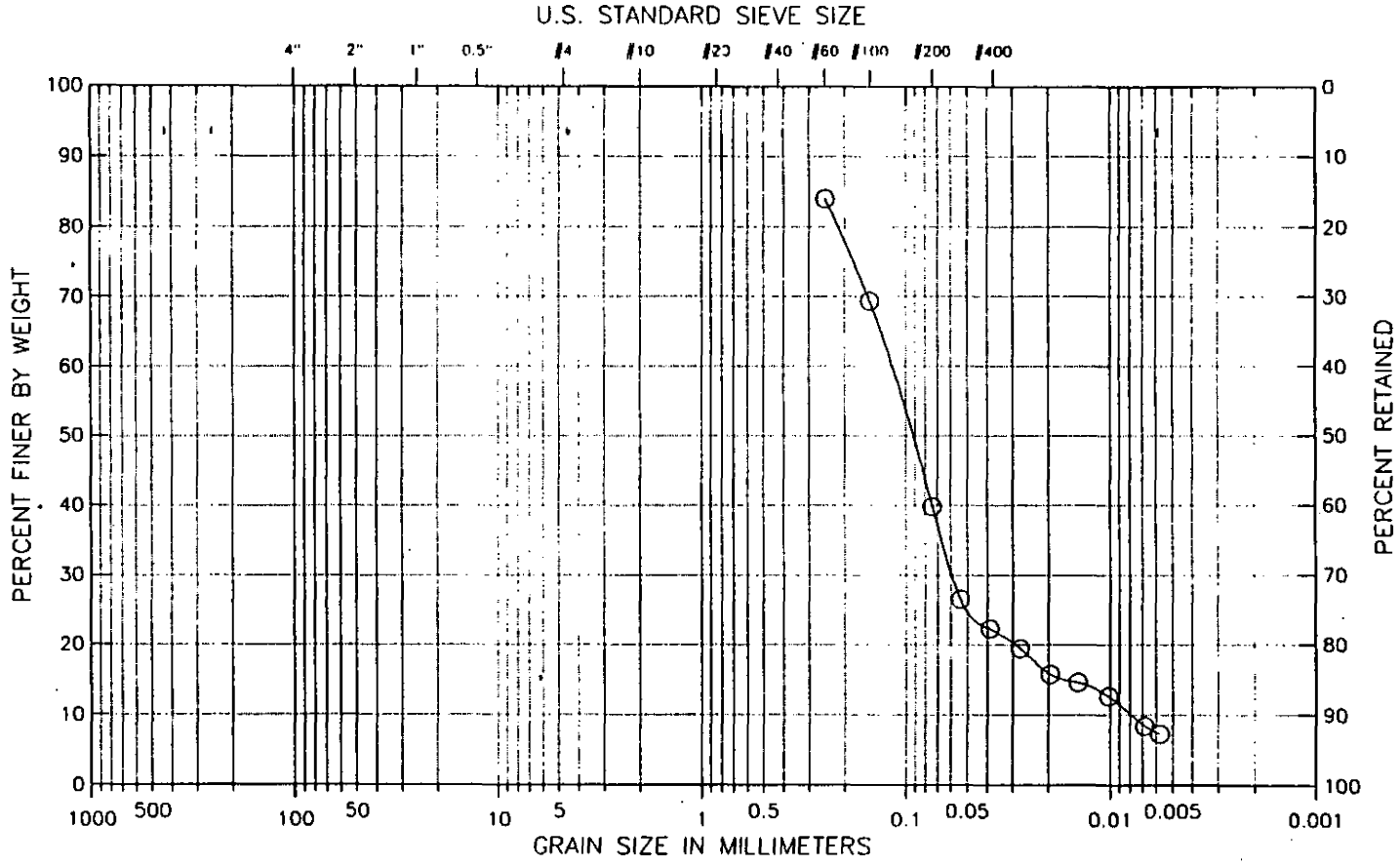


Classification :
(SM) Silty sand
Visual Description :
Oily Waste

Remarks :
Depth 9-11 ft

Figure 5

	Boring No. : C3-2 Sample No: ST-2 Tested by : WJO Filename : H6	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

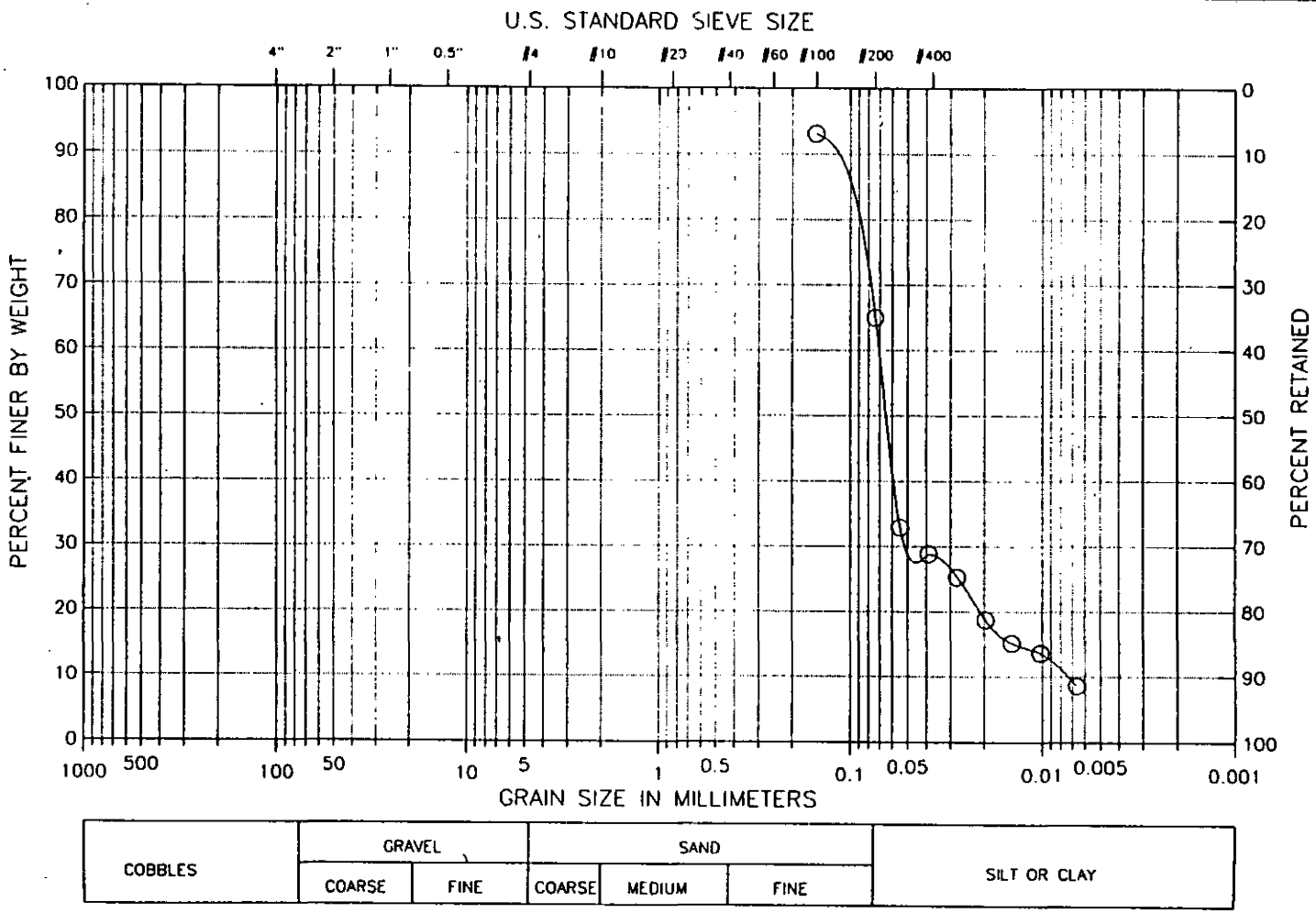


Classification :
(SM) Silty sand
Visual Description :
Oily Waste

Remarks :
Depth 8-10 ft

Figure 6

	Boring No. : C2-2 Sample No: ST-1 Tested by : WJO Filename : H7	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

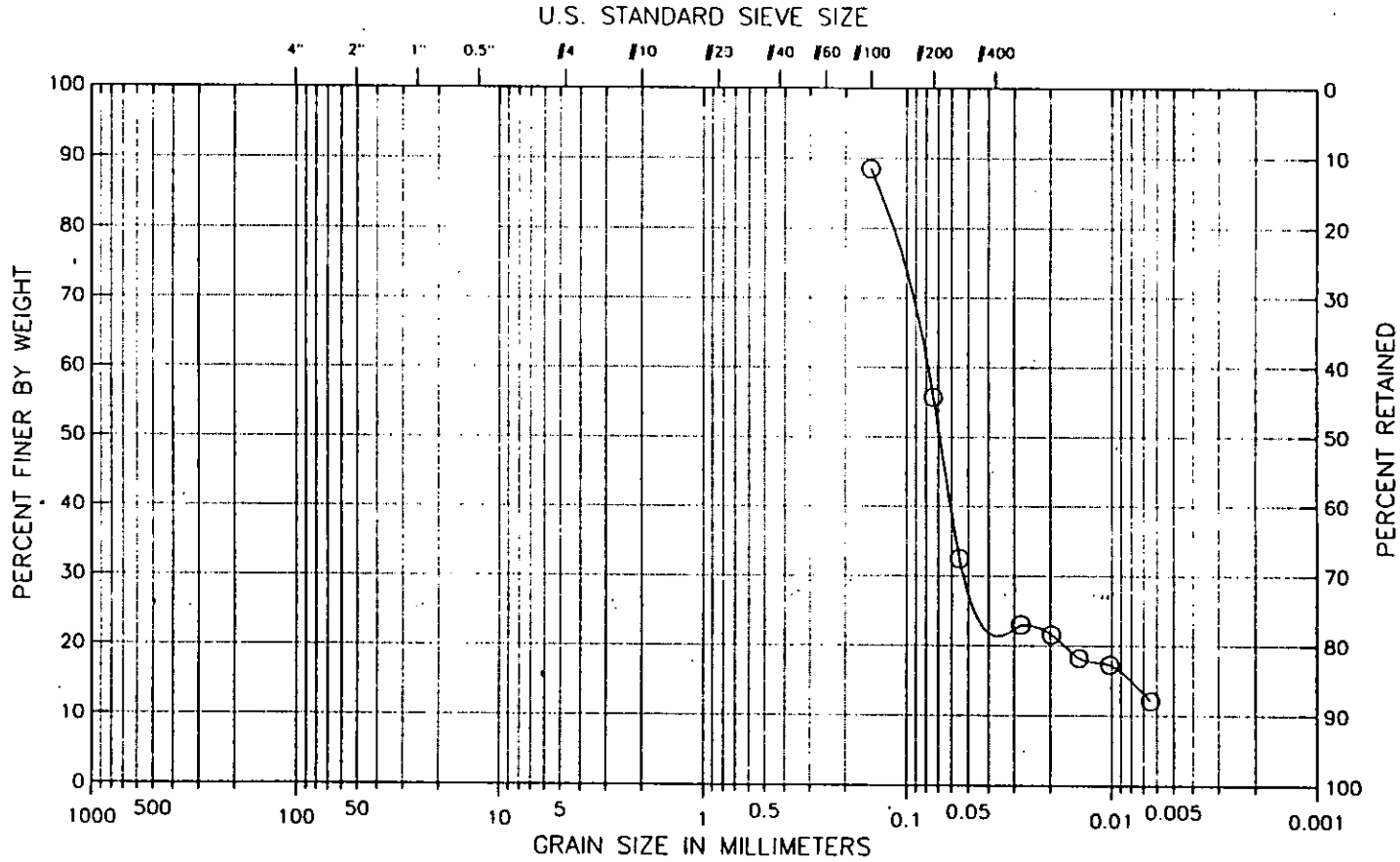


Classification :
(ML) Sandy silt
Visual Description :
Oily Waste

Remarks :
Depth 4-6 ft

Figure 7

	Boring No. : C3-2 Sample No: ST-2 Tested by : WJO Filename : H8	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

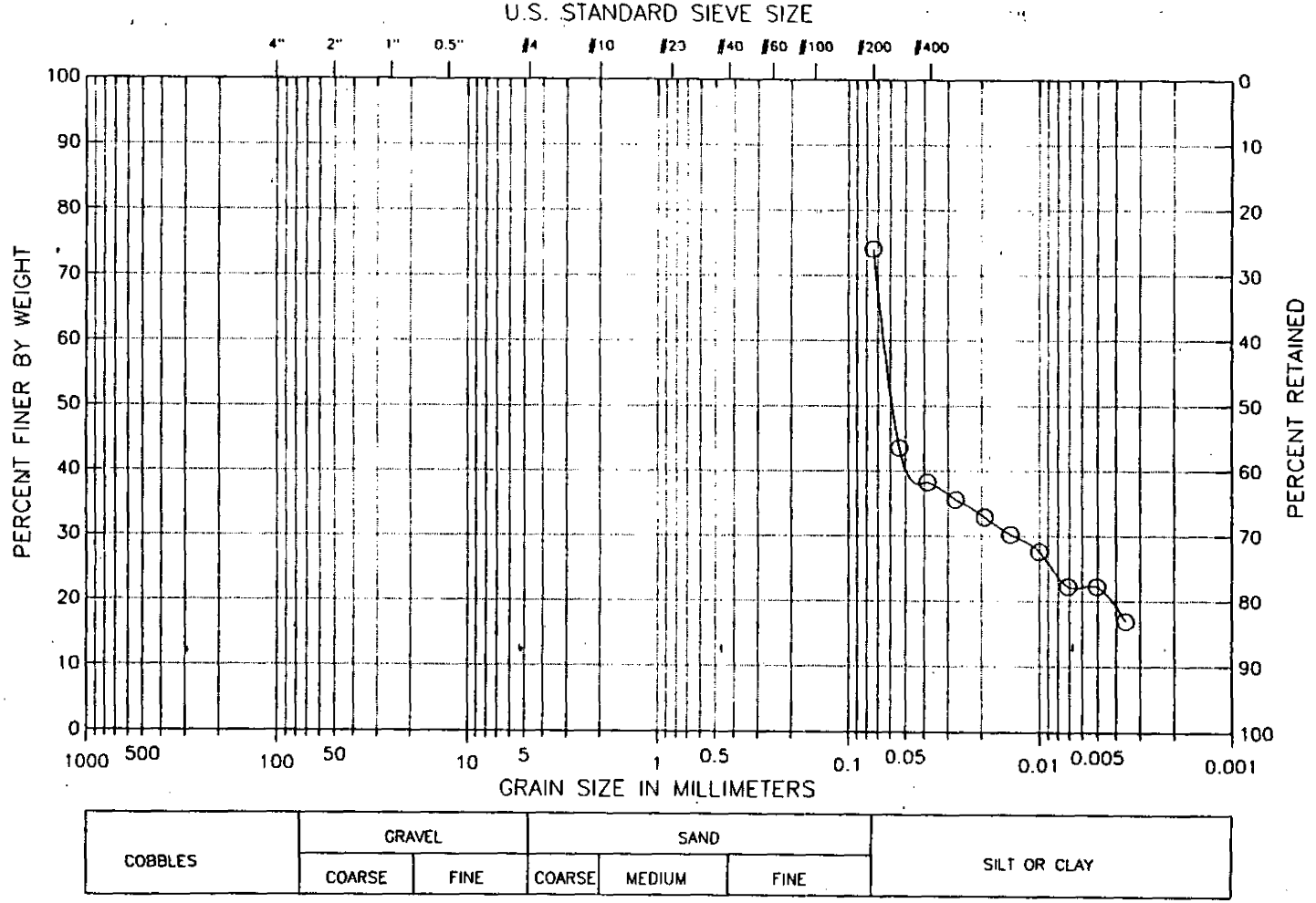


Classification :
(ML) Sandy silt
Visual Description :
Oily Waste

Remarks :
Depth 8-10 ft

Figure 8

	Boring No. : C1-2 Sample No: ST-2 Tested by : WJO Filename : H9	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

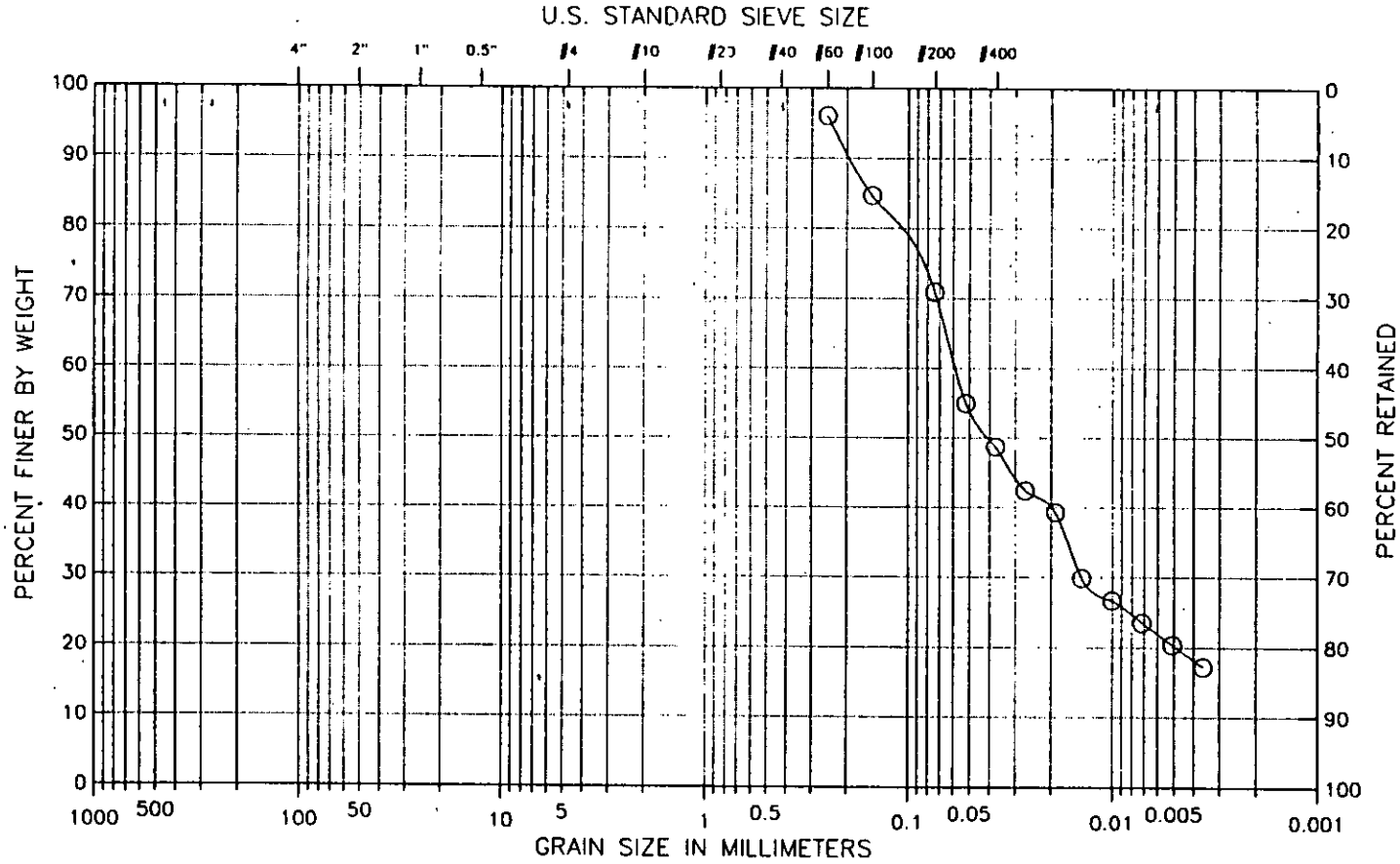


Classification :
(ML) silt with sand
Visual Description :
Oily Waste

Remarks :
Depth 10-12 ft

Figure 9

	Boring No. : C4-2 Sample No: ST-2 Tested by : WJO Filename : H10	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

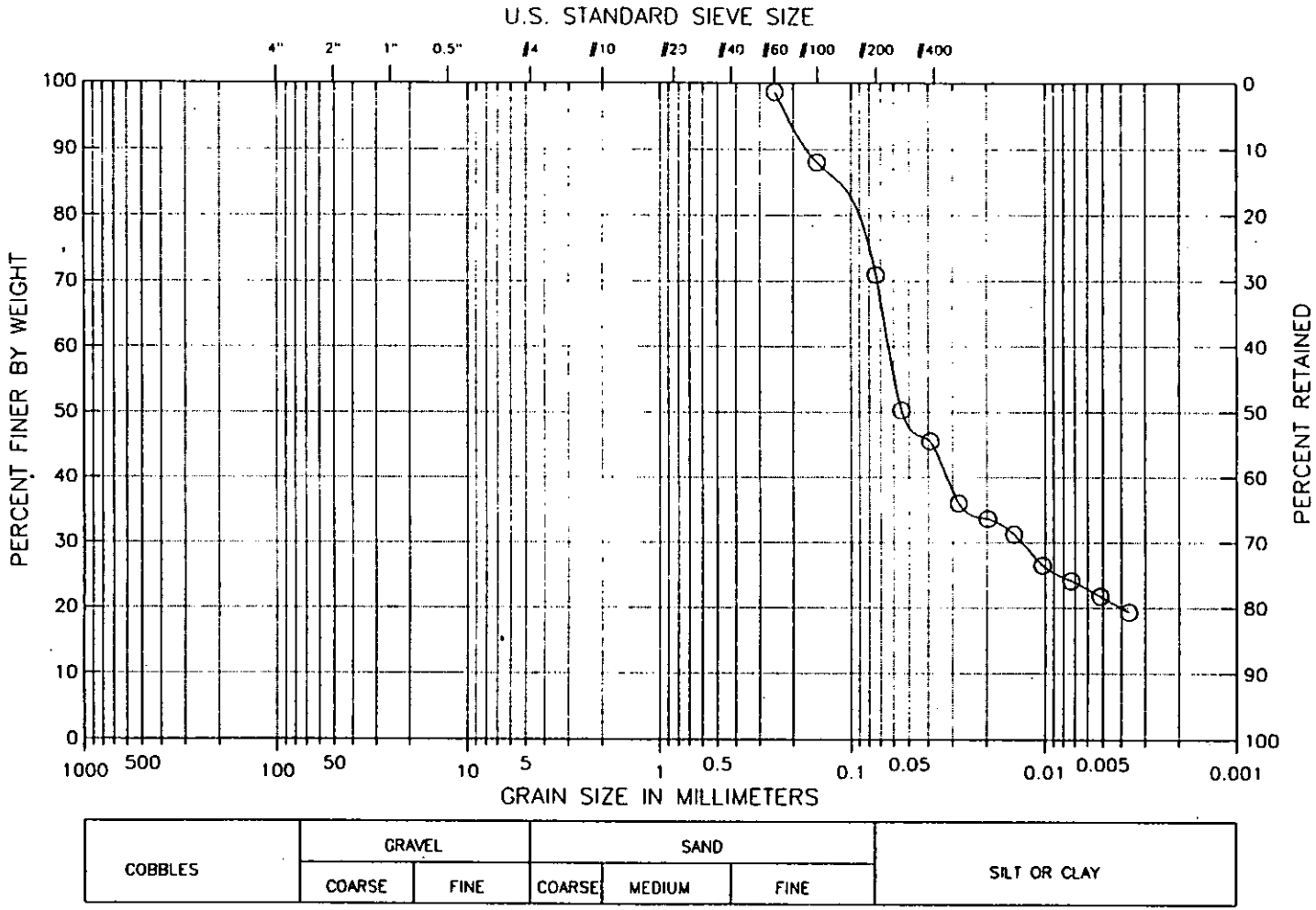


Classification :
(ML) silt with sand
Visual Description :
Oily Waste

Remarks :
Depth 9-11 ft

Figure 10

	Boring No. : C3-2 Sample No: ST-2 Tested by : WJO Filename : H11	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

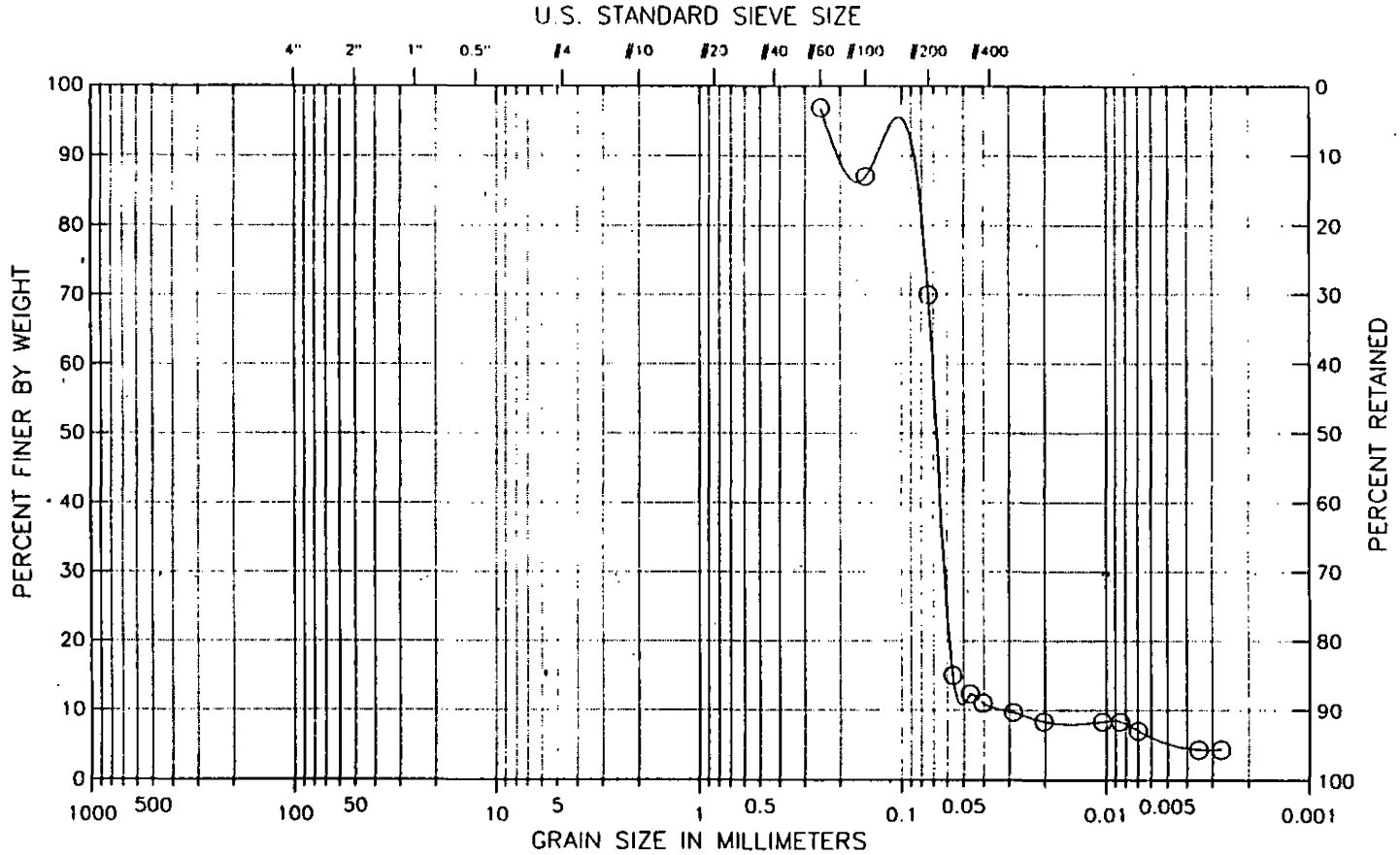


Classification :
(ML) silt with sand
Visual Description :
Oily Waste

Remarks :
Depth 8-10 ft

Figure 11

	Boring No. : C3-2 Sample No: ST-1 Tested by : WJO Filename : H12	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

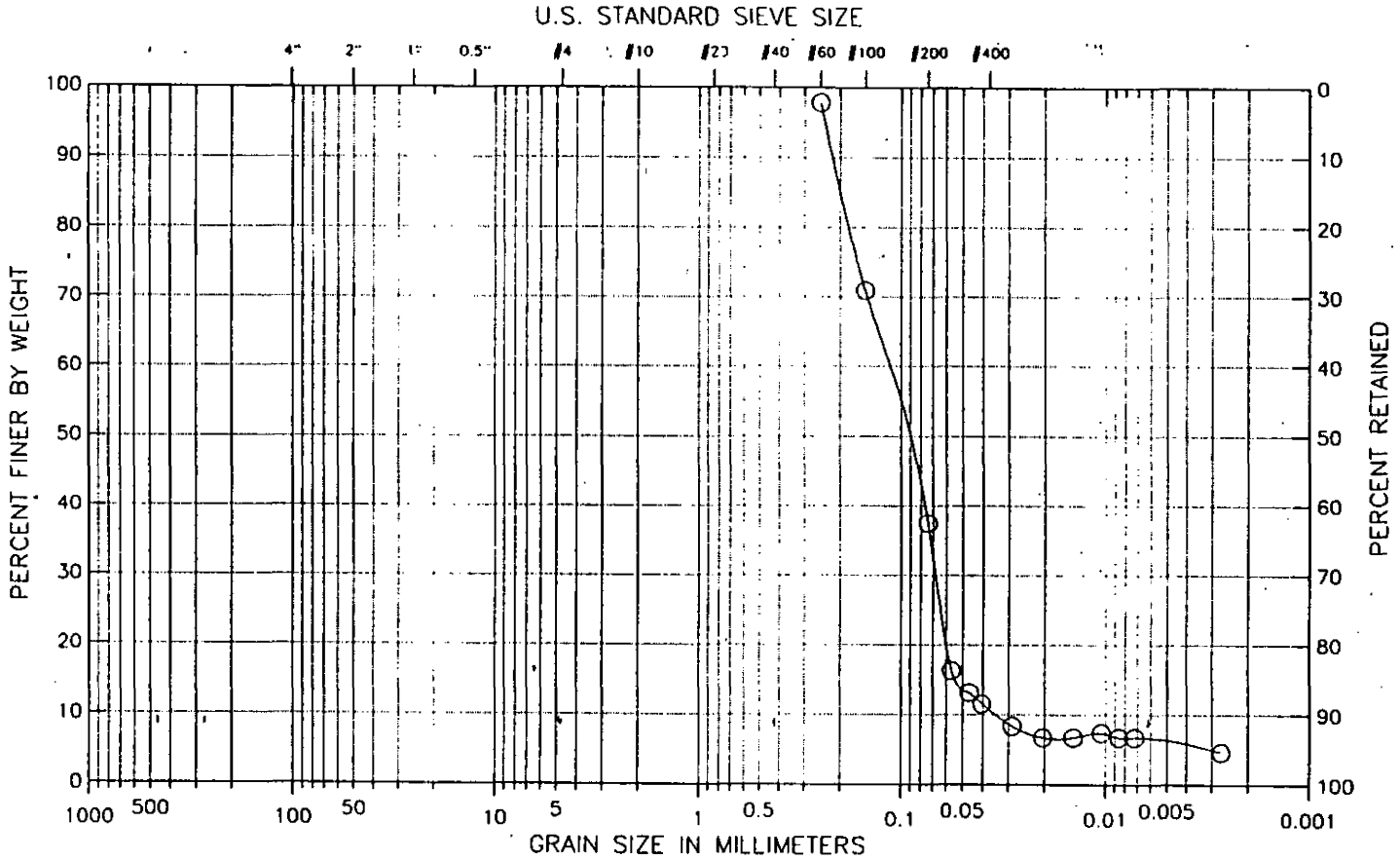


Classification :
(ML) Sandy silt
Visual Description :
Oily Waste

Remarks :
Depth 4-6 ft

Figure 12

	Boring No. : C3-2 Sample No.: ST-1 Tested by : WJO Filename : H13	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

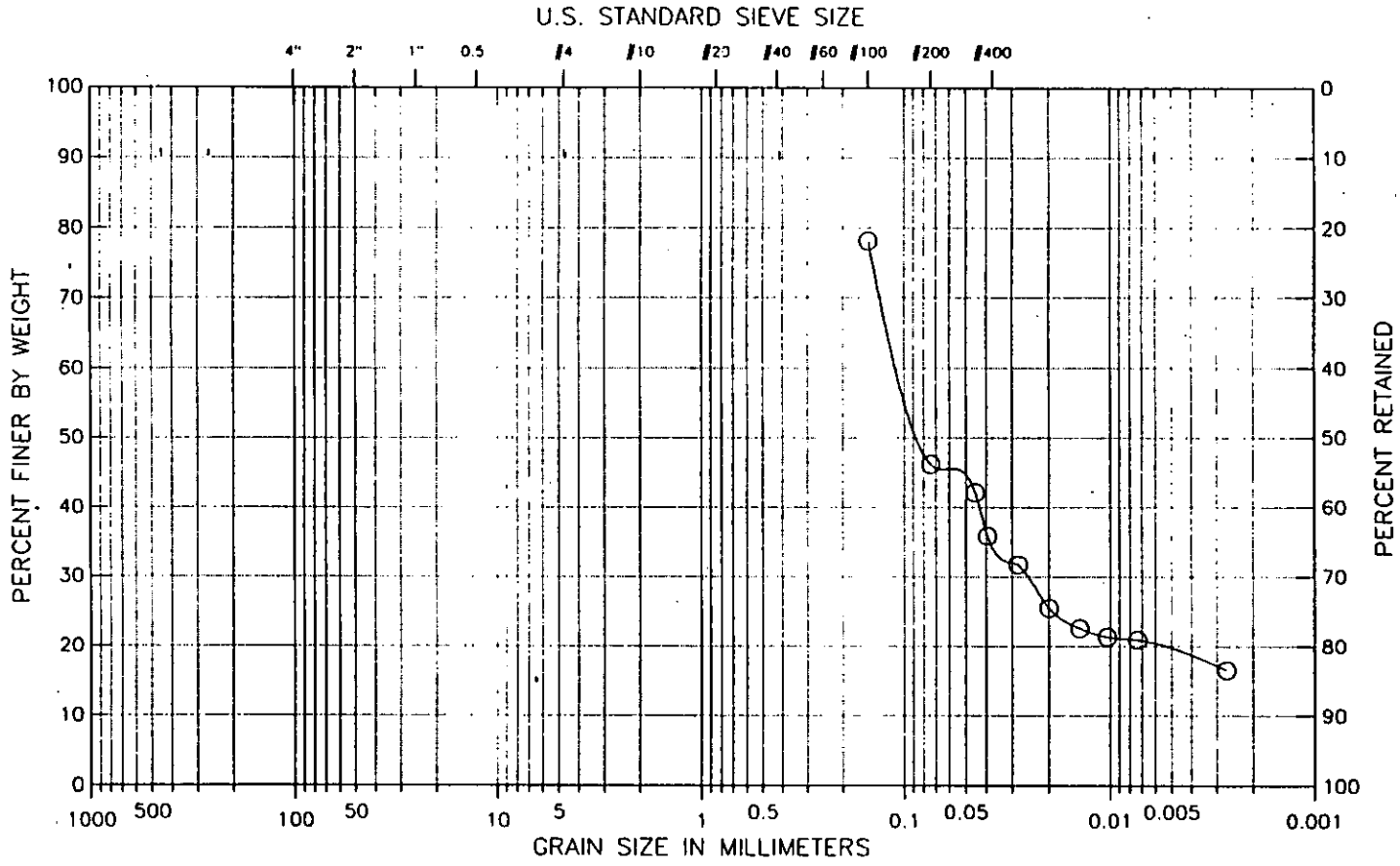


Classification :
(SM) Silty sand
Visual Description :
Oily Waste

Remarks :
Depth 4-6 ft

Figure 13

	Boring No. : C1-2 Sample No.: ST-2 Tested by : WJO Filename : H14	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

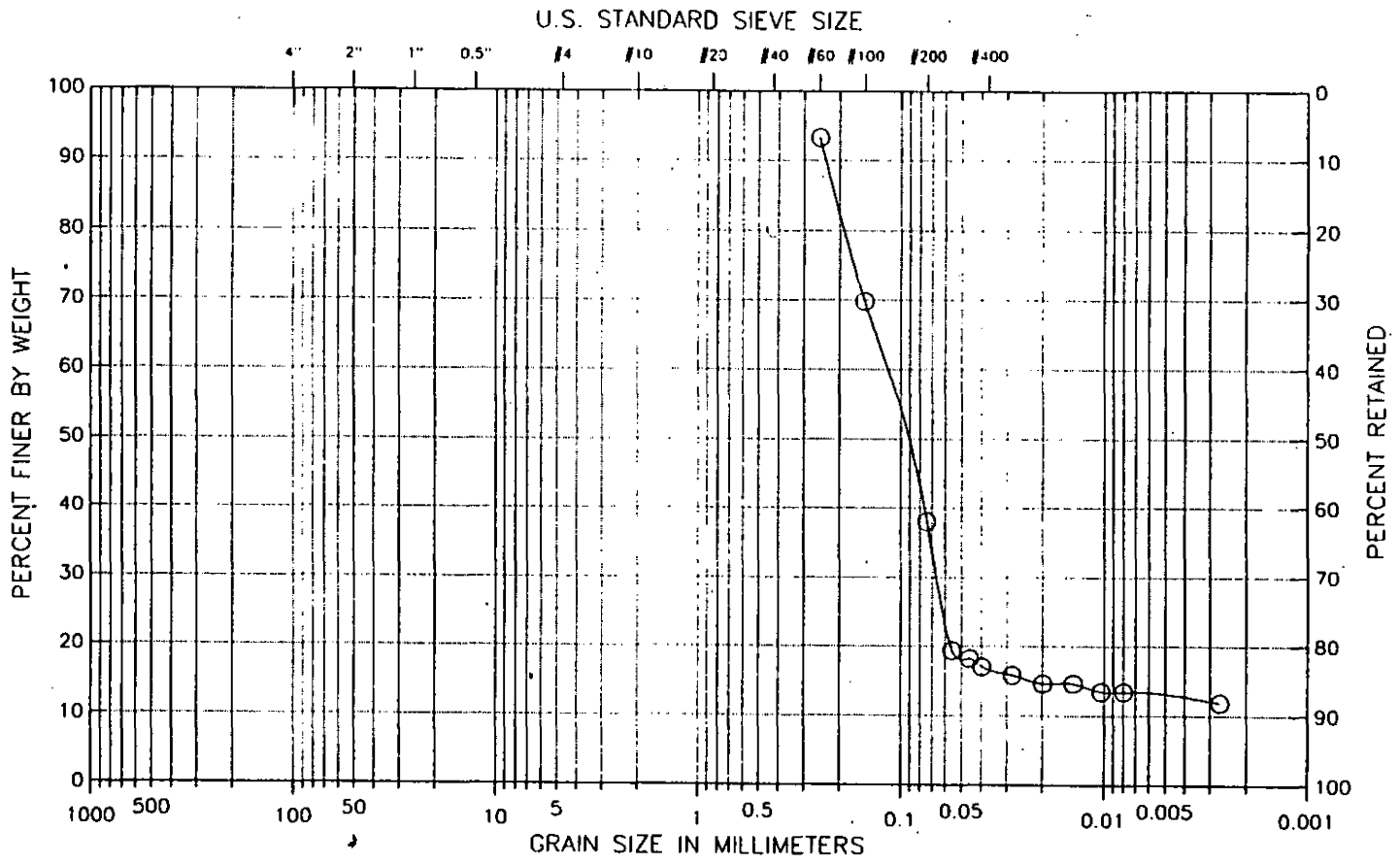


Classification :
(SM) Silty sand
Visual Description :
Oily Waste

Remarks :
Depth 10-12 ft

Figure 14

	Boring No. : C1-2 Sample No.: ST-2 Tested by : WJO Filename : H15	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

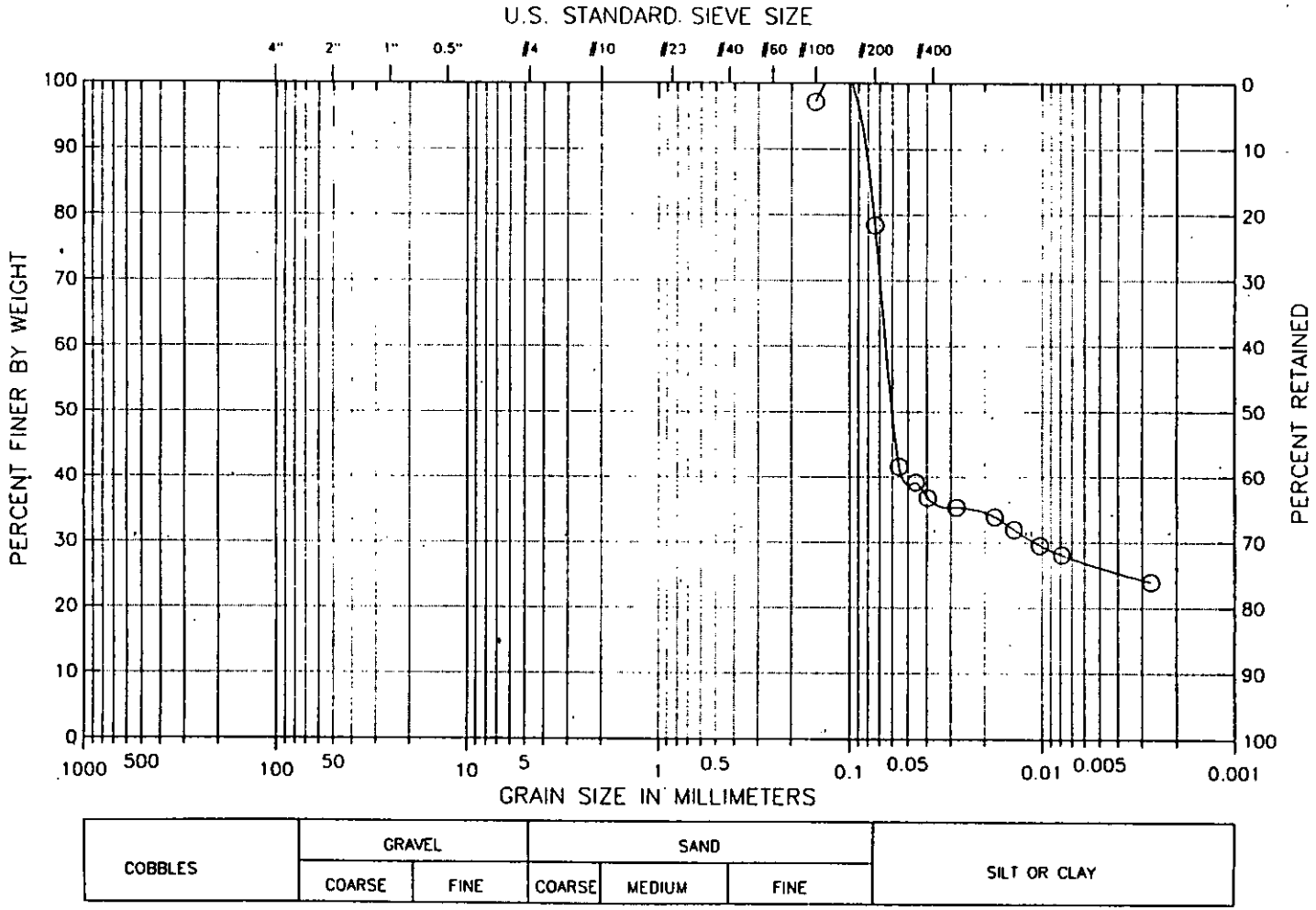


Classification :
(SM) Silty sand
Visual Description :
Oily Waste

Remarks :
Depth 10-12 ft

Figure 15

	Boring No. : C4-2 Sample No: ST-1 Tested by : WJO Filename : H16	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

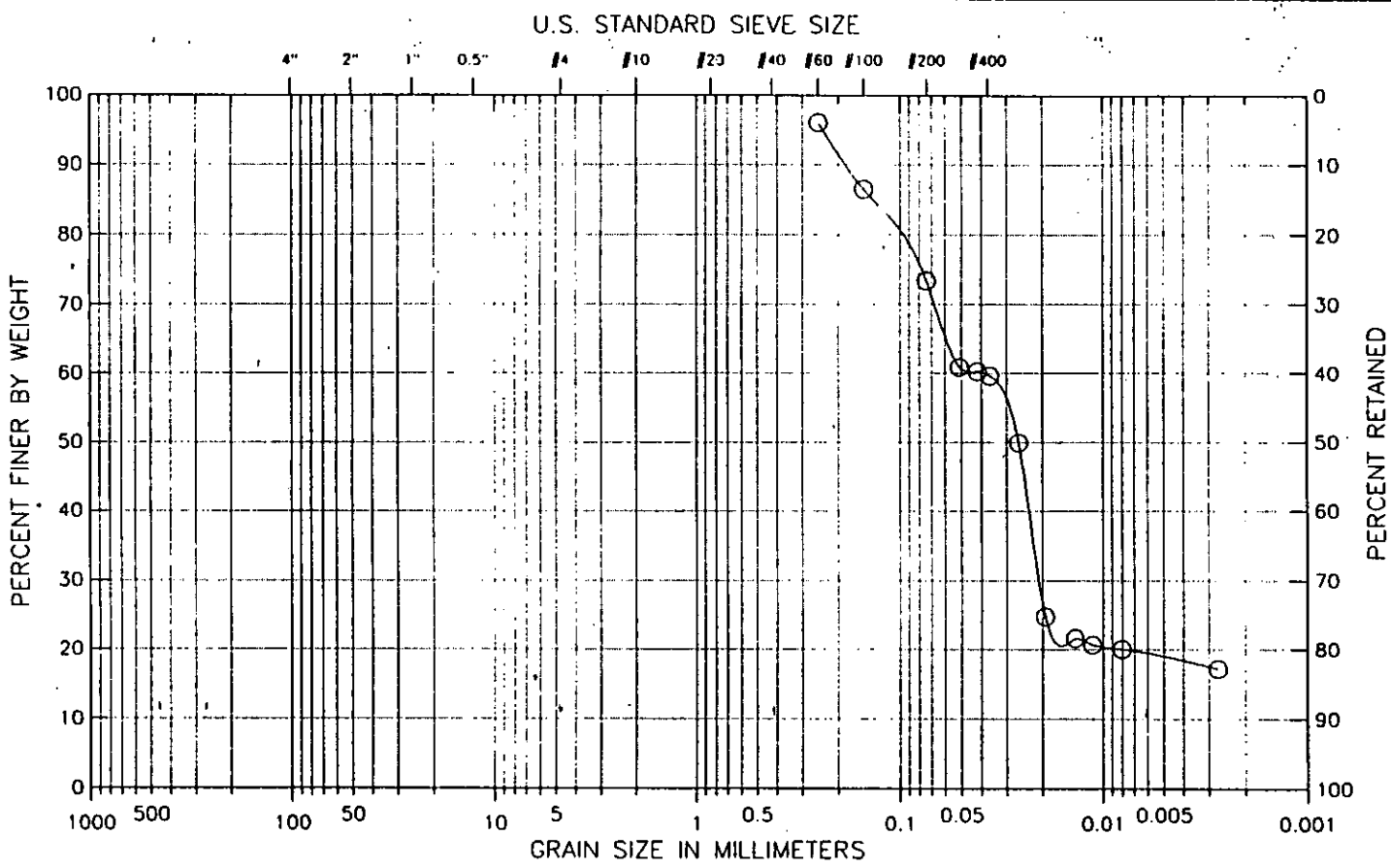


Classification :
(ML) silt with sand
Visual Description :
Oily Waste

Remarks :
Depth 4-6 ft

Figure 16

	Boring No. : C4-2 Sample No.: ST-3 Tested by : WJO Filename : H17	Project : ARCO / Sinclair Refinery Project No : GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

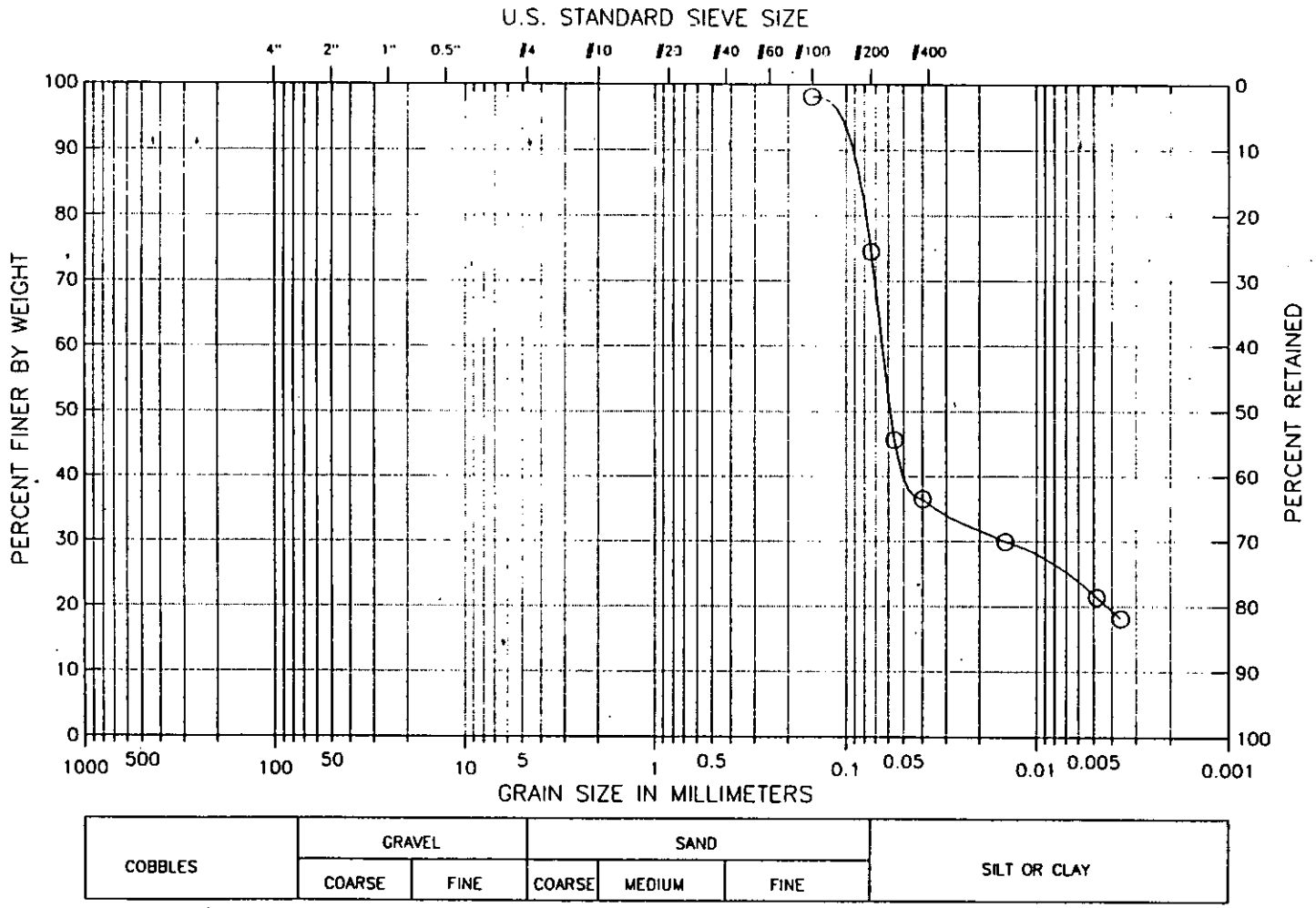


Classification :
(ML) silt with sand
Visual Description :
Oily Waste

Remarks :
Depth 14-15 ft

Figure 17

	Boring No : C4-2 Sample No: ST-3 Tested by : WJO Filename : H18	Project : ARCO / Sinclair Refinery Project No : GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

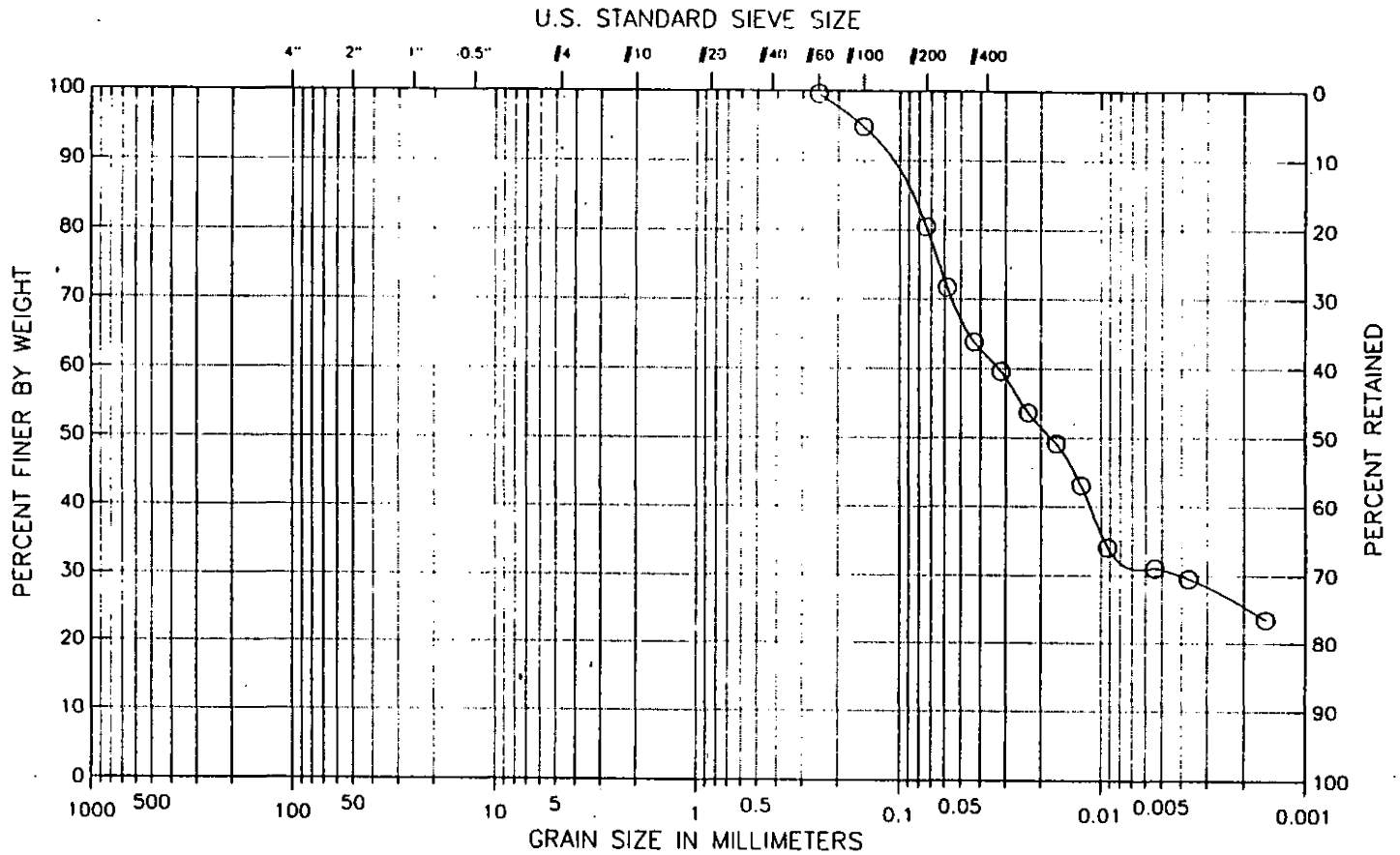


Classification :
(ML) silt with sand
Visual Description :
Oily Waste

Remarks :
Depth 14-15 ft

Figure 18

	Boring No. : C4-2 Sample No: ST-3 Tested by : WJO Filename : H19	Project : ARCO / Sinclair Refinery Project No.: GTX-112 Location: Wellsville, NY Date : Wed Mar 13 1991

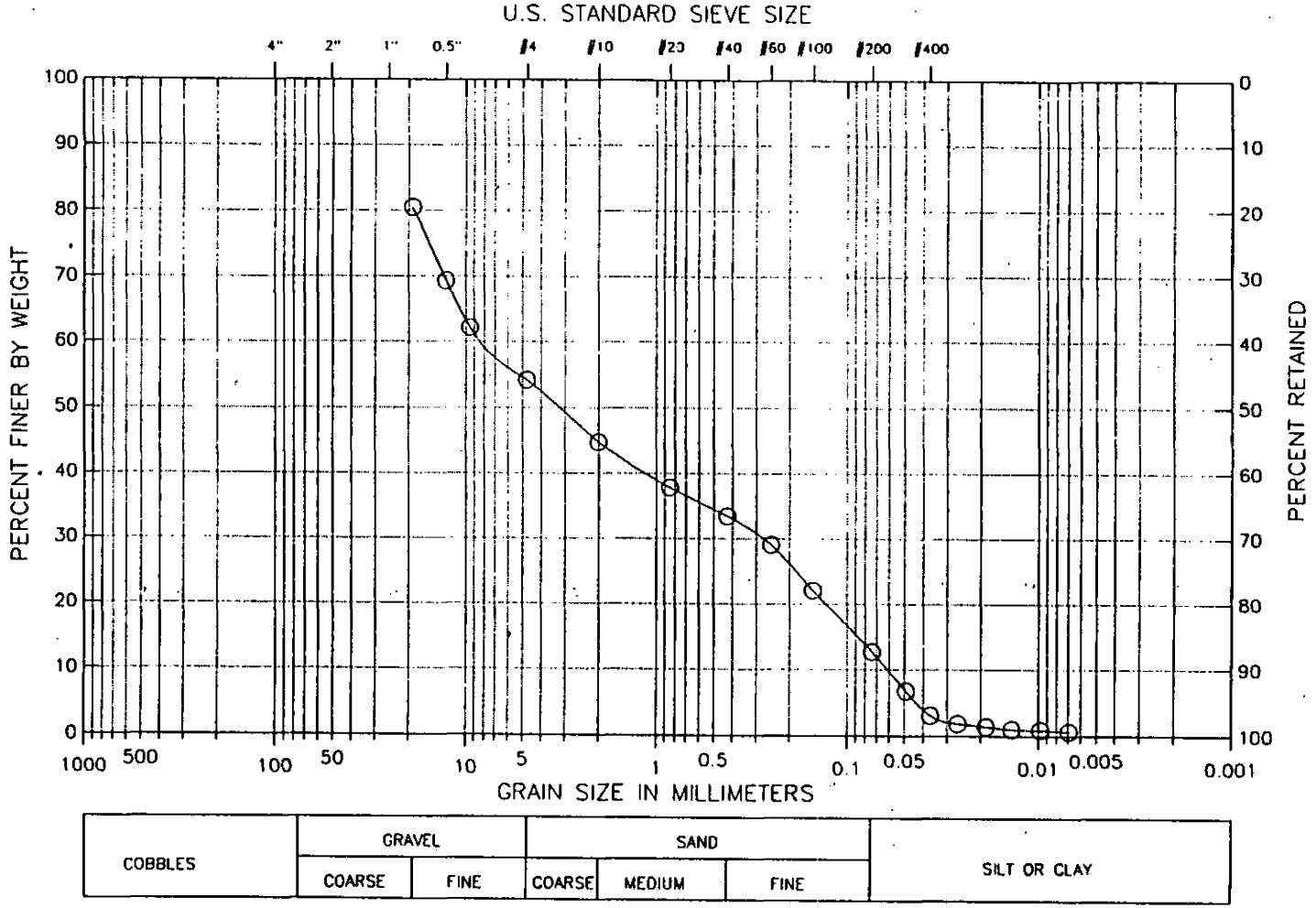


Classification :
(ML) silt with sand
Visual Description :
Oily Waste

Remarks :
Depth 14-15 ft

Figure 19

	Boring No. : C1-1 Sample No: SS-1 Tested by : WJO Filename : H20	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

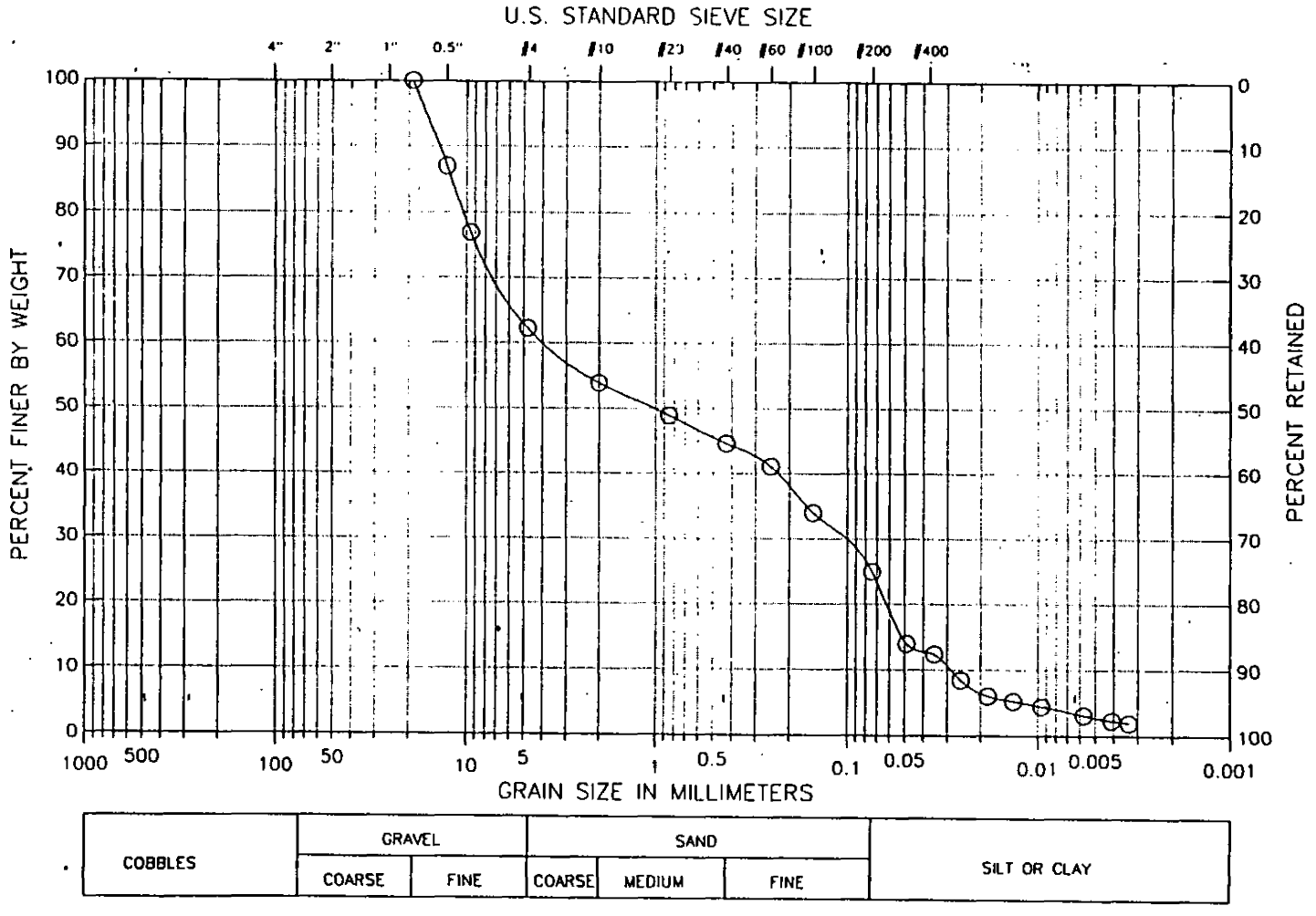


Classification :
(GM) Silty gravel with sand
Visual Description :
Oily Waste

Remarks :
Depth 15.5-17.5 ft

Figure 20

	Boring No. : C1-1 Sample No: SS-2 Tested by : WJO Filename : H21	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

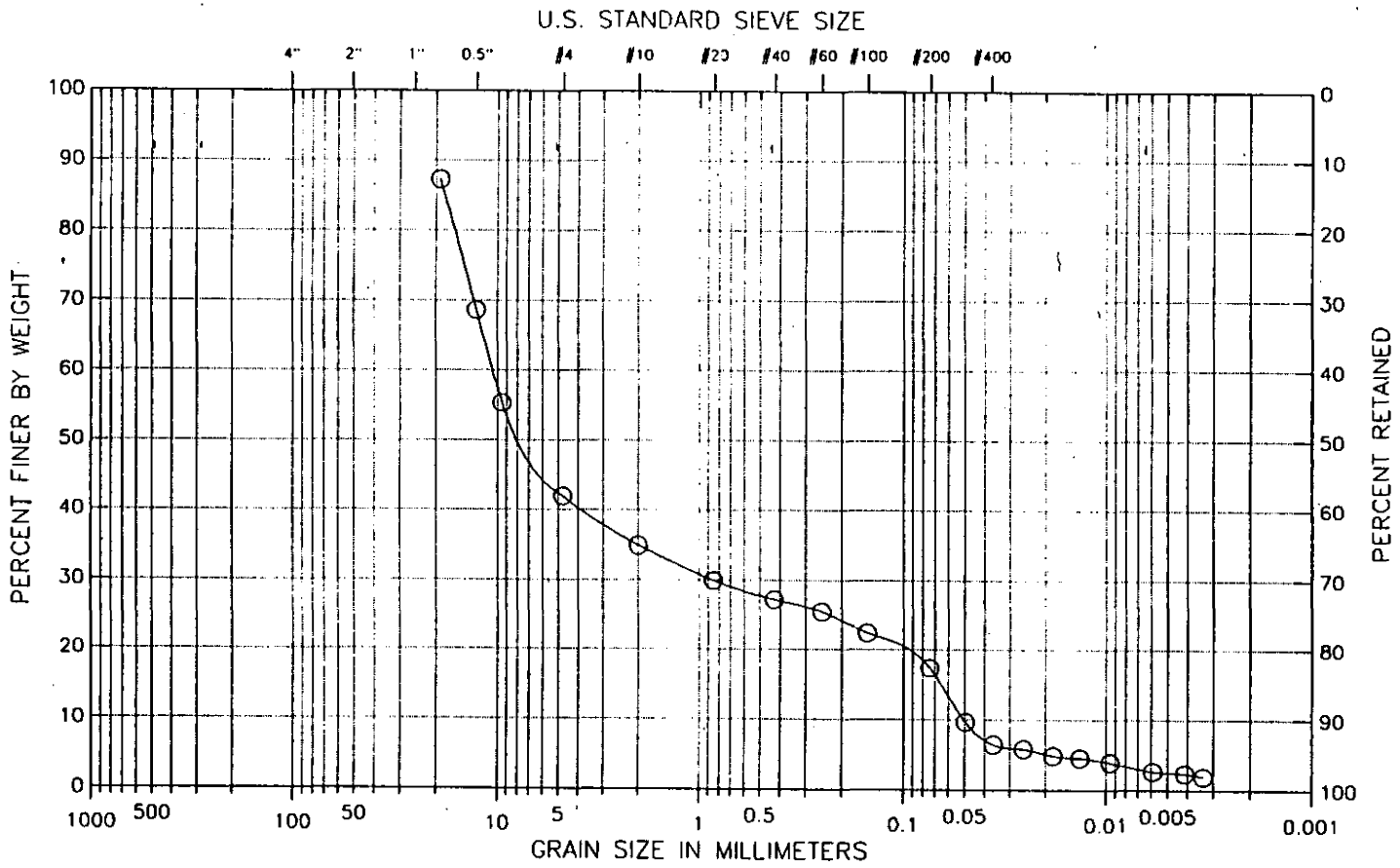


Classification :
(GM) Silty gravel with sand
Visual Description :
Oily Waste

Remarks :
Depth 17-19 ft

Figure 21

	Boring No. : C1-1 Sample No: SS-3 Tested by : WJO Filename : H22	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

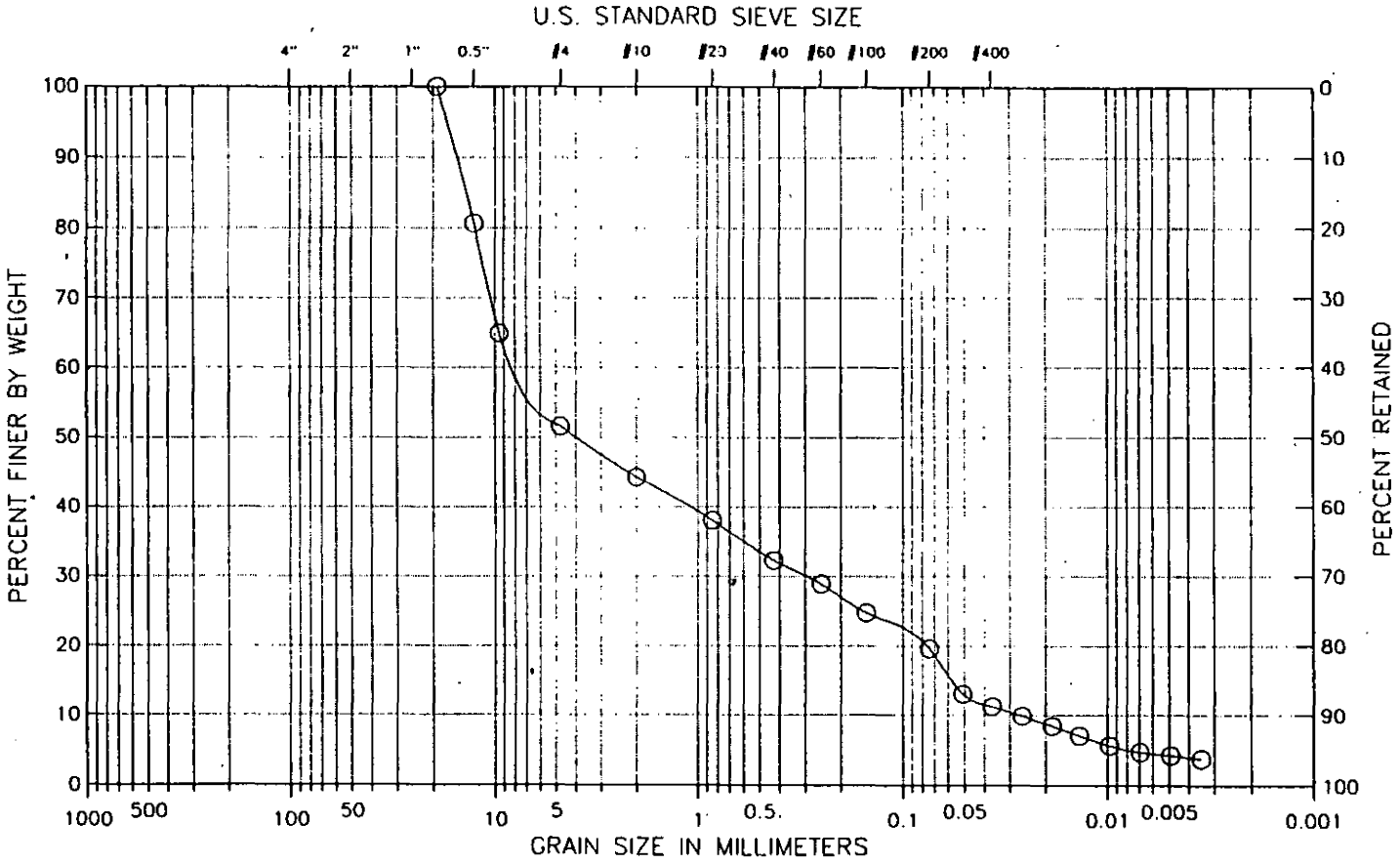


Classification :
(GM) Silty gravel with sand
Visual Description :
Oily Waste

Remarks :
Depth 19.5-20.8 ft

Figure 22

	Boring No. : C2-1 Sample No.: SS-1 Tested by : WJO Filename : H23	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

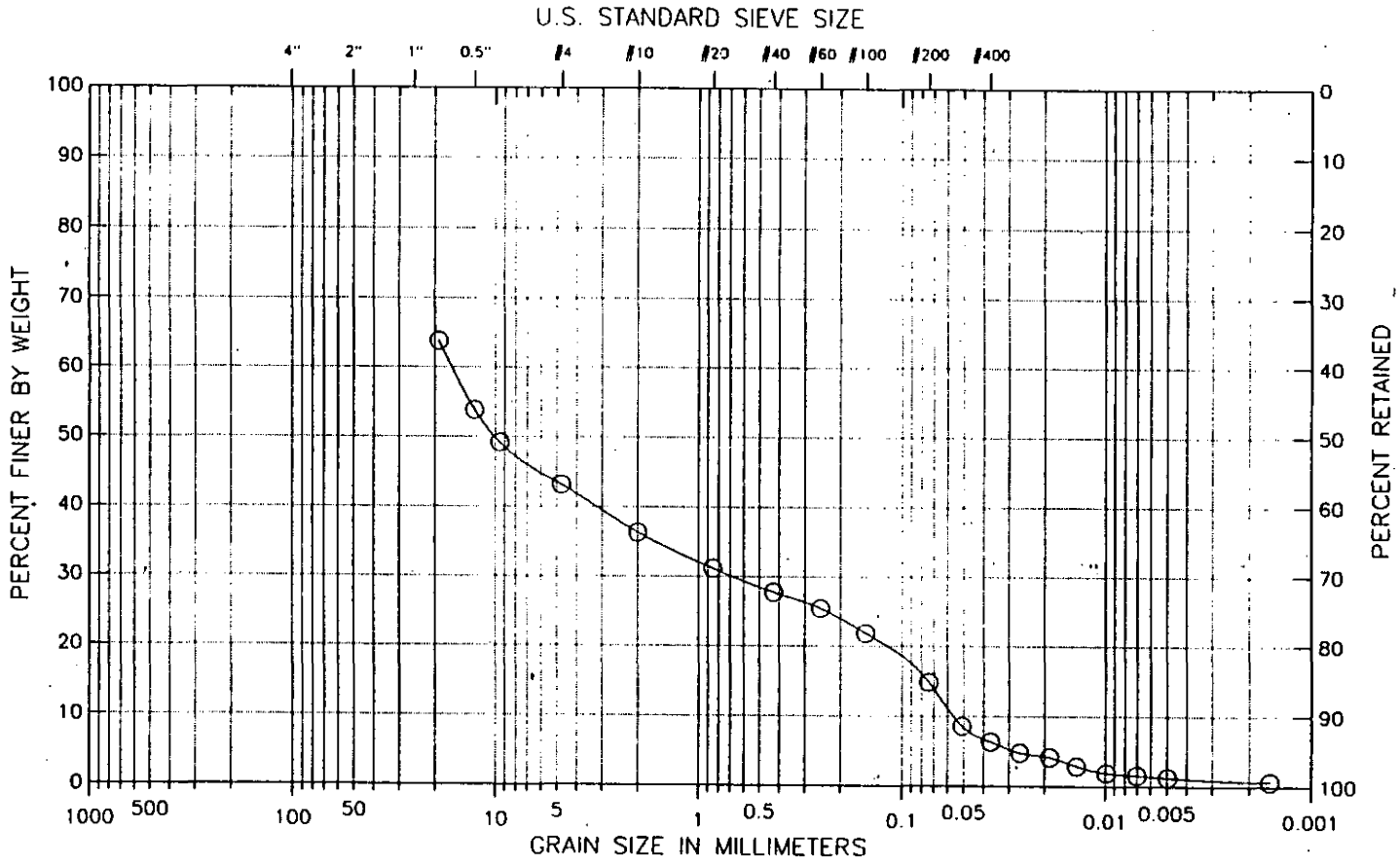


Classification :
(GM) Silty gravel with sand
Visual Description :
Oily Waste

Remarks :
Depth 13-15 ft

Figure 23

	Boring No : C2-1 Sample No: SS-2 Tested by : WJO Filename : H24	Project : ARCO/Sinclair Refinery Project No : GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

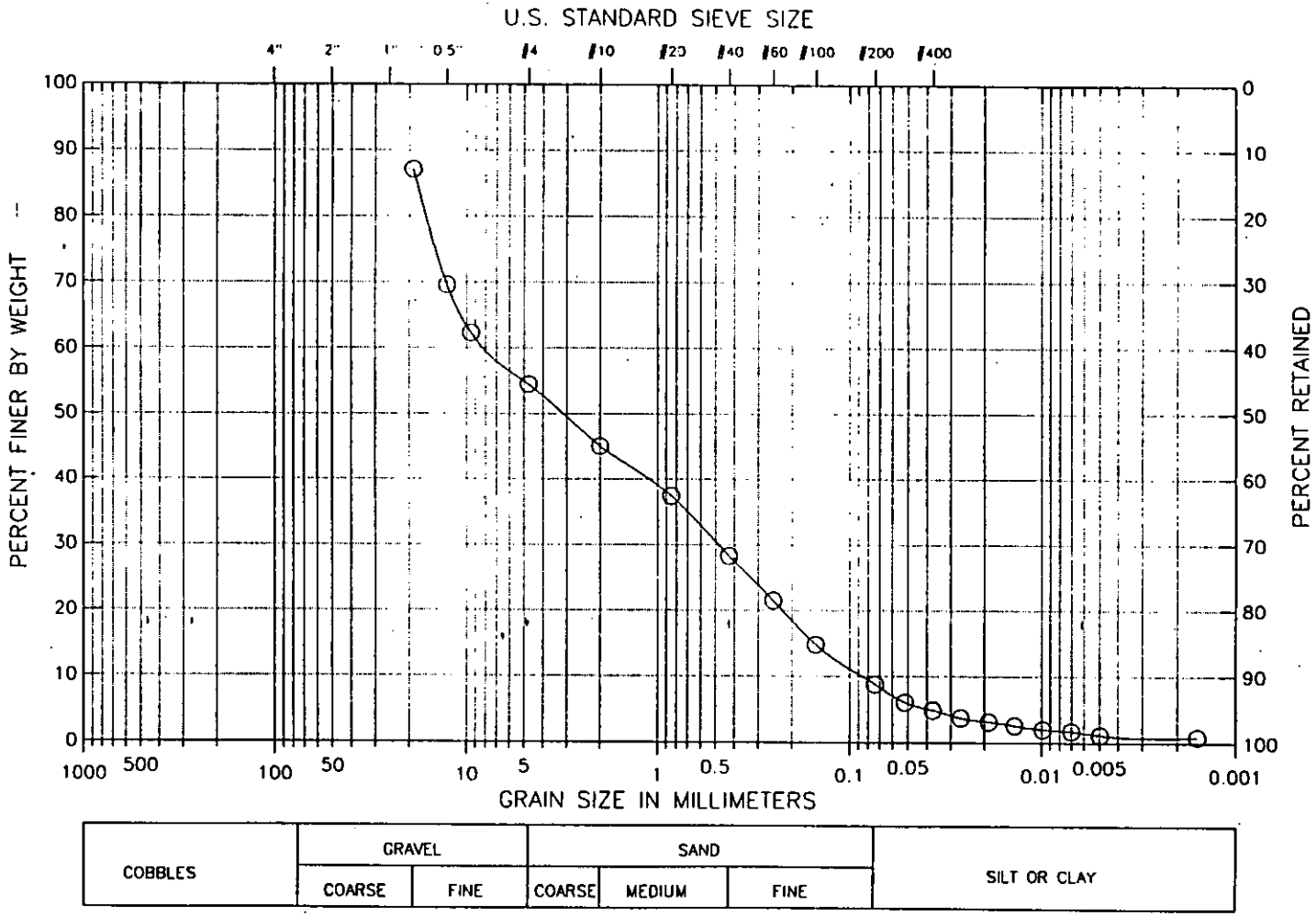


Classification :
(GM) Silty gravel with sand
Visual Description :
Oily Waste

Remarks :
Depth 15-17 ft

Figure 24

	Boring No. : C2-1 Sample No: SS-3 Tested by : WJO Filename : H25	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

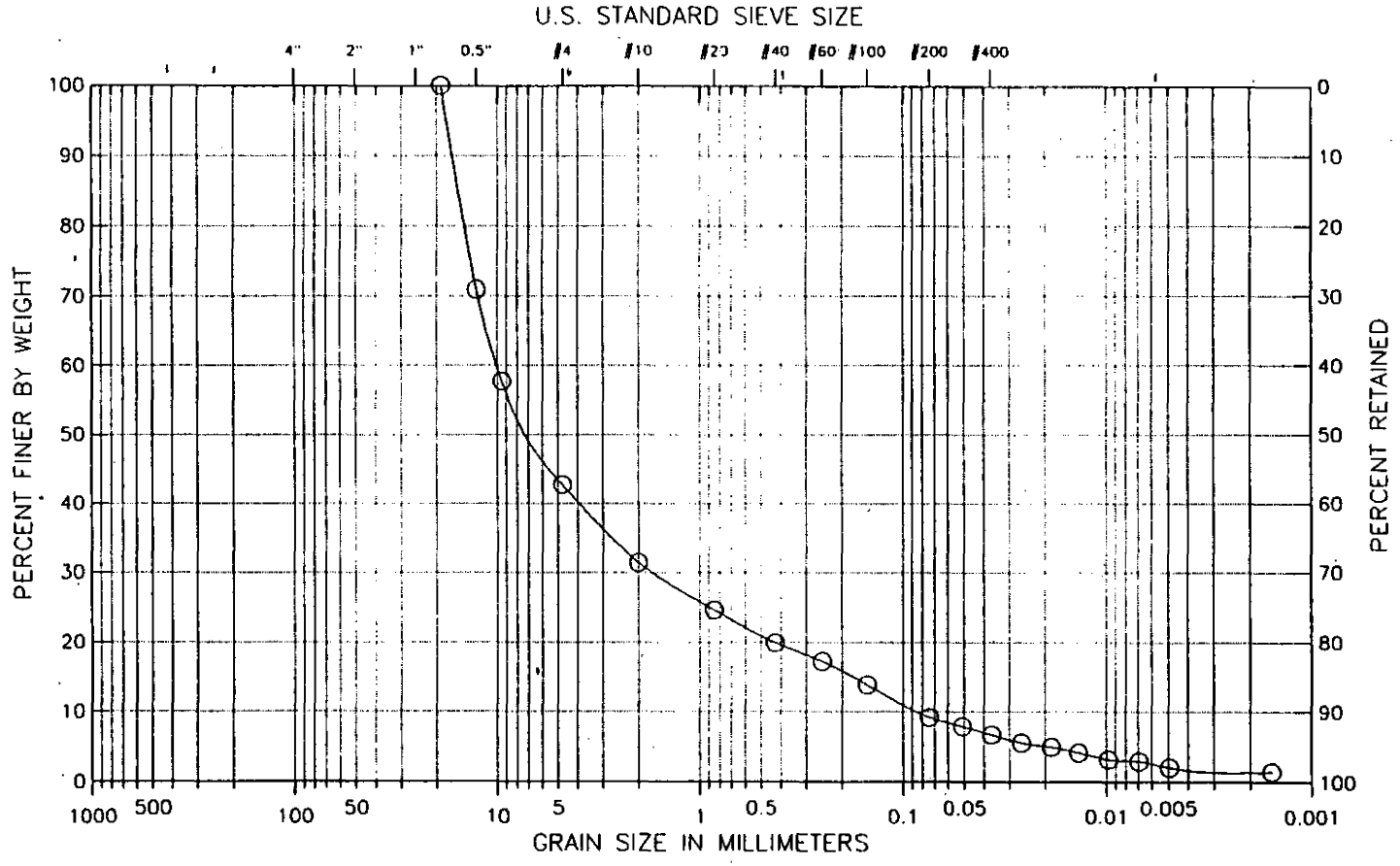


Classification :
(SP-SM) Poorly graded sand with silt and gravel
Visual Description :
Oily Waste

Remarks :
Depth 17-19 ft

Figure 25

	Boring No. : C2-1 Sample No: SS-5 Tested by : WJO Filename : H26	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

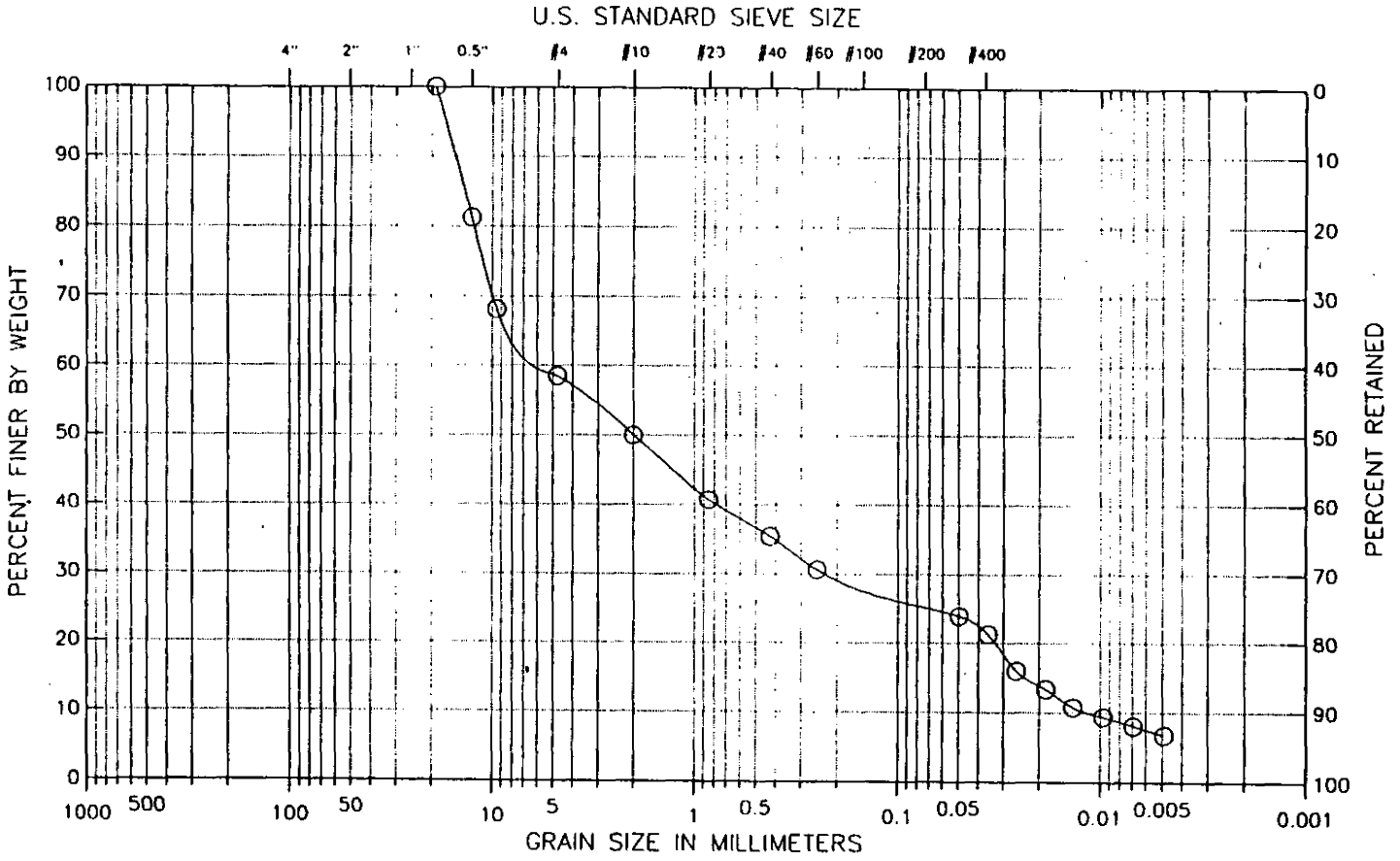


Classification :
(GP-GM) Poorly graded gravel with silt and sand
Visual Description :
Oily Waste

Remarks :
Depth 21-23 ft

Figure 26

	Boring No. : C3-1 Sample No.: SS-1 Tested by : WJO Filename : H27	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

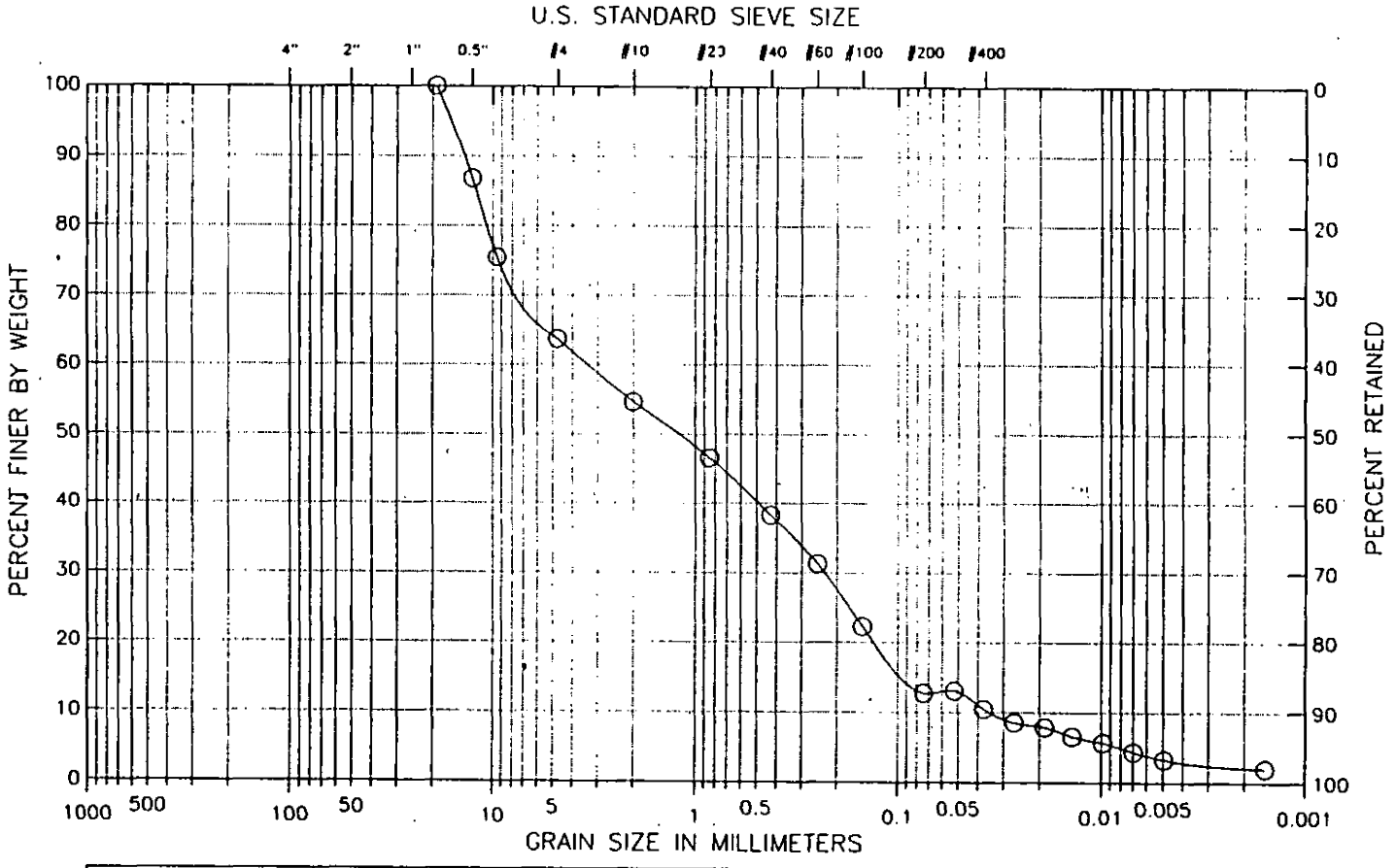


Classification :
()
Visual Description :
Oily Waste

Remarks :
Depth 14-16 ft

Figure 27

	Boring No. : C3-1 Sample No.: SS-2 Tested by : WJO Filename : H28	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

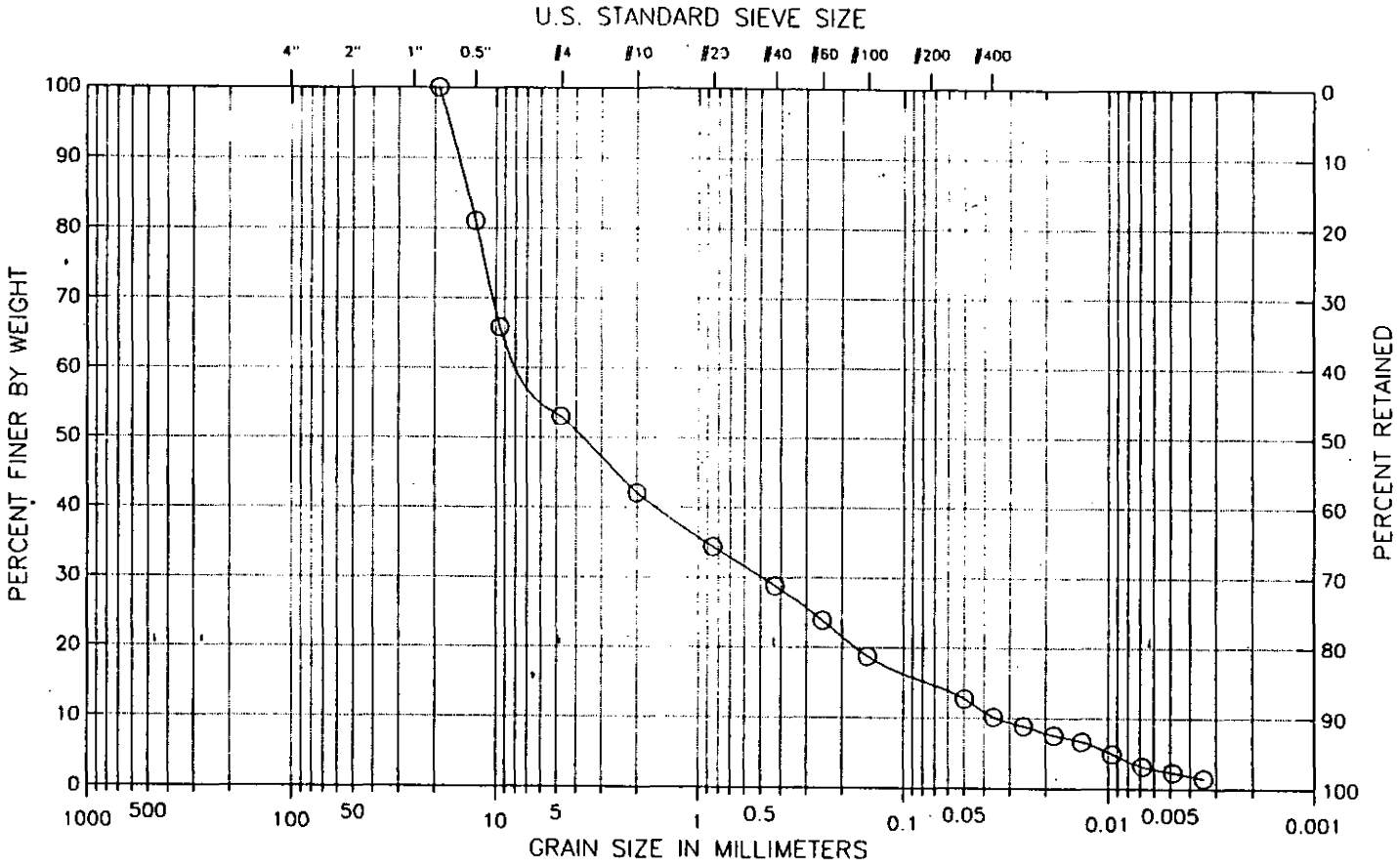


Classification :
(SM) Silty sand with gravel
Visual Description :
Oily Waste

Remarks :
Depth 16-18 ft

Figure 28

	Boring No. : C3-1 Sample No: SS-3 Tested by : WJO Filename : H29	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991

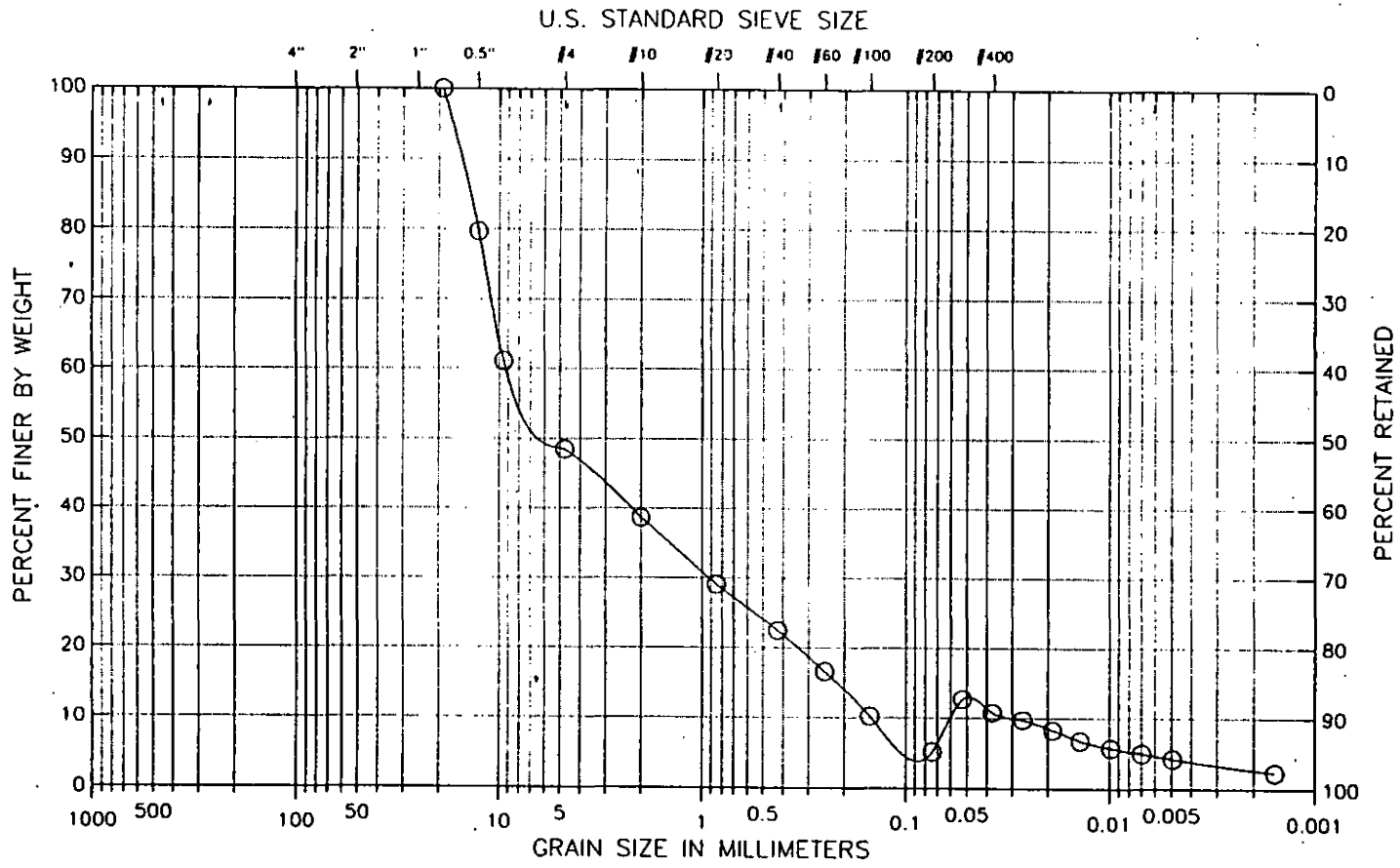


Classification :
()
Visual Description :
Oily Waste

Remarks :
Depth 18-20 ft

Figure 29

	Boring No. : C3-1 Sample No.: SS-4 Tested by : WJO Filename : H30	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991



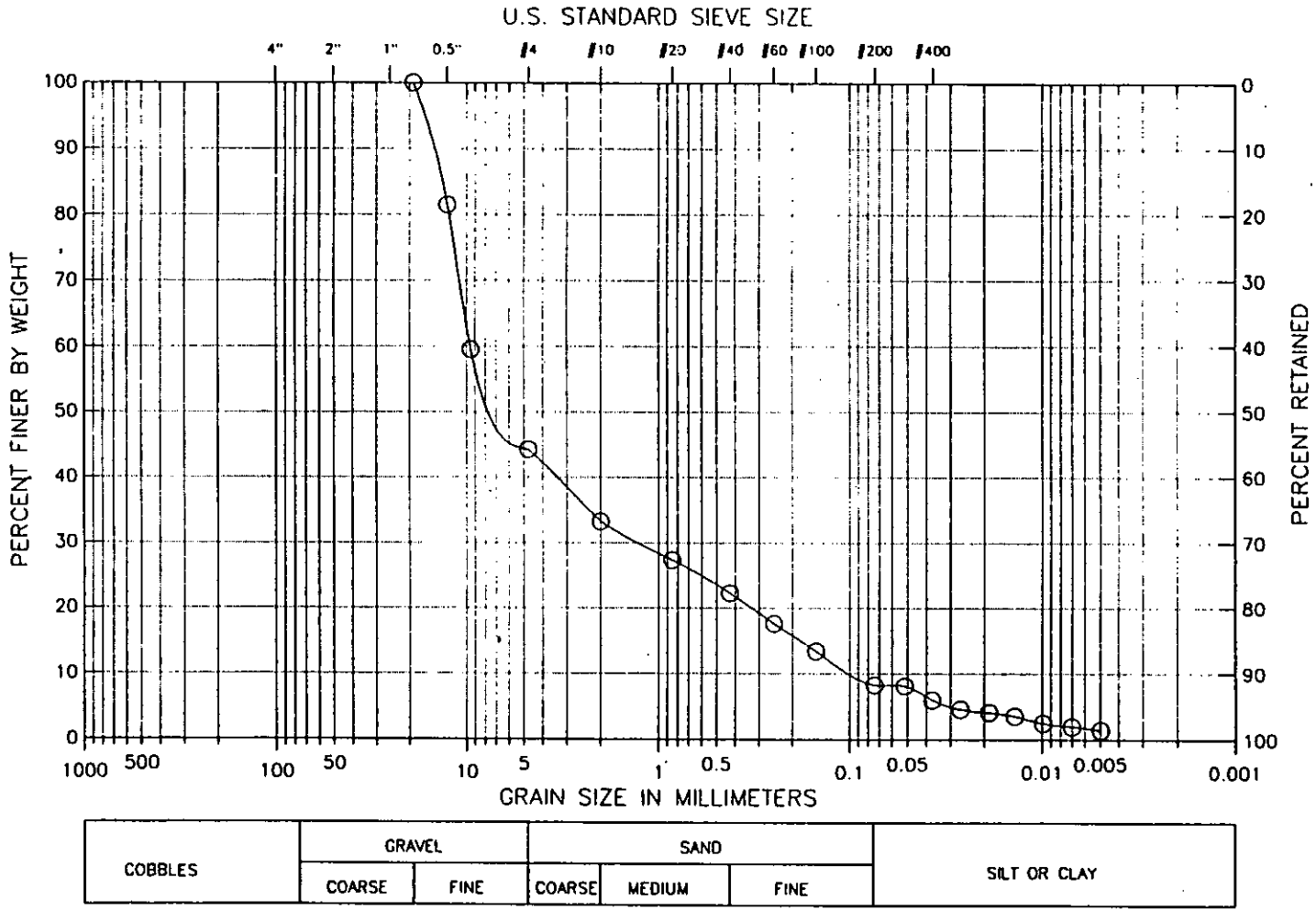
Classification :
(GP-GM) Poorly graded gravel with silt and sand

Visual Description :
Oily Waste

Remarks :
Depth 20-22 ft

Figure 30

	Boring No. : C4-1 Sample No: SS-1 Tested by : WJO Filename : H31	Project : ARCO/Sinclair Refinery Project No : GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991



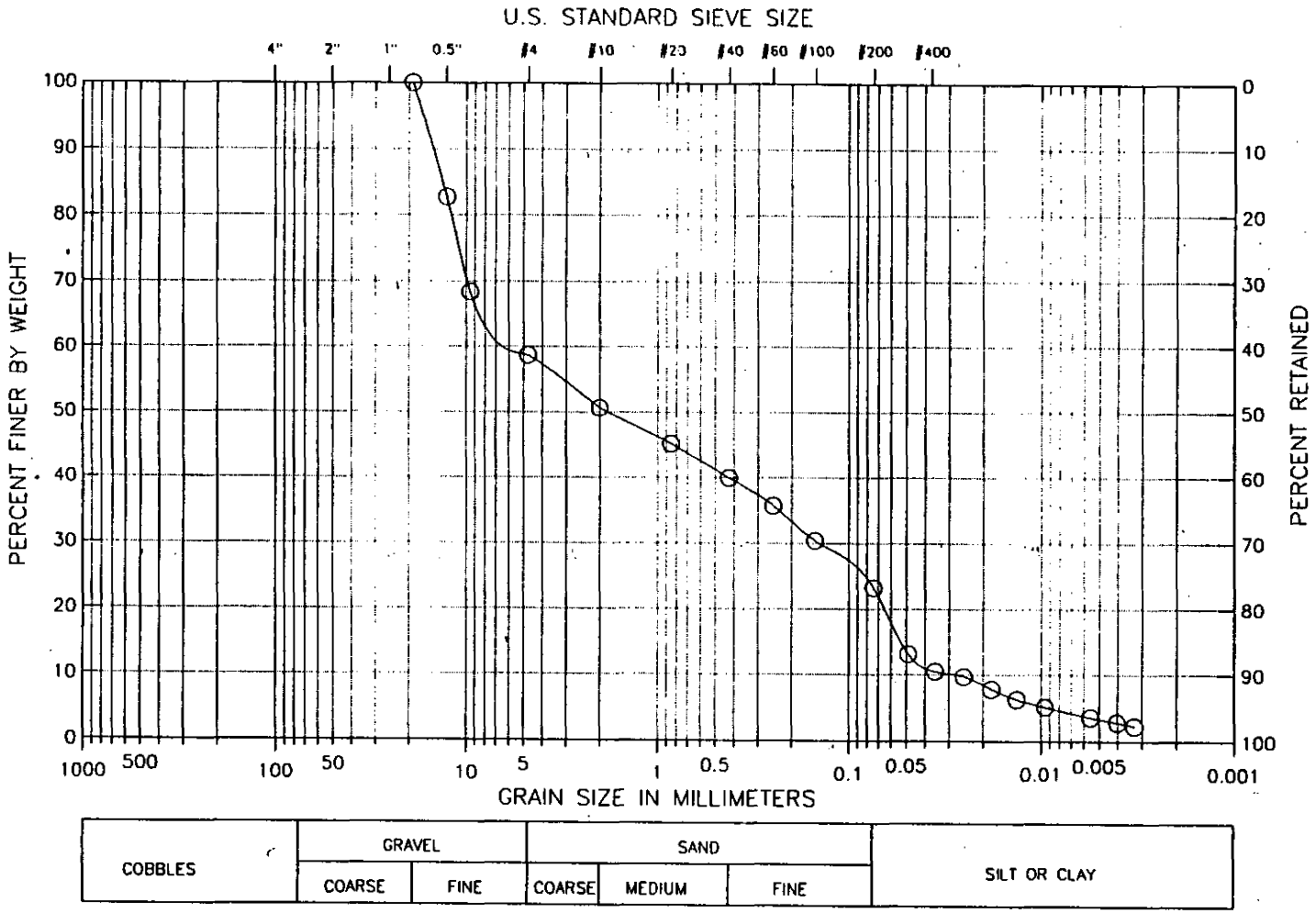
Classification :
(GW-GM) Well-graded gravel with silt and sand

Visual Description :
Oily Waste

Remarks :
Depth 16-18 ft

Figure 31

	Boring No. : C4-1 Sample No: SS-2 Tested by : WJO Filename : H32	Project : ARCO/Sinclair Refinery Project No.: GTX-111 Location: Wellsville, NY Date : Wed Mar 13 1991



Classification :
(GM) Silty gravel with sand
Visual Description :
Oily Waste

Remarks :
Depth 18-20 ft

Figure 32

Appendix D

SOIL BORING LOGS FROM 1984 SITE INVESTIGATION

SMC MARTIN, INC.

BORING NO. MW-2

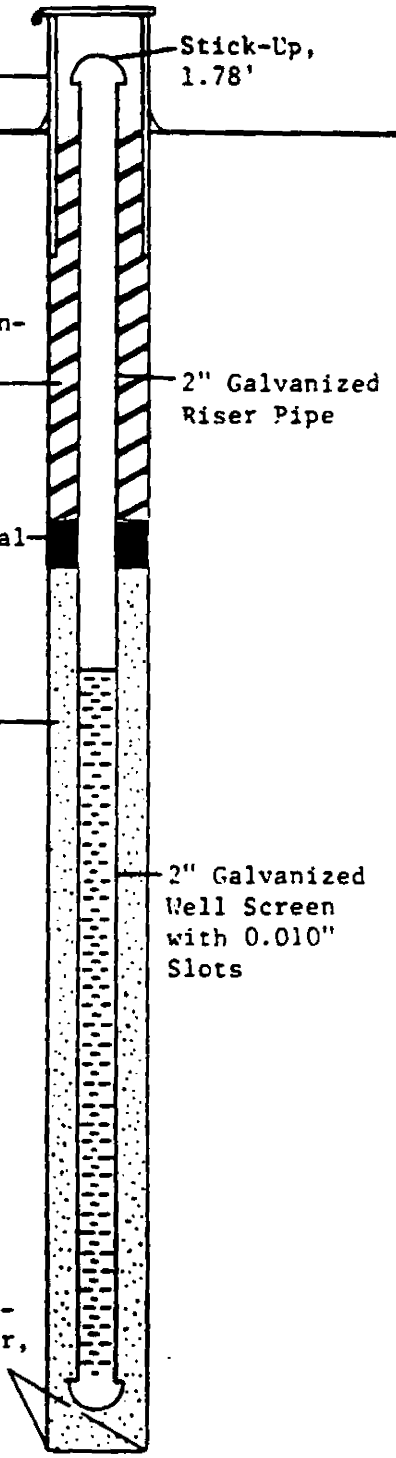
SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 2-1/4" split-barrel sampler

LOCATION N 767, 040
E 675, 264

DEPTH, FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2" PENETRATION
			SURFACE ELEV: 1508.94 ft ms	
			Brown to black SILTY SAND (SM)	
			- silty fine sand to 3'	7
			- tan and dark gray 3'-5'	12
5			- dark gray, brown and black, with organic matter and some gravel below 5'	27
			Dark brown to black SILT with organic matter (ML-MH)	46
10			Brown SAND (SW)	43
			- with trace of silt	
			- with coarse gravel below 11'	77
			Gray and Black SILTY SAND (SM)	37
15			- with organic matter to 15'	
			- with visible oil contamination to 15'	
			- with orange stains below 15'	47
			Gray GRAVELLY SAND (SW)	82
			- with orange stains to 17'	
20			- medium brown, with silt seams 17'-19'	61
			- light to reddish brown below 19'	103
			Brown SANDY SILT (ML)	80
			- with gravel	
25			Brown SILTY CLAY (CL)	34

WELL COMPLETION DETAILS



COMPLETION DEPTH 27 ft
DATE 03/02/84

SMC MARTIN INC.

BORING NO. MW-3

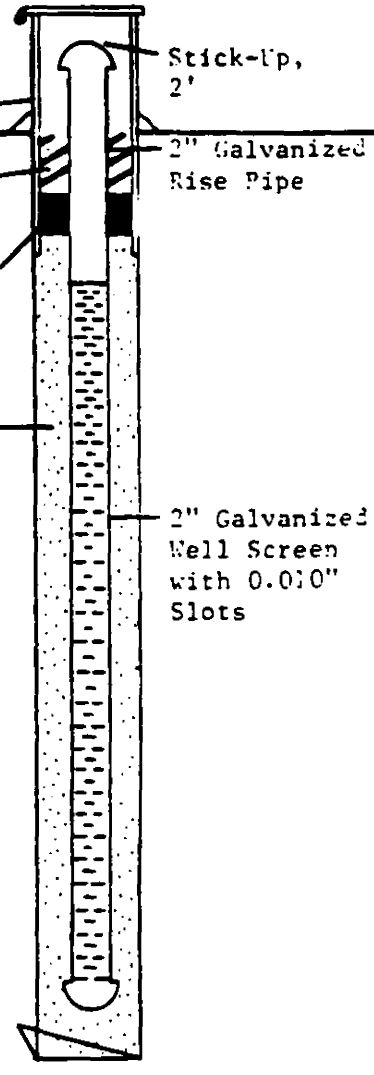
SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 2-1/4" split spoon

LOCATION N 767, 632
E 675, 756

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2' PENETRATION
			SURFACE ELEV: 1498.24 ft msl	
			Brown SANDY SILT (ML)	5
			Brown and tan SANDY SILT (ML) and GRAVEL	67
			- with petrochemical odor and oil sheen	48
5				70
			Interlayered tan SILTY SAND (SM) and SANDY SILT (ML)	108
10			- with gravel-size rock fragments	89
				260
15			- tan and brown below 15'	85
				125
20				
25				

WELL COMPLETION DETAILS



COMPLETION DEPTH 19 ft
DATE 04/28/84

SMC MARTIN INC.

BORING NO. MW-4

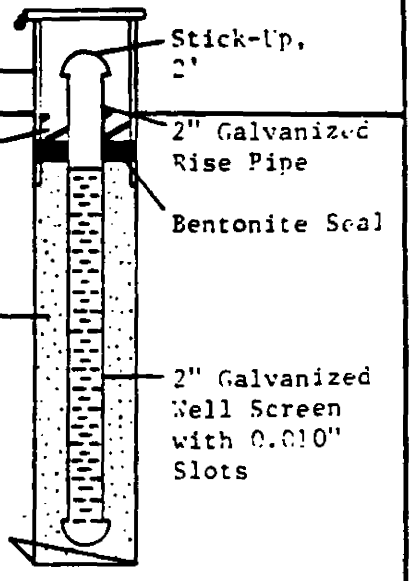
SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 2-1/4" split spoon

LOCATION N 768, 016
E 675, 808

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2" PENETRATION
			SURFACE ELEV: 1497.44 ft msl	
			Tan SILT (ML) - with gravel	5 6
5			Tan SILTY SAND (SM) - with gravel-size rock fragments	93 40 18 26
10				
			Greenish gray SANDY CLAY (CL)	38
15			- with silt pockets and gravel	27 23 19
20			Greenish gray SILTY CLAY (CL)	23 22
25				19 22
				18
30			Gray CLAY (CH)	12 20 18 27 15 14
40				31 15 27 17 11
50				33 24 36 25 20 27 28
60				
70			Gray SILTY CLAY (CL)	30 25 20 39

WELL COMPLETION DETAILS



NOTE: Monitoring Well MW-4 was installed about 8 ft from the sampled soil boring which was grouted at completion

COMPLETION DEPTH 74 ft
DATE 04/27/84

SMC MARTIN INC.

BORING NO. MW-5

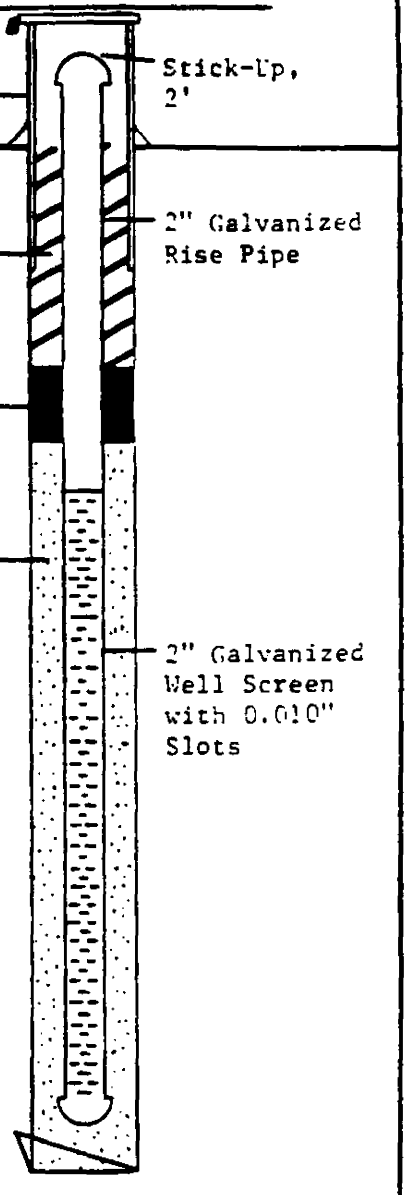
SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 2-1/4" split spoon

LOCATION N 768, 152
E 675, 360

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2' PENETRATION
			SURFACE ELEV: 1499.60 ft msl	
			Brown SILT (ML)	11
			- with black oil stains	
			- with gravel	37
			- tan 4'-6'	20
5			- black, with petrochemical odor below 6'	31
			Black SILTY SAND (SM)	40
			- with oily sheen and clay pockets and gravel	26
10				43
			Tan SANDY SILT (ML)	135
15			- with gravel	235
				245
20				178
25				

WELL COMPLETION DETAILS



COMPLETION DEPTH 21 ft
DATE 04/25/84

SMC MARTIN INC.

BORING NO. MW-6

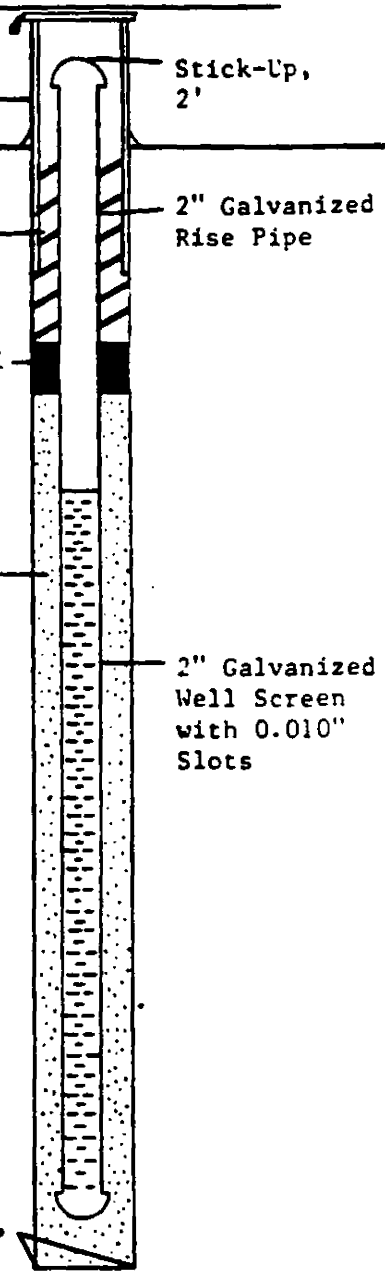
SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 2-1/4" split spoon

LOCATION N 768, 024 E 675, 100

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2 FT PENETRATION
			SURFACE ELEV 1501.34 ft msl	
			Brown GRAVELLY to SANDY SILT (ML)	
				13
				18
5			- with clay pockets at 5'	18
				85
				51
10			- with gravel-size rock fragments below 7'	
				71
			- tan and gray, very gravelly below 13'	106
15				105
				109
20				152
25				

WELL COMPLETION DETAILS



COMPLETION DEPTH 23 ft
DATE 05/23/84

SMC MARTIN INC.

LOG OF BORING NO. AB-34

SINCLAIR REFINERY-LANDFILL AREA
WELLSVILLE, NEW YORK

TYPE: 6-1/4-inch hollow-stem auger
2-1/4-inch split-spoon sampler

LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS FOR 2" PENETRATION
			SURF EL 1502.6 ft msl	
			Dark brown SILT (ML) - w/some clay, roots and twigs - with petrochemical odor	—
			Brownish black GRAVELLY SAND (SP) - w/some silt - with petrochemical odor	79
10			Brown SANDY GRAVEL (GW) - w/petrochemical odor	34
				97
20				156/12
				229/18
30				51
			Brownish gray SILTY CLAY (CL)	23
40				17

COMPLETION DEPTH 42 ft.
DATE 4-25-85

SMC Martin Inc

BORING NO. MW-16

SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE: 7-inch hollow-stem auger
2-1/4-inch split-spoon sampler

LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 1 FT PENETRATION	WELL COMPLETION DETAILS	OVA READING (ppm)
			SURFACE ELEV: 1498.9 ft msl		Protective Casing with Lock; Stick-up 1.99'	
5			Dark brown SILT (ML) - w/roots and some sand	54	Cement/ Bentonite Grout Column; 2" Galvanized Riser Pipe	.4
			Grayish black SILTY SAND (SM)	9		.2
10				75	Bentonite Seal	.4
15			Dark brown GRAVEL (GP) - w/some silt and fine sand - w/petrochemical odor and oily sheen to 20'	77	2" Galvanized Well Screen w/.010" Slots	.2
20			- rock fragments at 21'	53	Bentonite Seal	ND
25			Gray SILTY CLAY (CL)	14	Filter Sand	0.9
30				25		
35					Nominal Borehole Diameter, 7"	

COMPLETION DEPTH 32 ft
DATE 4-22-85

SMC MARTIN INC.

BORING NO. MW-48

SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 7-inch hollow-stem auger
2-1/4-inch split-spoon sampler

LOCATION

DEPTH, ft	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2 PENETRATION	WELL COMPLETION DETAILS	OVA READING (ppm)
			SURFACE ELEV. 1502.5 ft msl		Protective Casing with Lock; Stick-up 2.18'	
5			Dark brown SILTY SAND (SM) - w/some gravel	—	Cement/ Bentonite Grout Column	ND
				18		ND
10			- gray, with visible contamination and clay pockets below 11'	32	2" Galvanized Riser Pipe; Bentonite Seal	0.2
15				56	Filter Sand	0.1
20				100/18"	2" Galvanized Well Screen w/.010" Slots	ND
25				100/15"		ND
30				92	Bentonite Seal	0.3
			Gray SILTY CLAY (CL)		Sand	
35				15		
40				14		
45					Nominal Borehole Diameter, 7"	

COMPLETION DEPTH 42 ft
DATE 04/12/85

SMC MARTIN INC.

BORING NO. MWC-18

SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 6-1/4-inch hollow-stem auger
2-1/4-inch split-spoon sampler

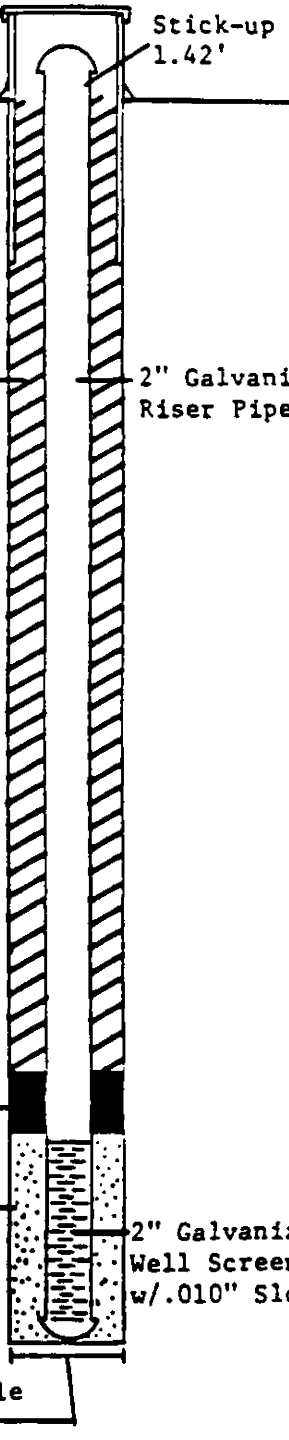
LOCATION

SURFACE ELEV 1509.8 ft msl

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS PER 6" PENETRATION	OVA READING (ppm)
0			FILL: Black clay w/sludge and petrochemical odor w/wood debris to 5'	—	ND
5			FILL: Black and gray sand w/petrochemical odor	6	ND
				4	ND
10			Gray CLAYEY SAND (SC) w/sludge pockets, some silt and petrochemical odor	7	0.4
15			Gray and brown fine SAND (SP) - w/oil stains - w/gravel at 15.5'	149	0.3
20			Gray SANDY GRAVEL (GW) - w/oil stains and sludge pockets to 25'	28/18	0.2
25				92/18	0.2
30			brown and green below 30'	221	ND
35				196	ND
40			Grayish brown SILTY CLAY (CL)	41	ND
				30	ND
50				26	ND
				32	ND
60				28	ND

NOTE SCALE CHANGE

WELL COMPLETION DETAILS



COMPLETION DEPTH 62 ft
DATE 04/15/85

SMC MARTIN INC.

BORING NO. MWD-44

SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 7-1/2-inch hollow-stem auger
2-1/4-inch split-spoon sampler

LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2 1FT PENETRATION	WELL COMPLETION DETAILS	OVA READING (ppm)
			SURFACE ELEV 1497.0 ft msl		Protective Casing with Lock; Stick-up 3.57'	
10			Brown SANDY GRAVEL (GW) - cobbles on surface	36	Cement/ Bentonite Grout Column	ND
				74		ND
			Greenish gray GRAVELLY SAND (SW)	111		ND
20			Greenish gray SILTY CLAY (CL) -possibly varved	39		ND
				22	2" Galvanized Riser Pipe	ND
30				14		ND
			Greenish gray CLAY (CH)	10		ND
40						
				10		ND
50					Bentonite Seal	
				12		ND
60						
				4	Filter Sand	ND
70					2' Galvanized Well Screen w/.010" Slots	
				13		ND
80				10		ND
90					Nominal Borehole Diameter, 7-1/2"	

COMPLETION DEPTH 82 ft
DATE 04/18/85

SMC MARTIN INC.

BORING NO. MWD-45

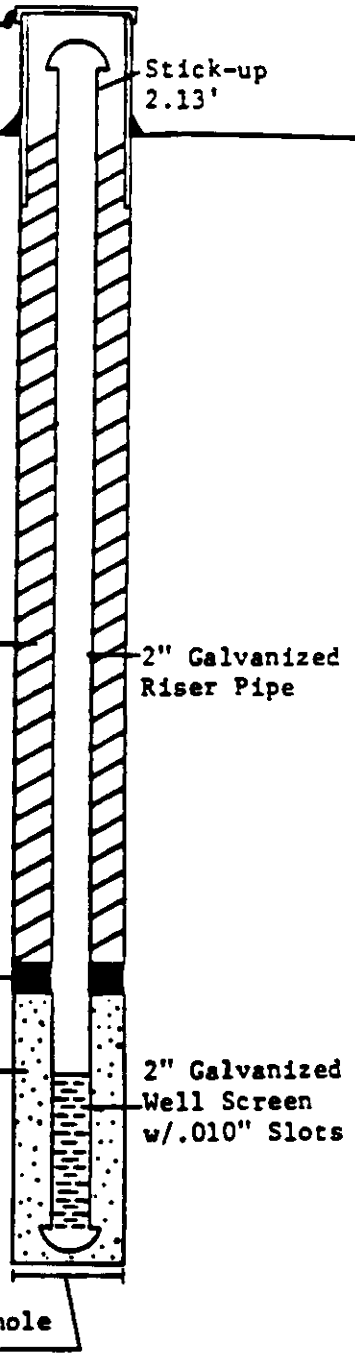
SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 7-1/2-inch hollow-stem auger
2-1/4-inch split-spoon sampler

LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2" PENETRATION	OVA READING (ppm)
			SURFACE ELEV 1499.3 ft msl		
			Brown-gray GRAVELLY SAND (SW)	64	ND
10			- greenish gray w/petrochemical odor 11' - 15'	60	ND
				98	ND
20			Gray SANDY GRAVEL (GW) w/light petrochemical odor	61	ND
			Greenish gray GRAVELLY SAND (SW)	77	ND
30				83	ND
			Greenish gray SILTY CLAY (CL) - possibly varved	27	ND
40				20	ND
				17	ND
50				18	ND
			Greenish gray CLAY (CH)	13	ND
60				13	ND
				21	ND
70				18	ND
				15	ND
80				15	ND
				14	ND
90				19	ND
100					

WELL COMPLETION DETAILS



COMPLETION DEPTH 92 ft
DATE 04/12/85

SMC MARTIN INC.

BORING NO. MWD-43

SINCLAIR REFINERY
WELLSVILLE, NEW YORK

7-inch hollow-stem auger

TYPE 2-1/4-inch split-spoon sampler LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS/FOOT or TYPE OF DRILLING FLUID	WELL COMPLETION DETAILS	OVA READING (ppm)
			Surface Elev 1501.9 ft msl		Protective Casing with Lock; Stick-up 2.25'	
			Brown GRAVELLY SAND (SW)	-		0.1
				36		0.1
10			Greenish Gray SANDY GRAVEL (GW) - w/petrochemical odor below 12'	50		0.1
				78	Cement/ Bentonite Grout Column	0.1
20			Greenish gray SILTY CLAY (CL) - possibly varved	21		ND
				13		ND
30				10	2" Galvanized Riser Pipe	ND
				12		ND
40			Greenish gray CLAY (CH)	11		ND
				13		ND
50				14		ND
				14		ND
60				11	Bentonite Seal	ND
				13	2" Galvanized Well Screen w/.010" Slots	ND
70				12		ND
					Filter Sand	
80				15		ND
					Nominal Borehole Diameter, 7"	

COMPLETION DEPTH 82 ft
DATE 04/16/85

SMC MARTIN INC.

BORING NO. MWC-15

SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE: 7-inch hollow-stem auger
2-1/4-inch split-spoon sampler

LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 1 FT PENETRATION	WELL COMPLETION DETAILS	OVA READING (ppm)
			SURFACE ELEV 1496.1 ft msl		Protective Casing with Lock; Stick-up 2.26'	
0			Dark brown GRAVELLY SAND (SW)	—		ND
			- w/twigs			
5			- slightly clayey below 5'	28		ND
			- brownish gray below 5'		Cement/ Bentonite Grout Column	
10				78		ND
					2" Galvanized Riser Pipe	
15			Greenish brown SANDY GRAVEL (GW)	155		ND
			- w/fines, 16.5' - 20'			
20			- w/coarse grained sand below 20'	128		ND
25			Gray SILTY CLAY (CL)	76	Bentonite Seal	ND
				51		ND
30						
35			Gray CLAY (CH)	24	Filter Sand	ND
					2" Galvanized Well Screen w/.010" Slots	
40				23		ND
45				28		ND
					Nominal Borehole Diameter, 7"	
50						

COMPLETION DEPTH 47 ft
DATE 04/19/85

SMC MARTIN INC.

BORING NO. MW-19

SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE: 7-inch hollow-stem auger
2-1/4-inch split-spoon sampler

LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	BLOWS FOR 2 TIMES 6 INCH PENETRATION	WELL COMPLETION DETAILS	OVA READING (ppm)
			Surface Elev 1496.8 ft msl		Protective Casing with Lock; Stick-up 3.89'	
0			Brown GRAVELLY SAND (SW)	—	Cement/ Bentonite Grout Column	ND
5			- grayish brown, 5.5' - 10'	52	Bentonite Seal; 2" Galvanized Riser Pipe	ND
10				136		ND
15			- becoming sandier below 15'	208/18	Filter Sand; 2" Galvanized Well Screen w/.010 Slots	ND
20			Grayish brown SILTY CLAY (CL)	48	Bentonite Seal	ND
25				25	Filter Sand	ND
30				19		ND
35					Nominal Borehole Diameter, 7"	

COMPLETION DEPTH 32 ft
DATE 04/17/85

SMC MARTIN INC.

BORING NO. MW-13

SINCLAIR REFINERY
WELLSVILLE, NEW YORK

TYPE 7-inch hollow-stem auger
2-1/4-inch split-spoon sampler

LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIALS	HNU/OVA READING (ppm)	WELL COMPLETION DETAILS	OVA READING (ppm)
			Surface Elev 1511.8 ft msl		Protective Casing with Lock; Stick-up 2.14'	
5			FILL: Variable petrochemical waste intermixed with clay	—		ND
				7	Cement/ Bentonite Grout Column	0.3
10				7	2" Galvanized Riser Pipe	1.0
15				12		1.1
20			Brown medium SAND (SP) - w/rock fragments	51		0.3
					Bentonite Seal	
25			Light brown SILTY GRAVEL (GM)	118		ND
					2" Galvanized Well Screen w/.010" Slots	
30				138		ND
			Light brown GRAVELLY SAND (SW)		Filter Sand	
35				259		0.2
					Sand Bentonite Seal	
40				66		ND
			Gray SILTY CLAY (CL)			
45				25	Sand	0.2
50				31	Nominal Borehole Diameter 7"	0.2

COMPLETION DEPTH 52 ft
DATE 04/24/85

SMC MARTIN INC.

LOG OF BOR NO. MWW-17

SINCLAIR REFINERY-LANDFILL AREA
WELLSVILLE, NEW YORK

TYPE 6-1 4-inch hollow-stem auger LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS FOR 2" PENETRATION
			SURF EL 1509.4 ft msl	
5			FILL: Black sludge and petrochemical waste intermixed with soil	
10				
15				
20				
25				

COMPLETION DEPTH 13ft
DATE: 4-12-85

SMC Martin Inc

LOG OF BORING NO. MWW-12

SINCLAIR REFINERY-LANDFILL AREA
WELLSVILLE, NEW YORK

TYPE 6-1/4-inch hollow-stem auger LOCATION

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS FOR 2' PENETRATION
			SURF EL 1512.2 ft msl	
			FILL: Blackish brown sludge and petrochemical waste intermixed with soil	
5				
			- wet gelatinous waste at 8'	
10				
15				
20				
25				

COMPLETION DEPTH 15 ft
DATE 4-25-85

SMC Martin Inc

Appendix E

SOIL BORING LOGS FROM 1991 SITE INVESTIGATION
FOR CLAY LAYER VERIFICATION

EBASCO SERVICES, INC.

Ebasco Services, Inc.
LOG OF BORING

Project:Sinclair Refinery Site
Location:Wellsville, NY.
Project Number:1088.340

Boring Number: SW1
Date Started: 5/23/91
Date Completed: 5/29/91
Field Geologist: White/Pennifill
Driller: Empire
Sampling Method: 2" carbon split spoon/Shelby tube
Drilling Method: 4.25" ID hollow stem auger
Elevation: 1499.3
GW Depth: 6.4 feet

Sample ID	Depth (feet)	Blows per 6"	Recover (in.)	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
	1								
	2								
	3								
	4					Augered to 8 feet.			
	5								
	6								
	7								
	8								
	9	5 8 11	9		GW	Gray GRAVEL and SAND; some clay. Gravel up to 4" diameter. 4" layer of gray silty CLAY; little sand.	0755	5/23	Cobbles in cuttings up to 4"in length. No oil sheen.
	10	12							
	11								
	12								
	13								
	14								
	15					Augered to 18 feet.			
	16								
	17								
	18								
	19	19 17	20		GW	Grayish brown GRAVEL; some sand; little silt and clay.	0815	5/23	Auger sounds like on cobbles.No cuttings. HNu=NAB No oil sheen.
	20	16 17							
	21								
	22								
	23								
	24					Augered to 28 feet.			
	25								
	26								
	27								
	28								

Notes: NAB=not above background.

Ebasco Services, Inc.
LOG OF BORING

Project: Sinclair Refinery Site
Location: Wellsville, NY.
Project Number: 1088.340

Boring Number: SW1
Date Started: 5/23/91
Date Completed: 5/29/91
Field Geologist: White/Pennifill
Driller: Empire
Sampling Method: 2" carbon split spoon/Shelby tube
Drilling Method: 4.25" ID hollow stem auger
Elevation: 1499.3
GW Depth: 6.4 feet

Sample ID	Depth (feet)	Blows per 6"	Recover (in.)	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
	29	12 19 17	12		GW	Grayish brown GRAVEL; some sand; trace silt and clay. Gravel up to 1.5" diameter, appears to be cut by spoon.	0847	5/23	No oil sheen.
	30	17 6							
	31	6 7	8		GW/SW	Brown SAND; some gravel; little silt and clay.	1324	5/23	
	32	4 8			GW	0-12" Brown GRAVEL; some sand; little silt and clay.			
	33	17 14	18				1340	5/23	
	34	13 11			CL/ML	12-18" Grey silty CLAY (top 3" slighty brown).			
	35	13 18	11			Gray CLAY; some silt. No fractures or sand zones observed in clay.	1358	5/23	
	36	21							
	37								
	38				CL/ML	Same as above.	0830	5/24	3" Shelby tube. (36.5'-39')
	39								
	40								
	41				CL/ML	Same as above.	0700	5/29	2" Shelby tube. (40'-42')
	42								
	43								
	44					Total depth = 42 feet.			
	45								
	46								
	47								
	48								
	49								
	50								
	51								
	52								
	53								
	54								
	55								
	56								

Notes: Borehole grouted after drilling.

Ebasco Services, Inc.
LOG OF BORING

Project:Sinclair Refinery Site
Location:Wellsville, NY.
Project Number:1088.340

Boring Number: SW2
Date Started: 5/24/91
Date Completed: 5/30/91
Field Geologist: White/Pennifill
Driller: Empire
Sampling Method: 2" carbon split spoon/Shelby tube
Drilling Method: 4.25" ID hollow stem auger
Elevation: 1499.4
GW Depth: 7.5'

Sample ID	Depth (feet)	Blows per 6"	Recover (in.)	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
	1								
	2								
	3								
	4					Augered to 8 feet.			
	5								
	6								
	7								
	8								
	9	13 17 18	0		-	Cobble in mouth of spoon.	1333	5/24	Oil sheen.
	10	12 22							
	11	19 25	14		SW/GW	Dark brown SAND and GRAVEL; some silt; sheen.	1343	5/24	Oil sheen.
	12	27							
	13				-				
	14								
	15					Augered to 18 feet.			
	16								
	17								
	18								
	19	22 27 30	18		SW/GW	Brown SAND and GRAVEL; trace silt and clay; Gravel up to 2" dia.	1245	5/28	Oil staining.
	20	23							
	21				-				
	22				-				
	23								
	24					Augered to 28 feet.			
	25								
	26								
	27								
	28								

Notes: Borehole grouted after drilling.

Ebasco Services, Inc.
LOG OF BORING

Project: Sinclair Refinery Site
Location: Wellsville, NY.
Project Number: 1088.340

Boring Number: SW2
Date Started: 5/24/91
Date Completed: 5/30/91
Field Geologist: White/Pennifill
Driller: Empire
Sampling Method: 2" carbon split spoon/Shelby tube
Drilling Method: 4.25" ID hollow stem auger
Elevation: 1498.4
GW Depth: 7.5'

Sample ID	Depth (feet)	Blows per 6"	Recover (in.)	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
		30			GW/SW	Gray SAND; some gravel; trace silt;			
	29	6	24			Oil stained.	1310	5/28	
		8			CL	Gray silty CLAY. No brown layers,			
	30	9				no joints.			
		5							
	31	6	8			Same as above. Possible parting but	1322	5/28	
		8				clay soft; difficult to tell if			
	32	8				parting is real.			
	33	—	6				1400	5/28	3" Shelby tube. (32' - 34')
	34								
	35						1046	5/30	2" Shelby tube (35' - 37')
	36								
	37								
		2							
	38	4	8		CL	Gray silty CLAY. One piece of gravel	1109	5/30	
		8				about 1" diameter in sample.			
	39	5							
	40					Total depth = 39 feet.			
	41								
	42								
	43								
	44								
	45								
	46								
	47								
	48								
	49								
	50								
	51								
	52								
	53								
	54								
	55								
	56								

Notes: Borehole grouted after drilling.

Ebasco Services, Inc.
LOG OF BORING

Project: Sinclair Refinery Site
Location: Wellsville, NY.
Project Number: 1088.340

Boring Number: SW3
Date Started: 5/29/91
Date Completed: 5/30/91
Field Geologist: R. Pennifill
Driller: Empire
Sampling Method: 2" split spoon + 3" Shelby tube
Drilling Method: HSA
Elevation: 1497.1
GW Depth: Not measured

Sample ID	Depth (feet)	Blows per 6"	Recover (in.)	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9	18 23	20		GW	Brown GRAVEL, some sand, little silt and clay	1/07	5/29	No oil.
	10	23 19							
	11								
	12								
	13								
	14								Cobbles in cuttings up to 3" diameter.
	15								
	16								
	17								
	18								
	19	50 67	14		GW	Brown GRAVEL, some sand, trace silt. Gravel up to 2" length in spoon.			
	20	57 33							
	21								
	22								
	23								
	24								
	25								
	26								
	27								
	28								

Notes: Borehole grouted after drilling.

Ebasco Services, Inc.
LOG OF BORING

Project: Sinclair Refinery Site
Location: Wellsville, NY.
Project Number: 1088.340

Boring Number: SW3
Date Started: 5/29/91
Date Completed: 5/30/91
Field Geologist: R. Pennifill
Driller: Empire
Sampling Method: 2" split spoon + 3" Shelby tube
Drilling Method: HSA
Elevation: 1497.1
GW Depth: Not measured

Sample ID	Depth (feet)	Blows per 6"	Recover (in.)	Profile	USCS Class	Material Description	Collection Time	Collection Date	Comments
		6			GW	Gray silty CLAY. Top of sample some			After using 2"
	29	5	0			(1"- 2") gravel. Based on sample and	1424	5/29	spoon, resampled
		7			CL/ML	feel of drilling, interface @ about			with 3" spoon.
	30	7				28.5 feet.			
							1500	5/29	Shelby tube
	31		24						(30' - 32')
	32								
		3							
	33	3	24			Same. Two 0.1" thick silty layers			
		5				observed. 0.25" layering visible in			
	34	5				clay.			
	35						0800	5/30	3" Shelby tube
									(34' - 36')
	36								
		4							
	37	4	24			Same. No layering	0815	5/30	
		6							
	38	8							
	39					Total depth = 38 feet.			
	40								
	41								
	42								
	43								
	44								
	45								
	46								
	47								
	48								
	49								
	50								
	51								
	52								
	53								
	54								
	55								
	56								

Notes: Borehole grouted after drilling.

Sheet: 2 of 2

APPENDIX F

LABORATORY ANALYTICAL RESULTS

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OIL

I Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) SOIL Lab Sample ID: 50698A

Sample wt/vol: 4.0 (g/mL) G Lab File ID: Y7975

Level: (low/med) MED Date Received: 05/24/91

% Moisture: not dec. ____ Date Analyzed: 06/03/91

Column: (pack/cap) CAP Dilution Factor: 200

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
74-87-3	Chloromethane	250000	U
74-83-9	Bromomethane	250000	U
75-01-4	Vinyl chloride	250000	U
75-00-3	Chloroethane	250000	U
75-09-2	Methylene chloride	160000	
67-64-1	Acetone	250000	U
75-15-0	Carbon disulfide	120000	U
75-35-4	1,1-Dichloroethene	120000	U
75-34-3	1,1-Dichloroethane	120000	U
540-59-0	1,2-Dichloroethene (total)	120000	U
67-66-3	Chloroform	120000	U
107-06-2	1,2-Dichloroethane	120000	U
78-93-3	2-Butanone	180000	J
71-55-6	1,1,1-Trichloroethane	120000	U
56-23-5	Carbon tetrachloride	120000	U
108-05-4	Vinyl acetate	250000	U
75-27-4	Bromodichloromethane	120000	U
78-87-5	1,2-Dichloropropane	120000	U
10061-01-5	cis-1,3-Dichloropropene	120000	U
79-01-6	Trichloroethene	120000	U
124-48-1	Dibromochloromethane	120000	U
79-00-5	1,1,2-Trichloroethane	120000	U
71-43-2	Benzene	610000	
10061-02-6	Trans-1,3-dichloropropene	120000	U
75-25-2	Bromoform	120000	U
108-10-1	4-Methyl-2-pentanone	250000	U
591-78-6	2-Hexanone	250000	U
127-18-4	Tetrachloroethene	120000	U
79-34-5	1,1,2,2-Tetrachloroethane	120000	U
108-88-3	Toluene	410000	
108-90-7	Chlorobenzene	120000	U
100-41-4	Ethylbenzene	1400000	
100-42-5	Styrene	120000	U
1330-20-7	Total xylenes	12000000	E

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OIL

I Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) SOIL Lab Sample ID: 50698A

Sample wt/vol: 4.0 (g/mL) G Lab File ID: Y7975

Level: (low/med) MED Date Received: 05/24/91

% Moisture: not dec. ____ Date Analyzed: 06/03/91

Column (pack/cap) CAP Dilution Factor: 200

Number TICs found: 11

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	96-14-0	PENTANE, 3-METHYL-	8.79	4200000	J
2.	110-82-7	CYCLOHEXANE (DOT)	11.29	3300000	J
3.		UNKNOWN CYCLIC HYDROCARBON	13.05	9900000	J
4.		UNKNOWN HYDROCARBON	13.45	6300000	J
5.		UNKNOWN HYDROCARBON	13.79	4100000	J
6.	111-65-9	OCTANE (DOT)	14.59	6800000	J
7.		UNKNOWN HYDROCARBON	15.75	2200000	J
8.		UNKNOWN HYDROCARBON	16.70	5200000	J
9.		UNKNOWN HYDROCARBON	17.92	8600000	J
10.		UNKNOWN HYDROCARBON	19.07	2200000	J
11.		UNKNOWN SUB BENZENE	22.25	3200000	J

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-4A

Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) WATER Lab Sample ID: 50697B

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: Y7944

Level: (low/med) LOW Date Received: 05/24/91

% Moisture: not dec. ____ Date Analyzed: 06/01/91

Column: (pack/cap) CAP Dilution Factor: 50

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	500	U
74-83-9	Bromomethane	500	U
75-01-4	Vinyl chloride	500	U
75-00-3	Chloroethane	500	U
75-09-2	Methylene chloride	250	U
67-64-1	Acetone	460	J
75-15-0	Carbon disulfide	250	U
75-35-4	1,1-Dichloroethene	250	U
75-34-3	1,1-Dichloroethane	250	U
540-59-0	1,2-Dichloroethene (total)	250	U
67-66-3	Chloroform	250	U
107-06-2	1,2-Dichloroethane	250	U
78-93-3	2-Butanone	500	U
71-55-6	1,1,1-Trichloroethane	250	U
56-23-5	Carbon tetrachloride	250	U
108-05-4	Vinyl acetate	500	U
75-27-4	Bromodichloromethane	250	U
78-87-5	1,2-Dichloropropane	250	U
10061-01-5	cis-1,3-Dichloropropene	250	U
79-01-6	Trichloroethene	250	U
124-48-1	Dibromochloromethane	250	U
79-00-5	1,1,2-Trichloroethane	250	U
71-43-2	Benzene	3500	
10061-02-6	Trans-1,3-dichloropropene	250	U
75-25-2	Bromoform	250	U
108-10-1	4-Methyl-2-pentanone	500	U
591-78-6	2-Hexanone	500	U
127-18-4	Tetrachloroethene	250	U
79-34-5	1,1,2,2-Tetrachloroethane	250	U
108-88-3	Toluene	290	
108-90-7	Chlorobenzene	250	U
100-41-4	Ethylbenzene	590	
100-42-5	Styrene	250	U
1330-20-7	Total xylenes	6000	

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MW-4A

Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) WATER Lab Sample ID: 50697B

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: Y7944

Level: (low/med) LOW Date Received: 05/24/91

% Moisture: not dec. ____ Date Analyzed: 06/01/91

Column (pack/cap) CAP Dilution Factor: 50

Number TICs found: 10

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	108-87-2	CYCLOHEXANE, METHYL-	13.19	1000	J
2.		UNKNOWN HYDROCARBON	13.57	400	J
3.	111-65-9	OCTANE (DOT)	14.70	540	J
4.		UNKNOWN HYDROCARBON	16.80	590	J
5.		UNKNOWN HYDROCARBON	17.10	440	J
6.		UNKNOWN HYDROCARBON	18.02	1100	J
7.		UNKNOWN HYDROCARBON	20.14	550	J
8.		UNKNOWN HYDROCARBON	20.50	400	J
9.		UNKNOWN SUB BENZENE	22.17	1000	J
10.		UNKNOWN SUB BENZENE	22.34	1100	J

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OIL-DL

1 Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) SOIL Lab Sample ID: 50698A-DL

Sample wt/vol: 4.0 (g/mL) G Lab File ID: Y7976

Level: (low/med) MED Date Received: 05/24/91

% Moisture: not dec. ____ Date Analyzed: 06/03/91

Column: (pack/cap) CAP Dilution Factor: 2000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
74-87-3	Chloromethane	2500000	U
74-83-9	Bromomethane	2500000	U
75-01-4	Vinyl chloride	2500000	U
75-00-3	Chloroethane	2500000	U
75-09-2	Methylene chloride	1200000	U
67-64-1	Acetone	2500000	D
75-15-0	Carbon disulfide	1200000	U
75-35-4	1,1-Dichloroethene	1200000	U
75-34-3	1,1-Dichloroethane	1200000	U
540-59-0	1,2-Dichloroethene (total)	1200000	U
67-66-3	Chloroform	1200000	U
107-06-2	1,2-Dichloroethane	1200000	U
78-93-3	2-Butanone	2500000	U
71-55-6	1,1,1-Trichloroethane	1200000	U
56-23-5	Carbon tetrachloride	1200000	U
108-05-4	Vinyl acetate	2500000	U
75-27-4	Bromodichloromethane	1200000	U
78-87-5	1,2-Dichloropropane	1200000	U
10061-01-5	cis-1,3-Dichloropropene	1200000	U
79-01-6	Trichloroethene	1200000	U
124-48-1	Dibromochloromethane	1200000	U
79-00-5	1,1,2-Trichloroethane	1200000	U
71-43-2	Benzene	1200000	U
10061-02-6	Trans-1,3-dichloropropene	1200000	U
75-25-2	Bromoform	1200000	U
108-10-1	4-Methyl-2-pentanone	2500000	U
591-78-6	2-Hexanone	2500000	U
127-18-4	Tetrachloroethene	1200000	U
79-34-5	1,1,2,2-Tetrachloroethane	1200000	U
108-88-3	Toluene	1200000	U
108-90-7	Chlorobenzene	1200000	U
100-41-4	Ethylbenzene	1100000	JP
100-42-5	Styrene	1200000	U
1330-20-7	Total xylenes	10000000	D

MAT

MAT

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OIL-DL

I Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) SOIL Lab Sample ID: 50698A-DL

Sample wt/vol: 4.0 (g/mL) G Lab File ID: Y7976

Level: (low/med) MED Date Received: 05/24/91

% Moisture: not dec. ____ Date Analyzed: 06/03/91

Column (pack/cap) CAP Dilution Factor: 2000

Number TICs found: 10

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN	8.22	1700000	J
2.	96-14-0	PENTANE, 3-METHYL-	8.95	6400000	J
3.	96-37-7	CYCLOPENTANE, METHYL-	10.20	2600000	J
4.		UNKNOWN HYDROCARBON	10.65	5400000	J
5.	108-87-2	CYCLOHEXANE, METHYL-	13.15	12000000	J
6.		UNKNOWN HYDROCARBON	13.55	5700000	J
7.		UNKNOWN HYDROCARBON	13.87	3600000	J
8.	111-65-9	OCTANE (DOT)	14.67	6600000	J
9.		UNKNOWN HYDROCARBON	16.77	4200000	J
10.		UNKNOWN HYDROCARBON	18.00	7100000	J

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-A4

Lab Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) WATER Lab Sample ID: 50695

Sample wt/vol: 990 (g/mL) ML Lab File ID: T8579

Level: (low/med) LOW Date Received: 05/24/91

% Moisture: not dec. ____ dec. ____ Date Extracted: 05/28/91

Extraction: (SepF/Cont/Sonc) CONT Date Analyzed: 06/05/91

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 5.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	50	U
111-44-4	bis(2-Chloroethyl)ether	50	U
95-57-8	2-Chlorophenol	50	U
541-73-1	1,3-Dichlorobenzene	50	U
106-46-7	1,4-Dichlorobenzene	50	U
100-51-6	Benzyl alcohol	50	U
95-50-1	1,2-Dichlorobenzene	50	U
95-48-7	2-Methylphenol	50	U
108-60-1	bis(2-Chloroisopropyl)ether	50	U
106-44-5	4-Methylphenol	50	U
621-64-7	N-Nitroso-di-n-propylamine	50	U
67-72-1	Hexachloroethane	50	U
98-95-3	Nitrobenzene	50	U
78-59-1	Isophorone	50	U
88-75-5	2-Nitrophenol	50	U
105-67-9	2,4-Dimethylphenol	760	
65-85-0	Benzoic Acid	250	U
111-91-1	bis(2-Chloroethoxy)methane	50	U
120-83-2	2,4-Dichlorophenol	50	U
120-82-1	1,2,4-Trichlorobenzene	50	U
91-20-3	Naphthalene	92	X
106-47-8	4-Chloroaniline	50	U
87-68-3	Hexachlorobutadiene	50	U
59-50-7	4-Chloro-3-methylphenol	50	U
91-57-6	2-Methylnaphthalene	130	
77-47-4	Hexachlorocyclopentadiene	50	U
88-06-2	2,4,6-Trichlorophenol	50	U
95-95-4	2,4,5-Trichlorophenol	250	U
91-58-7	2-Chloronaphthalene	50	U
88-74-4	2-Nitroaniline	250	U
131-11-3	Dimethylphthalate	50	U
208-96-8	Acenaphthylene	50	U
606-20-2	2,6-Dinitrotoluene	50	U

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-A4

L Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) WATER Lab Sample ID: 50695

Sample wt/vol: 990 (g/mL) ML Lab File ID: T8579

Level: (low/med) LOW Date Received: 05/24/91

% Moisture: not dec. ____ dec. ____ Date Extracted: 05/28/91

Extraction: (SepF/Cont/Sonc) CONT Date Analyzed: 06/05/91

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 5.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
99-09-2	3-Nitroaniline	250	U
83-32-9	Acenaphthene	50	U
51-28-5	2,4-Dinitrophenol	250	U
100-02-7	4-Nitrophenol	250	U
132-64-9	Dibenzofuran	50	U
121-14-2	2,4-Dinitrotoluene	50	U
84-66-2	Diethylphthalate	50	U
7005-72-3	4-Chlorophenyl-phenylether	50	U
86-73-7	Fluorene	50	U
100-01-6	4-Nitroaniline	250	U
534-52-1	4,6-Dinitro-2-methylphenol	250	U
86-30-6	N-nitrosodiphenylamine (1)	50	U
101-55-3	4-Bromophenyl-phenylether	50	U
118-74-1	Hexachlorobenzene	50	U
87-86-5	Pentachlorophenol	250	U
85-01-8	Phenanthrene	69	
120-12-7	Anthracene	50	U
84-74-2	Di-n-butylphthalate	50	U
206-44-0	Fluoranthene	50	U
129-00-0	Pyrene	50	U
85-68-7	Butylbenzylphthalate	50	U
91-94-1	3,3'-Dichlorobenzidine	100	U
56-55-3	Benzo(a)anthracene	50	U
218-01-9	Chrysene	50	U
117-81-7	bis(2-Ethylhexyl)phthalate	50	U
117-84-0	Di-n-octyl phthalate	50	U
205-99-2	Benzo(b)fluoranthene	50	U
207-08-9	Benzo(k)fluoranthene	50	U
50-32-8	Benzo(a)pyrene	50	U
193-39-5	Indeno(1,2,3-cd)pyrene	50	U
53-70-3	Dibenz(a,h)anthracene	50	U
191-24-2	Benzo(g,h,i)perylene	50	U

(1) - Cannot be separated from Diphenylamine

100016

1F

EPA SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

MW-A4

L Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) WATER Lab Sample ID: 50695

Sample wt/vol: 990 (g/mL) ML Lab File ID: T8579

Level: (low/med) LOW Date Received: 05/24/91

% Moisture: not dec. ____ dec. ____ Date Extracted: 05/28/91

Extraction: (SepF/Cont/Sonc) CONT Date Analyzed: 06/05/91

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 5.0

Number TICs found: 26

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN SUBSTITUTED BENZENE	3.38	2400	J
2.		UNKNOWN CYCLIC HYDROCARBON	3.57	610	J
3.		UNKNOWN	3.68	3500	J
4.		UNKNOWN HYDROCARBON	3.87	370	J
5.		UNKNOWN	4.07	1800	J
6.		UNKNOWN	4.17	570	J
7.		UNKNOWN HYDROCARBON	4.33	830	J
8.		UNKNOWN SUBSTITUTED BENZENE	4.45	1100	J
9.		UNKNOWN SUBSTITUTED BENZENE	4.53	1500	J
10.		UNKNOWN CYCLIC HYDROCARBON	4.72	490	J
11.		UNKNOWN	4.88	3000	J
12.		UNKNOWN HYDROCARBON	5.15	650	J
13.		UNKNOWN SUBSTITUTED BENZENE	5.23	740	J
14.		UNKNOWN CYCLIC HYDROCARBON	5.32	460	J
15.		UNKNOWN	5.65	690	J
16.		UNKNOWN	6.10	990	J
17.		UNKNOWN HYDROCARBON	7.30	640	J
18.		UNKNOWN HYDROCARBON	8.47	620	J
19.		UNKNOWN	9.55	290	J
20.		UNKNOWN	10.22	240	J
21.		UNKNOWN HYDROCARBON	11.59	350	J
22.		UNKNOWN HYDROCARBON	12.05	230	J
23.		UNKNOWN HYDROCARBON	12.52	730	J
24.		UNKNOWN HYDROCARBON	13.40	660	J
25.		UNKNOWN HYDROCARBON	14.25	320	J
26.	10544-50-0	SULFUR, MOL. (S8)	15.87	200	J

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OIL

L Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) SOIL Lab Sample ID: 50696

Sample wt/vol: 1.0 (g/mL) G Lab File ID: T8578

Level: (low/med) LOW Date Received: 05/24/91

% Moisture: not dec. ____ dec. ____ Date Extracted: 05/29/91

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 06/05/91

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 5

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
108-95-2	Phenol	500000	U
111-44-4	bis(2-Chloroethyl)ether	500000	U
95-57-8	2-Chlorophenol	500000	U
541-73-1	1,3-Dichlorobenzene	500000	U
106-46-7	1,4-Dichlorobenzene	500000	U
100-51-6	Benzyl alcohol	500000	U
95-50-1	1,2-Dichlorobenzene	500000	U
95-48-7	2-Methylphenol	500000	U
108-60-1	bis(2-Chloroisopropyl)ether	500000	U
106-44-5	4-Methylphenol	500000	U
621-64-7	N-Nitroso-di-n-propylamine	500000	U
67-72-1	Hexachloroethane	500000	U
98-95-3	Nitrobenzene	500000	U
78-59-1	Isophorone	500000	U
88-75-5	2-Nitrophenol	500000	U
105-67-9	2,4-Dimethylphenol	500000	U
65-85-0	Benzoic Acid	2400000	U
111-91-1	bis(2-Chloroethoxy)methane	500000	U
120-83-2	2,4-Dichlorophenol	500000	U
120-82-1	1,2,4-Trichlorobenzene	500000	U
91-20-3	Naphthalene	260000	JX
106-47-8	4-Chloroaniline	500000	U
87-68-3	Hexachlorobutadiene	500000	U
59-50-7	4-Chloro-3-methylphenol	500000	U
91-57-6	2-Methylnaphthalene	540000	
77-47-4	Hexachlorocyclopentadiene	500000	U
88-06-2	2,4,6-Trichlorophenol	500000	U
95-95-4	2,4,5-Trichlorophenol	2400000	U
91-58-7	2-Chloronaphthalene	500000	U
88-74-4	2-Nitroaniline	2400000	U
131-11-3	Dimethylphthalate	500000	U
208-96-8	Acenaphthylene	500000	U
606-20-2	2,6-Dinitrotoluene	500000	U

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OIL

L Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) SOIL Lab Sample ID: 50696

Sample wt/vol: 1.0 (g/mL) G Lab File ID: T8578

Level: (low/med) LOW Date Received: 05/24/91

% Moisture: not dec. ____ dec. ____ Date Extracted: 05/29/91

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 06/05/91

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 5

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
99-09-2	3-Nitroaniline	2400000	U
83-32-9	Acenaphthene	500000	U
51-28-5	2,4-Dinitrophenol	2400000	U
100-02-7	4-Nitrophenol	2400000	U
132-64-9	Dibenzofuran	500000	U
121-14-2	2,4-Dinitrotoluene	500000	U
84-66-2	Diethylphthalate	500000	U
7005-72-3	4-Chlorophenyl-phenylether	500000	U
86-73-7	Fluorene	500000	U
100-01-6	4-Nitroaniline	2400000	U
534-52-1	4,6-Dinitro-2-methylphenol	2400000	U
86-30-6	N-nitrosodiphenylamine (1)	500000	U
101-55-3	4-Bromophenyl-phenylether	500000	U
118-74-1	Hexachlorobenzene	500000	U
87-86-5	Pentachlorophenol	2400000	U
85-01-8	Phenanthrene	280000	J
120-12-7	Anthracene	500000	U
84-74-2	Di-n-butylphthalate	500000	U
206-44-0	Fluoranthene	500000	U
129-00-0	Pyrene	500000	U
85-68-7	Butylbenzylphthalate	500000	U
91-94-1	3,3'-Dichlorobenzidine	1000000	U
56-55-3	Benzo(a)anthracene	500000	U
218-01-9	Chrysene	500000	U
117-81-7	bis(2-Ethylhexyl)phthalate	500000	U
117-84-0	Di-n-octyl phthalate	500000	U
205-99-2	Benzo(b)fluoranthene	500000	U
207-08-9	Benzo(k)fluoranthene	500000	U
50-32-8	Benzo(a)pyrene	500000	U
193-39-5	Indeno(1,2,3-cd)pyrene	500000	U
53-70-3	Dibenz(a,h)anthracene	500000	U
191-24-2	Benzo(g,h,i)perylene	500000	U

(1) - Cannot be separated from Diphenylamine

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OIL

Lab Name: VERSAR INC. Contract: _____

Lab Code: VERSAR Case No.: 4823 SAS No.: _____ SDG No.: 2

Matrix: (soil/water) SOIL Lab Sample ID: 50696

Sample wt/vol: 1.0 (g/mL) G Lab File ID: T8578

Level: (low/med) LOW Date Received: 05/24/91

% Moisture: not dec. ____ dec. ____ Date Extracted: 05/29/91

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 06/05/91

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 5

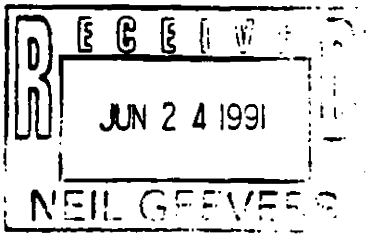
Number TICs found: 27

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN CYCLIC HYDROCARBON	3.57	4700000	J
2.		UNKNOWN HYDROCARBON	3.68	9600000	J
3.		UNKNOWN	3.80	2100000	J
.		UNKNOWN HYDROCARBON	3.87	2300000	J
5.		UNKNOWN ALCOHOL	3.95	3500000	J
6.		UNKNOWN	4.07	7600000	J
7.		UNKNOWN HYDROCARBON	4.17	2900000	J
8.		UNKNOWN HYDROCARBON	4.33	4400000	J
9.		UNKNOWN HYDROCARBON	4.45	6600000	J
10.		UNKNOWN	4.53	5200000	J
11.		UNKNOWN CYCLIC HYDROCARBON	4.72	2700000	J
12.		UNKNOWN SUBSTITUTED BENZENE	4.87	12000000	J
13.		UNKNOWN HYDROCARBON	5.15	3100000	J
14.		UNKNOWN SUBSTITUTED BENZENE	5.22	3100000	J
15.		UNKNOWN CYCLIC HYDROCARBON	5.32	2000000	J
16.		UNKNOWN	5.65	1800000	J
17.		UNKNOWN HYDROCARBON	6.10	3600000	J
18.		UNKNOWN HYDROCARBON	7.30	3400000	J
19.		UNKNOWN HYDROCARBON	8.45	3200000	J
20.		UNKNOWN HYDROCARBON	10.20	770000	J
21.		UNKNOWN HYDROCARBON	11.57	1400000	J
22.		UNKNOWN HYDROCARBON	12.52	2900000	J
23.		UNKNOWN HYDROCARBON	12.57	3100000	J
24.		UNKNOWN HYDROCARBON	13.40	3000000	J
25.		UNKNOWN HYDROCARBON	14.25	1300000	J
26.		UNKNOWN HYDROCARBON	15.05	660000	J
27.		UNKNOWN	20.54	1100000	J

Versar Laboratories Inc.

June 19, 1991



Mr. Neil Geevers
Ebasco Services, Inc.
160 Chubb Avenue
Lyndhurst, New Jersey 07071

Reference: VLI Project No. 420.2
VLI Control No. 4925

Dear Neil:

Enclosed please find the viscosity and specific gravity results for one oil sample received May 10, 1991.

If you have any questions, please call me at (703) 642-6941.

Sincerely,

Versar Laboratories, Inc.

Sheila Maguire

Sheila Maguire
Program Manager

SM/mar

Enclosure

6850 Versar Center • P. O. Box 1549 • Springfield, Virginia 22151 • Telephone: (703) 750-3000 • 1-800-283-7727

GALBRAITH

Laboratories, Inc.

QUANTITATIVE MICROANALYSES
ORGANIC — INORGANIC
PHONE 615/546-1335 FAX 615/546-7209

Ms. Sheila Maguire
Versar Laboratories,Inc.
6850 Versar Center
Springfield,Virginia 22151

June 12, 1991

Received: June 12th
PO#91-1087

Dear Ms.Maguire:

Analysis of your compound gave the following results:

Your #,	Our #,	Analyses,	
50696 #Oil	R-4176	Specific Gravity @70°F	0.806
		Viscosity,Kinematic @25°C (77°F),cSt	2.68

Sincerely yours,

GALBRAITH LABORATORIES,INC.

Gail R Hutchens/sc

Gail R. Hutchens
Exec.Vice-President

GRH:np

SECTION 02200

PLACEMENT OF MATERIAL IN CELA

PART 1 - GENERAL

The work required under this section includes furnishing all plant, labor, equipment and materials for performing all operations for placement of fill material on the Central Elevated Landfill Area (CELA) prior to placement of cap materials as shown on the Contract Drawings (AR-14, AR-15, AR-16, AR-21).

1.1 Definitions

1.1.1 Placement: Placement shall consist of rough grading the CELA by redistribution or excavation, stabilizing the CELA surface and on site fill material, as required; placing, and compacting the same to the lines and grades of the CELA prior to placement of cap materials as specified on the Contract Drawings.

1.1.2 On Site Fill Material: On site fill material consists of the material excavated during rough grading the CELA, SLA material placed temporarily on the southern end of CELA, test fill material on the CELA, and stockpiled dike material shown on the Contract Drawings (AR-12). Contaminated refinery surface soil shall also be considered on site fill material and placed on the CELA.

1.1.3 Off Site Fill Material: Off site fill material consists of fill obtained by the Contractor from off site sources.

1.2 Intent of the Specification

The Contractor shall determine the need for stabilization of the materials using additives supplemented by material drying before stabilization. The intent of this specification is to achieve a minimum unconfined compressive strength of 1000 psf (ASTM D2166-85) and a suitable working base for the placement of the cap. The Contractor shall ensure that the stabilized material can be placed and compacted so as to be free of ruts, depressions and excessive moisture and assure a stable base for the cap placement. These requirements apply to all on site fill material and off site fill material, surfaces where the CELA is excavated to obtain the grades shown on the Contract Drawings (see AR-21) to an additional depth of 3 feet below the excavated grade, and surfaces of the CELA where the first layer of the cap is placed directly over the CELA to a depth of 3 feet below the surface. The Contractor shall be responsible to achieve the above requirements by suitable stabilization techniques.

PART 2 - APPLICABLE PUBLICATIONS

ASTM D2166-85 Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2216-80 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregates Mixture

PART 3 - REQUIRED WORK

3.1 The Contractor shall rough grade the CELA and stabilize the CELA surface and on-site fill material as required. On-site fill material shall be placed on the CELA. Placement of additional fill material (i.e., off site fill material specified in Paragraph 1.1.3), if required, to achieve the required lines and grades, on the CELA shall be at the discretion of the Construction Manager. The Contractor shall compact all material placed on the CELA as well as the CELA surface in accordance with paragraph 1.2 to the lines and grades prior to placement of cap materials, as specified on the Contract Drawings (AR-21) and as described in this section.

3.2 During the rough grading operations, some excavation or redistribution of the CELA will be required to obtain the necessary grades shown on the Contract Drawing (AR-21).

3.3 The Contractor shall perform the necessary surveys during the performance of the required work and submit the results to the Construction Manager for acceptance.

3.4 All equipment and material supplied shall be in good working condition and shall not be contaminated.

3.5 The Contractor shall handle runoff which comes in contact with contaminated soil as described in Section 02210 - Stormwater Management.

3.6 The Contractor shall handle contaminated material in a manner that will protect site personnel, the public, and the environment in accordance with all applicable Federal, state, and local laws and regulations.

3.7 The Contractor shall decontaminate all equipment prior to removal from the site in accordance with the Project Health and Safety Plan of this Contract.

3.8 The Contractor shall maintain all work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to others. Dust control shall be performed as the work proceeds and whereever a dust nuisance or hazard occurs. Refer to Section 02040 - Dust and Vapor Control, for dust control requirements.

3.9 The Contractor shall design, furnish, install and maintain all erosion control measures during the course of placement operations in accordance with Section 02485 - Seeding and Erosion Protection.

3.10 The Contractor shall develop a construction plan as described in this section and submit to the Construction Manager for review and acceptance prior to proceeding with the work.

3.11 Placement activities specified in this Section shall conform to safety requirements as specified in OSHA part 1926.

PART 4 - QUALITY ASSURANCE

4.1 Field Testing of the Fill Material.

4.1.1 All on-site fill material and all other stabilized and compacted material placed shall also be cored with Shelby tubes. One sample shall be taken for each 500 cubic yards placed but not less frequently than one test each day for each area being compacted. The cored samples shall be tested for unconfined compressive strength in accordance with ASTM D2166-85 and as specified in paragraph 1.2.

4.2 The Contractor shall perform the necessary surveys required during the placement operations.

4.3 The Contractor shall give advance notice to the Construction Manager or his designee to witness and/or inspect all activities, particularly testing.

PART 5 - SUBMITTALS

Documents shall be submitted in accordance with the attached form: "Document Submittal Requirements" and as required by the Project Quality Assurance Plan of this Contract.

PART 6 - MATERIALS

6.1 Fill Materials

6.1.1 On-Site Fill Materials

On-site fill materials consist of the material excavated during rough grading the CELA including SLA material, test fill material on the CELA, stockpiled dike material and contaminated refinery surface soil. On-site fill material shall be stabilized with suitable additives, if required, to achieve the workability and compatibility characteristics specified herein.

6.1.2 Off Site Fill Material

The Contractor shall furnish sufficient amounts of off-site fill material, if required, from an off-site location as needed. Off-site fill material fill shall contain no sod, brush, roots, or other perishable materials. Off-site fill shall be obtained from off-site area(s) accepted by the Construction Manager or his designee as specified in the Project Quality Assurance Plan of this Contract. This material shall also meet the unconfined compressive strength criteria specified in paragraph 1.2.

6.2 Stabilizing Agents

6.2.1 The Contractor shall furnish sufficient amounts of stabilizing agents and additives to achieve the placement requirements specified herein. The Contractor shall make every attempt to use on site fill materials without using stabilizing agents to achieve the requirements specified herein. The use of additives and off site materials shall be minimized to the maximum extent practicable.

6.2.2 Treatability studies on material from the CELA, SLA and test fill have been performed to determine the required mix of stabilizing agents. However, the Contractor shall be responsible to make his own determination of the stabilization mix design. Use of existing studies shall not relieve the Contractor of his responsibility to meet the specified requirements.

6.2.3 Contractor's proposed method for stabilizing materials shall be submitted to the Construction Manager for review and acceptance.

PART 7 - CONSTRUCTION PLAN

7.1 General

The Contractor shall prepare a construction plan for excavating, hauling, stabilizing, backfilling, compacting and grading the CELA. This plan shall be submitted to the Construction Manager or his designee for acceptance prior to proceeding with the work specified in this section.

7.2 Requirements

The construction plan, as a minimum, shall include the following:

(1) Proposed method(s) and sequence of excavation including the details of equipment

(2) Proposed method(s) of hauling, stockpiling, mixing and stabilizing excavated areas of the CELA and on site fill material
(3) Proposed method(s) of hauling, stockpiling off site fill material and other material
(4) Proposed method(s) and sequence of placement, curing and grading
(5) Proposed method(s) to control infiltration of the precipitation in the backfill areas.

PART 8 - EXECUTION

8.1 Prior to the placement activities the Contractor shall evaluate the need to provide a working pad, such as a layer of crushed stone/pit-run gravel over geotextile fabric to facilitate movement of the construction equipment over the CELA. If needed, this shall be provided by the Contractor at no additional cost to ARCO.

8.1.1 The Contractor shall inform the Construction Manager in advance if the on-site fill material available is not adequate to meet the lines and grades specified on the Contract Drawings. The Construction Manager may, at his option, authorize the use of off-site fill or revise the cap configuration to minimize the use of off-site material provided that the minimum slopes required for cap drainage and erosion control are met.

8.2 The Contractor shall rough grade the CELA as required to obtain the grades shown on the Contract Drawings.

8.2.1 Handling, characterization and disposition of drums, if encountered in the course of excavation, shall be in accordance with the requirements of Section 02095 - Drum Handling Characterization and Disposition.

8.3 A tolerance of minus 3 inches will be permitted for rough grading the CELA.

8.4 Runoff which comes in contact with contaminated soil during construction shall be handled as described in Section 02210 - Stormwater Management.

8.5 On-site fill and other stabilized material shall be placed in approximately horizontal layers not to exceed 12 inches and compacted to the rough graded lines.

8.6 The Contractor shall obtain a core sample from each 500 cubic yards for materials described in paragraph 1.2 to assure that the compacted material has a minimum unconfined compressive strength (ASTM D2166-85) of 1000 psf.

8.6.1 Materials described in paragraph 1.2 shall be placed in 12 inch lifts before compaction and compacted to achieve a minimum of unconfined compressive strength of 1000 psf.

8.7 Off-site fill, if required, shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed 12 inches. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than 12 inches thickness before being compacted.

8.7.1 The Contractor shall obtain a core sample from each 500 cubic yards of off-site fill to assure that the compacted material has a minimmum unconfined compressive strength (ASTM D2166-85) of 1000 psf.

8.8 The Contractor shall take the necessary precautions to prevent infiltration of precipitation onto areas where fill has been placed such that there will be no reduction of the minimum unconfined compressive strength required.

END OF SECTION

DOCUMENT SUBMITTAL REQUIREMENTS

SUBMIT DOCUMENTS PRIOR TO THE POINTS INDICATED BY THE CODE BELOW:

F - FABRICATION
T - TESTING
S - SHIPMENT
C -CONSTRUCTION/INSTALLATION
A - FINAL ACCEPTANCE

DOCUMENT REQUIREMENTS	See Paragraph	For Acceptance	For Record
1. Construction Plan	7	*	*
2. Unconfined compression strength test report	4.1.1	*	*

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SECTION 02210

STORMWATER MANAGEMENT

PART 1 - GENERAL

The work under this section shall consist of furnishing all labor, equipment and materials for the temporary diversion, collection, analysis, treatment (if required) and disposal of runoff which comes in contact with disturbed surfaces of the CELA during the performance of work under this Contract.

PART 2 - REQUIRED WORK

2.1 The Contractor shall provide temporary diversion to collect runoff which comes in contact with disturbed surfaces of the CELA.

2.2 The Contractor shall provide bermed collection pond(s) to contain the maximum runoff from a 10 year, 24 hours storm from the tributary area. The total area of the site is approximately 11 acres. The pond(s) shall also provide 12 inches of freeboard.

2.3 The Contractor shall sample and analyze the runoff collected within the pond(s) prior to discharge. Collected runoff may be discharged at the local publicly owned treatment works (POTW) provided that the discharge requirements are met as demonstrated by results of the analysis performed.

2.4 Based on the results of the landfill field investigation, runoff from the CELA may contain low levels of oil, volatile organic compounds and heavy metals. The Contractor shall ensure that the runoff meets the levels specified in either Tables 02210-1 or 02210-2, for dischare to the POTW or Genesee River, respectively. This may require treatment consisting of a clarifier/separator to allow for the removal of oils and filtration for organics removal prior to discharge.

PART 3 - EXECUTION

3.1 The Contractor shall provide temporary runoff diversion to collect runoff which comes in contact with disturbed surfaces of the CELA by constructing berms leading to a collection pond(s).

3.2 The collection pond(s) shall be located within the slurry wall boundary and shall be bermed to contain the maximum runoff from a 10 year, 24 hour storm and 11 acre area. 12 inches of freeboard shall also be provided.

3.3 The Contractor shall take the necessary precautions such that runoff from the disturbed surfaces of the CELA does not come in contact with the dike surfaces. The dike shall not be substituted as a berm where berms are required.

3.4 The Contractor shall sample and analyze the runoff contained within the pond prior to discharge. Collected runoff may be discharged at the local POTW provided analysis shows that the runoff does not exceed the POTW discharge requirements. Runoff which, by analysis,does not exceed the discharge requirements of the Genesee River may be discharged to the Genesee River.

3.5 Runoff which does not meet the discharge requirements of the POTW shall be treated. The most likely methods of treatment may involve filtration and/or removal of oil and grease.

3.6 The POTW discharge requirements are provided in Table 02210-1. The discharge requirements to the Genesee River are presented in Table 02210-2 herein.

TABLE 02210-1

PROPOSED POTW DISCHARGE REQUIREMENTS

Parameter	Criteria
Temperature	30-C maximum
pH	6 minimum
	9 maximum
Total Suspended Solids (TSS)	300 mg/l maximum
Oil and Grease	100 mg/l maximum
Total Organic Carbon (TOC)	200 mg/l maximum
Total Volatile Organics (TVO)	10 mg/l maximum
Arsenic	1 mg/l maximum
Chromium	1 mg/l maximum
Lead	1 mg/l maximum

TABLE 02210-2

GENESEE RIVER DISCHARGE REQUIREMENTS

Compound	Criteria (ug/l)
ORGANICS:	
Benzene	0.7 (G)
Butyl benzyl phthalate	50 (G)
Chlorobenzene	20
1,1-Dichloroethane	5
Diethylphthalate	50 (G)
Ethylbenzene	5 (G)
2-Hexanone	50 (G)
Naphthalene	10
Nitrobenzene	30
Phenanthrene	50 (G)
1,1,2,2-Tetrachloroethane	0.2 (G)
Toluene	5 (G)
Trans-1,2-Dichloroethene	5 (G)
1,1,1-Trichloroethane	5 (G)
Trichloroethene	3 (G)
Total Xylenes	5 (G)
METALS:	
Aluminum, ionic	100 (A)
Arsenic	50
Barium	1,000
Beryllium	3 (G)
Cadmium	10
Chromium	50
Cobalt	5 (A)
Copper	200
Iron	300
Lead	50
Magnesium	35,000
Manganese	300
Mercury	2
Silver	50
Sodium	20,000
Vandium	14 (A)
Zinc	300

NOTES:

(G) = Guidance value
(A) = Value designated for protection of aquatic life.
Source: New York State Ambient Water Quality Standards and Guidance Values (Revised September 25, 1990).

SECTION 02220

CELA CLOSURE

PART 1 - GENERAL

The work under this Section shall consist of furnishing all the labor, supervision, equipment and materials required for the closure of the Central Elevated Landfill Area (CELA) at the Sinclair Refinery Site as shown on the Contract Drawings.

PART 2 - APPLICABLE PUBLICATIONS

ASTM A501-89	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Tubing
ASTM D374-88	Standard Test Method for Thickness of Solid Electrical Insulation
ASTM D413-82	Test Methods for Rubber Property--Adhesion to Flexible Substrate
ASTM D638-89	Test Method for Tensile Properties of Plastics
ASTM D698-78	Test Method for Moisture-Density of Soil and Soil Aggregate Mixture, Using a 5.5 lb (2.49 kg) Rammer and 12-inch (304.8mm) Drop
ASTM D746-87	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D882-90	Test Method for Tensile Properties of Thin Plastic Sheeting
ASTM D1004-90	Test Method for Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1140-90	Test Method for Amount of Material in Soil Finer than the No. 200 Sieve
ASTM D1204-84	Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
ASTM D1238-90	Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1505-85	Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D1593-89	Specification for Nonrigid Vinyl Chloride Plastic Sheeting
ASTM D1556-82	Standard Test Method for Density of Soil In-Place by the Sand Cone Method
ASTM D1557-90	Test Method for Moisture-Density Relation of Soils and Soil-Aggregate Mixtures Using 10 lb 4.54 kg) Rammer and 18-in. (457 mm) Drop
ASTM D1603-88	Test Method for Carbon Black in Olefin Plastics
ASTM D1638-74	Standard Methods of Testing Urethane Foam Isocyanate Raw Materials
ASTM D1777-75	Standard Method for Measuring Thickness of Textile Materials

ASTM D2216-80	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregates Mixture
ASTM D2922-81	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017-88	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D3083-89	Specification for Flexible Poly(Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining
ASTM D3350-84	Specification for Polyethylene Plastic Pipe and Fittings Materials
ASTM D3776-90	Standard Test Methods for Mass per Unit Area (Weight of Woven Fabric)
ASTM D4439-87	Terminology for Geotextiles
ASTM D4491-89	Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4533-85	Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D4632-86	Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
ASTM D4716-87	Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products
ASTM D4751-87	Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D4833-88	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM F714-90	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
FTMS 101C2065.1	Puncture Resistance and Elongation Test

PART 3 - REQUIRED WORK

3.1 Construction of a passive gas venting system.

3.2 Construction (placement, compaction, grading) of a multi-layered cap on the CELA.

3.3 Installation of steel pipe for future subsurface access

3.4 Construction of a drainage system to intercept the surface runoff and discharging the same to the culvert.

3.5 Construction of an access road to the utility pole within the cap boundary.

3.6 Seeding and stabilizing of the finished surface.

3.7 Developing a construction plan for review and acceptance by the Construction Manager prior to proceeding with the work described herein.

3.7.1 The construction plan shall include the following, as a minimum.

(1) Proposed method(s) of hauling, stockpiling and placing cap materials.
(2) Proposed method(s) and sequence of construction
(3) Proposed method(s) of storing, placing and testing synthetic materials
(4) Proposed method(s) of temporary runoff and runon diversion
(5) Proposed method(s) of collection, analysis and disposal of runoff that comes in contact with contaminated soil

PART 4 - QUALITY ASSURANCE

4.1 The synthetic materials supplied under these specifications shall be first quality products designed and manufactured specifically for the purpose of this work and which have been satisfactorily demonstrated by prior use to be suitable and durable. The installers of the materials shall have demonstrated, by previous experience, their ability to do the work. A representative from each manufacturer shall be available a minimum of one day during the installation and shall provide technical assistance as required.

4.2 Materials supplied under this section shall be in accordance with the requirements of the Project Quality Assurance Plan of this Contract and as specified herein.

4.3 Field testing of materials placed under this section shall be in accordance with the Project Quality Assurance Plan of this Contract.

4.4 The Contractor shall perform the necessary surveys required during cap construction operations and submit the results to the Construction Manager.

4.5 The Contractor shall give advance notice to the Construction Manager or his designee to witness and/or inspect all activities, particularly testing.

PART 5 - SUBMITTALS

5.1 The Contractor shall submit a Construction Plan for work described in this section to the Construction Manager for review and acceptance prior to proceeding with the work.

5.2 Prior to furnishing and installation of synthetic materials, the Contractor shall submit to the Construction Manager, for acceptance, the following:

(1) The name of the manufacturer and the type of material chosen for use.

(2) Manufacturer certification that the materials are in compliance with the requirements of the standards specified herein. Samples of the proposed materials shall be submitted.

(3) The qualifications and experience of the geosynthetic and geomembrane installers and the designated installation supervisor. A minimum of five years experience in geosynthetic or geomembrane installation as applicable is required.

(4) Shop drawings showing the proposed layout of the materials, details of joining the materials, anchoring, connecting, penetration and other construction details.

(5) The testing, maintenance and repair procedures for the materials.

(6) Chemical resistance test results.

5.3 The Contractor shall submit results of field tests performed on a daily basis.

PART 6 - MATERIAL WARRANTY

The manufacturers shall warrant the materials against manufacturing defects and chemical incompatiblity for a period of 5 years for the textured geomembrane liner (VLDPE), polyethylene piping, and geosynthetic drainage layer (FABRI-NET, or equivalent), including filter fabric, and the low permeability geosynthetic liner (CLAYMAX, or equivalent) from the date of installation. The manufacturers shall replace, at no expense, materials which fail from the above causes within the warranty period. The manufacturers shall furnish a written warranty covering the requirements.

PART 7 - MATERIALS

The Contractor shall obtain a certificate of compliance from the manufacturer(s) of synthetic materials specified herein that the item supplied conforms with the requirements of this section. Fill materials including riprap, bedding, crushed stone and sand shall meet the requirements of the Project Quality Assurance Plan of this Contract and those specified herein.

7. Low Permeability Geosynthetic Liner (CLAYMAX by Clem Environmental Corporation or other functionally equivalent product)

7.1.1 The low permeability geosynthetic liner shall be a flexible polypropylene bentonite sandwich providing a uniform layer of clay in carpet form with a maximum permeability at any location of 1 x 10^{-9} cm/sec at 35 feet of head pressure.

7.1.2 The low permeability geosynthetic liner shall be stored on dry ground, under a roof or other protective covering particularly against ultraviolet rays.

7.2 60-Mil VLDPE Textured Geomembrane (GUNDLE Hyperlastic VLDPE Textured by Gundle Lining Systems, Inc. or other functionally equivalent product)

The geomembrane liner shall be manufactured of 100% domestic, first-quality raw materials, using no more than 2% recycled ingredients that originate from the same formulation and the same production lot and which are free of any foreign contaminants. The Contractor shall provide certification that the resin meets or exceeds these requirements along with a copy of the quality control certificates.

7.2.1 The VLDPE sheets shall be uniform in color, thickness, size and surface texture.

7.2.2 The VLDPE sheets shall be free of pinholes, blisters, nodules, and contaminants and other imperfections.

7.2.3 The VLDPE sheets shall conform to the physical requirements listed in Table 02220-1.

7.2.4 The geomembrane liner shall be adequately protected at all times from puncture, abrasion, excessive heat, degradation of the material, adhesion of individual whorls of a roll or layers or other damaging circumstances. Appropriate handling equipment and techniques, as recommended by the manufacturer and accepted by the Construction Manager, shall be used. Any geomembrane damaged as a result of poor delivery, storage, or handling methods shall be repaired or replaced, as determined by the Construction Manager.

7.3 Geosynthetic Drainage Liner (FABRI-NET by Gundle Lining Systems, Inc or other functionally equivalent product)

7.3.1 The geosynthetic drainage liner shall be a Polyfelt, or equivalent filter fabric/Gundnet, or equivalent synthetic drainage liner composite with the geotextile filter fabric heat bonded to one side of the Gundnet or equivalent.

7.3.2 The material properties of the Polyfelt, or equivalent filter fabric are shown on Table 02220-2.

7.3.3 The Gundnet, or equivalent shall be a structure made of two sets of plastic strands arranged together to form a "net" or "mesh" and shall have a minimum hydraulic transmissivity of 2×10^{-3} m^2/sec. The material properties of the Gundnet, or equivalent, layer are shown on Table 02220-3.

7.3.4 The geosynthetic drainage liner shall be stored on dry ground under a roof or other protective covering for protection, particularly against ultraviolet rays.

7.4 Geotextile Filter Fabric

The geotextile filter (Polyfelt or equivalent) fabric shall be a nonwoven fabric consisting only of continuous chain polymeric filaments or yarns of polyester, formed into a stable network by needle punching. The fabric shall be inert to commonly encountered chemicals and hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant, and shall conform to the properties shown in Table 02220-2.

7.5 Common Fill

The Contractor shall furnish sufficient amounts of common fill from an off-site location as needed. This includes common fill in areas adjacent to the perimeter swale, as required, for proper drainage. Common fill shall contain no sod, brush, roots, stumps or other perishable materials. Rock particles larger than 3 inches in equivalent diameter shall be removed prior to compaction. Fines (material passing the No. 200 sieve) content shall range from 15 to 35%. The material from the dike excavation which was found non-contaminated by the sampling and testing performed in accordance with the project post-excavation sampling and analysis plan, shall also be used as common fill if it meets the requirements of the Project Quality Assurance Plan of this Contract.

7.6 Topsoil

Topsoil shall be fertile, friable, natural topsoil of loamy character without admixture of subsoil material, obtained from a well drained arable site, free from heavy clay, coarse sand, stones, plants, roots, sticks and other foreign materials. The topsoil shall be capable of sustaining plant species that will minimize erosion and shall meet the requirements as specified in Section 713-01 of the New York State Department of Transportation (NYSDOT) Standard Specifications.

7.7 Grass Seed

Grass seed shall be selected, rated and tested in accordance with Section 02485 - Seeding and Erosion Protection, of these specifications.

7.8 Riprap

Riprap stone shall be durable and of a suitable quality to assure permanence in the application and the climate in which it is to be used. Stone shall be free of cracks, seams, and other defects that would tend to increase unduly its deterioration from natural causes or breakage in handling or dumping. Stone shall weigh, when dry, not less than 145 pounds per cubic foot (specific gravity of the stone equal to or greater than 2.3).

The inclusion of objectionable quantities of dirt, sand, clay and rock fines will not be permitted. Only granite, quartzite, rhyolite, traprock and certain dolomitic limestone are acceptable. Riprap shall be reasonably well graded from a minimum of 2 inches to a maximum of 12 inches (see gradation table below). Stone for riprap shall be roughly cubical in shape. Flat pieces, such that the average thickness is less than 1/3 of the average width, will be rejected. Stone shall have a mean diameter D_{50} of 6 inches.

Riprap

Size of Stones (inches)	Percent Finer by Weight
12	100
9	70-80
6	40-50
2	0

7.9 Bedding

7.9.1 Aggregate for bedding shall be composed of crushed stone or gravel, free of soft, non-durable particles, organic material, and thin or elongated particles.

7.9.2 Bedding material shall comply with Section 620-2.05 of the New York State Department of Transportation (NYSDOT) Standard Specifications, excluding blast furnace slag (see table below for gradation).

Bedding Material

US Standard Sieve Size	Percent Finer by Weight
2 in.	100
1 in.	15-60
1/4 in.	0-25
No. 4	0-10

7.10 Gas Vent Layer

7.10.1 The crushed stone for the gas vent layer shall consist of stone with a maximum size of 1-1/2 inch, and graded within the following limits. Only granite, quartzite, rhyolite, traprock and certain dolomitic limestone (i.e., igneous or metamorphic rock) are acceptable.

Sieve Size	Percentage Passing (by weight)
1-1/2 inches	100
1 inch	0-26
3/4 inch	0-6
1/2 inch	0-3
No. 4	0

7.10.2 Sand for the gas vent layer shall be free of organic matter, rubbish, debris, or other unsuitable materials, and no more than 10 percent of the material shall pass a No. 200 sieve when tested in accordance with ASTM D1140-71. The maximum allowable size of material shall be 1/4 inches.

7.11 Polyethylene Pipe

The pipe for gas venting shall be high performance, high molecular weight, high density polyethylene pipe, Type III, PE 3408, unless noted or specified otherwise on the drawings.

7.11.1 The polyethylene pipe shall conform to the applicable requirements of ASTM D3350-84 as having a cell classification of PE 335434C (black with 2% minimum carbon black). Dimensions and workmanship shall be specified in ASTM F714-90. The fittings shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe specified herein. To ensure compatibility of polyethylene resins, all fittings shall be of the same manufacture as the pipe being supplied.

7.11.2 The pipe supplied shall be SDR 11 and have a nominal IPS (Iron Pipe Size) outside diameter as specified on the Contract Drawings.

7.12 Corrugated Metal Culvert Pipe

7.12.1 Corrugated metal culvert pipe shall confrom to the latest revision of American Association of State Highway and Transportation Officials (AASHTO) Specification M-36 for Type I.

7.13 Pipe Sleeve For Future Subsurface Access

7.13.1 The pipe sleeve for future subsurface penetration shall be steel pipe, extra strong conforming to ASTM A501-89.

PART 8 - PREPARATION

8.1 The Contractor shall perform the necessary surveys during the performance of the work specified herein and submit the results to the Construction Manager for acceptance.

8.2 The Contractor shall provide temporary runoff diversion to collect runoff which comes in contact with disturbed surfaces of the CELA in accordance with Section 02210 - Stormwater Management. Runoff from the CELA surface which is not disturbed, or from areas where cap construction is completed need not be diverted.

PART 9 - PLACEMENT

9.1 Low Permeability Geosynthetic Liner (CLAYMAX, or equivalent)

9.1.1 The top of compacted gas vent layer where the CLAYMAX, or equivalent liner is to be laid shall be smooth, free from irregular surface changes and uniformly graded. Protrusions larger than 1/2 inch in diameter shall be removed. The degree of finish shall be that ordinarily obtained by a smooth drum roller. The soil/CLAYMAX, or equivalent interface shall be free of depressed areas where water would pond.

9.1.2 The low permeability geosynthetic liner shall be installed according to the manufacturer's specifications. Once the first run has been laid, adjoining runs shall be laid with a 24-inch overlap on each side. All seams on slopes shall be vertical and perpendicular to the base. All soil shall be removed from the overlap area of the liner to ensure a monolithic seal. The seam overlap shall be stapled (with uncrimped staples) or pinned to the base soil. Care shall be exercised to keep the liner dry during installation and prevent hydration of the liner. Liner placement shall not exceed an area which may be adequately protected from precipitation.

9.1.3 The geomembrane liner (VLDPE) shall be placed on top of the CLAYMAX, or equivalent whenever there is possibility that precipitation may hydrate the low permeability liner and layer, or equivalent afford maximum protection during installation. Installation personnel only shall be allowed access on the liner.

No vehicular traffic shall be allowed directly on the low permeability liner (CLAYMAX, or equivalent) without the approval of the Construction Manager.

9.2 VLDPE Textured Geomembrane

9.2.1 The top surface of the CLAYMAX, or equivalent layer shall be flat and free of debris before the installation of the VLDPE geomembrane.

9.2.2 Each panel of the VLDPE geomembrane shall be laid out and installed in accordance with the manufacturer's recommendation and the accepted shop drawings prepared by the Contractor. The layout shall be designed to keep field joining of the VLDPE geomembrane to a minimum and shall be consistent with proper methods of geomembrane installation.

9.2.3 The VLDPE geomembrane shall be installed where shown on the Contract Drawings by crews experienced in lining installation in such a manner as to assure minimum handling. Any equipment used shall not damage the geomembrane. No vehicular traffic shall be allowed directly on the geomembrane without the approval of the Construction Manager. The geomembrane shall be protected in traffic areas by geotextiles, extra geomembrane, or other suitable materials.

9.2.4 Any portion of the geomembrane damaged during installation shall be removed or repaired in accordance with the manufacturer's recommendations.

9.2.5 All edges of the VLDPE geomembrane shall be properly weighted to avoid uplift due to wind.

9.2.6 All VLDPE field seams shall be made using wedge welding as the primary method. Extrusion welding shall only be used for patching and seaming around appurtenances.

9.2.7 All VLDPE rolls/panels shall be overlapped 4 inches minimum for wedge welding and 3 inches minimum for extrusion welding.

9.2.8 The VLDPE geomembrane shall be locked into trenches at the low points of the slopes near the dikes.

9.2.9 Prior to and during seaming, the seam area shall be clean and free of moisture, dust, dirt, and foreign material.

9.2.10 Prior to covering the geomembrane, all seams and non-seam areas shall be visually inspected for defects, holes, damage due to wind uplift and any sign of contamination by foreign material. Suspect seam and non-seam areas shall be non-destructively tested as appropriate. Each location that fails the non-destructive

testing shall be marked and repaired by the Contractor. The geomembrane shall not be covered until all seam tests are accepted by the Construction Manager.

9.2.11 The Contractor shall verify that geomembrane thickness is in conformance with the specifications. At least two thickness readings shall be taken along the edge across each panel/roll width and four along each panel/roll length in accordance with ASTM standards. Additional readings shall be taken across the width at any point where the panel/roll has been cut. Panels/rolls whose mil thickness fails below the specified minimum value shall be rejected and replaced.

9.2.12 Test seams shall be made on test strips of geomembrane to verify that seaming conditions are adequate. All test seams shall be made in the area to be seamed and in contact with the subgrade. Such test seams shall be made each day prior to production seaming, whenever there is a change in seaming personnel or seaming equipment and at least once every four hours, by each seamer and seaming equipment used that day. Where weather conditions are marginal for seaming and with the concurrence of the Construction Manager, test seams shall be made as described above to decide if production seaming can proceed. Seaming shall not be allowed during any precipitation, in the presence of excessive moisture, excessive winds or whenever the temperature is below 40°F. One sample shall be obtained from each test seam. This sample shall be at least 2 feet long by 1 foot wide with the seam centered lengthwise. Four random specimens 1 inch wide shall be cut from the sample by the Contractor using the appropriate ASTM cutting tool. Two specimens shall be field tested by the Contractor for bonded seam strength and two specimens shall be field tested by the Contractor for peel adhesion using an accepted quantitative tensiometer. If the field tests fail to meet the minimum specified seam requirements, the entire operation shall be repeated. If the additional test seam fails, the seaming apparatus or seamer shall not be accepted or used for seaming until the deficiencies are corrected and two consecutive successful test seams are achieved.

9.2.13 The Contractor shall obtain a minimum of one destructive test sample per 500 linear feet of field seam prepared at an ambient temperature above 50°F or one test sample per 300 linear feet of field seam length prepared at an ambient temperature between 40°F and 50°F. The locations of test samples will be specified by the Construction Manager. Sample locations shall not be identified prior to seaming. The samples shall be a minimum of 18 inches wide by 48 inches long with the seam centered lengthwise. Each sample shall be cut into three equal pieces with one piece retained by the Contractor, one piece given to an independent laboratory, and the remaining piece given to the Construction Manager for quality assurance testing and permanent record. Each sample shall be tagged to identify; (1) roll/panel number; (2) seam

number; (3) top sheet; (4) date and time cut; (5) ambient temperature; (6) seaming unit designation; (7) name of seamer; and (8) welding apparatus temperature and pressures, where applicable.

9.2.14 The Contractor shall cut a minimum of four 1-inch wide replicated specimens from his sample using the appropriate ASTM cutting tool. A minimum of two specimens shall be tested for bonded seam strength and two for peel adhesion using an approved field quantitative tensiometer. Both tracks of a double wedge seam shall be tested for peel adhesion. To be acceptable, all replicated test specimens must meet the specified seam requirements. If the field tests fail the seam shall be repaired.

9.2.15 The Contractor shall non-destructively test all field seams over their full length using the appropriate test units and procedures as outlined herein. Testing shall be performed as the seaming work progresses, not at the completion of field seaming. VLDPE field seams shall be vacuum tested or air pressure tested (for double wedge process only). Any seams which fail shall be documented and repaired.

9.2.16 The Contractor shall non-destructively test all field seams over their full length using the Vacuum Test or Air Pressure Test (for double wedge process only) procedure as appropriate. The Vacuum Test and Air Pressure Test procedures are described in paragraphs 9.2.19 and 9.2.20 respectively. Testing shall be performed as the seaming work progresses, not at the completion of field seaming. Any failed seams shall be repaired and retested at no additional cost to ARCO.

9.2.17 Any seam failing a non-destructive or destructive test shall be reconstructed between the failed location and any passed test location. Seam reconstruction shall be achieved by cutting out the existing seam, repositioning the panel and reseaming or adding a cap strip over the defective area. In lieu of this, the seaming path shall be retraced to an intermediate location (at 10 feet minimum each side of the failed seam location). At each location a 12 inch by 12 inch minimum size sample shall be taken for five additional bonded seam strength and five additional peel adhesion tests using an approved quantitative field tensiometer. If these field tests pass, then the remaining sample portion shall be sent to the independent laboratory for five bonded seam strength and five peel adhesion tests in accordance with ASTM D 3083-76 and D413-82 respectively. To be acceptable, four out of five tests must meet the specified requirements. If these laboratory tests pass, then the seam, shall be reconstructed between that location and the original failed location. If field or laboratory tests fail, then the process is repeated. After reconstruction, the entire reconstructed seam shall be non-destructively tested. In any case, all acceptable seams shall be bounded by two passed test locations. Certified test results on all repaired seams shall be submitted to the Construction Manager for acceptance.

9.2.18 All damage and subsequent repairs shall be recorded and located on a drawing for future investigations.

9.2.19 Vacuum Test

a) Vacuum Test Unit. The vacuum test unit shall be comprised of the following:

- o A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.
- o A vacuum pump assembly equipped with a pressure controlled and pipe connections;
- o A rubber pressure/vacuum hose with fittings and connections;
- o A plastic bucket and wide paint brush;
- o A soapy solution.

b) Vacuum Test Procedure. The vacuum test procedure shall consist of the following steps:

- o Clean the window gasket surfaces and check for leaks;
- o Energize the vacuum pump and reduce the tank pressure to approximately 5 psi absolute;
- o Wet a strip of geomembrane approximately 12 in. by 48 in. (length of box) with the soapy solution;
- o Place the box over the wetted are and compress;
- o Close the bleed valve and open the vacuum valve;
- o Ensure that a leak tight seal is created;
- o For a period of not less than 15 seconds from the time the vacuum gauge registers the required vacuum, examine the geomembrane through the viewing window for the presence of soap bubbles;
- o If no bubble(s) appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 2 in. overlap and repeat the process;

- All areas where soap bubbles appear shall be marked, repair and retested.

9.2.20 Air Pressure Test (For VLDPE double wedge seam only)

a) Air Pressure Test Unit. The air pressure test unit shall be comprised of the following:

- An air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining the required pressure;
- A rubber hose with fittings and connections;
- A sharp hollow needle, or other approved pressure feed device with a pressure gauge capable of reading and sustaining the required test pressure.

b) Air Pressure Test Procedure. The air pressure test procedure shall consist of the following steps:

- Seal both ends of the seam to be tested;
- Insert needle or other approved pressure feed device into the tunnel created by the wedge weld;
- Energize the air pump to a pressure between 25 and 30 psi, close valve, and sustain pressure for approximately 3 minutes after equilibrium is achieved.
- If loss of pressure exceeds 3 psi or does not stabilize, locate faulty area and repair.

9.3 Geosynthetic Drainage Liner

9.3.1 The top surface of the VLDPE membrane shall be free of debris before the installation of the geosynthetic drainage liner (Fabri-Net, or equivalent).

9.3.2 The geosynthetic drainage liner shall be installed according to the manufacturer's recommendation. Adjacent rolls shall be joined by plastic ties supplied with the Fabri-Net. At joints, a minimum of 24 inches overlap shall be provided.

9.3.3 The geosynthetic drainage liner shall be locked into trenches along the perimeter of the cap.

9.3.4 The geosynthetic drainage liner shall be covered with common fill to a minimum loose thickness of 12 inches. The common fill shall be compacted to 90% Standard Proctor density as shown on the Contract Drawings. A total of 5 sand cone density tests (ASTM D1556-82) shall be performed.

9.4 Geotextile Fabric Installation

9.4.1 The geotextile fabric (Polyfelt or equivalent) shall be installed where shown in the Contract Drawings and in accordance with the manufacturer's recommendations. Separate rolls or panels shall be joined by 18-inch minimum overlap. Foldovers and wrinkles in the fabric shall be eliminated in the installation. The complete fabric installation shall be inspected and accepted by the Construction Manager prior to the placement of any material on top of it. All work shall meet the requirements as to line, grade, and workmanship as determined by the Construction Manager. All discrepancies shall be noted and repaired by the Contractor at his own expense.

9.4.2 Mechanical equipment shall not be driven on top of the geotextile fabric without the approval of the Construction Manager.

9.4.3 All areas of the geotextile damaged during installation or use, shall be repaired by the Contractor in accordance with the manufacturer's repair procedure or replaced at no additional cost to ARCO.

9.5 Common Fill Material

9.5.1 Common fill shall not be placed until the CLAYMAX, textured VLDPE geomembrane and Fabri-Net installations have been inspected and accepted by the Construction Manager. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

9.5.2 Fill material shall be placed in approximately horizontal layers. Materials placed by dumping in piles or windrows shall be spread uniformly before being compacted. Construction equipment shall not be driven directly over the installed geosynthetic material.

9.5.3 Density of the common fill shall be a minimum of 90% of the maximum dry density achieved in Standard Proctor tests (ASTM D698-78) unless otherwise specified. The water content shall not vary more than plus or minus 3% of the optimum moisture content as determined in the lab and accepted by the Construction Manager. In-place density and moisture content testing on material shall be performed by nuclear methods in accordance with ASTM Standards ASTM D2922-80 and ASTM D3017-78 or the Sand Cone Method for density in accordance with ASTM Standard D1556-82. However, prior to use, calibration of the nuclear equipment shall be performed using either laboratory or field methods in accordance with ASTM D2922-80 and ASTM D3017-78. A comparison to results from sand cone testing in accordance with ASTM D1556-82 shall be performed at least once for each 10 tests performed using nuclear density equipment. In-place density shall be determined at a depth of 8 inches below grade and tests shall be performed for each 750 cubic yards placed

but not less frequently than one test each day for area being compacted. Care shall be exercised not to damage the underlying geosynthetic material. The nuclear density equipment shall be recalibrated whenever a different soil is to be placed.

9.5.4 Compaction equipment used shall be smooth drum rollers or other accepted equipment suitable for the specific operation. No projection type equipment such as sheep's foot rollers may be used. Care shall be exercised such that the geosynthetic layers are not damaged during compaction.

9.6 Topsoil

9.6.1 The topsoil shall be uniformly distributed on the designated areas and evenly spread to a minimum thickness of 6 inches. The spreading shall be performed in such a manner that planting can proceed with little additional soil preparation of tillage. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or the proposed planting.

9.6.2 The topsoiled areas in the CELA shall be smooth and uniformly graded. The finished surface shall be reasonably smooth and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations. The finished surface shall be free of depressed areas where water would pond.

9.7 Seeding

9.7.1 Prior to seeding, any damage to prepared areas shall be reworked and restored to the condition previously specified.

9.7.2 The Contractor shall accomplish seeding and mulching application in accordance with Section 02485 of these specifications.

9.7.3 The finished CELA cap shall be drained by a system of drainage channels as shown on the applicable Contract Drawings.

9.8 Riprap shall be placed over areas shown on the Contract Drawings to a uniform depth with a tolerance of minus 0 to plus 3 inches. Riprap shall be placed on the sand and gravel bedding in such a manner as to ensure that the bedding material is not disturbed and that the individual sections interlock and form a rough surface so that the completed riprap is stable, without tendency to slide and with no unreasonably large protrusions or hollows in the surface or unfilled spaces within the riprap.

9.9 Bedding: Aggregate bedding shall be placed to the full specified thickness in one operation, using methods which will not cause segregation of particle sizes or damage the geosynthetic drainage liner.

9.10 Gas Vent Layer

9.10.1 The crushed stone for the gas vent layer shall not be placed until the rough graded area has been inspected and accepted by the Construction Manager. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

9.10.2 Crushed stone shall be placed over the geotextile filter fabric in approximately a horizontal layer. The thickness of the layer before compaction shall not exceed 8 inches. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than 8 inches before being compacted.

9.10.3 The crushed stone for the gas vent layer shall be proof rolled with a smooth drum roller. The Contractor shall ensure that the slotted polyethylene (PE) pipe is not damaged in any way during the compaction process.

9.10.4 A layer of geotextile filter fabric shall be installed over the compacted crushed stone.

9.10.5 Sand shall be placed over the geotextile filter fabric and proof rolled with a smooth drum roller. The Contractor shall ensure that pipe within the gas vent layer is not damaged during the compaction process. The moisture content at time of placing shall not vary more than plus or minus 4 percent from the optimum moisture content established by Test Method C as defined in ASTM D1557-78.

9.11 Polyethylene Pipe

9.11.1 Polyethylene piping should be handled in such a manner to prevent damage to the pipe. Care shall be exercised to avoid cutting or gouging. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be in accordance with the pipe manufacturer's recommendations.

9.11.2 Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method.

9.11.3 Sections of the polyethylene pipe shall be joined in continuous lengths above ground prior to placement. The joining

method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommended written instructions, including, but no limited to, temperature requirements, alignment, and fusion pressures.

9.11.4 Fused segments of pipe shall be handled to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable type chokers shall be avoided. Nylon slings are preferred. Spreader bars shall be used when lifting long fused sections.

9.12 Corrugated Metal Culvert Pipe

9.12.1 Installation of corrugated culvert pipe shall conform to the applicable requirements of Section 603 of the New York State Department of Transportation (NYSDOT) Standard Specifications and the Contract Drawings.

9.13 Pipe Sleeve For Future Subsurface Access

9.13.1 The Contractor shall install the pipe sleeve for future subsurface access as shown on Contract Drawing AR-15. The pipe shall be filled with compacted bentonite pellets and capped.

9.14 Access Road to Utility Pole

9.14.1 The Contractor shall provide an access road to the utility pole as shown on Contract Drawing AR-14.

END OF SECTION

TABLE 02220-1

MATERIAL PROPERTIES
TEXTURED VERY LOW DENSITY POLYETHYLENE (VLDPE)

Property	Value	Test Method
Gauge (minimum)	60 mil	
Tensile Properties (Min)		ASTM D638-89 Type IV Dumbbell @ 2 ipm
1. Tensile strength @ Break	70	
2. Elongation @ Break (Percent)	300	
Puncture Resistance Pounds (Typical)	57	FTMS 101 Method 2065
Tear Resistance Initiation Pounds (Typical)	24	ASTM D1004-90 Die C
Dimensional Stability % Change Each Direction (Max)	+/-2	ASTM D1204-84 212dF 1 hr.
Low Temperature brittleness Degree F (Typical)	-112	ASTM D746M-87
Environmental Stress Crack Hours (Min)	1500	ASTM D1638-74 50 dc
Resin Density g/cc (Min)	0.90	ASTM D1505-85
Resin Melt Index g/10 min. (Max)	1.1	ASTM D1238-90 Condition E
Carbon Black % (Min)	2.0	ASTM D1603-88

TABLE 02220-2

MATERIAL PROPERTIES
GEOTEXTILE FILTER FABRIC

Property	Value	Test Method
Fabric Weight (oz/yd^2) minimum	8.3	ASTM D3776-90
Thickness (mil) minimum	105	ASTM D1777-75
Grab Tensile (lb) minimum	225	ASTM D4632-86
Grab Elongation (%)	>50	ASTM D4632-86
Puncture (lb) minimum	120	ASTM D4833-88
Trapezoidal Tear (lb) minimum	100	ASTM D4533-85
Water Flow Rate ($gpm/ft.^2$) minimum	130	ASTM D4491-89
Apparent Opening Size (sieve size)	120-80	ASTM D4751-87

TABLE 02220-3

MATERIAL PROPERTIES
GEOSYNTHETIC DRAINAGE LINER (GUNDNET)

Property	Value	Test Method
Resin Melt Index (g/10 minutes) maximum	0.3	ASTM D 1238-82 Condition E
Specific Gravity (g/cm^3) minimum	0.94	ASTM D1505-68
Thickness (minimum)	5.0-6.5mm 200 mil-265 mil	ASTM D374-88 at Strand Intersection
Transmissivity (minimum)	2×10^{-3} m^2/sec	ASTM D4716-87 10,000 psf compressive load 0.25 gradient

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SECTION 02225

REFINERY AREA EARTHWORK

PART 1 - GENERAL

The work required under this section shall include furnishing all labor, materials, and equipment for performing all operations for excavation and removal of contaminated surface soil from the refinery and swale areas and backfill of the excavated areas as shown on the Contract Drawings and as specified herein.

PART 2 - APPLICABLE PUBLICATIONS

American Society for Testing and Materials (ASTM)

D1556-82 Test Method for Density of Soil in Place by the Sand-Cone Method.

D2922-81 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D3017-88 Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

PART 3 - REQUIRED WORK

The work required under this section shall include, but is not limited to, the following activities:

(1) Excavation of surface soil contaminated with arsenic and/or lead from the refinery and swale areas as shown on the Contract Drawings (AR-23 and AR-24).

(2) Temporary runoff/runon diversion at the excavated areas.

(3) Implementing dust control (see Section 02040).

(4) Transport of excavated soil to CELA via onsite haul roads.

(5) Stockpiling excavated soil at designated areas in CELA as directed by the Construction Manager.

(6) Installation of temporary erosion and sediment control measures as per Section 02485.

(7) Furnishing backfill material from offsite sources.

(8) Backfill and compaction of the excavated areas.

(9) Revegetation (see Section 02485).

PART 4 - CONSTRUCTION PLAN

4.1 The contractor shall prepare and submit a construction plan for the required work to the Construction Manager or his designee for approval twenty (20) days prior to the anticipated start of work.

4.2 At a minimum, the construction plan shall include:

(1) Proposed methods of excavation.
(2) Proposed methods of transport of materials.
(3) Procedures for protecting existing structures and utilities.
(4) Sequencing of operations.

PART 5 - QUALITY ASSURANCE

5.1 The Contractor shall ensure that the material and workmanship provided conform with the requirements of this section.

5.2 The Contractor shall implement his quality control in accordance with the requirements of the Quality Assurance Project Plan of this Contract.

5.3 The Contractor shall give advance notice to the Construction Manager or his designee to witness all field testing.

5.4 The contractor shall perform the necessary surveys during excavation and backfill and shall also provide as-built records.

PART 6 - SUBMITTALS

The Contractor's submittal of documents shall be in accordance with the attached form: "Document Submittal Requirements" and as required by the Quality Assurance Project Plan of this Contract.

PART 7 - MATERIALS

7.1 Excavated Refinery Surface Soil

The contaminated surface soil excavated from the refinery and swale areas shall be transported to the CELA as described in Para 8.4 (See Section 02200 for placement of this material in CELA).

7.2 Common Fill

See Paragraph 7.5 of Section 02220-CELA Closure.

7.3 Topsoil

See Paragraph 7.6 of Section 02220-CELA Closure.

PART 8 - EXECUTION

8.1 General

8.1.1 The Contractor shall handle contaminated material in a manner that will protect site personnel, the public, and the environment in accordance with all applicable Federal, state, and local laws and regulations.

8.1.2 The Contractor shall decontaminate all equipment that may come in contact with the contaminated soil prior to removal from the areas in accordance with the health and safety project plan of this Contract.

8.1.3 The Contractor shall maintain all work areas and access roads free from excess dust to such reasonable degrees as to avoid causing a hazard or nuisance to others. Dust control shall be performed as the work proceeds and wherever a dust nuisance or hazard occurs. Refer to Section 02040 for dust control requirements.

8.1.4 The Contractor shall design, furnish, install and maintain all erosion control measures during the course of the work in accordance with Section 02485.

8.2 Excavation

8.2.1 The location, areal extent and depth of excavation shall be as shown on the Contract Drawings (AR-23 and AR-24).

8.2.2 The Contractor shall designate an Exclusion Zone for each excavation area for the staging of equipment and shall provide a physical barrier to preclude unauthorized entry to the Exclusion Zone during excavation.

8.2.3 The Contractor shall provide temporary runoff and runon diversion by constructing berms or trenches around the excavation as needed.

8.2.4 The Contractor shall determine the locations of existing utilities in the excavation areas. The Contractor shall contact the Wellsville Utility Coordinator (see Section 02060) and all potentially affected utilities prior to proceeding with excavation.

It shall be the Contractor's responsibility to take necessary measures to prevent damage to utilities and assume all liability for the damage.

8.3 Post-Excavation Sampling

8.3.1 After excavation to the limits shown on the Contract Drawings, the Contractor shall perform confirmatory sampling of soil beyond the horizontal excavation boundary to determine whether the ROD clean-up criteria for surface soil have been achieved. Sampling for subsurface soil below the depth shown on the Contract Drawings shall not be required.

8.3.2 One soil sample from the center of each 14 ft x 14 ft adjoining area/cell immediately outside the excavation boundary and from each previously sampled location outside the excavation boundry (dwgs. AR-23 and AR-24) shall be collected, and analyzed for arsenic and lead for determining compliance with the following ROD clean-up criteria:

Analyte	ROD Clean-up Criteria for Surface Soil (ppm)
Arsenic	25
Lead	1,000

8.3.2 If any of the samples fails to meet the ROD clean-up criteria, additional soil excavation shall be made in the areas/cells represented by these failed samples. This process shall be followed until the clean-up criteria are met.

8.4 Transport of Excavated Soil

8.4.1 The Contractor shall transport all excavated soil via onsite haul roads to the designated stockpile area(s) in CELA as directed by the Construction Manager.

8.4.2 Handling of contaminated soil during loading, transporting, and unloading shall be conducted in a manner that minimizes the need for decontamination of personnel and equipment. Specifically:

(1) Crew size shall be kept to a minimum.
(2) Excavated soil shall be loaded into drop boxes with liners. The top of the load shall be covered during transport.
(3) During loading of contaminated soil, drop box haul units shall be parked on decontamination pads constructed of crushed stone and geomembrane. Each dump shall be rinsed prior to leaving the pad. If dumps are required to travel over contaminated CELA areas, the dumps shall be rinsed prior to leaving the contaminated CELA area. The crushed stone and geomembrane shall be consolidated in the CELA upon completion of this activity.

8.5 Common Fill Placement

8.5.1 Common fill shall not be placed until the excavated areas have been inspected and approved for backfill by the Construction Manager. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

8.5.2 Common fill shall be placed in approximately horizontal layers and compacted to the required depth as shown on the Contract Drawings. Fill materials placed by dumping in piles or windows shall be spread uniformly before being compacted.

8.5.3 In-place density of the common fill shall be a minimum of 85% of the maximum dry density achieved in Standard Proctor tests (ASTM D698-78) unless otherwise specified. The water content shall not vary more than plus or minus 3% of the optimum moisture content as determined in the lab and accepted by the Construction Manager. In-place density and moisture content testing on material shall be performed by nuclear methods in accordance with ASTM D2922-80 and ASTM D3017-78 or the Sand Cone Method for density in accordance with ASTM D1556-82. However, prior to use, calibration of the nuclear equipment shall be performed using either laboratory or field methods in accordance with ASTM D2922-80 and ASTM D3017-78. A comparison to results from sand cone testing in accordance with ASTM D1556-82 shall be performed at least once for each 10 tests performed using nuclear density equipment. In-place density shall be determined at a depth of 4 inches below grade and tests shall be performed for each 100 cubic yards placed but not less frequently than one test each day for area being compacted. The nuclear density equipment shall be recalibrated whenever a different soil is to be placed.

Alternatively, at the approval of the Construction Manager, the Contractor may opt to establish the following correlations for the field control of compaction:

(1) The required in-place density correlated with the number of passes of the compaction equipment intended for the work, and

(2) The required range of in-place moisture content correlated with that required at the offsite source.

The Contractor, shall document such correlations for the Construction Manager's approval prior to proceeding with the work.

8.6 Topsoil Placement

8.6.1 The topsoil shall be uniformly distributed on the designated areas and evenly spread to a minimum thickness of 6 inches. The spreading shall be performed in such a manner that planting can proceed with little additional soil preparation or

tillage. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or the proposed planting.

8.6.2 The top soiled areas shall receive a finish grading to achieve a reasonably smooth surface free of depressions where ponding could occur. The finished grade shall generally correspond to that which existed before excavation.

DOCUMENT SUBMITTAL REQUIREMENTS

SUBMIT DOCUMENTS PRIOR TO THE POINTS INDICATED BY THE CODE BELOW:

F - FABRICATION
T - TESTING
S - SHIPMENT
C - CONSTRUCTION/INSTALLATION
A - FINAL ACCEPTANCE

Document Requirements	See Paragraph	For Approval	For Record
1. Construction Plan	4.1	*	*
2. In-place density test reports (if applicable)	8.5.3	*	*
3. Alternate compaction control records (if applicable)	8.5.3	*	*

END OF SECTION
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SECTION 02485

SEEDING AND EROSION PROTECTION

PART 1 - GENERAL

The work required under this Section includes furnishing all plant, labor, equipment, and materials to:

(1) Provide fertilizer, mulching, and seeding for the Central Elevated Landfill Area (CELA) fill area and the refinery backfill area as well as any other disturbed areas requiring vegetation.

PART 2 - APPLICABLE PUBLICATIONS

Federal Specifications (FS)

FS O-F-241D	Fertilizer, Mixed, Commercial
FS JJJ-S-181B	Seeds, Agricultural

PART 3 - MATERIALS

3.1 Fertilizers

3.1.1 Quality and Formulation: Fertilizer may be either fluid or dry formulations of commercial carriers of available plant nutrients. Fertilizer shall contain total nitrogen, available phosphoric acid, and soluble potash in the ratio of 10-6-4.

3.1.2 Basis of Acceptance: Manufacturer's label or certificate indicating compliance with specifications. The Construction Manager or his designee reserves the right to reject any material that has become caked or otherwise damaged.

3.2 Seeds

3.2.1 Quality: Each species, variety, and strain of grasses, legumes, and cereals shall be as specified unless otherwise approved.

3.2.1.1 Materials other than pure live seed shall comprise only nonviable seed, chaff, hulls, live seed of crop plants other than those specified, harmless inert matter and weed seeds except that weed seeds other than seed of noxious weeds will be permitted up to 1 percent of gross weight of each kind of seed. Legume seeds shall be accompanied by adequate amounts of proper inoculants unless accompanied by certification of preinoculation.

3.2.1.2 The percentage of purity as shown on the label shall be acceptable. The percentage of germination as shown on the label shall be not less than the minimum percentage specified.

3.2.2 Nomenclature: The common and scientific names of grasses, legumes, and cereals under this Contract are in conformity with Standard Plant Names.

3.2.3 Weight of Pure Live Seed: Weight of pure live seed in each lot of seed is computed by labeled purity percent, times labeled germination percent, times weight. (Example: 34 pounds of pure live seed of a particular grass is required. Stock available has 85 percent purity and 80 percent germination, which meets the minimum requirements in this example and equals 68.0 percent pure live seed, 34 divided by 68 percent equals 50 pounds gross as being required to furnish 34 pounds of pure live seed). Other material shall comprise the remaining 32 percent, between 68 percent of pure live seed and 100 percent in the example.

3.2.4 Legume Inoculants: Inoculants for treating seeds of legumes shall be standard culture of nitrogen fixing bacteria not more than one year old. Each inoculant shall be the specific culture required by each legume. It shall be supplied only from manufacturers licensed to sell legume inoculants in the State of New York.

3.2.5 Packaging: Each kind of seed shall be furnished and delivered, unless otherwise approved, in separate, sealed containers, or bags acceptably sewn tight or sealed.

3.2.6 Labeling: All seed and seed labels shall be in accordance with state and federal laws, rules, and regulations.

3.2.7 Basis of Acceptance: Seeds shall meet minimum specified requirements regardless of guarantee of qualities or dates of testing and after the application of tolerances approved by the Department of Seed Investigations, New York State Agricultural Experiment Station, Geneva, New York. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable. Seed, after delivery to the Contractor, shall be stored to protect it from damage and deterioration. Provisional acceptance of seeds shall be obtained before the seed is sown. Final acceptance may be subject to results of official sampling and testing.

3.2.8 Seed Mixture: Seed mixture shall be:

Name	Variety	Wt. of Pure Live Seed/Acre (lbs)
Red Fescue (Festuca rubra)	Commercial	40
Perennial Ryegrass (Lolium perenne)	Commercial	15
White Clover (Trifolium repens)	Commercial Max 25 percent hard seed	5
	Total	60 lbs/acre

3.3 Mulch: Either hay or straw may be used for mulch. Hay for mulching shall be mowings of acceptable herbaceous growth free from noxious weeds. Straw for mulching shall be stalks of oats, wheat, rye or other approved crops free from noxious weeds. Materials which are low grade and unfit for farm use such as "U.S. Sample Grade" will be acceptable. Weight shall be calculated on the basis of material having not more than 15% of moisture content. In addition, wood chips, if available, may be used as mulch.

PART 4 - APPLICATION AND CONSTRUCTION

4.1 Fertilizer Application: Fertilizer shall be evenly spread over surface of soil in areas as directed. Rates of application shall be as required to promote plant growth. Tests required to determine rate of fertilizer application shall be made by the Contractor and the rate accepted by the Construction Manager. Any method of application which will ensure an even distribution will be acceptable.

4.2 Seeding Application

4.2.1 Rates: Rates for seeding shall be as specified.

4.2.2 Season: Unless otherwise directed by the Construction Manager, work shall be performed during normal planting seasons of the year. The Contractor shall notify the Construction Manager at least 48 hours in advance of the time he intends to begin sowing seed and shall not proceed with such work until permission has been obtained. When delays in operations carry the work beyond dates which are specified, or when conditions of high winds, excessive moisture or ice are such that satisfactory results are not likely to be obtained for any stage of the work, the Construction Manager will stop work. Work shall be resumed with the Construction

Manager's approval when desired results are likely to be obtained or when accepted corrective measures and procedures are adopted.

4.2.3 Sampling, Mixing, and Inoculating Seeds: Provisional acceptance of seeds shall be obtained before seeds are mixed. Each lot of seed shall be subject to sampling and testing before mixing. Sowing seed shall not be delayed pending reports of these tests. Sampling shall be performed by the Contractor and will be verified by the Construction Manager. Testing for compliance with these specified requirements shall be performed by the Department of Seed Investigations, New York State Agricultural Experiment Station, Geneva N.Y., and results obtained will be considered official. Seeds of kinds specified shall be mixed on the job in formula specified unless otherwise approved. Seed mixed prior to delivery may be approved on the basis of a certification by the vendor stating minimum percentage of germination and purity of each kind of seed and quantity of each kind of seed in mixture. All seed of leguminous plants shall be inoculated prior to mixing or sowing unless otherwise specified or approved or unless accompanied by a certification preinoculation. When seed is to be sown dry and is to be inocu- lated, culture shall be applied as directed by the manufacturer and seed allowed to dry sufficiently to be in the proper condi- tion for mixing or sowing. Seed shall be sown within thirty hours after this treatment. Where seed is to be distributed by water pressure, proper proportion of inoculant may be added to water and seed mixture, together with fertilizer specified, providing the alkalinity of solution does not exceed 8 pH.

4.2.4 Ground Preparation and Seeding

4.2.4.1 Areas to be seeded shall be maintained at approved grades. Irregularities and low places which will hold water shall be eliminated. Fertilizers and seeds shall be evenly distributed on the surfaces to be seeded. All mechanical equipment for soil preparation or seeding shall be as approved and shall pass parallel to the contours unless otherwise approved.

4.2.4.2 When directed by the Construction Manager, measured plots shall be established to determine if specified quantities of seed, fertilizer, and mulch are being applied. The finished surface of any area that is seeded shall not be rougher, more uneven or have more or larger stones, clods, roots, or other foreign materials than the area it adjoins.

4.2.4.3 Areas to be seeded shall be scarified sufficiently to break up surface crust immediately before seeding except where ground is loose and friable as immediately following grading or as otherwise approved. All stones over six inches in greatest dimension which are loose and subject to rolling or sliding or other sizes as specified and all other objects detrimental to mowing shall be removed and disposed of as approved. Fertilizers

and seed may be mixed together immediately before placing. Methods of distribution such as by air or water pressure will be acceptable except that the seed shall not be injured in the process of spreading.

4.3 Mulching

4.3.1 Surface of areas where mulch is to be applied shall be cleared of stones, stumps, wire, and other obstacles which might hinder subsequent seeding operations. Ground shall be harrowed or disked to produce a state of suitable tillage.

4.3.2 Mulch shall be spread uniformly in a continuous blanket of sufficient thickness to completely hide soil from view. Mulch may be spread before or not later than three days after seeding unless otherwise approved. Anchorage to hold mulch in place may be applied by an approved method during mulching operation or subsequently.

4.4 Erosion and Sediment Control

4.4.1 Contractor shall prepare an erosion and sediment control plan for submittal and acceptance by the Construction Manager and the New York State Conservation Engineer, USDA Soil Conservation Service. The plan shall comply with the New York State Guidelines for Urban Erosion and Sediment Control.

4.4.2 Contractor shall conduct his operations in accordance with his certified erosion and sediment control plan. Surface drainage from cuts and fills within the limits of work shall be held in suitable sedimentation ponds or the surface shall be graded to control erosion within acceptable limits. Temporary erosion and sediment control measures shall be provided and maintained until the permanent work is completed. The area of bare soil exposed at any given time by construction shall be restricted to a minimum.

4.4.3 Borrow area erosion and sediment control is the responsibility of the Contractor.

PART 5 - CARE DURING CONSTRUCTION

The Contractor shall care for seeded and mulched areas until final acceptance. Such care shall consist of providing protection against traffic by approved warning signs or barricades, and repairing areas damaged following seeding or mulching operations due to wind, water, fire or other causes. Damaged areas shall be repaired to re-establish condition and grade of area prior to seeding and shall be refertilized, reseeded, and remulched as specified herein. The Contractor shall keep seeded areas mowed until acceptance by cutting to a height of three inches when growth reaches six inches, or as directed.

PART 6 - QUALITY CONTROL

6.1 Liability: Final acceptance of seed may be subject to results of official sampling and testing. Weight of seed sown is based on labeled purity and germination. Tolerances approved by the Department of Seed Investigations, New York State Agricultural Experiment Station, Geneva, New York, for seed species, shall be used in the determination of whether seed conforms to labeled purity and germination statements and meets the minimum specified. When, after application of the appropriate tolerances, purity and germination of seed except cereal grain and legumes are shown by official tests to be less than that shown on label but germination meets minimum specified with the appropriate tolerance applied, and specified weight of pure live seed has not been sown, deficiency shall be sown.

6.1.1 When the germination of seed except cereal grains and legumes is shown by official tests to be less than minimum specified, after appropriate tolerances have been applied, it will be considered a total deficiency. Such deficiency shall require complete reseeding of kind of seed which was deficient.

6.1.2 Reseeding together with necessary grading and trimming shall be done at the expense of the Contractor by spreading seed by an approved method during an approved season.

6.1.3 When, in the judgment of the Construction Manager, at any time prior to acceptance, any area which has been seeded fails to produce a satisfactory growth of grass after a suitable period of time has elapsed, the Contractor shall reseed and refertilize such areas as specified. If deemed necessary by the Construction Manager, the Contractor shall also remulch such areas at the rate specified.

END OF SECTION

SECTION 02620

MONITORING AND PIEZOMETER WELL INSTALLATION AND DEVELOPMENT

PART 1 - GENERAL

This Section describes the installation and development of monitoring wells and piezometers including equipment, labor and materials to perform the work as shown on the Contract Drawings and specified herein.

PART 2 - APPLICABLE PUBLICATIONS

ASTM D1586-84 Method for Penetration Test and Split - Barrel Sampling of Soils

PART 3 - WORK REQUIRED

Furnish all labor, equipment and materials for the drilling, installation and development of monitoring wells and piezometers as described in this Section.

PART 4 - EQUIPMENT AND MATERIALS

4.1 The monitoring wells and piezometers shall be of the open standpipe type with stainless steel screen and riser pipes.

4.2 Monitoring well and piezometer borings shall be drilled using the hollow stem auger method. The auger shall be of sufficient diameter to make a boring that is at least 8 inches in diameter. The boring shall be sampled using a split spoon sampler of the dimensions specified in ASTM D1586-84.

4.3 Well screen and riser shall consist of 4 inch diameter stainless steel Type 304. The screen shall be the wire-wrapped type having a slot size of 0.010 inches. All joints shall be threaded and flush. Monitoring wells shall be screened from one (1) foot above the groundwater level to the bottom of the well and shall penetrate a minimum of one foot into the clay layer. Piezometers shall be screened to a minimum elevation of one (1) foot above the groundwater table with the bottom end of the piezometer at Elevation 1480. The riser pipe shall have a water tight cap. The work shall conform to the details given on Contract Drawing AR-16.

4.4 Annular backfill materials shall consist of the following: a sand pack composed of clean Morie #00 sand placed around the well screen; a well seal consisting of bentonite pellets placed around the riser above the sand; and the remaining annular space to the

surface shall consist of a cement-bentonite mixture in the ratio of 10 gallons potable water to 5 pounds of dry bentonite per 94 pound bag of cement.

4.5 Monitoring wells and piezometers shall be protected with a stainless steel Type 304 outer casing, 6 to 8 inches in diameter, set at least three feet into the ground surface. The casing shall have a locking cap with a padlock. The casing shall extend at least three feet above the CELA cap. However, monitoring wells located on the center line of the dike shall be flush with the top of the dike. All monitoring wells shall be provided with a concrete collar to prevent infiltration of surface water along the outer casing.

4.6 The Contractor shall provide a steam sprayer to decontaminate all drilling equipment and well materials.

4.7 The Contractor shall provide a surge block, centrifugal pump and hoses to develop the monitoring wells and piezometers, and drums to containerize the resulting development fluids.

PART 5 - EXECUTION

5.1 Prior to drilling each borehole, the Contractor shall steam wash the drilling rig and all down-hole tools (i.e., augers, rods, samplers) until all the dirt and visible residue has been removed.

5.2 The Contractor shall drill the boring using the hollow stem auger method to the required depth, shown on Contract Drawing AR-16. During advancement of the boring, split spoon samples shall be collected at intervals not to exceed 5 feet from the top of one sampling interval to the top of the next. Sampling shall be performed according to the specifications of ASTM D1586-84.

5.3 With the augers still in place in the boring, the Contractor shall begin well installation. Clean sand shall be placed in the boring to a depth of approximately 12 inches above the bottom. The well screen and riser shall be placed in the boring above the sand and centered. The final height of the riser shall be as shown on the applicable drawings. The screen shall be placed in accordance with the details shown on the Contract Drawing AR-16. The sand pack shall be set in place by gradually adding sand while slowly retracting the augers in a manner that shall allow the sand to fill the annular space around the screen while avoiding caving of formation materials around the screen. A bentonite pellet seal, at least one foot in thickness, shall be placed in the annulus above the sand pack in a similar manner by adding the pellets while retracting the augers. Potable water shall be poured on top of the pellets and they shall be allowed to hydrate for at least one hour before proceeding. After the bentonite pellets have sufficiently hydrated, the cement-bentonite grout shall be placed in the remaining annulus. The grout shall be pumped through a tremie pipe

to fill the annulus from the bottom up as the augers are gradually retracted. The cement-bentonite shall be placed to depths indicated on the Contract Drawing AR-16.

5.4 The cement-bentonite grout shall be allowed to set overnight and then checked for settling. If necessary, more grout shall be added. The outer seal protective casing shall be placed so that the bottom extends at least 3 feet below the ground surface and the top is less then six inches above the riser pipe. The casing shall be secured in concrete which shall also extend at least three feet below the surface. The well shall be secured with a padlock and the Contractor shall clean up and remove all waste materials from the site.

5.5 After the surface concrete seal has set at least 24 hours each well and piezometer shall be developed to remove fine grained materials from the well and filter pack. A surge block, at least 3.5 inches in diameter, shall be raised and lowered through the screened interval to help develop the well. The surge block will then be removed, and a hose inserted to within a foot of the base of the well. The well shall then be pumped for an hour to remove water and sediment from the well. This process shall be repeated four times for piezometers and eight times for wells. If a well or piezometer is developed, such that a turbidity of 10 NTUs or less is obtained immediately after surging, development may be stopped.

SECTION 02830
FENCES AND GATES

PART 1 - GENERAL

This section covers the requirements for fencing and gate materials, construction features, quality and handling of the materials described herein.

PART 2 - APPLICABLE PUBLICATIONS

ASTM A53-90	Standard Specifications for Pipe, Steel, Black Hot-Dipped Zinc Coated (galvanized) Welded and Seamless
ASTM A123-84	Standard Specifications for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A153-87	Standard Specifications for Zinc Coatings (Hot-Dipped) on Iron and Steel Hardware
ASTM A392-89	Specifications for Zinc Coated Steel Chain - Link Fence Fabric
ASTM A817-86	Specifications for Metallic-Coated Steel Wire for Chain Link Fence Fabric
ASTM C94-90	Specification for Ready-Mixed Concrete

PART 3 - REQUIRED WORK

3.1 The work under this section shall include furnishing all materials and installation of fences and gates where required by this Contract Document. The fencing installation shall be a 8-foot steel chain-link fence. Locked access gates shall be located as shown on the Contract Drawings.

3.2 It is not the intent of this Section and associated drawings to specify all details of fabrication and construction. It shall be the responsibility of the Contractor to provide and install materials that have been specified in accordance with high standards and workmanship that is suitable for the specified work.

3.3 The work includes supply, erection and complete installation of the following:

(1) Concrete Footings
(2) Fencing
(3) Gates

PART 4 - SUBMITTALS

Contractor shall submit the name of the fence fabricator, size of fabric and type of posts, to the Construction Manager.

PART 5 - MATERIALS

5.1 Posts and Rails

All posts, rails, gate frames, and post braces shall be Schedule 40 standard steel pipe produced to the requirements of ASTM A53-90, (no hydrostatic testing is required) and hot-dip galvanized in accordance with ASTM A123-84, except for sliding gate posts which shall be Schedule 80.

5.1.1 Minimum NPS pipe diameters shall be as follows:

End, corner and pull posts	2-1/2 in.
Line posts	2 in.
Swing gate posts	
o Double swing (up to 12 feet)	2 in.
o Double swing (from 12 to 26 feet)	3-1/2 in.
Top rail	1-1/4 in.
Horizontal post braces	1-1/4 in.

5.1.2 All posts shall be equipped with pressed steel combination tops. Tops shall be provided with a hole to permit through passage of the top rail.

5.1.3 Post tops, extension arms, rail sleeves, and miscellaneous clamps shall be hot-dip galvanized in accordance with ASTM A123-84.

5.2 Fence Fabric

5.2.1 Wire for chain link fence fabric shall be No. 9 coated wire gage carbon steel produced in accordance with ASTM A817-86.

5.2.2 Fence fabric shall be zinc coated steel mesh.

5.2.3 Coated fence fabric shall be produced from helically wound and interwoven steel wire forming a continuous 2 inch mesh in accordance with ASTM A392-89.

5.2.4 Ties or clips of adequate strength shall be provided in sufficient number for attachment of the fabric to line posts at intervals not exceeding 15 inches and to the top rail at a maximum 24 inch spacing.

5.3 Tension Bars

5.3.1 Tension bars shall be minimum 3/16 inch by 3/4 inch flat steel plates and no more than 2 inches shorter than the fabric height. Bars shall be hot-dip galvanized in accordance with ASTM A123-84.

5.4 Terminal Post Bands

5.4.1 Bands or clips of adequate strength shall be provided in sufficient number for attachment of the fabric and stretcher bars to all terminal posts at intervals not exceeding 15 inches. Tension bands shall be formed from No. 12 gage flat or beveled steel and attached with 3/8 inch diameter carriage bolts hot-dip galvanized in accordance with ASTM A153-87.

5.5 Gates

Gates shall be double swing as indicated on the drawings, complete with latches, stops, keepers and hinges.

5.5.1 Gate frames shall be constructed of Schedule 40, 1-1/4 inch NPS diameter standard steel pipe produced to the requirements of ASTM A53-90 and hot-dip galvanized in accordance with ASTM A123-84. Frames shall be welded at corners or assembled with fittings, and when fittings are used, 3/8 inch minimum diameter truss rods shall be provided to prevent sag or twist.

5.5.2 Gate leaves shall have vertical intermediate bracing as required, spaced so that no members are more than 8 feet apart.

5.5.3 Gate fabric shall be the same type as used in the fence construction.

5.5.4 Hinges for swing gates shall permit full opening to a position paralleled to the fence. Hinges shall not twist or turn under gate motion, and shall be non-removable after installation. The gate should be easily opened by one person.

5.5.5 Gate latches, stops, and keepers shall be provided for all gates. Latches shall have a plunger-bar arranged to engage the center stop, except that for single gates with openings less than 10 feet wide, a forked latch may be provided. Catches shall be arranged for locking. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger bar of the latch of double gates. No stop is required for single gates.

Keepers shall consist of a mechanical device for securing the free end of the gate in the full open position.

5.5.6 All gate hardware shall be zinc coated in accordance with ASTM A153-87.

PART 6 - CONSTRUCTION

6.1 Requirements

6.1.1 Perimeter fence and gates shall be 8 feet overall in height above the ground. Post shall extend 36 to 60 inches under the ground in concrete footings (see drawing AR-15).

6.1.2 Line posts shall be spaced equally not more than 10 feet on centers.

6.1.3 Rails shall be furnished in random lengths averaging a minimum of 20 feet. Joints shall be made up with extra long pressed steel sleeves to provide a rigid connection while permitting expansion and contraction.

6.1.4 All end and corner posts shall be braced horizontally to the adjoining line post at the mid-height of the fabric by means of standard steel pipe.

6.1.5 Diagonal tension bracing shall be provided from end, corner, or gate posts to line posts, consisting of 3/8 inch minimum diameter steel truss rods with turnbuckles or equivalent provision for adjustment.

6.1.6 One tension bar shall be provided for each end and gate post, and two (2) for each corner and pull post.

6.2 Installation

6.2.1 The fence and gates shall be installed in accordance with the requirements of the Contract Documents and the manufacturer's instructions and recommendations.

6.2.2 All work shall be performed by competent, trained workmen, skilled in the field to which they are executing the work.

6.2.3 The chain link fence shall be installed with a minimum overall height of 8 feet above the ground and 3 strands of barbed wire on the top.

6.2.4 All equipment shall be properly and securely installed such that undue stresses are not exerted on fences, gates and connections.

6.2.5 Contractor shall construct footings and install all fencing and accessories to the extent indicated on the Contract Drawings. Concrete post footings shall be poured monolithically, and the top surface shall be approximately 2 inches above the surrounding ground line. A concrete block or flat stone shall be placed at the bottom of an augered hole before the post concrete is placed.

6.2.6 Concrete shall conform to ASTM C94-90, using 3/4 inch maximum-size aggregate, and having a minimum compressive strength of 3000 psi after 28 days, and shall be cured for a minimum of 72 hours after posts are set before fence installation continues.

6.2.7 Fence shall be grounded at each side of every gate, at points 150 feet each side at overhead power lines, at intervals of every 1000 feet of length when fences are located in isolated places, and every 500 to 750 feet when in close proximity (100 feet or less) to public roads, highways and buildings. Fence shall be grounded at locations where fence alignment changes more than 15 degrees.

6.2.8 Each fence post to be grounded shall be connected to a ground electrode consisting of a copper-clad steel ground rod 3/4 inch in diameter and 10 feet long, driven not less than 11 feet into the ground with rod located at the fence line or as near the fence line as is practicable. Connection of fence post to ground electrode shall be made below grade with not less than No. 4 AWG Stranded-Copper wire with TW insulation by approved molded exothermic weld process or approved clamp-type fittings of copper on fence post and electrode. Each gate panel shall be bonded with a flexible bond strap to its gate post.

6.3 Testing and Inspections

6.3.1 Each material shall be given requisite inspections, as necessary, to determine that the work and materials are free from defects and to establish that the design and construction meet the requirements of the Contract Documents.

6.3.2 Acceptance tests, after the fence is completely installed, may be performed by the Construction Manager to demonstrate performance requirements, as specified herein.

6.3.3 Contractor shall certify that materials and coatings furnished have been tested and conform to the referenced ASTM Specifications.

END OF SECTION